MITSUBISHI ELECTRIC

General-Purpose AC Servo

MELSERVO-J2-Super Series

SSCNET Compatible

MODEL

MR-J2S-□B

SERVO AMPLIFIER
INSTRUCTION MANUAL

G

● Safety Instructions ●

(Always read these instructions before using the equipment.)

Do not attempt to install, operate, maintain or inspect the servo amplifier and servo motor until you have read through this Instruction Manual, Installation guide, Servo motor Instruction Manual and appended documents carefully and can use the equipment correctly. Do not use the servo amplifier and servo motor 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, always 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, always confirm from the front of the servo amplifier, whether the charge lamp is off or not.
- Connect the servo amplifier and servo motor to ground.
- 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, you may get an electric shock.
- Operate the switches with dry hand to prevent an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock.
- During power-on or operation, do not open the front cover of the servo amplifier. You may get 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 or periodic inspection, do not remove the front cover even of the servo amplifier if the power is off. The servo amplifier is charged and you may get an electric shock.

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 a fire.
- Always connect a magnetic contactor (MC) between the main circuit power supply and L_1, L_2, and L_3 of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- When a regenerative resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

3. To prevent injury, note the follow

⚠ CAUTION

- Only the voltage specified in the Instruction Manual should be applied to each terminal. Otherwise, a burst, damage, etc. may occur.
- Connect the terminals correctly to prevent a burst, damage, etc.
- Ensure that polarity (+, −) is correct. Otherwise, a burst, damage, etc. may occur.
- Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the servo amplifier heat sink, regenerative resistor, servo motor, etc. since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged.
- During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their weights.
- Stacking in excess of the specified number of products is not allowed.
- Do not carry the servo motor by the cables, shaft or encoder.
- Do not hold the front cover to transport the servo amplifier. The servo amplifier may drop.
- Install the servo amplifier in a load-bearing place in accordance with the Instruction Manual.
- Do not climb or stand on servo equipment. Do not put heavy objects on equipment.
- The servo amplifier and servo motor must be installed in the specified direction.
- Leave specified clearances between the servo amplifier and control enclosure walls or other equipment.
- Do not install or operate the servo amplifier and servo motor which has been damaged or has any parts missing.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and servo motor.
- Do not drop or strike servo amplifier or servo motor. Isolate from all impact loads.
- When you keep or use it, please fulfill the following environmental conditions.

Environment			Conditions		
			Servo amplifier	Servo motor	
Ambient temperature	In operation	[℃]	0 to +55 (non-freezing)	0 to +40 (non-freezing)	
		[°F]	32 to 131 (non-freezing)	32 to 104 (non-freezing)	
	In storage	[℃]	−20 to +65 (non-freezing)	−15 to +70 (non-freezing)	
		[°F]	−4 to 149 (non-freezing)	5 to 158 (non-freezing)	
Ambient humidity	In operation		90%RH or less (non-condensing)	80%RH or less (non-condensing)	
	In storage		90%RH or less (non-condensing)		
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt		
Altitude			Max. 1000m (3280 ft) above sea level		
(Note) Vibration		[m/s^2]	5.9 or less	HC-KFS Series HC-MFS Series HC-UFS13 to 73	X ▪ Y : 49
				HC-SFS81 HC-SFS52 to 152 HC-SFS53 to 153 HC-RFS Series HC-UFS 72 ▪ 152	X ▪ Y : 24.5
				HC-SFS121 ▪ 201 HC-SFS202 ▪ 352 HC-SFS203 ▪ 353 HC-UFS202 to 502	X : 24.5 Y : 49
				HC-SFS301 HC-SFS502 to 702	X : 24.5 Y : 29.4
				HA-LFS11K2 to 22K2	X : 11.7 Y : 29.4
		[ft/s^2]	19.4 or less	HC-KFS Series HC-MFS Series HC-UFS 13 to 73	X ▪ Y : 161
				HC-SFS81 HC-SFS52 to 152 HC-SFS53 to 153 HC-RFS Series HC-UFS 72 ▪ 152	X ▪ Y : 80
				HC-SFS121 ▪ 201 HC-SFS202 ▪ 352 HC-SFS203 ▪ 353 HC-UFS202 to 502	X : 80 Y : 161
				HC-SFS301 HC-SFS502 to 702	X : 80 Y : 96
				HA-LFS11K2 to 22K2	X : 38 Y : 96

Note. Except the servo motor with reduction gear.

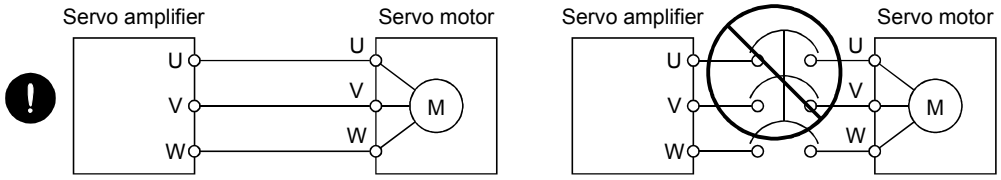
⚠ CAUTION

- Securely attach the servo motor to the machine. If attach insecurely, the servo motor may come off during operation.
- The servo motor with reduction gear must be installed in the specified direction to prevent oil leakage.
- Take safety measures, e.g. provide covers, to prevent accidental access to the rotating parts of the servo motor during operation.
- Never hit the servo motor or shaft, especially when coupling the servo motor to the machine. The encoder may become faulty.
- Do not subject the servo motor shaft to more than the permissible load. Otherwise, the shaft may break.
- When the equipment has been stored for an extended period of time, consult Mitsubishi.

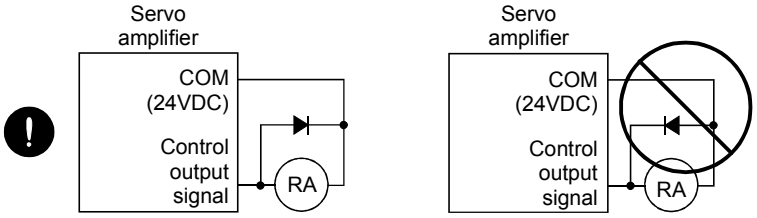
(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate.
- Do not install a power capacitor, surge absorber or radio noise filter (FR-BIF option) between the servo motor and servo amplifier.
- Connect the output terminals (U, V, W) correctly. Otherwise, the servo motor will operate improperly.
- Connect the servo motor power terminal (U, V, W) to the servo motor power input terminal (U, V, W) directly. Do not let a magnetic contactor, etc. intervene.



- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed on the DC output signal relay of the servo amplifier must be wired in the specified direction. Otherwise, the forced stop (EM1) and other protective circuits may not operate.



- When the cable is not tightened enough to the terminal block (connector), the cable or terminal block (connector) may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.

(3) Test run adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- The parameter settings must not be changed excessively. Operation will be insatiable.

(4) Usage

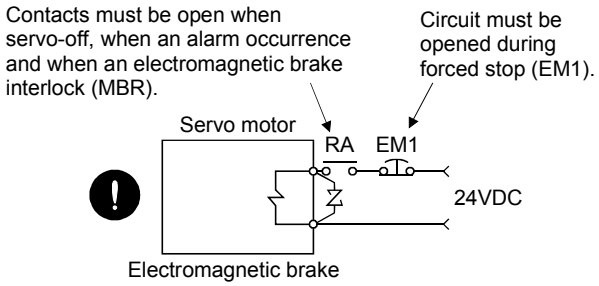
⚠ CAUTION

- Provide a forced stop circuit to ensure that operation can be stopped and power switched off immediately.
- Any person who is involved in disassembly and repair should be fully competent to do the work.
- Before resetting an alarm, make sure that the run signal of the servo amplifier is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on.
- Do not modify the equipment.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near the servo amplifier.
- Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break a servo amplifier.
- 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

- When it is assumed that a hazardous condition may take place at the occur due to a power failure or a product fault, use a servo motor with electromagnetic brake or an external brake mechanism for the purpose of prevention.
- Configure the electromagnetic brake circuit so that it is activated not only by the interface unit signals but also by a forced stop (EM1).



- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly (design the machine so that it is secured against hazard if restarted).

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- With age, the electrolytic capacitor of the servo amplifier will deteriorate. To prevent a secondary accident due to a fault, it is recommended to replace the electrolytic capacitor every 10 years when used in general environment.
  Please consult our sales representative.

(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.

● About processing of waste ●

When you discard servo amplifier, a battery (primary battery), and other option articles, please follow the law of each country (area).

⚠ FOR MAXIMUM SAFETY

- These products have been manufactured as a general-purpose part for general industries, and have not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine, passenger movement vehicles or under water relays, contact Mitsubishi.
- These products have been manufactured under strict quality control. However, when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

⚠ 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 and/or converter unit may fail 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

Precautions for Choosing the Products

Mitsubishi will not be held liable for damage caused by factors found not to be the cause of Mitsubishi; machine damage or lost profits caused 0y faults in the Mitsubishi products; damage, secondary damage, accident compensation caused by special factors unpredictable by Mitsubishi; damages to products other than Mitsubishi products; and to other duties.

COMPLIANCE WITH EC DIRECTIVES

1. WHAT ARE EC DIRECTIVES?

The EC directives were issued to standardize the regulations of the EU countries and ensure smooth distribution of safety-guaranteed products. In the EU countries, the machinery directive (effective in January, 1995), EMC directive (effective in January, 1996) and low voltage directive (effective in January, 1997) of the EC directives require that products to be sold should meet their fundamental safety requirements and carry the CE marks (CE marking). CE marking applies to machines and equipment into which servo amplifiers have been installed.

(1) EMC directive

The EMC directive applies not to the servo units alone but to servo-incorporated machines and equipment. This requires the EMC filters to be used with the servo-incorporated machines and equipment to comply with the EMC directive. For specific EMC directive conforming methods, refer to the EMC Installation Guidelines (IB(NA)67310).

(2) Low voltage directive

The low voltage directive applies also to servo units alone. Hence, they are designed to comply with the low voltage directive.

This servo is certified by TUV, third-party assessment organization, to comply with the low voltage directive.

(3) Machine directive

Not being machines, the servo amplifiers need not comply with this directive.

2. PRECAUTIONS FOR COMPLIANCE

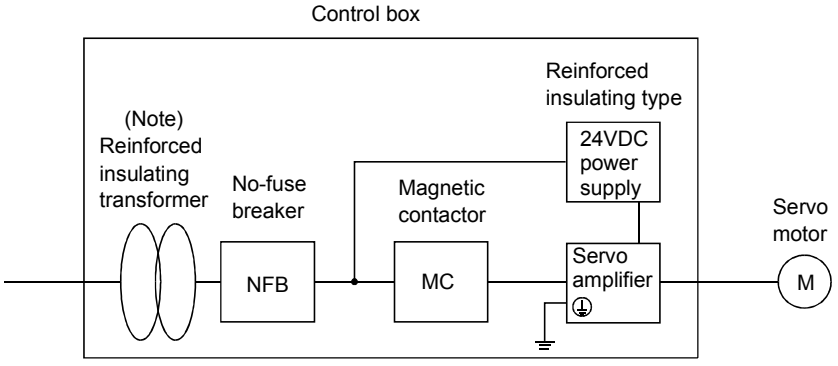
(1) Servo amplifiers and servo motors used

Use the servo amplifiers and servo motors which comply with the standard model.

Servo amplifier :MR-J2S-10B to MR-J2S-22KB
MR-J2S-10B1 to MR-J2S-40B1

Servo motor :HC-KFS□
HC-MFS□
HC-SFS□
HC-RFS□
HC-UFS□
HA-LFS□
HC-LFS□

(2) Configuration



Note. The insulating transformer is not required for the 11kW or more servo amplifier.

(3) Environment

Operate the servo amplifier at or above the contamination level 2 set forth in IEC60664-1. For this purpose, install the servo amplifier in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

(4) Power supply

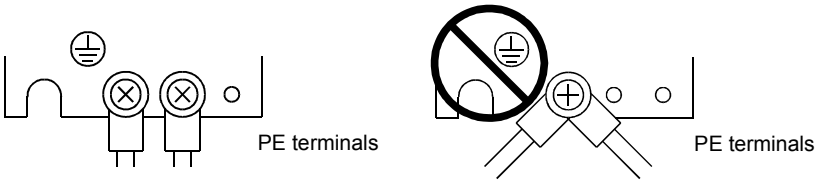
(a) Operate the servo amplifier 7kW or less to meet the requirements of the overvoltage category II set forth in IEC60664-1. For this purpose, a reinforced insulating transformer conforming to the IEC or EN standard should be used in the power input section.
Since the 11kW or more servo amplifier can be used under the conditions of the overvoltage category III set forth in IEC60664-1, a reinforced insulating transformer is not required in the power input section.

(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

(5) Grounding

(a) To prevent an electric shock, always connect the protective earth (PE) terminals (marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

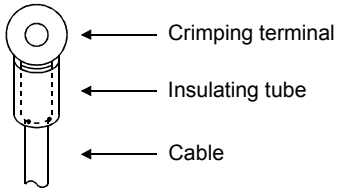
(b) Do not connect two ground cables to the same protective earth (PE) terminal (⏚) Always connect the cables to the terminals one-to-one.



(c) If a leakage current breaker is used to prevent an electric shock, the protective earth (PE) terminals of the servo amplifier must be connected to the corresponding earth terminals.

(6) Wiring

(a) The cables to be connected to the terminal block of the servo amplifier must have crimping terminals provided with insulating tubes to prevent contact with adjacent terminals.



(b) Use the servo motor side power connector which complies with the EN Standard. The EN Standard compliant power connector sets are available from us as options.

(7) Auxiliary equipment and options

(a) The no-fuse breaker and magnetic contactor used should be the EN or IEC standard-compliant products of the models described in section 12.2.2.

(b) The sizes of the cables described in section 12.2.1 meet the following requirements. To meet the other requirements, follow Table 5 and Appendix C in EN60204-1.
- Ambient temperature: 40 (104) [°C (°F)]
- Sheath: PVC (polyvinyl chloride)
- Installed on wall surface or open table tray

(c) Use the EMC filter for noise reduction.

(8) Performing EMC tests

When EMC tests are run on a machine/device into which the servo amplifier has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.
For the other EMC directive guidelines on the servo amplifier, refer to the EMC Installation Guidelines(IB(NA)67310).

CONFORMANCE WITH UL/C-UL STANDARD

(1) Servo amplifiers and servo motors used

Use the servo amplifiers and servo motors which comply with the standard model.

Servo amplifier :MR-J2S-10B to MR-J2S-22KB
MR-J2S-10B1 to MR-J2S-40B1

Servo motor :HC-KFS□
HC-MFS□
HC-SFS□
HC-RFS□
HC-UFS□
HA-LFS□
HC-LFS□

(2) Installation

Install a cooling fan of 100CFM (2.8m^3/min) air flow 4 in (10.16 cm) above the servo amplifier or provide cooling of at least equivalent capability.

(3) Short circuit rating

This servo amplifier conforms to the circuit whose peak current is limited to 5000A or less. Having been subjected to the short-circuit tests of the UL in the alternating-current circuit, the servo amplifier conforms to the above circuit.

(4) Capacitor discharge time

The capacitor discharge time is as listed below. To ensure safety, do not touch the charging section for 10 minutes after power-off.

Servo amplifier	Discharge time [min]
MR-J2S-10B(1) • 20B(1)	1
MR-J2S-40B(1) • 60B	2
MR-J2S-70B to 350B	3
MR-J2S-500B • 700B	5
MR-J2S-11KB	4
MR-J2S-15KB	6
MR-J2S-22KB	8

(5) Options and auxiliary equipment

Use UL/C-UL standard-compliant products.

(6) Attachment of a servo motor

For the flange size of the machine side where the servo motor is installed, refer to "CONFORMANCE WITH UL/C-UL STANDARD" in the Servo Motor Instruction Manual.

(7) About wiring 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.

<<About the manuals>>

This Instruction Manual and the MELSERVO Servo Motor Instruction Manual are required if you use the General-Purpose AC servo MR-J2S-B for the first time. Always purchase them and use the MR-J2S-B safely.
Also read the manual of the servo system controller.

Relevant manuals

Manual name	Manual No.
MELSERVO-J2-Super Series To Use the AC Servo Safely (Packed with the servo amplifier)	IB(NA)0300010
MELSERVO Servo Motor Instruction Manual	SH(NA)3181
EMC Installation Guidelines	IB(NA)67310

CONTENTS

Optional Servo Motor Instruction Manual CONTENTS

The rough table of contents of the optional MELSERVO Servo Motor Instruction Manual is introduced here for your reference. Note that the contents of the Servo Motor Instruction Manual are not included in the Servo Amplifier Instruction Manual.

MEMO

1. FUNCTIONS AND CONFIGURATION

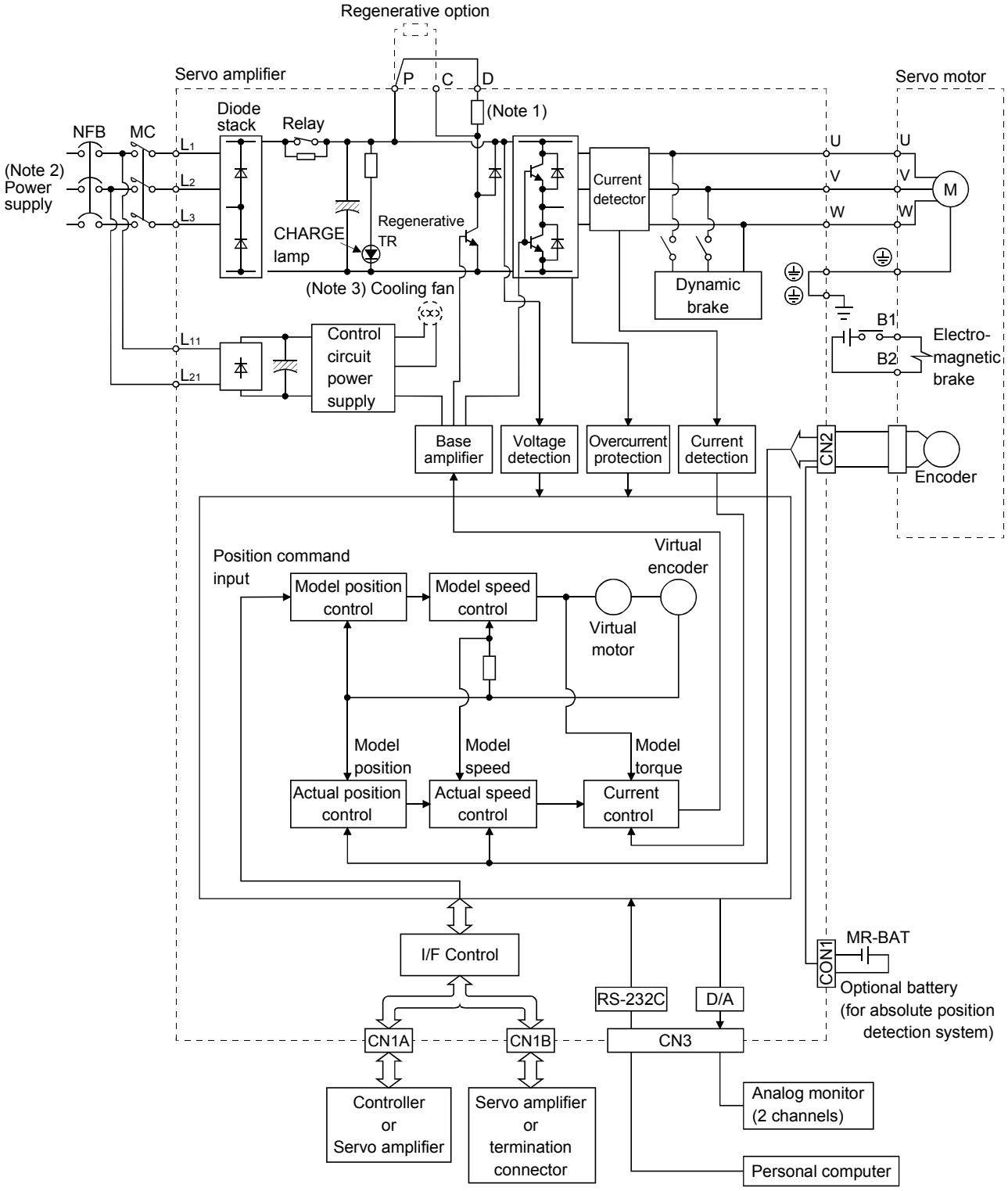
1.1 Introduction

The Mitsubishi MELSERVO-J2-Super series general-purpose AC servo is based on the MELSERVO-J2 series and has further higher performance and higher functions.
It is connected with a servo system controller or similar device via a serial bus (SSCNET) and the servo amplifier reads position data directly to perform operation.
Data from a command unit controls the speed and rotation direction of the servo motor and executes precision positioning.
A torque limit is imposed on the servo amplifier by the clamp circuit to protect the power transistor in the main circuit from overcurrent due to sudden acceleration/deceleration or overload. The torque limit value can be changed to any value with an external analog input or the parameter.
As this new series has the RS-232C serial communication function, a MR Configurator (servo configuration software)-installed personal computer or the like can be used to perform parameter setting, test operation, status display monitoring, gain adjustment, etc.
With real-time auto tuning, you can automatically adjust the servo gains according to the machine.
The MELSERVO-J2-Super series servo motor is equipped with an absolute position encoder which has the resolution of 131072 pulses/rev to ensure more accurate control as compared to the MELSERVO-J2 series. Simply adding a battery to the servo amplifier makes up an absolute position detection system. This makes home position return unnecessary at power-on or alarm occurrence by setting a home position once.

1.2 Function block diagram

The function block diagram of this servo is shown below.

(1) MR-J2S-350B or less

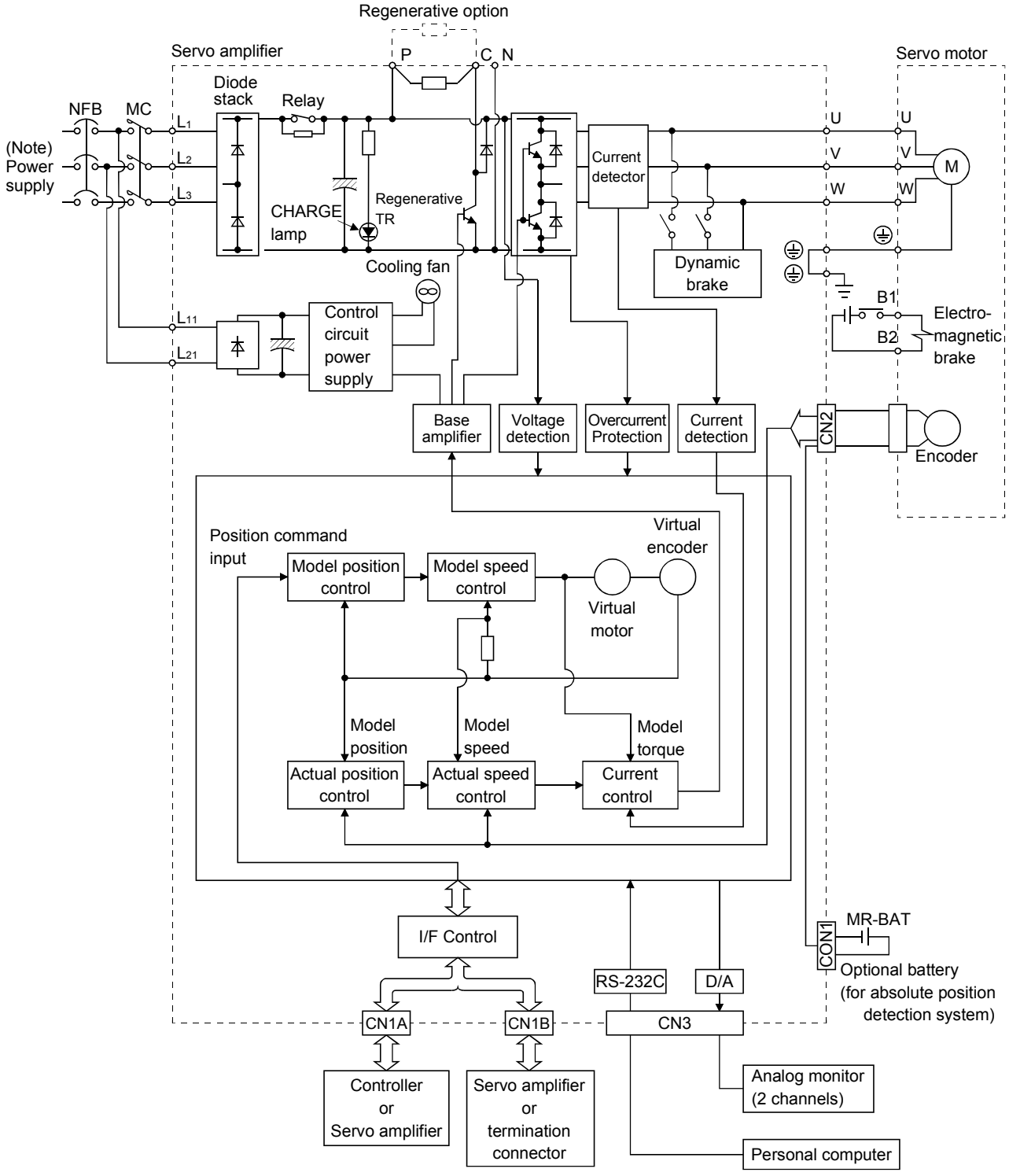


Note 1. The built-in regenerative resistor is not provided for the MR-J2S-10B (1).

2. For 1-phase 230V, connect the power supply to L_1, L_2 and leave L_3 open.
   L_3 is not provided for a 1-phase 100 to120V power supply. Refer to section 1.3 for the power supply specification.

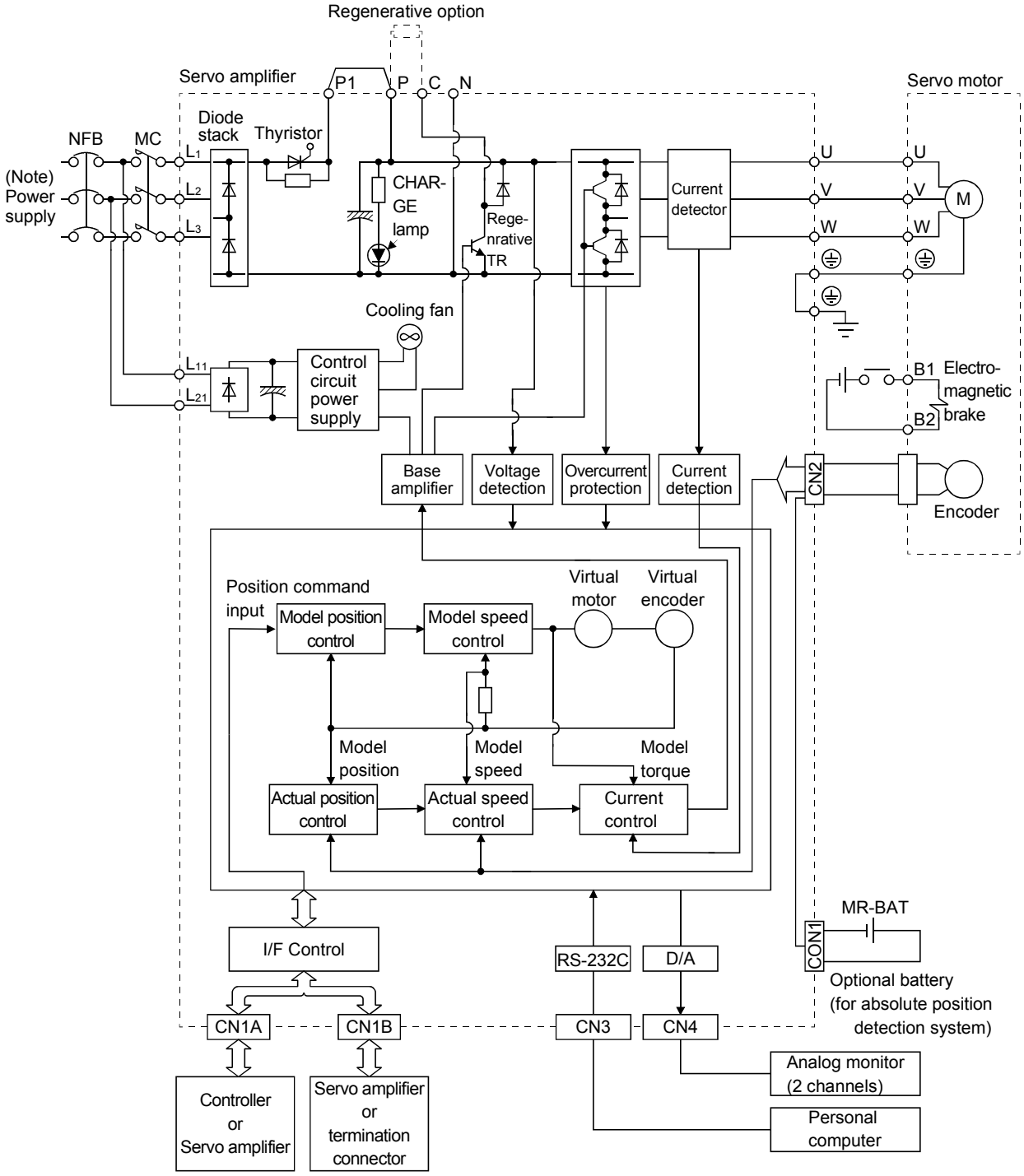
3. Servo amplifiers MR-J2S-200B have a cooling fan.

(2) MR-J2S-500B, MR-J2S-700B



Note. Refer to section 1.3 for the power supply specification.

(3) MR-J2S-11KB or more



Note. Refer to section 1.3 for the power supply specification.

1.3 Servo amplifier standard specifications

Item \ Servo amplifier MR-J2S-□				10B	20B	40B	60B	70B	100B	200B	350B	500B	700B	11KB	15KB	22KB	10B1	20B1	40B1
Power supply	Voltage/frequency			3-phase 200 to 230VAC, 50/60Hz or 1-phase 230VAC, 50/60Hz					3-phase 200 to 230VAC, 50/60Hz								1-phase 100 to 120VAC 50/60Hz		
	Permissible voltage fluctuation			3-phase 200 to 230VAC:170 to 253VAC 1-phase 230VAC: 207 to 253VAC					3-phase 170 to 253VAC								1-phase 85 to 127VAC		
	Permissible frequency fluctuation			Within ±5%															
	Power supply capacity			Refer to section 11.2															
	Inrush current			Refer to section 11.5															
Control system				Sine-wave PWM control, current control system															
Dynamic brake				Built-in															
Protective functions				Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder fault protection, regenerative fault protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection															
Structure				Self-cooled, open (IP00)						Force-cooling, open (IP00)				External			Self-cooled, open(IP00)		
Environment	Ambient temperature	In operation	[℃]	0 to +55 (non-freezing)															
			[℉]	32 to +131 (non-freezing)															
		In storage	[℃]	−20 to +65 (non-freezing)															
			[℉]	−4 to +149 (non-freezing)															
	Ambient humidity	In operation		90%RH or less (non-condensing)															
		In storage																	
	Ambient			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt															
	Altitude			Max. 1000m (3280ft) above sea level															
	Vibration			5.9 [m/s^2] or less															
				19.4 [ft/s^2] or less															
Mass			[kg]	0.7	0.7	1.1	1.1	1.7	1.7	2.0	2.0	4.9	7.2	16	16	20	0.7	0.7	1.1
			[lb]	1.5	1.5	2.4	2.4	3.75	3.75	4.4	4.4	10.8	15.9	35.3	35.3	44.1	1.5	1.5	2.4

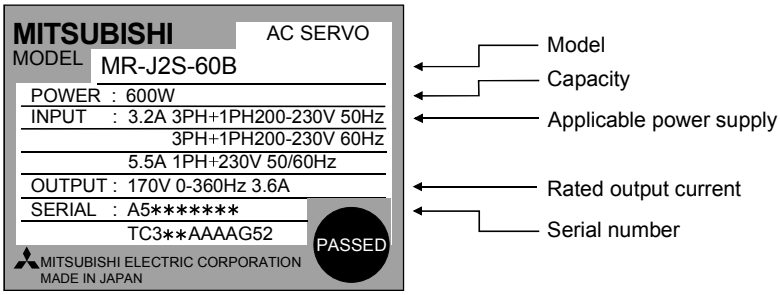
1.4 Function list

The following table lists the functions of this servo. For details of the functions, refer to the reference field.

Function	Description	Reference
High-resolution encoder	High-resolution encoder of 131072 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 13
Adaptive vibration suppression control	Servo amplifier detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 7.3
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 7.4
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a MR Configurator (servo configuration software)-installed personal computer and servo amplifier.	
Machine simulation	Can simulate machine motions on a personal computer screen on the basis of the machine analyzer results. The MR Configurator (servo configuration software) is required.	
Gain search function	Personal computer changes gains automatically and searches for overshoot-free gains in a short time. The MR Configurator (servo configuration software) is required.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	Parameter No.24
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies. Higher in performance than MELSERVO-J2 series servo amplifier.	Chapter 6
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 12.1.1
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used with the MR-J2S-500B to MR-J2S-22KB.	Section 12.1.2
Return converter	Used when the regenerative option cannot provide enough regenerative power. Can be used with the MR-J2S-500B to MR-J2S-22KB.	Section 12.1.3
Torque limit	Servo motor torque can be limited to any value.	Parameters No.10, 11
Forced stop signal automatic ON	Forced stop (EM1) can be automatically switched on internally to invalidate it.	Parameter No.23
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for output signal wiring check, etc.	Section 4.4 (1) (e)
Test operation mode	JOG operation ▪ positioning operation ▪ motor-less operation ▪ DO forced output	Section 4.4
Analog monitor output	Servo status is output in terms of voltage in real time.	Parameter No. 22
MR Configurator (Servo configuration software)	Using a personal computer, parameter setting, test operation, status display, etc. can be performed.	Section 12.1.8

1.5 Model code definition

(1) Rating plate



(2) Model

MR–J2S– □ B □ □

Series

With no regenerative resistor

Symbol	Description
–PX	Indicates a servo amplifier of 11k to 22kW that does not use a regenerative resistor as standard accessory.

Power Supply

Symbol	Power supply
None	3-phase 200 to 230V (Note 2) 1-phase 230V
(Note1) 1	1-phase 100V to 120V

Note 1. 1-phase 200V to 230V is supported by 400W or less.
2. 1-phase 100V to 120V is supported by 750W or less.

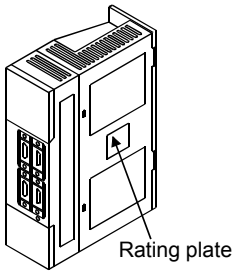
SSCNET compatible

Rated output

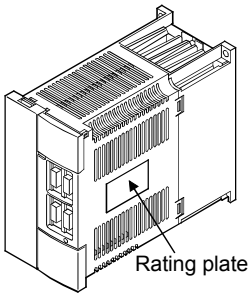
Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
60	0.6
70	0.75
100	1
200	2

Symbol	Rated output [kW]
350	3.5
500	5
700	7
11k	11
15k	15
22k	22

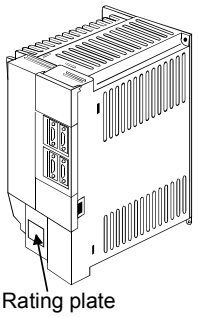
MR–J2S–100B or less



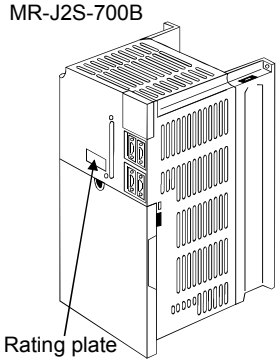
MR–J2S–200B・350B



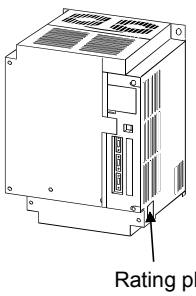
MR-J2S-500B



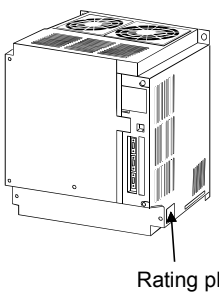
MR-J2S-700B



MR-J2S-11KB・15KB



MR-J2S-22KB



1.6 Combination with servo motor

The following table lists combinations of servo amplifiers and servo motors. The same combinations apply to the models with electromagnetic brakes and the models with reduction gears.

Servo amplifier	Servo motors							
	HC-KFS□	HC-MFS□	HC-SFS□			HC-RFS□	HC-UFS□	
			1000r/min	2000r/min	3000r/min		2000r/min	3000r/min
MR-J2S-10B(1)	053・13	053・13						13
MR-J2S-20B(1)	23	23						23
MR-J2S-40B(1)	43	43						43
MR-J2S-60B				52	53			
MR-J2S-70B	(Note 1) 73	73					72	73
MR-J2S-100B			81	102	103			
MR-J2S-200B			121・201	152・202	153・203	103・153	152	
MR-J2S-350B			301	352	353	(Note 1) 203	(Note 1)202	
MR-J2S-500B				(Note 1) 502		(Note 1) 353・503	(Note 1) 352・502	
MR-J2S-700B				(Note 1) 702				

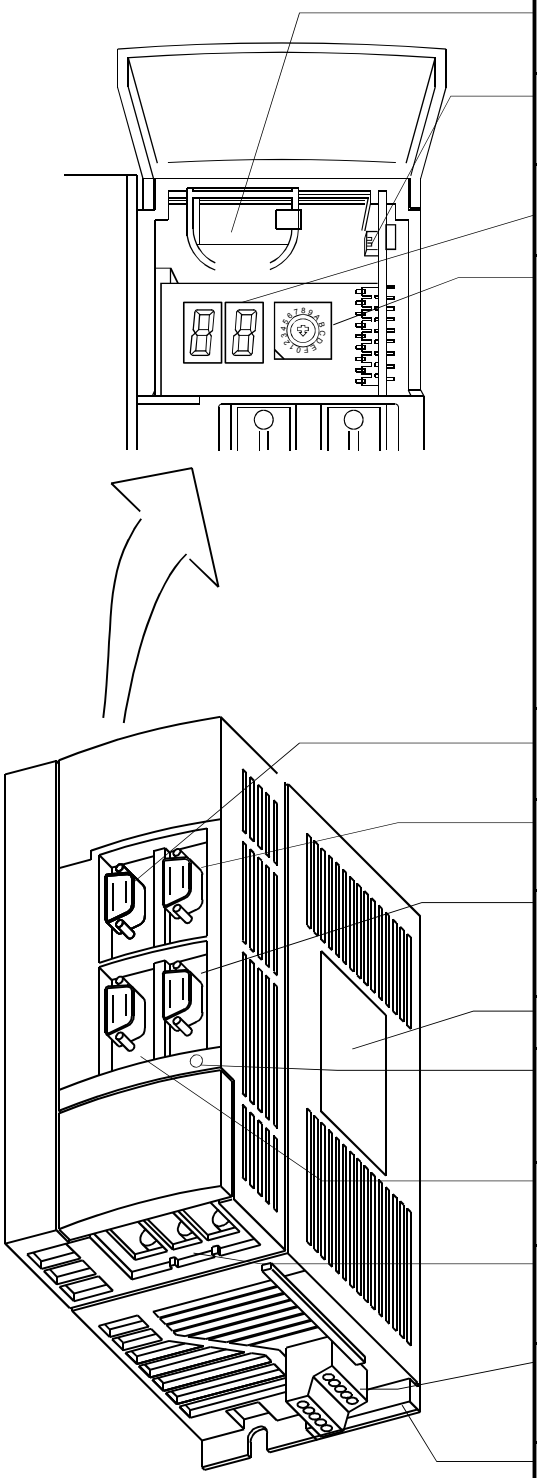
Servo amplifier	Servo motors			
	HA-LFS□			(Note 1) HC-LFS□
	1000r/min	1500r/min	2000r/min	
MR-J2S-60B				52
MR-J2S-100B				102
MR-J2S-200B				152
MR-J2S-350B				202
MR-J2S-500B			(Note 1) 502	302
MR-J2S-700B	(Note 2)601	(Note 2)701M	(Note 1) 702	
MR-J2S-11KB	(Note 1) 801・12K1	(Note 1) 11K1M	(Note 1) 11K2	
MR-J2S-15KB	(Note 1)15K1	(Note 1) 15K1M	(Note 1) 15K2	
MR-J2S-22KB	(Note 1) 20K1・25K1	(Note 1) 22K1M	(Note 1) 22K2	

Note 1. These servo motors may not be connected depending on the production time of the servo amplifier. Please refer to appendix.
2. Consult us since the servo amplifier to be used with any of these servo motors is optional.

1.7 Structure

1.7.1 Parts identification

(1) MR-J2S-100B or less

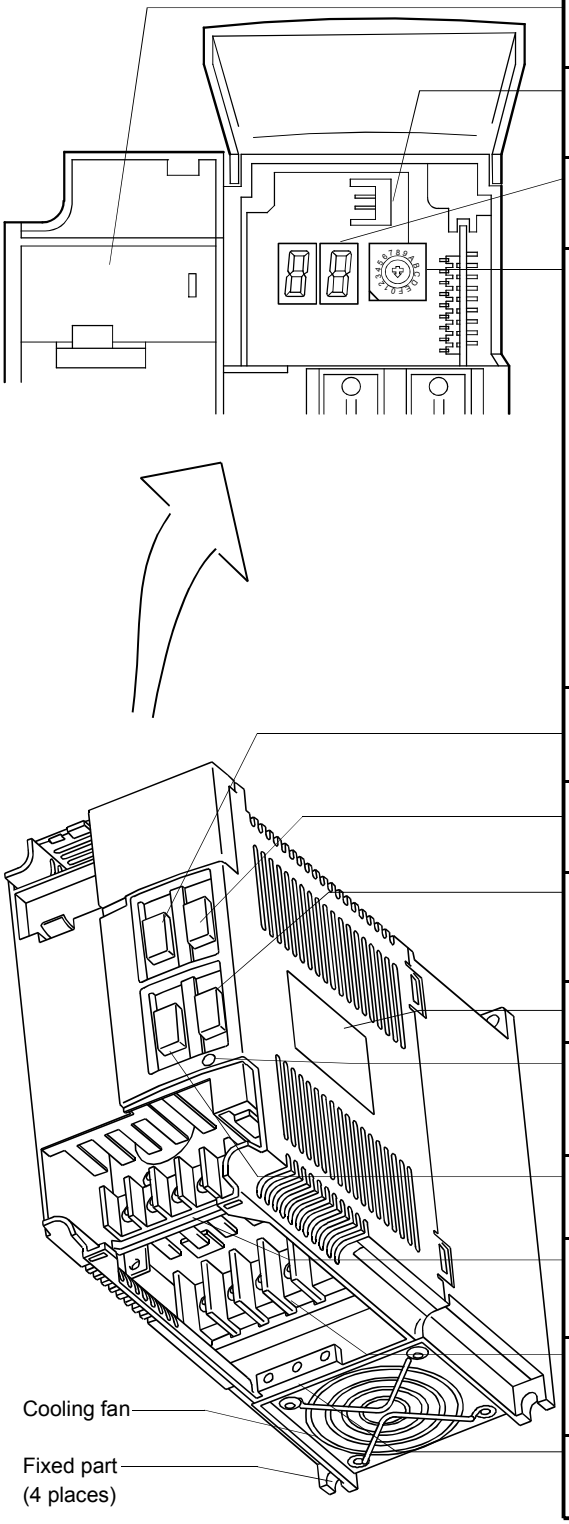


Name/Application	Reference
Battery holder Contains the battery for absolute position data backup.	Section 13.3
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section 13.3
Display The two-digit, seven-segment LED shows the servo status and alarm number.	Chapter 4
Axis select switch (SW1) SW1  Used to set the axis number of the servo amplifier.	Section 3.11
Bus cable connector (CN1A) Used to connect the servo system controller or preceding axis servo amplifier.	Section 3.2
Bus cable connector (CN1B) Used to connect the subsequent axis servo amplifier or termination connector (MR-A-TM).	Section 3.2
Communication connector (CN3) Used to connect a personal computer (RS-232C) or output analog monitor data.	Section 3.2 Section 12.1.5
Rating plate	Section 1.5
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.2 Section 12.1.5
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 3.5.2 Section 10.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply and regenerative option.	Section 3.5.2 Section 10.1 Section 12.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.8 Section 10.1

(2) MR-J2S-200B ▪ MR-J2S-350B

POINT

▪ The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

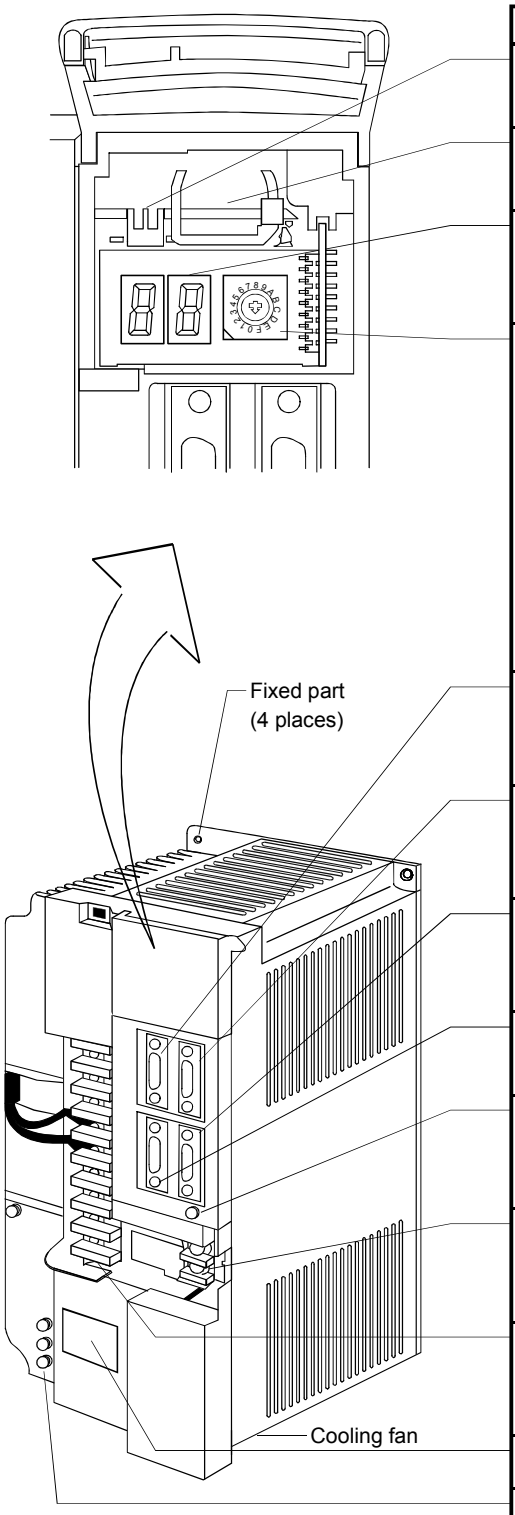


Name/Application	Reference
Battery holder Contains the battery for absolute position data backup.	Section 13.3
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section 13.3
Display The two-digit, seven-segment LED shows the servo status and alarm number.	Chapter 4
Axis select switch (SW1) SW1  Used to set the axis number of the servo amplifier.	Section 3.11
Bus cable connector (CN1A) Used to connect the servo system controller or preceding axis servo amplifier.	Section 3.2
Bus cable connector (CN1B) Used to connect the subsequent axis servo amplifier or termination connector (MR-A-TM).	Section 3.2
Communication connector (CN3) Used to connect a personal computer (RS-232C) or output analog monitor data.	Section 3.2 Section 12.1.5
Rating plate	Section 1.5
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.2 Section 12.1.5
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 3.5.2 Section 10.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply and regenerative option.	Section 3.5.2 Section 10.1 Section 12.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.8 Section 10.1

(3) MR-J2S-500B

POINT

- The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

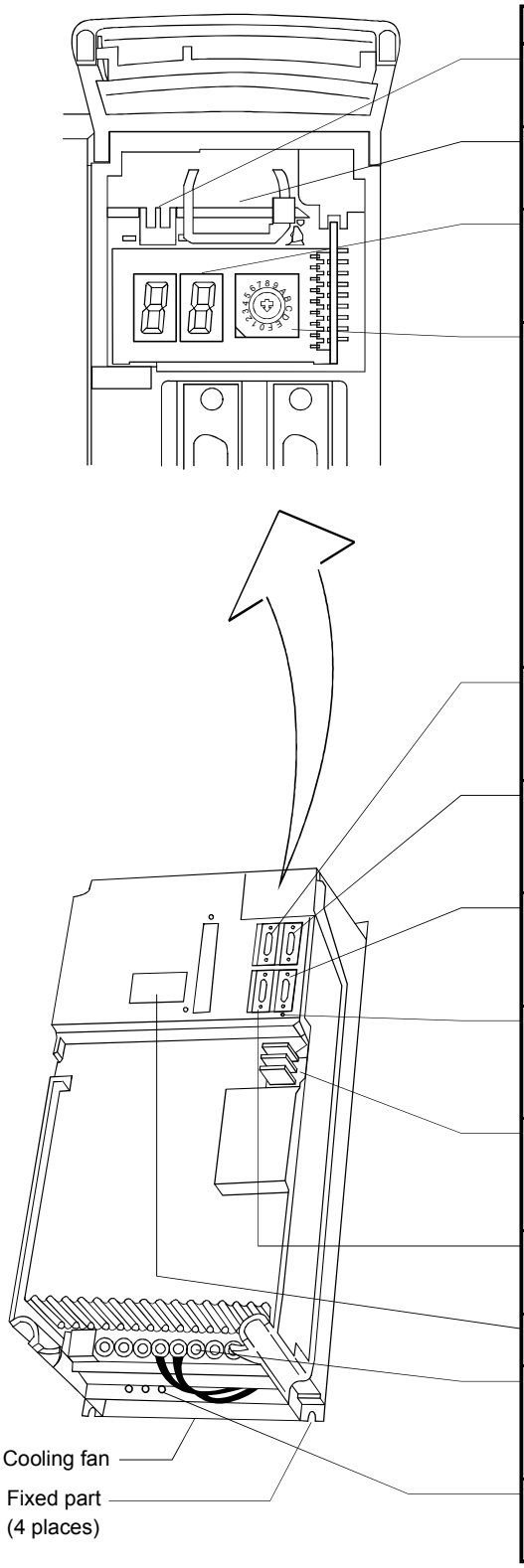


Name/Application	Reference
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section 13.3
Battery holder Contains the battery for absolute position data backup.	Section 13.3
Display The two-digit, seven-segment LED shows the servo status and alarm number.	Chapter 4
Axis select switch (SW1) SW1  Used to set the axis number of the servo amplifier.	Section 3.11
Bus cable connector (CN1A) Used to connect the servo system controller or preceding axis servo amplifier.	Section 3.2
Bus cable connector (CN1B) Used to connect the subsequent axis servo amplifier or termination connector (MR-A-TM).	Section 3.2
Communication connector (CN3) Used to connect a personal computer (RS-232C) or output analog monitor data.	Section 3.2 Section 12.1.5
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.2 Section 12.1.5
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.5.2 Section 10.1 Section 12.1.1
Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option and servo motor.	Section 3.5.2 Section 10.1
Rating plate	Section 1.5
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.8 Section 10.1

(4) MR-J2S-700B

POINT

- The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

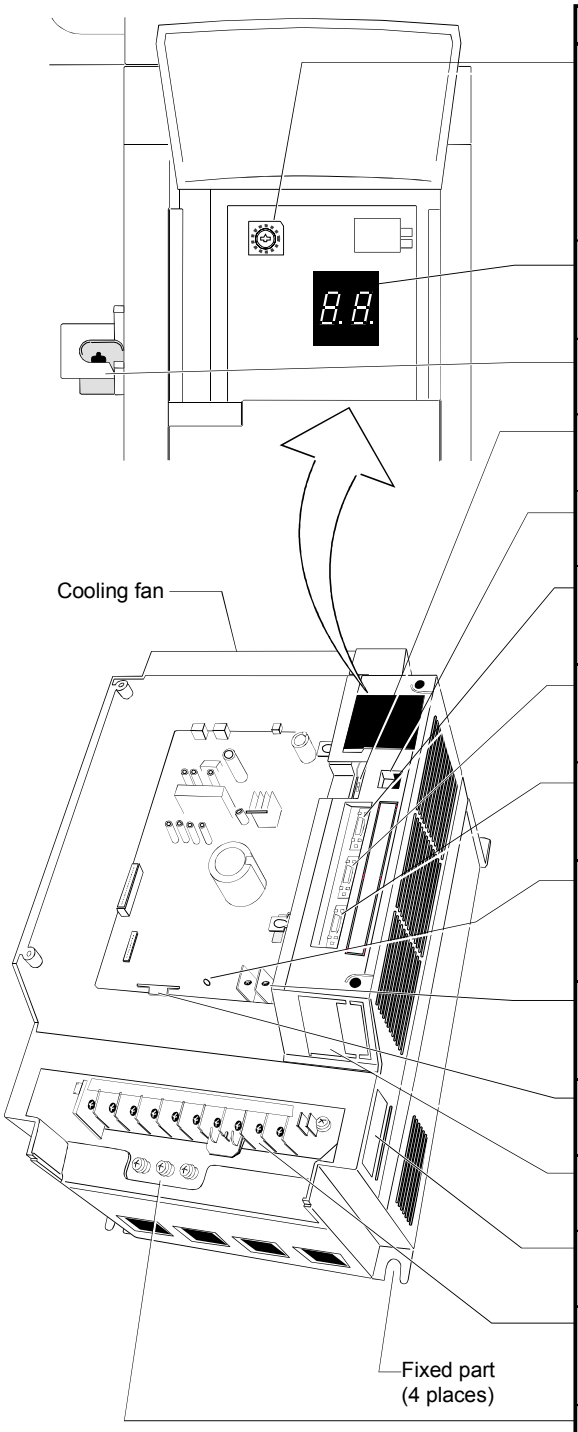


Name/Application	Reference
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section 13.3
Battery holder Contains the battery for absolute position data backup.	Section 13.3
Display The two-digit, seven-segment LED shows the servo status and alarm number.	Chapter 4
Axis select switch (SW1) SW1  Used to set the axis number of the servo amplifier.	Section 3.11
Bus cable connector (CN1A) Used to connect the servo system controller or preceding axis servo amplifier.	Section 3.2
Bus cable connector (CN1B) Used to connect the subsequent axis servo amplifier or termination connector (MR-A-TM).	Section 3.2
Communication connector (CN3) Used to connect a personal computer (RS-232C) or output analog monitor data.	Section 3.2 Section 12.1.5
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.5.2 Section 10.1 Section 12.1.1
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.2 Section 12.1.5
Rating plate	Section 1.5
Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option and servo motor.	Section 3.5.2 Section 10.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.8 Section 10.1

(5) MR-J2S-11KB or more

POINT

・The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.



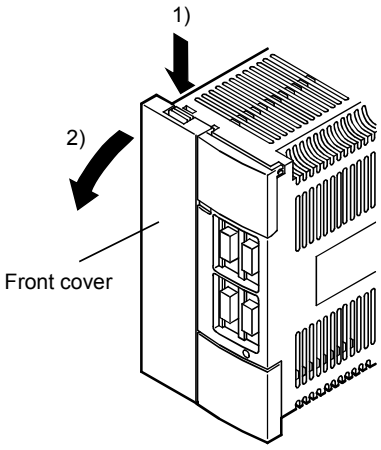
Name/Application	Reference
Axis select switch (SW1) SW1  Used to set the axis number of the servo amplifier.	Section 3.11
Display The two-digit, seven-segment LED shows the servo status and alarm number.	Chapter 4
Battery holder Contains the battery for absolute position data backup.	Section 13.3
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section 13.3
Monitor output terminal (CN4) Used to output monitor values on two channels in the form of analog signals.	Section 3.2 Section 12.1.5
Communication connector (CN3) Used to connect a personal computer (RS-232C) .	Section 3.2 Section 12.1.5
Bus cable connector (CN1A) Used to connect the servo system controller or preceding axis servo amplifier.	Section 3.2
Bus cable connector (CN1B) Used to connect the subsequent axis servo amplifier or termination connector (MR-A-TM).	Section 3.2
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.5.2 Section 10.1 Section 12.1.1
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.2 Section 12.1.5
I/O signal connector (CON2) Used to connect digital I/O signals.	Section 3.2 Section 12.1.5
Rating plate	Section 1.5
Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option and servo motor.	Section 3.5.2 Section 10.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.8 Section 10.1

1.7.2 Removal and reinstallation of the front cover

⚠ CAUTION	▪ 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not.

(1) For MR-J2S-350B or less

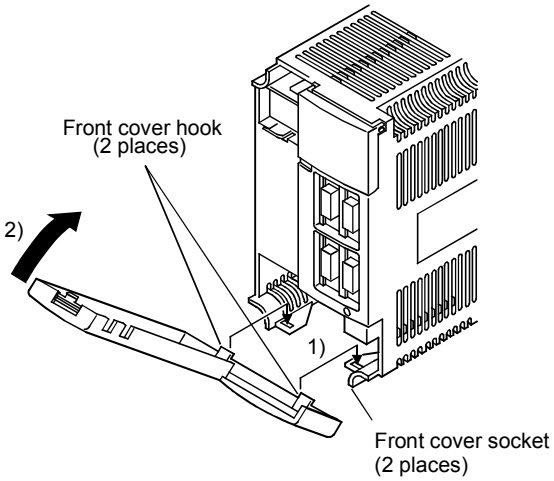
Removal of the front cover



1) Hold down the removing knob.

2) Pull the front cover toward you.

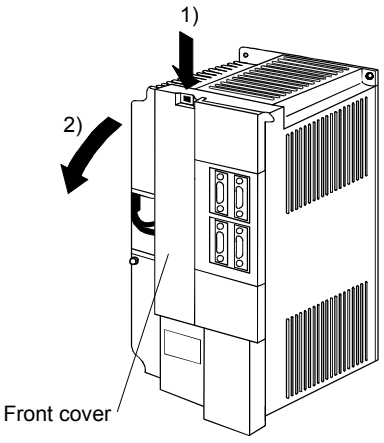
Reinstallation of the front cover



1) Insert the front cover hooks into the front cover sockets of the servo amplifier.
2) Press the front cover against the servo amplifier until the removing knob clicks.

(2) For MR-J2S-500B

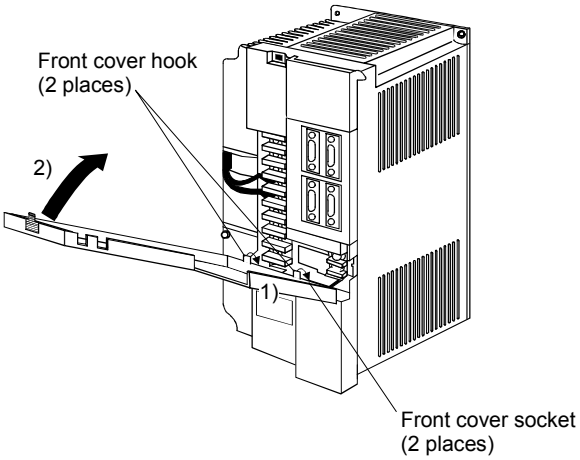
Removal of the front cover



1) Hold down the removing knob.

2) Pull the front cover toward you.

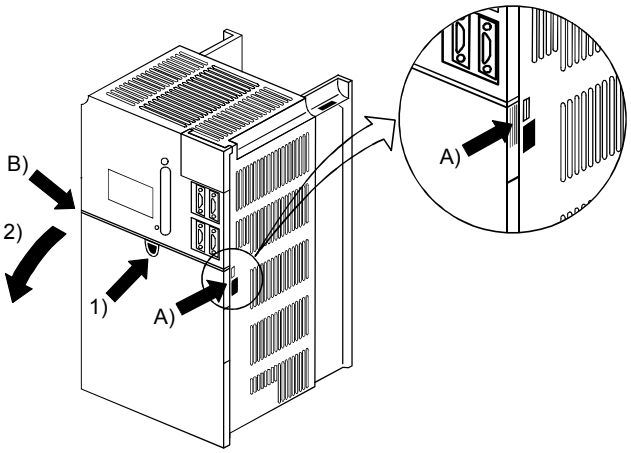
Reinstallation of the front cover



1) Insert the front cover hooks into the front cover sockets of the servo amplifier.
2) Press the front cover against the servo amplifier until the removing knob clicks.

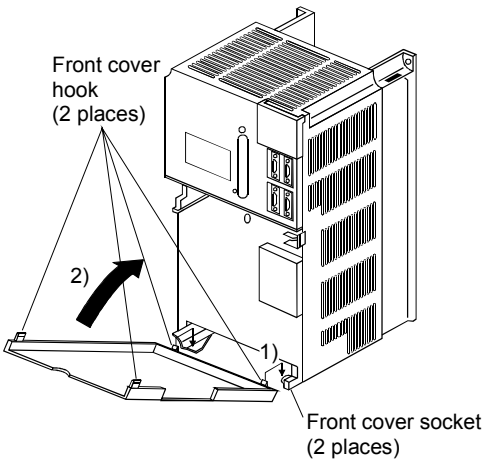
(3) For MR-J2S-700B

Removal of the front cover



1) Push the removing knob A) or B), and put you finger into the front hole of the front cover.
2) Pull the front cover toward you.

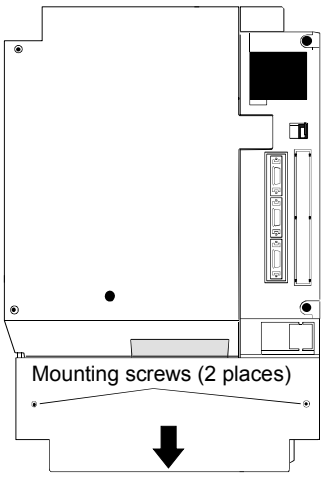
Reinstallation of the front cover



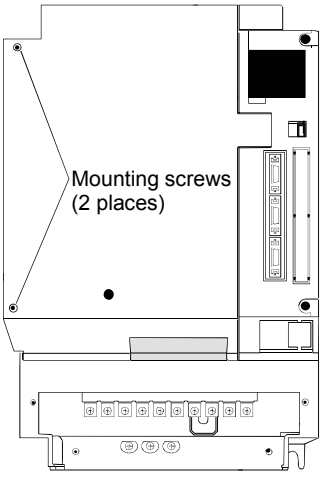
1) Insert the two front cover hooks at the bottom into the sockets of the servo amplifier.
2) Press the front cover against the servo amplifier until the removing knob clicks.

(4) For MR-J2S-11KB or more

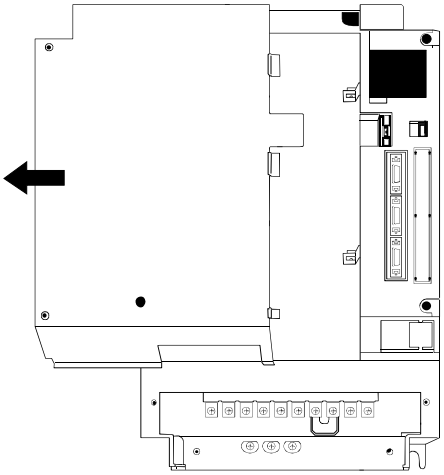
Removal of the front cover



1) Remove the front cover mounting screws (2 places) and remove the front cover.

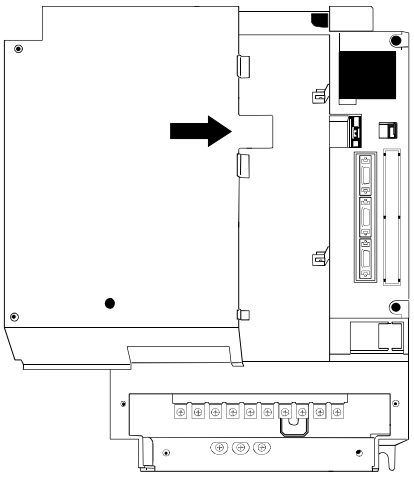


2) Remove the front cover mounting screws (2 places).

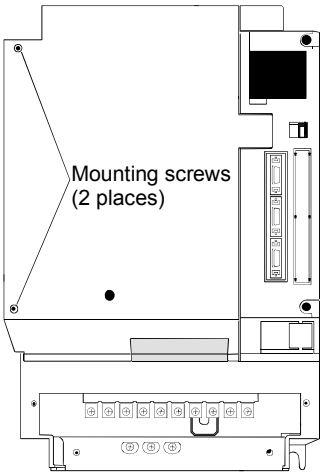


3) Remove the front cover by drawing it in the direction of arrow.

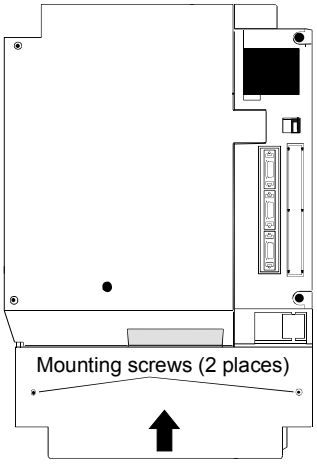
Reinstallation of the front cover



1) Insert the front cover in the direction of arrow.



2) Fix it with the mounting screws (2 places).



3) Fit the front cover and fix it with the mounting screws (2 places).

1.8 Servo system with auxiliary equipment

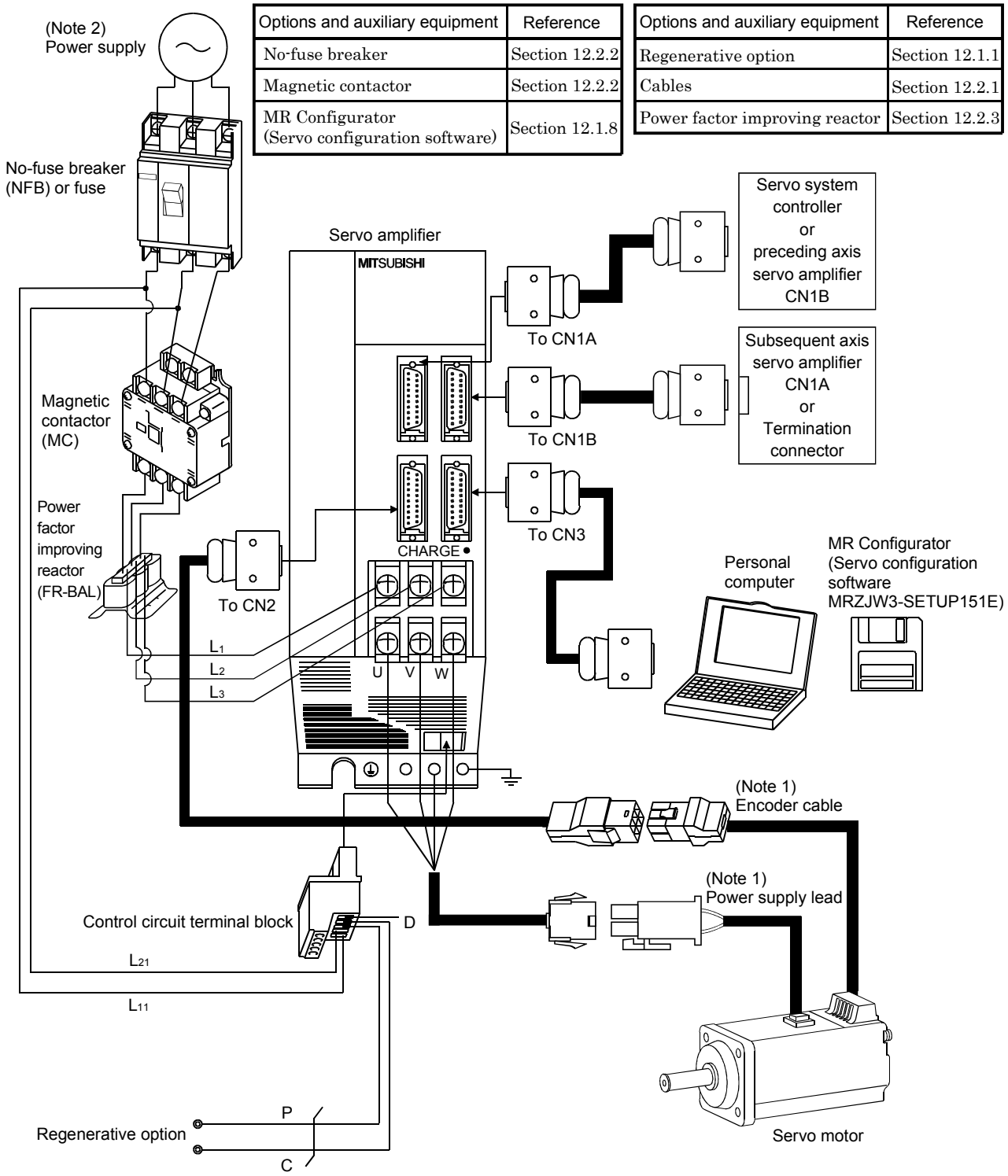
WARNING To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box.

(1) MR-J2S-100B or less

(a) For 3-phase 200V to 230V or 1-phase 230V

Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (Servo configuration software)	Section 12.1.8

Options and auxiliary equipment	Reference
Regenerative option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3



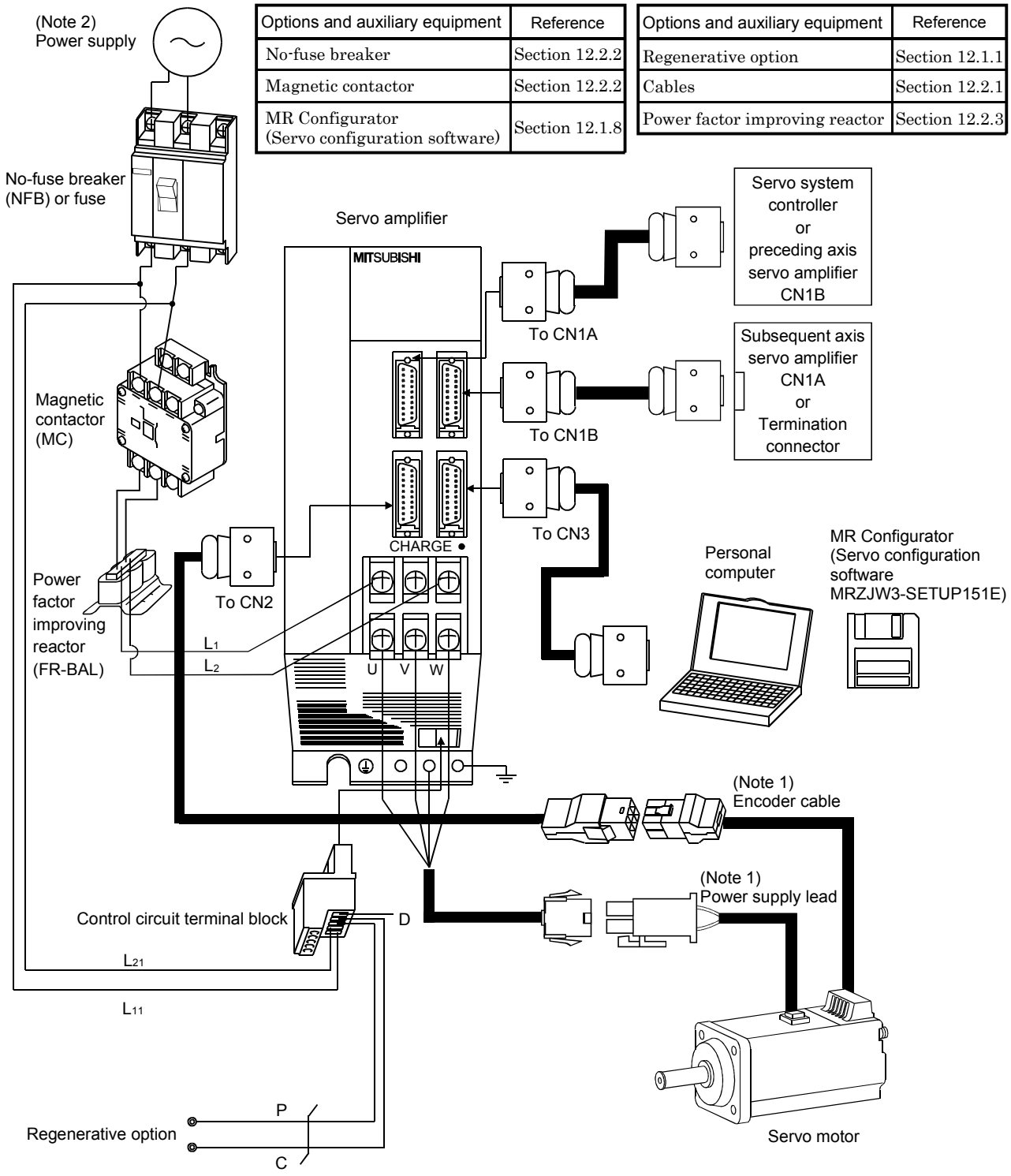
Note 1. The HC-SFS, HC-RFS series have cannon connectors.

2. A 1-phase 230V power supply may be used with the servo amplifier of MR-J2S-70B or less. For 1-phase 230V, connect the power supply to L_1 • L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.

(b) For 1-phase 100V to 120V

Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (Servo configuration software)	Section 12.1.8

Options and auxiliary equipment	Reference
Regenerative option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3

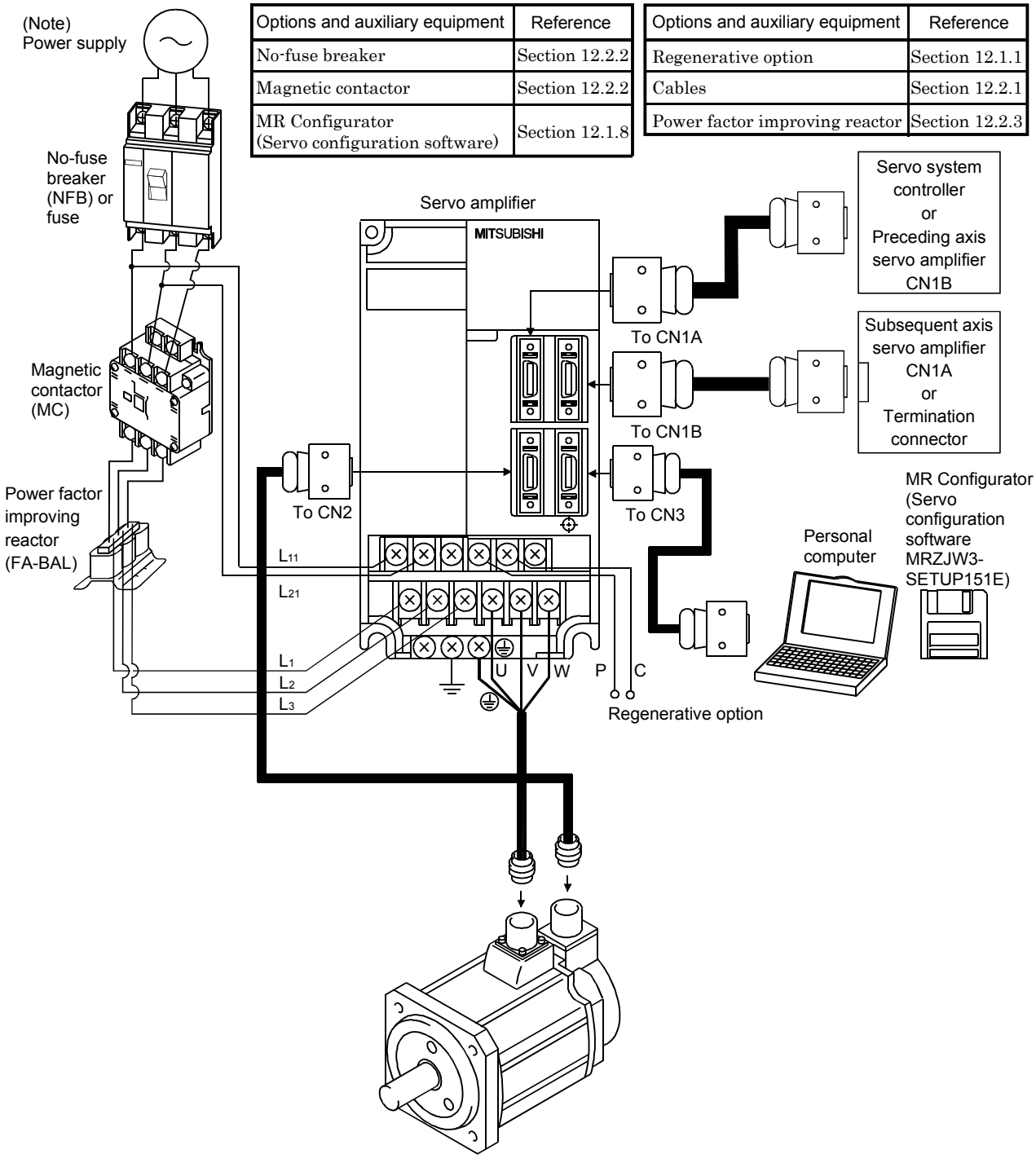


Note 1. The HC-SFS, HC-RFS series have cannon connectors.
2. Refer to section 1.3 for the power supply specification.

(2) MR-J2S-200B ▪ MR-J2S-350B

Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (Servo configuration software)	Section 12.1.8

Options and auxiliary equipment	Reference
Regenerative option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3

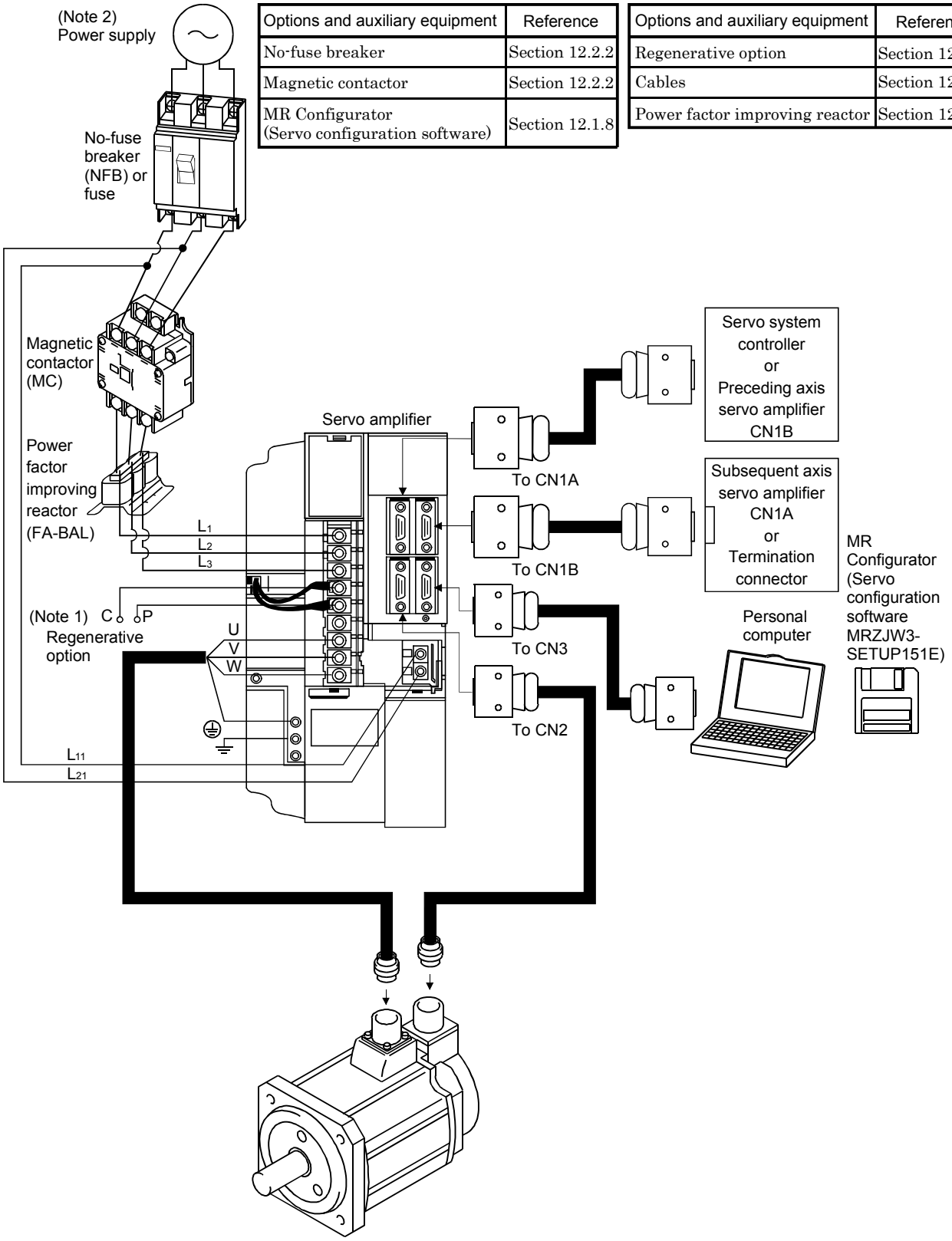


Note. Refer to section 1.3 for the power supply specification.

(3) MR-J2S-500B

Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (Servo configuration software)	Section 12.1.8

Options and auxiliary equipment	Reference
Regenerative option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3

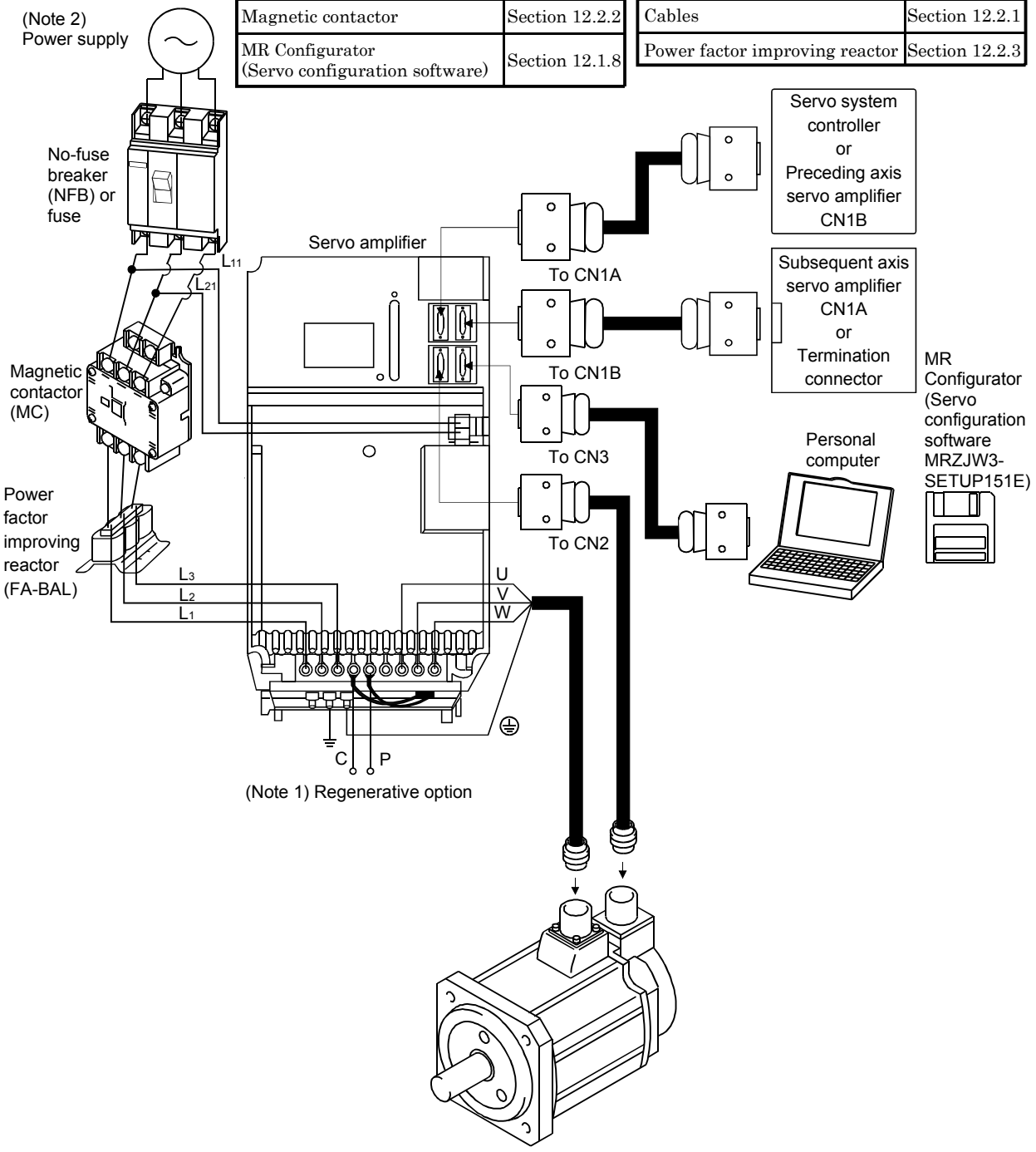


Note 1. When using the regenerative option, remove the lead wires of the built-in regenerative resistor.
2. Refer to section 1.3 for the power supply specification.

(4) MR-J2S-700B

Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (Servo configuration software)	Section 12.1.8

Options and auxiliary equipment	Reference
Regenerative option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3

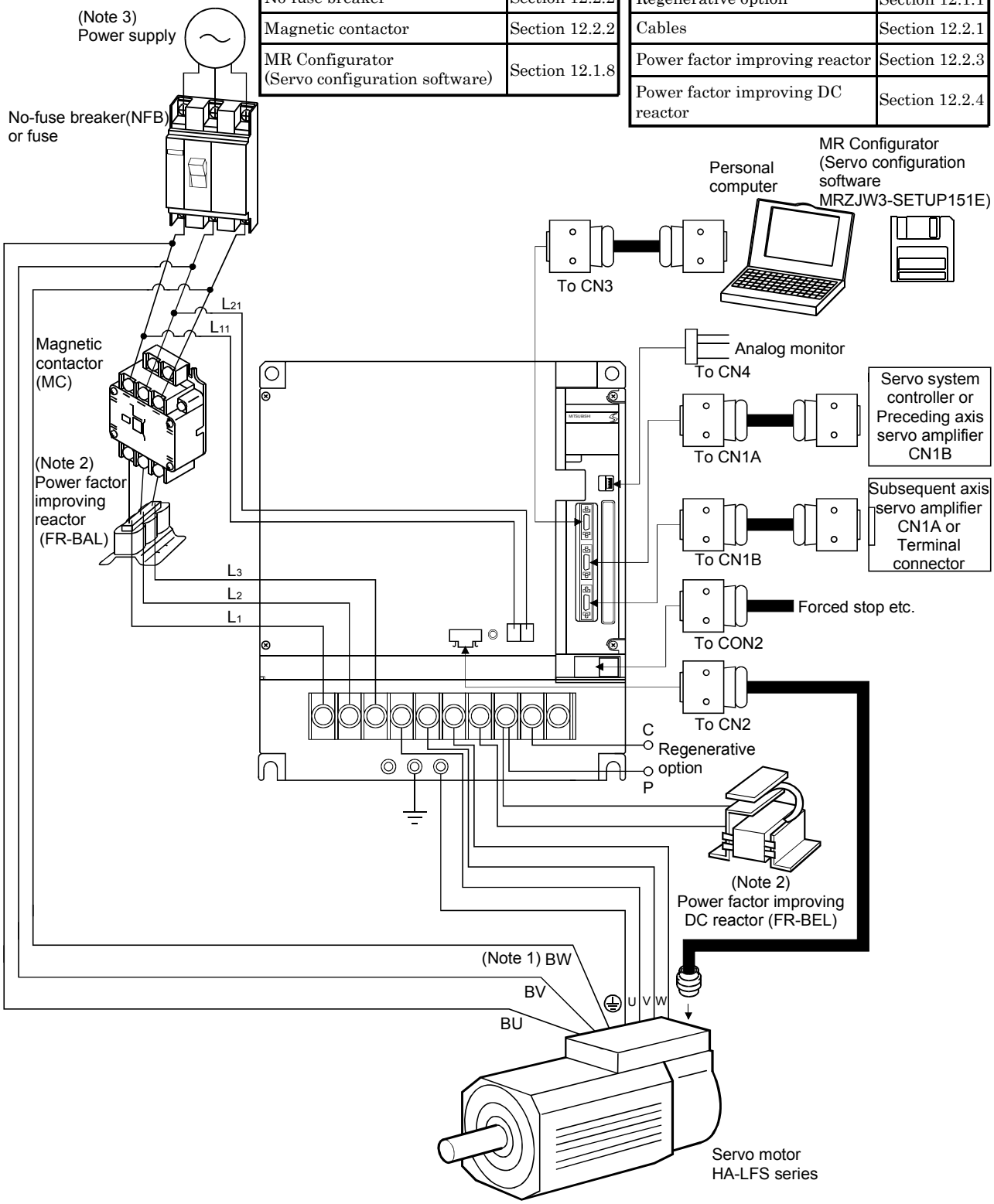


Note 1. When using the regenerative option, remove the lead wires of the built-in regenerative resistor.
2. Refer to section 1.3 for the power supply specification.

(5) MR-J2S-11KB or more

Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (Servo configuration software)	Section 12.1.8

Options and auxiliary equipment	Reference
Regenerative option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3
Power factor improving DC reactor	Section 12.2.4



Note 1. There is no BW when the HA-LFS 11K2 is used.

2. Use either the FR-BAL or FR-BEL power factor improving reactor.

3. Refer to section 1.3 for the power supply specification.

2. INSTALLATION

⚠ CAUTION	・Stacking in excess of the limited number of products is not allowed. ・Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire. ・Install the equipment in a load-bearing place in accordance with this Instruction Manual. ・Do not get on or put heavy load on the equipment to prevent injury. ・Use the equipment within the specified environmental condition range. (For the environmental conditions, refer to section 1.3.) ・Provide an adequate protection to prevent screws, metallic detritus and other conductive matter or oil and other combustible matter from entering the servo amplifier. ・Do not block the intake/exhaust ports of the servo amplifier. Otherwise, a fault may occur. ・Do not subject the servo amplifier to drop impact or shock loads as they are precision equipment. ・Do not install or operate a faulty servo amplifier. ・When the product has been stored for an extended period of time, consult Mitsubishi. ・When treating the servo amplifier, be careful about the edged parts such as the corners of the servo amplifier.

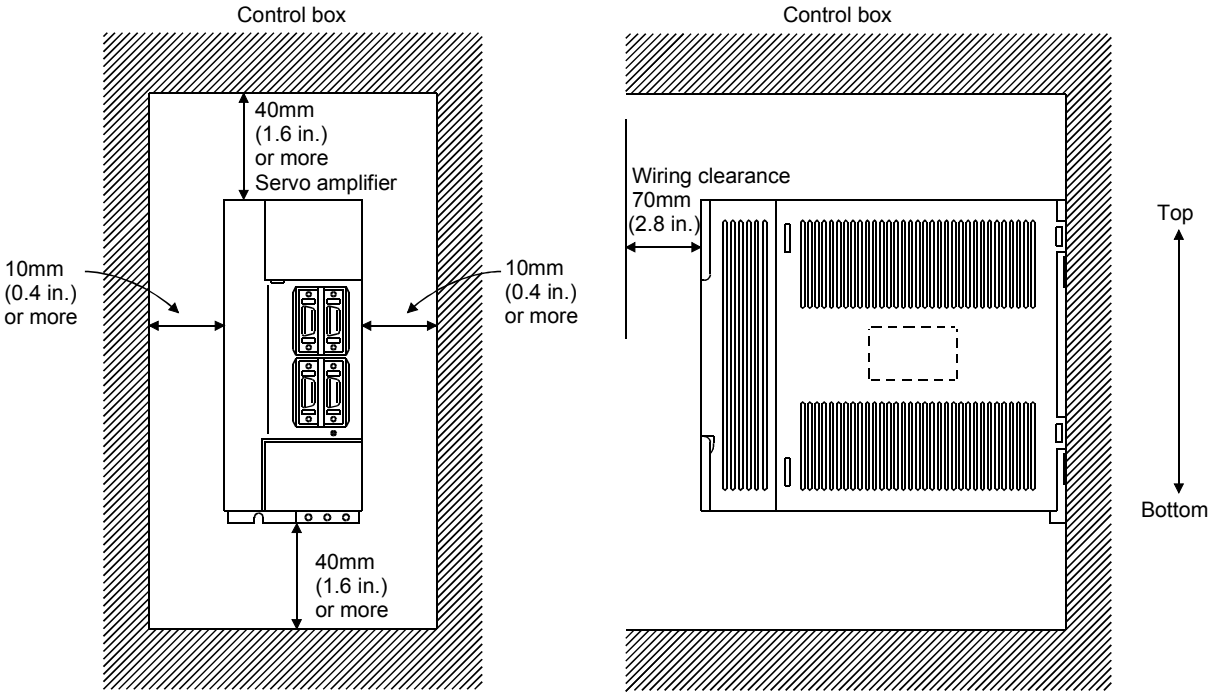
2.1 Environmental conditions

Environment			Conditions
Ambient temperature	In operation	[℃]	0 to +55 (non-freezing)
		[℉]	32 to +131 (non-freezing)
	In storage	[℃]	−20 to +65 (non-freezing)
		[℉]	−4 to +149 (non-freezing)
Ambient humidity	In operation		90%RH or less (non-condensing)
	In storage		
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
Altitude			Max. 1000m (3280 ft) above sea level
Vibration		[m/s^2]	5.9 [m/s^2] or less
		[ft/s^2]	19.4 [ft/s^2] or less

2.2 Installation direction and clearances

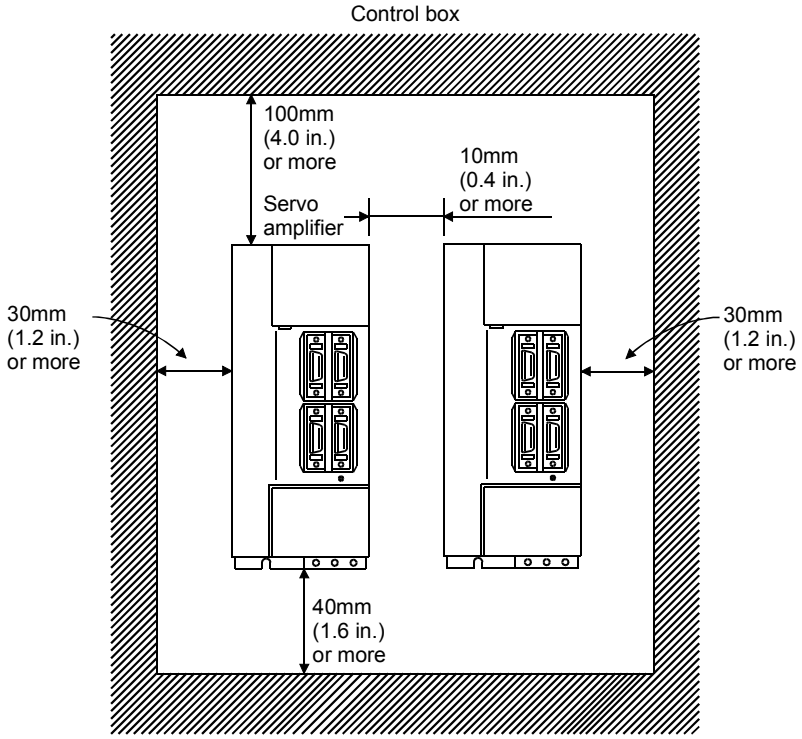
⚠ CAUTION	・The equipment must be installed in the specified direction. Otherwise, a fault may occur. ・Leave specified clearances between the servo amplifier and control box inside walls or other equipment.

(1) Installation of one servo amplifier



(2) Installation of two or more servo amplifiers

Leave a large clearance between the top of the servo amplifier and the internal surface of the control box, and install a cooling fan to prevent the internal temperature of the control box from exceeding the environmental conditions.



(3) 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.

2.3 Keep out foreign materials

(1) When installing the unit in a control box, 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 control box or a cooling fan installed on the ceiling.

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

2.4 Cable stress

(1) The way of clamping the cable must be fully examined so that flexing 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, brake) supplied with the servo motor, and flex the optional encoder cable or the power supply and brake wiring cables. Use the optional encoder cable within the flexing life range. Use the power supply and brake wiring cables within the flexing life of the cables.
(3) Avoid any probability that the cable sheath 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 will move, the flexing radius should be made as large as possible. Refer to section 11.4 for the flexing life.

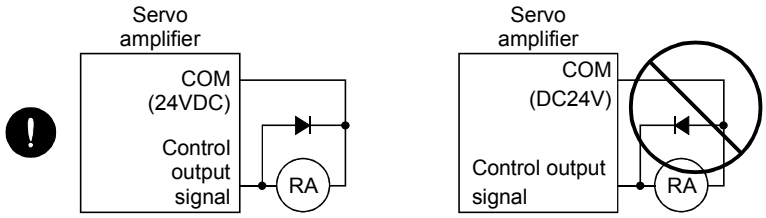
3. SIGNALS AND WIRING

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, always confirm from the front of the servo amplifier whether the charge lamp is off or not.
- Ground the servo amplifier and the servo motor securely.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock.
- The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate, resulting in injury.
- Connect cables to correct terminals to prevent a burst, fault, etc.
- Ensure that polarity (+, −) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay designed for control output should be fitted in the specified direction. Otherwise, the signal is not output due to a fault, disabling the forced stop(EM1) and other protective circuits.



- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) 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.
- During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

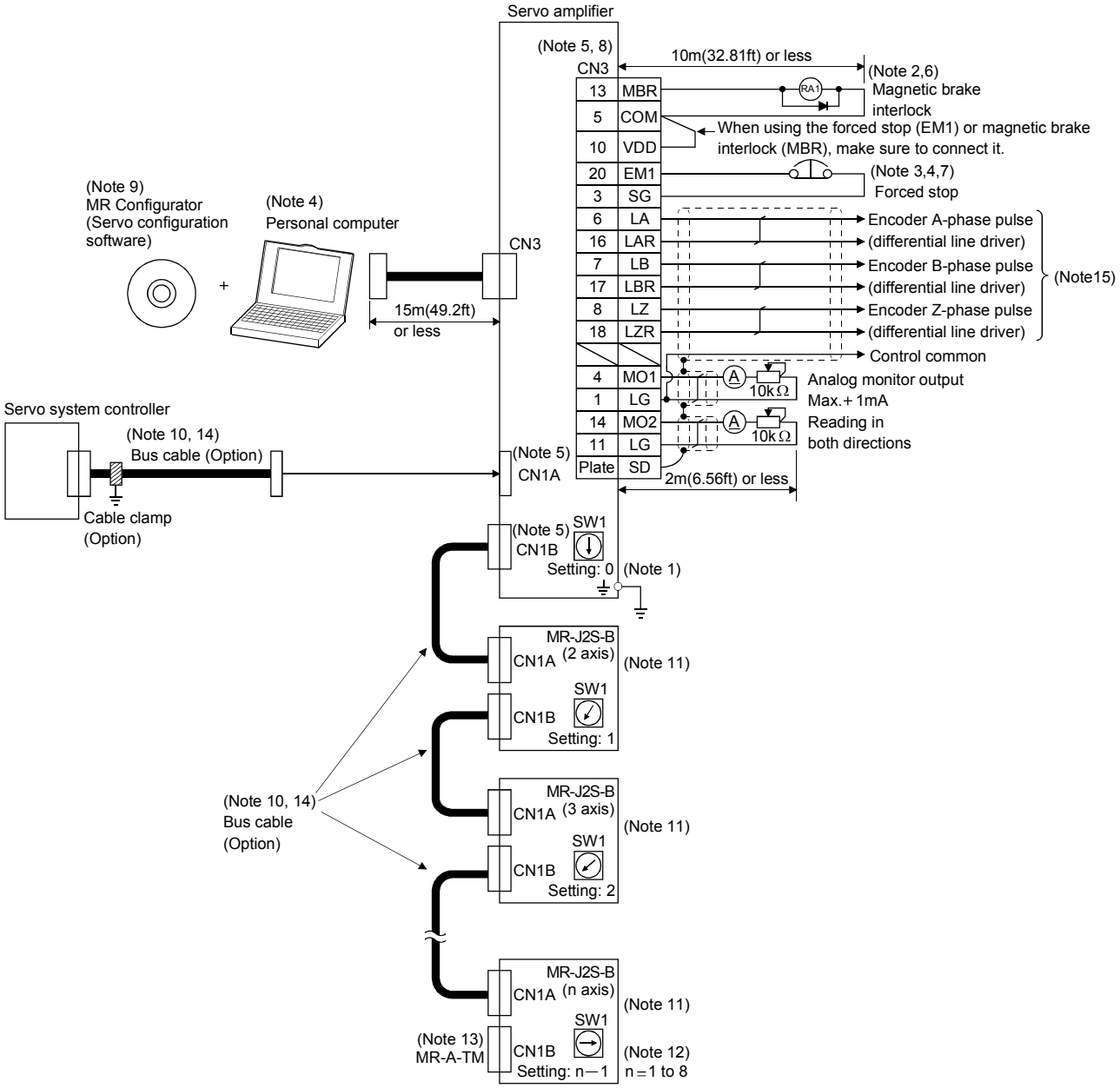
POINT

- CN1A, CN1B, CN2 and CN3 have the same shape. Wrong connection of the connectors will lead to a failure. Connect them correctly.

3.1 Connection example of control signal system

> **POINT**
>
> ▪ Refer to section 3.5 for the connection of the power supply system and to section 3.6 for connection with the servo motor.

3.1.1 MR-J2S-700B or less

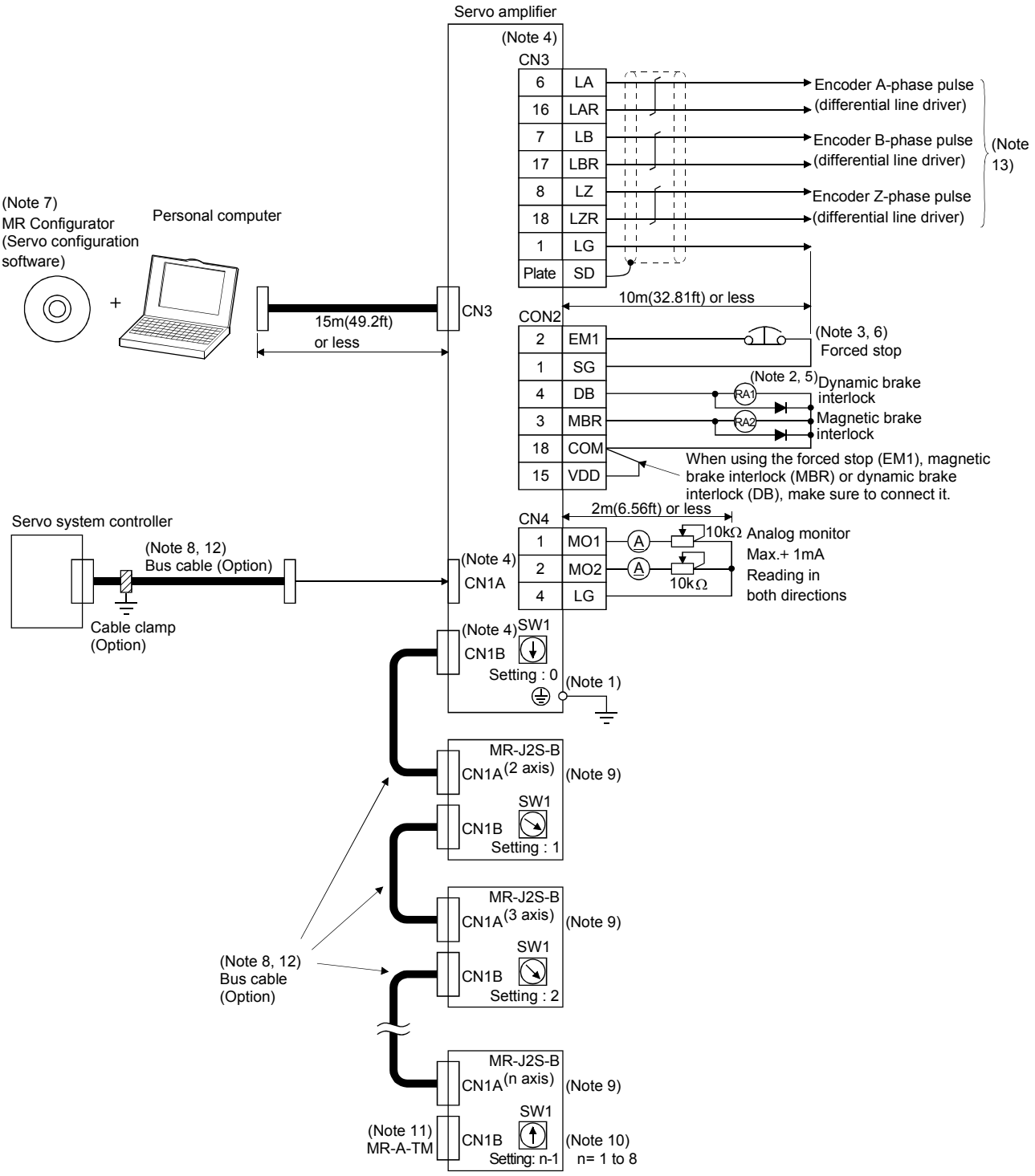


Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the forced stop (EM1) and other protective circuits.
3. If the controller does not have a forced stop function, always install a forced stop switch (Normally closed).
4. When a personal computer is connected for use of the test operation mode, always use the maintenance junction card (MR-J2CN3TM) to enable the use of the forced stop (EM1). (Refer to section 12.1.6)
5. CN1A, CN1B, CN2 and CN3 have the same shape. Wrong connection of the connectors will lead to a fault.
6. The sum of currents that flow in the external relays should be 80mA max.
7. When starting operation, always turn on the forced stop (EM1). (Normally closed contacts) By setting “0001” in parameter No.23, the forced stop (EM1) can be made invalid.
8. When connecting the personal computer together with analog monitor outputs 1, 2, use the maintenance junction card (MR-J2CN3TM). (Refer to section 12.1.3.)
9. Use MRZJW3-SETUP151E.
10. Use the bus cable at the overall distance of 30m(98.4ft) or less. In addition, to improve noise immunity, it is recommended to use a cable clamp and data line filters (three or four filters connected in series) near the connector outlet.
11. The wiring of the second and subsequent axes is omitted.
12. Up to eight axes (n = 1 to 8) may be connected. The MR-J2S-□B/MR-J2-03B5 servo amplifier may be connected on the same bus.
13. Always insert the termination connector (MR-A-TM) into CN1B of the servo amplifier located at the termination.
14. The bus cable used with the SSCNET depends on the preceding or subsequent controller or servo amplifier connected. Refer to the following table and choose the bus cable.

		MR-J2S-□B	MR-J2-03B5
QD75M		MR-J2HBUS□M	
Motion controller	Q172CPU(N)	Q172J2BCBL□M(-B)	
	Q173CPU(N)	Q173J2B△CBL□M	
	A motion	MR-J2HBUS□M-A	
MR-J2S-□B・MR-J2-03B5 Maintenance junction card		MR-J2HBUS□M	

15. When the A1SD75M (AD75M) is used as the controller, encoder pulses may not be output depending on the software version of the controller. For details, refer to the A1SD75M (AD75M) Manual.

3.1.2 MR-J2S-11KB or more



Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the base unit to the protective earth (PE) of the control box.
2. Connect the diode in the correct direction. If it is connected reversely, the interface unit will be faulty and will not output signals, disabling the forced stop and other protective circuits.
3. If the controller does not have a forced stop (EM1) function, always install a forced stop switch (Normally closed).
4. CN1A, CN1B, and CN3 have the same shape. Wrong connection of the connectors will lead to a fault.
5. The sum of currents that flow in the external relays should be 80mA max.
6. When starting operation, always turn on the forced stop (EM1). (Normally closed contacts) By setting "0001" in DRU parameter No.23 of the drive unit, the forced stop (EM1) can be made invalid.
7. Use MRZJW3-SETUP151E.
8. Use the bus cable at the overall distance of 30m(98.4ft) or less. In addition, to improve noise immunity, it is recommended to use a cable clamp and data line filters (three or four filters connected in series) near the connector outlet.
9. The wiring of the second and subsequent axes is omitted.
10. Up to eight axes (n = 1 to 8) may be connected. The MR-J2S-□B/MR-J2-03B5 servo amplifier may be connected on the same bus.
11. Always insert the termination connector (MR-A-TM) into CN1B of the interface unit located at the termination.
12. The bus cable used with the SSCNET depends on the preceding or subsequent controller or servo amplifier connected. Refer to the following table and choose the bus cable.

		MR-J2S-□B	MR-J2-03B5
QD75M		MR-J2HBUS□M	
Motion controller	Q172CPU(N)	Q172J2BCBL□M(-B)	
	Q173CPU(N)	Q173J2B△CBL□M	
	A motion	MR-J2HBUS□M-A	
MR-J2S-□B・MR-J2-03B5 Maintenance junction card		MR-J2HBUS□M	

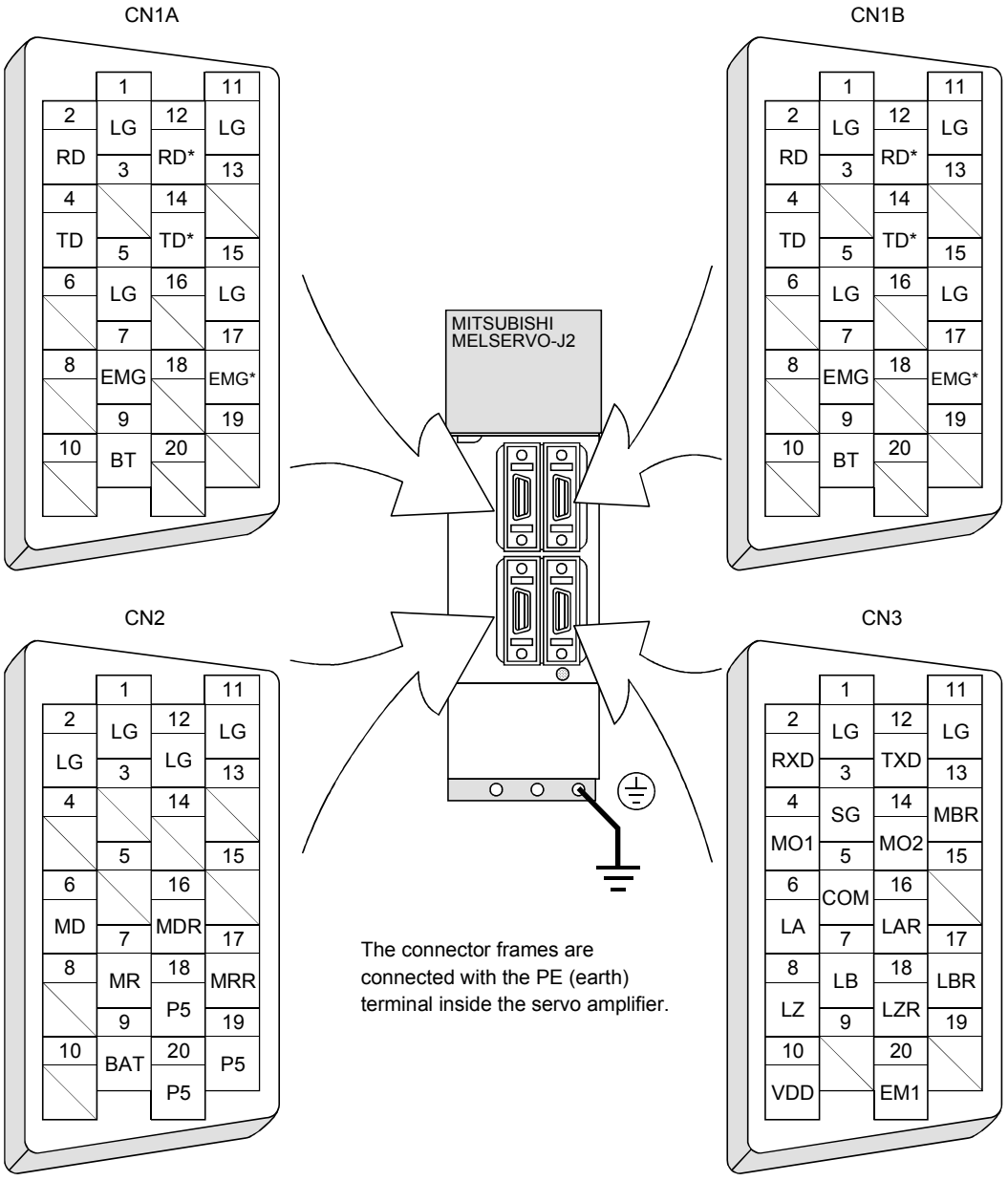
13. When the A1SD75M (AD75M) is used as the controller, encoder pulses may not be output depending on the software version of the controller. For details, refer to the A1SD75M (AD75M) Manual.

3.2 I/O signals

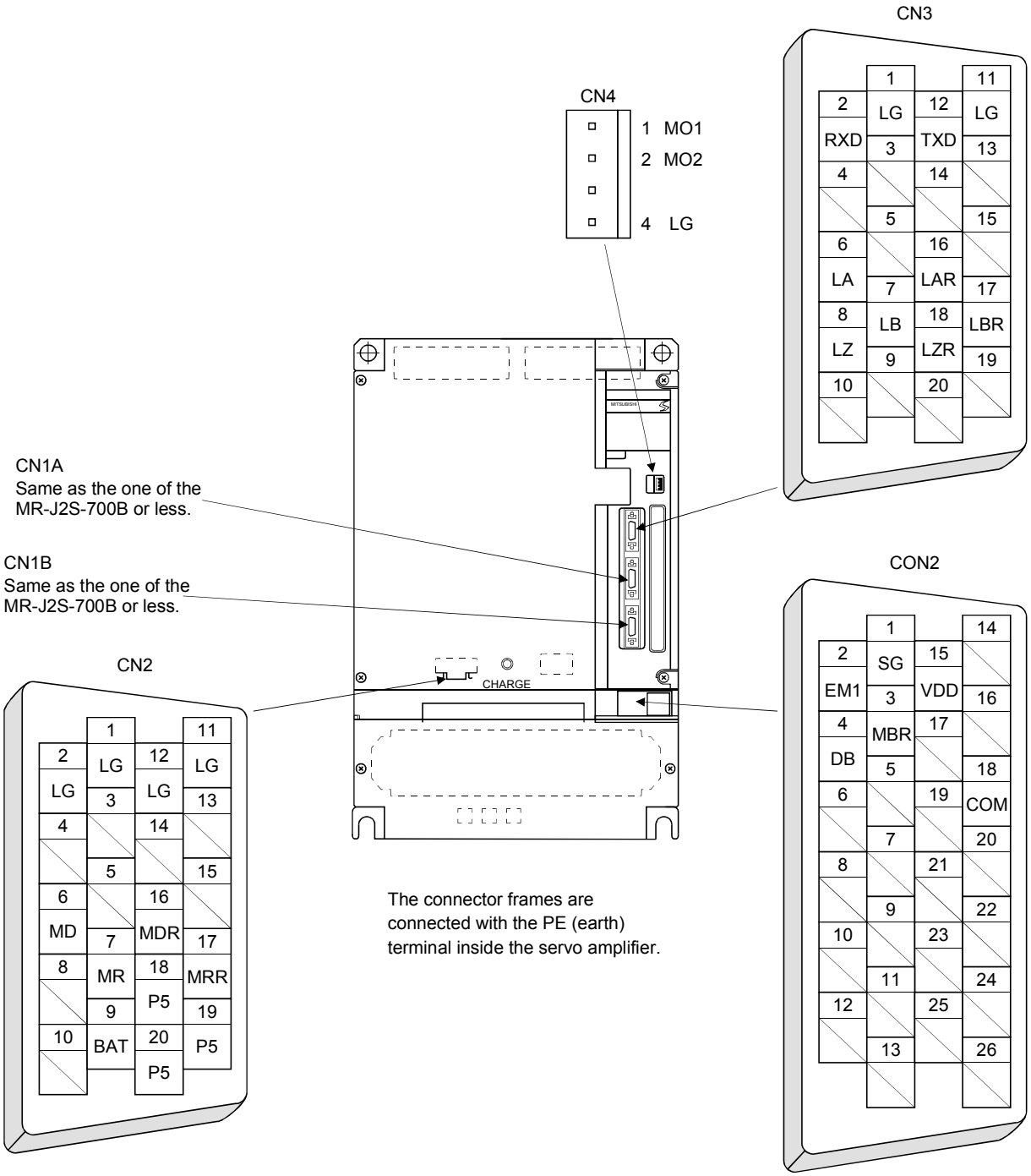
3.2.1 Connectors and signal arrangements

POINT
・The pin configurations of the connectors are as viewed from the cable connector wiring section.

(1) MR-J2S-700B or less



(2) MR-J2S-11KB or more



3.2.2 Signal explanations

For the I/O interfaces (symbols in I/O column in the table), refer to section 3.4.2.

(1) Connector applications

Connector	Name	Function/Application
CN1A	Connector for bus cable from preceding axis.	Used for connection with the controller or preceding-axis servo amplifier.
CN1B	Connector for bus cable to next axis	Used for connection with the next-axis servo amplifier or for connection of the termination connector.
CN2	Encoder connector	Used for connection with the servo motor encoder.
CN3	Communication connector (I/O signal connector)	Used for connection with the personal computer. Serves as an I/O signal connector when the personal computer is not used.
(Note) CN4	Analog monitor output connector	Used to output analog monitor 1 (MO1) and analog monitor 2 (MO2).
(Note) CON2	IO signal connector	Used to input a forced stop and output the dynamic brake interlock(DB), the electromagnetic brake interlock

Note. These connectors are exclusive to the MR-J2S-11KB or more.

(2) I/O signals

(a) Input signal

Signal	Symbol	Connector Pin No.		Function/Application	I/O Division
		7kW or less	11kW or more		
Forced stop	EM1	CN3 20	CON2 2	Turn EM1 off (open EM1 common) to bring the motor to a forced stop state, in which the base circuit is shut off and the dynamic brake is operated. Turn EM1 on (short EM1 common) in the forced stop state to reset that state.	DI-1

(b) Output signals

Signal	Symbol	Connector Pin No.		Function/Application	I/O Division
		7kW or less	11kW or more		
Electromagnetic brake interlock	MBR	CN3 13	CON2 3	In the servo-off or alarm status, MBR turns off.	DO-1
Dynamic brake interlock	DB		CON2 4	When using this signal, set □1□□ in the parameter No. 2. When the dynamic brake is operated, DB turns off.	DO-1
Encoder A-phase pulse (Differential line driver)	LA LAR	CN3 6 CN3 16	CN3 6 CN3 16	Outputs pulses per servo motor revolution set in parameter No.38 in the differential line driver system. 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.	DO-2
Encoder B-phase pulse (Differential line driver)	LB LBR	CN3 7 CN3 17	CN3 7 CN3 17		
Encoder Z-phase pulse (Differential line driver)	LZ LZR	CN3 8 CN3 18	CN3 8 CN3 18	The zero-phase signal of the encoder is output in the differential line driver system.	DO-2
Analog monitor 1	MO1	CN3 4	CN4 1	Used to output the data set in parameter No.22 to across MO1-LG in terms of voltage. Resolution 10 bits	Analog output
Analog monitor 2	MO2	CN3 14	CN4 2	Used to output the data set in parameter No.22 to across MO2-LG in terms of voltage. Resolution 10 bits	Analog output

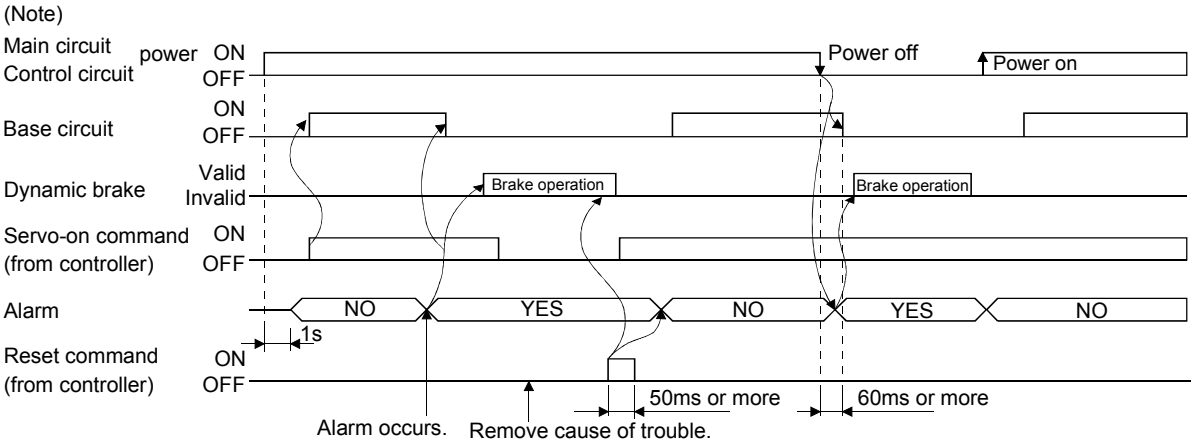
(c) Power supply

Signal	Symbol	Connector Pin No.		Function/Application
		7kW or less	11kW or more	
Internal power output for interface	VDD	CN3 10	CON2 15	Driver power output terminal for digital interface. Used to output +24V±10% to across VDD-COM. Connect with COM. Permissible current: 80mA
Power input for digital interface	COM	CN3 5	CON2 18	Driver power input terminal for digital interface. Used to input 24VDC (200mA or more) for input interface. Connect with VDD.
Common for digital interface	SG	CN3 3	CON2 1	Common terminal to VDD and COM. Pins are connected internally. Separated from LG.
Control common	LG	CN3 1 11	CN4 4	Common terminal to MO1 and MO2.
Shield	SD	Plate	Plate	Connect the external conductor of the shield cable.

3.3 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.

When an alarm occurs in the servo amplifier, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To deactivate the alarm, power the control circuit off, then on 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.



Note. Switch off the main circuit power as soon as an alarm occurs.

(1) Overcurrent, overload 1 or overload 2

If operation is repeated by switching control circuit power off, then on to reset the overcurrent (32), overload 1 (50) or overload 2 (51) alarm after its occurrence, without removing its cause, the servo amplifier and servo motor may become faulty due to temperature rise. Securely remove the cause of the alarm and also allow about 30 minutes for cooling before resuming operation.

(2) Regenerative alarm

If operation is repeated by switching control circuit power off, then on to reset the regenerative (30) alarm after its occurrence, the external regenerative resistor will generate heat, resulting in an accident.

(3) Instantaneous power failure

Undervoltage (10) occurs when the input power is in either of the following statuses.

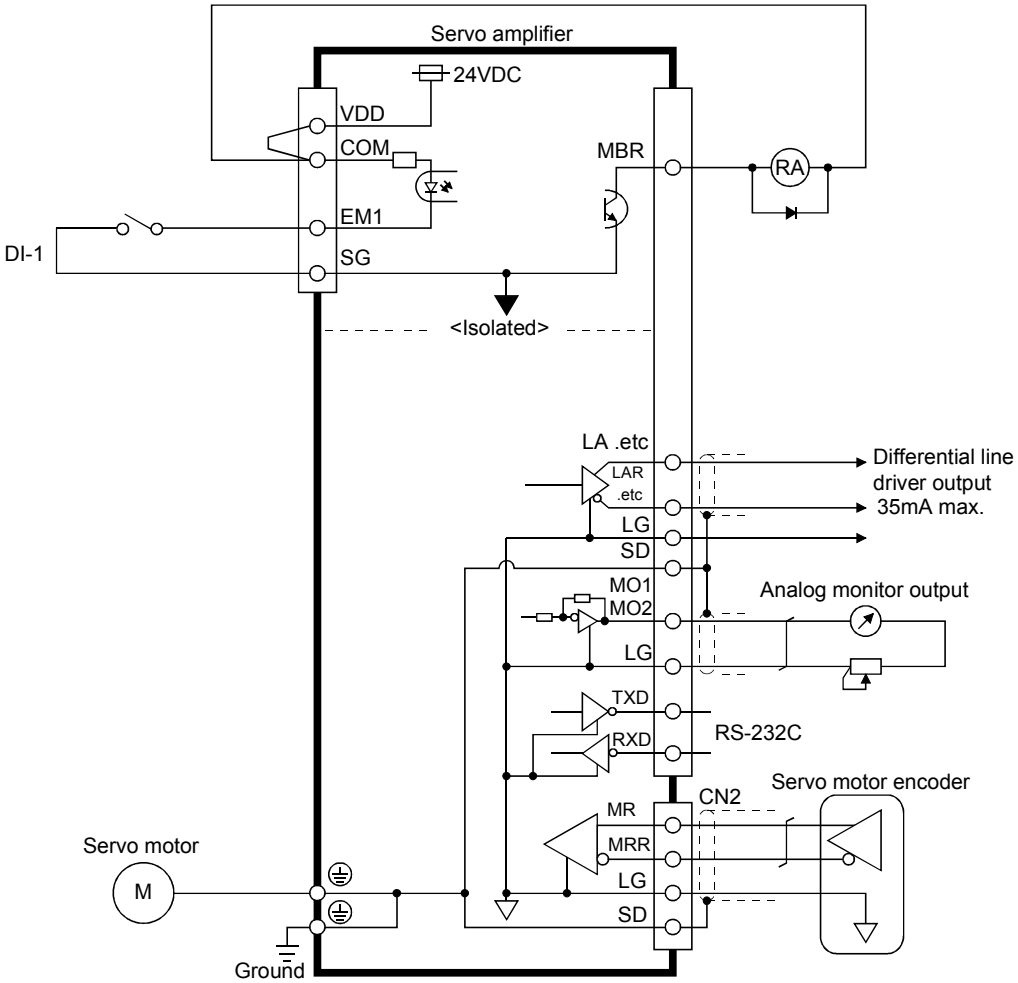
・A power failure of the control circuit power supply continues for 60ms or longer and the control circuit is not completely off.

・The bus voltage dropped to 200VDC or less for the MR-J2S □B, or to 158VDC or less for the MR-J2S □B1.

3.4 Interfaces

3.4.1 Common line

The following diagram shows the power supply and its common line.
To conform to the EMC directive, refer to the EMC Installation Guide lines (IB(NA)67310).

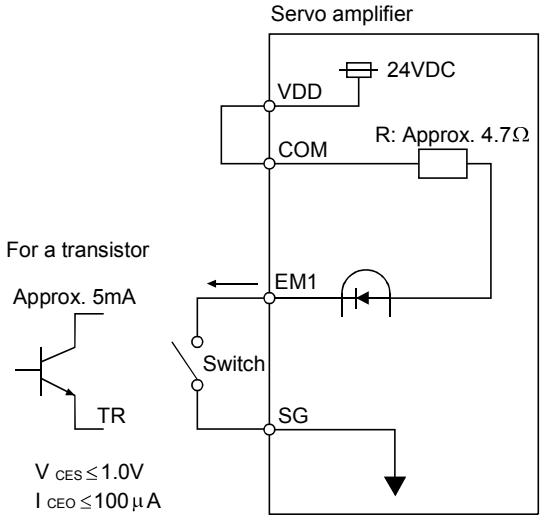


3.4.2 Detailed description of the interfaces

This section gives the details of the I/O signal interfaces (refer to I/O Division in the table) indicated in section 3.2.2.
Refer to this section and connect the interfaces with the external equipment.

(1) Digital input interface DI-1

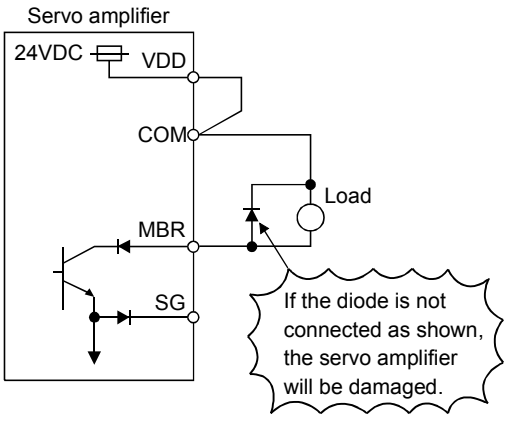
Give a signal with a relay or open collector transistor.



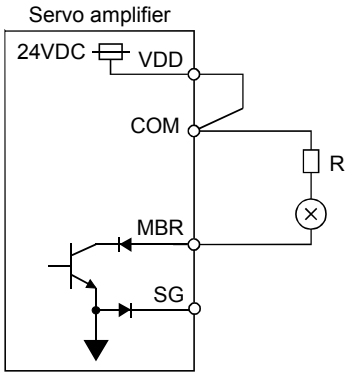
(2) Digital output interface DO-1

A lamp, relay or photocoupler can be driven. Provide a diode (D) for an inductive load, or an inrush current suppressing resistor (R) for a lamp load. (Permissible current: 40mA or less, inrush current: 100mA or less)

(a) Inductive load



(b) Lamp load

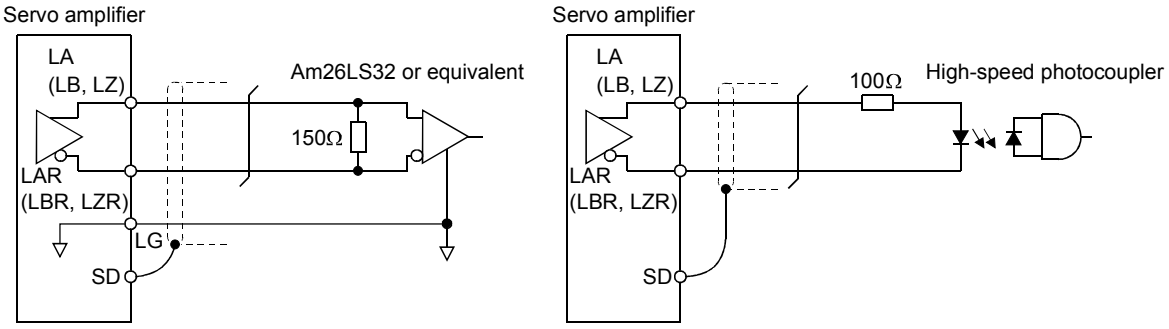


(3) Encoder pulse output DO-2

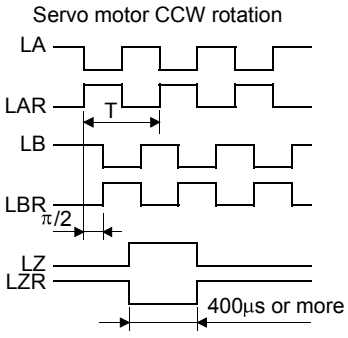
(Differential line driver system)

1) Interface

Max. output current: 35mA



2) Pulse output



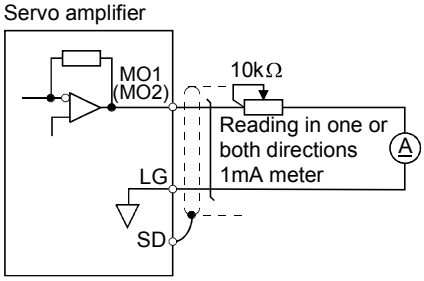
Time cycle (T) is determined by the settings of parameter No.33 and 38.

(4) Analog output

Output voltage :± 10V

Max. output current :1mA

Resolution :10bit



3.5 Power line circuit

⚠ CAUTION	・Always connect a magnetic contactor (MC) between the main circuit power supply and L_1, L_2, and L_3 of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions. ・Switch power off at detection of an alarm. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

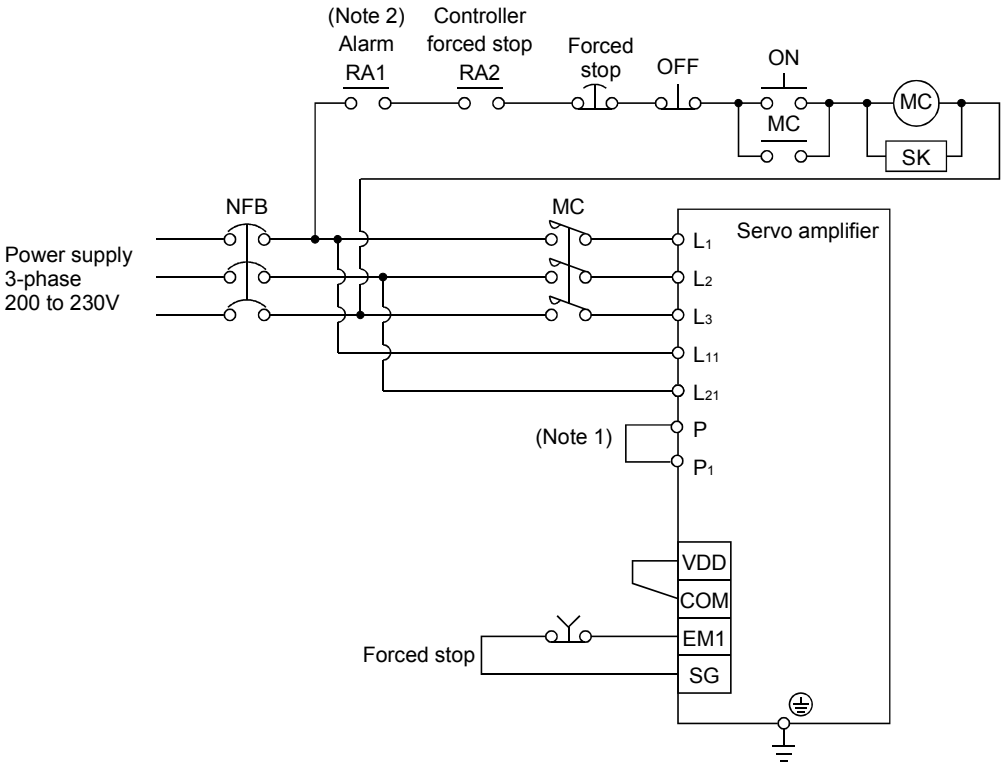
POINT

・For the power line circuit of the MR-J2S-11KB to MR-J2S-22KB, refer to section 3.12 where the power line circuit is shown together with the servo motor connection diagram.

3.5.1 Connection example

Wire the power supply/main circuit as shown below so that power is shut off and the servo-on command turned off as soon as an alarm occurs, a servo forced stop is made valid, or a controller forced stop is made valid. A no-fuse breaker (NFB) must be used with the input cables of the power supply.

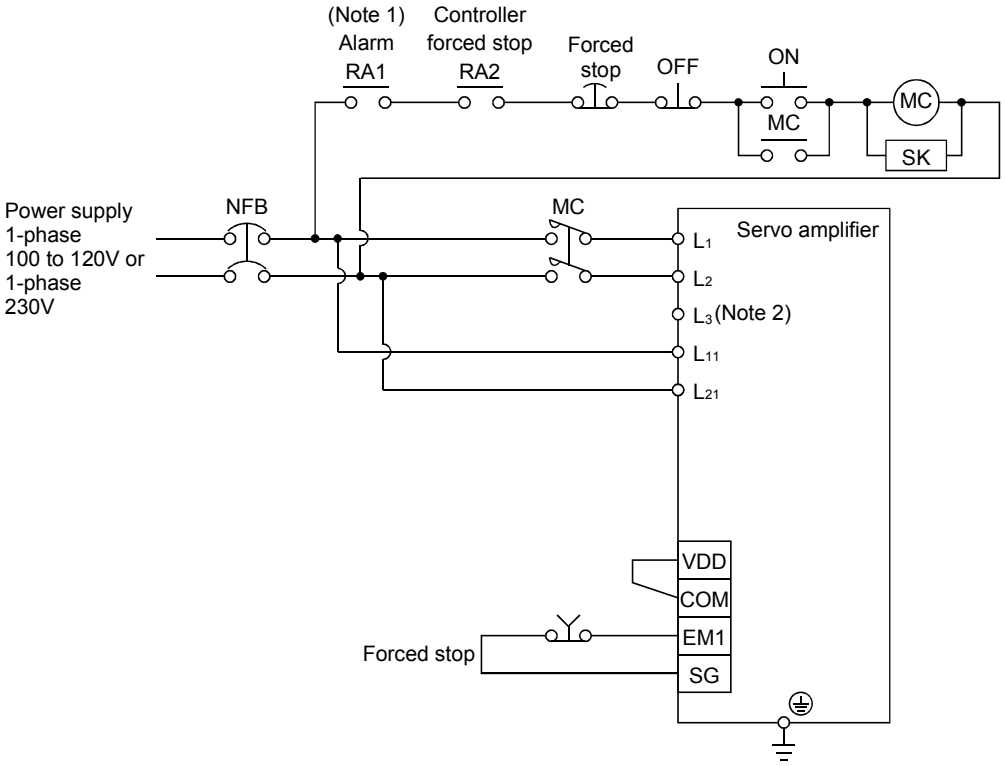
(1) For 3-phase 200 to 230V power supply



Note 1. Make sure to connect P_1-P. (Factory-wired.) When using the power factor improving DC reactor, refer to section 12.2.4.

2. Configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side.

(2) For 1-phase 100 to 120V or 1-phase 230V power supply



Note 1. Configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side.

2. Not provided for 1-phase 100 to 120V.

3.5.2 Terminals

The positions and signal arrangements of the terminal blocks change with the capacity of the servo amplifier. Refer to section 10.1.

<table>
<tr><th>Symbol</th><th>Connection Target (Application)</th><th>Description</th></tr>
<tr><td>L_1, L_2, L_3</td><td>Main circuit power supply</td><td>Supply L_1, L_2 and L_3 with the following power.
For 1-phase 230V, connect the power supply to L_1/L_2 and leave L_3 open.
<table>
<tr><th>Servo amplifier / Power supply</th><th>MR-J2S-10B to 70B</th><th>MR-J2S-100B to 22K</th><th>MR-J2S-10B1 to 40B1</th></tr>
<tr><td>3-phase 200 to 230VAC, 50/60Hz</td><td colspan="2">L_1・L_2・L_3</td><td></td></tr>
<tr><td>1-phase 230VAC, 50/60Hz</td><td>L_1・L_2</td><td></td><td></td></tr>
<tr><td>1-phase 100 to 120VAC, 50/60Hz</td><td></td><td></td><td>L_1・L_2</td></tr>
</table></td></tr>
<tr><td>U, V, W</td><td>Servo motor output</td><td>Connect to the servo motor power supply terminals (U, V, W). During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.</td></tr>
<tr><td>P_1</td><td>Power factor improving DC reactor</td><td>When not using the power factor improving DC reactor, connect P_1 and P. (Factory-wired.)
When using the power factor improving DC reactor, disconnect the wiring across P_1-P and connect the power factor improving DC reactor across P_1-P.
Refer to section 11.2.4.</td></tr>
<tr><td>L_{11}, L_{21}</td><td>Control circuit power supply</td><td>Supply the following power to L_{11}, L_{21}.
<table>
<tr><th>Servo amplifier / Power supply</th><th>MR-J2S-10B to 700B</th><th>MR-J2S-10B1 to 40B1</th></tr>
<tr><td>1-phase 200 to 230VAC, 50/60Hz</td><td>L_{11}・L_{21}</td><td></td></tr>
<tr><td>1-phase 100 to 120VAC, 50/60Hz</td><td></td><td>L_{11}・L_{21}</td></tr>
</table></td></tr>
<tr><td>P, C, D</td><td>Regenerative option</td><td>1) MR-J2S-350B or less
When using servo amplifier built-in regenerative resistor, connect between P and D terminals. (Wired by default)
When using regenerative option, disconnect between P-D terminals and connect regenerative option to P terminal and C terminal.
2) MR-J2S-500B and 700B
MR-J2S-500B and 700B do not have D terminal.
When using servo amplifier built-in regenerative resistor, connect P terminal and C terminal. (Wired by default)
When using regenerative option, disconnect P terminal and C terminal and connect regenerative option to P terminal and C terminal.
Refer to section 12.1.1.
3) MR-J2S-11KB to 22KB
MR-J2S-11KB to 22KB do not have D terminal.
When not using the power supply return converter and the brake unit, make sure to connect the regenerative option to P terminal and C terminal.
Refer to section 12.1.1.</td></tr>
<tr><td>N</td><td>Return converter
Brake unit</td><td>When using return converter/brake unit, connect to P terminal and N terminal.
Do not connect to servo amplifier MR-J2S-200B or less.
For details, refer to section 12.1.2 to 12.1.3.</td></tr>
<tr><td>  </td><td>Protective earth (PE)</td><td>Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.</td></tr>
</table>

3.5.3 Power-on sequence

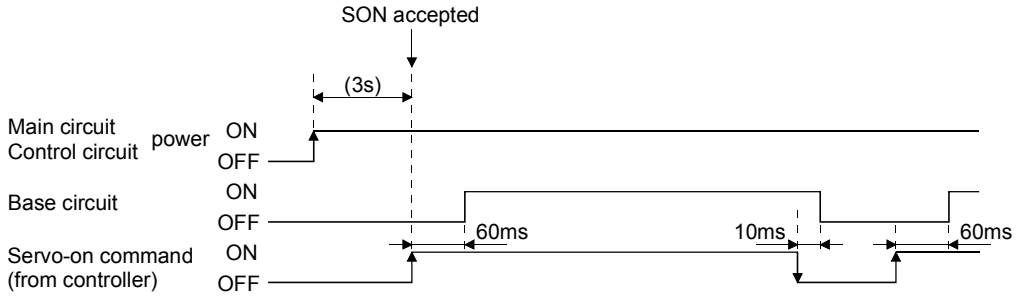
(1) Power-on procedure

1) Always wire the power supply as shown in above section 3.5.1 using the magnetic contactor with the main circuit power supply (3-phase 200V: L1, L2, L3, 1-phase 230V: L1, L2, 1-phase: L1 ▪ L2). Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Switch on the control circuit power supply L11, L21 simultaneously with the main circuit power supply or before switching 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 servo amplifier will operate properly.

3) The servo amplifier can accept the servo-on command within 3s the main circuit power supply is switched on. (Refer to paragraph (2) in this section.)

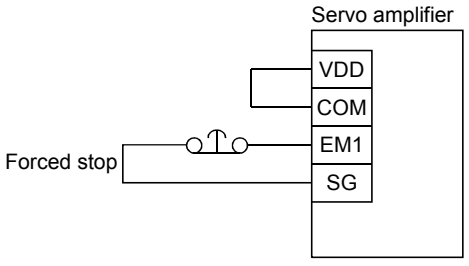
(2) Timing chart



(3) Forced stop

⚠ CAUTION	▪ Install an forced stop circuit externally to ensure that operation can be stopped and power shut off immediately.

If the controller does not have a forced stop function, make up a circuit that switches off main circuit power as soon as EM1 is turned off at a forced stop. When EM1 is turned off, the dynamic brake is operated to stop the servo motor. At this time, the display shows the servo forced stop warning (E6). During ordinary operation, do not use forced stop (EM1) to alternate stop and run. The service life of the servo amplifier may be shortened.



3.6 Connection of servo amplifier and servo motor

3.6.1 Connection instructions

⚠ WARNING	・Insulate the connections of the power supply terminals to prevent an electric shock.

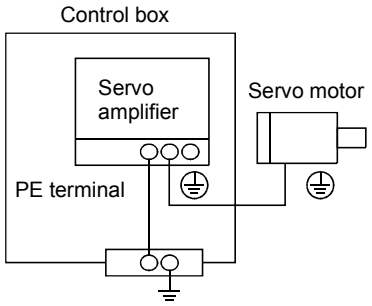
⚠ CAUTION	・Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and servo motor. Otherwise, the servo motor will operate improperly. ・Do not connect AC power supply directly to the servo motor. Otherwise, a fault may occur.

POINT

・Do not apply the test lead bars or like of a tester directly to the pins of the connectors supplied with the servo motor. Doing so will deform the pins, causing poor contact.

The connection method differs according to the series and capacity of the servo motor and whether or not the servo motor has the electromagnetic brake. Perform wiring in accordance with this section.

(1) For grounding, connect the earth cable of the servo motor to the protective earth (PE) terminal (⏚) of the servo amplifier and connect the ground cable of the servo amplifier to the earth via the protective earth of the control box. Do not connect them directly to the protective earth of the control panel.



(2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.

3.6.2 Connection diagram

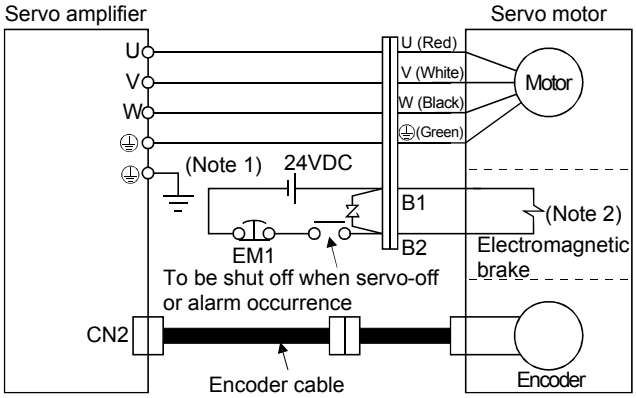
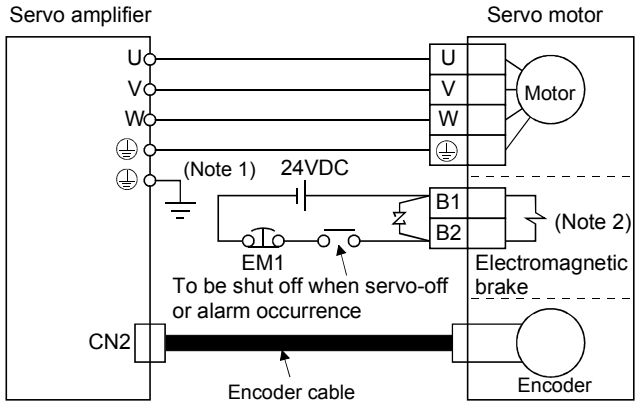
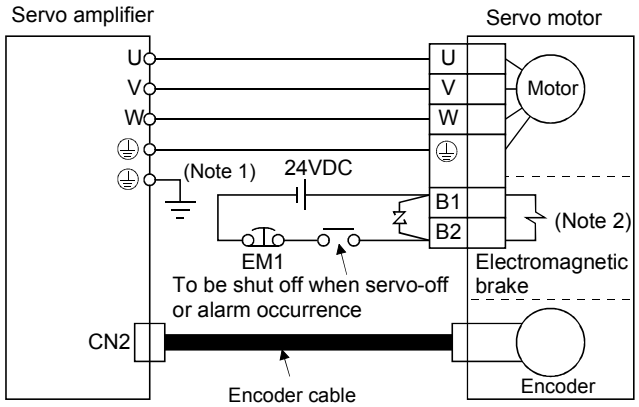
⚠ CAUTION	・During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

POINT

・ For the connection diagram of the MR-J2S-11KB to MR-J2S-22KB, refer to section 3.12 where the connection diagram is shown together with the power line circuit.

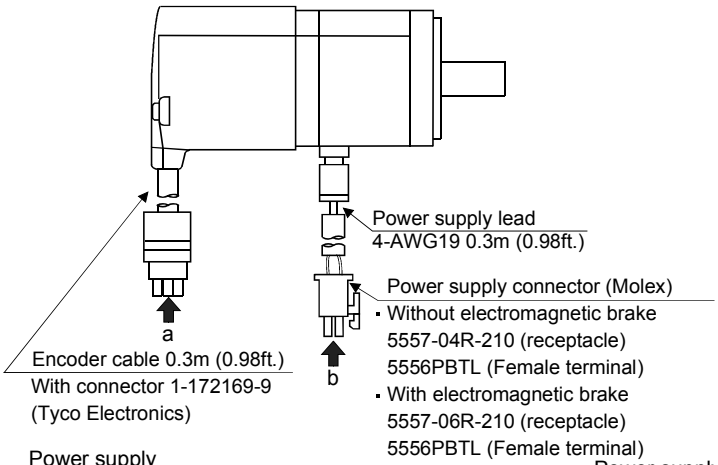
The following table lists wiring methods according to the servo motor types. Use the connection diagram which conforms to the servo motor used. For cables required for wiring, refer to section 12.2.1. For encoder cable connection, refer to section 12.1.4. For the signal layouts of the connectors, refer to section 3.6.3.

For the servo motor connector, refer to chapter 3 of the Servo Motor Instruction Manual.

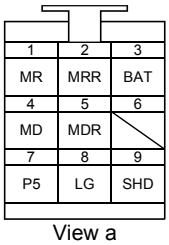
Servo motor	Connection diagram
HC-KFS053 (B) to 73 (B) HC-MFS053 (B) to 73 (B) HC-UFS13 (B) to 73 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.
HC-SFS121 (B) to 301 (B) HC-SFS202 (B) to 702 (B) HC-SFS203 (B) ▪ 353 (B) HC-UFS202 (B) to 502 (B) HC-RFS353 (B) ▪ 503 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.
HC-SFS81 (B) HC-SFS52 (B) to 152 (B) HC-SFS53 (B) to 153 (B) HC-RFS103 (B) to 203 (B) HC-UFS72 (B) ▪ 152 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.

3.6.3 I/O terminals

(1) HC-KFS・HC-MFS・HC-UFS3000r/min series

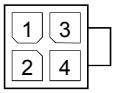


Encoder connector signal arrangement



View a

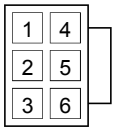
Power supply connector 5557-04R-210



View b

Pin	Signal
1	U
2	V
3	W
4	⏚(Earth)

Power supply connector 5557-06R-210

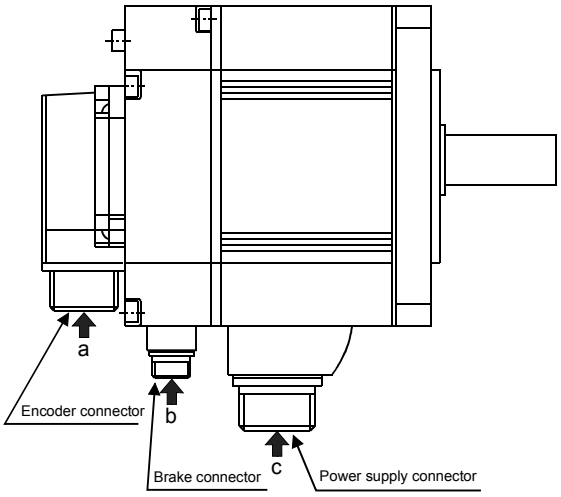


View b

Pin	Signal
1	U
2	V
3	W
4	⏚(Earth)
5	(Note) B1
6	(Note) B2

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

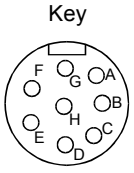
(2) HC-SFS・HC-RFS・HC-UFS2000 r/min series



Servo motor	Servo motor side connectors		
	For power supply	For encoder	Electromagnetic brake connector
HC-SFS81(B) HC-SFS52(B) to 152(B) HC-SFS53(B) to 153(B)	CE05-2A22-23PD-B	MS3102A20-29P	The connector for power is shared.
HC-SFS121(B) to 301(B) HC-SFS202(B) to 502 (B) HC-SFS203(B)・353(B)	CE05-2A24-10PD-B		MS3102A10SL-4P
HC-SFS702(B)	CE05-2A32-17PD-B		
HC-RFS103(B) to 203 (B)	CE05-2A22-23PD-B		The connector for power is shared.
HC-RFS353(B)・503(B)	CE05-2A24-10PD-B		
HC-UFS72(B)・152(B)	CE05-2A22-23PD-B		
HC-UFS202(B) to 502(B)	CE05-2A24-10PD-B		MS3102A10SL-4P

Power supply connector signal arrangement

CE05-2A22-23PD-B

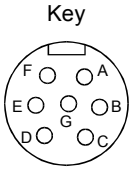


View c

Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)
E	
F	
G	(Note) B1
H	(Note) B2

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

CE05-2A24-10PD-B

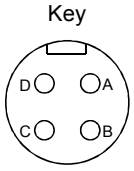


View c

Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)
E	(Note) B1
F	(Note) B2
G	

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

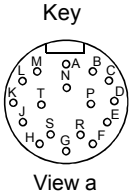
CE05-2A32-17PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

Encoder connector signal arrangement

MS3102A20-29P



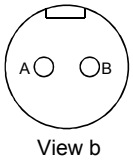
View a

Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	

Pin	Signal
K	
L	
M	
N	SD
P	
R	LG
S	P5
T	

Electromagnetic brake connector signal arrangement

MS3102A10SL-4P



View b

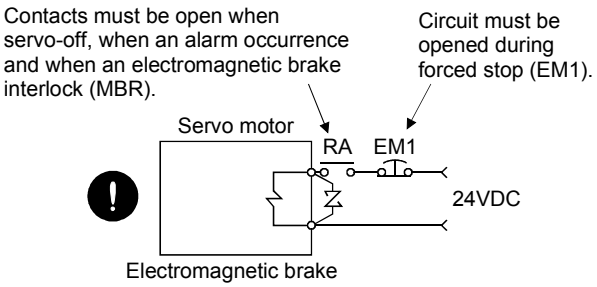
Pin	Signal
A	(Note)B1
B	(Note)B2

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

3.7 Servo motor with electromagnetic brake

⚠ CAUTION

- Configure the electromagnetic brake circuit so that it is activated not only by the interface unit signals but also by a forced stop (EM1).



- The electromagnetic brake is provided for holding purpose and must not be used for ordinary braking.
- Before performing the operation, be sure to confirm that the electromagnetic brake operates properly.

POINT

- Refer to the Servo Motor Instruction Manual for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.

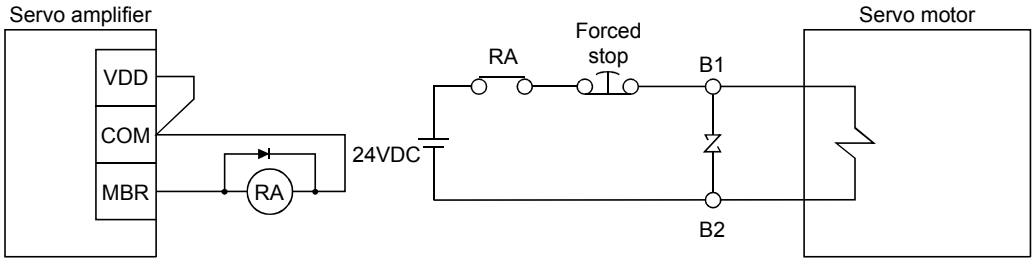
Note the following when the servo motor equipped with electromagnetic brake is used.

1) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.

2) The brake will operate when the power (24VDC) switches off.

3) Switch off the servo-on command after the servo motor has stopped.

(1) Connection diagram



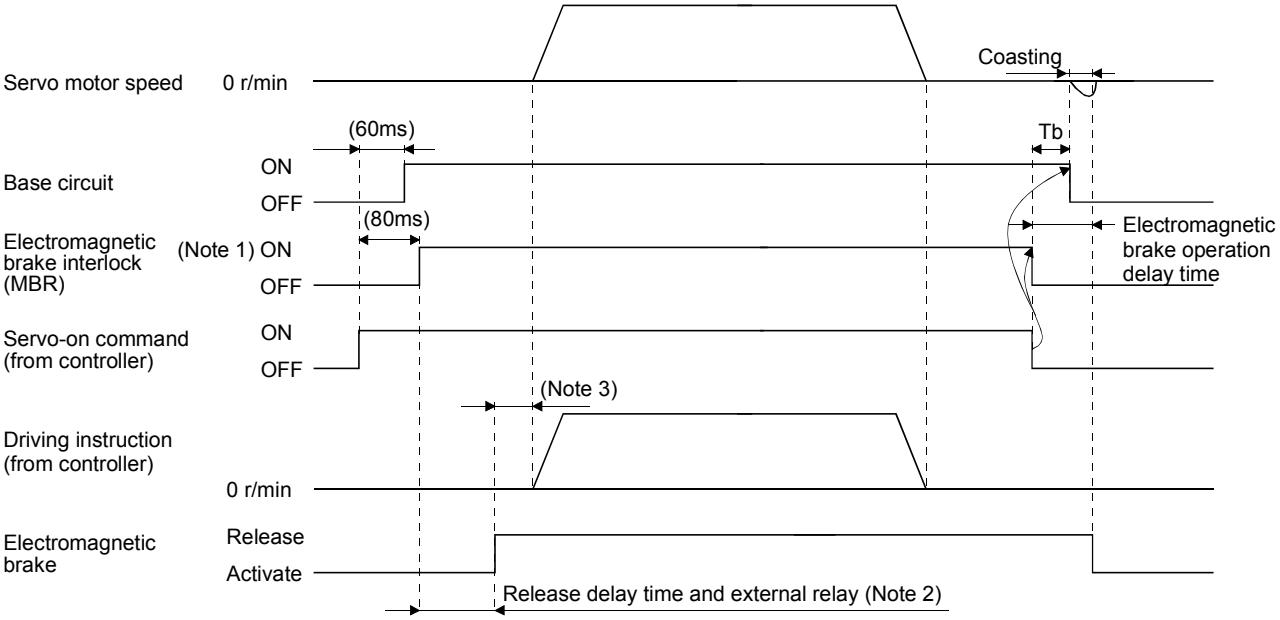
(2) Setting

In parameter No.21 (electromagnetic brake sequence output), set the time delay (Tb) from electromagnetic brake operation to base circuit shut-off at a servo off time as in the timing chart in (3) in this section.

(3) Timing charts

(a) Servo-on command (from controller) ON/OFF

Tb [ms] after the servo-on is switched off, the servo lock is released and the servo motor coasts. If the electromagnetic brake is made valid in the servo lock status, the brake life may be shorter. Therefore, when using the electromagnetic brake in a vertical lift application or the like, set delay time (Tb) to about the same as the electromagnetic brake operation delay time to prevent a drop.

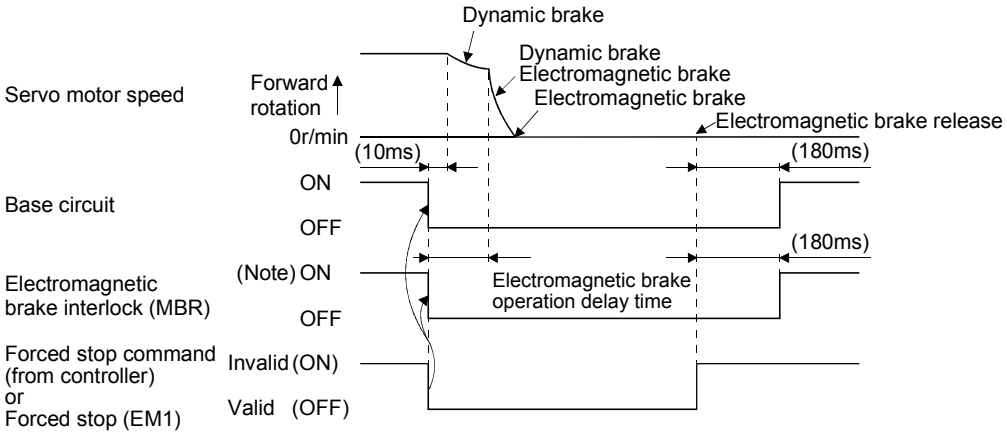


Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

2. Electromagnetic brake is released after delaying for the release delay time of electromagnetic brake and operation time of external circuit relay. For the release delay time of electromagnetic brake, refer to the Servo Motor Instruction Manual.

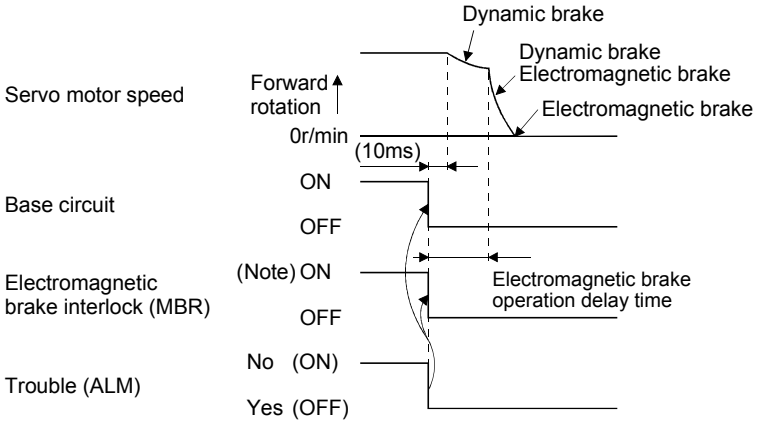
3. After the electromagnetic brake is released, give the operation command from the controller.

(b) Forced stop command (from controller) or forced stop (EM1) ON/OFF



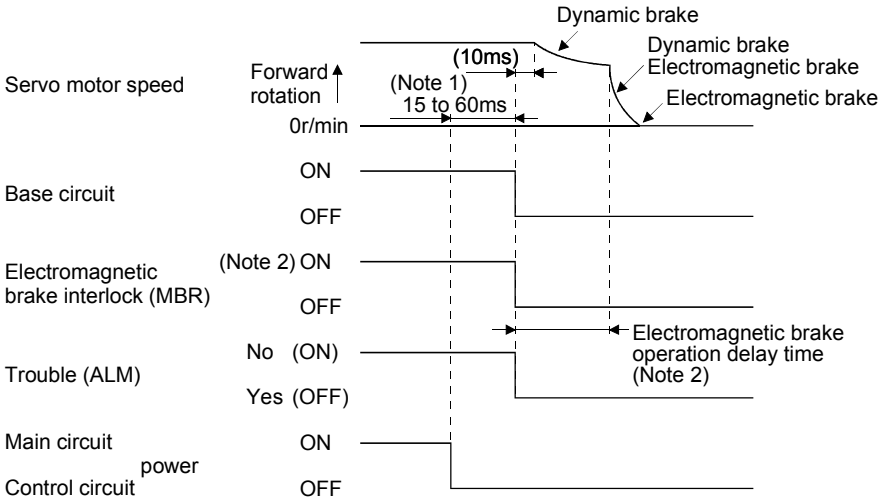
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(c) Alarm occurrence



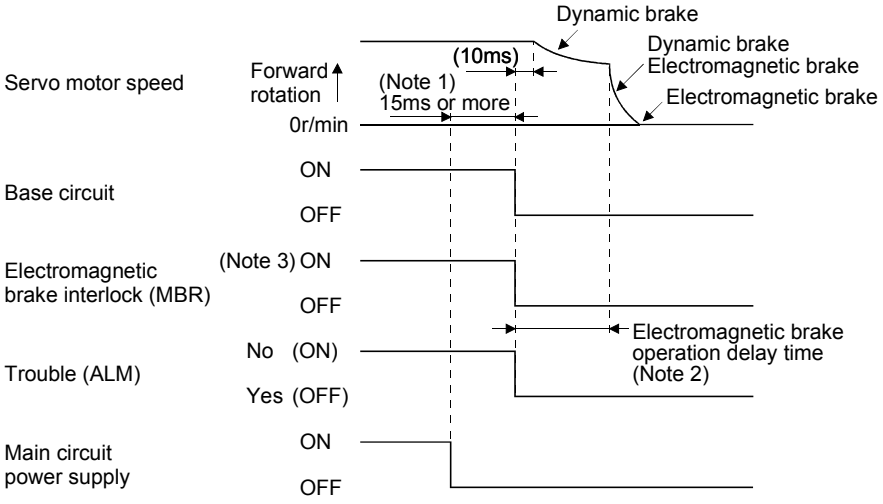
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(d) Both main and control circuit power supplies off



Note 1. Changes with the operating status.
2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(e) Only main circuit power supply off (control circuit power supply remains on)



Note 1. Changes with the operating status.

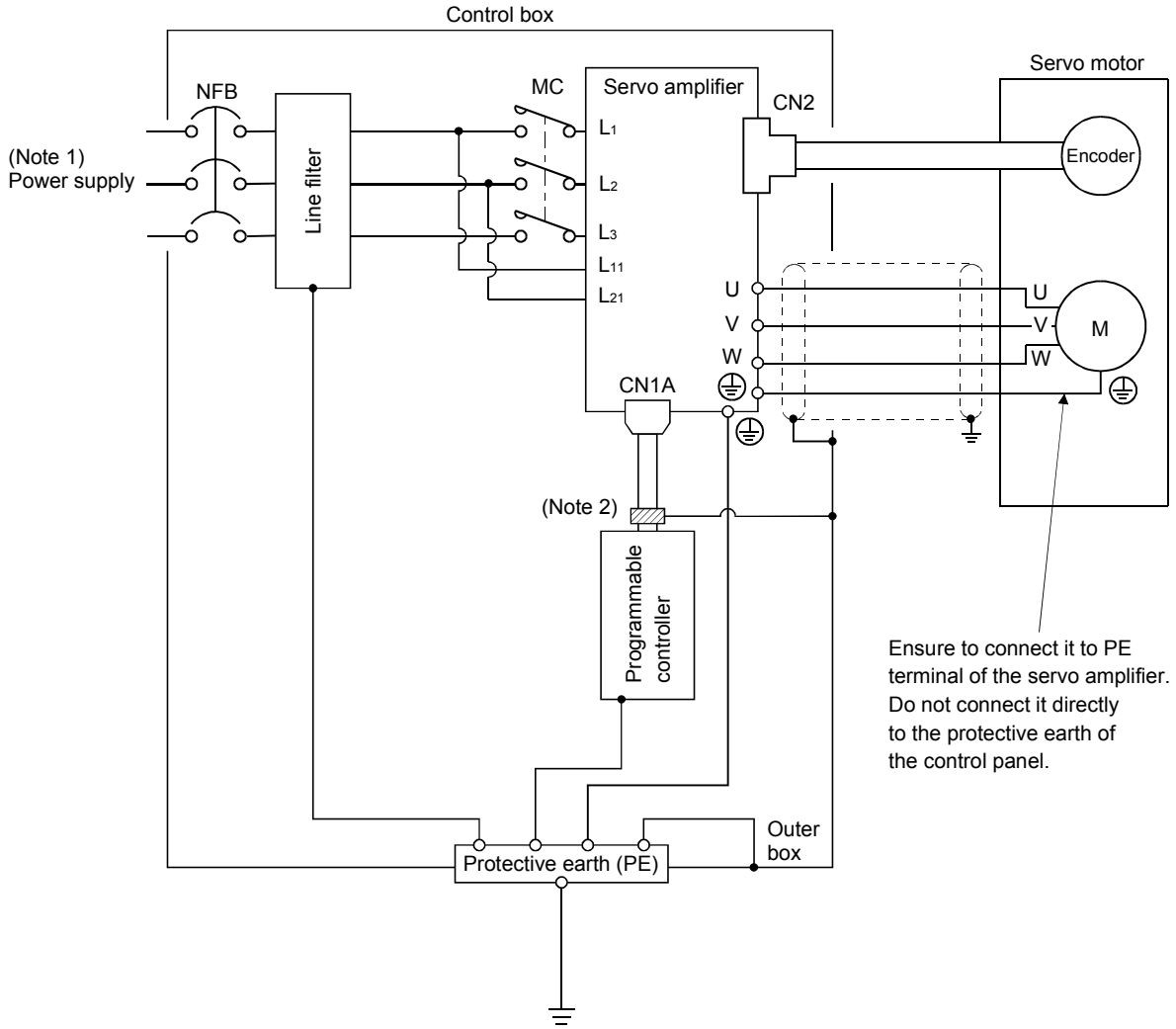
2. When the main circuit power supply is off in a motor stop status, the main circuit off warning (E9) occurs and the trouble (ALM) does not turn off.

3. ON: Electromagnetic brake is not activated.
   OFF: Electromagnetic brake is activated.

3.8 Grounding

⚠ WARNING	・Ground the servo amplifier and servo motor securely. ・To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier with the protective earth (PE) of the control box.

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 the EMC Installation Guidelines (IB(NA)67310).



Note 1. For 1-phase 230V, connect the power supply to L_1 ・ L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120V power supply. Refer to section 1.3 for the power supply specification.
2. To reduce the influence of external noise, we recommend you to ground the bus cable near the controller using a cable clamping fixture or to connect three or four data line filters in series.

3.9 Servo amplifier terminal block (TE2) wiring method

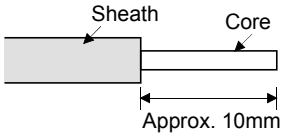
> **POINT**
> - Refer to table 12.1 2) and (4) of section 12.2.1 for the wire sizes used for wiring.

3.9.1 For servo amplifier produced later than January, 2006

(1) Termination of the cables

(a) Solid wire

After the sheath has been stripped, the cable can be used as it is.



(b) Twisted wire

1) When the cable is inserted directly

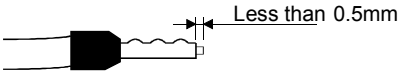
Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault.

2) When the twisted wires are put together using a bar terminal

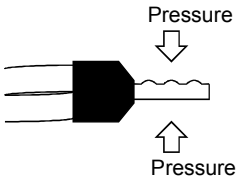
Use the bar terminal shown below.

Cable Size		Bar Terminal Type		Crimping Tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25/1.5	16	AI1.5-10BK	AI-TWIN2 × 1.5-10BK	CRIMPFOX ZA 3	Phoenix Contact
2/2.5	14	AI2.5-10BU			

Cut the cable running out of bar terminal to less than 0.5 mm



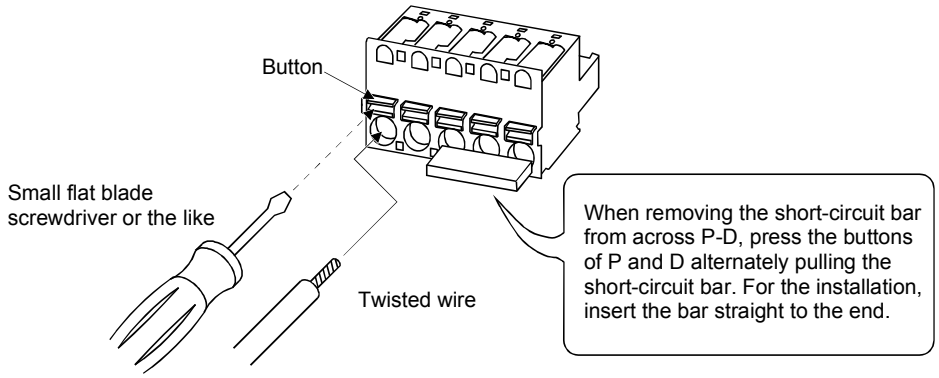
When using a bar terminal for 2 cables, insert the cables in the direction where the insulation sleeve does not interfere with next pole, and pressure then.



(2) Connection

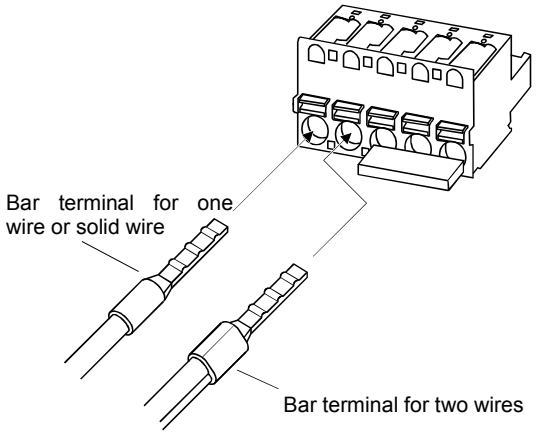
(a) When the cable is inserted directly

Insert the cable to the end pressing the button with a small flat-blade screwdriver or the like.



(b) When the twisted wires are put together using a bar terminal

Insert a bar terminal with the odd-shaped side of the pressured terminal on the button side.

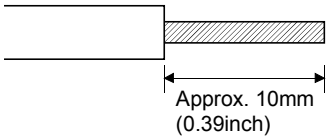


When two cables are inserted into one opening, a bar terminal for 2 cables is required.

3.9.2 For servo amplifier produced earlier than December, 2005

(1) Termination of the cables

Solid wire: After the sheath has been stripped, the cable can be used as it is.

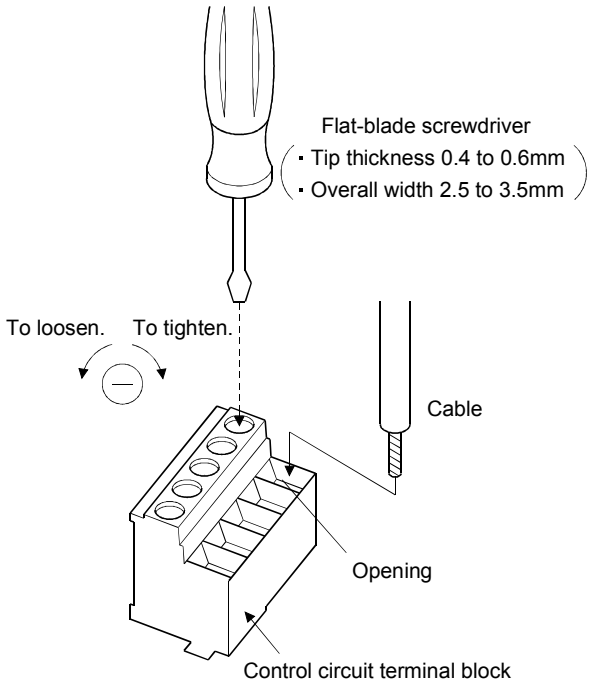


Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault.
Alternatively, a bar terminal may be used to put the wires together.

Cable Size		Bar Terminal Type		Crimping Tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25/1.5	16	AI1.5-10BK	AI-TWIN2×1.5-10BK	CRIMPFOX ZA 3 or CRIMPFOX UD 6	Phoenix Contact
2/2.5	14	AI2.5-10BU			

(2) Connection

Insert the core of the cable into the opening and tighten the screw with a flat-blade screwdriver so that the cable does not come off. (Tightening torque: 0.3 to 0.4N・m(2.7 to 3.5 lb・in)) Before inserting the cable into the opening, make sure that the screw of the terminal is fully loose.
When using a cable of 1.5mm^2 or less, two cables may be inserted into one opening.

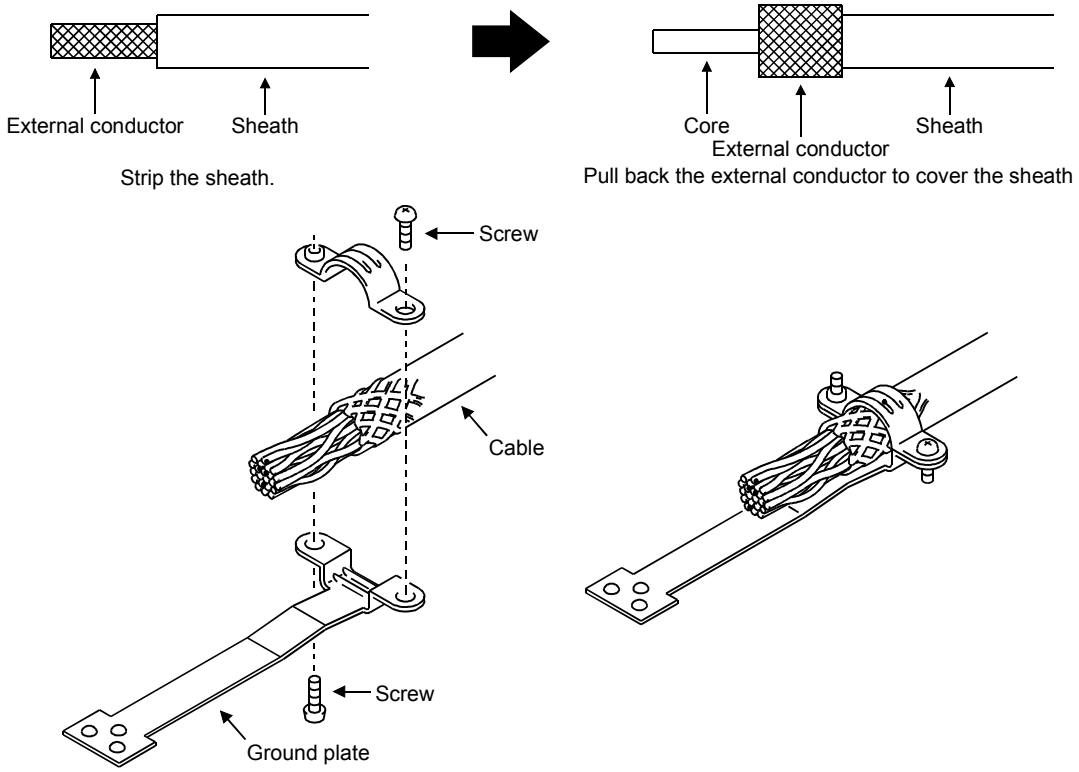


Use of a flat-blade torque screwdriver is recommended to manage the screw tightening torque. The following table indicates the recommended products of the torque screwdriver for tightening torque management and the flat-blade bit for torque screwdriver. When managing torque with a Phillips bit, please consult us.

Product	Model	Manufacturer/Representative
Torque screwdriver	N6L TDK	Nakamura Seisakusho
Bit for torque screwdriver	B-30, flat-blade, H3.5 X 73L	Shiro Sangyo

3.10 Instructions for the 3M connector

When fabricating an encoder cable or the like, securely connect the shielded external conductor of the cable to the ground plate as shown in this section and fix it to the connector shell.

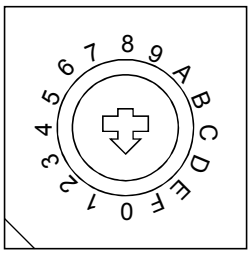


3.11 Control axis selection

POINT
▪ The control axis number set to SW1 should be the same as the one set to the servo system controller.

Use the axis select 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 bus cable connection sequence.
Set the switch to "F" when executing the test operation mode using MR Configurator (servo configuration software).

Axis select switch (SW1)



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

3.12 Power line circuit of the MR-J2S-11KB to MR-J2S-22KB

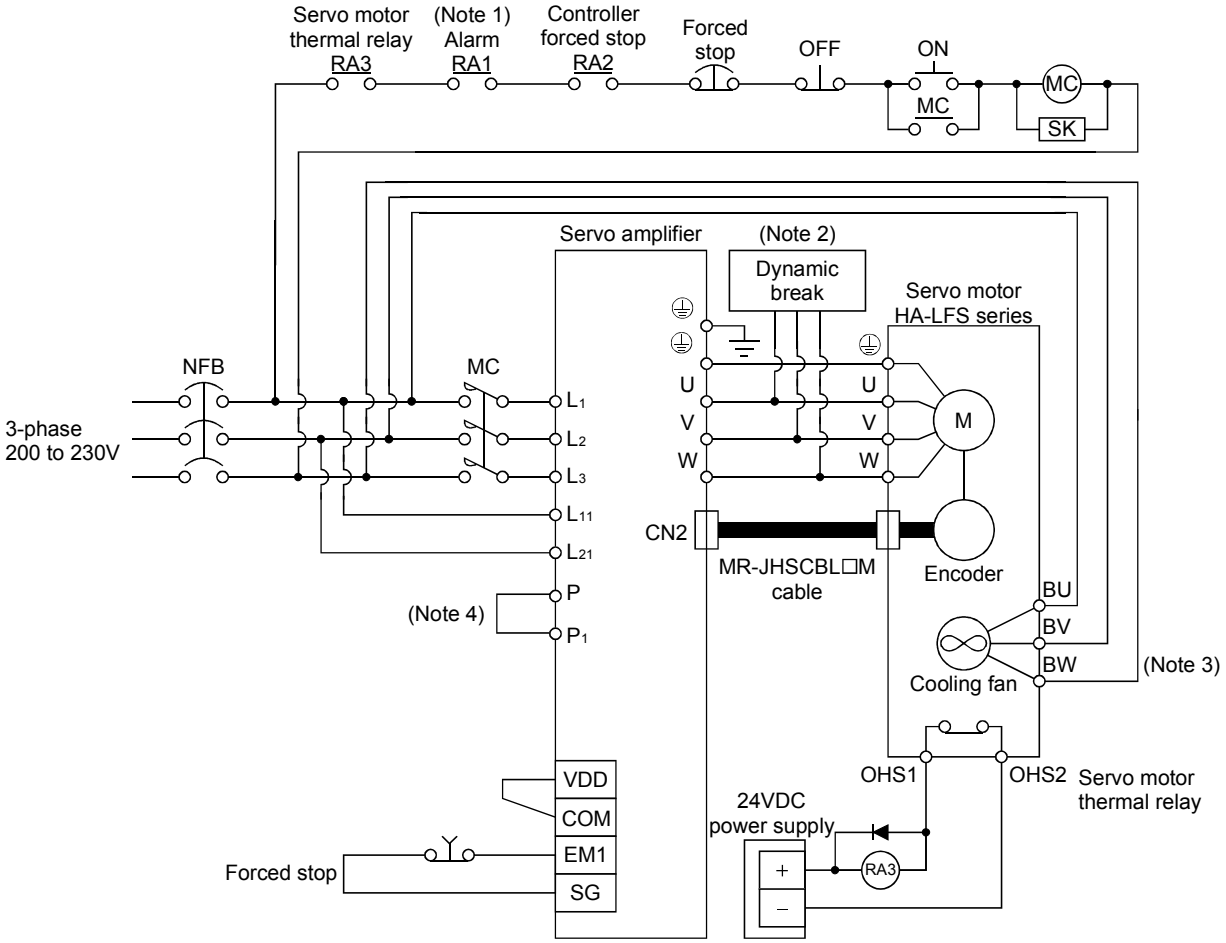
⚠ CAUTION	・Always connect a magnetic contactor (MC) between the main circuit power supply and L1, L2, and L3 of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions. ・Switch power off at detection of an alarm. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire. ・During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

POINT

・The power-on sequence is the same as in section 3.5.3.

3.12.1 Connection example

Wire the power supply/main circuit as shown below so that power is shut off and the servo-on signal turned off as soon as an alarm occurs, a servo forced stop is made valid, a controller forced stop, or a servo motor thermal relay alarm is made valid. A no-fuse breaker (NFB) must be used with the input cables of the power supply.



Note 1. Configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side.

2. When using the external dynamic break, refer to section 12.1.4.

3. Cooling fan power supply of the HA-LFS11K2 servo motor is 1-phase. Power supply specification of the cooling fan is different from that of the servo amplifier. Therefore, separate power supply is required.

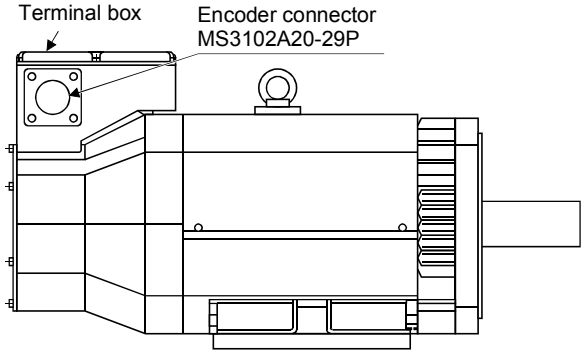
4. Always connect P_1 and P. (Factory-wired.) When using the power factor improving DC reactor, refer to section 12.2.4.

3.12.2 Servo amplifier terminals

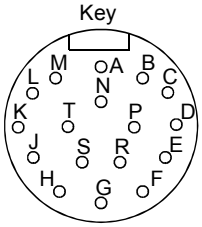
The positions and signal arrangements of the terminal blocks change with the capacity of the servo amplifier. Refer to section 10.1.

Symbol	Connection Target (Application)	Description
L_1, L_2, L_3	Main circuit power supply	Supply L_1, L_2 and L_3 with three-phase 200 to 230VAC, 50/60Hz power.
U, V, W	Servo motor output	Connect to the servo motor power supply terminals (U, V, W).
L_{11}, L_{21}	Control circuit power supply	Supply L_{11} and L_{21} with single-phase 200 to 230VAC power.
P, C	Regenerative option	The servo amplifier built-in regenerative resistor is not connected at the time of shipment. When using the regenerative option, wire it across P-C. Refer to section 12.1.1 for details.
N	Return converter Brake unit	When using the return converter or brake unit, connect it across P-N. Refer to sections 12.1.2 and 12.1.3 for details.
	Protective earth (PE)	Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.
P_1, P	Power factor improving DC reactors	P_1-P are connected before shipment. When connecting a power factor improving DC reactor, remove the short bar across P_1-P. Refer to section 12.2.4 for details.

3.12.3 Servo motor terminals



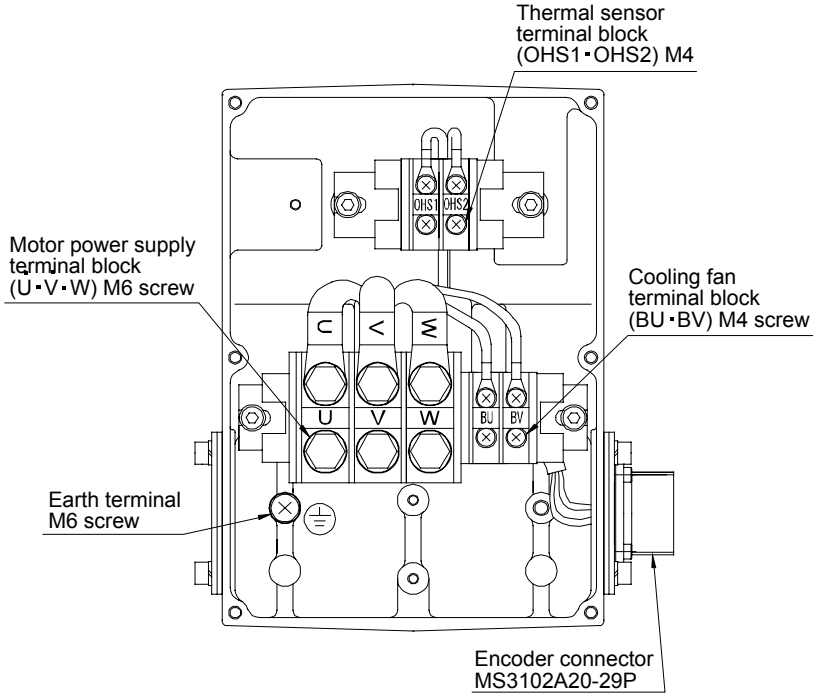
Encoder connector signal arrangement MS3102A20-29P



Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	

Pin	Signal
K	
L	
M	
N	SHD
P	
R	LG
S	P5
T	

Terminal box inside (HA-LFS601・701M・11K2)

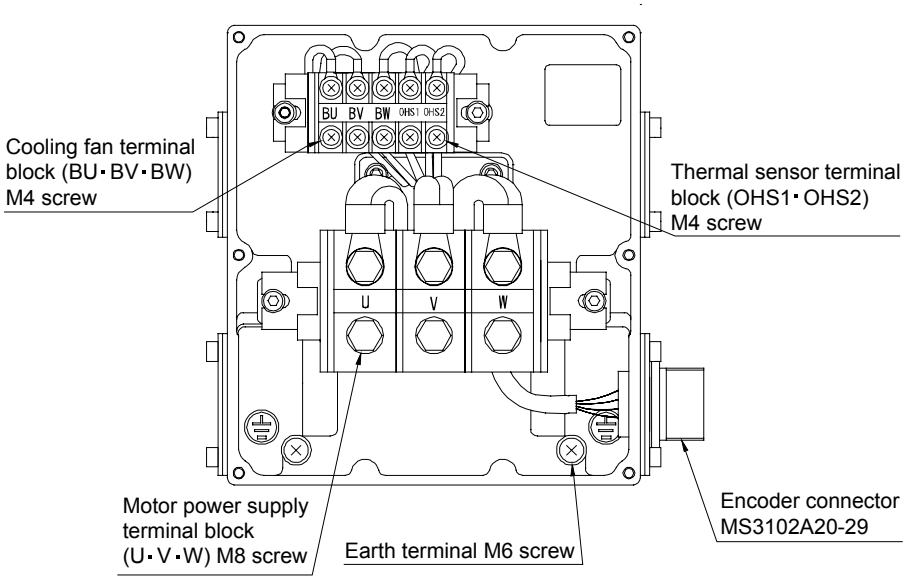


Terminal block signal arrangement

OHS1	OHS2

U	V	W	BU	BV

Terminal box inside (HA-LFS801・12K1・11K1M・15K1M・15K2・22K2)

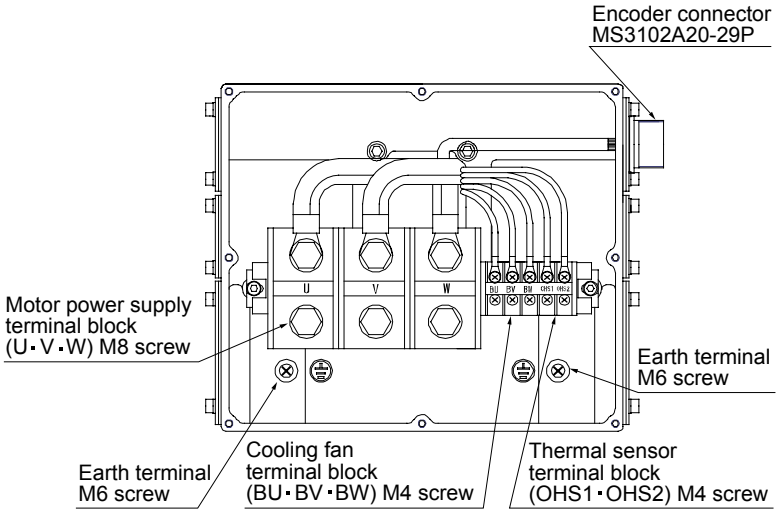


Terminal block signal arrangement

BU	BV	BW	OHS1	OHS2

U	V	W

Terminal box inside (HA-LFS15K1・20K1・22K1M・25K1)



Terminal block signal arrangement

U	V	W	BU	BV	BW	OHS1	OHS2

<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Description</th></tr>
<tr><td>Power supply</td><td>U・V・W</td><td>Connect to the motor output terminals (U, V, W) of the servo amplifier.</td></tr>
<tr><td>Cooling fan</td><td>(Note)
BU・BV・BW</td><td>Supply power which satisfies the following specifications.
<table>
<tr><th>Servo motor</th><th>Voltage division</th><th>Voltage/frequency</th><th>Power consumption [W]</th><th>Rated current [A]</th></tr>
<tr><td>HA-LFS601, 701M, 11K2</td><td rowspan="4">200V class</td><td rowspan="4">1-phase 200 to 220VAC 50Hz
1-phase 200 to 230VAC 60Hz
3-phase 200 to 230VAC 50Hz/60Hz</td><td>42(50Hz)
54(60Hz)</td><td>0.21(50Hz)
0.25(60Hz)</td></tr>
<tr><td>HA-LFS801 12K1, 11K1M, 15K1M, 15K2, 22K2</td><td>62(50Hz)
76(60Hz)</td><td>0.18(50Hz)
0.17(60Hz)</td></tr>
<tr><td>HA-LFS-15K1, 20K1, 22K1M</td><td>65(50Hz)
85(60Hz)</td><td>0.20(50Hz)
0.22(60Hz)</td></tr>
<tr><td>HA-LFS25K1</td><td>120(50Hz)
175(60Hz)</td><td>0.65(50Hz)
0.80(60Hz)</td></tr>
</table></td></tr>
<tr><td>Motor thermal relay</td><td>OHS1・OHS2</td><td>OHS1-OHS2 are opened when heat is generated to an abnormal temperature.</td></tr>
<tr><td>Earth terminal</td><td>  </td><td>For grounding, connect to the earth of the control box via the earth terminal of the servo amplifier.</td></tr>
</table>

Note. There is no BW when the HA-LFS11K2 is used.

MEMO

4. OPERATION AND DISPLAY

4.1 When switching power on for the first time

Before starting operation, check the following.

(1) Wiring

(a) A correct power supply is connected to the power input terminals (L_1, L_2, L_3, L_{11}, L_{21}) of the servo amplifier.

(b) The servo motor power supply terminals (U, V, W) of the servo amplifier match in phase with the power input terminals (U, V, W) of the servo motor.

(c) The servo motor power supply terminals (U, V, W) of the servo amplifier are not shorted to the power input terminals (L_1, L_2, L_3) of the servo motor.

(d) The earth terminal of the servo motor is connected to the PE terminal of the servo amplifier.

(e) Note the following when using the regenerative option, brake unit or power regeneration converter.

1) For the MR-J2S-350B or less, the lead has been removed from across D-P of the control circuit terminal block, and twisted cables are used for its wiring.

2) For the MR-J2S-500B・MR-J2S-700B, the lead has been removed from across P-C of the servo amplifier built-in regenerative resistor, and twisted cables are used for its wiring.

(f) 24VDC or higher voltages are not applied to the pins of connector CN3.

(g) SD and SG of connector CN3 are not shorted.

(h) The wiring cables are free from excessive force.

(i) CN1A should be connected with the bus cable connected to the servo system controller or preceding axis servo amplifier, and CN1B should connected with the bus cable connected to the subsequent axis servo amplifier or with the termination connector (MR-A-TM.)

(2) Axis number

The axis number setting of SW1 should be the same as that of the servo system controller. (Refer to section 3.11.)

(3) Parameters

On the servo system controller screen or using the MR Configurator (servo configuration software), make sure that correct values have been set in the parameters.

(4) Environment

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

(5) Machine

(a) The screws in the servo motor installation part and shaft-to-machine connection are tight.

(b) The servo motor and the machine connected with the servo motor can be operated.

4.2 Start up

⚠ WARNING	・Do not operate the switches with wet hands. You may get an electric shock. ・Do not operate the controller with the front cover removed. High-voltage terminals and charging area exposed and you may get an electric shock. ・During power-on or operation, do not open the front cover. You may get an electric shock.

⚠ CAUTION	・Before starting operation, check the parameters. Some machines may perform unexpected operation. ・Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the servo amplifier heat sink, regenerative resistor, servo motor, etc.since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged. ・During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

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 switched on, "b1" (for the first axis) appears on the servo amplifier display.

In the absolute position detection system, first power-on results in the absolute position lost (25) alarm and the servo system cannot be switched on. This is not a failure and takes place due to the uncharged capacitor in the encoder.

The alarm can be deactivated by keeping power on for a few minutes in the alarm status and then switching power off once and on again.

Also in the absolute position detection system, if power is switched on at the servo motor speed of 500r/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

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

Parameter No.	Name	Setting	Description
7	Rotation direction setting	0	Increase in positioning address rotates the motor in the CCW direction.
8	Auto tuning	□□□1	Used.
9	Servo response	□□□5	Slow response (initial value) is selected.

After setting the above parameters, switch power off once. Then switch power on again to make the set parameter values valid.

(3) Servo-on

Switch the servo-on in the following procedure.

1) Switch on main circuit/control circuit power supply.

2) The controller transmits the servo-on command.

When placed in the servo-on status, 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.

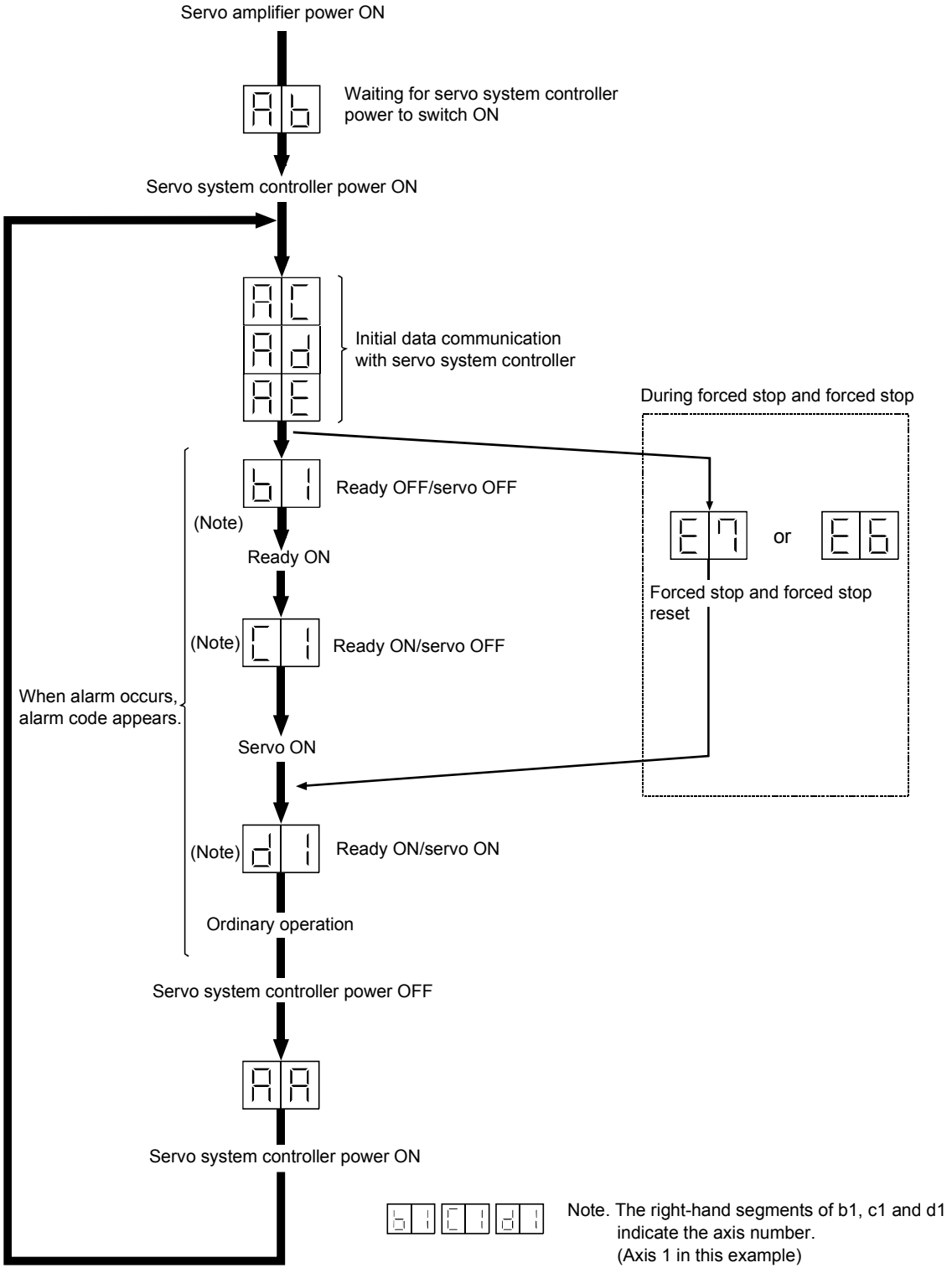
When the servo motor is equipped with an electromagnetic brake, refer to section 3.7.

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

4.3 Servo amplifier display

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

(1) Display sequence



(2) Indication list

Indication	Status	Description
AA	Initializing	Power to the servo system controller was switched off during power-on of the servo amplifier.
Ab	Initializing	・The servo amplifier was switched on when power to the servo system controller is off. ・The axis No. set to the servo system controller does not match the axis No. set with the axis setting switch (SW1) of the servo amplifier. ・A servo amplifier fault occurred or an error took place in communication with the servo system controller. In this case, the indication changes. "Ab" → "AC" → "Ad" → "Ab" ・The servo system controller is faulty.
AC	Initializing	Communication started between the servo system controller and servo amplifier.
Ad	Initializing	The initial parameters from the servo system controller were received.
AE	Initialize completion	Initial data communication with the servo system controller was completed.
(Note 1) b#	Ready OFF	The ready off signal from the servo system controller was received.
(Note 1) d#	Servo ON	The ready off signal from the servo system controller was received.
(Note 1) C#	Servo OFF	The ready off signal from the servo system controller was received.
(Note 2) **	Alarm・Warning	The alarm No./warning No. that occurred is displayed. (Refer to section 9.1.)
88	CPU error	Initial data communication with the servo system controller was completed.
(Note 3) b0.	(Note 3) Test operation mode	JOG operation, positioning operation, programmed operation, DO forced output.
(Note 1) b#. d#. c#.		Motor-less operation

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	First axis
2	Second axis
3	Third axis
4	Fourth axis
5	Fifth axis
6	Sixth axis
7	Seventh axis
8	Eighth axis

2. ** indicates the warning/alarm No.

3. Requires the MR Configurator (servo configuration software).

4.4 Test operation mode

⚠ CAUTION	・The test operation mode is designed for servo operation confirmation and not for machine operation confirmation. Do not use this mode with the machine. Always use the servo motor alone. ・If an operation fault occurred, use the forced stop (EM1) to make a stop.

By using a personal computer and the MR Configurator (servo configuration software MRZJW3-SETUP121E), you can execute jog operation, positioning operation, motor-less operation and DO forced output without connecting the motion controller.
When executing the test operation at start up, confirm that the servo motor operates normally at the slowest speed.

(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 or off and whether the servo system controller is connected or not.
Exercise control on the jog operation screen of the MR Configurator (servo configuration software).

1) Operation pattern

Item	Initial value	Setting range
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	1 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 or off and whether the servo system controller is connected or not.
Exercise control on the positioning operation screen of the MR Configurator (servo configuration software).

1) Operation pattern

Item	Initial value	Setting range
Travel [pulse]	100000	0 to 9999999
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	1 to 50000

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 or off and whether the servo system controller is connected or not.

Exercise control on the programmed operation screen of the MR Configurator (servo configuration software). For full information, refer to the MR Configurator (Servo Configuration Software) Installation Guide.

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

(d) Motorless operation

> **POINT**
>
> ・Motor-less operation may be used with the MR Configurator (servo configuration software). Usually, however, use motor-less operation which is available by making the servo system controller parameter setting.

Without connecting the servo motor, 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 amplifier connected to the servo system controller.

Exercise control on the motor-less operation screen of the MR Configurator (servo configuration software).

1) Load conditions

Load Item	Condition
Load torque	0
Load inertia moment ratio	Same as servo motor inertia moment

2) Alarms

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

- Encoder error 1 (16)
- Encoder error 2 (20)
- Absolute position erasure (25)
- Battery cable breakage warning (92)
- Battery warning (9F)

(e) Output signal (DO) forced output

Output signals can be switched on/off forcibly independently of the servo status. Use this function for output signal wiring check, etc.

Exercise control on the DO forced output screen of the MR Configurator (servo configuration software).

(2) Configuration

Configuration should be as in section 3.1. Always install a forced stop switch to enable a stop at occurrence of an alarm.

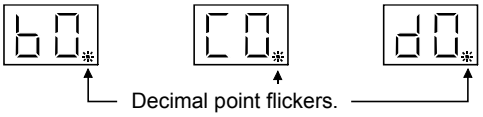
(3) Operation procedure

(a) Jog operation, positioning operation, program operation, DO forced output.

1) Switch power off.

2) Set SW1 to "F".
When SW1 is set to the axis number and operation is performed by the servo system controller, the test operation mode screen is displayed on the personal computer, but no function is performed.

3) Switch servo amplifier power on.
When initialization is over, the display shows the following screen.

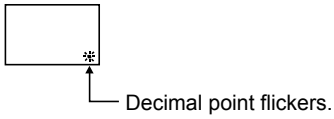


4) Perform operation with the personal computer.

(b) Motor-less operation

1) Switch off the servo amplifier.

2) Perform motor-less operation with the personal computer.
The display shows the following screen.



5. PARAMETERS

CAUTION	・Never adjust or change the parameter values extremely as it will make operation instable.

POINT

- When the servo amplifier is connected with the servo system controller, the parameters are set to the values of the servo system controller. Switching power off, then on makes the values set on the MR Configurator (servo configuration software) invalid and the servo system controller values valid.
- In the manufacturer setting parameters, do not set any values other than the initial values.
- Setting may not be made to some parameters and ranges depending on the model or version of the servo system controller. For details, refer to the servo system controller user's manual.

5.1 Parameter write inhibit

POINT

- When setting the parameter values from the servo system controller, the parameter No. 40 setting need not be changed.

In this servo amplifier, the parameters are classified into the basic parameters (No. 1 to 11), adjustment parameters (No. 12 to 26) and expansion parameters (No. 27 to 40) according to their safety aspects and frequencies of use. The values of the basic parameters may be set/changed by the customer, but those of the adjustment and expansion parameters cannot. When in-depth adjustment such as gain adjustment is required, change the parameter No. 40 value to make all parameters accessible. Parameter No. 40 is made valid by switching power off, then on after setting its value.
The following table indicates the parameters which are enabled for reference and write by parameter No. 40 setting.

Setting	Operation	Operation from controller	Operation from MR Configurator (servo configuration software)
0000(initial value)	Reference	Parameter No. 1 to 75	Parameter No. 1 to 11・40
	Write		
000A	Reference	Parameter No. 1 to 75	Parameter No. 40
	Write		
000C	Reference	Parameter No. 1 to 75	Parameter No. 1 to 40
	Write		Parameter No. 1 to 11・40
000E	Reference	Parameter No. 1 to 75	Parameter No. 1 to 40
	Write		
000F	Reference	Parameter No. 1 to 75	Parameter No. 1 to 75
	Write		
100E	Reference	Parameter No. 1 to 75	Parameter No. 1 to 40
	Write		Parameter No. 40

5.2 Lists

POINT

- For any parameter whose symbol is preceded by*, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid. The parameter is set when communication between the servo system controller and servo amplifier is established (b* is displayed). After that, power the servo amplifier off once and then on again.

(1) Item list

Classification	No.	Symbol	Name	(Note 1) Initial Value	Unit	Customer setting
Basic parameters	1	*AMS	Amplifier setting	0000		
	2	*REG	Regenerative resistor	0000		
	3		For manufacturer setting by servo system controller Automatically set from the servo system controller	0080		
	4			000		
	5			1		
	6	*FBP	Feedback pulse number	0		
	7	*POL	Rotation direction selection	0		
	8	ATU	Auto tuning	0001		
	9	RSP	Servo response	7kW or less: 0005 11kW or more: 0002		
	10	TLP	Forward rotation torque limit (Note 2)	300	%	
	11	TLN	Reverse rotation torque limit (Note 2)	300	%	
Adjustment parameters	12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	7.0	times	
	13	PG1	Position control gain 1	7kW or less: 35 11kW or more: 19	rad/s	
	14	VG1	Speed control gain 1	7kW or less: 177 11kW or more: 96	rad/s	
	15	PG2	Position control gain 2	7kW or less: 35 11kW or more: 19	rad/s	
	16	VG2	Speed control gain 2	7kW or less: 817 11kW or more: 455	rad/s	
	17	VIC	Speed integral compensation	7kW or less:48 11kW or more:91	ms	
	18	NCH	Machine resonance suppression filter 1 (Notch filter)	0000		
	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	0001		
	23	*OP1	Optional function 1	0000		
	24	*OP2	Optional function 2	0000		
	25	LPF	Low-pass filter/adaptive vibration suppression control	0000		
	26		For manufacturer setting	0		
Expansion parameters	27	MO1	Analog monitor 1 offset	0	mV	
	28	MO2	Analog monitor 2 offset	0	mV	
	29		For manufacturer setting	0001		
	30	ZSP	Zero speed	50	r/min	
	31	ERZ	Error excessive alarm level	80	(Note 3) 0.025rev	
	32	OP5	Optional function 5	0000		
	33	*OP6	Optional function 6	0000		
	34	VPI	PI-PID control switch-over position droop	0	pulse	
	35		For manufacturer setting	0		
	36	VDC	Speed differential compensation	980		
	37		For manufacturer setting	0010		
	38	*ENR	Encoder pulses output	4000	pulse/rev	
	39		For manufacturer setting	0		
	40	*BLK	Parameter write inhibit (Note 2)	0000		

Note 1. Factory settings of the servo amplifier. Connecting it with the servo system controller and switching power on changes them to the settings of the servo system controller.

2. Setting and changing cannot be made from the peripheral software of the motion controller.

3. The setting unit of 0.025rev applies for the servo amplifier of software version B1 or later. For the amplifier of software version older than B1, the setting unit of 0.1rev is applied.

Classification	No.	Symbol	Name	Initial Value	Unit	Customer setting
Expansion parameter 2	41		For manufacturer setting	500		
	42			0000		
	43			0111		
	44			20		
	45			50		
	46			0		
	47			0		
	48			0		
	49	*CDP	Gain changing selection	0000		
	50	CDS	Gain changing condition	10	(Note)	
	51	CDT	Gain changing time constant	1	ms	
	52	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	7.0	time	
	53	PG2B	Position control gain 2 changing ratio	100	%	
	54	VG2B	Speed control gain 2 changing ratio	100	%	
	55	VICB	Speed integral compensation changing ratio	100	%	
	56		For manufacturer setting	0000		
	57			0000		
	58			0000		
	59			0000		
	60	*OPC	Optional function C	0000		
	61	NH2	Machine resonance suppression filter 2	0000		
	62		For manufacturer setting	0000		
	63			400		
	64			100		
	65			1		
	66			1		
	67			0		
	68			0		
	69			0		
	70			0		
	71			0		
	72			0		
	73			0		
	74			0		
	75			0		

Note. Depends on parameter No. 49 setting.

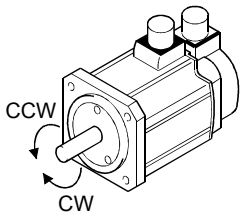
(2) Details list

Classification	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Basic parameters	1	*AMS	Amplifier setting Used to select the absolute position detection. 0 0 0 [ ] Absolute position detection selection 0: Invalid (Used in incremental system.) 1: Valid (Used in absolute position detection system.)	0000		Refer to name and function column.
	2	*REG	Regenerative resistor Used to select the regenerative option used. 0 0 [ ] [ ] Regenerative selection option 00: • Regenerative option is not used with 7kW or less servo amplifier (The built-in regenerative resistor is used. However, the MR-J2S-10B does not have a built-in regenerative resistor and therefore cannot use it.) • Supplied regenerative resistors or regenerative option is used with 11k to 22kW amplifier 01: FR-RC, FR-BU2, FR-CV 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 regenerative resistors or regenerative option supplied to 11k to 22kW are cooled by cooling fans to increase capability 10: MR-RB032 11: MR-RB12 The MR-RB65, 66 and 67 are regenerative options that have encased the GRZG400-2Ω, GRZG400-1Ω and GRZG400-0.8Ω, respectively. When using any of these regenerative options, make the same parameter setting as when using the GRZG400-2Ω, GRZG400-1Ω or GRZG400-0.8Ω (supplied regenerative resistors or regenerative option is used with 11k to 22kW servo amplifier). Select the external dynamic brake. 0: Invalid 1: Valid Select "1" when using the external dynamic brake with the MR-J2S-11KB to 22KB. **POINT** • Wrong setting may cause the regenerative option to burn. • If the regenerative option selected is not for use with the servo amplifier, parameter error (37) occurs.	0000		Refer to name and function column.
	3		For manufacturer setting by servo system controller	0080		
	4		Automatically set from the servo system controller	0000		
	5			1		

<table>
<tr><th>Classifi-cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="3">Basic parameters</td><td>6</td><td>*FBP</td><td>Feedback pulse number
Set the number of pulses per revolution in the controller side command unit. Information on the motor such as the feedback pulse value, present position, droop pulses and within-one-revolution position are derived from the values converted into the number of pulses set here.

<table>
<tr><th>Setting</th><th>Number of feedback pulses</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 motor resolution pulses.</td></tr>
</table>

POINT
· If the number of pulses set exceeds the actual motor resolution, the motor resolution is set automatically.</td><td>0</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>7</td><td>*POL</td><td>Rotation direction selection
Used to select the rotation direction of the servo motor.
0: Forward rotation (CCW) with the increase of the positioning address.
1: Reverse rotation (CW) with the increase of the positioning address.

 
</td><td>0</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>8</td><td>ATU</td><td>Auto tuning
Used to select the gain adjustment mode of auto tuning.

<table>
<tr><td>0</td><td>0</td><td>0</td><td></td></tr>
</table>
Gain adjustment mode selection
(For details, refer to section 6.1.1.)

<table>
<tr><th>Set value</th><th>Gain adjustment mode</th><th>Description</th></tr>
<tr><td>0</td><td>Interpolation mode</td><td>Fixes position control gain 1 (parameter No. 13).</td></tr>
<tr><td>1</td><td>Auto tuning mode 1</td><td>Ordinary auto tuning.</td></tr>
<tr><td>3</td><td>Auto tuning mode 2</td><td>Fixes the load inertia moment ratio set in parameter No. 12. Response level setting can be changed.</td></tr>
<tr><td>4</td><td>Manual mode1</td><td>Simple manual adjustment.</td></tr>
<tr><td>2</td><td>Manual mode 2</td><td>Manual adjustment of all gains.</td></tr>
</table></td><td>0001</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>Classifi-cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="4">Basic parameters</td><td>9</td><td>RSP</td><td>Servo response
Used to select the response of auto tuning.
0 0 0 ☐
Response level selection
<table><tr><th>Set value</th><th>Response level</th><th>Machine resonance frequency guideline</th></tr><tr><td>1</td><td rowspan="16">Low response
↑
Middle response
↑
High response</td><td>15Hz</td></tr><tr><td>2</td><td>20Hz</td></tr><tr><td>3</td><td>25Hz</td></tr><tr><td>4</td><td>30Hz</td></tr><tr><td>5</td><td>35Hz</td></tr><tr><td>6</td><td>45Hz</td></tr><tr><td>7</td><td>55Hz</td></tr><tr><td>8</td><td>70Hz</td></tr><tr><td>9</td><td>85Hz</td></tr><tr><td>A</td><td>105Hz</td></tr><tr><td>B</td><td>130Hz</td></tr><tr><td>C</td><td>160Hz</td></tr><tr><td>D</td><td>200Hz</td></tr><tr><td>E</td><td>240Hz</td></tr><tr><td>F</td><td>300Hz</td></tr></table>
・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.</td><td>7kW or less :0005

11kW or more :0002</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>10</td><td>TLP</td><td>Forward rotation torque limit
Assume that the rated torque is 100[%].
Used to limit the torque in the forward rotation driving mode and reverse rotation regenerative mode.
In other than the test operation mode on the MR Configurator (servo configuration software), the torque limit value on the servo system controller side is made valid.</td><td>300</td><td>%</td><td>0
to
500</td></tr>
<tr><td>11</td><td>TLN</td><td>Reverse rotation torque limit
Assume that the rated torque is 100[%].
Used to limit the torque in the forward rotation driving mode and forward rotation regenerative mode.
In other than the test operation mode on the MR Configurator (servo configuration software), the torque limit value on the servo system controller side is made valid.</td><td>300</td><td>%</td><td>0
to
500</td></tr>
<tr><td rowspan="2">Adjustment parameters</td><td>12</td><td>GD2</td><td>Ratio of load inertia to servo motor inertia (load inertia ratio)
Used to set the ratio of the load inertia (inertia moment) to the inertia moment of the servo motor shaft. When auto tuning mode 1 and interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 6.1.1)</td><td>7.0</td><td>times</td><td>0.0
to
300.0</td></tr>
<tr><td>13</td><td>PG1</td><td>Position control gain 1
Used to set the gain of position loop 1. Increase the gain to improve track ability performance in response to the position command.
When auto turning mode 1,2 is selected, the result of auto turning is automatically used.</td><td>7kW or less:35

11kW or more:19</td><td>rad/s</td><td>4
to
2000</td></tr>
</table>

<table>
<tr><th>Classifi-cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="7">Adjustment parameters</td><td>14</td><td>VG1</td><td>Speed control gain 1
Normally this parameter setting need not be changed. Higher setting increases the response level but is liable to generate vibration and/or noise.
When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.</td><td>7kW or less:177

11kW or more:96</td><td>rad/s</td><td>20
to
5000</td></tr>
<tr><td>15</td><td>PG2</td><td>Position control gain 2
Used to set the gain of the position loop.
Set this parameter to increase position response to load disturbance.
Higher setting increases the response level but is liable to generate vibration and/or noise.
When auto tuning mode 1・2, manual mode and interpolation mode is selected, the result of auto tuning is automatically used.</td><td>7kW or less:35

11kW or more:19</td><td>rad/s</td><td>1
to
1000</td></tr>
<tr><td>16</td><td>VG2</td><td>Speed control gain 2
Set this parameter when vibration occurs on machines of low rigidity or large backlash.
Higher setting increases the response level but is liable to generate vibration and/or noise.
When auto tuning mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.</td><td>7kW or less:817

11kW or more:455</td><td>rad/s</td><td>20
to
20000</td></tr>
<tr><td>17</td><td>VIC</td><td>Speed integral compensation
Used to set the constant of integral compensation.
When auto tuning mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.</td><td>7kW or less:48

11kW or more:91</td><td>ms</td><td>1
to
1000</td></tr>
<tr><td>18</td><td>NCH</td><td>Machine resonance suppression filter 1 (Notch filter)
Used to select the machine resonance suppression filter.
(Refer to section 7.2.)
 

<table><tr><th>Setting</th><th>Frequency</th><th>Setting</th><th>Frequency</th><th>Setting</th><th>Frequency</th><th>Setting</th><th>Frequency</th></tr><tr><td>00</td><td>Invalid</td><td>08</td><td>562.5</td><td>10</td><td>281.3</td><td>18</td><td>187.5</td></tr><tr><td>01</td><td>4500</td><td>09</td><td>500</td><td>11</td><td>264.7</td><td>19</td><td>180</td></tr><tr><td>02</td><td>2250</td><td>0A</td><td>450</td><td>12</td><td>250</td><td>1A</td><td>173.1</td></tr><tr><td>03</td><td>1500</td><td>0B</td><td>409.1</td><td>13</td><td>236.8</td><td>1B</td><td>166.7</td></tr><tr><td>04</td><td>1125</td><td>0C</td><td>375</td><td>14</td><td>225</td><td>1C</td><td>160.1</td></tr><tr><td>05</td><td>900</td><td>0D</td><td>346.2</td><td>15</td><td>214.3</td><td>1D</td><td>155.2</td></tr><tr><td>06</td><td>750</td><td>0E</td><td>321.4</td><td>16</td><td>204.5</td><td>1E</td><td>150</td></tr><tr><td>07</td><td>642.9</td><td>0F</td><td>300</td><td>17</td><td>195.7</td><td>1F</td><td>145.2</td></tr></table>
Notch depth selection
<table><tr><th>Setting</th><th>Depth</th><th>Gain</th></tr><tr><td>0</td><td rowspan="4">Deep
to
Shallow</td><td>−40dB</td></tr><tr><td>1</td><td>−14dB</td></tr><tr><td>2</td><td>−8dB</td></tr><tr><td>3</td><td>−4dB</td></tr></table></td><td>0000</td><td></td><td>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 1s or more as the acceleration/deceleration time constant up to the rated speed.</td><td>0</td><td>%</td><td>0
to
100</td></tr>
</table>

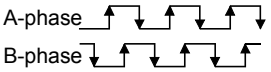
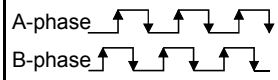
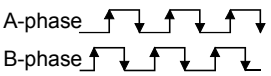
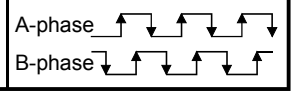
<table>
<tr><th>Classifi-
cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial
Value</th><th>Unit</th><th>Setting
Range</th></tr>
<tr><td rowspan="4">Adjustment parameters</td><td>20</td><td>INP</td><td>In-position range
Used to set the droop pulse range in which the in-position (INP) will be output to the controller. Make setting in the feedback pulse unit (parameter No. 6).
For example, when you want to set ±10μm in the conditions that the ball screw is direct coupled, the lead is 10mm, and the feedback pulses are 8192 pulses/rev (parameter No. 6 : 1), set "8" as indicated by the following expression.
$\frac{10\times10^{-6}}{10\times10^{-3}}\cdot 8192 = 8.192 \fallingdotseq 8$</td><td>100</td><td>pulse</td><td>0
to
50000</td></tr>
<tr><td>21</td><td>MBR</td><td>Electromagnetic brake sequence output
Used to set a time delay (Tb) from when the electromagnetic brake interlock signal (MBR) turns off until the base circuit is shut off.</td><td>0</td><td>ms</td><td>0
to
1000</td></tr>
<tr><td>22</td><td>MOD</td><td>Analog monitor output
Used to select the signal provided to the analog monitor (MO1) · analog monitor (MO2).
(Refer to section 5.3.)
0 | | 0 |
<table><tr><th>Setting</th><th>Analog monitor1 (MO1)</th><th>Analog monitor2 (MO2)</th></tr><tr><td>0</td><td colspan="2">Servo motor speed (±8V/max. speed)</td></tr><tr><td>1</td><td colspan="2">Torque (±8V/max. torque) (Note)</td></tr><tr><td>2</td><td colspan="2">Servo motor speed (+8V/max. speed)</td></tr><tr><td>3</td><td colspan="2">Torque (+8V/max. torque) (Note)</td></tr><tr><td>4</td><td colspan="2">Current command (±8V/max. current command)</td></tr><tr><td>5</td><td colspan="2">Speed command (±8/max. speed)</td></tr><tr><td>6</td><td colspan="2">Droop pulses (±10V/128 pulses)</td></tr><tr><td>7</td><td colspan="2">Droop pulses (±10V/2048 pulses)</td></tr><tr><td>8</td><td colspan="2">Droop pulses (±10V/8192 pulses)</td></tr><tr><td>9</td><td colspan="2">Droop pulses (±10V/32768 pulses)</td></tr><tr><td>A</td><td colspan="2">Droop pulses (±10V/131072 pulses)</td></tr><tr><td>B</td><td colspan="2">Bus voltage (+8V/400V)</td></tr></table>Note. 8V is outputted at the maximum torque.</td><td>0001</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>23</td><td>*OP1</td><td>Optional function 1
Used to make the servo forced stop function invalid.
0 | 0 | 0 |
Servo forced stop selection
0: Valid (Use the forced stop (EM1).)
1: Invalid (Do not use the forced stop (EM1).)
Automatically switched on internally</td><td>0000</td><td></td><td>Refer to name and function column.</td></tr>
</table>

Classification	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Adjustment parameters	24	*OP2	Optional function 2 Used to select slight vibration suppression control and motor-less operation 0 _ _ 0 Slight vibration suppression control selection Made valid when auto tuning selection is set to "0002" in parameter No.8. Used to suppress vibration at a stop. 0: Invalid 1: Valid Motor-less operation selection 0: Invalid 1: Makes motor-less operation valid. When motor-less operation is made valid, signal output or status display can be provided as if the servo motor is running actually in response to the servo system controller command, without the servo motor being connected. Motor-less operation is performed as in the motor-less operation using the MR Configurator (servo configuration software). (Refer to (d), (1) of section 4.4.)	0000		Refer to name and function column.
	25	LPF	Low-pass filter/adaptive vibration suppression control Used to select the low-pass filter and adaptive vibration suppression control. (Refer to chapter 7.) _ _ _ 0 Low-pass filter selection 0: Valid (Automatic adjustment) 1: Invalid When you choose "valid", the filter of the handwidth represented by the following expression is set automatically. For 1kW or less $\frac{\text{VG2 setting}\times 10}{2\pi\times(1+\text{GD2 setting}\times 0.1)}$ [Hz] For 2kW or more $\frac{\text{VG2 setting}\times 5}{2\pi\times(1+\text{GD2 setting}\times 0.1)}$ [Hz] Adaptive vibration suppression control selection 0: Invalid 1: Valid Machine resonance frequency is always detected and the filter is generated in response to resonance to suppress machine vibration. 2: Held The characteristics of the filter generated so far are held, and detection of machine resonance is stopped. Adaptive vibration suppression control sensitivity selection Used to select the sensitivity of machine resonance detection. 0: Normal 1: Large sensitivity	0000		Refer to name and function column.
	26		For manufacturer setting Do not change this value by any means.	0		

Classification	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Expansion parameters	27	MO1	Analog monitor 1 offset Used to set the offset voltage of the analog monitor1 (MO1) output.	0	mV	−999 to 999
	28	MO2	Analog monitor 2 offset Used to set the offset voltage of the analog monitor2 (MO2) output.	0	mV	−999 to 999
	29		For manufacturer setting Do not change this value by any means.	0001		
	30	ZSP	Zero speed Used to set the output range of the zero speed signal (ZSP).	50	r/min	0 to 10000
	31	ERZ	Error excessive alarm level Used to set the output range of the error excessive alarm. Note: The setting unit of 0.025rev applies for the servo amplifier of software version B1 or later. For the amplifier of software version older than B1, the setting unit of 0.1rev is applied.	80	(Note) 0.025rev	1 to 1000
	32	OP5	Optional function 5 Used to select PI-PID control switch-over. 0 0 0 □ PI-PID control switch over selection 0: PI control is always valid. 1: Droop-based switching is valid in position control mode (refer to parameter No. 34). 2: PID control is always valid.	0000		Refer to name and function column.
	33	*OP6	Option function 6 Used to select the serial communication baud rate, serial communication response delay time setting and encoder pulse output setting. 0 □ □ □ Serial communication baud rate selection 0: 9600[bps] 1: 19200[bps] 2: 38400[bps] 3: 57600[bps] Serial communication response delay time 0: Invalid 1: Valid, replay sent in 800μs or more Encoder pulse output setting selection (refer to parameter No.38) 0: Pulse output designation 1: Division ratio setting	0000		Refer to name and function column.
	34	VPI	PI-PID control switch-over position droop Used to set the position droop value (number of pulses) at which PI control is switched over to PID control. Set "0001" in parameter No. 32 to make this function valid.	0	pulse	0 to 50000
	35		For manufacturer setting Do not change this value by any means.	0		
	36	VDC	Speed differential compensation Used to set the differential compensation.	980		0 to 1000
	37		For manufacturer setting Do not change this value by any means.	0010		

<table>
<tr><th>Classifi-cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="3">Expansion parameters</td><td>38</td><td>*ENR</td><td>Encoder pulses output
Used to set the encoder pulses (A-phase, B-phase) output by the servo amplifier.
Set the value 4 times greater than the A-phase and B-phase pulses.
You can use parameter No. 33 to choose the pulse output 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 1.3Mpps (after multiplication by 4). Use this parameter within this range.
・For pulse output designation
Set "0□□□" (initial value) in parameter No. 33.
Set the number of pulses per servo motor revolution.
Pulse output = set value [pulses/rev]
At the setting of 5600, for example, the actually output A-phase and B-phase pulses are as indicated below.
A-phase and B-phase pulses output $= \frac{5600}{4} = 1400$[pulse]
・For output division ratio setting
Set "1□□□" in parameter No. 33.
The number of pulses per servo motor revolution is divided by the set value.
Pulse output $= \frac{\text{Resolution per servo motor revolution}}{\text{Set value}}$ [pulses/rev]
At the setting of 8, for example, the actually output A-phase and B-phase pulses are as indicated below.
A-phase and B-phase pulses output $= \frac{131072}{8} \cdot \frac{1}{4} = 4096$[pulse]</td><td>4000</td><td>pulse/rev</td><td>1
to
65535</td></tr>
<tr><td>39</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0</td><td></td><td></td></tr>
<tr><td>40</td><td>*BLK</td><td>Parameter write inhibit
<table>
<tr><th>Setting</th><th>Operation</th><th>Operation from controller</th><th>Operation from MR Configurator (servo configuration)</th></tr>
<tr><td rowspan="2">0000 (initial value)</td><td>Reference</td><td rowspan="2">Parameter No. 1 to 75</td><td rowspan="2">Parameter No. 1 to 11・40</td></tr>
<tr><td>Write</td></tr>
<tr><td rowspan="2">000A</td><td>Reference</td><td rowspan="2">Parameter No. 1 to 75</td><td rowspan="2">Parameter No. 40</td></tr>
<tr><td>Write</td></tr>
<tr><td rowspan="2">000C</td><td>Reference</td><td rowspan="2">Parameter No. 1 to 75</td><td>Parameter No. 1 to 40</td></tr>
<tr><td>Write</td><td>Parameter No. 1 to 11・40</td></tr>
<tr><td rowspan="2">000E</td><td>Reference</td><td rowspan="2">Parameter No. 1 to 75</td><td>Parameter No. 1 to 40</td></tr>
<tr><td>Write</td><td>Parameter No. 1 to 75</td></tr>
<tr><td rowspan="2">000F</td><td>Reference</td><td rowspan="2">Parameter No. 1 to 75</td><td>Parameter No. 1 to 40</td></tr>
<tr><td>Write</td><td>Parameter No. 40</td></tr>
<tr><td rowspan="2">100E</td><td>Reference</td><td rowspan="2">Parameter No. 1 to 75</td><td>Parameter No. 1 to 40</td></tr>
<tr><td>Write</td><td>Parameter No. 40</td></tr>
</table></td><td>0000</td><td></td><td>Refer to name and function column.</td></tr>
</table>

Classification	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Expansion parameter 2	41		For manufacturer setting Do not change this value by any means.	500		
	42			0000		
	43			0111		
	44			20		
	45			50		
	46			0		
	47			0		
	48			0		
	49	*CDP	Gain changing selection Select the gain changing condition. (Refer to section 7.5) 0 0 0 [ ] Gain changing selection Under any of the following conditions, the gains change on the basis of the parameter No. 52 to 55 settings. 0: Invalid 1: Control instructions from a controller. 2: Command frequency (Parameter No.50 setting) 3: Droop pulse value (Parameter No.50 setting) 4: Servo motor speed (Parameter No.50 setting)	0000		Refer to Name and function column.
	50	CDS	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No. 49. The set value unit changes with the changing condition item. (Refer to section 7.5)	10	kpps pulse r/min	0 to 9999
	51	CDT	Gain changing time constant Used to set the time constant at which the gains will change in response to the conditions set in parameters No. PB26 and PB27. (Refer to section 7.6.)	1	ms	0 to 100
	52	GD2B	Ratio of load inertia moment to servo motor inertia moment 2 Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid.	7.0	times	0 to 300.0
	53	PG2B	Position control gain 2 changing ratio Used to set the ratio of changing the position control gain 2 when gain changing is valid. Made valid when auto tuning is invalid.	100	%	10 to 200
	54	VG2B	Speed control gain 2 changing ratio Used to set the ratio of changing the speed control gain 2 when gain changing is valid. Made valid when auto tuning is invalid.	100	%	10 to 200
	55	VICB	Speed integral compensation changing ratio Used to set the ratio of changing the speed integral compensation when gain changing is valid. Made valid when auto tuning is invalid.	100	%	50 to 1000
	56		For manufacturer setting Do not change this value by any means.	0000		
	57			0000		
	58			0000		
	59			0000		

<table>
<tr><th>Classifi-cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="2">Expansion parameter 2</td><td>60</td><td>*OPC</td><td>Optional function C
Used to select the encoder pulse output direction.
0 □ 0 0
Encoder pulse output phase changing
Changes the phases of A, B-phase encoder pulses output .
<table>
<tr><th rowspan="2">Set 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>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>61</td><td>NH2</td><td>Machine resonance suppression filter 2
Used to selection the machine resonance suppression filter 2. (Refer to section 7.2.)
0 □ □ □
Notch frequency selection
Set "00" when you have set adaptive vibration suppression control to be "valid" or "held" (parameter No. 25: □1□□ or □2□□).
<table>
<tr><th>Setting</th><th>Frequency</th><th>Setting</th><th>Frequency</th><th>Setting</th><th>Frequency</th><th>Setting</th><th>Frequency</th></tr>
<tr><td>00</td><td>Invalid</td><td>08</td><td>562.5</td><td>10</td><td>281.3</td><td>18</td><td>187.5</td></tr>
<tr><td>01</td><td>4500</td><td>09</td><td>500</td><td>11</td><td>264.7</td><td>19</td><td>180</td></tr>
<tr><td>02</td><td>2250</td><td>0A</td><td>450</td><td>12</td><td>250</td><td>1A</td><td>173.1</td></tr>
<tr><td>03</td><td>1500</td><td>0B</td><td>409.1</td><td>13</td><td>236.8</td><td>1B</td><td>166.7</td></tr>
<tr><td>04</td><td>1125</td><td>0C</td><td>375</td><td>14</td><td>225</td><td>1C</td><td>160.1</td></tr>
<tr><td>05</td><td>900</td><td>0D</td><td>346.2</td><td>15</td><td>214.3</td><td>1D</td><td>155.2</td></tr>
<tr><td>06</td><td>750</td><td>0E</td><td>321.4</td><td>16</td><td>204.5</td><td>1E</td><td>150</td></tr>
<tr><td>07</td><td>642.9</td><td>0F</td><td>300</td><td>17</td><td>195.7</td><td>1F</td><td>145.2</td></tr>
</table>
Notch depth selection
<table>
<tr><th>Setting</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td rowspan="4">Deep
to
Shallow</td><td>−40dB</td></tr>
<tr><td>1</td><td>−14dB</td></tr>
<tr><td>2</td><td>−8dB</td></tr>
<tr><td>3</td><td>−4dB</td></tr>
</table></td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

Classification	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Expansion parameter 2	62		For manufacturer setting Do not change this value by any means.	0000		
	63			400		
	64			100		
	65			1		
	66			1		
	67			0		
	68			0		
	69			0		
	70			0		
	71			0		
	72			0		
	73			0		
	74			0		
	75			0		

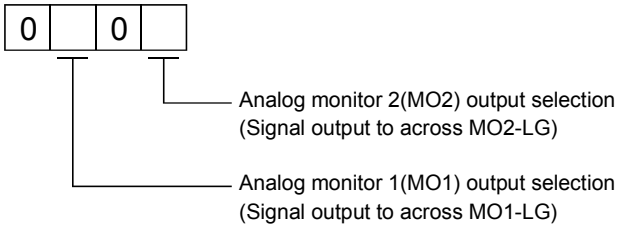
5.3 Analog monitor

The servo status can be output to two channels in terms of voltage. The servo status can be monitored using an ammeter.

(1) Setting

Change the following digits of parameter No. 22.

Parameter No. 22



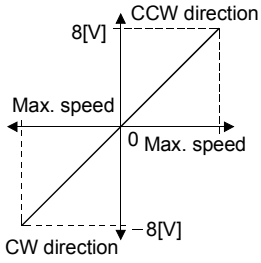
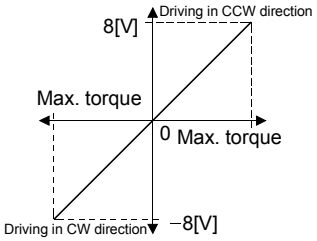
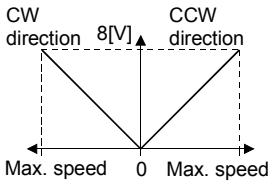
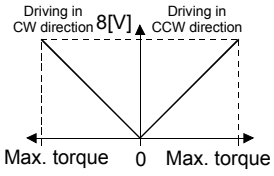
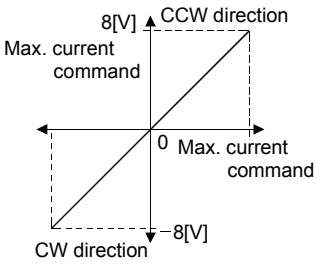
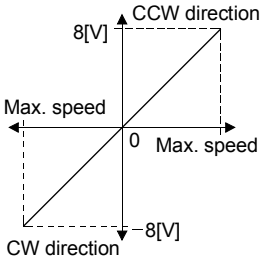
Parameters No. 27 and 28 can be used to set the offset voltages to the analog output voltages. The setting range is between −999 and 999mV.

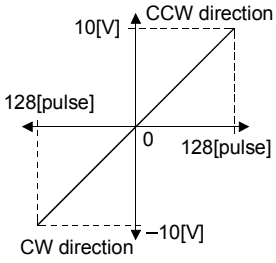
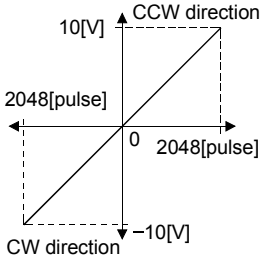
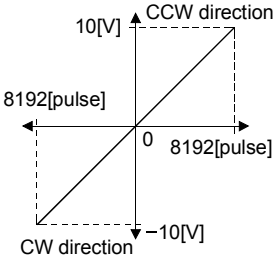
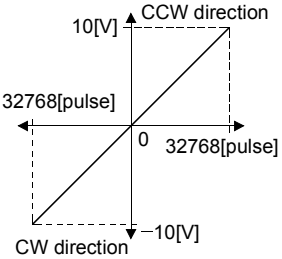
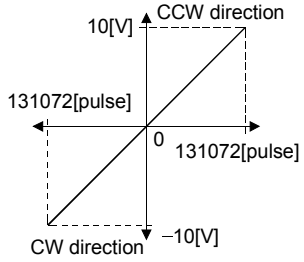
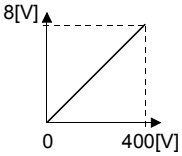
Parameter No.	Description	Setting range [mV]
27	Used to set the offset voltage for the analog monitor 1(MO) output.	−999 to 999
28	Used to set the offset voltage for the analog monitor 2(MO2) output.	

(2) Setting description

The servo amplifier is factory-set to output the servo motor speed to analog monitor (MO1) and the torque to analog monitor (MO2). The setting can be changed as listed below by changing the parameter No. 22 (Analog monitor output) value.

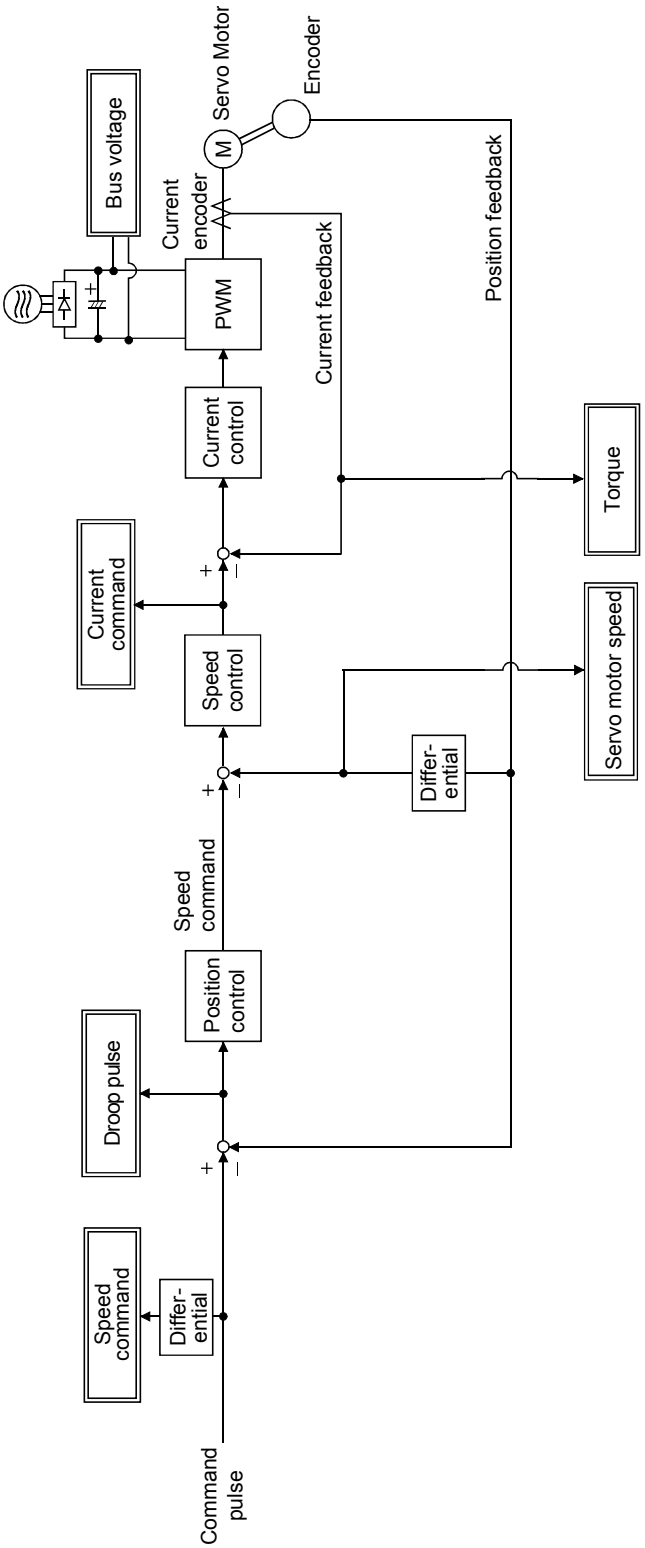
Refer to (3) in this section for the measurement point.

Setting	Output item	Description
0	Servo motor speed	
1	Torque (Note)	
2	Servo motor speed	
3	Torque (Note)	
4	Current command	
5	Speed command	

Setting	Output item	Description
6	Droop pulses (±10V/128pulse)	
7	Droop pulses (±10V/2048pulse)	
8	Droop pulses (±10V/8192pulse)	
9	Droop pulses (±10V/32768pulse)	
A	Droop pulses (±10V/131072pulse)	
B	Bus voltage	

Note. Outputs 8V at the maximum torque.

(3) Analog monitor block diagram



5.4 Replacement of MR-J2-□B by MR-J2S-□B

When using the MR-J2S-□B on the servo system controller peripheral software incompatible with the MR-J2S-□B, you cannot use some parameter functions. Read this section carefully and set appropriate values in the parameters.

5.4.1 Main modifications made to the parameters

The following table lists the parameters whose settings have been modified from the MR-J2-□B or added to the MR-J2S-□B. The peripheral software of the servo system controller may not be compatible with some parameters whose settings are different or have been added. For details, refer to the servo system controller manual.

Parameter No.	Code	Name	Main modifications/additions	(Note) Setting from peripheral software of conventional servo system controller
6	FBP	Feedback pulse number	The encoder resolution of the compatible motor changed to 131072 pulses/rev.	Setting cannot be made. The resolution is 16384 pulses/rev.
8	ATU	Auto tuning	Gain adjustment modes were increased.	Setting can be made but the added modes cannot be used.
9	RSP	Servo response level	The response level setting range was increased to meet the enhanced response.	Some response levels cannot be set.
18	NCH	Machine resonance suppression filter 1 (Notch filter)	The machine resonance suppression filter (notch filter) setting range was increased.	Some filter frequencies cannot be set.
20	INP	In-position range	The setting unit become the feedback pulse unit in parameter No. 6.	Setting can be made.
22	MOD	Analog monitor output	The data that may be output by analog monitor was added.	Setting can be made but the bus voltage cannot be set.
25	LPF	Low-pass filter/adaptive vibration suppression control	The low-pass filter and adaptive vibration suppression control functions were newly added.	Setting can be made.
31	ERZ	Error excessive alarm level	The setting unit was changed in response to the enhanced resolution (131072 pulses/rev) of the encoder.	Setting can be made but the setting unit is [0.1 rev].
33	OP6	Optional function 6	The communication baud rate with the personal computer was changed to max. 57600bps.	Setting cannot be made.
38	ENR	Encoder pulses output	The encoder feedback pulses can be output from the servo amplifier. These pulses can be set.	Setting cannot be made.

Note. As of November, 2003

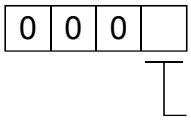
5.4.2 Explanation of the modified parameters

(1) Feedback pulse number (parameter No. 6)

This parameter was newly added to the MR-J2S-□B. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, this parameter setting cannot be changed. When the servo motor used is the HC-KFS or HC-MFS, the feedback pulse number is 8192 pulses/rev, and when it is the HC-SFS, HC-RFS or HC-UFS, the feedback pulse number is 16384 pulses/rev.

(2) Auto tuning (parameter No. 8)

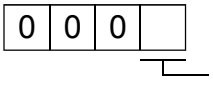
The set values of this parameter were newly added to the MR-J2S-□B. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, the parameter settings are as indicated below. The auto tuning mode 2 and manual mode 1 cannot be used.



Set value	Gain adjustment mode	Description
0	Interpolation mode	Fixes position control gain 1 (parameter No. 13).
1	Auto tuning mode 1	Ordinary auto tuning.
2	Manual mode 2	Manual adjustment of all gains.

(3) Servo response level (parameter No. 9)

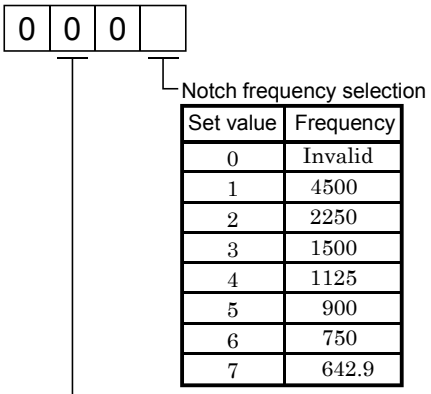
The set values of this parameter were newly added to the MR-J2S-□B. In addition, the machine resonance frequency guidelines corresponding to the set values were changed. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, the parameter settings are as indicated below.



Set value	Response level	Machine resonance frequency guideline
1	Low response	15Hz
2		20Hz
3	↑	25Hz
4		30Hz
5		35Hz
6		45Hz
7	Middle response	55Hz
8		70Hz
9	↑	85Hz
A		105Hz
B	High response	130Hz
C		160Hz

(4) Machine resonance suppression filter 1 (parameter No. 18)

The settings of this parameter were changed for the MR-J2S-□B. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, the parameter settings are as indicated below. The notch depth is −40dB.



Set value	Frequency
0	Invalid
1	4500
2	2250
3	1500
4	1125
5	900
6	750
7	642.9

Set value	Depth	Gain
0	Deep	−40dB

(5) In-position range (parameter No. 20)

The setting of this parameter was changed for the MR-J2S-□B. The setting unit was changed from the conventional input pulse unit to the feedback pulse unit. For details, refer to section 5.2.

(6) Analog monitor output (parameter No. 22)

The setting of this parameter was changed for the MR-J2S-□B. "Bus voltage" is a new choice, but you cannot select it if the peripheral software of the servo system controller is not compatible with the MR-J2S-□B.

Also, the droop pulse output is the encoder resolution unit of the actual motor. For details, refer to section 5.3.

(7) Low-pass filter/adaptive vibration suppression control (parameter No. 25)

This parameter was newly added to the MR-J2S-□B. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, this parameter setting cannot be changed. Hence, the low-pass filter is "valid" and the adaptive vibration suppression control is "invalid". For details, refer to sections 7.3 and 7.4.

(8) Error excessive alarm level (parameter No. 31)

The setting of this parameter was changed for the MR-J2S-□B. The setting unit was changed from conventional [k pulse] to [0.1rev]. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, the unit is set as [0.1rev] to the MR-J2S-□B even when the on-screen setting unit is [k pulse]. For details, refer to section 5.2.

(9) Optional function 6 (parameter No. 33)

This parameter was newly added to the MR-J2S-□B. If the peripheral software of the servo system controller is not compatible with the MR-J2S-□B, this parameter setting cannot be changed. Hence, the serial communication baud rate is “9600 [bps]”, the serial communication response ready time is “invalid”, and the encoder pulse output setting selection is "pulse output setting". For details, refer to section 5.2.

MEMO

6. GENERAL GAIN ADJUSTMENT

6.1 Different adjustment methods

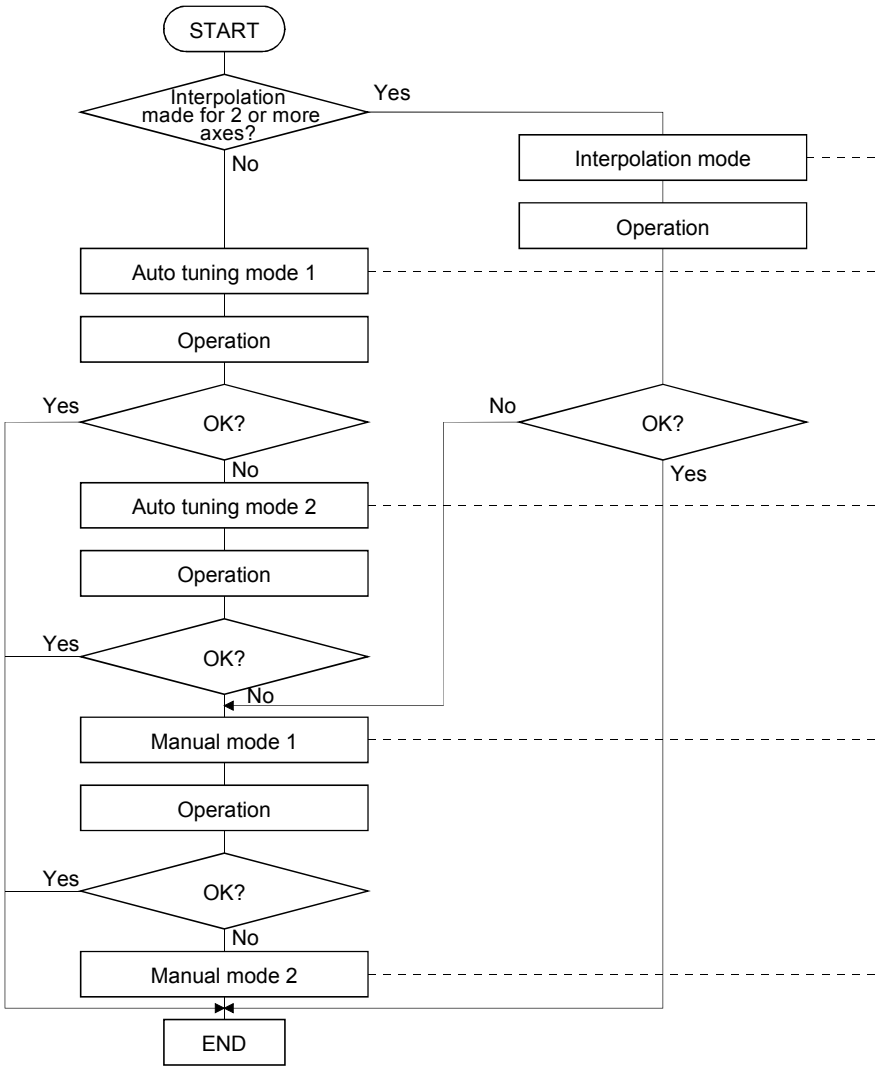
6.1.1 Adjustment on a single servo amplifier

The gain adjustment in this section can be made on a single servo amplifier. For gain adjustment, first execute auto tuning mode 1. If you are not satisfied with the results, execute auto tuning mode 2, manual mode 1 and manual mode 2 in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	Parameter No. 8 setting	Estimation of load inertia moment ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	0001	Always estimated	GD2 (parameter No. 12) PG1 (parameter No. 13) VG1 (parameter No. 14) PG2 (parameter No. 15) VG2 (parameter No. 16) VIC (parameter No. 17)	RSP (parameter No. 9)
Auto tuning mode 2	0003	Fixed to parameter No. 12 value	PG1 (parameter No. 13) VG1 (parameter No. 14) PG2 (parameter No. 15) VG2 (parameter No. 16) VIC (parameter No. 17)	GD2 (parameter No. 12) RSP (parameter No. 9)
Manual mode 1	0004		VG1 (parameter No. 14) PG2 (parameter No. 15)	GD2 (parameter No. 12) PG1 (parameter No. 13) VG2 (parameter No. 16) VIC (parameter No. 17)
Manual mode 2	0002			GD2 (parameter No. 12) PG1 (parameter No. 13) VG1 (parameter No. 14) PG2 (parameter No. 15) VG2 (parameter No. 16) VIC (parameter No. 17)
Interpolation mode	0000	Always estimated	GD2 (parameter No. 12) PG2 (parameter No. 15) VG2 (parameter No. 16) VIC (parameter No. 17)	PG1 (parameter No. 13) VG1 (parameter No. 14)

(2) Adjustment sequence and mode usage



Usage
Used when you want to match the position gain (PG1) 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 conditions of auto tuning mode 1 are not met and the load inertia moment ratio could not be estimated properly, for example.
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 (servo configuration software)

> **POINT**
>
> ・When using the machine analyzer, set the servo amplifier's axis number for "F". (Refer to section 3.11.)

This section gives the functions and adjustment that may be performed by using the servo amplifier with the MR Configurator (servo configuration software) which operates on a personal computer.

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 the 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.
Gain search	Executing gain search under to-and-fro positioning command measures settling characteristic while simultaneously changing gains, and automatically searches for gains which make settling time shortest.	・You can automatically set gains which make positioning settling time shortest.
Machine simulation	Response at positioning settling of a machine can be simulated from machine analyzer results on personal computer.	・You can optimize gain adjustment and command pattern on personal computer.

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 inertia moment 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 the auto tuning mode 1.

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

The following parameters are automatically adjusted in the auto tuning mode 1.

Parameter No.	Abbreviation	Name
12	GD2	Ratio of load inertia moment to servo motor inertia moment
13	PG1	Position control gain 1
14	VG1	Speed control gain 1
15	PG2	Position control gain 2
16	VG2	Speed control gain 2
17	VIC	Speed integral compensation

POINT

- The auto tuning mode 1 may not be performed properly if the following conditions are not satisfied.
  - Time to reach 2000r/min is the acceleration/deceleration time constant of 5s or less.
  - Speed is 150r/min or higher.
  - The ratio of load inertia moment to servo motor is not more than 100 times.
  - 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 the auto tuning mode 2 or manual mode 1 • 2 to make gain adjustment.

(2) Auto tuning mode 2

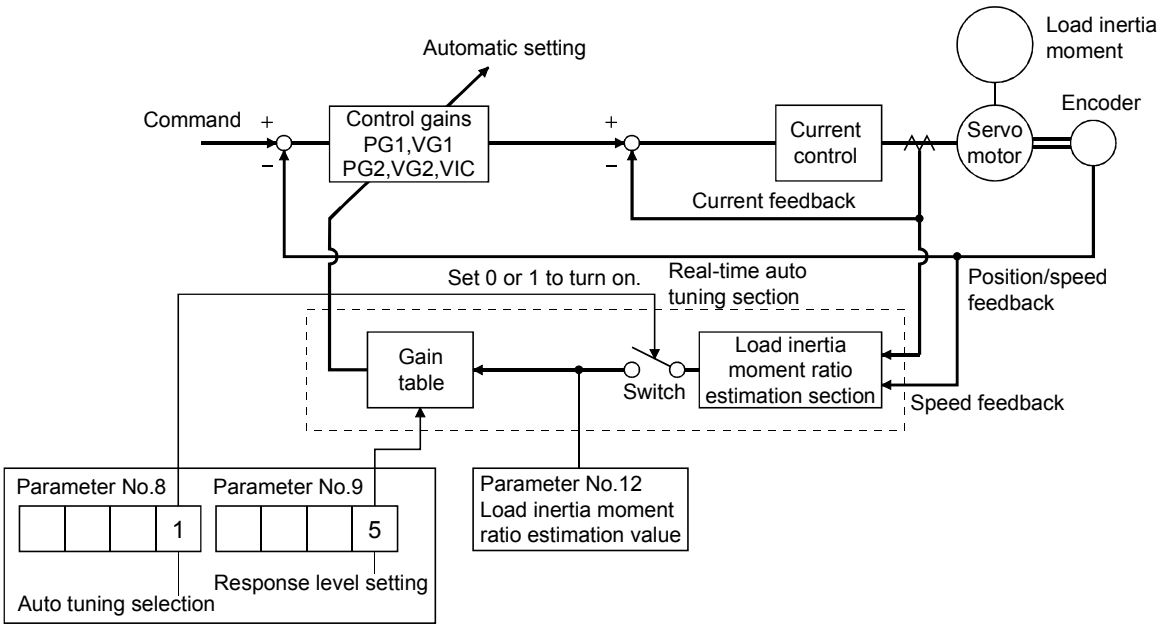
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (parameter No. 12).

The following parameters are automatically adjusted in the auto tuning mode 2.

Parameter No.	Abbreviation	Name
13	PG1	Position control gain 1
14	VG1	Speed control gain 1
15	PG2	Position control gain 2
16	VG2	Speed control gain 2
17	VIC	Speed integral compensation

6.2.2 Auto tuning mode operation

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



When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No. 12 (the ratio of load inertia moment to servo motor). These results can be confirmed on the status display screen of the MR Configurator (servo configuration software) section.

If the value of the load inertia moment ratio is already known or if estimation cannot be made properly, chose the "auto tuning mode 2" (parameter No. 8: 0003) to stop the estimation of the load inertia moment ratio (Switch in above diagram turned off), and set the load inertia moment ratio (parameter No. 12) manually.

From the preset load inertia moment ratio (parameter No. 12) value and response level (parameter No. 9), the optimum control gains are automatically set on the basis of the internal gain tale.

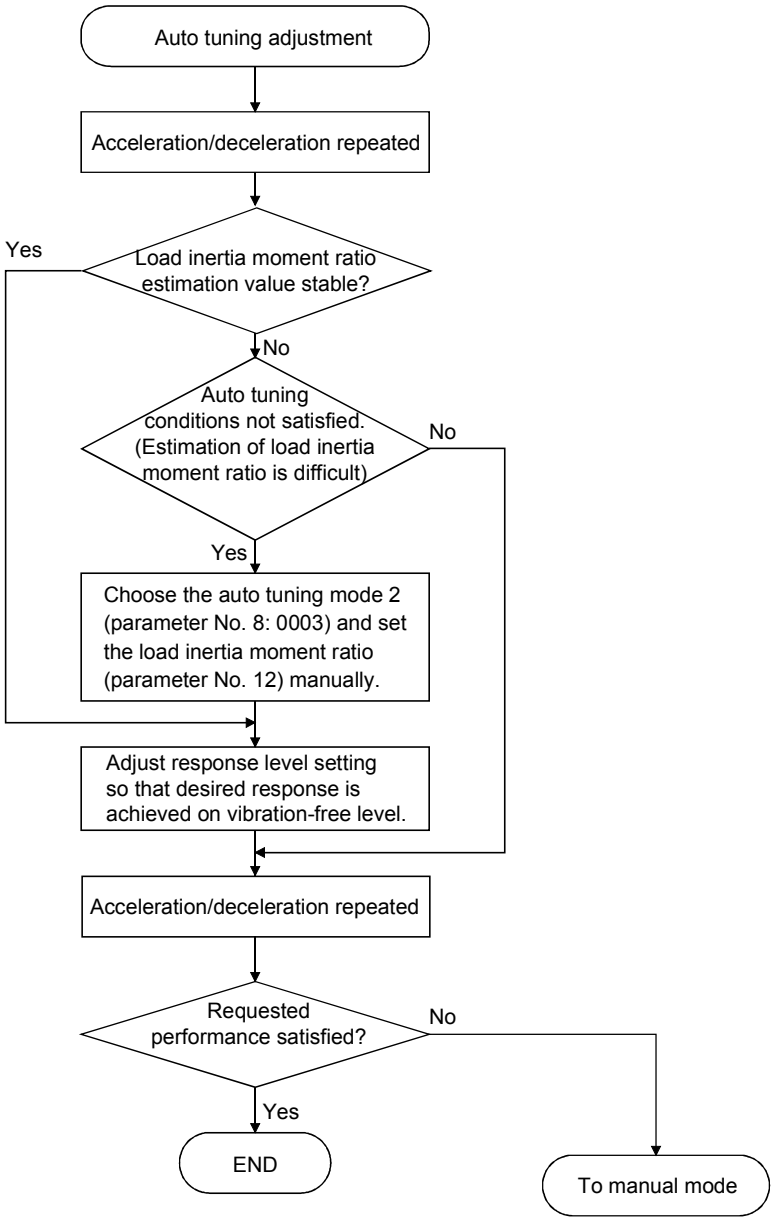
The auto tuning results are saved in the EEP-ROM of the servo amplifier every 6 minutes since power-on. At power-on, auto tuning is performed with the value of each control gain saved in the EEP-ROM being used as an initial value.

POINT

- If sudden disturbance torque is imposed during operation, the estimation of the inertia moment ratio may malfunction temporarily. In such a case, choose the "auto tuning mode 2" (parameter No. 8: 0003) and set the correct load inertia moment ratio in parameter No. 12.
- When any of the auto tuning mode 1, auto tuning mode 2 and manual mode 1 settings is changed to the manual mode 2 setting, the current control gains and load inertia moment ratio estimation value are saved in the EEP-ROM.

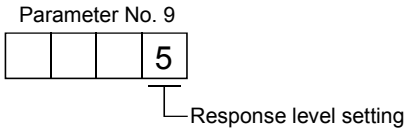
6.2.3 Adjustment procedure by auto tuning

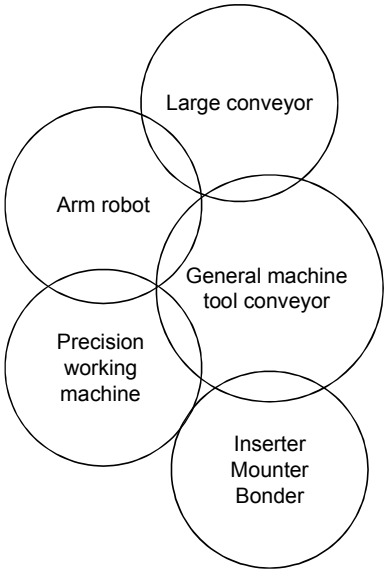
Since auto tuning is made valid before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



6.2.4 Response level setting in auto tuning mode

Set the response (parameter No. 9) of the whole servo system. 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 100Hz, adaptive vibration suppression control (parameter No. 25) or machine resonance suppression filter (parameter No. 18) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 7.2, 7.3 for adaptive vibration suppression control and machine resonance suppression filter.



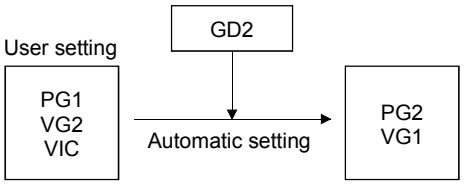
Response level setting	Machine characteristic		
	Machine rigidity	Machine resonance frequency guideline	Guideline of corresponding machine
1	Low	15Hz	
2		20Hz	
3		25Hz	
4	↑	30Hz	
5		35Hz	
6		45Hz	
7		55Hz	
8	Middle	70Hz	
9		85Hz	
A		105Hz	
B		130Hz	
C	↓	160Hz	
D		200Hz	
E		240Hz	
F	High	300Hz	

6.3 Manual mode 1 (simple manual adjustment)

If you are not satisfied with the adjustment of auto tuning, you can make simple manual adjustment with three parameters.

6.3.1 Operation of manual mode 1

In this mode, setting the three gains of position control gain 1 (PG1), speed control gain 2 (VG2) and speed integral compensation (VIC) 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 system (position gain, speed gain, speed integral time constant). Here, the position gain corresponds to PG1, the speed gain to VG2 and the speed integral time constant to VIC. When making gain adjustment in this mode, set the load inertia moment ratio (parameter No. 12) correctly.

6.3.2 Adjustment by manual mode 1

> **POINT**
>
> ▪ If machine resonance occurs, adaptive vibration suppression control (parameter No. 25) or machine resonance suppression filter (parameter No. 18) may be used to suppress machine resonance. (Refer to section 7.2, 7.3.)

(1) For speed control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
12	GD2	Ratio of load inertia moment to servo motor inertia moment
16	VG2	Speed control gain 2
17	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment (parameter No. 12).	
2	Increase the speed control gain 2 (parameter No. 16) within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed control gain.
3	Decrease the speed integral compensation (parameter No. 17) within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
4	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 adaptive vibration suppression control or machine resonance suppression filter and then executing steps 2 and 3.	Suppression of machine resonance Refer to section 7.2, 7.3.
5	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Speed control gain 2 (parameter No. 16)

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency(Hz)} = \frac{\text{Speed control gain setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})\times 2\pi}$$

2) Speed integral compensation (parameter No. 17)

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 inertia moment 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.

$$\text{Speed integral composition setting (ms)} \geq \frac{2000 \text{ to } 3000}{\text{Speed control gain 2 setting}/\ (1+\text{ratio of load inertia moment to servo motor inertia moment.})}$$

(2) For position control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
12	GD2	Ratio of load inertia moment to servo motor inertia moment
13	PG1	Position control gain 1
16	VG2	Speed control gain 2
17	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment (parameter No. 12).	
2	Set a slightly smaller value to the position control gain 1 (parameter No. 13).	
3	Increase the speed control gain 2 (parameter No. 16) within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed control gain.
4	Decrease the speed integral compensation (parameter No. 17) within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
5	Increase the position control gain 1 (parameter No. 13).	Increase the position control gain.
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 adaptive vibration suppression control or machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance Refer to section 7.2 and 7.3.
7	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Position control gain 1 (parameter No. 13)

This parameter determines the response level of the position control loop. Increasing position control gain 1 improves track ability to a position command but a too high value will make overshooting liable to occur at the time of settling.

$$\text{Position control gain 1 guideline} \leq \frac{\text{Speed control gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})} \times \left(\frac{1}{3} \text{ to } \frac{1}{5}\right)$$

2) Speed control gain 2 (parameter No. 16)

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency(Hz)} = \frac{\text{Speed control gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment}) \times 2\pi}$$

3) Speed integral compensation (parameter No. 17)

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 inertia moment 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.

$$\text{Speed integral compensation setting(ms)} \geq \frac{\text{2000 to 3000}}{\text{Speed control gain 2 setting/ (1+ ratio of load inertia moment to servo motor inertia moment set value)}}$$

6.4 Interpolation mode

The interpolation mode is used to match the position control 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, the position control gain 1 and speed control gain 1 which determine command track ability are set manually and the other gain adjusting parameters are set automatically.

(1) Parameter

(a) Automatically adjusted parameters

The following parameters are automatically adjusted by auto tuning.

Parameter No.	Abbreviation	Name
12	GD2	Ratio of load inertia moment to servo motor inertia moment
15	PG2	Position control gain 2
16	VG2	Speed control gain 2
17	VIC	Speed integral compensation

(b) Manually adjusted parameters

The following parameters are adjustable manually.

Parameter No.	Abbreviation	Name
13	PG1	Position control gain 1
14	VG1	Speed control gain 1

(2) Adjustment procedure

Step	Operation	Description
1	Choose the auto tuning mode 1 (parameter No. 8: 0001) and set the machine resonance frequency of the response level to 15Hz 1 (parameter No. 9: 0001).	Select the auto tuning mode 1.
2	During operation, increase the response level selection (parameter No. 9), and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check the values of position control gain 1 (parameter No. 13) and speed control gain 1 (parameter No. 14).	Check the upper setting limits.
4	Choose the interpolation mode (parameter No. 8: 0000).	Select the interpolation mode.
5	Set the position control 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 control gain 1.	Set position control gain 1.
6	Using the speed control gain 1 value checked in step 3 as the guideline of the upper limit, look at the rotation status and set in speed control gain 1 the value three or more times greater than the position control gain 1 setting.	Set speed control gain 1.
7	Looking at the interpolation characteristic and rotation status, fine-adjust the gains and response level setting.	Fine adjustment.

(3) Adjustment description

(a) Position control gain 1 (parameter No.13)

This parameter determines the response level of the position control loop. Increasing PG1 improves track ability to a position command but a too high value will make overshooting liable to occur at the time of settling. The droop pulse value is determined by the following expression.

$$\text{Droop pulse value (pulse)} = \frac{\dfrac{\text{Rotation speed (r/min)}}{60} \times 131{,}072\text{(pulse)}}{\text{Position control gain set value}}$$

(b) Speed control gain 1 (parameter No. 14)

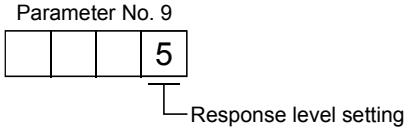
Set the response level of the speed loop of the model. Make setting using the following expression as a guideline.

Speed control gain 1 setting ≥ Position control gain 1 setting×3

6.5 Differences in auto tuning between MELSERVO-J2 and MELSERVO-J2-Super

6.5.1 Response level setting

To meet higher response demands, the MELSERVO-J2-Super series has been changed in response level setting range from the MELSERVO-J2 series. The following table lists comparison of the response level setting.

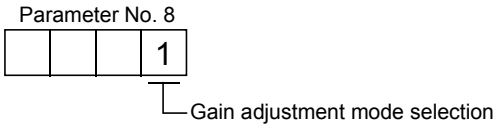


MELSERVO-J2 series		MELSERVO-J2-Super series	
Response level setting	Machine resonance frequency	Response level setting	Machine resonance frequency guideline
		1	15Hz
1	20Hz	2	20Hz
		3	25Hz
		4	30Hz
		5	35Hz
2	40Hz	6	45Hz
		7	55Hz
3	60Hz	8	70Hz
4	80Hz	9	85Hz
5	100Hz	A	105Hz
		B	130Hz
		C	160Hz
		D	200Hz
		E	240Hz
		F	300Hz

Note that because of a slight difference in gain adjustment pattern, response may not be the same if the resonance frequency is set to the same value.

6.5.2 Auto tuning selection

The MELSERVO-J2-Super series has an addition of the load inertia moment ratio fixing mode. It also has the addition of the manual mode 1 which permits manual adjustment with three parameters.



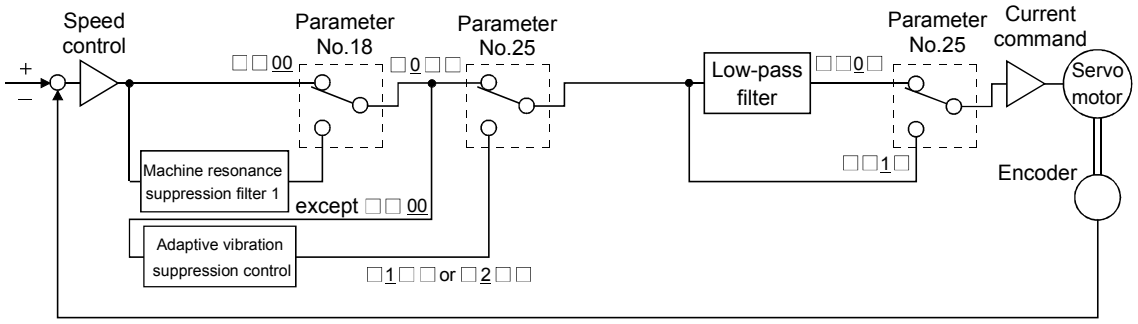
Gain adjustment mode		Auto tuning selection		Remarks
		MELSERVO-J2 series	MELSERVO-J2-Super series	
Interpolation mode		0	0	Position control gain 1 is fixed.
Auto tuning	Auto tuning mode 1	1	1	Ordinary auto tuning
	Auto tuning mode 2		3	Estimation of load inertia moment ratio stopped. Response level setting valid.
Auto tuning invalid	Manual mode 1		4	Simple manual adjustment
	Manual mode 2	2	2	Manual adjustment of all gains

7. SPECIAL ADJUSTMENT FUNCTIONS

POINT
▪ The functions given in this chapter need not be used generally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 6.

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 and adaptive vibration suppression control functions can suppress the resonance of the mechanical system.

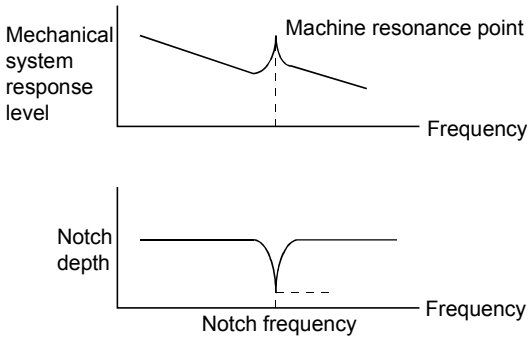
7.1 Function block diagram



7.2 Machine resonance suppression filter

(1) Function

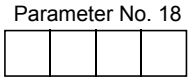
The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency) and gain decreasing depth.



POINT
▪ The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.

(2) Parameters

Set the notch frequency and notch depth of the machine resonance suppression filter 1 (parameter No. 18).



Notch frequency selection

Setting	Frequency	Setting	Frequency	Setting	Frequency	Setting	Frequency
00	Invalid	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	Depth (Gain)
0	Deep (−40dB)
1	↑ (−14dB)
2	↓ (−8dB)
3	Shallow (−4dB)

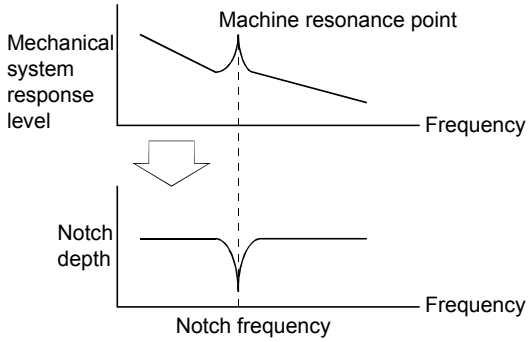
POINT

- 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 the MR Configurator (servo configuration software). This allows the required notch frequency and depth to be determined.

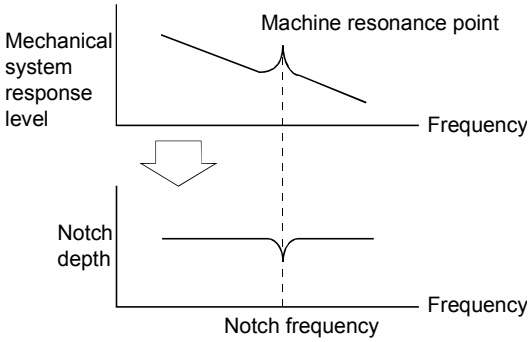
7.3 Adaptive vibration suppression control

(1) Function

Adaptive vibration suppression control is a function in which the servo amplifier detects machine resonance and sets the filter characteristics automatically to suppress mechanical system vibration. Since the filter characteristics (frequency, depth) are set automatically, you need not be conscious of the resonance frequency of a mechanical system. Also, while adaptive vibration suppression control is valid, the servo amplifier always detects machine resonance, and if the resonance frequency changes, it changes the filter characteristics in response to that frequency.



When machine resonance is large and frequency is low



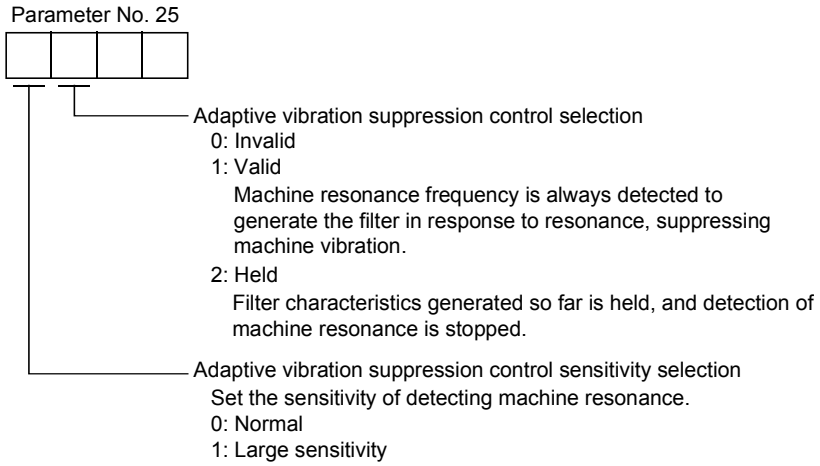
When machine resonance is small and frequency is high

POINT

- The machine resonance frequency which adaptive vibration suppression control can respond to is about 150 to 500Hz. Adaptive vibration suppression control has no effect on the resonance frequency outside this range. Use the machine resonance suppression filter for the machine resonance of such frequency.
- Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics or which has too large resonance.
- Under operating conditions in which sudden disturbance torque is imposed during operation, the detection of the resonance frequency may malfunction temporarily, causing machine vibration. In such a case, set adaptive vibration suppression control to be "held" (parameter No. 25: □2□□) to fix the characteristics of the adaptive vibration suppression control filter.

(2) Parameters

The operation of adaptive vibration suppression control selection (parameter No. 25).



POINT

- Adaptive vibration suppression control is factory-set to be "invalid" (parameter No. 25: 0000).
- Selection the adaptive vibration suppression control sensitivity can change the sensitivity of detecting machine resonance. Selection of "large sensitivity" detects smaller machine resonance and generates a filter to suppress machine vibration. However, since a phase delay will also increase, the response of the servo system may not increase.

7.4 Low-pass filter

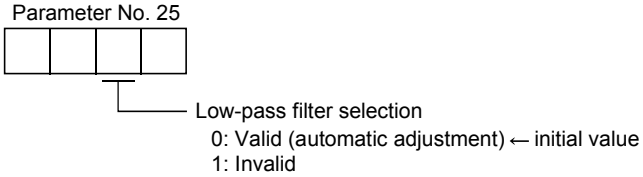
(1) Function

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 factory-set to be valid for a torque command. The filter frequency of this low-pass filter is automatically adjusted to the value in the following expression.

$$\text{Filter frequency (Hz)} = \frac{\text{Speed control gain 2 set value} \times 10}{2\pi \times (1 + \text{ratio of load inertia moment to servo motor inertia moment set value} \times 0.1)}$$

(2) Parameter

Set the operation of the low-pass filter (parameter No. 25).



POINT

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

7.5 Gain changing function

This function can change the gains. You can change between gains during rotation and gains during stop or can use an external signal to change gains during operation.

7.5.1 Applications

This function is used when.

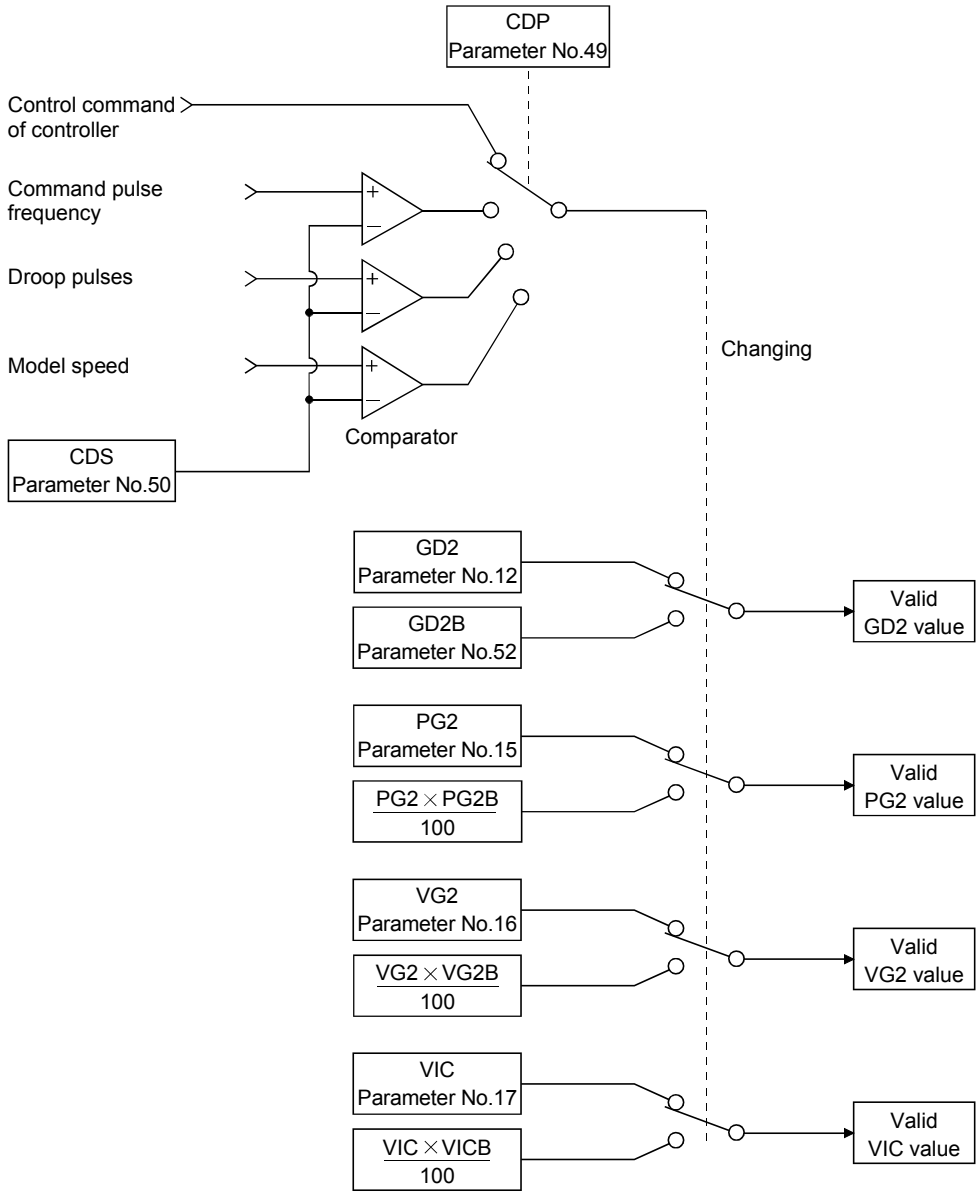
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.

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

(3) You want to change the gains using an external signal to ensure stability of the servo system since the load inertia moment ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

7.5.2 Function block diagram

The valid control gains PG2, VG2, VIC and GD2 of the actual loop are changed according to the conditions selected by gain changing selection CDP (parameter No. 49) and gain changing condition CDS (parameter No. 50).



7.5.3 Parameters

When using the gain changing function, always set "□□□ 2" in parameter No.8 (auto tuning) to choose the manual mode 2 of the gain adjustment modes. The gain changing function cannot be used in the auto tuning mode.

Parameter No.	Abbreviation	Name	Unit	Description
13	PG1	Position control gain 1	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
14	VG1	Speed control gain 1	rad/s	
12	GD2	Ratio of load inertia moment to servo motor inertia moment	0.1 times	Control parameters before changing
15	PG2	Position control gain 2	rad/s	
16	VG2	Speed control gain 2	rad/s	
17	VIC	Speed integral compensation	ms	
52	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	0.1 times	Used to set the ratio of load inertia moment to servo motor inertia moment after changing.
53	PG2B	Position control gain 2 changing ratio	%	Used to set the ratio (%) of the after-changing position control gain 2 to position control gain 2.
54	VG2B	Speed control gain 2 changing ratio	%	Used to set the ratio (%) of the after-changing speed control gain 2 to speed control gain 2.
55	VICB	Speed integral compensation changing ratio	%	Used to set the ratio (%) of the after-changing speed integral compensation to speed integral compensation.
49	CDP	Gain changing selection		Used to select the changing condition.
50	CDS	Gain changing condition	kpps pulse r/min	Used to set the changing condition values.
51	CDT	Gain changing time constant	ms	You can set the filter time constant for a gain change at changing.

(1) Parameters No. 12 to 17

These parameters are the same as in ordinary manual adjustment. Gain changing allows the values of ratio of load inertia moment to servo motor inertia moment, position control gain 2, speed control gain 2 and speed integral compensation to be changed.

(2) Ratio of load inertia moment to servo motor inertia moment 2 (parameter No. 52)

Set the ratio of load inertia moment to servo motor inertia moment after changing. If the load inertia moment ratio does not change, set it to the same value as ratio of load inertia moment to servo motor inertia moment (parameter No. 34).

(3) Position control gain 2 changing ratio (parameter No. 53), speed control gain 2 changing ratio (parameter No. 54), speed integral compensation changing ratio (parameter No. 55)

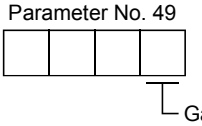
Set the values of after-changing position control gain 2, speed control gain 2 and speed integral compensation in ratio (%). 100% setting means no gain change.

For example, at the setting of position control gain 2 = 100, speed control gain 2 = 2000, speed integral compensation = 20 and position control gain 2 changing ratio = 180%, speed control gain 2 changing ratio = 150% and speed integral compensation changing ratio = 80%, the after-changing values are as follows.

Position control gain 2 = Position control gain 2 × Position control gain 2 changing ratio /100=180rad/s
Speed control gain 2 = Speed control gain 2 × Speed control gain 2 changing ratio /100 = 3000rad/s
Speed integral compensation = Speed integral compensation × Speed integral compensation changing ratio /100 = 16ms

(4) Gain changing selection (parameter No. 49)

Used to set the gain changing condition. Choose the changing condition in the first digit. If setting "1" here, the gain changing can be switched with the control command of controller.



Gain changing selection
Gains are changed in accordance with the settings of parameters No. 52 to 55 under any of the following conditions:
0: Invalid
1: Control command of controller
2: Command frequency is equal to higher than parameter No. 50 setting
3: Droop pulse value is equal to higher than parameter No. 50 setting
4: Servo motor speed is equal to higher than parameter No. 50 setting

(5) Gain changing condition (parameter No. 50)

When you selected "command frequency", "droop pulses" or "servo motor speed" in gain changing selection (parameter No.50), set the gain changing level.

The setting unit is as follows.

Gain changing condition	Unit
Command frequency	kpps
Droop pulses	pulse
Servo motor speed	r/min

(6) Gain changing time constant (parameter No. 51)

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

7.5.4 Gain changing operation

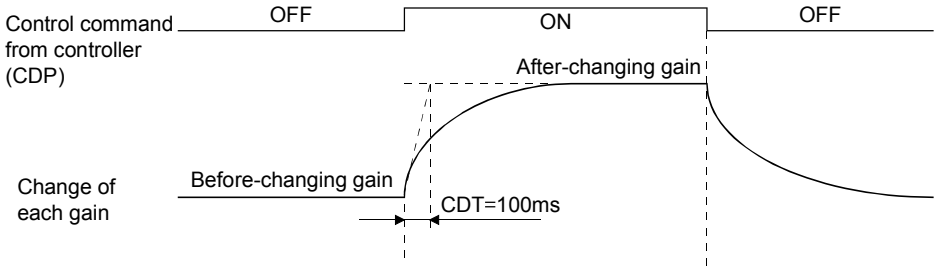
This operation will be described by way of setting examples.

(1) When you choose changing by external input

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
13	PG1	Position control gain 1	100	rad/s
14	VG1	Speed control gain 1	1000	rad/s
12	GD2	Ratio of load inertia moment to servo motor inertia moment	4	0.1 times
15	PG2	Position control gain 2	120	rad/s
16	VG2	Speed control gain 2	3000	rad/s
17	VIC	Speed integral compensation	20	ms
52	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	100	0.1 times
53	PG2B	Position control gain 2 changing ratio	70	%
54	VG2B	Speed control gain 2 changing ratio	133	%
55	VICB	Speed integral compensation changing ratio	250	%
49	CDP	Gain changing selection	0001 Control command from controller	
51	CDT	Gain changing time constant	100	ms

(b) Changing operation



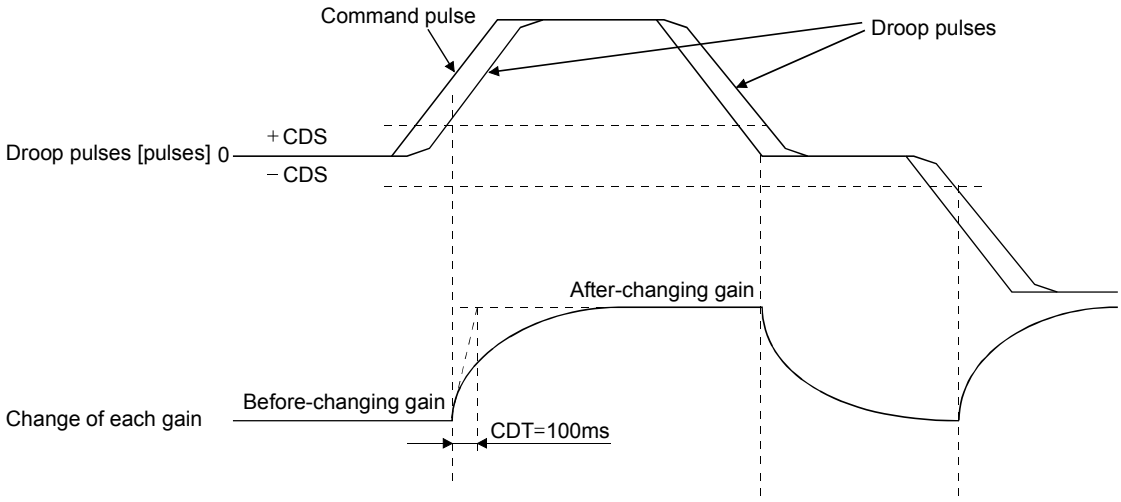
Position control gain 1	100			
Speed control gain 1	1000			
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→ 4.0
Position control gain 2	120	→	84	→ 120
Speed control gain 2	3000	→	4000	→ 3000
Speed integral compensation	20	→	50	→ 20

(2) When you choose changing by droop pulses

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
13	PG1	Position control gain 1	100	rad/s
14	VG1	Speed control gain 1	1000	rad/s
12	GD2	Ratio of load inertia moment to servo motor inertia moment	40	0.1 times
15	PG2	Position control gain 2	120	rad/s
16	VG2	Speed control gain 2	3000	rad/s
17	VIC	Speed integral compensation	20	ms
52	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	100	0.1 times
53	PG2B	Position control gain 2 changing ratio	70	%
54	VG2B	Speed control gain 2 changing ratio	133	%
55	VICB	Speed integral compensation changing ratio	250	%
49	CDP	Gain changing selection	0003 (Changed by droop pulses)	
50	CDS	Gain changing condition	50	pulse
51	CDT	Gain changing time constant	100	ms

(b) Changing operation



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

MEMO

8. INSPECTION

⚠ 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not. ・Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

POINT

・Do not test the servo amplifier with a megger (measure insulation resistance), or it may become faulty.

・Do not disassemble and/or repair the equipment on customer side.

(1) Inspection

It is recommended to make the following checks periodically.

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

(b) Check the cables and the like for scratches and cracks. Perform periodic inspection according to operating conditions.

(2) Life

The following parts must be changed periodically as listed below. If any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental conditions. For parts replacement, please contact your sales representative.

Part name		Life guideline
Servo amplifier	Smoothing capacitor	10 years
	Relay	Number of power-on and number of forced stop times:100,000times.
	Cooling fan	10,000 to 30,000hours (2 to 3 years)
	Absolute position battery	Refer to section 13.2

(a) Smoothing capacitor

Affected by ripple currents, etc. and deteriorates in characteristic. 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 normal air-conditioned environment.

(b) Relays

Their contacts will wear due to switching currents and contact faults occur. Relays reach the end of their life when the cumulative number of power-on and forced stop times is 100,000, which depends on the power supply capacity.

(c) Servo amplifier cooling fan

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

MEMO

9. TROUBLESHOOTING

9.1 Alarms and warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to section 9.2 or 9.3 and take the appropriate action.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

	Display	Name	Alarm deactivation		
			Power OFF→ON	Error reset	CPU reset
Alarms	10	Undervoltage	○	○	○
	12	Memory error 1	○		
	13	Clock error	○		
	15	Memory error 2	○		
	16	Encoder error 1	○		
	17	Board error	○		
	19	Memory error 3	○		
	1A	Motor combination error	○		
	20	Encoder error 2	○		
	24	Main circuit error	○	○	○
	25	Absolute position erase	○ (Note 2)		
	30	Regenerative error	○ (Note 1)	○ (Note 1)	○ (Note 1)
	31	Overspeed	○	○	○
	32	Overcurrent	○	○	○
	33	Overvoltage	○	○	○
	34	CRC error	○	○	○
	35	Command frequency error	○	○	○
	36	Transfer error	○	○	○
	37	Parameter error	○		○
	45	Main circuit device overheat	○ (Note 1)	○ (Note 1)	○ (Note 1)
	46	Servo motor overheat	○ (Note 1)	○ (Note 1)	○ (Note 1)
	50	Overload 1	○ (Note 1)	○ (Note 1)	○ (Note 1)
	51	Overload 2	○ (Note 1)	○ (Note 1)	○ (Note 1)
	52	Error excessive	○	○	○
	8E	Serial communication error	○	○	○
	88	Watchdog	○		
Warnings	92	Open battery cable warning	Removing the cause of occurrence deactivates the alarm automatically.		
	96	Home position setting warning			
	9F	Battery warning			
	E0	Excessive regenerative warning			
	E1	Overload warning			
	E3	Absolute position counter warning			
	E4	Parameter warning			
	E6	Servo forced stop warning			
	E7	Controller forced stop warning			
	E9	Main circuit off warning			
	EE	SSCNET error warning			

Note 1. Deactivate the alarm 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.

9.2 Remedies for alarms

CAUTION

- When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.
- If an absolute position erase alarm (25) occurred, always make home position setting again. Otherwise, misoperation may occur.
- As soon as an alarm occurs, mark Servo-off and power off the main circuit and control circuit.

POINT

- When any of the following alarms has occurred, always remove its cause and allow about 30 minutes for cooling before resuming operation. If operation is resumed by switching control circuit power off, then on to reset the alarm, the servo amplifier and servo motor may become faulty. To protect the main circuit elements, any of these servo 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.
  - Regenerative error (30)
  - Overload 1 (50)
  - Overload 2 (51)
- The alarm can be deactivated by switching power off, then on or by the error reset command • CPU reset from the servo system controller. For details, refer to section 9.1.

When an alarm occurs, the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No.
The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. The MR Configurator (servo configuration software) may be used to refer to the cause.

Display	Name	Definition	Cause	Action
10	Undervoltage	Power supply voltage dropped. MR-J2S-□B: 160VAC or less MR-J2S-□B1: 83VAC or less	1. Power supply voltage is low.	Check the power supply.
			2. There was an instantaneous control circuit power failure of 60ms or longer.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. Main voltage has dropped to the following voltage or less. MR-J2S-□B: 200VDC MR-J2S-□B1: 158VDC	
			5. Faulty parts in the servo amplifier Checking method Alarm (10) occurs if power is switched on after CN1A, CN1B and CN3 connectors are disconnected.	Change the servo amplifier.
12	Memory error 1	RAM, memory fault	Faulty parts in the servo amplifier Checking method Alarm (any of 12 and 13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
13	Clock error	Printed board fault		

Display	Name	Definition	Cause	Action
15	Memory error 2	EEP-ROM fault	1. Faulty parts in the servo amplifier Checking method Alarm (15) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
			2. The number of write times to EEP-ROM exceeded 100,000.	
16	Encoder error 1	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
17	Board error	CPU/parts fault	1. Faulty parts in the servo amplifier Checking method Alarm (17) occurs if power is switched on after disconnection of all cable but the control circuit power supply cable.	Change 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.	Correctly connect the output terminals U, V, W of the servo amplifier and the input terminals U, V, W of the servo motor.
19	Memory error 3	ROM memory fault	Faulty parts in the servo amplifier Checking method Alarm (19) occurs if power is switched on after disconnection of all cable but the control circuit power supply cable.	Change the servo amplifier.
1A	Motor combination error	Wrong combination of servo amplifier and servo motor.	Wrong combination of servo amplifier and servo motor connected.	Use correct combination.
20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
		Encoder detected acceleration error.	4. Excessive acceleration is occurred due to oscillation and others.	1. Decrease the speed control gain 2. 2. Decrease the auto tuning response level.
24	Main circuit error	Ground fault occurred at the servo motor outputs (U,V and W phases) of the servo amplifier.	1. Power input wires and servo motor output wires are in contact at main circuit terminal block (TE1).	Connect correctly.
			2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			3. Main circuit of servo amplifier failed. Checking method Alarm (24) occurs if the servo is switched on after disconnecting the U, V, W power cables from the servo amplifier.	Change the servo amplifier.
25	Absolute position erase	Absolute position data in error	1. Battery voltage low	Change the battery.
			2. Battery cable or battery is faulty.	Always make home position setting again.
		Power was switched on for the first time in the absolute position detection system.	3. Super capacitor of the absolute position encoder is not charged.	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.

Display	Name	Definition	Cause	Action
30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	1. Mismatch between used regenerative option and parameter No. 2 setting	Set correctly.
			2. Built-in regenerative resistor or regenerative option is not connected.	Connect correctly.
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. Checking method Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative option of larger capacity. 3. Reduce the load.
			4. Power supply voltage is abnormal. MR-J2S-□B:260VAC or more MR-J2S-□B1:135VAC or more	Review power supply
			5. Built-in regenerative resistor or regenerative option faulty.	Change the servo amplifier or regenerative option.
		Regenerative transistor fault	6. Regenerative transistor faulty. Checking method 1) The regenerative option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Change the servo amplifier.
31	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time constant.
			2. Servo system is instable to cause overshoot.	1. Reset servo gain to proper value. 2. If servo gain cannot be set to proper value. 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/ deceleration time constant.
			3. Encoder faulty.	Change the servo motor.
32	Overcurrent	Current that flew is higher than the permissible current of the servo amplifier. (When the alarm (32) occurs, switch the power OFF and then ON to reset the alarm. Then, turn on the servo-on. When the alarm (32) still occurs at the time, the transistor (IPM · IGBT) of the servo amplifier may be at fault. Do not switch the power OFF/ON repeatedly; check the transistor according to the cause 2 checking method.)	1. Short occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			2. Transistor of the servo amplifier faulty. Checking method Alarm (32) occurs if power is switched on after U,V and W are disconnected.	Change the servo amplifier.
			3. Ground fault occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
		Current higher than the permissible current flew in the regenerative transistor. (MR-J2S-500B only)	5. Improper wiring of the regenerative option.	Wire the regenerative option correctly.

Display	Name	Definition	Cause	Action
33	Overvoltage	Converter bus voltage exceeded 400VDC.	1. Regenerative option is not used.	Use the regenerative option.
			2. Though the regenerative option is used, the parameter No. 2 setting is "□□00 (not used)".	Make correct setting.
			3. Lead of built-in regenerative resistor or regenerative option is open or disconnected.	1. Change the lead. 2. Connect correctly.
			4. Regenerative transistor faulty.	Change the servo amplifier.
			5. Wire breakage of built-in regenerative resistor or regenerative option	1. For wire breakage of built-in regenerative resistor, change the servo amplifier. 2. For wire breakage of regenerative option, change the regenerative option.
			6. Capacity of built-in regenerative resistor or regenerative option is insufficient.	Add regenerative option or increase capacity.
			7. Power supply voltage high.	Review the power supply.
			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.
34	CRC error	Bus cable is faulty	1. Bus cable disconnected.	Connect correctly.
			2. Bus cable fault	Change the cable.
			3. Noise entere bus cable.	Take measures against noise.
			4. Termination connector disconnected.	Connect termination connector.
			5. The same No. exists in the servo amplifier side axis setting.	Set correctly.
35	Command frequency error	Input frequency of command pulse is too high.	1. Command given is greater than the maximum speed of the servo motor.	Review operation program.
			2. Noise entered bus cable.	Take action against noise.
			3. Servo system controller failure	Change the servo system controller.
36	Transfer error	Bus cable or printed board is faulty	1. Bus cable is disconnected.	Connect the connector of the bus cable.
			2. Bus cable fault.	Change the cable.
			3. Printed board is faulty.	Change the servo amplifier.
			4. Terimination connector disconnected	Connect termination connector.
37	Parameter error	Parameter setting is wrong.	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the servo amplifier.
			2. There is a parameter whose value was set to outside the setting range by the controller.	Change 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.	Change the servo amplifier.
45	Main circuit device overheat	Main circuit device overheat	1. Servo amplifier faulty.	Change the servo amplifier.
			2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
			3. Air cooling fan of servo amplifier stops.	1. Change the servo amplifier or cooling fan. 2. Reduce ambient temperature.

Display	Name	Definition	Cause	Action
46	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40℃ (104℉).	Review environment so that ambient temperature is 0 to 40℃ (32 to 104℉).
			2. Servo motor is overloaded.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
			3. Thermal sensor in encoder is faulty.	Change the servo motor.
50	Overload 1	Load exceeded overload protection characteristic of servo amplifier.	1. Servo amplifier is used in excess of its continuous output current.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
			2. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change the auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			3. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			4. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			5. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off,the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
51	Overload 2	Machine collision or the like caused max. For the time of the alarm occurrence, refer to the section 11.1.	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			3. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change the auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			4. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off,the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.

Display	Name	Definition	Cause	Action
52	(Note) Error excessive	The deviation between the model position and the actual servo motor position exceeds the parameter No.31 setting value (initial value: 2 revolutions).	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Torque limit value is too small.	Increase the torque limit value.
			3. Motor cannot be started due to torque shortage caused by power supply voltage drop.	1. Review the power supply capacity. 2. Use servo motor which provides larger output.
			4. Position control gain 1 (parameter No.13) value is small.	Increase set value and adjust to ensure proper operation.
			5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
			6. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			7. Encoder faulty	Change the servo motor.
			8. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
8E	Serial communication error	Serial communication error occurred between servo amplifier and communication device (e.g. personal computer).	1. Communication cable fault (Open cable or short circuit)	Repair or change the cable.
			2. Communication device (e.g. personal computer) faulty	Change the communication device (e.g. personal computer).
88	Watchdog	CPU, parts faulty	Fault of parts in servo amplifier Checking method Alarm (88) occurs if power is switched on after disconnection of all cable but the control circuit power supply cable.	Change the servo amplifier.

Note. The error excessive detection for 2 revolutions is available only when the servo amplifier of software version B1 or later is used. For the servo amplifier of software version older than B1, an error excessive alarm occurs when the deviation (deviation counter value) between the instructed position and the actual servo motor position exceeds the parameter No. 1 setting value (initial value: 8 revolutions).

9.3 Remedies for warnings

POINT

- When any of the following alarms has occurred, do not resume operation by switching power of the servo amplifier OFF/ON repeatedly. The servo amplifier and servo motor may become faulty. If the power of the servo amplifier is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.
  - Excessive regenerative warning (E0)
  - Overload warning 1 (E1)

If servo forced stop warning (E6), controller forced stop warning (E7) or SSCNET error warning (EE) occurs, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed. Eliminate the cause of the warning according to this section. Use the MR Configurator (servo configuration software) to refer to the cause of warning.

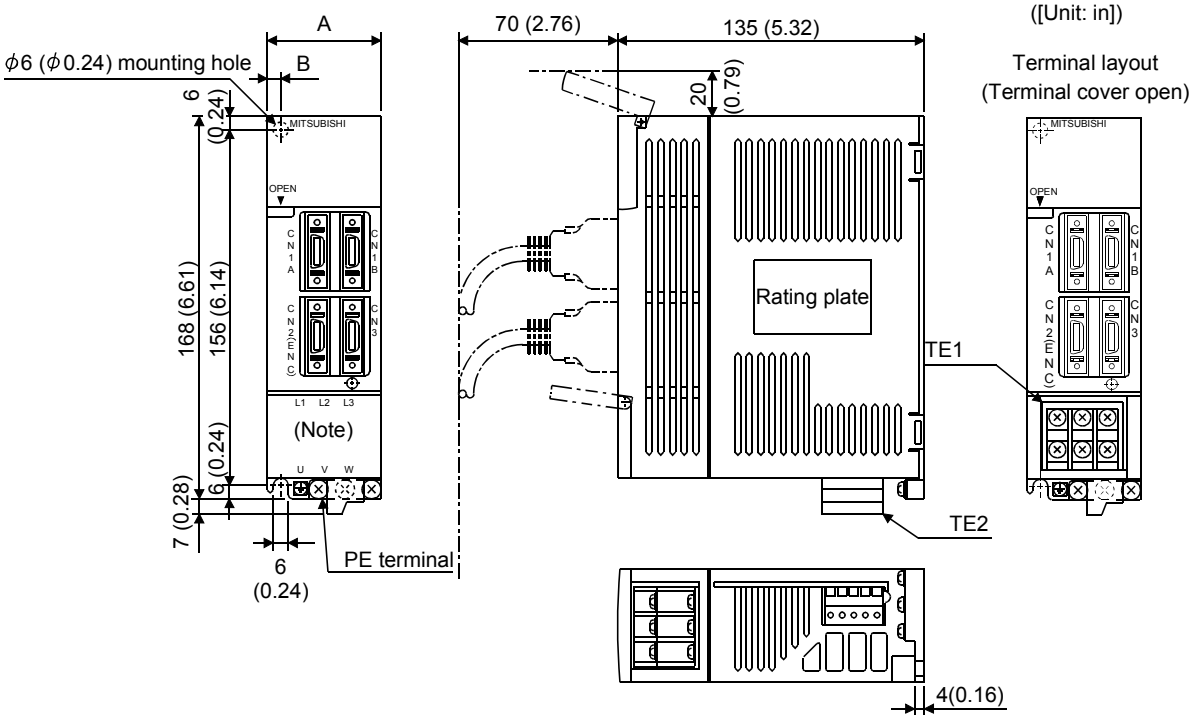
Display	Name	Definition	Cause	Action
92	Open battery cable warning	Absolute position detection system battery voltage is low.	1. Battery cable is open.	Repair cable or changed.
			2. Battery voltage supplied from the servo amplifier to the encoder fell to about 3.2V or less. (Detected with the encoder)	Change the battery.
96	Home position setting warning	Home position return could not be made in the precise position.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence.
			2. Home position return was executed during operation command.	Reduce creep speed.
			3. Creep speed high.	
9F	Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less. (Detected with the servo amplifier)	Change the battery.
E0	Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative resistor or regenerative option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change regenerative option for the one with larger capacity. 3. Reduce load.
E1	Overload warning	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. Cause, checking method Refer to 50, 51.	Refer to 50, 51.
E3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change the servo motor.
E4	Parameter warning	Parameter outside setting range.	Parameter value set from servo system controller is outside setting range	Set it correctly.
E6	Servo forced stop warning	EM1 is off.	External forced stop was made valid. (EM1 turned off.)	Ensure safety and deactivate forced stop.
E7	Controller forced stop warning		Forced stop signal was entered into the servo system controller.	Ensure safety and deactivate forced stop.
E9	Main circuit off warning	Servo-on command was issued with main circuit power off.		Switch on main circuit power.
EE	SSCNET error warning	The servo system controller connected is not SSCNET-compatible.		

10. OUTLINE DIMENSION DRAWINGS

10.1 Servo amplifiers

(1) MR-J2S-10B to MR-J2S-60B
MR-J2S-10B1 to MR-J2S-40B1

[Unit: mm]
([Unit: in])



Servo amplifier	Variable dimensions		Mass
	A	B	[kg]([lb])
MR-J2S-10B(1)	50 (1.97)	6 (0.24)	0.7 (1.54)
MR-J2S-20B(1)			
MR-J2S-40B(1)	70 (2.76)	22 (0.87)	1.1 (2.43)
MR-J2S-60B			

Note. This data applies to the 3-phase 200 to 230V and 1-phase 230V power supply models.

Terminal signal layout

TE1

- For 3-phase 200 to 230V and 1-phase 230V

L_1	L_2	L_3
U	V	W

Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

- For 1-phase 100 to 120V

L_1		L_2
U	V	W

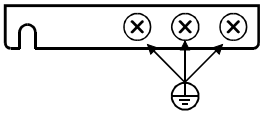
Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

TE2

←Front

D	C	P	L_{21}	L_{11}

PE terminals

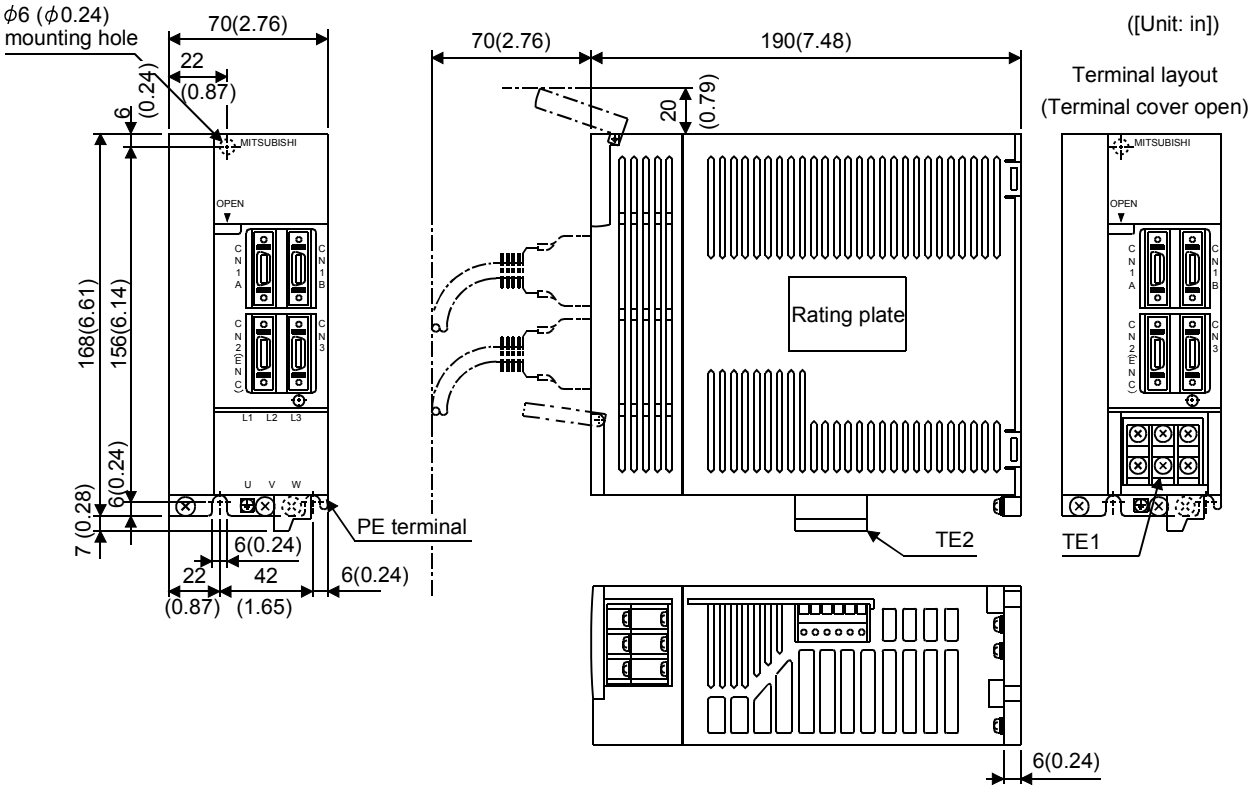


Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

Mounting Screw
Screw Size:M5
Tightening torque:
3.24[N・m]
(28.676 [lb・in])

(2) MR-J2S-70B・MR-J2S-100B

[Unit: mm]
([Unit: in])



Servo amplifier	Mass [kg]([lb])
MR-J2S-70B	1.7 (3.75)
MR-J2S-100B	

Terminal signal layout

TE1

L_1	L_2	L_3
U	V	W

Terminal screw: M4

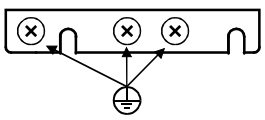
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

TE2

← Front

D	C	P	L_{21}	L_{11}	N

PE terminals



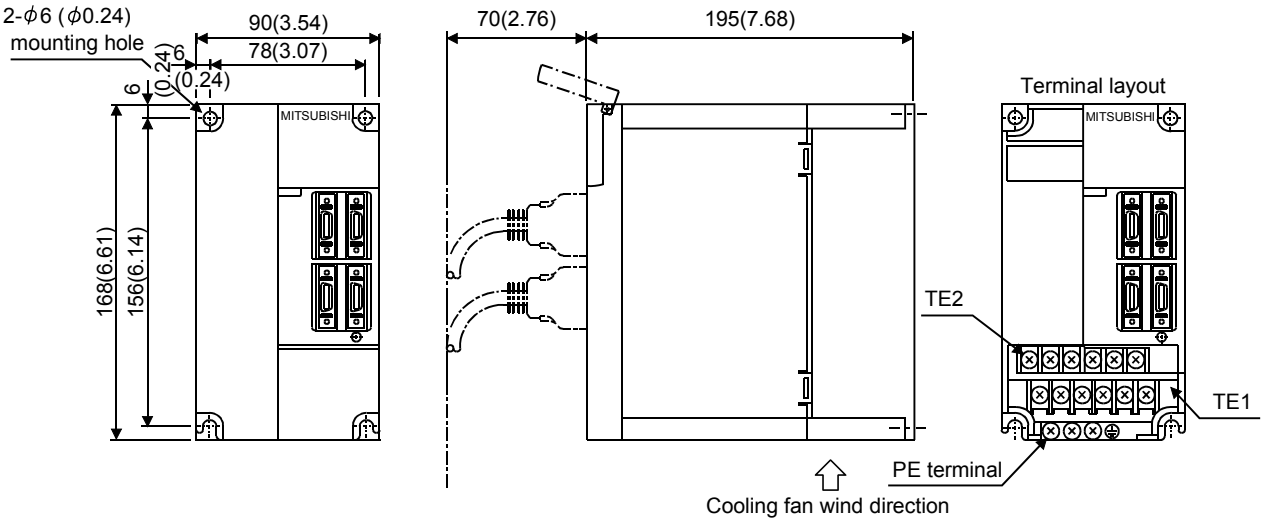
Terminal screw: M4

Tightening torque: 1.2 [N・m] (10.6 [lb・in])

Mounting Screw
Screw Size:M5
Tightening torque:3.24[N・m](28.676 [lb・in])

(3) MR-J2S-200B・MR-J2S-350B

[Unit: mm]
([Unit: in])



Servo amplifier	Mass [kg]([lb])
MR-J2S-200B	2.0 (4.41)
MR-J2S-350B	

Terminal signal layout

TE1

L_1	L_2	L_3	U	V	W

Terminal screw: M4

Tightening torque: 1.2 [N・m] (10.6 [lb・in])

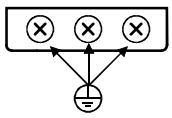
TE2

L_{11}	L_{21}	D	P	C	N

Terminal screw: M4

Tightening torque: 1.2 [N・m] (10.6 [lb・in])

PE terminals

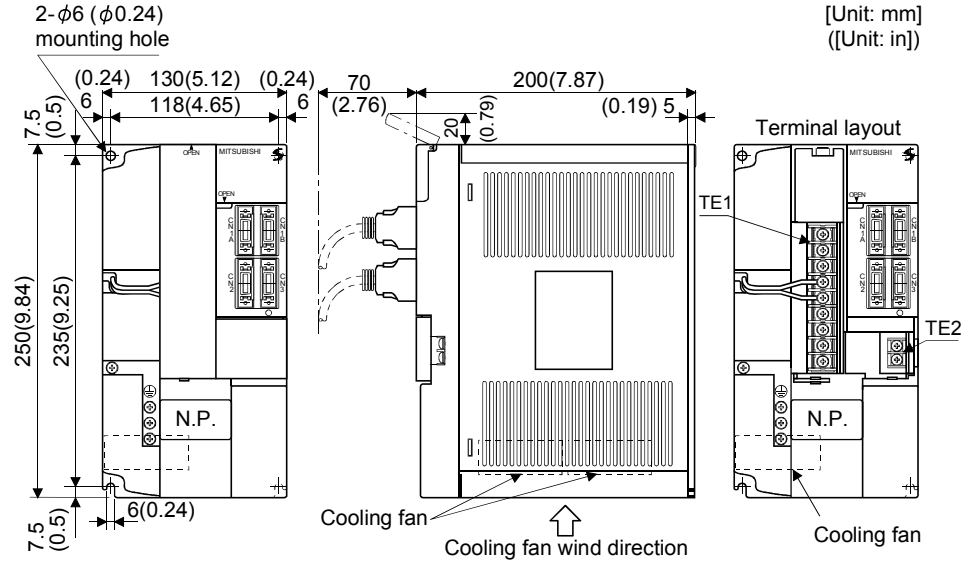


Terminal screw: M4

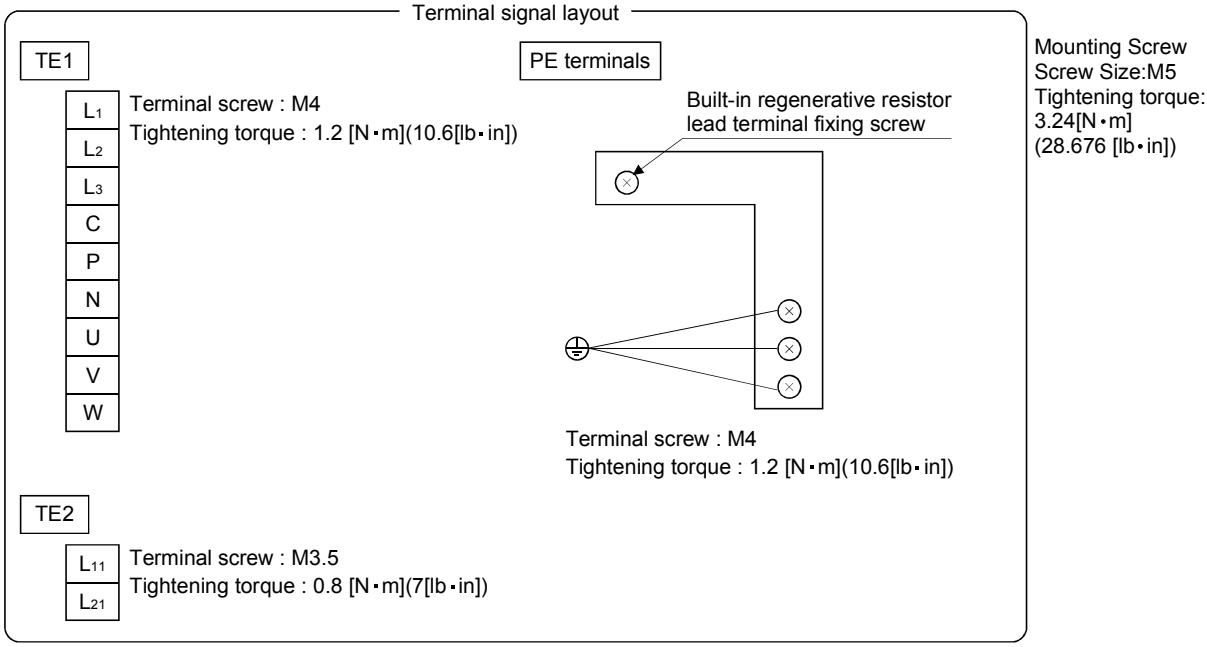
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

Mounting Screw
Screw Size:M5
Tightening torque:
3.24[N・m]
(28.676 [lb・in])

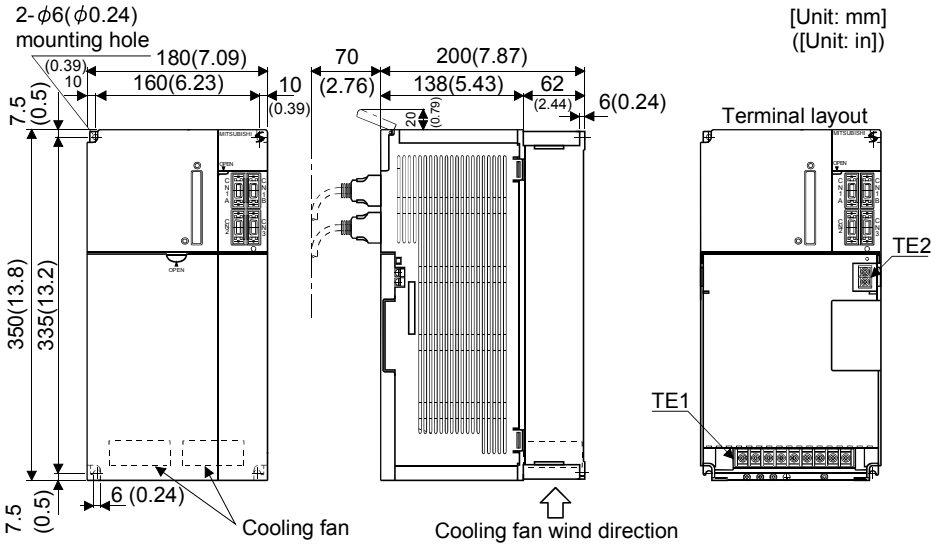
(4) MR-J2S-500B



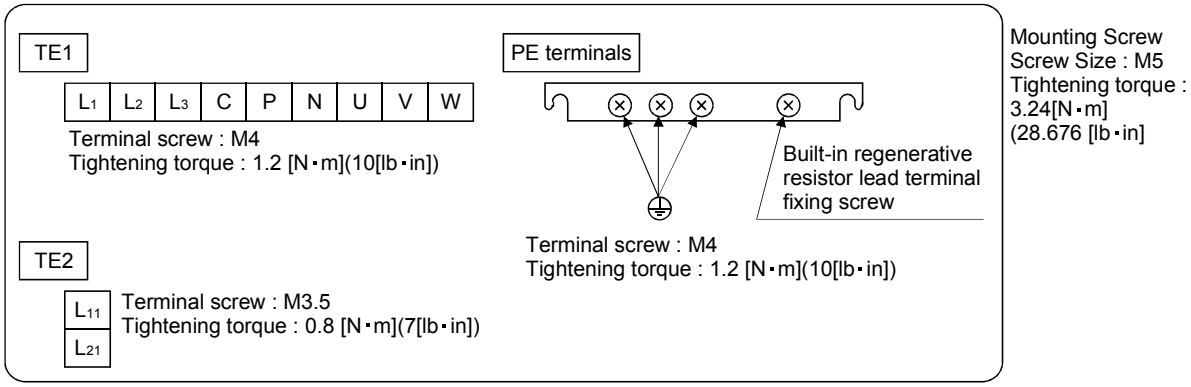
Servo amplifier	Mass [kg]([lb])
MR-J2S-500B	4.9(10.8)



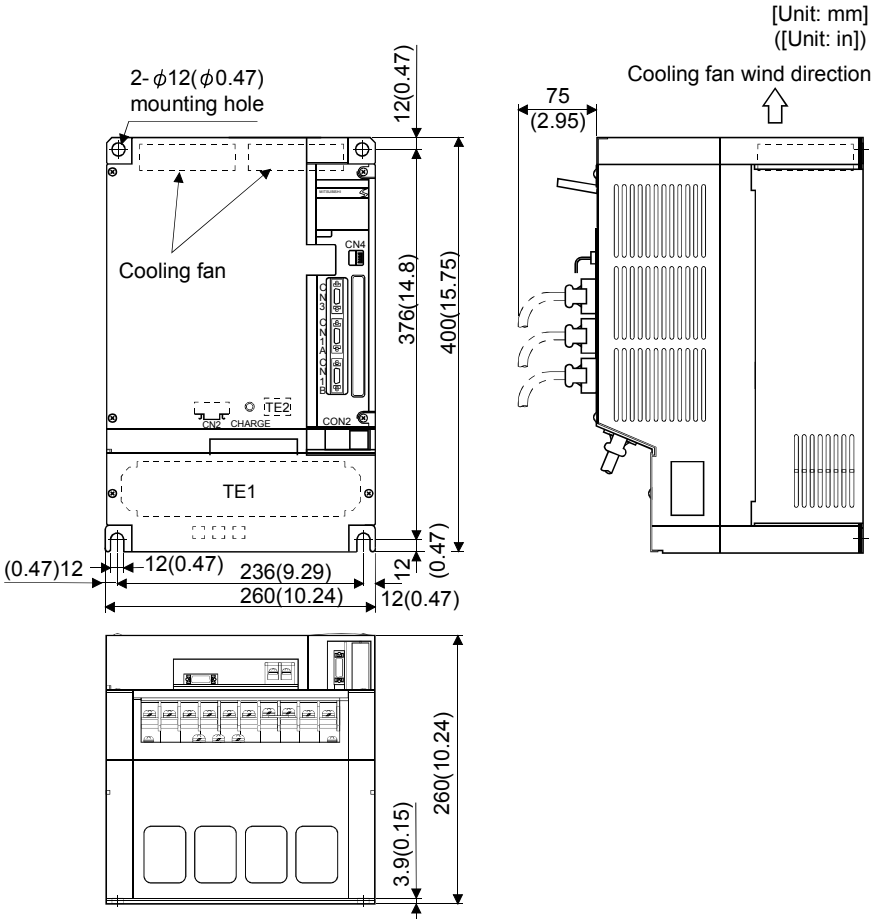
(5) MR-J2S-700B



Servo amplifier	Mass [kg]([lb])
MR-J2S-700B	7.2(15.9)



(6) MR-J2S-11KB・15KB



Servo amplifier	Mass [kg]([lb])
MR-J2S-11KB	15(33.1)
MR-J2S-15KB	16(35.3)

Terminal signal layout

TE1

L1	L2	L3	U	V	W	P1	P	C	N

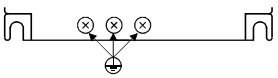
Terminal screw : M6
Tightening torque : 3.0[N・m] (26[lb・in)]

TE2

L11	L21

Terminal screw : M4
Tightening torque : 1.2[N・m] (10.6[lb・in])

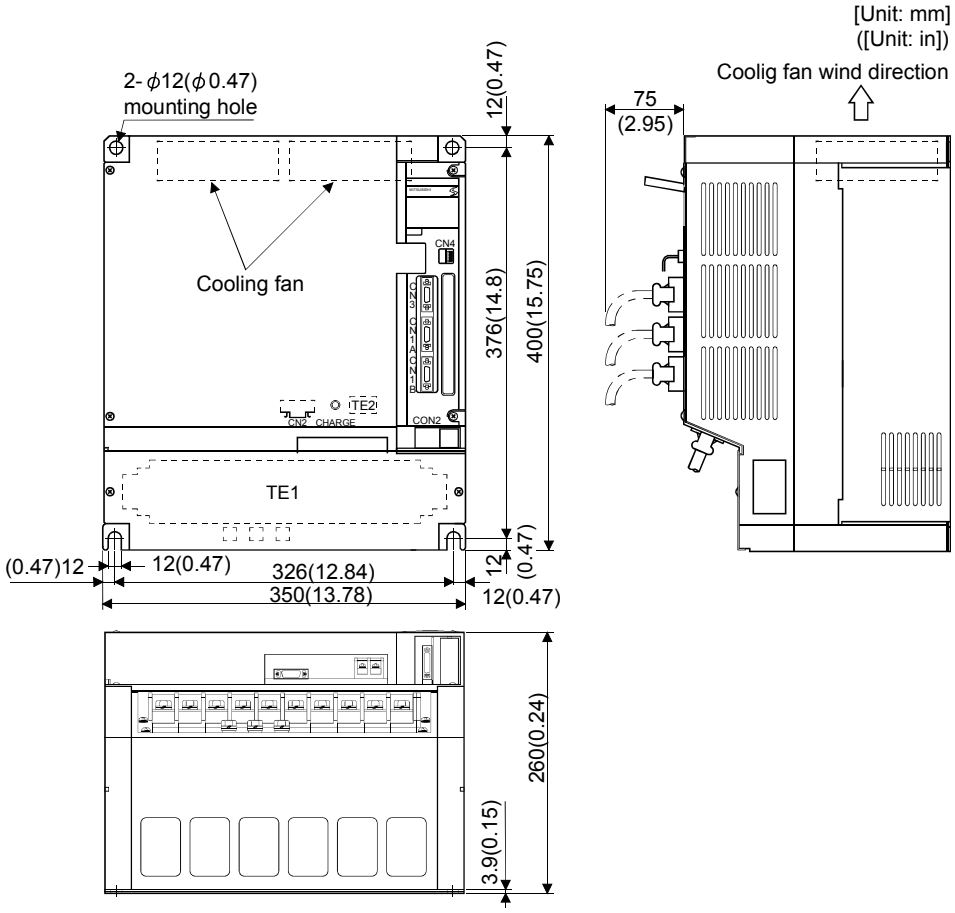
PE terminal



Terminal screw : M6
Tightening torque : 6.0[N・m] (52[lb・in)]

Mounting Screw
Screw Size:M10
Tightening torque:
26.5[N・m]
(234.545[lb・in])

(7) MR-J2S-22KB



Servo amplifier	Mass [kg]([lb])
MR-J2S-22KB	20(44.1)

Terminal signal layout

TE1

L_1	L_2	L_3	U	V	W	P_1	P	C	N

Terminal screw : M8
Tightening torque : 6.0[N・m] (52[lb・in)]

TE2

L_{11}	L_{21}

Terminal screw : M4
Tightening torque : 1.2[N・m] (10.6[lb・in)]

PE terminal

Terminal screw : M8
Tightening torque : 6.0[N・m] (52[lb・in)]

Mounting Screw
Screw Size:M10
Tighting torque:
26.5[N・m]
(234.545[lb・in])

10.2 Connectors

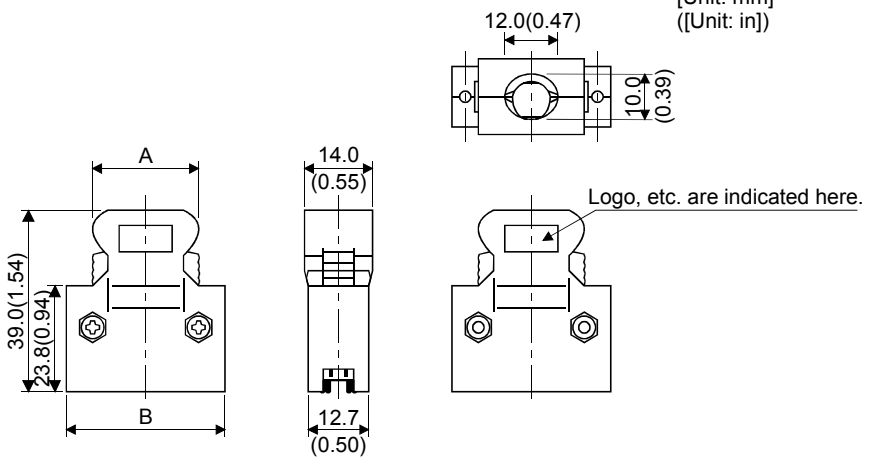
(1) Servo amplifier side

<3M>

(a) Soldered type

Model
Connector : 10120-3000PE ・10126-3000PE
Shell kit : 10320-52F0-008 ・10326-52F0-008

[Unit: mm]
([Unit: in])

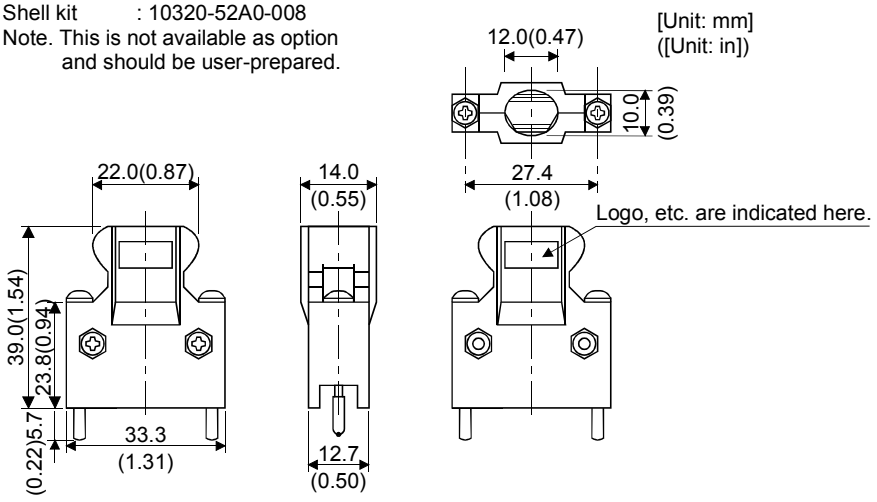


Connector	Shell kit	Variable dimensions	
		A	B
10120-3000PE	10320-52F0-008	22.0(0.87)	33.3(1.31)
10126-3000PE	10326-52F0-008	25.8(1.02)	37.2(1.47)

(b) Threaded type

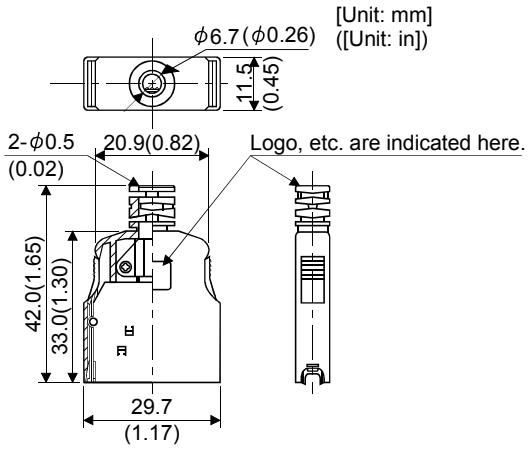
Model
Connector : 10120-3000PE
Shell kit : 10320-52A0-008
Note. This is not available as option
and should be user-prepared.

[Unit: mm]
([Unit: in])



(c) Insulation displacement type

Model
Connector : 10120-6000EL
Shell kit : 10320-3210-000

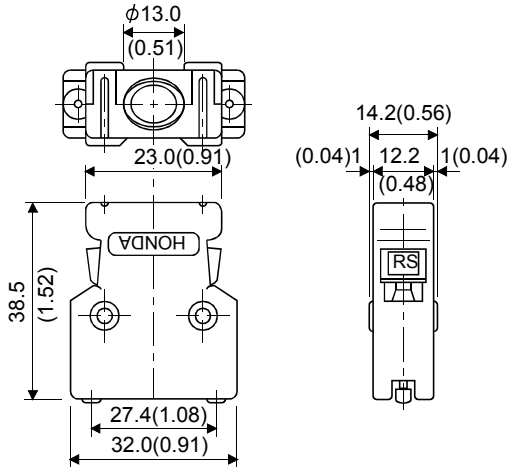


(2) Bus cable connector

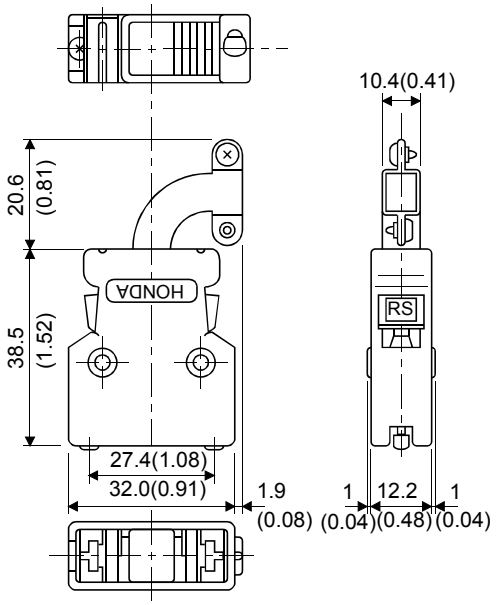
(a) Honda Tsushin Industry PCR type

[Unit: mm]
([Unit: in])

PCR-LS20LA1



PCR-LS20LA1W



Number of Pins	(Note) Model		
	Connector	Case	Crimping terminal
20	PCR-S20FS+ (soldering type)	PCR-LS20LA1	FHAT-002A
	PCR-S20F (insulation displacement type)	PCR-LS20LA1W	

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

(b) Honda Tsushin Industry HDR type

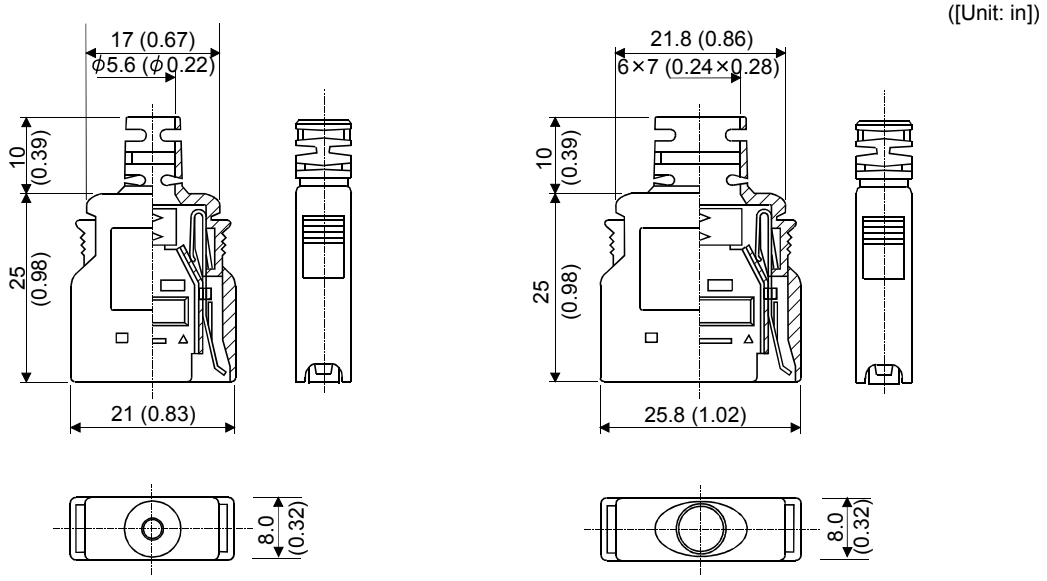
Number of Pins	Model HDR		
	Connector	Connector case	(Note) Crimping terminal
14	HDR-E14MG1	HDR-E14LPA5	Wire straightening tool : FHAT-0029
26	HDR-E26MG1	HDR-E26LPA5	Insulation displacement tool : FHPT-0004C

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

Model Connector : HDR-E14MG1
Connector case : HDR-E14LPA5

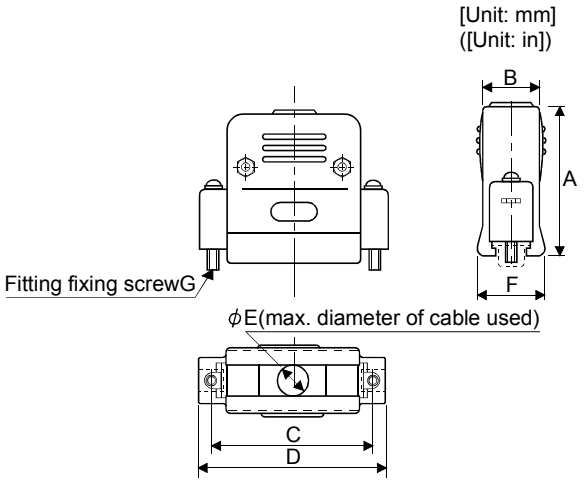
Model Connector : HDR-E26MG1
Connector case : HDR-E26LPA5

[Unit: mm]
([Unit: in])



(3) Communication cable connector
<Japan Aviation Electronics Industry>

[Unit: mm]
([Unit: in])

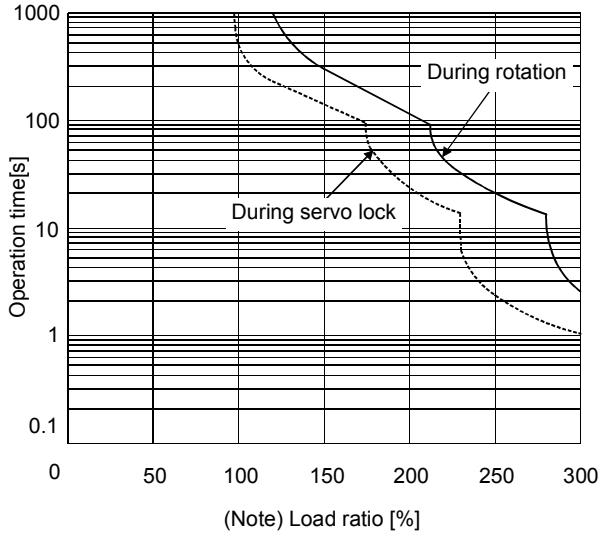


Type	A ±1	B ±1	C ±0.25	D ±1	φE	F Reference	G
DE-C1-J6-S6	34.5(1.36)	19(0.75)	24.99(0.98)	33(1.30)	6(0.24)	18(0.71)	#4-40

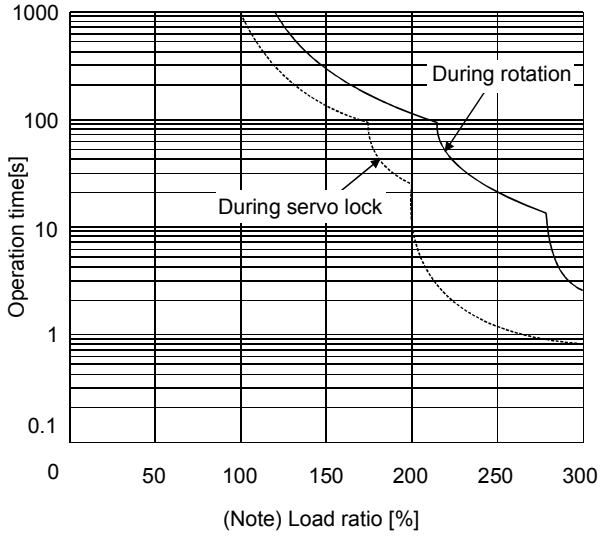
11. CHARACTERISTICS

11.1 Overload protection characteristics

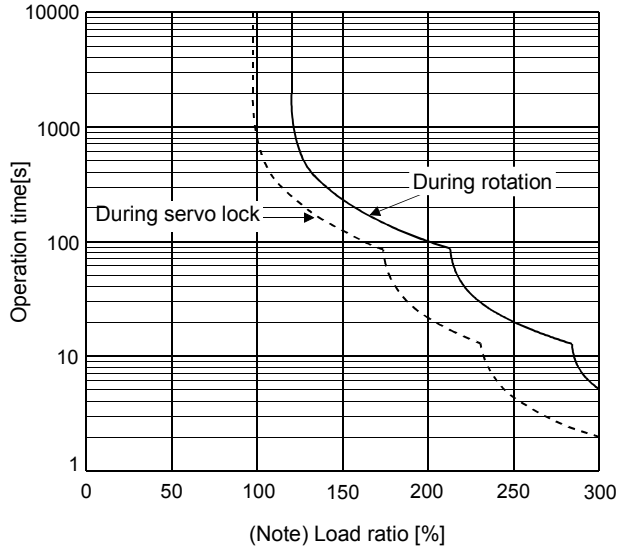
An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. Overload 1 alarm (50) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 11.1, Overload 2 alarm (51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.
In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.



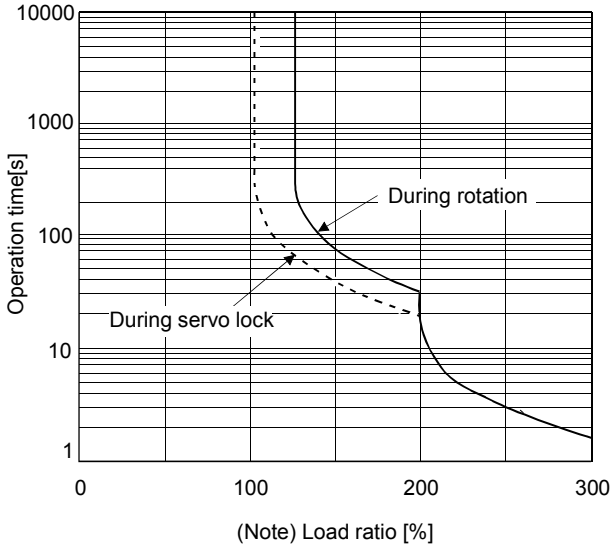
a. MR-J2S-10B to MR-J2S-100B



b. MR-J2S-200B to MR-J2S-350B



c. MR-J2S-500B・MR-J2S-700B



d. MR-J2S-11KB to MR-J2S-22KB

Note. 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 30r/min or less low-speed operation status, the servo amplifier may fail even when the electronic thermal relay protection is not activated.

Fig 11.1 Electronic thermal relay protection characteristics

11.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 11.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 11.1 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 maximum 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 11.1 Power supply capacity and generated heat per servo amplifier 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	
			At rated torque	With servo off	[m²]	[ft²]
MR-J2S-10B(1)	HC-KFS053・13	0.3	25	15	0.5	5.4
	HC-MFS053・13	0.3	25	15	0.5	5.4
	HC-UFS13	0.3	25	15	0.5	5.4
MR-J2S-20B(1)	HC-KFS23	0.5	25	15	0.5	5.4
	HC-MFS23	0.5	25	15	0.5	5.4
	HC-UFS23	0.5	25	15	0.5	5.4
MR-J2S-40B(1)	HC-KFS43	0.9	35	15	0.7	7.5
	HC-MFS43	0.9	35	15	0.7	7.5
	HC-UFS43	0.9	35	15	0.7	7.5
MR-J2S-60B	HC-SFS52	1.0	40	15	0.8	8.6
	HC-SFS53	1.0	40	15	0.8	8.6
	HC-LFS52	1.0	40	15	0.8	8.6
MR-J2S-70B	HC-KFS73	1.3	50	15	1.0	10.8
	HC-MFS73	1.3	50	15	1.0	10.8
	HC-UFS72・73	1.3	50	15	1.0	10.8
MR-J2S-100B	HC-SFS81	1.5	50	15	1.0	10.8
	HC-SFS102・103	1.7	50	15	1.0	10.8
	HC-LFS102	1.7	50	15	1.0	10.8
MR-J2S-200B	HC-SFS121	2.1	90	20	1.8	19.4
	HC-SFS201	3.5	90	20	1.8	19.4
	HC-SFS152・153	2.5	90	20	1.8	19.4
	HC-SFS202・203	3.5	90	20	1.8	19.4
	HC-RFS103	1.8	50	15	1.0	10.8
	HC-RFS153	2.5	90	20	1.8	19.4
	HC-UFS152	2.5	90	20	1.8	19.4
	HC-LFS152	2.5	90	20	1.8	19.4
MR-J2S-350B	HC-SFS301	4.8	120	20	2.7	29.1
	HC-SFS352・353	5.5	130	20	2.7	29.1
	HC-RFS203	3.5	90	20	1.8	19.4
	HC-UFS202	3.5	90	20	1.8	19.4
	HC-LFS202	3.5	90	20	1.8	19.4

Servo amplifier	Servo motor	(Note 1) Power supply capacity[kVA]	(Note 2) Servo amplifier-generated heat[W]		Area required for heat dissipation	
			At rated torque	With servo off	[m²]	[ft²]
MR-J2S-500B	HC-SFS502	7.5	195	25	3.9	42.0
	HC-RFS353	5.5	135	25	2.7	29.1
	HC-RFS503	7.5	195	25	3.9	42.0
	HC-UFS352	5.5	195	25	3.9	42.0
	HC-UFS502	7.5	195	25	3.9	42.0
	HC-LFS302	4.5	120	25	2.4	25.8
	HA-LFS502	7.5	195	25	3.9	42.0
MR-J2S-700B	HC-SFS702	10.0	300	25	6.0	64.6
	HA-LFS702	10.6	300	25	6.0	64.6
MR-J2S-11KB	HA-LFS11K2	16.0	530	45	11	118.4
	HA-LFS801	12.0	390	45	7.8	83.9
	HA-LFS12K1	18.0	580	45	11.6	124.8
	HA-LFS11K1M	16.0	530	45	11.0	118.4
MR-J2S-15KB	HA-LFS15K2	22.0	640	45	13	139.0
	HA-LFS15K1	22.0	640	45	13	139.0
	HA-LFS15K1M	22.0	640	45	13	139.0
MR-J2S-22KB	HA-LFS22K2	33.0	850	55	17	183.0
	HA-LFS20K1	30.1	775	55	15.5	166.8
	HA-LFS25K1	37.6	970	55	19.4	208.8
	HA-LFS22K1M	33.0	850	55	17.0	193.0

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value assumes that the power factor improving 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, use Equation 12.1 refer to section 12.1.1.

(2) Heat dissipation area for enclosed servo amplifier

The enclosed control box (hereafter called the control box) 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 a 5°C (41°F) safety margin, the system should operate within a maximum 55°C (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 11.1.

$$A = \frac{P}{K \cdot \Delta T} \quad \cdots\cdots (11.1)$$

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

When calculating the heat dissipation area with Equation 11.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 11.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the enclosure is directly installed on an insulated wall, that extra amount must be added to the enclosure's surface area.
The required heat dissipation area will vary wit the conditions in the enclosure. If convection in the enclosure is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the enclosure and the use of a cooling fan should be considered.
Table 11.1 lists the enclosure dissipation area for each servo amplifier when the servo amplifier is operated at the ambient temperature of 40°C (104°F) under rated load.

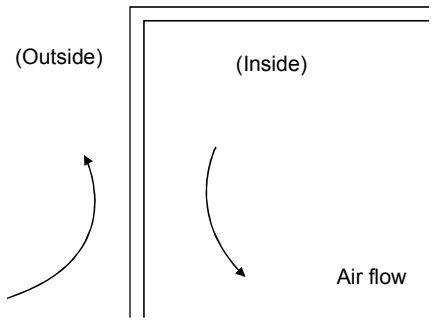


Fig. 11.2 Temperature distribution in enclosure

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

11.3 Dynamic brake characteristics

11.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 11.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 11.2 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) in this section.)

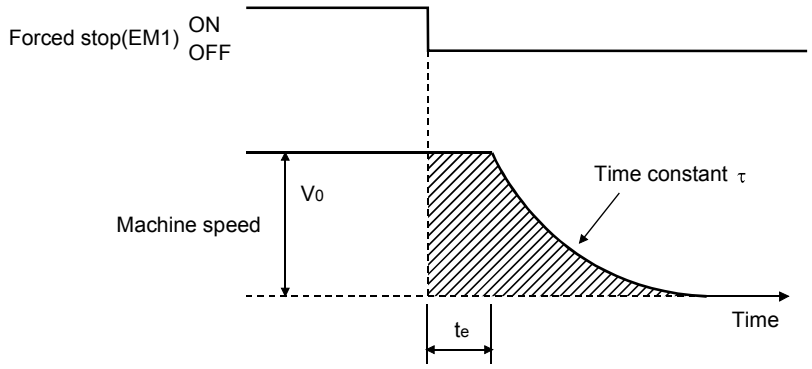


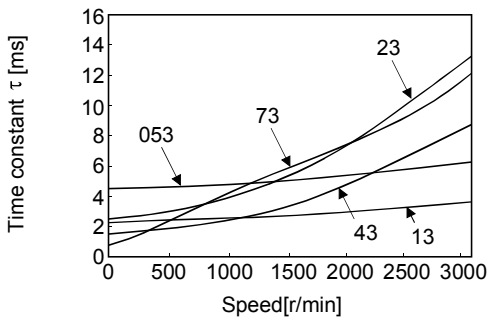
Fig. 11.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad (11.2)$$

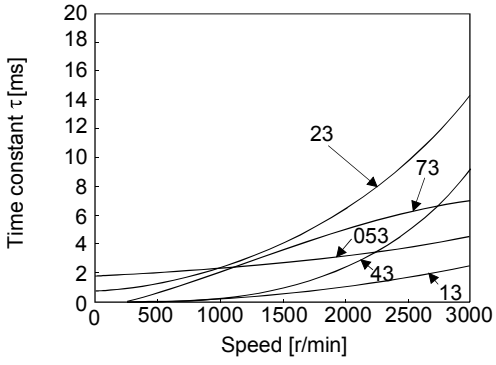
L_{max} : Maximum coasting distance [mm][in]
V_0 : Machine rapid feed rate [mm/min][in/min]
J_M : Servo motor inertial moment [kg・cm²][oz・in²]
J_L : Load inertia moment converted into equivalent value on servo motor shaft [kg・cm²][oz・in²]
τ : Brake time constant [s]
t_e : Delay time of control section [s]
For 7kW or less servo, there is internal relay delay time of about 30ms. For 11k to 22kW servo, there is delay time of about 100ms caused by a delay of the external relay and a delay of the magnetic contactor built in the external dynamic brake.

(2) Dynamic brake time constant

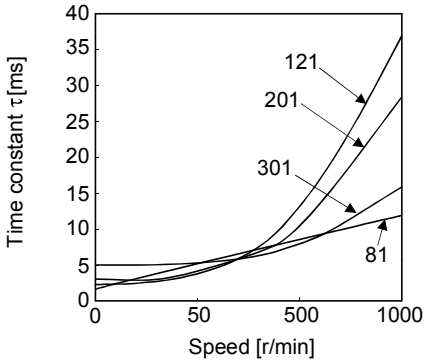
The following shows necessary dynamic brake time constant τ for the equations (11.2).



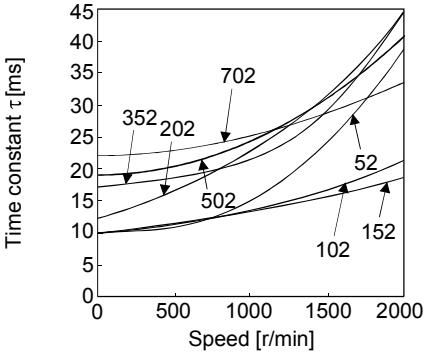
HC-KFS series



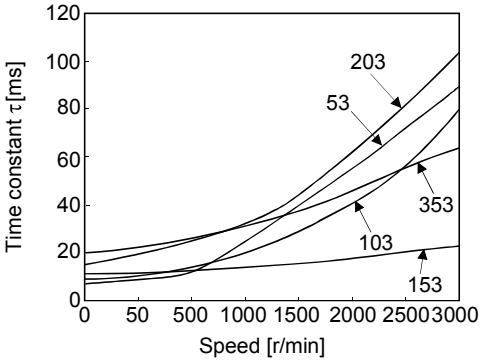
HC-MFS series



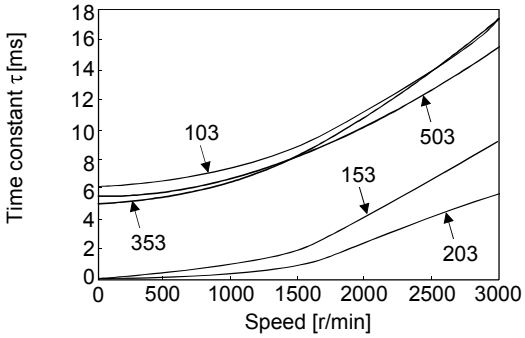
HC-SFS1000r/min series



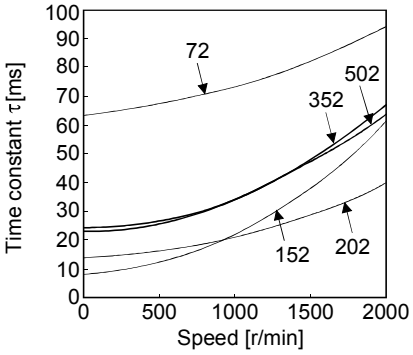
HC-SFS2000r/min series



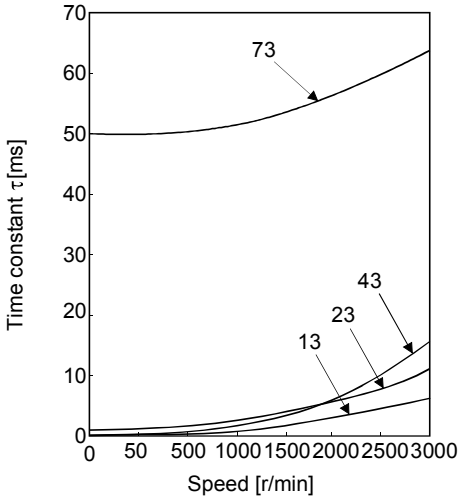
HC-SFS3000r/min series



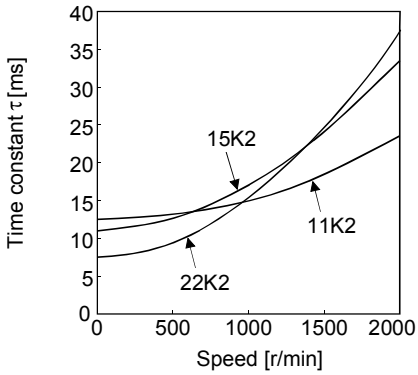
HC-RFS series



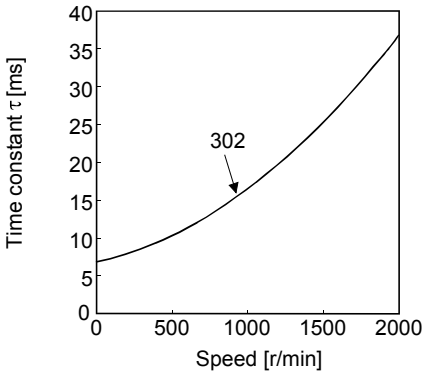
HC-UFS 2000r/min series



HC-UFS3000r/min series



HA-LFS series



HC-LFS series

11.3.2 The dynamic brake at the load inertia moment

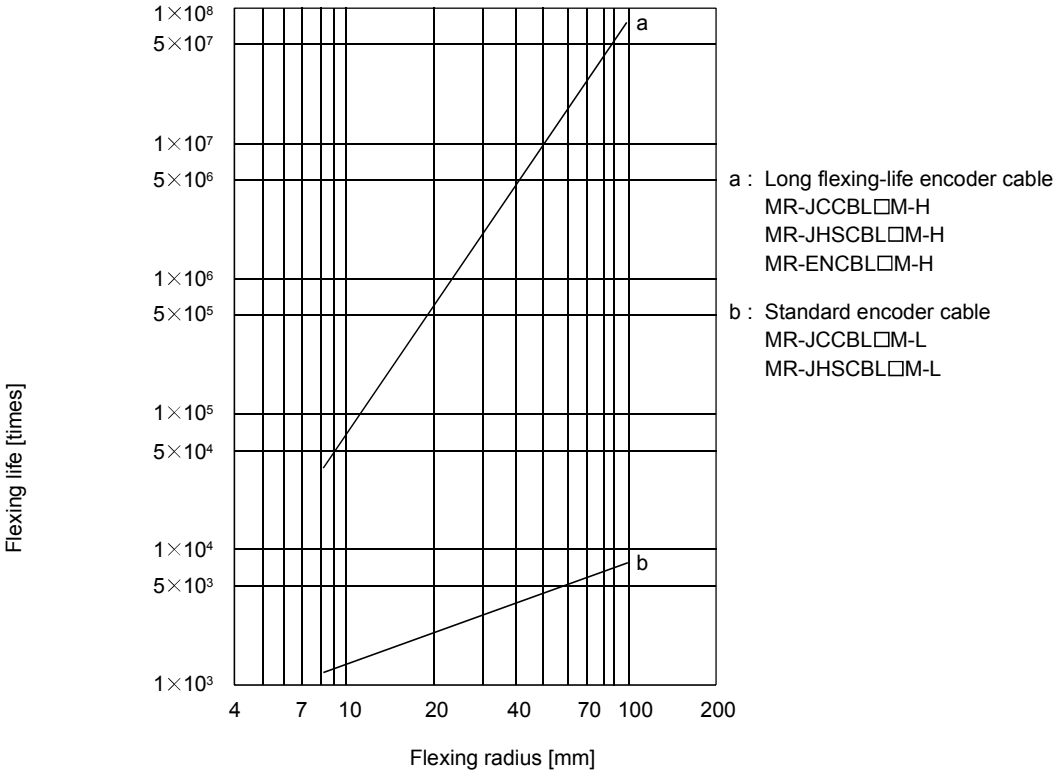
Use the dynamic brake under the load inertia moment ratio indicated in the following table. If the load inertia moment is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact Mitsubishi.

Servo amplifier	Load inertia moment ratio [times]
MR-J2S-10B to MR-J2S-200B MR-J2S-10B1 to MR-J2S-40B1	30
MR-J2S-350B	16
MR-J2S-500B	15
MR-J2S-700B	
(Note)MR-J2S-11KB to MR-J2S-22KB	(Note) 30

Note. Assumes that the external dynamic brake is used.

11.4 Encoder cable flexing life

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



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

The following table indicates the inrush currents (reference value) that will flow when the maximum permissible voltage (253VAC) is applied at the power supply capacity of 2500kVA and the wiring length of 10m.

Servo amplifier	Inrush Currents (A_{0-p})	
	Main circuit power supply (L_1, L_2, L_3)	Control circuit power supply (L_{11}, L_{21})
MR-J2S-10B・20B	30A (Attenuated to approx. 5A in 10ms)	70 to 100A (Attenuated to approx. 0A in 0.5 to 1ms)
MR-J2S-40B・60B	30A (Attenuated to approx. 5A in 10ms)	
MR-J2S-70B・100B	54A (Attenuated to approx. 12A in 10ms)	
MR-J2S-200B・350B	120A (Attenuated to approx. 12A in 20ms)	100 to 130A (Attenuated to approx. 0A in 0.5 to 1ms)
MR-J2S-500B	44A (Attenuated to approx. 20A in 20ms)	30A (Attenuated to approx. 0A in several ms)
MR-J2S-700B	88A (Attenuated to approx. 20A in 20ms)	
MR-J2S-11KB	235A (Attenuated to approx. 20A in 20ms)	
MR-J2S-15KB		
MR-J2S-22KB		
MR-J2S-10B1・20B1	59A (Attenuated to approx. 5A in 4ms)	100 to 130A (Attenuated to approx. 0A in 0.5 to 1ms)
MR-J2S-40B1	72A (Attenuated to approx. 5A in 4ms)	

Since large inrush currents flow in the power supplies, always use no-fuse breakers and magnetic contactors. (Refer to section 12.2.2.)
When circuit protectors are used, it is recommended to use the inertia delay type that will not be tripped by an inrush current.

12. OPTIONS AND AUXILIARY 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not.

⚠ CAUTION	・Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

12.1 Options

12.1.1 Regenerative options

⚠ CAUTION	・The specified combinations of regenerative options and servo amplifiers may only be used. Otherwise, a fire may occur.

(1) Combination and regenerative power

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

Servo amplifier	Regenerative power[W]							
	Built-in regenerative resistor	MR-RB032 [40Ω]	MR-RB12 [40Ω]	MR-RB32 [40Ω]	MR-RB30 [13Ω]	(Note) MR-RB50 [13Ω]	MR-RB31 [6.7Ω]	(Note) MR-RB51 [6.7Ω]
MR-J2S-10B(1)		30						
MR-J2S-20B(1)	10	30	100					
MR-J2S-40B(1)	10	30	100					
MR-J2S-60B	10	30	100					
MR-J2S-70B	20	30	100	300				
MR-J2S-100B	20	30	100	300				
MR-J2S-200B	100				300	500		
MR-J2S-350B	100				300	500		
MR-J2S-500B	130				300	500		
MR-J2S-700B	170						300	500

Note. Always install a cooling fan.

Servo amplifier	(Note) Regenerative power[W]			
	External regenerative resistor (Accessory)	MR-RB65 [8Ω]	MR-RB66 [5Ω]	MR-RB67 [4Ω]
MR-J2S-11KB	500 (800)	500 (800)		
MR-J2S-15KB	850 (1300)		850 (1300)	
MR-J2S-22KB	850 (1300)			850 (1300)

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

(2) Selection of the regenerative option

(a) Simple selection method

In horizontal motion applications, select the regenerative option as described below.

When the servo motor is run without load in the regenerative mode from the running speed to a stop, the permissible duty is as indicated in section 5.1 of the separately available Servo Motor Instruction Manual.

For the servo motor with a load, the permissible duty changes according to the inertia moment of the load and can be calculated by the following formula.

$$\text{Permissible duty} = \frac{\text{Permissible duty for servo motor with no load (value indication section 5.1 in Servo Motor Instruction Manual)}}{(m+1)} \times \left(\frac{\text{ratedspeed}}{\text{running speed}}\right)^2 \text{[times/min]}$$

where m = load inertia moment/servo motor inertia moment

From the permissible duty, find whether the regenerative option is required or not.

Permissible duty < number of positioning times [times/min]

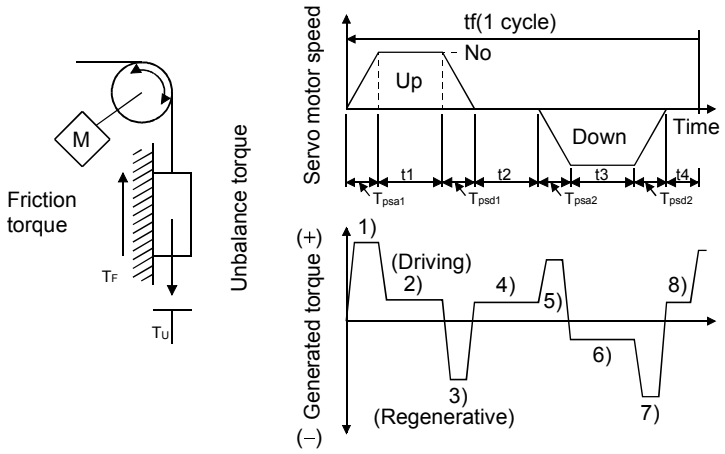
Select the regenerative option out of the combinations in (1) in this section.

(b) To make selection according to regenerative energy

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

Use the following table to calculate the regenerative energy.



Formulas for calculating torque and energy in operation

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

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

b. Losses of 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-J2S-10B	55	9
MR-J2S-10B1	55	4
MR-J2S-20B	70	9
MR-J2S-20B1	70	4
MR-J2S-40B	85	11
MR-J2S-40A1	85	12
MR-J2S-60B	85	11
MR-J2S-70B	80	18
MR-J2S-100B	80	18
MR-J2S-200B	85	40
MR-J2S-350B	85	40
MR-J2S-500B	90	45
MR-J2S-700B	90	70
MR-J2S-11KB	90	120
MR-J2S-15KB	90	170
MR-J2S-22KB	90	250

Inverse efficiency (η) :Efficiency including some efficiencies of the servo motor and servo amplifier when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and 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.

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

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

$$PR\ [W] = ER/tf$$

(3) Parameter setting

Set parameter No.2 according to the option to be used.

The MR-RB65, 66 and 67 are regenerative options that have encased the GRZG400-2Ω, GRZG400-1Ω and GRZG400-0.8Ω, respectively. When using any of these regenerative options, make the same parameter setting as when using the GRZG400-2Ω, GRZG400-1Ω or GRZG400-0.8Ω (supplied regenerative resistors or regenerative option is used with 11kW or more servo amplifier).

Parameter No.2

0	0		

Selection of regenerative
00: ・Regenerative option is not used with 7kW or less servo amplifier
・(The built-in regenerative resistor is used. However, the MR-J2S-10B does not have a built-in regenerative resistor and therefore cannot use it.)
・Supplied regenerative resistors or regenerative option is used with 11k to 22kW servo amplifier
01: FR-RC, FR-BU2, FR-CV
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 regenerative resistors or regenerative option supplied to 11k to 22kW are cooled by cooling fans to increase capability
10: MR-RB032
11: MR-RB12

(4) Connection of the regenerative option

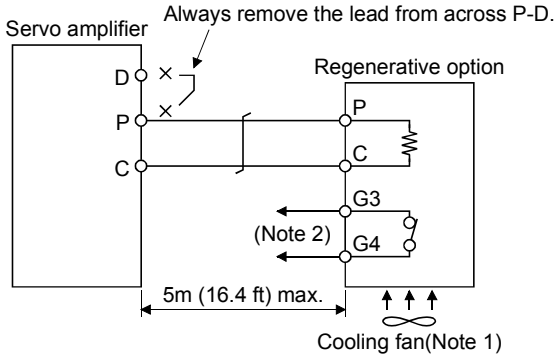
POINT
・When the MR-RB50・MR-RB51 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer.

The regenerative option will generate heat of about +100℃. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use flame-resistant cables and keep them clear of the regenerative option body. Always use twisted cables of max. 5m(16.4ft) length for connection with the servo amplifier.

(a) MR-J2S-350B or less

Always remove the wiring from across P-D and fit the regenerative option across P-C.

The G3 and G4 terminals act as a thermal sensor. G3-G4 is opened when the regenerative option overheats abnormally.

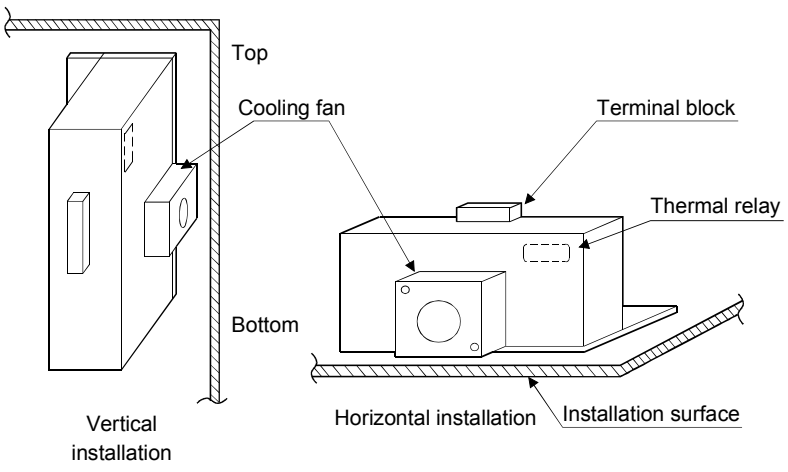


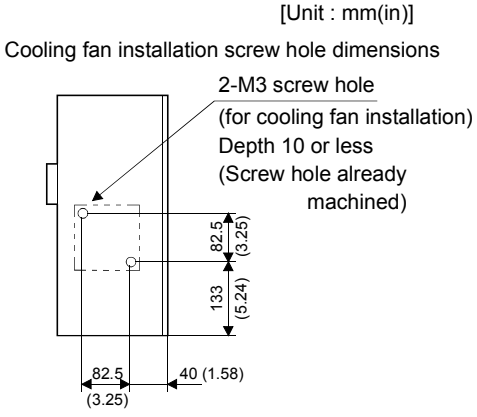
Note 1. When using the MR-RB50, forcibly cool it with a cooling fan (92×92, minimum air flow: 1.0m^3).

2. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
   G3-G4 contact specifications
   Maximum voltage: 120V AC/DC
   Maximum current: 0.5A/4.8VDC
   Maximum capacity: 2.4VA

For the MR-RB50 install the cooling fan as shown.

[Unit : mm(in)]

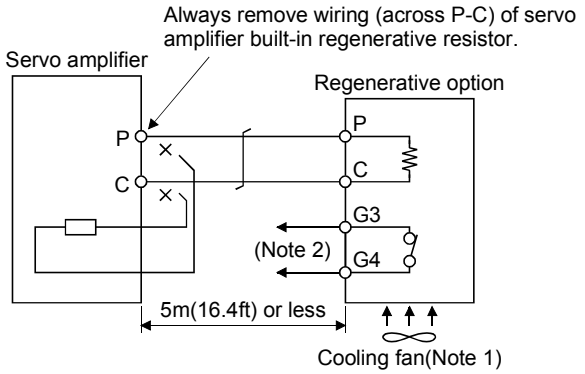




(b) MR-J2S-500B・MR-J2S-700B

Always remove the wiring (across P-C) of the servo amplifier built-in regenerative resistor and fit the regenerative option across P-C.

The G3 and G4 terminals act as a thermal sensor. G3-G4 is opened when the regenerative option overheats abnormally.

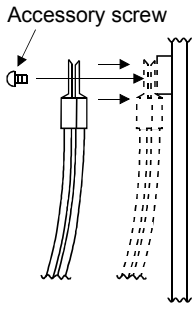


Note 1. When using the MR-RB50・MR-RB51, forcibly cool it with a cooling fan (92×92, minimum air flow: 1.0m^3).

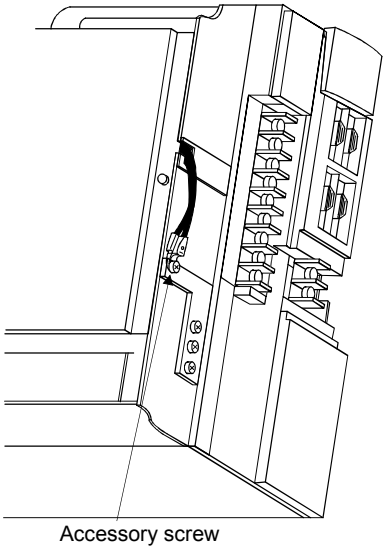
2. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
   G3-G4 contact specifications
   Maximum voltage: 120V AC/DC
   Maximum current: 0.5A/4.8VDC
   Maximum capacity: 2.4VA

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

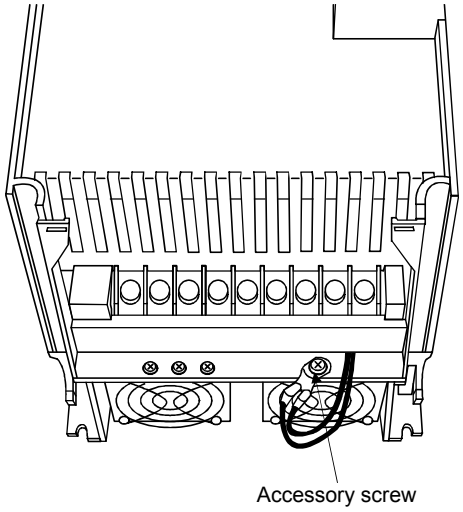
Mounting method



For MR-J2S-500B

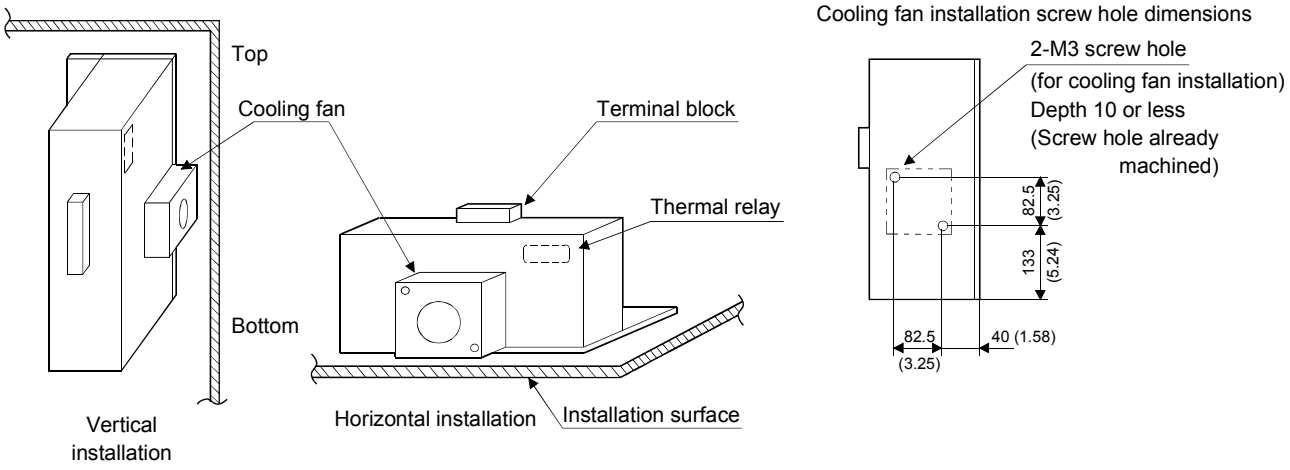


For MR-J2S-700B



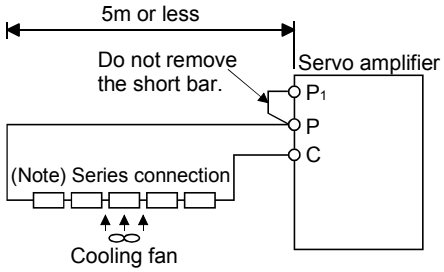
For the MR-RB50・MR-RB51 install the cooling fan as shown.

[Unit : mm(in)]



(c) MR-J2S-11KB to MR-J2S-22KB (when using the supplied regenerative resistor)

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 70mm. Cooling the resistors with two cooling fans (92 × 92, minimum air flow : 1.0m^3) improves the regeneration capability. In this case, set "0E □□" in parameter No. 2.



Note. The number of resistors connected in series depends on the resistor type. Install a thermal sensor or like to configure a circuit that will shut off the main circuit power at abnormal overheat. The supplied regenerative resistor does not have a built-in thermal sensor. If the regenerative brake circuit fails, abnormal overheat of the resistor is expected to occur. On the customer side, please also install a thermal sensor for the resistor and provide a protective circuit that will shut off the main circuit power supply at abnormal overheat. The detection level of the thermal sensor changes depending on the resistor installation method. Please install the thermal sensor in the optimum position according to the customer's design standards, or use our regenerative option having built-in thermal sensor (MR-RB65, 66, 67).

Servo amplifier	Regenerative resistor	Regenerative power [W]		Resistance [Ω]	Number of resistors
		Normal	Cooling		
MR-J2S-11KB	GRZG400-2Ω	500	800	8	4
MR-J2S-15KB	GRZG400-1Ω	850	1300	5	5
MR-J2S-22KB	GRZG400-0.8Ω	850	1300	4	5

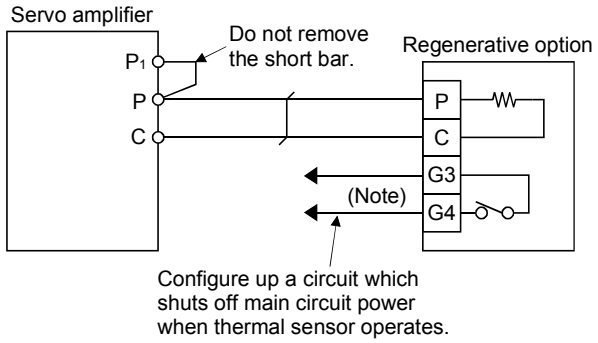
(d) MR-J2S-11KB-PX to MR-J2S-22KB-PX (when using the regenerative option)

The MR-J2S-11KB-PX to MR-J2S-22KB-PX servo amplifiers are not supplied with regenerative resistors. When using any of these servo amplifiers, always use the MR-RB65, 66 or 67 regenerative option.

The MR-RB65, 66 and 67 are regenerative options that have encased the GRZG400-2Ω, GRZG400-1Ω and GRZG400-0.8Ω, respectively. When using any of these regenerative options, make the same parameter setting as when using the GRZG400-2Ω, GRZG400-1Ω or GRZG400-0.8Ω (supplied regenerative resistors or regenerative option is used with 11kW or more servo amplifier).

Cooling the regenerative option with cooling fans improves regenerative capability.

The G3 and G4 terminals are for the thermal sensor. G3-G4 is opened when the regenerative option overheats abnormally.



Note. Specifications of contact across G3-G4

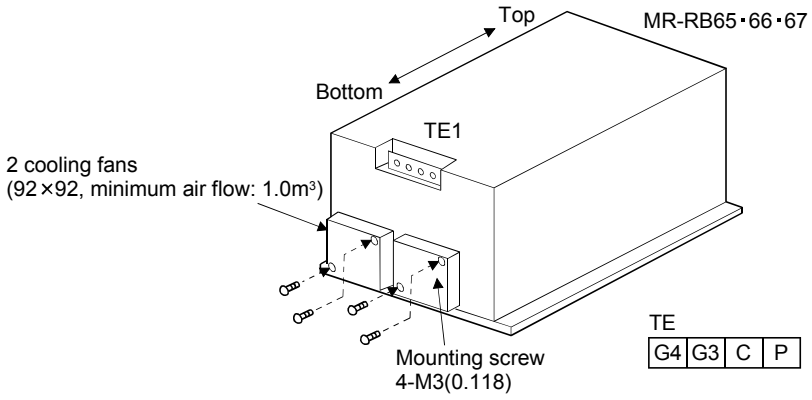
Maximum voltage :120V AC/DC

Maximum current :0.5A/4.8VDC

Maximum capacity : 2.4VA

Servo amplifier	Regenerative option model	Resistance [Ω]	Regenerative power [W]	
			Without cooling fans	With cooling fans
MR-J2S-11KB-PX	MR-RB65	8	500	800
MR-J2S-15KB-PX	MR-RB66	5	850	1300
MR-J2S-22KB-PX	MR-RB67	4	850	1300

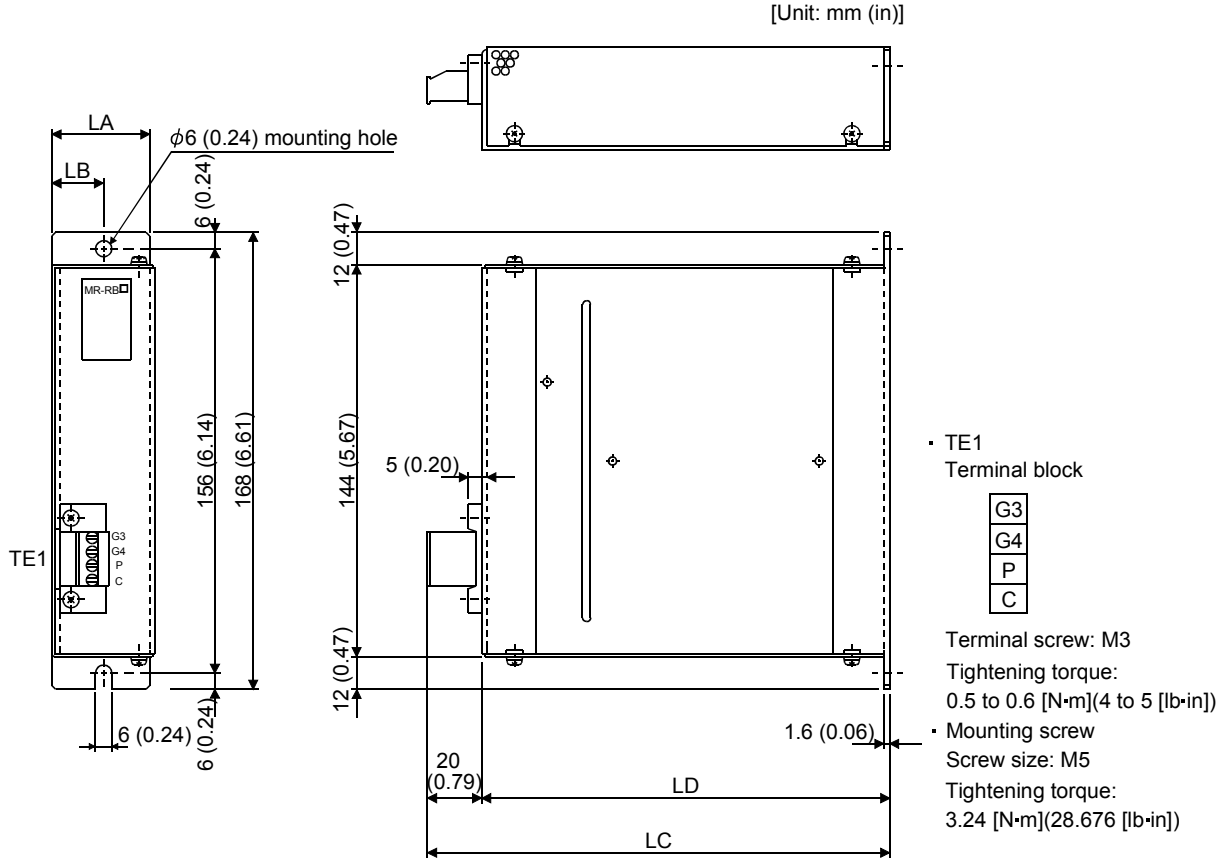
When using cooling fans, install them using the mounting holes provided in the bottom of the regenerative option. In this case, set "0E □□" in parameter No. 2.



(5) Outline drawing

(a) MR-RB032 • MR-RB12

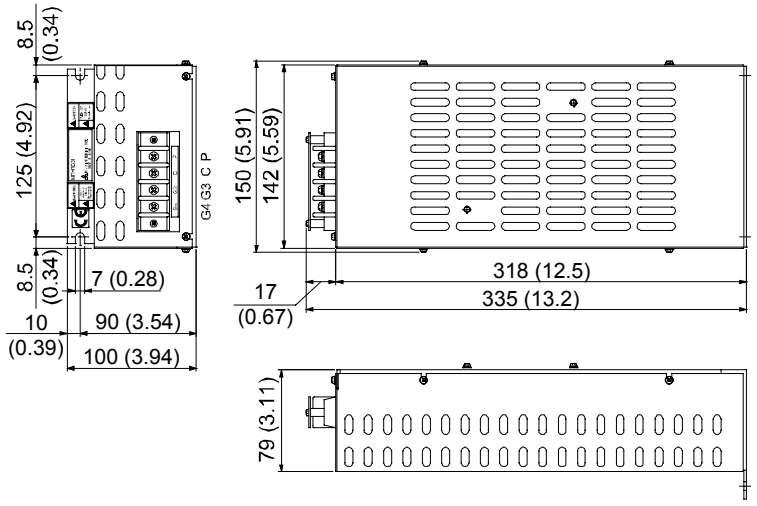
[Unit: mm (in)]



Regenerative option	Variable dimensions				Mass	
	LA	LB	LC	LD	[kg]	[lb]
MR-RB032	30 (1.18)	15 (0.59)	119 (4.69)	99 (3.9)	0.5	1.1
MR-RB12	40 (1.58)	15 (0.59)	169 (6.65)	149 (5.87)	1.1	2.4

(b) MR-RB30 • MR-RB31 • MR-RB32

[Unit: mm (in)]



• Terminal block

P
C
G3
G4

Terminal screw: M4
Tightening torque: 1.2 [N • m] (10.6 [lb • in])

• Mounting screw

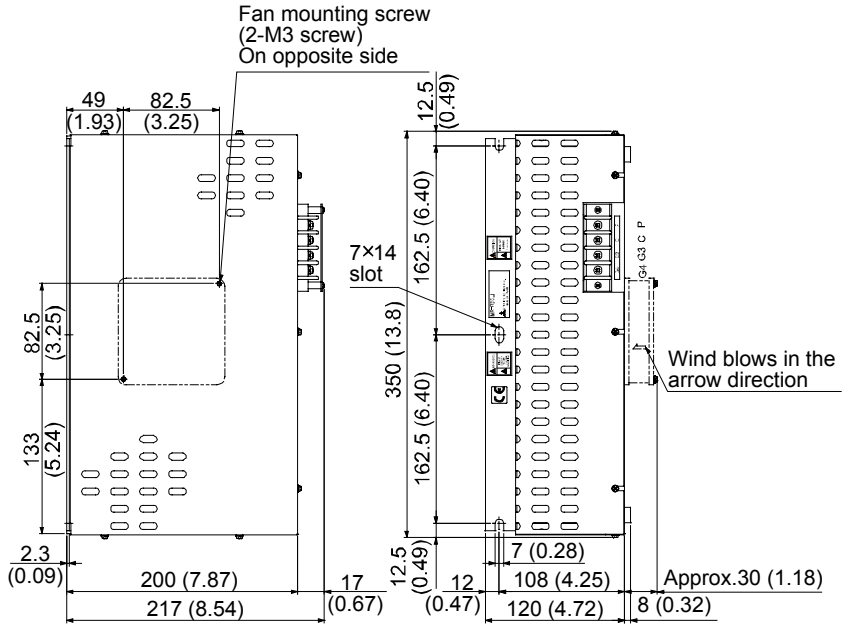
Screw: M6

Tightening torque: 5.4 [N • m] (47.79 [lbi • n])

Regenerative option	Mass [kg] (lb)
MR-RB30	2.9 (6.4)
MR-RB31	
MR-RB32	

(c) MR-RB50・MR-RB51

[Unit: mm (in)]



・Terminal block

P
C
G3
G4

Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

・Mounting screw

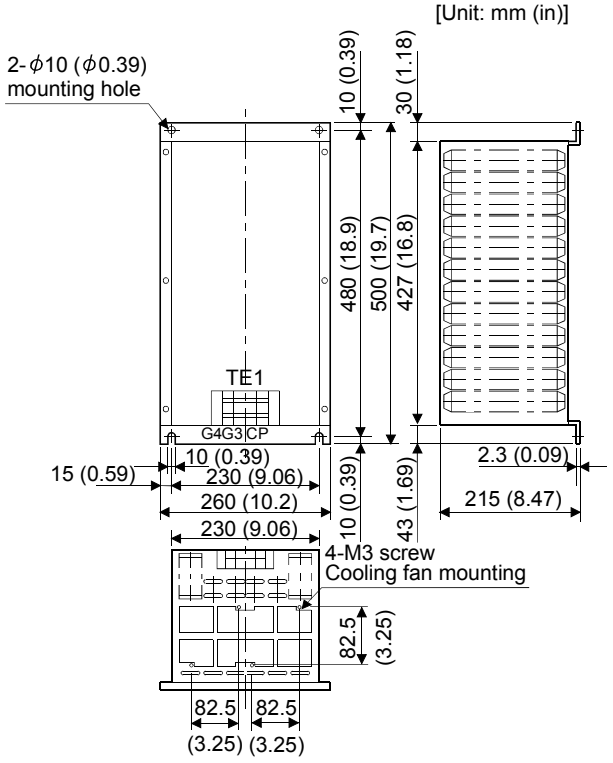
Screw: M6

Tightening torque: 5.4 [N・m] (47.79 [lb・in])

Regenerative option	Mass [kg] (lb)
MR-RB50	5.6 (12.3)
MR-RB51	

(d) MR-RB65・MR-RB66・MR-RB67

[Unit: mm (in)]



・Terminal block

G4	G3	C	P

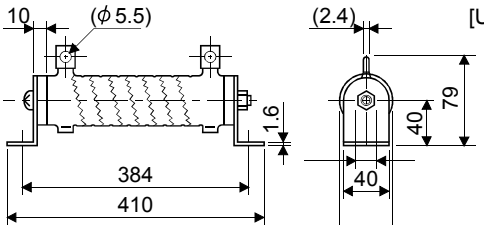
Terminal screw: M5
Tightening torque: 2.0 [N・m](17 [lb・in])

・Mounting screw
Screw size: M8
Tightening torque: 13.2 [N・m](116.83 [lb・in])

Regenerative option	Mass	
	[kg]	(lb)
MR-RB65	10	22.0
MR-RB66	11	24.3
MR-RB67	11	24.3

(e) GRZG400-2Ω・GRZG400-1Ω・ GRZG400-0.8Ω (standard accessories)

[Unit: mm (in)]



・Mounting screw
Screw size: M8
Tightening torque: 13.2 [N・m](116.83 [lb・in])

12.1.2 FR-BU2 brake unit

POINT

- The brake unit and resistor unit of other than 200V class are not applicable to the servo amplifier. Combination of different voltage class units and servo amplifier cannot be used.
- Install a brake unit and a resistor unit on a flat surface vertically. When the unit is installed horizontally or diagonally, the heat dissipation effect diminishes.
- Temperature of the resistor unit case rises to higher than 100℃. Keep cables and flammable materials away from the case.
- Ambient temperature condition of the brake unit is between −10℃ (14℉) and +50℃ (122℉). Note that the condition is different from the ambient temperature condition of the servo amplifier (between 0℃ (32℉) and +55℃ (131℉)).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and resistor unit under abnormal condition.
- Use the brake unit with a combination indicated in (1) of this section.
- For executing a continuous regenerative operation, use FR-RC power regeneration converter or FR-CV 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 the parameter No.2 of the servo amplifier to "□□01".
When using the brake unit, always refer to the FR-BU2-(H) Brake Unit Instruction Manual.

(1) Selection

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

Brake unit	Resistor unit	Number of connected units	Permissible continuous power [kW]	Total resistance [Ω]	Applicable servo amplifier
FR-BU2-15K	FR-BR-15K	1	0.99	8	MR-J2S-350B MR-J2S-500B
FR-BU2-30K	FR-BR-30K	1	1.99	4	MR-J2S-500B MR-J2S-700B MR-J2S-11KB MR-J2S-15KB
FR-BU2-55K	FR-BR-55K	1	3.91	2	MR-J2S-11KB MR-J2S-15KB MR-J2S-22KB
	MT-BR5-55K	1	5.5	2	MR-J2S-22KB

(2) Brake unit parameter setting

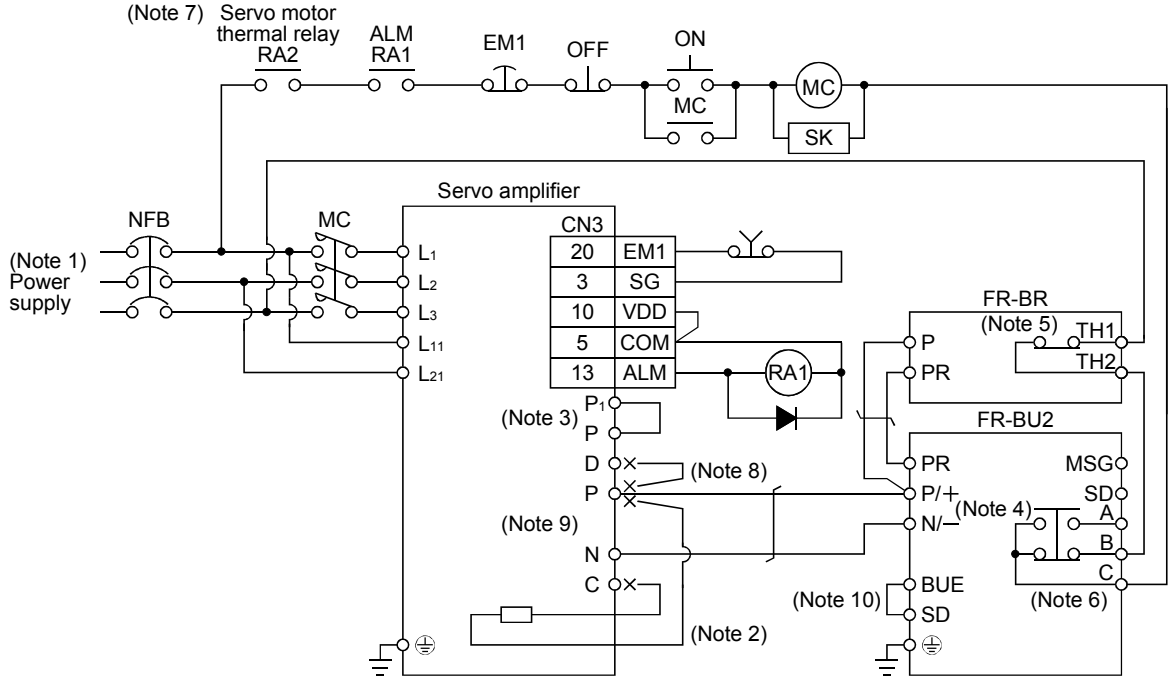
Normally, when using the FR-BU2, changing parameters is not necessary. Whether a parameter can be changed or not is listed below.

Parameter		Change possible/ impossible	Remarks
No.	Name		
0	Brake mode switchover	Impossible	Do not change the parameter.
1	Monitor display data selection	Possible	Refer to the FR-BU2-(H) 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

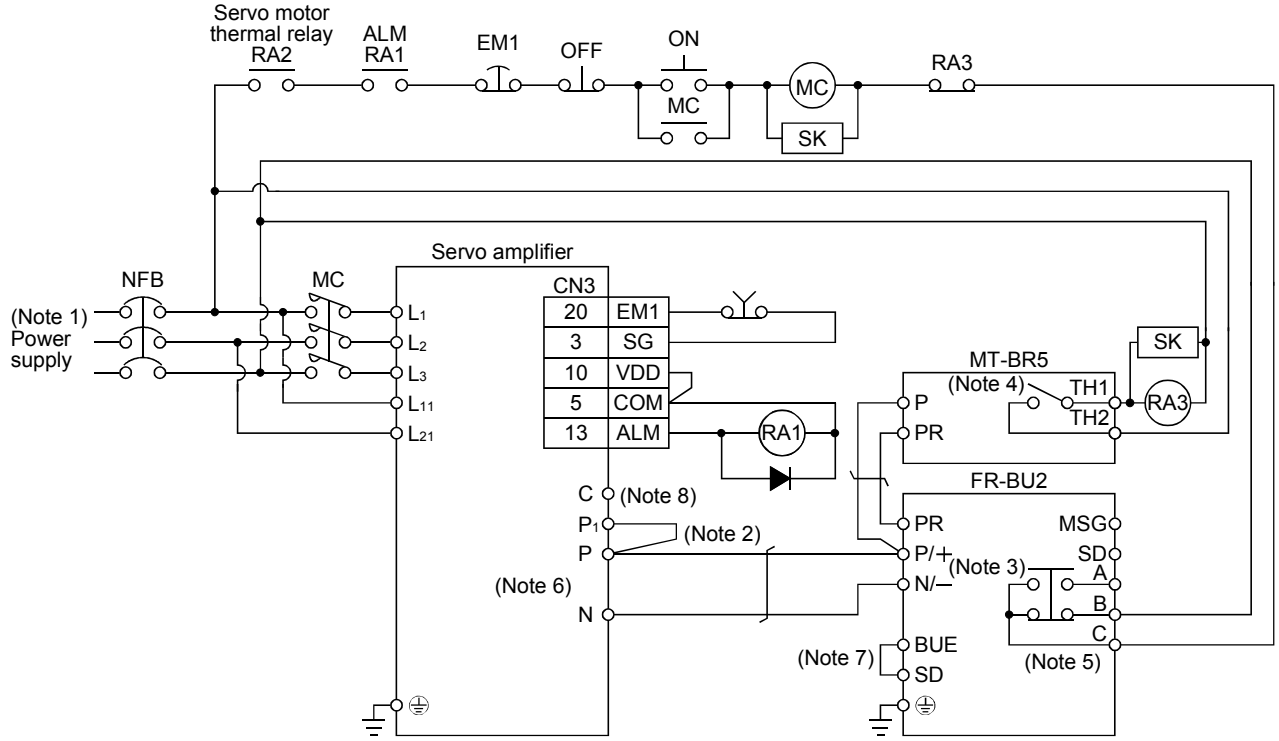
POINT
▪ Connecting PR terminal of the brake unit to P terminal of the servo amplifier results in brake unit malfunction. Always connect the PR terminal of the brake unit to the PR terminal of the resistor unit.

(a) Combination with FR-BR resistor unit



Note 1. For power supply specifications, refer to section 1.3.
2. For the servo amplifier of 5k and 7kW, always disconnect the lead of built-in regenerative resistor, which is connected to the P and C terminals. For the servo amplifier of 11k to 22kW, do not connect a supplied regenerative resistor to the P and C terminals.
3. For the servo amplifier of 11k to 22kW, always connect P_1 and P (Factory-wired). When using the power factor improving DC reactor, refer to section 12.2.4.
4. Connect the P/＋ and N/－ terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
5. Contact rating 1b contact, 110VAC_5A/220VAC_3A
Normal condition TH1-TH2 is conducting. Abnormal condition TH1-TH2 is not conducting.
6. Contact rating 230VAC_0.3A/30VDC_0.3A
Normal condition B-C is conducting/A-C is not conducting. Abnormal condition B-C is not conducting/A-C is conducting.
7. For the servo amplifier of 11kW or more, connect the thermal relay censor of the servo amplifier.
8. For the servo amplifier of 3.5kW, always disconnect the wiring between P and D terminals.
9. Do not connect more than one cable to each P and N terminals of the servo amplifier.
10. Make sure to connect BUE and SD (Factory-wired).

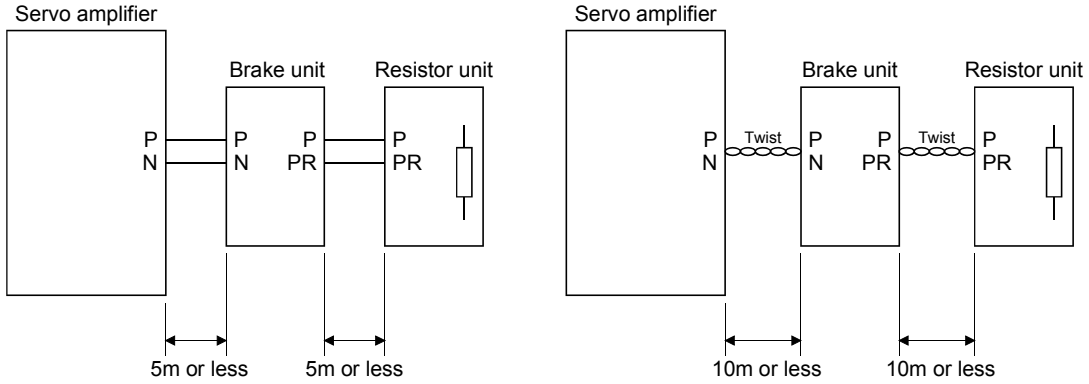
(b) Combination with MT-BR5 resistor unit



Note 1. For power supply specifications, refer to section 1.3.
2. Make sure to connect P_1 and P (Factory-wired). When using the power factor improving DC reactor, refer to section 12.2.4.
3. Connect the P/＋ and N/－ terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
4. Contact rating 1a contact, 110VAC_5A/220VAC_3A
Normal condition TH1-TH2 is not conducting. Abnormal condition TH1-TH2 is conducting.
5. Contact rating 230VAC_0.3A/30VDC_0.3A
Normal condition B-C is conducting/A-C is not conducting. Abnormal condition B-C is not conducting/A-C is conducting.
6. Do not connect more than one cable to each P and N terminals of the servo amplifier.
7. Make sure to connect BUE and SD (Factory-wired).
8. For the servo amplifier of 22kW, do not connect a supplied regenerative resistor to the P and C terminals.

(c) Precautions for wiring

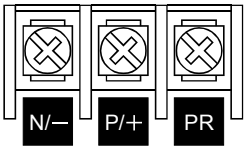
The cables between the servo amplifier and the brake unit, and between the resistor unit and the brake unit should be as short as possible. Always twist the cable longer than 5m (twist five times or more per one meter). Even when the cable is twisted, the cable should be less than 10m. Using cables longer than 5m without twisting or twisted cables longer than 10m, may result in the brake unit malfunction.



(d) Cables

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

a) Main circuit terminal

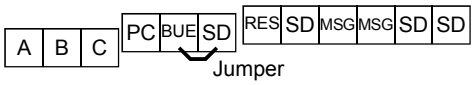


Terminal block

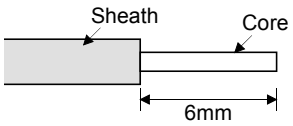
Brake unit	Main circuit terminal screw size	Crimping terminal	Tightening torque [N・m] ([lb・in])	Cable size	
		N/−, P/+, PR, ⏚		N/−, P/+, PR, ⏚	
				HIV cables, etc. [mm^2]	AWG
FR-BU2-15K	M4	5.5-4	1.5 (13.3)	3.5	12
FR-BU2-30K	M5	5.5-5	2.5 (22.1)	5.5	10
FR-BU2-55K	M6	14-6	4.4 (38.9)	14	6

b) Control circuit terminal

> **POINT**
>
> ・Undertightening can cause a cable disconnection or malfunction. Overtightening 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: 0.5N・m to 0.6N・m

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

Screw driver: Small flat-blade screwdriver

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

(e) Crimping terminals for P and N terminals of servo amplifier

POINT

- Always use recommended crimping terminals or equivalent since some crimping terminals cannot be installed depending on the size.

Servo amplifier	Brake unit	Number of connected units	Crimping terminal (Manufacturer)	(Note) Applicable tool
MR-J2S-350B	FR-BU2-15K	1	FVD5.5-S4 (Japan Solderless Terminal)	b
MR-J2S-500B	FR-BU2-15K	1		
	FR-BU2-30K	1		
MR-J2S-700B	FR-BU2-30K	1		
MR-J2S-11KB	FR-BU2-30K	1	FVD5.5-6(Japan Solderless Terminal)	b
	FR-BU2-55K	1	FVD14-6(Japan Solderless Terminal)	a
MR-J2S-15KB	FR-BU2-30K	1	FVD5.5-6(Japan Solderless Terminal)	b
	FR-BU2-55K	1	FVD14-6(Japan Solderless Terminal)	a
MR-J2S-22KB	FR-BU2-55K	1	FVD14-8(Japan Solderless Terminal)	a

Note. Symbols in the applicable tool field indicate the following applicable tools.

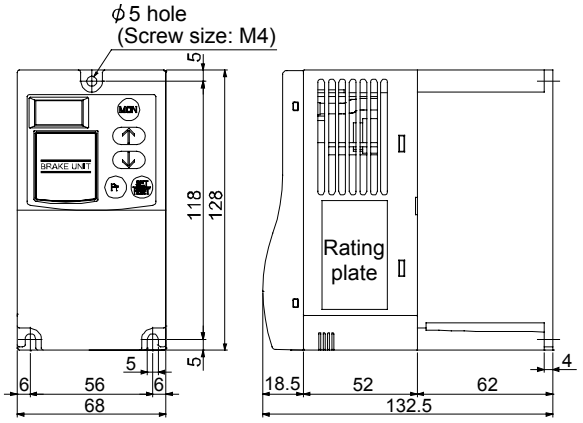
Symbol	Applicable tool	Manufacturer
a	Body YF-1・E-4 Head YNE-38 Dice DH-112・DH-122	Japan Solderless Terminal
b	YNT-1210S	

(4) Outline dimension drawings

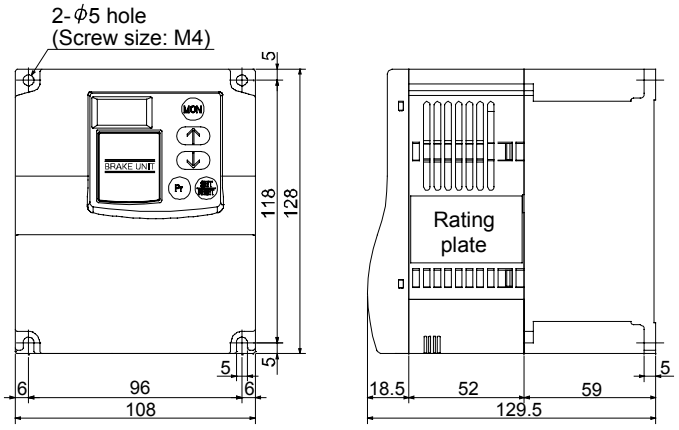
(a) FR-BU2 brake unit

[Unit: mm]

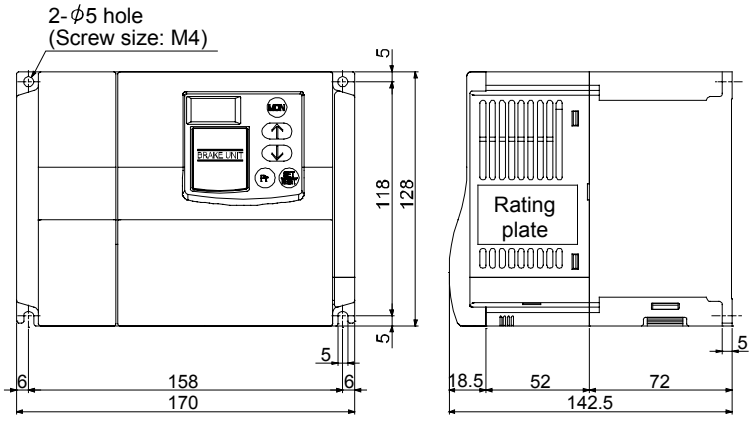
FR-BU2-15K



FR-BU2-30K

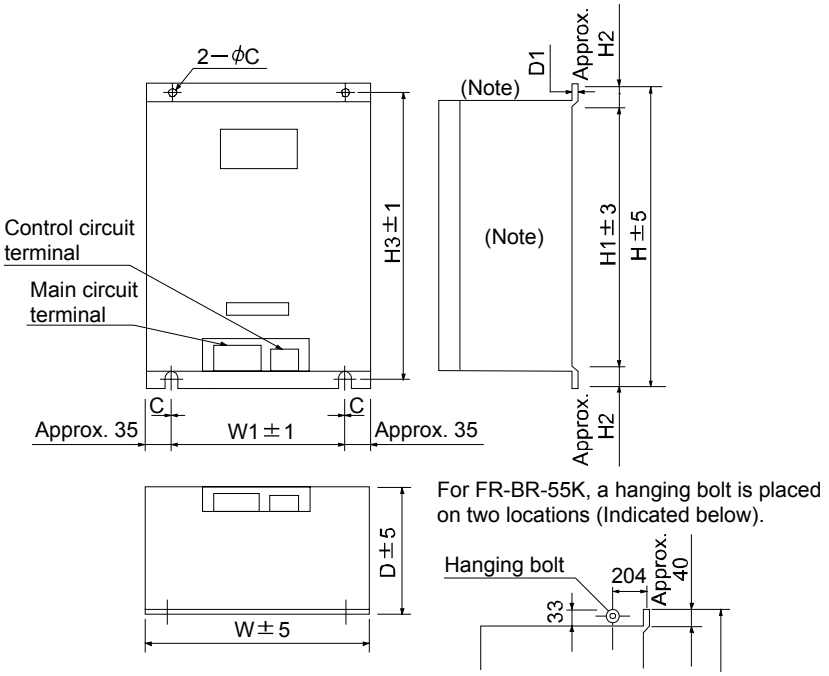


FR-BU2-55K



(b) FR-BR resistor unit

[Unit: mm]

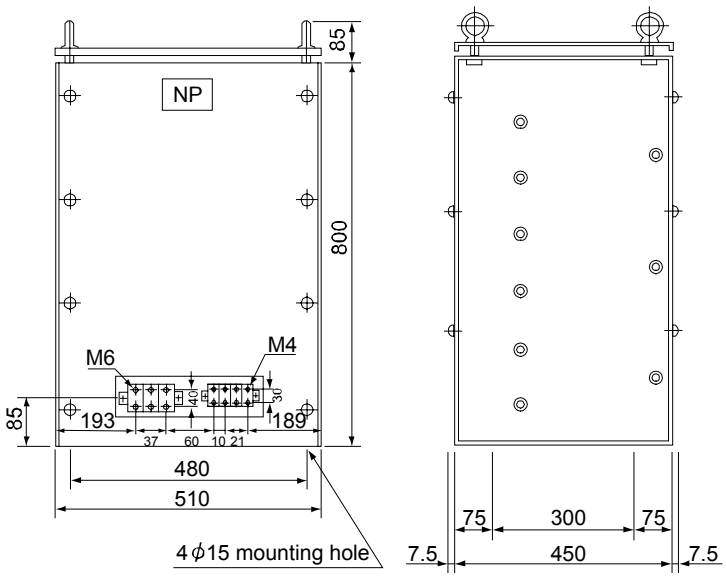


Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Resistor unit	W	W1	H	H1	H2	H3	D	D1	C	Approximate mass [kg] ([lb])
FR-BR-15K	170	100	450	410	20	432	220	3.2	6	15 (33.1)
FR-BR-30K	340	270	600	560	20	582	220	4	10	30 (66.1)
FR-BR-55K	480	410	700	620	40	670	450	3.2	12	70 (154)

(c) MT-BR5- (H) resistor unit

[Unit: mm]



Resistor unit	Resistance value	Approximate mass [kg] ([lb])
MT-BR5-55K	2.0Ω	50 (110)

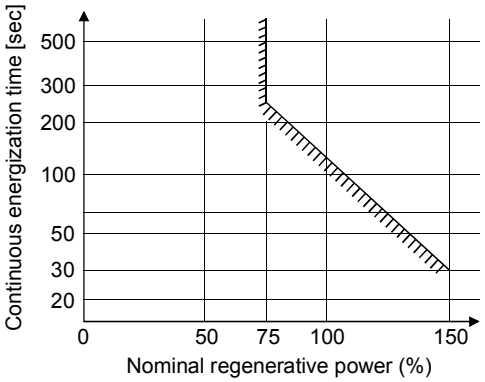
12.1.3 Power regeneration converter

When using the power regeneration converter, set "□□01" in parameter No.2.

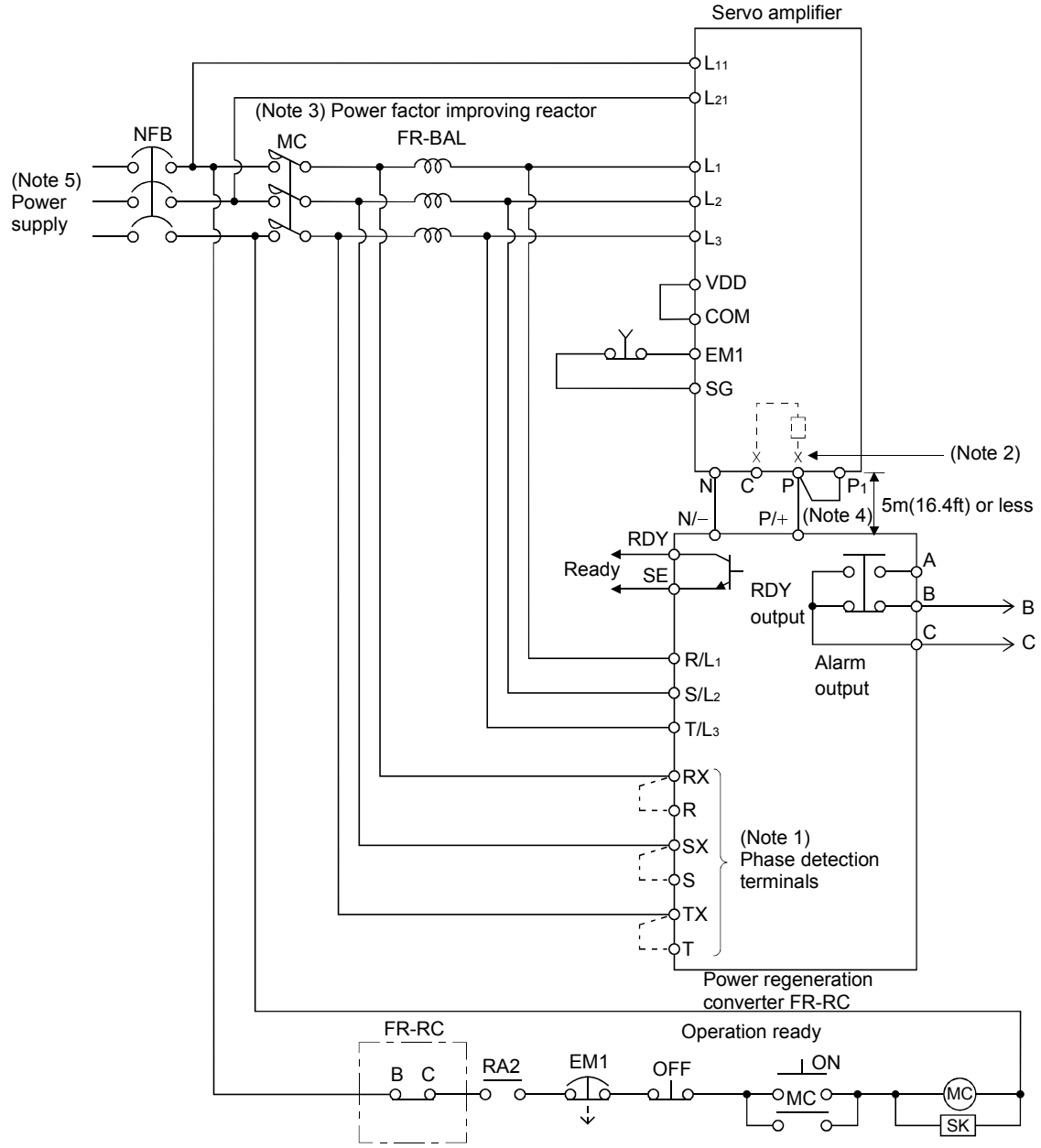
(1) Selection

The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of the MR-J2S-500B to MR-J2S-22KB.

Power regeneration converter	Nominal regenerative power (kW)	Servo amplifier
FR-RC-15K	15	MR-J2S-500B MR-J2S-700B
FR-RC-30K	30	MR-J2S-11KB MR-J2S-15KB
FR-RC-55K	55	MR-J2S-22KB



(2) Connection example

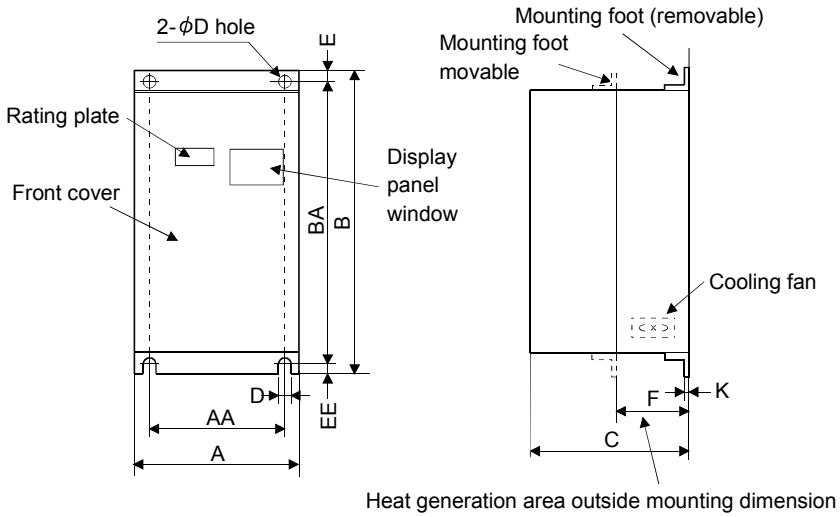


Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC will not operate.

2. When using servo amplifiers of 5kW and 7kW, always remove the lead of built-in regenerative resistor connected to P terminal and C terminal.
3. For the power factor improving reactor (FR-BAL) to be used, refer to POWER REGENERATION CONVERTER FR-RC INSTRUCTION MANUAL (IB (NA) 67096). When using FR-BAL with the servo amplifier of 11 k to 22 kW, do not use with the power factor improving reactor (FR-BAL).
4. When using the servo amplifier of 11k to 22kW, make sure to connect P_1 and P. (Factory-wired.)
5. Refer to section 1.3 for the power supply specification.

(3) Outside dimensions of the power regeneration converters

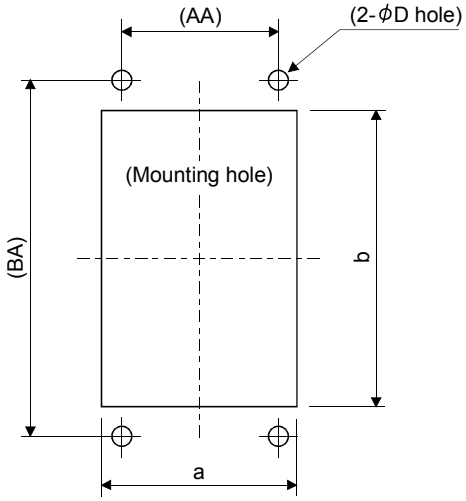
[Unit : mm(in)]



Power regeneration converter	A	AA	B	BA	C	D	E	EE	K	F	Approx. mass [kg(lb)]
FR-RC-15K	270 (10.6)	200 (7.87)	450 (17.7)	432 (17.0)	195 (7.68)	10 (0.39)	10 (0.39)	8 (0.32)	3.2 (0.13)	87 (3.43)	19 (41.9)
FR-RC-30K	340 (13.4)	270 (10.6)	600 (23.6)	582 (22.9)	195 (7.68)	10 (0.39)	10 (0.39)	8 (0.32)	3.2 (0.13)	90 (3.54)	31 (68.3)
FR-RC-55K	480 (18.9)	410 (16.1)	700 (27.6)	670 (26.4)	250 (9.84)	12 (0.47)	15 (0.59)	15 (0.59)	3.2 (0.13)	135 (5.32)	55 (121)

(4) Mounting hole machining dimensions

When the power regeneration converter is fitted to a totally enclosed type box, mount the heat generating area of the converter outside the box to provide heat generation measures. At this time, the mounting hole having the following dimensions is machined in the box.



[Unit : mm(in)]

Model	A	B	D	AA	BA
FR-RC-15K	260 (10.2)	412 (16.2)	10 (0.39)	200 (7.87)	432 (17.0)
FR-RC-30K	330 (13.0)	562 (22.1)	10 (0.39)	270 (10.6)	582 (22.9)
FR-RC-55K	470 (18.5)	642 (25.3)	12 (0.47)	410 (16.1)	670 (26.4)

12.1.4 External dynamic brake

POINT

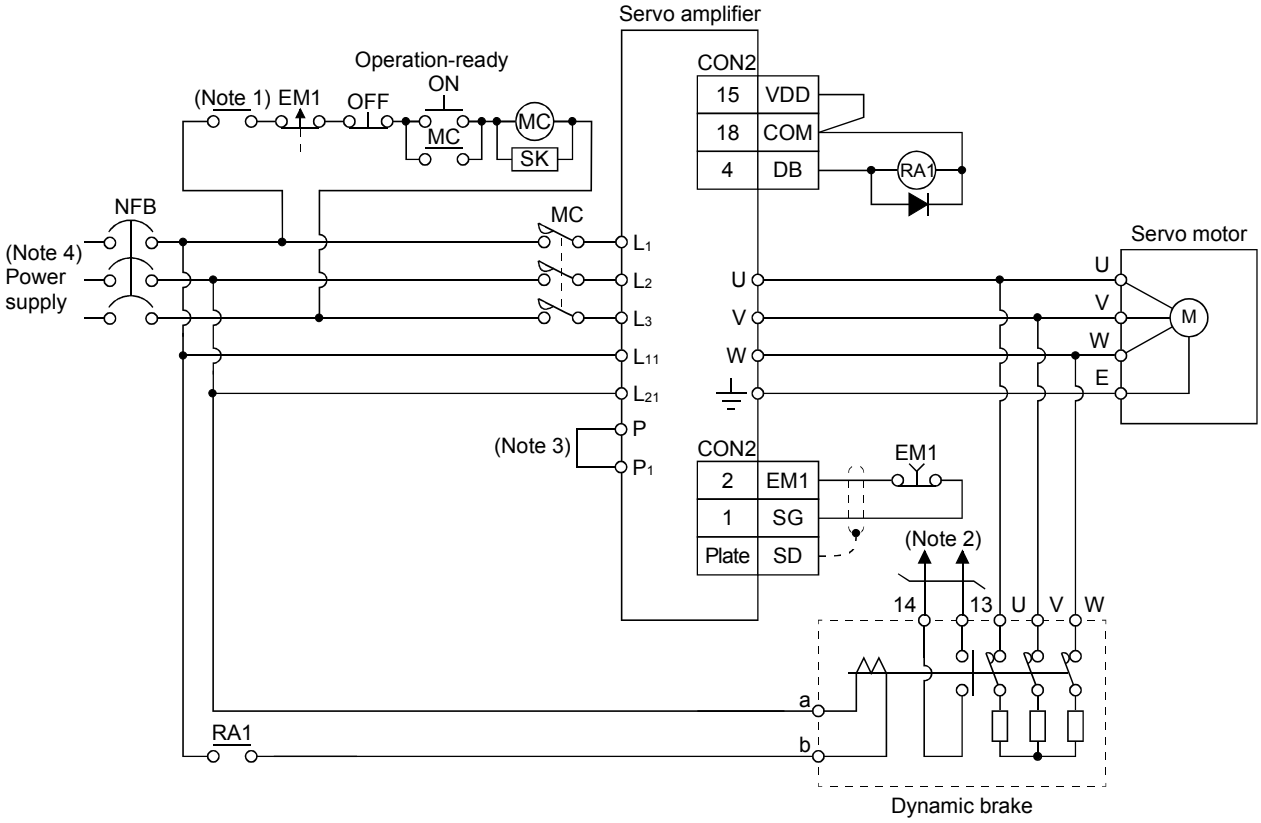
- Configure up a sequence which switches off the contact of the brake unit after (or as soon as) it has turned off the servo on signal at a power failure or failure.
- For the braking time taken when the dynamic brake is operated, refer to section 13.3.
- The brake unit is rated for a short duration. Do not use it for high duty.

(1) Selection of 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 7kW or less servo amplifier. Since it is not built in the 11kW or more servo amplifier, purchase it separately if required. Set "□1□□" in the parameter No. 2.

Servo amplifier	Dynamic brake
MR-J2S-11KB	DBU-11K
MR-J2S-15KB	DBU-15K
MR-J2S-22KB	DBU-22K

(2) Connection example

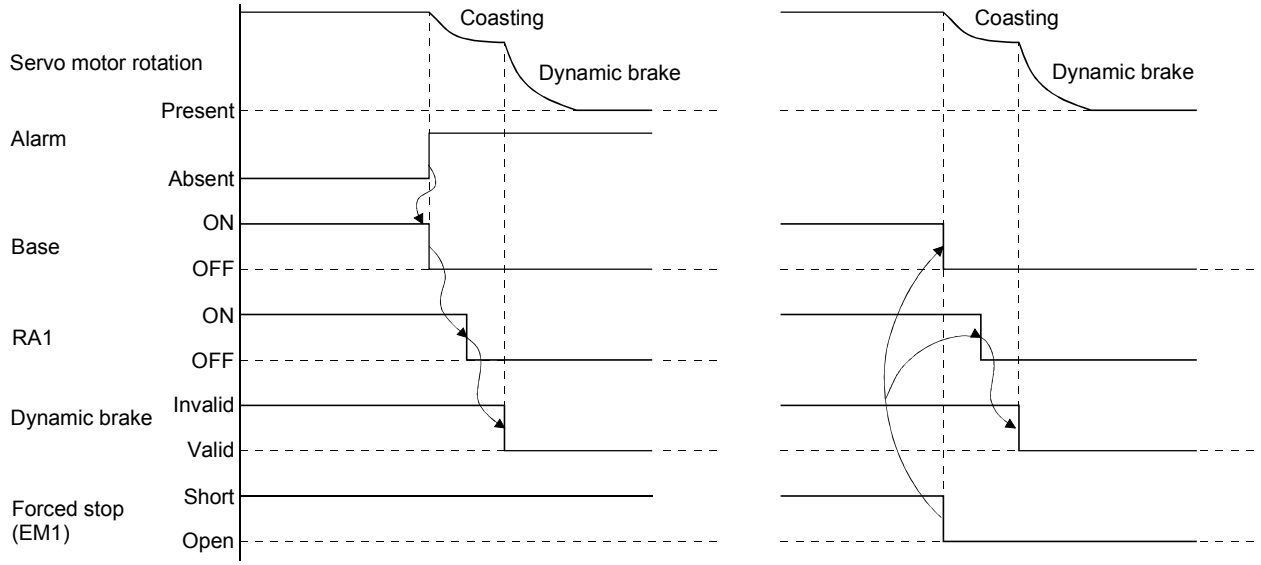


Note 1. Configure up the circuit to switch power off in the external sequence at servo alarm occurrence.

2. Terminals 13, 14 are normally open contact outputs. If the dynamic brake is seized, terminals 13, 14 will open. Therefore, configure up an external sequence to prevent servo-on.

3. When using the servo amplifier of 11k to 22kW, make sure to connect P_1 and P. (Factory-wired.) When using the power factor improving DC reactor, refer to section 12.2.4.

4. Refer to section 1.3 for the power supply specification.

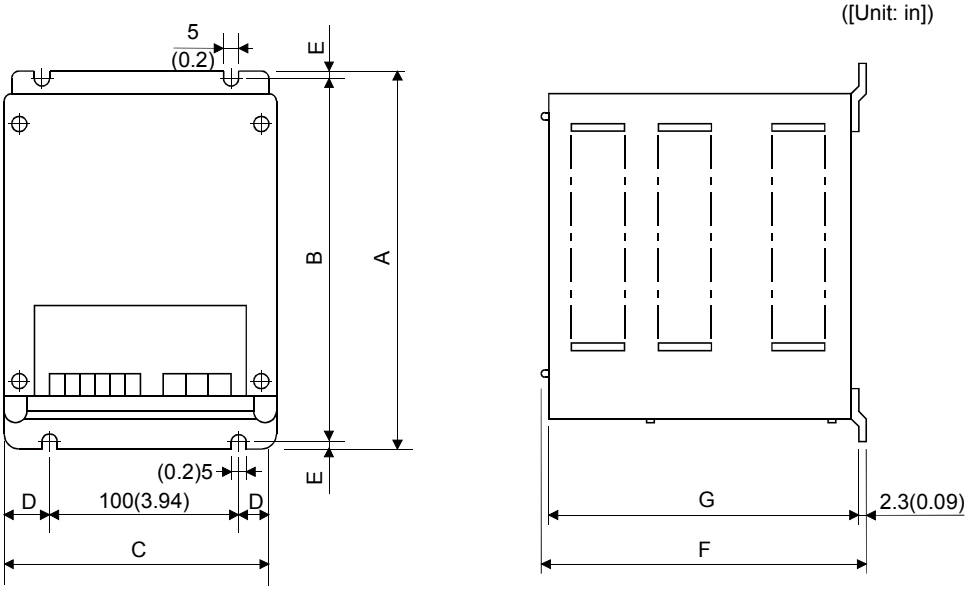


a. Timing chart at alarm occurrence

b. Timing chart at forced stop (EM1) validity

(3) Outline dimension drawing

[Unit: mm]
([Unit: in])



Terminal block

E (GND)		a	b	13	14

Screw : M3.5

Tightening torque: 0.8 [N•m](7 [lb•in])

U	V	W

Screw : M4

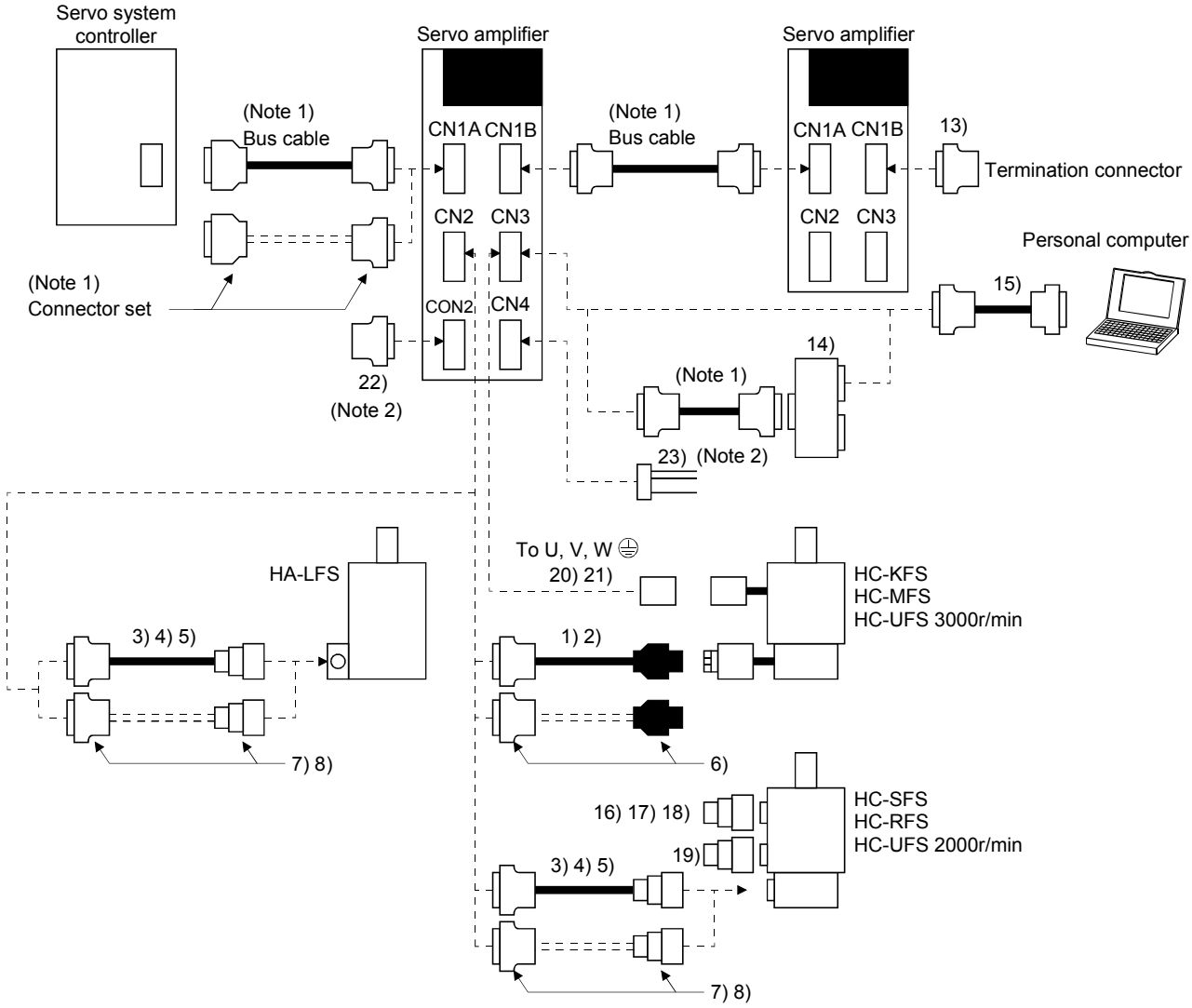
Tightening torque: 1.2 [N•m](10.6 [lb•in])

Dynamic brake	A	B	C	D	E	F	G	Mass [kg]([lb])	Connection wire [mm^2]
DBU-11K	200 (7.87)	190 (7.48)	140 (5.51)	20 (0.79)	5 (0.2)	170 (6.69)	163.5 (6.44)	2 (4.41)	5.5
DBU-15K, 22K	250 (9.84)	238 (9.37)	150 (5.91)	25 (0.98)	6 (0.24)	235 (9.25)	228 (8.98)	6 (13.23)	5.5

12.1.5 Cables and connectors

(1) Cable make-up

The following cables are used for connection with the servo motor and other models.
The broken line areas in the diagram are not options.

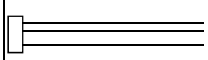


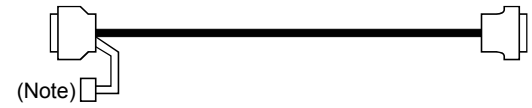
Note 1. The bus cable used with the SSCNET depends on the preceding or subsequent controller or servo amplifier connected. Refer to the following table and choose the bus cable.

		MR-J2S-□B	MR-J2-03B5
QD75M		10) Bus cable :MR-J2HBUS □ M	12) Connector set:MR-J2CN1
Motion controller	Q172CPU(N)	24) Bus cable :Q172J2BCBL □ M(-B)	
	Q173CPU(N)	25) Bus cable :Q173J2B △ CBL □ M	
	A motion	9) Bus cable :MR-J2HBUS □ M-A	11) Connector set:MR-J2CN1-A
MR-J2S-□B MR-J2-03B5 Maintenance junction card		10) Bus cable :MR-J2HBUS □ M	12) Connector set:MR-J2CN1

2. The cable and connector are used for only servo amplifier of 11kW or more.

No.	Product	Model	Description	Application
1)	Standard encoder cable	MR-JCCBL□M-L Refer to (2) in this section.	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Housing: 1-172161-9 Connector pin: 170359-1 (AMP or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry)	Standard flexing life IP20
2)	Long flexing life encoder cable	MR-JCCBL□M-H Refer to (2) in this section.		Long flexing life IP20
3)	Standard encoder cable	MR-JHSCBL□M-L Refer to (2) in this section.	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Plug: D/MS3106B20-29S Cable clamp: D/MS3057-12A (DDK)	Standard flexing life IP20
4)	Long flexing life encoder cable	MR-JHSCBL□M-H Refer to (2) in this section.		Long flexing life
5)	IP65-compliant encoder cable	MR-ENCBL□M-H Refer to (2) in this section.	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Plug: D/MS3106A20-29S (D190) Cable clamp: CE3057-12A-3-D Back shell: CE02-20BS-D (DDK) 	Long flexing life IP65 IP67 Not oil-resistant.
6)	Encoder connector set	MR-J2CNM	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Housing: 1-172161-9 Connector Pin: 170359-1 (AMP or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry) 	IP20
7)	Encoder connector set	MR-J2CNS	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Plug: D/MS3106B20-29S Cable clamp: D/MS3057-12A (DDK) 	IP20
8)	Encoder connector set	MR-ENCNS	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Plug: D/MS3106A20-29S (D190) Cable clamp: CE3057-12A-3-D Back shell: CE02-20BS-S-D (DDK) 	IP65 IP67
9)	Bus cable	MR-J2HBUS□M-A Refer to (4) in this section.	Connector: PCR-S20FS Case: PCR-LS20LA1 (Honda Tsushin) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	
10)	Bus cable	MR-J2HBUS□M Refer to (4) in this section.	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	

No.	Product	Model	Description	Application
11)	Connector set	MR-J2CN1-A Refer to (4) in this section	Connector: PCR-S20FS Shell kit: PCR-LS20LA1 (Honda Tsushin)  Connector: 10120-3000PL Shell kit: 10320-52F0-008 (3M or equivalent) 	
12)	Control signal connector set	MR-J2CN1	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)  Qty: 2 each	
13)	Termination connector	MR-A-TM		
14)	Maintenance junction card	MR-J2CN3TM	Refer to section 12.1.6.	
15)	Communication cable	MR-CPCATCBL3M Refer to (3) in this section.	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: DE-9SF-N Case: DE-C1-J6-S6 (Japan Aviation Electronics) 	For connection with PC-AT-compatible personal computer
16)	Power supply connector set	MR-PWCNS1 Refer to the Servo Motor Instruction Manual.	 Plug: CE05-6A22-23SD-D-BSS Cable clamp:CE3057-12A-2-D (DDK)	EN Standard-compliant IP65 IP67
17)	Power supply connector set	MR-PWCNS2 Refer to the Servo Motor Instruction Manual.	 Plug: CE05-6A24-10S1D-D-BSS Cable clamp: CE3057-16A-2-D (DDK)	
18)	Power supply connector set	MR-PWCNS3 Refer to the Servo Motor Instruction Manual.	 Plug: CE05-6A32-17SD-D-BSS Cable clamp: CE3057-20A-1-D (DDK)	
19)	Brake connector set	MR-BKCN Refer to the Servo Motor Instruction Manual.	 Plug: D/MS3106A10SL-4S (D190) (DDK) Cable connector: YS010-5-8 (Daiwa Dengyo)	EN Standard-compliant IP65 IP67
20)	Power supply connector set	MR-PWCNK1	 Plug: 5559-04P-210 Terminal: 5558PBT3L (For AWG16)(6 pcs.) (Molex)	IP20
21)	Power supply connector set	MR-PWCNK2	 Plug: 5559-06P-210 Terminal: 5558PBT3L (For AWG16)(8 pcs.) (Molex)	For motor with brake IP20
22)	Connector Set	MR-J2CMP2	 Connector: 10126-3000PE Shell kit: 10326-52F0-008 (3M or equivalent)	
23)	Monitor cable	MR-H3CBL1M	 Servo amplifier side connector (Tyco Electronics) Housing: 171822-4	

No.	Product	Model	Description	Application
24)	Bus cable	Q172J2BCBL□M (-B) Refer to (4) in this section	Connector: HDR-E14MG1 Connector: 10120-6000EL Shell kit: HDR-E14LPA5 Shell kit: 10320-3210-000 (Honda Tsushin) (3M or equivalent)  Socket: HCN2-2.5S-2 Terminal: HCN2-2.5S-D-B (Hirose Electric) Note. When using the battery unit Q170BAT, use the Q172J2BCBL □ M-B.	
25)	Bus cable	Q173J2B△CBL□M Refer to (4) in this section	Connector: HDR-E26MG1 Connector: 10120-6000EL Shell kit: HDR-E26LPA5 Shell kit: 10320-3210-000 (Honda Tsushin) (3M or equivalent) 	

(2) Encoder cable

> **CAUTION**
> - If you have fabricated the encoder cable, connect it correctly. Otherwise, misoperation or explosion may occur.

> **POINT**
> - The encoder cable is not oil resistant.
> - Refer to section 11.4 for the flexing life of the encoder cable.
> - When the encoder cable is used, the sum of the resistance values of the cable used for P5 and the cable used for LG should be within 2.4Ω.
> - When soldering the wire to the connector pin, insulate and protect the connection portion using heat-shrinkable tubing.

Generally use the encoder cable available as our options. If the required length is not found in the options, fabricate the cable on the customer side.

(a) MR-JCCBL□M-L・MR-JCCBL□M-H

These encoder cables are used with the HC-KFS・HC-MFS・HC-UFS3000r/min series servo motors.

1) Model explanation

Model: MR-JCCBL□M-□

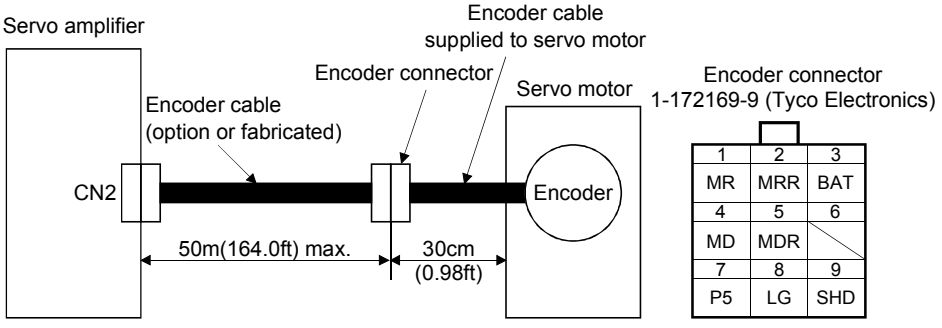
Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	(Note) Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

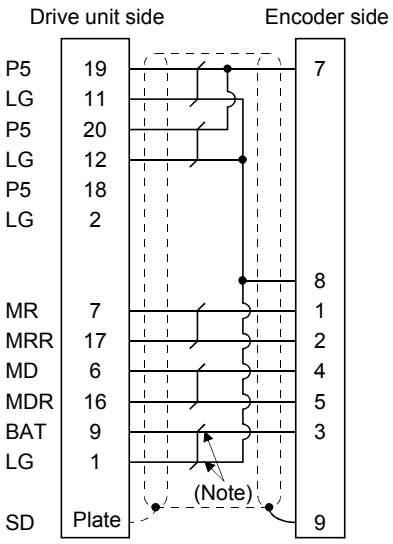
Note. MR-JCCBL□M-H has no 40(131.2ft) and 50m(164.0ft) sizes.

2) Connection diagram

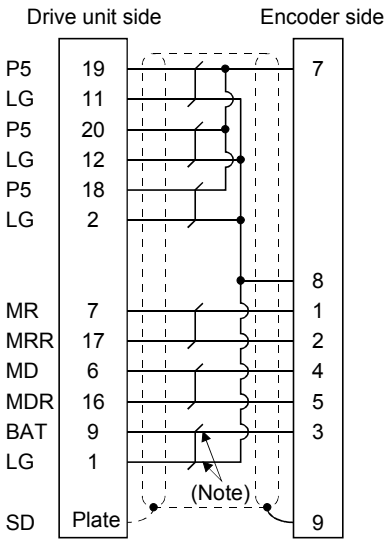
The signal assignment of the encoder connector is as viewed from the pin side. For the pin assignment on the servo amplifier side, refer to section 3.2.1.



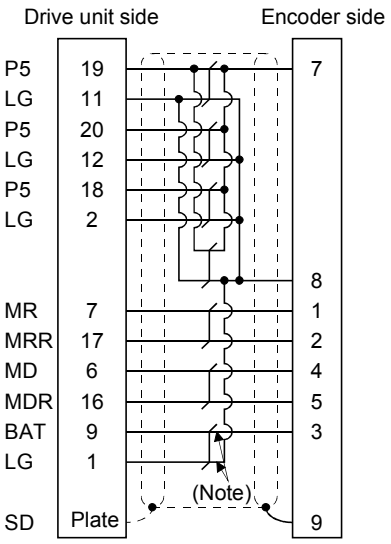
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L
to
MR-JCCBL30M-L



MR-JCCBL10M-H
to
MR-JCCBL50M-H



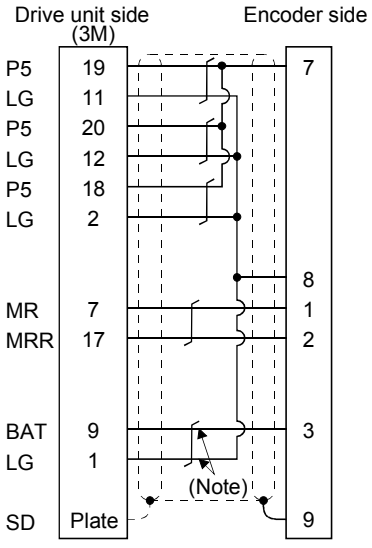
Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

When fabricating an encoder cable, use the recommended wires given in section 12.2.1 and the MR-J2CNM connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m(164.0ft) length including the length of the encoder cable supplied to the servo motor.

When the encoder cable is to be fabricated by the customer, the wiring of MD and MDR is not required.

Refer to chapter 3 of the servo motor instruction manual and choose the encode side connector according to the servo motor installation environment.

For use of AWG22



Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

(b) MR-JHSCBL□M-L・MR-JHSCBL□M-H・MR-ENCBL□M-H

These encoder cables are used with the HC-SFS・HC-RFS・HC-UFS2000r/min series servo motors.

1) Model explanation

Model: MR-JHSCBL□M-□

Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	(Note) Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

Note. MR-JHSCBL□M-L has no 40(131.2ft) and 50m(164.0ft) sizes.

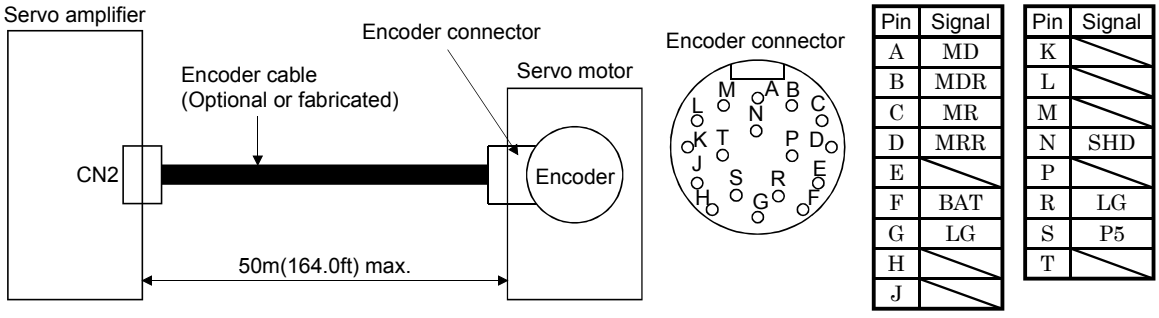
Model: MR-ENCBL□M-H

Long flexing life

Symbol	Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

2) Connection diagram

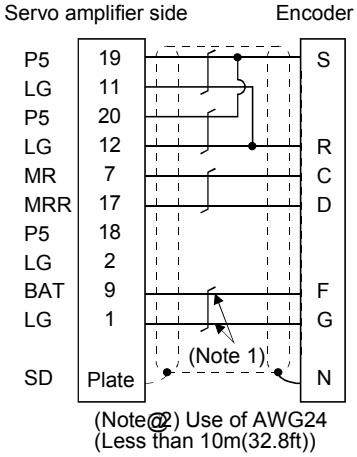
For the pin assignment on the servo amplifier side, refer to section 3.2.1.



Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	

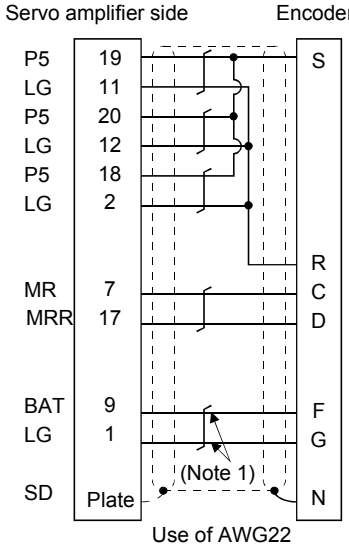
Pin	Signal
K	
L	
M	
N	SHD
P	
R	LG
S	P5
T	

MR-JHSCBL2M-L
MR-JHSCBL5M-L
MR-JHSCBL2M-H
MR-JHSCBL5M-H
MR-ENCBL2M-H
MR-ENCBL5M-H



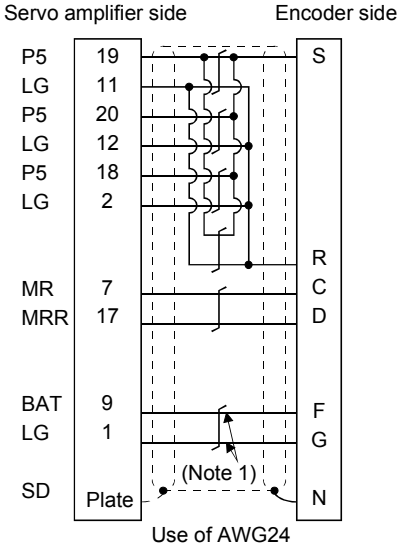
(Note2) Use of AWG24
(Less than 10m(32.8ft))

MR-JHSCBL10M-L
to
MR-JHSCBL30M-L



Use of AWG22
(10m(32.8ft) to 50m(164.0ft))

MR-JHSCBL10M-H
to
MR-JHSCBL50M-H
MR-ENCBL10M-H
to
MR-ENCBL50M-H



Use of AWG24
(10m(32.8ft) to 50m(164.0ft))

Note 1. This wiring is required for use in the absolute position detection system. This wiring is not needed for use in the incremental system.
2. AWG28 can be used for 5m(16.4ft) or less.

When fabricating an encoder cable, use the recommended wires given in section 12.2.1 and the MR-J2CNS connector set for encoder cable fabrication, and fabricate an encoder cable in accordance with the optional encoder cable wiring diagram given in this section. You can fabricate an encoder cable of up to 50m(164.0ft) length.
Refer to chapter 3 of the servo motor instruction guide and choose the encode side connector according to the servo motor installation environment.

(3) Communication cable

POINT
▪ This cable may not be used with some personal computers. After fully examining the signals of the RS-232C connector, refer to this section and fabricate the cable.

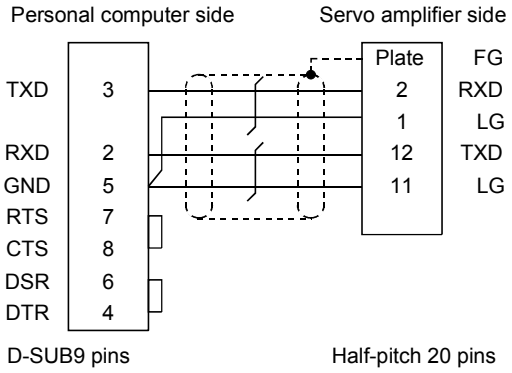
(a) Model definition

Model: MR-CPCATCBL3M

Cable length 3[m](10[ft])

(b) Connection diagram

▪ MR-CPCATCBL3M



When fabricating the cable, refer to the connection diagram in this section.
The following must be observed in fabrication.

1) Always use a shielded, multi-core cable and connect the shield with FG securely.

2) The optional communication cable is 3m(10ft) long. When the cable is fabricated, its maximum length is 15m(49ft) in offices of good environment with minimal noise.

(4) Bus cable

CAUTION	▪ When fabricating the bus cable, do not make incorrect connection. Doing so can cause misoperation or explosion.

When fabricating this cable, use the recommended cable given in section 12.2.1 and fabricate it in accordance with the connection diagram shown in this section. The overall distance of the bus cable on the same bus is 30m(98.4ft).

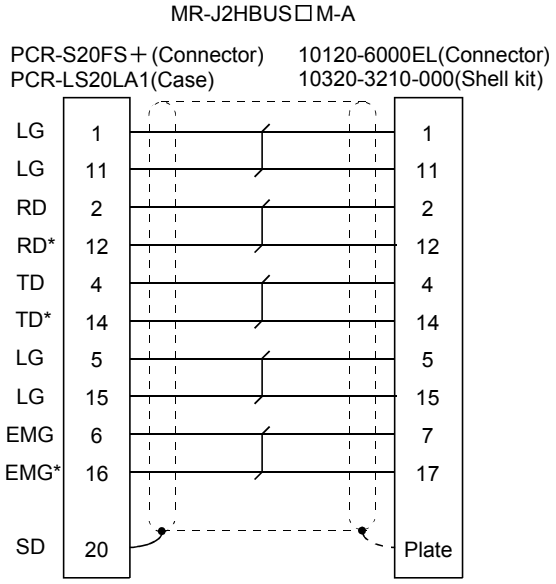
(a) MR-J2HBUS□M-A

1) Model definition

Model: MR-J2HBUS□M-A

Symbol	Cable length [m(ft)]
05	0.5 (1.64)
1	1 (3.28)
5	5 (16.4)

2) Connection diagram



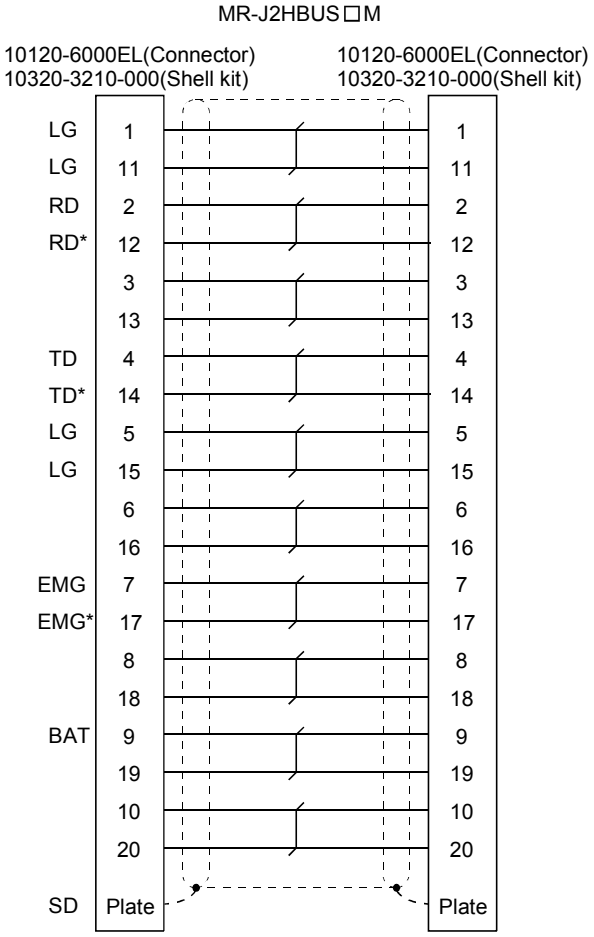
(b) MR-J2HBUS□M

1) Model definition

Model: MR-J2HBUS□M

Symbol	Cable length [m(ft)]
05	0.5 (1.64)
1	1 (3.28)
5	5 (16.4)

2) Connection diagram



(c) Q172J2BCBL□M(-B)

When using the battery unit Q170BAT, use the Q172J2BCBL□M-B. For the Q170BAT, refer to the Motion Controller Q Series User's Manual (IB(NA)0300021).

1) Model definition

Model: Q172J2BCBL□M-□

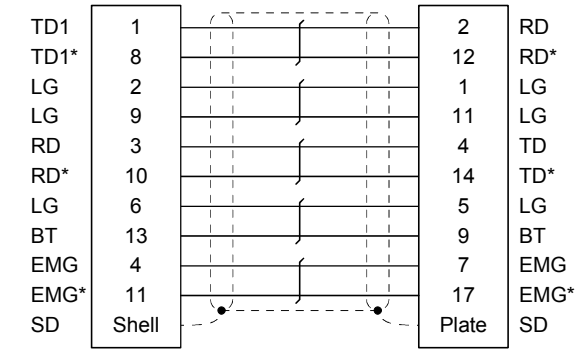
Symbol	Connection of battery unit
No	No
-B	Yes

Symbol	Cable length [m(ft)]
05	0.5 (1.64)
1	1 (3.28)
5	5 (16.4)

2) Connection diagram

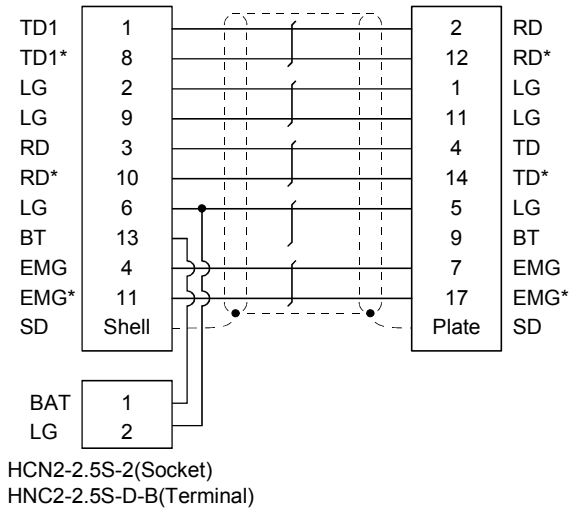
Q172J2BCBL□M

HDR-E14MG1(Connector) 10120-6000EL(Connector)
HDR-E14-LPA5(Connector case) 10320-3210-000(Shell kit)



Q172J2BCBL□M-B

HDR-E14MG1(Connector) 10120-6000EL(Connector)
HDR-E14-LPA5(Connector case) 10320-3210-000(Shell kit)



HCN2-2.5S-2(Socket)
HNC2-2.5S-D-B(Terminal)

(d) Q173J2B△CBL□M

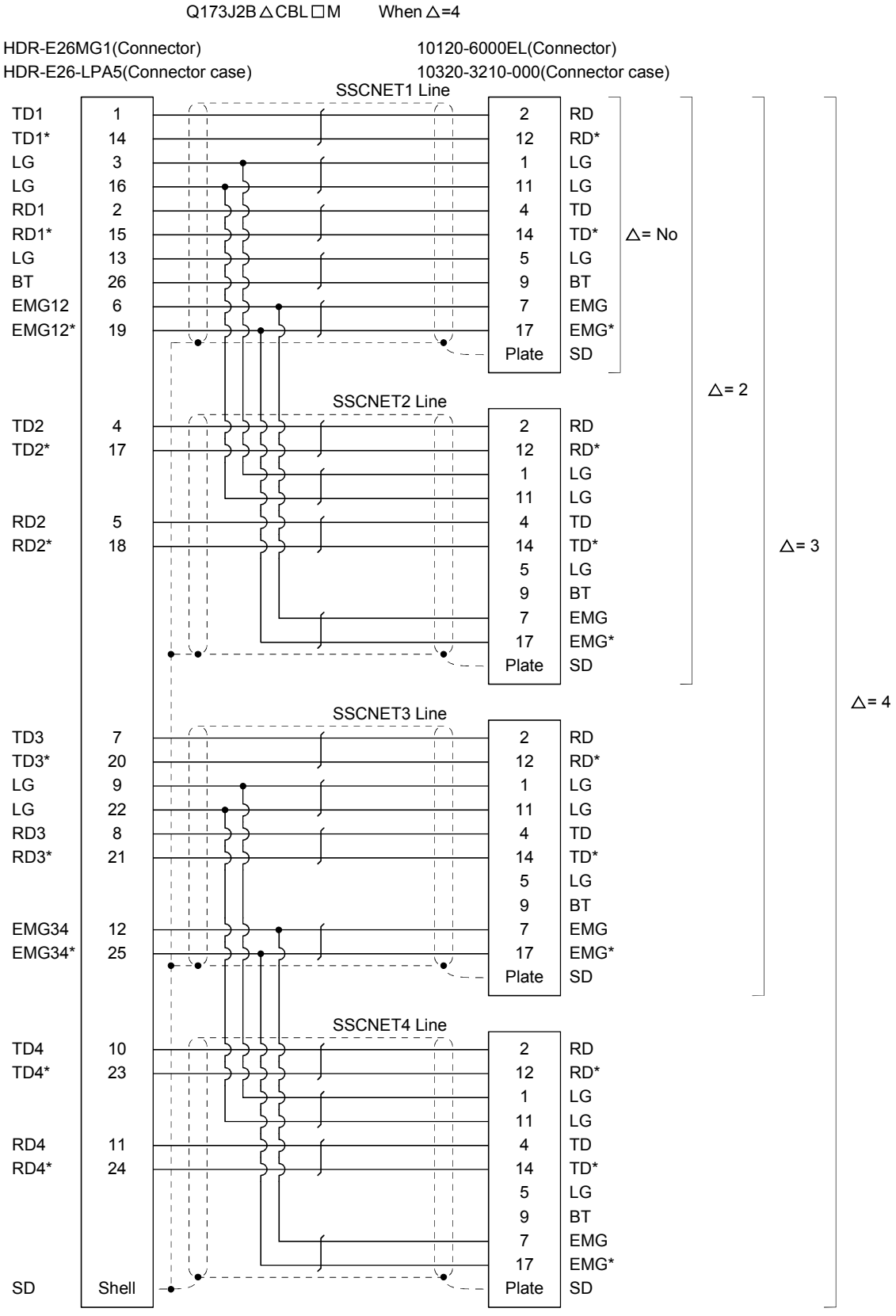
1) Model definition

Model: Q173J2B△CBL□M

Symbol	Cable length [m(ft)]
05	0.5 (1.64)
1	1 (3.28)
5	5 (16.4)

Symbol	SSCNET line number
No	SSCNET1 Line
2	SSCNET2 Line
3	SSCNET3 Line
4	SSCNET4 Line

2) Connection diagram

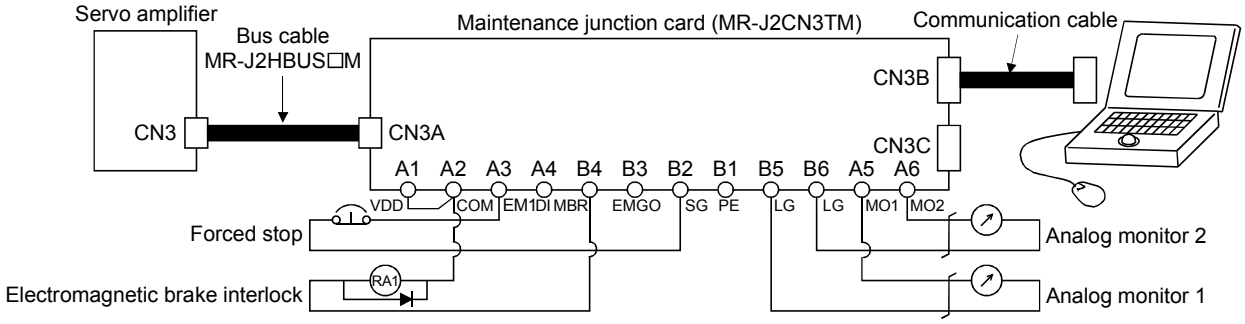


12.1.6 Maintenance junction card (MR-J2CN3TM)

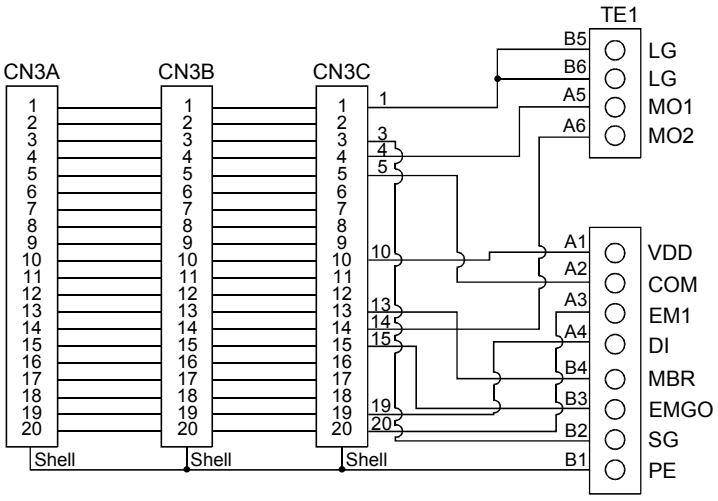
> **POINT**
>
> ▪ The MR-J2S-11KB or more allows only the relaying of signals using CN3A/CN3C. Since TE1 cannot be used, keep it open.

(1) Usage

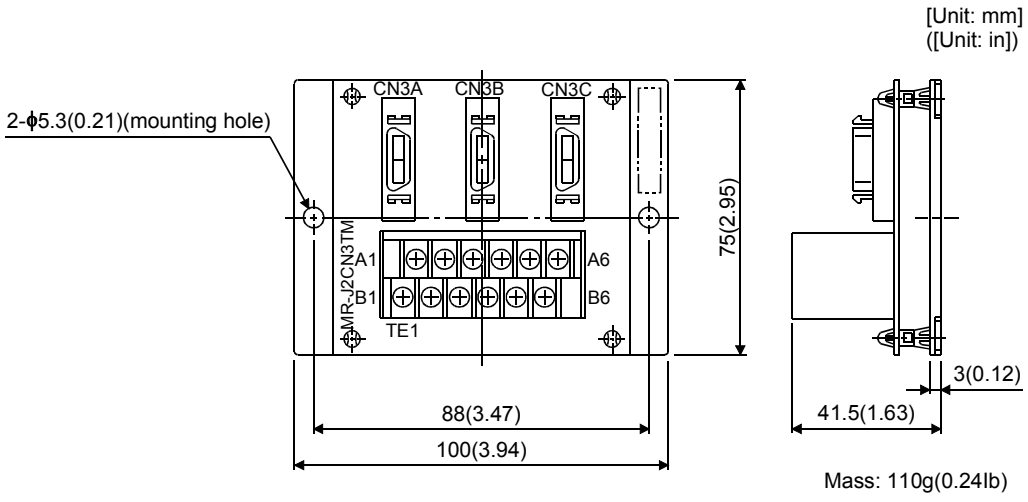
The maintenance junction card (MR-J2CN3TM) is designed for use when a personal computer and analog monitor outputs are used at the same time.



(2) Connection diagram



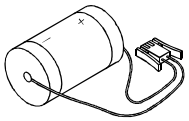
(3) Outline drawing



12.1.7 Battery (MR-BAT, A6BAT)

> **POINT**
>
> ▪ The revision (Edition 44) of the Dangerous Goods Rule of the International Air Transport Association (IATA) went into effect on January 1, 2003 and was enforced immediately. In this rule, "provisions of the lithium and lithium ion batteries" were revised to tighten the restrictions on the air transportation of batteries. However, since this battery is non-dangerous goods (non-Class 9), air transportation of 24 or less batteries is outside the range of the restrictions. Air transportation of more than 24 batteries requires packing compliant with the Packing Standard 903. When a self-certificate is necessary for battery safety tests, contact our branch or representative. For more information, consult our branch or representative. (As of November, 2007).

Use the battery to build an absolute position detection system.



12.1.8 MR Configurator (servo configurations software)

The MR Configurator (servo configuration software) uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

(1) Specifications

Item	Description
Communication signal	Conforms to RS-232C.
Baud rate [bps]	57600, 38400, 19200, 9600
Monitor	Display, high speed monitor, trend graph Minimum resolution changes with the processing speed of the personal computer.
Alarm	Display, history, amplifier data
Diagnostic	Digital I/O, no motor rotation, total power-on time, amplifier version info, motor information, tuning data, absolute encoder data, Axis name setting.
Parameters	Parameter list, turning, change list, detailed information
Test operation	Jog operation, positioning operation, motor-less operation, Do forced output, program operation.
Advanced function	Machine analyzer, gain search, machine simulation.
File operation	Data read, save, print
Others	Automatic demo, help display

(2) System configuration

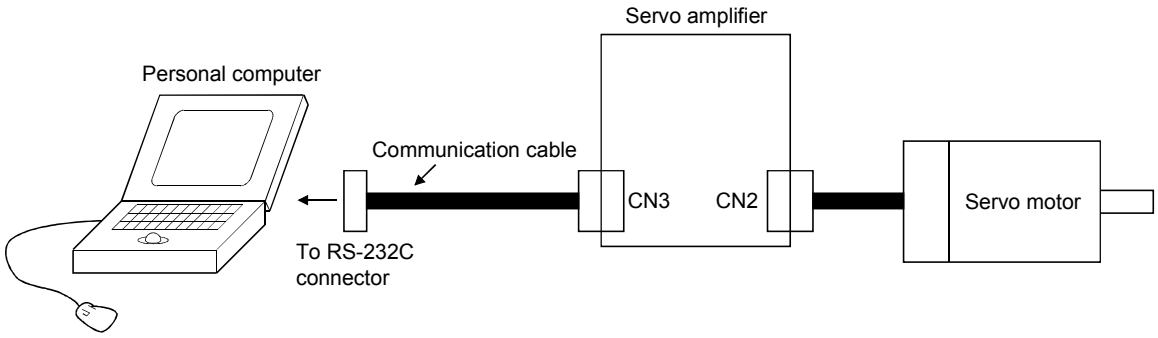
(a) Components

To use this software, the following components are required in addition to the servo amplifier and servo motor.

Model	(Note 1) Description
(Note 2) 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 and Windows® XP Home Edition operates Processor: Pentium® 133MHz or more (Windows® 95, Windows® 98, Windows NT® Workstation 4.0, Windows® 2000 Professional) Pentium® 150MHz or more (Windows® Me) Pentium® 300MHz or more (Windows® XP Professional, Windows® XP Home Edition) Memory: 16MB or more (Windows® 95) 24MB or more (Windows® 98) 32MB or more (Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional) 128MB or more (Windows® XP Professional, Windows® XP Home Edition) Free hard disk space: 60MB or more Serial port used
OS	Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional (English version)
Display	One whose resolution is 800×600 or more and that can provide 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. Note that a serial mouse is not used.
Printer	Connectable with the above personal computer.
Communication cable	MR-CPCATCBL3M When this cannot be used, refer to section 12.1.5 (3) and fabricate.

Note 1. Windows and Windows NT are the registered trademarks of Microsoft Corporation in the United State and other countries.
Pentium is the registered trademarks of Intel Corporation.
2. On some personal computers, this software may not run properly.

(b) Configuration diagram



12.1.9 Power regeneration common converter

POINT

- For details of the power regeneration common converter FR-CV, refer to the FR-CV Installation Guide (IB(NA)0600075).
- Do not supply power to the main circuit power supply terminals (L1, L2, L3) of the servo amplifier. Doing so will fail the servo amplifier and FR-CV.
- Connect the DC power supply between the FR-CV and servo amplifier with correct polarity. Connection with incorrect polarity will fail the FR-CV and servo amplifier.
- Two or more FR-CV's cannot be installed to improve regeneration capability. Two or more FR-CV's cannot be connected to the same DC power supply line.

When using the power regeneration common converter, set parameter No. 2 to "□□01".

(1) Selection

The power regeneration common converter FR-CV can be used with 750W to 22kW servo amplifiers. There are the following restrictions on use of the FR-CV.

(a) Up to six servo amplifiers can be connected to one FR-CV.

(b) FR-CV capacity [W] ≥ Total of rated capacities [W] of servo amplifiers connected to FR-CV × 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 servo amplifier of the maximum capacity should be equal to or less than the maximum connectable capacity [W].

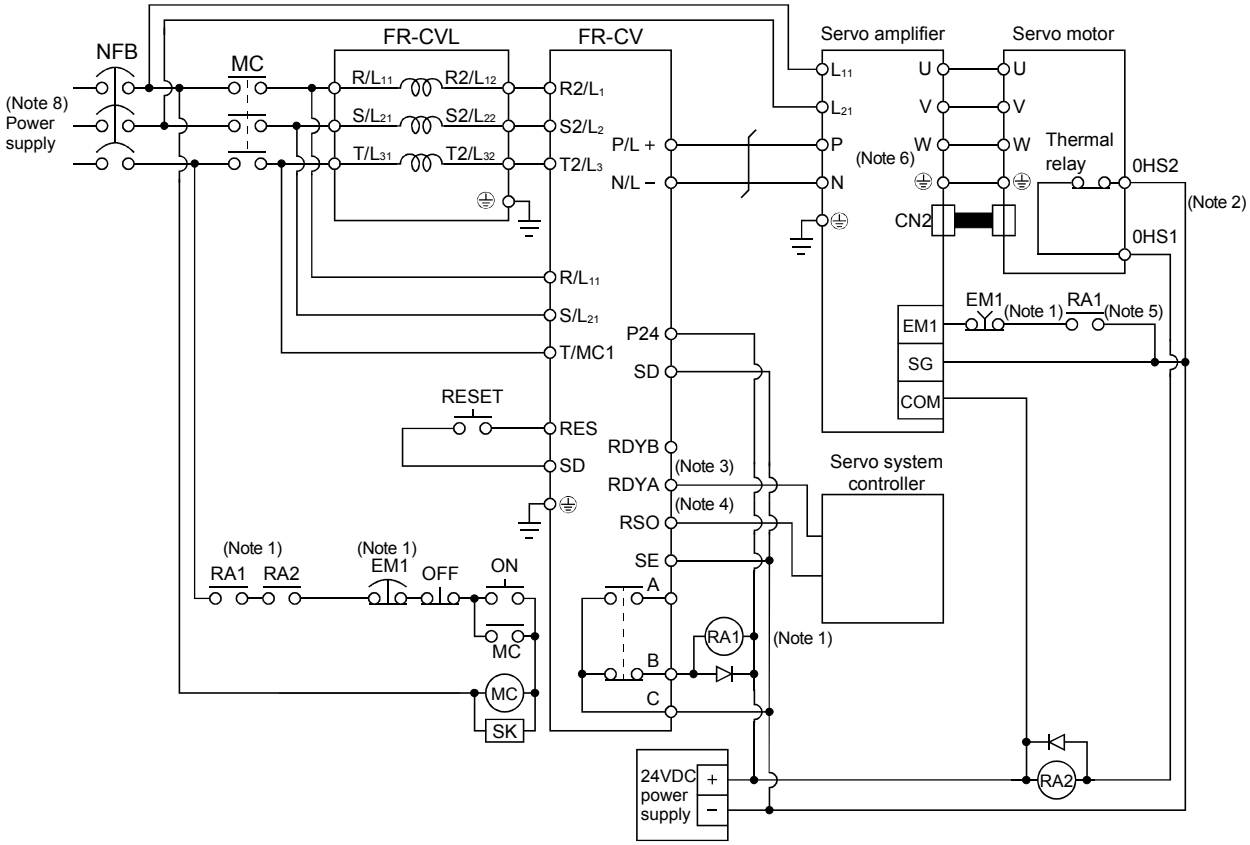
The following table lists the restrictions.

Item	FR-CV-□						
	7.5K	11K	15K	22K	30K	37K	55K
Maximum number of connected servo amplifiers	6						
Total of connectable servo amplifier capacities [kW]	3.75	5.5	7.5	11	15	18.5	27.5
Total of connectable servo motor rated currents [A]	33	46	61	90	115	145	215
Maximum servo amplifier capacity [kW]	3.5	5	7	11	15	15	22

When using the 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) Connection diagram



Note 1. Configure a sequence that will shut off main circuit power at a forced stop or at FR-CV or servo amplifier alarm occurrence.
2. For the servo motor with thermal relay, configure a sequence that will shut off main circuit power when the thermal relay operates.
3. For the servo amplifier, configure a sequence that will switch the servo on after the FR-CV is ready.
4. For the FR-CV, the RSO signal turns off when it is put in a ready-to-operate status where the reset signal is input. Configure a sequence that will make the servo inoperative when the RSO signal is on.
5. Configure a sequence that will make a stop with the forced stop input of the servo system controller if an alarm occurs in the FR-CV. When the servo system controller does not have a forced stop input, use the forced stop input of the servo amplifier to make a stop as shown in the diagram.
6. For 7kW or less servo amplifier, always remove the wiring (3.5kW or less: across P-D, 5k・7kW: across P-C) of built-in regenerative resistor.
7. When using the servo amplifier of 11k to 22kW, make sure to connect P_1 and P. (Factory-wired.)
8. Refer to section 1.3 for the power supply specification.

(3) Wires used for wiring

(a) Wire sizes

1) Across P-P, N-N

The following table indicates the connection wire sizes of the DC power supply (P, N terminals) between the FR-CV and servo amplifier. The used wires are based on the 600V vinyl wires.

Total of servo amplifier capacities [kW]	Wires[mm^2]
1 or less	2
2	3.5
5	5.5
7	8
11	14
15	22
22	50

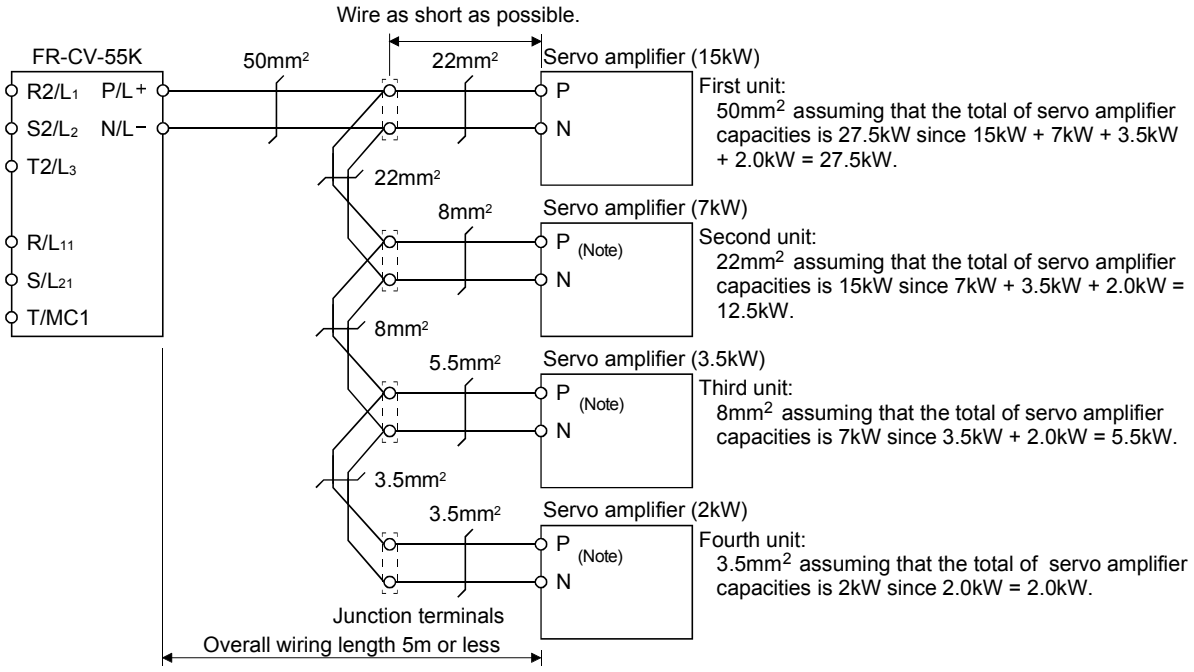
2) Grounding

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	14
FR-CV-22K・FR-CV-30K	22
FR-CV-37K・FR-CV-55K	38

(b) Example of selecting the wire sizes

When connecting multiple servo amplifiers, always use junction terminals for wiring the servo amplifier terminals P, N. Also, connect the servo amplifiers in the order of larger to smaller capacities.



Note. For 7kW or less servo amplifier, always remove the wiring (3.5kW or less: across P-D, 5k・7kW: across P-C) of built-in regenerative resistor.

(4) Other precautions

(a) Always use the FR-CVL as the power factor improving reactor. Do not use the FR-BAL or FR-BEL.

(b) The inputs/outputs (main circuits) of the FR-CV 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) or line noise filter (FR-BSF01, FR-BLF).

(c) The overall wiring length for connection of the DC power supply between the FR-CV and servo amplifiers should be 5m or less, and the wiring must be twisted.

(5) Specifications

Item \ Power regeneration common converter FR-CV-□			7.5K	11K	15K	22K	30K	37K	55K
Total of connectable servo amplifier capacities [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, 60s (Note 1)						
		Continuous rating	100% torque						
Power supply	Rated input AC voltage/frequency		Three-phase 200 to 220V 50Hz, 200 to 230V 60Hz						
	Permissible AC voltage fluctuation		Three-phase 170 to 242V 50Hz, 170 to 253V 60Hz						
	Permissible frequency fluctuation		±5%						
	Power supply capacity (Note 2) [kVA]		17	20	28	41	52	66	100
Protective structure (JEM 1030), cooling system			Open type (IP00), forced cooling						
Environment	Ambient temperature		−10℃ to +50℃ (14°F to 122°F)(non-freezing)						
	Ambient humidity		90%RH or less (non-condensing)						
	Ambience		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt)						
Altitude, vibration			1000m or less above sea level, 5.9m/s^2 or less						
No-fuse breaker or leakage current breaker			30AF 30A	50AF 50A	100AF 75A	100AF 100A	225AF 125A	225AF 125A	225AF 175A
Magnetic contactor			S-N20	S-N35	S-N50	S-N65	S-N95	S-N95	S-N125

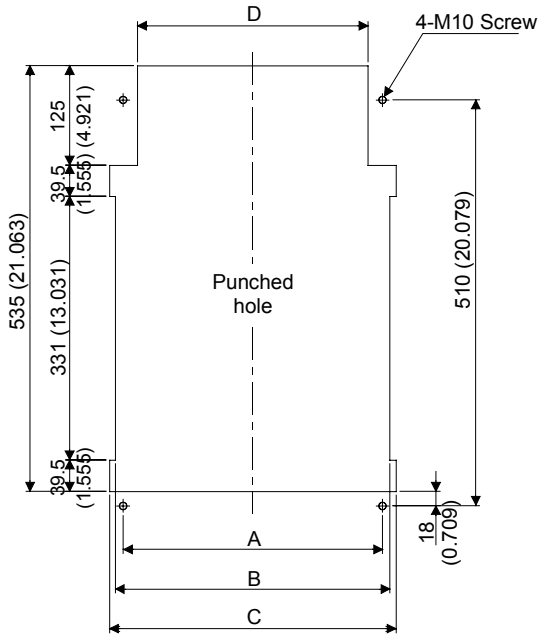
Note 1. This is the time when the protective function of the FR-CV is activated. The protective function of the servo amplifier is activated in the time indicated in section 11.1.

2. When connecting the capacity of connectable servo amplifier, specify the value of servo amplifier.

12.1.10 Heat sink outside mounting attachment (MR-JACN)

Use the heat sink outside mounting attachment to mount the heat generation area of the servo amplifier in the outside of the control box to dissipate servo amplifier-generated heat to the outside of the box and reduce the amount of heat generated in the box, thereby allowing a compact control box to be designed. In the control box, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier to the control box.
The environment outside the control box when using the heat sink outside mounting attachment should be within the range of the servo amplifier operating environment conditions.

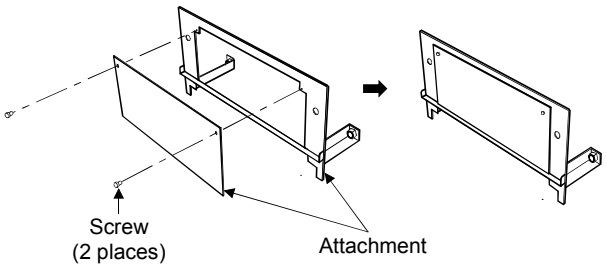
(1) Panel cut dimensions



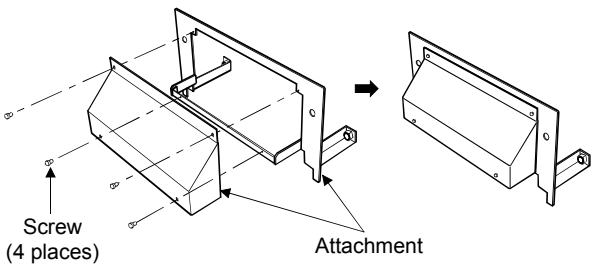
[Unit: mm(in)]

Changeable dimension / Model	A	B	C	D	Servo amplifier
MR-JACN15K	236 (9.291)	255 (10.039)	270 (10.63)	203 (7.992)	MR-J2S-11KB MR-J2S-15KB
MR-JACN22K	326 (12.835)	345 (13.583)	360 (14.173)	290 (11.417)	MR-J2S-22KB

(2) How to assemble the attachment for a heat sink outside mounting attachment

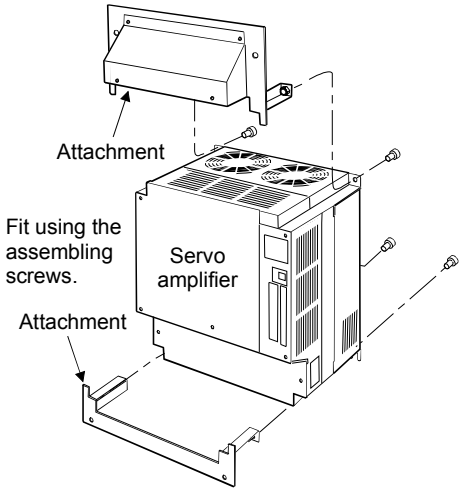


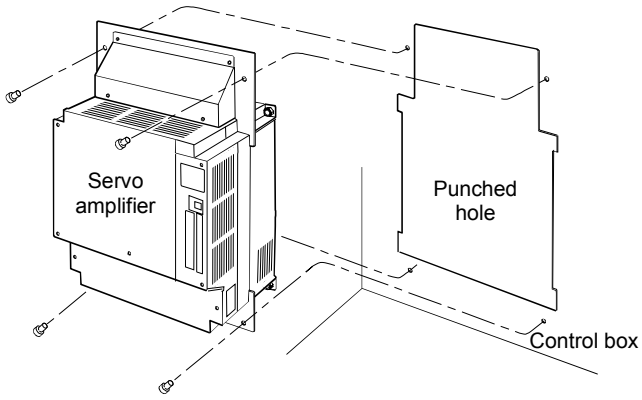
MR-JACN15K



MR-JACN22K

(3) Fitting method



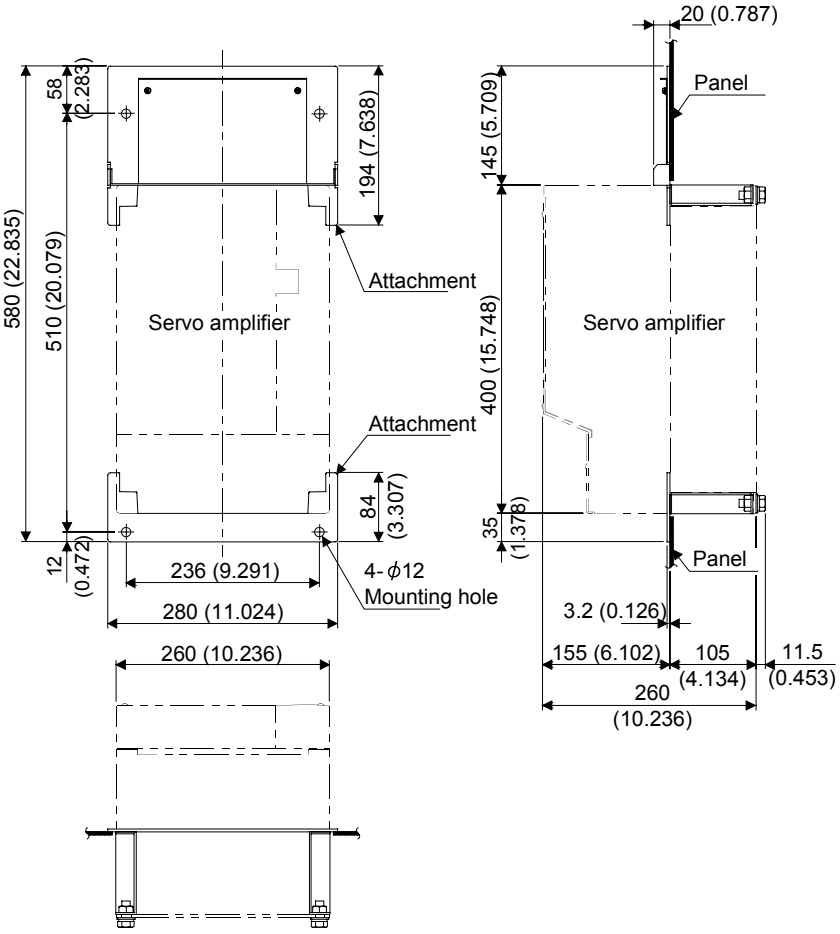


a. Assembling the heat sink outside mounting attachment

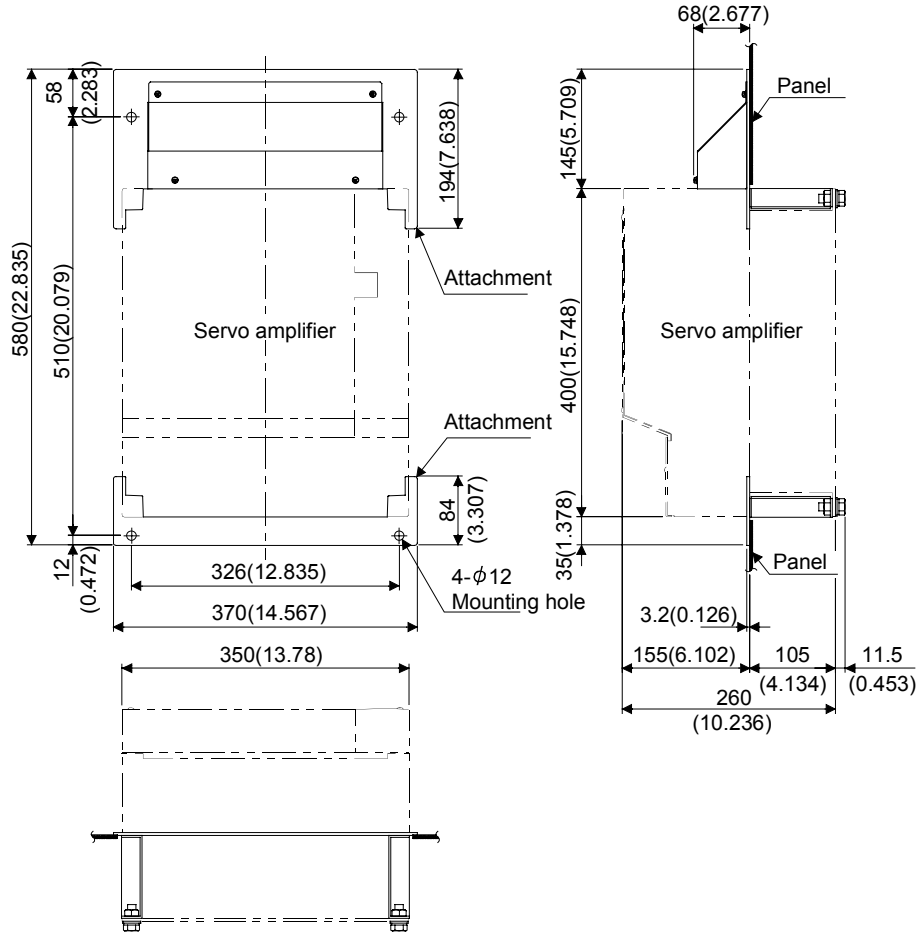
b. Installation to the control box

(4) Outline dimension drawing

(a) MR-JACN15K (MR-J2S-11KB, MR-J2S-15KB)



(b) MR-JACN22K (MR-J2S-22KB)



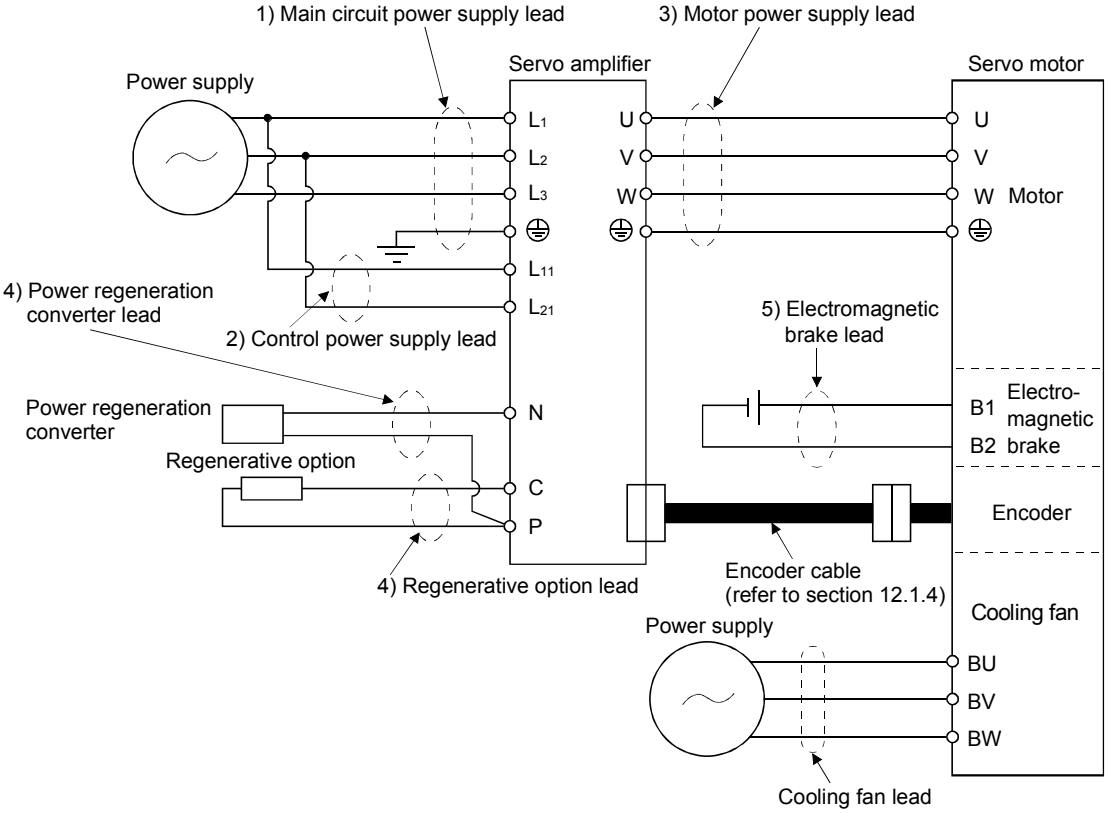
12.2 Auxiliary equipment

Always use the devices indicated in this section or equivalent. To comply with the EN Standard or UL/C-UL (CSA) Standard, use the products which conform to the corresponding standard.

12.2.1 Recommended wires

(1) Wires for power supply wiring

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



The following table lists wire sizes. The wires used assume that they are 600V vinyl wires and the wiring distance is 30m(98.4ft) max. If the wiring distance is over 30m(98.4ft), choose the wire size in consideration of voltage drop.

The alphabets (a, b, c) in the table correspond to the crimping terminals (Table 12.2) used to wire the servo amplifier. For connection with the terminal block TE2 of the MR-J2S-100B or less, refer to section 3.9.

The servo motor side connection method depends on the type and capacity of the servo motor. Refer to section 3.6.

To comply with the UL/C-UL (CSA) Standard, use UL-recognized copper wires rated at 60°C (140°F) or more for wiring.

Table 12.1 Recommended wires

Servo amplifier	(Note 1) Wires [mm^2]					
	1) L1・L2・L3・⏚	2) L11・L21	3) U・V・W・ P1・P・⏚	4) P・C・N	5) B1・B2	6) BU・BV・BW
MR-J2S-10B(1)	2 (AWG14) : a	1.25 (AWG16)	1.25 (AWG16) : a	2 (AWG14) : a	1.25 (AWG16)	
MR-J2S-20B(1)						
MR-J2S-40B(1)						
MR-J2S-60B						
MR-J2S-70B						
MR-J2S-100B			2 (AWG14) : a			
MR-J2S-200B	3.5 (AWG12) : b		3.5 (AWG12) : b			
MR-J2S-350B	5.5 (AWG10) : b		(Note 2) 5.5 (AWG10) : b			
MR-J2S-500B			5.5 (AWG10) : b			
MR-J2S-700B	8 (AWG8) : c		8 (AWG8) : c	3.5(AWG12): b		
MR-J2S-11KB	14 (AWG6) :d		22 (AWG4) :e	5.5(AWG10): b		2(AWG14)
MR-J2S-15KB	22 (AWG4) :e		30 (AWG2) :f			
MR-J2S-22KB	50 (AWG1/0) :g		60 (AWG2/0) :g			

Note 1. For the crimping terminals and applicable tools, see the table 12.2.
2. 3.5mm^2 for use of the HC-RFS203 servo motor.

Use wires 6) of the following sizes with the power regeneration converter (FR-RC).

Model	Wires[mm^2]
FR-RC-15K	14(AWG6)
FR-RC-30K	14(AWG6)
FR-RC-55K	22(AWG4)

Table 12.2 Recommended crimping terminals

Symbol	Servo amplifier side crimping terminals		
	Crimping terminal	Applicable tool	Manufacturer name
a	32959	47387	Tyco Electronics
b	FVD5.5-4	YNT-1210S	Japan Solderless Terminal
c	FVD8-5	Body YF-1・E-4 Head YNE-38 Dice DH-111・DH-121	
d	FVD14-6	Body YF-1・E-4 Head YNE-38 Dice DH-112・DH-122	
e	FVD22-6	Body YF-1・E-4 Head YNE-38 Dice DH-113・DH-123	
(Note 1・2) f	38-S6	Body YPT-60-21 Dice TD-124・TD-112	
		Body YF-1・E-4 Head YET-60-1 Dice TD-124・TD-112	
	R38-6S	NOP60 NOM60	NICHIFU
g	(Note 1)R60-8	Body YDT-60-21 Dice TD-125・TD-113	Japan Solderless Terminal
		Body YF-1・E-4 Head YET-60-1 Dice TD-125・TD-113	

Note 1. Cover the crimped portion with an insulating tape.
2. Always use recommended crimping terminals or equivalent since some crimping terminals cannot be installed depending on the size.

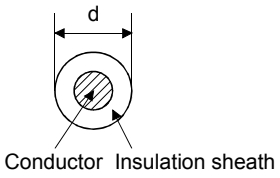
(2) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

Table 12.3 Wires for option cables

Type	Model	Length [m(ft)]	Core size [mm²]	Number of Cores	Characteristics of one core			(Note 3) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance[Ω/mm]	Insulation coating ODd[mm] (Note 1)		
Encoder cable	MR-JCCBL□M-L	2 to 10 (6.56 to 32.8)	0.08	12 (6 pairs)	7/0.127	222	0.38	5.6	UL20276 AWG#28 6pair (BLACK)
		20・30 (65.6・98.4)	0.3	12 (6 pairs)	12/0.18	62	1.2	8.2	UL20276 AWG#22 6pair (BLACK)
	MR-JCCBL□M-H	2・5 (6.56・16.4)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
		10 to 50 (32.8 to 164)	0.2	14 (7 pairs)	40/0.08	105	0.88	8.0	(Note 2) A14B0238 7P
	MR-JHSCBL□M-L	2・5 (6.56・16.4)	0.08	8 (4 pairs)	7/0.127	222	0.38	4.7	UL20276 AWG#28 4pair (BLACK)
		10 to 30 (32.8 to 98.4)	0.3	12 (6 pairs)	12/0.18	62	1.2	8.2	UL20276 AWG#22 6pair (BLACK)
	MR-JHSCBL□M-H	2・5 (6.56・16.4)	0.2	8 (4 pairs)	40/0.08	105	0.88	6.5	(Note 2) A14B2339 4P
		10 to 50 (32.8 to 164)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
	MR-ENCBL□M-H	2・5 (6.56・16.4)	0.2	8 (4 pairs)	40/0.08	105	0.88	6.5	(Note 2) A14B2339 4P
		10 to 50 (32.8 to 164)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
Communication cable	MR-CPCATCBL3M	3 (9.84)	0.08	6 (3 pairs)	7/0.127	222	0.38	4.6	UL20276 AWG#28 3pair (BLACK)
Bus cable	MR-J2HBUS□M	0.5 to 5 (1.64 to 16.4)	0.08	20 (10 pairs)	7/0.127	222	0.38	6.1	UL20276 AWG#28 10pair (CREAM)
	MR-J2HBUS□M-A								
	Q172J2BCBL□M(-B)			14 (7 pairs)				5.5	UL20276 AWG#28 7pair (CREAM)
	Q173J2B△CBL□M								

Note 1. d is as shown below.



2. Purchased from Toa Electric Industry

3. Standard OD. Max. OD is about 10% greater.

12.2.2 No-fuse breakers, fuses, magnetic contactors

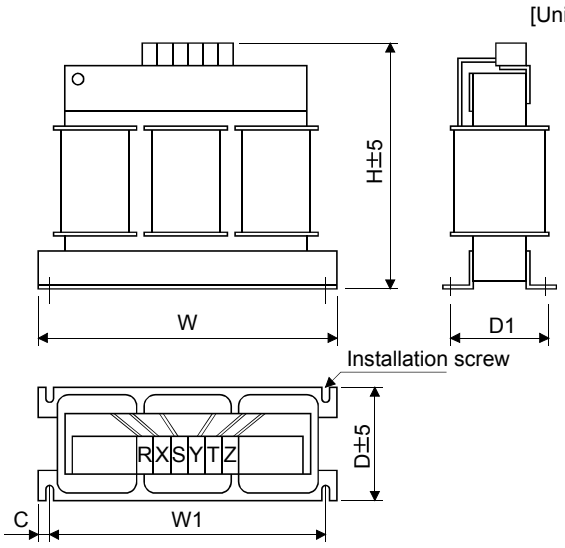
Always use one no-fuse breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the no-fuse breaker, use the one having the specifications given in this section.

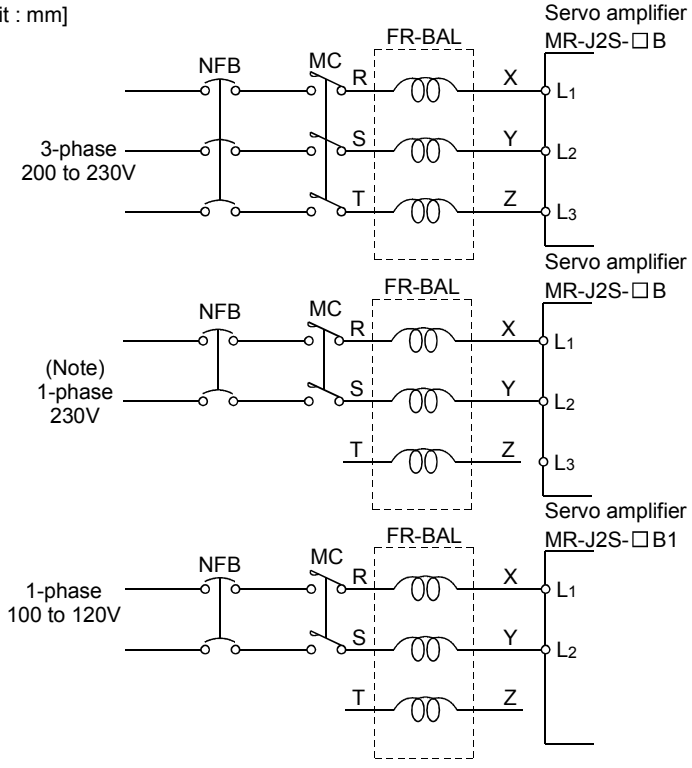
Servo amplifier	No-fuse breaker	Fuse			Magnetic contactor
		Class	Current [A]	Voltage AC[V]	
MR-J2S-10B(1)	30A frame 5A	K5	10	250	S-N10
MR-J2S-20B	30A frame 5A	K5	10		
MR-J2S-40B・20B1	30A frame 10A	K5	15		
MR-J2S-60B・40B1	30A frame 15A	K5	20		
MR-J2S-70B	30A frame 15A	K5	20		
MR-J2S-100B	30A frame 15A	K5	25		
MR-J2S-200B	30A frame 20A	K5	40		S-N18
MR-J2S-350B	30A frame 30A	K5	70		S-N20
MR-J2S-500B	50A frame 50A	K5	125		S-N35
MR-J2S-700B	100A frame 75A	K5	150		S-N50
MR-J2S-11KB	100A frame 100A	K5	200		S-N65
MR-J2S-15KB	225A frame 125A	K5	250		S-N95
MR-J2S-22KB	225A frame 175A	K5	350		S-N25

12.2.3 Power factor improving reactors

The input power factor is improved to be about 90%. For use with a 1-phase power supply, it may be slightly lower than 90%.

[Unit : mm]



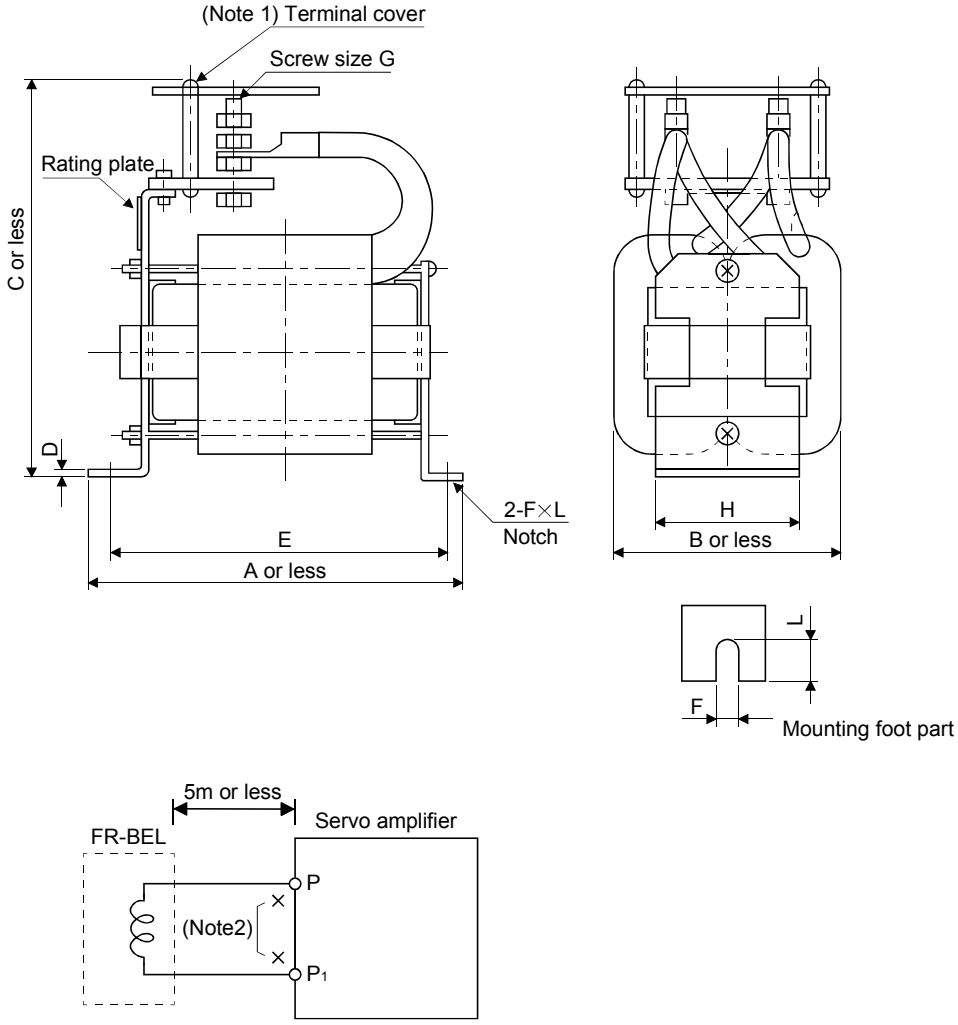


Note. For the 1-phase 230V power supply, Connect the power supply to L_1, L_2 and leave L_3 open.

Servo amplifier	Model	Dimensions [mm (in)]						Mounting screw size	Terminal screw size	Mass [kg (lb)]
		W	W1	H	D	D1	C			
MR-J2S-10B(1)/20B	FR-BAL-0.4K	135 (5.31)	120 (4.72)	115 (4.53)	59 (2.32)	$45^{0}_{-2.5}$ ($1.77^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	2.0 (4.4)
MR-J2S-40B/20B1	FR-BAL-0.75K	135 (5.31)	120 (4.72)	115 (4.53)	69 (2.72)	$57^{0}_{-2.5}$ ($2.24^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	2.8 (6.17)
MR-J2S-60B/70B/40B1	FR-BAL-1.5K	160 (6.30)	145 (5.71)	140 (5.51)	71 (2.79)	$55^{0}_{-2.5}$ ($2.17^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	3.7 (8.16)
MR-J2S-100B	FR-BAL-2.2K	160 (6.30)	145 (5.71)	140 (5.51)	91 (3.58)	$75^{0}_{-2.5}$ ($2.95^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	5.6 (12.35)
MR-J2S-200B	FR-BAL-3.7K	220 (8.66)	200 (7.87)	192 (7.56)	90 (3.54)	$70^{0}_{-2.5}$ ($2.76^{0}_{-0.098}$)	10 (0.39)	M5	M4	8.5 (18.74)
MR-J2S-350B	FR-BAL-7.5K	220 (8.66)	200 (7.87)	194 (7.64)	120 (4.72)	$100^{0}_{-2.5}$ ($3.94^{0}_{-0.098}$)	10 (0.39)	M5	M5	14.5 (32.0)
MR-J2S-500B	FR-BAL-11K	280 (11.02)	255 (10.04)	220 (8.66)	135 (5.31)	$100^{0}_{-2.5}$ ($3.94^{0}_{-0.098}$)	12.5 (0.49)	M6	M6	19 (41.9)
MR-J2S-700B/11KB	FR-BAL-15K	295 (11.61)	270 (10.62)	275 (10.83)	133 (5.24)	$110^{0}_{-2.5}$ ($4.33^{0}_{-0.098}$)	12.5 (0.49)	M6	M6	27 (59.5)
MR-J2S-15KB	FR-BAL-22K	290 (11.41)	240 (9.75)	301 (11.85)	199 (7.84)	170±5 (6.69±0.2)	25 (0.98)	M8	M8	35 (77.16)
MR-J2S-22KB	FR-BAL-30K	290 (11.41)	240 (9.75)	301 (11.85)	219 (8.62)	190±5 (7.48±0.2)	25 (0.98)	M8	M8	43 (94.79)

12.2.4 Power factor improving DC reactors

The input power factor is improved to be about 95%.



Note 1. Fit the supplied terminal cover after wiring.
2. When using the DC reactor, remove the short-circuit bar across P_1-P.

Servo amplifier	Power factor improving DC reactors	Dimensions [mm (in)]									Terminal screw size	Mass [kg (lb)]	Used wire [mm^2]
		A	B	C	D	E	F	L	G	H			
MR-J2S-11KB	FR-BEL-15K	170(6.69)	93(3.66)	170(6.69)	2.3(0.09)	155(6.10)	6(0.24)	14(0.55)	M8	56(2.21)	M5	3.8(8.38)	22(AWG4)
MR-J2S-15KB	FR-BEL-22K	185(7.28)	119(4.69)	182(7.17)	2.6(0.10)	165(6.49)	7(0.28)	15(0.59)	M8	70(2.77)	M6	5.4(11.91)	30(AWG2)
MR-J2S-22KB	FR-BEL-30K	185(7.28)	119(4.69)	201(7.91)	2.6(0.10)	165(6.49)	7(0.28)	15(0.59)	M8	70(2.77)	M6	6.7(14.77)	60(AWG1/0)

12.2.5 Relays

The following relays should be used with the interfaces.

Interface	Selection example
Relay used for digital input signals (interface DI-1)	To prevent defective contacts , use a relay for small signal (twin contacts). (Ex.) Omron : type G2A , MY
Relay used for digital output signals (interface DO-1)	Small relay with 12VDC or 24VDC of 40mA or less (Ex.) Omron : type MY

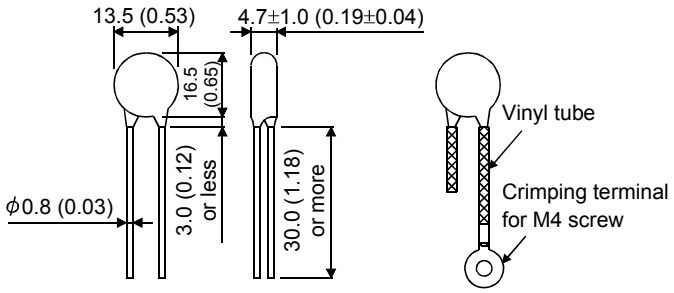
12.2.6 Surge absorbers

A surge absorber is required for the electromagnetic brake. Use the following surge absorber or equivalent. Insulate the wiring as shown in the diagram.

Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
Permissible circuit voltage		Surge immunity	Energy immunity	Rated power				
AC[Vma]	DC[V]	[A]	[J]	[W]	[A]	[V]	[pF]	[V]
140	180	(Note) 500/time	5	0.4	25	360	300	220 (198 to 242)

Note. 1 time = 8 × 20μs

(Example) ERZV10D221 (Matsushita Electric Industry)
TNR-10V221K (Nippon Chemi-con)
Outline drawing [mm] ([in]) (ERZ-C10DK221)



12.2.7 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 devices 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 devices malfunction 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

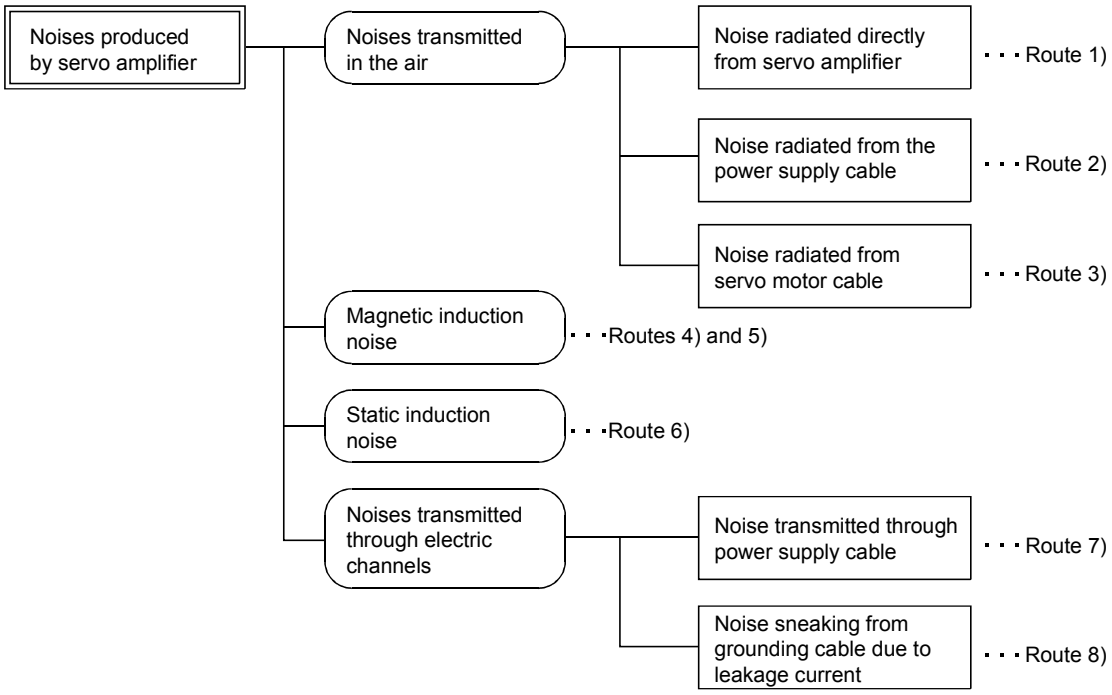
(a) General reduction techniques

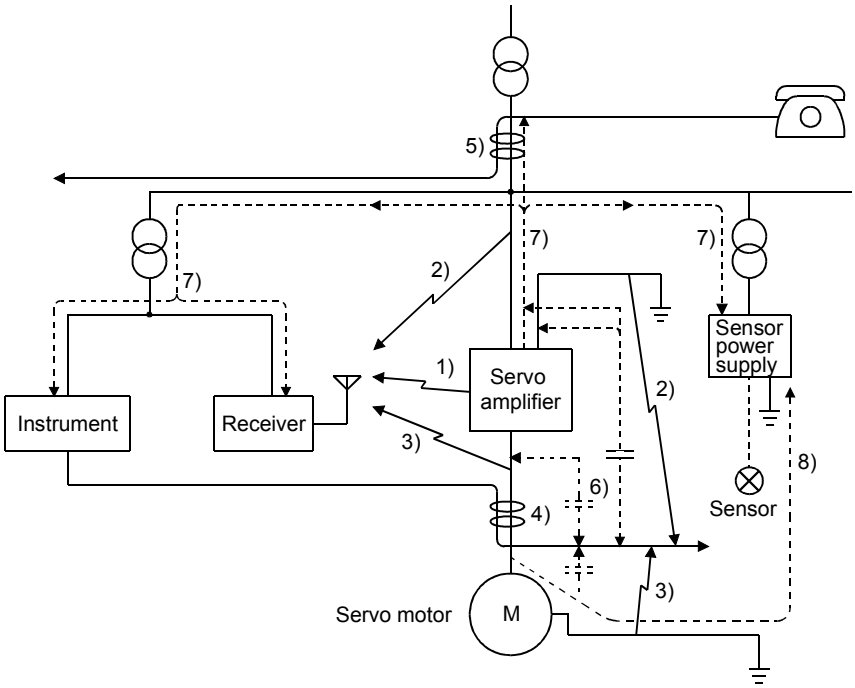
- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- 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 absorbers 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 devices 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 devices 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 control box 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 laying the power lines (I/O cables of the servo amplifier) and signal cables 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 cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables 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 laying the power lines (I/O cables of the servo amplifier) and signal cables side by side or bundling them together. (4) Use shielded wires for signal and power cables or put the cables in separate metal conduits.
7)	When the power supply of peripheral devices 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) Insert the radio noise filter (FR-BIF) on the power cables (input cables) of the servo amplifier. (2) Insert the line noise filter (FR-BSF01・FR-BLF) on the power cables of the servo amplifier.
8)	When the cables of peripheral devices are connected to the servo amplifier to make a closed loop circuit, leakage current may flow to malfunction the peripheral devices. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction products

(a) Data line filter

Noise can be prevented by installing a data line filter onto the encoder cable, etc.

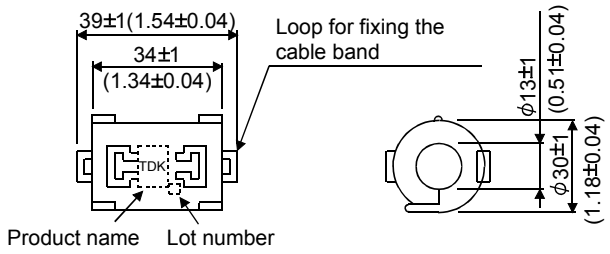
For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC Tokin are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below.

This impedances are reference values and not guaranteed values.

Impedance[Ω]	
10 to 100MHz	100 to 500MHz
80	150

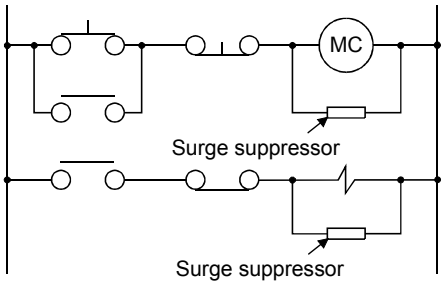
[Unit: mm]([Unit: in.])

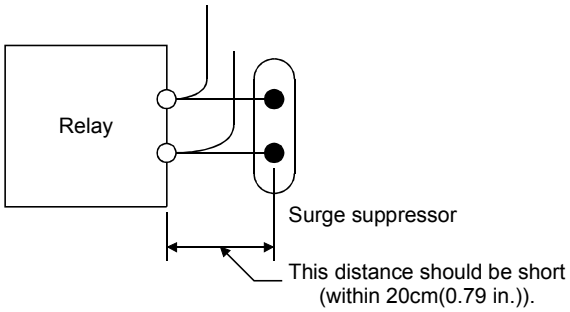


Outline drawing (ZCAT3035-1330)

(b) Surge suppressor

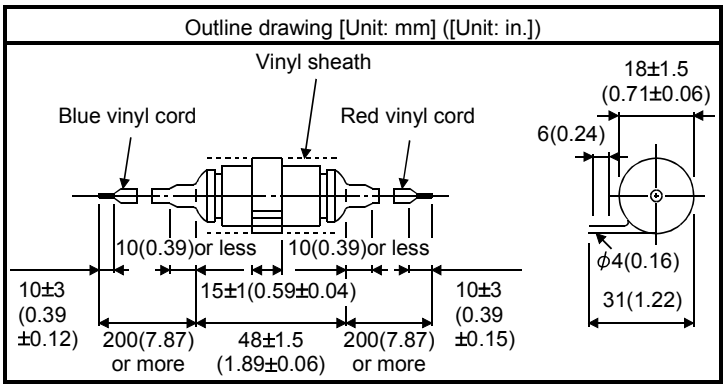
The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near the servo amplifier is shown below. Use this product or equivalent.





(Ex.) 972A.2003 50411
(Matsuo Electric Co.,Ltd.-200V rating)

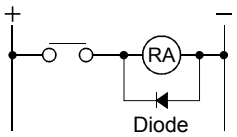
Rated voltage AC[V]	C [μF]	R [Ω]	Test voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1 to 5s)



Note that a diode should be installed to a DC relay, DC valve or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or the like

Maximum current: Not less than twice the drive current of the relay or the like

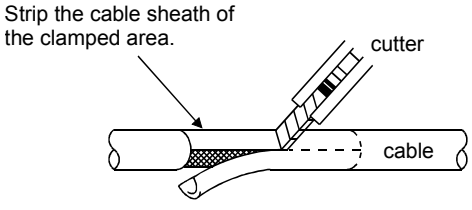


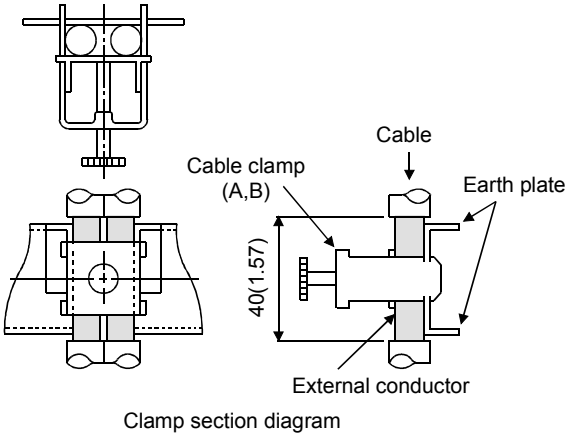
(c) Cable clamp fitting (AERSBAN□-SET)

Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below.

Install the earth 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 earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



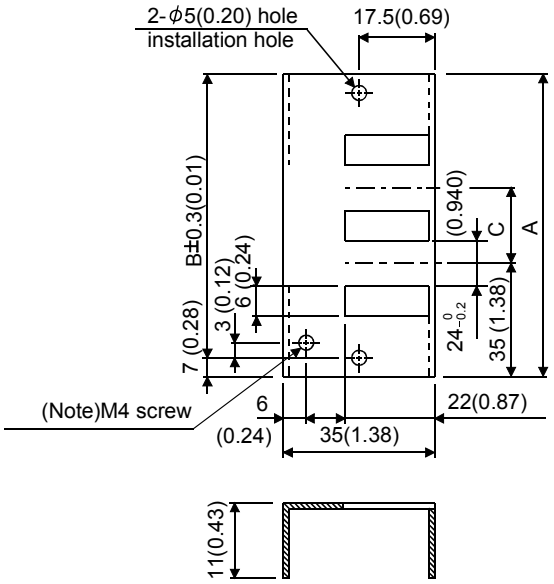


Clamp section diagram

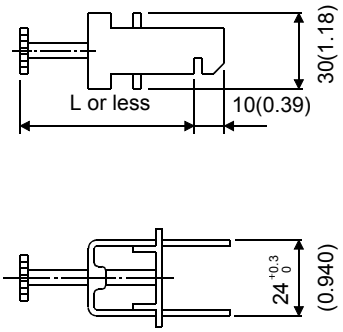
▪ Outline drawing

[Unit: mm]
([Unit: in.])

Earth plate



Clamp section diagram



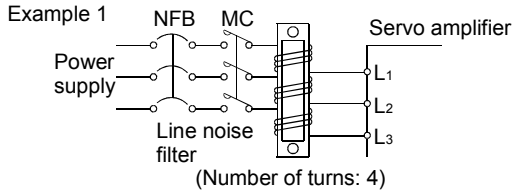
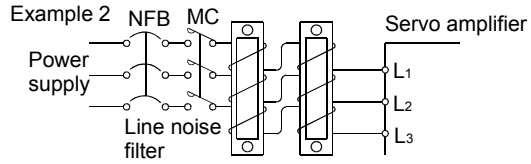
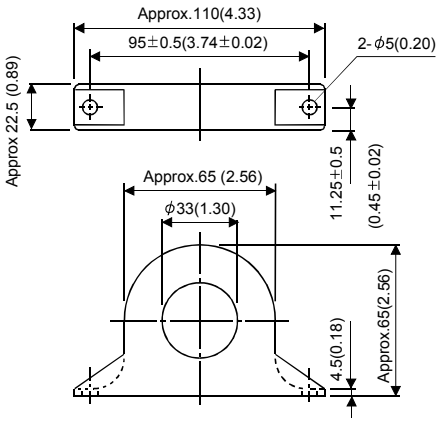
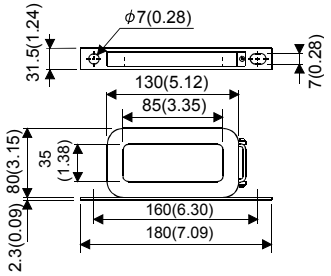
Note. Screw hole for grounding. Connect it to the earth plate of the control box.

Type	A	B	C	Accessory fittings
AERSBAN-DSET	100 (3.94)	86 (3.39)	30 (1.18)	clamp A: 2pcs.
AERSBAN-ESET	70 (2.76)	56 (2.20)		clamp B: 1pc.

Clamp fitting	L
A	70 (2.76)
B	45 (1.77)

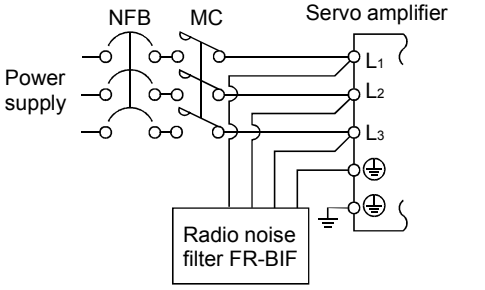
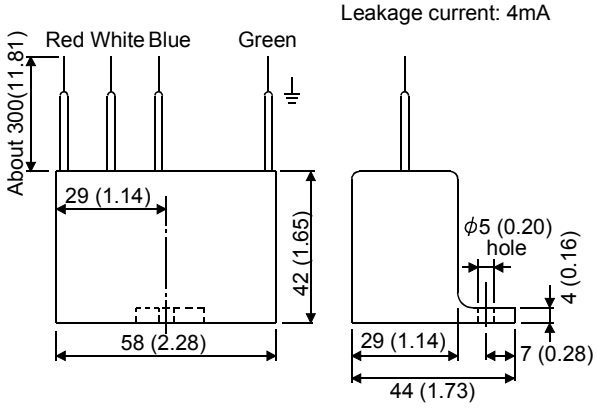
(d) Line noise filter (FR-BLF, FR-BSF01)

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 (zero-phase current) especially within 0.5MHz to 5MHz band.

Connection diagram	Outline drawing [Unit: mm] ([Unit: in.])
Use the line noise filters for wires of the main power supply (L_1 · L_2 · L_3) and of the motor power supply (U · V · W). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For the main power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or 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. Example 1  (Number of turns: 4) Example 2  Two filters are used (Total number of turns: 4)	FR-BSF01(for MR-J2S-200B or less)  FR-BLF(MR-J2S-350B or more) 

(e) Radio noise filter (FR-BIF)...for the input side only

This filter is effective in suppressing noises radiated from the power supply side of the servo amplifier especially in 10MHz and lower radio frequency bands. The FR-BIF is designed for the input only.

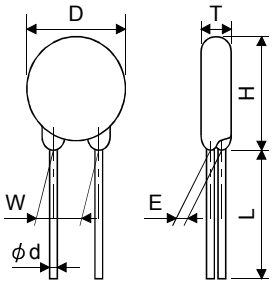
Connection diagram	Outline drawing (Unit: mm) ([Unit: in.])
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase wire, always insulate the wires that are not used for wiring.  	Leakage current: 4mA 

(f) Varistors 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 and TND20V-471K manufactured by Nippon Chemi-con, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
	Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power				
	AC[V_{rms}]	DC[V]	8/20μs[A]	2ms[J]	[W]	[A]	[V]	[pF]	[V]
TND20V-431K	275	350	10000/1 time	195	1.0	100	710	1300	430(387 to 473)
TND20V-471K	300	385	7000/2 time	215			775	1200	470(423 to 517)

[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			

Note. For special purpose items for lead length (L), contact the manufacturer.

12.2.8 Leakage current breaker

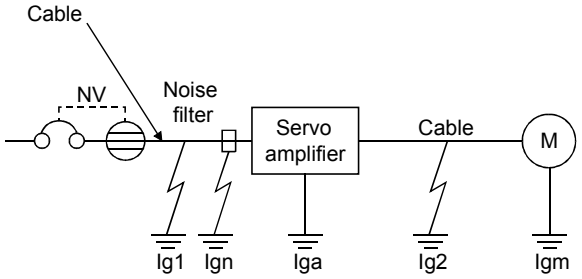
(1) Selection method

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 a leakage current breaker according to the following formula, and ground the servo amplifier, servo motor, etc. securely.

Make the input and output cables as short as possible, and also make the grounding cable as long as possible (about 30cm (11.8 in)) to minimize leakage currents.

Rated sensitivity current ≥ 10 • {Ig1+Ign+Iga+K • (Ig2+Igm)} [mA] .....(12.1)



K: Constant considering the harmonic contents

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 leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 12.1.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (Found from Fig. 12.1.)

Ign: Leakage current when a filter is connected to the input side (4.4mA per one FR-BIF)

Iga: Leakage current of the servo amplifier (Found from Table 12.5.)

Igm: Leakage current of the servo motor (Found from Table 12.4.)

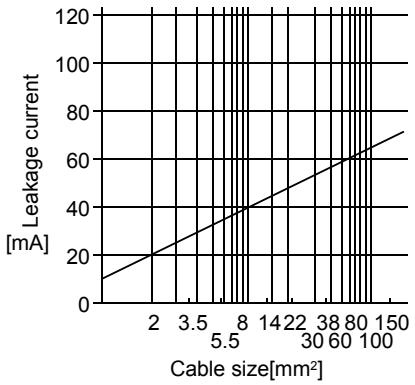


Fig. 12.1 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

Table 12.4 Servo motor's leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 0.5	0.1
0.6 to 1.0	0.1
1.2 to 2.2	0.2
3 to 3.5	0.3
5	0.5
7	0.7
11	1.0
15	1.3
22	2.3

Table 12.5 Servo amplifier's leakage current example (Iga)

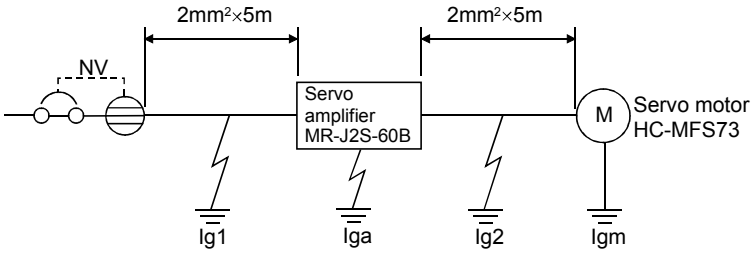
Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.6	0.1
0.7 to 3.5	0.15
5•7	2
11•15	5.5
22	7

Table 12.6 Leakage circuit breaker selection example

Servo amplifier	Rated sensitivity current of leakage circuit breaker [mA]
MR-J2S-10B to MR-J2S-350B MR-J2S-10B1 to MR-J2S-40B1	15
MR-J2S-500B	30
MR-J2S-700B	50
MR-J2S-11KB to MR-J2S-22KB	100

(2) Selection example

Indicated below is an example of selecting a leakage current breaker under the following conditions.



Use a leakage current breaker designed for suppressing harmonics/surges.
Find the terms of Equation (12.1) 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 (12.1).

$$Ig \geq 10 \cdot \{0.1+0+0.1+1 \cdot (0.1+0.1)\}$$

$$\geq 4 \text{ [mA]}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 4[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-SP/CP/SW/CW/HW series.

12.2.9 EMC filter

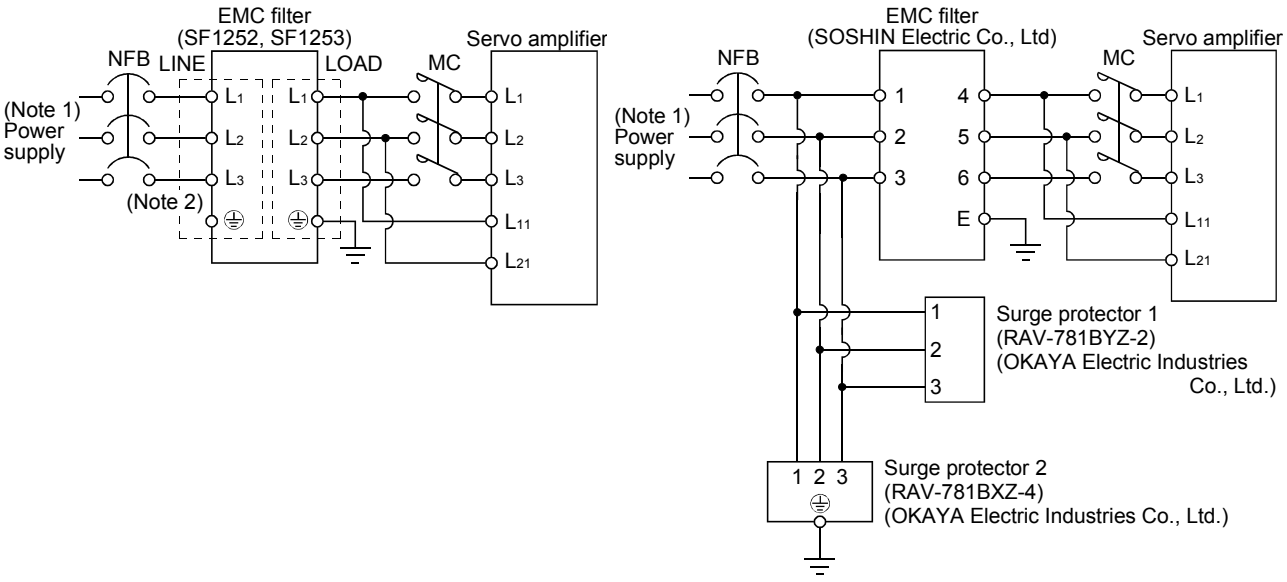
For compliance with the EMC directive of the EN standard, it is recommended to use the following filter. Some EMC filters are large in leakage current.

(1) Combination with the servo amplifier

Servo amplifier	Recommended filter		Mass
	Model	Leakage current [mA]	[kg]([lb])
MR-J2S-10B to MR-J2S-100B MR-J2S-10B1 to MR-J2S-40B1	SF1252	38	0.75(1.65)
MR-J2S-200B・MR-J2S-350B	SF1253	57	1.37(3.02)
MR-J2S-500B	(Note) HF3040A-TM	1.5	6.0(13.23)
MR-J2S-700B	(Note) HF3050A-TM	1.5	6.7(14.77)
MR-J2S-11KB	(Note) HF3060A-TMA	3.0	10.0(22.05)
MR-J2S-15KB	(Note) HF3080A-TMA	3.0	13.0(28.66)
MR-J2S-22KB	(Note) HF3100A-TMA	3.0	14.5(31.97)

Note. Soshin Electric. A surge protector is separately required to use any of these EMC filters. (Refer to the EMC Installation Guidelines.)

(2) Connection example



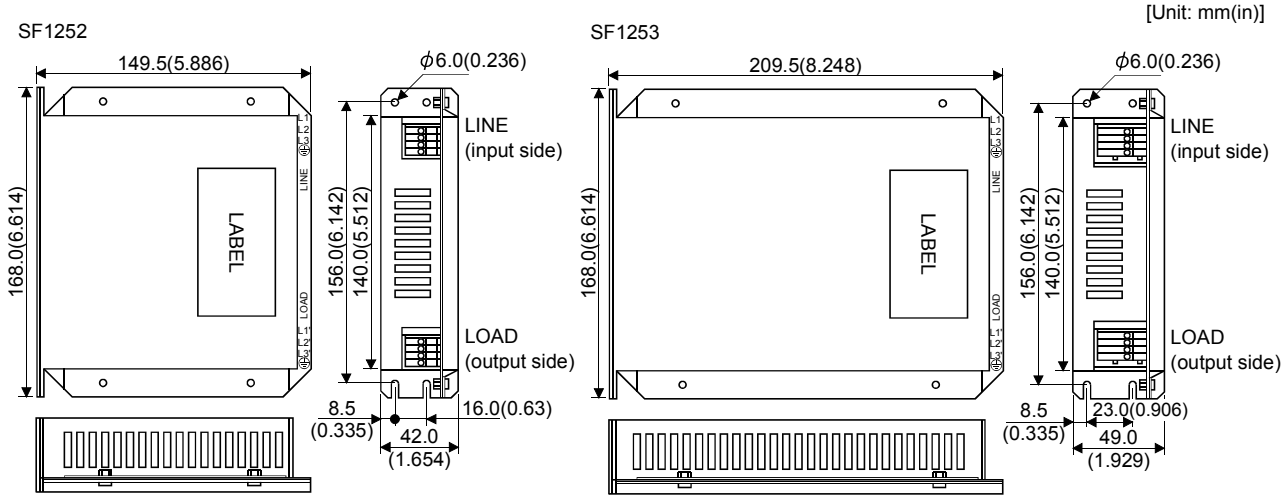
Note 1. For 1-phase 230V power supply, connect the power supply to L_1, L_2 and leave L_3 open. There is no L_3 for 1-phase 100 to 120V power supply. Refer to section 1.3 for the power supply specification.

2. Connect when the power supply has earth.

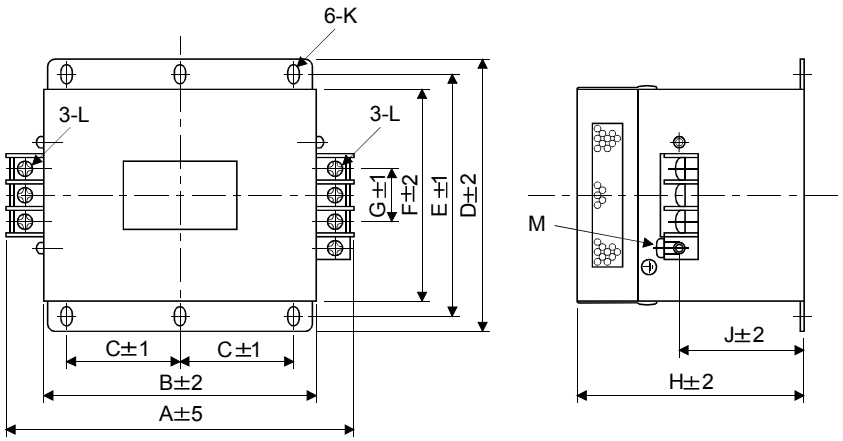
(3) Outline drawing

(a) EMC filter

[Unit: mm(in)]

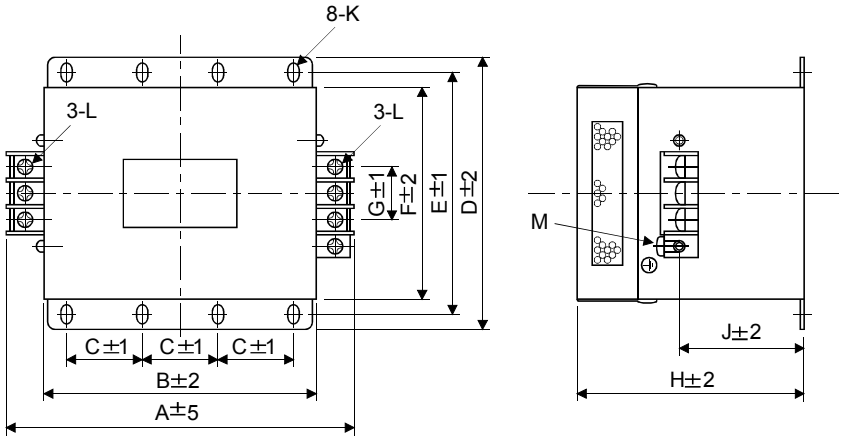


HF3040A-TM・HF3050A-TM・HF3060A-TMA



Model	Dimensions [mm(in)]											
	A	B	C	D	E	F	G	H	J	K	L	M
HF3040A-TM	260 (10.24)	210 (8.27)	85 (8.35)	155 (6.10)	140 (5.51)	125 (4.92)	44 (1.73)	140 (5.51)	70 (2.76)	R3.25 (0.128), length 8 (0.32)	M5	M4
HF3050A-TM	290 (11.42)	240 (9.45)	100 (3.94)	190 (7.48)	175 (6.89)	160 (6.29)	44 (1.73)	170 (6.69)	100 (3.94)		M6	M4
HF3060A-TMA	290 (11.42)	240 (9.45)	100 (3.94)	190 (7.48)	175 (6.89)	160 (6.29)	44 (1.73)	230 (9.06)	160 (6.29)		M6	M4

HF3080A-TMA・HF3100A-TMA

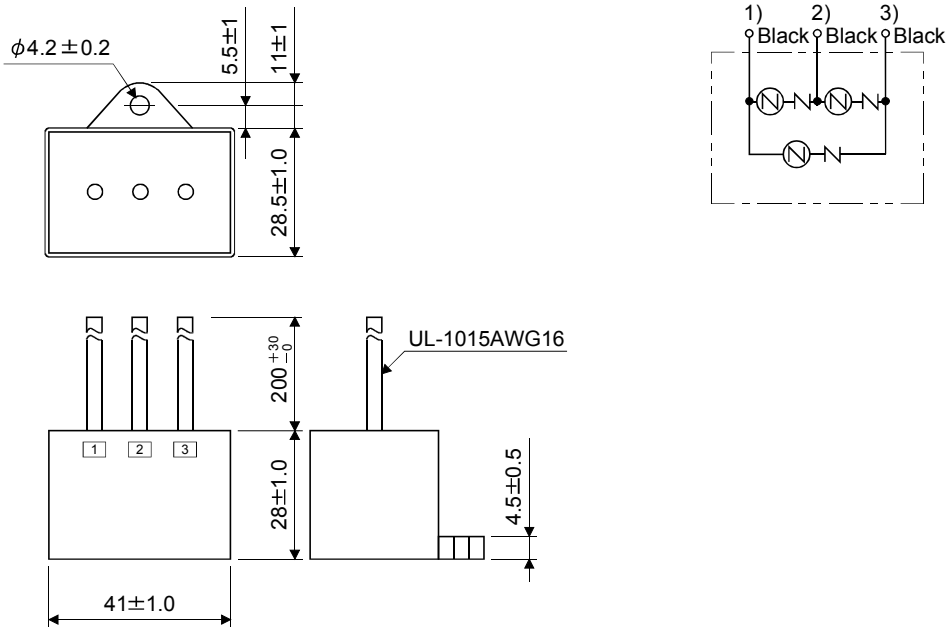


Model	Dimensions [mm(in)]											
	A	B	C	D	E	F	G	H	J	K	L	M
HF3080A-TMA HF3100A-TMA	405 (15.95)	350 (13.78)	100 (3.94)	220 (8.66)	200 (7.87)	180 (7.09)	56 (2.21)	210 (8.27)	135 (5.32)	R4.25 (0.167), length 12(0.472)	M8	M6

(b) Surge protector

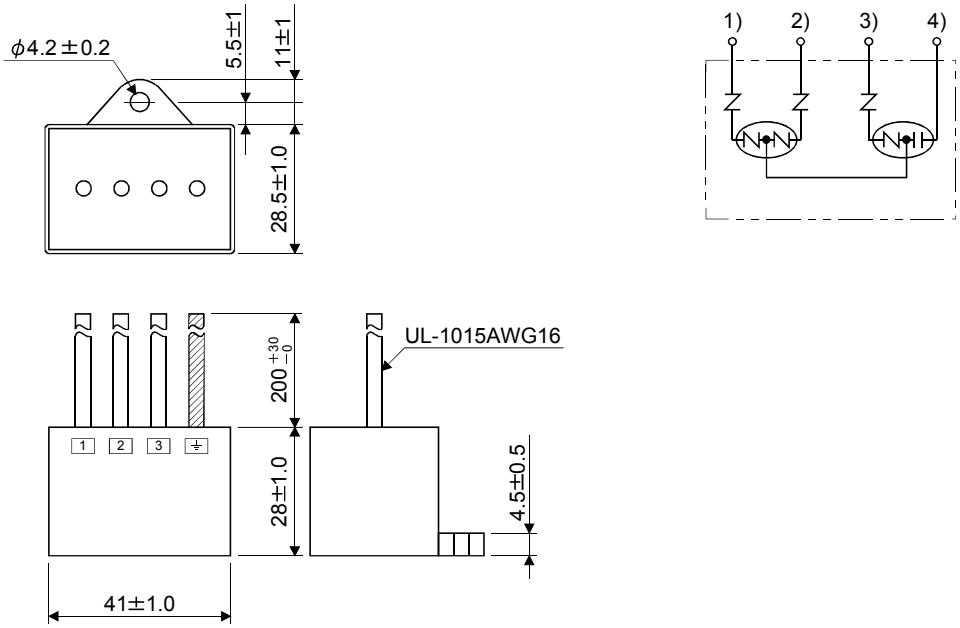
RAV-781BYZ-2

[Unit: mm]



RAV-781BXZ-4

[Unit: mm]



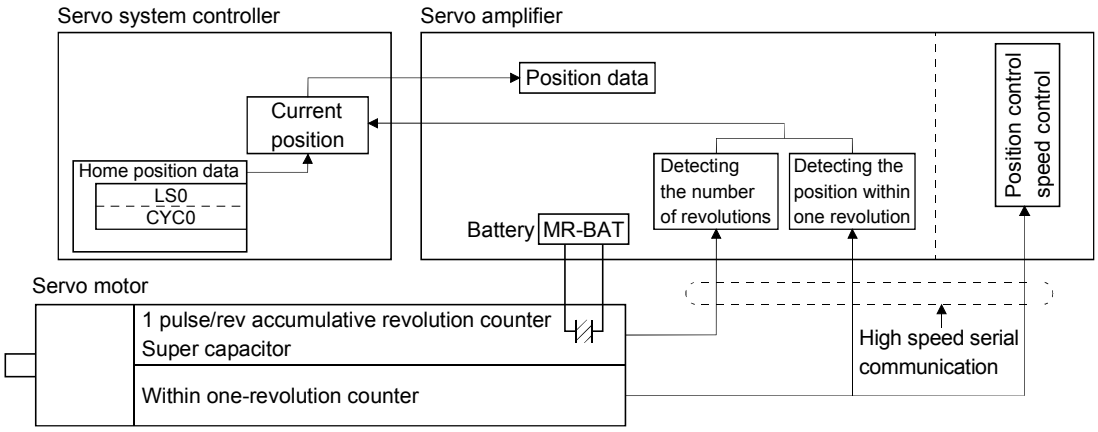
13. ABSOLUTE POSITION DETECTION SYSTEM

CAUTION

- If an absolute position erase alarm (25) or an absolute position counter warning (E3) has occurred, always perform home position setting again. Not doing so can cause runaway.

13.1 Features

For normal operation, as shown below, 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.
If a power failure or a fault occurs, restoration is easy.
Also, the absolute position data, which is battery-backed by the super capacitor in the encoder, can be retained within the specified period (cumulative revolution counter value retaining time) if the cable is unplugged or broken.



13.2 Specifications

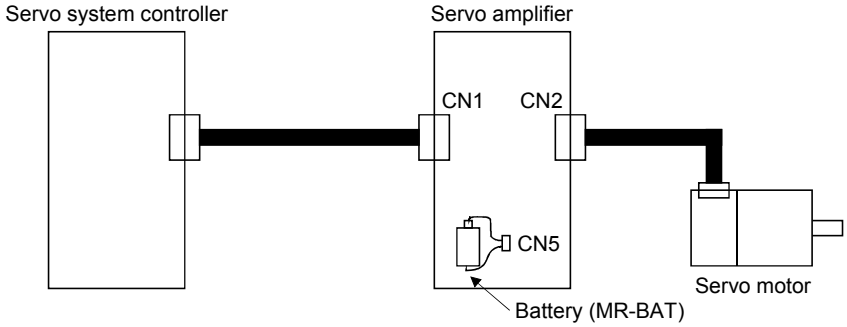
(1) Specification list

Item	Description
System	Electronic battery backup system
Battery	1 piece of lithium battery (primary battery, nominal + 3.6V) Type: MR-BAT or A6BAT
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure	500r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
(Note 3) Data holding time during battery replacement	2 hours at delivery, 1 hour in 5 years after delivery
Battery storage period	5 years from date of manufacture

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.

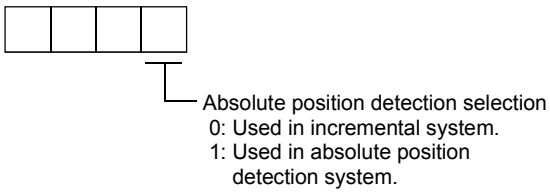
2. Time to hold data by a battery with power off. It is recommended to replace the battery in three years independently of whether power is kept on or off.
3. Period during which data can be held by the super capacitor in the encoder after power-off, with the battery voltage low or the battery removed, or during which data can be held with the encoder cable disconnected.
   Battery replacement should be finished within this period.

(2) Configuration



(3) Parameter setting

Set "0001" in parameter No.1 to make the absolute position detection system valid.



13.3 Battery installation procedure

⚠ WARNING	・Before installing a battery, turn off the main circuit power while keeping the control circuit power on. 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not.

POINT

・The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.

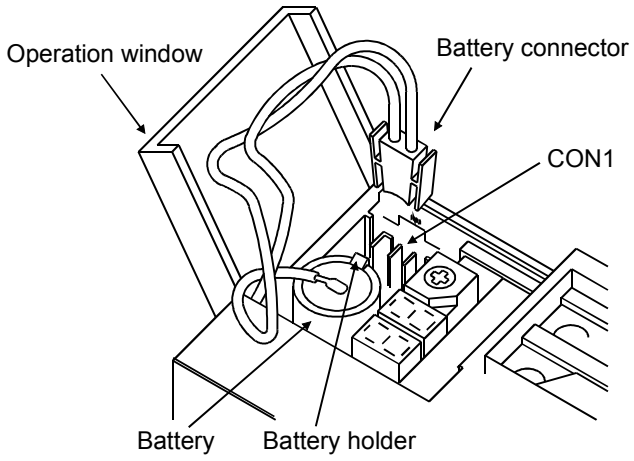
・Ground human body and work bench.

・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

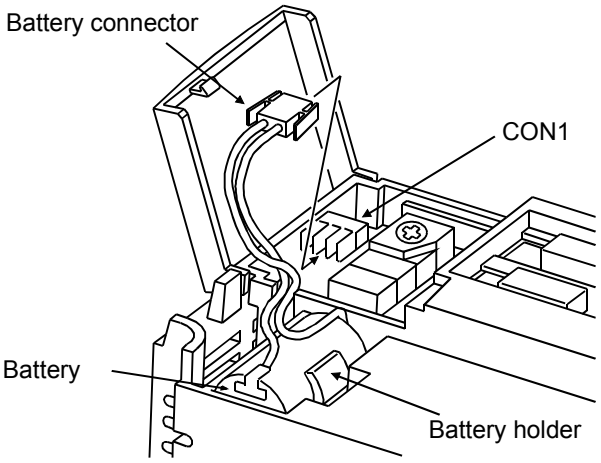
1) Open the operation window. (When the model used is the MR-J2S-200B・MR-J2S-350B, also remove the front cover.)

2) Install the battery in the battery holder.

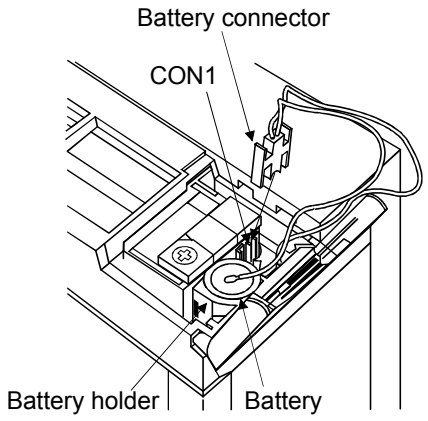
3) Install the battery connector into CON1 until it clicks.



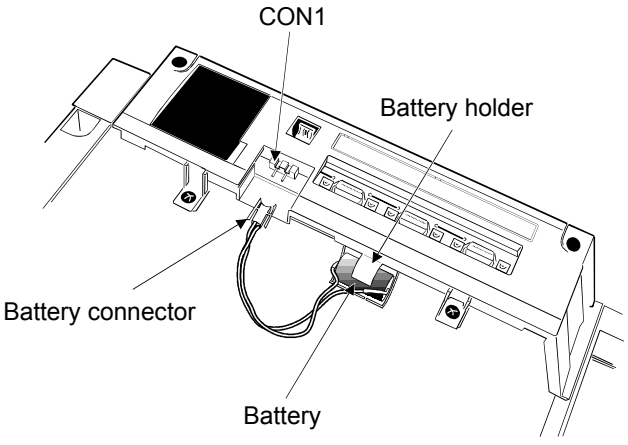
For MR-J2S-200B or less



For MR-J2S-200B・MR-J2S-350B



For MR-J2S-500B・MR-J2S-700B

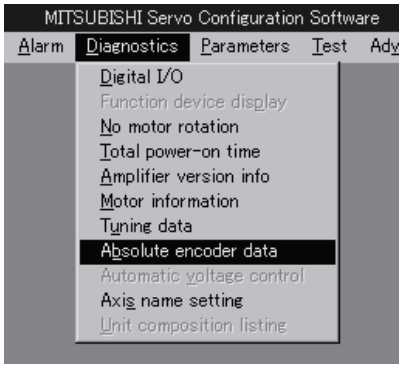


For MR-J2S-11KB or more

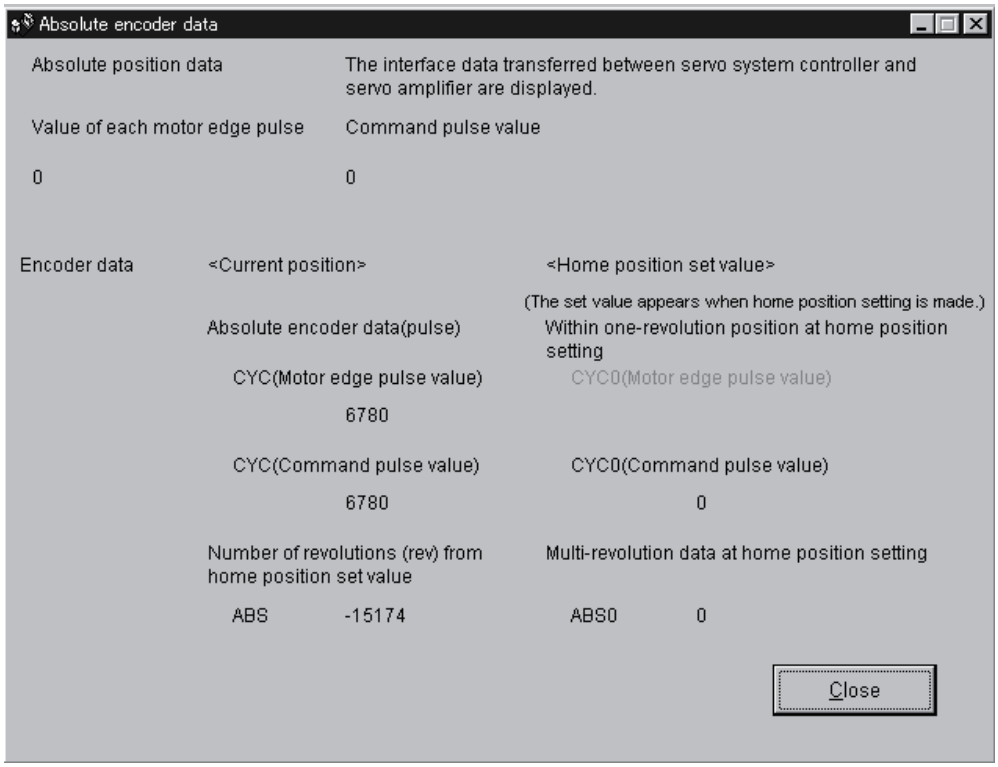
13.4 Confirmation of absolute position detection data

You can confirm the absolute position data with MR Configurator (servo configuration software). Click "Diagnostics" and "Absolute Encoder Data" to open the absolute position data display screen.

(1) Clicking "Diagnostics" in the menu opens the sub-menu as shown below.



(2) By clicking "Absolute Encoder Data" in the sub-menu, the absolute encoder data display window appears.



(3) Click the "Close" button to close the absolute encoder data display window.

App 1. Combination of servo amplifier and servo motor

The servo amplifier software versions compatible with the servo motors are indicated in the parentheses. The servo amplifiers whose software versions are not indicated can be used regardless of the versions.

Servo motor	Servo amplifier (Software version)
HC-KFS053	MR-J2S-10B MR-J2S-10B1
HC-KFS13	MR-J2S-10B MR-J2S-10B1
HC-KFS23	MR-J2S-20B MR-J2S-20B1
HC-KFS43	MR-J2S-40B MR-J2S-40B1
HC-KFS73	MR-J2S-70B (Version A3 or later)
HC-MFS053	MR-J2S-10B MR-J2S-10B1
HC-MFS13	MR-J2S-10B MR-J2S-10B1
HC-MFS23	MR-J2S-20B MR-J2S-20B1
HC-MFS43	MR-J2S-40B MR-J2S-40B1
HC-MFS73	MR-J2S-70B
HC-SFS81	MR-J2S-100B
HC-SFS121	MR-J2S-200B
HC-SFS201	MR-J2S-200B
HC-SFS301	MR-J2S-350B
HC-SFS52	MR-J2S-60B
HC-SFS102	MR-J2S-100B
HC-SFS152	MR-J2S-200B
HC-SFS202	MR-J2S-200B
HC-SFS352	MR-J2S-350B
HC-SFS502	MR-J2S-500B (Version B0 or later)
HC-SFS702	MR-J2S-700B (Version B0 or later)
HC-SFS53	MR-J2S-60B
HC-SFS103	MR-J2S-100B
HC-SFS153	MR-J2S-200B
HC-SFS203	MR-J2S-200B
HC-SFS353	MR-J2S-350B

Servo motor	Servo amplifier (Software version)
HC-RFS103	MR-J2S-200B
HC-RFS153	MR-J2S-200B
HC-RFS203	MR-J2S-350B (Version B0 or later)
HC-RFS353	MR-J2S-500B (Version B0 or later)
HC-RFS503	MR-J2S-500B (Version B0 or later)
HC-UFS72	MR-J2S-70B
HC-UFS152	MR-J2S-200B
HC-UFS202	MR-J2S-350B (Version B0 or later)
HC-UFS352	MR-J2S-500B (Version B0 or later)
HC-UFS502	MR-J2S-500B (Version B0 or later)
HC-UFS13	MR-J2S-10B MR-J2S-10B1
HC-UFS23	MR-J2S-20B MR-J2S-20B1
HC-UFS43	MR-J2S-40B MR-J2S-40B1
HC-UFS73	MR-J2S-70B
HC-LFS52	MR-J2S-60B (Version B3 or later)
HC-LFS102	MR-J2S-100B (Version B3 or later)
HC-LFS152	MR-J2S-200B (Version B3 or later)
HC-LFS202	MR-J2S-350B (Version B3 or later)
HC-LFS302	MR-J2S-500B (Version B3 or later)
HA-LFS801	MR-J2S-11KB (Version A3 or later)
HA-LFS12K1	MR-J2S-11KB (Version A3 or later)
HA-LFS15K1	MR-J2S-15KB (Version A3 or later)
HA-LFS20K1	MR-J2S-22KB (Version A3 or later)
HA-LFS25K1	MR-J2S-22KB (Version A3 or later)
HA-LFS11K1M	MR-J2S-11KB (Version A4 or later)
HA-LFS15K1M	MR-J2S-15KB (Version A3 or later)
HA-LFS502	MR-J2S-500B (Version B0 or later)
HA-LFS702	MR-J2S-700B (Version B0 or later)
HA-LFS11K2	MR-J2S-11KB (Version A3 or later)
HA-LFS15K2	MR-J2S-15KB (Version A3 or later)
HA-LFS22K2	MR-J2S-22KB (Version A3 or later)

App 2. Change of connector sets to the RoHS compatible products

Connector sets (options) in the following table are changed to the RoHS compatible products after September, 2006 shipment.
Please accept that the current products might be mixed with RoHS compatible products based on availability.

Model	Current Product	RoHS Compatible Product
MR-J2CNM MR-J2CN1	Amplifier connector (3M or equivalent) 10120-3000VE (connector)	Amplifier connector (3M or equivalent) 10120-3000PE (connector)
MR-J2CNS	Amplifier connector (3M or equivalent) 10120-3000VE (connector) Encoder connector (DDK) MS3057-12A (Cable clump) MS3106B20-29S (Straight plug)	Amplifier connector (3M or equivalent) 10120-3000PE (connector) Encoder connector (DDK) D/MS3057-12A (Cable clump) D/MS3106B20-29S (Straight plug)
MR-ENCBL□M-H MR-ENCNS	Amplifier connector (3M or equivalent) 10120-3000VE (connector) MS3106A20-29S (D190) (Plug, DDK) CE3057-12A-3 (D265) (Cable clump, DDK) CE02-20BS-S (Back shell, DDK)	Amplifier connector (3M or equivalent) 10120-3000PE (connector) D/MS3106A20-29S (D190) (Plug, DDK) CE3057-12A-3-D (Cable clump, DDK) CE02-20BS-S-D (Back shell, DDK)
MR-PWCNS1	Power supply connector (DDK) CE05-6A22-23SD-B-BSS (Connector and back shell) CE3057-12A-2 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A22-23SD-D-BSS (Connector and back shell) CE3057-12A-2-D (Cable clump)
MR-PWCNS2	Power supply connector (DDK) CE05-6A24-24SD-B-BSS (Connector and back shell) CE3057-16A-2 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A24-10SD-B-BSS (Connector and back shell) CE3057-16A-2-D (Cable clump)
MR-PWCNS3	Power supply connector (DDK) CE05-6A32-17SD-B-BSS (Connector and back shell) CE3057-20A-1 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A32-17SD-D-BSS (Connector and back shell) CE3057-20A-1-D (Cable clump)
MR-BKCN	Electromagnetic brake connector MS3106A10SL-4S (D190) (Plug, DDK)	Electromagnetic brake connector D/MS3106A10SL-4S (D190) (Plug, DDK)
MR-J2CN1-A	Controller connector (Honda Tsushin Industry) PCR-S20FS (Connector) Amplifier connector (3M or equivalent) 10120-3000VE (Connector)	Controller connector (Honda Tsushin Industry) PCR-S20FS+ (Connector) Amplifier connector (3M or equivalent) 10120-3000PE (Connector)

Note. RoHS compatible 36210-0100FD may be packed with current connector sets.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision
Sep., 2000	SH(NA)030007-A	First edition
Jan., 2001	SH(NA)030007-B	Servo amplifier: Addition of MR-J2S-500B and MR-J2S-700B Servo motor: Addition of HC-KFS73, HC-SFS502, HC-SFS702, HC-RFS353, HC-RFS503, HC-UFS502 and HC-UFS352 Section 1.4: Addition of brake unit and regeneration converter Section 1.7: Overall reexamination Section 3.5.2: Addition of return converter and brake unit Section 3.7: Reexamination of section 3.7 and later Section 5.2 (2): Addition of regenerative brake option to parameter No. 2 Section 6.1.2: Addition of POINT Changing of alarm 24 name Section 9.2: Changes made to alarm 20 cause and action fields Addition of alarm 33 causes 1, 2 Section 10.2 (2): Addition Section 12.1.1 (3): Overall reexamination Section 12.1.1 (4): Addition Section 12.1.1 (5): Addition of MR-RB31 and MR-RB51 regenerative brake options Section 12.1.2: Addition Section 12.1.3: Addition Section 12.1.4: Addition of power supply connector set Section 12.2.1 (1): Changing of wiring diagram Addition of brake unit and power regeneration converter wire size list Section 12.2.8 (3): Addition of outline drawing
Oct., 2002	SH(NA)030007-C	Servo amplifier: Addition of MR-J2S-11KB, MR-J2S-15KB and MR-J2S-22KB Servo motor: Addition of HA-LFS and HC-LFS series About processing of waste: Addition of about processing of waste SAFETY INSTRUCTIONS: Addition of FOR MAXIMIM SAFETY CONFORMANCE WITH UL/C-UL STANDARD: Addition of MR-J2S-11KB to MR-J2S-22KB to(4) Capacitor discharge time Addition of(6) Attachment of servo motor Addition of(7) About wiring protection Section 1.4: Modification made to the contents of the test operation mode Section 1.7.1: Deletion of (6) Section 3.1.1: Addition of MR-J2S-700B or less Section 3.1.2: Addition of MR-J2S-11KB or less Section 3.2.1 (2): Addition of MR-J2S-11KB or less Section 3.2.2: Addition of 11kW and more to the connector pin No. Section 3.2.2 (C): Addition of dynamic brake sequence Section 3.3: Addition of Note Section 3.4.2 (2), (3): Wiring reexamination Section 3.5: Addition of POINT Section 3.6.2: Addition of POINT Section 3.6.3: Addition of Note Section 3.9: Reexamination of contents Section 3.12: Addition

Print Data	*Manual Number	Revision
Oct., 2002	SH(NA)030007-C	Section 3.12.2: Addition of power factor improving DC reactor Section 4.3 (2): Addition of initialization completion Section 5.2 (2): Addition of external dynamic brake selection to parameter No. 2 Renaming of parameter Nos. 3 to 5 Reexamination of parameter No. 19 contents Section 9.1: Addition of Note to alarm 30 Section 9.2: Addition of occurrence factor 4 to alarm 16 Changing of occurrence factor and checking method of alarm 50 Changing of occurrence factor and checking method of alarm 51 Section 10.1 (7), (8): Addition of MR-J2S-11KB, 15KB and 22KB Section 10.2 (a): Addition of connectors and shell kits Section 11.1 (4): Addition Section 11.3: Reexamination of HC-KFS series dynamic brake time constants Addition of HA-LFS series Section 12.1.1 (3): Addition of sentences Section 12.1.1 (4) (a): Reexamination of contents Section 12.1.1 (4) (b): Reexamination of contents Section 12.1.1 (4) (c): Addition of sentences Section 12.1.1 (4) (d): Addition Section 12.1.1 (5) (e): Addition Section 12.1.2 (1), (3): Addition of FR-BU-55K brake unit Section 12.1.2 (3) (a), (b): Addition of FR-BR-55K resistor unit Section 12.1.3 (1), (3), (4): Addition of FR-RC-55K power regeneration converter Section 12.1.4: Addition; reexamination of subsequent sections Section 12.1.5: Addition of HA-LFS series wiring Addition of connector sets and monitor cables Section 12.1.6: Addition of POINT Section 12.1.7 (1): Reexamination of contents Section 12.1.7 (2) (a): Reexamination of contents Section 12.2.1 (1): Addition of cooling fan wiring Addition of FR-RC-30K and FR-RC-50K Section 12.2.1 (2): Reexamination of optional cable table Section 12.2.4: Addition of power factor improving DC reactor; reexamination of subsequent sections Section 12.2.5: Changing of interface name into digital input signals Section 12.2.8 (1): Reexamination of our leakage current breaker products Section 12.2.9 (3): Addition of outline drawing Section 13.3: Addition of MR-J2S-11KB and more Section 13.4: Screen change
May., 2003	SH(NA)030007-D	COMPLIANCE WITH EC DIRECTIVES 2 (6): Addition of (6) CONFORMANCE WITH UL/C-UL STANDARD: Addition of (2) Air volume ($2.8m^3$/min) Section 1.3: Inrush current addition Section 3.1.1: Reexamination of table in Note Section 3.1.2: Reexamination of table in Note Section 3.6.3: Addition of power supply connector signal arrangement CE05-2A32-17PD-B Section 3.12.3: Change of terminal box inside of HA-LFS11K2 Section 5.2 (1): Reexamination of alarm 8 initial value Section 5.2 (2): Addition of "Use of built-in regenerative brake resistor" to parameter No. 2 Section 5.2 (2): Reexamination of alarm 8 initial value

Print Data	*Manual Number	Revision
May., 2003	SH(NA)030007-D	Section 9.1: Partial sentence change Section 9.2: Partial POINT sentence reexamination Section 9.2: Reexamination of alarm 12, 13 definitions Reexamination of alarm 15 definition Addition of alarm 37 occurrence factor and corrective action Addition of During rotation: 2.5s or more to alarm 51 Section 10.2 (2) (a): Addition of model PCR Section 11.3: Reexamination of explanation of te Section 11.5: Addition of inrush currents at power-on of main circuit and control circuit Section 12.1.2: Partial sentence addition Section 12.1.3: Partial sentence addition Section 12.1.3 (2): Addition of Note Section 12.1.4 (2): Correction of connection example Addition of Note Section 12.1.5: Addition of bus cable connected to motion controller Section 12.1.5 (4): Reexamination/addition of contents Section 12.1.6: POINT sentence change Section 12.2.1 (1): Correction of error in writing of recommended wire MR-J2S-22KB wire size Section 12.2.1 (2): Addition of bus cable Q172J2BCBL□M/Q173J2B△CBL□M
Jan., 2004	SH(NA)030007-E	Safety Instructions: Overall reexamination Section 1.5 (2): Partial addition Section 1.6: Table reexamination Section 1.8 (3): Note addition Section 1.8 (4): Note addition Section 3.1.1: Note 15. reexamination Section 3.1.2: Note 15. reexamination Section 4.2: Partial reexamination/addition of CAUTION sentence Section 5.2: Partial addition of POINT sentence Section 5.2 (1): Addition of Note 3 Section 5.2 (2): Partial addition of parameter No. 2 Note addition of parameter No. 31 Section 5.4.2: (10) deletion Section 9.2: Display 32 item addition, Partial reexamination/Note addition of display 52 Section 10.1: Overall reexamination Section 11.2: Table change Section 11.3: Partial text addition Section 12.1.1 (3): Partial text deletion Section 12.1.1 (4): Partial text change Section 12.1.1 (5): Overall reexamination Section 12.1.4 (2): Addition of Note 2 Section 12.1.7: POINT addition Section 12.1.8 (1)(a): Partial table reexamination Section 12.1.9 (2): Partial figure reexamination Section 12.1.10: Addition Section 12.2.9 (3): Partial reexamination Appendix: Addition WARNING of “To prevent electric shock”: Correction of “10 minutes” to “15 minutes” Correction of axis switch model to “SW1”

Print Data	*Manual Number	Revision
Jan., 2006	SH(NA)030007-F	Correction of "Thermal protector" to "Thermal sensor" Safety Instructions: Addition of 4.(2) CAUTION sentence Safety Instructions: Addition of 4.(4) CAUTION sentence FOR MAXIMUM SAFETY: Sentence addition EEP-ROM life: Sentence addition Section 1.2 (1): Correction of error in writing Section 1.2 (2): Correction of error in writing Section 1.2 (3): Correction of error in writing Section 1.5 (2): Reexamination of expression for Note of Power Supply Section 1.7.1 (1): Reexamination of expression for Application of Encoder connector・Correction of error in writing Section 1.7.1 (2): Reexamination of expression for Application of Encoder connector・Correction of error in writing Section 1.7.1 (3): Reexamination of expression for Application of Encoder connector・Correction of error in writing Section 1.7.1 (4): Reexamination of expression for Application of Encoder connector・Correction of error in writing Section 1.7.1 (5): Reexamination of expression for Application of Encoder connector・Correction of error in writing Section 1.8 (1): Note 2. Sentence reexamination Section 1.8 (1): Addition of "CN1B" for preceding axis servo amplifier Section 1.8 (2): Addition of "CN1B" for preceding axis servo amplifier Section 1.8 (3): Addition of "CN1B" for preceding axis servo amplifier Section 1.8 (4): Addition of "CN1B" for preceding axis servo amplifier Section 1.8 (5): Addition of "CN1B" for preceding axis servo amplifier Chapter 2: Addition of CAUTION sentence Section 3.1.1: Reexamination of connection example・correction of error in writing Section 3.1.2: Reexamination of connection example・correction of error in writing Section 3.2.2 (1): Correction of error in writing of CON2 Function description Section 3.2.2 (2) (a): Correction of error in writing Section 3.3 (3): Sentence reexamination Section 3.4.2 (3) 2): Deletion of "OP" Section 3.5.1 (1): Reexamination of connection example・correction of error in writing/Note addition Section 3.5.2: Addition of "Power factor improving DC reactor" Main circuit power supply: Correction of error in writing of Servo amplifier model name Reexamination of descriptions for Regenerative brake option, Return converter and Brake unit Section 3.7: Addition of CAUTION sentence Section 3.7 (3) (d), (e): Reexamination of description Correction of error in writing of Servo motor speed Section 3.9: POINT addition Section 3.9.1: Addition Section 3.9.2: Addition Section 3.12.3: Correction of Encoder connector position Correction of error in writing of Terminal box inside Section 4.4: Sentence addition Section 5.2 (1), (2): Reexamination of English translation for parameter No.40

Print Data	*Manual Number	Revision
Jan., 2006	SH(NA)030007-F	Section 5.2 (1), (2): Addition of parameter Nos. 49 to 55, 60, 61 Section 5.3: Sentence reexamination Section 5.3 (2): Addition of Note for Torque Section 7.5: Addition of "Gain changing function" Section 9.1: Addition of Note 2 Section 9.2: Addition of CAUTION sentence Reexamination of expression for 17・19 Addition of Cause 6 to Display 33 Section 9.3: POINT addition Reexamination of description for Cause 2 of Display 92 Partial addition of sentence to Cause of Display 9F Reexamination of description for Display E9 Section 11.1: Reexamination of Note sentence Section 11.2: Note addition Section 11.3: Reexamination of Dynamic brake time constant Section 12.1.1 (2) (b): Partial reexamination of Table b. "Losses of servo motor and servo amplifier in regenerative mode" Section 12.1.1 (4): Partial reexamination of sentence Section 12.1.1 (4) (c): Reexamination of Note sentence Section 12.1.1 (5) (c): Change of outline drawings Section 12.1.1 (5) (d): Change of outline drawings Section 12.1.1 (5) (e): Change of outline drawings Section 12.1.2 (2): Reexamination of connection example Section 12.1.3 (2): Reexamination of connection example・Note addition Section 12.1.4 (2): Reexamination of connection example・Note addition Section 12.1.8 (2): Reexamination of descriptions Section 12.1.9 (2): Addition of Note 6, 7 Section 12.1.9 (3) (b): Note addition Section 12.1.10 (3): Partial change of error for Figure of "Fitting method" Section 12.2.3: Partial change of outline drawing and wiring diagram Section 12.2.7 (2) (d): Partial correction of outline dimension lines Section 12.2.7 (2) (e): Partial change of connection diagram Section 12.2.9 (3): Partial reexamination of outline drawing Chapter 13: Addition of "absolute position counter warning (E3)" to CAUTION
Nov., 2007	SH(NA)030007-G	Safety Instructions: 1 Change of sentence 2 Change of sentence 4-(2) Change of diagram Addition of sentence Section 1.2: Change of power supply notation Partial change of diagram Addition of Note Section 1.7.2: Change of CAUTION sentence Section 1.8: Change of power supply notation Addition of Note Chapter 2: Change and addition of CAUTION sentence Chapter 3: Addition of WARNING sentence and phrase Addition of CAUTION sentence Section 3.4.2 (2) (a) (b): Partial change of diagram Section 3.5: Addition of CAUTION sentence Section 3.5.2: Addition of sentence Section 3.6.2: Addition of CAUTION sentence Section 3.7 (3) (a): Change of timing chart

Print Data	*Manual Number	Revision
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MODEL	MR-J2S-B GIJUTU SIRYOU
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