



General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS
MELSERVO-J4

Instructions and Cautions for Drive of HC/HA
Series Servo Motor with MR-J4-B-RJ020
Servo Amplifier

«About the manual»

You must have this guide and the following manuals to use this servo. Ensure to prepare them to use the servo safely.

Relevant manuals

Manual name	Manual No.
MELSERVO-J4 Series Instructions and Cautions for Safe Use of AC Servos (Packed with the servo amplifier)	IB(NA)0300175 (Note 1)
	IB(NA)0300197 (Note 2)
MR-J4-_B_-RJ020 MR-J4-T20 Servo Amplifier Instruction Manual	SH(NA)030125
Conversion unit for SSCNET of MR-J2S-B MR-J4-T20 Instruction Manual (Packed with MR-J4-T20.)	IB(NA)0300204
MR-J2S-_B Servo Amplifier Instruction Manual	SH(NA)030007
MELSERVO Servo Motor Instruction Manual	SH(NA)3181

- Note 1. This manual explains about 200 V class servo amplifier.
2. This manual explains about 400 V class servo amplifier.

CONTENTS

1. INTRODUCTION	1- 1 to 1- 2
-----------------	--------------

2. COMBINATION WITH HC SERIES/HA SERIES SERVO MOTOR	2- 1 to 2- 2
---	--------------

3. PRECAUTIONS	3- 1 to 3- 2
----------------	--------------

3.1 When you replace MR-J2S-_B_ servo amplifier with MR-J4-_B_-RJ020 servo amplifier	3- 1
3.2 Difference from using HG series servo motor	3- 1
3.3 Gain adjustment.....	3- 1

4. CHARACTERISTICS	4- 1 to 4-12
--------------------	--------------

4.1 Overload protection characteristics	4- 1
4.2 Power supply capacity and generated loss	4- 3
4.3 Dynamic brake characteristics.....	4- 5
4.4 Cable bending life	4-10
4.5 Inrush currents at power-on of main circuit and control circuit.....	4-11

5. OPTIONS AND PERIPHERAL EQUIPMENT	5- 1 to 5-20
-------------------------------------	--------------

5.1 Combinations of encoder cables	5- 1
5.2 Encoder cable list.....	5- 2
5.3 Detail of the encoder cable	5- 3
5.4 Regenerative option.....	5-12

6. SELECTION EXAMPLE OF WIRES	6- 1 to 6- 2
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1. INTRODUCTION

1. INTRODUCTION

This guide explains instructions and cautions for drive of HC/HA series servo motor with MR-J4-__B__RJ020 servo amplifier. Refer to "MR-J4-__B__RJ020 MR-J4-T20 Servo Amplifier Instruction Manual" for details of functions, specifications, startup, etc. When you replace an amplifier with an MR-J4-__B__RJ020 servo amplifier practically using existing wiring, use the MR-J2S-__B__ renewal tools manufactured by Mitsubishi Electric System & Service.

MR-J2S-__B__ renewal tools are for using an MR-J4-__B__RJ020 servo amplifier as a replacement of MR-J2S-__B__ servo amplifier.

For the details of the MR-J2S-__B__ renewal tools, contact your local sales office.

2. COMBINATION WITH HC SERIES/HA SERIES SERVO MOTOR

2. COMBINATION WITH HC SERIES/HA SERIES SERVO MOTOR

Refer to the following table for combination with HC series/HA series servo motor.

(1) 200 V class

Servo amplifier	Servo motor						
	HC-KFS	HC-MFS	HC-SFS	HC-RFS	HC-UFS	HA-LFS	HC-LFS
MR-J4-10B-RJ020	053 13	053 13			13		
MR-J4-20B-RJ020	23	23			23		
MR-J4-40B-RJ020	43	43			43		
MR-J4-60B-RJ020			52 53				52
MR-J4-70B-RJ020	46 410 73	73			72 73		
MR-J4-100B-RJ020			81 102 103				102
MR-J4-200B-RJ020			121 201 152 202 153 203	103 153	152		152
MR-J4-350B-RJ020			301 352 353	203	202		202
MR-J4-500B-RJ020			502	353 503	352 502	502	302
MR-J4-700B-RJ020			702			(Note) 601 (Note) 701M 702	

Note. When you use this servo motor, please contact your local sales office.

(2) 400 V class

Servo amplifier	Servo motor	
	HC-SFS	HA-LFS
MR-J4-60B4-RJ020	524	
MR-J4-100B4-RJ020	1024	
MR-J4-200B4-RJ020	1524 2024	
MR-J4-350B4-RJ020	3524	
MR-J4-500B4-RJ020	5024	
MR-J4-700B4-RJ020	7024	(Note) 6014 (Note) 701M4

Note. When you use this servo motor, please contact your local sales office.

3. PRECAUTIONS

3. PRECAUTIONS

3.1 When you replace MR-J2S-_B_ servo amplifier with MR-J4-_B_-RJ020 servo amplifier

Please note the following when replacing MR-J2S-_B_ servo amplifier with MR-J4-_B_-RJ020 servo amplifier.

- (1) The mounting holes are not interchangeable.
- (2) The dimensions of an MR-J4-_B_-RJ020 servo amplifier with MR-J4-T20 can be larger than those of MR-J2S-_B_ servo amplifier.
- (3) The wire sizes can be different from those of MR-J2S-_B_ servo amplifier.
- (4) The dynamic brake characteristics of this amplifier with motors are different from those of MR-J2S-_B_ servo amplifier.
- (5) Operation timing is partly different from MR-J2S-_B_ servo amplifier. Especially, please be careful of electromagnetic brake release time of vertical axes. The vertical axes can fall.
- (6) For options and peripheral equipment which are not described in this chapter, select them referring contents in chapter 11 of "MR-J4-_B_-RJ020 MR-J4-T20 Servo Amplifier Instruction Manual".

3.2 Difference from using HG series servo motor

- (1) Servo amplifier power supply specifications (200 V class only)

The following shows items which differ from using an HG series servo motor.

Model: MR-J4-_B_-RJ020		10B	20B	40B	60B	70B	100B	200B	350B	500B	700B
Main circuit power supply input	Voltage/Frequency	3-phase 200 V AC to 230 V AC, 50 Hz/60 Hz or 1-phase 230 V AC, 50 Hz/60 Hz					3-phase 200 V AC to 230 V AC, 50 Hz/60 Hz				
	Permissible voltage fluctuation	3-phase 200 V AC to 230 V AC: 170 V AC to 253 V AC 1-phase 170 V AC: 207 V AC to 253 V AC					3-phase 170 V AC to 253 V AC				

- (2) Startup in the absolute position detection system

The [AL. 25 Absolute position erased] occurrence at the first power-on does not mean an alarm. To cancel the alarm, wait for three minutes with power-on and cycle the power. If power is switched on at the servo motor speed of 500 r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

- (3) MR-BAT6V1SET battery specifications

The following shows items which differ from using an HG series servo motor.

Item	Description
Maximum speed at power failure [r/min]	500
Battery backup time	Approximately 10,000 hours (equipment power supply: off, ambient temperature: 20 °C)

3.3 Gain adjustment

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

4. CHARACTERISTICS

4. CHARACTERISTICS

4.1 Overload protection characteristics

An electronic thermal is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power wires from overloads.

[AL. 50 Overload 1] occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 4.1. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.

For the system where the unbalanced torque occurs, such as a vertical axis system, it is recommended that the unbalanced torque of the machine be kept at 70% or less of the motor's rated torque.

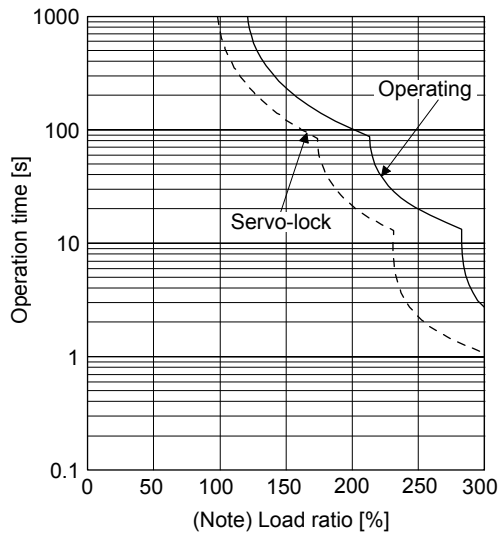
This servo amplifier has servo motor overload protective function. (The servo motor overload current (full load current) is set on the basis of 115% rated current of the servo amplifier.)

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

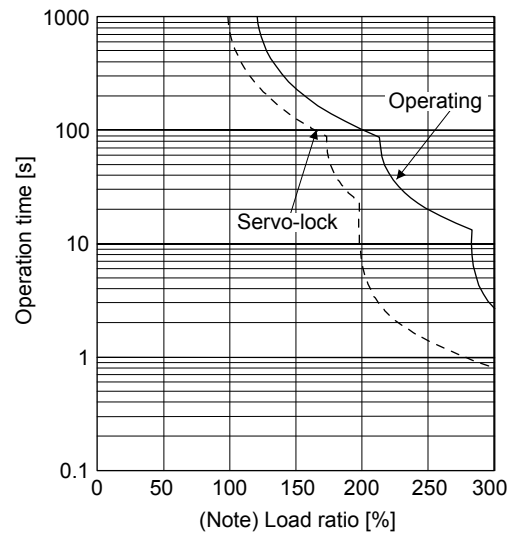
Servo motor							Graph of overload protection characteristics
HC-KFS	HC-MFS	HC-UFS	HC-SFS	HC-LFS	HC-RFS	HA-LFS	
053 13 23 43 73 46 410	053 13 23 43 73	13 23 43 72 73	52 53 81 102 103 524 1024	52 102			Characteristics a
		152 202	121 201 152 202 153 203 301 352 353 1524 2024 3524	152 202	103 153 203		
		352 502	502 702 5024 7024	302	353 503	502 601 701M 702 6014 701M4	Characteristics c

4. CHARACTERISTICS

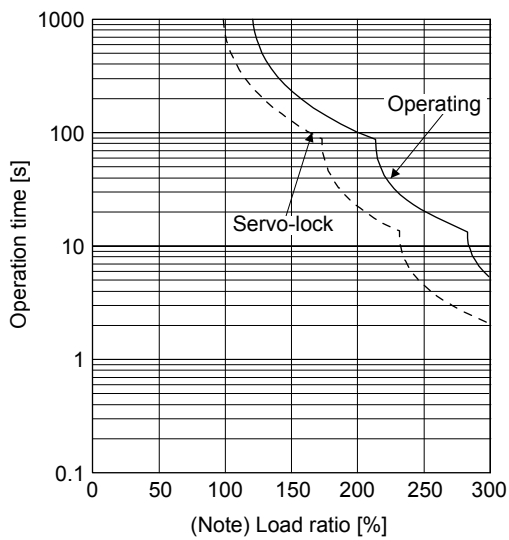
The following graphs show overload protection characteristics.



Characteristics a



Characteristics b



Characteristics c

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 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

Fig. 4.1 Electronic thermal protection characteristics

4. CHARACTERISTICS

4.2 Power supply capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 4.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosed type cabinet, use the values in the table in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo-off according to the duty used during operation. When the servo motor is run at less than the rated speed, the power supply capacity will be smaller than the value in the table, but the servo amplifier's generated heat will not change.

Table 4.1 Power supply capacity and generated loss per servo motor at rated output

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier- generated heat [W]		Area required for heat dissipation [m ²]
			At rated output	With servo-off	
MR-J4-10B-RJ020	HC-KFS053	0.3	25	15	0.5
	HC-KFS13	0.3	25	15	0.5
	HC-MFS053	0.3	25	15	0.5
	HC-MFS13	0.3	25	15	0.5
	HC-UFS13	0.3	25	15	0.5
MR-J4-20B-RJ020	HC-KFS23	0.5	25	15	0.5
	HC-MFS23	0.5	25	15	0.5
	HC-UFS23	0.5	25	15	0.5
MR-J4-40B-RJ020	HC-KFS43	0.9	35	15	0.7
	HC-MFS43	0.9	35	15	0.7
	HC-UFS43	0.9	35	15	0.7
MR-J4-60B(4)-RJ020	HC-SFS52(4)	1.0	40	15	0.8
	HC-SFS53	1.0	40	15	0.8
	HC-LFS52	1.0	40	15	0.8
MR-J4-70B-RJ020	HC-KFS73	1.3	50	15	1.0
	HC-KFS46	0.9	40	15	0.8
	HC-KFS410	0.9	40	15	0.8
	HC-MFS73	1.3	50	15	1.0
	HC-UFS72	1.3	50	15	1.0
MR-J4-100B(4)-RJ020	HC-UFS73	1.3	50	15	1.0
	HC-SFS81	1.5	50	15	1.0
	HC-SFS102(4)	1.7	50	15	1.0
	HC-SFS103	1.7	50	15	1.0
MR-J4-200B(4)-RJ020	HC-LFS102	1.7	50	15	1.0
	HC-SFS121	2.1	90	20	1.8
	HC-SFS201	3.5	90	20	1.8
	HC-SFS152(4)	2.5	90	20	1.8
	HC-SFS202(4)	3.5	90	20	1.8
	HC-SFS153	2.5	90	20	1.8
	HC-SFS203	3.5	90	20	1.8
	HC-RFS103	1.8	50	15	1.0
	HC-RFS153	2.5	90	20	1.8
	HC-UFS152	2.5	90	20	1.8
MR-J4-350B(4)-RJ020	HC-LFS152	2.5	90	20	1.8
	HC-SFS301	4.8	120	20	2.7
	HC-SFS352(4)	5.5	130	20	2.7
	HC-SFS353	5.5	130	20	2.7
	HC-RFS203	3.5	90	20	1.8
	HC-UFS202	3.5	90	20	1.8
MR-J4-500B(4)-RJ020	HC-LFS202	3.5	90	20	1.8
	HC-SFS502(4)	7.5	195	25	3.9
	HC-RFS353	5.5	135	25	2.7
	HC-RFS503	7.5	195	25	3.9
	HC-UFS352	5.5	195	25	3.9
	HC-UFS502	7.5	195	25	3.9
	HA-LFS502	7.5	195	25	3.9
HC-LFS302	4.5	120	25	2.4	

4. CHARACTERISTICS

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier-generated heat [W]		Area required for heat dissipation [m ²]
MR-J4-700B(4)-RJ020	HC-SFS702(4)	10	300	25	6.0
	HA-LFS601(4)	8.6	300	25	6.0
	HA-LFS701M(4)	10	300	25	6.0
	HA-LFS702	10.6	300	25	6.0

- Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value is applicable when the power factor improving AC reactor or power factor improving DC reactor are not used.
- Note 2. Heat generated during regeneration is not included in the servo amplifier-generated heat. Calculate generated heat referring section 11.2 of "MR-J4-_B_-RJ020 MR-J4-T20 Servo Amplifier Instruction Manual".

(2) Heat dissipation area for an enclosed type cabinet

The enclosed type cabinet (hereafter called the cabinet) which will contain the servo amplifier should be designed to ensure that its temperature rise is within +10 °C at the ambient temperature of 40 °C. (With an approximately 5 °C safety margin, the system should operate within a maximum 55 °C limit.) The necessary cabinet heat dissipation area can be calculated by equation 4.1.

$$A = \frac{P}{K \cdot \Delta T} \dots\dots\dots(4.1)$$

A: Heat dissipation area [m²]

P: Loss generated in the cabinet [W]

ΔT: Difference between internal and ambient temperatures [°C]

K: Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with equation 4.1, assume that P is the sum of all losses generated in the cabinet. Refer to table 4.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the cabinet is directly installed on an insulated wall, that extra amount must be added to the cabinet's surface area. The required heat dissipation area will vary with the conditions in the cabinet. If convection in the cabinet is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the cabinet and the use of a cooling fan should be considered. Table 4.1 lists the cabinet dissipation area for each servo amplifier (guideline) when the servo amplifier is operated at the ambient temperature of 40 °C under rated load.

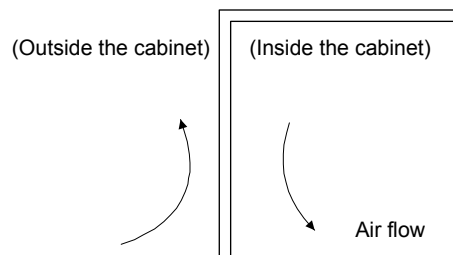


Fig. 4.2 Temperature distribution in an enclosed type cabinet

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

4. CHARACTERISTICS

4.3 Dynamic brake characteristics

POINT
<ul style="list-style-type: none"> ● Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency. ● For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes. ● Be sure to enable EM1 (Forced stop) after servo motor stops when using EM1 (Forced stop) frequently in other than emergency. ● The dynamic brake characteristics in this section are different from those of MR-J2S-_B_ servo amplifier.

(1) Dynamic brake operation

(a) Calculation of coasting distance

Fig. 4.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 4.2 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 (1) (b) of this section.)

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

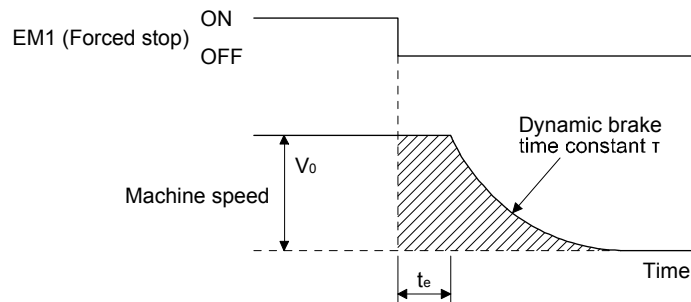


Fig. 4.3 Dynamic brake operation diagram

$$L_{\max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \dots \dots \dots (4.2)$$

- L_{\max} : Maximum coasting distance [mm]
- V_0 : Machine's fast feed speed [mm/min]
- J_M : Moment of inertia of the servo motor [$\times 10^{-4}$ kg·m²]
- J_L : Load moment of inertia converted into equivalent value on servo motor shaft [$\times 10^{-4}$ kg·m²]
- τ : Dynamic brake time constant [s]
- t_e : Delay time of control section [s]

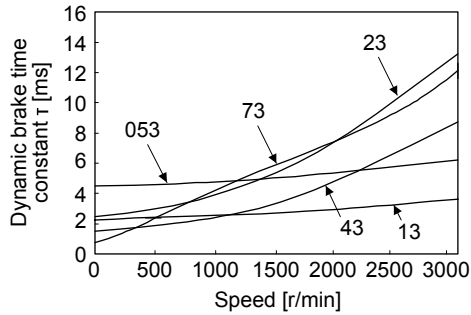
There is internal relay delay time of about 10 ms.

4. CHARACTERISTICS

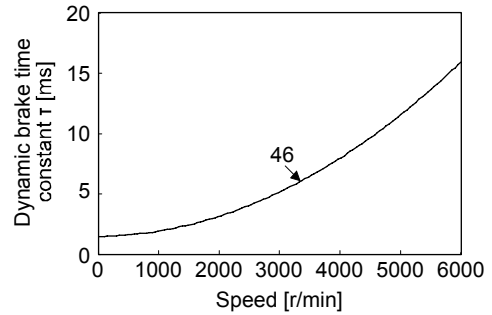
(b) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 4.2.

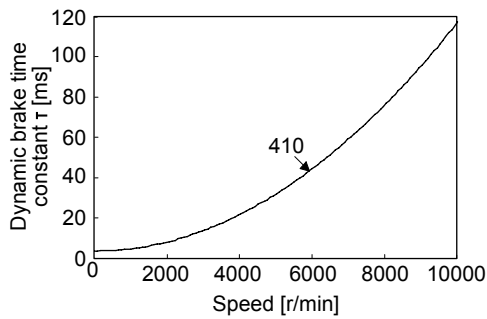
1) 200 V class servo motor



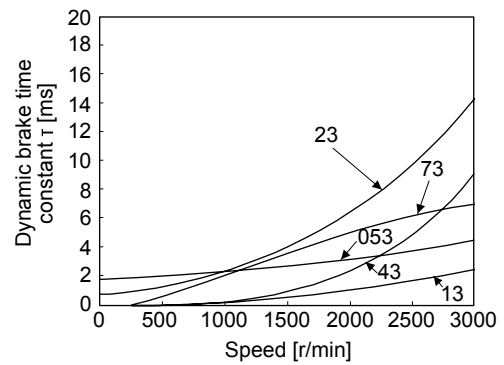
HC-KFS 3000 r/min series



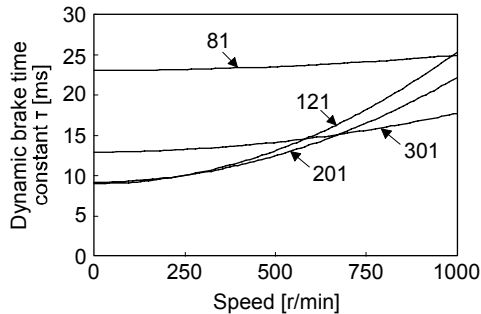
HC-KFS 6000 r/min series



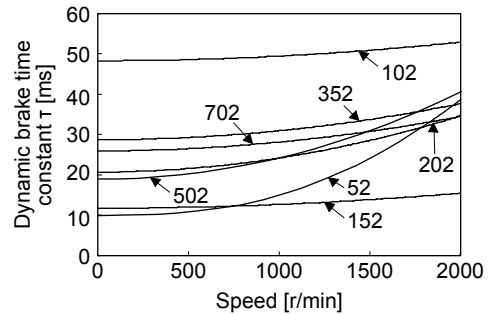
HC-KFS 10000 r/min series



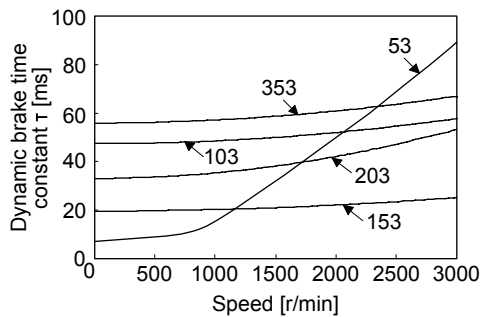
HC-MFS series



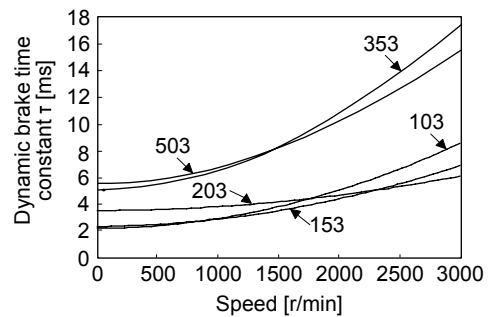
HC-SFS 1000 r/min series



HC-SFS 2000 r/min series

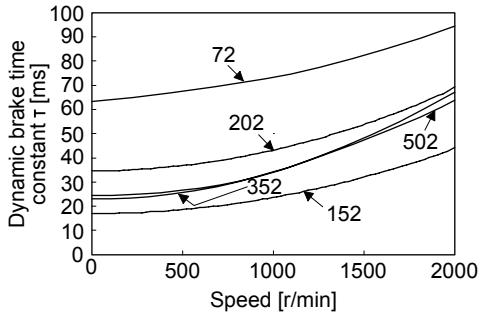


HC-SFS 3000 r/min series

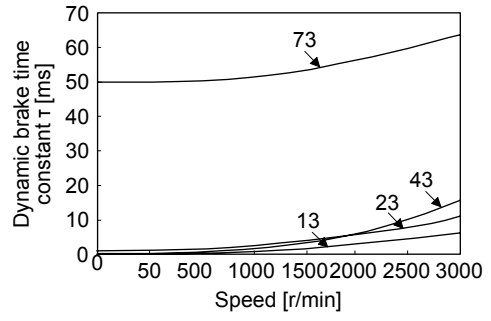


HC-RFS series

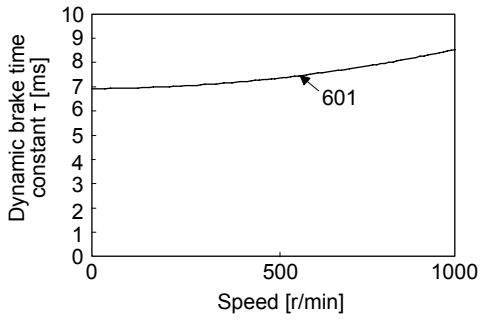
4. CHARACTERISTICS



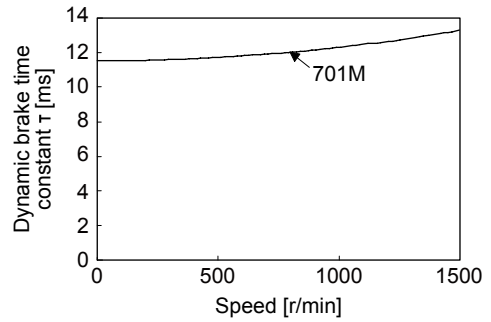
HC-UFS 2000 r/min series



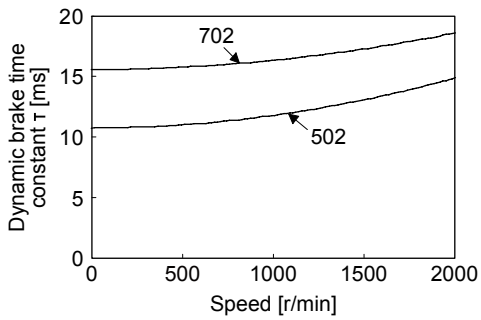
HC-UFS 3000 r/min series



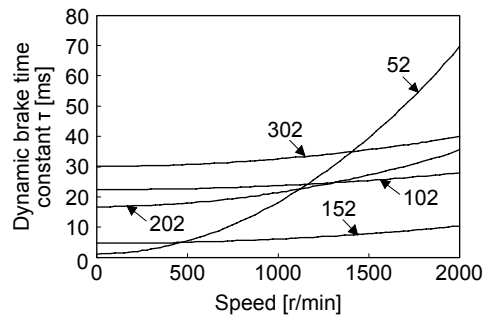
HA-LFS 1000 r/min series



HA-LFS 1500 r/min series



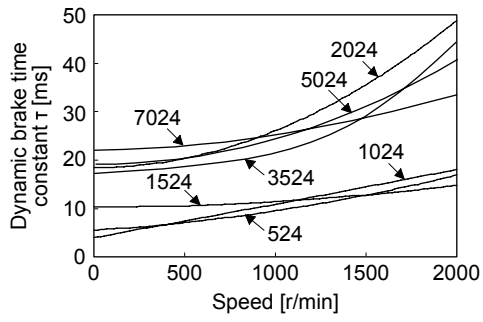
HA-LFS 2000 r/min series



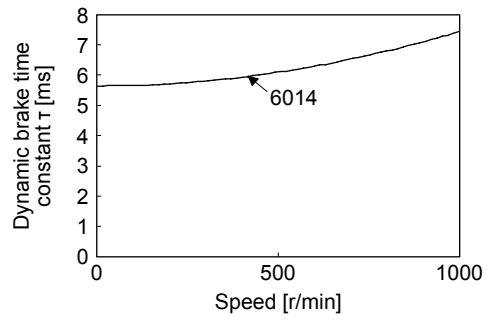
HC-LFS series

4. CHARACTERISTICS

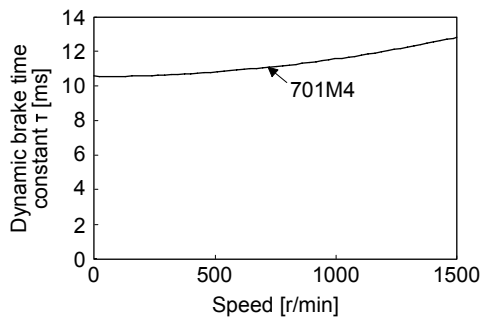
2) 400 V class servo motor



HC-SFS series



HA-LFS 1000 r/min series



HA-LFS 1500 r/min series

4. CHARACTERISTICS

(2) Permissible load to motor inertia when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the ratio is higher than this value, the dynamic brake may burn. If there is a possibility that the ratio may exceed the value, contact your local sales office.

The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor.

(a) 200 V class servo motor

Servo motor	Permissible load to motor inertia ratio [multiplier]
HC-KFS053	30
HC-KFS13	
HC-KFS23	
HC-KFS43	
HC-KFS73	
HC-KFS46	
HC-KFS410	
HC-MFS053	
HC-MFS13	
HC-MFS23	
HC-MFS43	
HC-MFS73	
HC-SFS52	
HC-SFS53	
HC-SFS81	
HC-SFS102	
HC-SFS103	
HC-SFS121	
HC-SFS201	
HC-SFS152	
HC-SFS202	
HC-SFS153	
HC-SFS203	
HC-SFS301	16
HC-SFS352	
HC-SFS353	

Servo motor	Permissible load to motor inertia ratio [multiplier]
HC-SFS502	15
HC-SFS702	
HC-RFS103	30
HC-RFS153	
HC-RFS203	16
HC-RFS353	15
HC-RFS503	
HC-UFS13	30
HC-UFS23	
HC-UFS43	
HC-UFS72	
HC-UFS73	
HC-UFS152	
HC-UFS202	16
HC-UFS352	15
HC-UFS502	
HA-LFS502	
HA-LFS601	
HA-LFS701M	
HA-LFS702	
HC-LFS52	30
HC-LFS102	
HC-LFS152	
HC-LFS202	16
HC-LFS302	15

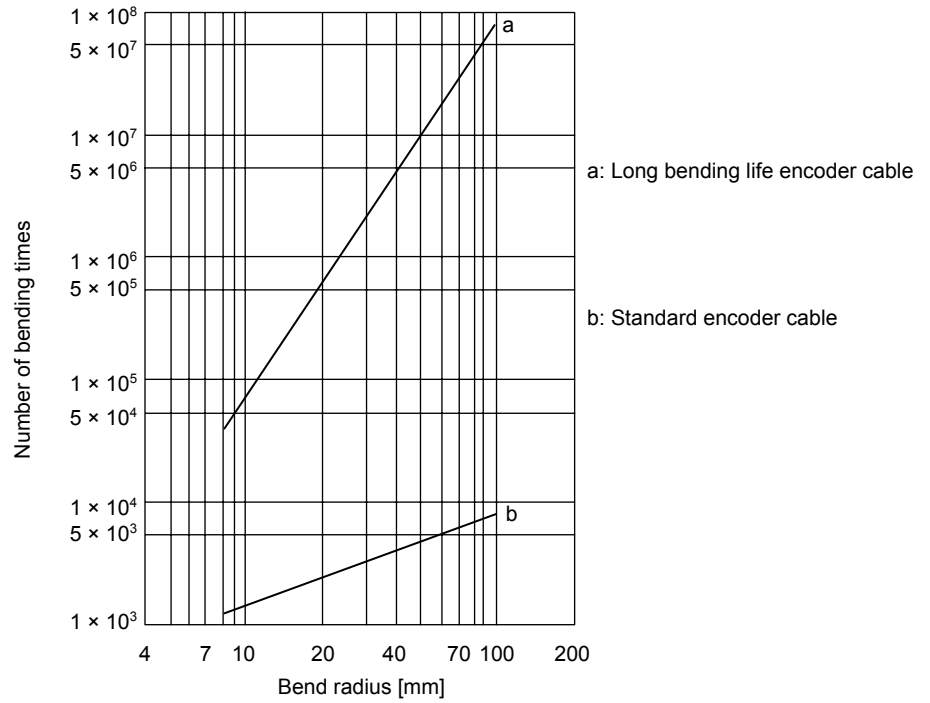
(b) 400 V class servo motor

Servo motor	Permissible load to motor inertia ratio [multiplier]
HC-SFS524	30
HC-SFS1024	
HC-SFS1524	
HC-SFS2024	
HC-SFS3524	16
HC-SFS5024	15
HC-SFS7024	
HA-LFS6014	
HA-LFS701M4	

4. CHARACTERISTICS

4.4 Cable bending life

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



4. CHARACTERISTICS

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

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to "MR-J4-_B_-RJ020 MR-J4-T20 Servo Amplifier Instruction Manual" section 11.10.)

When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

(1) 200 V class servo amplifier

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

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

(2) 400 V class servo amplifier

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

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

MEMO

5. OPTIONS AND PERIPHERAL EQUIPMENT

5. OPTIONS AND PERIPHERAL EQUIPMENT

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

! CAUTION ● Use the specified peripheral equipment and options to prevent a malfunction or a fire.

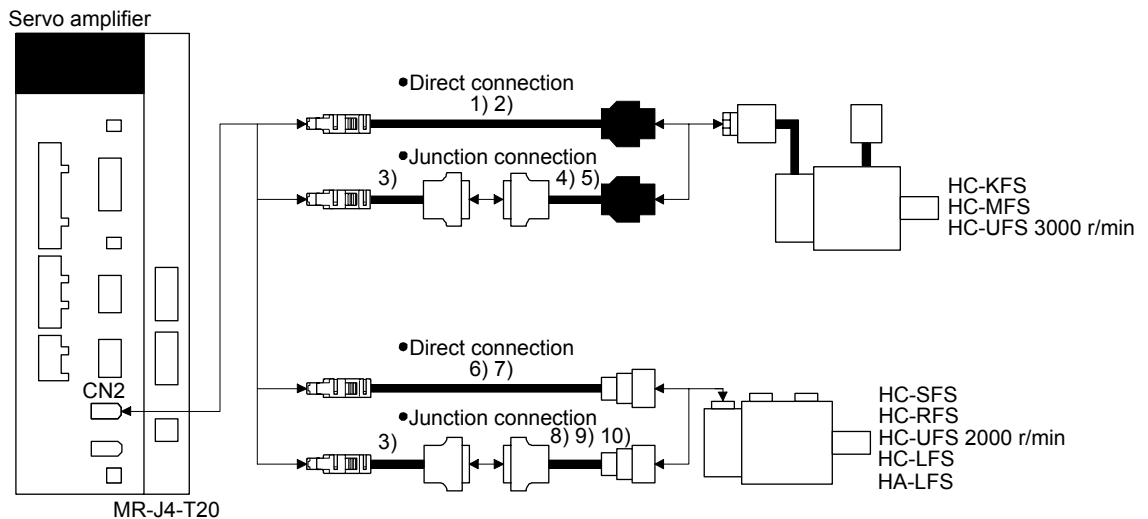
This chapter describes only encoder cables and regenerative options for connecting HC/HA series servo motors to an MR-J4-_B_-RJ020 servo amplifier. For options for the servo amplifier, refer to chapter 11 of "MR-J4-_B_-RJ020 MR-J4-T20 Servo Amplifier Instruction Manual". For options for the HC/HA series servo motor, refer to "MR-J2S-_B_ Servo Amplifier Instruction Manual (SH(NA)030007)" and "Servo Motor Instruction Manual (SH(NA)3181)".

POINT

● The IP rating indicated for cables and connectors is their protection against ingress of dust and raindrops when they are connected to a servo amplifier or servo motor. If the IP rating of the cable, connector, servo amplifier and servo motor vary, the overall IP rating depends on the lowest IP rating of all components.







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

5.1 Combinations of encoder cables



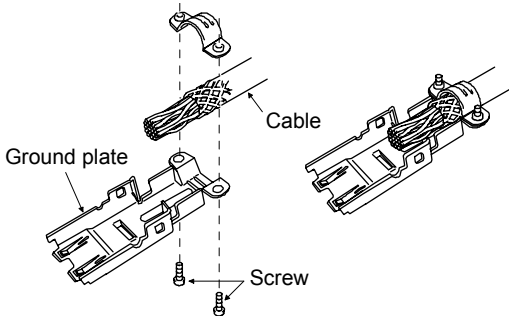
5. OPTIONS AND PERIPHERAL EQUIPMENT

5.2 Encoder cable list

No.	Product name	Model	Description	Application	
1)	Encoder cable	MR-EKCBL_M-L Cable length: 20/30 m	 Refer to section 5.3 (1) for details.	IP20	
2)	Encoder cable	MR-EKCBL_M-H Cable length: 20/30/40/50 m		IP20 Long bending life	
3)	Encoder cable	MR-J3CH00 Cable length: 0.2 m	 Refer to section 5.3 (2) for details.	IP20	
4)	Encoder cable	MR-JCCBL_M-L Cable length: 2/5/10/20/30 m	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)	Housing: 1-172161-9 Connector pin: 170359-1 (TE Connectivity or equivalent) Cable clamp: MT1-0002 (Toa Electric Industrial)	IP20
5)	Encoder cable	MR-JCCBL_M-H Cable length: 2/5/10/20/30/40/50 m		IP20 Long bending life	
6)	Encoder cable	MR-ESCBL_M-L Cable length: 2/5/10/20/30 m	 Refer to section 5.3 (3) for details.	IP20	
7)	Encoder cable	MR-ESCBL_M-H Cable length: 2/5/10/20/30/40/50 m		IP20 Long bending life	
8)	Encoder cable	MR-JHSCBL_M-L Cable length: 2/5/10/20/30 m	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)	Plug: D/MS3106B20-29S Cable clamp: D/MS3057-12A (DDK)	IP20
9)	Encoder cable	MR-JHSCBL_M-H Cable length: 2/5/10/20/30/40/50 m		IP20 Long bending life	
10)	Encoder cable	MR-ENCBL_M-H Cable length: 2/5/10/20/30/40/50 m	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)	Plug: D/MS3106A20-29S(D190) Cable clamp: CE3057-12A-3-D Backshell: CE02-20BS-S-D (DDK)	IP65 Long bending life
					

5. OPTIONS AND PERIPHERAL EQUIPMENT

5.3 Detail of the encoder cable

POINT
<p>● For the CN2 side connector, securely connect the shielded external conductor of the cable to the ground plate and fix it to the connector shell.</p>  <p>● The following encoder cables are of four-wire type.</p> <p>MR-EKCBL30M-L MR-EKCBL30M-H MR-EKCBL40M-H MR-EKCBL50M-H MR-ESCBL30M-L MR-ESCBL30M-H MR-ESCBL40M-H MR-ESCBL50M-H</p> <p>When using any of these encoder cables, set [Pr. 23] to "_ 1 _" to select "four-wire type". Incorrect setting will trigger [AL. 16 Encoder error 1].</p>

(1) MR-EKCBL_M_

These cables are encoder cables for the HC-KFS, HC-MFS, and HC-UFS 3000 r/min series servo motors.

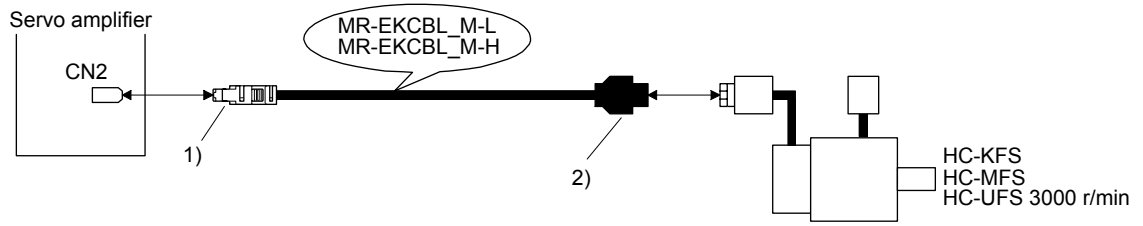
The numbers in the cable length field of the table indicate the symbol filling the underline "_" in the cable model. The cables of the lengths with the symbols are available.

Cable model	Cable length				IP rating	Bending life	Application
	20 m	30 m	40 m	50 m			
MR-EKCBL_M-L	20	(Note) 30	/	/	IP20	Standard	For the HC-KFS, HC-MFS, and HC-UFS 3000 r/min series servo motors
MR-EKCBL_M-H	20	(Note) 30	(Note) 40	(Note) 50	IP20	Long bending life	

Note. Four-wire type cable

5. OPTIONS AND PERIPHERAL EQUIPMENT

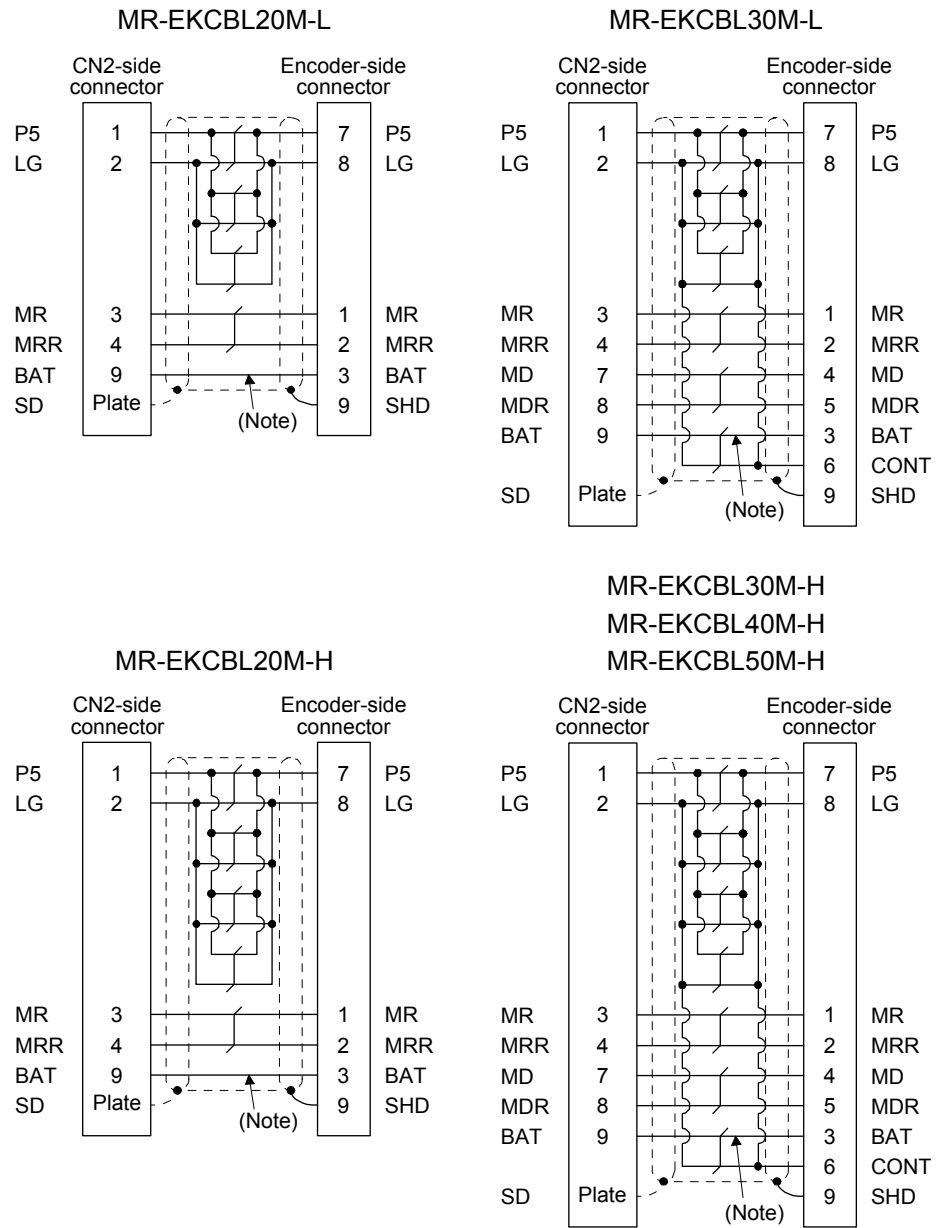
(a) Connection of servo amplifier and servo motor



Cable model	1) CN2-side connector		2) Encoder-side connector
MR-EKCBL_M-L	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M)	Connector set: 54599-1019 (Molex)	Housing: 1-172161-9 Connector pin: 170359-1 Crimping tool: 91529-1 (TE Connectivity or equivalent) Cable clamp: MTI-0002 (Toa Electric Industrial)
MR-EKCBL_M-H	<p>View seen from the wiring side. (Note) View seen from the wiring side. (Note)</p>		<p>View seen from the wiring side.</p>
<p>Note. Do not connect anything to the pins shown as . Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.</p>			

5. OPTIONS AND PERIPHERAL EQUIPMENT

(b) Cable internal wiring diagram



Note. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

5. OPTIONS AND PERIPHERAL EQUIPMENT

(2) MR-J3CH00

The servo amplifier and the servo motor cannot be connected by this cable alone. Use it with the following encoder cables.

MR-JCCBL_M-L

MR-JCCBL_M-H

MR-JHSCBL_M-L

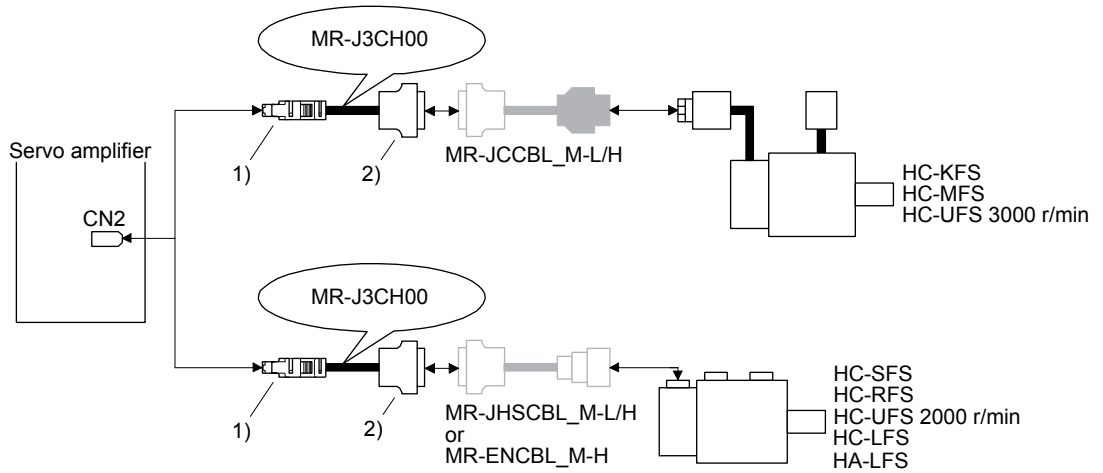
MR-JHSCBL_M-H

MR-ENCBL_M-H

Cable model	Cable length	IP rating	Bending life	Application
MR-J3CH00	0.2 m	IP20	Standard	For the HC-KFS, HC-MFS series, and HC-UFS 3000 r/min servo motors Use this in combination with MR-JCCBL_M-L/H.
				For the HC-SFS, HC-RFS, HA-LFS series, and HC-UFS 2000 r/min servo motors Use this in combination with MR-JHCBL_M-L/H or MR-ENCBL_M-H.

5. OPTIONS AND PERIPHERAL EQUIPMENT

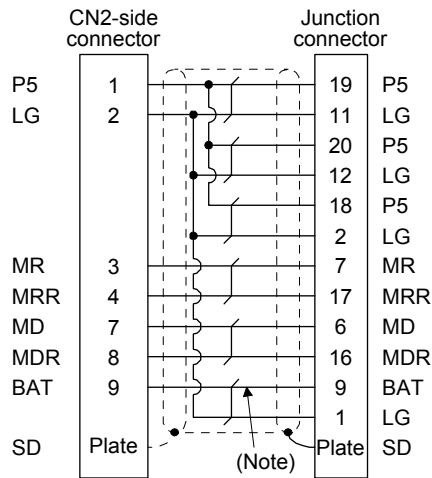
(a) Connection of servo amplifier and servo motor



Cable model	1) CN2-side connector	2) Junction connector
MR-J3CH00	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) View seen from the wiring side. (Note) View seen from the wiring side. (Note)	Connector: 10220-0200EL Shell kit: 10320-E2W0-008 (3M) View seen from the wiring side. (Note)
	Note. Do not connect anything to the pins shown as . Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	Note. Do not connect anything to the pins shown as .

5. OPTIONS AND PERIPHERAL EQUIPMENT

(b) Cable internal wiring diagram



Note. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

(3) MR-ESCBL_M-

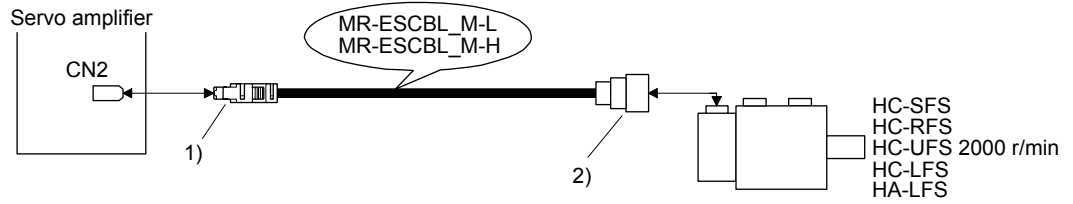
These encoder cables are for HC-SFS, HC-RFS, HC-LFS, HA-LFS series and HC-UFS 2000 r/min servo motors. The numbers in the cable length field of the table indicate the symbol filling the underline "_" in the cable model. The cables of the lengths with the symbols are available.

Cable model	Cable length							IP rating	Bending life	Application
	2 m	5 m	10 m	20 m	30 m	40 m	50 m			
MR-ESCBL_M-L	2	5	10	20	(Note) 30	/	/	IP20	Standard	For the HC-SFS, HC-RFS, HC-LFS, HA-LFS series, and HC-UFS 2000 r/min servo motors
MR-ESCBL_M-H	2	5	10	20	(Note) 30	(Note) 40	(Note) 50	IP20	Long bending life	

Note. Four-wire type cable

5. OPTIONS AND PERIPHERAL EQUIPMENT

(a) Connection of servo amplifier and servo motor



Cable model	1) CN2-side connector	2) Encoder-side connector																																								
MR-ESCBL_M-L	<p>Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M)</p> <p>Connector set: 54599-1019 (Molex)</p> <p>View seen from the wiring side. (Note) View seen from the wiring side. (Note)</p> <p>Note. Do not connect anything to the pins shown as . Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.</p>	<p>Plug: D/MS3106B20-29S Cable clamp: D/MS3057-12A (DDK)</p> <p>View seen from the wiring side. (Note)</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Signal</th> <th>Pin</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>MD</td> <td>K</td> <td></td> </tr> <tr> <td>B</td> <td>MDR</td> <td>L</td> <td></td> </tr> <tr> <td>C</td> <td>MR</td> <td>M</td> <td>CONT</td> </tr> <tr> <td>D</td> <td>MRR</td> <td>N</td> <td>SHD</td> </tr> <tr> <td>E</td> <td></td> <td>P</td> <td></td> </tr> <tr> <td>F</td> <td>BAT</td> <td>R</td> <td>LG</td> </tr> <tr> <td>G</td> <td></td> <td>S</td> <td>P5</td> </tr> <tr> <td>H</td> <td></td> <td>T</td> <td></td> </tr> <tr> <td>J</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Note. Do not connect anything to the pins shown as </p>	Pin	Signal	Pin	Signal	A	MD	K		B	MDR	L		C	MR	M	CONT	D	MRR	N	SHD	E		P		F	BAT	R	LG	G		S	P5	H		T		J			
Pin	Signal	Pin	Signal																																							
A	MD	K																																								
B	MDR	L																																								
C	MR	M	CONT																																							
D	MRR	N	SHD																																							
E		P																																								
F	BAT	R	LG																																							
G		S	P5																																							
H		T																																								
J																																										
MR-ESCBL_M-H																																										

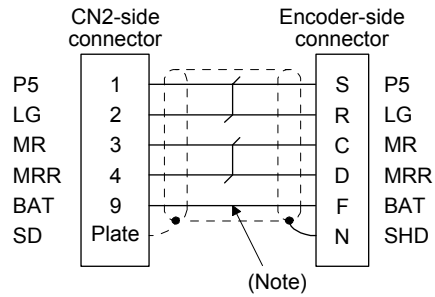
5. OPTIONS AND PERIPHERAL EQUIPMENT

(b) Cable internal wiring diagram

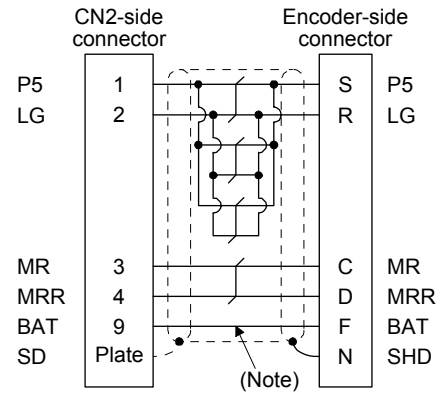
MR-ESCBL2M-L

MR-ESCBL5M-L

MR-ESCBL10M-L



MR-ESCBL20M-L

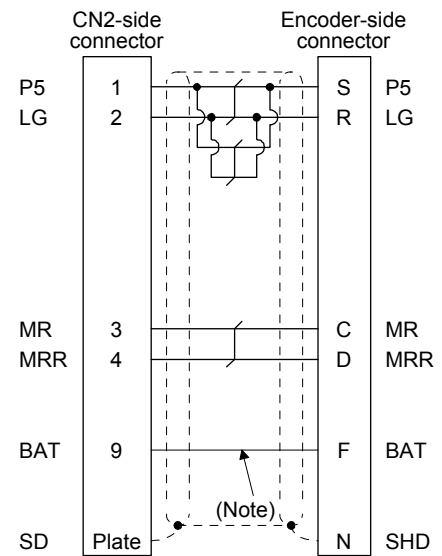
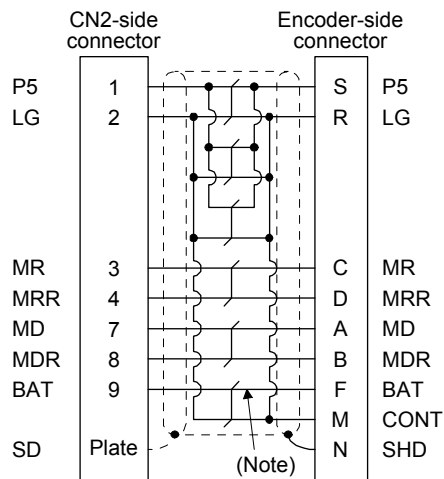


MR-ESCBL2M-H

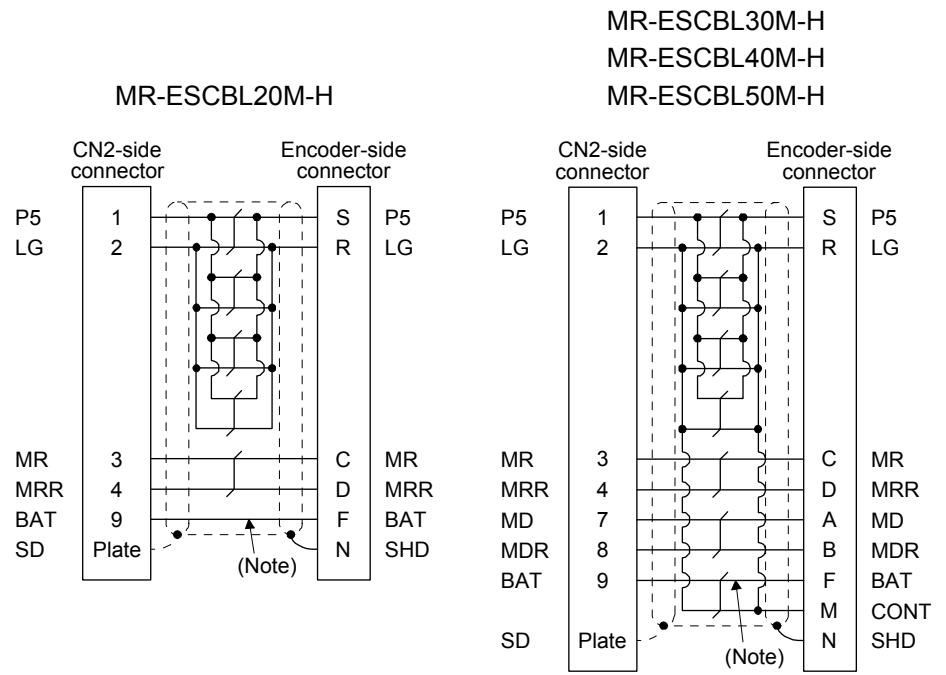
MR-ESCBL5M-H

MR-ESCBL10M-H

MR-ESCBL30M-L



5. OPTIONS AND PERIPHERAL EQUIPMENT



Note. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

5. OPTIONS AND PERIPHERAL EQUIPMENT

5.4 Regenerative option



CAUTION

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

(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 [40 Ω]	MR-RB12 [40 Ω]	MR-RB32 [40 Ω]	MR-RB30 [13 Ω]	(Note) MR-RB50 [13 Ω]	MR-RB31 [6.7 Ω]	(Note) MR-RB51 [6.7 Ω]
MR-J4-10B-RJ020		30						
MR-J4-20B-RJ020	10	30	100					
MR-J4-40B-RJ020	10	30	100					
MR-J4-60B-RJ020	10	30	100					
MR-J4-70B-RJ020	20	30	100	300				
MR-J4-100B-RJ020	20	30	100	300				
MR-J4-200B-RJ020	100				300	500		
MR-J4-350B-RJ020	100				300	500		
MR-J4-500B-RJ020	130				300	500		
MR-J4-700B-RJ020	170						300	500

Note. Always install a cooling fan.

(b) 400 V class

Servo amplifier	Regenerative power [W]								
	Built-in regenerative resistor	MR-RB1L-4 [270 Ω]	(Note) MR-RB3M-4 [120 Ω]	(Note) MR-RB3H-4 [80 Ω]	(Note) MR-RB5H-4 [80 Ω]	(Note) MR-RB3G-4 [47 Ω]	(Note) MR-RB5G-4 [47 Ω]	(Note) MR-RB34-4 [26 Ω]	(Note) MR-RB54-4 [26 Ω]
MR-J4-60B4-RJ020	15	100							
MR-J4-100B4-RJ020	15		300						
MR-J4-200B4-RJ020	100			300	500				
MR-J4-350B4-RJ020	100					300	500		
MR-J4-500B4-RJ020	130					300	500		
MR-J4-700B4-RJ020	170							300	500

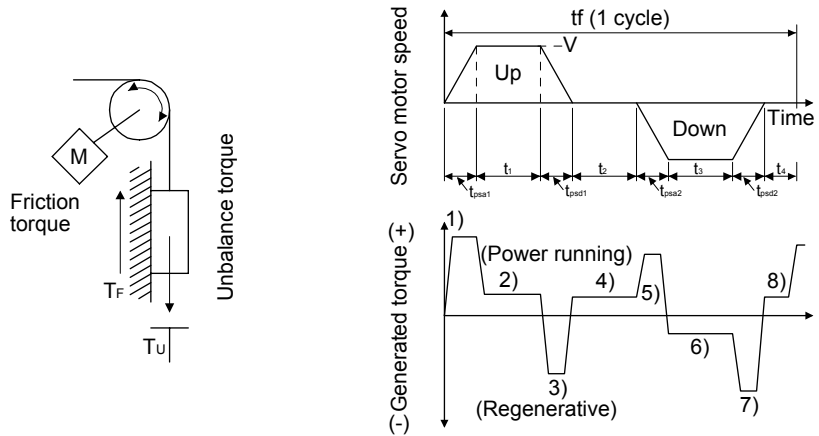
Note. Always install a cooling fan.

5. OPTIONS AND PERIPHERAL EQUIPMENT

(2) Selection of the regenerative option

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

(a) Regenerative energy calculation



Formulas for calculating torque and energy in operation

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

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

5. OPTIONS AND PERIPHERAL EQUIPMENT

(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-J4-10B-RJ020	55	9
MR-J4-20B-RJ020	70	9
MR-J4-40B-RJ020	85	11
MR-J4-60B-RJ020	85	11
MR-J4-70B-RJ020	80	18
MR-J4-100B-RJ020	80	18
MR-J4-200B-RJ020	85	36
MR-J4-350B-RJ020	85	40
MR-J4-500B-RJ020	90	45
MR-J4-700B-RJ020	90	70

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-J4-60B4-RJ020	85	12
MR-J4-100B4-RJ020	80	12
MR-J4-200B4-RJ020	85	25
MR-J4-350B4-RJ020	85	43
MR-J4-500B4-RJ020	90	45
MR-J4-700B4-RJ020	90	70

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 generated torque, allow for about 10%.

Capacitor charging (E_c): 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.

$$ER [J] = \eta \cdot E_s - E_c$$

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

$$PR [W] = ER/t_f$$

(3) Parameter setting

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

[Pr. 2]

0	0		
---	---	--	--

- 00: Regenerative option is not used.
 - For servo amplifier of 100 W, regenerative option is not used.
 - For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
- 01: FR-RC/FR-RC-H/FR-CV/FR-BU2/FR-BU2-H
- 05: MR-RB32
- 08: MR-RB30
- 09: MR-RB50 (Cooling fan is required.)
- 0B: MR-RB31
- 0C: MR-RB51 (Cooling fan is required.)
- 10: MR-RB032
- 11: MR-RB12
- 20: MR-RB3N
- 21: MR-RB5N (Cooling fan is required.)
- 80: MR-RB3H-4 (Cooling fan is required.)
- 81: MR-RB5H-4 (Cooling fan is required.)
- 82: MR-RB3G-4 (Cooling fan is required.)
- 83: MR-RB5G-4 (Cooling fan is required.)
- 84: MR-RB34-4 (Cooling fan is required.)
- 85: MR-RB54-4 (Cooling fan is required.)
- 86: MR-RB1L-4
- 87: MR-RB3M-4 (Cooling fan is required.)
- 90: MR-RB1H-4
- 9C: MR-RB3U-4 (Cooling fan is required.)
- 9D: MR-RB5U-4 (Cooling fan is required.)

5. OPTIONS AND PERIPHERAL EQUIPMENT

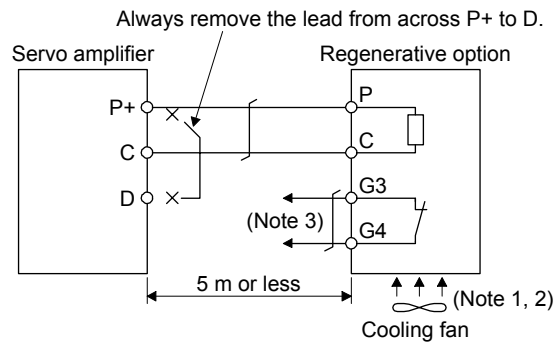
(4) Connection of regenerative option

POINT
<ul style="list-style-type: none"> ● When MR-RB50, MR-RB51, MR-RB3M-4, MR-RB3G-4, MR-RB5G-4, MR-RB34-4, MR-RB54-4, MR-RB3H-4, or MR-RB5H-4 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer. ● For the wire sizes used for wiring, refer to chapter 6.

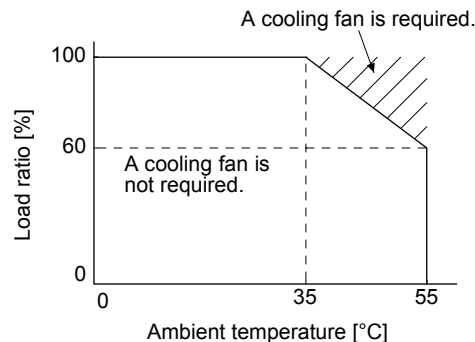
The regenerative option generates heat of 100 °C higher than the ambient temperature. Fully consider heat dissipation, installation position, wires used, etc. before installing the option. For wiring, use flame-resistant wires or make the wires flame-resistant and keep them away from the regenerative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

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

Always remove the wiring from across P+ to D and fit the regenerative option across P+ to C. G3 and G4 are terminals for thermal sensor. Between G3 and G4 is opened when the regenerative option overheats abnormally.



- Note 1. When using the MR-RB50, MR-RB3M-4, MR-RB3G-4, MR-RB5G-4, MR-RB3H-4, or MR-RB5H-4, forcibly cool it with a cooling fan (1.0 m³/min or more, 92 mm × 92 mm).
- Note 2. When the ambient temperature is more than 55 °C and the regenerative load ratio is more than 60% in MR-RB30, MR-RB31 and MR-RB32, forcefully cool the air with a cooling fan (1.0 m³/min or more, 92 mm × 92 mm). A cooling fan is not required if the ambient temperature is 35 °C or less. (A cooling fan is required for the shaded area in the following graph.)



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

G3-G4 contact specifications

Maximum voltage: 120 V AC/DC

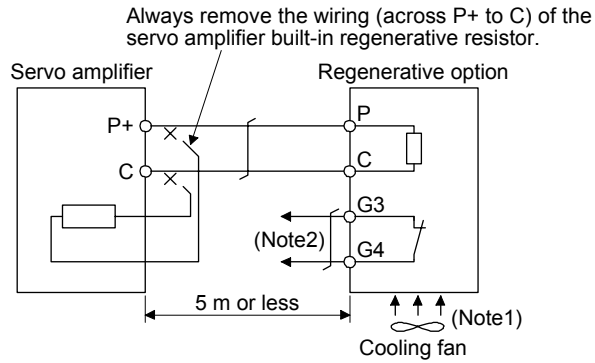
Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

5. OPTIONS AND PERIPHERAL EQUIPMENT

(b) MR-J4-500B4-RJ020/MR-J4-700B(4)-RJ020

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



- Note 1. When using the MR-RB51, MR-RB34-4, MR-RB54-4, MR-RB3G-4, or MR-RB5G-4, forcibly cool it with a cooling fan (1.0 m³/min or more, 92 mm × 92 mm).
- Note 2. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

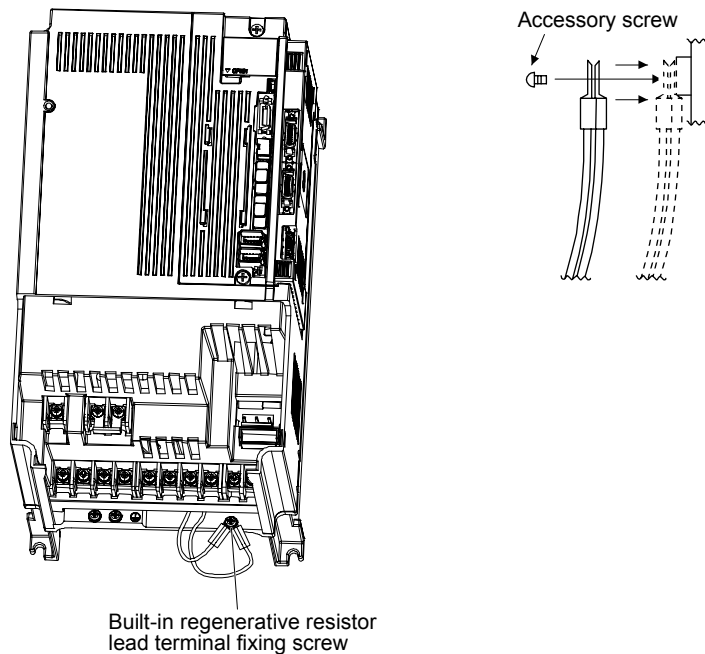
G3-G4 contact specifications

Maximum voltage: 120 V AC/DC

Maximum current: 0.5 A/4.8 V DC

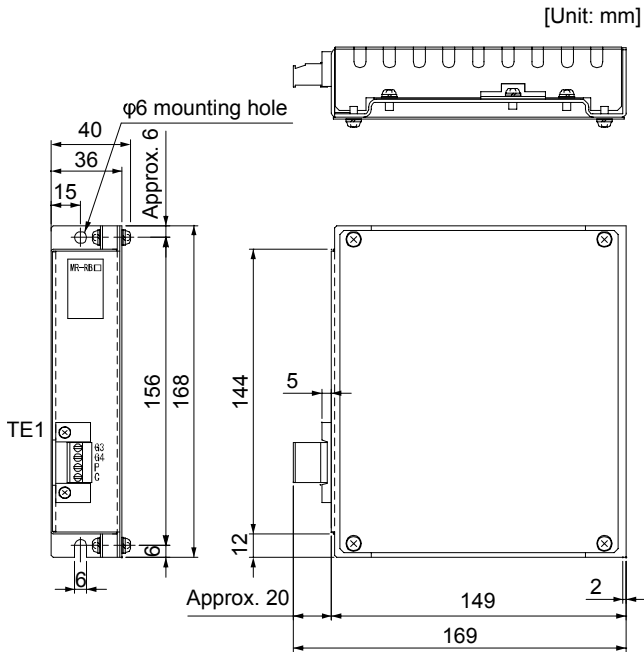
Maximum capacity: 2.4 VA

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



5. OPTIONS AND PERIPHERAL EQUIPMENT

(5) Dimensions (a) MR-RB12



• TE1 terminal block

G3
G4
P
C

Applicable wire size: 0.2 mm² to 2.5 mm² (AWG 24 to 12)

Tightening torque: 0.5 to 0.6 [N•m]

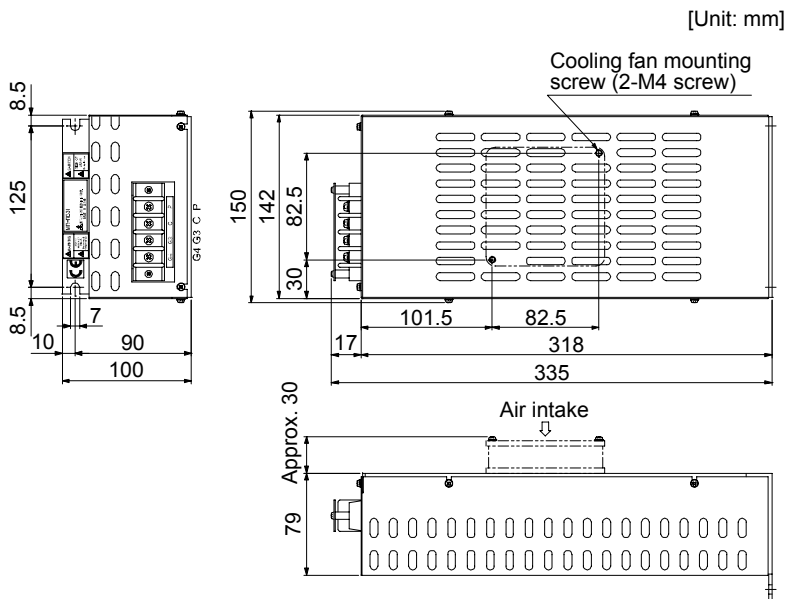
• Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(b) MR-RB30/MR-RB31/MR-RB32/MR-RB34-4/MR-RB3M-4/MR-RB3G-4/MR-RB3H-4



• Terminal block

P
C
G3
G4

Terminal screw size: M4

Tightening torque: 1.2 [N•m]

• Mounting screw

Screw size: M6

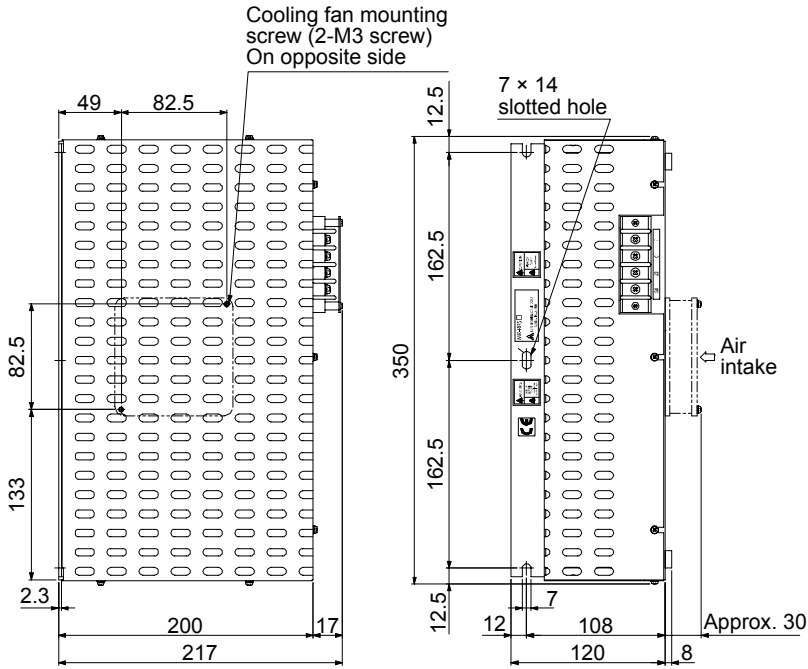
Tightening torque: 5.4 [N•m]

Mass: 2.9 [kg]

5. OPTIONS AND PERIPHERAL EQUIPMENT

(c) MR-RB50/MR-RB51/MR-RB54-4/MR-RB5G-4/MR-RB5H-4

[Unit: mm]



• Terminal block

P
C
G3
G4

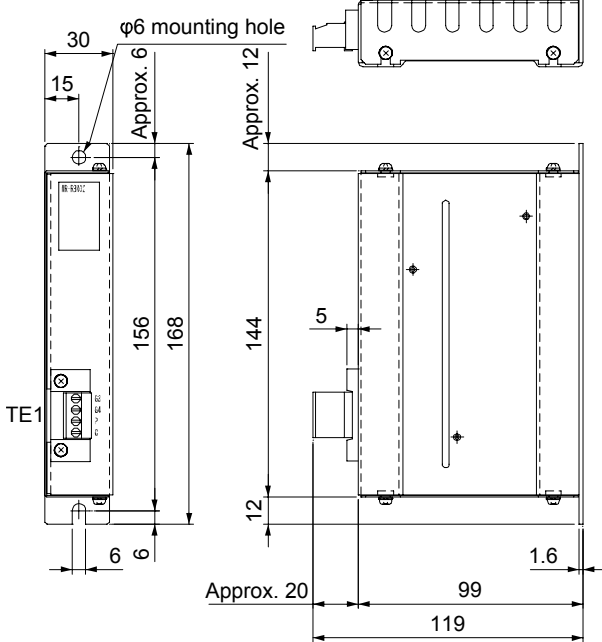
Terminal screw size: M4
Tightening torque: 1.2 [N•m]

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

Mass: 5.6 [kg]

(d) MR-RB032

[Unit: mm]



• TE1 terminal block

G3
G4
P
C

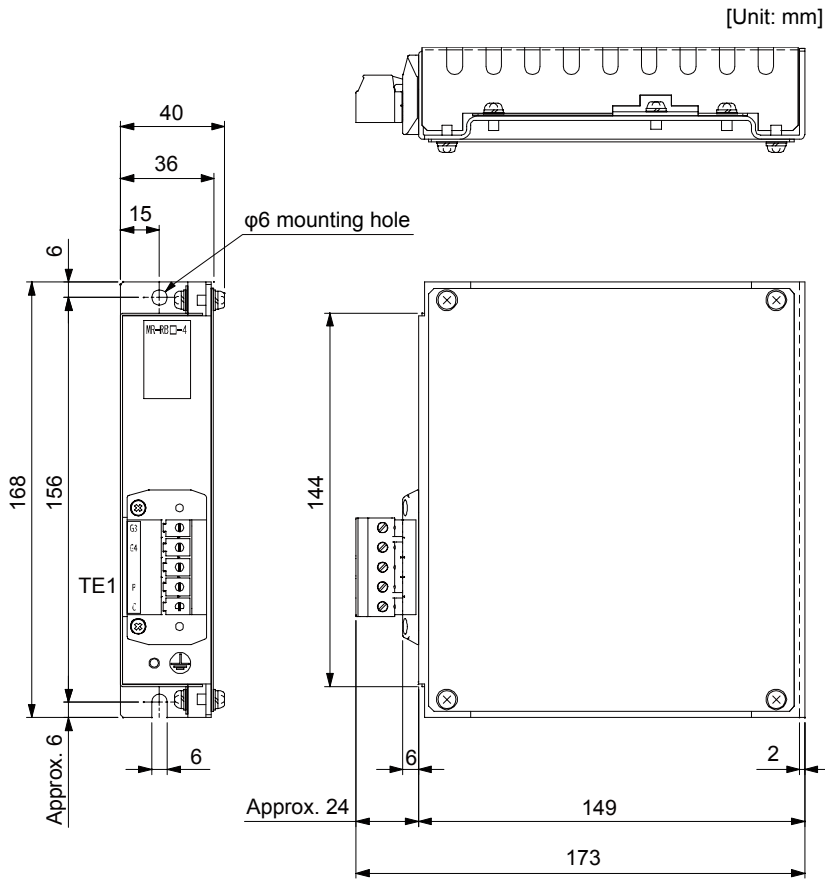
Applicable wire size: 0.2 mm² to 2.5 mm² (AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

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

Mass: 0.5 [kg]

5. OPTIONS AND PERIPHERAL EQUIPMENT

(e) MR-RB1L-4



• Terminal

G3
G4
P
C

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

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

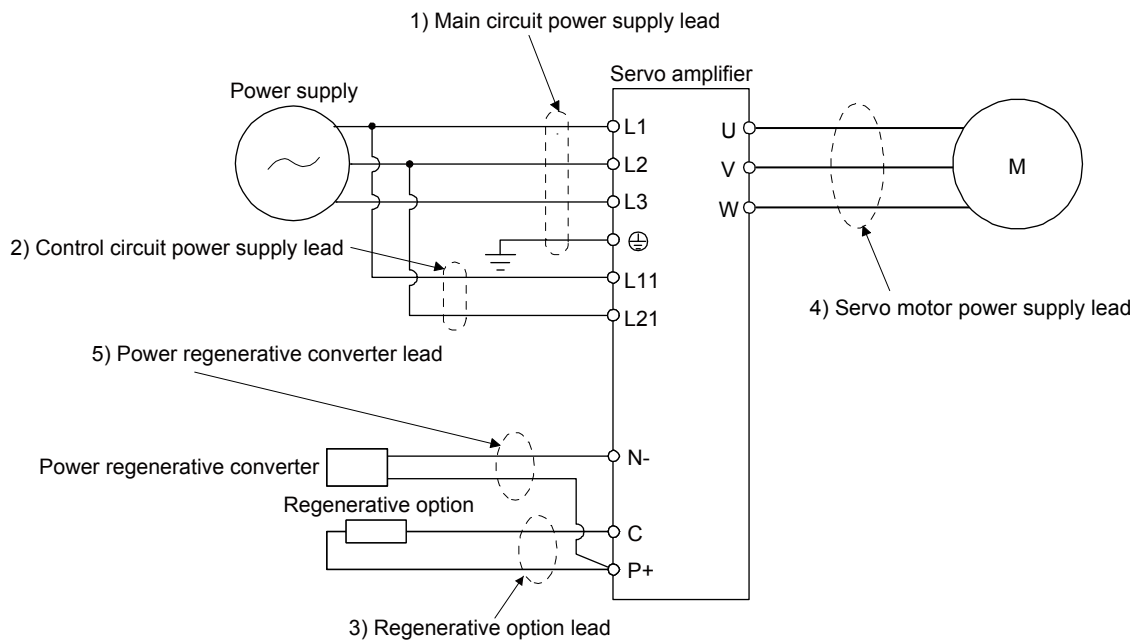
Mass: 1.1 [kg]

6. SELECTION EXAMPLE OF WIRES

6. SELECTION EXAMPLE OF WIRES

POINT
<ul style="list-style-type: none"> ● We recommend using HIV wires to wire the servo amplifiers, options, and peripheral equipment. Therefore, the recommended wire sizes may differ from those used for the previous servo amplifiers. ● Selection conditions of wire size is as follows. <ul style="list-style-type: none"> Construction condition: One wire is constructed in the air. Wire length: 30 m or less

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



6. SELECTION EXAMPLE OF WIRES

(1) Example of selecting the wire sizes

Use the 600 V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

Servo amplifier	Wire [mm ²] (Note 1)			
	1) L1/L2/L3/⊕	2) L11/L21	3) P+/C	4) U/V/W/⊕
MR-J4-10B-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14)	2 (AWG 14)	AWG 18 to 14
MR-J4-20B-RJ020				
MR-J4-40B-RJ020				
MR-J4-60B-RJ020				
MR-J4-70B-RJ020				
MR-J4-100B-RJ020				
MR-J4-200B-RJ020				AWG 16 to 10
MR-J4-350B-RJ020	3.5 (AWG 12)			
MR-J4-500B-RJ020 (Note 2)	5.5 (AWG 10): a	1.25 (AWG 16): a 2 (AWG 14): d	2 (AWG 14): c	2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a
MR-J4-700B-RJ020 (Note 2)	8 (AWG 8): b			2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a 8 (AWG 8): b
MR-J4-60B4-RJ020/ MR-J4-100B4-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14)	2 (AWG 14)	AWG 16 to 14
MR-J4-200B4-RJ020				
MR-J4-350B4-RJ020				
MR-J4-500B4-RJ020 (Note 2)	2 (AWG 14): c	1.25 (AWG 16): a 2 (AWG 14): d	2 (AWG 14): c	3.5 (AWG 12): a
MR-J4-700B4-RJ020 (Note 2)	3.5 (AWG 12) (Note)			5.5 (AWG 10): a

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this chapter.

2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.

Use wires 5) of the following sizes with the power regenerative converter (FR-RC-(H)).

Model	Wire [mm ²]
FR-RC-15K	14 (AWG 6)
FR-RC-30K	14 (AWG 6)
FR-RC-H15K	14 (AWG 6)

(2) Selection example of crimp terminals

Crimp terminal selection examples for the servo amplifier terminal blocks are indicated below.

Symbol	Servo amplifier-side crimp terminals				Manufacturer
	(Note 2) Crimp terminal	Applicable tool			
		Body	Head	Dice	
a	FVD5.5-4	YNT-1210S			JST
b (Note 1)	8-4NS	YHT-8S			
c	FVD2-4	YNT-1614			
d	FVD2-M3				

Note 1. Coat the crimping part with an insulation tube.

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

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision
Jun. 2013	SH(NA)030127-A	First edition

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Country/Region	Sales office	Tel/Fax
USA	Mitsubishi Electric Automation Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, USA	Tel : +1-847-478-2100 Fax : +1-847-478-0327
Germany	Mitsubishi Electric Europe B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
Italy	Mitsubishi Electric Europe B.V. Italian Branch Viale Colleoni 7 1-20041 Agrate Brianza (Milano), Italy	Tel : +39-39-60531 Fax : +39-39-6053312
China	Mitsubishi Electric Automation (China) Ltd. 4F Zhi Fu Plazz, No. 80 Xin Chang Road Shanghai 200003, China	Tel : +86-21-6120-0808 Fax : +86-21-6121-2444
Taiwan	Setsuyo Enterprise Co., Ltd. 6F, No.105 Wu-Kung 3rd Rd, Wu-Ku Hsiang, Taipei Hsine, Taiwan	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	Mitsubishi Electric Automation Korea Co., Ltd. 3F, 1480-6, Gayang-dong, Gangseo-gu, Seoul 157-200, Korea	Tel : +82-2-3660-9552 Fax : +82-2-3664-8372
Singapore	Mitsubishi Electric Asia Pte, Ltd. 307 Alexandra Road #05-01/02, Mitsubishi Electric Building Singapore 159943	Tel : +65-6470-2460 Fax : +65-6476-7439

Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
 - (iii) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
 - (vi) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of responsibility for compensation against loss of opportunity, secondary loss, etc.

Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

- (1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.
- (2) Our General-Purpose AC Servo is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used. We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

MODEL	INSTRUCTIONS FOR HC/HA WITH J4-B-RJ020
MODEL CODE	1CW815

MITSUBISHI ELECTRIC CORPORATION

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