

SANMOTION

AC SERVO SYSTEMS

R

TYPE M

Multi axis type AC servo amplifier

For Rotary Motor, 200/400V AC Input

Instruction Manual

SANYO DENKI

The Third edition (C)

- p. 6-1
 - Deleted control unit model number: RM2C4H0.
 - RoHS directive numbers are added.
 - "EN61000-6-2" has been added to Models with Safe Torque Breaking Function/EMC/EMC Directive/Standard No.
 - Control unit(Safe Torque Off function equipped model)/ EMC/ EMC Directive/ "EN61000-6-2" has been added to the standard number.
 - KC standard number updated.

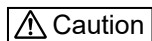
Safety Precautions

Please read this User Manual and its appendix carefully prior to installation, operation, maintenance or inspection and perform all tasks according to the instructions provided here. A good understanding of this equipment, its safety information as well as all Warnings / Cautions is also necessary before using.

Matters that require attention are ranked as “Danger” “Warning” and “Caution” in this document.

■ Warning Symbol

	Denotes immediate hazards that will probably cause severe bodily injury or death as a result of incorrect operation.
	Denotes immediate hazards which will probably cause severe bodily injury or death as a result of incorrect operation.
	Denotes hazards which could cause bodily injury and product or property damage as a result of incorrect operation.



Even those hazards denoted by this symbol could lead to a serious accident. Make sure to strictly follow these safety precautions.

■ Prohibited, Mandatory Symbols

	Indicates actions that must not be allowed to occur / prohibited actions.
	Indicates actions that must be carried out / mandatory actions.

Safety Precautions

■ Attention in use



Warning

- ◆ Do not use this device in explosive environment.
Injury or fire could otherwise result.
- ◆ Do not perform any wiring, maintenance or inspection when the device is hot-wired.
After switching the power off, wait at least 15 minutes before performing these tasks.
Electric shock or damage could otherwise result.
- ◆ The protective ground terminal ($\oplus$) of the power unit should always be grounded to the device or cabinet. The ground terminal of the motor should always be connected to the protective ground terminal ($\oplus$) of the amplifier unit.
Electric shock could otherwise result.
- ◆ Do not touch the inside of the power unit/amplifier unit.
Electric shock could otherwise result.
- ◆ Do not damage the cable, do not apply unreasonable stress to it, do not place heavy items on it, and do not insert it in between objects.
Electric shock could otherwise result.
- ◆ Do not touch the rotating part of the motor during operation.
Bodily injury could otherwise result.

Safety Precautions



Caution

- ◆ Use the power unit, amplifier unit and servo motor together in the specified combination.
Fire or damage to the device could otherwise result.
- ◆ Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on this device.
Electric shock, injury or fire could otherwise result.
- ◆ Do not expose the device to water, corrosive or flammable gases, or any flammable material.
Fire or damage to the device could otherwise result.
- ◆ Be careful of the high temperatures generated by the power unit/amplifier unit/servo motor and the peripherals.
Burn could otherwise result.
- ◆ Do not touch the radiation fin of the power unit/amplifier unit, the regenerative resistor, dynamic brake resistor or the servo motor while the device is powered up, or immediately after switching the power off, as these parts generate excessive heat.
Burn could otherwise result.
- ◆ In terms of designing safety systems using the Safe Torque Off function, personnel who have expertise of relevant safety standard are supposed to do that job with good understanding of this instruction manual.
Injury or damage to the device could otherwise result.
- ◆ Please read the User Manual carefully before installation, operation, maintenance or inspection, and perform these tasks according to the instructions.
Electric shock, injury or fire could otherwise result.
- ◆ Do not use the power unit, amplifier unit or servo motor outside their specifications.
Electric shock, injury or damage to the device could otherwise result.
- ◆ Regenerative resistor has instantaneous capacity. Contact our offices if the instantaneous regenerative power could be high as the result of high-inertia moment or high-velocity rotation.

■ Storage



Prohibited

- ◆ Do not store the device where it could be exposed to rain, water, toxic gases or other liquids.
Damage to the device could otherwise result.

Safety Precautions



Mandatory

- ◆ Store the device where it is not exposed to direct sunlight, and within the specified temperature and humidity ranges {- 20°C to + 65°C, below 90% RH (non-condensing)).
Damage to the device could otherwise result.
- ◆ Please contact our office if the power unit/amplifier unit is to be stored for a period of 3 years or longer. The capacity of the electrolytic capacitors decreases during long-term storage, and could cause damage to the device.
Damage to the device could otherwise result.
- ◆ Please contact our office if the servo motor is to be stored for a period of 3 years or longer.
Confirmations such as bearings and the brakes are necessary.

■ Transportation



Caution

- ◆ When handling or moving this equipment, do not hold the device by the cables, the motor shaft or detector portion.
Damage to the device or bodily injury could otherwise result.
- ◆ Keep in mind that it is dangerous at the time of conveyance if it falls and overturns.
Bodily injury could otherwise result.



Mandatory

- ◆ Follow the directions written on the outside box. Excess stacking could result in collapse.
Bodily injury could otherwise result.
- ◆ Use eyebolt of the motor only for transporting itself. Do not use for transportation of machinery combined with the servo motor.
Damage to the device or bodily injury could otherwise result.

■ Installation



Caution

- ◆ Do not stand on the device or place heavy objects on top of it.
Bodily injury could otherwise result.
- ◆ Make sure the mounting orientation is correct.
Fire or damage to the device could otherwise result.
- ◆ Do not drop this device or subject it to excessive shock of any kind.
Damage to the device could otherwise result.
- ◆ Do not obstruct the air intake and exhaust vents, and keep them free of debris and foreign matter.
Fire could otherwise result.
- ◆ Consult the User Manual regarding the required distance inside the power unit/amplifier unit disposition.
Fire or damage to the device could otherwise result.
- ◆ Open the box only after checking its top and bottom location.
Bodily injury could otherwise result.
- ◆ Verify that the products correspond to the order sheet/packing list.
Injury or damage could result.
- ◆ Take care of falling or overturning of the device during installation.
Use eyebolts of the servo motor if supplied.
Bodily injury could otherwise result.
- ◆ Install the device on a metal or other non-flammable support.
Fire could otherwise result.
- ◆ Make the collision safety device strong enough to resist the maximum output of the system.
Bodily injury could otherwise result.

Safety Precautions

■ Wiring



Caution

- ◆ Wiring connections must be secure.
Bodily injury could otherwise result.
- ◆ Wiring should be completed based on the Wiring Diagram or the User Manual.
Electric shock or fire could otherwise result.
- ◆ Wiring should follow electric equipment technical standards and indoor wiring regulations.
An electrical short or fire could otherwise result.
- ◆ Do not connect a commercial power supply to the U, V or W terminals of the servo motor.
Fire or damage to the device could otherwise result.
- ◆ Install a safety device such as a breaker to prevent external wiring short-circuits.
Fire could otherwise result.
- ◆ Do not bind or band the power cable, input/output signal cable and/or encoder cable together or pass through the same duct or conduit.
This action will cause faulty operation.
- ◆ Must connect a polarity of control power DC24V of power unit/amplifier unit, correctly.
- ◆ Must add the surge absorbing diode if inductive load as relay connect to the control signal output of the amplifier unit. Please take care of polarity of the diode that will be cause of amplifier unit failure.
- ◆ Do not connect DC90V or AC power to the DC24V Brake of the servo motor. Also, do not connect AC400V to the AC200V Fan of the servo motor.
An electrical short or fire could otherwise result.
- ◆ Please design a sequence that included braking delay time because the surge-absorbing component for the relay of holding brake of the servo motor gives braking delay time.
Injury or load falling could otherwise result.



Mandatory

- ◆ Install an external emergency stop circuit that can stop the device and cut off the power instantaneously. Install an external protective circuit to the power unit to cut off the power from the main circuit in the case of an alarm.
Motor runaway, bodily injury, burnout, fire and secondary damages could otherwise result.

■ Operation



Caution

- ◆ Do not perform extensive adjustments to the device as they may result in unstable operation.
Bodily injury could otherwise result.
- ◆ Trial runs should be performed with the motor in a fixed position, separated from the mechanism. After verifying successful operation, install the motor on the mechanism.
Bodily injury could otherwise result.
- ◆ The holding brake is not to be used as a safety stop for the mechanism. Install a safety stop device on the mechanism.
Bodily injury could otherwise result.
- ◆ In the case of an alarm, first remove the cause of the alarm, and then verify safety. Next, reset the alarm and restart the device.
Bodily injury could otherwise result.
- ◆ Check that input power supply voltage is keeping a specification range.
Damage to the device could otherwise result.
- ◆ Avoid getting close to the device, as a momentary power outage could cause it to suddenly restart (although it is designed to be safe even in the case of a sudden restart).
Bodily injury could otherwise result.
- ◆ Do not use power unit/amplifier unit/servo motor which is defective or failed and damaged by fire.
Injury or fire could otherwise result.
- ◆ In the case of any irregular operation, stop the device immediately.
Electric shock, injury or fire could otherwise result.
- ◆ When using the servo motor in vertical axis, provide safety devices to prevent falls during the work that will cause an alarm condition.
Injury or damage could result.

Safety Precautions

Prohibited

- ◆ The built-in brake is intended to secure the motor; do not use it for regular control.
Damage to the brake could otherwise result.
Damage to the device could otherwise result.
- ◆ Keep the motor's encoder cables away from static electricity and high voltage.
Damage to the device could otherwise result.
- ◆ Standard specification servo amplifiers have a dynamic brake resistor. Do not rotate the motor continuously from the outside when the amplifier unit is not powered on, because the dynamic brake resistor will heat up, and can be dangerous.
Fire or burn could otherwise result.
- ◆ Absolutely do not apply voltage more than the spec to the amplifier because overvoltage will be cause of part failure.
Damage to the device or bodily injury could otherwise result.
- ◆ Avoid frequent on and off power supply.
Inner parts might get premature failure in case of repeating ON/OFF of power supply 30 times or more per day, otherwise 5 times or more per hour.

Mandatory

- ◆ Install an external emergency stop circuit that can stop the device and cut off the power instantaneously. Install an external protective circuit to the power unit to cut off the power from the main circuit in the case of an alarm.
Motor runaway, bodily injury, burnout, fire and secondary damages could otherwise result.
- ◆ There is no safeguard on the motor. Use an over-voltage safeguard, short-circuit breaker, overheating safeguard, and emergency stop to ensure safe operation.
Injury or fire could otherwise result.
- ◆ Operate within the specified temperature and humidity range.
Power unit/Amplifier unit
Temperature 0°C to 55°C
Humidity below 90% RH (non-condensing).
Servo Motor
Temperature 0°C to 40°C
Humidity below 90% RH (non-condensing).}
Burnout or damage to the device could otherwise result.

Safety Precautions

■ Maintenance • Inspection



Caution

- ◆ Some parts of the power unit/amplifier unit (electrolytic capacitor, cooling fan, lithium battery for encoder, fuse and relay kinds) can deteriorate with long-term use. Please contact our offices for replacements.
Damage to the device could otherwise result.
- ◆ Do not touch or get close to the terminal while the device is powered up.
Electric shock could otherwise result.
- ◆ Be careful during maintenance and inspection, as the body of the power unit/amplifier unit becomes hot.
Burn could otherwise result.
- ◆ Please contact your distributor or sales office if repairs are necessary.
Disassembly could render the device inoperative.
Damage to the device could otherwise result.



Prohibited

- ◆ Do not overhaul the device.
Fire or electric shock could otherwise result.
- ◆ Do not measure the insulation resistance and the pressure resistance.
Damage to the device could otherwise result.
- ◆ Absolutely do not unplug the connector while the device is powered up because hot plug will give damaged by surge to component.
Electric shock or damage could otherwise result.
- ◆ Do not remove the nameplate cover attached to the device.

■ Disposal



Mandatory

- ◆ If the power unit, amplifier unit or the motor is no longer in use, it should be discarded as industrial waste.

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Preface

In this chapter, Introduction, Instruction manual, Illustration of system components, Model number structure and Part names of power unit/amplifier unit/motor are explained.

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1. Preface

1.1 Introduction

1.1.1 Product overview

Thank you for purchasing "SANMOTION R", 200/400V AC input type multi-axis servo amplifier, RM series. This instruction manual describes important things to notice to ensure your safety, such as specifications, installation, wiring, operation, functions and maintenance of the system. Please make sure to read this instruction manual before use to operate this AC servo system correctly. After reading, please keep it handy to refer as needed.

Multi-axis servo amplifier, RM series has lineup below.

- 200V input type: Five (5) power units (7.8 to 30kW) and six (6) amplifier units (1 to 30kW).
- 400V input type: Two (2) power units (16kW, 37kW) and six (6) amplifier units (550W to 37kW).

This product corresponds to the rotary motor R series and allows using an absolute encoder and incremental encoder as motor encoder.

For control unit, it can connect to 100Mbps high speed fieldbus EtherCAT communication and single axis analog interface. Connectable axes number of control unit against one power unit is 5 axes maximum with EtherCAT communication or 6 axes maximum with single axis analog interface.

1.1.2 Features of SANMOTION R multi-axis servo amplifier RM series

1. High speed fieldbus EtherCAT interface

Smooth motion is realized by control unit with EtherCAT communication which is 100Mbps high speed and high reliability fieldbus.

Single axis analog interface is prepared, also. It is able to share position information of encoder between each axis and perform high accurate correct sync operation so larger output device can drive.

2. Space-saving and flexible system composition

This is multi-axis servo amplifier which has construction of connecting single power unit and multiple amplifier units.

It can select power unit and amplifier unit according to control unit and motor capacity in use, and combine them. Flexible arrangement according to application, and space-saving are available.

3. Energy-saving

Regenerative power from motor is able to use as power for another axis motor.
It contributes to energy-saving of application.

1.1.3 Cautions for replacement from "QF series"

In case of replacing QF series to 400V AC input type RM series, pay attention below.

- Outline dimensions of power unit/amplifier unit are different from QF series.
Refer the section "6.8 Power unit/Amplifier unit dimensions".
- Specifications of input power is different from QF series.
Refer the section "2.3 Power unit/Amplifier".

1.2 Instruction manual

This manual outlines the specifications, installation, wiring, operations, functions, maintenance, etc. of the AC servo amplifier “SANMOTION R”, 200/400V AC input type multi-axis servo amplifier, RM series as below.

As note, specifications, wirings selections, outline drawings and option etc are different according to input voltage spec. Refer each description seen [200V input](#) and [400V input](#) for detail.

1.2.1 Contents

- Chapter 1 Preface
Describes product outline, model number, names of components
- Chapter 2 Specifications
Describes detailed specifications for Servo Motor, Motor Encoder, Power Unit and Amplifier Unit.
- Chapter 3 Installation
Describes product installation procedure
- Chapter 4 Wiring
Describes how to wire the products
- Chapter 5 Selection
Describes selection method for the servo motor/regenerative resistor capacity
- Chapter 6 Appendix
Describes international standards, servo motor data sheets, dimensions and options

Note) For Operation, Maintenance and Digital operator etc., refer another instruction manuals of each control unit.

- EtherCAT communication 4 axes-in-one control unit (Model number RM2C4H) : M0010515
- Analog interface single axis control unit (Model number RM2C1A0) : M0012086
- EtherCAT communication 1 axis control unit (Model number: RM3C1H) : M0011953

1.2.2 Precautions related to these instructions

In order to fully understand the functions of this product, please read this instruction manual thoroughly before using the product. After thoroughly reading the manual, keep it handy for reference.

Carefully and completely follow the safety instructions outlined in this manual.

Note that safety is not guaranteed for usage methods other than those specified in this manual or those methods intended for the original product.

Permission is granted to reproduce or omit a portion of the attached figures (as abstracts) for use.

The contents of this manual may be modified without prior notice as revisions or additions are created regarding the usage method of the product. Modifications are performed as per the revisions of this manual.

Although the manufacturer has taken all possible measures to ensure the veracity of the contents of this manual, should you notice any error or omission, please notify the nearest branch office or head office written in back cover.

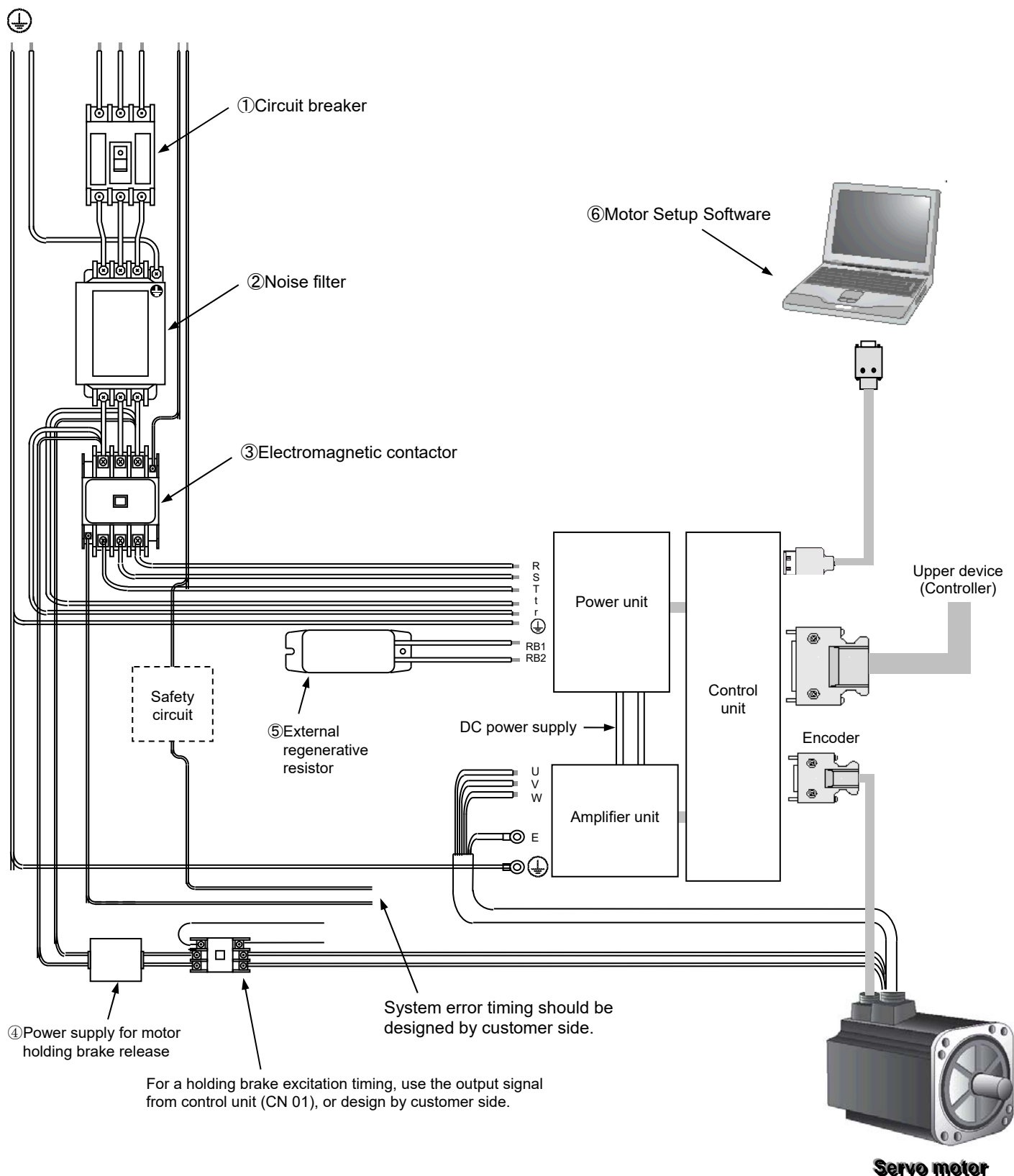
Moreover, original text of this instruction manual is Japanese. Original text writing has priority if there is difference between original text and the other language writing.

1. Preface

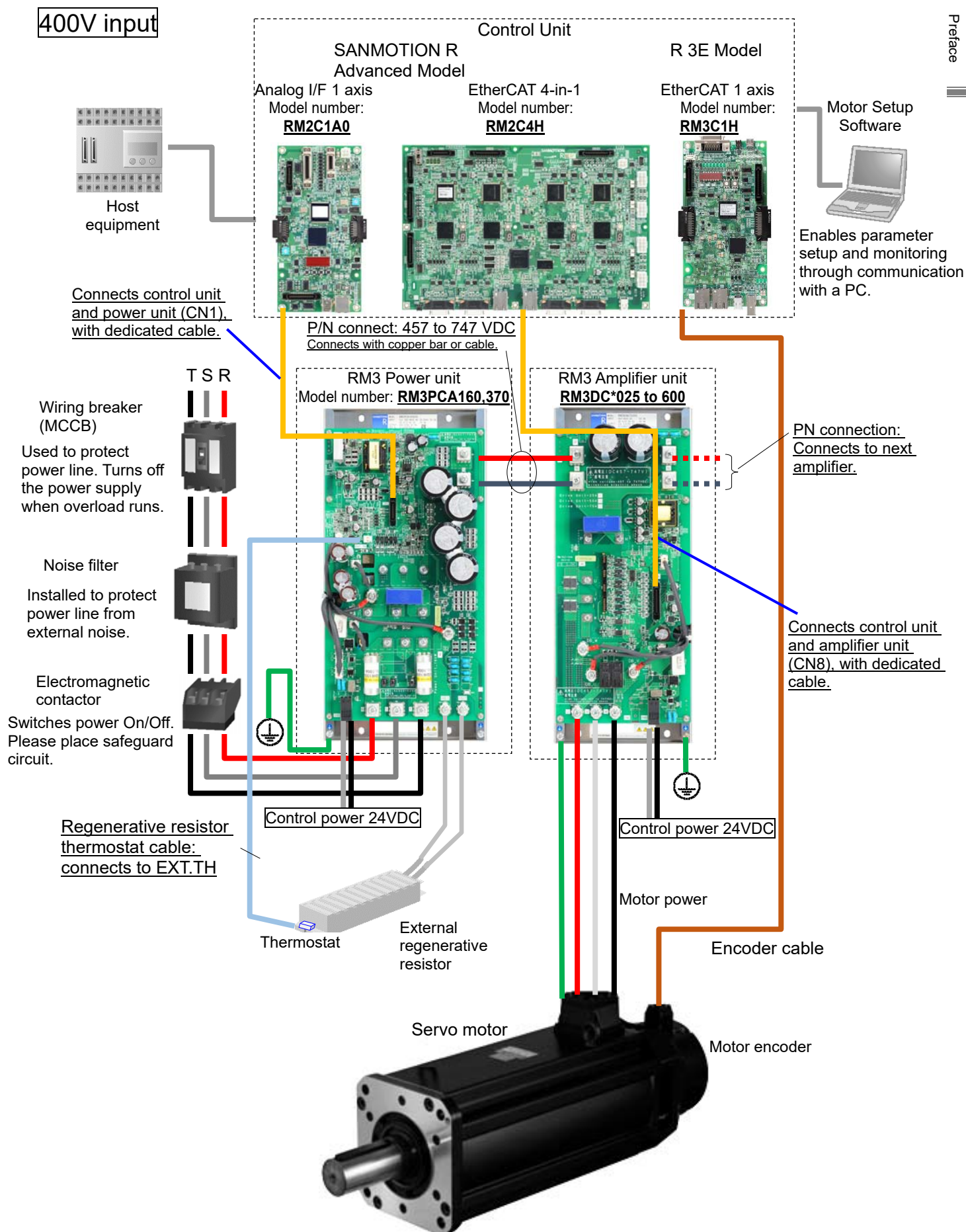
1.3 Illustration of system components

200V input

3 ϕ , 200 to 230V AC +10 to -15%, 50/60Hz



1.3 Illustration of system components

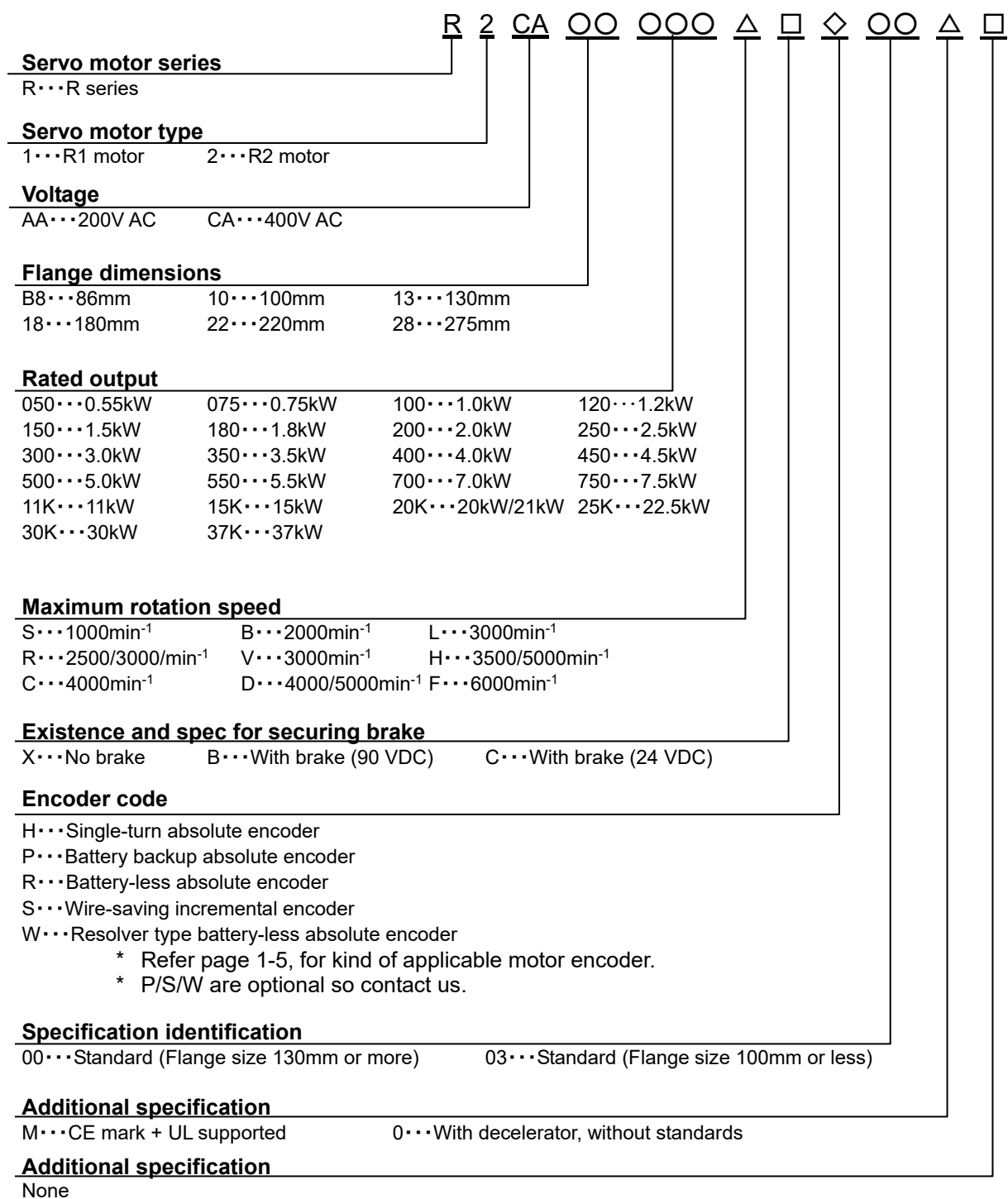


1. Preface

1.4 Model number structure

1.4.1 Servo Motor Model Number

■ R motor



1.4 Model number structure

◆ Absolute encoder (Standard)

Name (Code)	Motor model number Encoder code	Resolution per rotation	Multi turn amount	Transfer method
Single-turn absolute encoder (PA035S)	H	131,072 (17bit)	—	Half-duplex asynchronous 2.5Mbps
Battery backup absolute encoder (PA035C)	P	131,072 (17bit)	65,536 (16bit)	Half-duplex asynchronous 2.5Mbps
Battery-less absolute encoder (HA035)	R	131,072 (17bit)	65,536 (16bit)	Half-duplex asynchronous 2.5Mbps
Resolver type battery-less absolute encoder (RA035C)	W	131,072 (17bit)	65,536 (16bit)	Half-duplex asynchronous 2.5Mbps

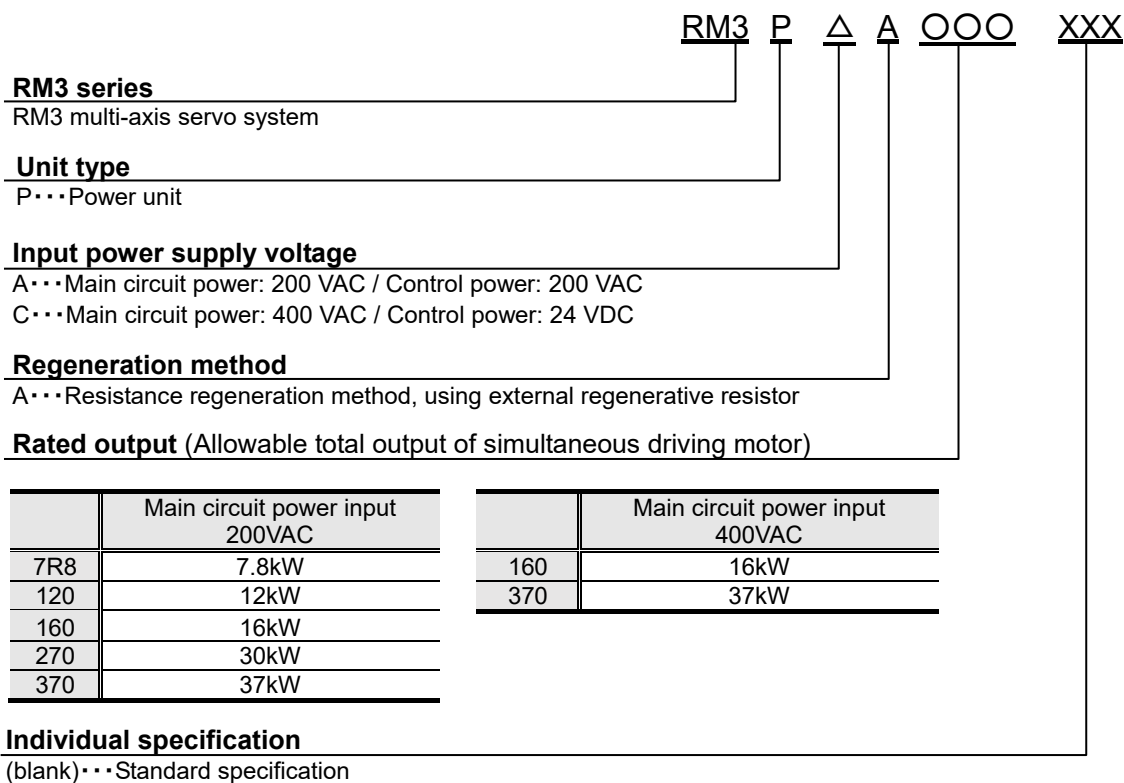
* Please contact us for the motor model number with the other encoder except above.

◆ Incremental encoder (Standard)

Name (Code)	Motor model number Encoder code	Division number (Number of pulse)
Wire-saving incremental encoder (PP031T, PP062)	S	8,000 (2,000P/R)

* Please contact us for the motor model number with the other encoder except above.

1.4.2 Power Unit Model Number



* Model numbers above are standard spec. Model number which is not listed spec in this manual will differ. Please contact us for the detail.

1. Preface

1.4.3 Amplifier Unit Model Number

RM3 series

RM3 multi-axis servo system

Unit type

D...Amplifier unit

Input power supply voltage

A...Main circuit power: 280 VDC / Control power:280 VDC

C...Main circuit power: 560 VDC / Control power: 24 VDC

Dynamic Brake (DB) specification

A...Built-in DB B...Without DB

Servo amplifier capacity

	Main circuit power input 280V DC		Main circuit power input 560V DC
050	50A	025	25A
100	100A	050	50A
150	150A	075	75A
300	300A	150	150A
600	600A	300	300A
900	900A	600	600A

* Refer page 1-9 for servo amplifier capacity and combination motor.

Individual specification

(blank)...Standard specification

* Model numbers above are standard spec. Model number which is not listed spec in this manual will differ. Please contact us for the detail.

■ Amplifier capacity (Amplifier unit model number) and Combination motor

200V input

Amplifier capacity (Amplifier unit model number)	Servo motor model number
50A (RM3DAA050)	R1AA10100F
	R1AA10150F
	R1AA10200H
	R1AA10250H
	R2AAB8075F
	R2AAB8100F
	R2AA10100F
	R2AA13120D
	R2AA13120L
	R2AA13180H
100A (RM3DAA100)	R2AA13200L
	R1AA13300F
	R1AA13400H
	R1AA13500H
	R2AA13180D
	R2AA13200D
	R2AA18350L
150A (RM3DAA150)	R1AA13400F
	R1AA13500F
	R2AA18350D
	R2AA18450H
	R2AA18550R
	R2AA22500L
	R2AA22700S

1.4 Model number structure

200V input

Amplifier capacity (Amplifier unit model number)	Servo motor model number
300A (RM3DAA300)	R1AA18550H
	R1AA18750L
	R1AA1811KR
	R1AA1815KB
	R2AA18550H
	R2AA18750H
	R2AA1811KR
	R2AA2211KB
	R2AA2215KB
600A (RM3DAB600)	R1AA2220KV
	R2AA2220KB
	R2AA2830KV
900A (RM3DAB900)	R2AA2837KB

400V input

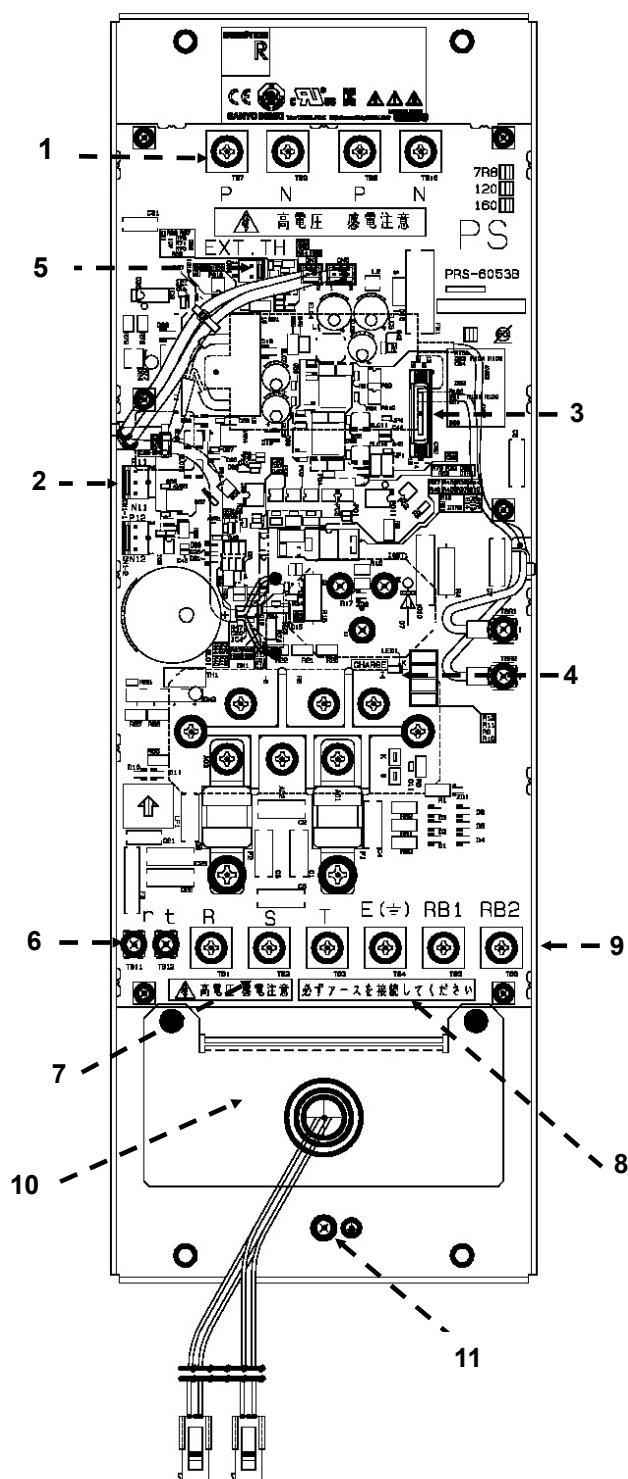
Amplifier capacity (Amplifier unit model number)	Servo motor model number
25A (RM3DCA025)	R1CA10150V
	R2CA10075F
	R2CA13050D
	R2CA13120R
	R2CA13180H
	R2CA13200L
50A (RM3DCA050)	R1CA10200V
	R1CA13300V
	R2CA10100F
	R2CA13120F
	R2CA13180D
	R2CA13200H
75A (RM3DCA075)	R2CA18350L
	R2CA18350C
	R2CA18450H
150A (RM3DCA150)	R2CA18550V
	R1CA18550H
	R1CA18750L
	R1CA1811KR
	R1CA1815KB
	R2CA18550H
	R2CA18750H
	R2CA2211KB
	R2CA2215KV
300A (RM3DCB300)	R1CA2220KV
	R2CA2220KV
	R2CA2830KV
600A (RM3DCB600)	R2CA2837KB

1. Preface

1.5 Part names

200V input

1.5.1 Power unit (RM3PAA7R8 to 160)



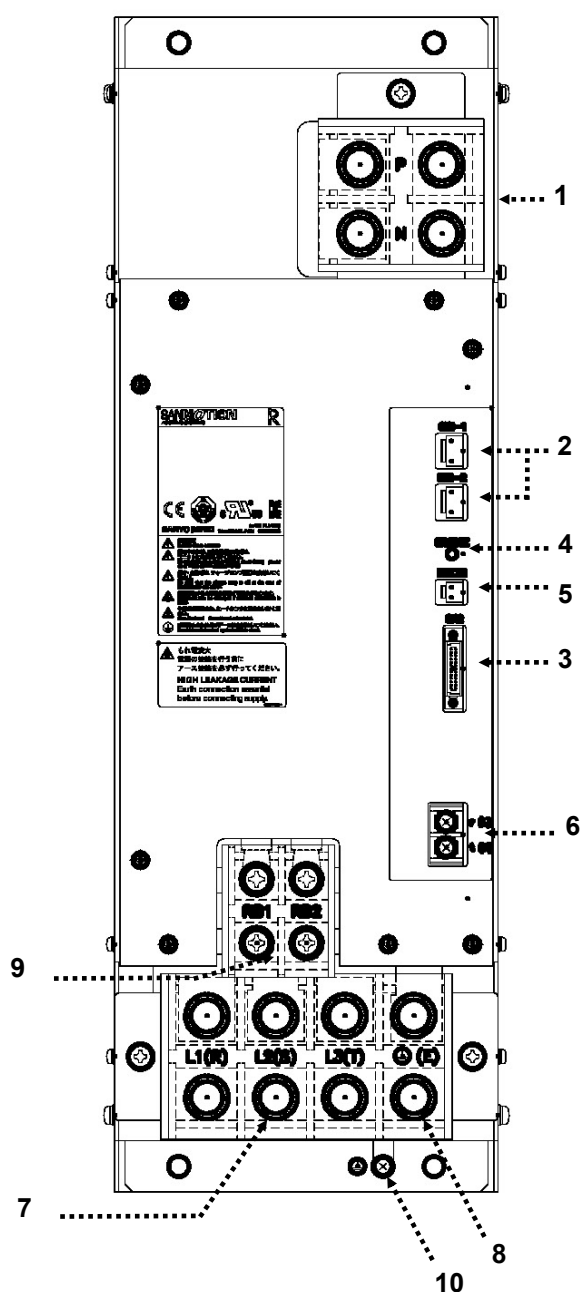
No.	Name/ Use
1	Terminal P, N...282 to 326V DC Main circuit power output terminal Provides main circuit power to amplifier unit.
2	CN1-1, CN1-2 Terminals for outputting control power Provides control power to amplifier unit.
3	Connector for control unit connection (CN2) Connects interface connector of control unit.
4	CHARGE LED (Red) Lighting on when 282 to 326V DC is output. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
5	EXT.TH External thermal sensor connector. It connects to thermal sensor in regenerative resistor, etc. Alarm detects when contact become open.
6	Terminal r, t...200 to 230V AC Connects control power source.
7	Terminal R, S, T...200 to 230V AC Connects main circuit power source.
8	Grounding terminal Connects with power source ground.
9	Terminal RB1, RB2 Connects regenerative resistor.
10	Fan motor power...24V DC Provides fan motor power.
11	Unit grounding terminal Connects to protective ground of 1st axis amplifier unit.

※ This product is open frame type so do not touch unit parts while power supplied (LED 1 to 3 lighting). There is a risk of electric shock or failure. To pick up a unit, grip a sheet metal part.

1.5 Part names

200V input

1.5.2 Power unit (RM3PAA270, RM3PAA370)



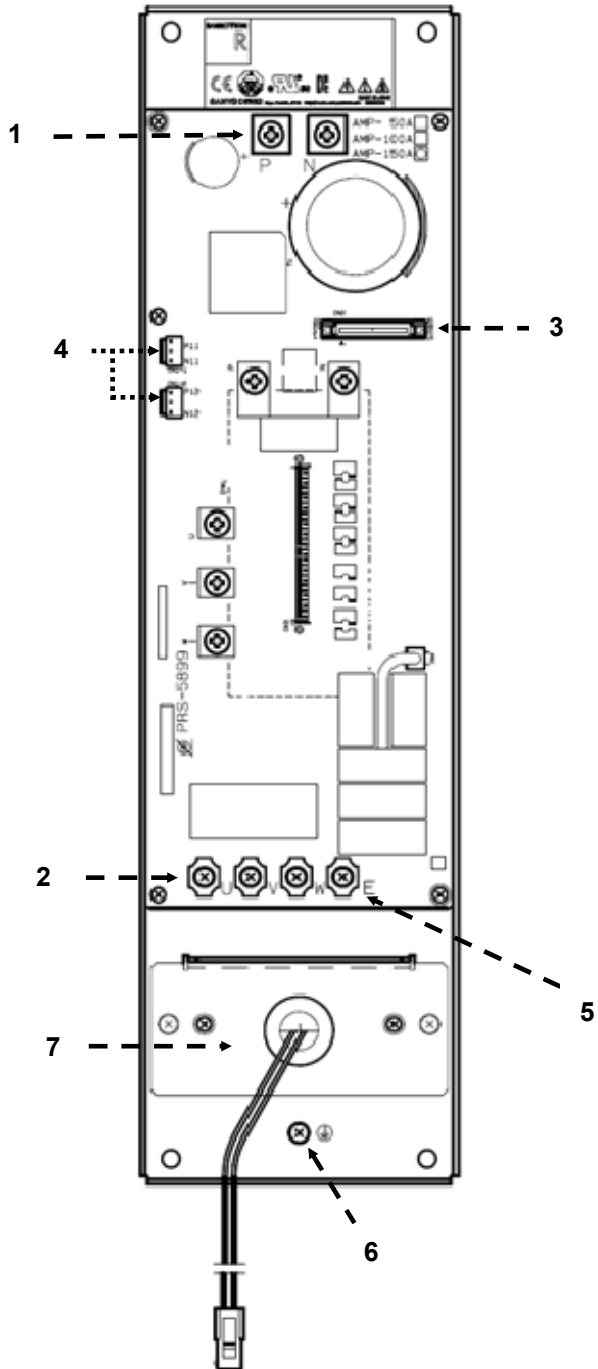
No.	Name/ Use
1	Terminal P, N...282 to 326V DC Main circuit power output terminal Provides main circuit power to amplifier unit.
2	CN1-1, CN1-2 Terminals for outputting control power Provides control power to amplifier unit.
3	Connector for control unit connection (CN2) Connects interface connector of control unit.
4	CHARGE LED (Red) Lighting on when 282 to 326V DC is output. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
5	EXT.TH External thermal sensor connector. It connects to thermal sensor in regenerative resistor, etc. Alarm detects when contact become open.
6	Terminal r, t...200 to 230V AC Connects control power source.
7	Terminal R, S, T...200 to 230V AC Connects main circuit power source.
8	Grounding terminal Connects with power source ground.
9	Terminal RB1, RB2 Connects regenerative resistor.
10	Unit grounding terminal Connects to protective ground of 1st axis amplifier unit.

※ Do not touch unit parts while power supplied.
(CHARGE LED lighting)
There is a risk of electric shock or failure.

1. Preface

200V input

1.5.3 Amplifier unit (RM3DAA050 to 150)



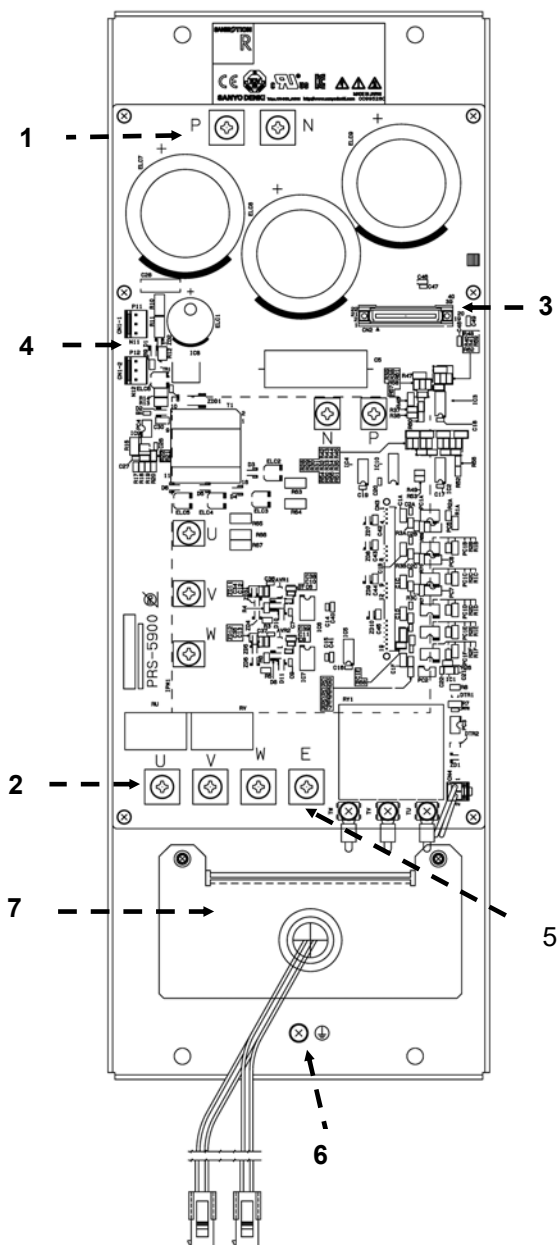
No.	Name/ Use
1	Terminal P, N···282 to 326V DC Main circuit power input/output terminal Inputs main circuit power provided from power unit. And provides main circuit power to amplifier unit.
2	Terminal U, V, W···Connects motor power line by cable.
3	Connector for control unit connection (CN2) Connects interface connector of control unit.
4	CN1-1, CN1-2 Terminals for inputting control power Inputs a control power provided from power unit. And transfers a control power to another amplifier unit.
5	Grounding terminal Connects with motor ground.
6	Protection grounding terminal Connects with power source ground. Protective ground terminal Connects to power ground, next unit protective ground terminals and unit grounding terminals.
7	Fan motor power···24V DC Provides fan motor power. (RM3DAA050 is not equipped.)

- ※ This product is open frame type so do not touch unit parts while power supplied (CHARGE LED of power unit lighting).
There is a risk of electric shock or failure.
To pick up a unit, grip a sheet metal part.

1.5 Part names

200V input

1.5.4 Amplifier unit (RM3DAA300)



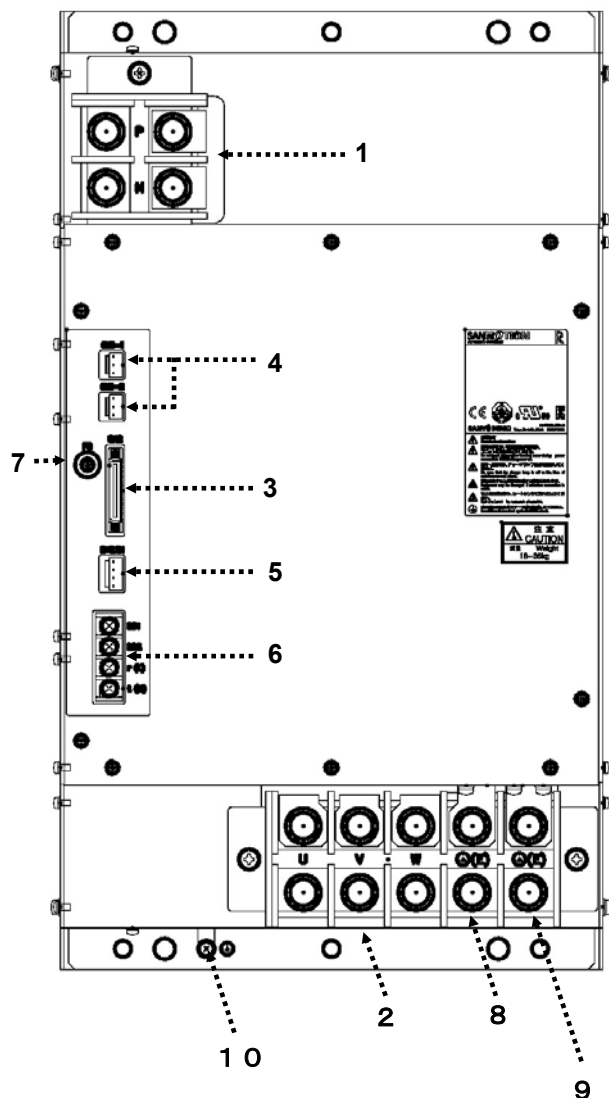
No.	Name/ Use
1	Terminal P, N...282 to 326V DC Main circuit power input/output terminal Inputs main circuit power provided from power unit. And provides main circuit power to amplifier unit.
2	Terminal U, V, W...Connects motor power line by cable.
3	Connector for control unit connection (CN2) Connects interface connector of control unit.
4	CN1-1, CN1-2 Terminals for inputting control power Inputs control power from power/amplifier unit.
5	Grounding terminal Connects with motor ground.
6	Protection grounding terminal Connects with power source ground. Protective ground terminal Connects to power ground, next unit protective ground terminals and unit grounding terminals.
7	Fan motor power...24V DC Provides fan motor power.

※ This product is open frame type so do not touch unit parts while power supplied (CHARGE LED of power unit lighting).
There is a risk of electric shock or failure.
To pick up a unit, grip a sheet metal part.

1. Preface

200V input

1.5.5 Amplifier unit (RM3DAB600, RM3DAB900)



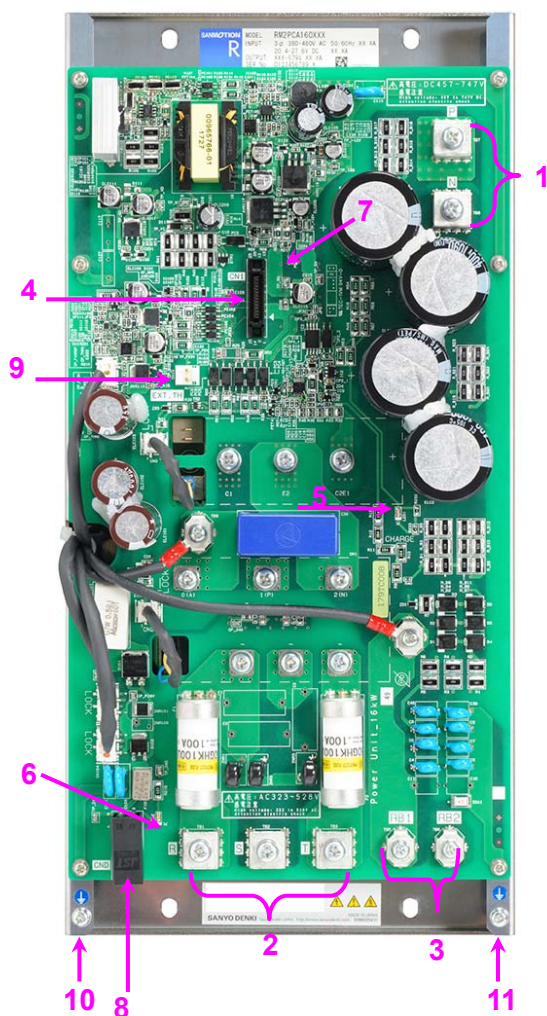
No.	Name/ Use
1	Terminal P, N...282 to 326V DC Main circuit power input/output terminal Inputs main circuit power provided from power unit. And provides main circuit power to amplifier unit.
2	Terminal U, V, W...Connects motor power line by cable.
3	Connector for control unit connection (CN2) Connects interface connector of control unit.
4	CN1-1, CN1-2 Terminals for inputting control power Inputs control power from power/amplifier unit.
5	EXT.TH Connector for thermal sensor of dynamic brake resistor or servo motor cooling fan. It should be short circuit if thermal sensor is not used.
6	DB1, DB2, r, t DB1 and DB2 are terminal of dynamic brake contact output. r and t are terminal of built-in cooling fan power. It should be connected to single-phase, 200 to 230 V AC.
7	FG Terminal for ground line of CN2 connection cable.
8	Grounding terminal Connects with motor ground.
9	Protection grounding terminal Connects with power source ground.
10	Unit grounding terminal Connects to next unit protective ground terminals and unit grounding terminals.

※ Do not touch unit parts while power supplied.

1.5 Part names

400V input

1.5.6 Power Unit (RM3PCA160)



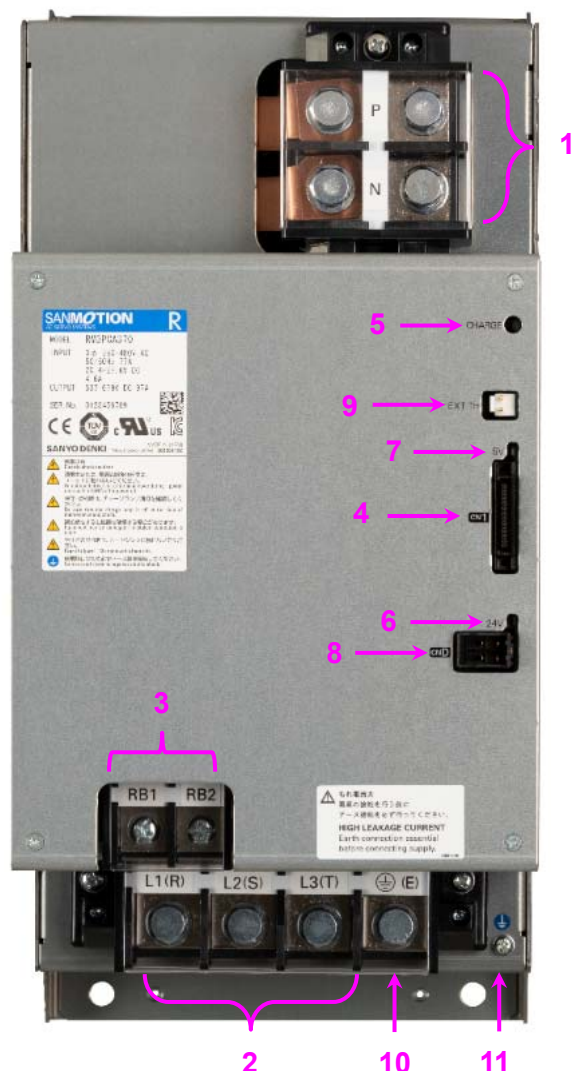
No.	Name/ Use
1	Terminal P, N...457 to 747V DC Main circuit power output terminal Provides main circuit power to amplifier unit.
2	Terminal R,S,T...380 to 480V AC Connects main circuit power source.
3	Terminal RB1, RB2 Connects regenerative resistor.
4	Connector for control unit connection (CN1) Connects interface connector of control unit.
5	Charge LED...LED1 (Red) Lighting on when 457 to 747V DC is output. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
6	24V LED...LED2 (Green) Lighting on when 24V DC is provided.
7	5V LED...LED3 (Blue) Lighting on when 5V DC is output.
8	Control power connector (CND) Connects 24V DC as control power.
9	EXT.TH (CN10) External thermal sensor connector. It connects to thermal sensor in regenerative resistor, etc. Alarm detects when contact become open.
10	Protection grounding terminal Connects with power source ground.
11	Unit grounding terminal Connects to protective ground of 1st axis amplifier unit.

※ It may not have some parts depending on a spec.
This product is open frame type so do not touch unit parts while power supplied (LED 1 to 3 lighting).
There is a risk of electric shock or failure.
To pick up a unit, grip a sheet metal part.

1. Preface

400V input

1.5.7 Amplifier Unit (RM3PCA370)



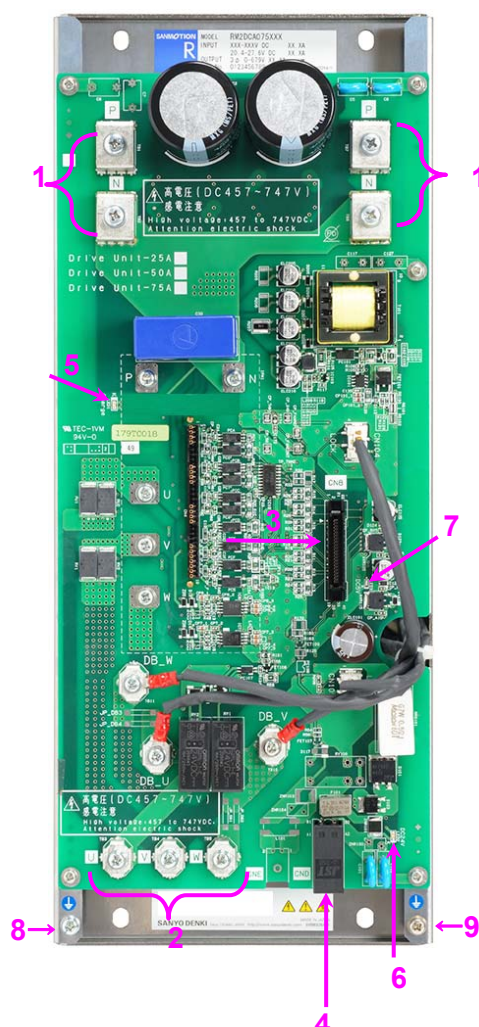
No.	Name/ Use
1	Terminal P, N...457 to 747V DC Main circuit power input/output terminal Provides main circuit power to amplifier unit.
2	Terminal R, S, T...380 to 480V AC Provides motor power to motor with cable.
3	Terminal RB1, RB2 Connects regenerative resistor.
4	Connector for control unit connection (CN1) Connects interface connector of control unit.
5	Charge LED...LED1 (Red) Lighting on when 457 to 747V DC is output. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
6	24V LED...LED2 (Green) Lighting on when 24V DC is provided.
7	5V LED...LED3 (Blue) Lighting on when 5V DC is output.
8	Control power connector (CND) Connects 24V DC as control power.
9	EXT.TH External thermal sensor connector. It connects to thermal sensor in regenerative resistor, etc. Alarm detects when contact become open.
10	Protection grounding terminal Connects with power source ground.
11	Unit grounding terminal Connects to next unit protective ground terminals and unit grounding terminals.

※ Do not touch unit parts while power supplied.
(CHARGE LED lighting)
There is a risk of electric shock or failure.

1.5 Part names

400V input

1.5.8 Amplifier Unit (RM3DCA025 to 075)



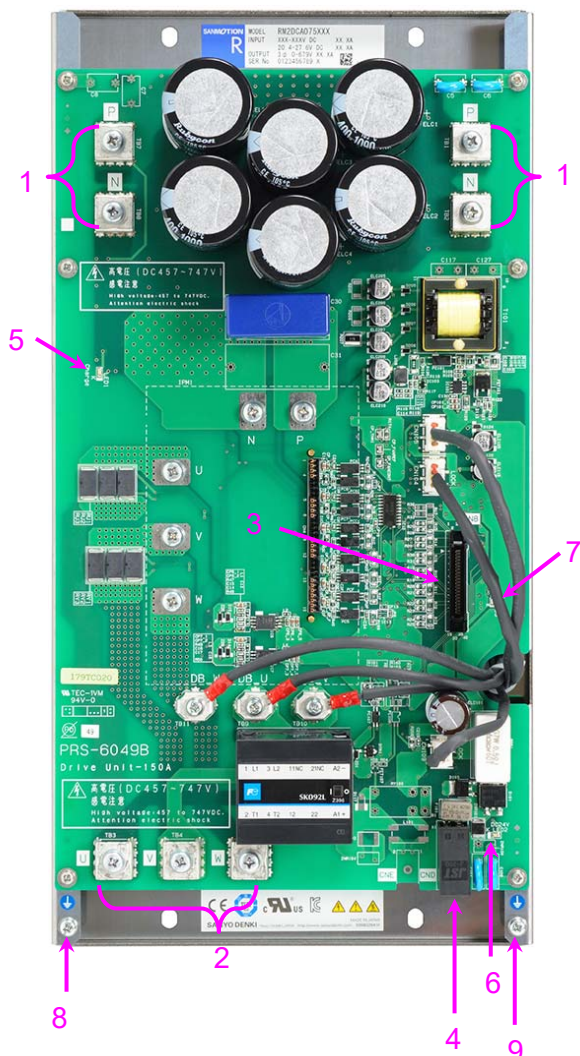
No.	Name/ Use
1	Terminal P, N...457 to 747V DC Main circuit power input/output terminal Inputs main circuit power from power unit. And transfers main circuit power to next amplifier unit.
2	Terminal U, V, W Provides motor power to motor with cable.
3	Connector for control unit connection (CN8) Connects interface connector of control unit.
4	Control power connector (CND) Connects 24V DC as control power.
5	Charge LED...LED1 (Red) Lighting on when 457 to 747V DC is input. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
6	24V LED...LED2 (Green) Lighting on when 24V DC is provided.
7	5V LED...LED3 (Blue) Lighting on when 5V DC is provided via CN8.
8	Grounding terminal Connects with motor ground.
9	Protection grounding terminal Connects with power source ground. Protective ground terminal Connects to power ground, next unit protective ground terminals and unit grounding terminals.

※ It may not have some parts depending on a spec.
This product is open frame type so do not touch unit parts while power supplied (LED 1 to 3 lighting).
There is a risk of electric shock or failure.
To pick up a unit, grip a sheet metal part.

1. Preface

400V input

1.5.9 Amplifier Unit (RM3DCA150)



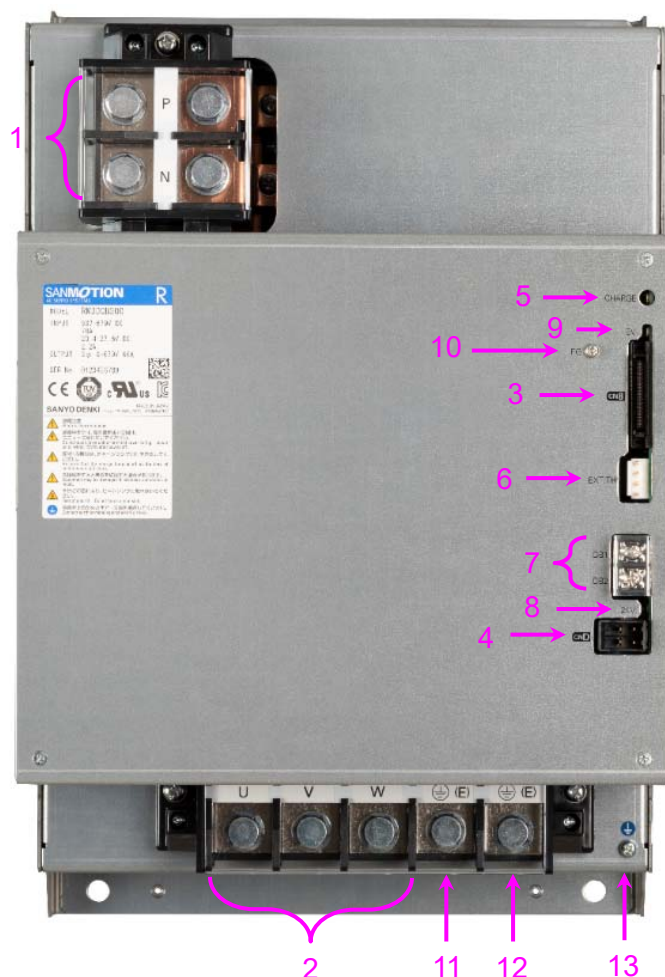
No.	Name/ Use
1	Terminal P, N...457 to 747V DC Main circuit power input/output terminal Inputs main circuit power from power unit. And transfers main circuit power to next amplifier unit.
2	Terminal U, V, W Provides motor power to motor with cable.
3	Connector for control unit connection (CN8) Connects interface connector of control unit.
4	Control power connector (CND) Connects 24V DC as control power.
5	Charge LED...LED1 (Red) Lighting on when 457 to 747V DC is input. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
6	24V LED...LED2 (Green) Lighting on when 24V DC is provided.
7	5V LED...LED3 (Blue) Lighting on when 5V DC is provided via CN8.
8	Grounding terminal Connects with motor ground.
9	Protection grounding terminal Connects with power source ground. Protective ground terminal Connects to power ground, next unit protective ground terminals and unit grounding terminals.

※ It may not have some parts depending on a spec.
This product is open frame type so do not touch unit parts while power supplied (LED 1 to 3 lighting).
There is a risk of electric shock or failure.
To pick up a unit, grip a sheet metal part.

1.5 Part names

400V input

1.5.10 Amplifier Unit (RM3DCB300, RM3DCB600)



No.	Name/ Use
1	Terminal P, N...457 to 747V DC Main circuit power input/output terminal Inputs main circuit power from power unit. And transfers main circuit power to next amplifier unit.
2	Terminal U, V, W Provides motor power to motor with cable.
3	Connector for control unit connection (CN8) Connects interface connector of control unit.
4	Control power connector (CND) Connects 24V DC as control power.
5	Charge LED...LED1 (Red) Lighting on when 457 to 747V DC is input. Continues lighting during internal capacitor has charge, even if main circuit power source turns to OFF. Do not touch power terminal during lighting. There is a risk of electric shock.
6	EXT.TH Connector for thermal sensor of dynamic brake resistor or servo motor cooling fan. It should be short circuit if thermal sensor is not used.
7	DB1, DB2 DB1 and DB2 are terminal of dynamic brake contact output.
8	24V LED...LED2 (Green) Lighting on when 24V DC is provided.
9	5V LED...LED3 (Blue) Lighting on when 5V DC is provided via CN8.
10	FG Terminal for ground line of CN8 connection cable.
11	Grounding terminal Connects with motor ground.
12	Protection grounding terminal Connects with power source ground.
13	Unit grounding terminal Connects to next unit protective ground terminals and unit grounding terminals.

※ Do not touch unit parts while power supplied.
(CHARGE LED of power unit lighting)
There is a risk of electric shock or failure.

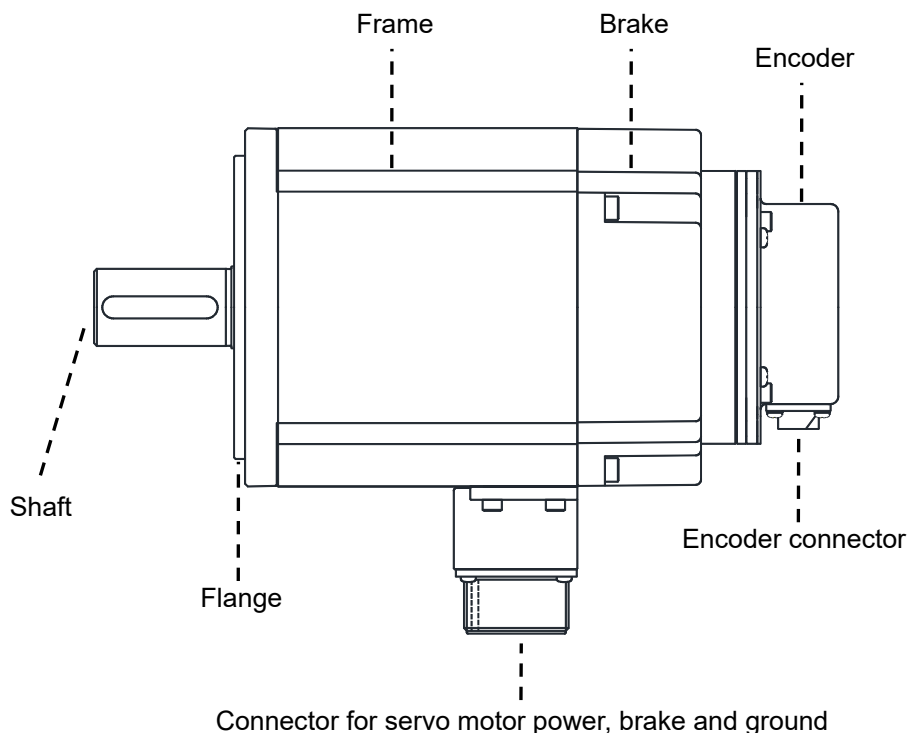
1. Preface

1.5.9 Servo motor

200V input

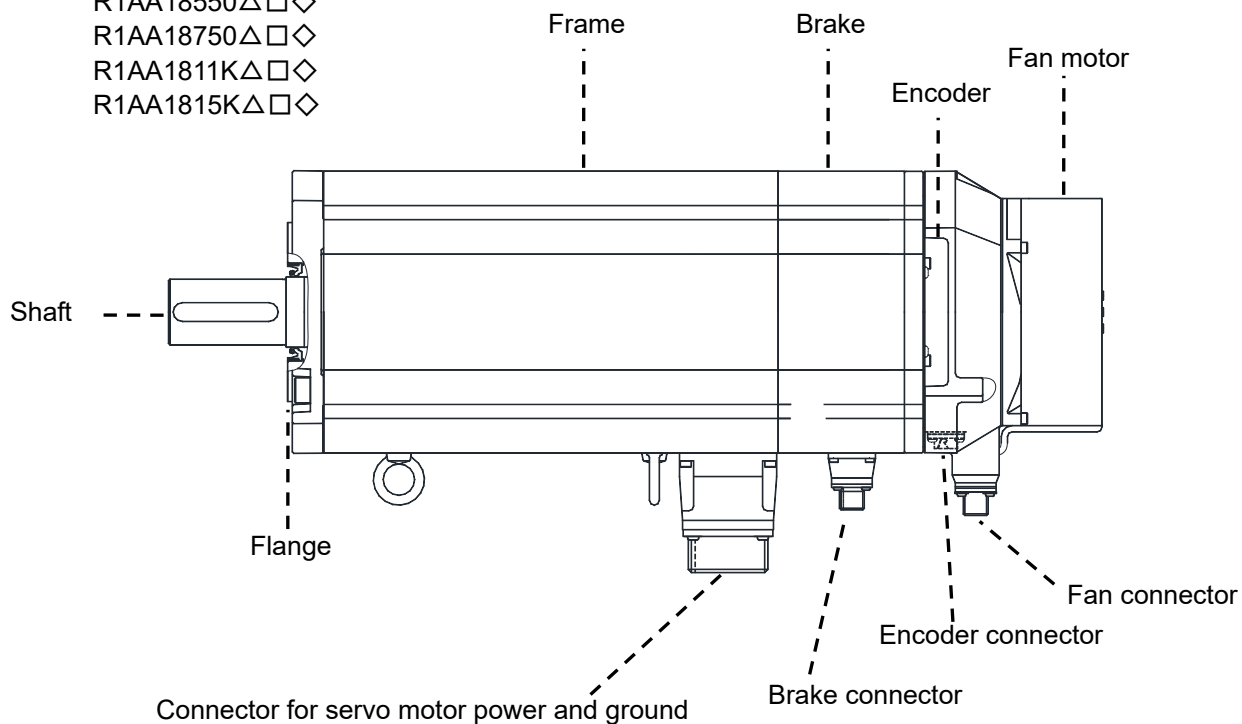
- R1 servo motor 100mm sq. 1.0 to 2.5kW, 130mm sq. 3 to 5kW,
R2 servo motor 130mm sq. 1.2k to 2kW, 180mm sq. 3.5 to 5.5kW (R-winding)

R1AA10100△□◇
R1AA10150△□◇
R1AA10200△□◇
R1AA10250△□◇
R1AA13300△□◇
R1AA13400△□◇
R1AA13500△□◇
R2AA13120△□◇
R2AA13180△□◇
R2AA13200△□◇
R2AA18350△□◇
R2AA18450△□◇
R2AA18550R□◇



- R1 servo motor 180mm sq. 5.5 to 15kW

R1AA18550△□◇
R1AA18750△□◇
R1AA1811K△□◇
R1AA1815K△□◇

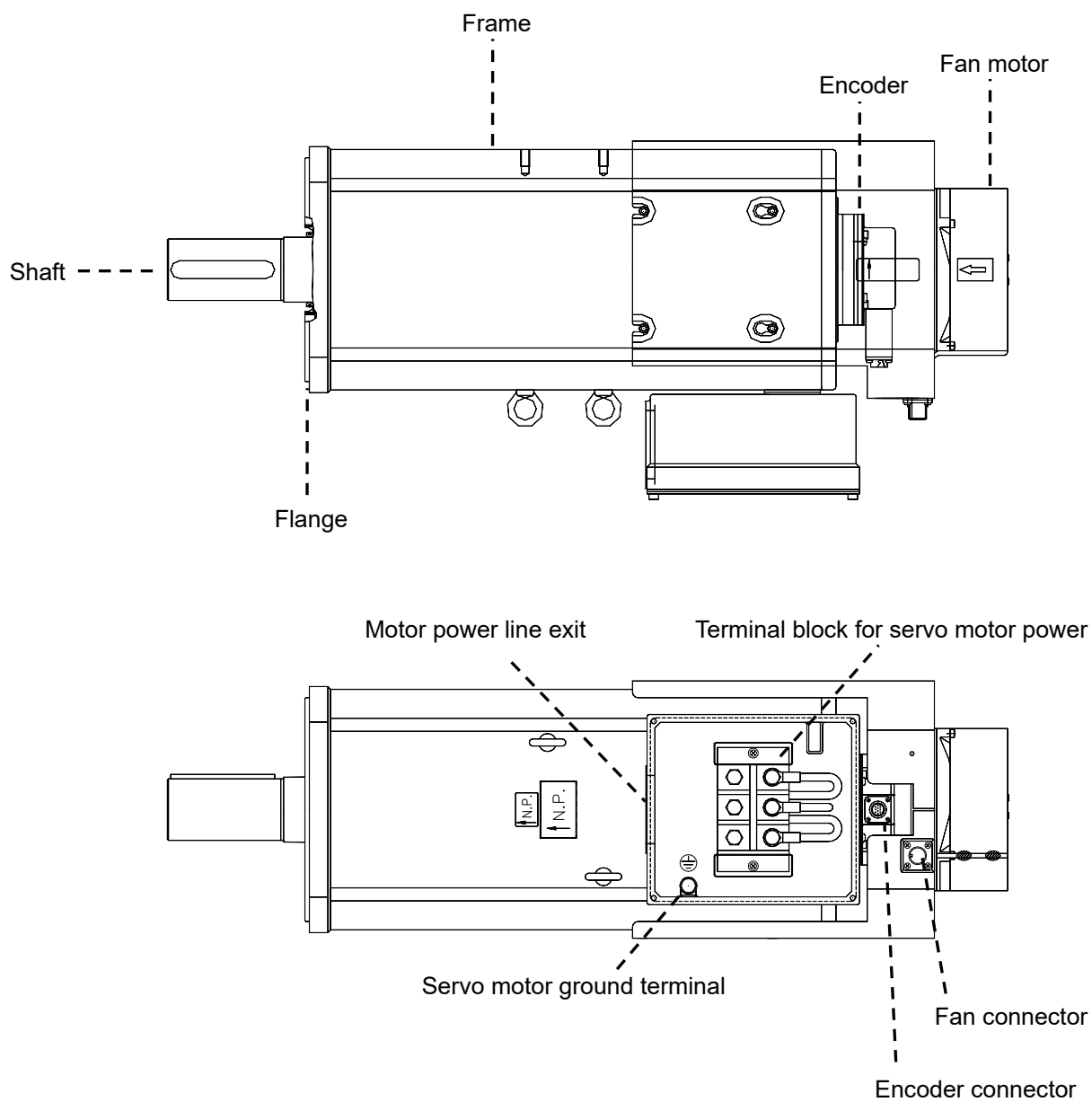


1.5 Part names

200V input

- R1 servo motor 220mm sq. 21kW

R1AA2220K△X◇



1. Preface

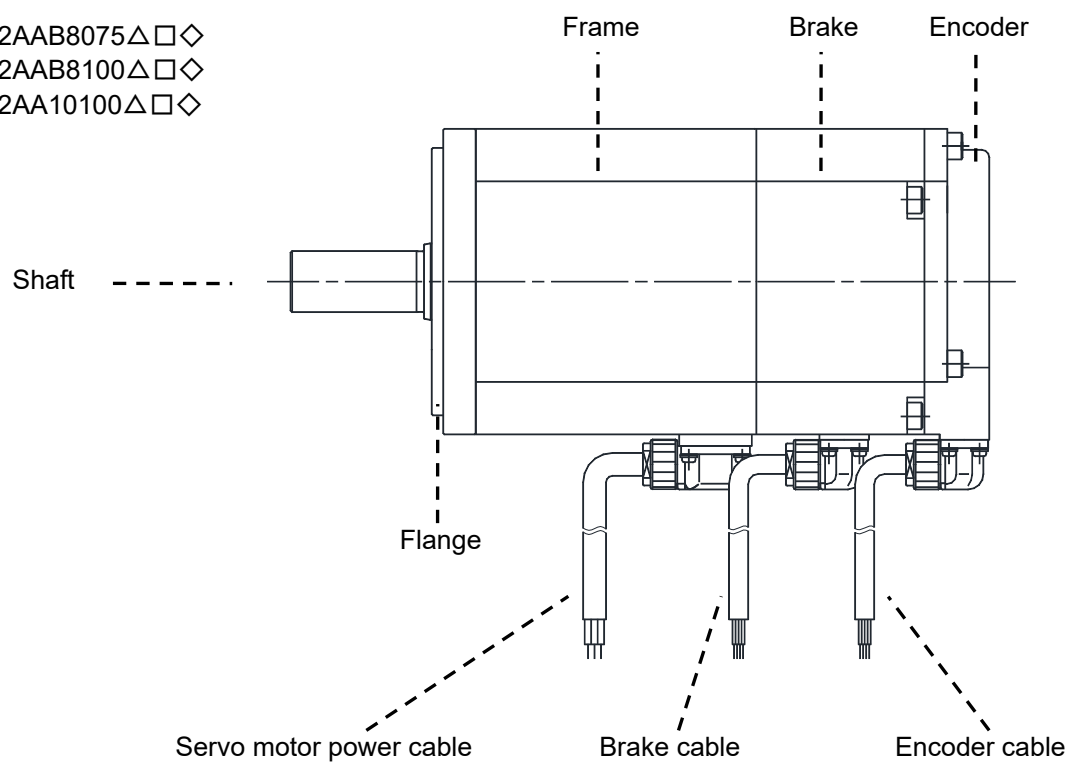
200V input

- R2 servo motor 80mm sq. 0.75kW to 1.0kW, 100mm sq. 1.0kW

R2AAB8075△□◇

R2AAB8100△□◇

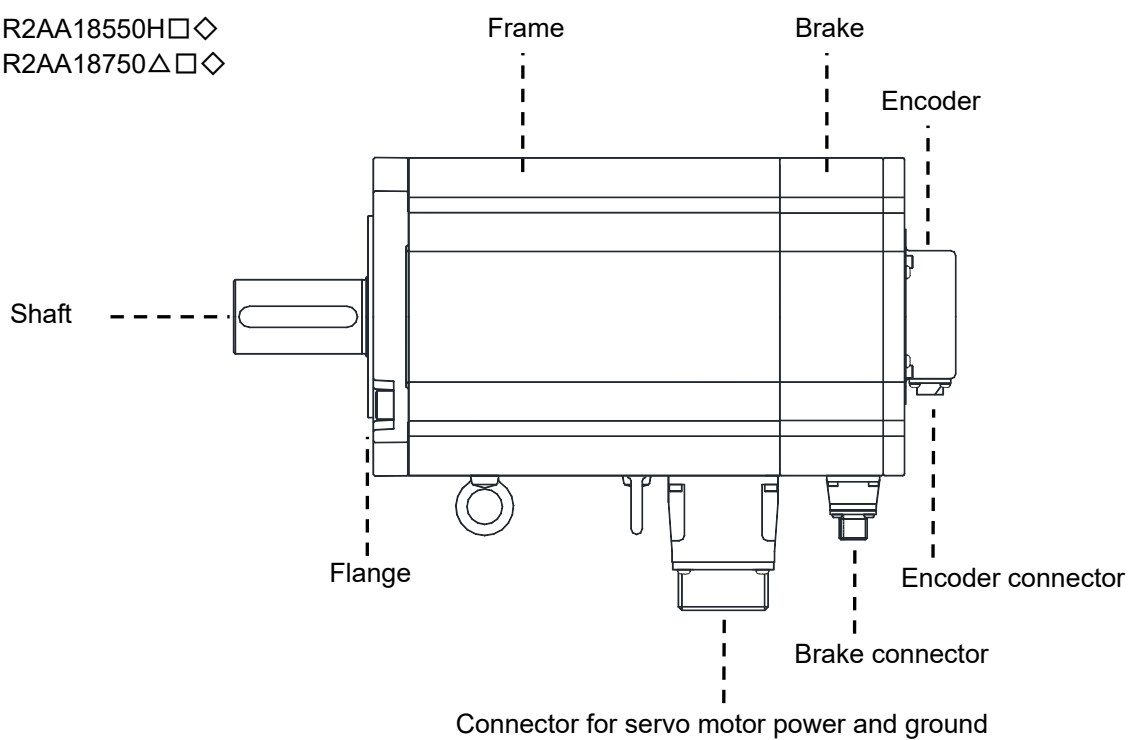
R2AA10100△□◇



- R2 servo motor 180mm sq. 5.5 (H-winding) to 7.5kW

R2AA18550H□◇

R2AA18750△□◇

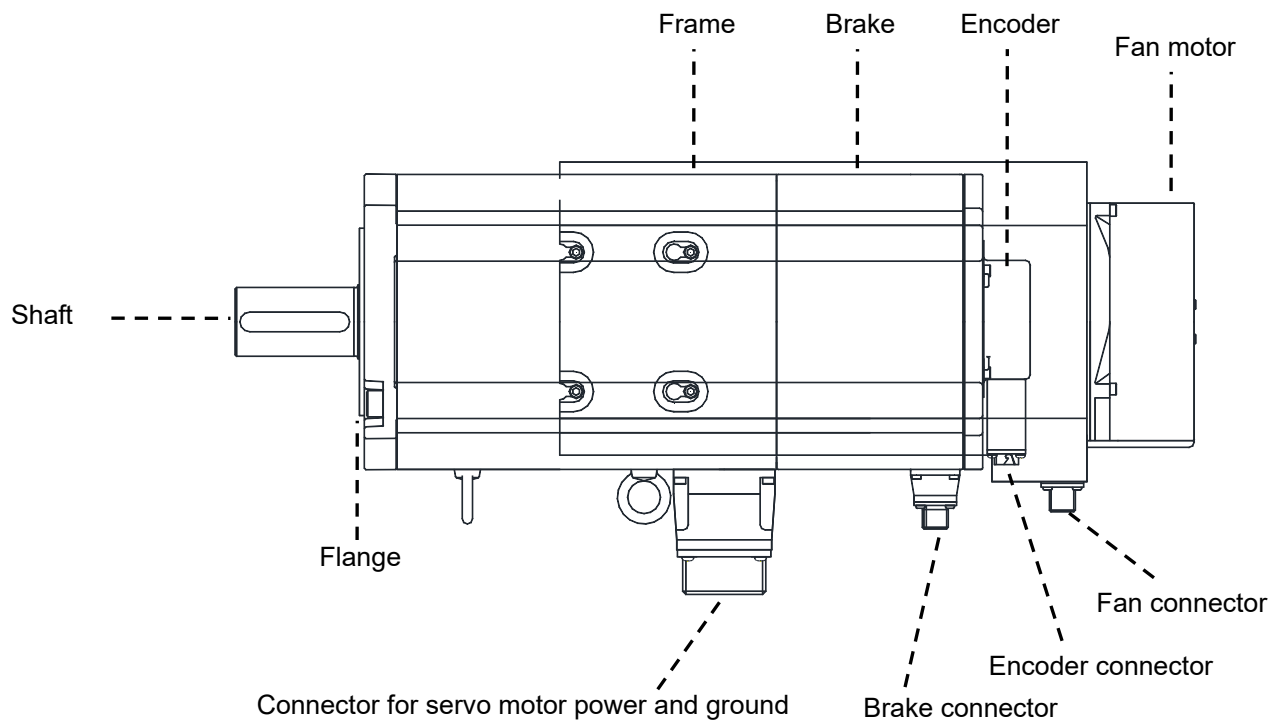


1.5 Part names

200V input

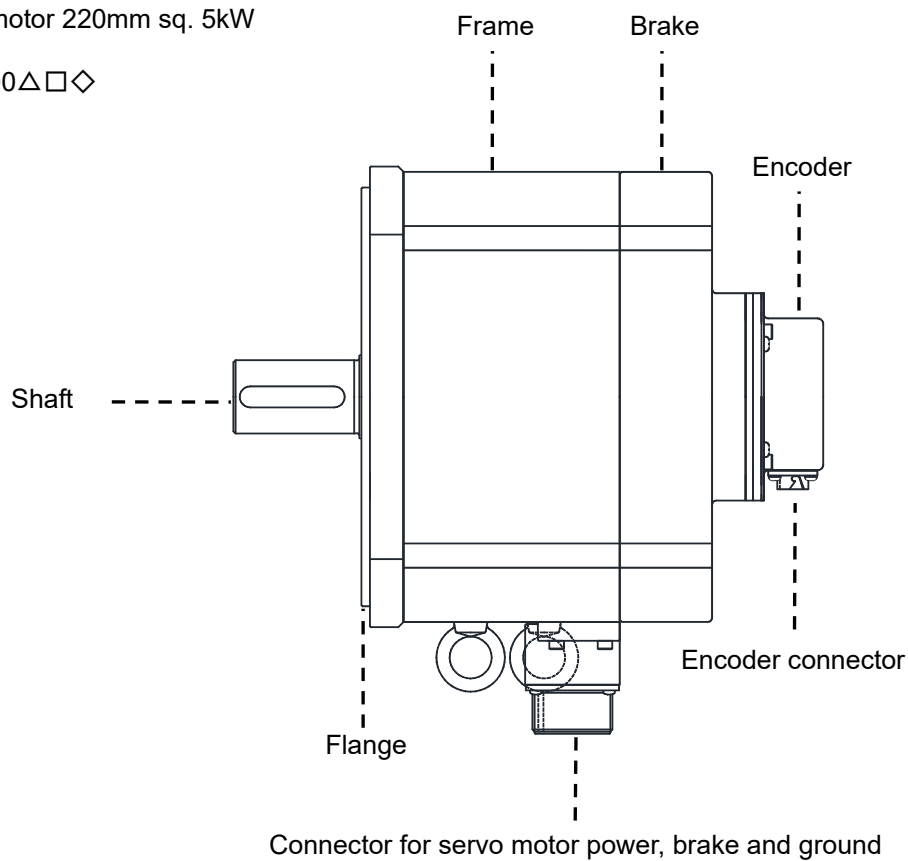
- R2 servo motor 180mm sq. 11kW

R2AA1811K△□◇



- R2 servo motor 220mm sq. 5kW

R2AA22500△□◇



1. Preface

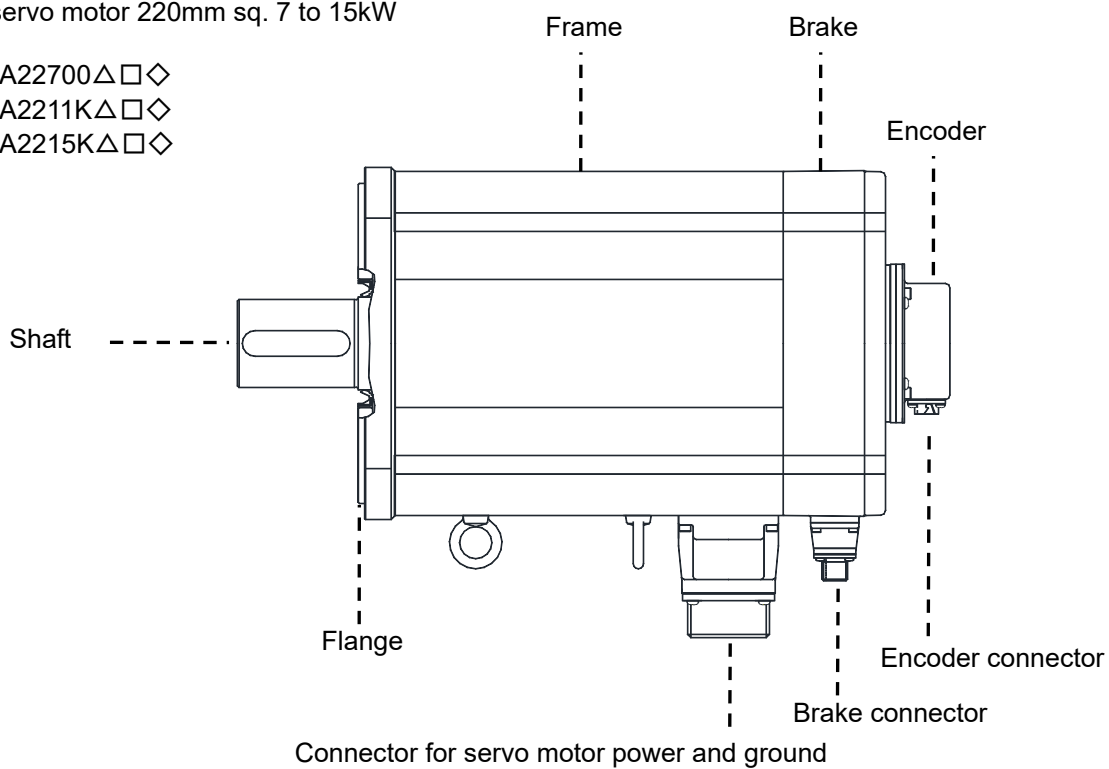
200V input

- R2 servo motor 220mm sq. 7 to 15kW

R2AA22700△□◇

R2AA2211K△□◇

R2AA2215K△□◇

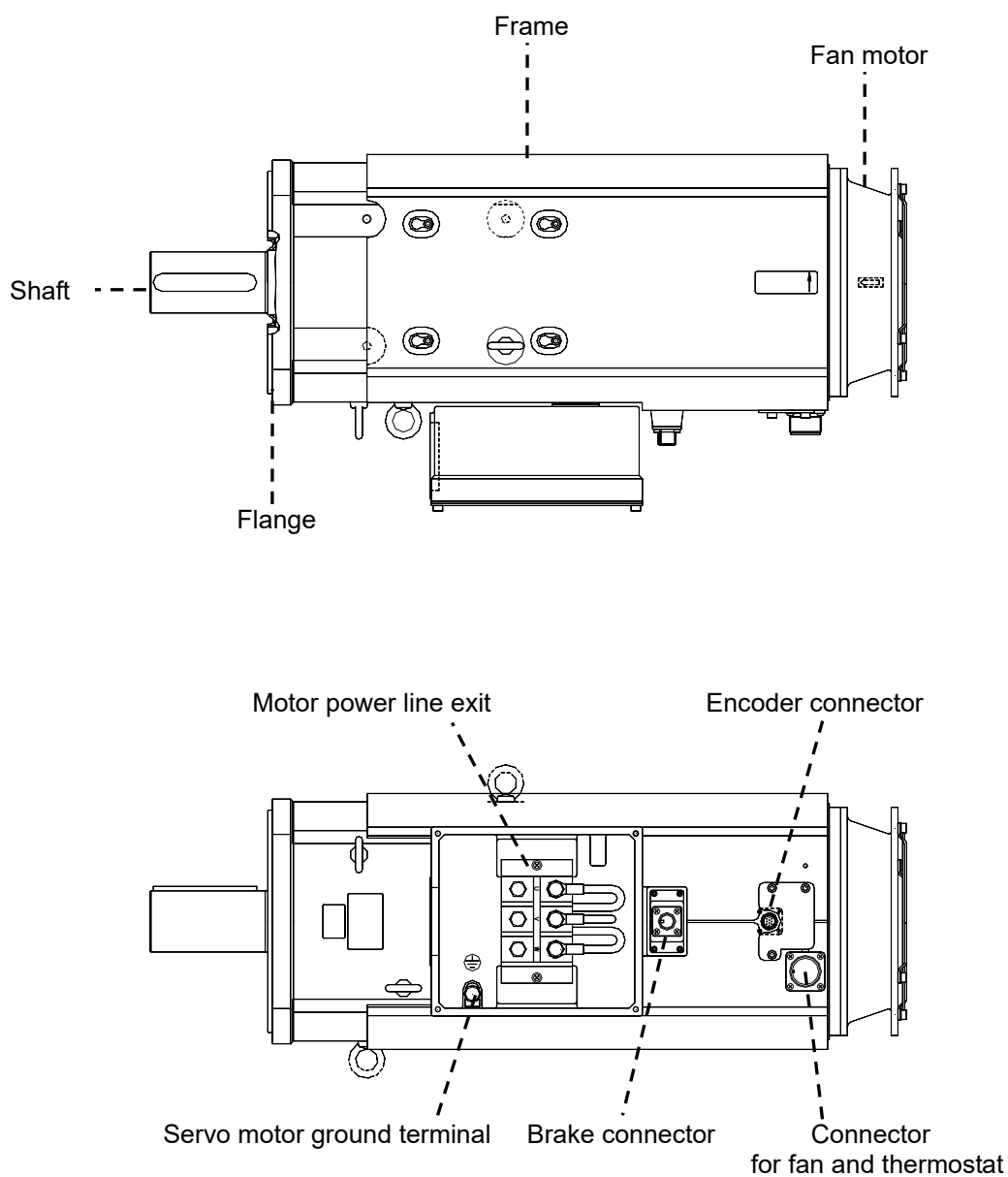


1.5 Part names

200V input

- R2 servo motor 220mm sq. 20kW

R2AA2220K△□◇

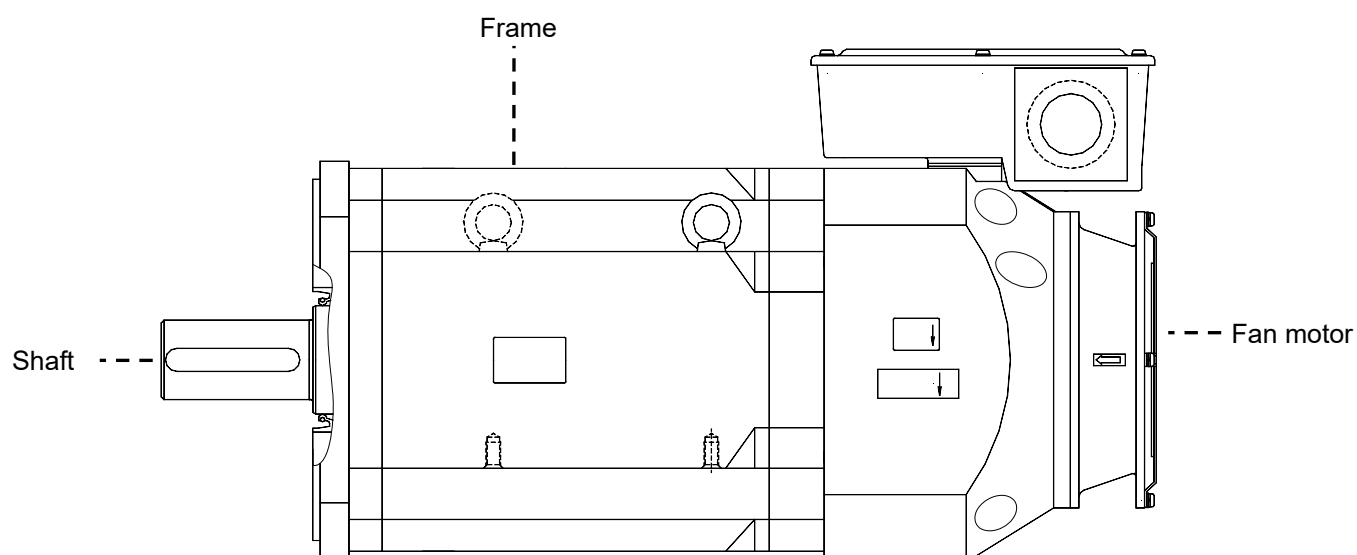
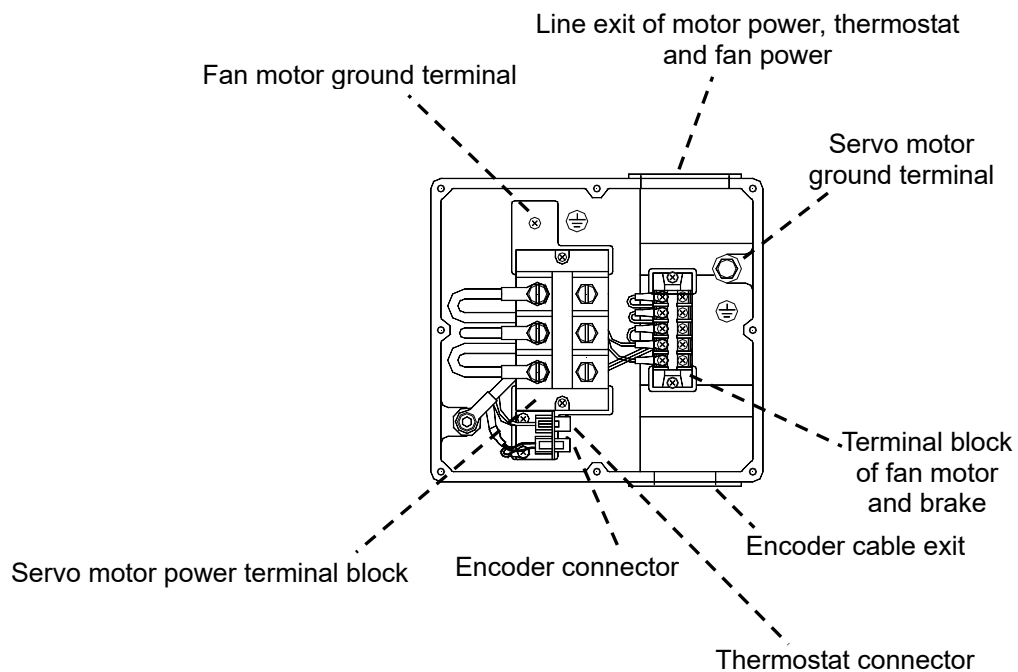


1. Preface

200V input

- R2 servo motor 280mm sq. 30kW

R2AA2830KV□◇

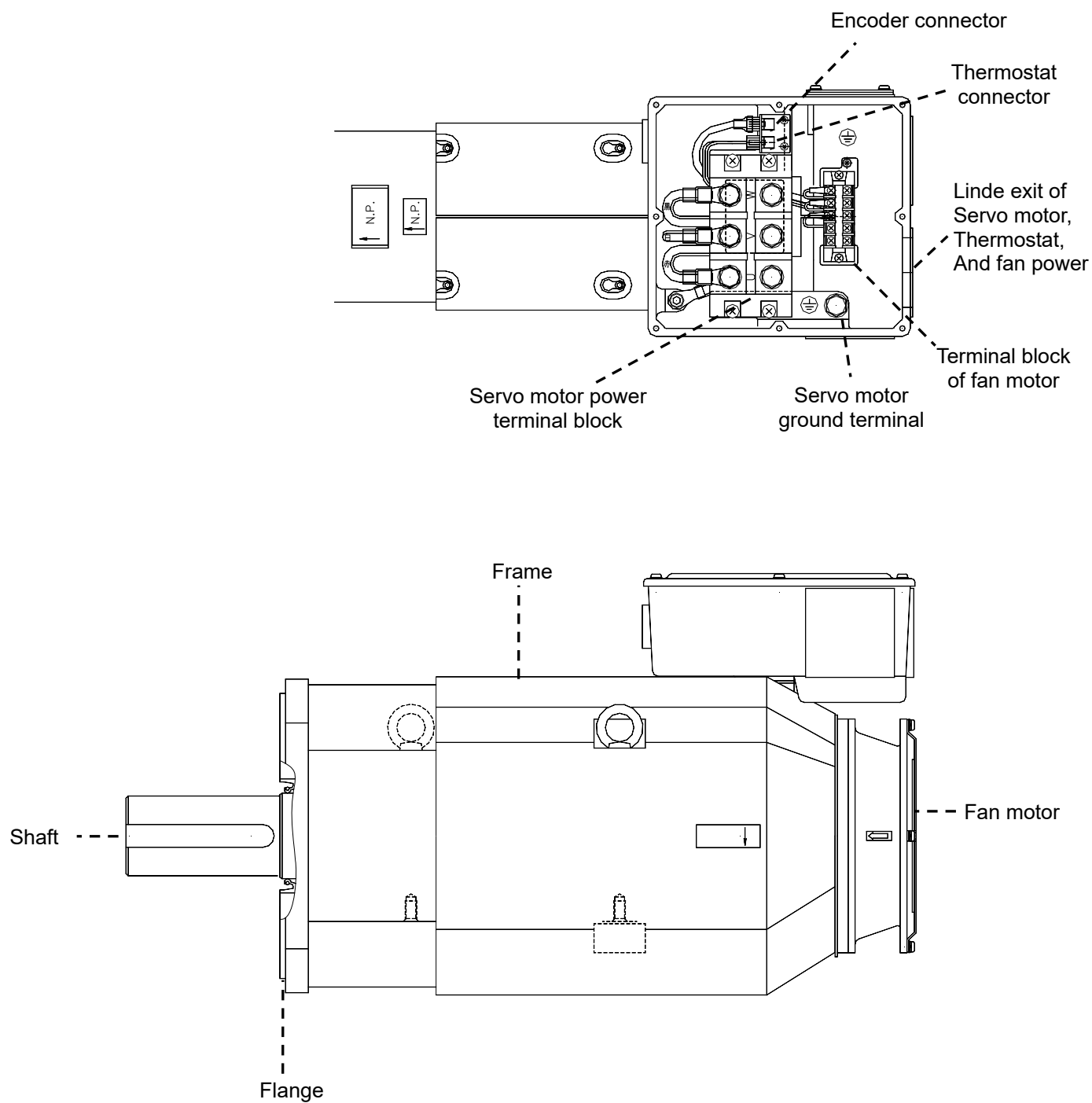


1.5 Part names

200V input

- R2 servo motor 280mm sq. 37kW

R2AA2837K△X◇



1. Preface

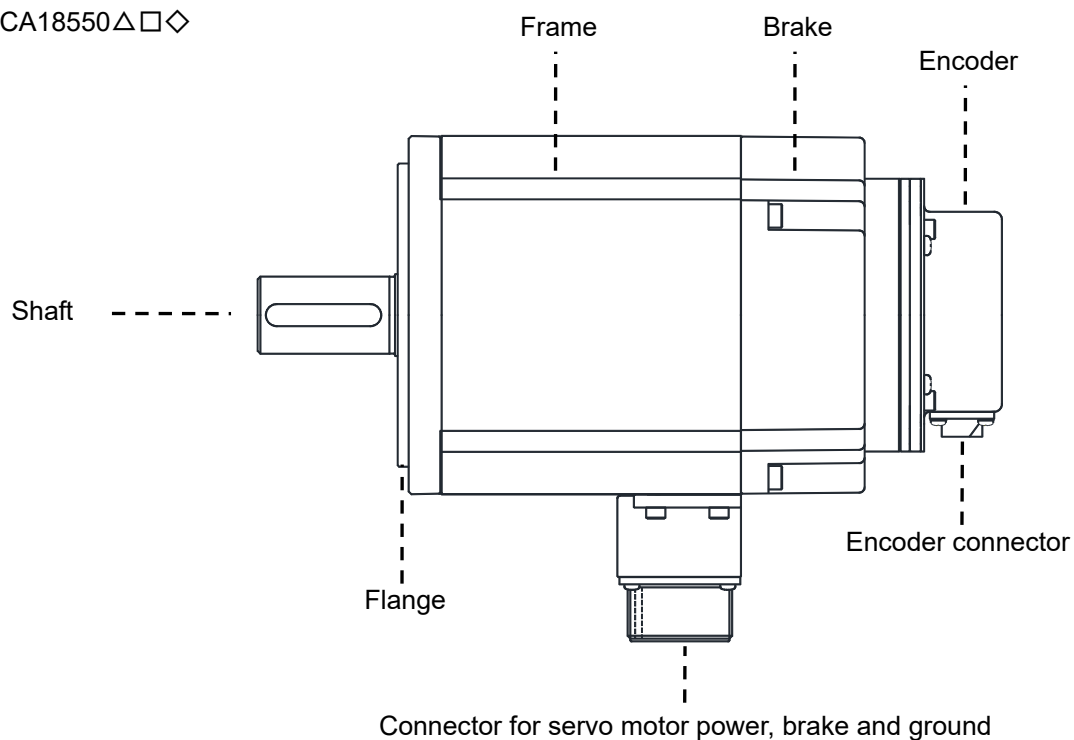
400V input

- R1 servo motor
100mm sq. 1.5 to 2.0kW, 130mm sq. 3.0kW

- R1CA10150△□◇
R1CA10200△□◇
R1CA13300△□◇

- R2 servo motor
100mm sq. 0.75 to 1.0kW, 130mm sq. 0.55 to 2.0kW,
180mm sq. 3.5 to 5.5kW

R2CA10075△□◇
R2CA10100△□◇
R2CA13050△□◇
R2CA13120△□◇
R2CA13180△□◇
R2CA13200△□◇
R2CA18350△□◇
R2CA18450△□◇
R2CA18550△□◇

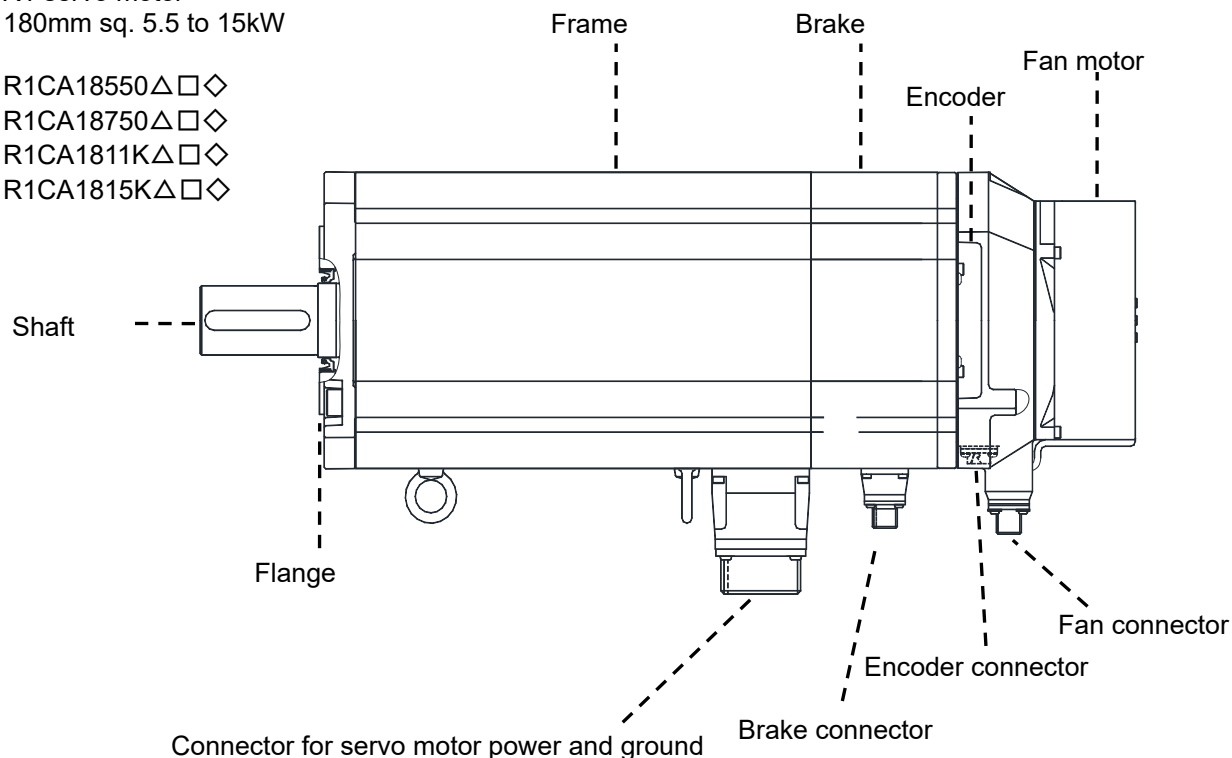


1.5 Part names

400V input

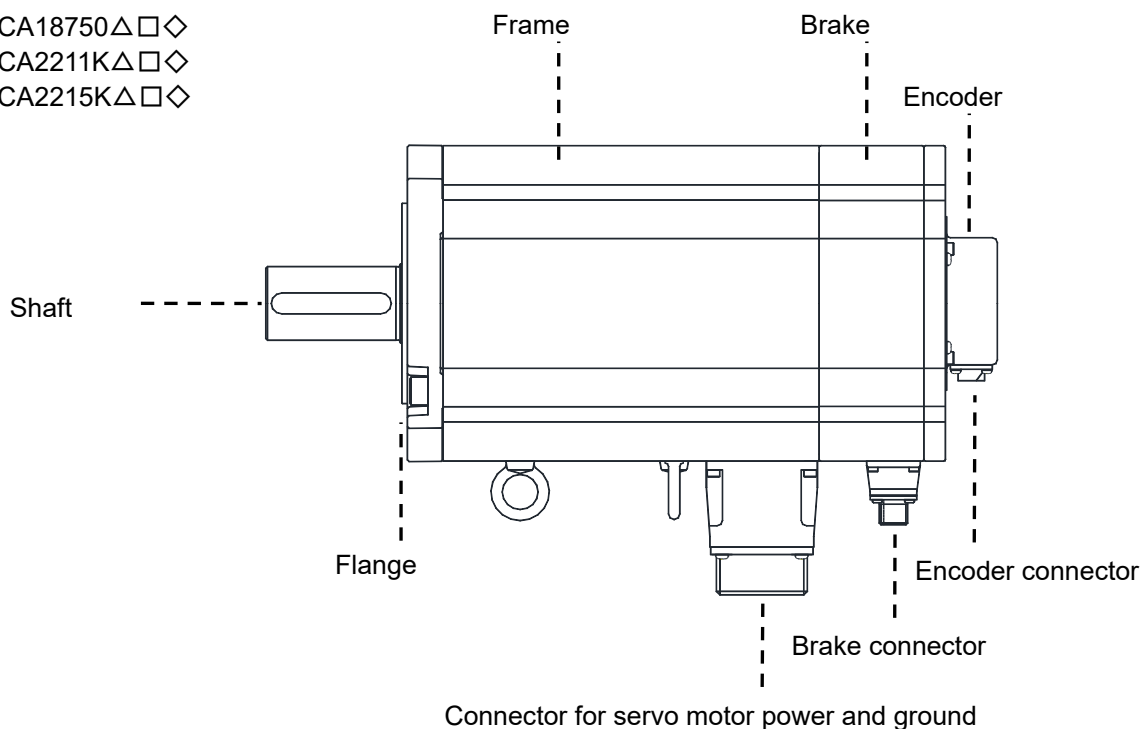
- R1 servo motor
180mm sq. 5.5 to 15kW

R1CA18550△□◇
R1CA18750△□◇
R1CA1811K△□◇
R1CA1815K△□◇



- R2 servo motor
180mm sq. 7.5kW, 220mm sq. 11 to 15kW

R2CA18750△□◇
R2CA2211K△□◇
R2CA2215K△□◇

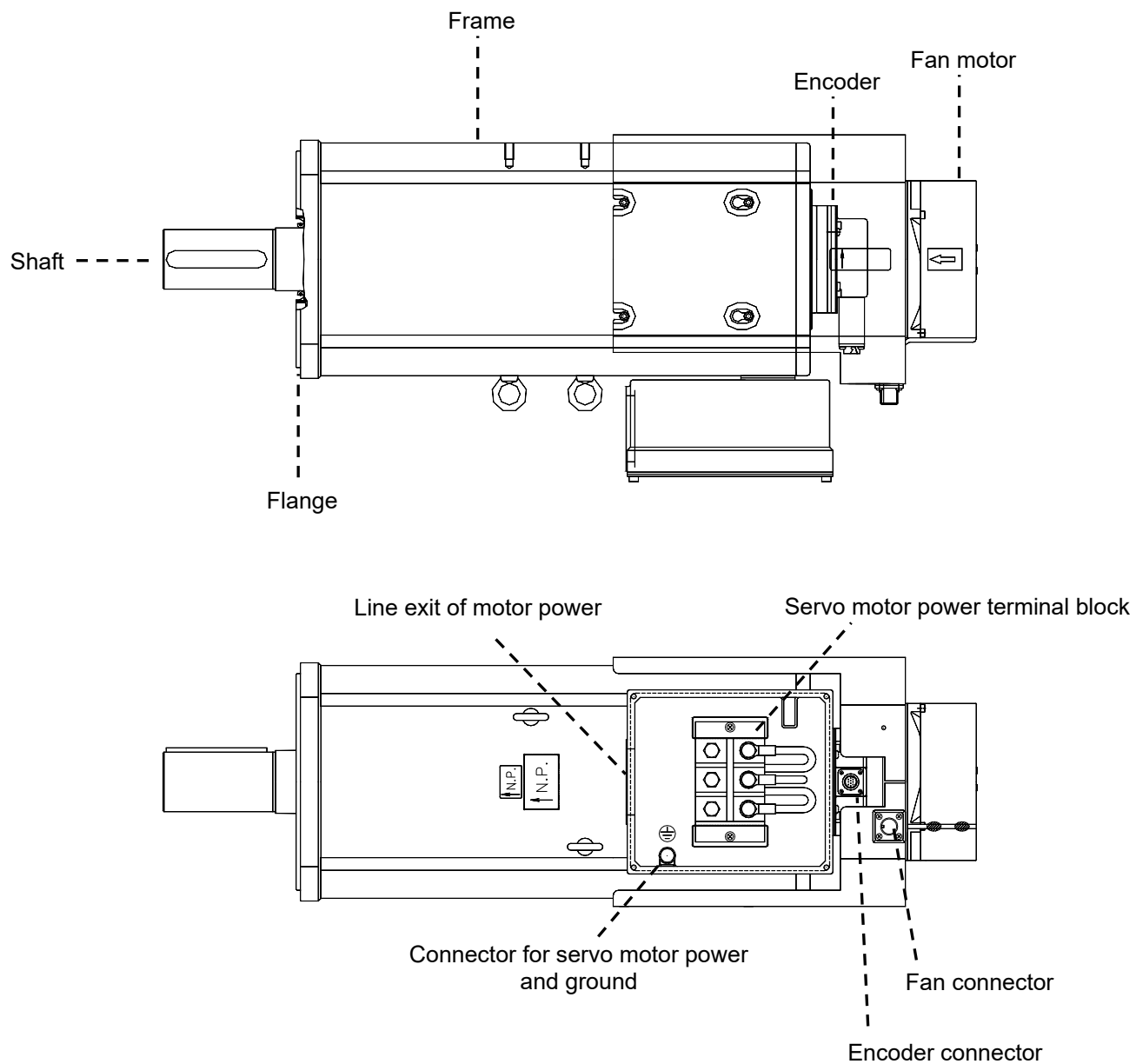


1. Preface

400V input

- R1 servo motor 220mm sq. 21kW

R1CA2220K△X◇

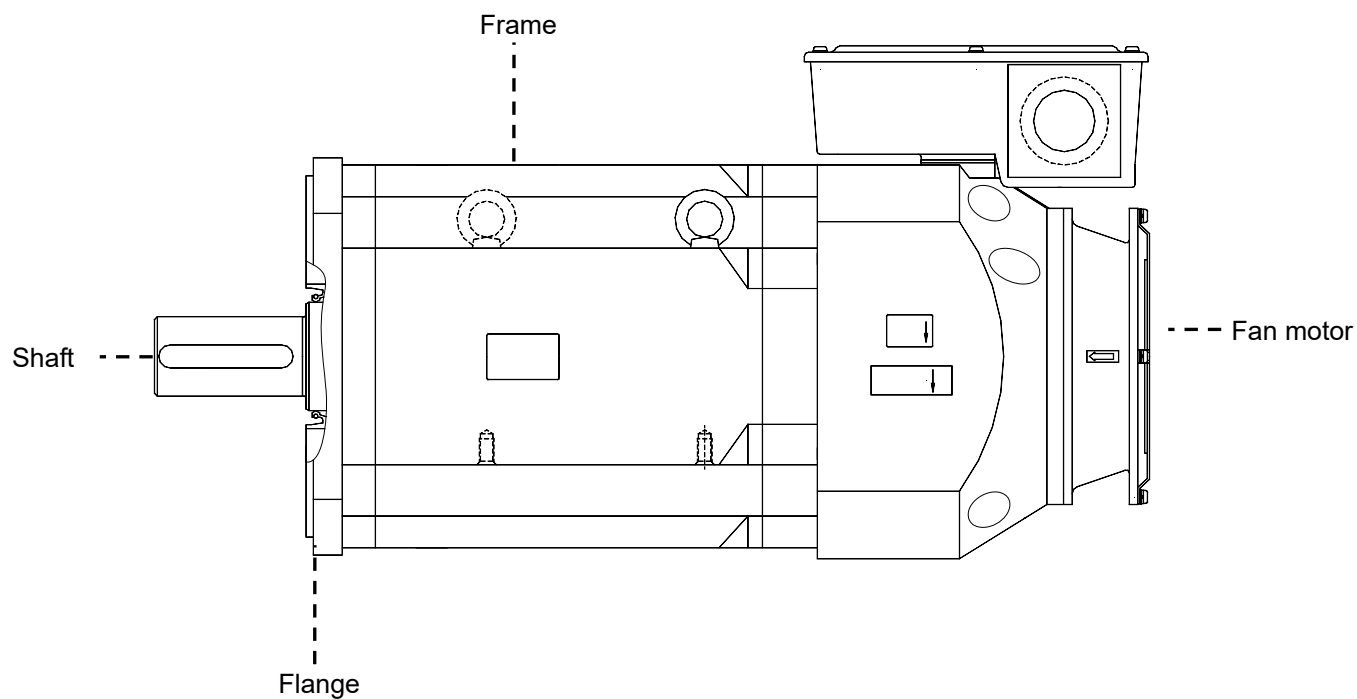
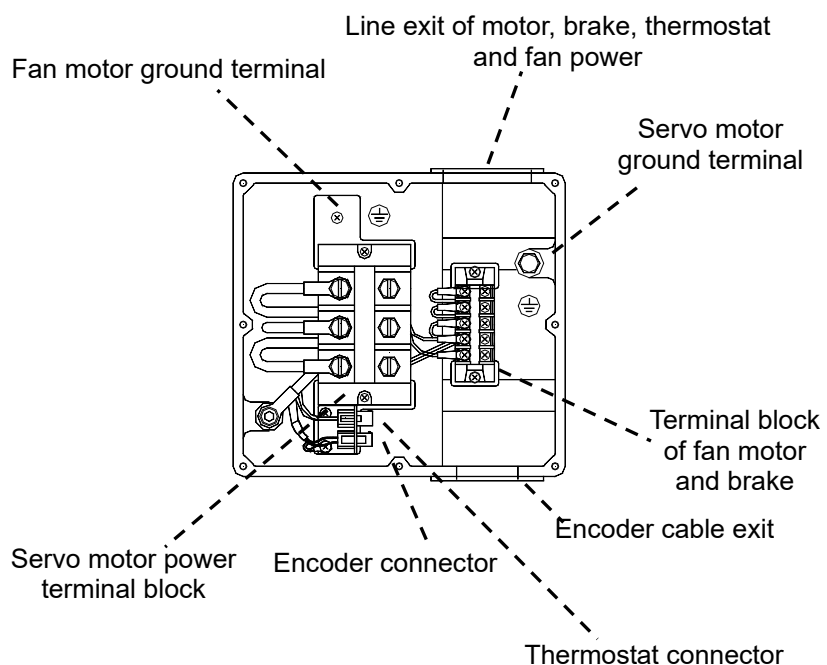


1.5 Part names

400V input

- R2 servo motor
280mm sq. 30kW

R2CA2830KV□◇

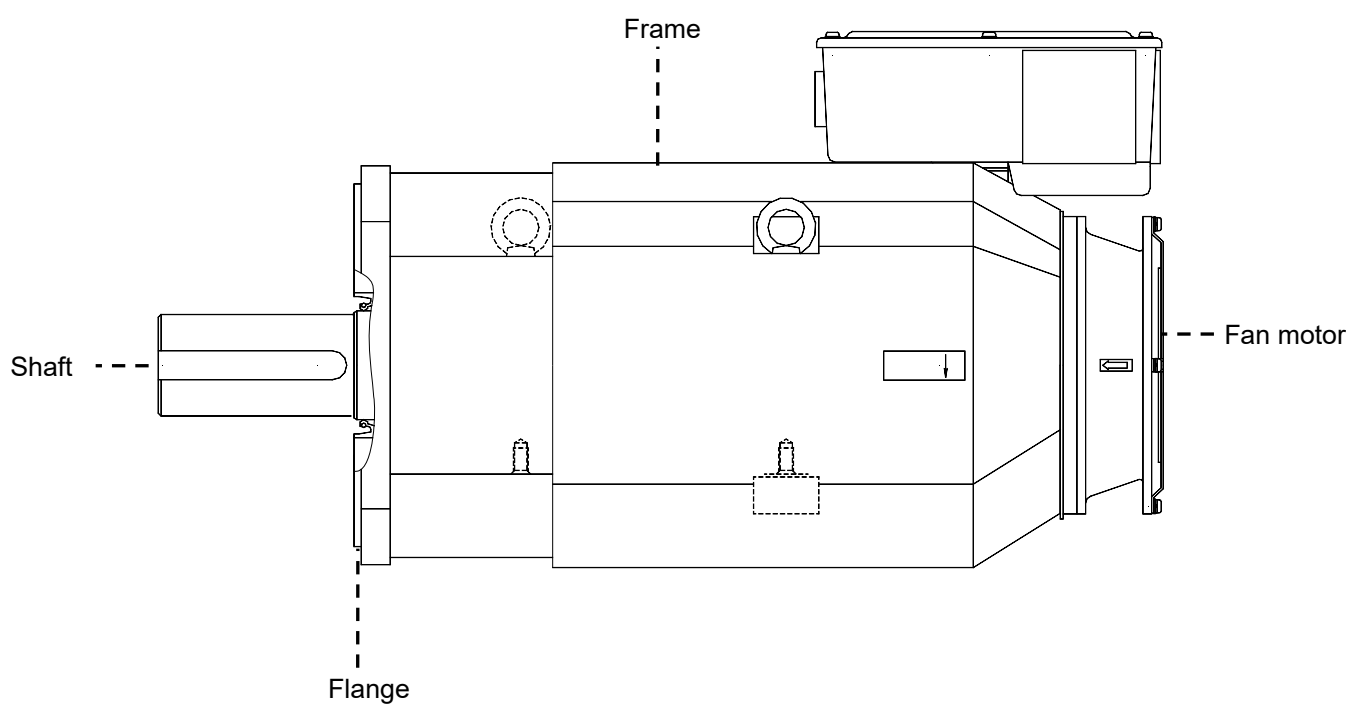
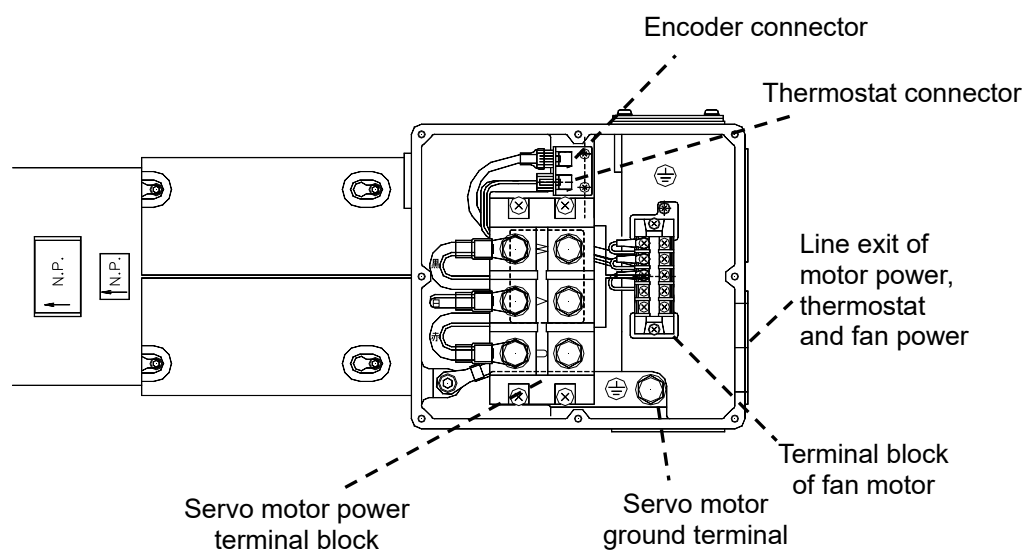


1. Preface

400V input

- R2 servo motor
280mm sq. 37kW

R2CA2837K△X◇



Specifications

In this chapter, specifications of servo motor, power unit and amplifier unit are explained.

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2. Specifications

2.1 Servo motor

2.1.1 General specifications

Series name	R2, R1
Time rating	Continuous
Insulation class	F
Voltage/Dielectric strength	1,500V AC, 1 minute for 200V AC input type, 2,000V AC, 1 minute for 400V AC input type
Insulation resistance	500V DC, greater than 10MΩ
Protection method	Totally Enclosed, Non-Ventilated IP65 or 67 for the motor of flange size 100 mm sq. or less, IP65 for the motor of flange size 130 mm sq. or over However, except for axial penetration part and cable tip part
Oil Sealing	Motor flange size 100 or less: No oil seal as standard (optionally available.) (Exceptionally 100 mm sq. flange R1 motors have oil seal.) Motor flange size 130 or over: With oil seal
Ambient temperature	0 to +40°C
Storage temperature	-20 to +65°C
Ambient humidity	20 to 90% (without condensation)
Vibration classification	V15
Excitation method	Permanent magnet type
Installation method	Flange mount

* Also there is the motor applying IP67 as option.
Please contact our sales for detail.

2.1.2 Exterior dimensions/ specifications/ mass

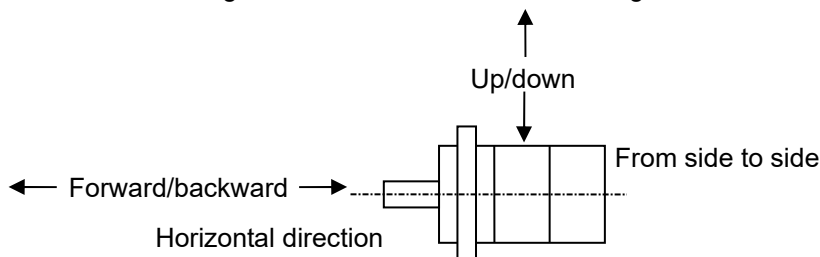
Refer to “6.3 Servo motor dimensions 200V input”, “ 6.4 Servo motor dimensions 400V input ”.
Refer to “6.5 Servo motor data sheet 200V input”, “ 6.6 Servo motor data sheet 400V input ”.

2.1.3 Mechanical specifications/ mechanical strength/ working accuracy

■ Vibration resistance

Install the servo motor horizontally (shown in the figure below), so when vibration occurs in any of three (3) directions (up/down, backward/forward, left/right) the motor will withstand vibration acceleration up to 24.5m/s².

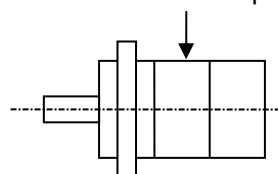
Exceptionally for 100 and 130mm flange size R1 motor, 49m/s² in rotating and 24.5m/s² at stop.



■ Vibration classification

The vibration classification of the servo motor is V15 or less at maximum rotation speed for a single servo motor unit and is measured as indicated in the figure below.

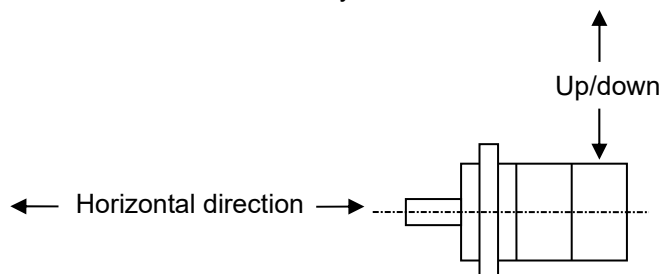
Vibration measurement position



2.1 Servo motor

■ Shock resistance

Install the shaft of servo motor in a horizontal direction (shown in the figure below). This shaft should withstand shock acceleration up to 98m/s^2 (when shock is applied in an upward/downward direction) for two (2) times. However, since a precision motor encoder is fixed to the counter-load side of the flange, any shock applied to the shaft may cause damage to the motor encoder. Therefore, try to avoid shock to the shaft under any circumstances.



■ Mechanical strength

The axis strength of the servo motor can withstand peak torque at stall.

■ Working accuracy

The following table shows the accuracy and precision of the servo motor output shaft (Total Indicator Reading) of the parts surrounding the shaft.

Items	T. I. R.	Reference Figure
Vibration of output shaft terminal: α	0.02	
Eccentricity of external diameter of flange on output shaft M: β	0.06 (86 or less)	
	0.08 (100 or over)	
Perpendicularity of flange face to output shaft M: γ	0.07 (86 or less)	
	0.08 (100 or over)	

* Number in parentheses are flange size of motor.

2.1.4 Oil seal type

S-Type oil seal (as shown in the table below) is fixed to the output shaft of the servo motor. This oil seal is produced by NOK Corporation, or equivalent.

Please contact us for replacement of this oil seal.

Servo motor model number	Oil seal type
R1□A10○○○□	Standard: Double Lip seal type
R1□A13○○○□	Standard: S-Type
R1□A18○○○□	Standard: S-Type
R1AA22○○○□	Standard: S-Type
R2AA□8○○○□	Standard: N/A, Optional: S-Type
R2□A10○○○□	Standard: N/A, Optional: S-Type
R2□A13○○○□	Standard: Double Lip seal type
R2□A18○○○□	Standard: S-Type
R2□A22○○○□	Standard: S-Type
R2□A28○○○□	Standard: S-Type

* Please contact us for specifications of the other model number above.

2. Specifications

2.1.5 Holding brake

An optional Holding Brake is available for the servo motor. Since the primary use of this brake is for holding, it should never be used for braking, except in emergency situations.

■ Surge-absorbing element

Must connect surge-absorbing element such as varistor or diode, to between holding brake terminals, for suppressing surge noise which occurs at holding brake excitation turn off.
Please note, the braking delay time will differ depending on used servo motor and surge-absorbing element, as see table below.

■ Holding brake control

Brake excitation shall be controlled by using holding brake excitation signal from amplifier unit.
In use of this signal, set suitable value to "Delay Time of Releasing Holding Brake [BOFFDLY]" and "Delay Time of Engaging Holding Brake [BONDLY]" by seeing the time in the table below as reference.

Refer the instruction manuals of each control board, for detail.

In use of the signal from other device for holding brake excitation control, also refer the time in the table below.

The values in table below do not include an operation delay time such as relay.

Release delay time is same for varistor and diode.

Servo motor model number		Static friction torque N·m	Release delay time ms	Braking delay time ms	
				Varistor	Diode
R1	R1AA10100F	9.3	100	30	140
	R1□A10150□				
	R1□A10200□				
	R1□A10250H				
	R1□A13300□	12	150	50	300
	R1AA13400□	16			
	R1AA13500□				
	R1□A18550H	54.9	300	140	400
	R1□A18750L				
	R1□A1811KR	75			
	R1□A1815KB	120		60	600
	R1□A2220KV	Without holding brake			

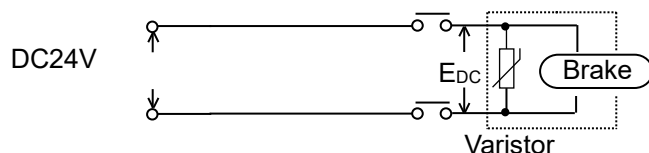
* Please contact us for specifications of the other model number above.

2.1 Servo motor

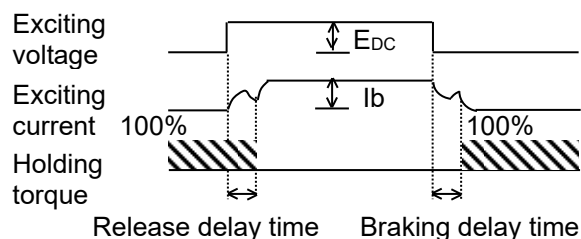
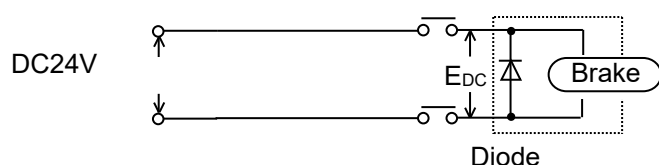
Servo motor model number		Static friction torque N·m	Release delay time ms	Braking delay time ms	
				Varistor	Diode
R2	R2□AB8075□	3.92	40	20	200
	R2□AB8100□				
	R2□A10075□				
	R2□A10100□				
	R2□A13050□	3.50	100	30	120
	R2□A13120□	9.0			130
	R2□A13180□	12.0			140
	R2□A13200□	22.0			150
	R2□A18350□	32.0	120	50	150
	R2□A18450□	42.0	150	60	250
	R2□A18550□	54.9	150		
	R2□A18750□	100	300	140	400
	R2□A1811K□	42			
	R2□A22500□	90	150	60	250
	R2□A22700□	170	300	140	400
	R2□A2211K□				
	R2□A2215K□				
	R2□A2220K□	170	250	—	350
	R2□A2830K□	191.2	600	—	600
	R2□A2837K□	Without holding brake			

- Measurement of release delay time and braking delay time
The value of release delay time and braking delay time are measured by the circuit below.

◆ Varistor-used circuit



◆ Diode-used circuit



2. Specifications

2.2 Motor encoder

2.2.1 Absolute encoder

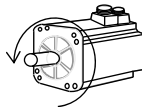
■ Absolute encoder specifications

Name (code)	Motor model number Encoder code	Resolution per rotation (Single turn)	Multi turn part amount (Multi turn)	Transfer method
Single-turn absolute encoder (PA035S)	H	131,072 (17bit)	-	Half duplex asynchronous 2.5Mbps / 4Mbps
Battery backup absolute encoder (PA035C)	P	131,072 (17bit)	65,536 (16bit)	Half duplex asynchronous 2.5Mbps / 4Mbps
Battery-less absolute encoder (HA035)	R	131,072 (17bit)	65,536 (16bit)	Half duplex asynchronous 2.5Mbps / 4Mbps
Resolver type battery-less absolute encoder (RA035C)	W	131,072 (17bit)	65,536 (16bit)	Half duplex asynchronous 2.5Mbps / 4Mbps

- Relation between servo motor rotation direction and absolute position data (PS data)
See below the relation between servo motor rotation direction and absolute position data (PS data).

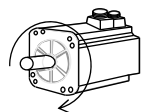
Servo motor rotation direction: CCW

Position signal output (PS data): Increase



Servo motor rotation direction: CW

Position signal output (PS data): Decrease

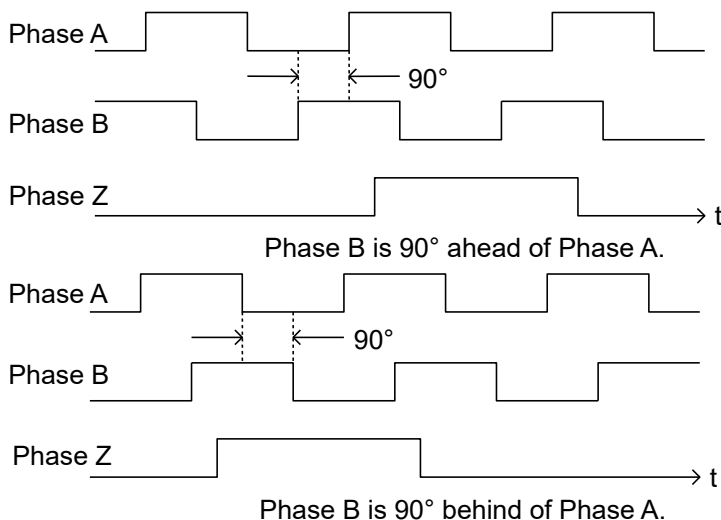
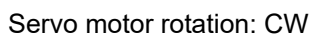


* PS data can be confirmed by "ABSPS" of "Monitor function". Refer the instruction manuals of each control board, for detail.

- Wire-saving incremental encoder

Model number example: R2-series 100mm sq., 750W-model
R2CA10075EXS00

- Servo motor rotation: CCW



2-6

2. Specifications

2.3 Power unit/Amplifier unit

2.3.1 Power unit

200V input

■ General specifications

Power unit model number		RM3PAA7R8	RM3PAA120	RM3PAA160	RM3PAA270	RM3PAA370
Main Circuit Power	Note 1)	Three-phase, 200 to 230V AC +10 to -15%, 50/60Hz±3Hz				
Control power	Note 1)	Single-phase, 200 to 230V AC +10 to -15%, 50/60Hz±3Hz				
Rated output capacity (main circuit)		7.8kW	12kW	16kW	30kW	37kW
Regenerative resistor allowed value		6.5 ohm or more	5.0 ohm or more	3.3 ohm or more	2.5 ohm or more	1.3 ohm or more
Environment	Ambient temperature	0 to 55°C				
	Storage temperature	-20 to +65°C				
	Operation/ Storage humidity	Below 90%RH (no condensation)				
	Elevation	Below 1000m				
	Vibration	4.9m/s ²				
	Shock	19.6m/s ²				
Structure		Built-in tray type power supply				
Cooling fan motor		Built in fan: 1 Note 2)			Built in fan: 1 Note 3)	
External dimensions (W×H×D)		154 × 460 × 150 mm			150 × 460 × 294 mm	200 × 460 × 305 mm
Mass		5.6 kg	5.3 kg	5.3 kg	12.0 kg	17.4 kg

Note 1) Power source voltage should be within the specified range.
Specified power supply range: Main circuit power/ Control power 170 to 253V AC
Moreover, Overvoltage Category of servo amplifier is III (EN61800-5-1).

Note 2) It should be provided a fan motor power: 21.6 to 26.4V DC (dissipation current 0.1A).

Note 3) Power supply is not required.

■ Built-in functions

Protection functions	Regenerative overload, External error, In-rush protection resistor overheat, Over voltage, Main circuit power low voltage, Main circuit power supply open phase, Control power supply low voltage.
Regeneration process circuit	Built-in (Regenerative resistor is attached externally)

2.2 Motor encoder

400V input

■ General specifications

Power unit model number		RM3PCA160	RM3PCA370
Main Circuit Power Note 1)		Three-phase, 380 to 480V AC +10 to -15%, 50/60Hz±3Hz	
Control power Note 1)		24V DC ±15%	
Rated output capacity (main circuit)		16kW	37kW
Regenerative resistor allowed value		13.3 ohm or more	4.7 ohm or more
Environment	Ambient temperature	0 to 55°C	
	Storage temperature	-20 to +65°C	
	Operation/ Storage humidity	Below 90%RH (no condensation)	
	Elevation	Below 1000m	
	Vibration	4.9m/s ²	
	Shock	19.6m/s ²	
Structure		Built-in tray type power supply	
Cooling fan motor		Speed controlled fan (Hi/Lo, 2 stages) Note 2) Built in fan: 2	Speed controlled fan (Hi/Lo, 2 stages) Note 3) Built in fan: 3
External dimensions (W×H×D)		184 × 380 × 168 mm	180 × 380 × 295 mm
Mass		5.2 kg	16.0 kg

Note 1) Power source voltage should be within the specified range.

Specified power supply range Main circuit power: 323 to 528V AC

Control power: 21.6 to 26.4V DC

Moreover, Overvoltage Category of servo amplifier is III (EN61800-5-1). So, use a DC power supply with reinforced insulation, for 24VDC control power and DC power of interface.

Note 2) Rotation speed changes due to unit internal temperature.

Hi: high speed rotation, more than 30°C.

Lo: low speed rotation, 30°C or less.

Note 3) Rotation speed changes due to unit internal temperature.

Hi: high speed rotation, more than 47°C.

Lo: low speed rotation, 43°C or less.

■ Built-in functions

Protection functions	Regenerative overload, External error, In-rush protection resistor overheat, Over voltage, Main circuit power low voltage, Main circuit power supply open phase, Control power supply low voltage.
Regeneration process circuit	Built-in (Regenerative resistor is attached externally)

2. Specifications

2.3.2 Amplifier unit

200V input

■ General specifications

Amplifier unit model number		RM3DAA 050	RM3DAA 100	RM3DAA 150	RM3DAA 300	RM3DAB 600	RM3DAB 900
Main Circuit Power Note 1)		282 to 326V DC +10 to -15%					
Control power Note 1)		282 to 326V DC +10 to -15%					
Environment	Ambient temperature	0 to 55°C					
	Storage temperature	-20 to +65°C					
	Operation/Storage humidity	Below 90%RH (no condensation)					
	Elevation	Below 1000m					
	Vibration	4.9m/s ²					
	Shock	19.6m/s ²					
Structure		Separate tray type power supply					
Cooling fan motor		None	Built in fan: 1 Note 2)		Built in fan: 2 Note 2)	Built in fan: 2 Note 3)	Built in fan: 5 Note 3)
External dimensions (W×H×D)		124 × 460 × 173 mm	124 × 460 × 182 mm		164 × 460 × 192 mm	260 × 460 × 294 mm	450 × 460 × 305 mm
Mass		4.1 kg	4.2 kg	4.4 kg	6.6 kg	20.2 kg	38.3 kg

Note 1) Power source voltage should be within the specified range.

Specified power supply range: Main circuit power/ Control power 240 to 358V DC
Moreover, Overvoltage Category of servo amplifier is III (EN61800-5-1).

Note 2) It should be provided a fan motor power: 21.6 to 26.4V DC (dissipation current 0.1A) per 1.

Note 3) Power supply is not required.

■ Built-in functions

Protection functions	Over current, Current detection error, Overload, Overheat error, Dynamic brake resistor overheat, Encoder error, Over velocity, Velocity control error, Velocity feedback error, Position deviation excess, Position command pulse error, Built-in memory error, Parameter error
Regeneration process circuit	RM3DAA050 to 300: Built in. RM3DAB600: Not built in.

2.2 Motor encoder

400V input

■ General specifications

Amplifier unit model number		RM3DCA025	RM3DCA050	RM3DCA075	RM3DCA150
Main Circuit Power	Note 1)	537 to 679V DC +10 to -15%			
Control power	Note 1)	24V DC $\pm 15\%$			
Environment	Ambient temperature	0 to 55°C			
	Storage temperature	-20 to +65°C			
	Operation/ Storage humidity	Below 90%RH (no condensation)			
	Elevation	Below 1000m			
	Vibration	4.9m/s ²			
	Shock	19.6m/s ²			
Structure		Separate tray type power supply			
Cooling fan motor		None	Speed controlled fan (Hi/Lo, 2 stages) Note 2) Built in fan: 1	Speed controlled fan (Hi/Lo, 2 stages) Note 2) Built in fan: 2	
External dimensions (W×H×D)		154 × 380 × 142 mm	154 × 380 × 147 mm	154 × 380 × 166 mm	194 × 380 × 168 mm
Mass		3.4 kg	3.9 kg	4.3 kg	6.1 kg

Note 1) Power source voltage should be within the specified range.

Specified power supply range

Main circuit power: DC457 to 747V

Control power: DC20.4V to DC27.6V

Moreover, Overvoltage Category of servo amplifier is III (EN61800-5-1). So, use a DC power supply with reinforced insulation, for 24VDC control power and DC power of interface.

Note 2) Rotation speed changes due to unit internal temperature.

Hi: high speed rotation, more than 30°C.

Lo: low speed rotation, 30°C or less.

■ Built-in functions

Protection functions	Over current, Current detection error, Overload, Overheat error, Dynamic brake resistor overheat, Encoder error, Over speed, Speed control error, Speed feedback error, Excessive position deviation, Position command pulse error, Built-in memory error, Parameter error.
Dynamic brake circuit	RM3DCA025 to 150: Built -in

2. Specifications

400V input

■ General specifications

Amplifier unit model number		RM3DCB300	RM3DCB600
Main Circuit Power	Note 1)	537 to 679V DC +10 to -15%	
Control power	Note 1)	24V DC $\pm 15\%$	
Environment	Ambient temperature	0 to 55°C	
	Storage temperature	-20 to +65°C	
	Operation/ Storage humidity	Below 90%RH (no condensation)	
	Elevation	Below 1000m	
	Vibration	4.9m/s ²	
	Shock	19.6m/s ²	
Structure		Separate tray type power supply	
Cooling fan motor		Speed controlled fan (Hi/Lo, 2 stages) Note 2) Built in fan: 3	Speed controlled fan (Hi/Lo, 2 stages) Note 2) Built in fan: 4
External dimensions (W×H×D)		250 × 380 × 295 mm	
Mass		20.0 kg	21.0 kg

Note 1) Power source voltage should be within the specified range.

Specified power supply range Main circuit power: DC457 to 747V
Control power: DC20.4V to DC27.6V

Moreover, Overvoltage Category of servo amplifier is III (EN61800-5-1). So, use a DC power supply with reinforced insulation, for 24VDC control power and DC power of interface.

Note 2) Rotation speed changes due to unit internal temperature.

Hi: high speed rotation, more than 46°C.

Lo: low speed rotation, 41°C or less.

■ Built-in functions

Protection functions	Over current, Current detection error, Overload, Overheat error, Dynamic brake resistor overheat, Encoder error, Over speed, Speed control error, Speed feedback error, Excessive position deviation, Position command pulse error, Built-in memory error, Parameter error.
Dynamic brake circuit	RM3DCB300, RM3DCB600: Not built -in

2.4 Power supply calorific value

2.4 Power supply, calorific value

2.4.1 Main circuit power supply capacity, control power supply capacity

200V input

■ Power unit

Power unit model number	Rated output (kW)	Main circuit power capacity (kVA)	Control power capacity (VA)	Built-in cooling fan motor (VA)
RM3PAA7R8	7.8	13	240	6
RM3PAA120	12	20		
RM3PAA160	16	27		
RM3PAA270	30	46		—
RM3PAA370	37	64		—

* Main circuit power capacities above are the value at power unit rated output operation.

* Control power capacity above is in condition with control unit connection of 5 axes RM3C1H (single axis EtherCAT communication).

■ Amplifier unit (Built-in cooling fan motor)

Power unit model number	Built-in cooling fan motor (VA)
RM3DAA050	—
RM3DAA100	3
RM3DAA150	3
RM3DAA300	6

400V input

■ Power unit

Power unit model number	Total rated output of servo motor (kW)	Main circuit power capacity (kVA)	Control power capacity (W)
RM3PCA160	Up to 2.0	3.7	100
	2.0 to 5.5	10.3	
	5.5 to 11.0	20.0	
	Up to 16.0	28.2	
RM3PCA370	Up to 30.0	44.0	110
	Up to 37.0	54.0	

* Main circuit power capacities above are total value of combination motors rated output.

* Control power capacity above is in condition with control unit connection of 5 axes (maximum allowed connection) RM3C1H (single axis EtherCAT communication) and a maximum rotation of fan.

■ Amplifier unit

Amplifier unit model number	Control power capacity (W)
RM3DCA025	10
RM3DCA050	18
RM3DCA075	18
RM3DCA150	32
RM3DCB300	55
RM3DCB600	67

* Control power capacities above are in condition of a maximum rotation of fan.

2. Specifications

2.4.2 Inrush current/Leakage current

200V input

■ Inrush current

Unit name	Unit model number	Control circuit (Maximum value between 1ms after input)	Main circuit (Maximum value between 1.2 seconds after input)
Power unit model number	RM3PAA7R8	40A(0-P)	18A(0-P)
	RM3PAA120	40A(0-P)	18A(0-P)
	RM3PAA160	40A(0-P)	18A(0-P)
	RM3PAA270	40A(0-P)	72A(0-P)
	RM3PAA370	40A(0-P)	72A(0-P)

- * Inrush current value of control circuit is in the condition of ordinary temperature and 200V AC input voltage.
- * Inrush current prevention circuit of control power uses thermistor. It may occur an inrush current higher than table above when thermistor temperature is high such as following: turns on power soon after turn off, repeats turn on/off power in short time, or into high ambient temperature etc.
- * Inrush current value of main circuit is in the condition of ordinary temperature and 230V AC input voltage.

■ Leakage current

Unit name	Unit model number	Electric leakage current per motor (for amplifier unit)
Power unit	RM3PAA7R8	12 mA or less
	RM3PAA120	12 mA or less
	RM3PAA160	12 mA or less
	RM3PAA270	12 mA or less
	RM3PAA370	12 mA or less
Amplifier unit	RM3DAA050	2 mA or less
	RM3DAA100	2 mA or less
	RM3DAA150	2 mA or less
	RM3DAA300	3 mA or less
	RM3DAB600	5 mA or less
	RM3DAB900	10 mA or less

- * Leakage current value above is measured by leak checker which has set 700 Hz filter.
- * While using amplifier units multiple, leakage current from each amplifier unit should be integrated.
- * These values are applicable when a tough rubber sheath cable of 2 meter is used as a power line. In the case of a shorter or longer cable length, values of the above table should be selected as closely as possible.
- * The machine should be grounded so that dangerous voltage does not occur at the main part of the machine, such as the operation panel, etc., during a period of emergency leakage current. (C-class or greater grounding is recommended.)
- * Please use an earth leakage circuit breaker which is allowing high harmonics because normal earth leakage circuit breaker or earth leakage protection relay might malfunction by flow of a high harmonics leakage current of ground floating capacitance of servo motor winding, power cable or servo amplifier.

2.4 Power supply calorific value

400V input

■ Inrush current

Unit name	Unit model number	Control circuit (Maximum value between 1ms after input)	Main circuit (Maximum value between 1.2 seconds after input)
Power unit	RM3PCA160	59A (0-P)	72A (0-P)
	RM3PCA370		143A (0-P)
Amplifier unit	RM3DCA025		—
	RM3DCA050		
	RM3DCA075		
	RM3DCA150		

- * Inrush current value of control circuit is in the condition of ordinary temperature and 27.6VDC input voltage.
- * Inrush current value of main circuit is in the condition of ordinary temperature and 480VAC input voltage.

■ Leakage current

Unit name	Unit model number	Electric leakage current
Power unit	RM3PCA160	2.0 mA or less
	RM3PCA370	3.5 mA or less
Amplifier unit	RM3DCA025	2.0 mA or less
	RM3DCA050	2.0 mA or less
	RM3DCA075	2.0 mA or less
	RM3DCA150	3.0 mA or less
	RM3DCB300	6 mA or less
	RM3DCB600	10 mA or less

- * Leakage current value above is measured with star-connection three-phase four-wire system, by leak checker which has set 700 Hz filter.
- * While using amplifier units multiple, leakage current from each amplifier unit should be integrated.
- * These values are applicable when a tough rubber sheath cable of 2 meter is used as a power line. In the case of a shorter or longer cable length, values of the above table should be selected as closely as possible.
- * The machine should be grounded so that dangerous voltage does not occur at the main part of the machine, such as the operation panel, etc., during a period of emergency leakage current. (C-class or greater grounding is recommended.)
- * Please use an earth leakage circuit breaker which is allowing high harmonics because normal earth leakage circuit breaker or earth leakage protection relay might malfunction by flow of a high harmonics leakage current of ground floating capacitance of servo motor winding, power cable or servo amplifier.

2. Specifications

2.4.3 Calorific value

200V input

■ Power unit

Power unit model number	Power unit total calorific value (W)
RM3PAA7R8	79
RM3PAA120	123
RM3PAA160	171
RM3PAA270	307
RM3PAA370	532

* Calorific values above exclude calorific value of regenerative resistor.

■ Amplifier unit

Amplifier unit model number	Servo motor model number	Amplifier unit total calorific value (W)
RM3DAA050	R1AA10100F	41
	R1AA10150F	44
	R1AA10200H	41
	R1AA10250H	48
	R2AAB8075F	26
	R2AAB8100F	33
	R2AA10100F	31
	R2AA13120D	48
	R2AA13120L	41
	R2AA13180H	58
RM3DAA100	R2AA13200L	58
	R1AA13300F	98
	R1AA13400H	100
	R1AA13500H	112
	R2AA13180D	88
	R2AA13200D	81
RM3DAA150	R2AA18350L	107
	R1AA13400F	106
	R1AA13500F	125
	R2AA18350D	99
	R2AA18450H	108
	R2AA18550R	143
	R2AA22500L	100
	R2AA22700S	153
RM3DAA300	R1AA18550H	210
	R1AA18750L	246
	R1AA1811KR	250
	R1AA1815KB	273
	R2AA18550H	210
	R2AA18750H	233
	R2AA1811KR	281
	R2AA2211KB	273
RM3DAB600	R2AA2215KB	300
	R1AA2220KV	455
	R2AA2220KB	527
RM3DAB900	R2AA2830KV	527
	R2AA2837KB	714

* Calorific values above are the condition of rated motor output operation.

2.4 Power supply calorific value

400V input

■ Power unit

Power unit model number	Servo motor total rated output (kW)	Power unit total calorific value (W)
RM3PCA160	Up to 2.0	96
	2.0 to 5.5	140
	5.5 to 11.0	172
	Up to 16.0	214
RM3PCA370	Up to 30.0	329
	Up to 37.0	396

* Calorific values above exclude calorific value of regenerative resistor.

■ Amplifier unit

Amplifier unit model number	Servo motor model number	Amplifier unit total calorific value (W)
RM3DCA025	R1CA10150V	66
	R2CA10075F	49
	R2CA13050D	50
	R2CA13120R	55
	R2CA13180H	70
	R2CA13200L	68
RM3DCA050	R1CA10200V	90
	R1CA13300V	117
	R2CA10100F	83
	R2CA13120F	104
	R2CA13180D	134
	R2CA13200H	109
RM3DCA075	R2CA18350L	127
	R2CA18350C	150
	R2CA18450H	163
RM3DCA150	R2CA18550V	182
	R1CA18550H	245
	R1CA18750L	263
	R1CA1811KR	286
	R1CA1815KB	309
	R2CA18550H	250
	R2CA18750H	286
	R2CA2211KB	328
RM3DCB300	R2CA2215KV	346
	R1CA2220KV	411
	R2CA2220KB	500
RM3DCB600	R2CA2830KV	488
	R2CA2837KV	839

* Calorific values above are the condition of rated motor output operation.

2. Specifications

2.5 Operation pattern

2.5.1 Time of acceleration and deceleration, permitted repetition, loading precaution

The motor's acceleration time (t_a), and deceleration time (t_b) when under constant load is calculated using the following method:

■ Acceleration time: $t_a = (J_M + J_L) \cdot (2\pi / 60) \cdot \{(N_2 - N_1) / (0.8 \times T_P - T_L)\}$ [s]

■ Deceleration time: $t_b = (J_M + J_L) \cdot (2\pi / 60) \cdot \{(N_2 - N_1) / (0.8 \times T_P + T_L)\}$ [s]

- ◆ t_a : Acceleration time (s)
- ◆ t_b : Deceleration time (s)
- ◆ J_M : Motor inertia moment ($\text{kg} \cdot \text{m}^2$)
- ◆ J_L : Load inertia moment ($\text{kg} \cdot \text{m}^2$)
- ◆ N_1, N_2 : Rotational speed of motor (min^{-1})
- ◆ T_P : Instantaneous maximum stall torque ($\text{N} \cdot \text{m}$)
- ◆ T_L : Load torque ($\text{N} \cdot \text{m}$)

* These expressions are for the rated speed values but exclude the viscous torque and friction of the motor.

■ Loading precaution

There are separate limitations on repetitive operations for both the servo motor and servo amplifier, and the conditions of both must be met simultaneously.

■ Frequency of permitted repetitions for the servo amplifier

When Start/Stop sequences are repeated frequently, confirm in advance that the frequency of repetitions are within tolerance range. Allowed repetitions differ depending on the type, capacity, load inertia moment, accel/decel torque and motor rotation speed of the motor in use. If the load inertia moment = motor inertia moment X m-times, and when the permitted Start/Stop repetitions (up to the maximum rotation speed) exceed the following value, please contact us for assistance, as precise calculation of effective torque and regenerating power is critical.

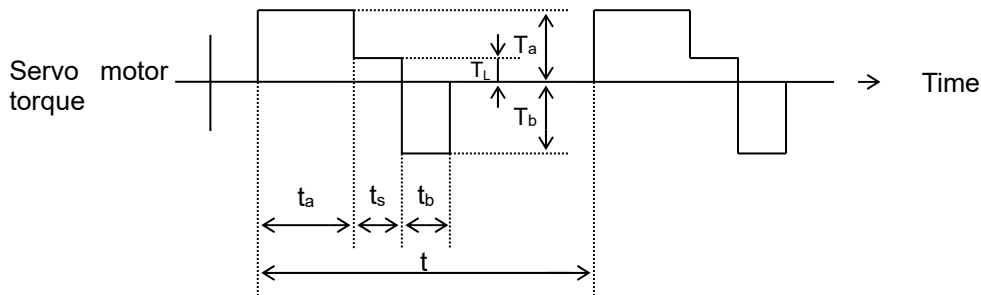
$$\text{Frequency of repetitions} = \frac{20}{m+1} \text{ times / min}$$

■ Frequency of permitted repetitions for the servo motor

Permitted Start/Stop repetitions differ according to the motor usage conditions, such as load condition and operating time.

2.5 Operation pattern

- When the motor repeats continuous speed status and stop status
In operating status (shown below) the motor should be used at a frequency in which its effective torque is less than the rated torque T_R .



- ◆ If the operating cycle is considered as "t", the usable range can be determined as follows:

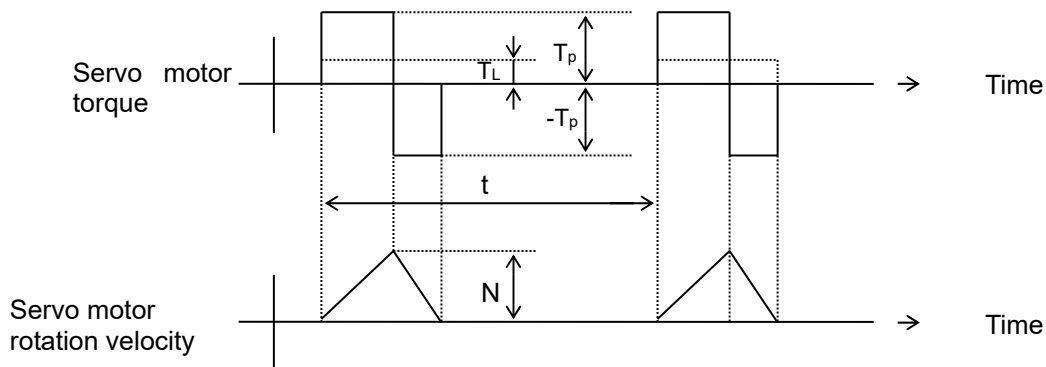
$$t \geq \frac{T_a^2 t_a + T_L^2 t_s + T_b^2 t_b}{T_R^2} \text{ [s]}$$

T_a : Acceleration torque
 T_b : Deceleration torque
 T_L : Load torque
 T_{rms} : Effective torque
 T_R : Rated torque
 t_s : constant speed time(s)

- ◆ When the cycle time (t) is predetermined T_a , T_b , t_a , and t_b appropriate in the above formula are required.

- * When actually determining the system drive mode, it is recommended to calculate the load margin and suppress it to $T_{rms} < 0.8 T_R$.

- When the motor repeats acceleration, deceleration and stop status
In operating status (shown below) the value of permitted repetitions n (times/minutes) is found with the following equation:

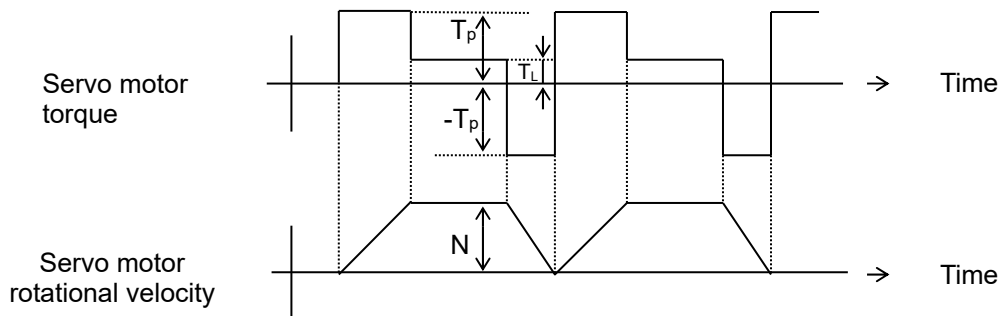


$$n = 2.86 \times 10^2 \times \frac{1}{N(J_M + J_L)} \times \frac{T_P^2 - T_L^2}{T_P^3} \times T_R^2 \text{ [times/ min]}$$

T_P : Peak Torque at stall (N·m)
 T_R : Rated torque
 N : Motor rotation speed (min^{-1})
 J_M : Servo motor inertia moment ($\text{kg} \cdot \text{m}^2$)
 J_L : Load inertia moment ($\text{kg} \cdot \text{m}^2$)

2. Specifications

- When the motor repeats acceleration – constant speed operation – deceleration status
For the operating status shown below, the value of permitted repetitions n (times/min) is found in the following equation:



$$n = 2.86 \times 10^2 \times \frac{1}{N(J_M + J_L)} \times \frac{T_R^2 - T_L^2}{T_P} \quad [\text{times/ min}]$$

- Negative load
Servo amplifier cannot perform continuous operation with a negative load from the servo motor. Please contact us when using the amplifier with a negative load.

Example

- Motor drive downward (when there is no center weight).
- Using like a generator, such as the wind-out spindle of a winder.

- Load inertia moment (JL)
When the servo amplifier is used with a load inertia moment exceeding the allowable load inertia moment calculated in terms of the motor shaft, “main circuit power over voltage detection” or “regenerative error function” may be issued at the time of the operation.

- ◆ Reduce the torque limit
- ◆ Extend the acceleration and deceleration times (slow down)
- ◆ Reduce the maximum rotation speed
- ◆ Re-examine regenerative resistance

2.6 Specifications for dynamic brake

2.6 Specifications for dynamic brake

2.6.1 Allowable frequency, instantaneous tolerance, decreasing the rotation angle of the dynamic brake

- Allowable frequency of the dynamic brake
Allowable number in condition of maximum allowable load inertia moment and maximum regenerative energy which has 1.2 times of maximum rotation speed (over speed) is 1,000 times around.
It will be required that relay replacement when exceeding 1,000 times.
For reference, mechanical life-span (ON/OFF) of relay without dynamic brake operation (after motor stop) is 100,000 times.
- Operation intervals
In basic terms, dynamic brake operation is allowed with following conditions: six (6) minute intervals, ten (10) times or less per hour, thirty (30) times or less per day, and maximum count 1,000 times with maximum energy. If the brake is to be operated more frequently, no dynamic brake model shall be used and dynamic brake circuit shall be constructed externally. Please consult us in that case.
- If/When load inertia moment (J_L) substantially exceeds allowable load inertia moment, abnormal heat can generate due to dynamic brake resistance. Take precautions against (Overheat alarm of the dynamic break) or (failure of dynamic brake resistance). Please consult us if such a situation is evident. No dynamic brake model shall be used and dynamic brake circuit shall be constructed externally.

200V input

- Instantaneous tolerance of dynamic brake

Amplifier unit model number	E_{RD} (J)
RM3DAA050, RM3DAA100, RM3DAA150	2,450
RM3DAA300	16,900

* It is not equipped dynamic brake resistor to RM3DAB600 and RM3DAB900.

- ◆ The consumption of energy E_{RD} by dynamic brake resistance in one dynamic brake operation is as follows:

$$E_{RD} = \frac{2.5}{R\phi + 2.5} \times \left\{ \frac{1}{2} (J_M + J_L) \times \left[\frac{2\pi}{60} N \right]^2 - I \times T_L \right\}$$

$R\phi$: Servo motor phase winding resistance (Ω)

J_M : Inertia moment of servo motor ($\text{kg} \cdot \text{m}^2$)

J_L : Load inertia moment (motor axis conversion)($\text{kg} \cdot \text{m}^2$)

N : Servo motor rotation speed in feed rate V (min^{-1})

I : Integrated stage-down rotation angle (rad.)

T_L : Load torque ($\text{N} \cdot \text{m}$)

It should prevent exceeding value in table above.

2. Specifications

- Staging down the rotation angle using the dynamic brake is show as follows:

$$l = l_1 + l_2 = \frac{2\pi N \times t_D}{60} + (J_M + J_L) \times (\alpha N + \beta N^3)$$

J_M : Inertia of servo motor ($\text{kg} \cdot \text{m}^2$)

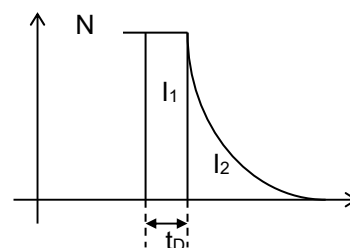
J_L : Load inertia (motor axis conversion) ($\text{kg} \cdot \text{m}^2$)

N : Servo motor rotation speed (min^{-1})

l_1 : Stage down rotation angle (rad) using amplifier internal process t_D

l_2 : Stage down rotation angle (rad) using dynamic brake operation

t_D : $24 \times 10^{-3}(\text{s})$



α · β : See below.

Amplifier unit model number	Servo motor model number	α	β	$J_M(\text{kg} \cdot \text{m}^2)$
RM3DAA050	R1AA10100F	1.92	3.53×10^{-7}	1.4×10^{-4}
	R1AA10150F	0.96	2.0×10^{-7}	2.0×10^{-4}
	R1AA10200H	0.44	3.75×10^{-7}	2.3×10^{-4}
	R1AA10250H	0.32	2.73×10^{-7}	2.8×10^{-4}
	R2AAB8075F	1.7	4.0×10^{-7}	1.64×10^{-4}
	R2AAB8100F	1.34	2.13×10^{-7}	2.38×10^{-4}
	R2AA10100F	1.3	5.01×10^{-7}	3.5×10^{-4}
	R2AA13120D	0.91	7.15×10^{-7}	6.3×10^{-4}
	R2AA13120L	0.71	1.28×10^{-6}	6×10^{-4}
	R2AA13180H	0.49	5.15×10^{-7}	9.0×10^{-4}
	R2AA13200L	0.41	3.46×10^{-7}	12.2×10^{-4}
RM3DAA100	R1AA13300F	1.29	1.01×10^{-7}	7.0×10^{-4}
	R1AA13400H	0.35	8.0×10^{-8}	8.8×10^{-4}
	R1AA13500H	0.25	6.8×10^{-8}	10.6×10^{-4}
	R2AA13180D	0.91	2.87×10^{-7}	9.0×10^{-4}
	R2AA13200D	0.72	2.13×10^{-7}	12.2×10^{-4}
	R2AA18350L	0.34	3.8×10^{-8}	40×10^{-4}
RM3DAA150	R1AA13400F	0.85	3.4×10^{-8}	8.8×10^{-4}
	R1AA13500F	0.78	2.3×10^{-8}	10.6×10^{-4}
	R2AA18350D	0.44	3.1×10^{-8}	40×10^{-4}
	R2AA18450H	0.28	3.0×10^{-8}	50×10^{-4}
	R2AA18550R	0.22	1.8×10^{-8}	68×10^{-4}
	R2AA22500L	0.33	9.9×10^{-8}	55×10^{-4}
	R2AA22700S	0.07	1.6×10^{-8}	136×10^{-4}
RM3DAA300	R1AA18550H	0.44	1.1×10^{-8}	33×10^{-4}
	R1AA18750L	0.27	6.0×10^{-9}	42×10^{-4}
	R1AA1811KR	0.17	5.0×10^{-9}	64×10^{-4}
	R1AA1815KB	0.1	4.0×10^{-9}	86×10^{-4}
	R2AA18550H	0.46	9.0×10^{-9}	68×10^{-4}
	R2AA18750H	0.29	6.0×10^{-9}	98×10^{-4}
	R2AA1811KR	0.21	7.0×10^{-9}	110×10^{-4}
	R2AA2211KB	0.17	3.0×10^{-9}	178×10^{-4}
	R2AA2215KB	0.14	3.0×10^{-9}	237×10^{-4}

- * The values for α , β are reached based on an assumed resistance value of the power line being 0 ohm. Contact us when the combination with an amplifier is different than those shown above (invariably values are different).

2.6 Specifications for dynamic brake

400V input

■ Instantaneous tolerance of dynamic brake

Servo amplifier model number	E_{RD} (J)
RM3DCA050	4,100
RM3DCA075, RM3DCA150	17,100

* RM3DCA025 has no dynamic brake resistor. In this case, dynamic brake works by making short circuit between motor windings.

◆ The consumption of energy E_{RD} by dynamic brake resistance in one dynamic brake operation is as follows:

$$E_{RD} = \frac{1.5}{R\phi + 1.5} \times \left\{ \frac{1}{2} (J_M + J_L) \times \left[\frac{2\pi}{60} N \right]^2 - I \times T_L \right\}$$

$R\phi$: Servo motor phase winding resistance(Ω)

J_M : Inertia moment of servo motor ($\text{kg} \cdot \text{m}^2$)

J_L : Load inertia moment (motor axis conversion)($\text{kg} \cdot \text{m}^2$)

N : Servo motor rotation speed in feed rate V (min^{-1})

I : Integrated stage-down rotation angle (rad.)

T_L : Load torque ($\text{N} \cdot \text{m}$)

2. Specifications

- Staging down the rotation angle using the dynamic brake is show as follows:

$$l = l_1 + l_2 = \frac{2\pi N \times t_D}{60} + (J_M + J_L) \times (\alpha N + \beta N^3)$$

J_M : Inertia of servo motor ($\text{kg} \cdot \text{m}^2$)

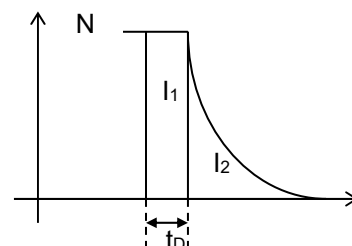
J_L : Load inertia (motor axis conversion) ($\text{kg} \cdot \text{m}^2$)

N : Servo motor rotation speed (min^{-1})

l_1 : Stage down rotation angle (rad) using amplifier internal process t_D

l_2 : Stage down rotation angle (rad) using dynamic brake operation

t_D : $10 \times 10^{-3}(\text{s})$



α · β : See below.

Amplifier unit model number	Servo motor model number	α	β	$J_M(\text{kg} \cdot \text{m}^2)$
RM3DCA025	R1CA10150V	0.57	1.84×10^{-6}	2.1×10^{-4}
	R2CA10075F	1.29	5.63×10^{-6}	2.5×10^{-4}
	R2CA13050D	0.86	1.21×10^{-5}	3.1×10^{-4}
	R2CA13120R	0.33	5.08×10^{-6}	6.0×10^{-4}
	R2CA13180H	0.19	4.06×10^{-6}	9.0×10^{-4}
	R2CA13200L	0.13	2.60×10^{-6}	12.2×10^{-4}
RM3DCA050	R1CA10200V	1.17	6.39×10^{-7}	2.4×10^{-4}
	R1CA13300V	0.78	3.12×10^{-7}	6.8×10^{-4}
	R2CA10100F	3.40	7.64×10^{-7}	3.9×10^{-4}
	R2CA13120F	1.84	9.59×10^{-7}	6.0×10^{-4}
	R2CA13180D	1.26	5.03×10^{-7}	9.0×10^{-4}
	R2CA13200H	0.68	1.05×10^{-6}	12.2×10^{-4}
RM3DCA075	R2CA18350L	0.30	2.19×10^{-7}	40×10^{-4}
	R2CA18350C	0.20	7.46×10^{-8}	40×10^{-4}
	R2CA18450H	0.15	5.27×10^{-8}	50×10^{-4}
RM3DCA150	R2CA18550V	0.08	5.30×10^{-8}	68×10^{-4}
	R1CA18550H	0.17	2.81×10^{-8}	33×10^{-4}
	R1CA18750L	0.12	2.17×10^{-8}	42×10^{-4}
	R1CA1811KR	0.07	1.22×10^{-8}	64×10^{-4}
	R1CA1815KB	0.04	1.04×10^{-8}	86×10^{-4}
	R2CA18550H	0.19	2.18×10^{-8}	68×10^{-4}
	R2CA18750H	0.13	1.69×10^{-8}	98×10^{-4}
	R2CA2211KB	0.07	8.17×10^{-9}	178×10^{-4}
	R2CA2215KV	0.05	4.70×10^{-9}	288×10^{-4}

- * The values for α , β are reached based on an assumed resistance value of the power line being 0 ohm. Contact us when the combination with an amplifier is different than those shown above (invariably values are different).

2.7 Regeneration process

Allowable minimum values of Built-in/ external regenerative resistor and allowable regenerative power of regenerative circuit of servo amplifier are shown below. See "6.3 Selection of regenerative resistor" for selection method of regenerative resistor.

Installation

In this chapter, installation of power unit, amplifier unit, control unit and servo motor are explained.

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3. Installation

3.1 Power unit/Amplifier unit/Control unit

3.1.1 Precautions

When installing, please be sure to protect the following precautions.

■ Various precautions

The device should be installed on non-flammable surfaces only. Installation on or near flammable materials can cause fire.

Do not stand on, or put heavy items on the servo amplifier.

Operate the device within the specified environmental conditions.

Do not drop the device or subject it to excessive shock.

Make sure no screws or other conductive or flammable materials get inside the each unit.

Do not obstruct the air intake and exhaust vents. The mounting direction should be observed strictly.

Please contact our office if the each unit is to be stored for a period of 3 years or longer. The capacity of the electrolytic capacitors decreases during long-term storage.

Any damaged parts or the products which have damaged parts shall be repaired by returning it to our company immediately.

■ If enclosed in a cabinet

The temperature inside the cabinet might exceed the external temperature depending on the power consumption of the device and the size of the cabinet. Consider the cabinet size, cooling, and placement, and make sure the temperature around the each unit does not exceed 55°C. For longevity and reliability purposes it is recommended to keep the temperature below 40°C.

■ If there is a vibration source nearby

Protect the each unit from vibration by installing it on a base with a shock absorber.

■ If there is a heat generator nearby

If the ambient temperature might increase by convection or radiation, make sure the temperature near the each unit does not exceed 55°C.

■ If corrosive gas is present

Long-term use may cause contact failure on the connectors and connecting parts. Never use the device where it may be exposed to corrosive gas.

■ If explosive or combustible gas is present

Never use the device where explosive or combustible gas is present.

The device's relays and contactors, regenerative resistors and other parts can generate arc (spark) and can cause fire or explosion.

■ If dust or oil mist is present

The device cannot be used where dust or oil mist is present. If dust or oil mist accumulates on the device, it can cause insulation deterioration or leakage between the conductive parts, and damage the each unit.

■ If a large noise source is present

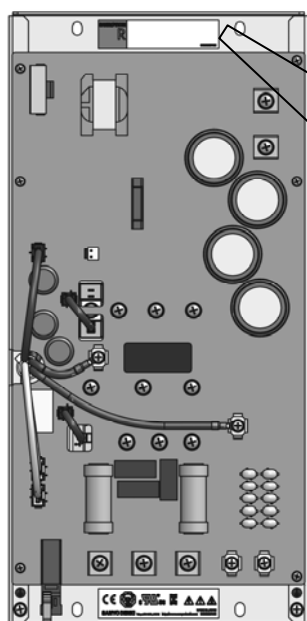
If inductive noise enters the input signals or the power circuit, it can cause a malfunction. If there is a possibility of noise, inspect the line wiring and take appropriate noise prevention measures. A noise filter should be installed before the power unit.

3.1 Power unit, Amplifier unit, Control unit

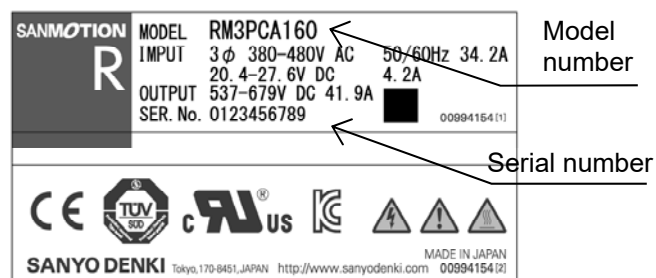
3.1.2 Unpacking

Verify the followings when the product arrives. If you find any discrepancy, contact your distributor or sales office.

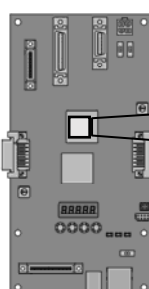
- Verify that the model number of each unit is the same as ordered. The model number is located on the main nameplate of each unit.
- Verify that there is no problem in the appearance of each unit.
- Verify that there are no loose screws on each unit.



400V input power unit (example)



Main nameplate of power unit (example)



Control unit (1 axis)



Main nameplate of control unit (1 axis)

Interpretation of the serial number

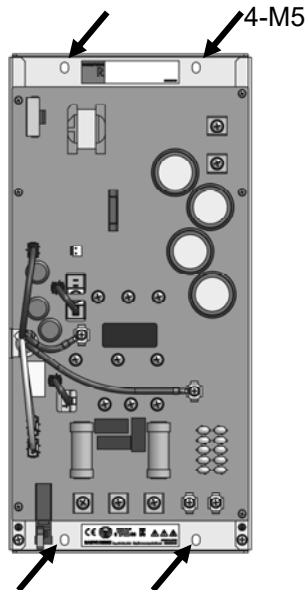
Month (2-digit) + Year (2-digit) + Day (2-digit) + Serial number (4-digit) + Revision ("A" abbreviated)

3. Installation

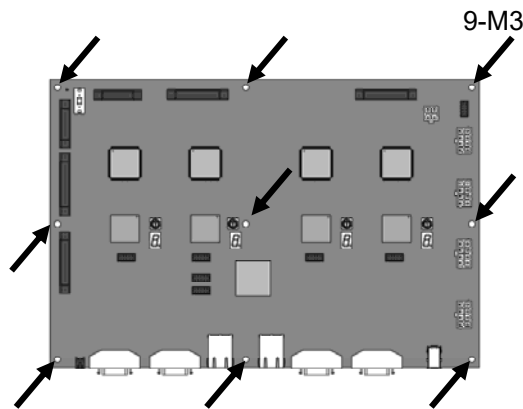
3.1.3 Mounting direction and location

- About mounting direction and points of each unit, refer outline drawings in section 7.7 (for 200V input) and 7.8 (for 400V input).

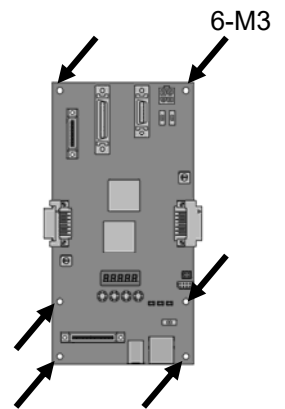
400V input power unit (example)



Control unit (4 axes)

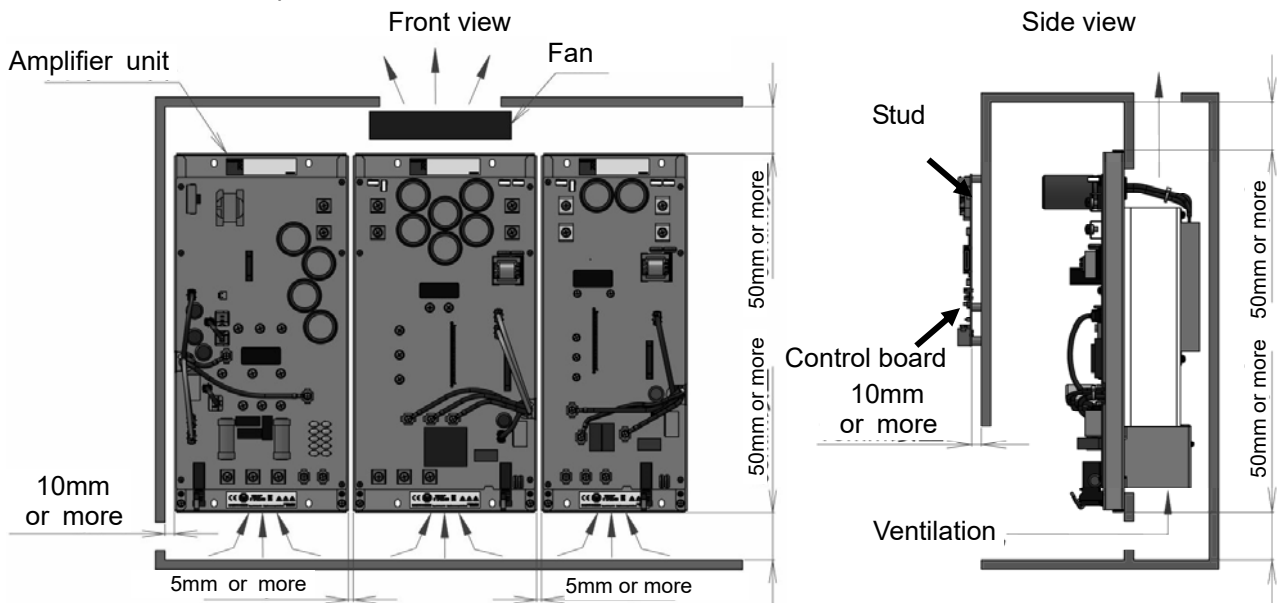


Control unit (1 axis)



3.1.4 Arrangement within the cabinet

- Leave at least 50 mm space above and below the power unit/amplifier unit to ensure unobstructed airflow from the inside of the power unit/amplifier unit and the radiator. If heat gets trapped around the power unit/amplifier unit, use a cooling fan to create airflow.
- Make sure the temperature around the power unit/amplifier unit does not exceed 55°C. For longevity and reliability purposes it is recommended to keep the temperature below 40°C.
- Leave at least 5 mm space on both sides of the power unit/amplifier unit to ensure unobstructed airflow from the heat sinks on the side and from the inside of the power unit/amplifier unit.



* Arrangement above is order of power unit (16kW), amplifier unit (150A) and amplifier unit (75A) from left side.

3.2 Servo motor

3.2.1 Precautions

■ Various precautions

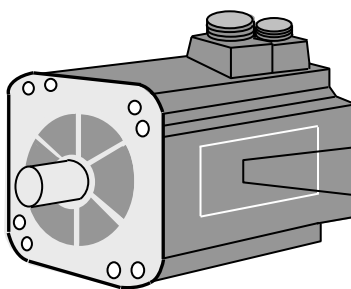
The device should be installed on non-flammable surfaces only. Installation on or near flammable materials can cause fire.
Do not stand on, or put heavy items on the servo amplifier.
Operate the device within the specified environmental conditions.
Do not drop the device or subject it to excessive shock.
The mounting instruction should be followed strictly.
Any damaged parts or the products which have damaged parts shall be repaired by returning it to our company immediately.
Please contact us for long-term period storage (for 3 years or more).

3.2.2 Unpacking

Verify the followings when the product arrives. If you find any discrepancy, contact your distributor or sales office.

- Verify that the model number of the servo motor is the same as ordered.
The model number is located on the main nameplate, following the word “MODEL”.
- Verify that there is no problem in the appearance of servo motor.
- Verify that there are no loose screws on the servo motor.

Servo motor



Servo motor main nameplate



3.2.3 Installation

Please note the following regarding the installation location and mounting method.

The servo motor is designed for indoor use. Make sure to install it indoors.

Do not use the device in locations where the oil seal lip is continuously exposed to oil, or where the device is exposed to large quantities of water, oil drops, or cutting fluid. The motor is designed to withstand only small amounts of moisture spray.

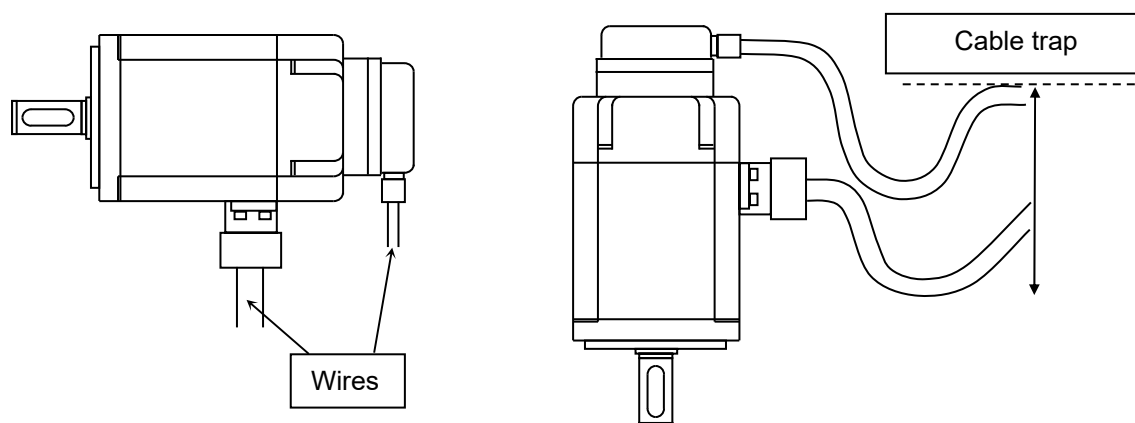
Ambient temperature: 0 to 40°C
Storage temperature: -20 to 65°C
Ambient humidity: 20 to 90%

Good ventilation, no corrosive or explosive gases present.
No dust or dirt accumulation in the environment.
Easy access for inspection and cleaning.

3. Installation

3.2.4 Mounting method

- Mounting in several orientations are acceptable as horizontal, or upper side/bottom side of the shaft end.
- If the output shaft is used in reduction devices that use grease, oil, or other lubricants, or in mechanisms exposed to liquids, the motor shaft should be installed in a perfectly horizontal or downward position. In some models, there is an oil-seal attached to the output shaft. If the shaft is facing upwards and the seal lip is continuously exposed to oil, oil can enter inside the motor and cause damage, as a result of wear and degradation of the oil seal. In such cases an oil seal should be used on the load-side as well. Contact your distributor or sales office if the device is to be used in such conditions.
- The motor connector and cable outlet should be installed facing downwards, as nearly vertical as possible.
- In vertical installation, create a cable trap to prevent oily water from getting into the motor.

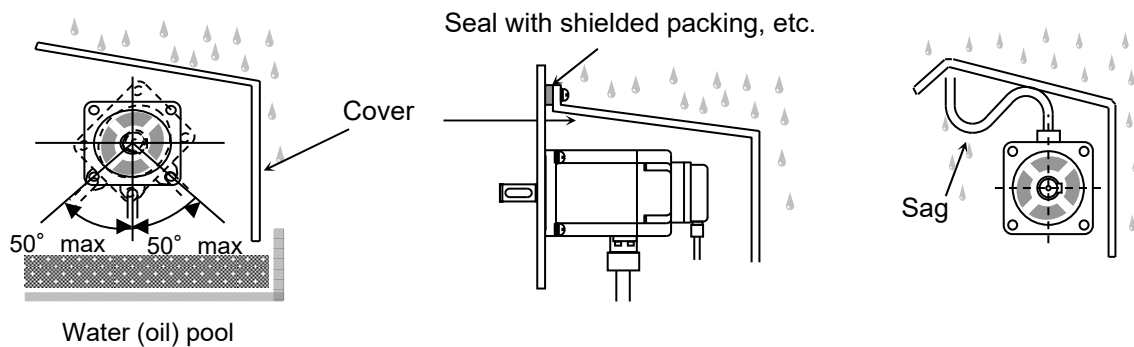


3.2.5 Waterproofing and dust proofing

- The protection inside the motor conforms to IEC standards (IEC34-5). However, such protection is suitable only for short-term use. For regular use, additional sealing measures are required. Be sure to handle the connector carefully, as damage to the exterior of the connector (painted surface) can reduce its waterproofing capability.
- Install a protective cover to prevent corrosion of the coating and the sealing material, which can be caused by certain types of coolants (especially water soluble types).
- In case of a cannon plug type motor, please use a waterproofed type plug.

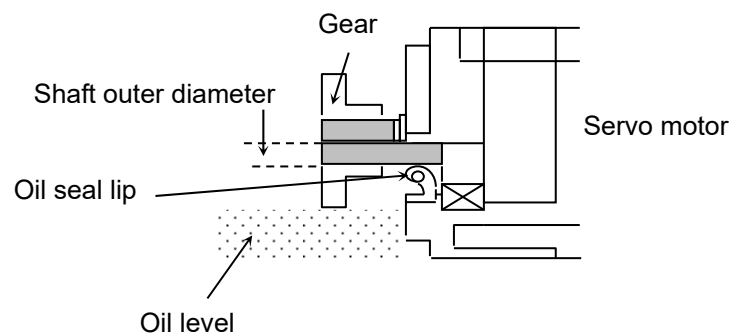
3.2.6 Protective cover installation

- Install a protective cover (as described below) for motors continuously subjected to liquids.
- Turn the connectors (lead outlets) downwards within the angle range shown in the picture below.
- Install the cover on the side where the water or oil would drip.
- Install the cover with slant (for runoff), to prevent water or oil from collecting.
- Make sure that the cable does not get soaked in water or oil.
- Create a sag in the cable outside the cover, to make sure water or oil does not penetrate to the motor.
- If it is not possible to install the connectors (lead outlets) facing downwards, create a sag in the cable to prevent water or oil from entering the motor.



3.2.7 Gear installation and Integration with the target machinery

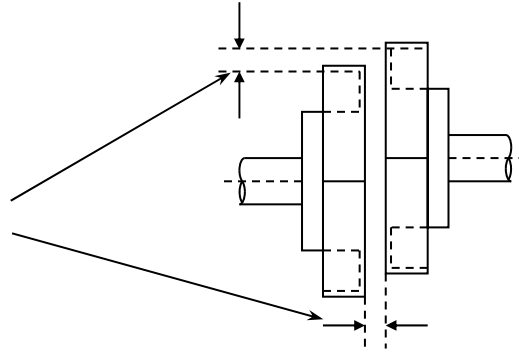
- The oil level of the gear box should be below the oil seal lip, for a slight spraying effect on the lip.
- Create a hole to prevent pressure build-up inside the gear box, as pressure can cause water or oil to penetrate the oil seal and enter inside the motor.
- If the motor is used with the shaft facing upwards, an oil seal should be used on the opposite side of the mechanism as well. In addition, install a drain to expel the water or oil that may penetrate through this oil seal.



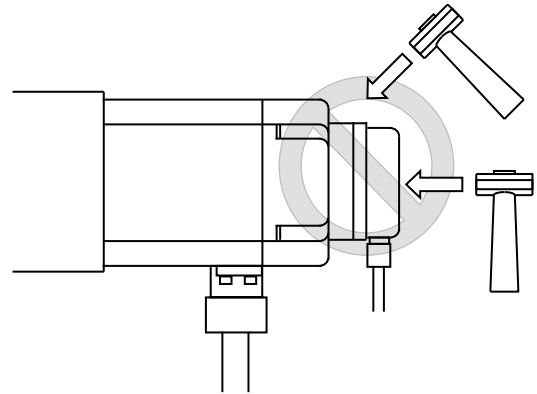
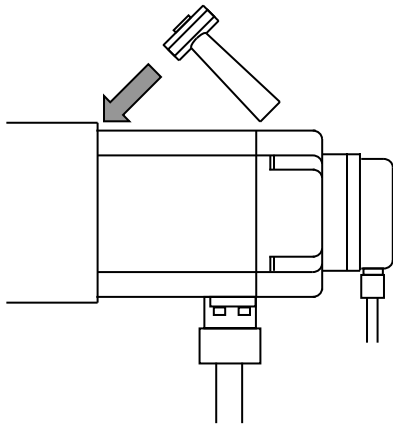
3. Installation

- Refer to the drawing below for correct centering of the motor shaft and the target machinery. Please note when using a rigid coupling that even a slight mistake in centering can damage the output shaft.

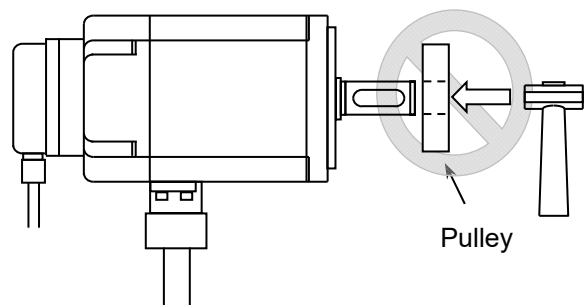
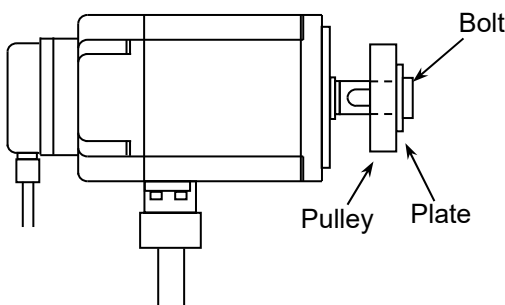
Measured at all 4 locations, the difference between the maximum and the minimum should not exceed $3/100\text{mm}$.
(coupling rotates jointly)



- Do not apply any shocks on the servo motor shaft because precision equipment, encoder is directly connected to it. If it is absolutely necessary to hit the motor for position adjustment or other reasons, use a rubber or plastic hammer and hit the front flange area.



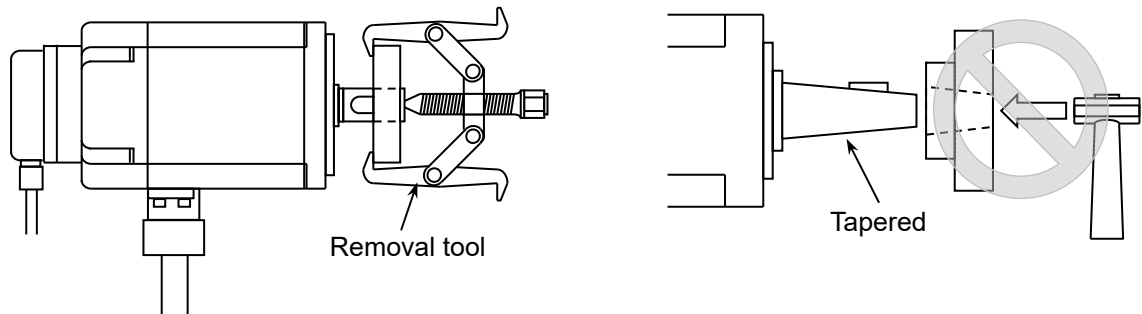
- For mounting to a machine, create accurate enough mounting holes for smooth coupling of the motor flange rabbet. The mounting surface should be flat, otherwise damage to the shaft or the load may occur.
- Use the screw at the end of the shaft for installing parts such as the gear, pulley, or coupling, to avoid shock.



- Tapered servo motor shafts transmit the torque via the tapered surface. Make sure the key fits without rattling. The tapered surface contact should be no less than 70%.

3.2 Servo motor

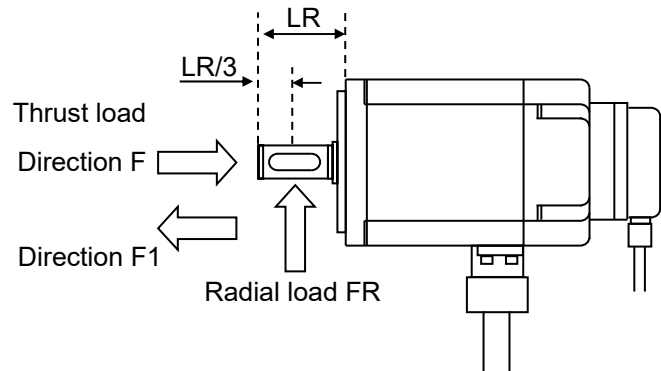
- Use a special tool for removing the gear, pulley, etc.



3.2.8 Allowable bearing load

- The table below shows the allowable bearing load of the servo motors. Do not apply excessive thrust load or radial load. In case of belt driving, make sure that the shaft converted value of belt tension does not exceed the allowable values shown below. The thrust load and radial load tolerance values assume individual application to the shaft.

The radial load tolerance value is the maximum load that can be applied at the point measured 1/3 of the distance from the tip of the output shaft.



200V input

	Servo motor model number	Assembly			Operation		
		Radial load (N)	Thrust load (N)		Radial load (N)	Thrust load (N)	
		FR	Direction F	Direction F1	FR	Direction F	Direction F1
R1	R1AA10100	980	290	290	690	290	290
	R1AA10150	980	290	290	690	290	290
	R1AA10200	980	290	290	690	290	290
	R1AA10250	980	290	290	690	290	290
	R1AA13300	2000	390	390	980	390	390
	R1AA13400	2000	390	390	980	390	390
	R1AA13500	2000	390	390	1200	390	390
	R1AA18550	3900	2000	2000	1800	590	590
	R1AA18750	3900	2000	2000	1800	590	590
	R1AA1811K	3900	2000	2000	1800	590	590
	R1AA1815K	3900	2000	2000	2700	1500	1500
	R1AA2220K	3900	2000	2000	2700	1500	1500

3. Installation

200V input

	Servo motor model number	Assembly			Operation		
		Radial load (N)	Thrust load (N)		Radial load (N)	Thrust load (N)	
		FR	Direction F	Direction F1	FR	Direction F	Direction F1
R2	R2AAB8075	590	780	290	340	200	200
	R2AAB8100	590	780	290	340	200	200
	R2AA10100	590	780	290	340	200	200
	R2AA13120	1700	1900	1900	640	490	490
	R2AA13180	1700	1900	1900	640	490	490
	R2AA13200	1700	1900	1900	640	490	490
	R2AA18350	2300	1900	1900	1500	290	290
	R2AA18450	2300	1900	1900	1500	290	290
	R2AA18550	3900	2000	2000	1800	590	590
	R2AA18750	3900	2000	2000	1800	590	590
	R2AA1811K	3900	2000	2000	1800	590	590
	R2AA22500	2300	1900	1900	1500	490	490
	R2AA22700	3900	2000	2000	2500	1100	1100
	R2AA2211K	3900	2000	2000	2700	1500	1500
	R2AA2215K	3900	2000	2000	2700	1500	1500
	R2AA2220K	3900	2000	2000	2700	1500	1500
	R2AA2830K	4700	2000	2000	3300	1500	1500
	R2AA2837K	4700	2000	2000	3300	1500	1500

400V input

	Servo motor model number	Assembly			Operation		
		Radial load (N)	Thrust load (N)		Radial load (N)	Thrust load (N)	
		FR	Direction F	Direction F1	FR	Direction F	Direction F1
R1	R1CA10150	980	290	290	690	290	290
	R1CA10200	980	290	290	690	290	290
	R1CA13300	2000	390	390	980	390	390
	R1CA18550	3900	2000	2000	1800	590	590
	R1CA18750	3900	2000	2000	1800	590	590
	R1CA1811K	3900	2000	2000	1800	590	590
	R1CA1815K	3900	2000	2000	2700	1500	1500
	R1CA2220K	3900	2000	2000	2700	1500	1500
R2	R2CA10075	590	780	290	340	200	200
	R2CA10100	590	780	290	340	200	200
	R2CA13050	980	1400	1400	640	490	490
	R2CA13120	1700	1900	1900	640	490	490
	R2CA13180	1700	1900	1900	640	490	490
	R2CA13200	1700	1900	1900	640	490	490
	R2CA18350	2300	1900	1900	1500	290	290
	R2CA18450	2300	1900	1900	1500	290	290
	R2CA18550	3900	2000	2000	1800	590	590
	R2CA18750	3900	2000	2000	1800	590	590
	R2CA2211K	3900	2000	2000	2700	1500	1500
	R2CA2215K	3900	2000	2000	2700	1500	1500
	R2CA2220K	3900	2000	2000	2700	1500	1500
	R2CA2830K	4700	2000	2000	3300	1500	1500
	R2CA2837K	4700	2000	2000	3300	1500	1500

3.2.9 Cable installation considerations

- Be careful not to apply excessive stress and damages onto cables.
- When installing cables in the place servo motor can move, take sufficient inflective radius so as not to apply excessive stress onto cables.
- Pass cables through the areas where cable insulators shall not be scratched by sharp cutting debris. Do not pass cables through the areas having possibility that machine corner scrapes against cables, or personnel/machines may tread on cables.
- Take measures such as clamp to machines so as not to apply flexion stress and own weight stress onto each connecting point of cables. When motor and cables need to be transferred with cableveyor (cable carrier), bending radius of cable shall be determined by referring required flexion life and wire type.
- Periodic replaceable structure for movable part of cable is recommended. Please contact us when you would like to use recommended cables for movable parts.

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Wiring

In this chapter, wiring between power unit, amplifier unit, servo motor and peripherals are explained.

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4. Wiring

4.1 Part name and function

200V input

Power unit: RM3PAA7R8 to RM3PAA160

Name	Symbol	Function	Remarks
Main circuit power terminal	R, S, T	Inputs three-phase, 200 to 230V AC.	Refer 4.2.1 to 4.2.4.
DC power terminal	P, N	Connects to P, N of amplifier unit.	
Control power input terminal	r, t	Inputs single-phase, 200 to 230V AC.	
Protective grounding terminal		Connects to power ground line.	
Regenerative resistor terminal	RB1, RB2	Connects to regenerative resistor line.	Refer 4.2.3 and 4.2.10.
Built-in cooling fan power connector	24V, 0V	Inputs 24V DC.	
Regenerative resistor thermal sensor terminal	EXT.TH	Connects thermal sensor line of regenerative resistor.	Refer 4.2.3 and 4.2.9.
Control power output connector	CN1-1 CN1-2 Note 1)	Connects to CN1-1 of amplifier unit.	Refer 4.2.3 and 4.3.1.
Control unit connection connector	CN2	Connects to control unit.	Refer 4.3.2.

Power unit: RM3PAA270, RM3PAA370

Name	Symbol	Function	Remarks
Main circuit power terminal	R, S, T	Inputs three-phase, 200 to 230V AC.	Refer 4.2.1 to 4.2.4.
DC power terminal	P, N	Connects to P, N of amplifier unit.	
Control power input terminal	r, t	Inputs single-phase, 200 to 230V AC.	
Protective grounding terminal		Connects to power ground line.	
Regenerative resistor terminal	RB1, RB2	Connects to regenerative resistor line.	Refer 4.2.3 and 4.2.9.
Regenerative resistor thermal sensor terminal	EXT.TH	Connects thermal sensor line of regenerative resistor.	
Control power output connector	CN1-1 CN1-2 Note 1)	Connects to CN1-1 of amplifier unit.	Refer 4.2.3 and 4.3.1.
Control unit connection connector	CN2	Connects to control unit.	Refer 4.3.2.

Note 1) Two connectors are the same power output signal.

4.1 Part name and function

200V input

Amplifier unit: RM3DAA050 to RM3DAA300

Name	Symbol	Function	Remarks
DC main circuit power terminal	P, N	Connects to P, N of power unit or previous/next amplifier units.	Refer 4.2.1 to 4.2.5.
Servo motor connection terminal	U, V, W, E	Connects to servo motor.	
Protective grounding terminal		Connects to power source ground.	
Built-in cooling fan power connector (Note 2)	24V, 0V	Inputs 24V DC.	Refer 4.2.3 and 4.2.10.
Control power input/output connector	CN1-1	Connects to CN1-2 of power unit or previous amplifier unit.	Refer 4.2.3 and 4.3.1.
	CN1-2	Connects to CN1-1 of next amplifier unit.	
Control unit connection connector	CN2	Connects to control unit.	Refer 4.3.3.

Note 2) RM3DAA050 is not equipped.

Amplifier unit: RM3DAB600, RM3DAB900

Name	Symbol	Function	Remarks
DC main circuit power terminal	P, N	Connects to P, N of power unit or previous/next amplifier units.	Refer 4.2.1 to 4.2.5.
Servo motor connection terminal	U, V, W	Connects to servo motor.	
Motor grounding terminal, Protective grounding terminal		Connects to servo motor ground and power source ground.	
DB signal connection terminal	DB1, DB2	This is for dynamic brake timing output. Connect to coil side of magnetic contactor for dynamic brake operation.	
Built-in cooling fan power connector	r, t	Inputs single-phase, 200 to 230V AC.	
External thermal sensor connector	EXT.TH	Connects a thermal sensor of dynamic brake resistor or servo motor cooling fan. Make short circuit when thermal sensor is not used.	Refer 4.2.3 and 4.2.8.
Control power input/output connector	CN1-1	Connects to CN1-2 of power unit or previous amplifier unit.	Refer 4.2.3 and 4.3.1.
	CN1-2	Connects to CN1-1 of next amplifier unit.	
Control unit connection connector	CN2	Connects to control unit.	Refer 4.3.3.

4. Wiring

400V input

Power unit

Name	Symbol	Function	Remarks
Main circuit power terminal	R, S, T	Inputs three-phase, 380 to 480V AC.	Refer 4.2.1 to 4.2.4.
DC main circuit power terminal	P, N	Connects to P, N of amplifier unit.	
Protective grounding terminal		Connects to power source ground.	
Regenerative resistor terminal	RB1, RB2	Connects to regenerative resistor.	Refer 4.2.3 and 4.2.9.
Regenerative resistor thermal sensor terminal	EXT.TH	Connects thermal sensor line of regenerative resistor.	
Control power connector	CND	Inputs 24V DC.	Refer 4.2.3 and 4.2.7.
Control unit connection connector	CN1	Connects to control unit.	Refer 4.3.2.

Amplifier unit: RM3DCA025 to 150

Name	Symbol	Function	Remarks
DC main circuit power terminal	P, N	Connects to P, N of power unit or previous/next amplifier units.	Refer 4.2.1 to 4.2.5.
Servo motor terminal	U, V, W	Connects to servo motor.	
Protective grounding terminal		Connects to ground of power source and servo motor.	
Control power connector	CND	Inputs 24V DC.	Refer 4.2.3 and 4.2.7.
Control unit connection connector	CN8	Connects to control unit.	Refer 4.3.3.

Amplifier unit: RM3DCB300, RM3DCB600

Name	Symbol	Function	Remarks
DC main circuit power terminal	P, N	Connects to P, N of power unit or previous/next amplifier units.	Refer 4.2.1 to 4.2.5.
Servo motor terminal	U, V, W	Connects to servo motor.	
Protective grounding terminal		Connects to ground of power source and servo motor.	
DB signal connection terminal	DB1, DB2	This is for dynamic brake timing output. Connect to coil side of magnetic contactor for dynamic brake operation.	Refer 4.2.3 and 4.2.7.
Control power connector	CND	Inputs 24V DC.	
External thermal sensor connector	EXT.TH	Connects a thermal sensor of dynamic brake resistor or servo motor cooling fan. Make short circuit when thermal sensor is not used.	Refer 4.2.3 and 4.2.8.
Control unit connection connector	CN8	Connects to control unit.	Refer 4.3.3.

4.2 Wiring to main circuit/control power, regenerative resistor, servo motor and protection ground

4.2.1 Wire

Electric wires for use in power unit/amplifier unit main circuit power are shown below.

■ Wire type

Kinds of wires		Conductor allowable temperature [°C]
Code	Name	
PVC	Common vinyl electric wire	—
IV	600V electric wire	60
HIV	Special heat-resistant vinyl wire	75

- * The information in this table is based on rated armature current running through three bundled lead wires at ambient temperature of 40°C.
Use the electric wire beyond voltage resistance 600V.
- * When wires are bundled or put into a wire-duct, such as a hardening vinyl pipe or a metallic conduit, take the allowable current reduction ratio into account.
- * At high ambient temperature, service life of the wires becomes shorter by heat-related deterioration. In this case, we recommend using heat-resistant vinyl wires (HIV).

4.2.2 Wire size - allowable current

Nominal cross-sectional area [mm ²]	Conductor resistance [Ω /km]	Allowable current over ambient temperature [A]		
		30°C	40°C	55°C
0.5	39.5	6.6	5.6	4.2
0.75	26.0	8.8	7.0	5.4
0.9	24.4	9.0	7.7	5.8
1.25	15.6	12.0	11.0	8.3
2.0	9.53	23.0	20.0	15.0
3.5	5.41	33.0	29.0	21.8
5.5	3.47	43.0	38.0	28.5
8.0	2.41	55.0	49.0	36.8
14.0	1.35	79.0	70.0	52.5
22.0	0.824	98.0	86.2	65.7
38.0	0.487	138.0	121.4	92.5
60.0	0.303	185.0	162.8	124.0

- * This is reference value in the case of a special heat-resistant vinyl wire (HIV).
- * Electric wire size and allowable current shows in case of three electric wires bundled.
- * Use wire at less than above-mentioned allowable current.

4. Wiring

4.2.3 Recommended wire size

The recommendation electric wire size used for power unit and amplifier unit are shown below.

200V input

Power unit

Power unit model number	Main circuit power				Main circuit DC power (P, N)		Control power (r, t)		Control power DC output terminal (CN1-1, CN1-2)	
	R, S, T									
	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.
RM3PAA7R8	3.5	12	14.0	6	14.0	6	2.0	14	0.75	18
RM3PAA120	5.5	10	14.0	6						
RM3PAA160	8.0	8	14.0	6						
RM3PAA270	38.0	2	38.0	2	38.0	2				
RM3PAA370	60.0	2/0	60.0	2/0	60.0	2/0				

Power unit model number	Regenerative resistor terminal RB1, RB2		Regenerative resistor thermal sensor connector (EXT-TH)		Built-in cooling fan connector (24V, 0V)	
	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.
RM3PAA7R8	3.5	12	0.5	20	0.2	24
RM3PAA120	3.5	12				
RM3PAA160	5.5	10				
RM3PAA270	8.0	8			—	—
RM3PAA370	14.0	6				

Amplifier unit

Amplifier unit model number	Motor power, protective ground, and main circuit DC power (U, V, W, E, ⊕, P, N)		DB signal connection terminal (DB1, DB2)		Control power DC output terminal (CN1-1, CN1-2)	
	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.
RM3DAA050	3.5	12	—	—	0.75	18
RM3DAA100	5.5	10				
RM3DAA150	8.0	8				
RM3DAA300	14.0	6				
RM3DAB600	38.0	2	2.0	14		
RM3DAB900	60.0	2/0				

Amplifier unit model number	External thermal sensor connector (EXT-TH)		Built-in cooling fan connector (24V, 0V)		Built-in cooling fan power terminal (r, t)	
	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.
RM3DAA050	—	—	—	—	—	—
RM3DAA100			0.2	24		
RM3DAA150						
RM3DAA300						
RM3DAB600	0.5	20	—	—	2.0	14
RM3DAB900						

- * The information in this table is based on rated armature current flowing through three bundled lead wires at ambient temperature of 40°C.
- * When wires are bundled or put into a wire-duct, take the allowable current reduction ratio into account.
- * At high ambient temperature, service life of the wires becomes shorter by heat-related deterioration. In this case, we recommend using heat-resistant vinyl wires (HIV).

4.2 Wiring to main circuit/control power, regenerative resistor, servo motor and protection ground

400V input

Power unit

Power unit model number	Servo motor total rated output	Main circuit power (R, S, T, $\oplus$)		Main circuit DC power (P, N)		Control power connector (CND)	
	kW	mm ²	AWG No.	mm ²	AWG No.	mm ²	AWG No.
RM3PCA160	Up to 2.0	1.25	16	1.25	16	1.25	16
	2.0 to 5.5	2.0	14	3.5	12		
	5.5 to 11.0	5.5	10	5.5	10		
	Up to 16.0	8.0	8	8.0	8		

Power unit model number	Servo motor total rated output	Regenerative resistor terminal RB1, RB2		Regenerative resistor thermal sensor connector (EXT-TH)	
	kW	mm ²	AWG No.	mm ²	AWG No.
RM3PCA160	Up to 2.0	3.5	12	0.5	20
	2.0 to 5.5				
	5.5 to 11.0				
	Up to 16.0				

Amplifier unit

Amplifier unit model number	Motor power, protective ground, main circuit DC power (U, V, W, $\oplus$, P, N)		Control power connector (CND)	
	mm ²	AWG No.	mm ²	AWG No.
RM3DCA025	1.25	16	1.25	16
RM3DCA050	2.0	14		
RM3DCA075	3.5	12		
RM3DCA150	8.0	8		

- * The information in this table is based on rated armature current flowing through three bundled lead wires at ambient temperature of 40°C.
- * When wires are bundled or put into a wire-duct, take the allowable current reduction ratio into account.
- * At high ambient temperature, service life of the wires becomes shorter by heat-related deterioration. In this case, we recommend using heat-resistant vinyl wires (HIV).

4. Wiring

400V input

Power unit

Power unit model number	Servo motor total rated output	Main circuit power (R, S, T, $\oplus$)		Main circuit DC power (P, N)		Control power connector (CND)	
	kW	mm ²	AWG No	mm ²	AWG No	mm ²	AWG No
RM3PCA370	Up to 21	8	8	14	6	1.25	16
	Up to 30	14	6	14	6		
	37	22	4	38	1		

Power unit model number	Servo motor total rated output	Regenerative resistor terminal RB1, RB2		Regenerative resistor thermal sensor connector (EXT-TH)	
	kW	mm ²	AWG No	mm ²	AWG No
RM3PCA370	Up to 37	3.5	12	0.5	20

Amplifier unit

Amplifier unit model number	Motor power, protective ground, main circuit DC power (U, V, W, $\oplus$, P, N)		Control power connector (CND)	
	mm ²	AWG No	mm ²	AWG No
RM3DCB300	14	6	1.25	16
RM3DCB600	38	2		

- * The information in this table is based on rated armature current flowing through three bundled lead wires at ambient temperature of 40°C.
- * When wires are bundled or put into a wire-duct, take the allowable current reduction ratio into account.
- * At high ambient temperature, service life of the wires becomes shorter by heat-related deterioration. In this case, we recommend using heat-resistant vinyl wires (HIV).

4.2 Wiring to main circuit/control power, regenerative resistor, servo motor and protection ground

4.2.4 Tightening torque

200V input

Power unit model number	R	S	T	P	N	⊕	RB1	RB2	r	t
RM3PAA7R8 RM3PAA120 RM3PAA160	[2.0 N·m] M5 (screw size)								[1.4 N·m] M4 (screw size)	

Power unit model number	R	S	T	P	N	⊕	RB1	RB2	r	t
RM3PAA270	[9.0 N·m] M8 (screw size)						[3.0 N·m] M6 (screw size)		[1.4 N·m] M4 (screw size)	
RM3PAA370	[12.0 N·m] M10 (screw size)						[9.0 N·m] M8 (screw size)			

Amplifier unit model number	U	V	W	⊕	P	N
RM3DAA050 RM3DAA100 RM3DAA150	[1.2 N·m] M4 (screw size)				[2.0 N·m] M5 (screw size)	
RM3DAA300	[2.0 N·m] M5 (screw size)					

Amplifier unit model number	U	V	W		P	N	DB1	DB2	r	t
RM3DAB600	[9.0 N·m] M8 (screw size)						[1.4 N·m] M4 (screw size)			
RM3DAB900	[9.0 N·m] M10 (screw size)									

400V input

Power unit model number	R	S	T	P	N	⊕	RB1	RB2
RM3PCA160	[2.0 N·m] M5 (screw size)					[1.4 N·m] M4 (screw size)	[1.2 N·m] M4 (screw size)	

Amplifier unit model number	U	V	W	P	N	⊕
RM3DCA025 RM3DCA050 RM3DCA075	[1.2 N·m] M4 (screw size)			[2.0 N·m] M5 (screw size)		[1.4 N·m] M4 (screw size)

Amplifier unit model number	U	V	W	P	N	⊕
RM3DCA150	[2.0 N·m] M5 (screw size)					[1.4 N·m] M4 (screw size)

4. Wiring

400V input

Power unit model number	R	S	T	E	P	N		RB1	RB2
RM3PCA370	[9.0 N·m] M8 (screw size)					[1.2 N·m] M4 (screw size)		[3.0 N·m] M6 (screw size)	

Amplifier unit model number	U	V	W	E	E	P	N	
RM3DCB300 RM3DCB600	[9.0 N·m] M8 (screw size)						[1.2 N·m] M4 (screw size)	

4.2 Wiring to main circuit/control power, regenerative resistor, servo motor and protection ground

4.2.5 Wiring for servo motor

200V input

- Specification and model number for canon plug of R-series servo motor
(Products of Japan Aviation Electronics Industry, Ltd.)

Servo motor model number	Plug for powering and braking line ①Plug (Manufacturer model number) ②Cable clamp (Manufacturer model number) ③Plug and Cable clamp (Model number ordering to us)		Plug for braking line ①Plug (Manufacturer model number) ②Cable clamp (Manufacturer model number) ③Plug and Cable clamp (Model number ordering to us)	
	Straight	Angle	Straight	Angle
R1AA10100F	①N/MS3106B20-15S ②N/MS3057A-12A ③MS06B20-15S-12	①N/MS3108B20-15S ②N/MS3057A-12A ③MS08B20-15S-12	Note 1)	Note 1)
R1AA10150F				
R1AA10200H				
R1AA10250H				
R1AA13300F				
R1AA13400H				
R1AA13500H				
R1AA13400F				
R1AA13500F				
R2AA13120D				
R2AA13120L				
R2AA13180H				
R2AA13180D				
R2AA13200L				
R2AA13200D				
R2AA18350L				
R2AA18350D				
R2AA18450H				
R2AA22500L				
R2AA22700S				
R1AA18550H				
R1AA18750L				
R1AA1811KR				
R1AA1815KB				
R2AA18550R				
R2AA18550H				
R2AA18750H				
R2AA1811KR				
R2AA2211KB				
R2AA2215KB				
R2AA2220KB				
R2AA2830KV				
R2AA2837KV				
Terminal block		Terminal block		

Note1) Plug for braking line is used in common with powering line.
Please contact us for waterproof type and TÜV-compliant products.

4. Wiring

400V input

- Specification and model number for canon plug of R-series servo motor
(Products of Japan Aviation Electronics Industry, Ltd.)

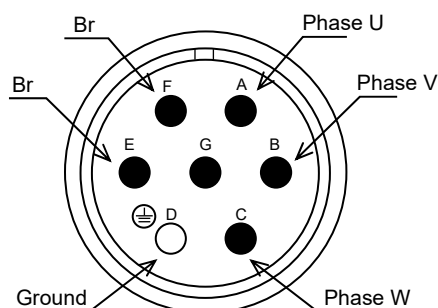
Servo motor model number	Plug for powering and braking line ①Plug (Manufacturer model number) ②Cable clamp (Manufacturer model number) ③Plug and Cable clamp (Model number ordering to us)		Plug for braking line ①Plug (Manufacturer model number) ②Cable clamp (Manufacturer model number) ③Plug and Cable clamp (Model number ordering to us)	
	Straight	Angle	Straight	Angle
R2CA10075F	①JL04V-6A20-15SE-EB-RK ②JL04-2022CK(12)-R ③332706X5	①JL04V-8A20-15SE-EBH-R ②JL04-2022CK(12)-R ③332707X5	Note 1)	Note 1)
R2CA10100F				
R1CA10150V				
R1CA10200V				
R2CA13050D				
R2CA13120R				
R2CA13120F				
R2CA13180H				
R2CA13180D				
R2CA13200L	①JL04V-6A24-11SE-EB-R ②JL04-2428CK(17)-R ③332706X10	①JL04V-8A24-11SE-EBH-R ②JL04-2428CK(17)-R ③332707X10		
R2CA13200H				
R2CA18350L				
R2CA18350C				
R2CA18450H				
R2CA18550V				
R2CA18550H				
R1CA13300V				
R2CA18750H				
R2CA2211KB				
R2CA2215KV			①JL04V-6A32-17SE-R ②－(Conduit) Note 2) ③JL04V-6A32-17SE	－
R1CA18550H				
R1CA18750L				
R1CA1811KR				
R1CA1815KB				
R2CA2220KV	Terminal block		① JL04V-6A10SL-3SE-EB-R ②JL04-1012CK(05)-R ③332706X1	①JL04V-8A10SL-3SE-EBH-R ②JL04-1012CK(05)-R ③332707X1
R1CA2220KV				
R2CA2830KV				
R2CA2837KB				
			Note 3)	
			Terminal block	
			Note 3)	

Note 1) Plug for braking line is used in common with powering line.

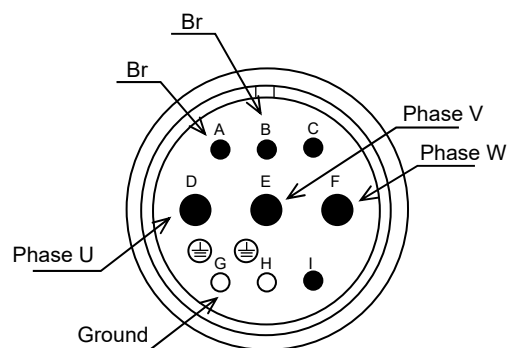
Note 2) Please prepare a conduit by customer side.

Note 3) There is no model with brake.

- Pin assignment

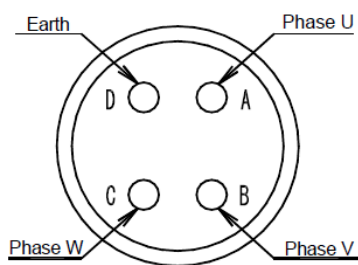


Canon plug for power line
(Model number: N/MS3106(8)B20-15S)
(Model number: JL04V-6(8)A20-15S)
Pin assignment (Viewed from cable)

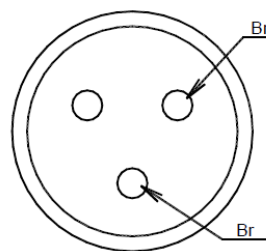


Canon plug for power line
(Model number: N/MS3106(8)B24-11S)
(Model number: JL04V-6(8)A24-11S)
Pin assignment (Viewed from cable)

4.2 Wiring to main circuit/control power, regenerative resistor, servo motor and protection ground



Canon plug for power line
(Model number: N/MS3106(8)B32-17S)
(Model number: JL04V-6A32-17S)
Pin assignment
(Viewed from cable)



Canon plug for brake
(Model number: JL04V-6(8)A10SL-3SE-EB-R)
Pin assignment
(Viewed from cable)

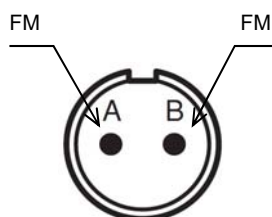
- Plug model numbers of cooling fan connected to motor
(Products of Japan Aviation Electronics Industry, Ltd.)

Motor model number	Plug model No. of cooling fan (Cable clamp model No.) [Plug + clamp model No.]	Connector type	Pin assignment code
			AC200V±10% Single-phase 50/60Hz
R1, R2 (Flange size: 180mm, 220mm)	N/MS3106B10SL-4S (N/MS3057-4A) [MS06B10SL-4S-4]	Straight	A, B
R2 (Flange size: 180mm)	N/MS3108B10SL-4S (N/MS3057-4A) [MS08B10SL-4S-4]	Angle	A, B

* [Plug + clamp model No.] is the model number ordering to us.

* We recommend 1.25mm² (AWG16)-wiring diameter of cooling fan.

(Pin assignment)



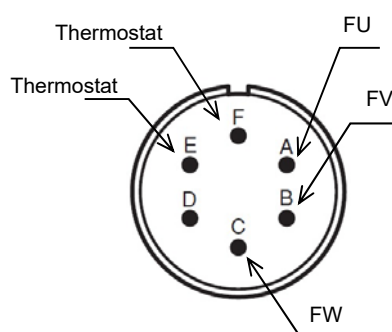
Plug for cooling fan
Pin assignment
(Viewed from cable)

4. Wiring

Motor model number	Plug model No. of cooling fan (Cable clamp model No.) [Plug + clamp model No.]	Connector type	Pin assignment code	
			200V AC±10%, Three-phase 50/60Hz	Thermostat
R2 (Flange size: 220mm)	JL04V-6A18-12SE-EB-R (JL04-18CK(13)-R) [332706X3]	Straight	A, B, C	E, F
	JL04V-8A18-12SE-EBH-R (JL04-18CK(13)-R) [332707X3]	Angle	A, B, C	E, F

- * [Plug + clamp model No.] is the model number ordering to us.
- * Thermostat should be connected to EXT.TH of amplifier unit.
- * We recommend 1.25mm² (AWG16)-wiring diameter of cooling fan.

(Pin assignment)



Plug for cooling fan
Pin assignment
(Viewed from cable)

- Model number of thermostat receptacle for motor connection
(Products of Molex)

Motor model number	Receptacle model number [Model number in SANYO] Contact model number [Model number in SANYO]	Pin assignment code
R2 (Flange size: 275mm)	Receptacle model number: 5557-02R [AL-00082504-08] Contact model number: 5556T2L [AL-00171350-01 Note 1)]	1, 2

Note 1) This model number provides quantity 1.

- * [Model number in SANYO] is the model number ordering to us.
- * It should be connected to EXT.TH of amplifier unit.

(Pin assignment)



Thermostat receptacle
Pin assignment
(Viewed from cable)

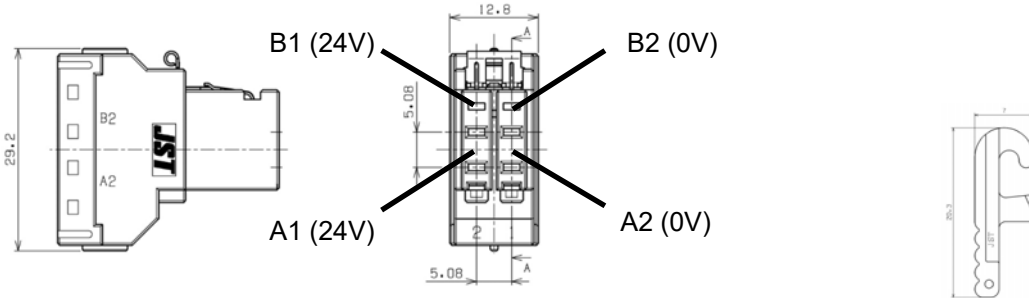
4.2 Wiring to main circuit/control power, regenerative resistor, servo motor and protection ground

4.2.6 Wiring for motor encoder **200V input** **400V input**

Refer the instruction manuals of each control board, for motor encoder wiring.

4.2.7 Wiring for control power **400V input**

Connect wires with using a provided connector and opening tool.



Connector model number: 04JFAT-SAGG-G-KK
(Manufacturer: J.S.T. Mfg. Co., Ltd.)

Opening tool model number: J-FAT-OT(N)

- * For DC24V (CND), connect "24V" to A1 and B1 terminals and "0V" to A2 and B2 terminals. However, do not use them for different side of daisy chain in multi-axis connection. Connector pin of some amplifier may be insufficient of current capacity. If daisy chain is required to multi-axis connection, use left side pins only (in the white line circle below) for avoiding flow of total current into contact point of connector.

4.2.8 Wiring for external thermal sensor cable

200V input **400V input**

Use a dedicated cable AL-00453107-□□ or equivalent.
Refer the section 6.9.8 for detail.

4.2.9 Wiring for regenerative resistor thermal sensor cable

200V input **400V input**

Use a dedicated cable AL-00397733-□□ or equivalent.
Refer the section 6.9.7 for detail.

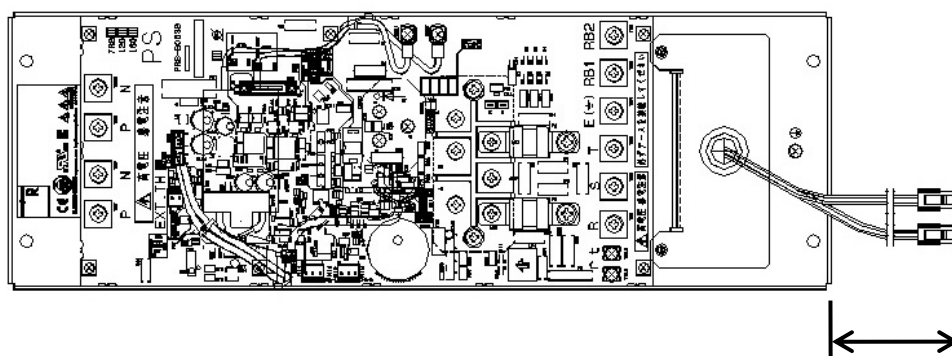
4. Wiring

4.2.10 Built-in cooling fan power wiring **200V input**

Wire a power line (customer side) to receptacle below, and connect to a connector of our unit.

Name	Model number	Signal	Manufacturer
Receptacle	5557-02R	1-pin···24V	Molex
Contact	5556T	2-pin···0V	

Wire length from unit (Ex. power unit: RM3PAA160)



150mm (minimum value)

* Quantity of equipped fan motor is different depends on unit. See below.

Unit name	Unit model number	Fan motor qty.	Consumption current (A)	Fan motor model number
Power unit	RM3PAA7R8	2	0.2	109R0624S4** (Product of SANYO DENKI)
	RM3PAA120			
	RM3PAA160			
Amplifier unit	RM3DAA100	1	0.1	
	RM3DAA150		0.1	
	RM3DAA300	2	0.2	

4.3 Wiring between units

4.3.1 Wiring between power unit/amplifier unit (control power)

200V input

Use a dedicated cable AL-00510002-□□ or equivalent.
Refer the section 6.9.4 for detail.

4.3.2 Wiring between power unit/control unit

200V input 400V input

Use a dedicated cable AL-0103686-□□ or equivalent.
Refer the section 6.9.2 for detail.

4.3.3 Wiring between amplifier unit/control unit

200V input 400V input

Use a dedicated cable AL-00510001-□□ or equivalent.
Refer the section 6.9.3 for detail.

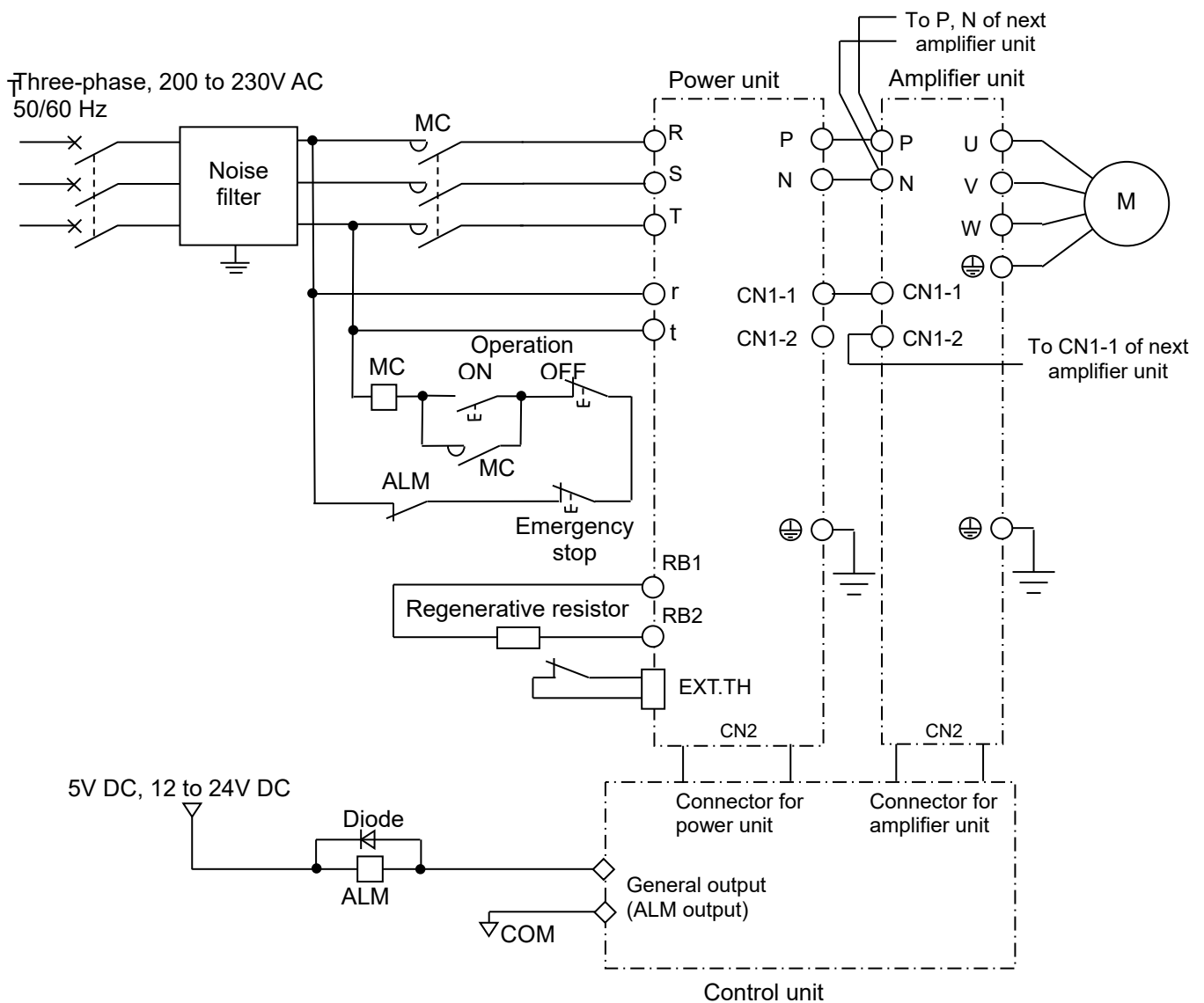
4.4 Wiring example

4.4 Wiring example

Even if it turns off power supply, high-pressure voltage may remain in power unit/amplifier unit. Therefore, do not touch a power supply terminal for 15 minutes for the prevention from an electric shock. Completion of electric discharge turns off the CHARGE LED. Please perform connection check work after checking that the CHARGE LED goes dark.

200V input

1) Power unit: RM3PAA7R8 to RM3PAA160, Amplifier unit: RM3DAA050 to RM3DAA300

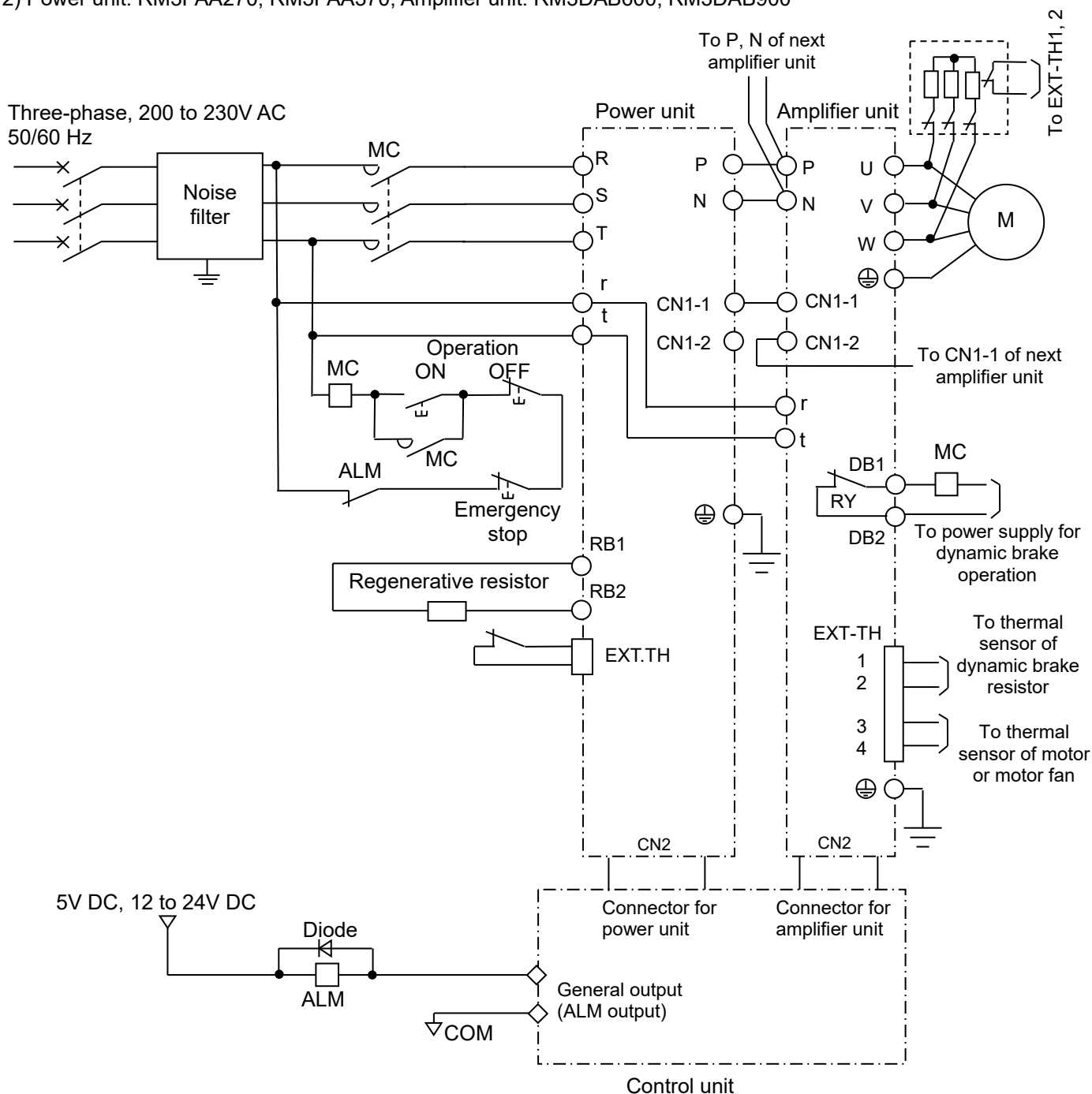


- * For ALM contact of safety circuit, uses general outputs, and sets either During ALM status output ON or During ALM status output OFF.
- * Must add the surge absorbing diode to if inductive load as relay connect to general outputs. Please take care of polarity of the diode that will be cause of each unit failure.

4. Wiring

200V input

2) Power unit: RM3PAA270, RM3PAA370, Amplifier unit: RM3DAB600, RM3DAB900

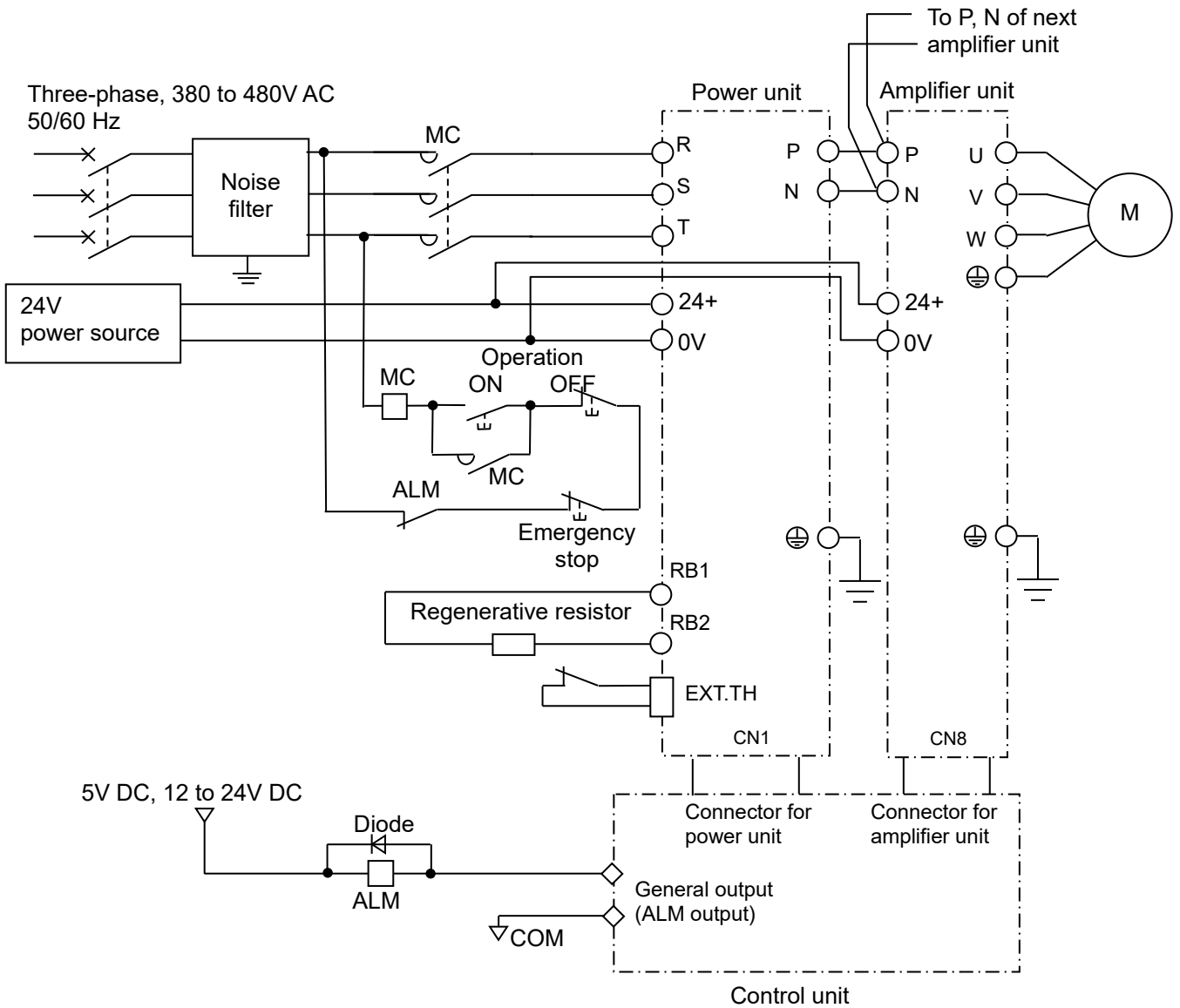


- * For ALM contact of safety circuit, uses general outputs, and sets either During ALM status output ON or During ALM status output OFF.
 - * Must add the surge absorbing diode to if inductive load as relay connect to general outputs. Please take care of polarity of the diode that will be cause of each unit failure.
 - * Make short circuit when EXT-TH of amplifier unit is not used.
 - * DB1 and DB2 are dynamic brake timing output. Magnetic contactor and resistor should be prepared by customer side.
- Contact rating: 250V AC/2A, 30V DC/2A, Inductive load ($\cos \phi = 0.4$, $L/R = 7\text{ms}$)

4.4 Wiring example

400V input

3) Power unit: RM3PCA160, Amplifier unit: RM3DCA025 to RM3DCA150

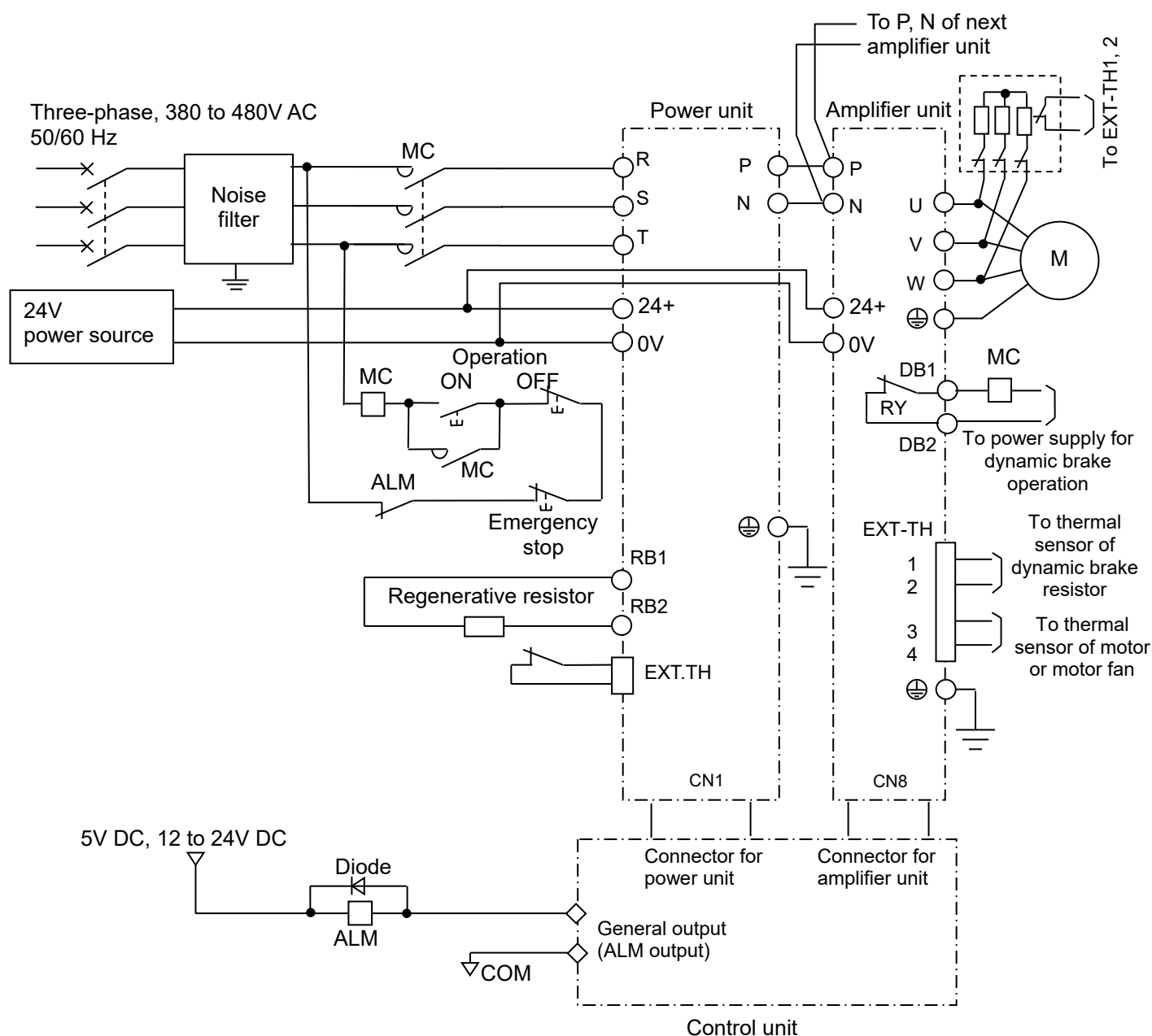


- * For ALM contact of safety circuit, uses general outputs, and sets either During ALM status output ON or During ALM status output OFF.
- * ~~Must add the surge absorbing diode to if inductive load as relay connect to general outputs.~~ Please take care of polarity of the diode that will be cause of each unit failure.
- * Make sure to perform 24V power turn ON/OFF while main circuit power OFF.

4. Wiring

400V input

4) Power unit: RM3PCA370, Amplifier unit: RM3DCB300, RM3DCB600



- * For ALM contact of safety circuit, uses general outputs, and sets either During ALM status output ON or During ALM status output OFF.
- * Must add the surge absorbing diode to if inductive load as relay connect to general outputs. Please take care of polarity of the diode that will be cause of each unit failure.
- * Make short circuit when EXT-TH of amplifier unit is not used.
- * DB1 and DB2 are dynamic brake timing output. Magnetic contactor and resistor should be prepared by customer side.
- * Contact rating: 30V DC/2A, Inductive load ($\cos \phi = 0.4$, $L/R = 7\text{ms}$)
- * Make sure to perform 24V power turn ON/OFF while main circuit power OFF.

4.5 Power supply capacity and peripherals list

4.5 Power supply capacity and peripherals list

200V input

Power unit model number	Total rated output of servo motors (kW)	Main circuit power rating (kVA) (at power unit rated output)	Molded Case Circuit Breaker (MCCB)	Noise filter	Magnetic contact	Surge absorber
RM3PAA7R8	7.8	13	<u>NF125, 75A</u> Mitsubishi Electric Corporation	<u>HF3280C-SZL</u> SOSHIN ELECTRIC Co., Ltd.	<u>S-T65</u> Mitsubishi Electric Corporation	<u>LV275DI-U4</u> OKAYA ELECTRIC INDUSTRIES CO., LTD.
RM3PAA120	12	20	<u>NF125, 100A</u> Mitsubishi Electric Corporation		<u>S-T80</u> Mitsubishi Electric Corporation	
RM3PAA160	16	27	<u>NF125, 125A</u> Mitsubishi Electric Corporation		<u>S-T100</u> Mitsubishi Electric Corporation	
RM3PAA270	30	46	<u>NF250, 200A</u> Mitsubishi Electric Corporation	<u>HF3200C-SZB</u> SOSHIN ELECTRIC Co., Ltd.	<u>S-N180</u> Mitsubishi Electric Corporation	

400V input

Power unit model number	Total rated output of servo motors (kW)	Main circuit power supply capacity (kVA)	Molded Case Circuit Breaker (MCCB)	Noise filter	Magnetic contact	Surge absorber
RM3PCA160	Up to 2.0	3.7	<u>BW125JAGU-3P020</u> Fuji Electric Co., Ltd.	<u>HF3060C-SZL-4DDD</u> SOSHIN ELECTRIC Co., Ltd.	<u>HS10</u> Hitachi Industrial Equipment Systems Co., Ltd.	<u>LV480DI-U4</u> OKAYA ELECTRIC INDUSTRIES CO., LTD.
	2.0 to 5.5	10.3			<u>HS20</u> Hitachi Industrial Equipment Systems Co., Ltd.	
	5.5 to 11.0	20.0	<u>BW125JAGU-3P030</u> Fuji Electric Co., Ltd.		<u>HS50</u> Hitachi Industrial Equipment Systems Co., Ltd.	
	Up to 16.0	28.2	<u>BW125JAGU-3P050</u> Fuji Electric Co., Ltd.		<u>HS50</u> Hitachi Industrial Equipment Systems Co., Ltd.	

* Add surge absorber to power line input of power unit if overvoltage like lightning surge may be given.

4. Wiring

400V input

Power unit model number	Total rated output of servo motors (kW)	Main circuit power supply capacity (kVA)	Molded Case Circuit Breaker (MCCB)	Noise filter	Magnetic contact	Surge absorber
RM3PCA370	~30	53.9	<u>BW125JAGU-3P100</u> Fuji Electric Co., Ltd.	Please contact us.	<u>H100C</u> Hitachi Industrial Equipment Systems Co., Ltd.	<u>LV480DI-U4</u> OKAYA ELECTRIC INDUSTRIES CO., LTD.
	37	67.2	<u>BW125JAGU-3P125</u> Fuji Electric Co., Ltd.		<u>H125C</u> Hitachi Industrial Equipment Systems Co., Ltd.	

* Add surge absorber to power line input of power unit if overvoltage like lightning surge may be given.

Selection

In this chapter, each kind of selections are explained.

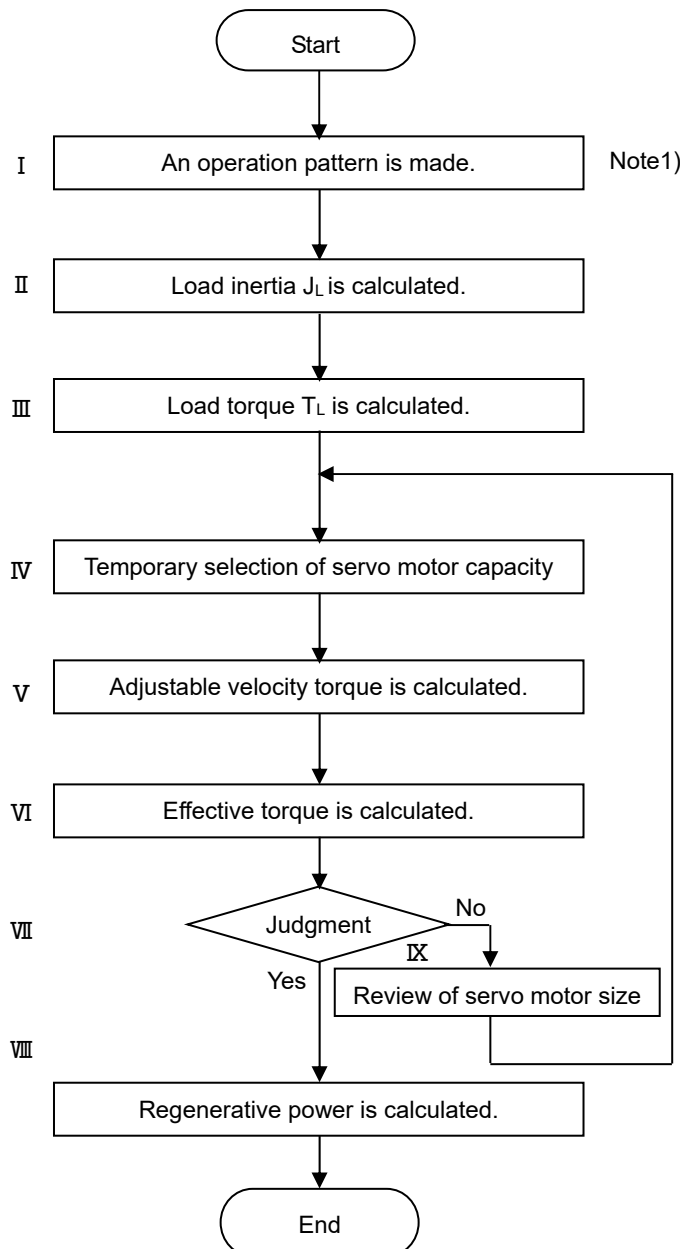
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5. Selection

5.1 Servo motor sizing

It is estimated that selection of servo motor capacity computes required servo motor capacity from machine specification (composition). In addition, since the capacity selection of a servo motor can download "the capacity selection software of a servo motor" for free from our company "website", please use it here. Here, the fundamental formula is described.

5.1.1 Flowchart of servo motor sizing



- I . Create operation pattern.
- II . Calculate load moment of inertia from a machine configuration.
- III . Calculate load torque from a machine configuration.
- IV . Select the following motor:
 - Load moment of inertia (J_L) is 10 times or less of servo motor rotor moment of inertia (J_M).
 - The load torque (T_L) is 80% ($T_R \times 0.8$) of the motor rated torque or less.
$$J_L \leq J_M \times 10$$

$$T_L \leq T_R \times 0.8$$
- V . Calculate the required adjustable velocity torque from an operation pattern.
- VI . Calculate the effective torque from a torque pattern.
- VII . Judge whether the followings have been established. Adjustable velocity torque (T_a , T_b) is 80% ($T_p \times 0.8$) or less of the peak torque at stall (T_p) of servo motor
The effective torque (T_{rms}) is 80% ($T_R \times 0.8$) or less of the rated torque (T_R) of servo motor

$$T_a \leq T_p \times 0.8$$

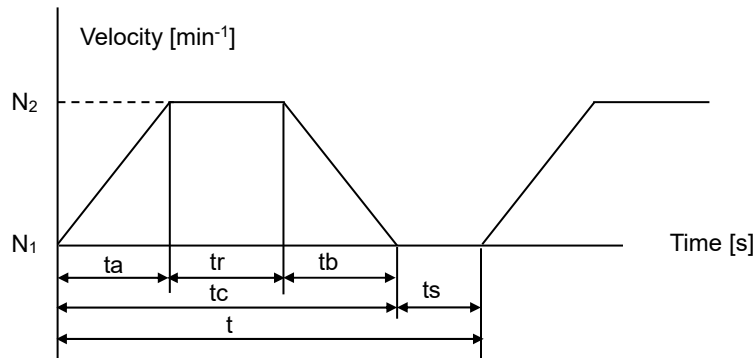
$$T_b \leq T_p \times 0.8$$

$$T_{rms} \leq T_R \times 0.8$$
- VIII . Calculate regeneration electric power, and if required, select an external regeneration resistor.
- IX . Improve servo motor capacity, such as raising the capacity of a servo motor.

Note1) For making operation pattern, must not exceed continuous maximum rotation speed by average rotation speed of motor.

5.1 Servo motor sizing

5.1.2 Make an operation pattern



t_a =Acceleration time
 t_b =Deceleration time
 t_r =Constant velocity time
 t_s =Stop time
 t =1 cycle

5.1.3 Calculate motor shaft conversion load moment of inertia (J_L)

- The inertia of a moving part.

$$J_L = \left(\frac{1}{G} \right)^2 \times \frac{\pi \times \rho \times D^4 \times L}{32} \quad [\text{kg} \cdot \text{m}^2]$$

G : Reduction ratio
 ρ : Moving part specific gravity [kg/m^3]
 D : Moving part diameter [m]
 L : Moving part length [m]

- Work inertia

$$J_L = \left(\frac{1}{G} \right)^2 \times W \times \left(\frac{P}{2\pi} \right)^2 \quad [\text{kg} \cdot \text{m}^2]$$

G : Reduction ratio
 W : Moving part mass [kg]
 P : In the case of a ball screw, is the lead of a ball screw [m]
 In the case of a belt pulley, is an outside diameter of a pulley. [m]
 $(P = \pi D)$

5. Selection

5.1.4 Calculate motor shaft conversion load torque (T_L)

- Ball screw (in horizontal axis)

$$T_L = \frac{(F + \mu W)}{\eta} \times \frac{P}{2\pi} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

- Ball screw (in vertical axis)

When motor drives upward

$$T_L = \frac{(F + (\mu + 1)W)}{\eta} \times \frac{P}{2\pi} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

When motor drives downward

$$T_L = \frac{(F + (\mu - 1)W)}{\eta} \times \frac{P}{2\pi} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

- When ball screw stops (in horizontal axis)

$$T_L = \frac{F}{\eta} \times \frac{P}{2\pi} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

- When ball screw stops (in vertical axis)

$$T_L = \frac{(F+W)}{\eta} \times \frac{P}{2\pi} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

F: External force [kg]
 η : Transmission efficiency
 μ : Coefficient of friction
W: Moving part mass [kg]
P: Ball screw lead [m]
G: Reduction ratio

5.1 Servo motor sizing

■ Belt pulley (in vertical axis)

$$T_L = \frac{(F + \mu W)}{\eta} \times \frac{D}{2} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

■ Belt pulley (in vertical axis)

Belt pulley (in vertical axis)

$$T_L = \frac{(F + (\mu + 1)W)}{\eta} \times \frac{D}{2} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

When motor drives downward

$$T_L = \frac{(F + (\mu - 1)W)}{\eta} \times \frac{D}{2} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

■ When belt pulley stops (in horizontal axis)

$$T_L = \frac{F}{\eta} \times \frac{D}{2} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

■ When belt pulley stops (in vertical axis)

$$T_L = \frac{(F + W)}{\eta} \times \frac{D}{2} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

F: External force [kg]

η : Transmission efficiency

μ : Coefficient of friction

W: Moving part mass [kg]

P: Diameter of a pulley [m]

G: Reduction ratio

5. Selection

5.1.5 Calculate acceleration torque (T_a)

$$T_a = \frac{2\pi (N_2 - N_1) \times (J_L + J_M)}{60 \times t_a} + T_L \quad [\text{N}\cdot\text{m}]$$

N_2 : Servo motor rotation velocity after acceleration [min^{-1}]

N_1 : Servo motor rotation velocity before acceleration [min^{-1}]

J_L : Load inertia [$\text{kg}\cdot\text{m}^2$]

J_M : Rotor inertia of servo motor [$\text{kg}\cdot\text{m}^2$]

5.1.6 Calculate deceleration torque (T_b)

$$T_b = \frac{2\pi (N_2 - N_1) \times (J_L + J_M)}{60 \times t_b} - T_L \quad [\text{N}\cdot\text{m}]$$

N_2 : Servo motor rotation velocity before deceleration [min^{-1}]

N_1 : Servo motor rotation velocity after deceleration [min^{-1}]

J_L : Load inertia [$\text{kg}\cdot\text{m}^2$]

J_M : Rotor inertia of servo motor [$\text{kg}\cdot\text{m}^2$]

5.1.7 Calculate effective torque (T_{rms})

$$T_{rms} = \sqrt{\frac{(T_a^2 \times t_a) + (T_L^2 \times t_r) + (T_b^2 \times t_b)}{t}} \quad [\text{N}\cdot\text{m}]$$

5.1.8 Judgment condition

- We consider the followings as the standard of the judgment.

- ◆ Load torque load ratio $T_L \leq T_R \times 0.8$ (Load torque is 80% or less of rated torque)
- ◆ Acceleration torque load ratio $T_a \leq T_P \times 0.8$ (Acceleration torque is 80% or less of peak torque at stall)
 - * T_P : peak torque at stall
- ◆ Deceleration torque load ratio $T_b \leq T_P \times 0.8$ (Deceleration torque is 80% or less of peak torque at stall)
 - * T_P : peak torque at stall
- ◆ Effective torque load ratio $T_{rms} \leq T_R \times 0.8$ (The effective torque is 80% or less of rated torque)
- ◆ Inertia ratio $J_L \leq J_M \times 10$ (Load moment of inertia is 10 times or less of the motor rotor moment of inertia)

In addition, the rise in heat of motor can be suppressed by taking the large degree of margin at torque load ratio. Moreover, when rotating a table mechanism slowly depending on inertia ratio, it may be able to control 10 or more times. We recommend you the check by the real machine.

5.2 Selection of power unit

5.2 Selection of power unit

Judge whether usage of a power unit is possible by the information of electrolytic capacitor values of connected control unit/amplifier unit and motor load condition.

5.2.1 Limitation of control unit

Maximum allowable axes numbers of control unit connecting to power unit is shown below.

Maximum allowable axes numbers of EtherCAT communication single axis control unit
(model number: RM3C1H) = 5 axes (Control unit: 1)

5.2.2 Limitation of main circuit electrolytic capacitor

Select the amplifier units so as to their total capacity of electrolytic capacitors is allowable capacity (CC) of power unit electrolytic capacitor or less.

Allowable capacity (CC) of power unit electrolytic capacitor > Σ [Internal electrolytic capacitor of each units (CA)]

200V input

Table 1. Internal electrolytic capacitor value of each units (200V input)

Unit model number	Electrolytic capacitor value (CA)
RM3PAA7R8	0 μ F
RM3PAA120	0 μ F
RM3PAA160	0 μ F
RM3PAA270	4,360 μ F
RM3DAA050	4,360 μ F
RM3DAA100	1,800 μ F
RM3DAA150	1,800 μ F
RM3DAA300	5,400 μ F
RM3DAB600	10,800 μ F

Table 2. Allowable capacity of power unit electrolytic capacitor, and rated output (200V input)

Power unit model number	Allowable capacity of electrolytic capacitor (CC)	Rated output (kW)
RM3PAA7R8	16,000 μ F	7.8
RM3PAA120	16,000 μ F	12
RM3PAA160	16,000 μ F	16
RM3PAA270	48,000 μ F	30

5. Selection

400V input

Table 3. Internal electrolytic capacitor value of each units (400V input)

Unit model number	Electrolytic capacitor value (CA)
RM3PCA160	1,090 μ F
RM3PCA370	2,180 μ F
RM3DCA025	340 μ F
RM3DCA050	340 μ F
RM3DCA075	545 μ F
RM3DCA150	1,635 μ F
RM3DCB300	3,270 μ F
RM3DCB600	4,360 μ F

Table 4. Allowable capacity of power unit electrolytic capacitor, and rated output (400V input)

Power unit model number	Allowable capacity of electrolytic capacitor (CC)	Rated output (kW)
RM3PCA160	6,000 μ F	16
RM3PCA370	15,000 μ F	37

5.2.3 Limitation due to motor load (continuous rated output)

Effective value of total motors rated output should be a value of power unit rated output or less.

Power unit rated output [W] (See table 2 or 4) $> \sum P$ [W]

* Motor output electric power: P [W] = (Rated speed [min^{-1}] x Effective torque [$\text{N}\cdot\text{m}$] x $2 \times \pi$) / 60

5.2.4 Limitation due to motor load (instantaneous maximum output)

Total motors instantaneous maximum output value which start/stop simultaneous should be a value of power unit rated output multiply 2 or less.

Power unit rated output multiply 2 or less [W] $> \sum P_{\text{max}}$ [W]

* Motor maximum output electric power: P_{max} [W] = (Rated speed [min^{-1}] x Maximum torque [$\text{N}\cdot\text{m}$] x $2 \times \pi$) / 60

5.3 Selection of regenerative resistor

5.3 Selection of regenerative resistor

Calculate "regeneration effective power (PM)," and determine the capacity of the regeneration resistance to be used. Judge whether usage of an internal regenerative resistor is possible by this calculation result.

5.3.1 How to find "regeneration effective power (PM)" of the horizontal axis drive by a formula

- Calculate regeneration energy.

$$EM = E_{hb} = \frac{1}{2} \times N \times 3 \times K_e \phi \times \frac{T_b}{K_T} \times t_b - \left[\frac{T_b}{K_T} \right]^2 \times 3 \times R \phi \times t_b$$

EM: EM: Regeneration energy during operations along horizontal axis [J]

E_{hb}: Regeneration energy during deceleration [J]

K_eϕ: Voltage constant per phase [Vrms/min⁻¹] (Motor constant)

K_T: Torque constant [N·m/Arms] (Motor constant)

N: Motor rotation speed [min⁻¹]

Rϕ: Phase resistance [Ω] (Motor constant)

t_b: Deceleration time [s]

T_b: Torque during deceleration [N·m]

- Calculate "regeneration effective power" from regeneration energy.

$$PM = \frac{EM}{t_o}$$

PM: Effective regeneration power [W]

EM: Regeneration energy [J]

t_o: Cycle time [s]

5. Selection

5.3.2 How to find "regeneration effective power (PM)" of the vertical axis drive by a formula

- Calculate regeneration energy.

$$EM = EVUb + EVD + EVDb$$

$$= \frac{1}{2} \times N \times 3 \cdot Ke \phi \times \frac{Tub}{KT} \times tUb - \left[\frac{Tub}{KT} \right]^2 \times 3 \cdot R \phi \times tUb$$

$$+ N \times 3 \cdot Ke \phi \times \frac{TD}{KT} \times tD - \left[\frac{TD}{KT} \right]^2 \times 3 \cdot R \phi \times tD$$

$$+ \frac{1}{2} \times N \times 3 \cdot Ke \phi \times \frac{TDb}{KT} \times tDb - \left[\frac{TDb}{KT} \right]^2 \times 3 \cdot R \phi \times tDb$$

EM: Regeneration energy during operation in horizontal axis [J]

EVUb: Regeneration energy while motor drives upward during deceleration [J]

EVD: Regeneration energy while motor drives downward [J]

EVDb: Regeneration energy while motor drives downward during deceleration [J]

$Ke \phi$: Voltage constant per phase [Vrms/min⁻¹] (Motor constant)

KT: Torque constant [N·m/Arms] (Motor constant)

N: Motor rotational velocity [min⁻¹]

$R \phi$: Phase resistance [Ω] (Motor constant)

Tub: Torque while motor drives upward during deceleration [N·m]

tUb: Period of time motor drives upward during deceleration [s]

TD: Torque while motor drives downward [N·m]

tD: Period of time motor drives downward [s]

TDb: Torque while motor drives downward during deceleration [N·m]

tDb: Period of time motor drives downward during deceleration [s]

- * When the calculation result of either of EVUb, EVD, or EVDb is negative, calculate EM by considering the value of those variables as 0.

- Calculate "regeneration effective power" from regeneration energy.

$$PM = \frac{EM}{to}$$

PM: Effective regeneration power [W]

EM: Regeneration energy during deceleration [J]

to: Cycle time [s]

5.3 Selection of regenerative resistor

5.3.3 Allowable power of an external regenerative resistor

- Allowable regenerative power and minimum resistance value of regenerative resistor are shown in below table.

200V input

Power unit model number	Allowable regenerative power to be used by an external regenerative resistor [PRO]	Allowable minimum resistance value of external regenerative resistor
RM3PAA7R8	4,800W or less	6.5 Ω
RM3PAA120	6,200W or less	5.0 Ω
RM3PAA160	9,400W or less	3.3 Ω
RM3PAA270	12,400W or less	2.5 Ω
RM3PAA370	24,000W or less	1.3 Ω

400V input

Power unit model number	Allowable regenerative power to be used by an external regenerative resistor [PRO]	Allowable minimum resistance value of external regenerative resistor
RM3PCA160	9,385W or less	13.3 Ω
RM3PCA370	26,557W or less	4.7 Ω

- * When regeneration effective power PM exceeds the maximum permitted power (PRO) of the external regeneration resistor, reconsider the acceleration constant, load inertia, etc.
- * For external regenerative resistor use, must set regenerative resistor value correctly to the system parameter ID_0B.
Accurate value is not shown in the average power monitor, if correct value is not set.

5.3.4 Selection of external regenerative resistor

With the regeneration effective power "PM" found from calculation, choose the external regeneration resistor to be used from the following table.

200V input

Power unit model number	[PM]	125W or less	250W or less	500W or less	1kW or less	2kW or less
RM3PAA7R8	Resistor Sign	C × 1	E × 2	C × 4	Contact us	
	Connection number	I	Ⅲ	Ⅳ		
RM3PAA120	Resistor Sign	C × 1	E × 2	C × 4	Contact us	
	Connection number	I	Ⅲ	Ⅳ		
RM3PAA160	Resistor Sign	B × 1	D × 2	B × 4	C × 8	Contact us
	Connection number	I	Ⅲ	Ⅳ	V	
RM3PAA270	Resistor Sign	B × 1	B × 2	B × 8	B × 8	Contact us
	Connection number	I	Ⅲ	V	V	
RM3PAA370	Resistor Sign	B × 1	B × 2	B × 8	Contact us	
	Connection number	I	Ⅲ	V		

5. Selection

400V input

Power unit model number	[PM]	125W or less	250W or less	500W or less	1kW or less	2kW or less
RM3PCA160	Resistor Sign	E × 1	C × 2	E × 4	C × 8	G × 8
	Connection number	I	II	IV	VI	VI
RM3PCA370	Resistor Sign	B × 1	D × 2	B × 4	D × 8	B × 16
	Connection number	I	III	IV	V	VII

- * The resistor sign of an external regeneration resistor and the connection number correspond with the following page.
- * The permissible effective power of external regenerative resistor is maximum 25% of the rated power under natural air cooling.
- * The permissible effective power of external regenerative resistor is maximum 50% of the rated power under forced air cooling by fan.

5.3.5 Specification of external regenerative resistor

The resistor model name corresponds with the sign of the external regeneration resistor selected for the preceding clause.

Resistor Sign	Resistor Model Number	Rated power [PR]	Resistance Value	Thermostat Detection temperature (Contact specification)	Permissible Effective Power [PM]	Mass
A	REGIST-500CW1R5B	500W	1.5 Ω	100°C±5°C (b-contact)	125 W	1.4 kg
B	REGIST-500CW5B		5 Ω			
C	REGIST-500CW7B		7 Ω			
D	REGIST-500CW10B		10 Ω			
E	REGIST-500CW14B		14 Ω			
F	REGIST-500CW20B		20 Ω			
G	REGIST-1000W6R7B	1,000W	6.7 Ω	140°C±5°C (b-contact)	250 W	2.9 kg

- * Refer "6.9.9 External regenerative resistor 200V input 400V input" for external dimension of regenerative resistor.
- * Permissible Effective Power value is at condition of natural air cooling.

5.3 Selection of regenerative resistor

5.3.6 Connection of regenerative resistor

The connection method of a resistor corresponds with the connection number of the external regeneration resistor selected by the section 5.3.4.

■ Connection of external regenerative resistor

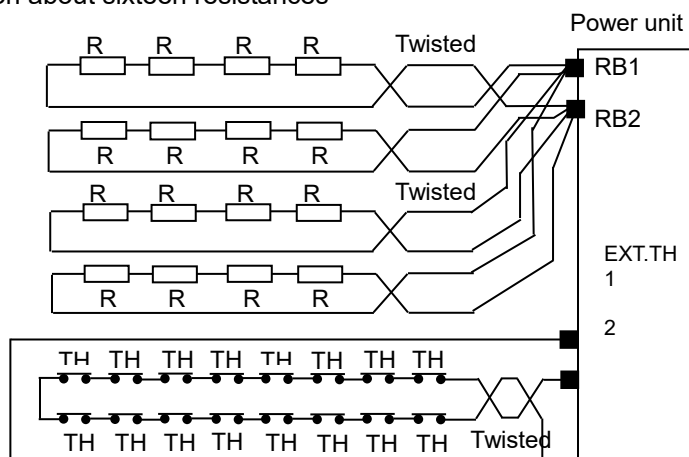
Connection Number I	Connection Number II
■ One resistance is connected.	■ Series connection about two resistances.
Connection Number III	Connection Number IV
■ Parallel connection about two resistances.	■ Series/parallel connection about FOUR resistances.
Connection Number V	Connection Number VI
■ Series/parallel connection about eight resistances.	■ Series/parallel connection about eight resistances.

Note) TH (thermostat) shall be connected to EXT.TH of power unit.

5. Selection

Connection Number VII

- Series/parallel connection about sixteen resistances



* Note) TH (thermostat) shall be connected to EXT.TH of power unit.

5.3.7 Thermostat connection of external regenerative resistor

TH (thermostat) shall be connected to EXT.TH of power unit.

5.3.8 Protection function of external regenerative resistor

For the external regenerative resistor connection, it is able to protect by setting appropriate parameters to control unit of each axis. Set the appropriate parameters by following the instructions given below.

- The two parameters requiring settings are given below.

EtherCAT communication single axis control unit (model number: RM3C1H)

- ◆ System parameter ID03 "Regenerative resistor selection"
 - Must set "02: External R" (initial value) to all axes.

- The protection functions are classified into two main types:

- ◆ Protection for a short-time, high load factor:
An error is detected when the power absorption of regenerative resistor is extremely high over a short time period (100 ms to several 10 seconds). A 'Regenerative Error' alarm "AL.43" is issued when this error is detected.
- ◆ Protection during thermostat operation of the external regenerative resistor:
An error will be detected when External Trip Function works. An 'External Error' alarm "AL.55" is issued when this error is detected.

5.3 Selection of regenerative resistor

5.3.9 Confirmation method of effective regeneration power PM in actual operation

Regeneration power PM can be easily confirmed in the digital operator or the setup software.

EtherCAT communication single axis control unit (model number: RM3C1H)

- Setup software: Monitor display ID16 ,REGP, "Regenerative Resistor Operation percentage monitor"
- CoE object: Object dictionary 0x210A, 0x00, "Regenerative Resistor Operation percentage monitor [REGP]"

- * The monitor value shows the operating rate of regeneration circuit.
- * The display range is 0.00 to 99.9%.

- The actual regeneration effective power PM can be calculated from this monitor value by following equation.

- ◆ Input Supply Voltage: In case of 200V AC specification

$$\text{Regeneration effective power [PM](W)} = \frac{400(\text{V}) \times 400(\text{V})}{\text{Regeneration resistance}(\Omega)} \times \frac{\text{Regenerative Resistor Operation Percentage}(\%)}{100(\%)}$$

- ◆ Input Supply Voltage: In case of 400V AC specification

$$\text{Regeneration effective power [PM](W)} = \frac{800(\text{V}) \times 800(\text{V})}{\text{Regeneration resistance}(\Omega)} \times \frac{\text{Regenerative Resistor Operation Percentage}(\%)}{100(\%)}$$

- Calculation Example
Input Supply Voltage: 400V AC specification
Regeneration resistance value: 14 Ω
Monitor Value (RegP): 0.12%

$$\text{Regeneration effective power [PM](W)} = \frac{800(\text{V}) \times 800(\text{V})}{\text{Regeneration resistance (14 } \Omega \text{)}} \times \frac{0.12(\%)}{100(\%)} = 55 \text{ (W)}$$

- * The regeneration power calculated from this monitor value continues to be the target until the end of operations. Regeneration power varies with the voltage fluctuation of the input power supply and changes across the ages of the amplifier unit and the loading device.
- * Be sure to opt for selection of regeneration resistance based on the regeneration effective power "PM" found from calculation of a pattern of operation and regeneration power.
- * Install the external regeneration resistor on equipment, and measure the temperature of the external regeneration resistor by the operating condition that the regeneration effective power "PM" becomes the maximum. Then do sufficient mounting check of alarm not being generated. In addition, it takes 1 to 2 hours until the temperature of the external regeneration resistor is saturated.

5. Selection

5.3.10 Precautions for external regenerative resistor use

- The place where corrosive gas has occurred, and when there is much dust, insulated degradation, corrosion, etc .may arise. There fore be careful of an attachment place.
- External regeneration resistor should be placed by keeping enough distance from the other parts so as not to be affected by the other parts-generated heat.
- Must wiring by twisted lines to external regenerative resistor. Wiring length keeps 5 m or less, and aims as short as it can.
- Wiring should keep no contact with regenerative resister, and using flame-retardant cable or giving flame-retardant by silicon tube.

Appendix

In this chapter, servo motor outline drawing and datasheet, servo amplifier outline drawing and option parts are explained.

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6. Appendix

6.1 Standards Conformity

In our company, compatibility examinations of overseas standards are carried out in certificate authorities, and attestation markings are done based on the published certificate of attestation.

6.1.1 Standards Conformity

■ This power unit/amplifier unit implements the standards examinations below.

Product model NO.	Applicable laws and Regulations		Standard code	Certificate authorities
	Class	Detailed class		
Power unit: RM3P***** Amplifier unit: RM3D*****	UL/c-UL standards	---	UL61800-5-1	UL (Underwriters Laboratories inc.) 
Power unit: RM3P***** Amplifier unit: RM3D***** Control unit: RM2C1A0	Electrical safety	Low Voltage Directive: LVD (2014/35/EU)	IEC61800-5-1 EN61800-5-1	TÜV (TÜV SÜD Japan, Ltd.) 
(Safe Torque Off function unequipped model)	EMC	EMC directive: EMC (2014/30/EU)	EN61000-6-2 IEC61800-3 (Note 1) EN61800-3 (Note 1)	TÜV (TÜV SÜD Japan, Ltd.)
Control unit: RM2C4H2 RM2C4H4 (Safe Torque Off function equipped model)	Electrical safety	Low Voltage Directive: LVD (2014/35/EU)	IEC61800-5-1 EN61800-5-1	TÜV (TÜV SÜD Japan, Ltd.)  (Blue octagon)
	Functional Safety	Generic Functional safety	IEC61508 EN61508 (SIL3)	
		Functional safety standards: FS (2006/42/EC)	IEC62061 EN62061 (SILCL3)	
		Functional safety standards: FS (2006/42/EC)	EN ISO13849-1/ 2015 (Cat.3, PL=e)	
		Functional safety standards: FS (2006/42/EC)	IEC61800-5-2 EN61800-5-2	
	EMC	EMC Directive: EMC (2014/30/EU)	EN61000-6-2 IEC61800-3 (Note 1) EN61800-3 (Note 1)	
		Functional safety EMC	IEC61326-3-1 EN61326-3-1 IEC 61000-6-7 EN 61000-6-7	
All of Power unit/ Amplifier unit/ Control unit	KC Mark		KS C 9610-6-2 KS C 9610-6-4	Ministry of Science, ICT & Future Planning 
Power unit: RM3P***** Amplifier unit: RM3D*****	RoHS Directive (2011/65/EU as amended by (EU)2015/863))		IEC 63000:2018 EN 63000:2018	—

Note 1) Category of this standards is C2.

Warning: In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.

6.1 Standards Conformity

- The servo motor implements the attestation examination to the following standards.

Standards	Standards code	Certificate authorities
UL standards	UL1004-1	UL (UL LLC)
	UL1004-6	
EN Directive	EN60034-1	TÜV (TÜV SÜD Japan, Ltd.)
	EN60034-5	TÜV (TÜV SÜD Japan, Ltd.) or UL (UL LLC)

- ✓ For products conforming to conformity standards, some specifications may differ from the standard product due to prerequisites necessary for obtaining approval. Contact us for more details.

6.1.2 Over-voltage Category, Protection Grade, Pollution Level

- The "over-voltage category" of each unit is "III" (EN61800-5-1). For the control power 24VDC and interface, use a DC power supply with reinforced and insulated input and outputs.
- Make sure to install each unit in your cabinet in an environment where the pollution level specified in EN61800-5-1 and IEC664 is no less than 2 (pollution level 1, 2). The protection grade of each unit is IP00. The cabinet installation configuration (under IP54) must exclude exposure to water, oil, carbon, dust, etc.

6.1.3 Connection and installation

Be careful of connection and installation as follows.

- ✓ Always ground the protective earth terminals of the power unit/amplifier unit to the power supply earth.
- ✓ When connecting grounding wire to the protective earth terminal, always connect one wire in one terminal; never connect jointly with multiple wires or terminals.
- ✓ When connecting the leakage stopper, make sure to connect the protective earth terminal to the power supply earth.
- ✓ Connect earthing wire by using a crimping terminal with insulated tube, so that the connected wire will not touch the neighboring terminals.
- ✓ For wire relays, use a fixed terminal block to connect wires; never connect wires directly.
- ✓ Connect an EMC filter to the input at the stage before power input port of power unit.
- ✓ Use an EN/ IEC-standard compatible no-fuse Circuit breaker and electromagnetic contactor.
- ✓ Wiring for main circuit power shall be done as with the circuit shown in the section "4.1.6 Example of wiring", to break power at alarm.

6.1.4 UL File Number

The UL file number of power unit/amplifier unit and servo motor is as follows.
Can check from the website of UL. <http://www.ul.com/database/>

- The UL file number of power unit/amplifier unit: E179775
- The UL file number of servo motor: E179832

6. Appendix

6.2 Compliance with EN Directives

We implement the conformity verification test of "Low Voltage Directive" and "an EMC Directive" in a certificate authority so that a user's CE Marking acquisition can be performed easily, and servo amplifier CE Marking is done based on the published certificate of attestation.

6.2.1 Conformity verification test

The following conformity verification tests are implemented.

Directive classification	Classification	Test	Test standard
Low voltage Directive (Servo amplifier)	—	—	EN61800-5-1
Low voltage Directive (Servo motor)	—	Rotating electrical machines-Part1: Rating and performance	EN60034-1
		Rotating electrical machines-Part5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)	EN60034-5
EMC Directive (Servo amplifier / servo motor)	Emission	Conducted emission	EN61800-3
		Radiated emission	EN61800-3
	Immunity	Electrostatic discharge immunity	EN61000-4-2
		Radiated electromagnetic field immunity	EN61000-4-3
		Electrical first transient/ burst immunity	EN61000-4-4
		Conducted disturbance immunity	EN61000-4-6
		Surge immunity	EN61000-4-5
		Voltage Dips & Interruptions immunity	EN61000-4-11
		Adjustable speed electrical power drive system	EN61800-3
		Safety of machinery	EN62061 (Annex E) Note 1)

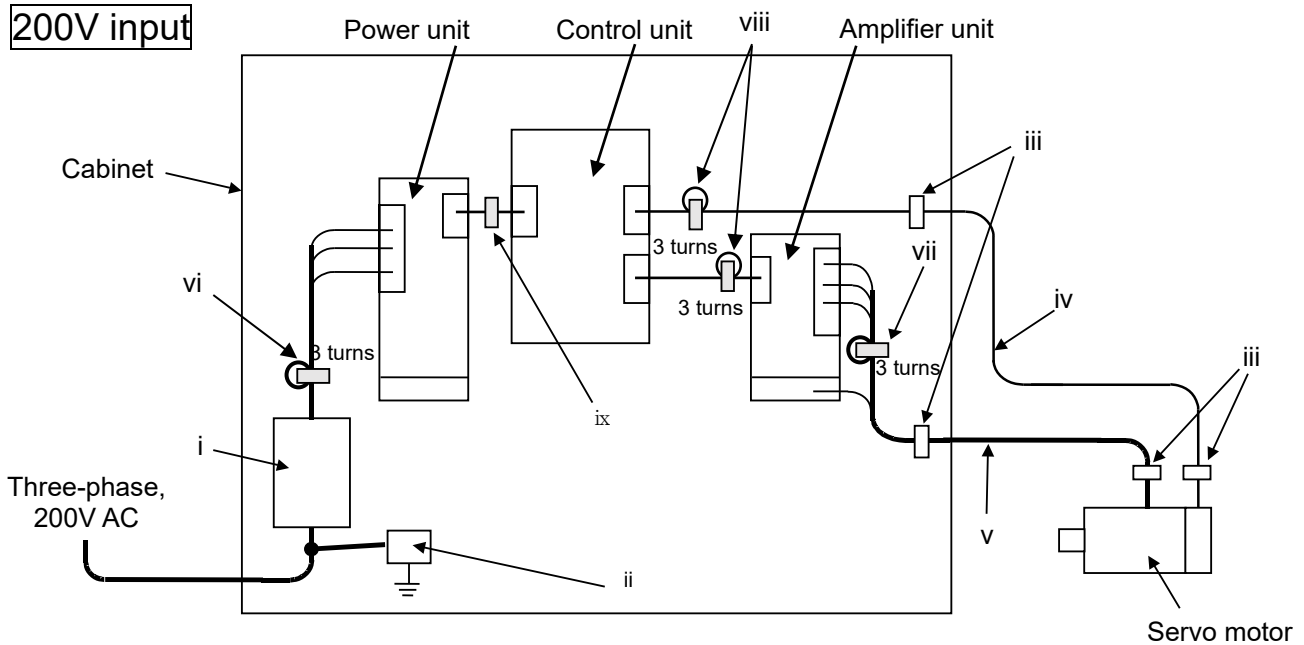
Note 1) Standards applicable only to Safe Torque Off function equipped models.

- ✓ Be sure to connect to power ground using our recommended wire diameter because Touch current may exceed 3.5 mA.

6.2 Compliance with EN Directives

6.2.2 EMC Installation Requirements

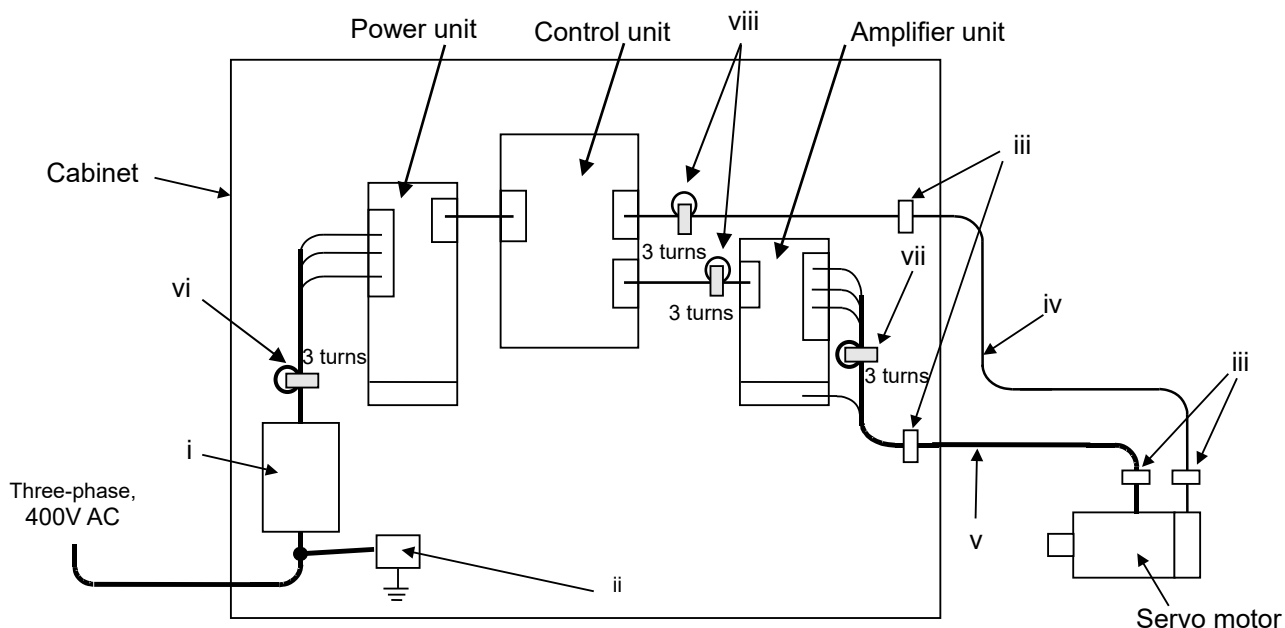
For the installation requirements, in our company the verification test is implemented by the following installations and measures methods, as machines and configurations differ depending on customers' needs. This power unit/amplifier unit has been authorized to display CE marking based on the recognition certificate issued by a certifying authority. Customers are instructed to perform the final conformity tests for all instruments and devices in use.



No.	Name	Remarks
i	Noise filter (Recommended prevention components)	•RM3AA7R8 to RM3PAA160 HF3080C-SZL (SOSHIN ELECTRIC Co., Ltd.) Rated voltage/rated current: Line-Line 500V AC / 80A •RM3PAA270, RM3PAA370 HF3200C-SZB (SOSHIN ELECTRIC Co., Ltd.) Rated voltage/rated current: Line-Line 500V AC / 200A
ii	Surge-absorber (Recommended prevention components)	LV275DI-U4 (OKAYA ELECTRIC INDUSTRIES CO., LTD.)
iii	Clamp grounding	-
iv	Encoder cable	Shielded cable
v	Servo motor power cable	Shielded cable
vi	Troidal core	RC1060Y (SOSHIN ELECTRIC Co., Ltd.) Put it between noise filter and power unit with 3 turns.
vii	Troidal core	T60x20x36 (TDK) Put it between servo motor and amplifier unit with 3 turns.
viii	Split Ferrite Core	E04SR401938 (SEIWA ELECTRIC MFG CO., Ltd.) Put it between control unit and amplifier unit/encoder with 3 turns.
ix	Split Ferrite Core	E04SR311835F (SEIWA ELECTRIC MFG CO., Ltd.) (RM3PAA160 only) Put it between control unit and power unit with 3 turns.

6. Appendix

400V input



No.	Name	Remarks
i	Noise filter (Recommended prevention components)	- RM3PCA160 HF3060C-SZL-4DDDD: SOSHIN ELECTRIC Co. Ltd. Rated voltage/rated current: Line-Line 500V AC / 60A Leakage current: 90mA_MAX 400VAC, 50Hz_Y-connection - RM3PCA370 Please contact us.
ii	Surge-absorber (Recommended prevention components)	LV480DI-U4: OKAYA ELECTRIC INDUSTRIES CO., LTD.
iii	Clamp grounding	-
iv	Encoder cable	Shielded cable
v	Servo motor power cable	Shielded cable
vi	Troidal core	RC1060Y (SOSHIN ELECTRIC Co. Ltd.) Put it between noise filter and power unit with 3 turns.
vii	Troidal core	T60x20x36 (TDK) Put it between servo motor and amplifier unit with 3 turns.
viii	Split Ferrite Core	E04SR401938 (SEIWA ELECTRIC MFG CO., Ltd.) Put it between control unit and amplifier unit/encoder with 3 turns.

- ✓ Use metallic materials for the door and main body of cabinet.
- ✓ Use EMI gasket so that there is zero clearance between the door and control panel. Install EMI gasket uniformly to the contact points between door and main body of cabinet to confirm their conductivity.
- ✓ Ground the noise filter frame to the cabinet.
- ✓ Use shield cables for motor power line and encoder cable. Clamp grounding of shield at the frame of cabinet and equipment.
- ✓ Use conducting metal P-clip or U-clip to ground and clamp shielded wire, and fix it directly with metal screws. Do not ground by soldering electric wire to shielded wire.
- ✓ Wire power unit at a short distance from the secondary side of noise filter, and wire the primary side and secondary side of noise filter separately.
- ✓ In case of multi axis, prevention components shall be applied to each axis.

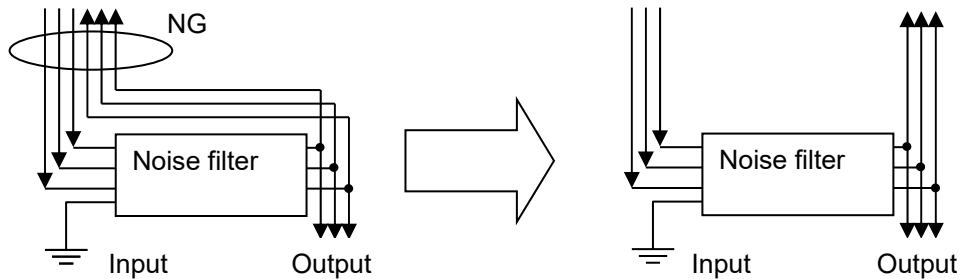
6.2 Compliance with EN Directives

6.2.3 Precautions for noise filter connection

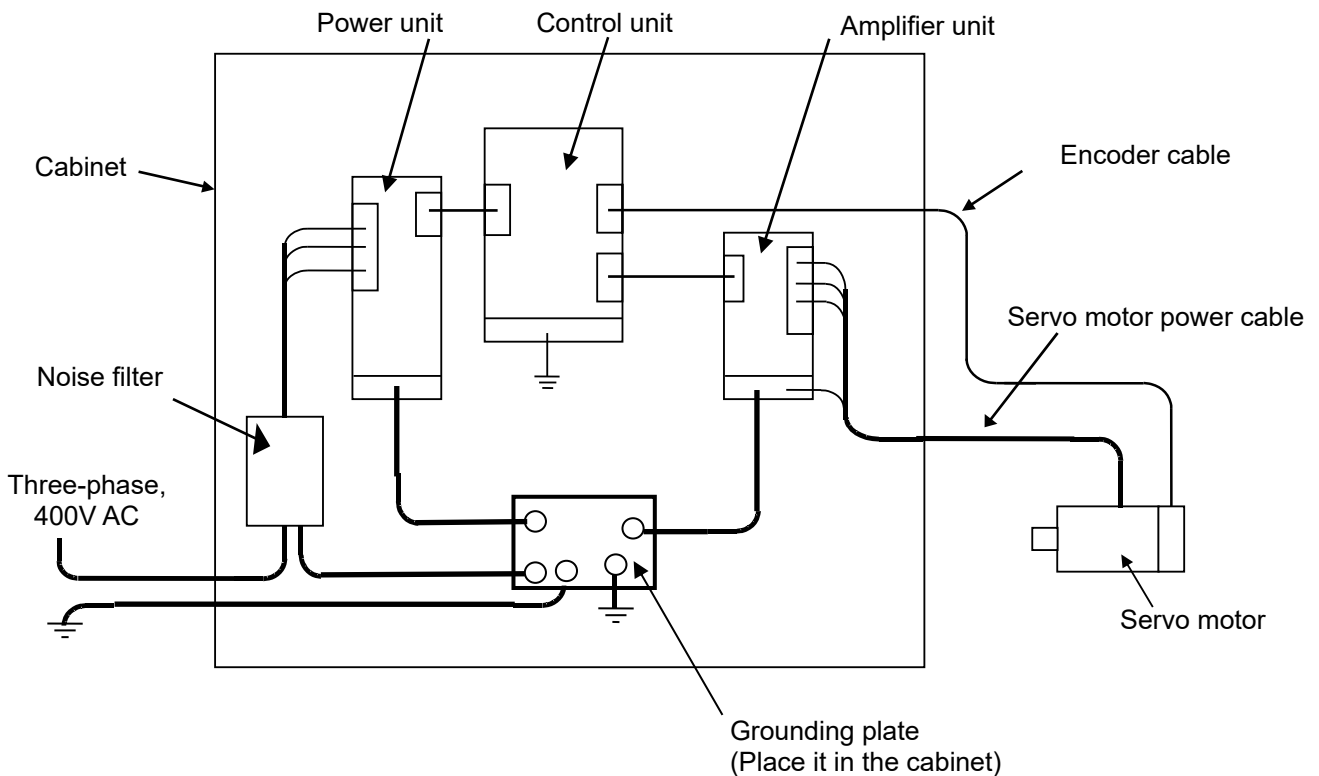
Precautions for noise filter mounting and wiring

See below precautions for mounting and wiring when noise filter is used.

- Do not bundle with input line and output line of noise filter. (Earth line also.)
Avoid that go through a same duct. (It might reduce effect of filter, and noise might come around through that point.)



- Each of earth line shall be connected to grounding plate in a control panel by single-point.
Also in case of multi axes construction in same control panel, grounding by single-point.



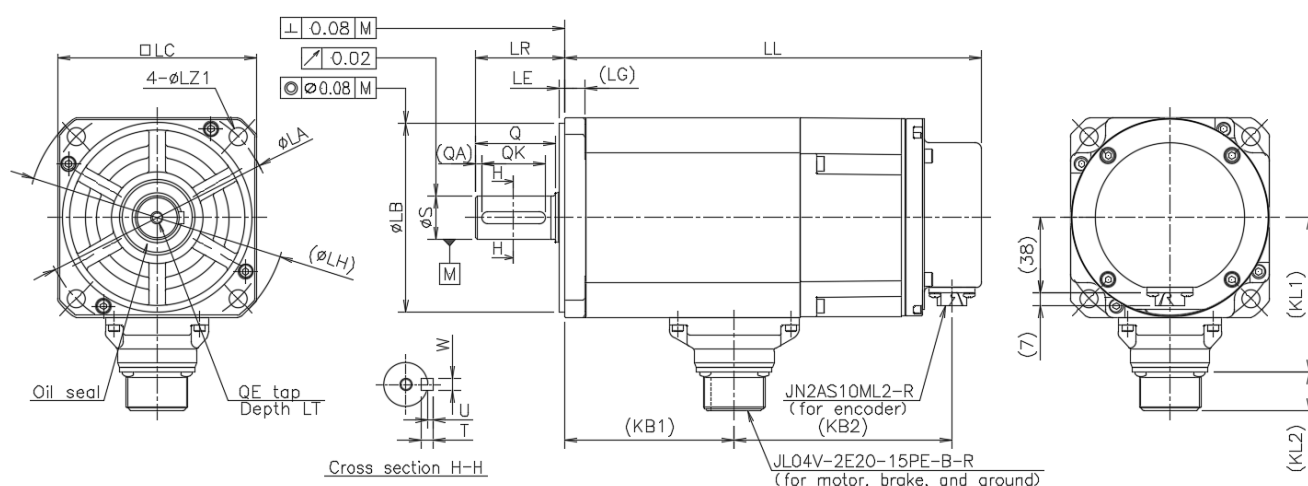
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6.3 Servo motor dimensions **200V input**

Below shows motor outline and dimensions drawing equipping battery-less absolute encoder or single-turn absolute encoder.

- ✓ Motor dimensions equipping battery backup encoder (PA035C) is same as the motor equipping single-turn absolute encoder.
- ✓ Contact us for the dimensions of the motors equipping Wire-saving incremental encoder or Resolver type battery-less absolute encoder (RA035C).

6.3.1 R1 motor, flange size 100mm

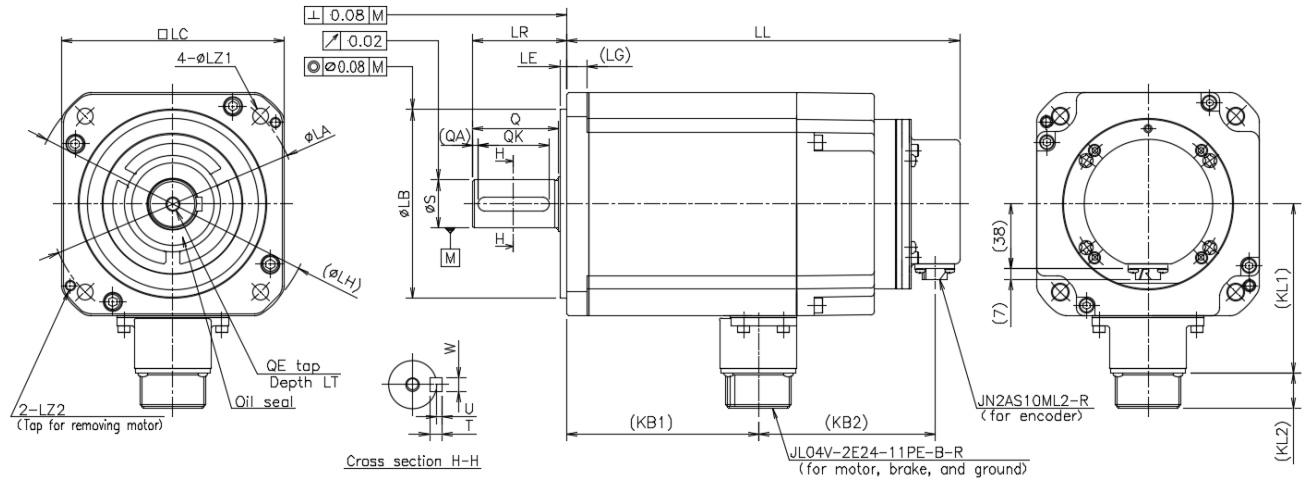


Unit: mm

Servo motor model number	Without brake			With brake											
	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1
R1AA10100△□◇	145	68	38	186	109	38	10	78	19	115	0 95 -0.035	3	130	100	9
R1AA10150△□◇	168			209											
R1AA10200△□◇	179			220											
R1AA10250△□◇	199			240											

6.3 Servo motor dimensions 200V input

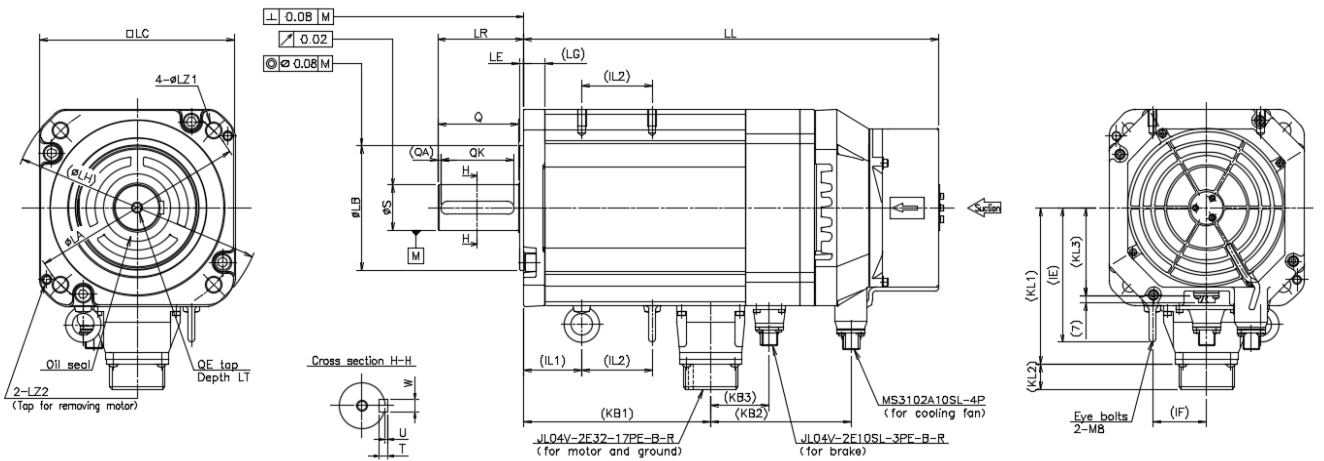
6.3.2 R1 motor, flange size 130mm



Unit: mm

	Without brake			With brake												
Servo motor model number	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2
R1AA13300△□◇	184	57	38	230	103	38	12	98	21	145	0 110 -0.035	4	165	130	9	M6
R1AA13400△□◇	208			251	100											
R1AA13500△□◇	232			275												

6.3.3 R1 motor, flange size 180mm

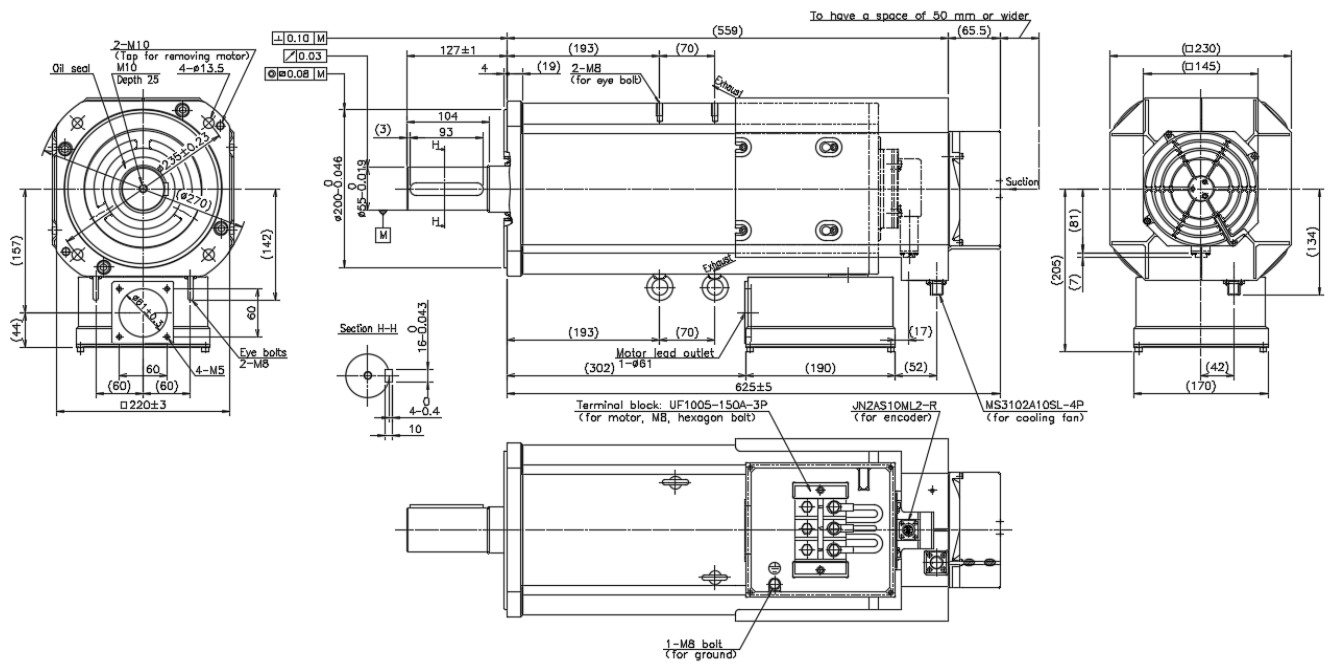


Unit: mm

Servo motor model number	Without brake				With brake				LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2
	LL	KB2	KB3	KL3	LL	KB2	KB3	KL3										
R1AA18550△□◇	333	80	-	81	383	130	54	81	19	143	23	200	0 114.3 -0.035	3	230	180	13.5	M8
R1AA18750△□◇	368				418													
R1AA1811K△□◇	438				517													
R1AA1815K△□◇	516				628													

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6.3.4 R1 motor, flange size 220mm (R1AA2220KVX◇)

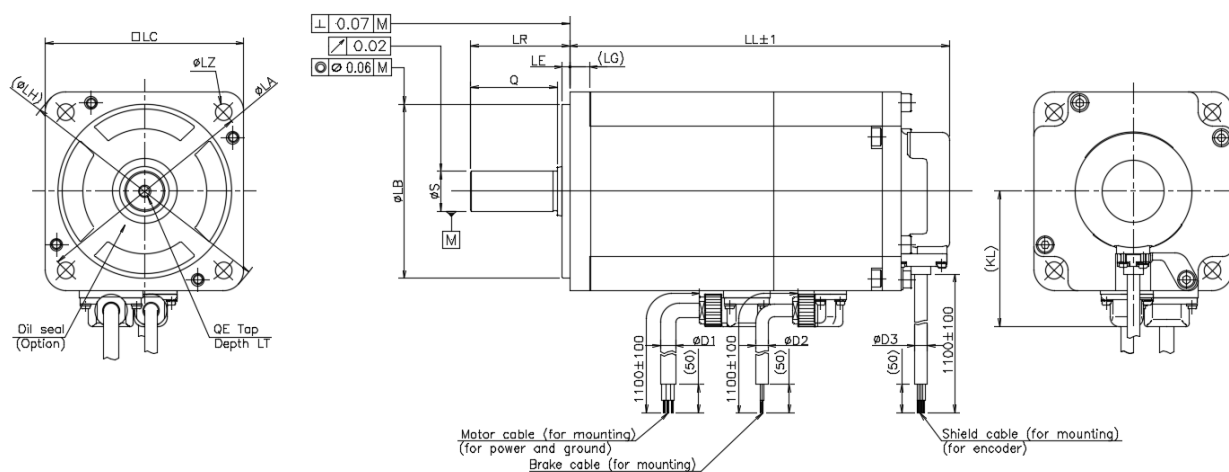


Unit: mm

6.3 Servo motor dimensions 200V input

6.3.5 R2 motor, flange size 86mm, 100mm

- Battery-less absolute encoder (encoder code: R)



Unit: mm

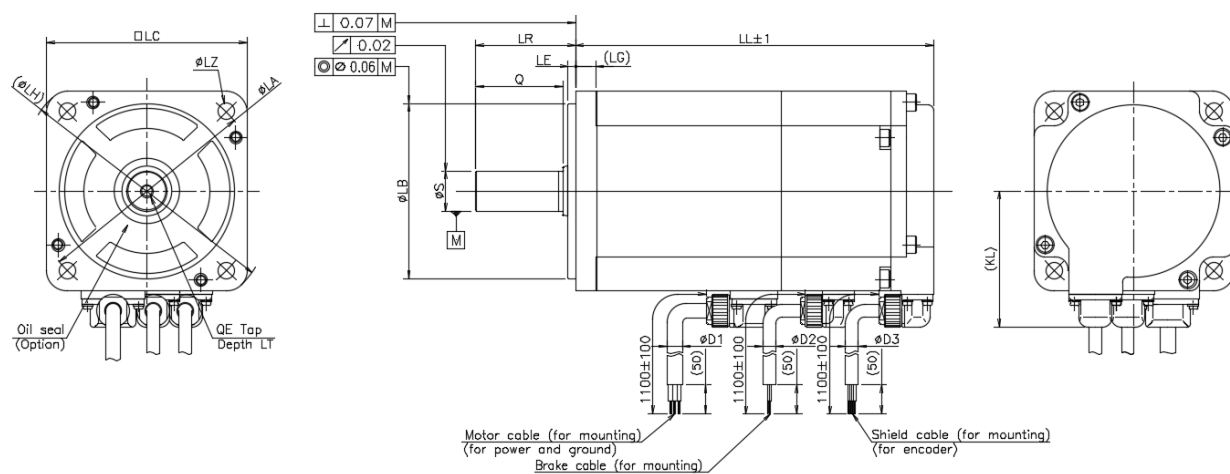
Servo motor model number	Without Oil Seal		With Oil Seal	
	Without brake	With brake	Without brake	With brake
R2AAB8075△□◇	LL	LL	LL	LL
R2AAB8100△□◇	123.1	149.0	123.1	149.0
R2AA10075△□◇	145.8	171.8	145.8	171.8
R2AA10075△□◇	117.1	134.6	117.1	134.6
R2AA10100△□◇	134.1	151.6	134.1	151.6

Servo motor model number	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2	D3
R2AAB8075△□◇	8	59.4	100	0	3	115.5	86	4-φ	35	0	35	M5	12	6	5	5
R2AAB8100△□◇				80-0.03				16-0.011		30						
R2AA10075△□◇	10	66.8	115	0	3	130	100	4-φ 9	45	0	40	M6	20			
R2AA10100△□◇				95-0.035				22-0.013								

- ✓ For motor without brake, no brake connector (or cable) attached.

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■ Single-turn absolute encoder (encoder code: H)



Unit: mm

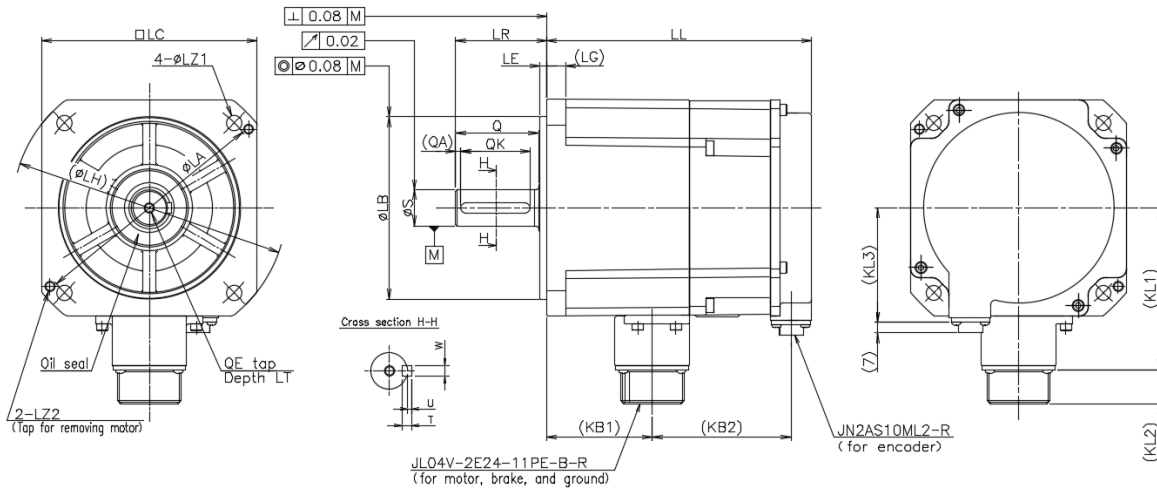
	Without Oil Seal		With Oil Seal	
	Without brake	With brake	Without brake	With brake
Servo motor model number	LL	LL	LL	LL
R2AAB8075△□◇	114.3	140.2	114.3	140.2
R2AAB8100△□◇	137	163	137	163
R2AA10075△□◇	111.3	128.8	111.3	128.8
R2AA10100△□◇	128.3	145.8	128.3	145.8

Servo motor model number	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2	D3
R2AAB8075△□◇	8	59.4	100	0	3	115.5	86	4-φ6.6	35	0	35	M5	12	6	5	5
R2AAB8100△□◇				80-0.03						16-0.011	30					
R2AA10075△□◇	10	66.8	115	0	3	130	100	4-φ9	45	0	40	M6	20	6	5	5
R2AA10100△□◇				95-0.035						22-0.013	40					

✓ For motor without brake, no brake connector (or cable) attached.

6.3 Servo motor dimensions 200V input

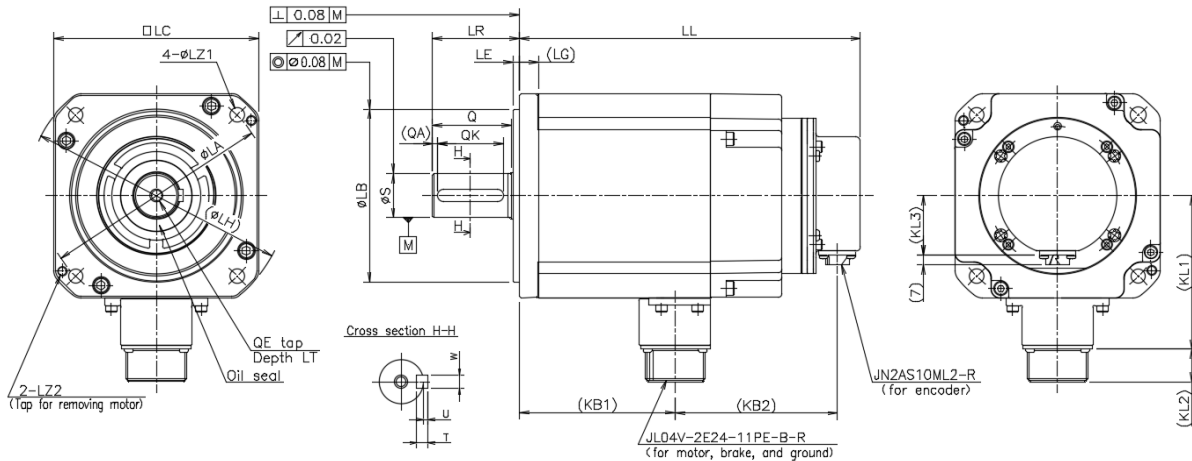
6.3.6 R2 motor, flange size 130mm, 1.2 to 1.8kW



Unit: mm

Servo motor model number	Without brake			With brake		
	LL	KB2	KL3	LL	KB2	KL3
R2AA13120△□◇	120.5	44	69	160	84	69
R2AA13180△□◇	138			179	86	

6.3.7 R2 motor, flange size 130mm, 2kW



Unit: mm

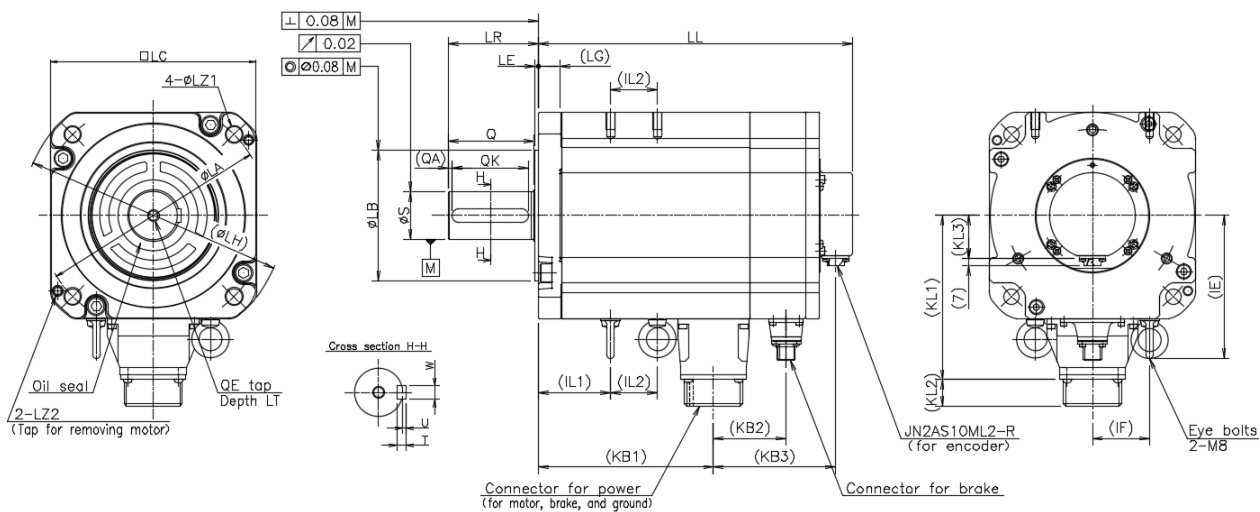
Servo motor model number	Without brake			With brake		
	LL	KB2	KL3	LL	KB2	KL3
R2AA13200△□◇	171	57	38	216	103	38

Servo motor model number	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R2AA13200△□◇	12	98	21	145	0 110 -0.035	4	165	130	9	M6	55	0 28 -0.013	50	3	42	0 8 -0.036	7	3	99	M8	25

6. Appendix

6.3.8 R2 motor, flange size 180mm, 3.5 to 7.5kW

- Battery-less absolute encoder (encoder code: R)



Unit: mm

	Without brake				With brake													
Servo motor model number	LL	KB2	KB3	KL3	LL	KB2	KB3	KL3	LG	KL1	KL2	LA	LB	LE	LH	W	T	U
R2AA18350△□◇	159	52	-	38	206	99	-	38	16	123	21	200	0 114.3 -0.035	3	230	0 10 -0.036	8	3
R2AA18450△□◇	176				223				19	144	22					0 12 -0.043		
R2AA18550△□◇	228	59			274	107	64		0									
R2AA18750△□◇	273				329	117	74		0									

Servo motor model number	LC	LZ1	LZ2	LR	S	Q	KB1	QE	LT	IE	IF	IL1	IL2	Connector model number for motor power	Connector model number for brake
R2AA18350△□◇	180	13.5	M8	65	0	60	92	M8	25	123	50	47	20	JL04V-2E24-11PE-B-R	- ①
R2AA18450△□◇					35 -0.016		109			57		20			
R2AA18550△□◇				79	0	153	M10	123		50	63	41	JL04V-2E32-17PE-B-R	JL04V-2E10SL-3PE-B-R	
R2AA18750△□◇					42 -0.016	198						86			

Note ① Brake cable is included in the connector for motor power.

- Single-turn absolute encoder (encoder code: H)

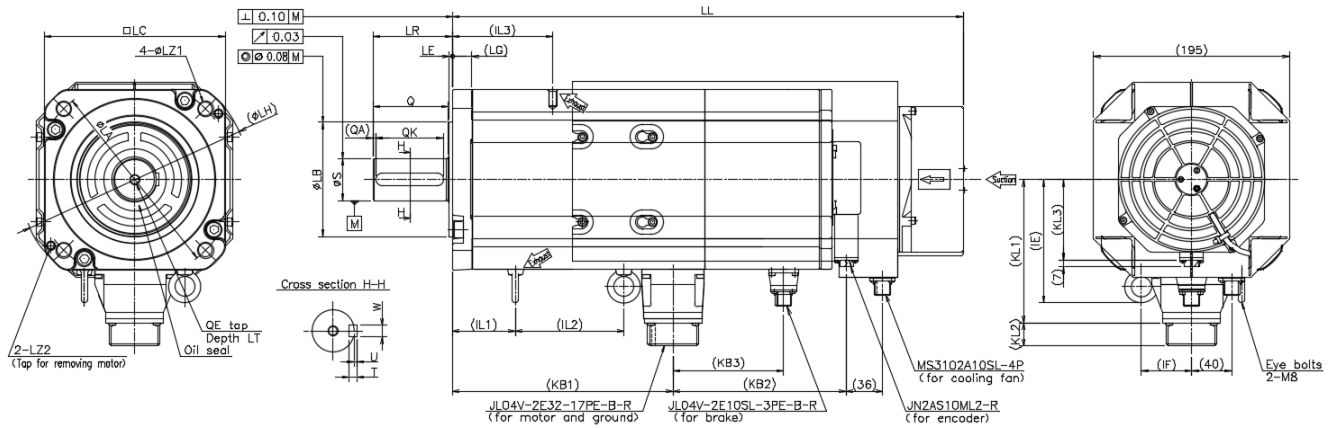
	Without brake				With brake													
Servo motor model number	LL	KB2	KB3	KL3	LL	KB2	KB3	KL3	LG	KL1	KL2	LA	LB	LE	LH	W	T	U
R2AA18350△□◇	155	48	-	38	205	98	-	38	16	123	21	200	0 114.3 -0.035	3	230	0	8	3
R2AA18450△□◇	172				222											10 -0.036		
R2AA18550△□◇	228	59			274	107	64		0									
R2AA18750△□◇	273				329	117	74		12 -0.043									

Servo motor model number	LC	LZ1	LZ2	LR	S	Q	KB1	QE	LT	IE	IF	IL1	IL2	Connector model number for motor power	Connector model number for brake
R2AA18350△□◇	180	13.5	M8	65	0	60	92	M8	25	123	50	47	20	JL04V-2E24- 11PE-B-R	-
R2AA18450△□◇					35 -0.016		109					57	20		①
R2AA18550△□◇				79	0	153	63	41		JL04V-2E32- 17PE-B-R	JL04V-2E10SL- 3PE-B-R				
R2AA18750△□◇					42 -0.016	198		86							

Note ① Brake cable is included in the connector for motor power.

6.3 Servo motor dimensions 200V input

6.3.9 R2 motor, flange size 180mm, 11kW

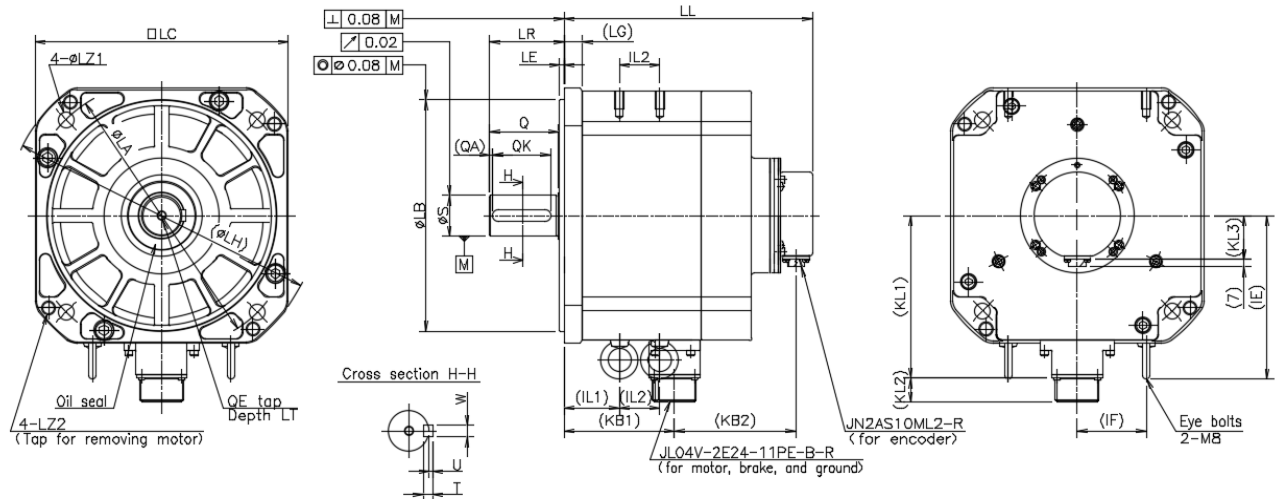


Unit: mm

Servo motor model number	Without brake				With brake			
	LL	KB2	KB3	KL3	LL	KB2	KB3	KL3
R2AA1811K $\triangle$ $\square$ $\diamond$	395	60	-	81	509	173	110	81

Servo motor model number	LG	KL1	KL2	LA	W	T	U	LB	LE	LH	LC	LZ1	LZ2	LR	S	Q	KB1	QE	LT	IE	IF	IL1	IL2	IL3
R2AA1811K $\triangle$ $\square$ $\diamond$	19	143	23	200	0 12 -0.043	8	3	0 14.3 -0.035	3	230	180	13.5	M8	79	0 42 -0.016	75	220	M10	25	123	50	63	108	100

6.3.10 R2 motor, flange size 220mm, 5kW



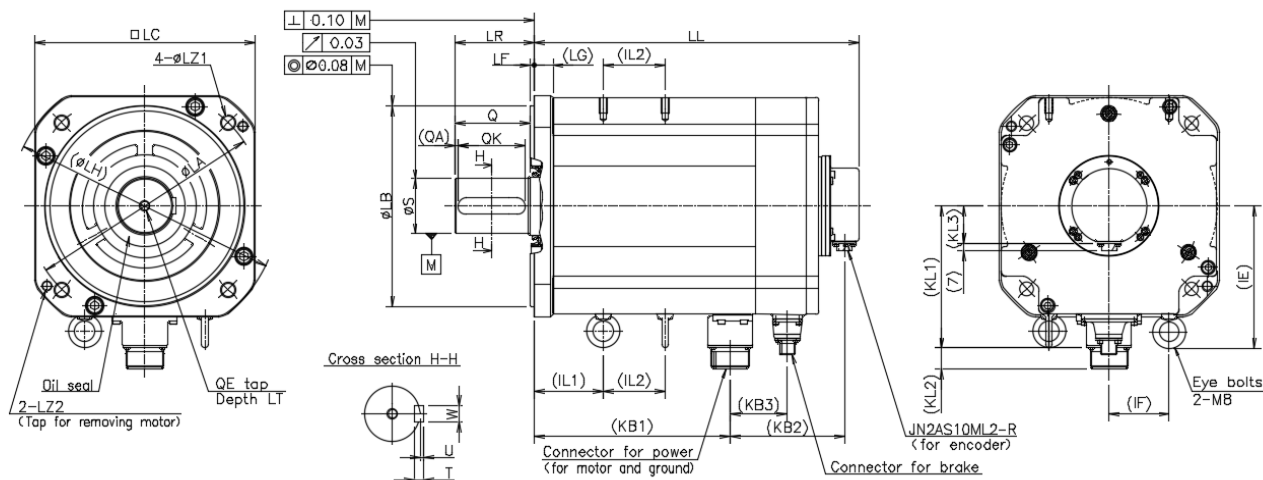
Unit: mm

Servo motor model number	Without brake			With brake		
	LL	KB2	KL3	LL	KB2	KL3
R2AA22500 $\triangle$ $\square$ $\diamond$	163	52	38	216	106	38

Servo motor model number	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2	LR	S	Q	KB1	QE	LT	W	T	U	IE	IF	IL1	IL2
R2AA22500 $\triangle$ $\square$ $\diamond$	16	142	21	235	0 200 -0.046	4	270	220	13.5	M12	65	0 35 -0.016	60	96	M8	25	0 10 -0.036	8	3	142	60	48	35

6. Appendix

6.3.11 R2 motor, flange size 220mm, 7 to 15kW



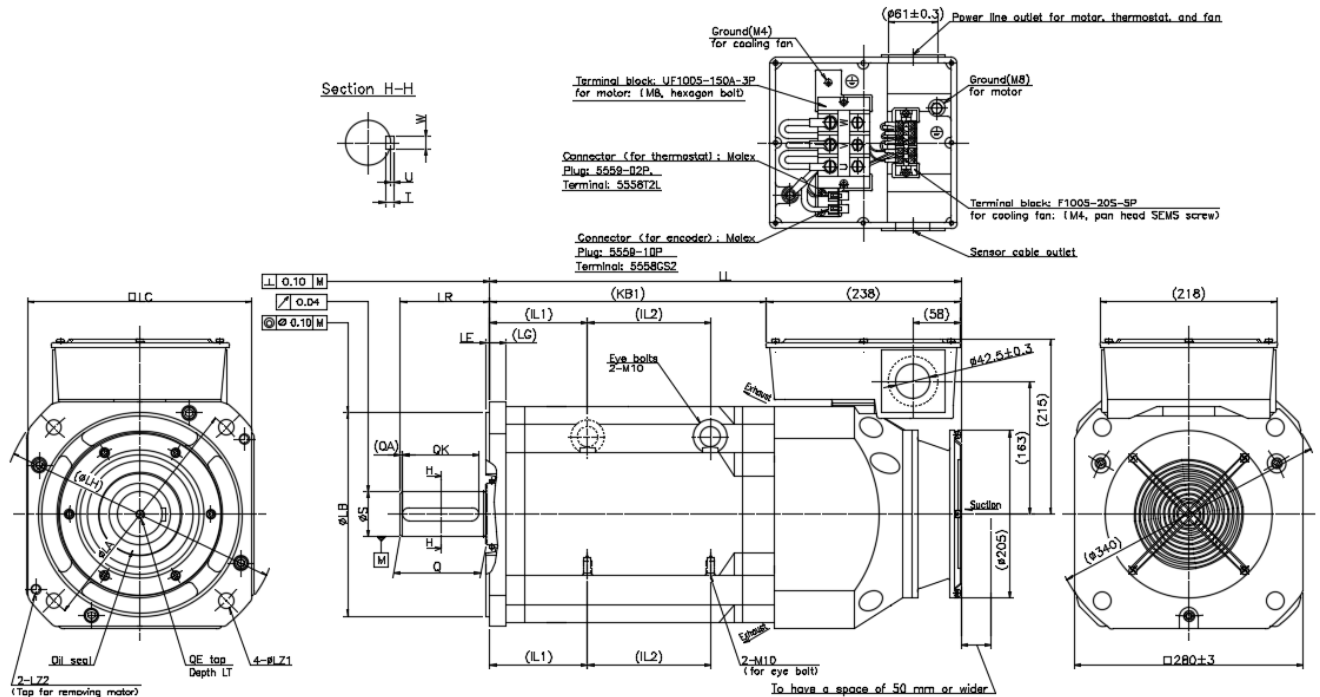
Unit: mm

	Without brake			With brake																
Servo motor model number	LL	KB2	KB3	LL	KB2	KB3	KL1	KL2	KB1	LG	KL1	KL2	LA	LB	LE	LH	W	T	U	
R2AA22700△□◇	265	54	-	325	114	57	141	21	196	19	141	21	235	0 200 -0.046	4	270	0 16 -0.043	10	4	
R2AA2211K△□◇	304	304		364	123	66	162	22	226		16	22								
R2AA2215K△□◇	343			403					265											

Servo motor model number	LC	LZ1	LZ2	LR	S	Q	KB1	QE	LT	IE	IF	IL1	IL2	Connector model number for motor power	Connector model number for brake
R2AA22700△□◇	220	13.5	M10	79	0 55 -0.019	75	196	M10	25	142	60	69	62	JL04V-2E24-11PE-B-R	JL04V-2E10SL-3PE-B-R
R2AA2211K△□◇							226						101	JL04V-2E32-17PE-B-R	
R2AA2215K△□◇							265						140		

6. Appendix

6.3.13 R2 motor, flange size 275mm, 30kW

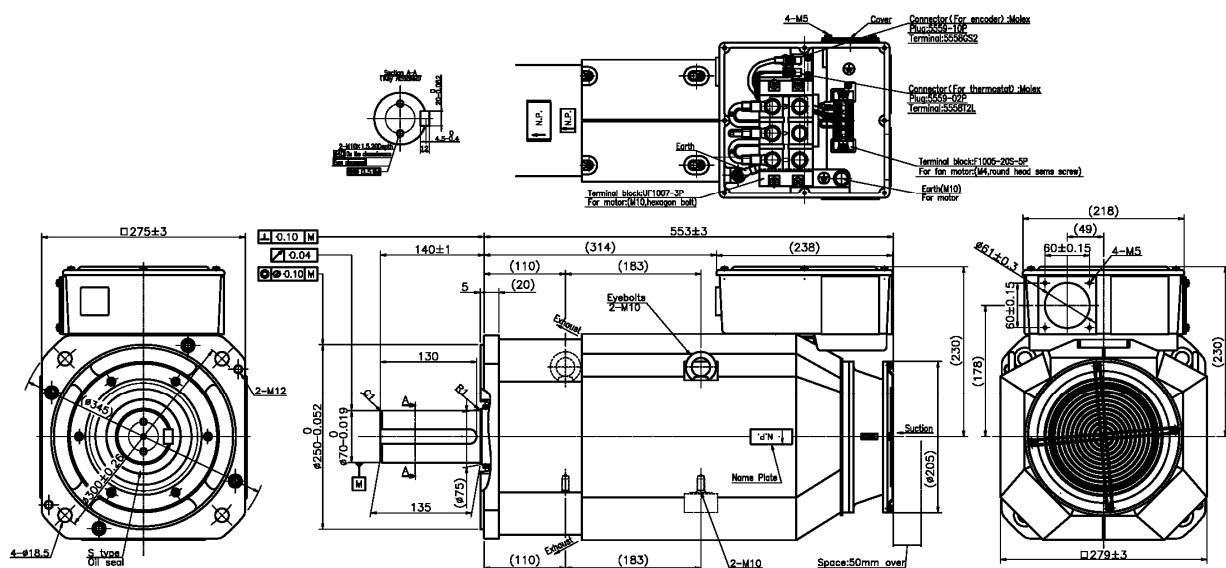


Unit: mm

	Without brake			With brake		
Servo motor model number	LL	KB1	IL2	LL	KB1	IL2
R2AA2830K△□◇	479	240	50	579	340	151

6.3.14 R2 motor, flange size 275mm, 37kW (R2AA2837KBX◇)

- Single-turn absolute encoder (encoder code: H)

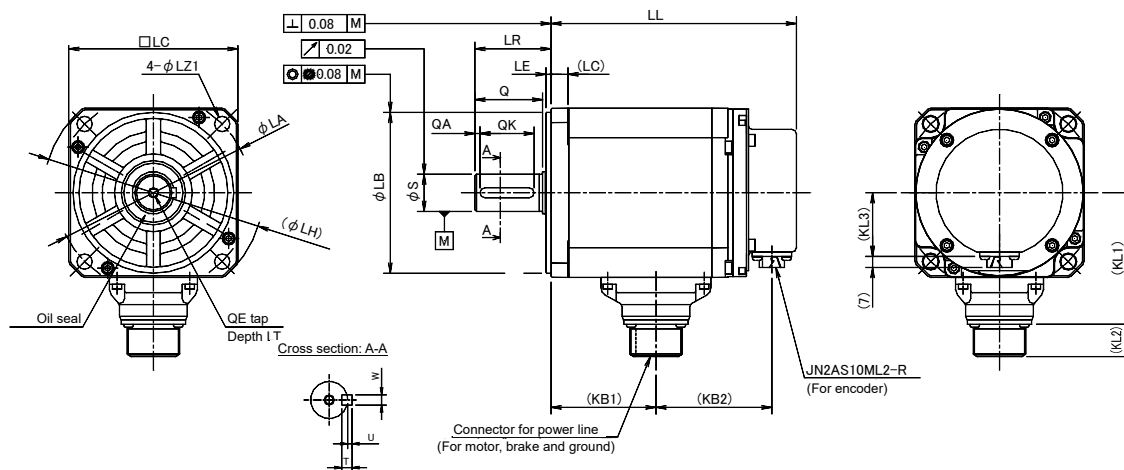


Unit: mm

6.4 Servo motor dimensions 400V input

6.4 Servo motor dimensions 400V input

6.4.1 R1 motor, flange size 100mm, 1.5 to 2.0kW

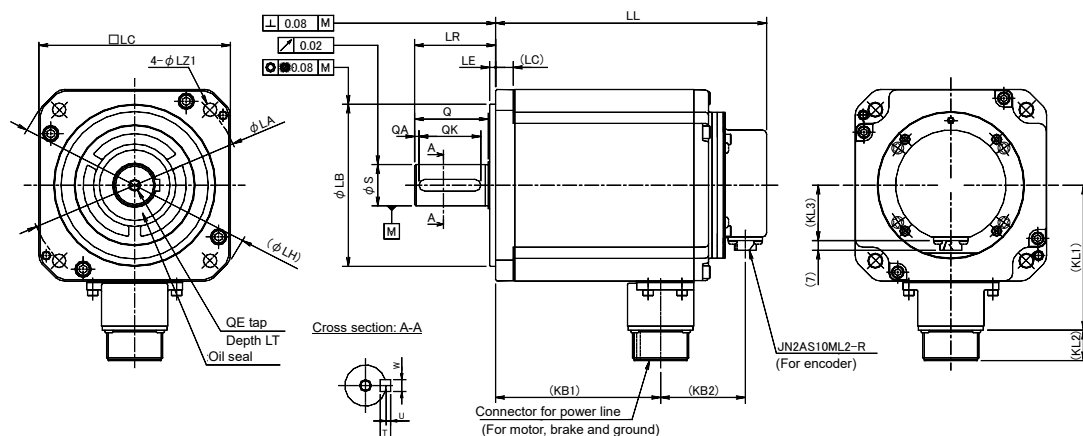


Unit: mm

Servo motor model number	Without brake			With brake			LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1
	LL	KB2	KL3	LL	KB2	KL3									
R1CA10150△□◇	168	68	38	209	109	38	10	78	19	115	0 95-0.035	3	130	100	9
R1CA10200△□◇	179			220											

Servo motor model number	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R1CA10150△□◇	45	0	40	3	32	0 6-0.03	6	2.5	85 96	M6	20
R1CA10200△□◇		22-0.013									

6.4.2 R1 motor, flange size 130mm, 3.0kW



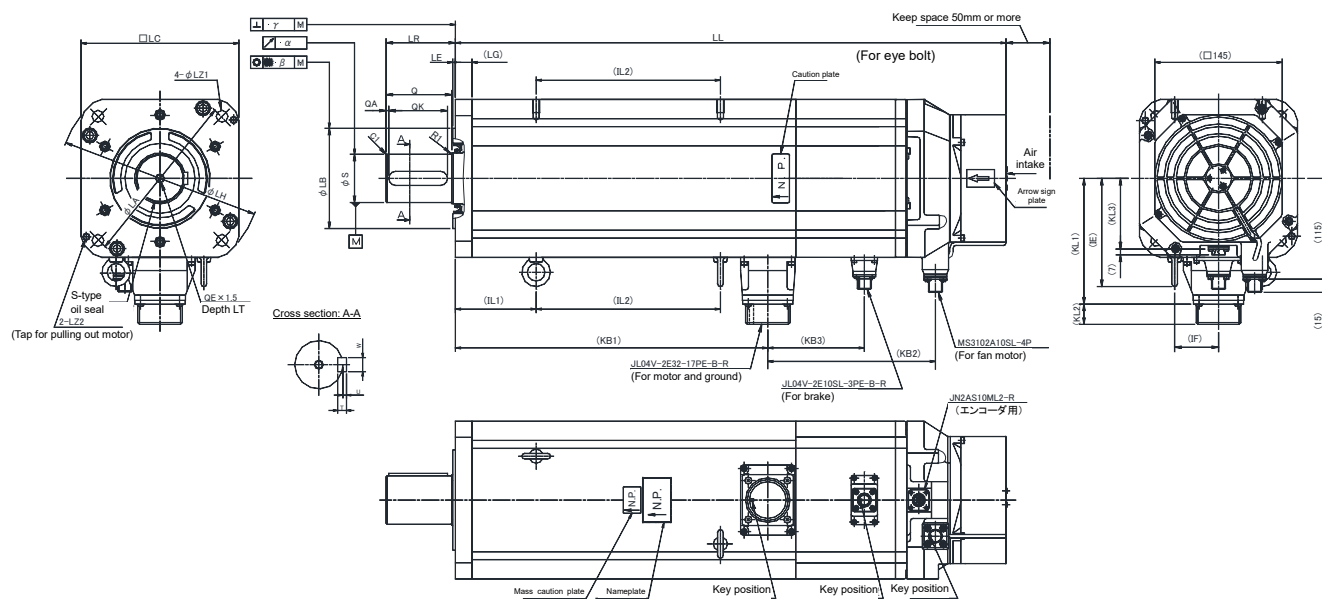
Unit: mm

Servo motor model number	Without brake			With brake			LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1
	LL	KB2	KL3	LL	KB2	KL3									
R1CA13300△□◇	184	57	38	230	100	38	12	98	21	145	0 110-0.035	4	165	130	9

Servo motor model number	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R1CA13300△□◇	55	0 28-0.013	50	3	42	0 8-0.036	7	3	112	M8	25

6. Appendix

6.4.3 R1 motor, flange size 180mm, 5.5 to 15kW



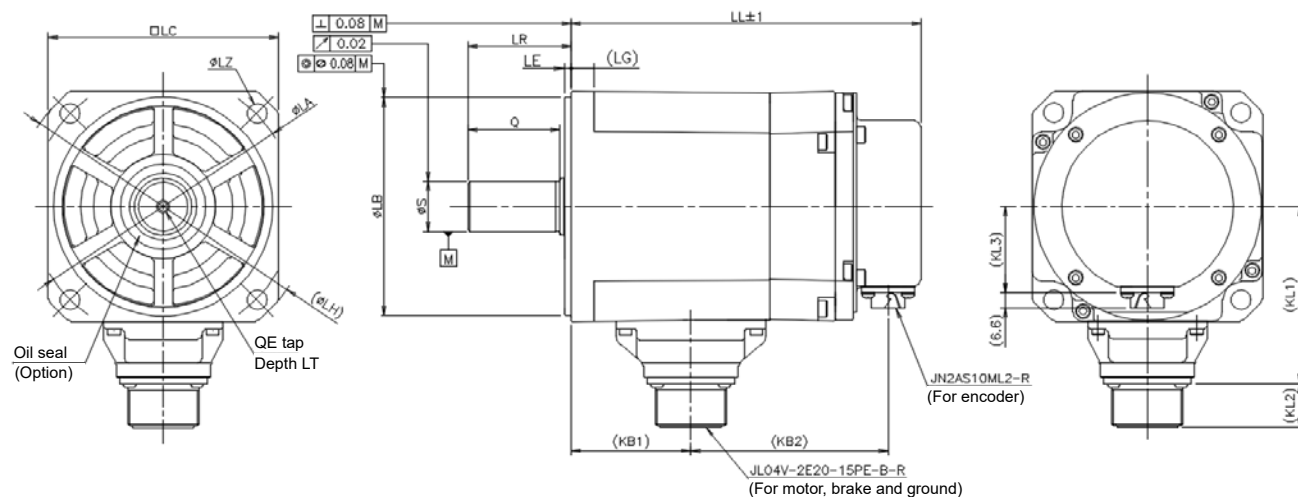
Unit: mm

Servo motor model number	Without brake				With brake				LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2
	LL	KB2	KB3	KL3	LL	KB2	KB3	KL3										
R1AA18550△□◇	333	80	-	81	383	130	54	81	19	143	23	200	0 114.3-0.035	3	230	180	13.5	M8
R1AA18750△□◇	368				418	130	63											
R1AA1811K△□◇	438				517	158	79											
R1AA1815K△□◇	516				628	191	110											

Servo motor model number	LR	S	Q	QA	QK	W	T	U	KB1	α	β	γ	QE	LT	IE	IF	IL1	IL2
R1AA18550△□◇	79	0	75	3	67	0	8	3	173	0.02	0.08	0.08	M10	25	124	50	54	65
R1AA18750△□◇		42-0.016				12-0.043			208								68	85
R1AA1811K△□◇		0				0			278								68	163
R1AA1815K△□◇		55-0.019				16-0.043	10	4	356	0.03	0.08	0.10					92	210

6. Appendix

6.4.5 R2 motor, flange size 100mm, 0.75 to 1.0kW



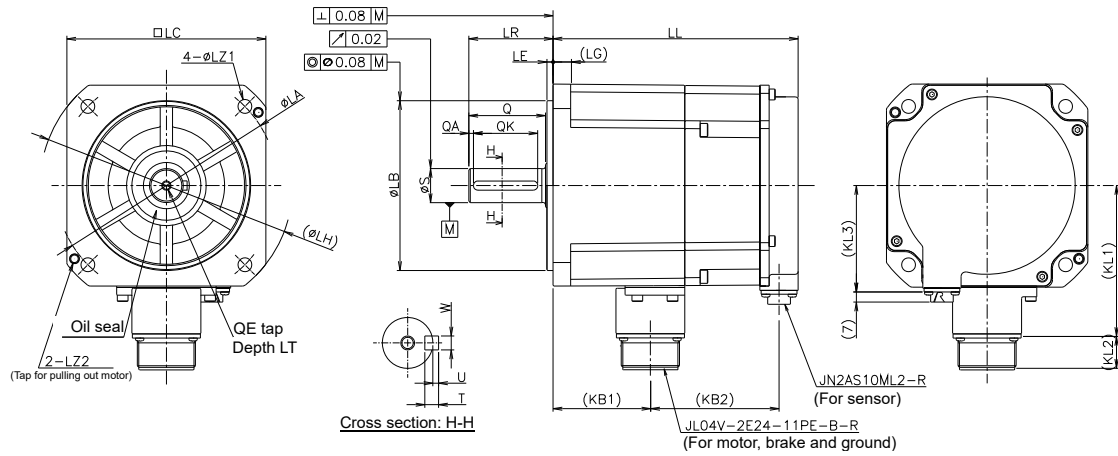
Unit: mm

Servo motor model number	Without brake			With brake						
	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA
R2CA10075△□◇	134.8	68.3	37.6	152.3	85.8	37.6	10	77.8	19.1	115
R2CA10100△□◇	151.8	68.3		169.3	85.8					

Servo motor model number	LB	LE	LH	LC	LZ	LR	S	Q	KB1	QE	LT
R2CA10075△□◇	0	95-0.035	3	130	4- ϕ 9	45	0 22-0.013	40	52 69	M6	20
R2CA10100△□◇	95-0.035										

6.4 Servo motor dimensions 400V input

6.4.6 R2 motor, flange size 130mm, 0.55 to 1.8kW

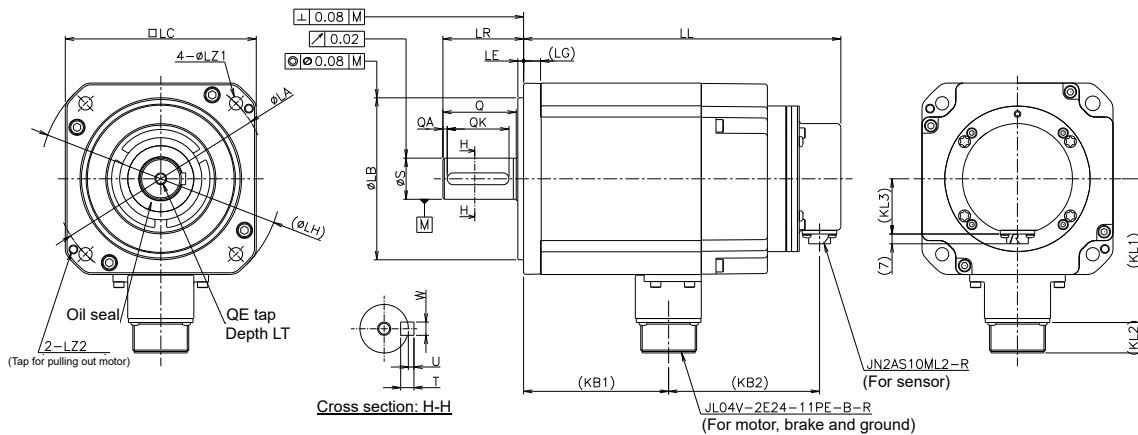


Unit: mm

Servo motor model number	Without brake			With brake			LG	KL1	KL2	LA
	LL	KB2	KL3	LL	KB2	KL3				
R2CA13050 $\triangle$ $\square$ $\diamond$	103			139.5	81					
R2CA13120 $\triangle$ $\square$ $\diamond$	120.5	44	69	160	84	69	12	98	21	145
R2CA13180 $\triangle$ $\square$ $\diamond$	138			179	86					

Servo motor model number	LB	LE	LH	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R2CA13050 $\triangle$ $\square$ $\diamond$															46		
R2CA13120 $\triangle$ $\square$ $\diamond$	0	4	165	130	9	M6	55	0	50	3	42	0	6	2.5	64	M6	20
R2CA13180 $\triangle$ $\square$ $\diamond$	110-0.035							22-0.013				6-0.030			81		

6.4.7 R2 motor, flange size 130mm, 2.0kW



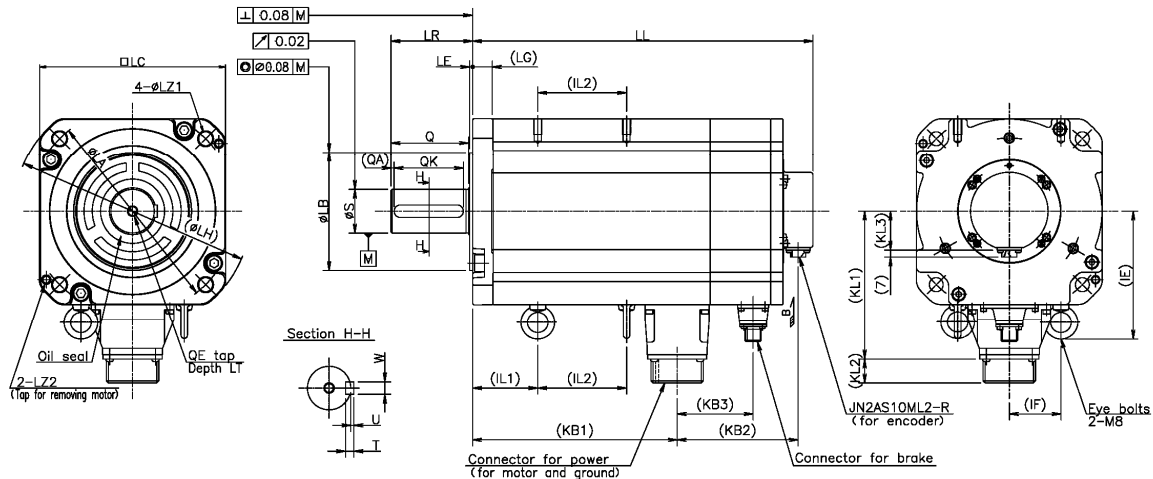
Unit: mm

Servo motor model number	Without brake			With brake			LG	KL1	KL2	LA
	LL	KB2	KL3	LL	KB2	KL3				
R2CA13200 $\triangle$ $\square$ $\diamond$	171	57	38	216	103	38	12	98	21	145

Servo motor model number	LB	LE	LH	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R2CA13200 $\triangle$ $\square$ $\diamond$	0	4	165	130	9	M6	55	0	50	3	42	0	7	3	99	M8	25
	110-0.035							28-0.013				8-0.036					

6. Appendix

6.4.8 R2 motor, flange size 180mm, 3.5 to 7.5kW



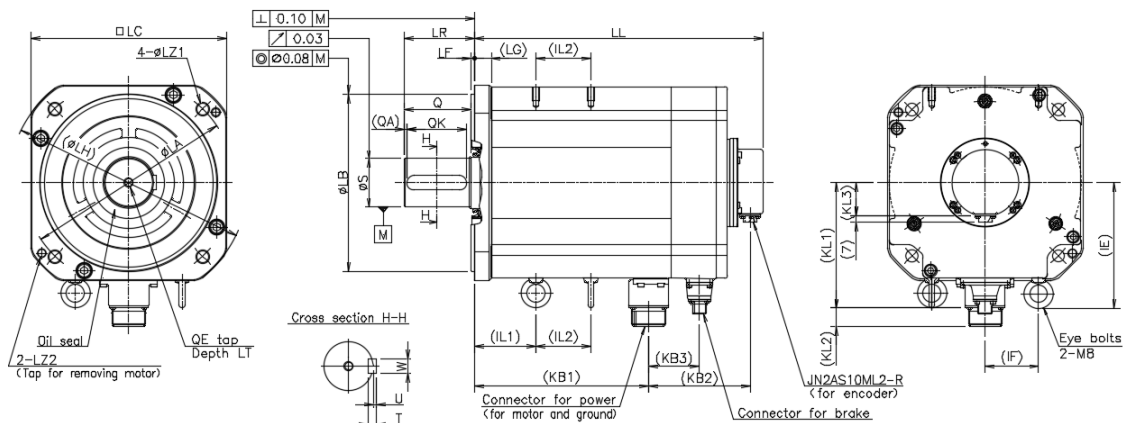
Unit: mm

	Without brake				With brake														
Servo motor model number	LL	KB2	KB3	KL3	LL	KB2	KB3	KL3	LG	KL1	KL2	LA	LB		LE	LH	W	T	U
R2CA18350△□◇	159	52	-	38	206	99	-	38	16	123	21	200	0 114.3 -0.035	3	230	0 10 -0.036	8	3	
R2CA18450△□◇	176				223														
R2CA18550△□◇	228				274											0 12 -0.043			
R2CA18750△□◇	273	59			329	117	74		19	144	22								

Servo motor model number	LC	LZ1	LZ2	LR	S	Q	KB1	QE	LT	IE	IF	IL1	IL2	Connector model number for motor power	Connector model number for brake		
R2CA18350△□◇	180	13.5	M8	65	0 35 -0.016	60	92 109	M8	25	123	50	47 57	20	JL04V-2E24-11PE-B-R	- ①		
R2CA18450△□◇																	
R2CA18550△□◇																	
R2CA18750△□◇																	

Note ① Brake cable is included in the connector for motor power.

6.4.9 R2 motor, flange size 220mm, 11 to 15kW



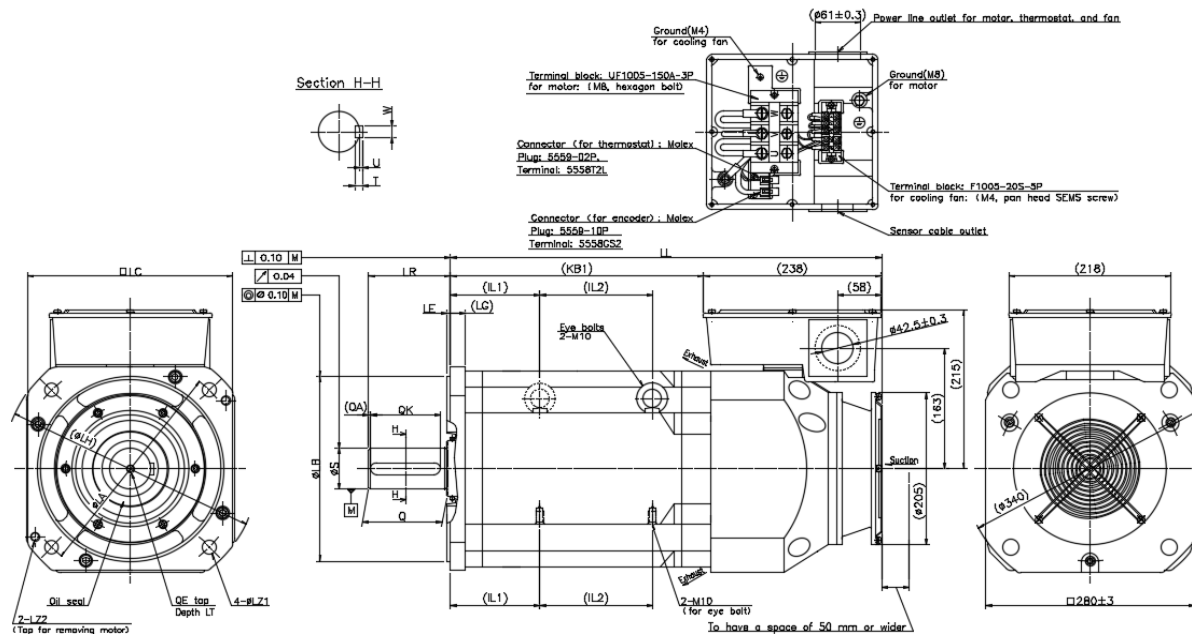
Unit: mm

Unit

	Without brake			With brake														
Servo motor model number	LL	KB2	KB3	LL	KB2	KB3	KL1	KL2	KL3	KB1	LG	LA	LB	LE	LH	W	T	U
R2CA2211KΔ□◇	304	63	-	364	123	66	162	22	38	226	19	235	0	4	270	0	10	4
R2CA2215KΔ□◇	397	78		501	182	90				304			200 -0.046			16 -0.043		

Servo motor model number	LC	LZ1	LZ2	LR	S	Q	QE	LT	IE	IF	IL1	IL2	Connector model number for motor power	Connector model number for brake
R2CA2211KΔ□◇	220	13.5	M10	79	0	75	M10	25	142	60	69	101	JL04V-2E32-17PE-B-R	JL04V-2E10SL-3PE-B-R
R2CA2215KΔ□◇					55 -0.019						98	150		

6.4.11 R2 motor, flange size 275mm, 30kW



Servo motor model number	Without brake			With brake			LG	LA	LB	LE	LH
	LL	KB1	IL2	LL	KB1	IL2					
R2CA2830K△□◇	479	240	50	579	340	151	20	300	0 250-0.052	5	345

Servo motor model number	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	QE	LT	IL1
R2CA2830K△□◇	275	18.5	M12	110	0 55-0.019	105	3	93	0 16-0.043	10	4	M10	25	120

6. Appendix

6.5 Servo motor data sheet **200V input**

6.5.1 Characteristics table

■ Specification of R1 motor, 200V AC

Servo motor model number R1AA			10100F	10150F	10200H	10250H	13300F
Applicable amplifier capacity			50A	50A	50A	50A	100A
*Rated output	P _R	kW	1.0	1.5	2.0	2.5	3.0
*Rated velocity	N _R	min ⁻¹	3000	3000	3000	3000	3000
*Maximum velocity	N _{max}	min ⁻¹	6000	6000	3000	3000	6000
*Rated torque	T _R	N·m	3.2	4.8	6.37	7.97	9.7
*Continuous Torque at stall	T _S	N·m	3.2	4.9	6.37	7.97	9.7
*Peak Torque at stall	T _P	N·m	10.5	15.0	24.0	27.5	29.0
*Rated armature current	I _R	Arms	7.7	8.2	7.7	9.0	17.5
*Armature current at stall	I _S	Arms	7.4	7.7	6.8	7.2	16.8
*Peak armature current at stall	I _P	Arms	26.5	26.5	26.5	26.5	55.0
*Torque constant	K _T	N·m/ Arms	0.46	0.64	1.07	1.24	0.63
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	15.9	22.4	37.3	43.2	21.8
Phase resistance	R _φ	Ω	0.27	0.26	0.61	0.58	0.08
*Rated power rate	Q _R	kW/s	73	115	176	227	134
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	1.4	2.0	2.3	2.8	7.0
Mass Note1)	WE	kg	3.8	5.0	5.7	6.7	9.7
Brake mass	W	kg	1.5	1.5	1.5	1.5	2.1
Aluminum plate		mm	t20 x 400	t20 x 400	t20 x 470	t20 x 470	t20 x 470

Note1) Contains Battery-less absolute encoder (Encoder code: R).

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates TYP.

6.5 Servo motor data sheet 200V input

Servo motor model number R1AA			13400H	13500H	13400F	13500F
Applicable amplifier capacity			100A	100A	150A	150A
*Rated output	P _R	kW	4.0	5.0	4.0	5.0
*Rated velocity	N _R	min ⁻¹	3000	3000	3000	3000
*Maximum velocity	N _{max}	min ⁻¹	3000	3000	6000	6000
*Rated torque	T _R	N·m	12.8	16.0	12.8	16.0
*Continuous Torque at stall	T _S	N·m	12.8	16.0	12.8	16.0
*Peak Torque at stall	T _P	N·m	47.0	55.0	39.0	48.0
*Rated armature current	I _R	Arms	17.8	20.0	23.4	27.7
*Armature current at stall	I _S	Arms	15.5	14.1	22.5	26.6
*Peak armature current at stall	I _P	Arms	55.0	55.0	74.0	83.0
*Torque constant	K _T	N·m/ Arms	1.01	1.21	0.62	0.65
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	35.4	42.3	21.8	22.8
Phase resistance	R _φ	Ω	0.13	0.15	0.053	0.047
*Rated power rate	Q _R	kW/s	186	242	186	242
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	8.8	10.6	8.8	10.6
Mass Note1)	WE	kg	12.2	14.3	12.2	14.3
Brake mass	W	kg	2.5	2.5	2.5	2.5
Aluminum plate		mm	t20 x 470	t20 x 540	t20 x 470	t20 x 540

Servo motor model number R1AA			18550H	18750L	1811KR	1815KB	2220KV
Applicable amplifier capacity			300A	300A	300A	300A	600A
*Rated output	P _R	kW	5.5	7.5	21	11	15
*Rated velocity	N _R	min ⁻¹	1500	1500	1500	1500	1500
*Maximum velocity	N _{max}	min ⁻¹	3000	3000	2000	2500	2000
*Rated torque	T _R	N·m	35	48	135	70	95.5
*Continuous Torque at stall	T _S	N·m	37	48	135	70	95.5
*Peak Torque at stall	T _P	N·m	110	135	380	195	230
*Rated armature current	I _R	Arms	46	49	100	55.0	60.0
*Armature current at stall	I _S	Arms	47	47	96	54.0	58.0
*Peak armature current at stall	I _P	Arms	155	155	290	155	155
*Torque constant	K _T	N·m/ Arms	0.86	1.09	1.51	1.4	1.77
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	30	38.1	52.8	48.7	61.6
Phase resistance	R _φ	Ω	0.029	0.031	0.014	0.033	0.033
*Rated power rate	Q _R	kW/s	370	550	1740	770	1060
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	33	42	105	64	86
Mass Note1)	WE	kg	33	39	107	52	64
Brake mass	W	kg	2.8	4.5	—	7.1	8.9
Aluminum plate		mm	t20 x 540	t20 x 540	t30 x 610	t30 x 610	t30 x 610

Note1) Contains Battery-less absolute encoder (Encoder code: R).

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates TYP.

6. Appendix

■ Specification of R2 motor, 200V AC

Servo motor model number R2AA			B8075F	B8100F	10100F	13120D	13120L	13180H
Applicable amplifier capacity			50A	50A	50A	50A	50A	50A
*Rated output	P _R	kW	0.75	1.0	1.0	1.2	1.2	1.8
*Rated velocity	N _R	min ⁻¹	3000	3000	3000	2000	2000	2000
*Maximum velocity	N _{max}	min ⁻¹	6000	6000	6000	5000	3000	3500
*Rated torque	T _R	N·m	2.38	3.18	3.18	5.7	5.7	8.6
*Continuous Torque at stall	T _S	N·m	2.94	3.92	3.92	6.0	6.0	10.0
*Peak Torque at stall	T _P	N·m	11.0	14.3	14.3	16.0	20.0	22.0
*Rated armature current	I _R	Arms	4.7	6.0	5.7	9.1	7.6	11.0
*Armature current at stall	I _S	Arms	5.5	6.8	6.8	9.3	8.4	11.8
*Peak armature current at stall	I _P	Arms	23.7	25.7	25.7	25.4	26.5	26.5
*Torque constant	K _T	N·m/ Arms	0.547	0.582	0.584	0.65	0.77	0.89
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	19.1	20.3	20.4	22.7	27.0	31.1
Phase resistance	R _φ	Ω	0.62	0.44	0.35	0.23	0.35	0.23
*Rated power rate	Q _R	kW/s	35	42	29	54	54	82
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	1.643	2.383	3.5	6.0	6.0	9.0
Mass Note1)	WE	kg	2.9	3.6	4.1	6.1	6.1	7.7
Brake mass	W	kg	0.84	0.84	0.9	1.5	1.5	1.5
Aluminum plate		mm	t12 x 305	t12 x 305	t12 x 305	t20 x 400	t20 x 400	t20 x 470

Servo motor model number R2AA			13180D	13200L	13200D	18350L	18350D	18450H
Applicable amplifier capacity			50A	50A	50A	50A	50A	50A
*Rated output	P _R	kW	1.8	2.0	2.0	3.5	3.5	4.5
*Rated velocity	N _R	min ⁻¹	2000	2000	2000	2000	2000	2000
*Maximum velocity	N _{max}	min ⁻¹	5000	3000	5000	3000	4000	3500
*Rated torque	T _R	N·m	8.6	9.5	9.5	17.0	17.0	21.5
*Continuous Torque at stall	T _S	N·m	10.0	12.0	12.0	22.0	22.0	30.0
*Peak Torque at stall	T _P	N·m	25.0	24.0	30.0	49.0	60.0	75.0
*Rated armature current	I _R	Arms	15.6	11.0	14.3	19.1	21.7	23.7
*Armature current at stall	I _S	Arms	17.3	12.0	17.5	23.7	27.0	31.7
*Peak armature current at stall	I _P	Arms	43.0	26.5	45.5	55.0	83.0	83.0
*Torque constant	K _T	N·m/ Arms	0.63	0.97	0.7	1.0	0.88	1.02
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	21.8	33.7	24.3	34.8	30.6	35.6
Phase resistance	R _φ	Ω	0.13	0.22	0.11	0.085	0.075	0.065
*Rated power rate	Q _R	kW/s	82	74	74	72	72	92
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	9.0	12.2	12.2	40	40	50
Mass Note1)	WE	kg	7.7	10.0	10.0	15.5	15.5	19.5
Brake mass	W	kg	1.5	2.0	1.5	2.4	2.4	2.8
Aluminum plate		mm	t20 x 470	t20 x 470	t20 x 470	t20 x 470	t20 x 470	t20 x 470

Note1) Contains Battery-less absolute encoder (Encoder code: R).

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates TYP.

6.5 Servo motor data sheet 200V input

Servo motor model number R2AA			18550R	18550H	18750H	1811KR	22500L	22700S
Applicable amplifier capacity			150A	300A	300A	300A	150A	150A
*Rated output	P _R	kW	5.5	5.5	7.5	11	5.0	7.0
*Rated velocity	N _R	min ⁻¹	1500	1500	1500	1500	2000	1000
*Maximum velocity	N _{max}	min ⁻¹	2500	3000	3000	2500	4000	1000
*Rated torque	T _R	N·m	35.0	35.0	48.0	70.0	24.0	67.0
*Continuous Torque at stall	T _S	N·m	37.3	37.5	54.9	80.0	32.0	70.0
*Peak Torque at stall	T _P	N·m	90.0	107.0	140.0	170.0	75.0	150.0
*Rated armature current	I _R	Arms	31.6	46.2	51.2	61.9	22.0	34.0
*Armature current at stall	I _S	Arms	32.9	48.0	56.8	66.0	34.0	34.0
*Peak armature current at stall	I _P	Arms	83.0	155.0	155.0	155.0	83.0	83.0
*Torque constant	K _T	N·m/ Arms	1.23	0.84	1.04	1.25	1.0	2.25
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	42.8	29.3	36.6	43.8	34.9	78.6
Phase resistance	R _φ	Ω	0.059	0.03	0.03	0.035	0.047	0.085
*Rated power rate	Q _R	kW/s	180	180	235	445	105	330
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	68	68	98	110	55	136
Mass Note1)	WE	kg	27.7	27.7	34	40	22.5	43
Brake mass	W	kg	2.8	2.8	4.5	8.9	3.7	7.8
Aluminum plate		mm	t20 × 540	t20 × 540	t20 × 540	t30 × 610	t20 × 540	t20 × 540

Servo motor model number R2AA			2211KB	2215KB	2220KB	2830KV
Applicable amplifier capacity			300A	300A	600A	600A
*Rated output	P _R	kW	11	15	20	30
*Rated velocity	N _R	min ⁻¹	1500	1500	1500	1500
*Maximum velocity	N _{max}	min ⁻¹	2000	2000	2000	2000
*Rated torque	T _R	N·m	70	95	125	191.1
*Continuous Torque at stall	T _S	N·m	80	95	125	191.1
*Peak Torque at stall	T _P	N·m	176	215	280	480
*Rated armature current	I _R	Arms	60	66	116	116
*Armature current at stall	I _S	Arms	66	66	113	114
*Peak armature current at stall	I _P	Arms	155	155	290	290
*Torque constant	K _T	N·m/ Arms	1.38	1.5	1.21	1.78
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	48.0	52.3	42.4	62.1
Phase resistance	R _φ	Ω	0.022	0.017	0.013	0.013
*Rated power rate	Q _R	kW/s	275	380	659	865
Moment of inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	178	237	237	422
Mass Note1)	WE	kg	55	62	73	110
Brake mass	W	kg	7.8	7.8	17	17
Aluminum plate		mm	t30 × 610	t30 × 610	t30 × 610	t30 × 610

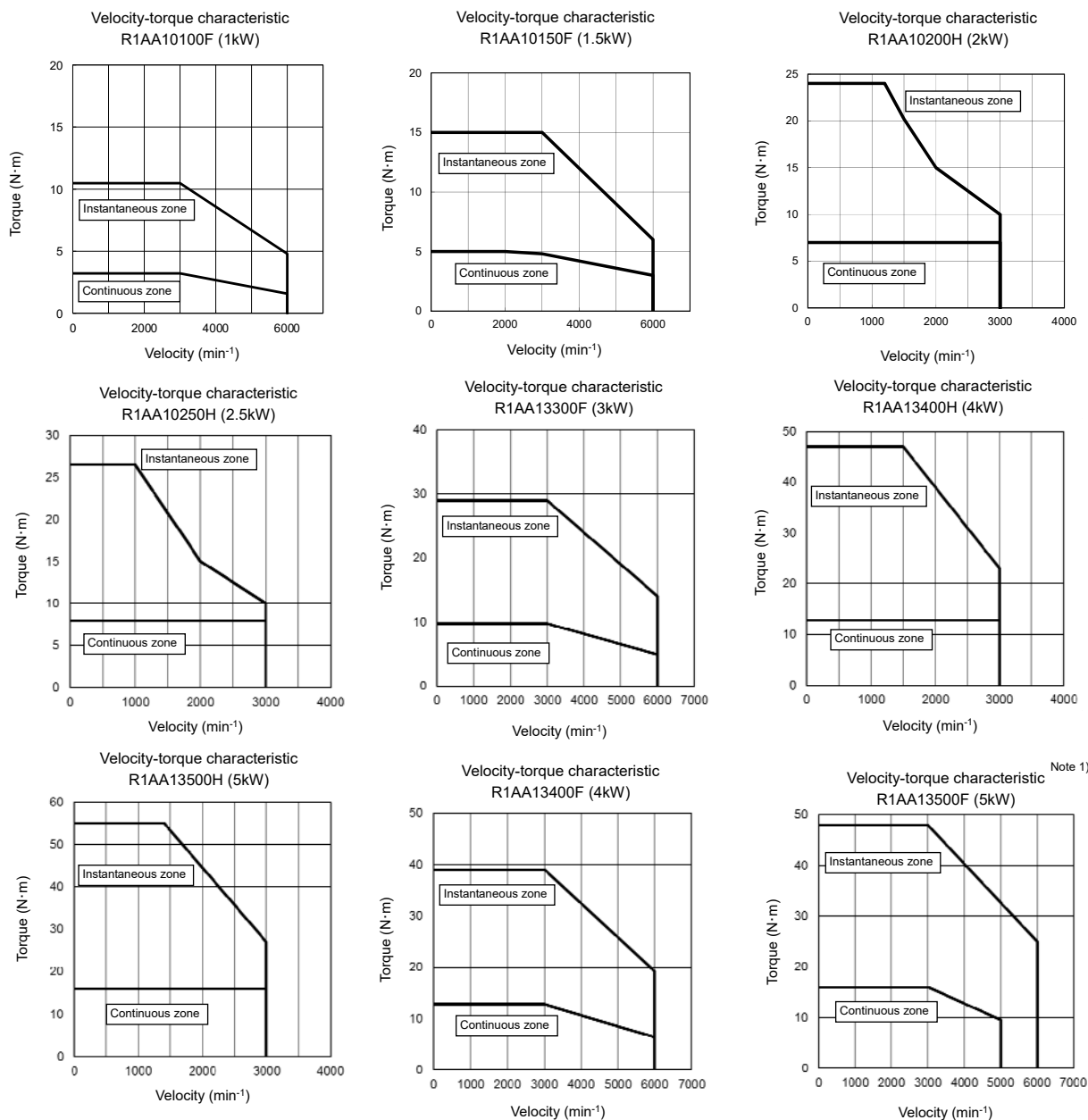
Note1) Contains Battery-less absolute encoder (Encoder code: R).

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates TYP.

6. Appendix

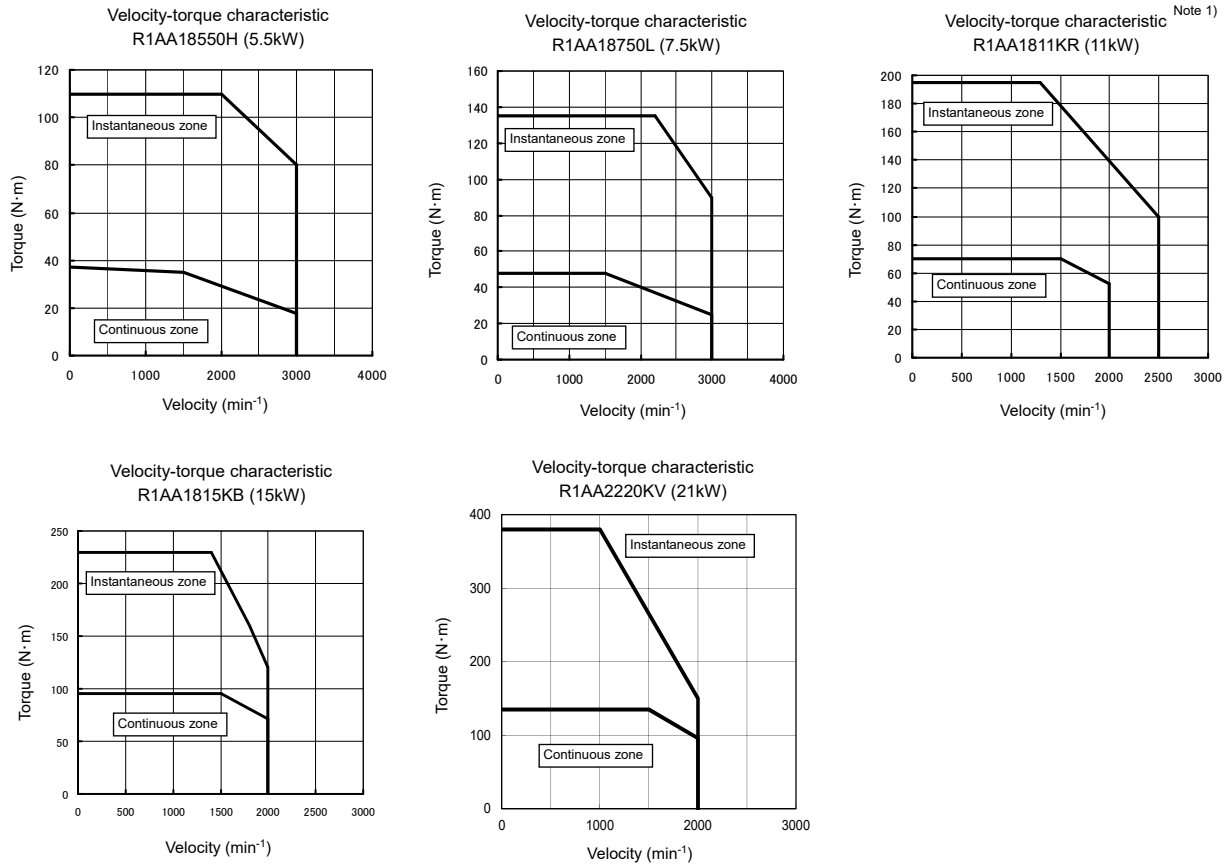
6.5.2 Velocity-torque characteristics

R1AA motor velocity-torque characteristics charts show the values when 200V AC is used as input power supply. When power supply voltage is less than 200V, instantaneous zone decreases.



6.5 Servo motor data sheet 200V input

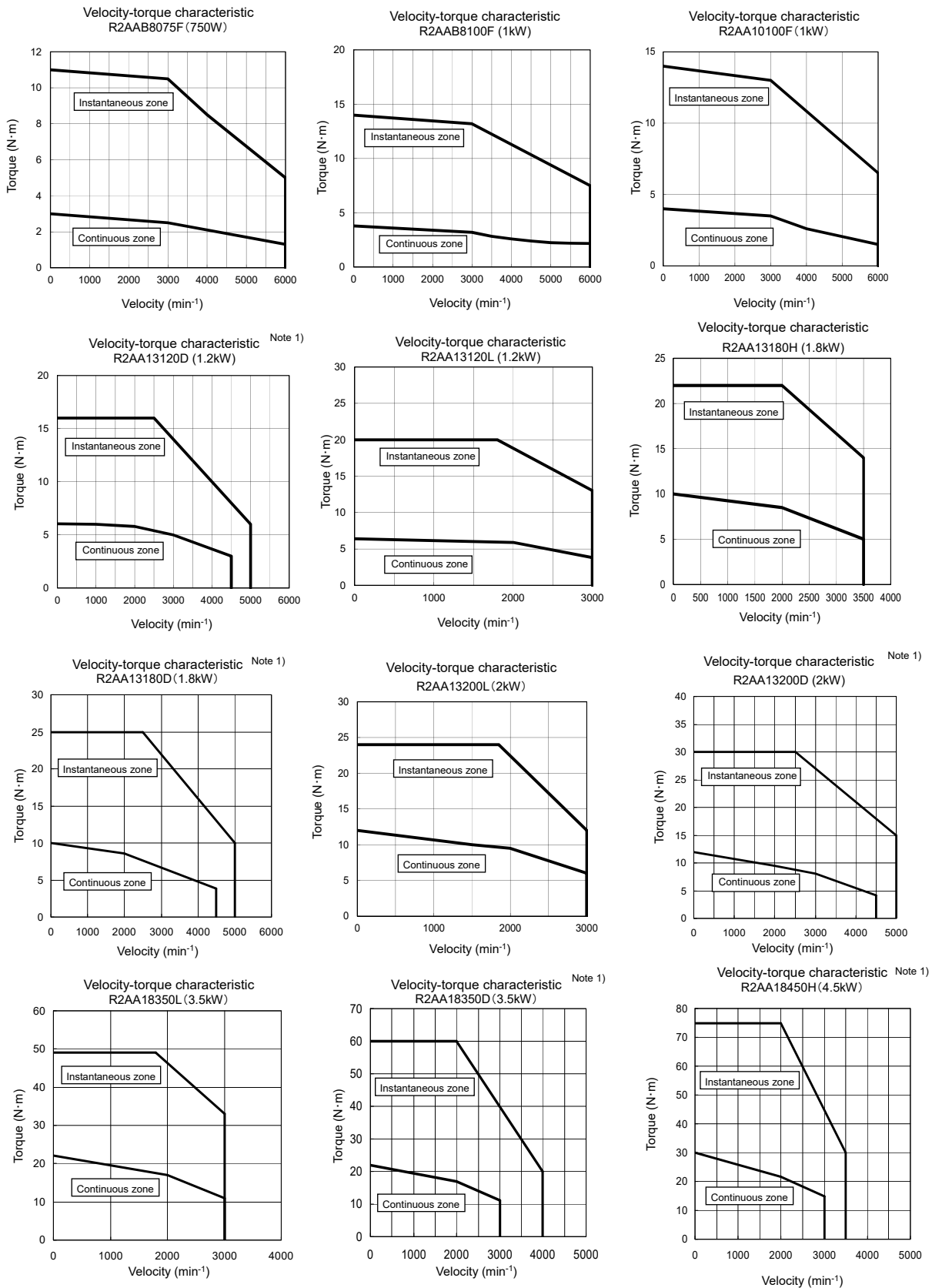
R1AA motor velocity-torque characteristics charts show the values when 200V AC is used as input power supply. When power supply voltage is less than 200V, instantaneous zone decreases.



Note1) When you use motor (R1AA1811KR) whose maximum rotational velocity N_{max} and maximum rotational velocity in the continuous zone are different, use the motor so that the motor average rotational velocity does not exceed maximum rotational velocity in the continuous zone.

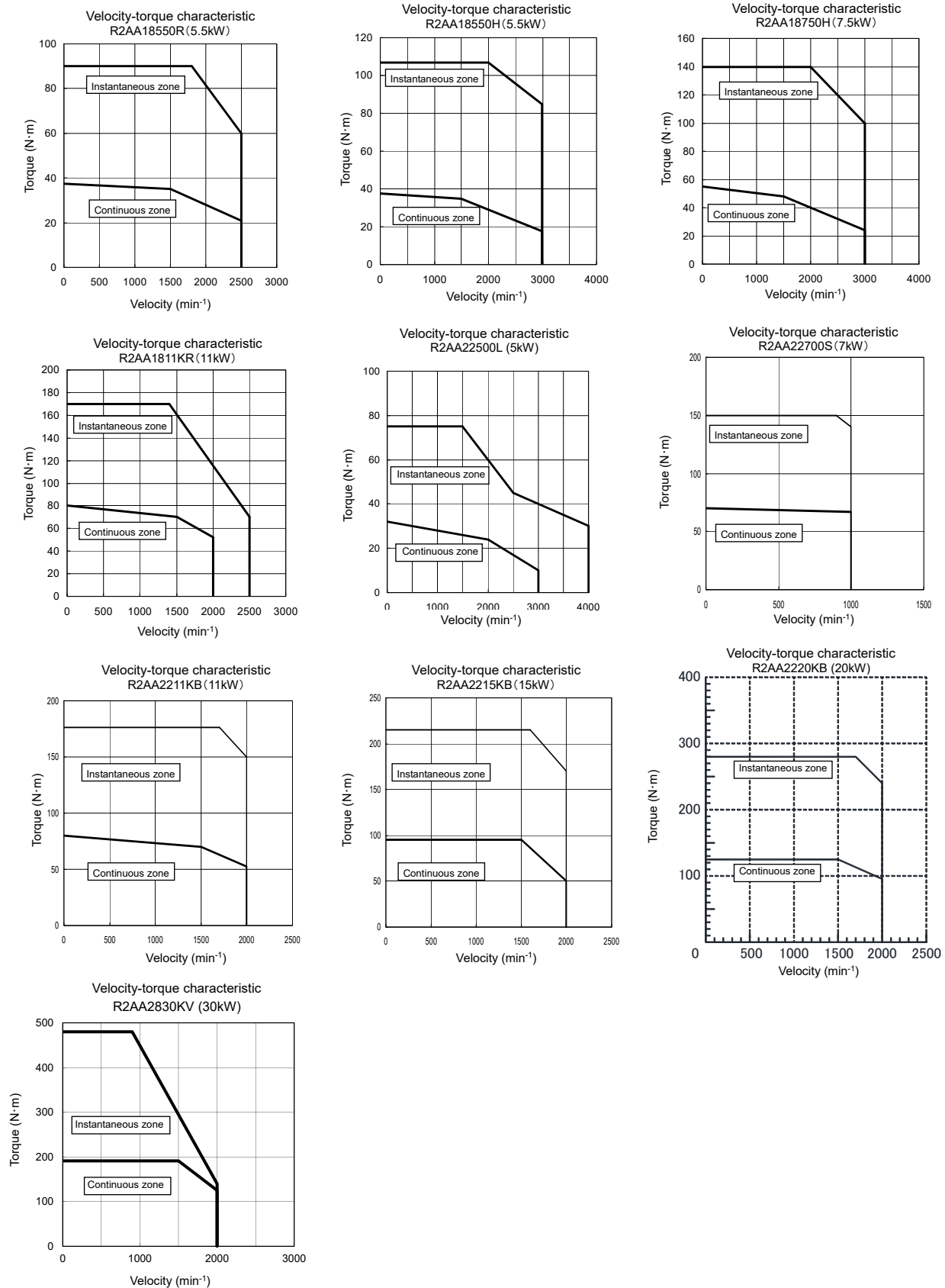
6. Appendix

R2AA motor velocity-torque characteristics charts show the values when 200V AC is used as input power supply. When power supply voltage is less than 200V, instantaneous zone decreases.



Note1) When you use motor (R2AA13120D, R2AA13180D, R2AA13200D, R2AA18350D or R2AA18450H) whose maximum rotational velocity N_{max} and maximum rotational velocity in the continuous zone are different, use the motor so that the motor average rotational velocity does not exceed maximum rotational velocity in the continuous zone.

6.5 Servo motor data sheet 200V input

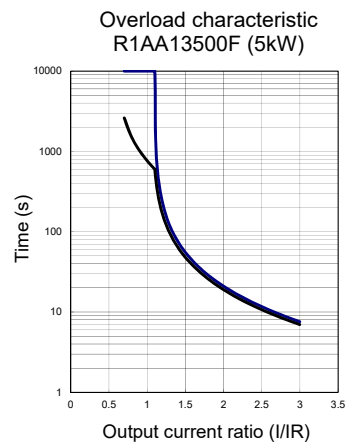
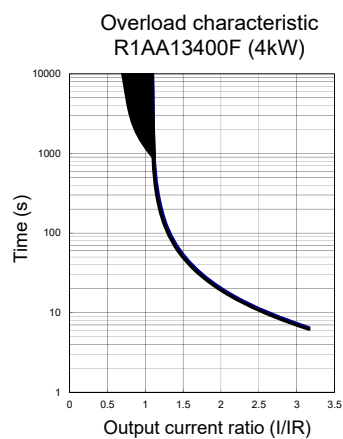
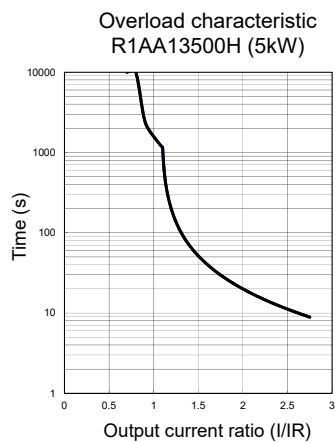
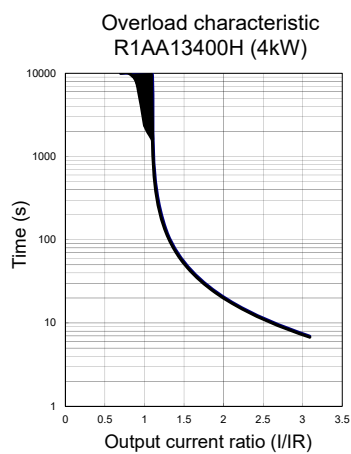
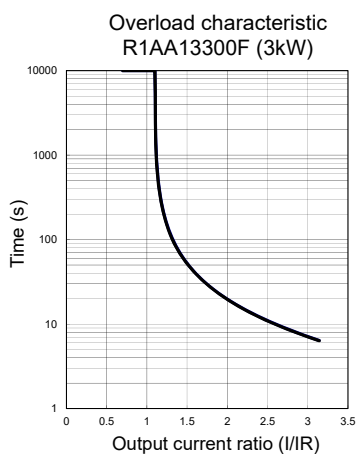
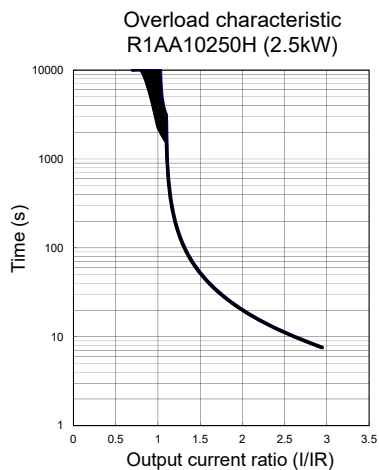
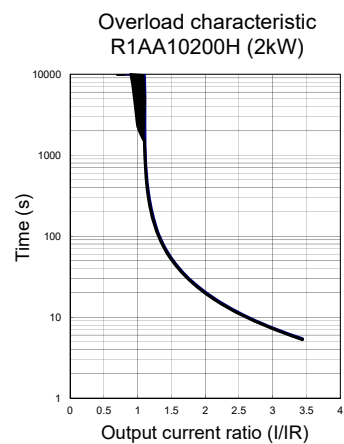
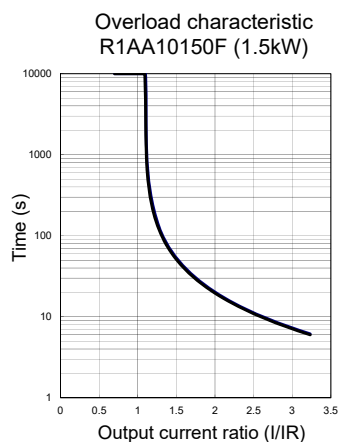
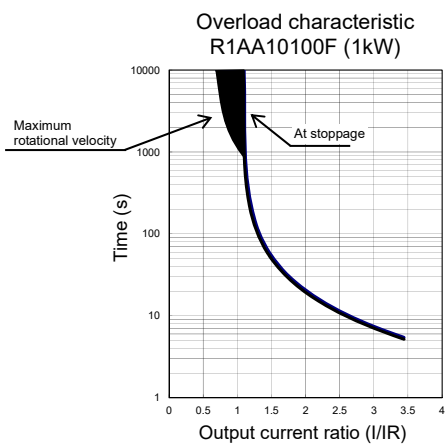


Note1) When you use motor (R2AA1811KR or R2AA22500L) whose maximum rotational velocity N_{max} and maximum rotational velocity in the continuous zone are different, use the motor so that the motor average rotational velocity does not exceed maximum rotational velocity in the continuous zone.

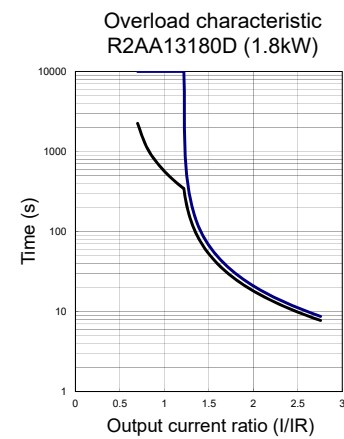
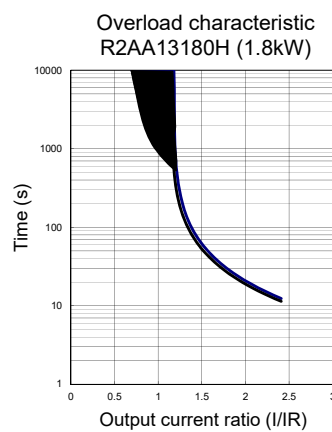
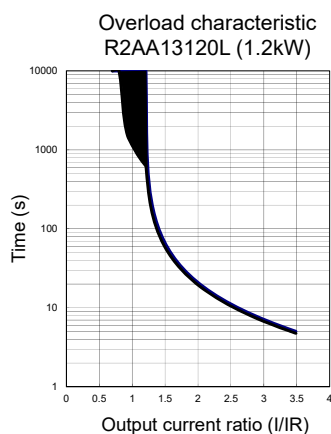
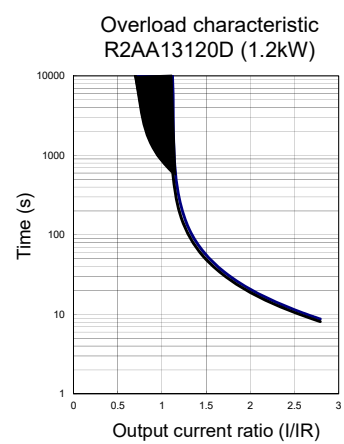
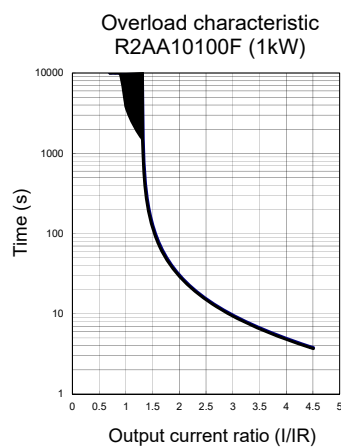
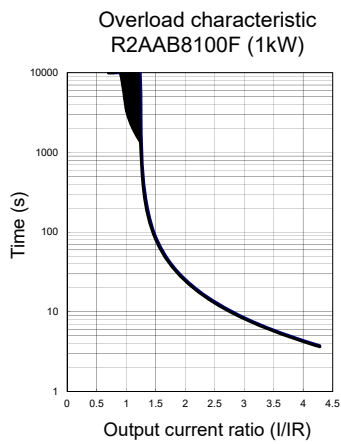
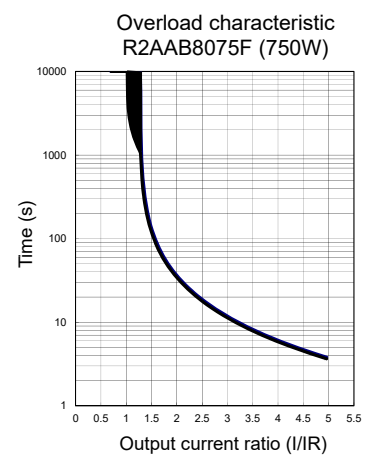
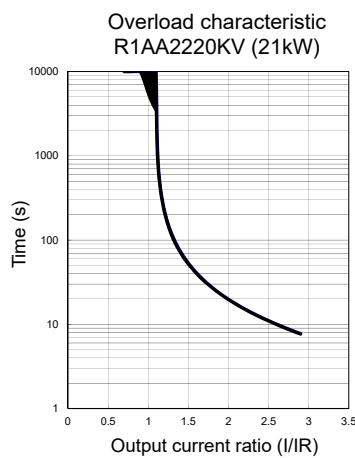
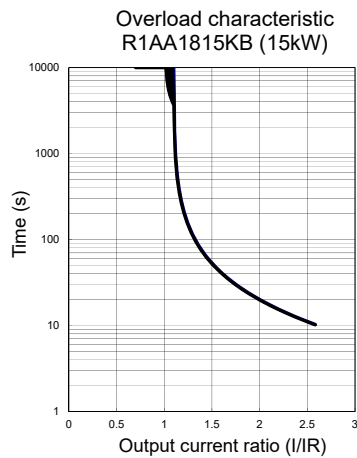
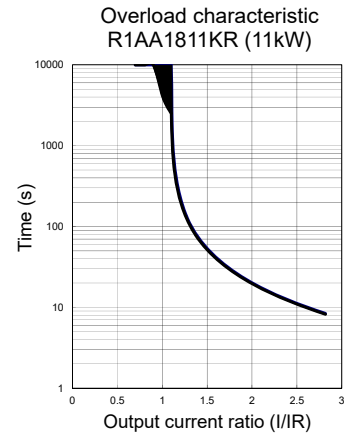
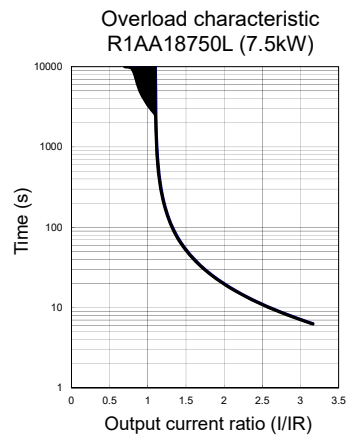
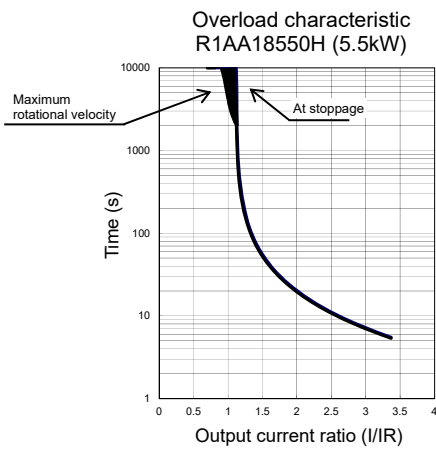
6. Appendix

6.5.3 Overload characteristics

The following show overload characteristics of R1AA and R2AA motors.

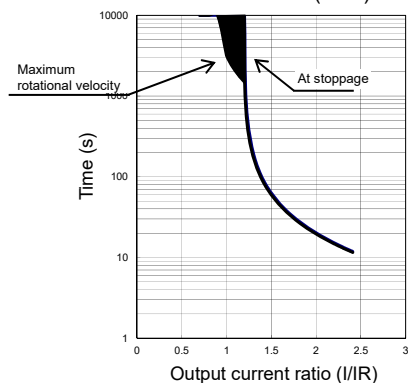


6.5 Servo motor data sheet 200V input

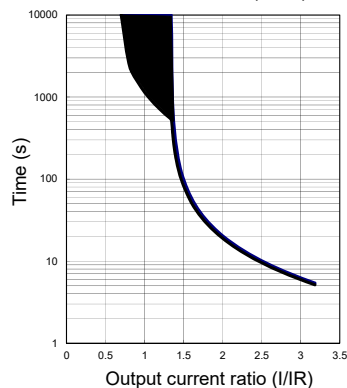


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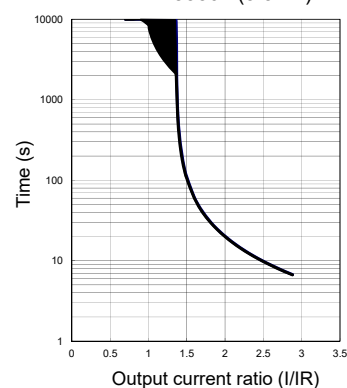
Overload characteristic
R2AA13200L (2kW)



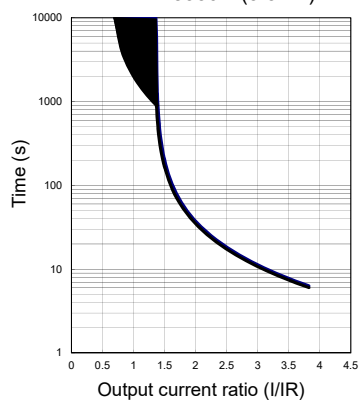
Overload characteristic
R2AA13200D (2kW)



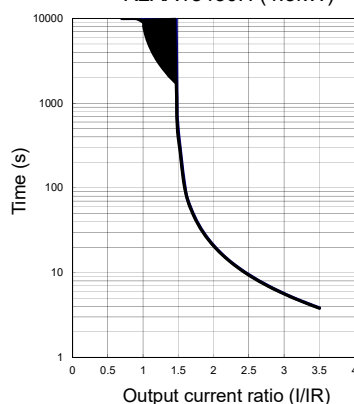
Overload characteristic
R2AA18350L (3.5kW)



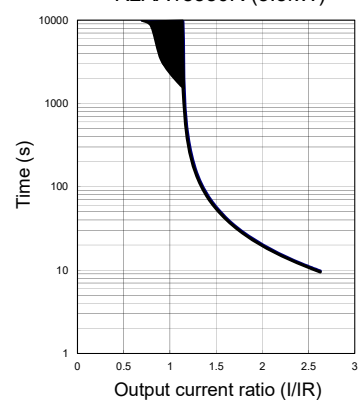
Overload characteristic
R2AA18350D (3.5kW)



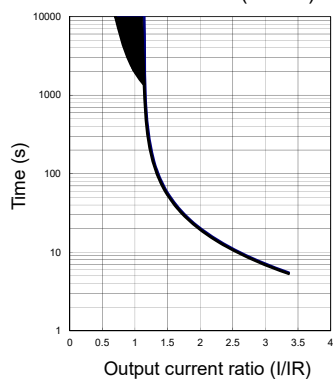
Overload characteristic
R2AA18450H (4.5kW)



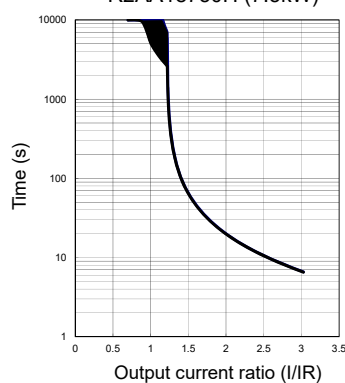
Overload characteristic
R2AA18550R (5.5kW)



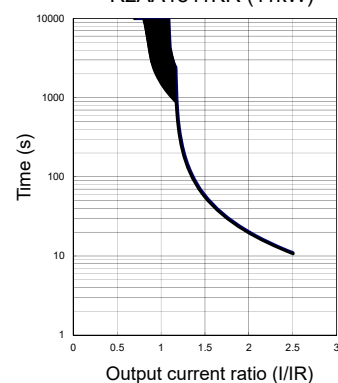
Overload characteristic
R2AA18550H (5.5kW)



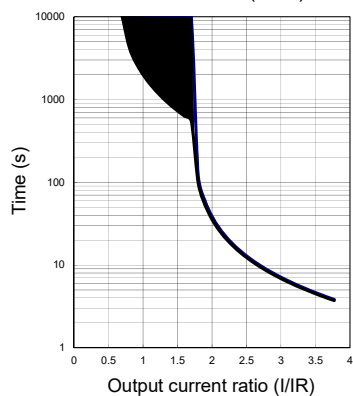
Overload characteristic
R2AA18750H (7.5kW)



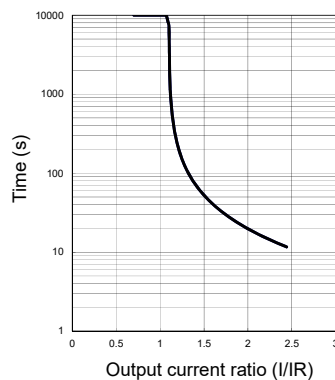
Overload characteristic
R2AA1811KR (11kW)



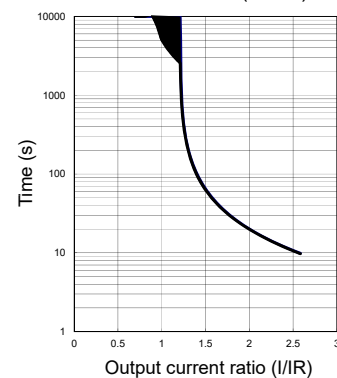
Overload characteristic
R2AA22500L (5kW)



Overload characteristic
R2AA22700S (7kW)

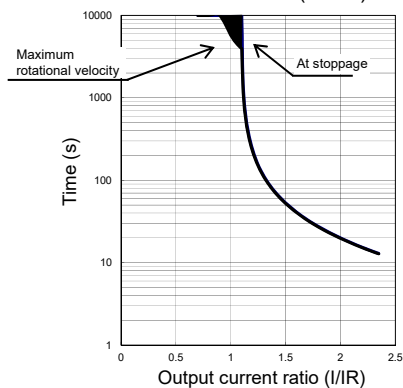


Overload characteristic
R2AA2211KB (11kW)

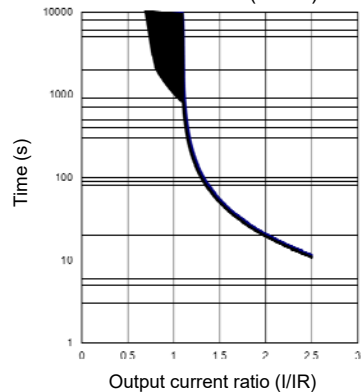


6.5 Servo motor data sheet 200V input

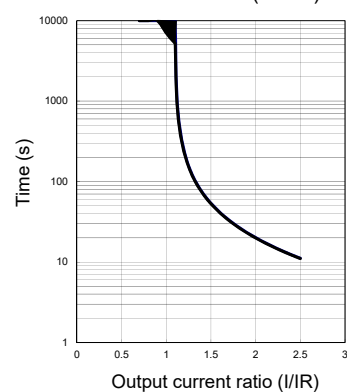
Overload characteristic
R2AA2215KB (15kW)



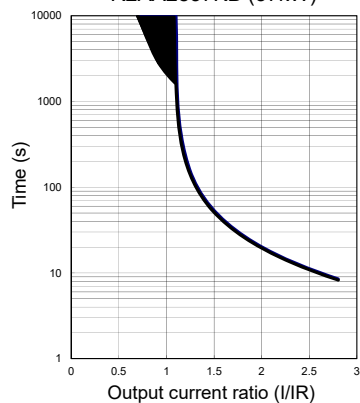
Overload characteristic
R2AA2220KB (20kW)



Overload characteristic
R2AA2830KV (30kW)



Overload characteristic
R2AA2837KB (37kW)



6. Appendix

6.6 Servo motor data sheet 400V input

6.6.1 Characteristics table

■ Specification of R1 motor, 400V AC

Servo motor model number R1CA			10150V	10200V	13300V	18550H	18750L	1811KR	1815KB
Amplifier size combined			25A	50A	50A	150A	150A	150A	150A
*Rated output	P _R	kW	1.5	2.0	3.0	5.5	7.5	11	15
*Rated velocity	N _R	min ⁻¹	3000	3000	3000	1500	1500	1500	1500
*Maximum velocity	N _{max}	min ⁻¹	5000	5000	5000	3000	3000	2500	2000
*Rated torque	T _R	N·m	4.77	6.37	9.55	35.0	48.0	70.0	95.5
*Continuous Torque at stall	T _S	N·m	4.77	6.37	9.55	37.0	48.0	70.0	95.5
*Peak Torque at stall	T _P	N·m	14.3	20.0	29.0	110	135	195	230
*Rated armature current	I _R	Arms	4.5	6.3	8.7	23.0	26.3	28.3	31.3
*Armature current at stall	I _S	Arms	4.3	6.1	8.3	23.2	25.1	27.5	30.2
*Peak armature current at stall	I _P	Arms	14.1	20.7	28.0	78.0	83.0	83.0	83.0
*Torque constant	K _T	N·m/ Arms	1.17	1.15	1.23	1.75	2.10	2.82	3.37
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	40.8	40.1	42.8	61.0	73.3	98.5	117.8
Phase resistance	R _φ	Ω	1.25	0.95	0.36	0.125	0.117	0.145	0.15
*Rated power rate	Q _R	kW/s	108	169	134	371	549	766	1060
Inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	2.1	2.4	6.8	33	42	64	86
Mass Note1)	WE	kg	5.0	5.7	9.7	33	39	52	64
Brake mass	W	kg	1.5	1.5	2.1	5	5	7	9
Aluminum plate		mm	t20 × 400	t20 × 470	t20 × 470	t20 × 540	t20 × 540	t30 × 610	t30 × 610

Note1) Contains battery-less absolute encoder.

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates typical value.

6.6 Servo motor data sheet 400V input

Servo motor model number	R1CA		2220KV
Amplifier size combined			300A
*Rated output	P _R	kW	21.0
*Rated velocity	N _R	min ⁻¹	1500
*Maximum velocity	N _{max}	min ⁻¹	2000
*Rated torque	T _R	N·m	135
*Continuous Torque at stall	T _S	N·m	135
*Peak Torque at stall	T _P	N·m	380
*Rated armature current	I _R	Arms	51.0
*Armature current at stall	I _S	Arms	49.0
*Peak armature current at stall	I _P	Arms	152.0
*Torque constant	K _T	N·m/ Arms	2.98
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	104.0
Phase resistance	R _φ	Ω	0.060
*Rated power rate	Q _R	kW/s	1740
Inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	105
Mass Note1)	WE	kg	107
Brake mass	W	kg	-
Aluminum plate		mm	t30 × 610

Note1) Contains battery-less absolute encoder (encoder code: R).

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates typical value.

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■ Specification of R2 motor, 400V AC

Servo motor model number R2CA			10075F	10100F	13050D	13120R	13120F	13180H	13180D
Amplifier size combined			RS3C02	RS3C05	RS3C02	RS3C02	RS3C05	RS3C02	RS3C05
*Rated output	P _R	kW	0.75	1.0	0.55	1.2	1.2	1.8	1.8
*Rated velocity	N _R	min ⁻¹	3000	3000	2000	2000	2000	2000	2000
*Maximum velocity	N _{max}	min ⁻¹	6000	6000	5000	3000	5000	3500	5000
*Rated torque	T _R	N·m	2.39	3.18	2.6	5.7	5.7	8.6	8.6
*Continuous Torque at stall	T _S	N·m	2.55	3.92	3.0	6.0	6.0	9.2	10.0
*Peak Torque at stall	T _P	N·m	8.6	14.3	9.0	20.0	20.0	24.0	25.0
*Rated armature current	I _R	Arms	3.1	5.7	3.2	3.6	7.5	4.8	10.2
*Armature current at stall	I _S	Arms	3.2	6.8	3.5	3.7	7.8	4.8	11.0
*Peak armature current at stall	I _P	Arms	11.3	25.7	12.0	12.9	27.7	12.9	29.2
*Torque constant	K _T	N·m/ Arms	0.868	0.584	0.92	1.69	0.79	2.10	0.94
Voltage constant for each phase	K _{Eφ}	mV/min ⁻¹	30.3	20.4	32.2	59.1	27.7	73.2	32.8
Phase resistance	R _φ	Ω	1.55	0.35	1.17	1.5	0.34	1.35	0.27
*Rated power rate	Q _R	kW/s	23	25.9	22	54	54	82	82
Inertia	J _M	× 10 ⁻⁴ Kg·m ² (GD ² /4)	2.5	3.9	3.1	6.0	6.0	9.0	9.0
Mass Note1)	WE	kg	3.9	4.7	4.5	6.1	6.1	8.0	8.0
Brake mass	W	kg	0.9	1.1	1.5	1.9	1.9	1.2	1.2
Aluminum plate		mm	t12 × 305	t12 × 305	t20 × 305	t20 × 400	t20 × 400	t20 × 470	t20 × 470

Servo motor model number R2CA			13200L	13200H	18350L	18350C	18450H	18550V	18550H
Amplifier size combined			RS3C02	RS3C05	RS3C05	75A	75A	75A	150A
*Rated output	PR	kW	2.0	2.0	3.5	3.5	4.5	5.5	5.5
*Rated velocity	NR	min ⁻¹	2000	2000	2000	2000	2000	1500	1500
*Maximum velocity	Nmax	min ⁻¹	3000	5000	3000	4000	3500	2500	3000
*Rated torque	TR	N·m	9.5	9.5	17.0	16.7	21.5	35.0	35.0
*Continuous Torque at stall	TS	N·m	12.0	12.0	22.0	22.0	30.0	37.3	37.5
*Peak Torque at stall	TP	N·m	30.0	30.0	49.0	60.0	75.0	95.0	107.0
*Rated armature current	IR	Arms	4.6	8.0	9.6	11.7	12.8	14.5	23.6
*Armature current at stall	IS	Arms	4.6	9.6	12.0	14.7	17.0	15.2	24.7
*Peak armature current at stall	IP	Arms	12.0	26.5	29.2	45.5	48.0	42.4	77.5
*Torque constant	KT	N·m/ Arms	2.83	1.34	1.96	1.68	1.89	2.71	1.67
Voltage constant for each phase	KE φ	mV/min ⁻¹	98.7	46.8	68.4	58.7	65.8	94.7	58.4
Phase resistance	R φ	Ω	1.70	0.44	0.35	0.264	0.23	0.312	0.125
*Rated power rate	QR	kW/s	74	74	72	72	92	180	180
Inertia	JM	× 10 ⁻⁴ Kg·m ² (GD ² /4)	12.2	12.2	40	40	50	68	68
Mass Note1)	WE	kg	10.0	10.0	15.5	15.5	19.5	27.7	27.7
Brake mass	W	kg	2.0	2.0	4.5	2.4	2.8	2.8	2.8
Aluminum plate		mm	t20 × 470	t20 × 470	t20 × 470	t20 × 470	t20 × 470	t20 × 540	t20 × 540

Note1) Contains battery-less absolute encoder.

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates typical value.

6.6 Servo motor data sheet 400V input

■ Specification of R2 motor, AC400V

Servo motor model number R2CA			18750H	2211KB	2215KV	2220KV	2830KV	2837KB
Amplifier size combined			150A	150A	150A	300A	300A	600A
*Rated output	PR	kW	7.5	11	15	20	30	37
*Rated velocity	NR	min ⁻¹	1500	1500	1500	1500	1500	1500
*Maximum velocity	Nmax	min ⁻¹	3000	2500	2000	2300	2000	2000
*Rated torque	TR	N·m	48.0	70.0	95.0	125.0	191.1	235
*Continuous Torque at stall	TS	N·m	54.9	80.0	95.0	125.0	191.1	235
*Peak Torque at stall	TP	N·m	140	176	215	280	480	650
*Rated armature current	IR	Arms	27.5	32.0	34.0	63.8	61.9	89.0
*Armature current at stall	IS	Arms	30.6	34.0	34.0	61.2	55.8	83.0
*Peak armature current at stall	IP	Arms	83.0	83.0	83.0	155.0	155.0	250
*Torque constant	KT	N·m/ Arms	1.97	2.63	3.10	2.28	3.80	3.1
Voltage constant for each phase	KE ϕ	mV/min ⁻¹	68.8	91.7	108.1	79.5	132.7	107
Phase resistance	R ϕ	Ω	0.115	0.078	0.065	0.037	0.057	0.028
*Rated power rate	QR	kW/s	235	275	313	543	865	905
Inertia	JM	$\times 10^{-4} \text{Kg} \cdot \text{m}^2$ (GD ² /4)	98	178	288	288	422	610
Mass Note1)	WE	Kg	34	55	74	83	110	132
Brake mass	W	kg	4.5	7.8	17	17	17	-
Aluminum plate		mm	t20 × 540	t30 × 610	t30 × 610	t30 × 610	t30 × 610	t30 × 610

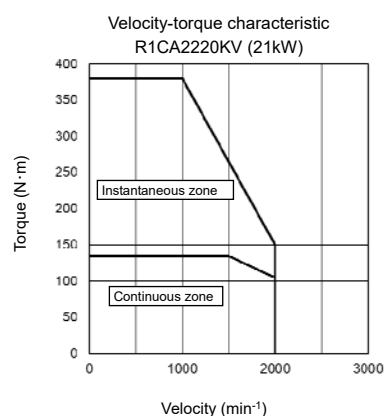
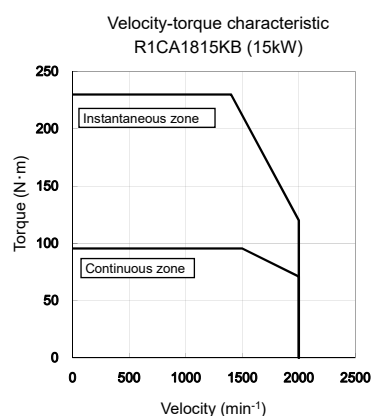
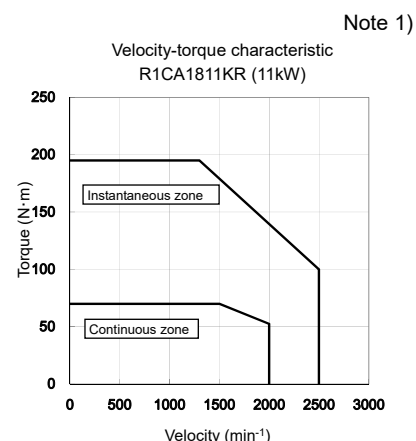
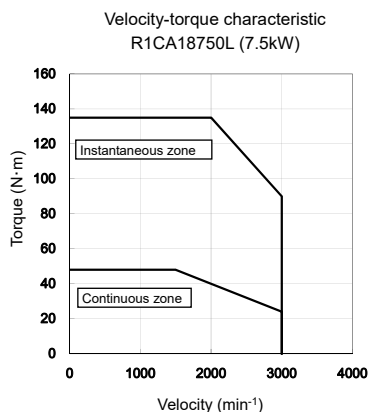
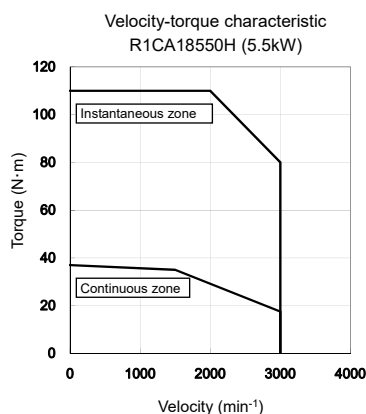
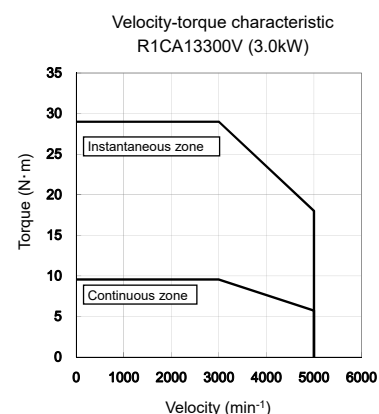
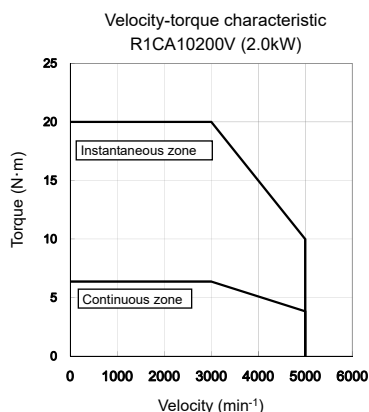
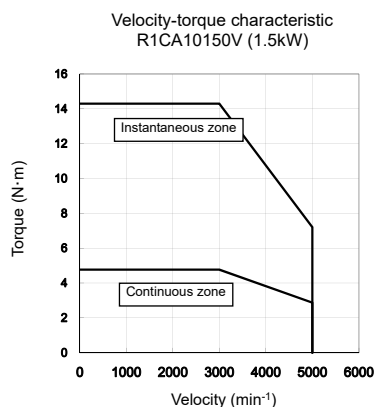
Note1) Contains battery-less absolute encoder.

- ✓ Constant in the table above is the value when motor is installed on heat releasing aluminum plate, indicates "thickness" x "length of a side of square.
- ✓ Items marked with * and Velocity-Torque Characteristics indicate values after temperature rise saturation. The others indicate values at 20°C.
- ✓ Each value indicates typical value.

6. Appendix

6.6.2 Velocity-torque characteristics

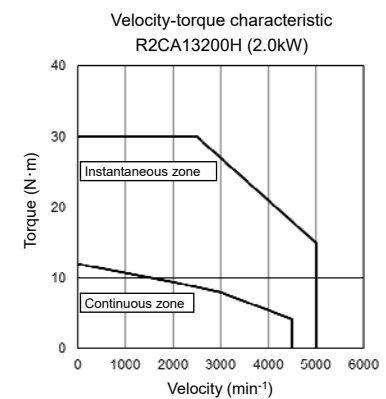
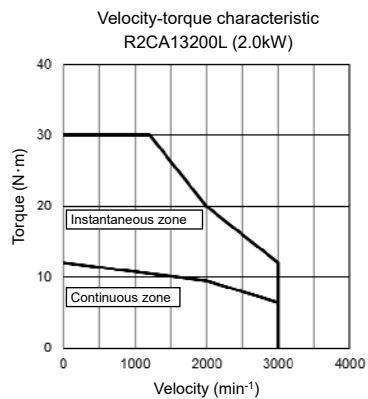
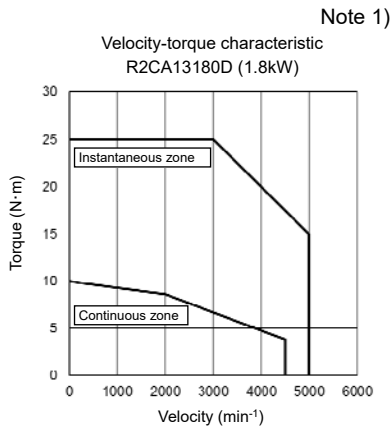
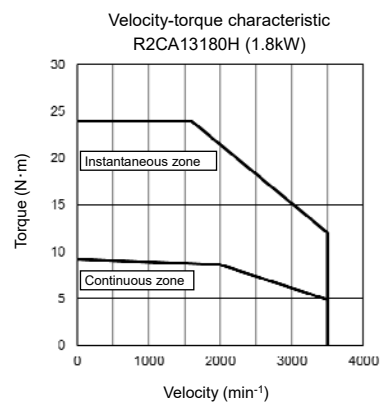
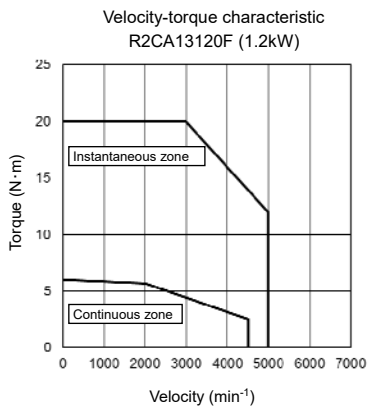
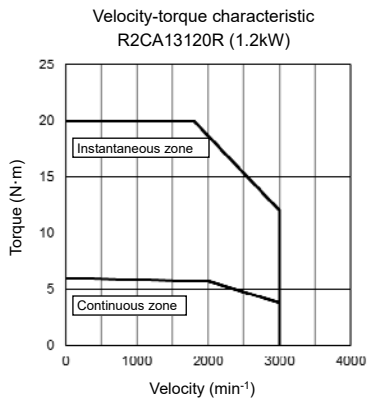
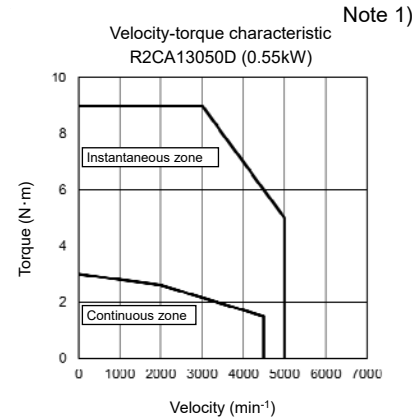
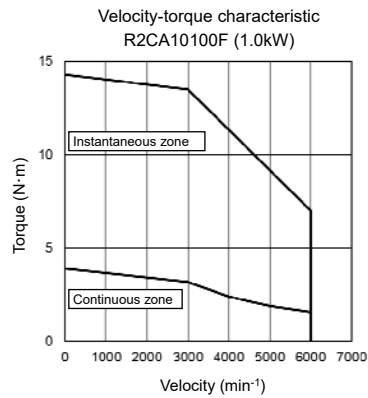
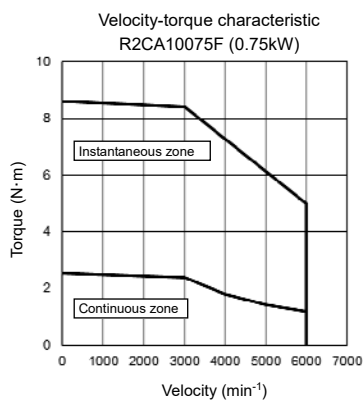
R1CA motor velocity-torque characteristics charts show the values when three-phase 400V AC is used as input power supply. When power supply voltage is less than 400V, instantaneous zone decreases.



Note1) When you use motor (R1CA1811KR), whose maximum rotational velocity N_{max} and maximum rotational velocity in the continuous zone are different, use the motor so that the motor average rotational velocity does not exceed maximum rotational velocity in the continuous zone.

6.6 Servo motor data sheet 400V input

R2CA motor velocity-torque characteristics charts show the values when three-phase 400V AC is used as input power supply. When power supply voltage is less than 400V, instantaneous zone decreases.

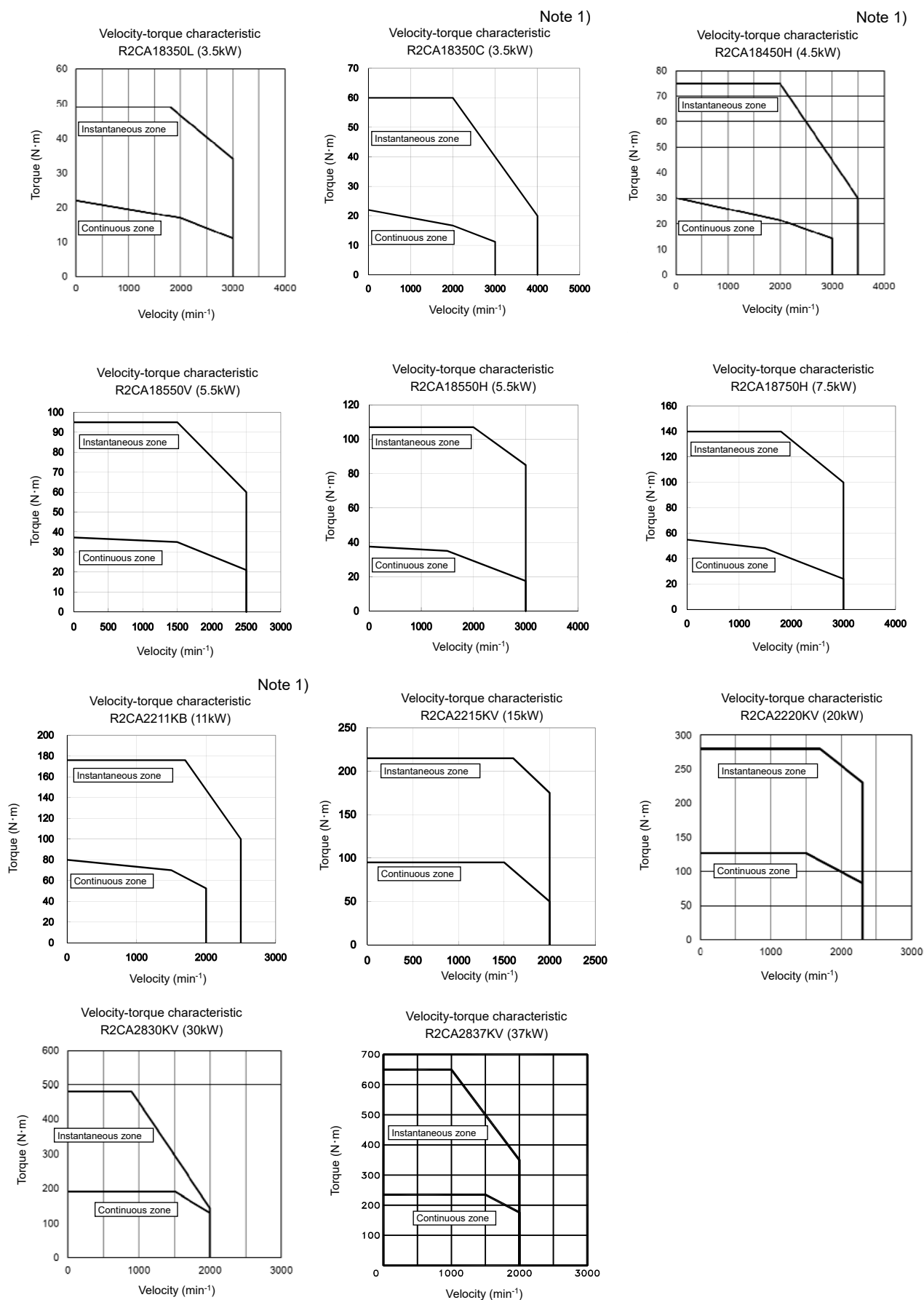


Note1) When you use motor

(R2CA13050D, R2CA13120F, R2CA13180D, R2CA13200H)

whose maximum rotational velocity N_{max} and maximum rotational velocity in the continuous zone are different, use the motor so that the motor average rotational velocity does not exceed maximum rotational velocity in the continuous zone.

6. Appendix

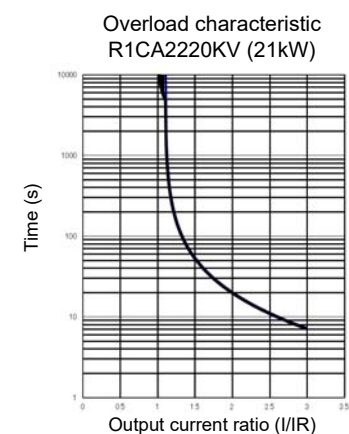
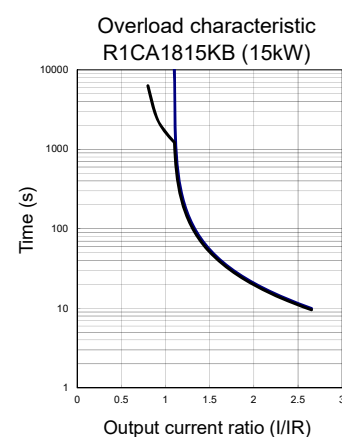
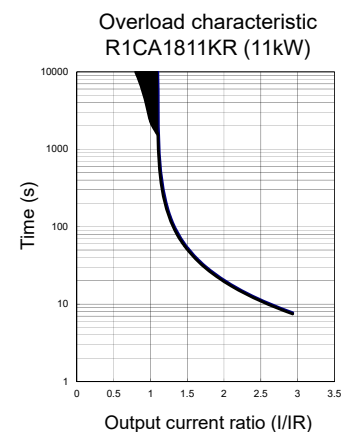
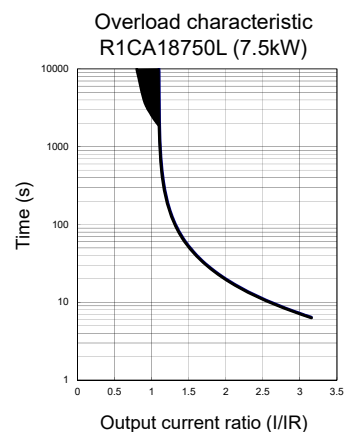
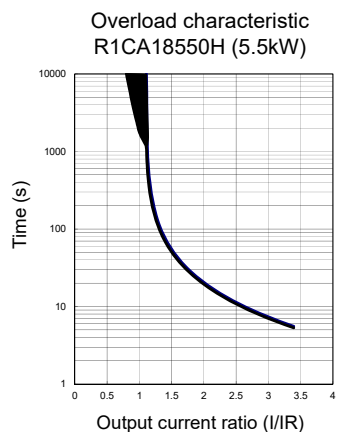
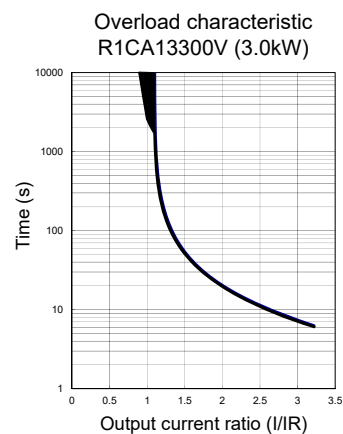
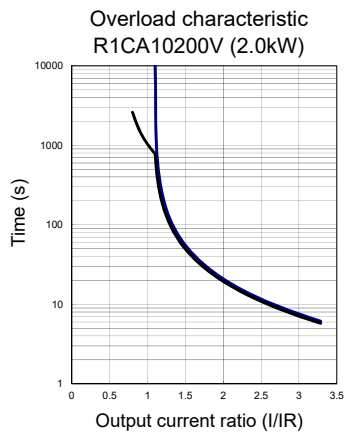
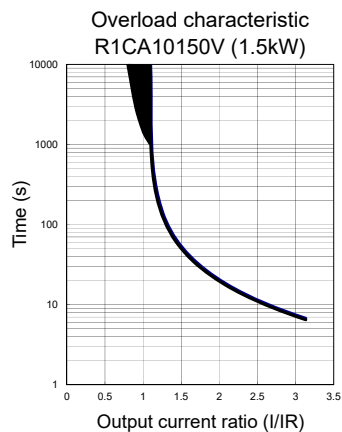


Note1) When you use motor (R2CA18350C, R2CA18450H, R2CA2211KB) whose maximum rotational velocity N_{max} and maximum rotational velocity in the continuous zone are different, use the motor so that the motor average rotational velocity does not exceed maximum rotational velocity in the continuous zone.

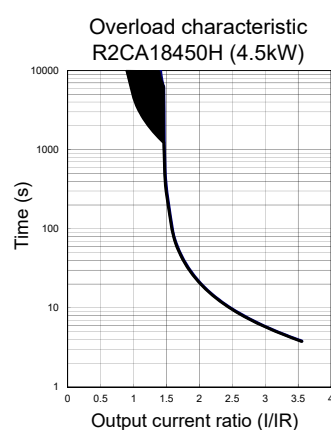
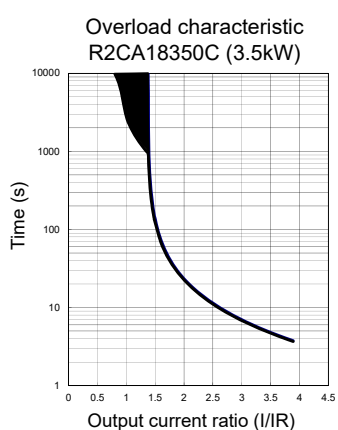
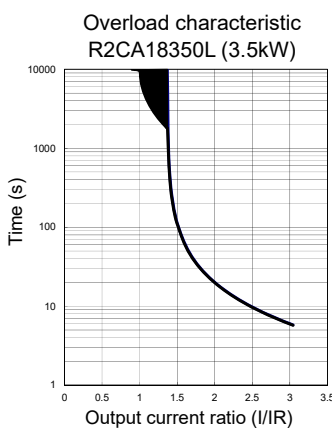
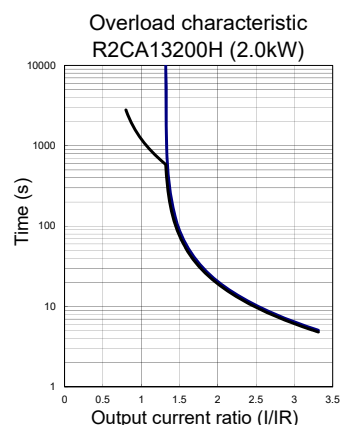
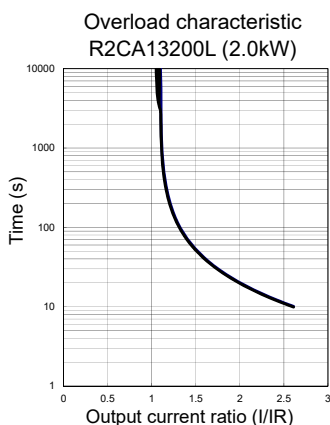
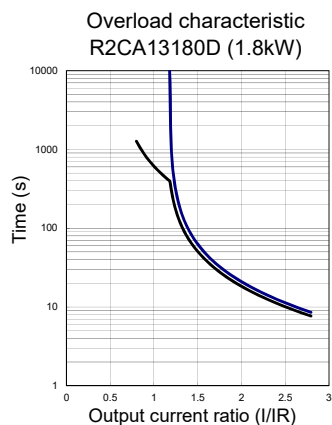
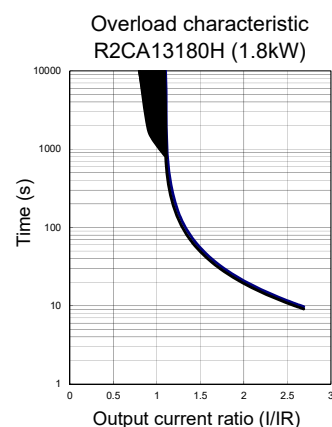
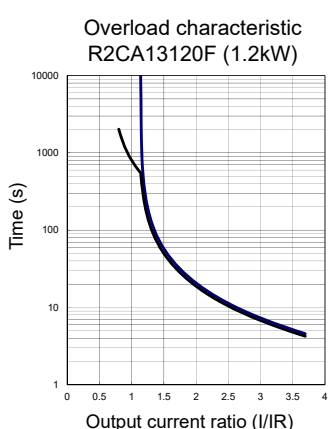
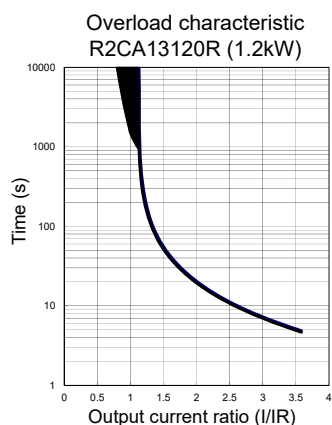
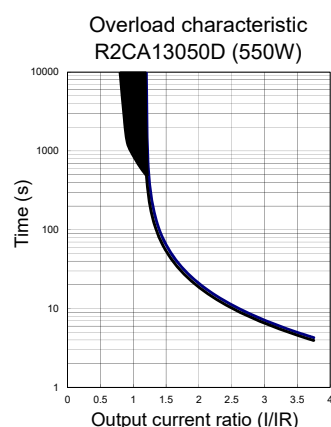
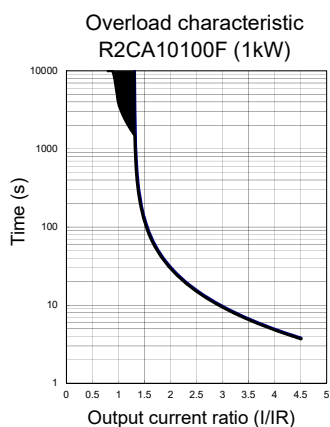
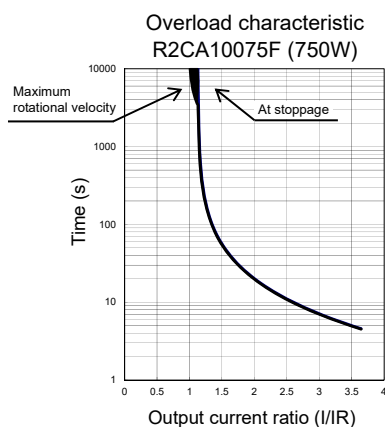
6.6 Servo motor data sheet 400V input

6.6.3 Overload characteristics

The following show overload characteristic of R1CA and R2CA motors.

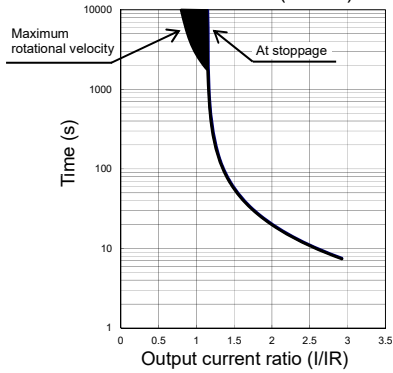


6. Appendix

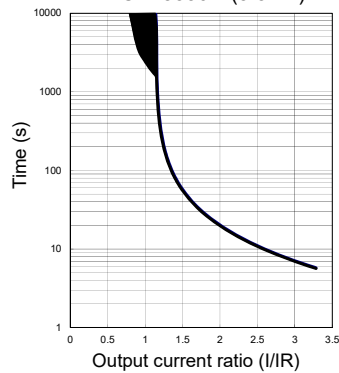


6.6 Servo motor data sheet 400V input

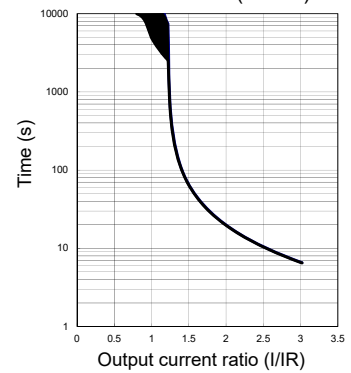
Overload characteristic
R2CA18550V (5.5kW)



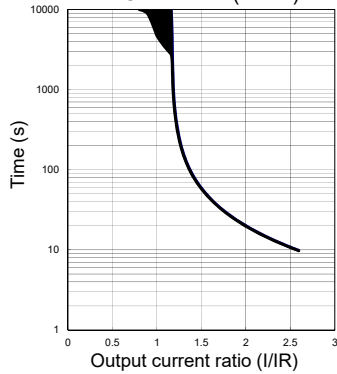
Overload characteristic
R2CA18550H (5.5kW)



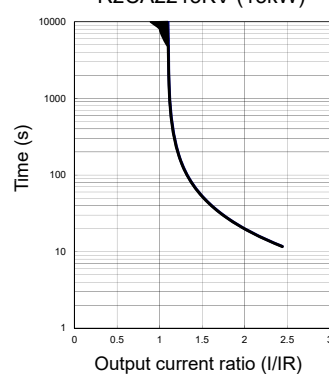
Overload characteristic
R2CA18750H (7.5kW)



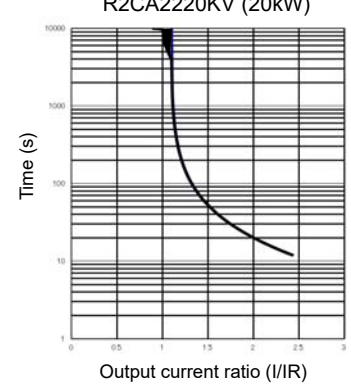
Overload characteristic
R2CA2211KB (11kW)



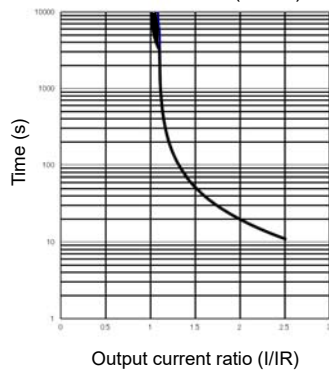
Overload characteristic
R2CA2215KV (15kW)



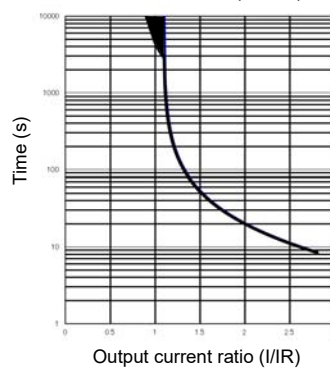
Overload characteristic
R2CA2220KV (20kW)



Overload characteristic
R2CA2830KV (30kW)



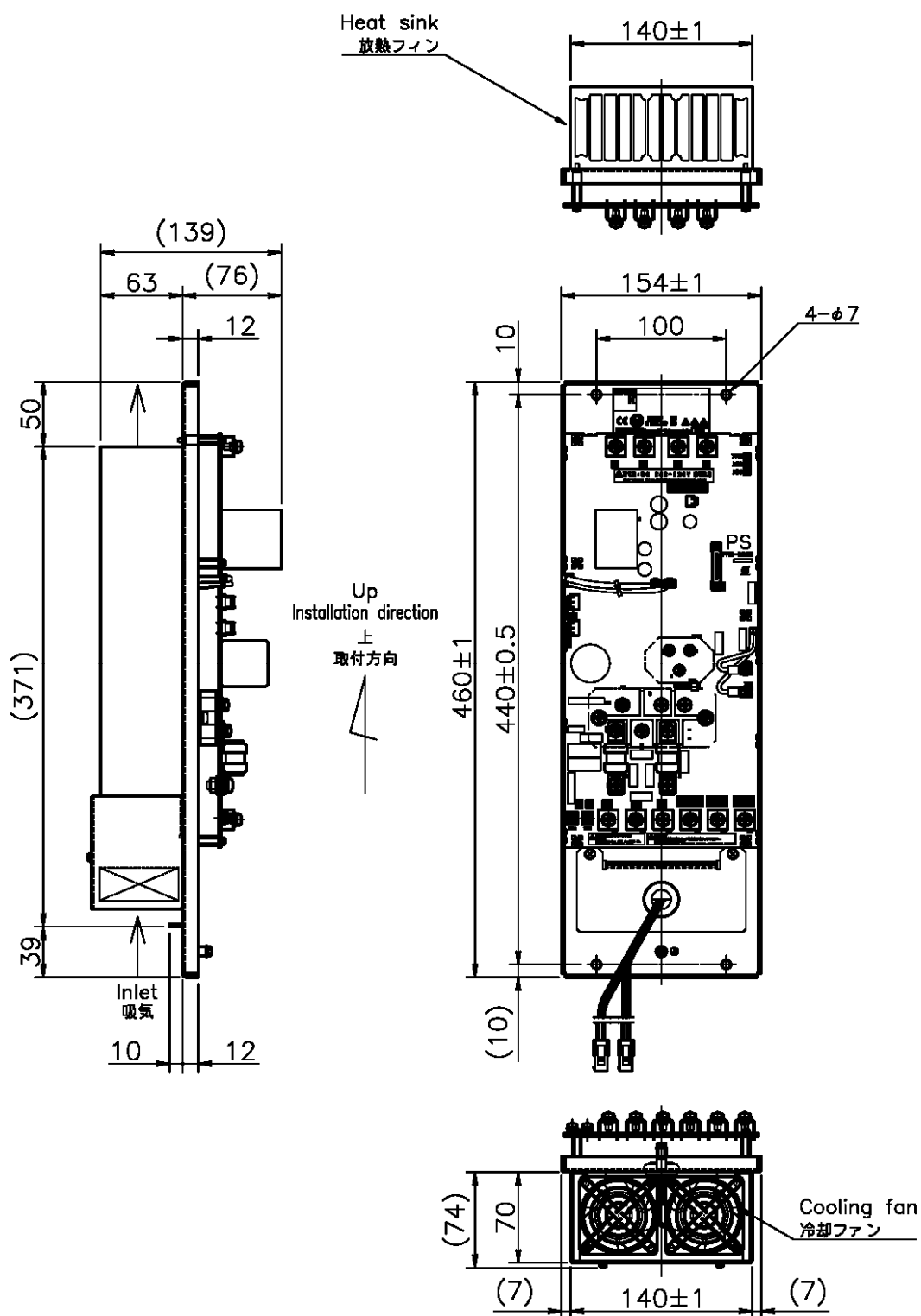
Overload characteristic
R2CA2837KV (37kW)



6. Appendix

6.7 Power unit/amplifier unit dimensions **200V input**

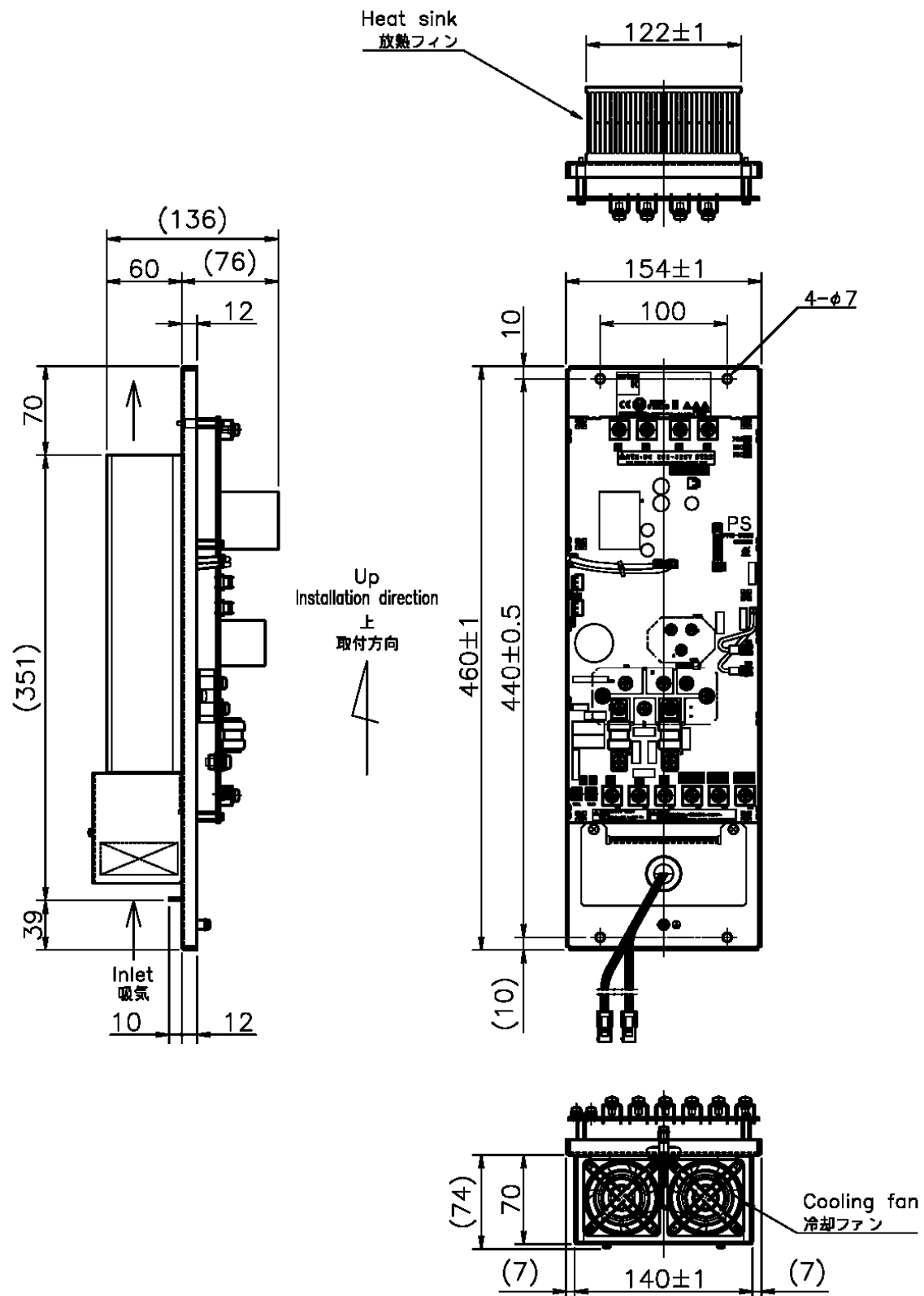
6.7.1 RM3PAA7R8 (Power unit)



Unit: mm
単位: mm

6.7 Optional parts dimensions 200V input

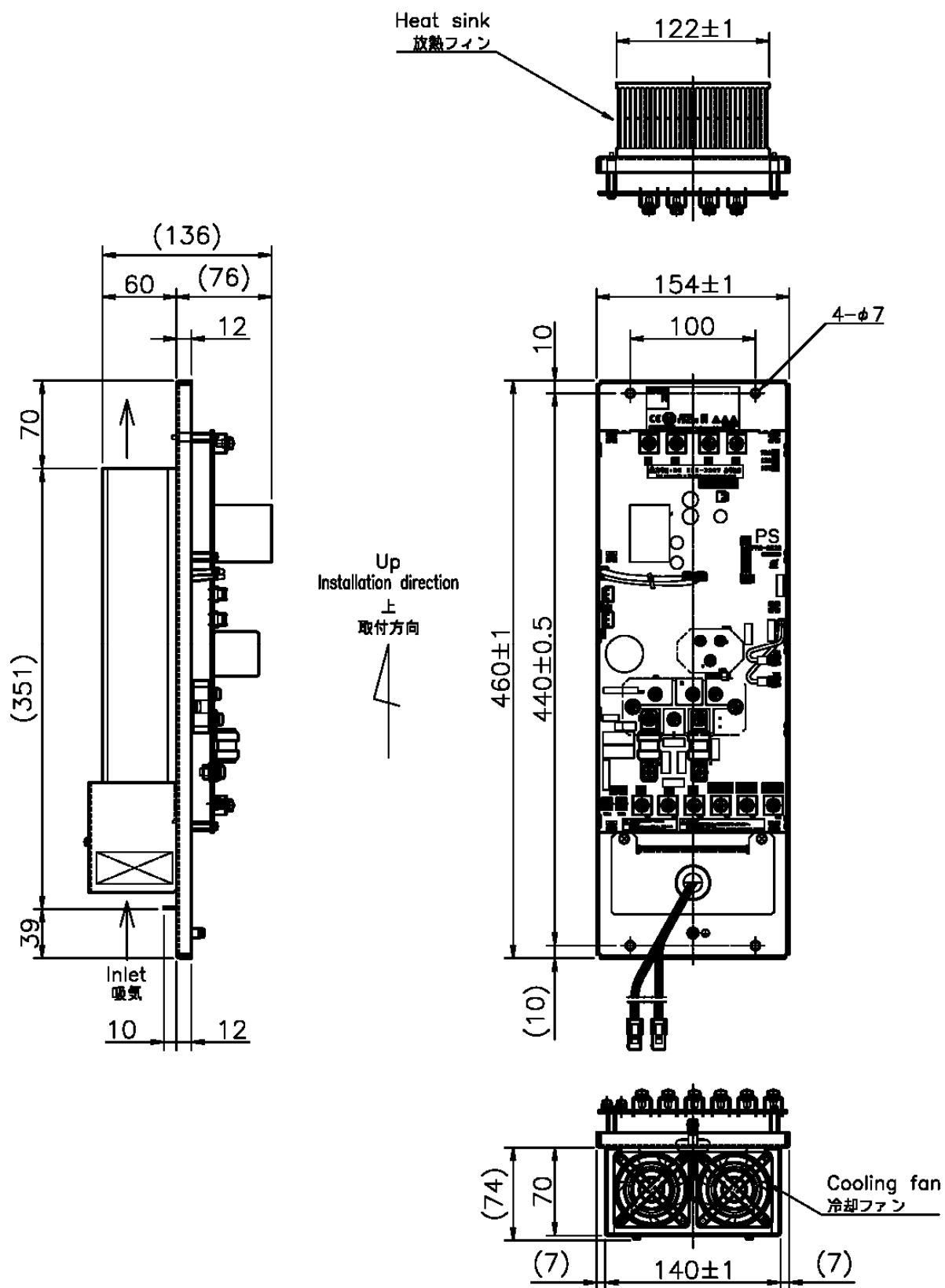
6.7.2 RM3PAA120 (Power unit)



Unit: mm
単位: mm

6. Appendix

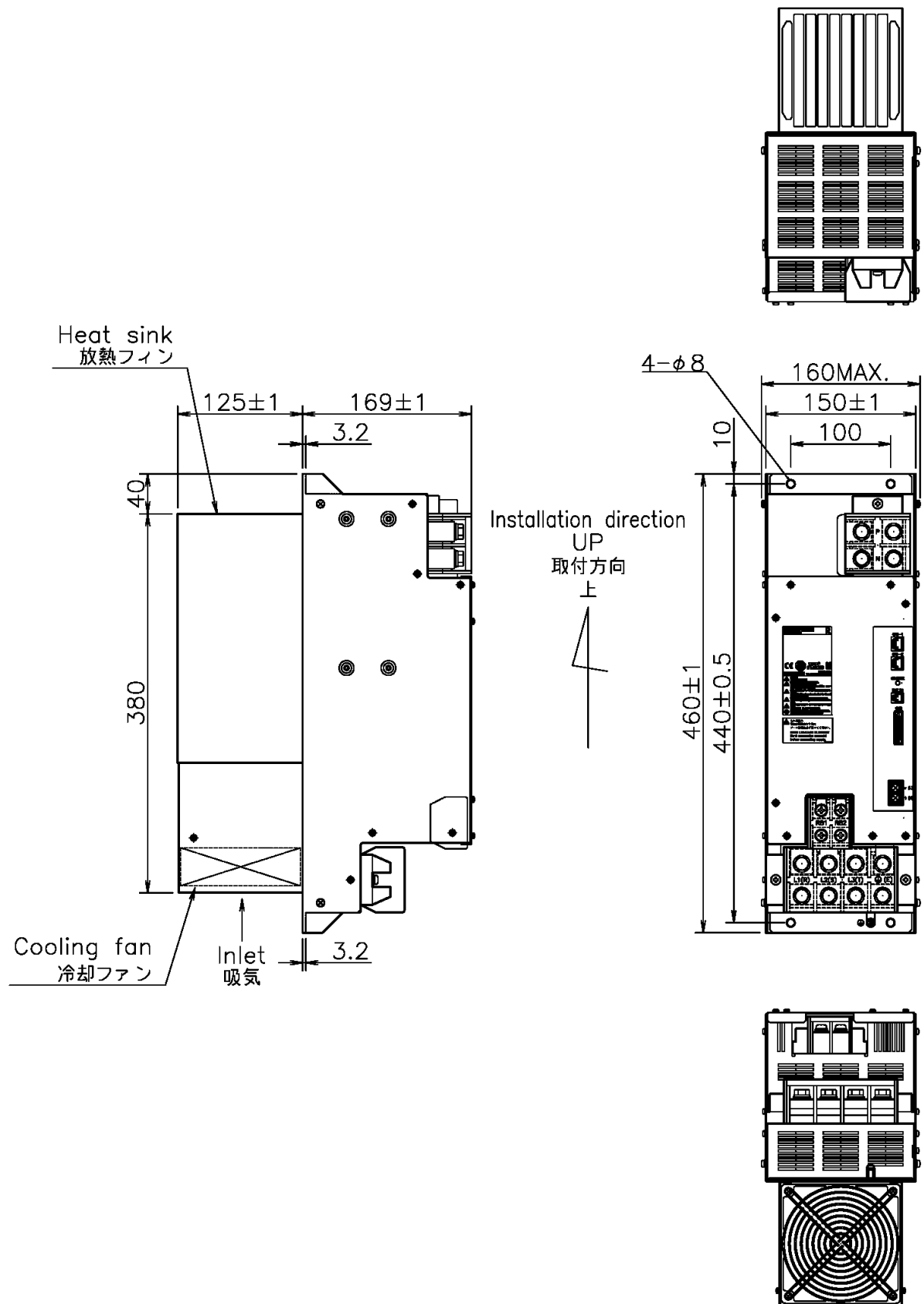
6.7.3 RM3PAA160 (Power unit)



Unit: mm
単位: mm

6.7 Optional parts dimensions 200V input

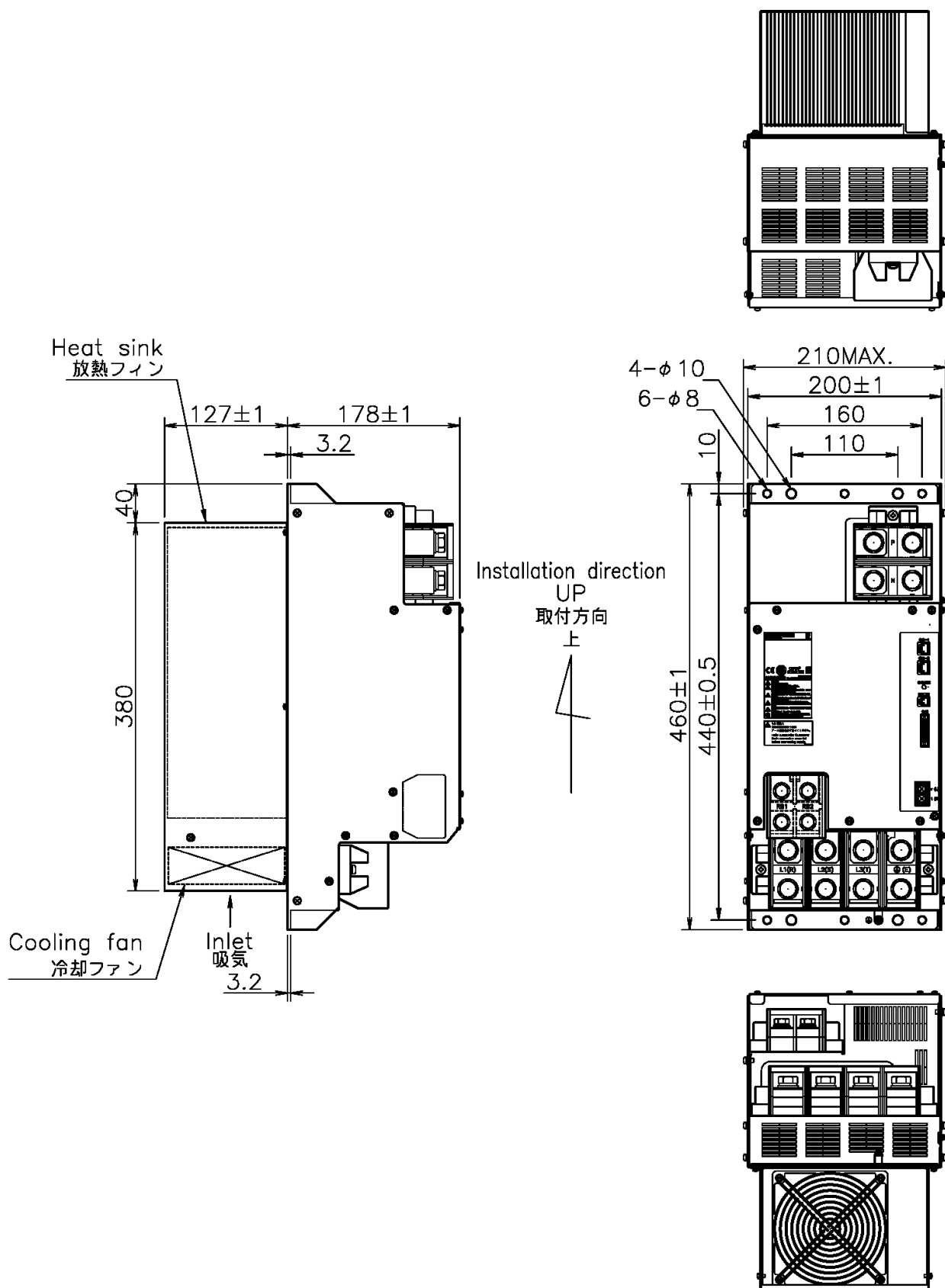
6.7.4 RM3PAA270 (Power unit)



Unit: mm
単位: mm

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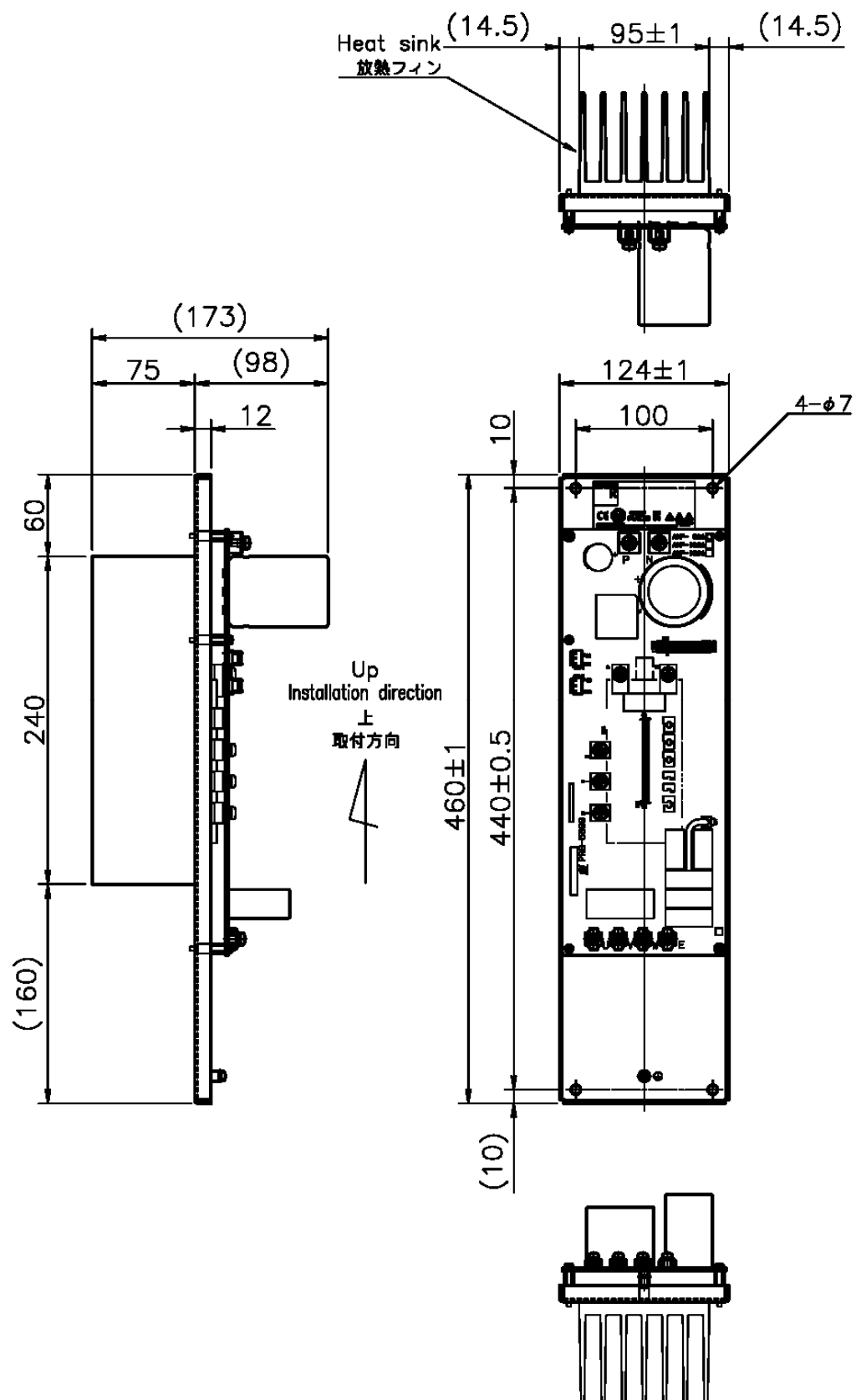
6.7.5 RM3PAA370 (Power unit)



Unit:mm
単位:mm

6.7 Optional parts dimensions 200V input

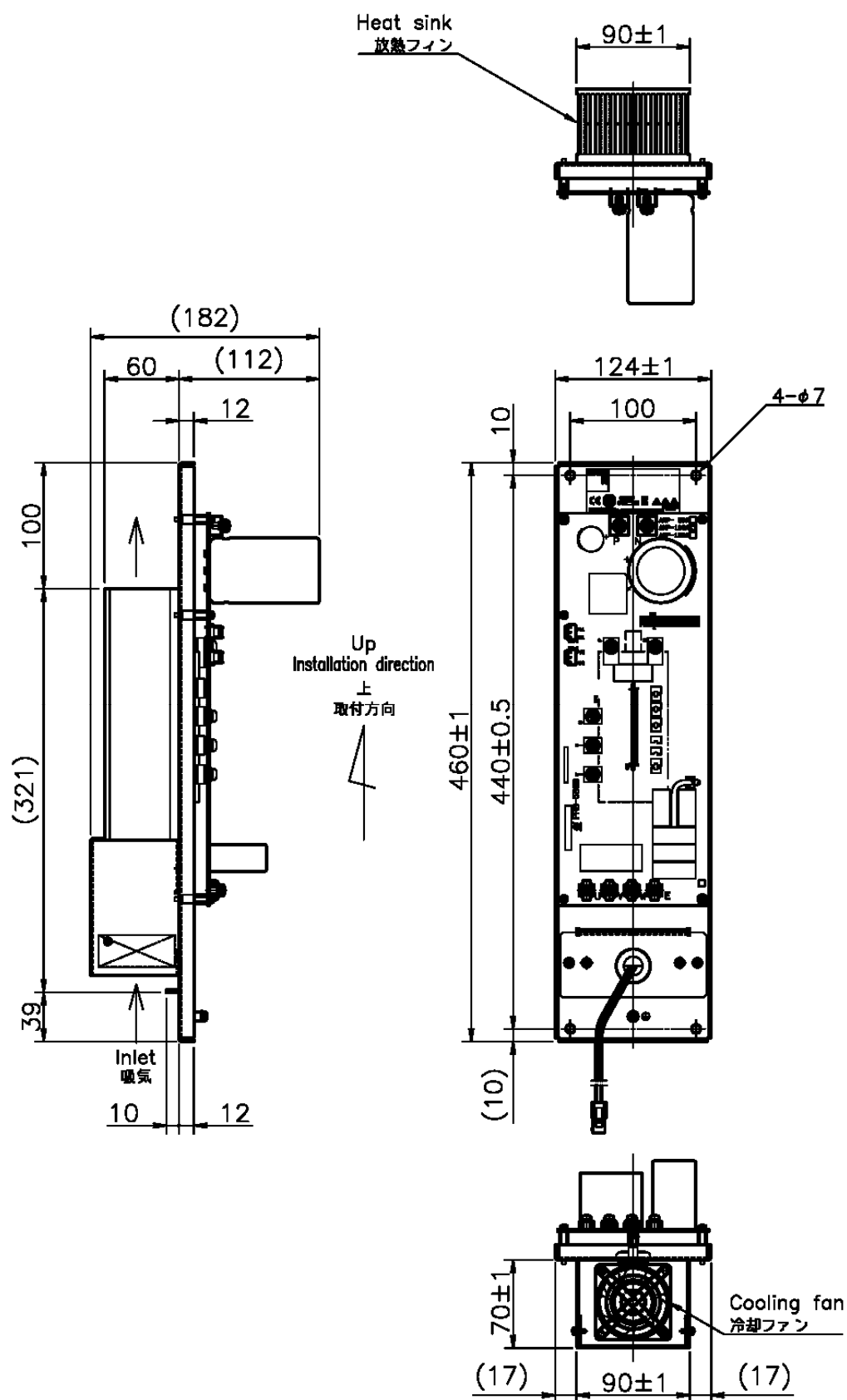
6.7.6 RM3DAA050 (Amplifier unit)



Unit: mm
単位: mm

6. Appendix

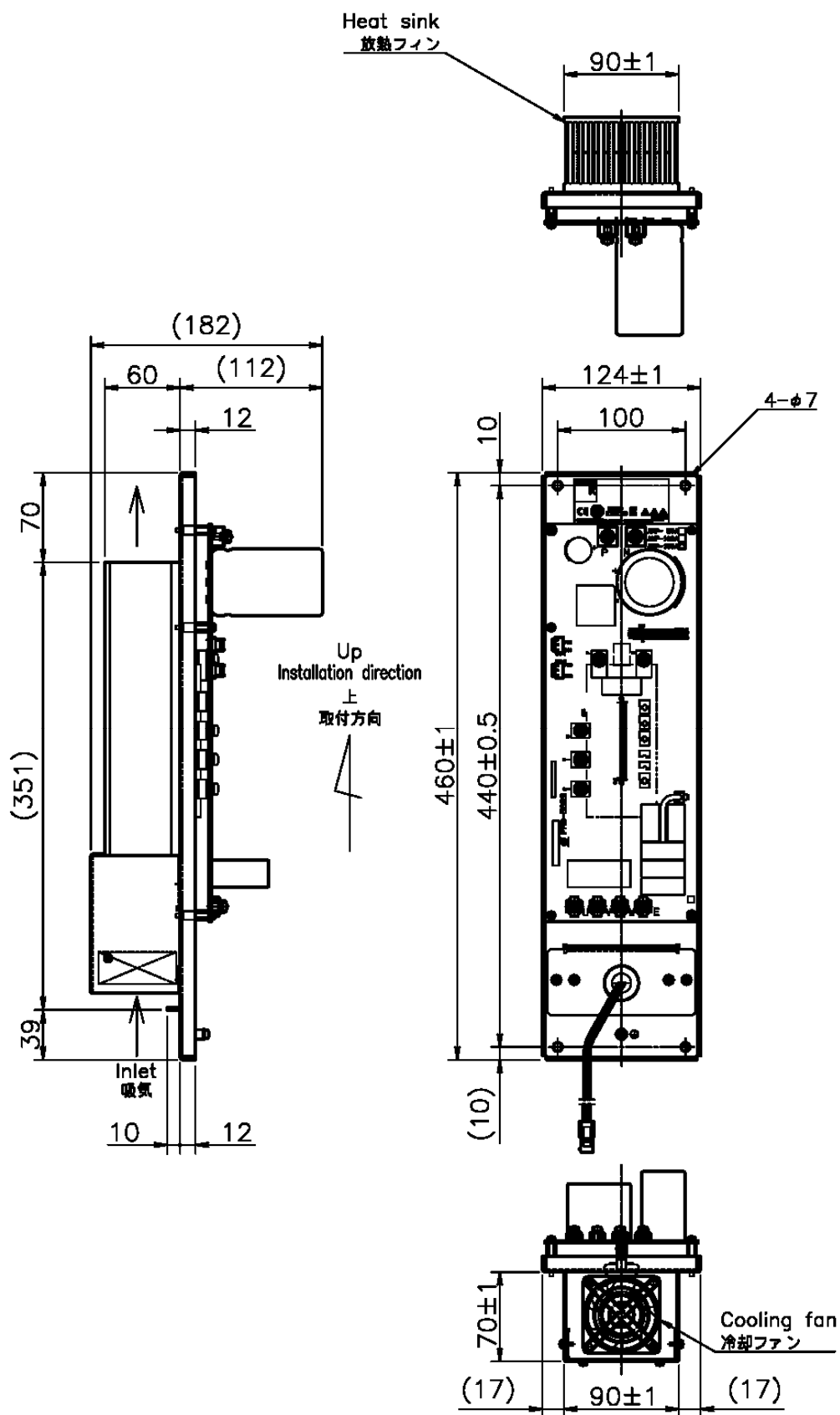
6.7.7 RM3DAA100 (Amplifier unit)



Unit: mm
単位: mm

6.7 Optional parts dimensions 200V input

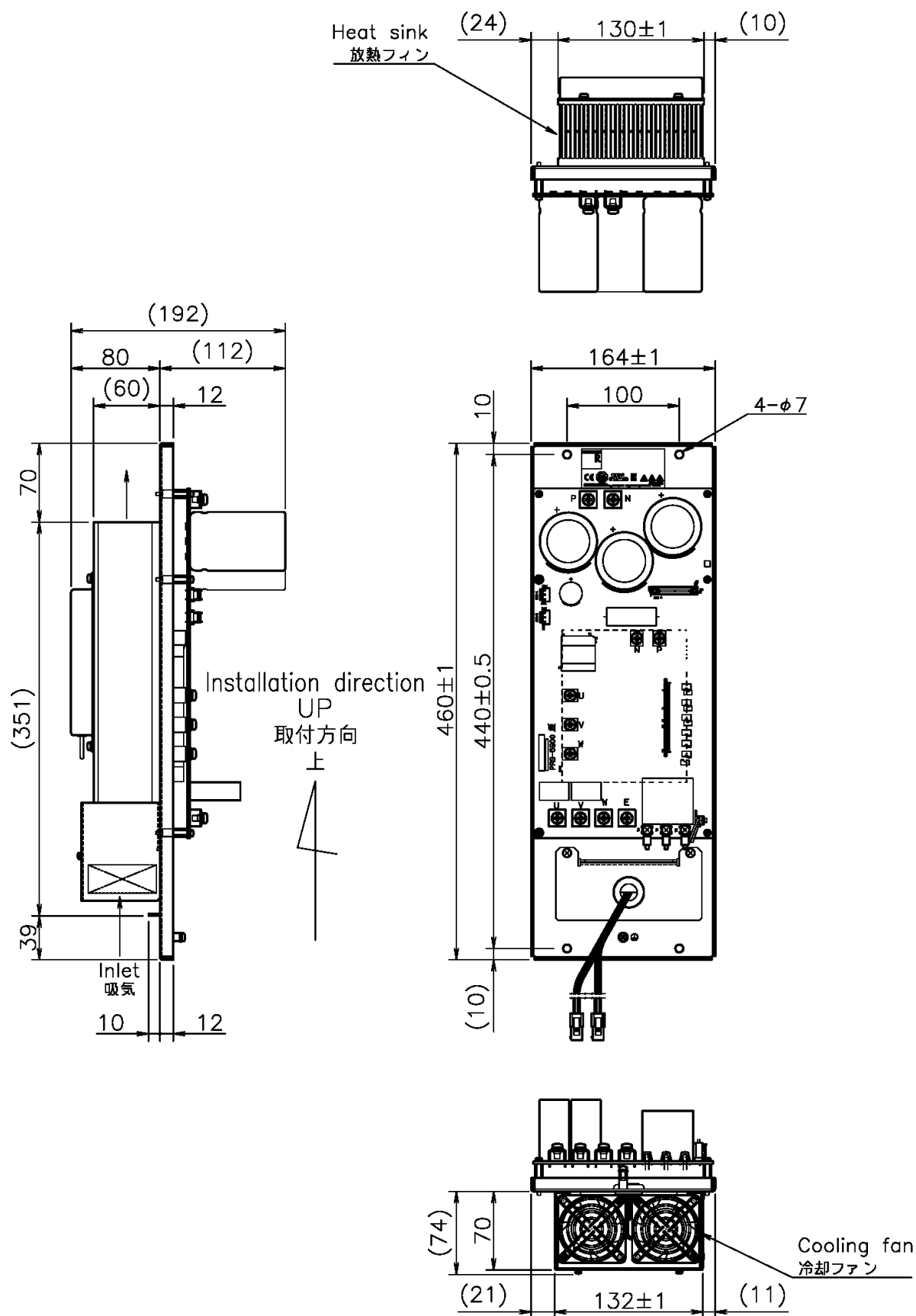
6.7.8 RM3DAA150 (Amplifier unit)



Unit: mm
単位: mm

6. Appendix

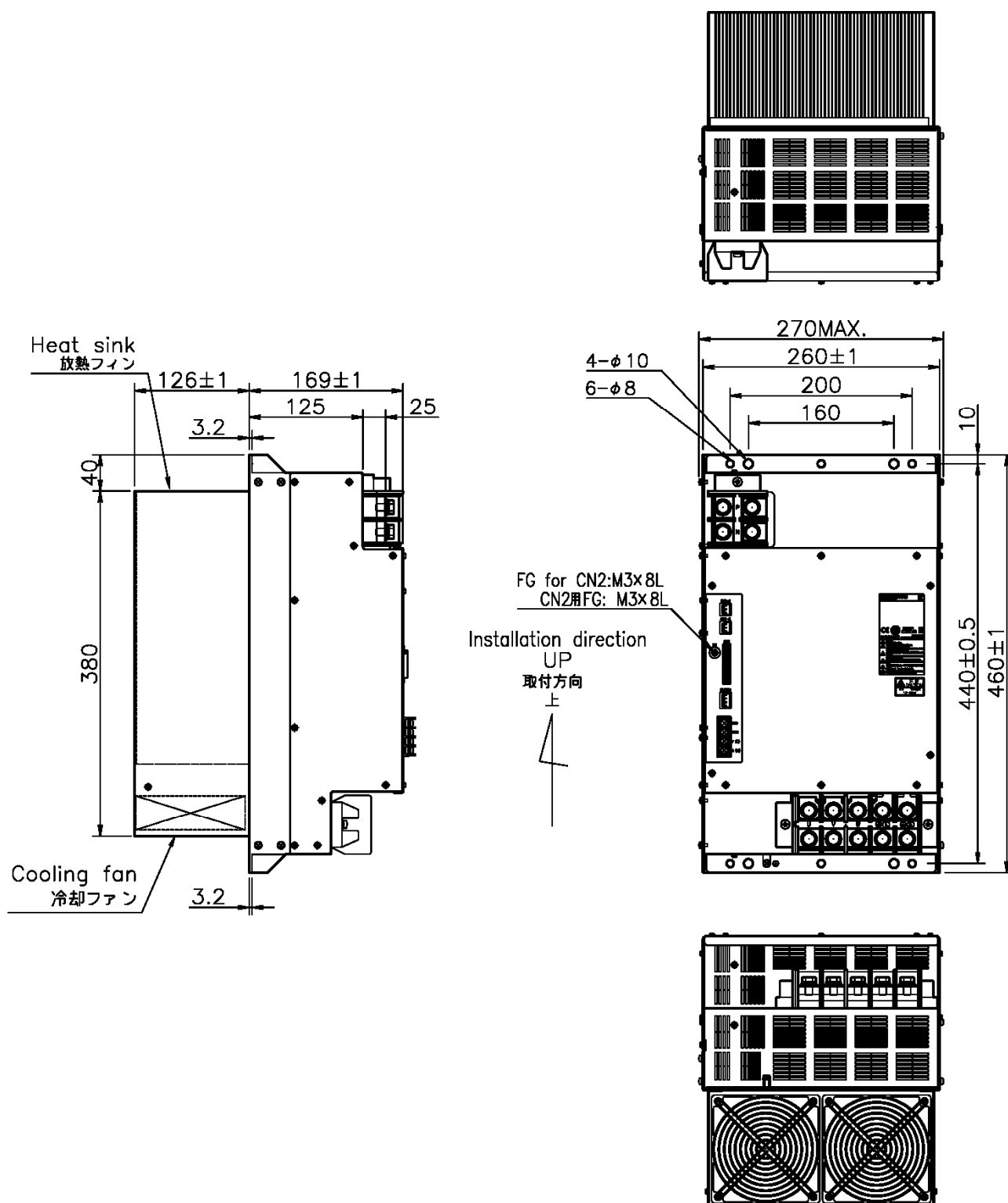
6.7.9 RM3DAA300 (Amplifier unit)



Unit: mm
單位: mm

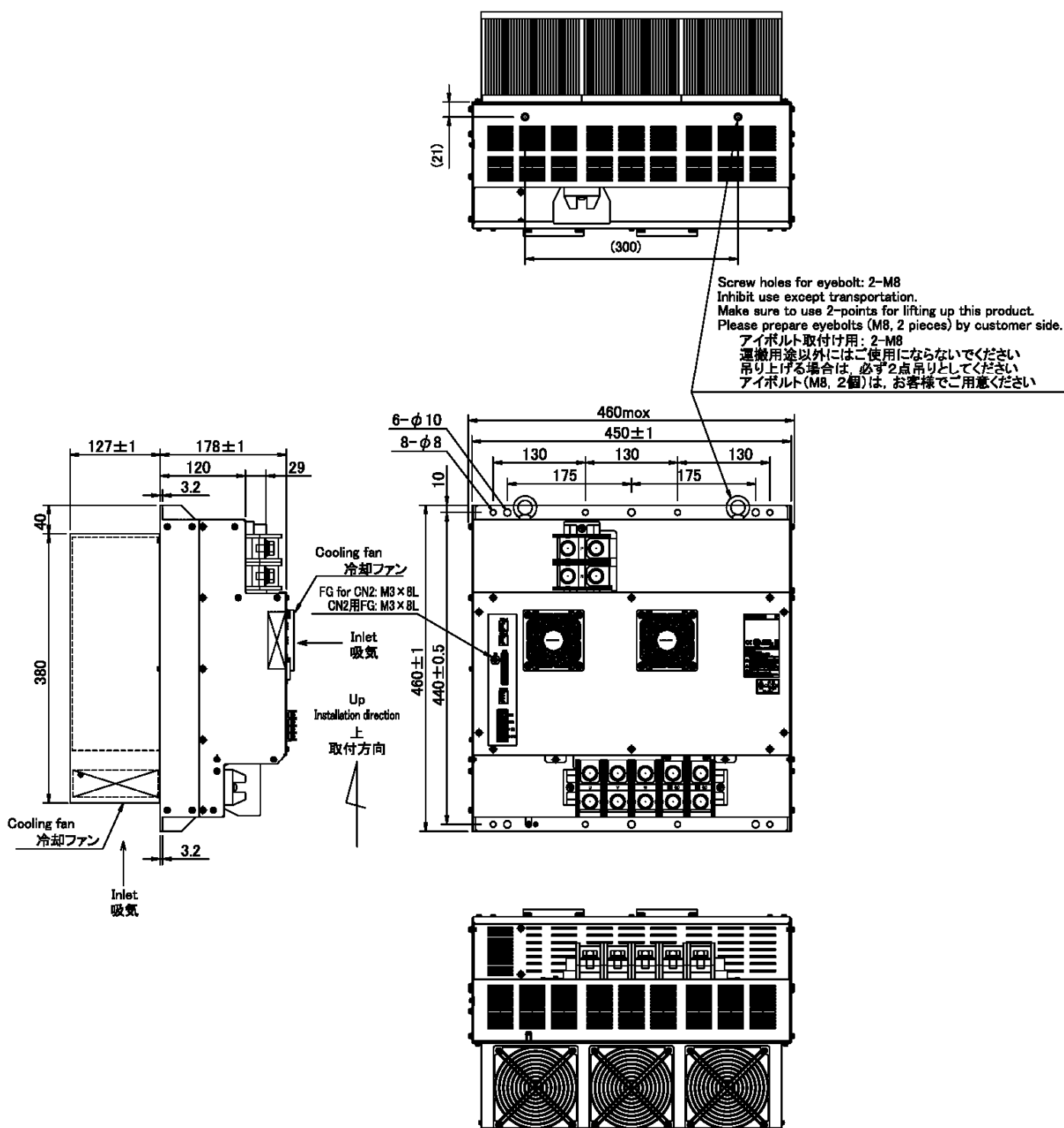
6.7 Optional parts dimensions 200V input

6.7.10 RM3DAB600 (Amplifier unit)



6. Appendix

6.7.11 RM3DAB900 (Amplifier unit)

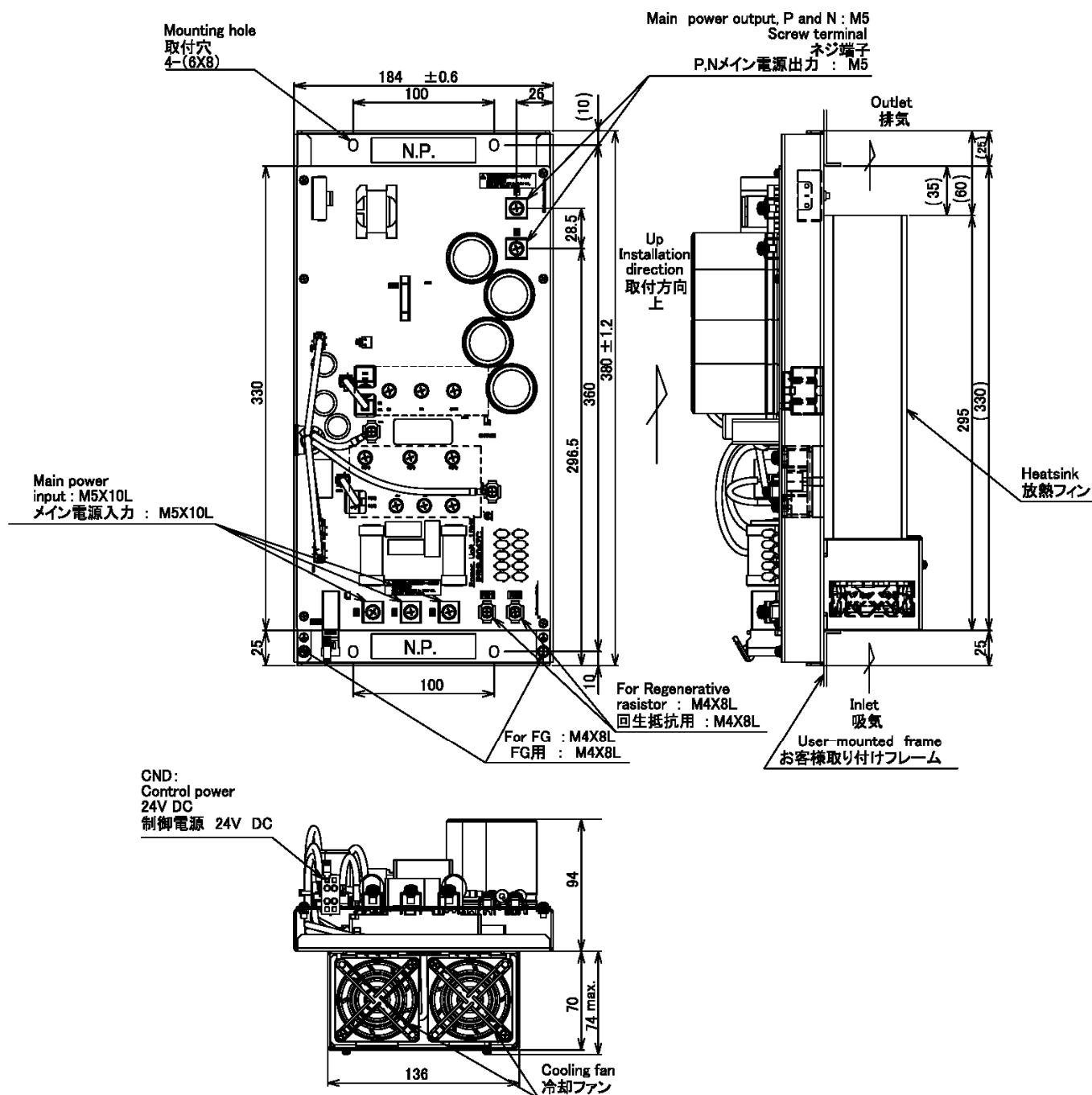


Unit: mm
単位: mm

6.8 Power unit/amplifier unit dimensions 400V input

6.8 Power unit/amplifier unit dimensions 400V input

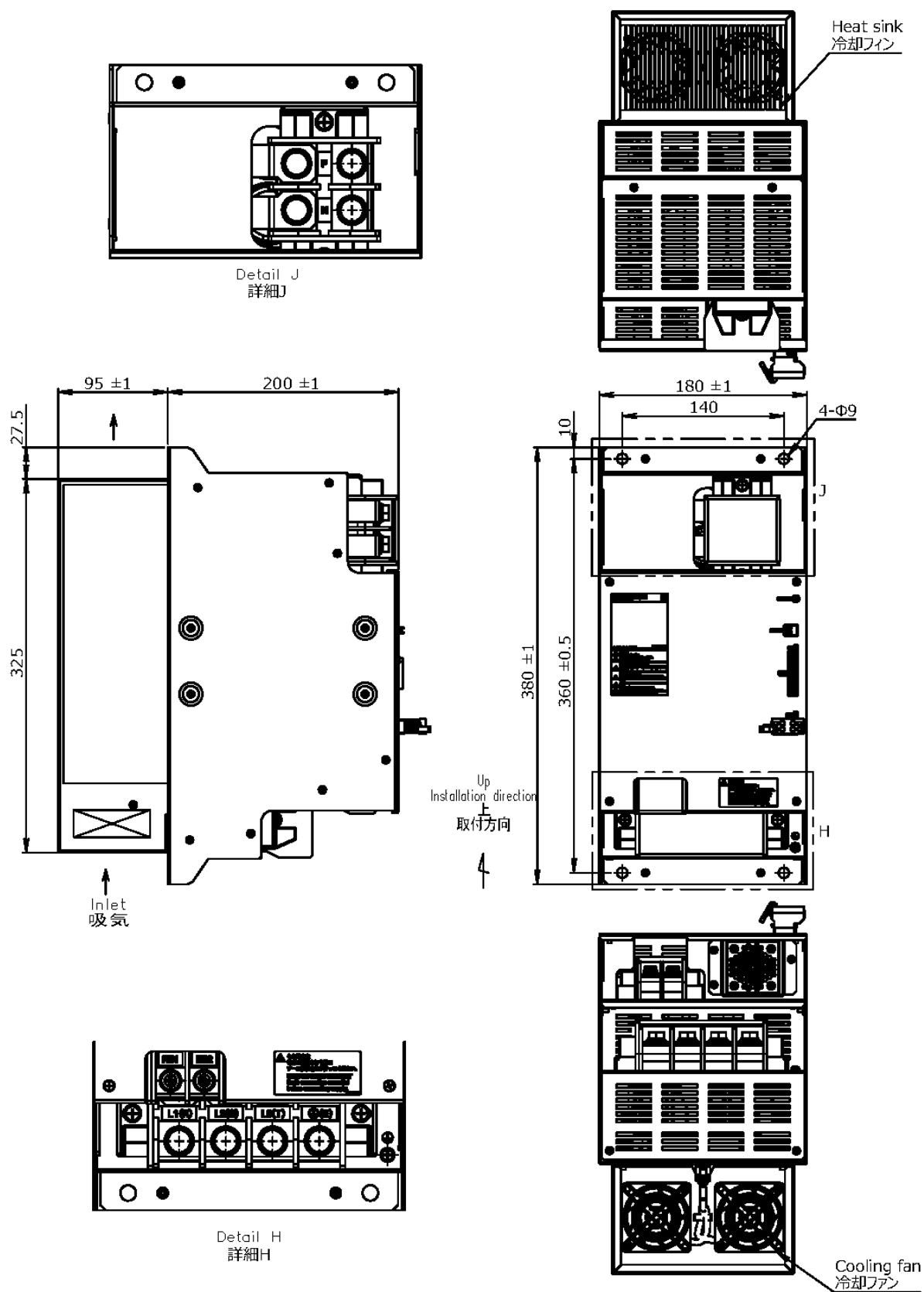
6.8.1 RM3PCA160 (Power unit)



Unit: mm
単位: mm

6. Appendix

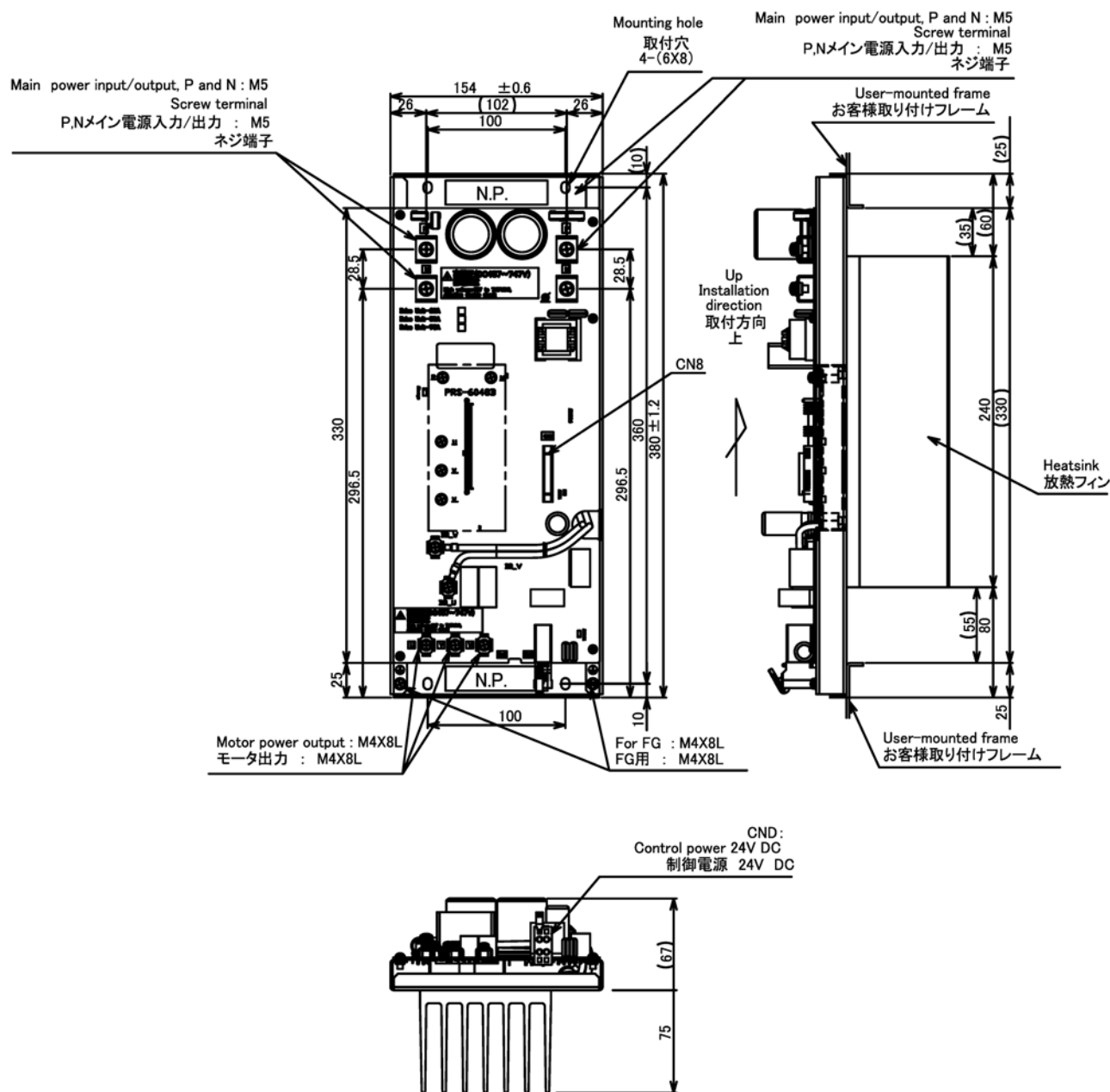
6.8.2 RM3PCA370 (Power unit)



Unit: mm
単位:mm

6.8 Power unit/amplifier unit dimensions 400V input

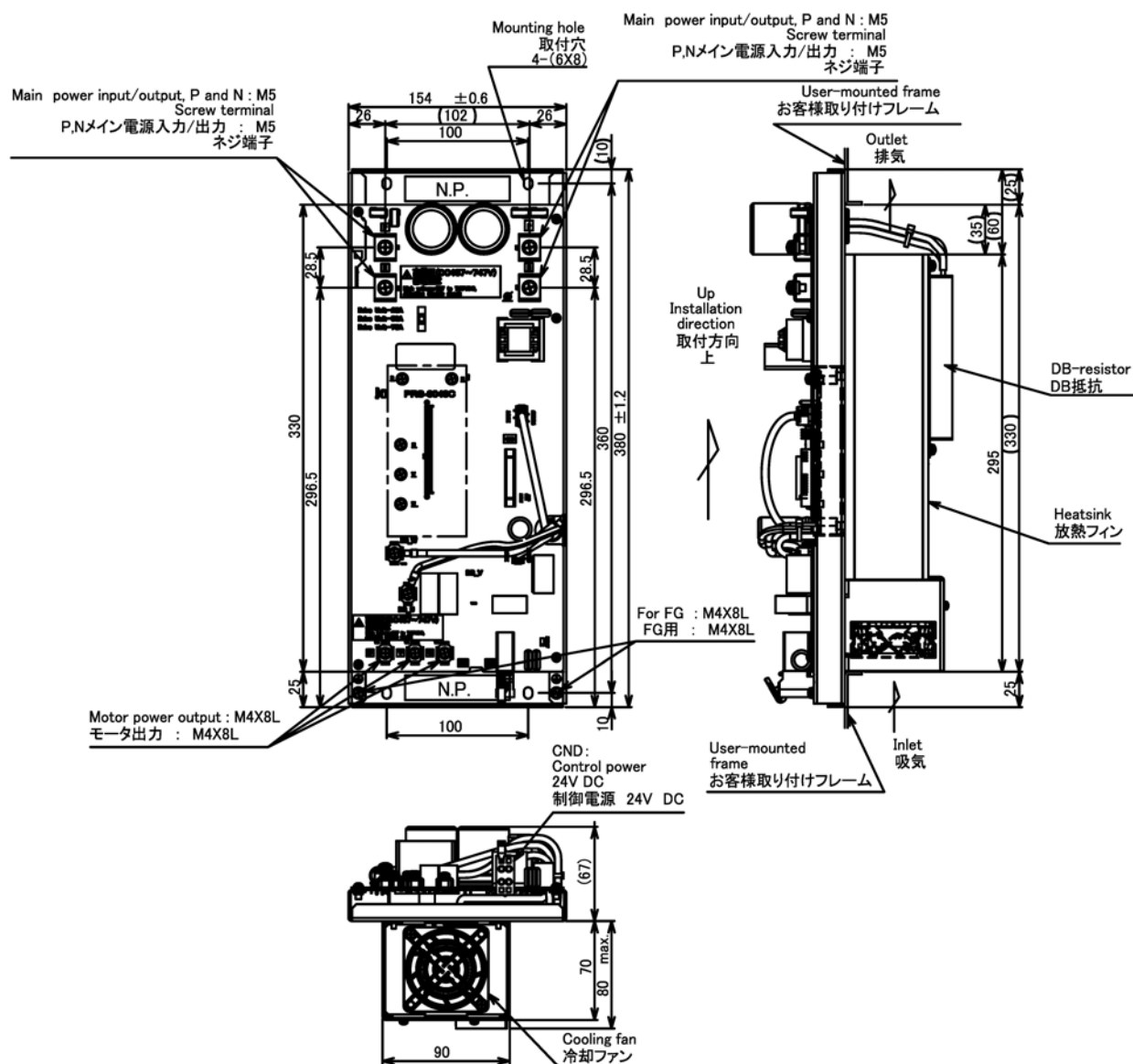
6.8.3 RM3DCA025 (Amplifier unit)



Unit: mm
単位: mm

6. Appendix

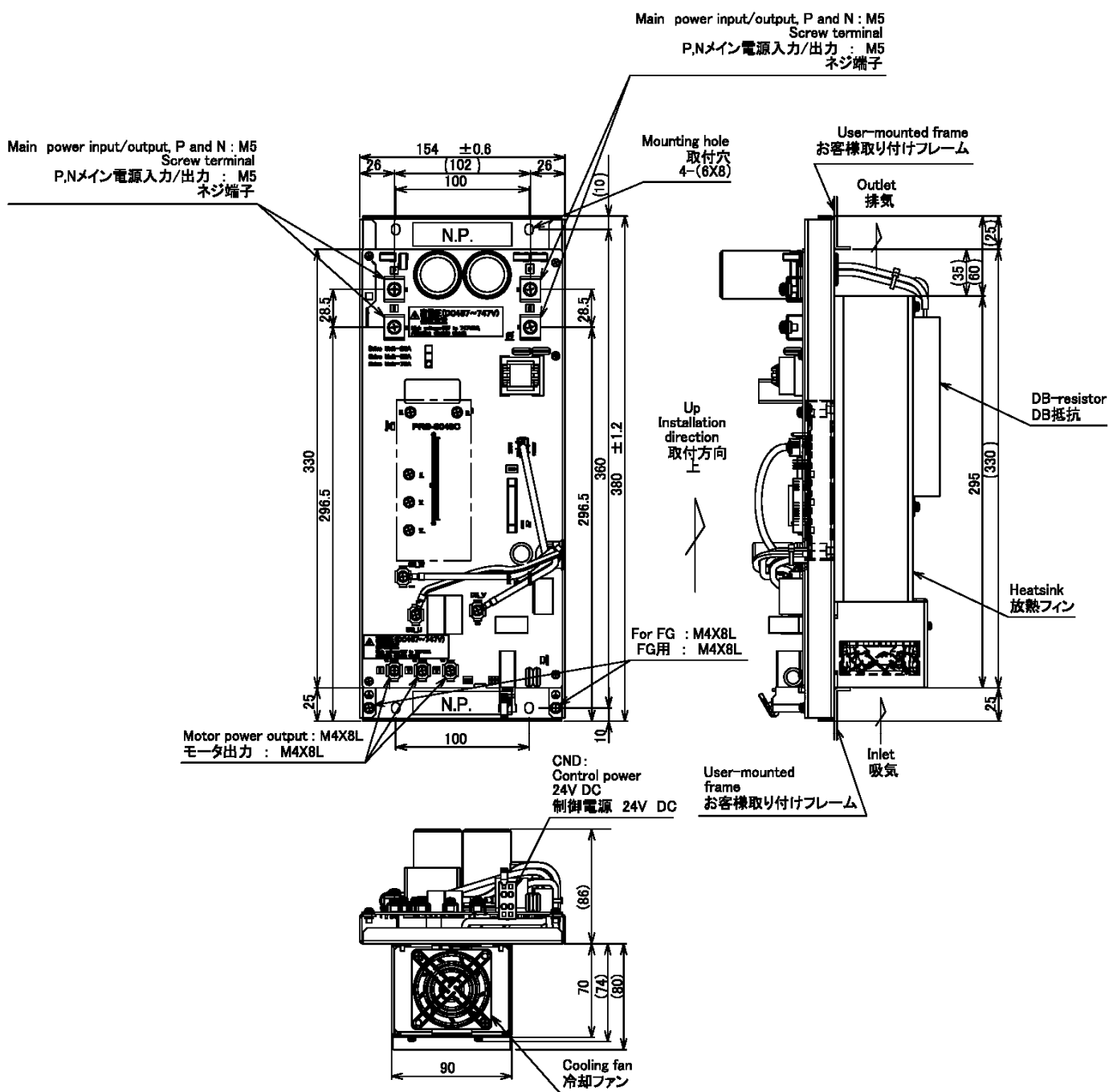
6.8.4 RM3DCA050 (Amplifier unit)



Unit: mm
単位: mm

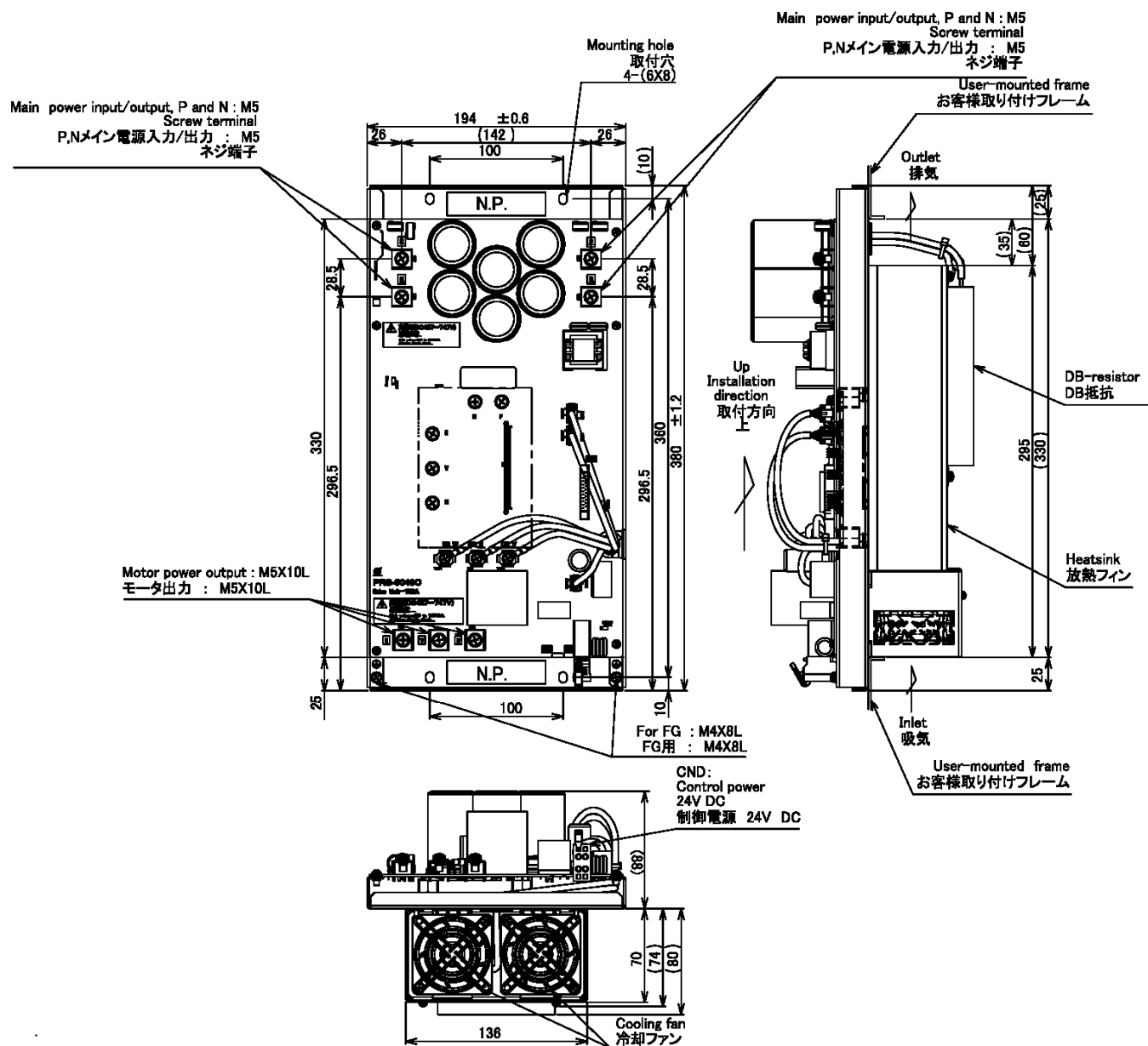
6.8 Power unit/amplifier unit dimensions 400V input

6.8.5 RM3DCA075 (Amplifier unit)



6. Appendix

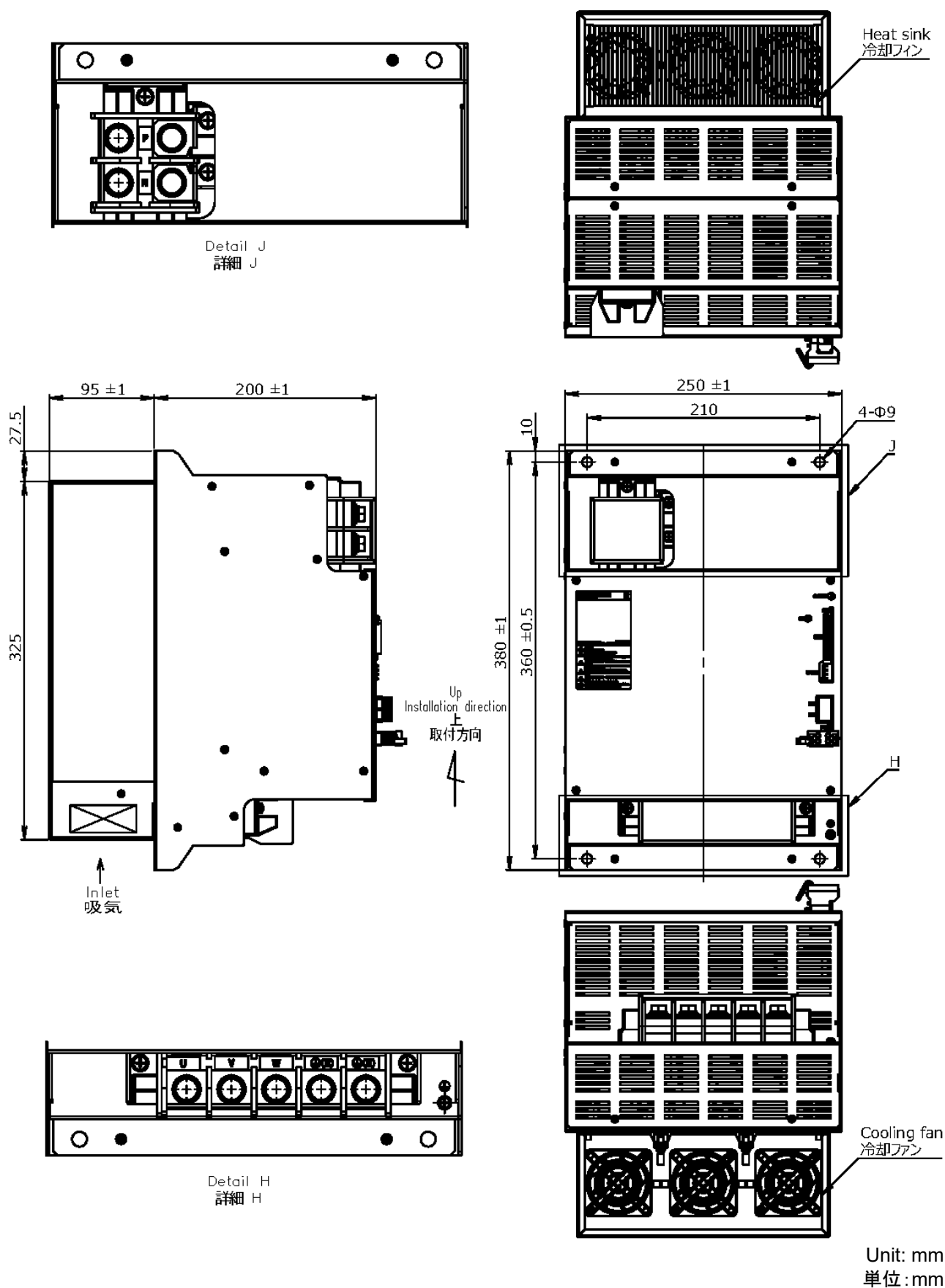
6.8.6 RM3DCA150 (Amplifier unit)



Unit: mm
単位: mm

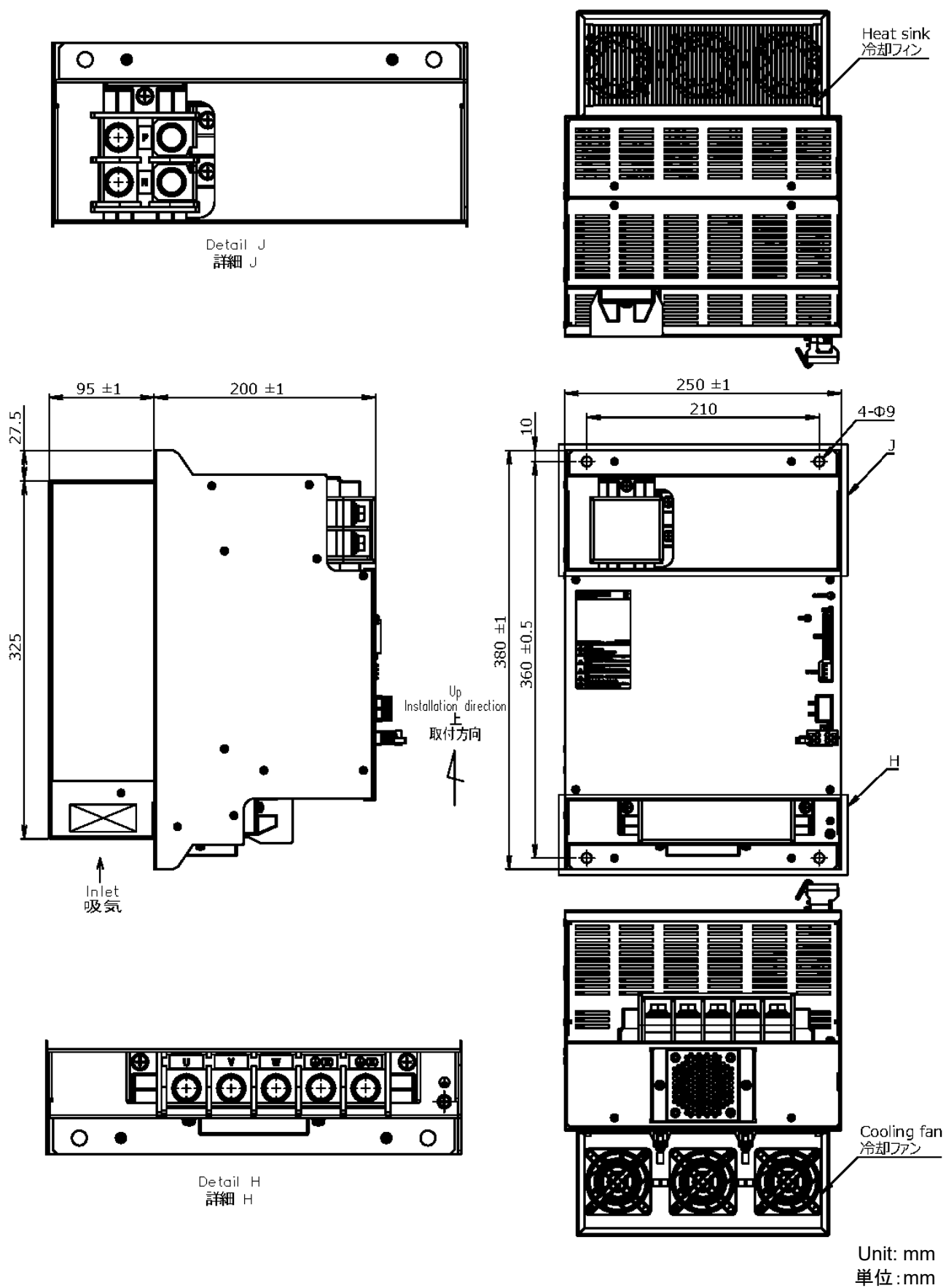
6.8 Power unit/amplifier unit dimensions 400V input

6.8.7 RM3DCB300 (Amplifier unit)



6. Appendix

6.8.8 RM3DCB600 (Amplifier unit)



6.9 Optional parts

SANYO DENKI offers the following optional parts.

6.9.1 Connectors of power unit/amplifier unit

200V input

- Model numbers of single connectors for power unit: RM3PAA###

Connector No. or symbol	Description	SANYO DENKI model number	Manufacturer model number	Manufacturer
CN2	For control unit connection	Note 1)	KHJF99-2389-#0	KEL Corporation
EXT.TH	For regenerative resistor thermal equipment connection	Note 2)	Housing: VHR-2N Contact: SVH-21GH-P1.1	J.S.T. Mfg. Co., Ltd.
CN1-1, CN1-2	For control power connection	Note 4)	Housing: VHR-3N Contact: SVH-21T-P1.1	J.S.T. Mfg. Co., Ltd.
Copper bar between power unit/amplifier unit (Up to 27kW, 600A)	For P-N connection	AL-01009379-01	-	-
Copper bar between power unit/amplifier unit (Up to 37kW, 600A)	For P-N connection	AL-01009380-01	-	-
Connector for fan motor power line	For fan motor power connection	AL-00922658	Connector: 5557-02R_NATURAL Contact: 5556TL Note 6)	Molex Japan LLC

- Model numbers of single connectors for amplifier unit: RM3DA*###

Connector No.	Description	SANYO DENKI model number	Manufacturer model number	Manufacturer
CN2	For control unit connection	Note 3)	KHIF19-1162-#0	KEL Corporation
EXT.TH (for 600A, 900A)	For external thermal equipment connection	Note 5)	Housing: VHR-4N Contact: SVH-21GH-P1.1	J.S.T. Mfg. Co., Ltd.
CN1-1, CN1-2	For control power connection	Note 4)	-	-
Connector for fan motor power line	For fan motor power connection	AL-00922658	Connector: 5557-02R_NATURAL Contact: 5556TL Note 6)	Molex Japan LLC

6. Appendix

400V input

■ Model numbers of single connectors for power unit: RM3PCA160

Connector No. or symbol	Description	SANYO DENKI model number	Manufacturer model number	Manufacturer
CN1	For control unit connection	Note 1)	KHJF99-2389-#0	KEL Corporation
EXT.TH	For external thermal equipment connection	Note 2)	Housing: VHR-2N Contact: SVH-21GH-P1.1	J.S.T. Mfg. Co., Ltd.
CND	For control power connection	AL-00961843-01	04JFAT-SAGG-G-KK	J.S.T. Mfg. Co., Ltd.
Open tool	For CND connector	AL-00961844-01	J-FAT-OT(N)	
Copper bar between power unit/amplifier unit (Up to 16kW, 25 to 150A)	For P-N connection	AL-00987401-01	-	-
Copper bar between power unit/amplifier unit (Up to 37kW, 300•600A)	For P-N connection	AL-01040279-01	-	-
Copper bar between power unit/amplifier unit (Up to 37kW, 25 to 150A)	For P-N connection	AL-01040278-01	-	-

■ Model numbers of single connectors for amplifier unit: RM3DCA###

Connector No.	Description	SANYO DENKI model number	Manufacturer model number	Manufacturer
CN8	For control unit connection	Note 3)	KHIF19-1162-#0	KEL Corporation
CND	For control power connection	AL-00961843-01	04JFAT-SAGG-G-KK	J.S.T. Mfg. Co., Ltd.
Open tool	For CND connector	AL-00961844-01	J-FAT-OT(N)	
EXT.TH (for 300A,600A)	For external thermal equipment connection	Note 5)	Housing: VHR-4N Contact: SVH-21GH-P1.1	J.S.T. Mfg. Co., Ltd.
Copper bar between amplifier units (25 to 150A—25 to 150A)	For P-N connection	AL-00987402-01	-	-
Copper bar between amplifier units (300•600A—25 to 150A)	For P-N connection	AL-01040280-01	-	-
Copper bar between amplifier units (300•600A—300•600A)	For P-N connection	AL-01040362-01	-	-

Note 1) SANYO DENKI model number differs due to cable length. Refer the section 6.9.2, for detail.

Note 2) SANYO DENKI model number differs due to cable length. Refer the section 6.9.7, for detail.

Note 3) SANYO DENKI model number differs due to cable length. Refer the section 6.9.3, for detail.

Note 4) SANYO DENKI model number differs due to cable length. Refer the section 6.9.4, for detail.

Note 5) SANYO DENKI model number differs due to cable length. Refer the section 6.9.8, for detail.

Note 6) For contact crimp of 5556TL, dedicated crimping tool below is required.

Please inquire to connector manufacturer for auto-crimping.

Model number	Applicable wire size	Manufacturer
63819-0901	AWG18 to AWG24	Molex Japan LLC

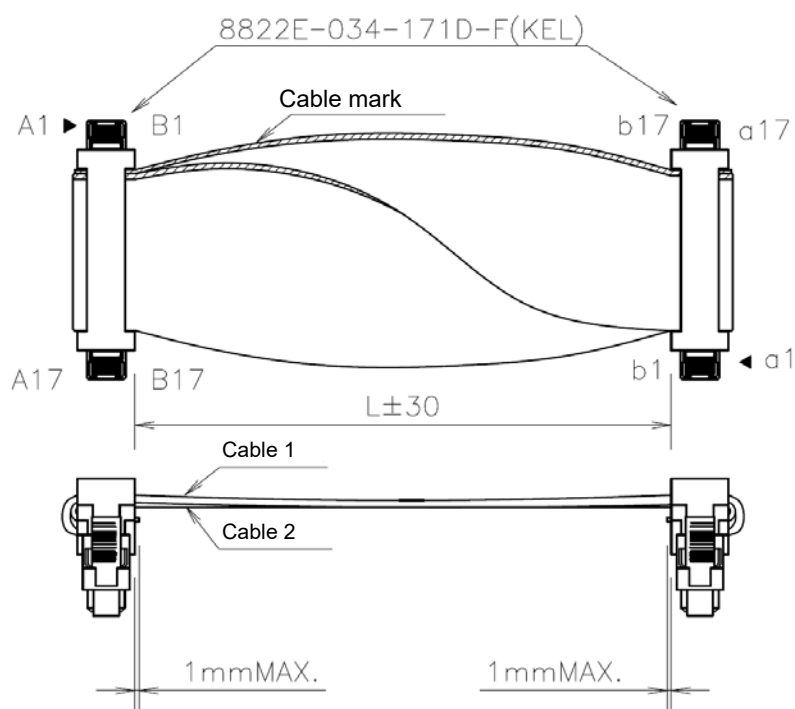
✓ Refer the section 1.5, for connector detail.

6.9 Optional parts

6.9.2 Cable between power unit/control unit 200V input 400V input

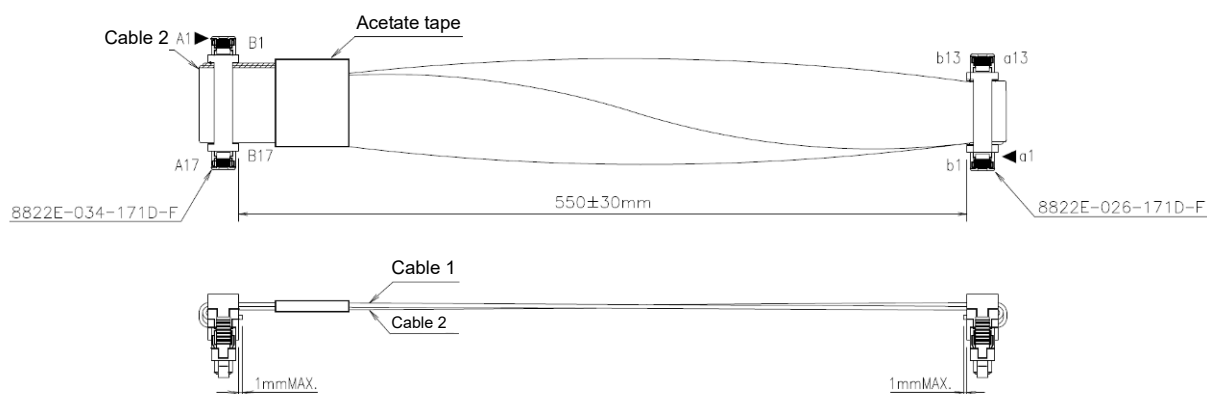
■ For RM3C1H4

Description	Cable length: L (mm)	SANYO DENKI model number
Power unit (※) ⇔ Control unit (CN3) ※: CN2 for 200V input, CN8 for 400V input	250	AL-01036866-01
	350	AL-01036866-02
	450	AL-01036866-03
	550	AL-01036866-04



■ For RM2C1A0, RM2C4H

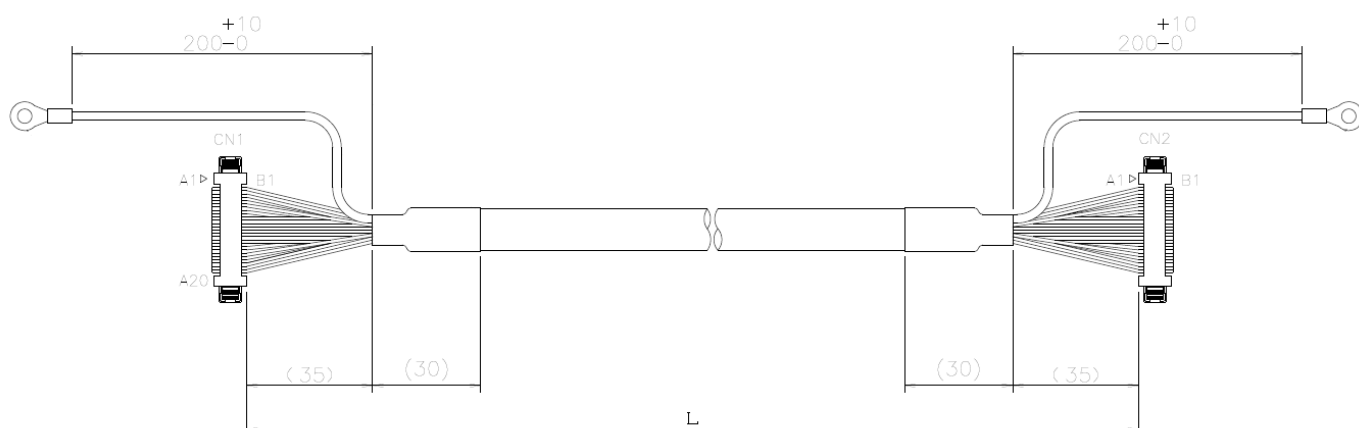
Description	Cable length: L (mm)	SANYO DENKI model number
Power unit (※) ⇔ Control unit (CN3) ※: CN2 for 200V input, CN8 for 400V input	250	AL-01103098-01
	350	AL-01103099-01
	450	AL-01103100-01
	550	AL-01103101-01



6. Appendix

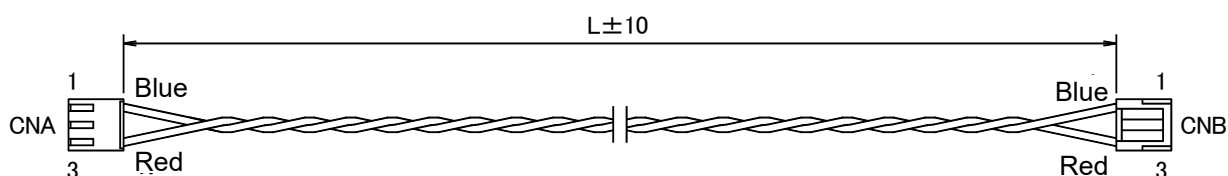
6.9.3 Cable between amplifier unit/control unit **200V input** **400V input**

Description	Cable length: L (mm)	SANYO DENKI model number
Amplifier unit (※) ⇔ Control unit (CN4) ※: CN2 for 200V input, CN8 for 400V input	500	AL-00510001-01
	750	AL-00510001-02
	1,000	AL-00510001-03
	1,500	AL-00510001-05



6.9.4 Control power cable between units **200V input**

Description	Cable length: L (mm)	SANYO DENKI model number
Power unit (CN1-□) ⇔ Amplifier unit (CN1-□) Amplifier unit (CN1-□) ⇔ Amplifier unit (CN1-□)	100	AL-00510002-01
	200	AL-00510002-02
	300	AL-00510002-03
	400	AL-00510002-04
	500	AL-00510002-05
	600	AL-00510002-06
	700	AL-00510002-07



6.9 Optional parts

6.9.5 Power cable for servo motor **400V input**

Refer the section 4.2.5, for individual connector model number of SANYO DENKI.

For a flange size: 100mm sq.

Model number		Cable length: L (mm)	Applicable motor
For power AWG#16 (1.25mm ²)	For power and holding brake #16 (1.25mm ²)*#20 (0.5mm ²)		
AL-00964811-01	AL-00964812-01	1,000	R1CA10150V, R2CA10075F
AL-00964811-02	AL-00964812-02	2,000	
AL-00964811-03	AL-00964812-03	3,000	
AL-00964811-05	AL-00964812-05	5,000	
AL-00964811-10	AL-00964812-10	10,000	

Item	Connector model number	Remarks
Motor side connector Common to with or without brake	Straight plug: JL04V-6A20-15SE-EB-RK Clamp: JL04-2022CK(12)-R	Japan Aviation Electronics Industry, Ltd.

For a flange size: 130mm sq.

Model number		Cable length: L (mm)	Applicable motor
For power AWG#16 (1.25mm ²)	For power and holding brake #16 (1.25mm ²)・#20 (0.5mm ²)		
AL-00965739-01	AL-00965740-01	1,000	R2CA13050D, R2CA13120R, R2CA13180H, R2CA13200L
AL-00965739-02	AL-00965740-02	2,000	
AL-00965739-03	AL-00965740-03	3,000	
AL-00965739-05	AL-00965740-05	5,000	
AL-00965739-10	AL-00965740-10	10,000	

Item	Connector model number	Remarks
Motor side connector Common to with or without brake	Straight plug: JL04V-6A24-11SE-EB-R Clamp: JL04-2428CK(11)-RK	Japan Aviation Electronics Industry, Ltd.

For a flange size: 130/180mm sq.

Model number		Cable length: L (m)	Applicable motor
For power AWG#14 (2.0mm ²)	For power and holding brake #14 (2.0mm ²)•#20 (0.5mm ²)		
AL-00965741-01	AL-00965742-01	1	R2CA13120F, R2CA13180D, R2CA13200H, R1CA13300V, R2CA18350L
AL-00965741-02	AL-00965742-02	2	
AL-00965741-03	AL-00965742-03	3	
AL-00965741-05	AL-00965742-05	5	
AL-00965741-10	AL-00965742-10	10	

Item	Connector model number	Remarks
Motor side connector Common to with or without brake	Straight plug: JL04V-6A24-11SE-EB-R Clamp: JL04-2428CK(17)-R	Japan Aviation Electronics Industry, Ltd.

For a flange size: 180mm sq.

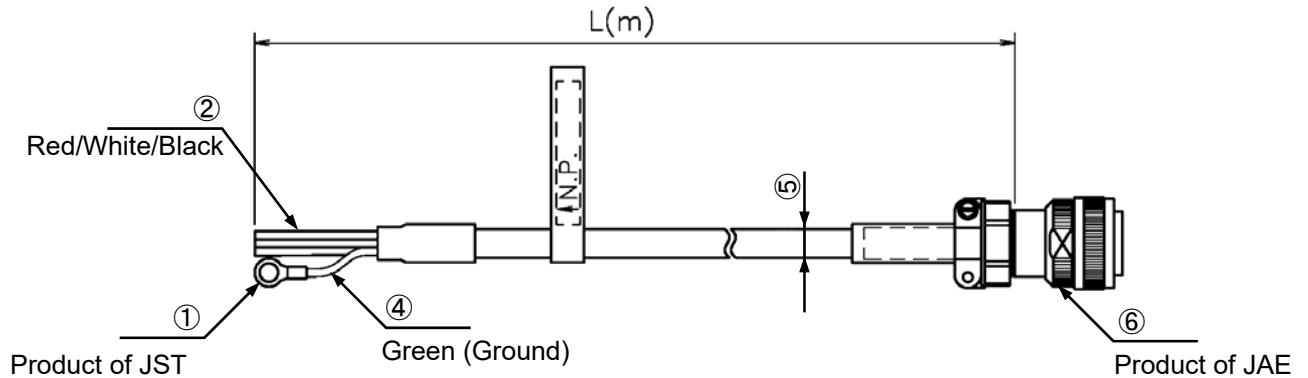
Range Size: 100mm² sq.

Model number		Cable length: L (m)	Applicable motor
For power AWG#12 (3.5mm ²)	For power and holding brake #12 (3.5mm ²)•#20 (0.5mm ²)		
AL-00965743-01	AL-00965744-01	1	R2CA18350C, R2CA18450H, R2CA18550V
AL-00965743-02	AL-00965744-02	2	
AL-00965743-03	AL-00965744-03	3	
AL-00965743-05	AL-00965744-05	5	
AL-00965743-10	AL-00965744-10	10	

Item	Connector model number	Remarks
Motor side connector Common to with or without brake	Straight plug: JL04V-6A24-11SE-EB-R Clamp: JL04-2428CK(17)-R	Japan Aviation Electronics Industry, Ltd.

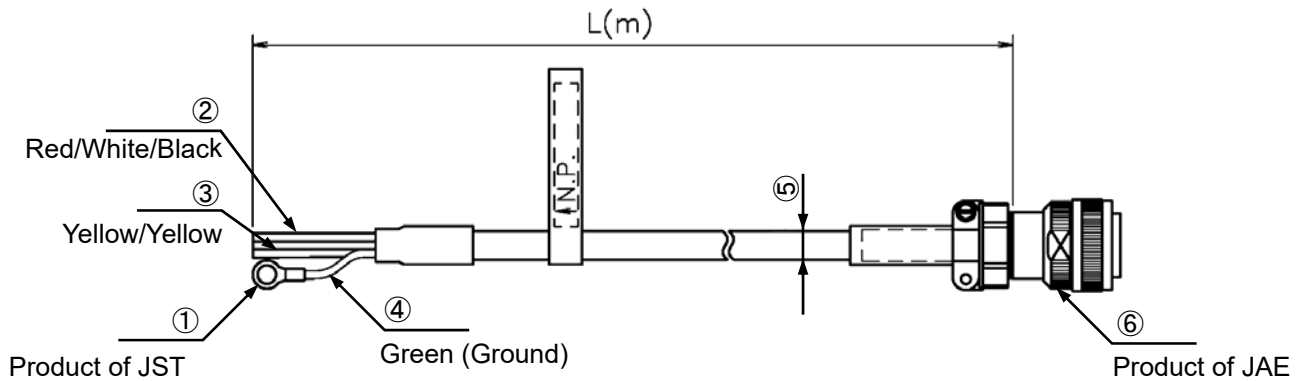
6. Appendix

■ For motor power



Model number	AL-00964811-□□	AL-00965739-□□	AL-00965741-□□	AL-00965743-□□																																																												
①Terminal	N2-M4	N2-M4	N2-M4	N5.5-S4																																																												
②Power cable	AWG16	AWG16	AWG14	AWG12																																																												
③Brake cable	—	—	—	-																																																												
④Ground cable	AWG16	AWG16	AWG14	AWG12																																																												
⑤Diameter	φ 11.6	φ 11.6	φ 12.5	φ 14.0																																																												
⑥Plug /Clamp	JL04V-6A20-15SE-EB-RK / JL04-2022CK(12)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(11)-RK	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R																																																												
Connection	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>A</td></tr><tr><td>Lead wire: White</td><td>V</td><td>B</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>C</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>D</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	A	Lead wire: White	V	B	Lead wire: Black	W	C	Lead wire: Green	Ground	D	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>D</td></tr><tr><td>Lead wire: White</td><td>V</td><td>E</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>F</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>G</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	D	Lead wire: White	V	E	Lead wire: Black	W	F	Lead wire: Green	Ground	G	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>D</td></tr><tr><td>Lead wire: White</td><td>V</td><td>E</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>F</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>G</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	D	Lead wire: White	V	E	Lead wire: Black	W	F	Lead wire: Green	Ground	G	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>D</td></tr><tr><td>Lead wire: White</td><td>V</td><td>E</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>F</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>G</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	D	Lead wire: White	V	E	Lead wire: Black	W	F	Lead wire: Green	Ground	G
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Lead wire: Red	U	D																																																														
Lead wire: White	V	E																																																														
Lead wire: Black	W	F																																																														
Lead wire: Green	Ground	G																																																														

■ For motor power and brake



Model number	AL-00964812-□□	AL-00965740-□□	AL-00965742-□□	AL-00965744-□□																																																												
①Terminal	N2-M4	N2-M4	N2-M4	N5.5-S4																																																												
②Power cable	AWG16	AWG16	AWG14	AWG12																																																												
③Brake cable	AWG20	AWG20	AWG20	AWG20																																																												
④Ground cable	AWG16	AWG16	AWG14	AWG12																																																												
⑤Diameter	φ 11.6	φ 11.6	φ 12.5	φ 14.0																																																												
⑥Plug /Clamp	JL04V-6A20-15SE-EB-RK / JL04-2022CK(12)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(11)-RK	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R																																																												
Connection	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>A</td></tr><tr><td>Lead wire: White</td><td>V</td><td>B</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>C</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>D</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	A	Lead wire: White	V	B	Lead wire: Black	W	C	Lead wire: Green	Ground	D	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>D</td></tr><tr><td>Lead wire: White</td><td>V</td><td>E</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>F</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>G</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	D	Lead wire: White	V	E	Lead wire: Black	W	F	Lead wire: Green	Ground	G	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>D</td></tr><tr><td>Lead wire: White</td><td>V</td><td>E</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>F</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>G</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	D	Lead wire: White	V	E	Lead wire: Black	W	F	Lead wire: Green	Ground	G	<table><tr><td></td><td>Motor side name</td><td>Connector pin number</td></tr><tr><td>Lead wire: Red</td><td>U</td><td>D</td></tr><tr><td>Lead wire: White</td><td>V</td><td>E</td></tr><tr><td>Lead wire: Black</td><td>W</td><td>F</td></tr><tr><td>Lead wire: Green</td><td>Ground</td><td>G</td></tr></table>		Motor side name	Connector pin number	Lead wire: Red	U	D	Lead wire: White	V	E	Lead wire: Black	W	F	Lead wire: Green	Ground	G
	Motor side name	Connector pin number																																																														
Lead wire: Red	U	A																																																														
Lead wire: White	V	B																																																														
Lead wire: Black	W	C																																																														
Lead wire: Green	Ground	D																																																														
	Motor side name	Connector pin number																																																														
Lead wire: Red	U	D																																																														
Lead wire: White	V	E																																																														
Lead wire: Black	W	F																																																														
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Lead wire: Red	U	D																																																														
Lead wire: White	V	E																																																														
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Lead wire: White	V	E																																																														
Lead wire: Black	W	F																																																														
Lead wire: Green	Ground	G																																																														

6.9 Optional parts

■ Cable specifications

For servo motor power

(TOTOKU ELECTRIC CO., LTD.) (Operating temperature range: -20 to 105°C)		
V-8C-MP NO.2	V-8C-MP NO.1	V-8C-MP NO.3
AL-00964811-01 to -10; 1 to 10m AL-00964812-01 to -10; 1 to 10m AL-00965739-01 to -10; 1 to 10m AL-00965740-01 to -10; 1 to 10m	AL-00965741-01 to -10; 1 to 10m AL-00965742-01 to -10; 1 to 10m	AL-00965743-01 to -10; 1 to 10m AL-00965744-01 to -10; 1 to 10m
1.25sq × 4C + 0.5sq × 4C Sheath thickness: 1.4mm Cable diameter: Around 11.6mm	2sq × 4C + 0.5sq × 4C Sheath thickness: 1.3mm Cable diameter: Around 12.5mm	3.5sq × 4C + 0.5sq × 4C Sheath thickness: 1.5mm Cable diameter: Around 14mm

Individual wire specification

3.5 sq. Conductor diameter: 2.47mm, Insulator thickness: 0.8 mm, Overall diameter: 4.07 mm

2.0 sq. Conductor diameter: 1.8 mm, Insulator thickness: 0.7 mm, Overall diameter: 3.2 mm

1.25 sq. Conductor diameter: 1.47mm, Insulator thickness: 0.7 mm, Overall diameter: 2.87 mm

0.5 sq. Conductor diameter: 1.0 mm, Insulator thickness: 0.5 mm, Overall diameter: 2.0 mm

(SUMIDEN HITACHI CABLE Ltd.) (Operating temperature range: up to 90°C)	
600V CV 4 8SQ	
AL-00968911-01 to -10; 1 to 10m	
8sq × 4C Sheath thickness: 1.5mm Cable diameter: Around 17mm	
Individual wire specification	
8 sq. Conductor diameter: 3.6mm, Insulator thickness: 1.0mm, Overall diameter: 5.6mm	

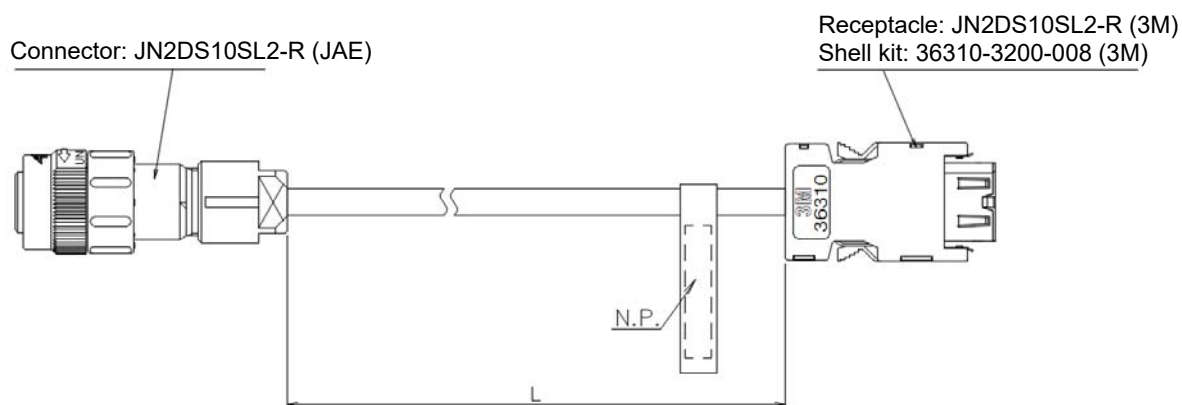
6. Appendix

6.9.6 Encoder cable **200V input** **400V input**

■ For RM3C1H

Model number	Cable length: L (mm)
For encoder	
AL-00937694-01	1,000
AL-00937694-02	2,000
AL-00937694-03	3,000
AL-00937694-05	5,000
AL-00937694-10	10,000

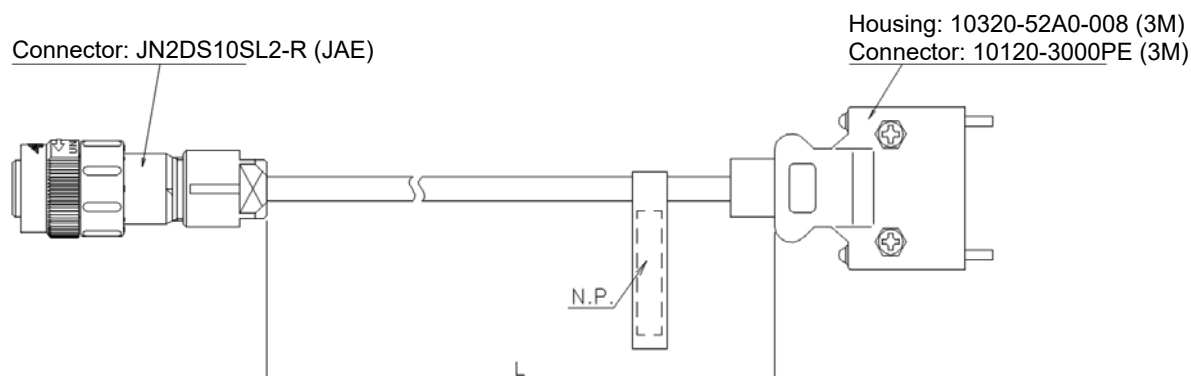
Item	Connector model number	Remarks
Motor side connector	Straight plug: JN2DS10SL2-R Contact: JN1-22-22F-PKG100	Japan Aviation Electronics Industry, Ltd.
Amplifier side connector	Receptacle: 36210-0100PL Shell kit: 36310-3200-008	3M Japan Limited



■ For RM2C1A0

Model number	Cable length: L (mm)
For encoder	
AL-00918637-01	1,000
AL-00918637-02	2,000
AL-00918637-03	3,000
AL-00918637-05	5,000
AL-00918637-10	10,000

Item	Connector model number	Remarks
Motor side connector	Straight plug: JN2DS10SL2-R Contact: JN1-22-22F-PKG100	Japan Aviation Electronics Industry, Ltd.
Amplifier side connector	Housing: 10320-52A0-008 Connector: 10120-3000PE	3M Japan Limited

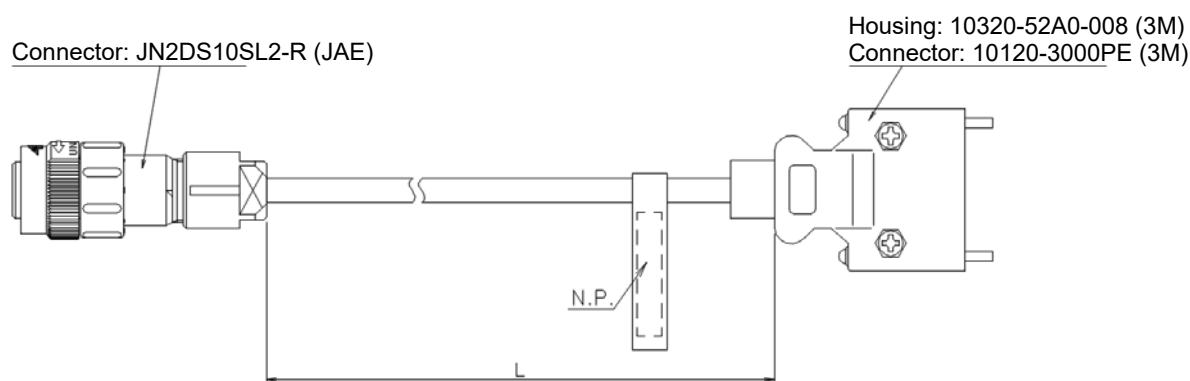


6.9 Optional parts

■ For RM2C4H

Model number	Cable length: L (mm)
For encoder	
AL-00997685-01	1,000
AL-00997685-02	2,000
AL-00997685-03	3,000
AL-00997685-05	5,000
AL-00997685-10	10,000

Item	Connector model number	Remarks
Motor side connector	Straight plug: JN2DS10SL2-R Contact: JN1-22-22F-PKG100	Japan Aviation Electronics Industry, Ltd.
Amplifier side connector	Housing: 10320-52A0-008 Connector: 10120-3000PE	3M Japan Limited



■ Cable specifications

For encoder

Robot Cable for high speed motion; UL-OREV30-SB, composite wire spec.
(OKANO CABLE Co., Ltd.)

With ETFE (fluoroplastic) insulation, vinyl sheath, braided shield

UL STYLE NO.20276 (Rating: 80°C, 30V)

AL-00937694-01 to -10; 1 to 10m lengths

AL-00918637-01 to -10; 1 to 10m lengths

22 AWG × 2C + 24 AWG × 2P

Sheath thickness: 1.0mm

Overall diameter: $\phi 6.7 \pm 0.5$ mm

Individual wire specification

22 AWG Conductor diameter: $\phi 0.77$ mm, Insulator thickness: 0.25mm, Overall diameter: $\phi 1.27$ mm

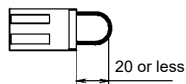
24 AWG Conductor diameter: $\phi 0.65$ mm, Insulator thickness: 0.20mm, Overall diameter: $\phi 1.05$ mm

6. Appendix

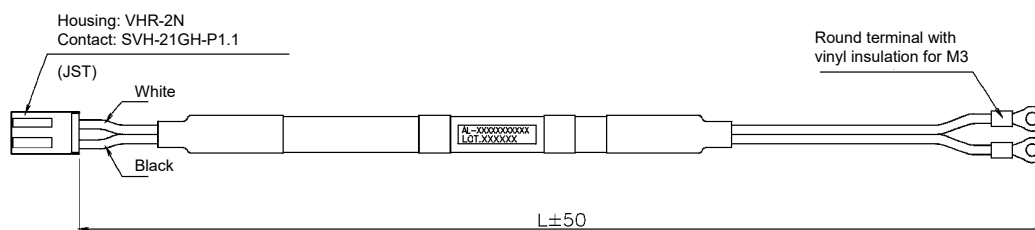
6.9.7 Regenerative resistor thermal equipment cable **200V input** **400V input**

Model number	Cable length: L (m)
AL-00397733-01	- (For short circuit use)
AL-00397733-02	1500
AL-00397733-03	3000
AL-00397733-04	5000

AL-00397733-01

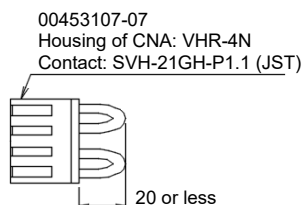
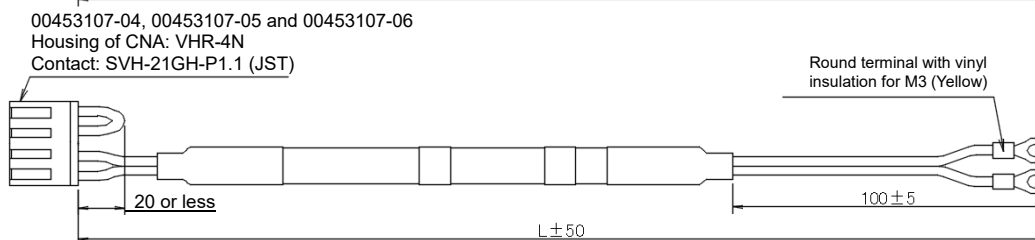
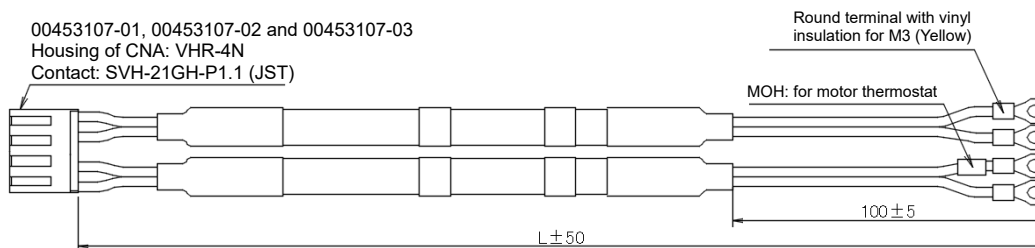


AL-00397733-02, AL-00397733-03 and AL-00397733-04



6.9.8 External thermal equipment cable **200V input** **400V input**

Description	Cable length: L (mm)	SANYO DENKI model number
600A 4-pin cable for external thermal equipment	1,500	AL-00453107-01
	3,000	AL-00453107-02
	5,000	AL-00453107-03
600A 3, 4-pin cable for external thermal equipment	1,500	AL-00453107-04
	3,000	AL-00453107-05
	5,000	AL-00453107-06
	- (Short circuit of 1-2 and 3-4)	AL-00453107-07

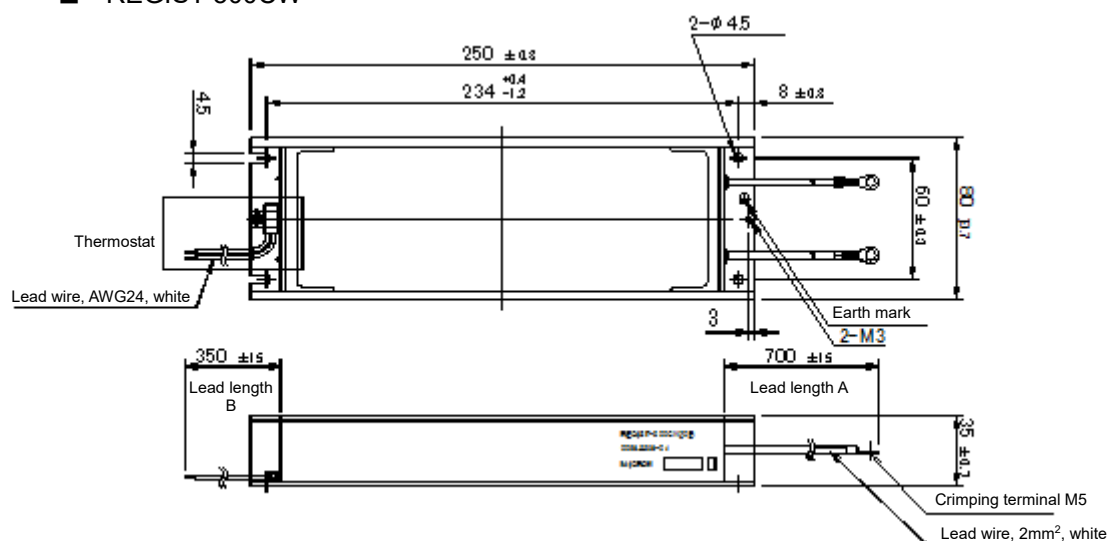


6.9 Optional parts

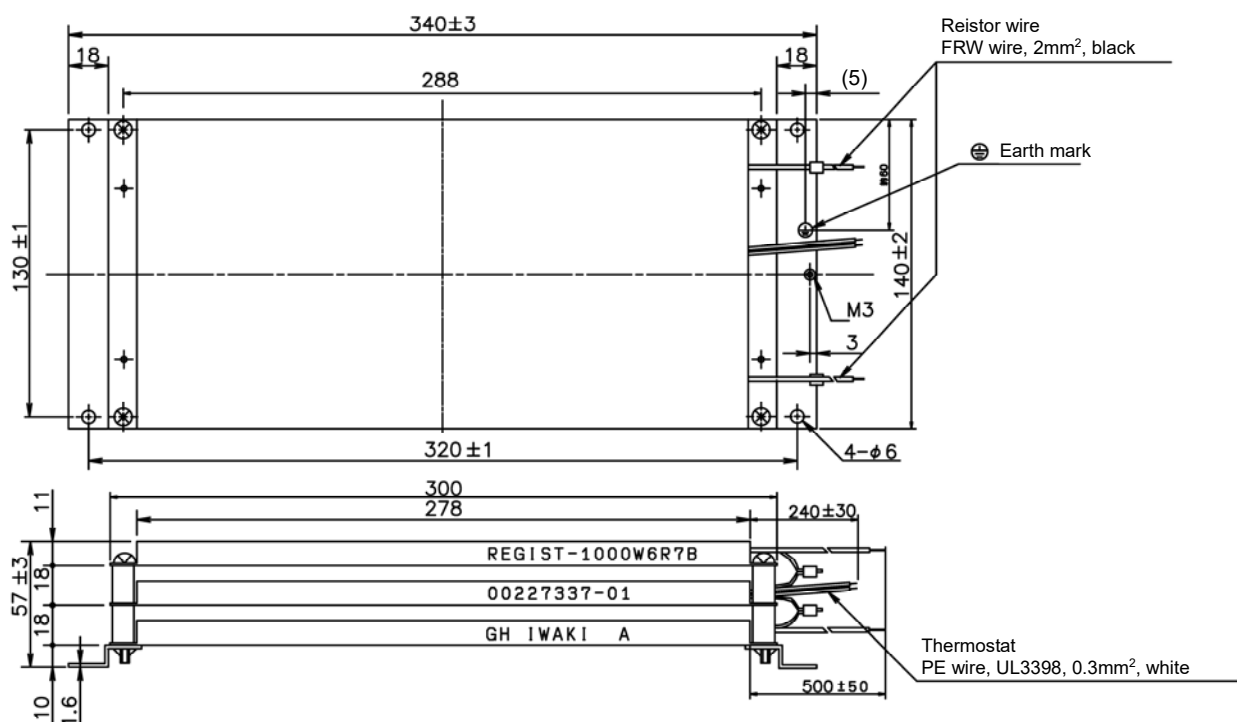
6.9.9 External regenerative resistor 200V input 400V input

Resistor Model Number	Rated power [PR]	Resistance value	Thermostat Detection temperature (Contact specification)	Mass
REGIST-500CW1R5B	500W	1.5 Ω	100°C $\pm$ 5°C (Switching contact b)	1.4kg
REGIST-500CW5B		5 Ω		
REGIST-500CW7B		7 Ω		
REGIST-500CW10B		10 Ω		
REGIST-500CW14B		14 Ω		
REGIST-500CW20B		20 Ω		
REGIST-1000W6R7B	1000W	6.7 Ω	140°C $\pm$ 5°C (Switching contact b)	2.9kg

■ REGIST-500CW



■ REGIST- 1000W

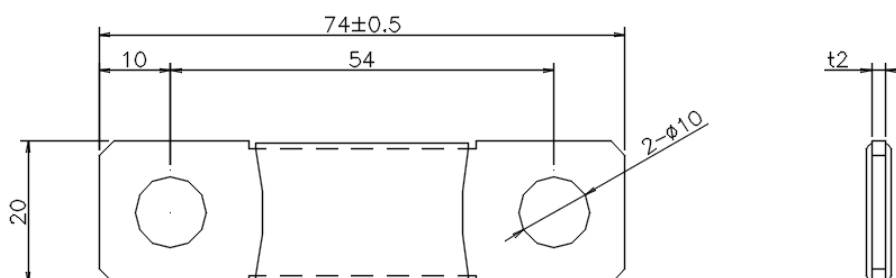


6. Appendix

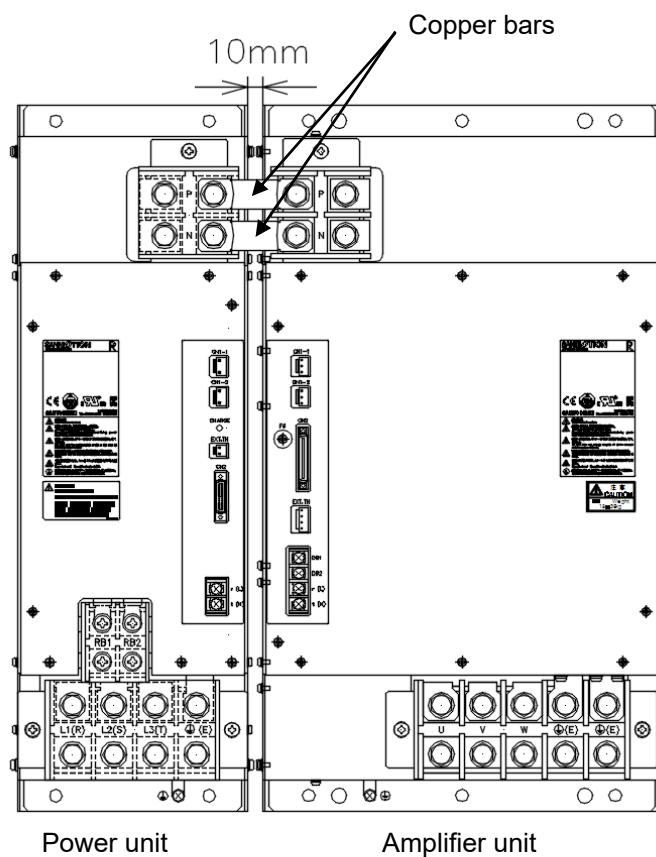
6.9.10 Copper bar between each unit **200V input**

- Copper bar between Power unit (27kW) and Amplifier unit (600A)

Description	SANYO DENKI model number	Remarks
Copper bar between Power unit (27kW) and Amplifier unit (600A)	AL-01009379-01	2 pieces-in-1 set



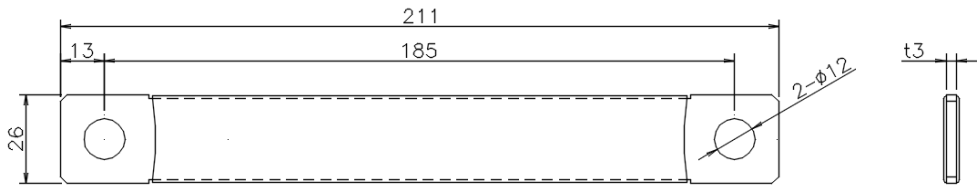
- ✓ Distance between units shall be 10mm.
Below shows how to attach copper bars.



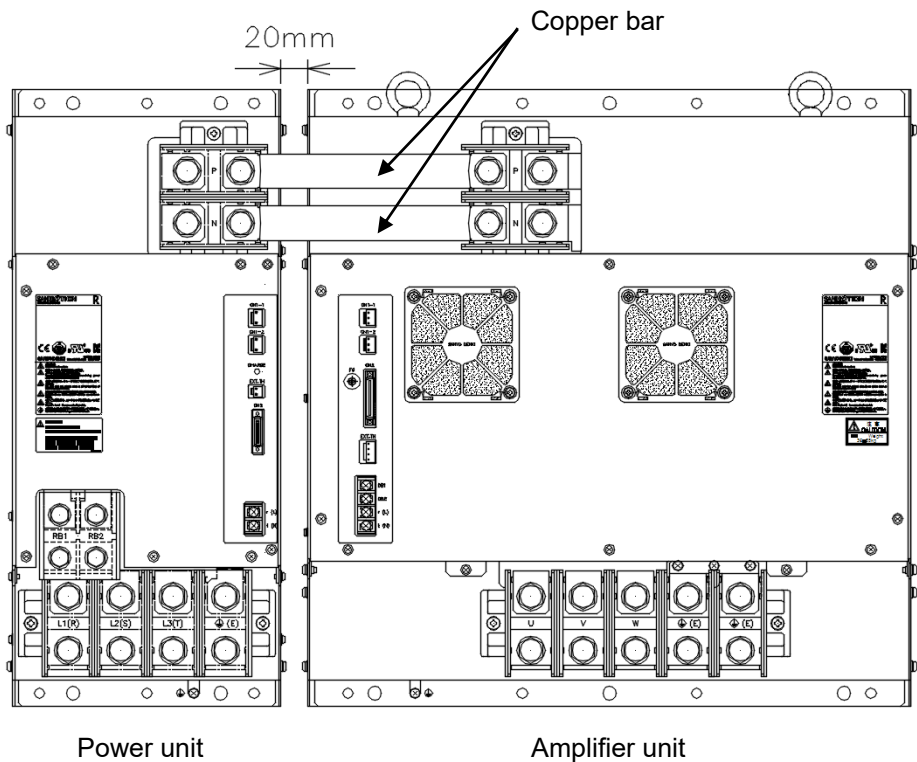
6.9 Optional parts

■ Copper bar between Power unit (37kW) and Amplifier unit (900A)

Description	SANYO DENKI model number	Remarks
Copper bar between Power unit (37kW) and Amplifier unit (900A)	AL-01009380-01	2 pieces-in-1 set



- ✓ Distance between units shall be 10mm.
Below shows how to attach copper bars.



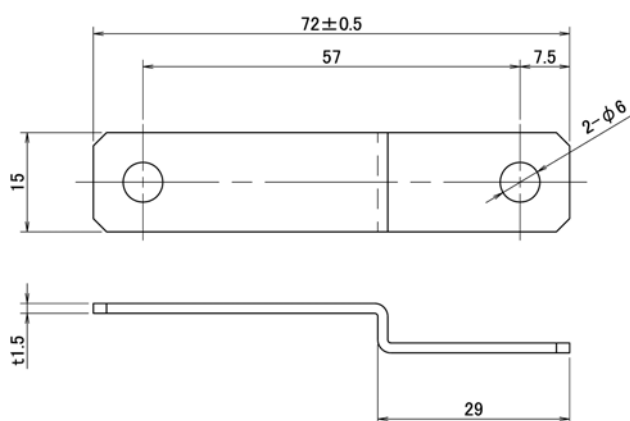
6. Appendix

6.9.11 Copper bar between each unit **400V input**

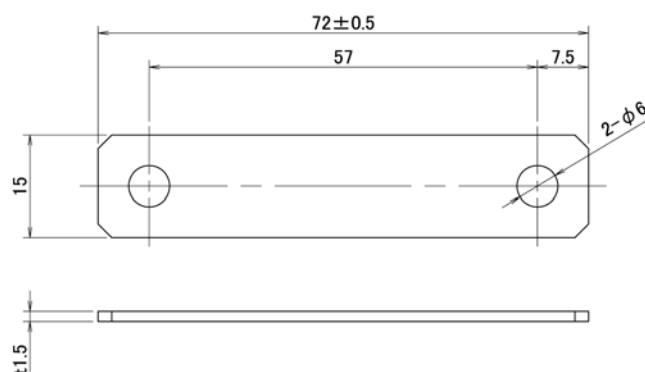
- Copper bar between Power unit (7.8 to 16kW) and Amplifier unit (25 to 150A)
- Copper bar between Amplifier unit (25 to 150A) and Amplifier unit (25 to 150A)

Description	SANYO DENKI model number	Remarks
Between Power unit (7.8 to 16kW) and Amplifier unit (25 to 150A)	AL-00987401-01	2 pieces-in-1 set
Between Amplifier unit (25 to 150A) and Amplifier unit (25 to 150A)	AL-00987402-01	

Between power unit and amplifier unit
AL-00987401-01

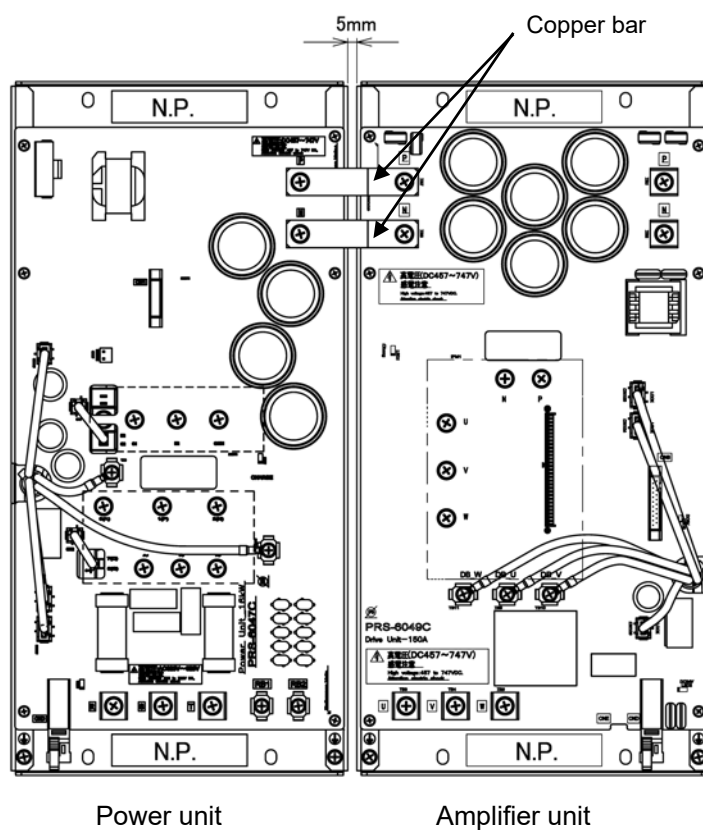


Between amplifier unit and amplifier unit
AL-00987402-01



- ✓ Distance between units shall be 5mm.
Below shows how to attach copper bars.

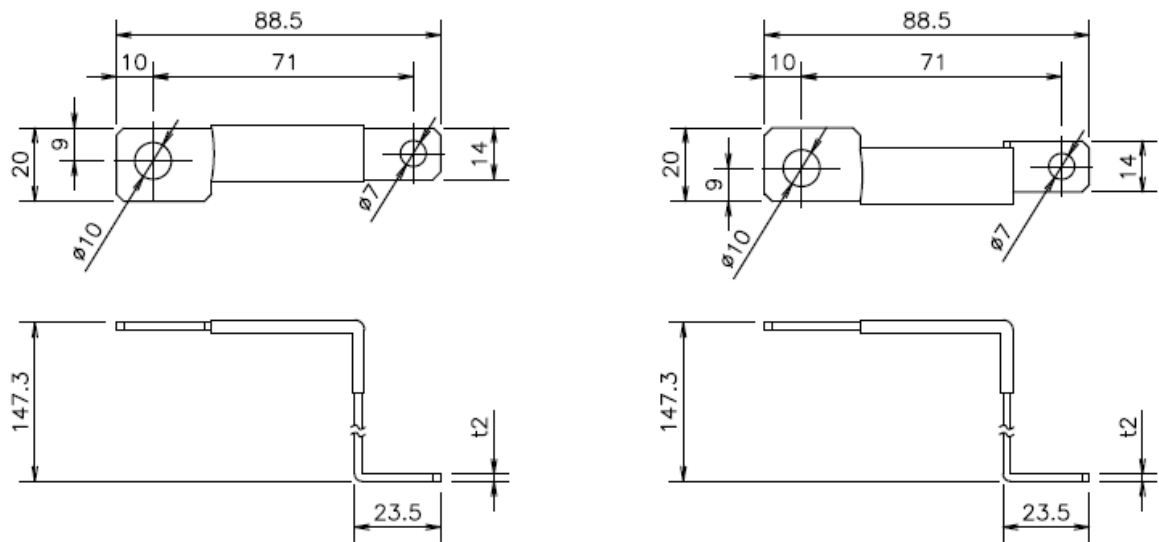
For example) Between power unit and amplifier unit



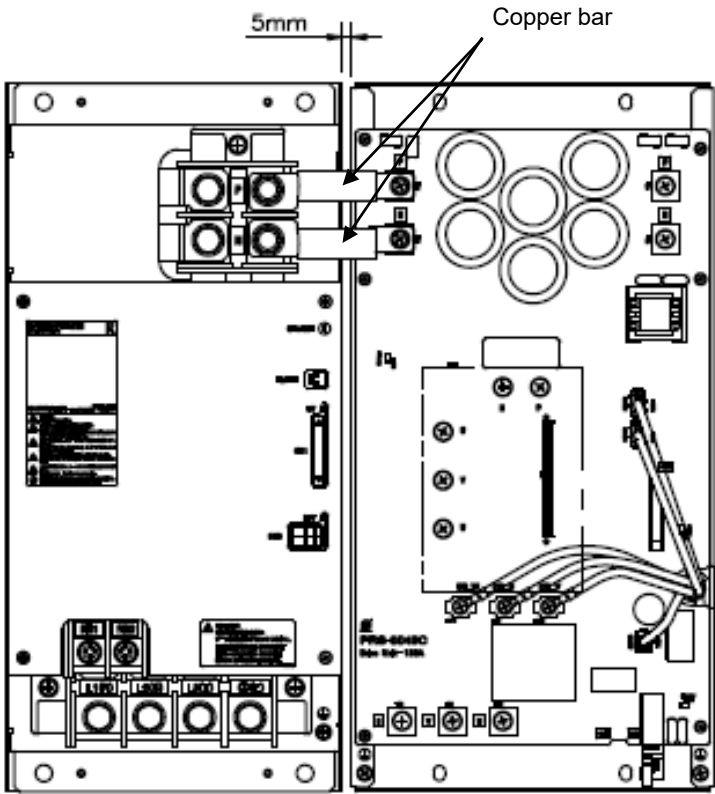
6.9 Optional parts

■ Copper bar between Power unit (37kW) and Amplifier unit (25 to 150A)

Description	SANYO DENKI model number	Remarks
Between Power unit (37kW) and Amplifier unit (25 to 150A)	AL-01040278-01	2 pieces-in-1 set



- ✓ Distance between units shall be 5mm.
Below shows how to attach copper bars.



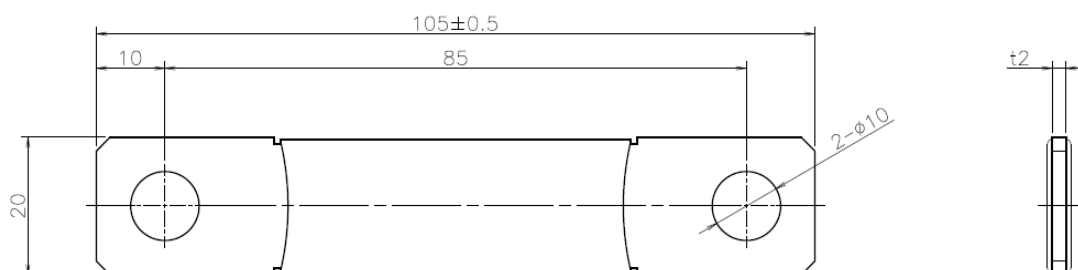
Power unit

Amplifier unit

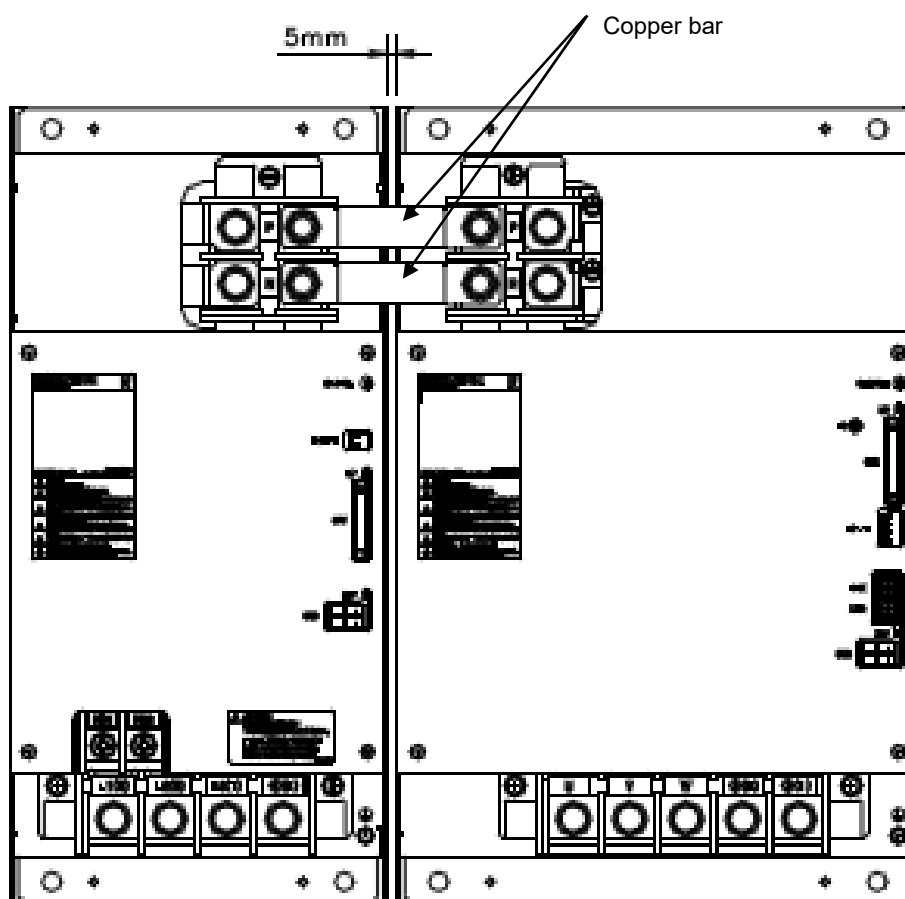
6. Appendix

■ Copper bar between Power unit (37kW) and Amplifier unit (300•600A)

Description	SANYO DENKI model number	Remarks
Between Power unit (37kW) and Amplifier unit (300, 600A)	AL-01040279-01	2 piece-in-1 set



- ✓ Distance between units shall be 5mm.
Below shows how to attach copper bars.



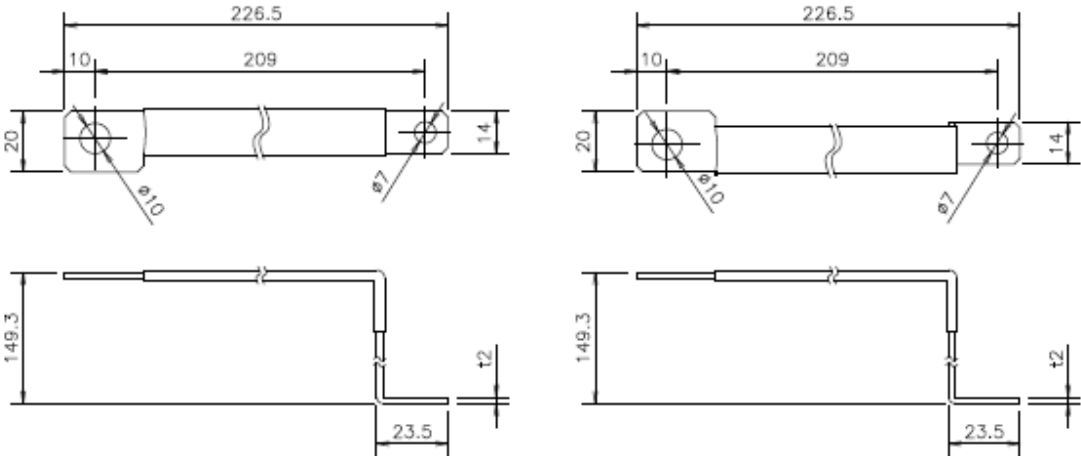
Power unit

Amplifier unit

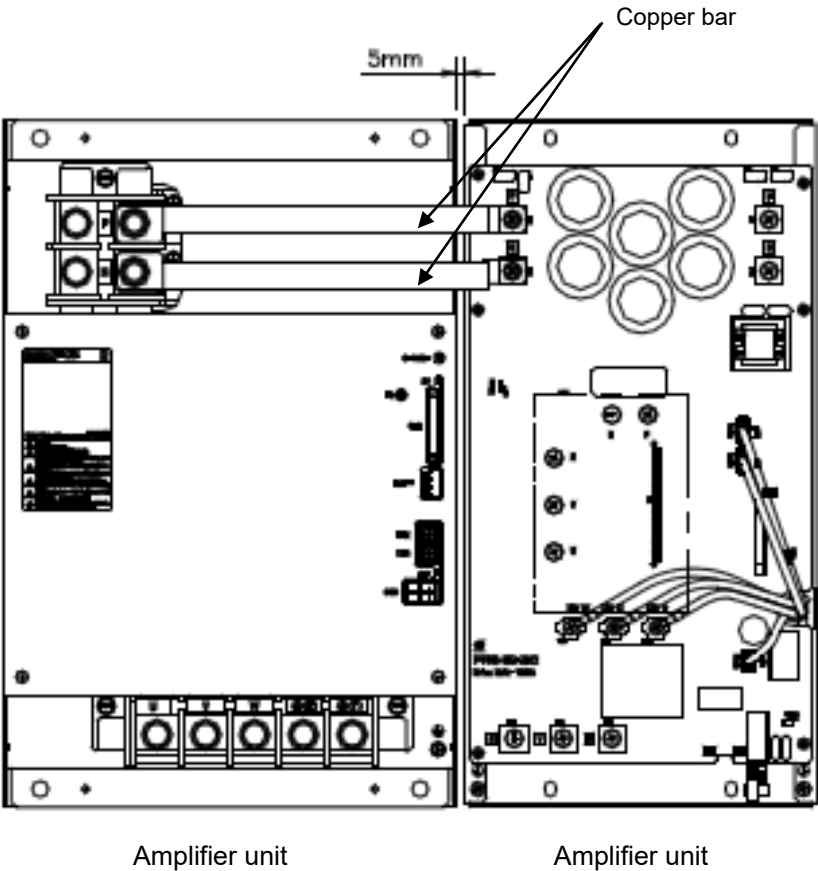
6.9 Optional parts

■ Copper bar between Amplifier unit (300, 600A) and Amplifier unit (25 to 150A)

Description	SANYO DENKI model number	Remarks
Between Amplifier unit (300, 600A) and Amplifier unit (25 to 150A)	AL-01040280-01	2 pieces-in-1 set



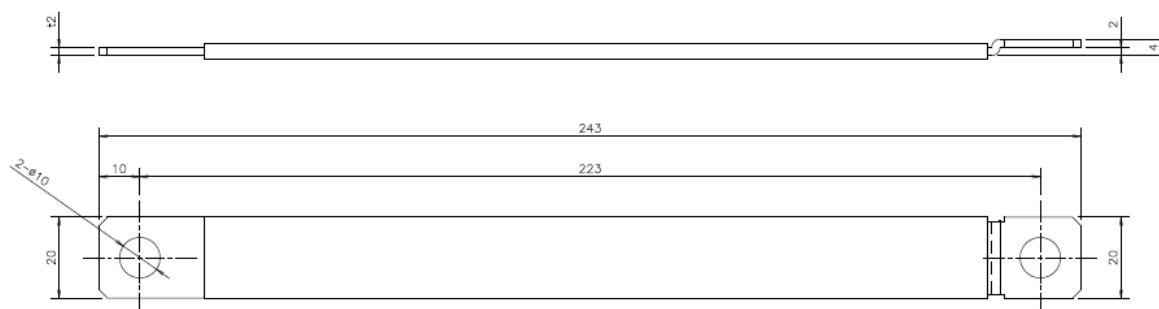
- ✓ Distance between units shall be 5mm.
Below shows how to attach copper bars.



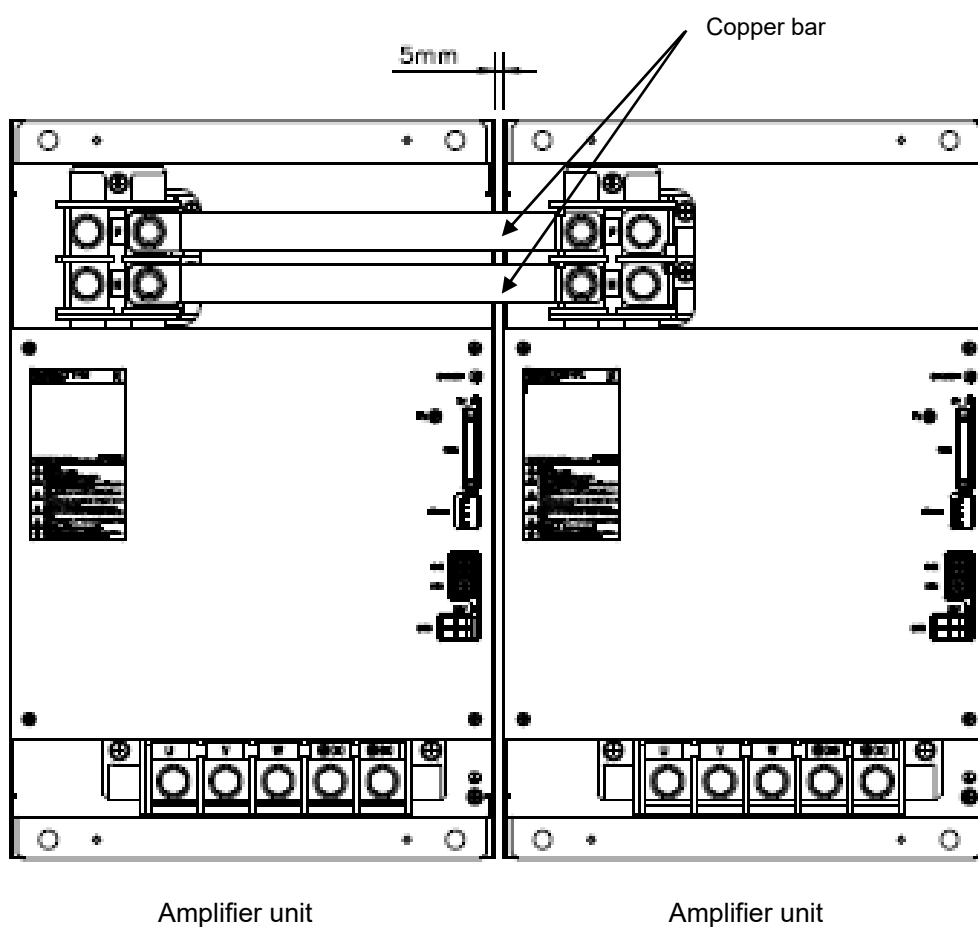
6. Appendix

■ Copper bar between Amplifier unit (300, 600A) and Amplifier unit (300・600A)

Description	SANYO DENKI model number	Remarks
Between Amplifier unit (300, 600A) and Amplifier unit (300, 600A)	AL-01040362-01	2 pieces-in-1 set



- ✓ Distance between units shall be 5mm.
Below shows how to attach copper bars.



Release	
Revision A	Dec. 2020
Revision B	Feb. 2021
Revision C	May. 2023



■ ECO PRODUCTS

Sanyo Denki's ECO PRODUCTS are designed with the concept of lessening impact on the environment in the process from product development to waste. The product units and packaging materials are designed for reduced environmental impact. We have established our own assessment criteria on the environmental impacts applicable to all processes, ranging from design to manufacture.

■ Precautions For Adoption

Failure to follow the precautions on the right may cause moderate injury and property damage, or in some circumstances, could lead to a serious accident.

Always follow all listed precautions.



Cautions

- Read the accompanying Instruction Manual carefully prior to using the product.
- If applying to medical devices and other equipment affecting people's lives please contact us beforehand and take appropriate safety measures.
- If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.
- Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.
- Do not perform any retrofitting, re-engineering, or modification to this equipment.
- The Products presented in this Instruction Manual are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc., please contact us beforehand.

* For any question or inquiry regarding the above, contact our Sales Department.

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