MITSUBISHI ELECTRIC

Mitsubishi Electric AC Servo System

MITSUBISHI ELECTRIC SERVO SYSTEM
MELSERVO-JET

Rotary Servo Motor
User's Manual
(For MR-JET)

-HK-KN_
-HK-FN_
-HK-SN_
-HG-KNS_
-HG-SNS_

SAFETY INSTRUCTIONS

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

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

Note that the CAUTION level may lead to a serious consequence depending on conditions.
Please follow the instructions of both levels because they are important to personnel safety.
Forbidden actions and required actions are indicated by the following diagrammatic symbols.

⃠	Indicates a forbidden action. For example, "No Fire" is indicated by  .
●	Indicates a required action. For example, grounding is indicated by  .

In this manual, precautions for hazards that can lead to property damage, instructions for other functions, and other information are shown separately in the "Point" area.
After reading this manual, keep it accessible to the operator.

[Installation/wiring]

⚠ WARNING

- To prevent an electric shock, turn off the power and wait for 15 minutes or more before starting wiring and/or inspection.
- To prevent an electric shock, ground the rotary servo motor securely.
- To prevent an electric shock, any person who is involved in wiring should be fully competent to do the work.
- To prevent an electric shock, do not attempt to wire the rotary servo motor until it has been mounted.
- To prevent an electric shock, do not touch the conductive parts.

[Installation/wiring]

⚠ CAUTION

- To prevent injury, do not touch the rotor of the rotary servo motor during operation.
- To prevent injury, transport the products correctly according to their mass.
- To prevent injury, do not touch any sharp edges such as the sharp edges of the rotary servo motor with bare hands when handling the rotary servo motor.

[Maintenance]

⚠ WARNING

- To prevent an electric shock, any person who is involved in inspection should be fully competent to do the work.

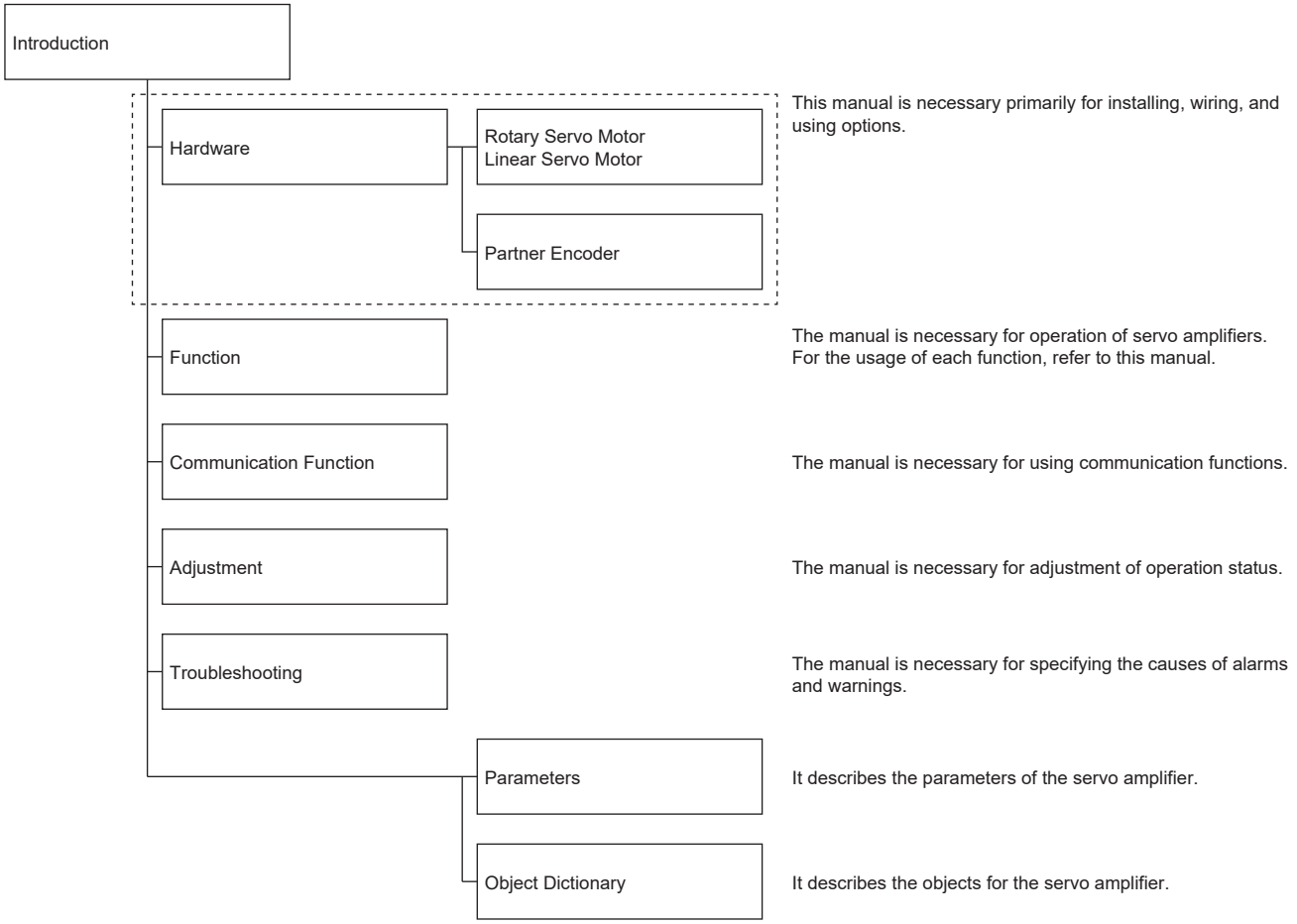
ABOUT THE MANUAL

Point

e-Manuals are Mitsubishi Electric FA electronic book manuals that can be browsed with a dedicated tool.
e-Manuals enable the following:

- Searching for desired information in multiple manuals at the same time (manual cross searching)
- Jumping from a link in a manual to another manual for reference
- Browsing for hardware specifications by scrolling over the components shown in product illustrations
- Bookmarking frequently referenced information
- Copying sample programs to engineering software

If using the servo for the first time, prepare and use the following related manuals to ensure that the servo is used safely. For the related manuals, refer to the User's Manual (Introduction).



Global standards and regulations

Compliance with the indicated global standards and regulations is current as of the release date of this manual. Some standards and regulations may have been modified or withdrawn.

CABLES USED FOR WIRING

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

U.S. CUSTOMARY UNITS

U.S. customary units are not shown in this manual. Convert the values if necessary according to the following table.

Quantity	SI (metric) unit	U.S. customary unit
Mass	1 [kg]	2.2046 [lb]
Length	1 [mm]	0.03937 [inch]
Torque	1 [N•m]	141.6 [oz•inch]
Moment of inertia	1 [(× 10^{-4} kg•m^2)]	5.4675 [oz•$inch^2$]
Load (thrust load/axial load)	1 [N]	0.2248 [lbf]
Temperature	N [°C]× 9/5 + 32	N [°F]

CONTENTS

1 INTRODUCTION

1.1 Rating plate

Products applied by Certification Bodies are marked. The mark depends on the Certification Bodies.

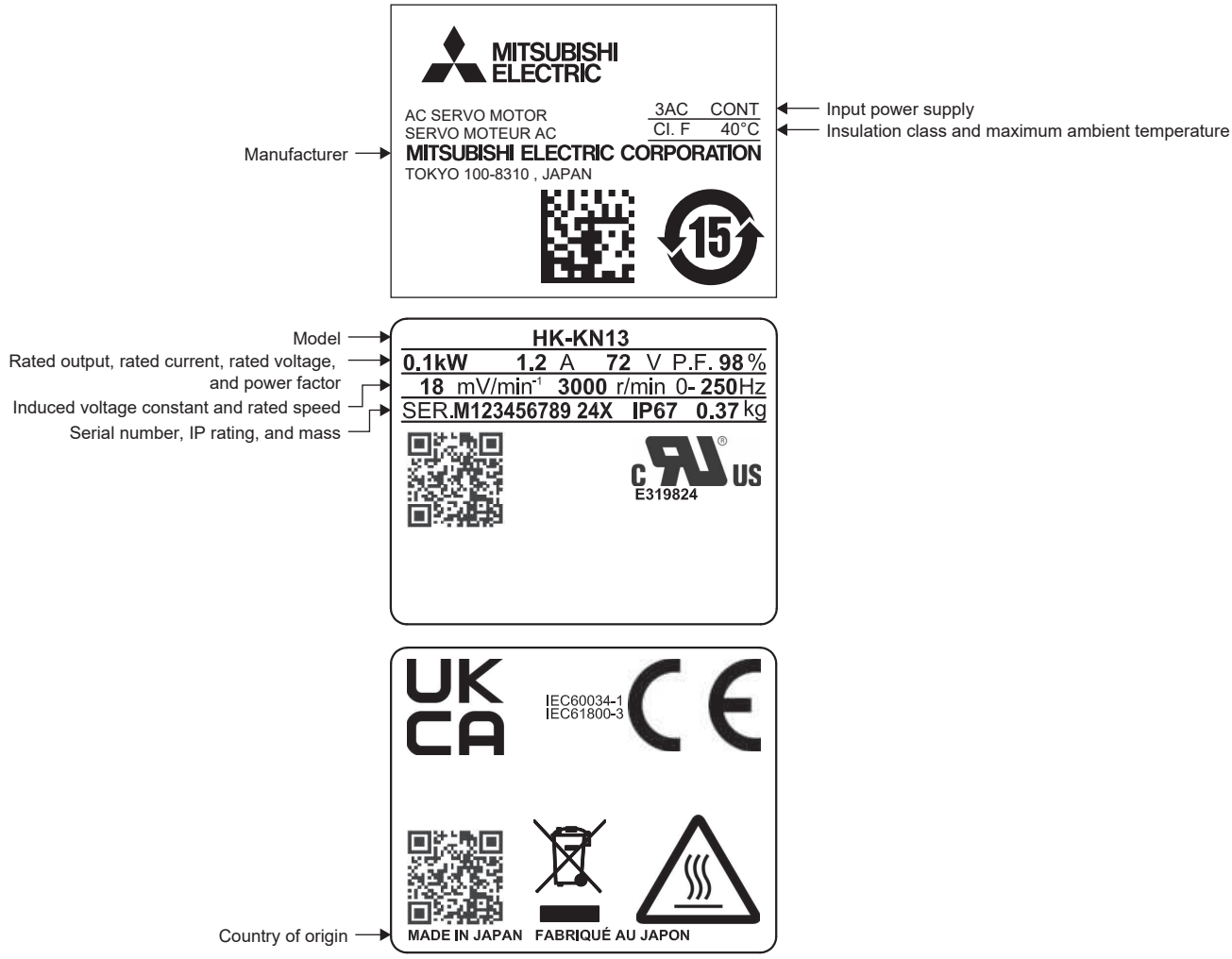
The production year and month of the rotary servo motor are indicated in the serial number on the rating plate.

The year and month of manufacture are indicated by the last two digits of the year and one digit of the month [1 to 9, X (10), Y (11), and Z (12)].

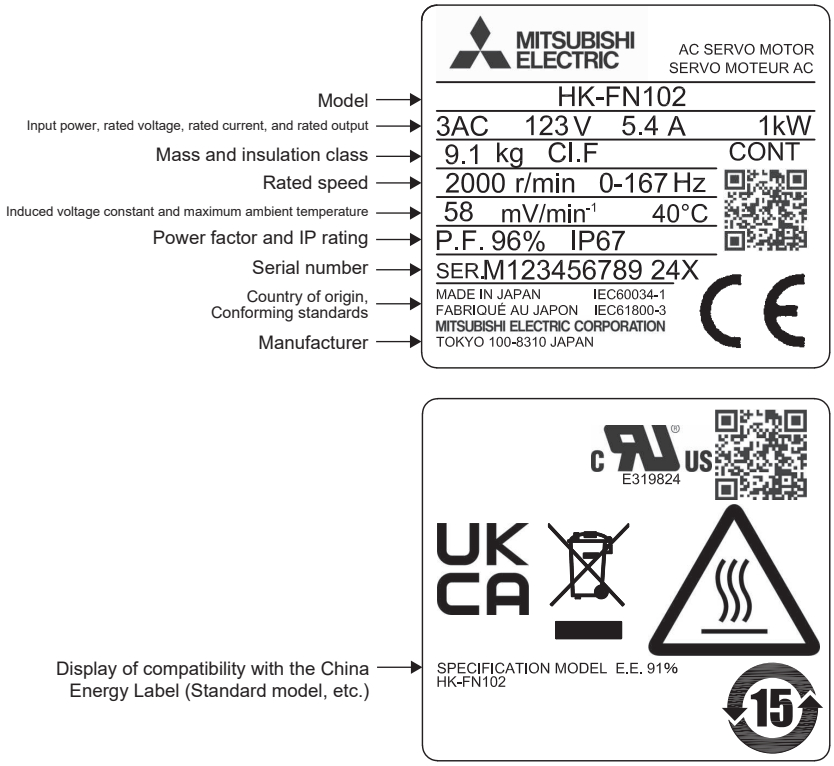
For October 2019, the serial number would be "SER. _ _ _ _ _ _ _ _ _ 19X".

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

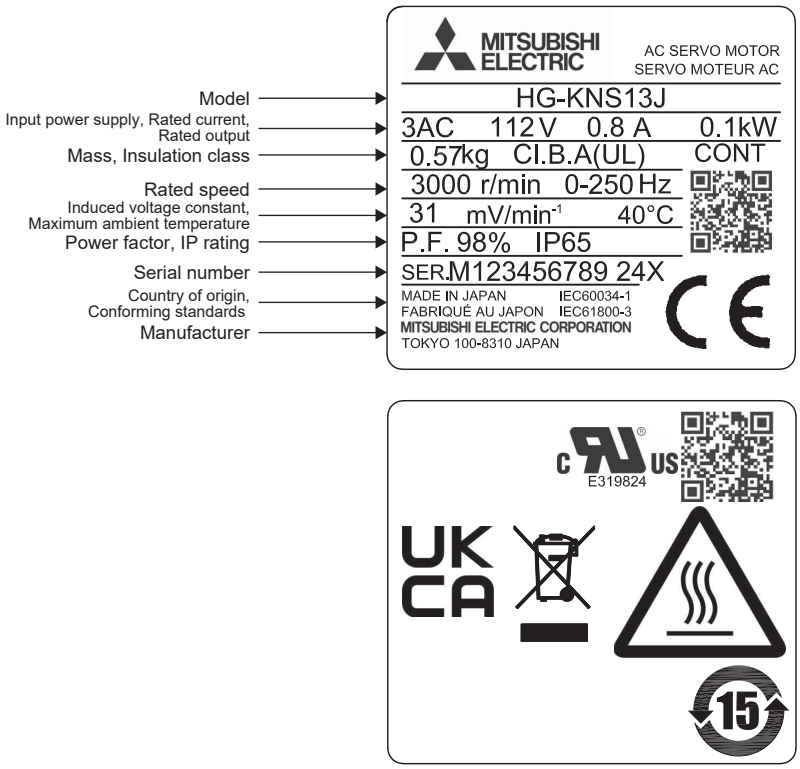
HK-KN series/HK-FN (0.1 kW - 0.75 kW) series



HK-FN (1.0 kW - 3.0 kW) series/HK-SN series



HG-KNS series/HG-SNS series



1.2 Environment

HK-KN series/HK-FN series/HK-SN series

Condition	Operation	Transportation/storage
Ambient temperature	0 °C to 60 °C (non-freezing) *2	-15 °C to 70 °C (non-freezing)
Ambient humidity	10 %RH to 90 %RH (non-condensing)	10 %RH to 90 %RH (non-condensing)
Ambience *1	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, dust, nor high magnetic field	
Altitude	2000 m or less *3	
External magnetic field	10 mT or less	
Vibration resistance	Refer to the following. ☞ Page 126 Standard specifications ☞ Page 148 Standard specifications ☞ Page 171 Standard specifications ☞ Page 193 Standard specifications	

*1 Do not use in an environment where there is exposure to oil mist, oil, and water.

*2 Refer to the following for restrictions on the ambient temperature.

☞ Page 133 Derating

☞ Page 155 Derating

☞ Page 178 Derating

☞ Page 198 Derating

*3 Refer to the following for restrictions on using this product at an altitude exceeding 1000 m and up to 2000 m.

☞ Page 133 Derating

☞ Page 155 Derating

☞ Page 178 Derating

☞ Page 198 Derating

HG-KNS series/HG-SNS series

Condition	Operation	Storage
Ambient temperature	0 °C to 40 °C (non-freezing)	-15 °C to 70 °C (non-freezing)
Ambient humidity	10 %RH to 80 %RH (non-condensing)	10 %RH to 90 %RH (non-condensing)
Ambience *1	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust	
Altitude	2000 m or less *2	
Vibration resistance	Refer to the following. ☞ Page 207 Standard specifications ☞ Page 224 Standard specifications	

*1 Do not use in an environment where there is exposure to oil mist, oil, and water.

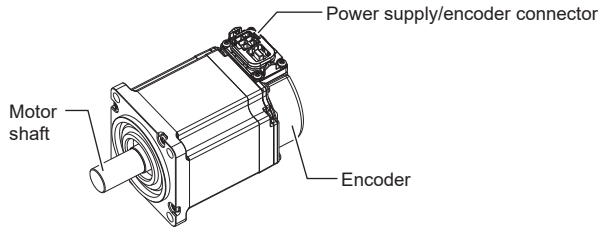
*2 Refer to the following for restrictions on using this product at an altitude exceeding 1000 m.

☞ Page 24 Restrictions when using this product at an altitude exceeding 1000 m and up to 2000 m (HG-KNS series/HG-SNS series)

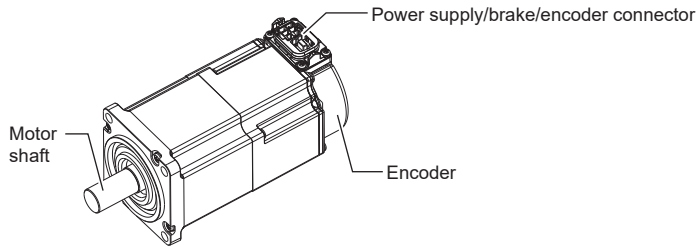
1.3 Parts identification

HK-KN series/HK-FN (0.1 kW - 0.75 kW) series

■Without an electromagnetic brake

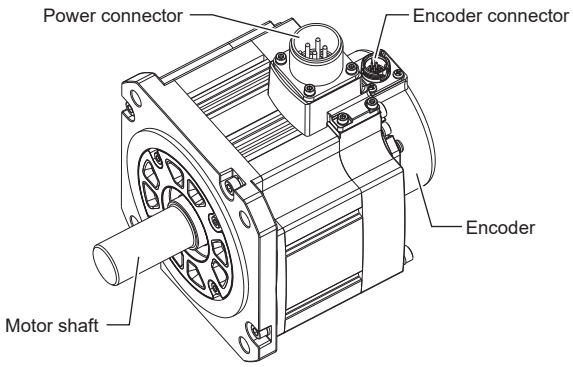


■With an electromagnetic brake

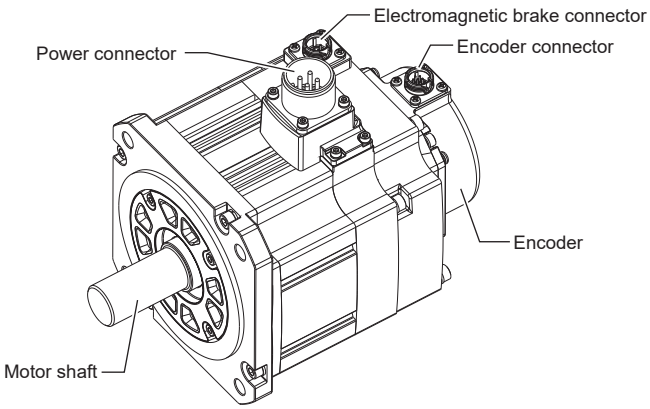


HK-FN (1.0 kW - 3.0 kW) series/HK-SN series

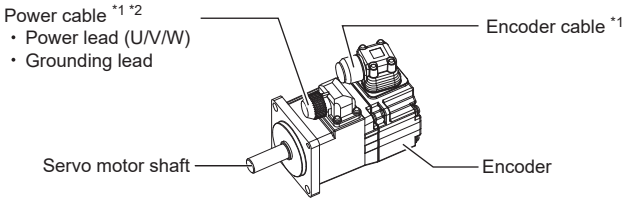
■Without an electromagnetic brake



■With an electromagnetic brake

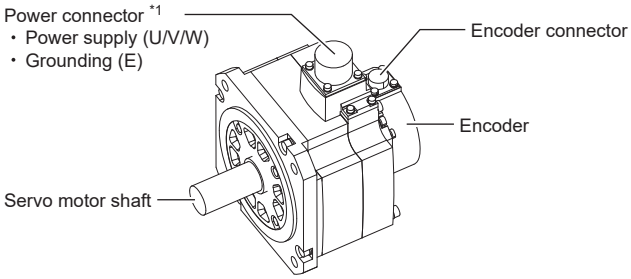


HG-KNS series



*1 The encoder cable and power supply cable are options.
*2 An electromagnetic brake cable is also required for servo motors with an electromagnetic brake.

HG-SNS series



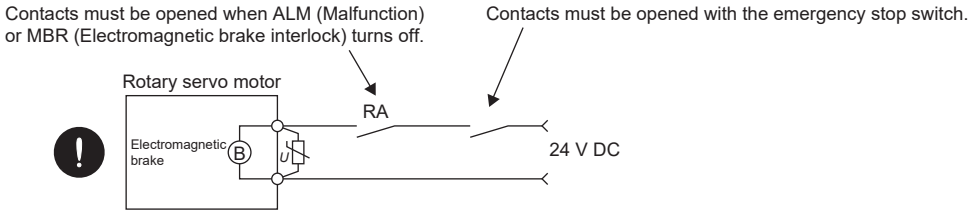
*1 An electromagnetic brake connector is also provided for servo motors with an electromagnetic brake.

1.4 Electromagnetic brake

The rotary servo motor with an electromagnetic brake can be used to prevent a drop in vertical lift applications or to ensure double safety at an emergency stop, for example. When operating the rotary servo motor, supply power to the electromagnetic brake to release the brake. Switching power off enables the electromagnetic brake.

Precautions

- The electromagnetic brake on the rotary servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- Incorrect wiring, service life, or the mechanical structure (e.g. where a ball screw and the rotary servo motor are coupled via a timing belt) may cause the electromagnetic brake to be unable to hold the motor shaft. To ensure safety, install a stopper on the machine side.
- If it is assumed that a power failure or product malfunction may result in a hazardous situation, use a rotary servo motor with an electromagnetic brake or provide an external brake system for holding purpose to prevent such hazard.
- Configure an electromagnetic brake circuit which is interlocked with an external emergency stop switch.



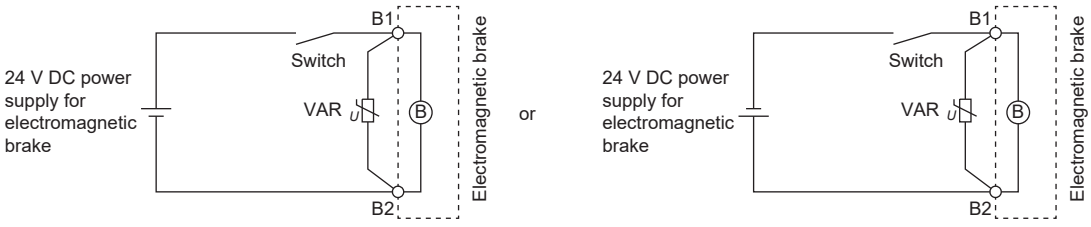
- The electromagnetic brake is provided to prevent a drop at a power failure or servo alarm occurrence during vertical drive or to hold a shaft at a stop. Do not use it for normal braking (including braking at servo-lock).
- The electromagnetic brake has a time lag. Ensure enough time between releasing the electromagnetic brake and starting the rotary servo motor. Check the release delay time with an actual machine.
- For details of the circuit configuration and timing chart, refer to the following.

MR-JET User's Manual (Hardware)

- When the electromagnetic brake is released, the temperature of the rotary servo motor may increase regardless of driving.
- The service life of the brake may be shortened under sudden acceleration/deceleration conditions.

Electromagnetic brake power supply

Prepare the following power supply for use with the electromagnetic brake only. The electromagnetic brake terminals (B1 and B2) have no polarity.



A surge absorber (VAR) must be installed between B1 and B2. For a selection example of surge absorbers, refer to the "Characteristics of electromagnetic brake" section appropriate for the rotary servo motor series being used.
When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.

Sound generation

The brake lining may rattle during a low-speed operation; however, it poses no functional problem.
The noise may be reduced or eliminated by the machine resonance suppression filter set with the servo amplifier parameters. For details, refer to "Machine resonance suppression filter" in the following manual.

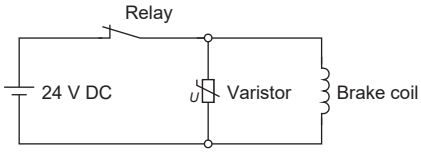
MR-JET User's Manual (Adjustment)

Selection of surge absorbers for electromagnetic brake circuit

The following shows an example of how to select a varistor as a surge absorber.

■Selection condition

Item	Condition
Electromagnetic brake specification	R [Ω]: Resistance L [H]: Inductance Vb [V]: Power supply voltage
Desired suppression voltage	Vs [V] or less
Durable surge application time	N times



■Tentative selection and verification of surge absorber

• Maximum permissible circuit voltage of varistor

Tentatively select a varistor whose maximum permissible voltage is larger than Vb [V].

• Brake current (Ib)

$$Ib = \frac{Vb}{R} \text{ [A]}$$

• Energy (E) generated by brake coil

$$E = \frac{L \times Ib^2}{2} \text{ [J]}$$

• Varistor limit voltage (Vi)

From the energy (E) generated in the brake coil and the varistor characteristic diagram, calculate the varistor limit voltage (Vi) when the brake current (Ib) flows into the tentatively selected varistor during opening of the circuit.

Vi is favorable when the varistor limit voltage (Vi) [V] is smaller than the desired suppressed voltage (Vs) [V].

If Vi is not smaller than Vs, reselect a varistor or improve the withstand voltage of devices.

• Surge current width (τ)

Given that the varistor absorbs all energies, the surge current width (τ) is as follows.

$$\tau = \frac{E}{Vi \times Ib} \text{ [S]}$$

• Examining surge life of varistor

From the varistor characteristic diagram, find the guaranteed current value (Ip) in which the number of the surge application life is N at the surge current width (τ). Calculate the guaranteed current value (Ip) ratio (Ip/Ib) to brake current (Ib).

If a sufficient margin is ensured for Ip/Ib, the number of the surge application life N [time] can be considered as favorable.

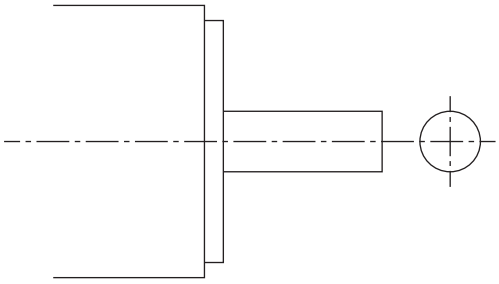
Other precautions

A leakage magnetic flux occurs at the shaft end of the servo motor with an electromagnetic brake. Note that chips, screws, and other debris are attracted.

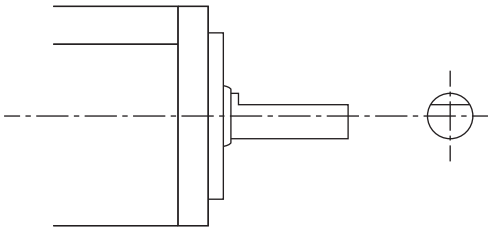
1.5 Rotary servo motor shaft shapes

Do not use shafts other than the straight shaft for frequent start/stop applications.
Use a friction coupling or the like when coupling the shaft with a machine.
There are five shaft shape types for the rotary servo motor: straight shaft, D-cut shaft, L-cut shaft, keyed shaft (without key), and keyed shaft (with double round-ended key). The keys are included as accessories and not attached to the shafts.

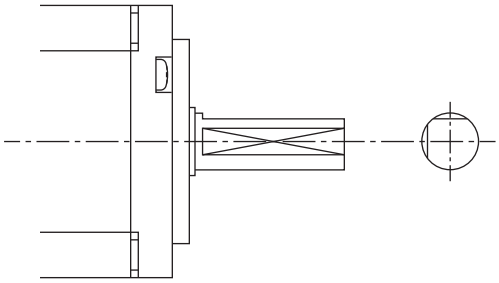
Straight shaft



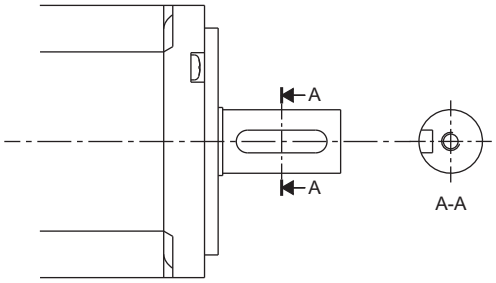
D cut shaft



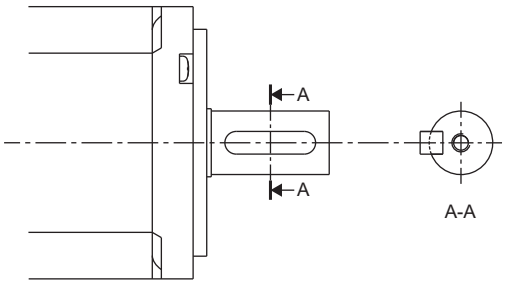
L cut shaft



Keyed shaft (without key)



Keyed shaft (with double round-ended key)



1.6 Instructions on storage

Precautions

Note the following when storing the rotary servo motor for an extended period of time (guideline: three or more months).

- Always store the linear servo motor indoors, in a clean and dry place.
- When storing in a dusty and humid area, take measures such as covering the whole product.
- If the insulation resistance of the winding decreases, check how to store the equipment.
- Although the servo motor has been given rust prevention treatment with paint and preventive oil before shipment, rust may still appear depending on the storage period and conditions. If the servo motor is to be stored for longer than six months, apply rust prevention oil again, especially to the machined surfaces of the shaft and other parts.
- Before using the product after storage for an extended period of time, hand-turn the rotary servo motor output shaft , and check to ensure that there is no abnormality. For the rotary servo motor with an electromagnetic brake, check it after releasing the electromagnetic brake with the brake power supply.
- When the product has been stored for an extended period of time, contact your local sales office.

1.7 Instructions on maintenance

Precautions

- To prevent the scuffed surface, do not scratch the coated surface with hard objects nor clean the coated surface with an organic solvent.
- For repair and parts replacement, contact your local sales office.

1.8 Instructions on protection

Precautions

- Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

2 INSTALLATION

Precautions

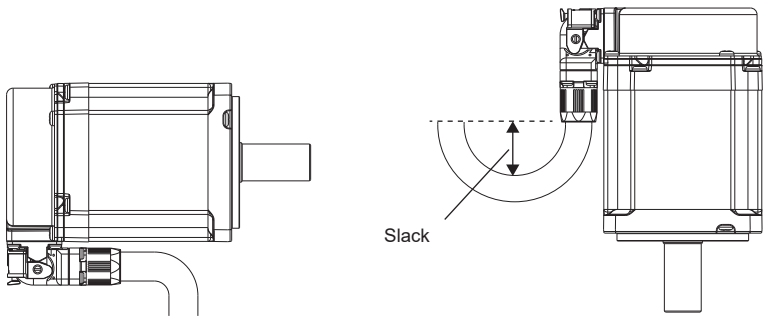
- Install the rotary servo motor on incombustible material. Installing them directly or close to combustibles will lead to smoke or a fire.
- Provide adequate protection so as to prevent conductive matter (such as screws and metal fragments) and combustible matter (such as oil) from entering the rotary servo motor.
- The temperature of the rotary servo motor may exceed 100 °C depending on the operating method. Take safety measures such as providing covers.
- The eyebolts of the rotary servo motor are only for transportation of the rotary servo motor.
- Do not use them to transport the rotary servo motor when it is mounted on a machine.
- Do not overtighten the eyebolts of the rotary servo motor. To prevent damage to the tap, avoid tightening too hard.
- Stacking in excess of the specified number of product packages is not allowed.
- Do not hold the cables, connectors, shaft, or encoder when carrying the rotary servo motor. Otherwise, it may drop.
- When installing the rotary servo motor, follow the user's manual and install the motor in a place that can support its weight.
- Do not install or operate the rotary servo motor which has been damaged or have any parts missing.
- Securely fix the rotary servo motor to a machine. If attached insecurely, the motor may come off during operation.
- To prevent a connection failure, malfunction, or similar problem, do not strike the connector.
- Be sure to measure the motor vibration level with the rotary servo motor mounted on a machine when checking the vibration level. A great vibration may cause early damage to a bearing, encoder, and brake. It may also cause the poor connector connection or bolt looseness.
- For the gain adjustment at the equipment startup, check the torque waveform and the speed waveform with a measurement device to check that no vibration occurs. If the vibration occurs due to high gain, the vibration may cause early damage to the rotary servo motor.
- Use the product within the specified environment. For the environment conditions, refer to the specifications of the rotary servo motor series.
- To prevent a malfunction on the encoder, do not apply shocks, e.g. hit with a hammer, when coupling the shaft end of the rotary drive motor.
- To prevent the shaft from being broken, do not subject the shaft of the rotary servo motor to more than the permissible load.
- To prevent the shaft from being broken and bearing from being worn out, do not use a rigid coupling when coupling a load to the rotary servo motor.
- To prevent vibration during rotary servo motor operation, or the cause of a damage to the bearings and encoder, the balance level of the load needs to be as even as possible.
- To prevent a malfunction, do not use the rotary servo motor where the shaft-through portion may be subject to pressure (e.g. compressed air).
- Take safety measures such as provide covers, to prevent accidental access to the rotor of the rotary servo motor during operation.
- Do not get on or put heavy load on the equipment.
- Do not drop or strike the rotary servo motor.
- To prevent a fire or injury from occurring in case of an earthquake or other natural disasters, securely install, mount, and wire the linear servo motor in accordance with the user's manual.
- To prevent an electric shock or a fire, do not disassemble, repair, or modify the product. Disassembled, repaired, and/or modified products are not covered under warranty.
- The equipment must be installed in the specified direction.
- Do not use the product in environments where it is exposed to strong magnetic fields, electric fields, or radiation.

2.1 Mounting direction

The mounting direction of the rotary servo motor is shown in the following table.

Rotary servo motor series	Mounting direction
HK-KN HK-FN HK-SN HG-KNS HG-SNS	All directions

It is recommended that the connector section be set downward for mounting the rotary servo motor in the horizontal direction. Examine the cable clamping method, and give a gentle slack to the connection cable, to prevent excessive load from being applied to the connector and cable connection part.

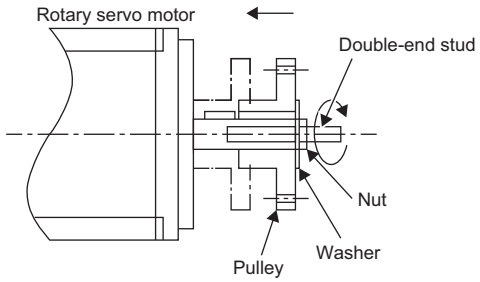


Rotary servo motor with an electromagnetic brake

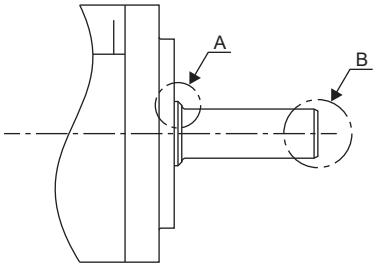
The rotary servo motor with an electromagnetic brake can also be mounted in the same directions as the one without an electromagnetic brake. When the servo motor with an electromagnetic brake is mounted with the shaft end upward, the brake plate may generate sliding sound but it is not a fault.

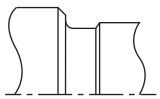
2.2 Load mounting/dismounting precautions

- When mounting a pulley to the rotary servo motor with a keyed shaft, use the screw hole in the shaft end. To fit the pulley, first insert a double-end bolt into the screw hole of the shaft, put a washer against the end face of the coupling, and insert and tighten a nut to force the pulley in.

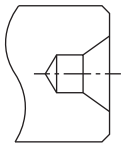


- For shafts without a keyway, use a friction coupling or the like for coupling the rotary servo motor with a load.
- When removing the pulley, use a pulley remover to protect the shaft from excessive load and impact.
- To ensure safety, fit a protective cover or the like on the rotary area, such as the pulley, mounted to the shaft.
- When a threaded shaft end part is needed to mount a pulley on the shaft, please contact your local sales office.
- The direction of the encoder on the rotary servo motor cannot be changed.
- When mounting the rotary servo motor, use spring washers or similar parts and fully tighten the bolts so that they do not become loose due to vibration.
- The part A of the shaft has a grinding clearance shaped as shown in the detailed figure of the part A, and the part B of the shaft has the center hole shaped as shown in the detailed figure of the part B. As these dimensions vary widely depending on the products and cannot be guaranteed, do not use the dimensions for positioning pulleys or washers. In addition, approximately C0.4 of the shaft edge is trimmed off (the dimensions may vary depending on the products).





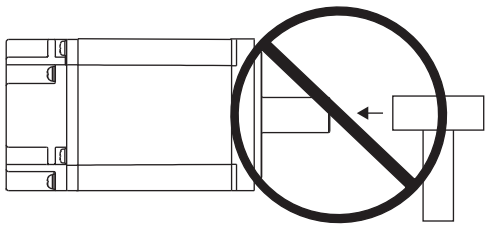
Detailed figure of part A
Clearance shape



Detailed figure of part B
Center hole shape

Precautions

- To prevent a malfunction on the encoder, the shaft end must not be hammered during assembling.



- Do not process the shaft to avoid damage to the encoder and bearing.

2.3 Permissible load for the shaft

For the permissible load for the shaft specific to the rotary servo motor, refer to the chapter of the rotary servo motor series.

- Use a flexible coupling and adjust the misalignment of the shaft to less than the permissible radial load.
- When using a pulley, sprocket, or timing belt, keep the radial load within the permissible value.
- Exceeding the permissible load can cause deterioration of the bearing and damage to the shaft.
- The load indicated in this section is static load in a single direction and does not include eccentric load. To prevent the rotary servo motor being damaged, make eccentric load as small as possible.

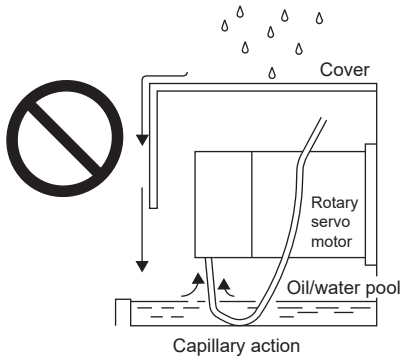
Precautions

Do not use a rigid coupling as it may apply excessive bending load to the shaft of the rotary servo motor, leading the shaft to break and the bearing to wear out.

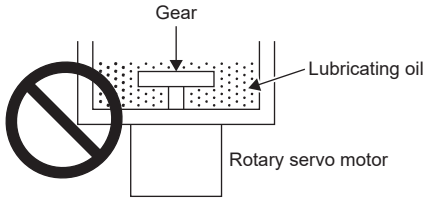
2.4 Protection from oil and water

Provide adequate protection to prevent foreign matter, such as oil from entering the rotary servo motor shaft. When installing the rotary servo motor, consider the items in this section.

- Do not use the rotary servo motor with its cable soaked in oil or water.



- When the servo motor is to be installed with the shaft end upward, provide measures so that it is not exposed to oil and water entering from the machine side, gear box, etc.



- If oil such as cutting oil splashes on the servo motor, the sealant, packing, cable, and other parts may be affected depending on the oil type.
- In the environment where the rotary servo motor is exposed to oil mist, oil, or water, the rotary servo motor of the standard specifications may not be usable. Please contact your local sales office.

2.5 Cable

The power supply and encoder cables routed from the rotary servo motor should be fixed to the rotary servo motor to keep them unmovable. Otherwise, the cable may be disconnected. In addition, do not modify the connectors, terminals, and other areas at the ends of the cables.

Precautions

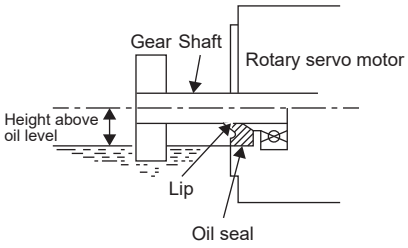
The cables should not be damaged, stressed, loaded, or pinched.

2.6 Rotary servo motors with an oil seal

For rotary servo motors with an oil seal, the oil seal prevents the entry of oil into the rotary servo motor. Make sure to install it in accordance with this section.
Even if the oil seal on the rotary servo motor makes noises during operation, it does not indicate a problem with the functions.

Pressure and oil level

Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip. If the oil level is higher than the oil seal lip, the oil enters the rotary servo motor and may cause a malfunction. Refer to the chapter of the rotary servo motor series for the height above oil level.



High pressure against the oil seal causes abrasion and shortens the service life of the product. Keep constant internal pressure by equipping a ventilator to the gear box.

Temperature

If the lip reaches a high temperature, the service life of the oil seal will be shortened. Maximum applicable temperature of material of the oil lip is 100 °C, and the temperature of the oil lip increases by 10 °C to 15 °C at maximum rotation. Keep high-temperature oil away from the oil lip.

2.7 Inspection items

- To prevent a malfunction, do not perform an insulation resistance test (megger test) on the rotary servo motor.
- Do not disassemble and/or repair the equipment on customer side.

Periodic inspection

Perform the following inspections.

- Check the bearings, brake section, and the like for unusual noise.
- Check the cables and the like for scratches or cracks.
- Check the rotary servo motor shaft and coupling for misalignment.
- Check the power connector and encoder connector for looseness.

2.8 Parts with a service life

The service life of the following parts is listed below. If any fault is found in a part, replace it immediately because its service life varies depending on the operating methods and environment. For parts replacement, please contact your local sales office.

Part name	Recommended service life
Bearings	20000 hours to 30000 hours
Encoder	20000 hours to 30000 hours
Oil seal	5000 hours

Bearings

When the motor is run at rated speed and at rated load, bearings should be changed in 20000 to 30000 hours as a guideline. As this differs depending on the operating conditions, the bearings must also be changed if unusual noise or vibration occurs during inspection.

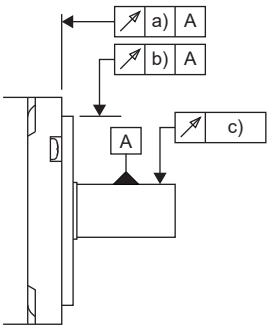
Oil seal

Oil seals must be changed in 5000 hours of operation at rated speed as a guideline. This differs depending on the operating conditions. The oil seals must also be changed if oil leakage a similar problem is found during inspection. Even if the oil seal on the rotary servo motor makes noises during operation, it does not indicate a problem with the functions.

2.9 Machine accuracy

The following table shows the machine accuracy of the output shaft and mounting parts of the rotary servo motor.

Accuracy [mm]	Measuring position	Flange size		
		□Less than 100	□130	□176
Runout of flange surface to output shaft	a)	0.05	0.06	0.08
Runout of fitting OD of flange surface	b)	0.04	0.04	0.06
Runout of output shaft end	c)	0.02	0.02	0.03



2.10 Mounting rotary servo motors

Be sure to use the rotary servo motor within the specified environment, and mount the rotary servo motor on a machine having the equivalent heat dissipation effect as the following aluminum flange.

The temperature of the rotary servo motor increases differently depending on its mounting environment, operating conditions, and other factors. Check the temperature with an actual machine.

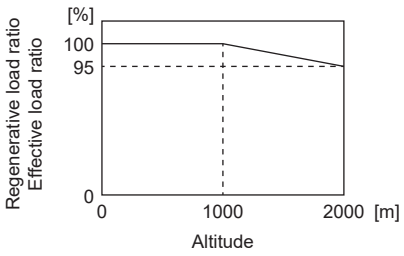
Flange size [mm]	Rotary servo motor					
	HK-KN (200 V)	HK-FN (200 V)	HK-KN (400 V)	HK-SN (400 V)	HG-KNS (200 V)	HG-SNS (200 V)
250 × 250 × 6	053 13 1M3 23	13 23	134 234	—	13J 23J	—
250 × 250 × 12	43	43	434	—	43J	52J 102J 152J
300 × 300 × 12	63 7M3 103	7M3 102 152	634 7M34 1034	—	73J	—
300 × 300 × 20	153 203 202	202	1534 2034	—	—	202J 302J
550 × 550 × 30	—	301M	—	3534 5034	—	—
650 × 650 × 35	—	—	—	7034	—	—

2.11 Restrictions when using this product at an altitude exceeding 1000 m and up to 2000 m (HG-KNS series/HG-SNS series)

As heat dissipation effects decrease in proportion to decreasing air density, use the product within the effective load ratio and regenerative load ratio shown in the following figure.

For restrictions on the HK-KN series and HK-FN series, refer to the following.

☞ Page 133 Derating
☞ Page 155 Derating



3 CONNECTORS USED FOR ROTARY SERVO MOTOR WIRING

Precautions

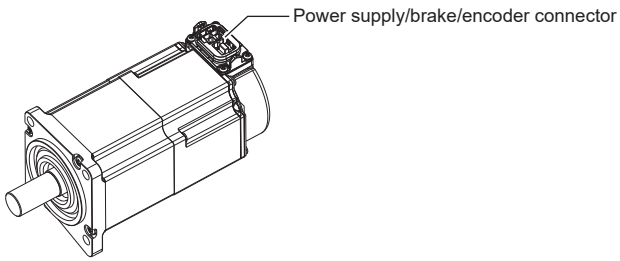
- The indicated IP rating is the connector's protection against ingress of dust and water when the connector is connected to a rotary servo motor. If the IP rating of the connector and rotary servo motor varies, the overall IP rating depends on the lowest IP rating of all components.
- If the fitting part of the connector has a flaw or an excessive load (including a temporary load at installation or other situations) is applied to the connector and cable clamp, the performance of the connector IP rating may not be satisfied.
- The fitting warranty is applied only to the option cables and the connectors manufactured by the manufacturers introduced in this manual.

3.1 Selection of connectors

Use the connector configuration products given in the table as the connectors for connection with the rotary servo motor. Refer to the following for the compatible connector configuration products.

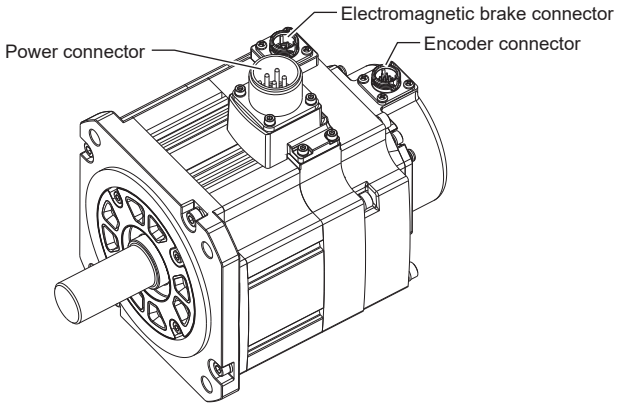
☞ Page 27 Wiring connectors (connector configurations A/B/C)
☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)
☞ Page 33 Wiring connectors (connector configuration H)

HK-KN series/HK-FN (0.1 kW - 0.75 kW) series



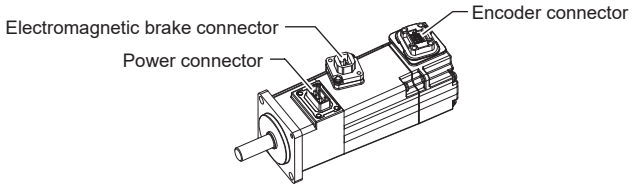
Rotary servo motor	Wiring connector		
	For encoder	For electromagnetic brake	For power supply
HK-KN_	Connector configuration H		
HK-FN13 HK-FN23 HK-FN43 HK-FN7M3			

HK-FN (1.0 kW - 3.0 kW) series/HK-SN series



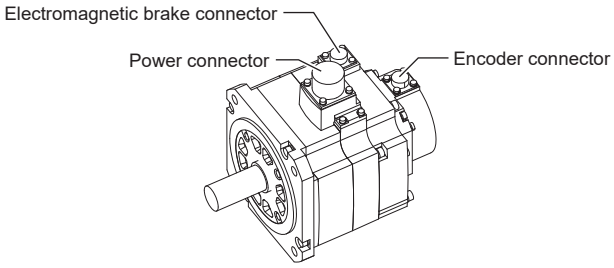
Rotary servo motor	Wiring connector		
	For encoder	For electromagnetic brake	For power supply
HK-FN102 HK-FN152 HK-SN3534 HK-SN5034	Connector configuration D	Connector configuration F	Connector configuration I
HK-FN202 HK-FN301M HK-SN7034			Connector configuration J

HG-KNS series



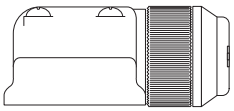
Rotary servo motor	Wiring connector		
	For encoder	For electromagnetic brake	For power supply
HG-KNS_J	Connector configuration A	Connector configuration C	Connector configuration B

HG-SNS series



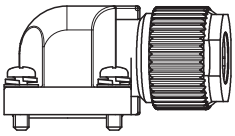
Rotary servo motor	Wiring connector		
	For encoder	For electromagnetic brake	For power supply
HG-SNS52J HG-SNS102J HG-SNS152J	Connector configuration D	Connector configuration F	Connector configuration E
HG-SNS202J HG-SNS302J			Connector configuration G

3.2 Wiring connectors (connector configurations A/B/C)



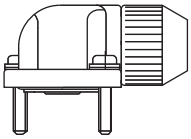
Connector configuration	Feature	Connector	Crimping tool	Rotary servo motor encoder connector *1
A	IP65	Connector: 2174053-1 (TE Connectivity)	For ground clip: 1596970-1 For receptacle contact: 1596847-1 (TE Connectivity)	1674339-1 (TE Connectivity)

*1 The connector to be mated.



Connector configuration	Feature	Connector	Crimping tool	Rotary servo motor power connector *1
B	IP65	Connector: KN4FT04SJ1-R Hood/socket insulator/bushing/ground nut Contact: ST-TMH-S-C1B-100(A534G) (JAE)	CT170-14-TMH5B (JAE)	JN4AT04NJ1 (JAE)

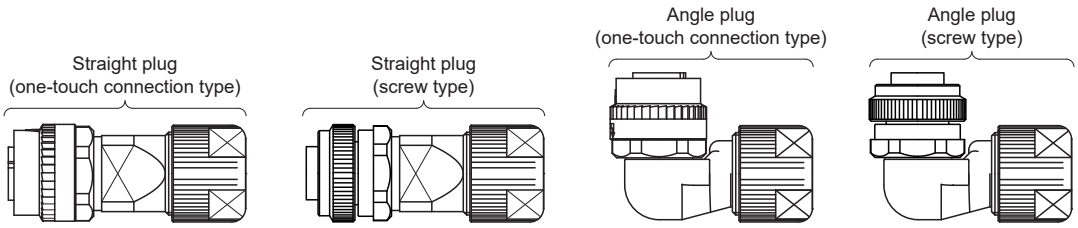
*1 The connector to be mated.



Connector configuration	Feature	Connector	Crimping tool	Rotary servo motor electromagnetic brake connector *1
C	IP65	Connector: JN4FT02SJ1-R Hood/socket insulator/bushing/ground nut Contact: ST-TMH-S-C1B-100(A534G) (JAE)	CT170-14-TMH5B (JAE)	JN4AT02PJ1 (JAE)

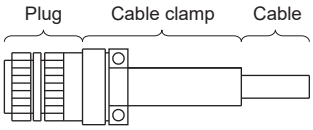
*1 The connector to be mated.

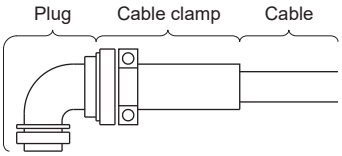
3.3 Wiring connectors (connector configurations D/E/F/G/I/J)



Connector configuration	Feature	Plug (DDK)					Rotary servo motor encoder connector*1
		Type	Plug	Socket contact	Contact shape	Cable OD [mm] (reference)	
D	IP67	Straight	CMV1-SP10S-M1 (One-touch connection type) CMV1S-SP10S-M1 (Screw type)	CMV1-#22 ASC-S1-100	Solder type Applicable wire size: AWG 20 or less	5.5 to 7.5	CMV1-R10P
				CMV1-#22 ASC-C1-100	Crimping type Applicable wire size: AWG 24 to 20 The crimping tool (357J-53162T) is required.		
				CMV1-#22 ASC-C2-100	Crimping type Applicable wire size: AWG 28 to 24 The crimping tool (357J-53163T) is required.		
			CMV1-SP10S-M2 (One-touch connection type) CMV1S-SP10S-M2 (Screw type)	CMV1-#22 ASC-S1-100	Solder type Applicable wire size: AWG 20 or less	7.0 to 9.0	
				CMV1-#22 ASC-C1-100	Crimping type Applicable wire size: AWG 24 to 20 The crimping tool (357J-53162T) is required.		
				CMV1-#22 ASC-C2-100	Crimping type Applicable wire size: AWG 28 to 24 The crimping tool (357J-53163T) is required.		
		Angle	CMV1-AP10S-M1 (One-touch connection type) CMV1S-AP10S-M1 (Screw type)	CMV1-#22 ASC-S1-100	Solder type Applicable wire size: AWG 20 or less	5.5 to 7.5	
				CMV1-#22 ASC-C1-100	Crimping type Applicable wire size: AWG 24 to 20 The crimping tool (357J-53162T) is required.		
				CMV1-#22 ASC-C2-100	Crimping type Applicable wire size: AWG 28 to 24 The crimping tool (357J-53163T) is required.		
			CMV1-AP10S-M2 (One-touch connection type) CMV1S-AP10S-M2 (Screw type)	CMV1-#22 ASC-S1-100	Solder type Applicable wire size: AWG 20 or less	7.0 to 9.0	
				CMV1-#22 ASC-C1-100	Crimping type Applicable wire size: AWG 24 to 20 The crimping tool (357J-53162T) is required.		
				CMV1-#22 ASC-C2-100	Crimping type Applicable wire size: AWG 28 to 24 The crimping tool (357J-53163T) is required.		

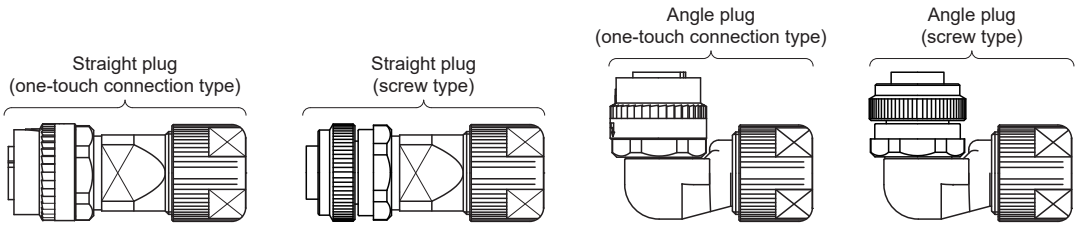
*1 The connector to be mated.





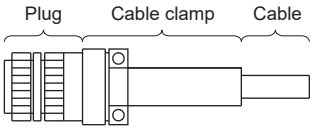
Connector configuration	Feature	Plug (DDK)		Cable clamp (DDK)		Rotary servo motor power connector *2
		Type	Model	Cable OD [mm] (reference)	Model	
E	IP67 EN compliant	Straight	CE05-6A18-10SD-D-BSS Applicable wire size: AWG 14 to 12	8.5 to 11	CE3057-10A-2-D	MS3102A18-10P
				10.5 to 14.1	CE3057-10A-1-D	
		Angle	CE05-8A18-10SD-D-BAS Applicable wire size: AWG 14 to 12	8.5 to 11	CE3057-10A-2-D	
				10.5 to 14.1	CE3057-10A-1-D	
	General environment *1	Straight	D/MS3106B18-10S Applicable wire size: AWG 14 to 12	14.3 or less (Bushing ID)	D/MS3057-10A	
		Angle	D/MS3108B18-10S Applicable wire size: AWG 14 to 12			

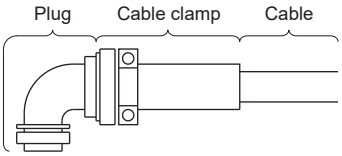
*1 Does not comply with EN.
*2 The connector to be mated.



Connector configuration	Feature	Plug (DDK)					Rotary servo motor electromagnetic brake connector*1
		Type	Plug	Socket contact	Contact shape	Cable OD [mm] (reference)	
F	IP67	Straight	CMV1-SP2S-S (One-touch connection type) CMV1S-SP2S-S (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	4.0 to 6.0	CMV1-R2P
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
			CMV1-SP2S-M1 (One-touch connection type) CMV1S-SP2S-M1 (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	5.5 to 7.5	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
			CMV1-SP2S-M2 (One-touch connection type) CMV1S-SP2S-M2 (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	7.0 to 9.0	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
			CMV1-SP2S-L (One-touch connection type) CMV1S-SP2S-L (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	9.0 to 11.6	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
		Angle	CMV1-AP2S-S (One-touch connection type) CMV1S-AP2S-S (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	4.0 to 6.0	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
			CMV1-AP2S-M1 (One-touch connection type) CMV1S-AP2S-M1 (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	5.5 to 7.5	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
			CMV1-AP2S-M2 (One-touch connection type) CMV1S-AP2S-M2 (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	7.0 to 9.0	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		
			CMV1-AP2S-L (One-touch connection type) CMV1S-AP2S-L (Screw type)	CMV1-# 22BSC-S2-100	Solder type Applicable wire size: AWG 16 or less	9.0 to 11.6	
				CMV1-# 22BSC-C3-100	Crimping type Applicable wire size: AWG 20 to 16 The crimping tool (357J-53164T) is required.		

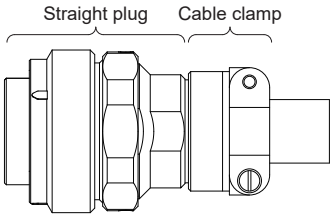
*1 The connector to be mated.

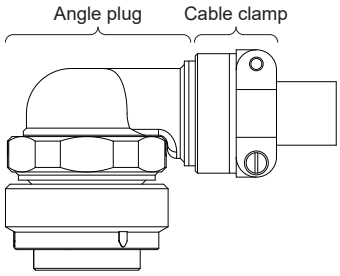




Connector configuration	Feature	Plug (DDK)		Cable clamp (DDK)		Rotary servo motor power connector *2
		Type	Model	Cable OD [mm] (reference)	Model	
G	IP67 EN compliant	Straight	CE05-6A22-22SD-D-BSS Applicable wire size: AWG 10 to 8	9.5 to 13	CE3057-12A-2-D	MS3102A22-22P
				12.5 to 16	CE3057-12A-1-D	
		Angle	CE05-8A22-22SD-D-BAS Applicable wire size: AWG 10 to 8	9.5 to 13	CE3057-12A-2-D	
				12.5 to 16	CE3057-12A-1-D	
	General environment *1	Straight	D/MS3106B22-22S Applicable wire size: AWG 10 to 8	15.9 or less (Bushing ID)	D/MS3057-12A	
		Angle	D/MS3108B22-22S Applicable wire size: AWG 10 to 8			

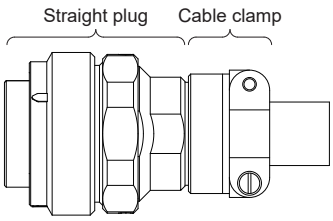
*1 Does not comply with EN.
*2 The connector to be mated.

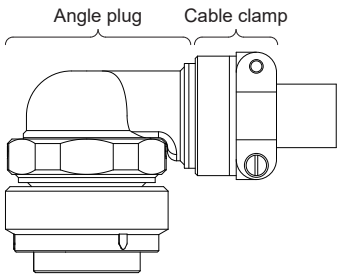




Connector configuration	Feature	Plug (JAE)		Cable clamp (JAE)		Rotary servo motor-side connector *2
		Type	Connector	Model *1	Cable OD [mm] (reference)	
I	IP67 EN compliant	One-touch connection type Straight	JL10-6A18-10SE-EB Applicable wire size: 3.5 mm^2 (AWG 12) or less	JL04-18CK(10)-_-R	8 to 11	JL10-2E18-10PCE
				JL04-18CK(13)-_-R	11 to 14.1	
		One-touch connection type Angle	JL10-8A18-10SE-EB Applicable wire size: 3.5 mm^2 (AWG 12) or less	JL04-18CK(10)-_-R	8 to 11	
				JL04-18CK(13)-_-R	11 to 14.1	
		Screw type Straight	JL04V-6A18-10SE-EB-R Applicable wire size: 3.5 mm^2 (AWG 12) or less	JL04-18CK(10)-_-R	8 to 11	
				JL04-18CK(13)-_-R	11 to 14.1	
		Screw type Angle	JL04V-8A18-10SE-EBH-R Applicable wire size: 3.5 mm^2 (AWG 12) or less	JL04-18CK(10)-_-R	8 to 11	
				JL04-18CK(13)-_-R	11 to 14.1	

*1 "_" in the model names are replaced with the following symbols which designate the materials of the rubber bushing for the cable clamps:
Blank: nitrile rubber
CR: chloroprene rubber
EPDM: terpolymer rubber of ethylene, propylene, and dimethylene
*2 The connector to be mated.





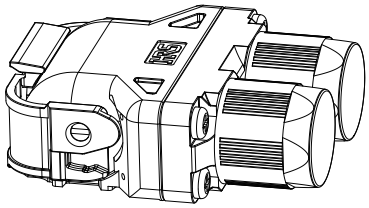
Connector configuration	Feature	Plug (JAE)		Cable clamp (JAE)		Rotary servo motor-side connector *2
		Type	Connector	Model *1	Cable OD [mm] (reference)	
J	IP67 EN compliant	One-touch connection type Straight	JL10-6A22-22SE-EB Applicable wire size: 8 mm^2 (AWG 8) or less	JL04-2022CK(12)-_-R	9.5 to 13	JL10-2E22-22PCE
				JL04-2022CK(14)-_-R	12.9 to 16	
		One-touch connection type Angle	JL10-8A22-22SE-EB Applicable wire size: 8 mm^2 (AWG 8) or less	JL04-2022CK(12)-_-R	9.5 to 13	
				JL04-2022CK(14)-_-R	12.9 to 16	
		Screw type Straight	JL04V-6A22-22SE-EB-R Applicable wire size: 8 mm^2 (AWG 8) or less	JL04-2022CK(12)-_-R	9.5 to 13	
				JL04-2022CK(14)-_-R	12.9 to 16	
		Screw type Angle	JL04V-8A22-22SE-EBH-R Applicable wire size: 8 mm^2 (AWG 8) or less	JL04-2022CK(12)-_-R	9.5 to 13	
				JL04-2022CK(14)-_-R	12.9 to 16	

*1 "_" in the model names are replaced with the following symbols which designate the materials of the rubber bushing for the cable clamps:
Blank: nitrile rubber
CR: chloroprene rubber
EPDM: terpolymer rubber of ethylene, propylene, and dimethylene

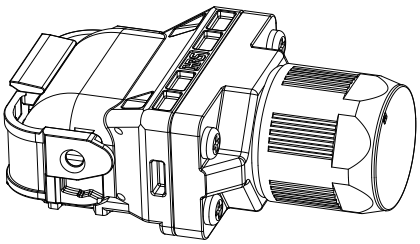
*2 The connector to be mated.

3.4 Wiring connectors (connector configuration H)

Load-side lead/opposite to load-side lead



Two cable type

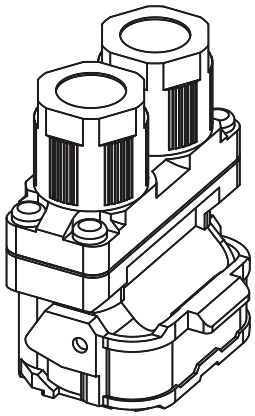


One cable type

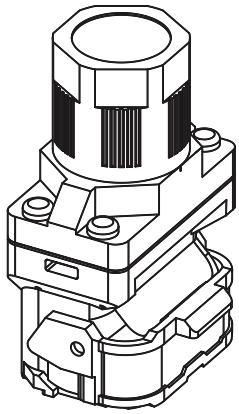
Connector configuration	Feature	Plug (Hirose Electric)				Rotary servo motor-side connector *1
		Type	Connector	Contact	Applicable cable OD	
H	IP67	Dual cable	MT50W-8D/2D4ES-CVLD(7.5)	(1) For power supply Contact model: MT50E-1820SCFA Applicable wire size: AWG 20 to 18 Crimping tool: HT802/MT50E-1820S (2) For electromagnetic brake/encoder Contact model: MT50D-2224SCFA Applicable wire size: AWG 24 to 22 Crimping tool: HT802/MT50D-2224S	φ7.5 ± 0.3	MT50W-8D/2D3E-PE-FL
		Single cable	MT50W-8D/2D4ES-CVL(11.9)		φ11.9 ± 0.3	

*1 The connector to be mated.

Vertical lead



Two cable type



One cable type

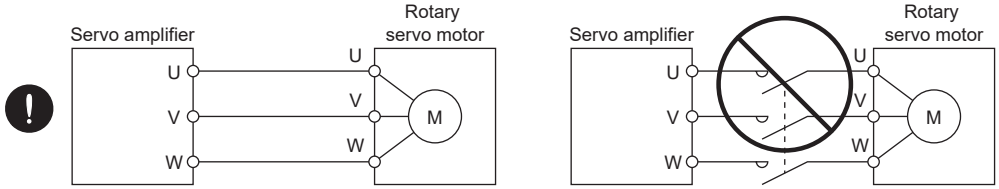
Connector configuration	Feature	Plug (Hirose Electric)				Rotary servo motor-side connector *1
		Type	Connector	Contact	Applicable cable OD	
H	IP67	Dual cable	MT50W-8D/2D4ES-CVSD(7.5)	(1) For power supply Contact model: MT50E-1820SCFA Applicable wire size: AWG 20 to 18 Crimping tool: HT802/MT50E-1820S (2) For electromagnetic brake/encoder Contact model: MT50D-2224SCFA Applicable wire size: AWG 24 to 22 Crimping tool: HT802/MT50D-2224S	φ7.5 ± 0.3	MT50W-8D/2D3E-PE-FL
		Single cable	MT50W-8D/2D4ES-CVS(11.9)		φ11.9 ± 0.3	

*1 The connector to be mated.

4 CONNECTION OF SERVO AMPLIFIER AND ROTARY SERVO MOTOR

Precautions

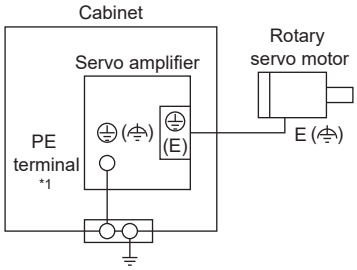
- Insulate the conductive parts of the terminals.
- To prevent unexpected operation of the rotary servo motor, wire the equipment correctly and securely.
- Make sure to connect the cables and connectors by using the fixing screws and the locking mechanism. Otherwise, the cables and connectors may be disconnected during operation.
- To prevent abnormal operation and malfunction, connect the servo amplifier power output (U/V/W) to the rotary servo motor power input (U/V/W) directly. Do not connect a magnetic contactor or the like between the servo amplifier power output and the rotary servo motor power input.



- To prevent a malfunction, do not connect AC power supply directly to the rotary servo motor.
- When the wires are not tightened enough to the terminal block, the wires or terminal block may generate heat because of the poor contact. Be sure to tighten the wires with specified torque.
- Use the rotary servo motor with the specified servo amplifier.
- Do not modify the equipment.
- To prevent malfunction, eliminate static electricity before wiring, switch operation, or similar operations.
- To prevent failure and malfunction, only the power/signal specified in the user's manual should be connected to each terminal.
- We recommend using HIV wires to connect the servo amplifier to the rotary servo motor. Therefore, the recommended wire sizes may be different from those of the wires used for previous generation rotary servo motors.

4.1 Precautions for wiring

For grounding, connect the grounding lead wire from the servo motor to the protective earth (PE) terminal of the servo amplifier, and then connect the wire from the servo amplifier to the ground via the protective earth of the cabinet. Do not connect the wire directly to the protective earth (PE) terminal of the cabinet.



*1 The number of PE terminals of the servo amplifier differs depending on the servo amplifier.

Precautions

- Do not install a power capacitor, surge killer, or radio noise filter (optional FR-BIF) on the servo amplifier output side.
- To avoid a malfunction, connect the wires to the correct phase terminals (U/V/W) of the servo amplifier and the rotary servo motor.
- Do not use the 24 V DC interface power supply for the electromagnetic brake. To prevent malfunction, use the power supply designed exclusively for the electromagnetic brake.
- Refer to the following for the selection of encoder cables.

☞ Page 52 WIRING OPTION (HK-KN SERIES/HK-FN SERIES/HK-SN SERIES)
☞ Page 96 WIRING OPTION (HG-KNS SERIES/HG-SNS SERIES)

- Refer to the chapter of the rotary servo motor series for the selection of a surge absorber for the electromagnetic brake.

4.2 Wiring

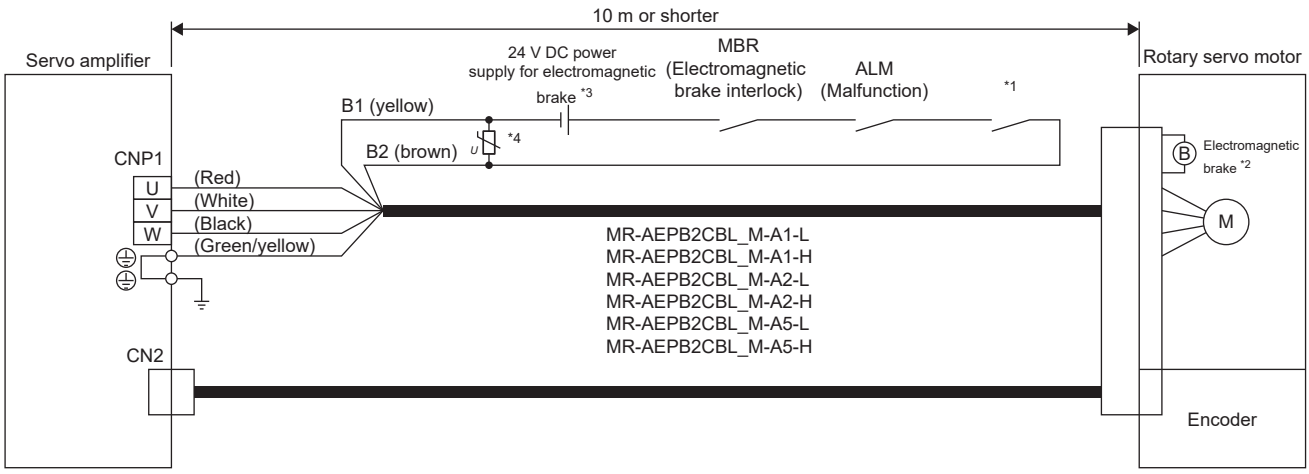
To wire to the servo amplifier, use connectors packed with the servo amplifier or optional connectors. For connectors, refer to "Wiring CNP1" in the following manual.

MR-JET User's Manual (Hardware)

HK-KN series/HK-FN (0.1 kW - 0.75 kW) series

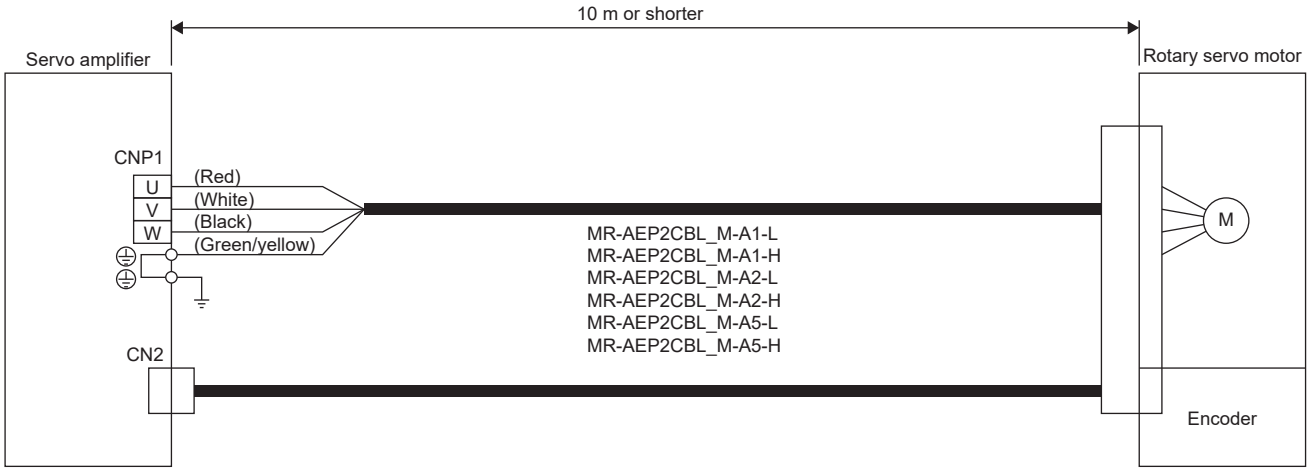
Cable type	Cable length	Electromagnetic brake cable	IP rating with extension cable	Connection diagram
Dual cable	10 m or less	○	—	Connection diagram 1
		×	—	Connection diagram 2
	Longer than 10 m	○	IP20	Connection diagram 3
			IP65	Connection diagram 4
		×	IP20	Connection diagram 5
			IP65	Connection diagram 6
Single cable	10 m or less	○	—	Connection diagram 7
		×	—	Connection diagram 8

Connection diagram 1



*1 Configure a circuit which shuts off by being interlocked with the emergency stop switch.
*2 The electromagnetic brake terminals (B1 and B2) have no polarity.
*3 Do not use the 24 V DC interface power supply for the electromagnetic brake.
*4 Connect a surge absorber as close to the rotary servo motor as possible.

Connection diagram 2

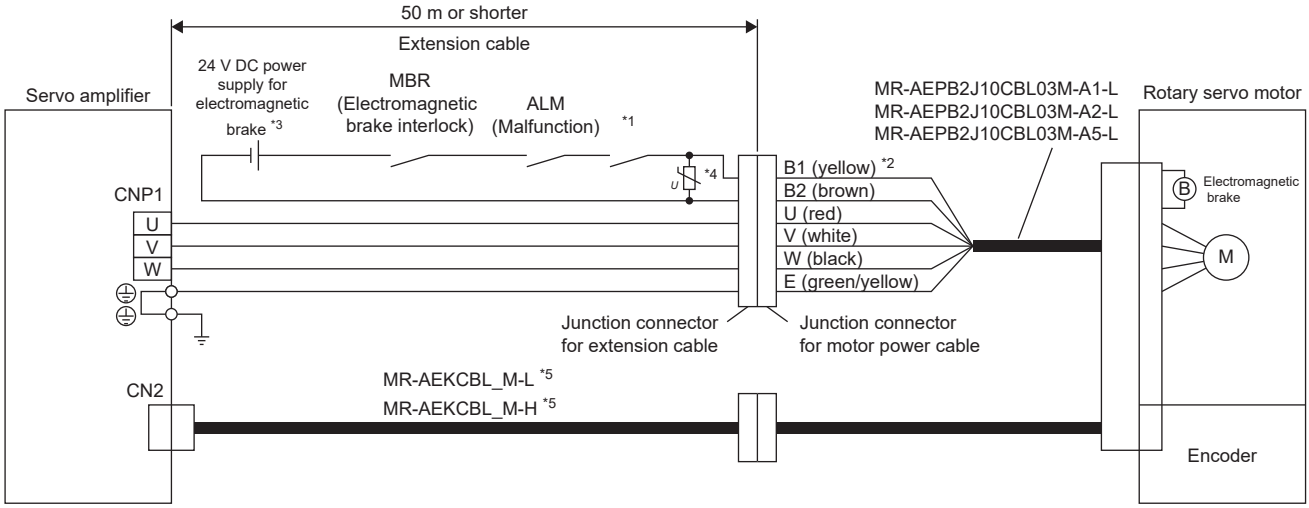


Connection diagram 3

Fabricate an extension cable as shown below.

Refer to the following for the wires used for the extension cable.

☞ Page 49 Selection example of wires



*1 Configure a circuit which shuts off by being interlocked with the emergency stop switch.

*2 The electromagnetic brake terminals (B1 and B2) have no polarity.

*3 Do not use the 24 V DC interface power supply for the electromagnetic brake.

*4 Connect a surge absorber as close to the rotary servo motor as possible.

*5 For MR-AEKCBL_M-_, refer to the following.

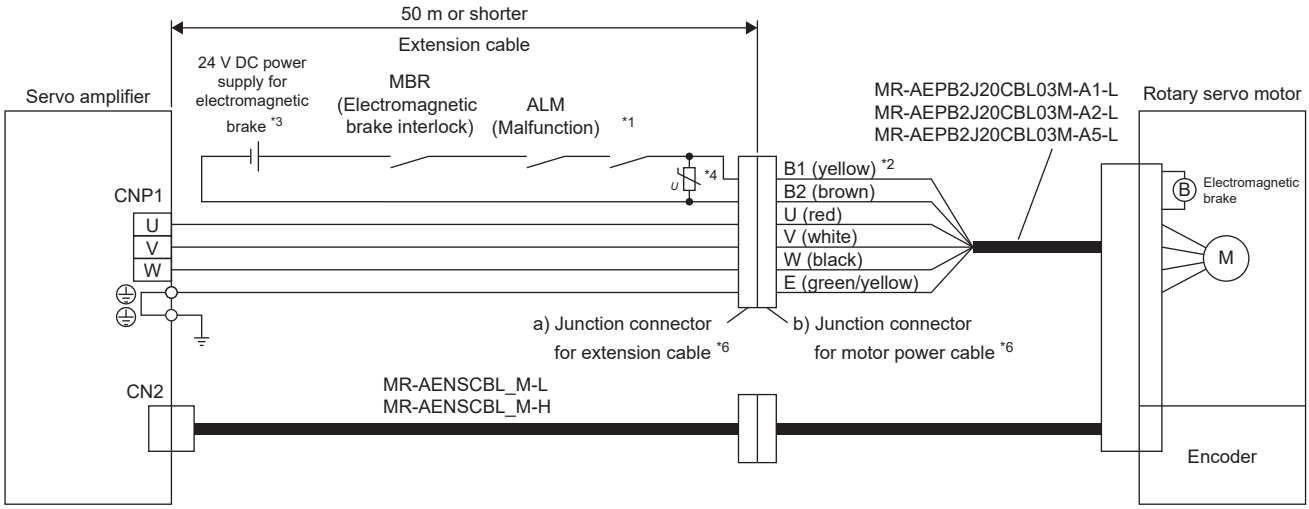
☞ Page 74 MR-AEKCBL_M-_

Connection diagram 4

Fabricate an extension cable as shown below.

Refer to the following for the wires used for the extension cable.

☞ Page 49 Selection example of wires



*1 Configure a circuit which shuts off by being interlocked with the emergency stop switch.

*2 The electromagnetic brake terminals (B1 and B2) have no polarity.

*3 Do not use the 24 V DC interface power supply for the electromagnetic brake.

*4 Connect a surge absorber as close to the rotary servo motor as possible.

*5 For MR-AENSCBL_M-_, refer to the following.

☞ Page 77 MR-AENSCBL_M-_

*6 Use of the following connectors is recommended:

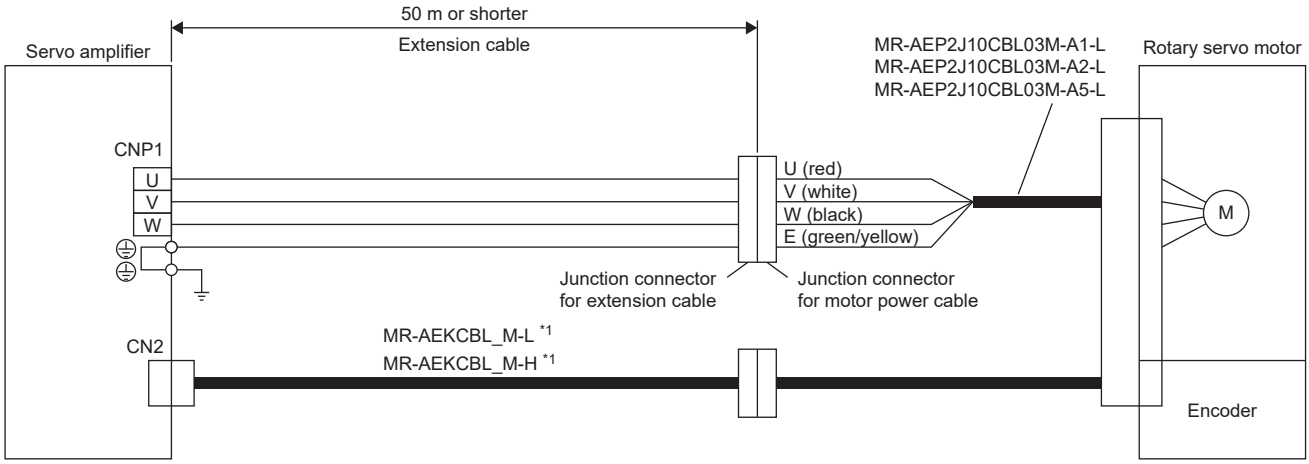
Junction connector	Description	IP rating
a) Junction connector for extension cable	Connector: CE05-6A22-23SD-D-BSS Cord clamp: CE3057-12A-2-D (DDK Ltd.) └── The number varies depending on the cable OD.	IP67
b) Junction connector for motor power cable	Connector: D/MS3101A22-23P(D263) Backshell: CE02-22BS-S-D Cord clamp: CE3057-12A-3-D (DDK Ltd.) └── The number varies depending on the cable OD.	IP67

Connection diagram 5

Fabricate an extension cable as shown below.

Refer to the following for the wires used for the extension cable.

☞ Page 49 Selection example of wires



*1 For MR-AEKCBL_M-_, refer to the following.

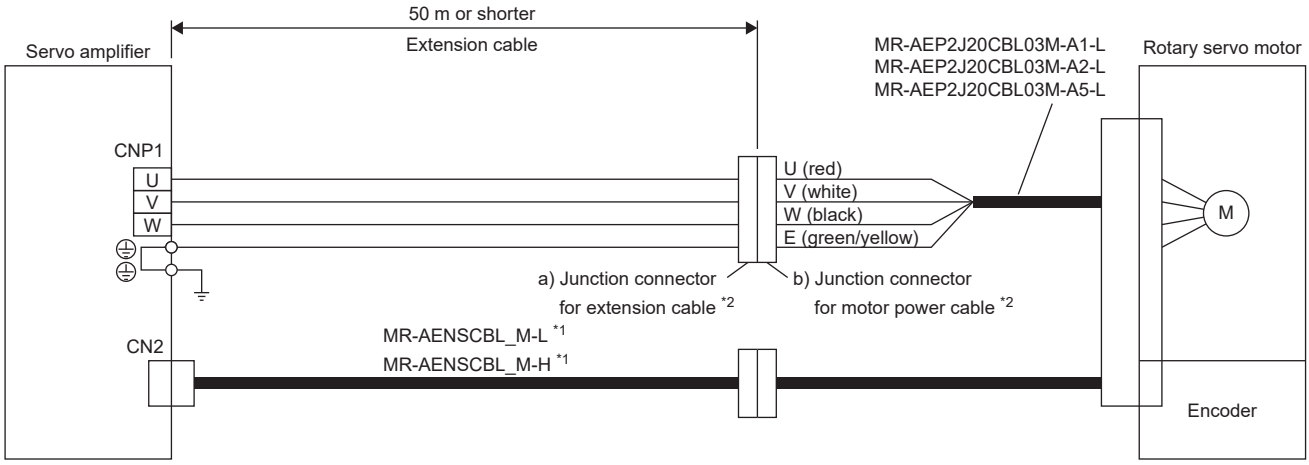
☞ Page 74 MR-AEKCBL_M-_

Connection diagram 6

Fabricate an extension cable as shown below.

Refer to the following for the wires used for the extension cable.

☞ Page 49 Selection example of wires



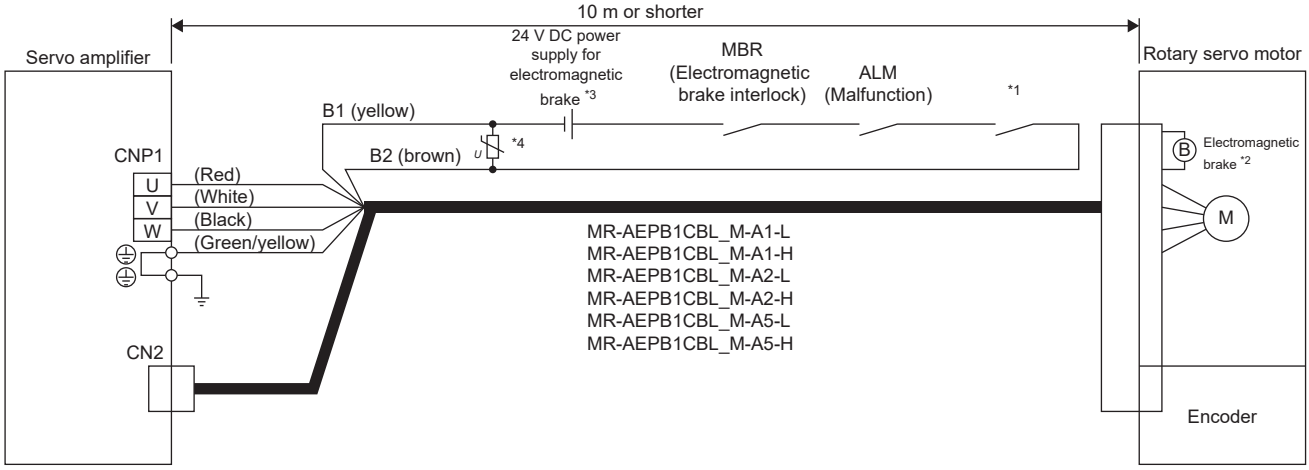
*1 For MR-AENSCBL_M-_, refer to the following.

☞ Page 74 MR-AEKCBL_M-_

*2 Use of the following connectors is recommended:

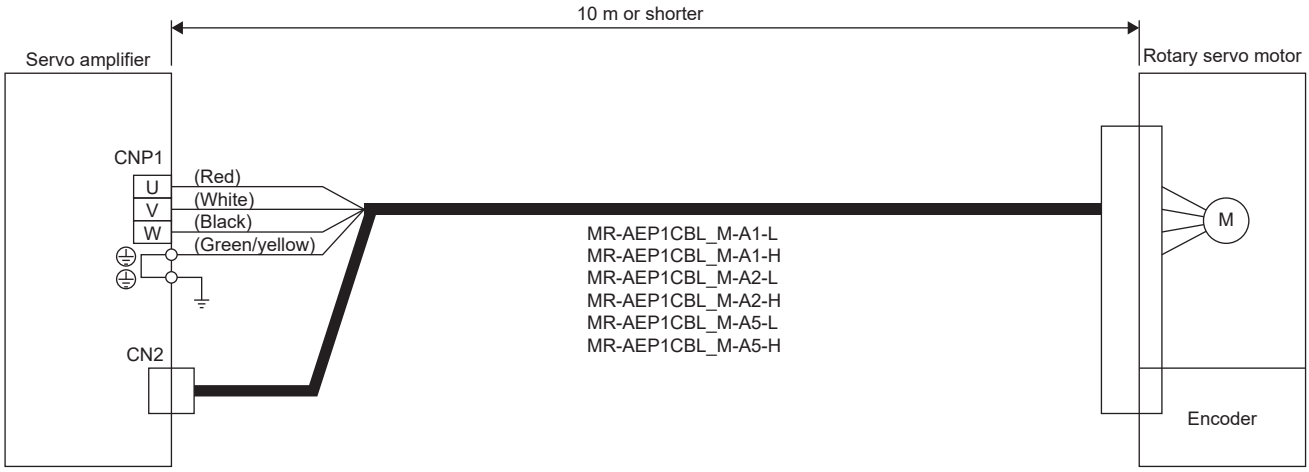
Junction connector	Description	IP rating
a) Junction connector for extension cable	Connector: CE05-6A18-10SD-D-BSS Cord clamp: CE3057-10A-2-D (DDK Ltd.) └── The number varies depending on the cable OD.	IP67
b) Junction connector for motor power cable	Connector: D/MS3101A18-10P(D263) Backshell: CE02-18BS-S-D Cord clamp: CE3057-10A-3-D (DDK Ltd.) └── The number varies depending on the cable OD.	IP67

Connection diagram 7



*1 Configure a circuit which shuts off by being interlocked with the emergency stop switch.
*2 The electromagnetic brake terminals (B1 and B2) have no polarity.
*3 Do not use the 24 V DC interface power supply for the electromagnetic brake.
*4 Connect a surge absorber as close to the rotary servo motor as possible.

Connection diagram 8

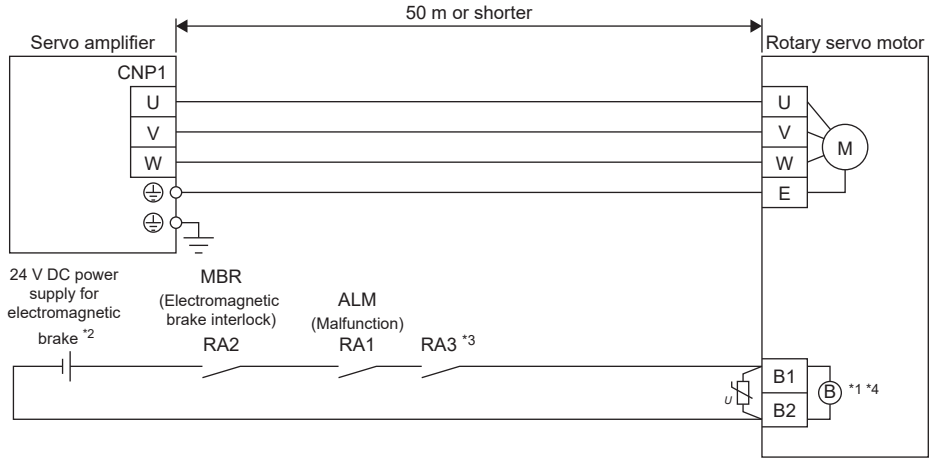


HK-FN (1.0 kW - 3.0 kW) series/HK-SN series

Refer to the following for the wires used for wiring.

☞ Page 49 Selection example of wires

Wiring diagram



*1 The electromagnetic brake terminals (B1 and B2) have no polarity.
*2 Do not use the 24 V DC interface power supply for the electromagnetic brake.
*3 Configure a circuit which shuts off by being interlocked with the emergency stop switch.
*4 Some rotary servo motors do not have an electromagnetic brake. Refer to the chapter of the rotary servo motor series.

Rotary servo motor terminal section

The rotary servo motor terminal section is shown in the following table.

Refer to the following for the details of the connectors.

☞ Page 42 Details of the rotary servo motor connectors

The connector fitting the rotary servo motor is prepared as options.

Refer to the following for details of the options.

☞ Page 52 WIRING OPTION (HK-KN SERIES/HK-FN SERIES/HK-SN SERIES)

For types other than those prepared as options, refer to the following.

☞ Page 25 CONNECTORS USED FOR ROTARY SERVO MOTOR WIRING

■HK-FN (1.0 kW - 3.0 kW) series/HK-SN series

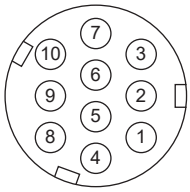
Rotary servo motor	Rotary servo motor terminal section		
	Encoder	Power supply	Electromagnetic brake
HK-FN102 HK-FN152 HK-SN3534 HK-SN5034	Connector A	Connector B	Connector D
HK-FN202 HK-FN301M HK-SN7034		Connector C	

Details of the rotary servo motor connectors

The following figures show the encoder connector, power connector, and electromagnetic brake connector which are viewed from the connection side.

■Connector A

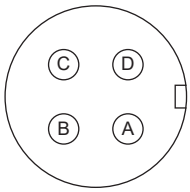
Encoder connector
CMV1-R10P



Terminal No.	Signal
1	MR
2	MRR
3	—
4	—
5	LG
6	—
7	—
8	P5
9	—
10	SHD

■Connector B

Power connector
JL10-2E18-10PCE
(MS3102A18-10P)



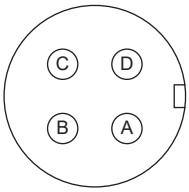
Terminal No.	Signal
A	U
B	V
C	W
D	E

■Connector C

Power connector

JL10-2E22-22PCE

(MS3102A22-22P)

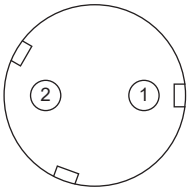


Terminal No.	Signal
A	U
B	V
C	W
D	E

■Connector D

Electromagnetic brake connector

CMV1-R2P

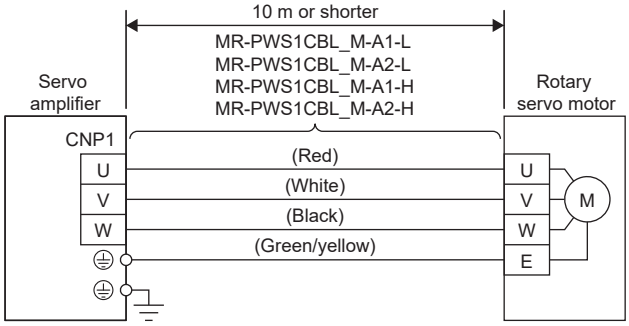


Terminal No.	Signal
1	B1 *1
2	B2 *1

*1 Supply electromagnetic brake power (24 V DC). There is no polarity.

Servo motor power supply cable wiring diagrams

■When cable length is 10 m or less

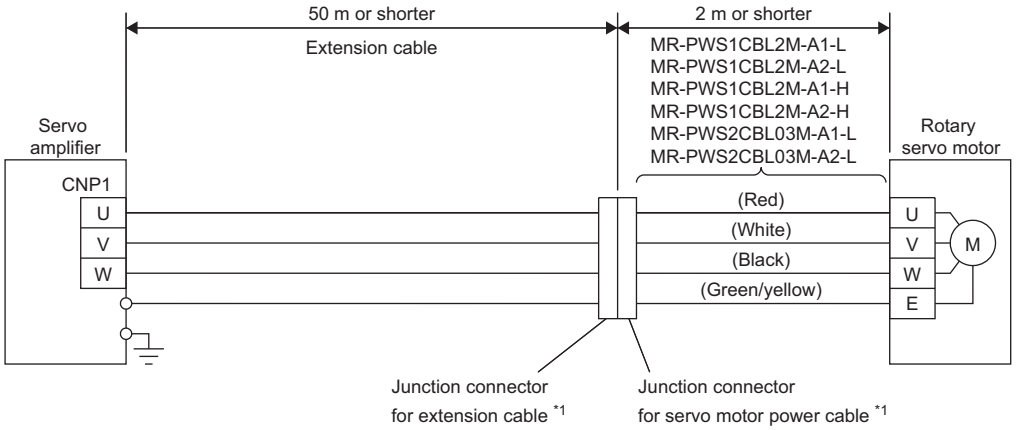


■When cable length exceeds 10 m

Fabricate an extension cable as shown below. In addition, the motor power supply cable running from the rotary servo motor should be within 2 m.

Refer to the following for the wires used for the extension cable.

☞ Page 49 Selection example of wires

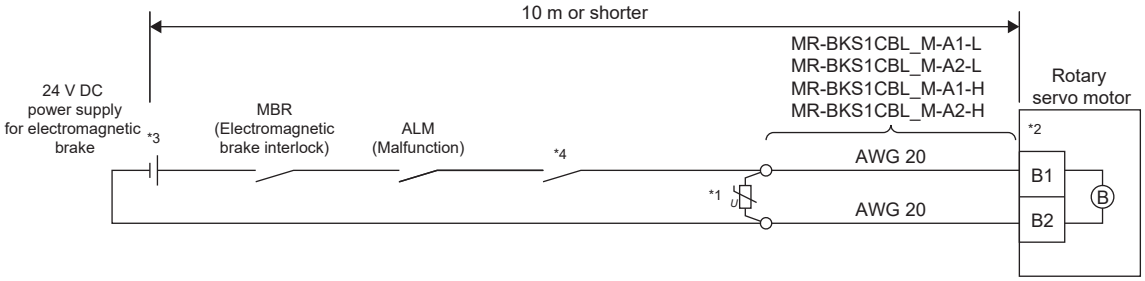


*1 Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Junction connector	Description	IP rating
Junction connector for extension cable	Connector: RM15WTPZ-4P(81) Cord clamp: JR13WCC-5(72) (Hirose Electric) └── The number varies depending on the cable OD.	IP65
Junction connector for motor power cable	Connector: RM15WTJZ-4S(81) Cord clamp: JR13WCC-8(72) (Hirose Electric) └── The number varies depending on the cable OD.	IP65

Electromagnetic brake cable wiring diagrams

■When cable length is 10 m or less



*1 Connect a surge absorber as close to the servo motor as possible.
*2 The electromagnetic brake terminals (B1 and B2) have no polarity.
*3 Do not use the 24 V DC interface power supply for the electromagnetic brake.
*4 Configure a circuit which shuts off by being interlocked with the emergency stop switch.

When fabricating electromagnetic brake cable MR-BKS1CBL_M-_, refer to the following.

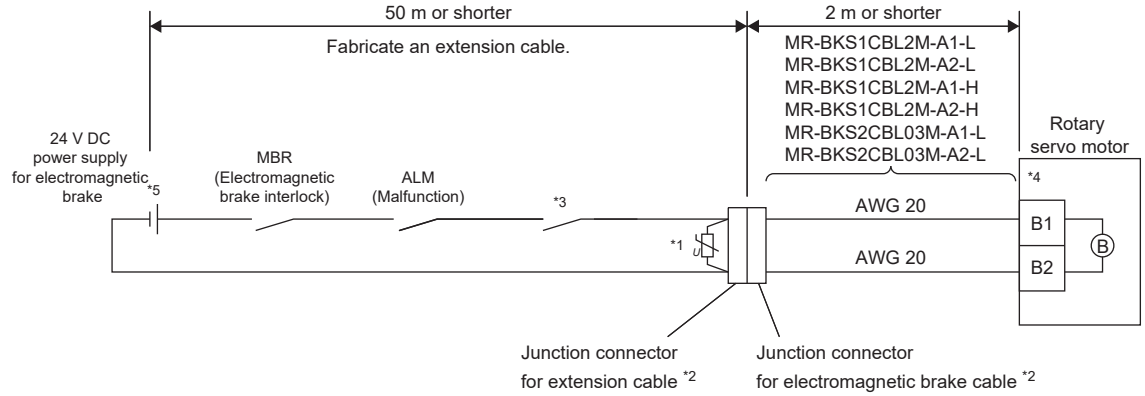
☞ Page 119 Electromagnetic brake cable
☞ Page 121 Wires for option cables

■When cable length exceeds 10 m

Fabricate an extension cable as shown below. In addition, the electromagnetic brake cable running from the rotary servo motor should be within 2 m.

Refer to the following for the wires used for the extension cable.

☞ Page 49 Selection example of wires



*1 Connect a surge absorber as close to the rotary servo motor as possible.
*2 Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Junction connector	Description	IP rating
Junction connector for extension cable	CM10-CR2P-_ (DDK) └Wire size: S, M, L	IP65
Junction connector for electromagnetic brake cable	CMV1-SP2S-_ (DDK) └Wire size: S, M1, M2, L	IP65

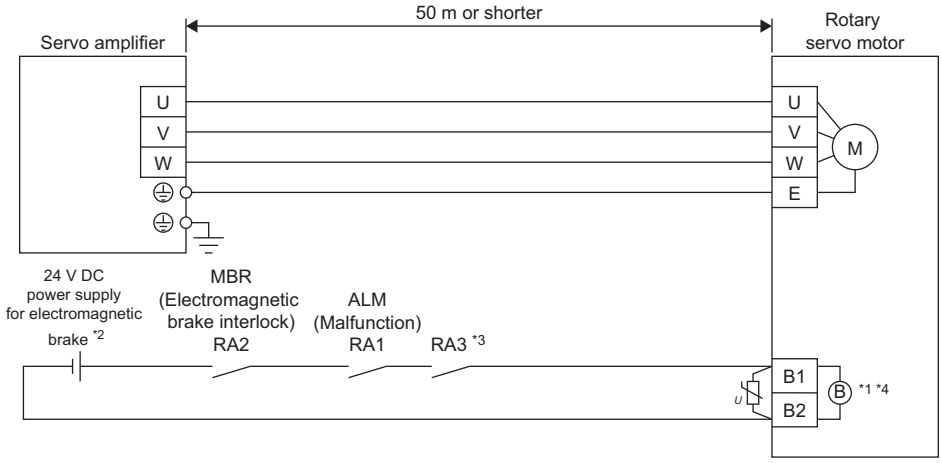
*3 Configure a circuit which shuts off by being interlocked with the emergency stop switch.
*4 The electromagnetic brake terminals (B1 and B2) have no polarity.
*5 Do not use the 24 V DC interface power supply for the electromagnetic brake.

HG-SNS series

Refer to the following for the wires used for wiring.

☞ Page 49 Selection example of wires

Wiring diagram



*1 The electromagnetic brake terminals (B1 and B2) have no polarity.

*2 Do not use the 24 V DC interface power supply for the electromagnetic brake.

*3 Configure a circuit which shuts off by being interlocked with the emergency stop switch.

*4 Some rotary servo motors do not have an electromagnetic brake. Refer to the chapter of the rotary servo motor series.

Rotary servo motor terminal section

The rotary servo motor terminal section is shown in the following table.

Refer to the following for the details of the connectors.

☞ Page 47 Details of the rotary servo motor connectors

The connector fitting the rotary servo motor is prepared as options.

Refer to the following for details of the options.

☞ Page 96 WIRING OPTION (HG-KNS SERIES/HG-SNS SERIES)

For types other than those prepared as options, refer to the following.

☞ Page 25 CONNECTORS USED FOR ROTARY SERVO MOTOR WIRING

■HG-SNS series

Rotary servo motor	Rotary servo motor terminal section		
	Encoder	Power supply	Electromagnetic brake
HG-SNS52J HG-SNS102J HG-SNS152J	Connector A	Connector B	Connector D
HG-SNS202J HG-SNS302J		Connector C	

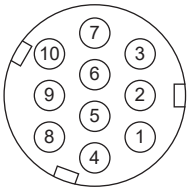
Details of the rotary servo motor connectors

The following figures show the encoder connector, power connector, and electromagnetic brake connector which are viewed from the connection side.

■Connector A

Encoder connector

CMV1-R10P

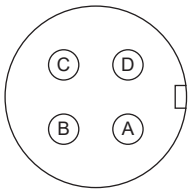


Terminal No.	Signal
1	MR
2	MRR
3	—
4	BAT
5	LG
6	—
7	—
8	P5
9	—
10	SHD

■Connector B

Power connector

MS3102A18-10P

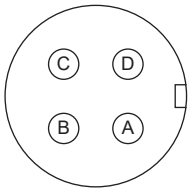


Terminal No.	Signal
A	U
B	V
C	W
D	E

■Connector C

Power connector

MS3102A22-22P

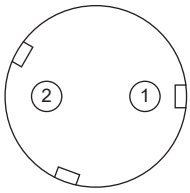


Terminal No.	Signal
A	U
B	V
C	W
D	E

■Connector D

Electromagnetic brake connector

CMV1-R2P



Terminal No.	Signal
1	B1 *1
2	B2 *1

*1 Supply electromagnetic brake power (24 V DC). There is no polarity.

4.3 Selection example of wires

Point

Wires indicated in this section are separated wires. When using a cable for power line (U/V/W) between the servo amplifier and rotary servo motor, use a 600 V grade EP rubber insulated chloroprene sheath cab-tire cable (2PNCT). For cable selection, refer to the following.

☞ Page 242 Selection example of rotary servo motor power cable

To comply with the UL/CSA standard, use the wires shown in the following for wiring.

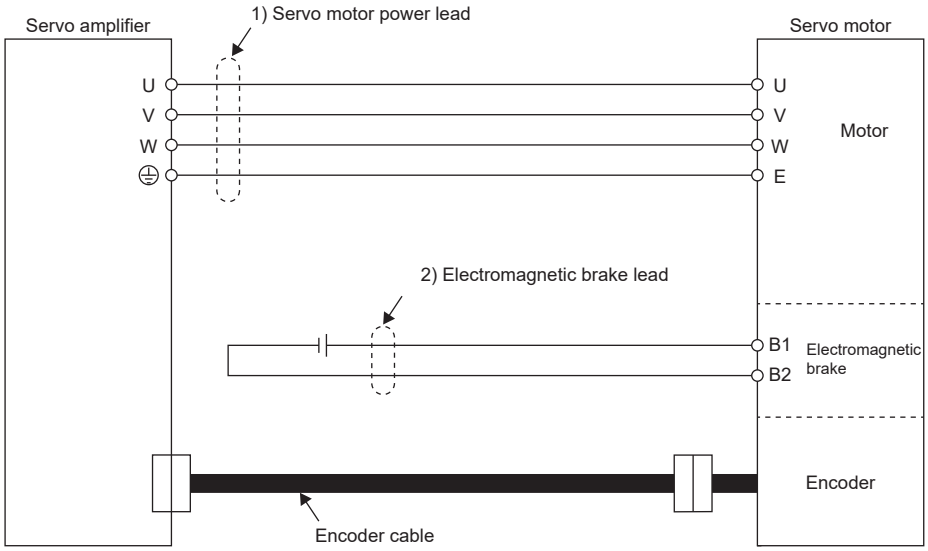
☞ Page 237 Compliance with UL/CSA standard

To comply with other standards, use wires that comply with each standard.

Selection conditions of wire size are as follows.

- Construction condition: Single wire set in midair
- Wiring length: 30 m or less

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



Wire size selection examples for the 600 V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire) are indicated below.
Even when the maximum torque is increased, the applicable wire sizes are the same.

HK-KN series (200 V)

Rotary servo motor	Wire [mm^2]	
	1) U/V/W/E	2) B1/B2
HK-KN053	0.75 (AWG 18) *1 *2	0.2 (AWG 24) *2 *4
HK-KN13		
HK-KN1M3		
HK-KN23		
HK-KN43		
HK-KN63		
HK-KN7M3		
HK-KN103		
HK-KN153		
HK-KN203	0.75 (AWG 18) *1 *3	
HK-KN202	0.75 (AWG 18) *1 *2	

*1 For the motor power connector wiring, use fluorine resin wire of 0.75 mm^2 (AWG 18).
*2 This applies when the wire length is 10 m or less. When fabricating an extension cable, use 1.25 mm^2 (AWG 16).
*3 This applies when the wire length is 10 m or less. When fabricating an extension cable, use 2.0 mm^2 (AWG 14).
*4 For wiring of the electromagnetic brake, use fluorine resin wire of 0.2 mm^2 (AWG 24).

HK-FN series (200 V)

Rotary servo motor	Wire [mm^2]	
	1) U/V/W/E	2) B1/B2
HK-FN13	0.75 (AWG 18) *1 *2	0.2 (AWG 24) *2 *3
HK-FN23		
HK-FN43		
HK-FN7M3		
HK-FN102	2 (AWG 14)	1.25 (AWG 16)
HK-FN152		
HK-FN202		
HK-FN301M		

*1 For the motor power connector wiring, use fluorine resin wire of 0.75 mm^2 (AWG 18).
*2 This applies when the wire length is 10 m or less. When fabricating an extension cable, use 1.25 mm^2 (AWG 16).
*3 For wiring of the electromagnetic brake, use fluorine resin wire of 0.2 mm^2 (AWG 24).

HK-KN series (400 V)

Rotary servo motor	Wire [mm^2]	
	1) U/V/W/E	2) B1/B2
HK-KN134	0.75 (AWG 18) *1 *2	0.2 (AWG 24) *2 *3
HK-KN234		
HK-KN434		
HK-KN634		
HK-KN7M34		
HK-KN1034		
HK-KN1534		
HK-KN2034		

*1 For the motor power connector wiring, use fluorine resin wire of 0.75 mm^2 (AWG 18).
*2 This applies when the wire length is 10 m or less. When fabricating an extension cable, use 1.25 mm^2 (AWG 16).
*3 For wiring of the electromagnetic brake, use fluorine resin wire of 0.2 mm^2 (AWG 24).

HK-SN series (400 V)

Rotary servo motor	Wire [mm^2]	
	1) U/V/W/E	2) B1/B2
HK-SN3534	2 (AWG 14)	1.25 (AWG 16)
HK-SN5034		
HK-SN7034	3.5 (AWG 12)	

HG-KNS series (200 V)/HG-SNS series (200 V)

Rotary servo motor	Wire [mm^2]	
	1) U/V/W/E	2) B1/B2
HG-KNS13J	0.75 (AWG 18) *1	0.5 (AWG 20) *1
HG-KNS23J		
HG-KNS43J		
HG-KNS73J		
HG-SNS52J	1.25 (AWG 16)	1.25 (AWG 16)
HG-SNS102J		
HG-SNS152J	2 (AWG 14)	
HG-SNS202J		
HG-SNS302J	3.5 (AWG 12)	

*1 This applies when the wire length is 10 m. When fabricating an extension cable, use 1.25 mm^2 (AWG 16).

5 WIRING OPTION (HK-KN SERIES/HK-FN SERIES/HK-SN SERIES)

When cables are fabricated by the customer, wires should be selected in accordance with the application.

Precautions

- Use specified options. Otherwise, it may cause a malfunction or fire.
- MR-J3SCNS(A) and MR-ENCNS2(A) connector sets are packed with a plug and contacts. As using contacts for other plugs may damage the connector, use the enclosed contacts.
- Correctly wire options and peripheral equipment, etc. in the correct combination.
- We recommend using HIV wires to wire the rotary servo motors, options, and peripheral equipment. Therefore, the recommended wire sizes may be different from those of the wires used for previous generation rotary servo motors.
- The fitting warranty is applied only to the option cables and the connectors manufactured by the manufacturers introduced in this chapter.

5.1 Cable/connector sets

Point

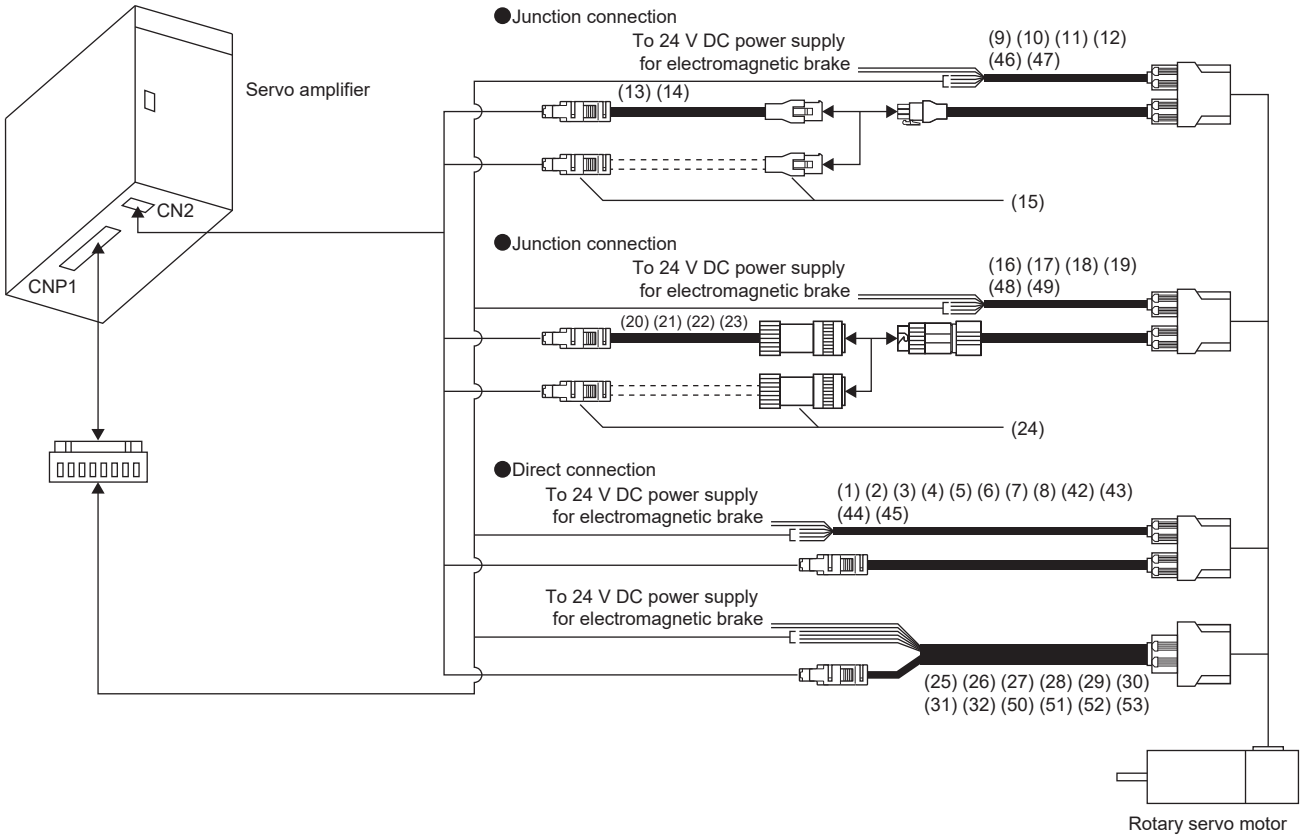
The indicated IP rating is the cable and connector's protection against ingress of dust and water when the cable and connector are connected to a rotary servo motor. If the IP rating of the cable, connector, and rotary servo motor varies, the overall IP rating depends on the lowest IP rating of all components.

Please purchase the cable and connector options indicated in this section for the rotary servo motor. When fabricating an encoder cable, refer to the following.

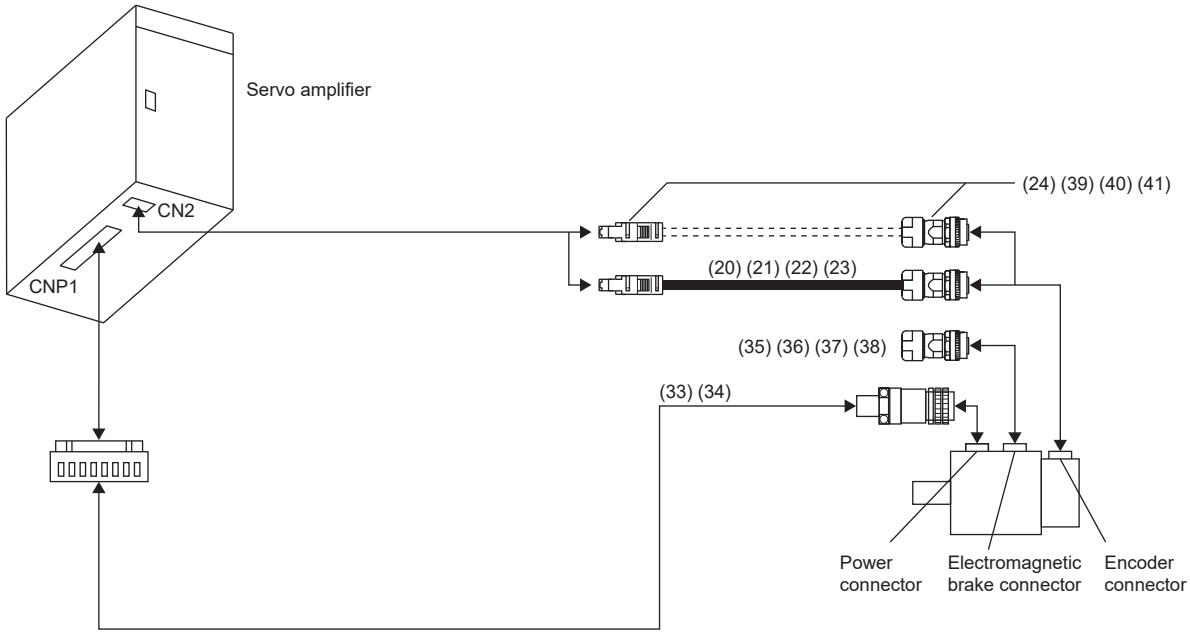
☞ Page 256 Fabrication of the encoder cable

Combinations of cable/connector sets

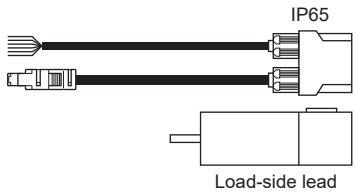
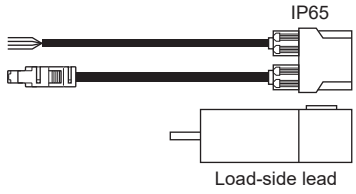
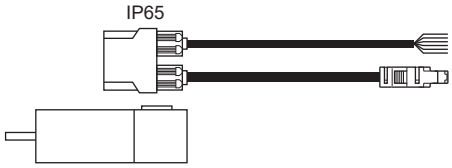
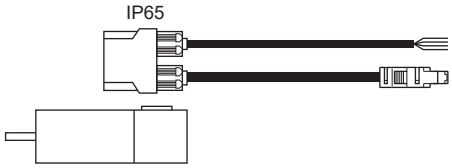
HK-KN series/HK-FN (0.1 kW - 0.75 kW) series

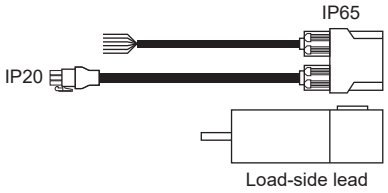
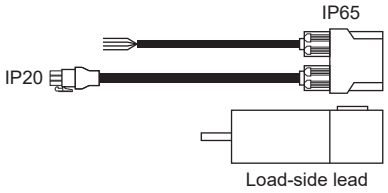
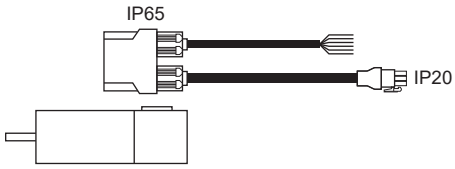
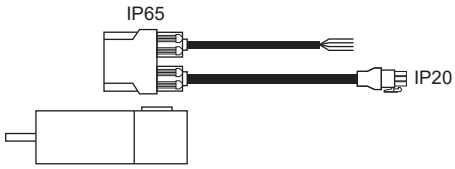


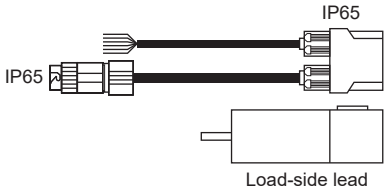
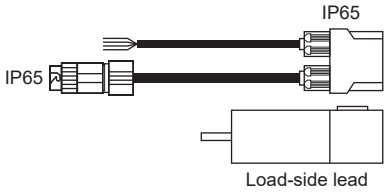
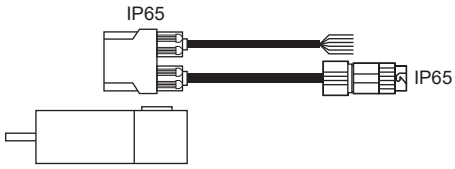
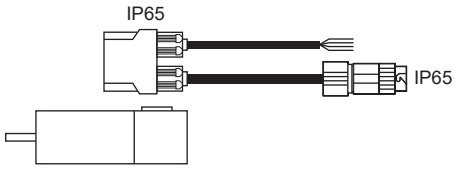
HK-FN (1.0 kW - 3.0 kW) series/HK-SN series

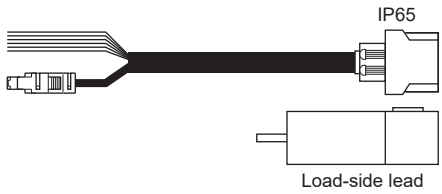
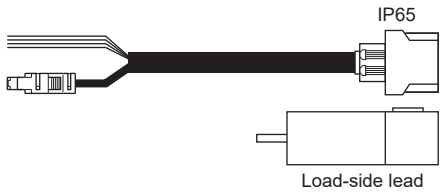
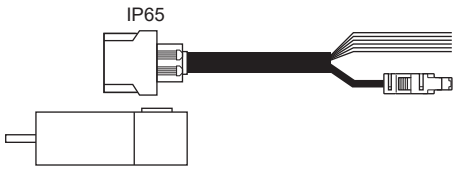
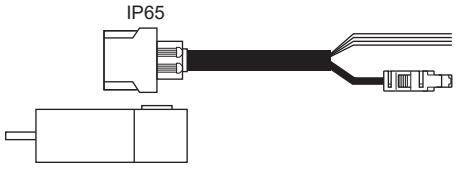


Cable and connector list

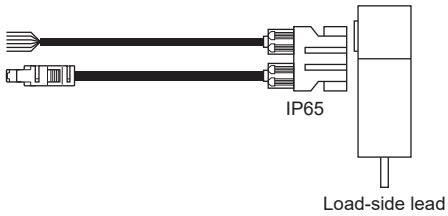
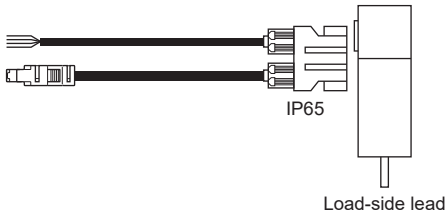
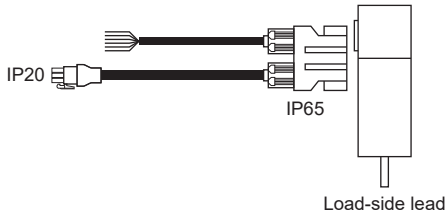
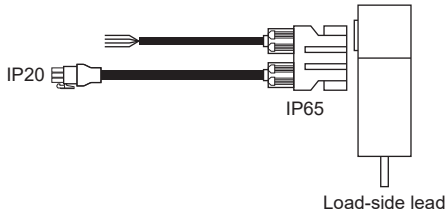
No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(1)	Motor cables (Dual cable type/ direct connection type) *1 Motor side: IP65	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEPB2CBL2M-A1-L	 Refer to the following for details. ☞ Page 61 MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_
				5 m	MR-AEPB2CBL5M-A1-L	
				10 m	MR-AEPB2CBL10M-A1-L	
(2)			Long bending life (for moving parts)	2 m	MR-AEPB2CBL2M-A1-H	
				5 m	MR-AEPB2CBL5M-A1-H	
				10 m	MR-AEPB2CBL10M-A1-H	
(3)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEP2CBL2M-A1-L	 Refer to the following for details. ☞ Page 61 MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_
				5 m	MR-AEP2CBL5M-A1-L	
				10 m	MR-AEP2CBL10M-A1-L	
(4)			Long bending life (for moving parts)	2 m	MR-AEP2CBL2M-A1-H	
				5 m	MR-AEP2CBL5M-A1-H	
				10 m	MR-AEP2CBL10M-A1-H	
(5)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEPB2CBL2M-A2-L	 Refer to the following for details. ☞ Page 61 MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_
				5 m	MR-AEPB2CBL5M-A2-L	
				10 m	MR-AEPB2CBL10M-A2-L	
(6)			Long bending life (for moving parts)	2 m	MR-AEPB2CBL2M-A2-H	
				5 m	MR-AEPB2CBL5M-A2-H	
				10 m	MR-AEPB2CBL10M-A2-H	
(7)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEP2CBL2M-A2-L	 Refer to the following for details. ☞ Page 61 MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_
				5 m	MR-AEP2CBL5M-A2-L	
				10 m	MR-AEP2CBL10M-A2-L	
(8)			Long bending life (for moving parts)	2 m	MR-AEP2CBL2M-A2-H	
				5 m	MR-AEP2CBL5M-A2-H	
				10 m	MR-AEP2CBL10M-A2-H	

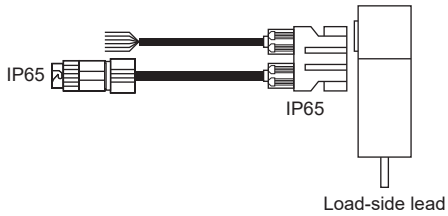
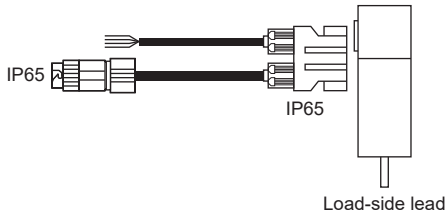
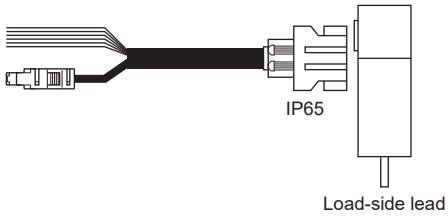
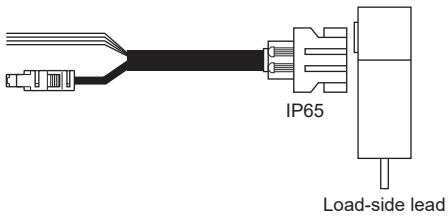
No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(9)	Motor cables (Dual cable type/ junction connection type) Motor side: IP65 Junction side: IP20	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEPB2J10CBL03M-A1-L	 Refer to the following for details. ☞ Page 65 MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L
(10)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEP2J10CBL03M-A1-L	 Refer to the following for details. ☞ Page 65 MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L
(11)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEPB2J10CBL03M-A2-L	 Refer to the following for details. ☞ Page 65 MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L
(12)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEP2J10CBL03M-A2-L	 Refer to the following for details. ☞ Page 65 MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L
(13)	Encoder cable Junction side: IP20	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3	Standard (for fixed parts)	20 m	MR-AEKCBL20M-L	 Refer to the following for details. ☞ Page 74 MR-AEKCBL_M-_
				30 m	MR-AEKCBL30M-L	
(14)			Long bending life (for moving parts)	20 m	MR-AEKCBL20M-H	
				30 m	MR-AEKCBL30M-H	
				40 m	MR-AEKCBL40M-H	
				50 m	MR-AEKCBL50M-H	
(15)	Encoder connector set Junction side: IP20	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3	—	—	MR-ECNM	 Refer to the following for details. ☞ Page 74 MR-AEKCBL_M-_

No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(16)	Motor cables (Dual cable type/ junction connection type) Motor side: IP65 Junction side: IP65	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEPB2J20CBL03M-A1-L	 Refer to the following for details. ☞ Page 68 MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L
(17)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEP2J20CBL03M-A1-L	 Refer to the following for details. ☞ Page 68 MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L
(18)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEPB2J20CBL03M-A2-L	 Refer to the following for details. ☞ Page 68 MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L
(19)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEP2J20CBL03M-A2-L	 Refer to the following for details. ☞ Page 68 MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L
(20)	Encoder cable Junction side: IP67	HK-KN series/ HK-FN series	Standard (for fixed parts)	2 m	MR-J3ENSCBL2M-L	 Refer to the following for details. ☞ Page 77 MR-AENSCBL_M-_ ☞ Page 81 MR-J3ENSCBL_M-_
				5 m	MR-J3ENSCBL5M-L	
				10 m	MR-J3ENSCBL10M-L	
(21)				20 m	MR-AENSCBL20M-L	
				30 m	MR-AENSCBL30M-L	
(22)			Long bending life (for moving parts)	2 m	MR-J3ENSCBL2M-H	
				5 m	MR-J3ENSCBL5M-H	
				10 m	MR-J3ENSCBL10M-H	
(23)				20 m	MR-AENSCBL20M-H	
				30 m	MR-AENSCBL30M-H	
				40 m	MR-AENSCBL40M-H	
				50 m	MR-AENSCBL50M-H	

No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(24)	Encoder connector set (One-touch connection type) Junction side: IP67	HK-KN series/ HK-FN series	—	—	MR-J3SCNS *2	 Refer to the following for details. ☞ Page 77 MR-AENSCBL_M-_ ☞ Page 81 MR-J3ENSCBL_M-_
(25)	Motor cables (Single cable type/direct connection type) Motor side: IP65	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEPB1CBL2M-A1-L	 Refer to the following for details. ☞ Page 71 MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_
				5 m	MR-AEPB1CBL5M-A1-L	
				10 m	MR-AEPB1CBL10M-A1-L	
(26)			Long bending life (for moving parts)	2 m	MR-AEPB1CBL2M-A1-H	
				5 m	MR-AEPB1CBL5M-A1-H	
				10 m	MR-AEPB1CBL10M-A1-H	
(27)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEP1CBL2M-A1-L	 Refer to the following for details. ☞ Page 71 MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_
				5 m	MR-AEP1CBL5M-A1-L	
				10 m	MR-AEP1CBL10M-A1-L	
(28)			Long bending life (for moving parts)	2 m	MR-AEP1CBL2M-A1-H	
				5 m	MR-AEP1CBL5M-A1-H	
				10 m	MR-AEP1CBL10M-A1-H	
(29)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEPB1CBL2M-A2-L	 Refer to the following for details. ☞ Page 71 MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_
				5 m	MR-AEPB1CBL5M-A2-L	
				10 m	MR-AEPB1CBL10M-A2-L	
(30)			Long bending life (for moving parts)	2 m	MR-AEPB1CBL2M-A2-H	
				5 m	MR-AEPB1CBL5M-A2-H	
				10 m	MR-AEPB1CBL10M-A2-H	
(31)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEP1CBL2M-A2-L	 Refer to the following for details. ☞ Page 71 MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_
				5 m	MR-AEP1CBL5M-A2-L	
				10 m	MR-AEP1CBL10M-A2-L	
(32)			Long bending life (for moving parts)	2 m	MR-AEP1CBL2M-A2-H	
				5 m	MR-AEP1CBL5M-A2-H	
				10 m	MR-AEP1CBL10M-A2-H	
(33)	Power connector set (One-touch connection type)	HK-FN102/ HK-FN152 HK-SN3534 HK-SN5034	—	—	MR-APWCNS4	 Plug: JL10-6A18-10SE-EB Cable clamp: JL04-18CK(13)-_-R (JAE) Applicable cable Applicable wire size: 3.5 mm^2 (AWG 12) or less Cable OD: 11 mm to 14.1 mm

No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(34)	Power connector set (One-touch connection type)	HK-FN202/ HK-FN301M HK-SN7034	—	—	MR-APWCNS5	IP67  Plug: JL10-6A22-22SE-EB Cord clamp: JL04-2022CK(14)-_-R (JAE) Applicable cable Applicable wire size: 8 mm^2 (AWG 8) or less Cable OD: 12.9 mm to 16 mm
(35)	Electromagnetic brake connector set	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-BKCNS1 *2	IP67  Straight plug: CMV1-SP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)
(36)	Electromagnetic brake connector set	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-BKCNS1A *2	IP67  Angle plug: CMV1-AP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)
(37)	Electromagnetic brake connector set	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-BKCNS2	IP67  Straight plug: CMV1S-SP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)
(38)	Electromagnetic brake connector set	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-BKCNS2A	IP67  Angle plug: CMV1S-AP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)
(39)	Encoder connector set (Screw type) Junction side: IP67	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-ENCNS2	 IP67  Refer to the following for details. ☞ Page 77 MR-AENSCBL_M-_ ☞ Page 81 MR-J3ENSCBL_M-_
(40)	Encoder connector set (One-touch connection type) Junction side: IP67	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-J3SCNSA *2	 IP67  Refer to the following for details. ☞ Page 77 MR-AENSCBL_M-_ ☞ Page 81 MR-J3ENSCBL_M-_
(41)	Encoder connector set (Screw type) Junction side: IP67	HK-FN102/ HK-FN152/ HK-FN202/ HK-FN301M	—	—	MR-ENCNS2A	 IP67  Refer to the following for details. ☞ Page 77 MR-AENSCBL_M-_ ☞ Page 81 MR-J3ENSCBL_M-_

No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(42)	Motor cables (Dual cable type/ direct connection type) *1 Motor side: IP65	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEPB2CBL2M-A5-L	 Refer to the following for details. ☞ Page 61 MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_
				5 m	MR-AEPB2CBL5M-A5-L	
				10 m	MR-AEPB2CBL10M-A5-L	
(43)			Long bending life (for moving parts)	2 m	MR-AEPB2CBL2M-A5-H	
				5 m	MR-AEPB2CBL5M-A5-H	
				10 m	MR-AEPB2CBL10M-A5-H	
(44)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEP2CBL2M-A5-L	 Refer to the following for details. ☞ Page 61 MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_
				5 m	MR-AEP2CBL5M-A5-L	
				10 m	MR-AEP2CBL10M-A5-L	
(45)			Long bending life (for moving parts)	2 m	MR-AEP2CBL2M-A5-H	
				5 m	MR-AEP2CBL5M-A5-H	
				10 m	MR-AEP2CBL10M-A5-H	
(46)	Motor cables (Dual cable type/ junction connection type) Motor side: IP65 Junction side: IP20	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEPB2J10CBL03M-A5-L	 Refer to the following for details. ☞ Page 65 MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L
(47)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEP2J10CBL03M-A5-L	 Refer to the following for details. ☞ Page 65 MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L

No.	Product name	Application	Flex type	Cable length	Model	Description/IP rating/Cable direction
(48)	Motor cables (Dual cable type/ junction connection type) Motor side: IP65 Junction side: IP65	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEPB2J20CBL03M-A5-L	 Refer to the following for details. ☞ Page 68 MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L
(49)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	0.3 m	MR-AEP2J20CBL03M-A5-L	 Refer to the following for details. ☞ Page 68 MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L
(50)	Motor cables (Single cable type/direct connection type) Motor side: IP65	HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 With electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEPB1CBL2M-A5-L	 Refer to the following for details. ☞ Page 71 MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_
				5 m	MR-AEPB1CBL5M-A5-L	
				10 m	MR-AEPB1CBL10M-A5-L	
(51)			Long bending life (for moving parts)	2 m	MR-AEPB1CBL2M-A5-H	
				5 m	MR-AEPB1CBL5M-A5-H	
				10 m	MR-AEPB1CBL10M-A5-H	
(52)		HK-KN series/ HK-FN13/ HK-FN23/ HK-FN43/ HK-FN7M3 Without electromagnetic brake cable	Standard (for fixed parts)	2 m	MR-AEP1CBL2M-A5-L	 Refer to the following for details. ☞ Page 71 MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_
				5 m	MR-AEP1CBL5M-A5-L	
				10 m	MR-AEP1CBL10M-A5-L	
(53)			Long bending life (for moving parts)	2 m	MR-AEP1CBL2M-A5-H	
				5 m	MR-AEP1CBL5M-A5-H	
				10 m	MR-AEP1CBL10M-A5-H	

*1 When IP67 cables are needed, contact your local sales office.

*2 The cable and the connector set may contain different connectors but still usable.

5.2 Motor cables/connector sets

MR-AEPB2CBL_M-_-_/MR-AEP2CBL_M-_-_

Model

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

MR - A E P B 2 C B L 2 M - A 1 - L

Flex type

Symbol	Flex type
L	Standard (for fixed parts)
H	High flex life (for moving parts)

Outlet direction

Symbol	Outlet direction
A1	Load-side lead
A2	Opposite to load-side lead
A5	Vertical lead

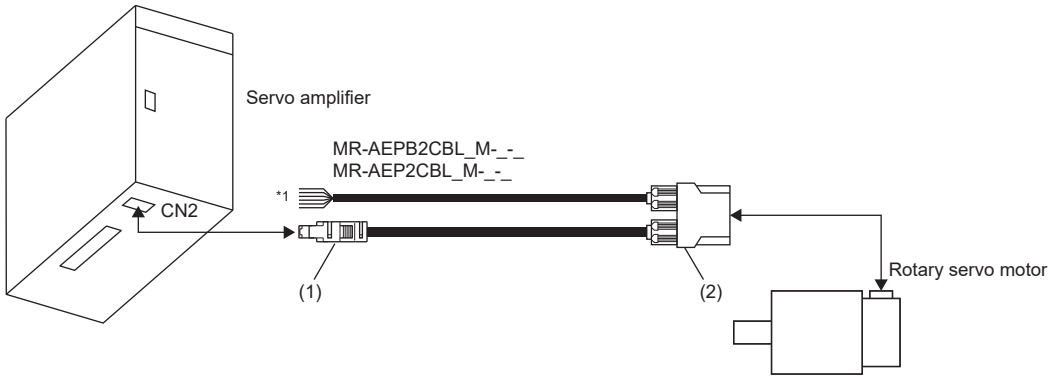
Cable length

Symbol	Cable length [m]
2	2
5	5
10	10

Electromagnetic brake cable

Symbol	Electromagnetic brake cable
None	None
B	○

Connection of servo amplifier and rotary servo motor



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

CN2-side connector (1)

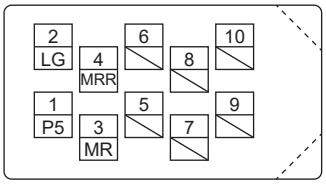
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 94 MR-J3ENSCBL_M-L/MR-J3ENSCBL_M-H

Receptacle: 36210-0100PL

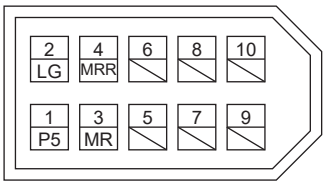
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1016

(Molex)



Motor-side connector (2)

■Load-side lead/opposite to load-side lead

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

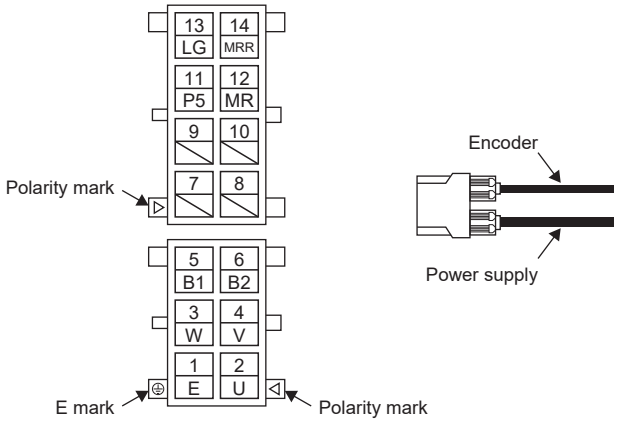
Connector set: MT50W-8D/2D4ES-CVLD(7.5)

Contact (for motor power supply): MT50E-1820SCFA

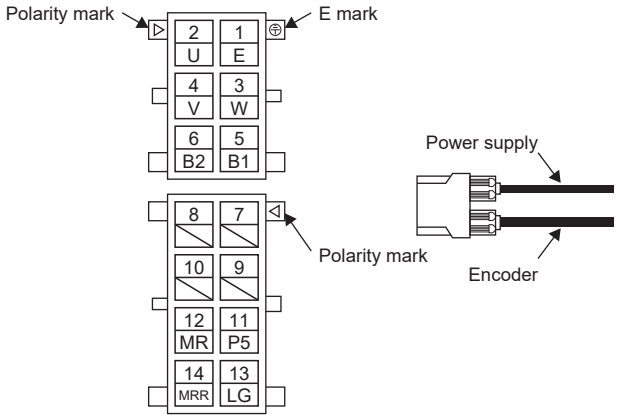
Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)

- Load-side lead



- Lead in opposite direction of load side



5

■Vertical lead

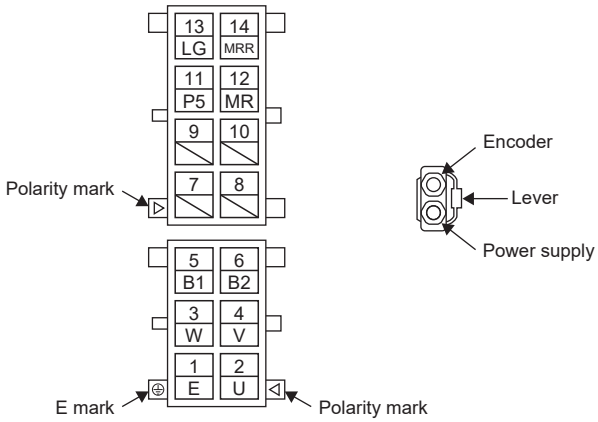
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector set: MT50W-8D/2D4ES-CVSD(7.5)

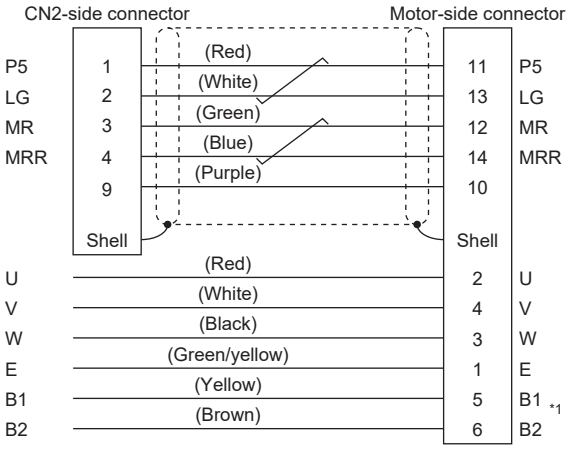
Contact (for motor power supply): MT50E-1820SCFA

Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)



Cable internal wiring diagram



*1 B1 and B2 are the wiring for electromagnetic brake. Wire when MR-AEPB2CBL_M-_-_ is used. If MR-AEP2CBL_M-_-_ is used, B1 and B2 do not need to be wired as MR-AEP2CBL_M-_-_ does not have B1 and B2.

MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L

The servo amplifier and the rotary servo motor cannot be connected by these cables alone. The servo amplifier-side encoder cable (MR-AEKCBL_M-_) is required.

Model

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

MR - A E P B 2 J 1 0 C B L 0 3 M - A 1 - L

Flex type

Symbol	Flex type
L	Standard (for fixed parts)

Outlet direction

Symbol	Outlet direction
A1	Load-side lead
A2	Opposite to load-side lead
A5	Vertical lead

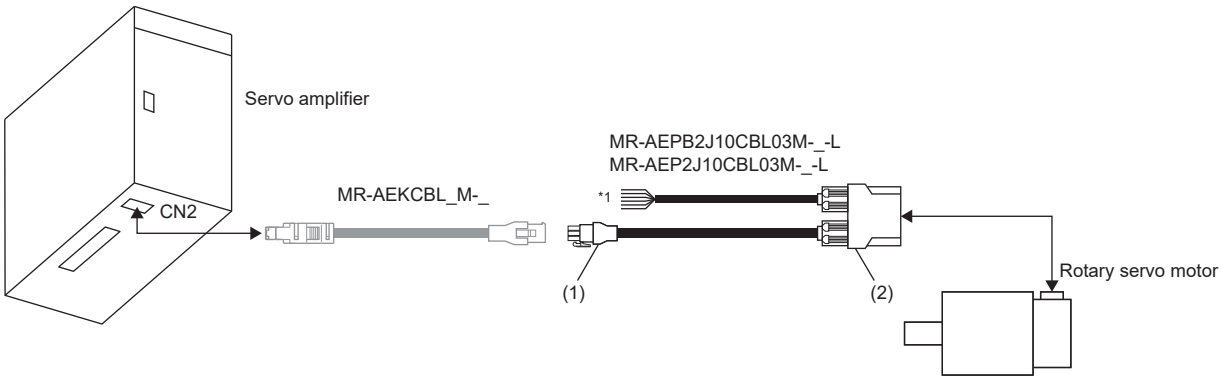
Cable length

Symbol	Cable length [m]
03	0.3

Electromagnetic brake cable

Symbol	Electromagnetic brake cable
None	None
B	Attached

Connection of servo amplifier and rotary servo motor



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

Junction connector (1)

The following shows the view from the wiring side.

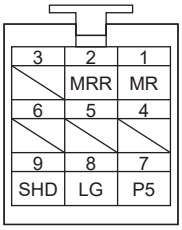
Housing: 1-172169-9

Contact: 170361-4

Cable clamp: 316454-1

Crimping tool: 91529-1

(TE Connectivity)



Motor-side connector (2)

■Load-side lead/opposite to load-side lead

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

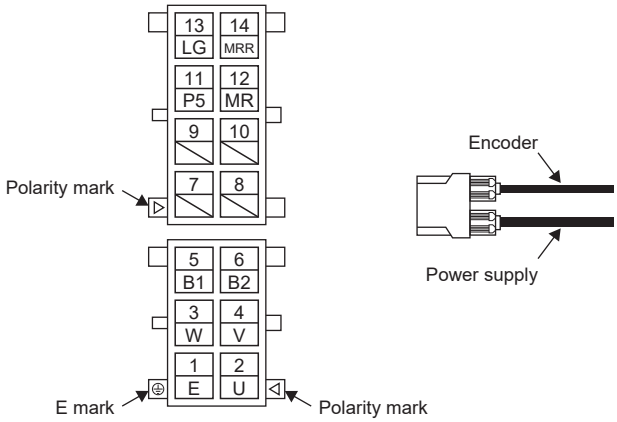
Connector set: MT50W-8D/2D4ES-CVLD(7.5)

Contact (for motor power supply): MT50E-1820SCFA

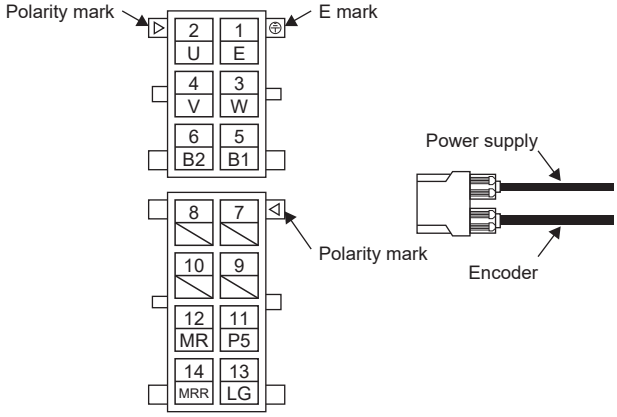
Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)

- Load-side lead



- Lead in opposite direction of load side



■Vertical lead

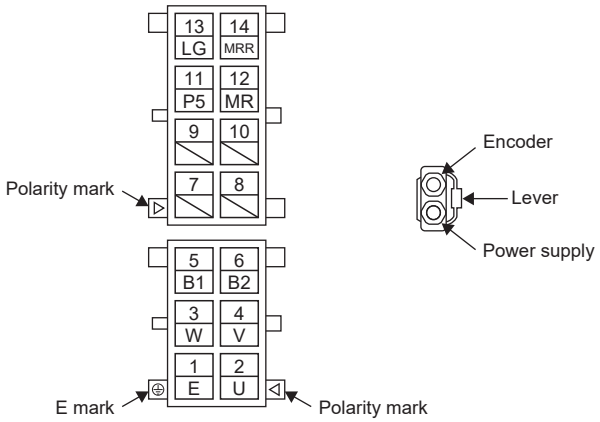
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector set: MT50W-8D/2D4ES-CVSD(7.5)

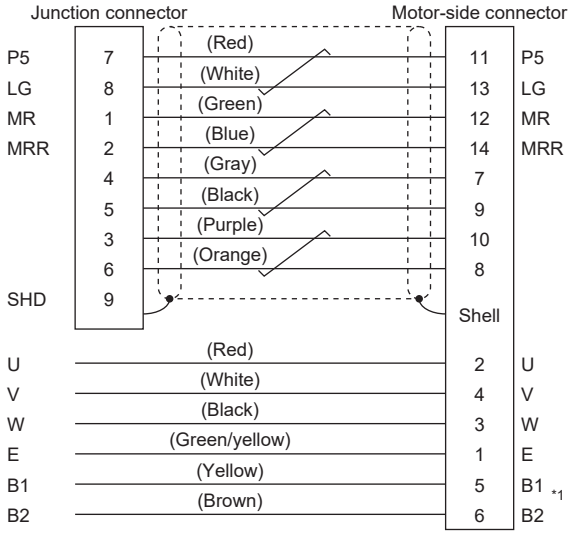
Contact (for motor power supply): MT50E-1820SCFA

Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)



Cable internal wiring diagram



*1 B1 and B2 are the wiring for electromagnetic brake. Wire when MR-AEPB2J10CBL03M-_-L is used. If MR-AEP2J10CBL03M-_-L is used, B1 and B2 do not need to be wired as MR-AEP2J10CBL03M-_-L does not have B1 and B2.

MR-AEPB2J20CBL03M-_-L/MR-AEP2J20CBL03M-_-L

The servo amplifier and the rotary servo motor cannot be connected by these cables alone. The servo amplifier-side encoder cables (MR-AENSCBL_M-_ and MR-J3ENSCBL_M-_) are required.

Model

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

MR - A E P B 2 J 2 0 C B L 0 3 M - A 1 - L

Flex type

Symbol	Flex type
L	Standard (for fixed parts)

Outlet direction

Symbol	Outlet direction
A1	Load-side lead
A2	Opposite to load-side lead
A5	Vertical lead

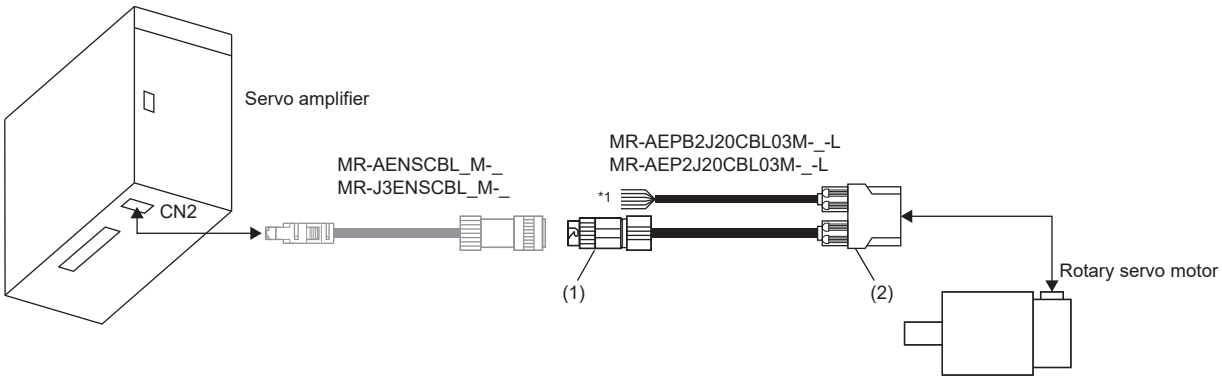
Cable length

Symbol	Cable length [m]
03	0.3

Electromagnetic brake cable

Symbol	Electromagnetic brake cable
None	None
B	○

Connection of servo amplifier and rotary servo motor



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

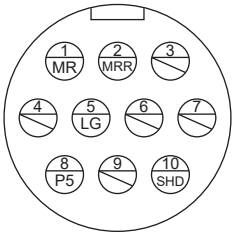
Junction connector (1)

The following shows the view from the wiring side.

Receptacle: CMV1-CR10P-M2

(DDK)

Applicable wire size: AWG 20 or less



Motor-side connector (2)

■Load-side lead/opposite to load-side lead

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

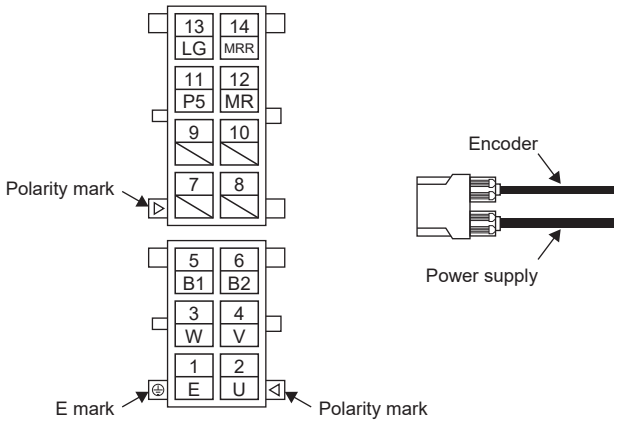
Connector set: MT50W-8D/2D4ES-CVLD(7.5)

Contact (for motor power supply): MT50E-1820SCFA

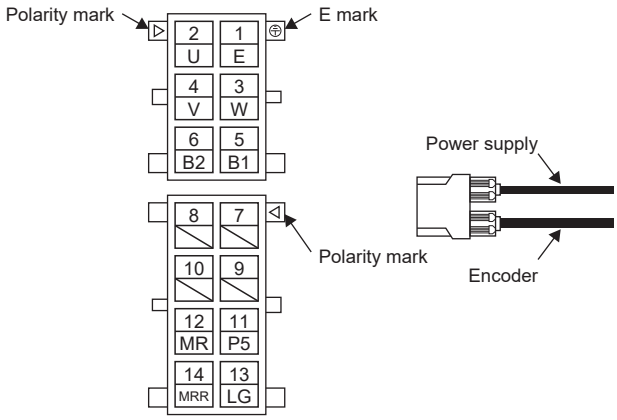
Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)

- Load-side lead



- Lead in opposite direction of load side



■Vertical lead

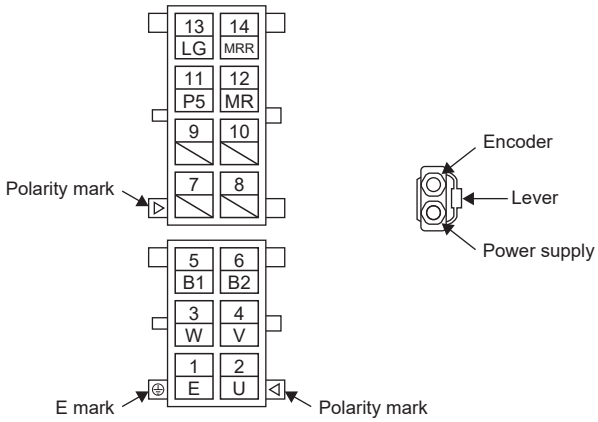
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector set: MT50W-8D/2D4ES-CVSD(7.5)

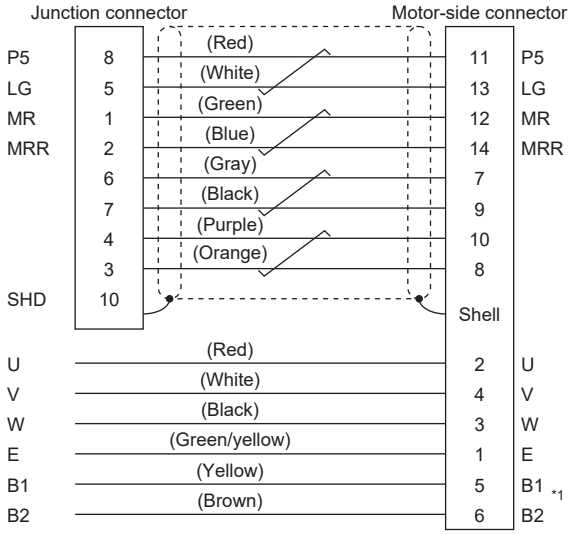
Contact (for motor power supply): MT50E-1820SCFA

Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)



Cable internal wiring diagram



*1 B1 and B2 are the wiring for electromagnetic brake. Wire when MR-AEPB2J20CBL03M-_-L is used. If MR-AEP2J20CBL03M-_-L is used, B1 and B2 do not need to be wired as MR-AEP2J20CBL03M-_-L does not have B1 and B2.

MR-AEPB1CBL_M-_-_/MR-AEP1CBL_M-_-_

Model

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

MR - A E P B 1 C B L 2 M - A 1 - L

Flex type

Symbol	Flex type
L	Standard (for fixed parts)
H	High flex life (for moving parts)

Outlet direction

Symbol	Outlet direction
A1	Load-side lead
A2	Opposite to load-side lead
A5	Vertical lead

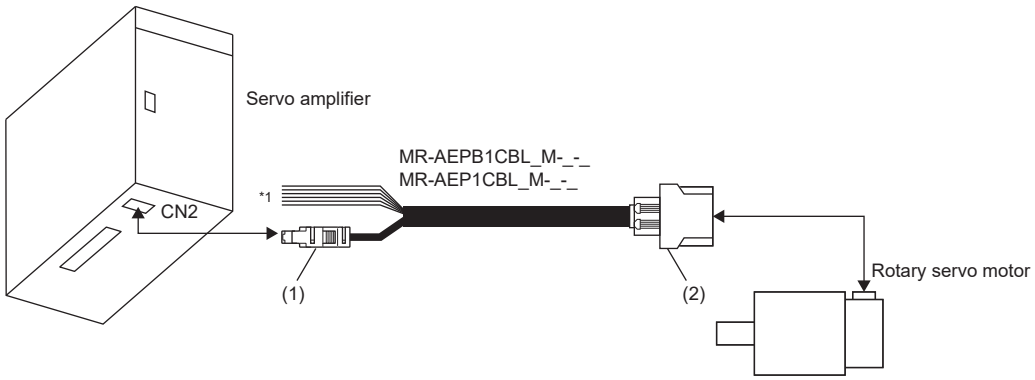
Cable length

Symbol	Cable length [m]
2	2
5	5
10	10

Electromagnetic brake cable

Symbol	Electromagnetic brake cable
None	None
B	○

Connection of servo amplifier and rotary servo motor



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

CN2-side connector (1)

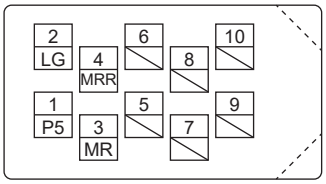
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 94 MR-J3ENSCBL_M-L/MR-J3ENSCBL_M-H

Receptacle: 36210-0100PL

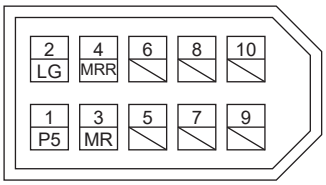
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1016

(Molex)



Motor-side connector (2)

■Load-side lead/opposite to load-side lead

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

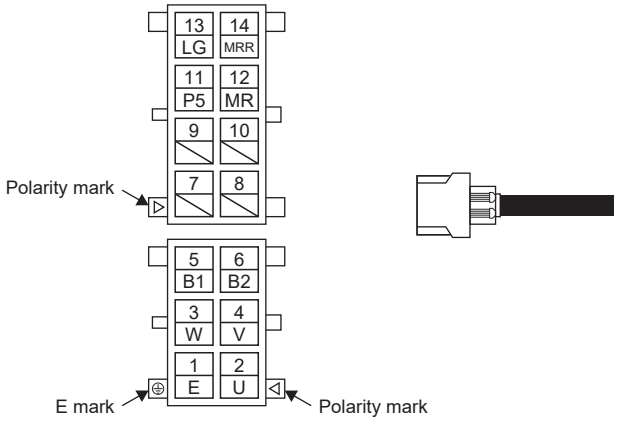
Connector set: MT50W-8D/2D4ES-CVL(11.9)

Contact (for motor power supply): MT50E-1820SCFA

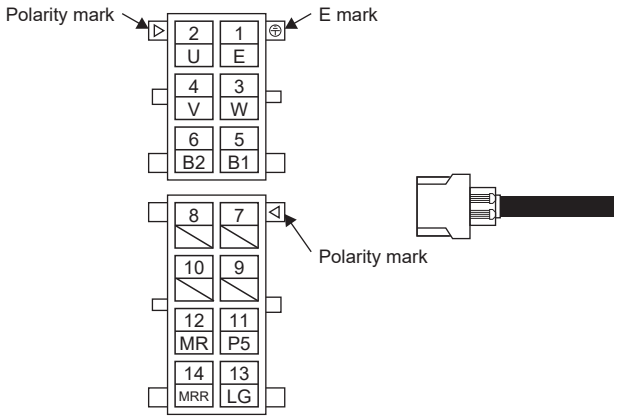
Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)

- Load-side lead



• Lead in opposite direction of load side



■Vertical lead

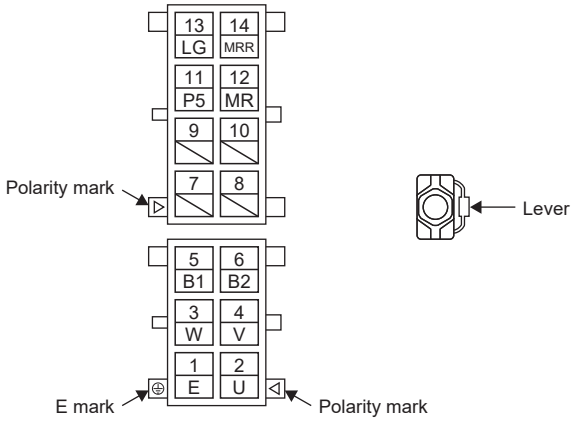
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector set: MT50W-8D/2D4ES-CVS(11.9)

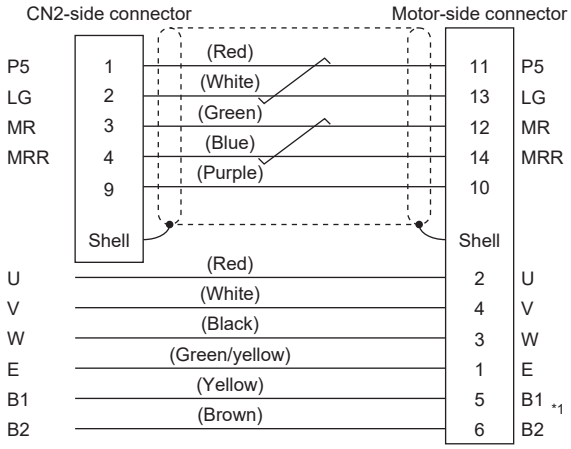
Contact (for motor power supply): MT50E-1820SCFA

Contact (for encoder and electromagnetic brake): MT50D-2224SCFA

(Hirose Electric)



Cable internal wiring diagram



*1 B1 and B2 are the wiring for electromagnetic brake. Wire when MR-AEPB1CBL_M-_-_ is used. If MR-AEP1CBL_M-_-_ is used, B1 and B2 do not need to be wired as MR-AEP1CBL_M-_-_ does not have B1 and B2.

5.3 Encoder cable

MR-AEKCBL_M-_

The servo amplifier and the rotary servo motor cannot be connected by these cables alone. The motor cables for rotary servo motors (MR-AEPB2J10CBL03M-_-L/MR-AEP2J10CBL03M-_-L) are required.

Model

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

MR - AE KCBL 20 M - L

Flex type

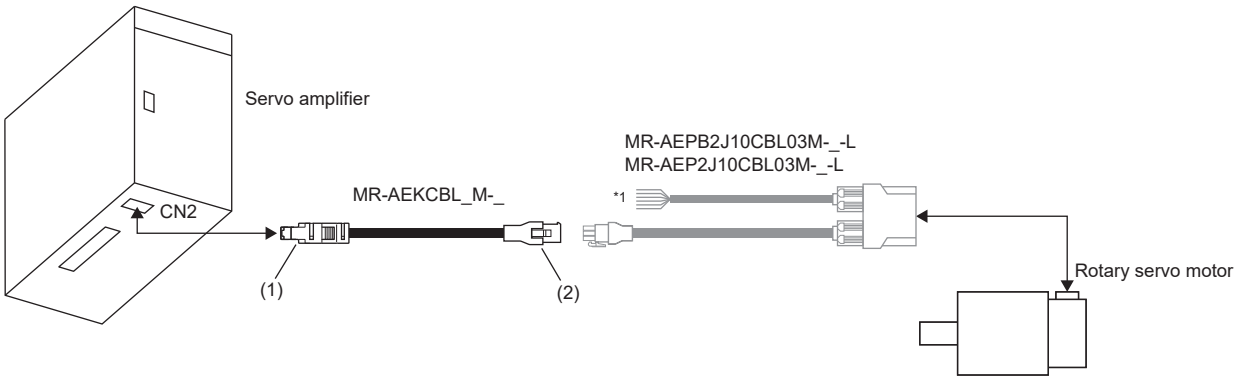
Symbol	Flex type
L	Standard (for fixed parts)
H	High flex life (for moving parts)

Cable length

Symbol	Cable length [m]
20	20
30	30
40	40
50	50

Connection of servo amplifier and rotary servo motor

This connection is for when electromagnetic brake cable is included.



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

CN2-side connector (1)

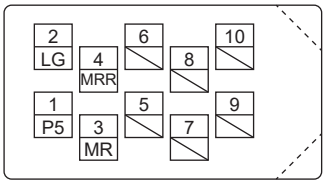
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 94 MR-J3ENSCBL_M-L/MR-J3ENSCBL_M-H

Receptacle: 36210-0100PL

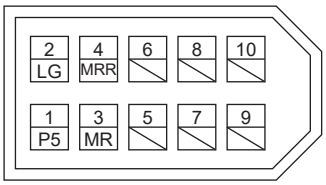
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1016

(Molex)



Junction connector (2)

The following shows the view from the wiring side.

Housing: 1-172161-9

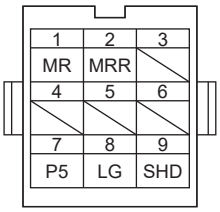
Connector pin: 170359-1

Crimping tool: 91529-1

(TE Connectivity or equivalent)

Cable clamp: MTI-0002

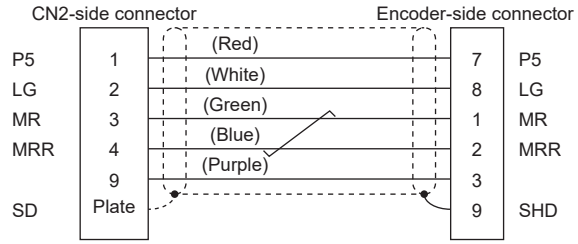
(Toa Electric Industrial)



Internal wiring diagram

The cable colors in the connection diagram apply to the following cables:

HRZDEV-SLAB-C18448(20276), RMDCV-SLAB-C18451(20276) manufactured by Dyden Corporation



When fabricating an encoder cable

Prepare the following parts, and fabricate the cable in accordance with the following.

☞ Page 76 Internal wiring diagram

Refer to the following for the specifications of the cable to use.

☞ Page 84 Wires for option cables

Parts (Connector set)	Description	
	CN2-side connector	Junction connector
MR-ECNM	 Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)	 Housing: 1-172161-9 Connector pin: 170359-1 (TE Connectivity or equivalent) Cable clamp: MTI-0002 (Toa Electric Industrial)

MR-AENSCBL_M-_

Model

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

MR-AENSCBL20M-L

Flex type

Symbol	Flex type
L	Standard (for fixed parts)
H	High flex life (for moving parts)

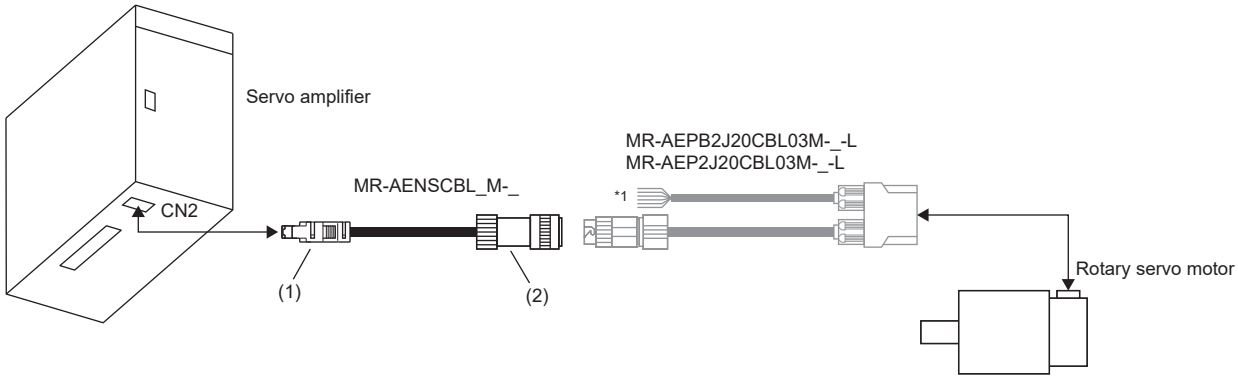
Cable length

Symbol	Cable length [m]
20	20
30	30
40	40
50	50

Connection of servo amplifier and rotary servo motor

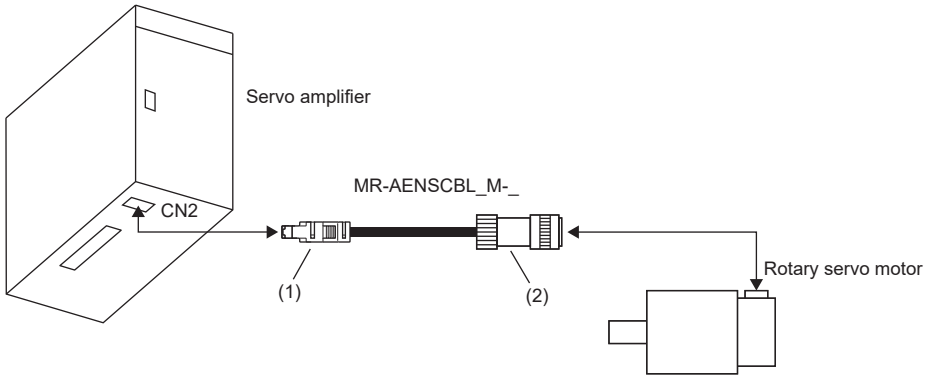
■HK-KN series/HK-FN (0.1 kW - 0.75 kW) series

This connection is for when electromagnetic brake cable is included.



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

■HK-FN (1.0 kW - 3.0 kW) series



CN2-side connector (1)

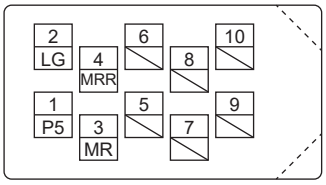
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 94 MR-J3ENSCBL_M-L/MR-J3ENSCBL_M-H

Receptacle: 36210-0100PL

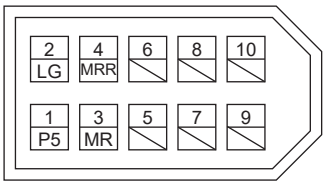
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1016

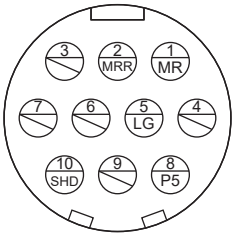
(Molex)



Junction connector (2)

Plug (DDK)	
Straight plug	**Socket contact**
CMV1-SP10S-M2	CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less

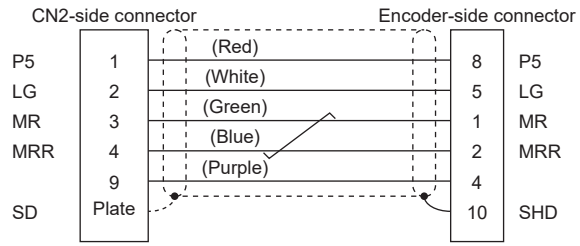
The following shows the view from the wiring side.



Cable internal wiring diagram

The cable colors in the connection diagram apply to the following cables:

HRZDEV-SLAB-C18448(20276), RMDCV-SLAB-C18451(20276) manufactured by Dyden Corporation



When fabricating an encoder cable

Prepare the following parts, and fabricate the cable in accordance with the following diagram.

☞ Page 79 Cable internal wiring diagram

Refer to the following for the specifications of the cable to use.

☞ Page 84 Wires for option cables

Parts (Connector set)	Description	
	Servo amplifier-side connector	Encoder-side connector (DDK)
MR-J3SCNS (One-touch connection type) *1	 Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)	 Straight plug: CMV1-SP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-ENCNS2 (Screw type) *1		 Straight plug: CMV1S-SP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-J3SCNSA (One-touch connection type) *1		 Angle plug: CMV1-AP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-ENCNS2A (Screw type) *1		 Angle plug: CMV1S-AP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less

*1 Cable clamps and bushings for cables with an outer diameter of 5.5 mm to 7.5 mm and 7.0 mm to 9.0 mm are included.

MR-J3ENSCBL_M-_

Model

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

MR - J3 E N S C B L 2 M - L

Flex type

Symbol	Flex type
L	Standard (for fixed parts)
H	High flex life (for moving parts)

Cable length

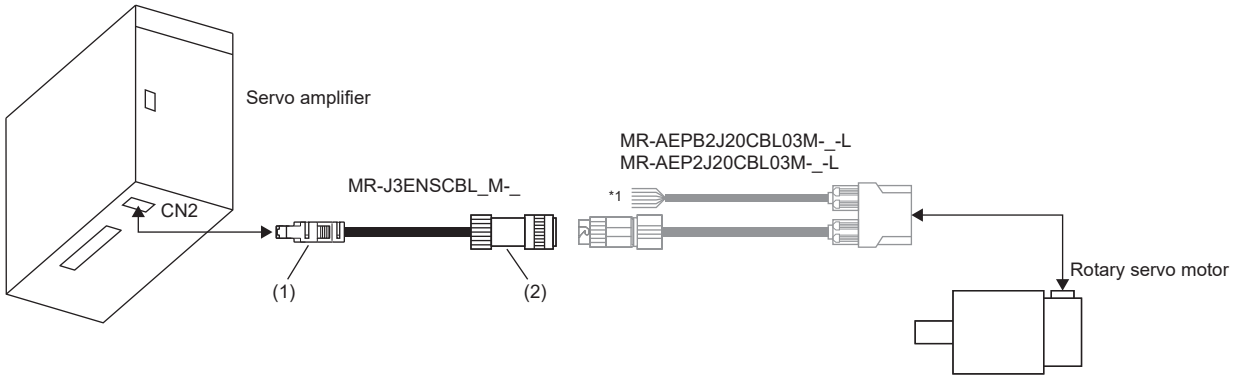
Symbol	Cable length [m]
2	2
5	5
10	10

5

Connection of servo amplifier and rotary servo motor

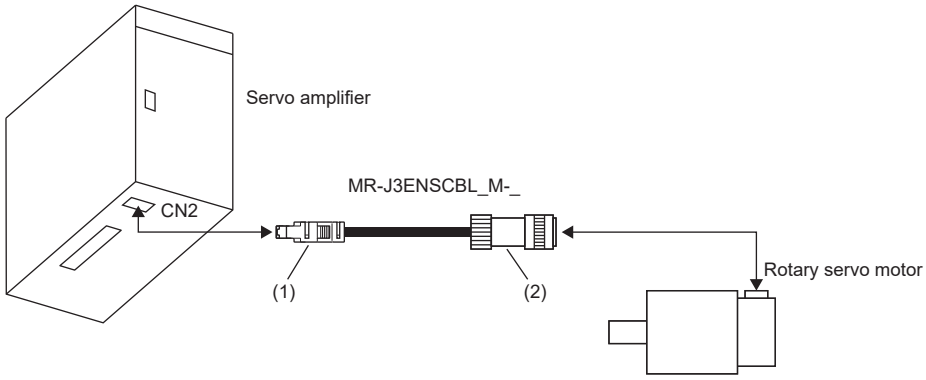
■HK-KN series/HK-FN (0.1 kW - 0.75 kW) series

This connection is for when electromagnetic brake cable is included.



*1 Refer to the following for connection of the power connector.
☞ Page 36 Wiring

■HK-FN (1.0 kW - 3.0 kW) series



CN2-side connector (1)

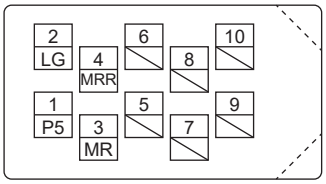
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 94 MR-J3ENSCBL_M-L/MR-J3ENSCBL_M-H

Receptacle: 36210-0100PL

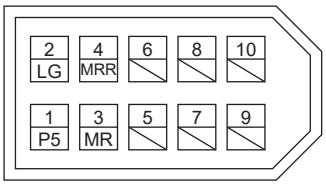
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1019

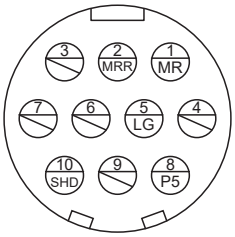
(Molex)



Junction connector (2)

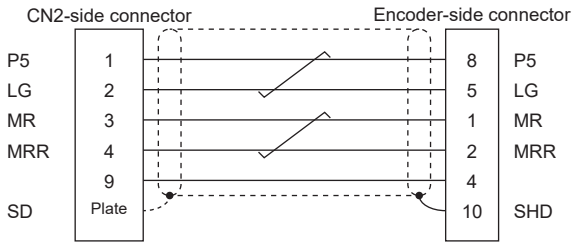
Plug (DDK)	
Straight plug	**Socket contact**
CMV1-SP10S-M1	CMV1-# 22ASC-C1-100 Applicable wire size: AWG 24 to 20 Crimping tool: 357J-53162T

The following shows the view from the wiring side.



Cable internal wiring diagram

- MR-J3ENSCBL2M-L
- MR-J3ENSCBL5M-L
- MR-J3ENSCBL10M-L
- MR-J3ENSCBL2M-H
- MR-J3ENSCBL5M-H
- MR-J3ENSCBL10M-H



When fabricating an encoder cable

Prepare the following parts, and fabricate the cable in accordance with the following diagram.

☞ Page 83 Cable internal wiring diagram

Refer to the following for the specifications of the cable to use.

☞ Page 84 Wires for option cables

Parts (Connector set)	Description	
	Servo amplifier-side connector	Encoder-side connector (DDK)
MR-J3SCNS (One-touch connection type) *1	 Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)	 Straight plug: CMV1-SP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-ENCNS2 (Screw type) *1		 Straight plug: CMV1S-SP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-J3SCNSA (One-touch connection type) *1		 Angle plug: CMV1-AP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-ENCNS2A (Screw type) *1		 Angle plug: CMV1S-AP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less

*1 Cable clamps and bushings for cables with an outer diameter of 5.5 mm to 7.5 mm and 7.0 mm to 9.0 mm are included.

5.4 Wires for option cables

Precautions for option cables

When wiring the cables, leave the minimum bending radius or more to prevent stress from being applied to the cables. Refer to the following for the cable flex life.

☞ Page 95 Cable bending life

If special length shielded cables or shielded power cables are required, use the HK series motor cables manufactured by Mitsubishi Electric System & Service Co., Ltd. that meet the following specifications.

- UL 758 (AWM) (For encoder: UL style 20276 For power supply/brake: UL style 2586)
- Flame retardant UL 1581 VW-1

For the detailed specifications, contact your local sales office.

MR-AEPB2CBL_M-_-L/MR-AEPB2CBL_M-_-H

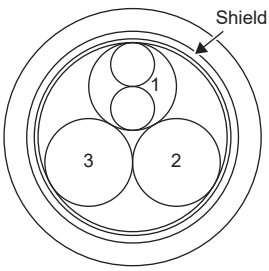
Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEPB2CBL_M-_-L	For encoder	2 to 10	Standard (for fixed parts)	UL style 20276	VW-1
	For power supply/brake			UL style 2586	VW-1
MR-AEPB2CBL_M-_-H	For encoder	2 to 10	High flex life (for moving parts)	UL style 20276	VW-1
	For power supply/brake			UL style 2586	VW-1

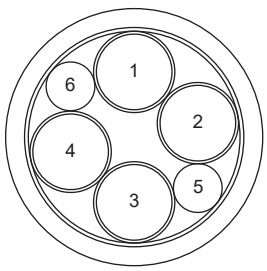
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEPB2CBL_M-_-L	For encoder	AWG 22 × 3 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply/brake	AWG 18 × 4 cores AWG 24 × 2 cores	—	Flame-retardant and oil-resistant PVC	Black
MR-AEPB2CBL_M-_-H	For encoder	AWG 22 × 3 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply/brake	AWG 18 × 4 cores AWG 24 × 2 cores	—	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEPB2CBL_M-_-L	For encoder	0.76 (AWG 22)	7.5	4 times the cable OD	10 or more	500
	For power supply/brake	1.21 (AWG 18) 0.6 (AWG 24)	7.5	4 times the cable OD	100 or more	2000
MR-AEPB2CBL_M-_-H	For encoder	0.77 (AWG 22)	7.5	4 times the cable OD	100 or more	500
	For power supply/brake	1.36 (AWG 18) 0.61 (AWG 24)	7.5	4 times the cable OD	100 or more	2000

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEPB2CBL_M-_-L	For encoder	80	55.0 or less	30	HRZVV-SB-C18465 (20276)	Dyden
	For power supply/brake	105	21.8 or less 92.2 or less	600	HRZFEV-C18213 (2586)	
MR-AEPB2CBL_M-_-H	For encoder	80	55.0 or less	30	RMFEV-SB-C18466 (20276)	
	For power supply/brake	105	25.6 or less 97.6 or less	600	RMFEV-C18211 (2586)	

HRZVV-SB-C18465(20276)/RMFEV-SB-C18466(20276)		HRZFEV-C18213(2586)/RMFEV-C18211(2586)	
Reference diagram	AWG 22 1: Red and white 2: Green and blue 3: Purple and orange	Reference diagram	Power supply (AWG 18) 1: Black 2: White 3: Red 4: Green/yellow Electromagnetic brake (AWG 24) 5: Brown 6: Yellow





MR-AEP2CBL_M-_-L/MR-AEP2CBL_M-_-H

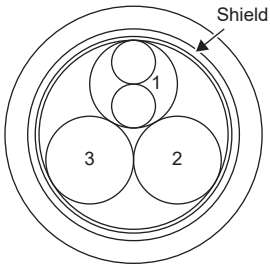
Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEP2CBL_M-_-L	For encoder	2 to 10	Standard (for fixed parts)	UL style 20276	VW-1
	For power supply			UL style 2586	VW-1
MR-AEP2CBL_M-_-H	For encoder	2 to 10	High flex life (for moving parts)	UL style 20276	VW-1
	For power supply			UL style 2586	VW-1

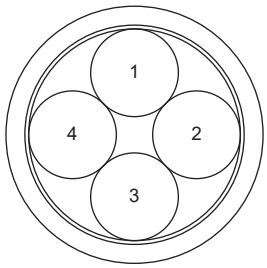
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEP2CBL_M-_-L	For encoder	AWG 22 × 3 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply	AWG 18 × 4 cores	—	Flame-retardant and oil-resistant PVC	Black
MR-AEP2CBL_M-_-H	For encoder	AWG 22 × 3 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply	AWG 18 × 4 cores	—	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEP2CBL_M-_-L	For encoder	0.76 (AWG 22)	7.5	4 times the cable OD	10 or more	500
	For power supply	1.21 (AWG 18)	7.5	4 times the cable OD	100 or more	2000
MR-AEP2CBL_M-_-H	For encoder	0.77 (AWG 22)	7.5	4 times the cable OD	100 or more	500
	For power supply	1.36 (AWG 18)	7.5	4 times the cable OD	100 or more	2000

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEP2CBL_M-_-L	For encoder	80	55.0 or less	30	HRZVV-SB-C18465 (20276)	Dyden
	For power supply	105	21.8 or less	600	HRZFEV-C18355 (2586)	
MR-AEP2CBL_M-_-H	For encoder	80	55.0 or less	30	RMFEV-SB-C18466 (20276)	
	For power supply	105	25.6 or less	600	RMFEV-C18353 (2586)	

HRZVV-SB-C18465(20276)/RMFEV-SB-C18466(20276)		HRZFEV-C18355(2586)/RMFEV-C18353(2586)	
Reference diagram	AWG 22 1: Red and white 2: Green and blue 3: Purple and orange	Reference diagram	AWG 18 1: Black 2: White 3: Red 4: Green/yellow





MR-AEPB2J20CBL03M-_-L/MR-AEPB2J10CBL03M-_-L

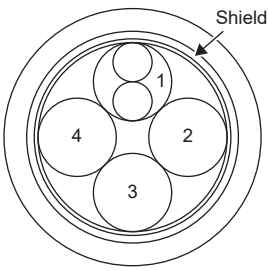
Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEPB2J20CBL03M-_-L	For encoder	0.3	Standard (for fixed parts)	UL style 20276	VW-1
	For power supply/brake			UL style 2586	VW-1
MR-AEPB2J10CBL03M-_-L	For encoder	0.3	Standard (for fixed parts)	UL style 20276	VW-1
	For power supply/brake			UL style 2586	VW-1

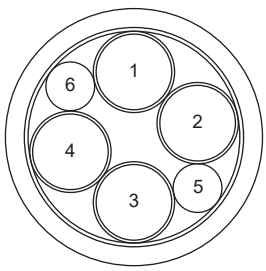
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEPB2J20CBL03M-_-L	For encoder	AWG 24 × 4 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply/brake	AWG 18 × 4 cores AWG 24 × 2 cores	—	Flame-retardant and oil-resistant PVC	Black
MR-AEPB2J10CBL03M-_-L	For encoder	AWG 24 × 4 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply/brake	AWG 18 × 4 cores AWG 24 × 2 cores	—	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEPB2J20CBL03M-_-L	For encoder	0.6 (AWG 24)	7.5	4 times the cable OD	10 or more	500
	For power supply/brake	1.21 (AWG 18) 0.6 (AWG 24)	7.5	4 times the cable OD	100 or more	2000
MR-AEPB2J10CBL03M-_-L	For encoder	0.6 (AWG 24)	7.5	4 times the cable OD	10 or more	500
	For power supply/brake	1.21 (AWG 18) 0.6 (AWG 24)	7.5	4 times the cable OD	100 or more	2000

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEPB2J20CBL03M-_-L	For encoder	80	92.2 or less	30	HRZVV-SB-C18467 (20276)	Dyden
	For power supply/brake	105	21.8 or less 92.2 or less	600	HRZFEV-C18213 (2586)	
MR-AEPB2J10CBL03M-_-L	For encoder	80	92.2 or less	30	HRZVV-SB-C18467 (20276)	
	For power supply/brake	105	21.8 or less 92.2 or less	600	HRZFEV-C18213 (2586)	

HRZVV-SB-C18467(20276)		HRZFEV-C18213(2586)	
Reference diagram	AWG 24 1: Red and white 2: Green and blue 3: Purple and orange 4: Gray and black	Reference diagram	Power supply (AWG 18) 1: Black 2: White 3: Red 4: Green/yellow Electromagnetic brake (AWG 24) 5: Brown 6: Yellow





MR-AEP2J20CBL03M-_-L/MR-AEP2J10CBL03M-_-L

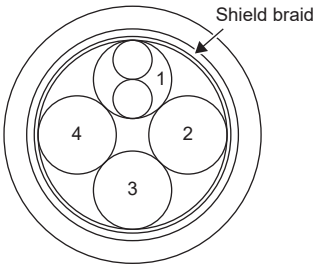
Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEP2J20CBL03M-_-L	For encoder	0.3	Standard (for fixed parts)	UL style 20276	VW-1
	For power supply			UL style 2586	VW-1
MR-AEP2J10CBL03M-_-L	For encoder	0.3	Standard (for fixed parts)	UL style 20276	VW-1
	For power supply			UL style 2586	VW-1

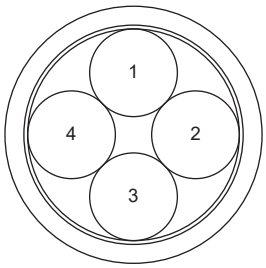
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEP2J20CBL03M-_-L	For encoder	AWG 24 × 4 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply	AWG 18 × 4 cores	—	Flame-retardant and oil-resistant PVC	Black
MR-AEP2J10CBL03M-_-L	For encoder	AWG 24 × 4 pairs	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
	For power supply	AWG 18 × 4 cores	—	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEP2J20CBL03M-_-L	For encoder	0.6 (AWG 24)	7.5	4 times the cable OD	10 or more	500
	For power supply	1.21 (AWG 18)	7.5	4 times the cable OD	100 or more	2000
MR-AEP2J10CBL03M-_-L	For encoder	0.6 (AWG 24)	7.5	4 times the cable OD	10 or more	500
	For power supply	1.21 (AWG 18)	7.5	4 times the cable OD	100 or more	2000

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEP2J20CBL03M-_-L	For encoder	80	92.2 or less	30	HRZVV-SB-C18467 (20276)	Dyden
	For power supply	105	21.8 or less	600	HRZFEV-C18355 (2586)	
MR-AEP2J10CBL03M-_-L	For encoder	80	92.2 or less	30	HRZVV-SB-C18467 (20276)	
	For power supply	105	21.8 or less	600	HRZFEV-C18355 (2586)	

HRZVV-SB-C18467(20276)		HRZFEV-C18355(2586)	
Reference diagram	AWG 24 1: Red and white 2: Green and blue 3: Purple and orange 4: Gray and black	Reference diagram	AWG 18 1: Black 2: White 3: Red 4: Green/yellow





MR-AEPB1CBL_M-_-L/MR-AEP1CBL_M-_-L

Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEPB1CBL_M-_-L	For encoder/power supply/brake	2 to 10	Standard (for fixed parts)	UL style 2586	VW-1
MR-AEP1CBL_M-_-L	For encoder/power supply	2 to 10	Standard (for fixed parts)	UL style 2586	VW-1

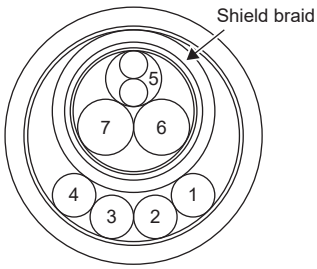
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEPB1CBL_M-_-L	For encoder/power supply/brake	AWG 18 × 4 cores AWG 24 × 2 cores AWG 22 × 3 pairs	Tinned annealed copper wire (encoder cables only)	Flame-retardant and oil-resistant PVC	Black
MR-AEP1CBL_M-_-L	For encoder/power supply	AWG 18 × 4 cores AWG 22 × 3 pairs	Tinned annealed copper wire (encoder cables only)	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEPB1CBL_M-_-L	For encoder/power supply/brake	1.21 (AWG 18) 0.6 (AWG 24) 0.76 (AWG 22)	11.9	4 times the cable OD	100 or more	2000
MR-AEP1CBL_M-_-L	For encoder/power supply	1.21 (AWG 18) 0.76 (AWG 22)	11.9	4 times the cable OD	100 or more	2000

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEPB1CBL_M-_-L	For encoder/power supply/brake	105	21.8 or less 92.2 or less 55.0 or less	600	HRZFEV-ESB-C18737 (2586)	Dyden
MR-AEP1CBL_M-_-L	For encoder/power supply	105	21.8 or less 55.0 or less	600	HRZFEV-ESB-C18785 (2586)	

HRZFEV-ESB-C18785(2586)

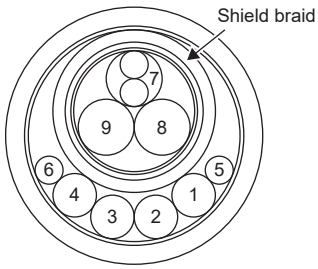
Reference diagram



Power supply (AWG 18)
1: Black
2: White
3: Red
4: Green/yellow
Encoder (AWG 22)
5: Red and white
6: Green and blue
7: Purple and orange

HRZFEV-ESB-C18737(2586)

Reference diagram



Power supply (AWG 18)
1: Black
2: White
3: Red
4: Green/yellow
Electromagnetic brake (AWG 24)
5: Brown
6: Yellow
Encoder (AWG 22)
7: Red and white
8: Green and blue
9: Purple and orange

5

MR-AEPB1CBL_M-_-H/MR-AEP1CBL_M-_-H

Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEPB1CBL_M-_-H	For encoder/power supply/brake	2 to 10	High flex life (for moving parts)	UL style 2586	VW-1
MR-AEP1CBL_M-_-H	For encoder/power supply	2 to 10	High flex life (for moving parts)	UL style 2586	VW-1

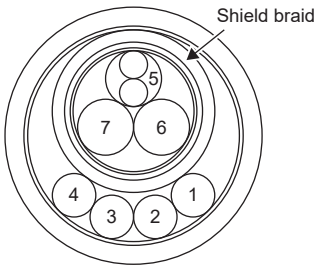
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEPB1CBL_M-_-H	For encoder/power supply/brake	AWG 18 × 4 cores AWG 24 × 2 cores AWG 22 × 3 pairs	Tinned annealed copper wire (encoder cables only)	Flame-retardant and oil-resistant PVC	Black
MR-AEP1CBL_M-_-H	For encoder/power supply	AWG 18 × 4 cores AWG 22 × 3 pairs	Tinned annealed copper wire (encoder cables only)	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEPB1CBL_M-_-H	For encoder/power supply/brake	1.36 (AWG 18) 0.61 (AWG 24) 0.77 (AWG 22)	11.9	4 times the cable OD	100 or more	2000
MR-AEP1CBL_M-_-H	For encoder/power supply	1.36 (AWG 18) 0.77 (AWG 22)	11.9	4 times the cable OD	100 or more	2000

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEPB1CBL_M-_-H	For encoder/power supply/brake	105	25.6 or less 97.6 or less 55.0 or less	600	RMFEV-ESB-C18222 (2586)	Dyden
MR-AEP1CBL_M-_-H	For encoder/power supply	105	25.6 or less 55.0 or less	600	RMFEV-ESB-C18786 (2586)	

RMFEV-ESB-C18786(2586)

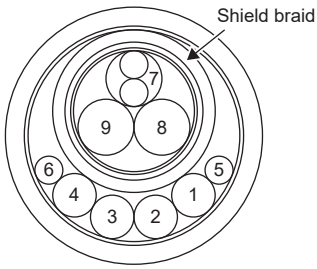
Reference diagram



Power supply (AWG 18)
1: Black
2: White
3: Red
4: Green/yellow
Encoder (AWG 22)
5: Red and white
6: Green and blue
7: Purple and orange

RMFEV-ESB-C18222(2586)

Reference diagram



Power supply (AWG 18)
1: Black
2: White
3: Red
4: Green/yellow
Electromagnetic brake (AWG 24)
5: Brown
6: Yellow
Encoder (AWG 22)
7: Red and white
8: Green and blue
9: Purple and orange

MR-AENSCBL_M-L/MR-AENSCBL_M-H

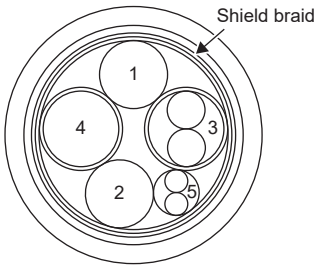
Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AENSCBL_M-L	For encoder	20, 30	Standard (for fixed parts)	UL style 20276	VW-1
MR-AENSCBL_M-H	For encoder	20 to 50	High flex life (for moving parts)	UL style 20276	VW-1

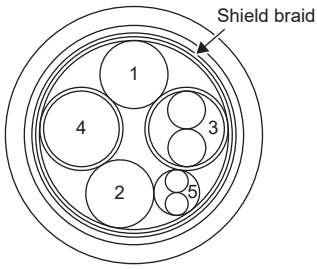
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AENSCBL_M-L	For encoder	AWG 15 × 2 cores AWG 22 × 2 pairs AWG 24 × 1 pair	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
MR-AENSCBL_M-H	For encoder	AWG 15 × 2 cores AWG 23 × 2 pairs AWG 24 × 1 pair	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AENSCBL_M-L	For encoder	1.83 (AWG 15) 0.78 (AWG 22) 0.6 (AWG 24)	8.6	4 times the cable OD	100 or more	500
MR-AENSCBL_M-H	For encoder	2.0 (AWG 15) 0.72 (AWG 23) 0.61 (AWG 24)	8.7	4 times the cable OD	100 or more	500

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AENSCBL_M-L	For encoder	80	10.5 or less 55.5 or less 93.9 or less	30	HRZDEV-SLAB-C18448 (20276)	Dyden
MR-AENSCBL_M-H	For encoder	80	11.0 or less 72.9 or less 99.4 or less	30	RMDCV-SLAB-C18451 (20276)	

HRZDEV-SLAB-C18448(20276)		RMDCV-SLAB-C18451(20276)	
Reference diagram	AWG 15 1: Red 2: White AWG 22 3: Green and blue 4: Gray and black AWG 24 5: Purple and orange	Reference diagram	AWG 15 1: Red 2: White AWG 23 3: Green and blue 4: Gray and black AWG 24 5: Purple and orange





MR-AEKCBL_M-L/MR-AEKCBL_M-H

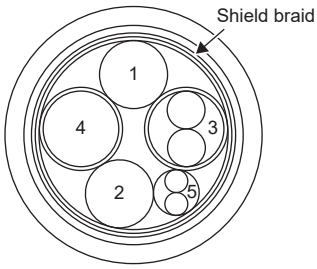
Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-AEKCBL_M-L	For encoder	20, 30	Standard (for fixed parts)	UL style 20276	VW-1
MR-AEKCBL_M-H	For encoder	20 to 50	High flex life (for moving parts)	UL style 20276	VW-1

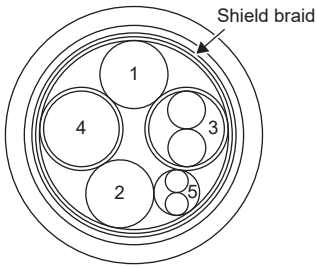
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-AEKCBL_M-L	For encoder	AWG 15 × 2 cores AWG 22 × 2 pairs AWG 24 × 1 pair	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black
MR-AEKCBL_M-H	For encoder	AWG 15 × 2 cores AWG 23 × 2 pairs AWG 24 × 1 pair	Tinned annealed copper wire	Flame-retardant and oil-resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD [*1] [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-AEKCBL_M-L	For encoder	1.83 (AWG 15) 0.78 (AWG 22) 0.6 (AWG 24)	8.6	4 times the cable OD	100 or more	500
MR-AEKCBL_M-H	For encoder	2.0 (AWG 15) 0.72 (AWG 23) 0.61 (AWG 24)	8.7	4 times the cable OD	100 or more	500

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-AEKCBL_M-L	For encoder	80	10.5 or less 55.5 or less 93.9 or less	30	HRZDEV-SLAB-C18448 (20276)	Dyden
MR-AEKCBL_M-H	For encoder	80	11.0 or less 72.9 or less 99.4 or less	30	RMDCV-SLAB-C18451 (20276)	

HRZDEV-SLAB-C18448(20276)		RMDCV-SLAB-C18451(20276)	
Reference diagram	AWG 15 1: Red 2: White AWG 22 3: Green and blue 4: Gray and black AWG 24 5: Purple and orange	Reference diagram	AWG 15 1: Red 2: White AWG 23 3: Green and blue 4: Gray and black AWG 24 5: Purple and orange





MR-J3ENSCBL_M-L/MR-J3ENSCBL_M-H

Item		Cable length [m]	Flex type	Applicable standard	
				For wiring between devices UL 758 (AWM)	Flame retardant UL 1581
MR-J3ENSCBL_M-L	For encoder	2 to 10	Standard (for fixed parts)	—	—
MR-J3ENSCBL_M-H	For encoder	2 to 10	High flex life (for moving parts)	—	—

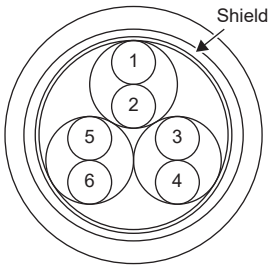
Item		Physical characteristics			
		Conductor construction	Braided shielding material	Sheath material	Color
MR-J3ENSCBL_M-L	For encoder	AWG 22 × 3 pairs	Tinned annealed copper wire	Lead-free heat resistant PVC	Black
MR-J3ENSCBL_M-H	For encoder	AWG 22 × 3 pairs	Tinned annealed copper wire	Lead-free heat resistant PVC	Black

Item		Wire specifications				
		Conductor OD [mm]	Cable OD *1 [mm]	Minimum bending radius [mm] (recommended value)	Insulation resistance (at 20 °C) [MΩ/km]	Withstand voltage [Vac/min]
MR-J3ENSCBL_M-L	For encoder	0.78 (AWG 22)	7.2	8 times the cable OD	10 or more	500
MR-J3ENSCBL_M-H	For encoder	0.77 (AWG 22)	7.2	8 times the cable OD	10 or more	500

Item		Wire specifications			Recommended product	
		Rated temperature [°C]	Conductor resistance (at 20 °C) [Ω/km]	Rated voltage [V]	Model	Manufacturer
MR-J3ENSCBL_M-L	For encoder	80	53.0 or less	30	VSVP 7/0.26 (AWG #22 or equivalent) -3P KB-1655	Bando Densen
MR-J3ENSCBL_M-H	For encoder	80	56.0 or less	30	TPE•SVP 70/0.08 (AWG #22 or equivalent) -3P KB-2237	

VSVP 7/0.26 (AWG #22 or equivalent) -3P KB-1655
TPE•SVP 70/0.08 (AWG #22 or equivalent) -3P KB-2237

Reference diagram

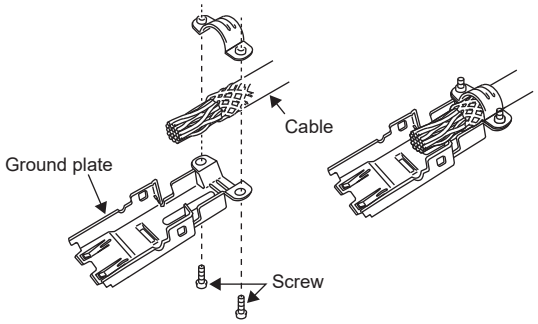


AWG 22
1: Black
2: White
3: Red
4: Green
5: Yellow
6: Brown

*1 Standard OD. The maximum OD is about 10 % greater.

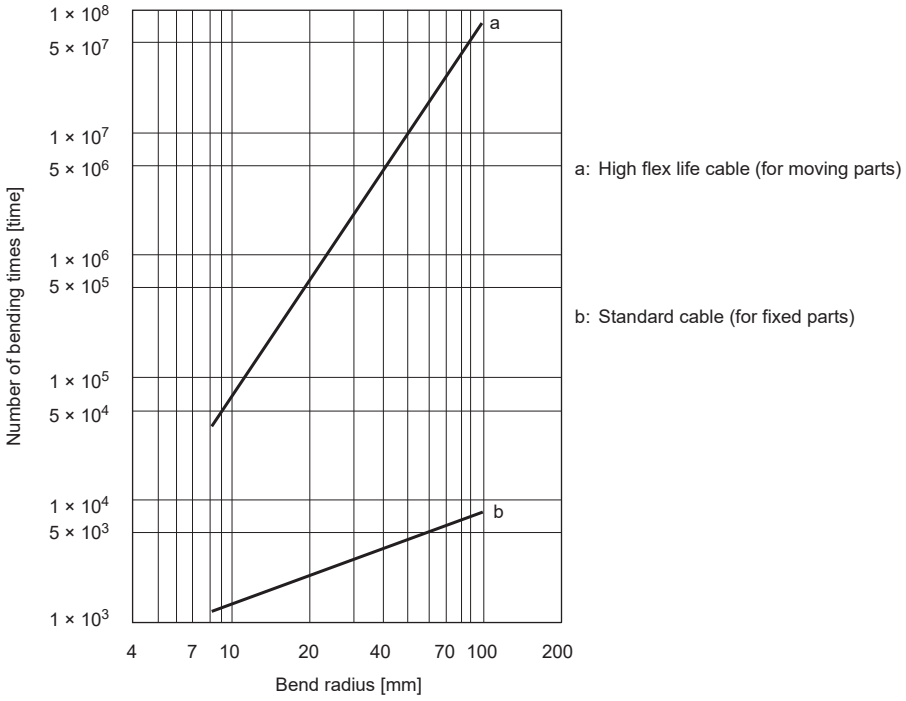
5.5 Shield procedure of CN2 side connectors

For the CN2 side connector, securely connect the shielded external conductor of the cable to the ground plate and fix it to the connector shell.



5.6 Cable bending life

The flex life of the cables is shown below. This graph shows calculated values and not guaranteed values. The values are calculated from fully disconnected cables and do not take into account wear from electrical characteristics, sheath abrasion, or insulation deterioration. Allow for some deviation in these values.



6 WIRING OPTION (HG-KNS SERIES/HG-SNS SERIES)

When cables are fabricated by the customer, wires should be selected in accordance with the application.

Precautions

- Use specified options. Otherwise, it may cause a malfunction or fire.
- MR-J3SCNS(A) and MR-ENCNS2(A) connector sets are packed with a plug and contacts. As using contacts for other plugs may damage the connector, use the enclosed contacts.
- Correctly wire options and peripheral equipment, etc. in the correct combination.
- We recommend using HIV wires to wire the rotary servo motors, options, and peripheral equipment. Therefore, the recommended wire sizes may be different from those of the wires used for previous generation rotary servo motors.

6.1 Cable/connector sets

Point

The indicated IP rating is the cable and connector's protection against ingress of dust and water when the cable and connector are connected to a rotary servo motor. If the IP rating of the cable, connector, and rotary servo motor varies, the overall IP rating depends on the lowest IP rating of all components.

Please purchase the cable and connector options indicated in this section for the rotary servo motor. When fabricating an encoder cable, refer to the following.

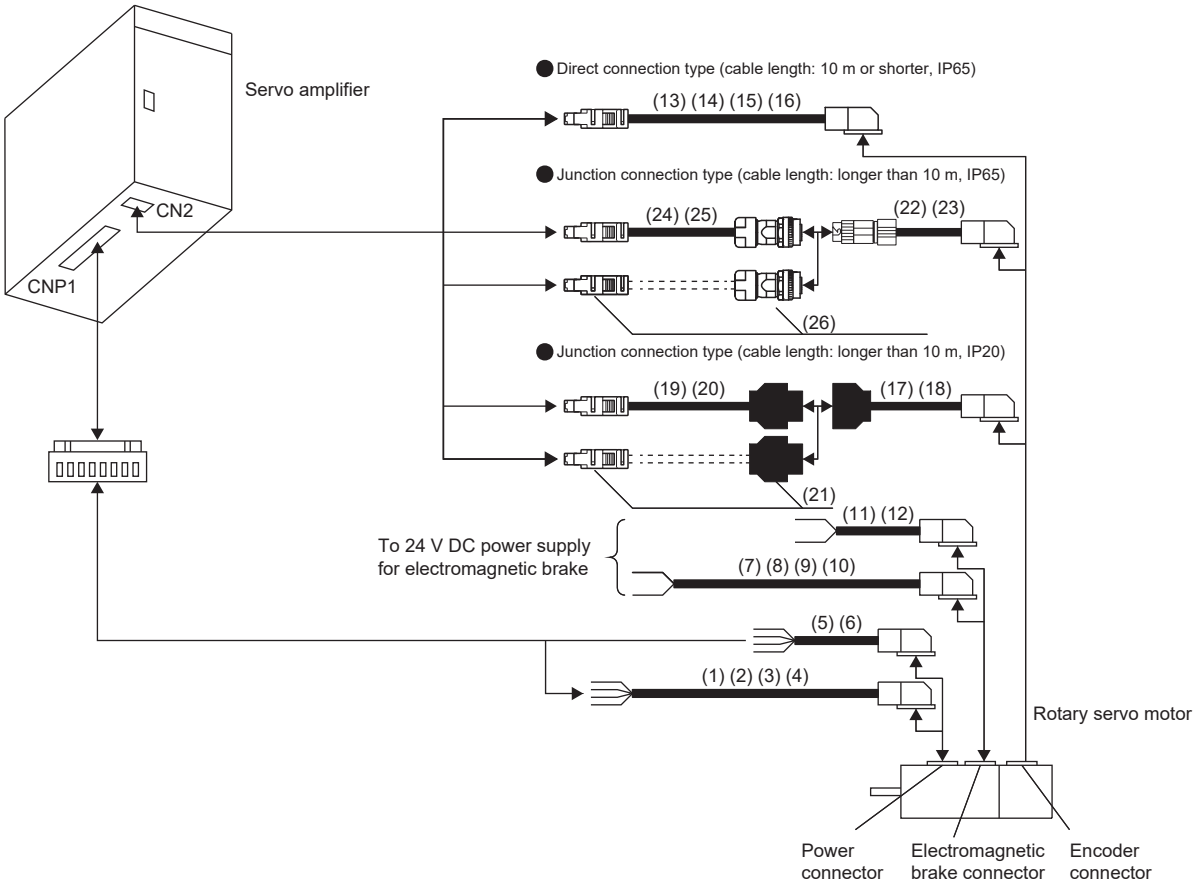
☞ Page 256 Fabrication of the encoder cable

For whether the battery is required when an absolute position detection system is configured, refer to "Battery" in the following manual.

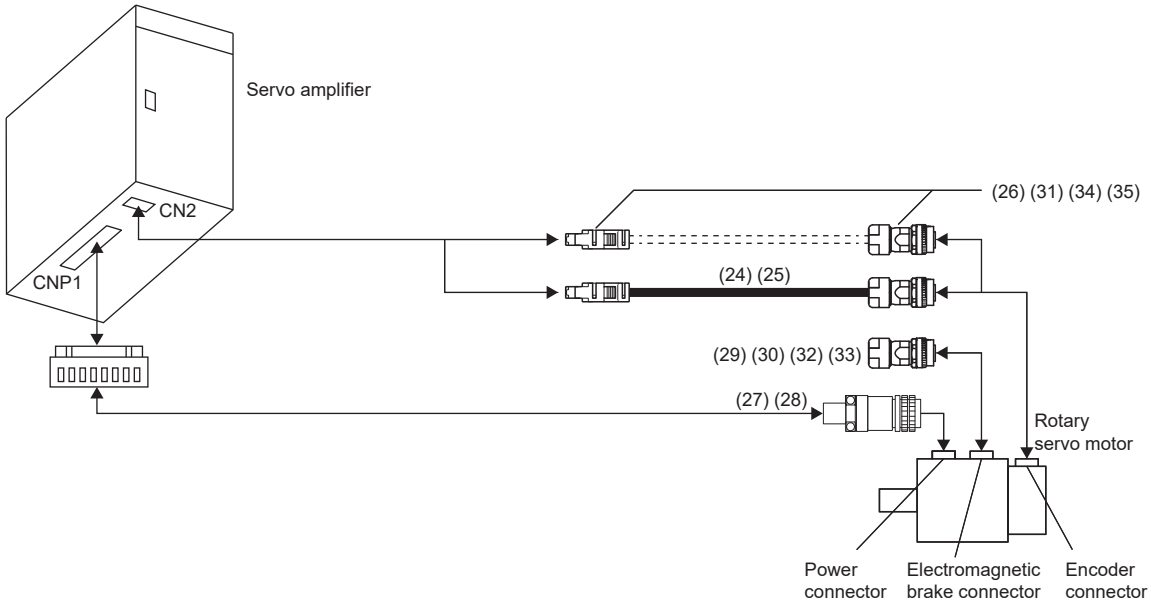
📖MR-JET User's Manual (Hardware)

Combinations of cable/connector sets

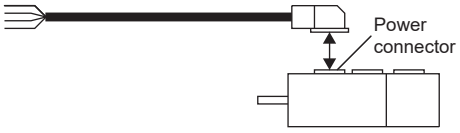
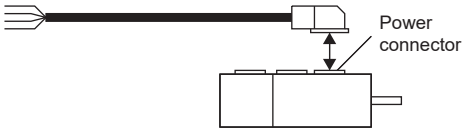
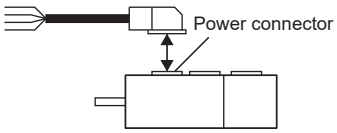
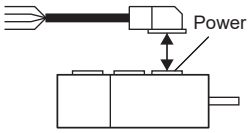
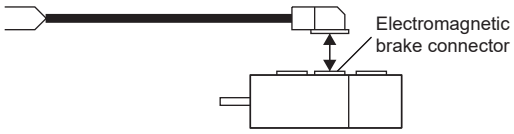
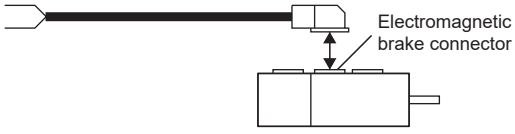
HG-KNS series

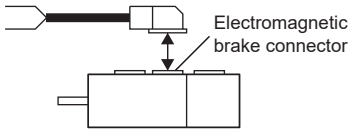
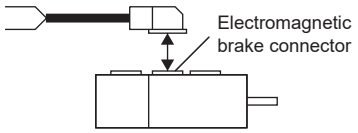
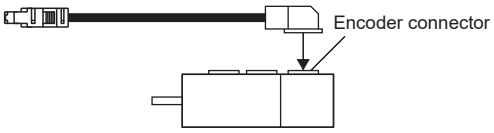
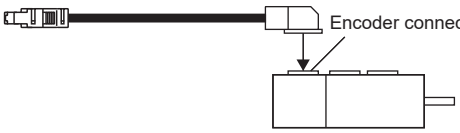
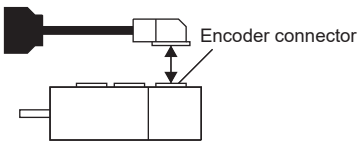
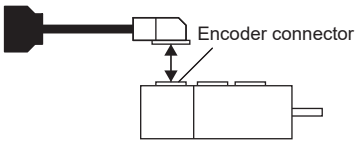


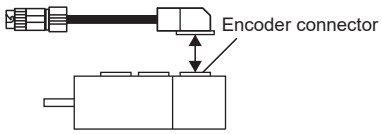
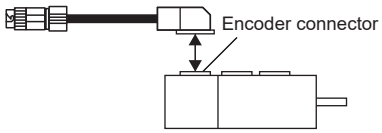
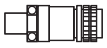
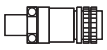
HG-SNS series



Cable and connector list

No.	Product name	Model	Description	Remark
(1)	Servo motor power cable	MR-PWS1CBL_M-A1-L [*1] Cable length: 2/5/10 m	 ☞ Page 117 Servo motor power cable	IP65 Load-side lead Standard (for fixed parts)
(2)	Servo motor power cable	MR-PWS1CBL_M-A1-H [*1] Cable length: 2/5/10 m		IP65 Load-side lead Long bending life (for moving parts)
(3)	Servo motor power cable	MR-PWS1CBL_M-A2-L [*1] Cable length: 2/5/10 m	 ☞ Page 117 Servo motor power cable	IP65 Lead in opposite direction of load side Standard (for fixed parts)
(4)	Servo motor power cable	MR-PWS1CBL_M-A2-H [*1] Cable length: 2/5/10 m		IP65 Lead in opposite direction of load side Long bending life (for moving parts)
(5)	Servo motor power cable	MR-PWS2CBL03M-A1-L [*1] Cable length: 0.3 m	 ☞ Page 117 Servo motor power cable	IP55 Load-side lead Standard (for fixed parts)
(6)	Servo motor power cable	MR-PWS2CBL03M-A2-L [*1] Cable length: 0.3 m	 ☞ Page 117 Servo motor power cable	IP55 Lead in opposite direction of load side Standard (for fixed parts)
(7)	Electromagnetic brake cable	MR-BKS1CBL_M-A1-L Cable length: 2/5/10 m	 ☞ Page 119 Electromagnetic brake cable	IP65 Load-side lead Standard (for fixed parts)
(8)	Electromagnetic brake cable	MR-BKS1CBL_M-A1-H Cable length: 2/5/10 m		IP65 Load-side lead Long bending life (for moving parts)
(9)	Electromagnetic brake cable	MR-BKS1CBL_M-A2-L Cable length: 2/5/10 m	 ☞ Page 119 Electromagnetic brake cable	IP65 Lead in opposite direction of load side Standard (for fixed parts)
(10)	Electromagnetic brake cable	MR-BKS1CBL_M-A2-H Cable length: 2/5/10 m		IP65 Lead in opposite direction of load side Long bending life (for moving parts)

No.	Product name	Model	Description	Remark
(11)	Electromagnetic brake cable	MR-BKS2CBL03M-A1-L Cable length: 0.3 m	 ☞ Page 119 Electromagnetic brake cable	IP55 Load-side lead Standard (for fixed parts)
(12)	Electromagnetic brake cable	MR-BKS2CBL03M-A2-L Cable length: 0.3 m	 ☞ Page 119 Electromagnetic brake cable	IP55 Lead in opposite direction of load side Standard (for fixed parts)
(13)	Encoder cable	MR-J3ENCBL_M-A1-L *1 Cable length: 2/5/10 m	 ☞ Page 103 MR-J3ENCBL_M-_-_	IP65 Load-side lead Standard (for fixed parts)
(14)	Encoder cable	MR-J3ENCBL_M-A1-H *1 Cable length: 2/5/10 m		IP65 Load-side lead Long bending life (for moving parts)
(15)	Encoder cable	MR-J3ENCBL_M-A2-L *1 Cable length: 2/5/10 m	 ☞ Page 103 MR-J3ENCBL_M-_-_	IP65 Lead in opposite direction of load side Standard (for fixed parts)
(16)	Encoder cable	MR-J3ENCBL_M-A2-H *1 Cable length: 2/5/10 m		IP65 Lead in opposite direction of load side Long bending life (for moving parts)
(17)	Encoder cable	MR-J3JCBL03M-A1-L *1 Cable length: 0.3 m	 ☞ Page 105 MR-J3JCBL03M-_-L	IP20 Load-side lead Standard (for fixed parts)
(18)	Encoder cable	MR-J3JCBL03M-A2-L *1 Cable length: 0.3 m	 ☞ Page 105 MR-J3JCBL03M-_-L	IP20 Lead in opposite direction of load side Standard (for fixed parts)
(19)	Encoder cable	MR-EKCBL_M-L Cable length: 20/30 m	 ☞ Page 109 MR-EKCBL_M-_	IP20 Standard (for fixed parts)
(20)	Encoder cable	MR-EKCBL_M-H Cable length: 20/30/40/50 m		IP20 Long bending life (for moving parts)

No.	Product name	Model	Description	Remark
(21)	Encoder connector set	MR-ECNM	 ☞ Page 109 MR-EKCBL_M-_	IP20
(22)	Encoder cable	MR-J3JSCBL03M-A1-L *1 Cable length: 0.3 m	 ☞ Page 107 MR-J3JSCBL03M-_-L	IP65 Load-side lead Standard (for fixed parts)
(23)	Encoder cable	MR-J3JSCBL03M-A2-L *1 Cable length: 0.3 m	 ☞ Page 107 MR-J3JSCBL03M-_-L	IP65 Load-side lead Standard (for fixed parts)
(24)	Encoder cable	MR-J3ENSCBL_M-L *1 Cable length: 2/5/10/20/30 m	 ☞ Page 113 MR-J3ENSCBL_M-_	IP67 Standard (for fixed parts)
(25)	Encoder cable	MR-J3ENSCBL_M-H *1 Cable length: 2/5/10/20/30/40/50 m		IP67 Long bending life (for moving parts)
(26)	Encoder connector set	MR-J3SCNS *1	 ☞ Page 113 MR-J3ENSCBL_M-_	IP67
(27)	Power connector set	MR-PWCNS4	 HG-SNS52J HG-SNS102J HG-SNS152J Plug: CE05-6A18-10SD-D-BSS Cable clamp: CE3057-10A-1-D (DDK) Applicable cable Applicable wire size: 2 mm^2 to 3.5 mm^2 (AWG 14 to 12) Cable OD: 10.5 mm to 14.1 mm	IP67 EN compliant
(28)	Power connector set	MR-PWCNS5	 HG-SNS202J HG-SNS302J Plug: CE05-6A22-22SD-D-BSS Cable clamp: CE3057-12A-1-D (DDK) Applicable cable Applicable wire size: 5.5 mm^2 to 8 mm^2 (AWG 10 to 8) Cable OD: 12.5 mm to 16 mm	IP67 EN compliant
(29)	Electromagnetic brake connector set	MR-BKCNS1 *1	 Straight plug: CMV1-SP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)	IP67

No.	Product name	Model	Description	Remark
(30)	Electromagnetic brake connector set	MR-BKCNS1A *1	 Angle plug: CMV1-AP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)	IP67
(31)	Encoder connector set	MR-J3SCNSA *1	  ☞ Page 113 MR-J3ENSCBL_M-_	IP67
(32)	Electromagnetic brake connector set	MR-BKCNS2	 Straight plug: CMV1S-SP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)	IP67
(33)	Electromagnetic brake connector set	MR-BKCNS2A	 Angle plug: CMV1S-AP2S-L Socket contact: CMV1-# 22BSC-S2-100 (DDK)	IP67
(34)	Encoder connector set	MR-ENCNS2	  ☞ Page 113 MR-J3ENSCBL_M-_	IP67
(35)	Encoder connector set	MR-ENCNS2A	  ☞ Page 113 MR-J3ENSCBL_M-_	IP67

*1 The cable and the connector set may contain different connectors but still usable.

6.2 Encoder cable/connector sets

Encoder cables are not subject to European Low Voltage Directive (50 V AC to 1000 V AC and 75 V DC to 1500 V DC).

MR-J3ENCBL_M-_-_

Model

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

MR - J 3 ENCBL 2M - A 1 - L

Bending life

Symbol	Bending life
L	Standard
H	Long bending life

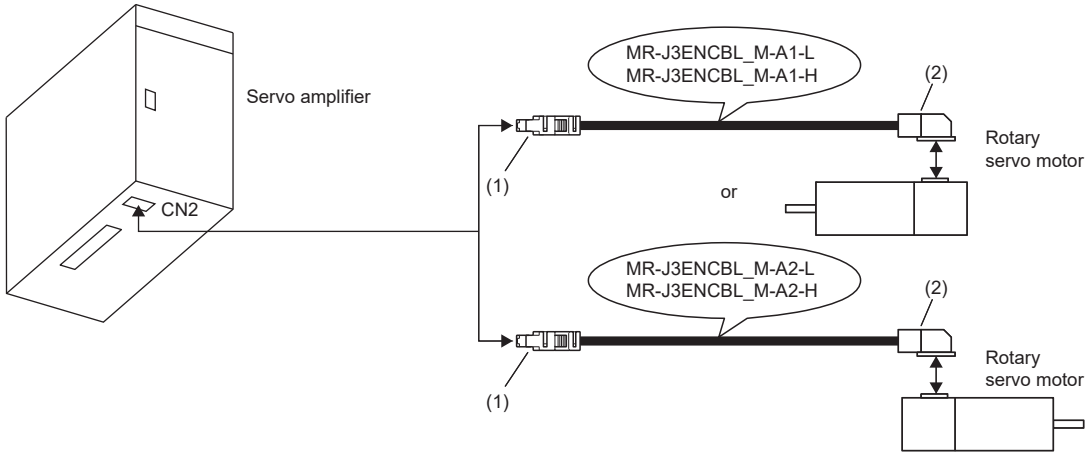
Cable direction

Symbol	Cable direction
A1	Load-side lead
A2	Lead in opposite direction of load side

Cable length

Symbol	Cable length [m]
2	2
5	5
10	10

Connection of servo amplifier and rotary servo motor



CN2-side connector (1)

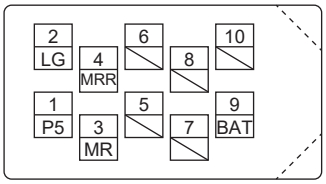
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 123 Shield procedure of CN2 side connectors

Receptacle: 36210-0100PL

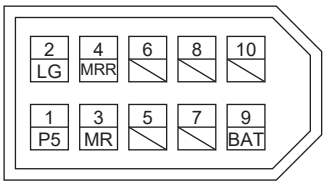
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1019

(Molex)



Encoder-side connector (2)

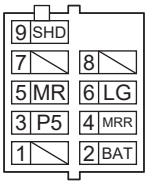
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector: 2174053-1

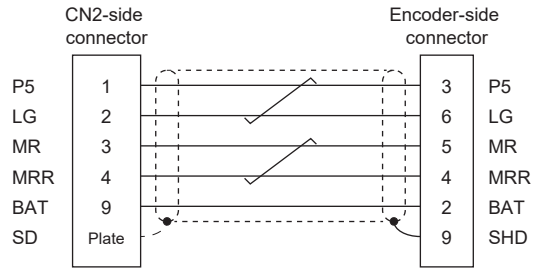
Crimping tool for ground clip: 1596970-1

Crimping tool for receptacle contact: 1596847-1

(TE Connectivity)



Cable internal wiring diagram



MR-J3JCBL03M-_-L

The servo amplifier and the rotary servo motor cannot be connected by these cables alone. The servo motor-side encoder cable (MR-EKCBL_M-_) is required.

Model

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

MR - J 3 J C B L 0 3 M - A 1 - L

Bending life

Symbol	Bending life
L	Standard

Cable direction

Symbol	Cable direction
A1	Load-side lead
A2	Lead in opposite direction of load side

Cable length

Symbol	Cable length [m]
03	0.3

Connection of servo amplifier and rotary servo motor

Junction connector (1)

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

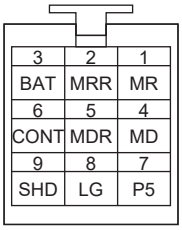
Housing: 1-172169-9

Contact: 1473226-1

Cable clamp: 316454-1

Crimping tool: 91529-1

(TE Connectivity)



Encoder-side connector (2)

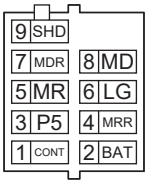
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector: 2174053-1

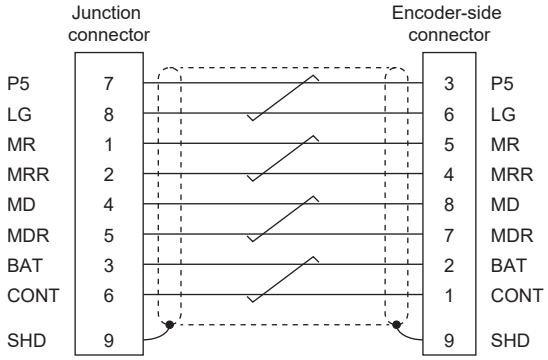
Crimping tool for ground clip: 1596970-1

Crimping tool for receptacle contact: 1596847-1

(TE Connectivity)



Cable internal wiring diagram



MR-J3JSCBL03M-_-L

The servo amplifier and the rotary servo motor cannot be connected by these cables alone. The servo motor-side encoder cable (MR-J3ENSCBL_M-_) is required.

Model

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

MR - J 3 J S C B L 0 3 M - A 1 - L

Bending life

Symbol	Bending life
L	Standard

Cable direction

Symbol	Cable direction
A1	Load-side lead
A2	Lead in opposite direction of load side

Cable length

Symbol	Cable length [m]
03	0.3

Connection of servo amplifier and rotary servo motor

*1 For details of this cable, refer to the following.
☞ Page 113 MR-J3ENSCBL_M-_

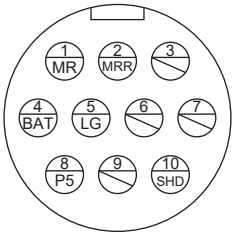
Junction connector (1)

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Receptacle: CM10-CR10P-M

(DDK)

Applicable wire size: AWG 20 or less



Encoder-side connector (2)

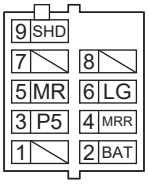
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Connector: 2174053-1

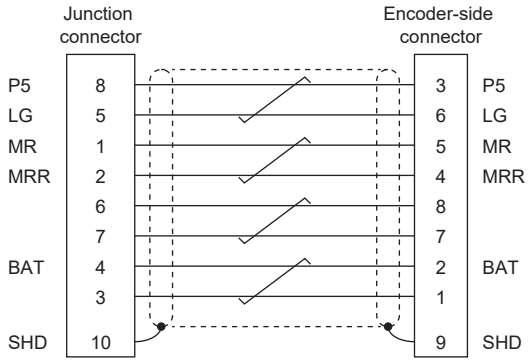
Crimping tool for ground clip: 1596970-1

Crimping tool for receptacle contact: 1596847-1

(TE Connectivity)



Cable internal wiring diagram



MR-EKCBL_M-_

Point

The following encoder cables are of four-wire type.

- MR-EKCBL30M-L
- MR-EKCBL30M-H
- MR-EKCBL40M-H
- MR-EKCBL50M-H

When using any of these encoder cables, refer to the user's manual (parameters) and select "four-wire type" for the corresponding servo parameter.

The servo amplifier and the rotary servo motor cannot be connected by these cables alone. Motor cables for rotary servo motors (MR-J3JCBL03M-_-L) are needed.

Model

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

MR - E KCBL 2 0M - L

Bending life

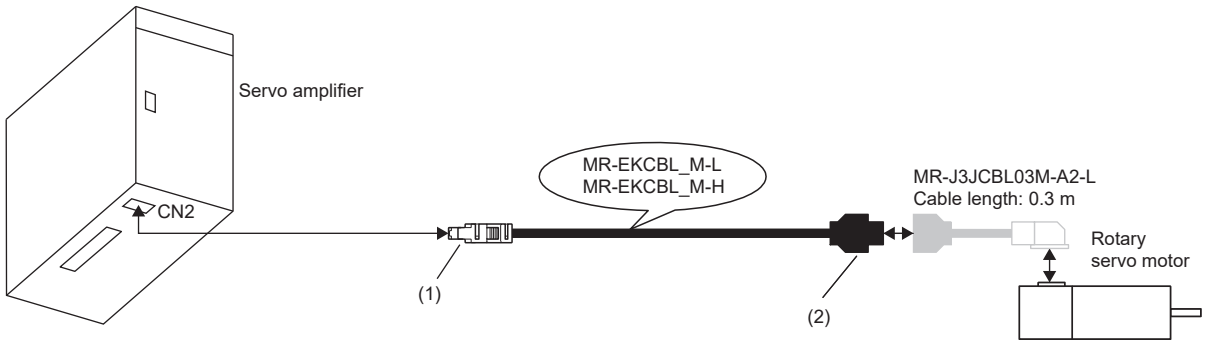
Symbol	Bending life
L	Standard
H	Long bending life

Cable length

Symbol	Cable length [m]
20	20
30	30
40	40
50	50

Connection of servo amplifier and rotary servo motor

This connection is for when electromagnetic brake cable is included.



CN2-side connector (1)

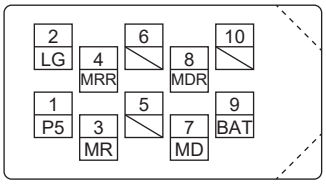
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 123 Shield procedure of CN2 side connectors

Receptacle: 36210-0100PL

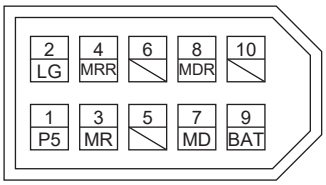
Shell kit: 36310-3200-008

(3M or equivalent)



Connector set: 54599-1019

(Molex)



Junction connector (2)

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.

Housing: 1-172161-9

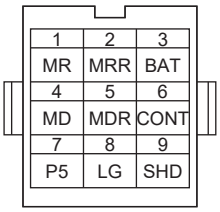
Connector pin: 170359-1

Crimping tool: 91529-1

(TE Connectivity or equivalent)

Cable clamp: MTI-0002

(Toa Electric Industrial)

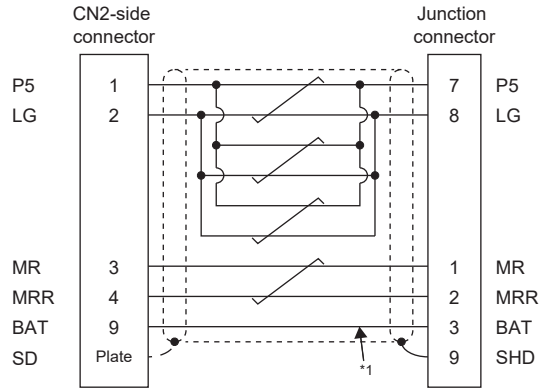


Internal wiring diagram

When fabricating the cable, use the wiring diagram corresponding to the length indicated below.

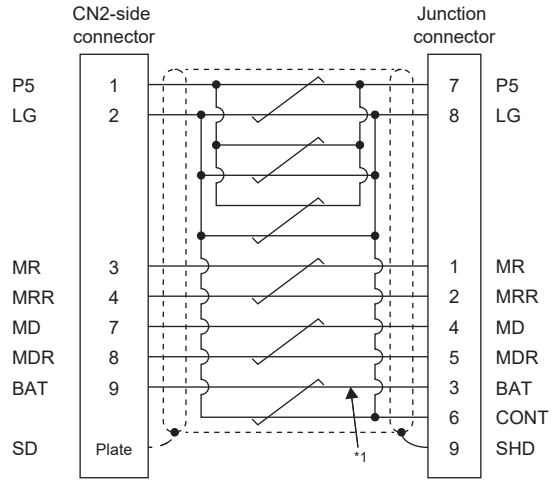
Cable bending life	Applicable wiring diagram	
	Less than 30 m	30 m to 50 m
Standard	MR-EKCBL20M-L	MR-EKCBL30M-L
Long bending life	MR-EKCBL20M-H	MR-EKCBL30M-H MR-EKCBL40M-H MR-EKCBL50M-H

■MR-EKCBL20M-L



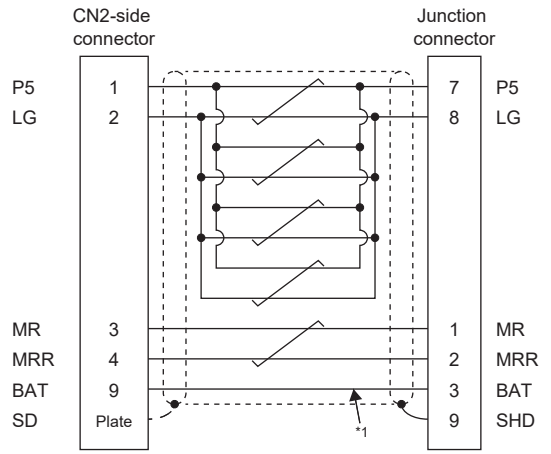
*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

■MR-EKCBL30M-L



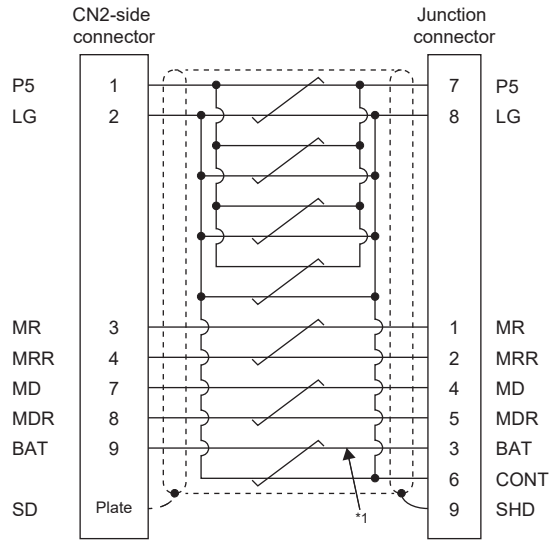
*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

■MR-EKCBL20M-H



*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

■MR-EKCBL30M-H/MR-EKCBL40M-H/MR-EKCBL50M-H



*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

When fabricating an encoder cable

Prepare the following parts, and fabricate the cable in accordance with the following.

☞ Page 111 Internal wiring diagram

Refer to the following for the specifications of the cable to use.

☞ Page 121 Wires for option cables

Parts (Connector set)	Description	
	CN2-side connector	Junction connector
MR-ECNM	 Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)	 Housing: 1-172161-9 Connector pin: 170359-1 (TE Connectivity or equivalent) Cable clamp: MTI-0002 (Toa Electric Industrial)

MR-J3ENSCBL_M-_

Model

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

MR - J3 E N S C B L 2 M - L

Bending life

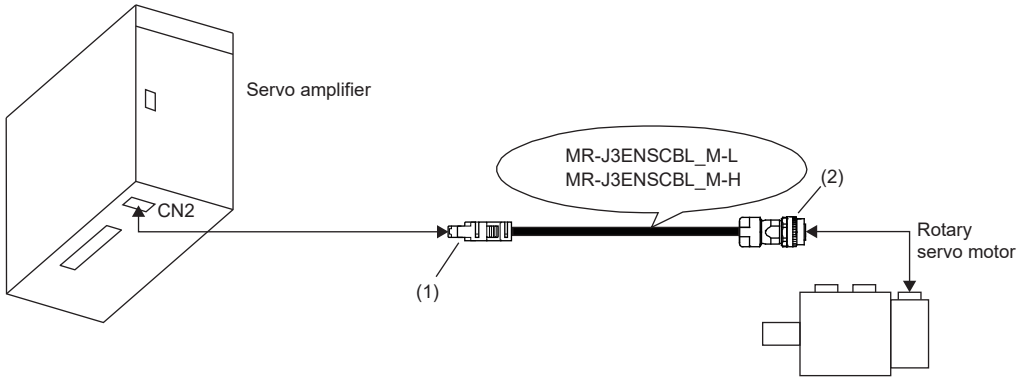
Symbol	Bending life
L	Standard
H	Long bending life

Cable length

Symbol	Cable length [m]
2	2
5	5
10	10
20	20
30	30
40	40
50	50

Connection of servo amplifier and rotary servo motor

This connection is for when electromagnetic brake cable is included.



CN2-side connector (1)

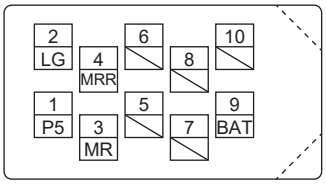
The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 123 Shield procedure of CN2 side connectors

Receptacle: 36210-0100PL

Shell kit: 36310-3200-008

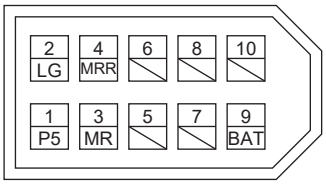
(3M)



or

Connector set: 54599-1019

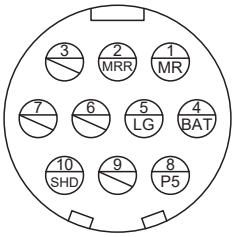
(Molex)



Junction connector (2)

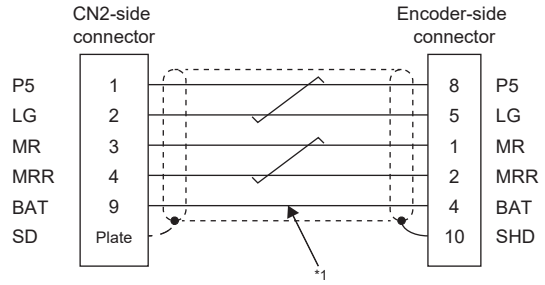
Cable length	Bending life	Plug (DDK)	
		Straight plug	Socket contact
10 m or less	Long bending life	CMV1-SP10S-M1	CMV1-# 22ASC-C1-100 Applicable wire size: AWG 24 to 20 Crimping tool: 357J-53162T
	Standard		
20 m or longer	Long bending life	CMV1-SP10S-M1	CMV1-# 22ASC-C2-100 Applicable wire size: AWG 28 to 24 Crimping tool: 357J-53163T
	Standard	CMV1-SP10S-M2	

The following shows the view from the wiring side. Do not connect anything to the pins shown with a diagonal line.



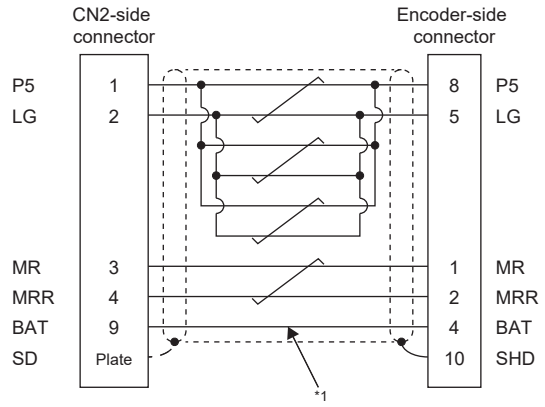
Cable internal wiring diagram

■MR-J3ENSCBL2M-L/MR-J3ENSCBL5M-L/MR-J3ENSCBL10M-L/MR-J3ENSCBL2M-H/MR-J3ENSCBL5M-H/MR-J3ENSCBL10M-H



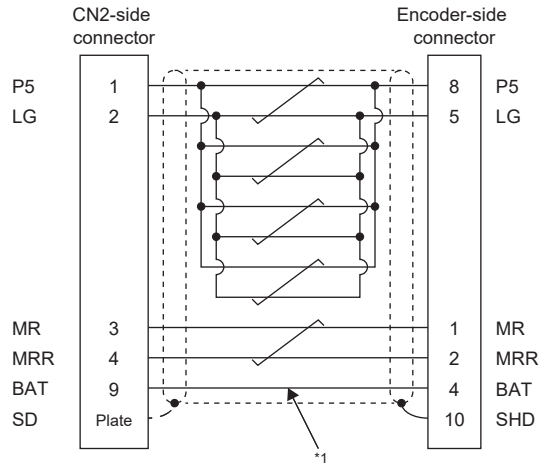
*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

■MR-J3ENSCBL20M-L/MR-J3ENSCBL30M-L



*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

■MR-J3ENSCBL20M-H/MR-J3ENSCBL30M-H/MR-J3ENSCBL40M-H/MR-J3ENSCBL50M-H



*1 Make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

When fabricating an encoder cable

Prepare the following parts, and fabricate the cable in accordance with the following diagram.

☞ Page 115 Cable internal wiring diagram

Refer to the following for the specifications of the cable to use.

☞ Page 121 Wires for option cables

Parts (Connector set)	Description	
	Servo amplifier-side connector	Encoder-side connector (DDK)
MR-J3SCNS (One-touch connection type) *1	 Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)	 Straight plug: CMV1-SP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-ENCNS2 (Screw type) *1		 Straight plug: CMV1S-SP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-J3SCNSA (One-touch connection type) *1		 Angle plug: CMV1-AP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less
MR-ENCNS2A (Screw type) *1		 Angle plug: CMV1S-AP10S-M2 Socket contact: CMV1-# 22ASC-S1-100 Applicable wire size: AWG 20 or less

*1 Cable clamps and bushings for cables with an outer diameter of 5.5 mm to 7.5 mm and 7.0 mm to 9.0 mm are included.

6.3 Servo motor power cable

Refer to the following for details regarding wiring.

☞ Page 97 HG-KNS series

Model

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

MR - PWS1CBL2M - A1 - L

Bending life

Symbol	Bending life
L	Standard
H	Long bending life

Cable direction

Symbol	Cable direction
A1	Load-side lead
A2	Lead in opposite direction of load side

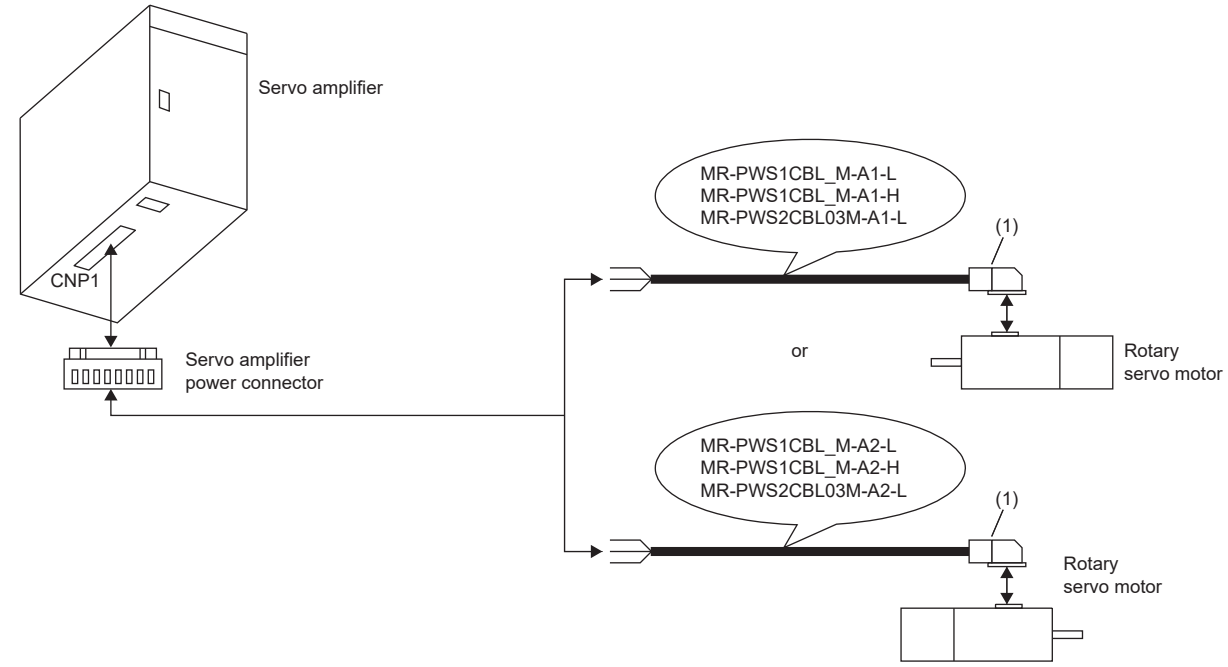
Cable length

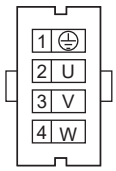
Symbol	Cable length [m]
03	0.3
2	2
5	5
10	10

IP rating

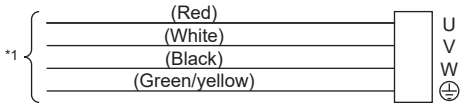
Symbol	IP rating
S1	IP65
S2	IP55

Connection of servo amplifier and rotary servo motor



Cable model	Servo motor power-side connector (1)	
MR-PWS1CBL_M-A1-L MR-PWS1CBL_M-A2-L MR-PWS1CBL_M-A1-H MR-PWS1CBL_M-A2-H	Connector: KN4FT04SJ1-R Hood/socket insulator Bushing/ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT170-14-TMH5B (JAE)	 View from the wiring side
MR-PWS2CBL03M-A1-L MR-PWS2CBL03M-A2-L	Connector: KN4FT04SJ2-R Hood/socket insulator Bushing/ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT170-14-TMH5B (JAE)	

Internal wiring diagram



*1 These are not shielded cables.

6.4 Electromagnetic brake cable

Refer to the following for details regarding wiring.

☞ Page 97 HG-KNS series

Model

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

MR - BK S 1 C B L 2 M - A 1 - L

Bending life

Symbol	Bending life
L	Standard
H	Long bending life

Lead out direction

Symbol	Lead out direction
A1	Load-side lead
A2	Lead in opposite direction of load side

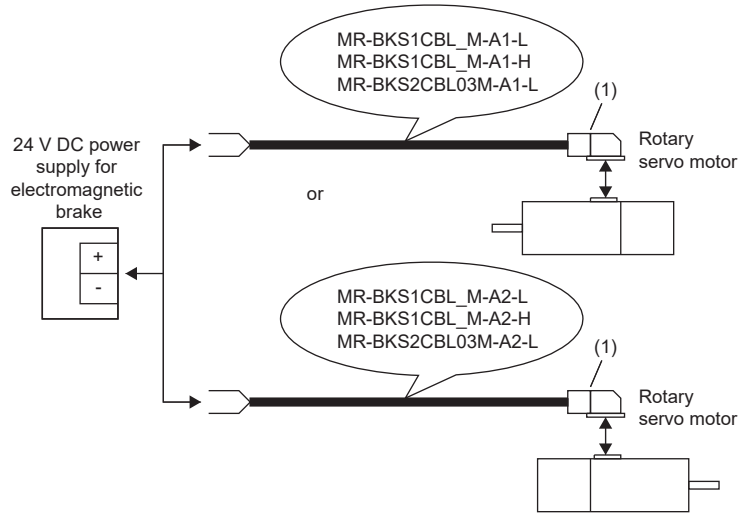
Cable length

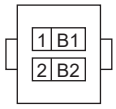
Symbol	Cable length [m]
03	0.3
2	2
5	5
10	10

IP rating

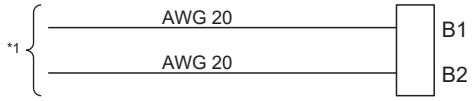
Symbol	IP rating
S1	IP65
S2	IP55

Connecting the electromagnetic brake power supply and the rotary servo motor



Cable model	Connector for electromagnetic brake (1)	
MR-BKS1CBL_M-A1-L MR-BKS1CBL_M-A2-L MR-BKS1CBL_M-A1-H MR-BKS1CBL_M-A2-H	Connector: JN4FT02SJ1-R Hood/socket insulator Bushing/ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT170-14-TMH5B (JAE)	 View from the wiring side
MR-BKS2CBL03M-A1-L MR-BKS2CBL03M-A2-L	Connector: JN4FT02SJ2-R Hood/socket insulator Bushing/ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT170-14-TMH5B (JAE)	

Internal wiring diagram



*1 These are not shielded cables.

6.5 Wires for option cables

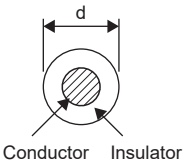
When wiring the cables, leave the minimum bending radius or more to prevent stress from being applied to the cables.
Refer to the following for the cable flex life.
☞ Page 124 Cable bending life

• List of applicable recommended wires

Type	Model	Length [m]	Core size	Number of cores	Characteristics of one core			Cable OD [mm] *2	Recommended wire model (manufacturer)
					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulator outer diameter (d) [mm] *1		
Encoder cable	MR-J3ENCBL_M-A1-L MR-J3ENCBL_M-A2-L	2 to 10	AWG 22	6 (3 pairs)	7/0.26	53 or less	1.18	7.1	VSVP 7/0.26 (AWG #22 or equivalent) - 3PKB-1655-2 (Bando Densen) *3
	MR-J3ENCBL_M-A1-H MR-J3ENCBL_M-A2-H	2 to 10	AWG 22	6 (3 pairs)	70/0.08	56 or less	1.17	7.1	TPE•SVP 70/0.08 (AWG #22 or equivalent) -3PKB-2237-2 (Bando Densen) *3
	MR-J3JCBL03M-A1-L MR-J3JCBL03M-A2-L	0.3	AWG 26	8 (4 pairs)	30/0.08	233 or less	1.2	7.1 ± 0.3	T/2464-1061/IIA-SB 4P×26 AWG (Taiyo Cabletec)
	MR-EKCBL_M-L	2 to 10	AWG 28	4 (2 pairs)	7/0.127	232 or less	1.18	7.0	20276 composite 6-core shielded cable Ban-gi-shi-16395-1 (Bando Densen) *3
			AWG 22	2	17/0.16	28.7 or less	1.50		
		20/30	AWG 23	12 (6 pairs)	12/0.18	63.6 or less	1.2	8.2 ± 0.3	20276 VSVP AWG #23×6PKB-0492 (Bando Densen) *3
	MR-EKCBL_M-H	2 to 10	0.2 mm^2	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	A14B2343 6P (Junkosha) *3
		20	AWG 24	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	TPE•SVP 40/0.08 (AWG #24 or equivalent) -6PKB-1928-2 (Bando Densen) *3
		30 to 50	AWG 24	14 (7 pairs)	40/0.08	105 or less	0.88	8.0	TPE•SVP 40/0.08 (AWG #24 or equivalent) -7PKB-1929-2 (Bando Densen) *3
	MR-J3JSCBL03M-A1-L MR-J3JSCBL03M-A2-L	0.3	AWG 26	8 (4 pairs)	7/0.16	146 or less	1.0	7.1 ± 0.3	VSVP 7/0.16 (AWG #26 or equivalent) - 4P Ban-gi-shi-16822 (Bando Densen) *3
	MR-J3ENSCBL_M-L	2 to 10	AWG 22	6 (3 pairs)	7/0.26	53 or less	1.18	7.1	VSVP 7/0.26 (AWG #22 or equivalent) - 3PKB-1655-2 (Bando Densen) *3
		20/30	AWG 23	12 (6 pairs)	12/0.18	63.3 or less	1.2	8.2 ± 0.3	20276 VSVP AWG #23×6PKB-0492 (Bando Densen) *3
	MR-J3ENSCBL_M-H	2 to 10	AWG 22	6 (3 pairs)	70/0.08	56 or less	1.17	7.1	TPE•SVP 70/0.08 (AWG #22 or equivalent) -3PKB-2237-2 (Bando Densen) *3
		20 to 50	AWG 24	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	TPE•SVP 40/0.08 (AWG #24 or equivalent) -6PKB-1928-2 (Bando Densen) *3

Type	Model	Length [m]	Core size	Number of cores	Characteristics of one core			Cable OD [mm] *2	Recommended wire model (manufacturer)
					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulator outer diameter (d) [mm] *1		
Servo motor power cable	MR-PWS1CBL_M-A1-L	2 to 10	AWG 18	4	34/0.18	21.8 or less	1.71	6.2 ± 0.3	HRZFEV-A(CL3) AWG 18 4 cores (Dyden) *4
	MR-PWS1CBL_M-A2-L	2 to 10							
	MR-PWS1CBL_M-A1-H	2 to 10	AWG 19 (0.75 mm^2)	4	150/0.08	29.1 or less	1.63	5.7 ± 0.5	RMFES-A(CL3X) AWG 19 4 cores (Dyden) *4
	MR-PWS1CBL_M-A2-H	2 to 10							
	MR-PWS2CBL03M-A1-L	0.3	AWG 19	4	30/0.18	25.8 or less	1.64	—	J11B2330 UL10125 (Junkosha) *3*5
	MR-PWS2CBL03M-A2-L	0.3							
Electromagnetic brake cable	MR-BKS1CBL_M-A1-L	2 to 10	AWG 20	2	21/0.18	34.6 or less	1.35	4.7 ± 0.1	HRZFEV-A(CL3) AWG 20 2 cores (Dyden) *4
	MR-BKS1CBL_M-A2-L	2 to 10							
	MR-BKS1CBL_M-A1-H	2 to 10	AWG 20	2	110/0.08	39.0 or less	1.37	4.5 ± 0.3	RMFES-A(CL3X) AWG 20 2 cores (Dyden) *4
	MR-BKS1CBL_M-A2-H	2 to 10							
	MR-BKS2CBL03M-A1-L	0.3	AWG 20	2	19/0.203	32.0 or less	1.42	—	J11B2331 UL10125 (Junkosha) *3*5
	MR-BKS2CBL03M-A2-L	0.3							

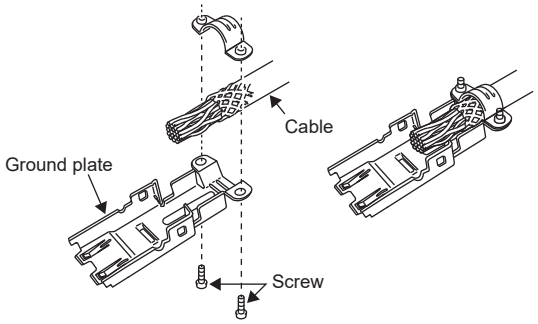
*1 Details regarding the outer diameter (d) are shown below.



*2 Standard OD. Maximum OD is about 10 % greater for the dimensions without tolerances.
*3 Supplier: Toa Electric Industrial
*4 Supplier: Taisei Co., Ltd.
*5 These models are solid wire models. The color of the wire must be specified separately.

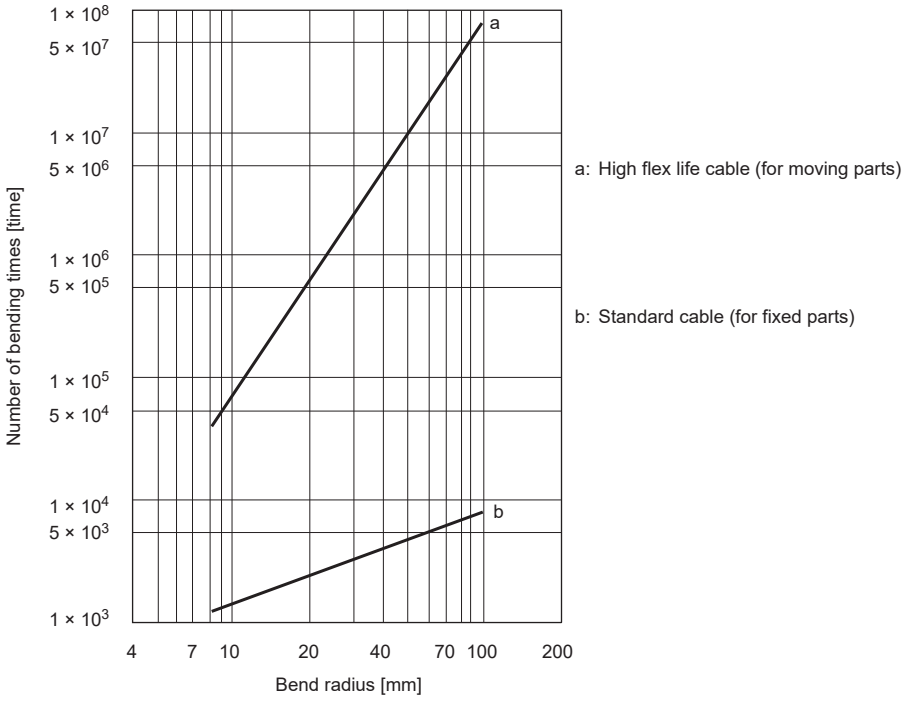
6.6 Shield procedure of CN2 side connectors

For the CN2 side connector, securely connect the shielded external conductor of the cable to the ground plate and fix it to the connector shell.



6.7 Cable bending life

The flex life of the cables is shown below. This graph shows calculated values and not guaranteed values. The values are calculated from fully disconnected cables and do not take into account wear from electrical characteristics, sheath abrasion, or insulation deterioration. Allow for some deviation in these values.



7 HK-KN SERIES (200 V)

This chapter provides information on the rotary servo motor specifications and characteristics. The indicated values and those without tolerance are representative values. When using the HK-KN series (200 V) rotary servo motor, read chapter 1 to 5 and SAFETY INSTRUCTIONS at the beginning of this manual in addition to this chapter.
For the combinations of servo amplifiers and rotary servo motors, restrictions on the firmware version of the servo amplifier, and restrictions by the date of manufacture of the rotary servo motor, refer to "Servo amplifier/motor combinations" in the following manual.
MR-JET User's Manual (Hardware)

7.1 Model designation

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

HK - KN 1 3 B _ _ _

Oil seal

Symbol	Oil seal
None	Not attached
J	Attached

Electromagnetic brake

Symbol	Electromagnetic brake
None	Not attached
B	Attached

Rated speed

Symbol	Rated speed [r/min]
2	2000
3	3000

Rated output

Symbol	Rated output [kW]
05	0.05
1	0.1
1M	0.15
2	0.2
4	0.4
6	0.6
7M	0.75
10	1.0
15	1.5
20	2.0

Shaft type

Symbol	Shaft shape
None	Standard (straight shaft)
D	D cut shaft
L	L-cut shaft
K	Keyed shaft (with key)
N	Keyed shaft (without key)

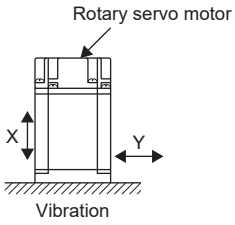
7.2 Standard specifications

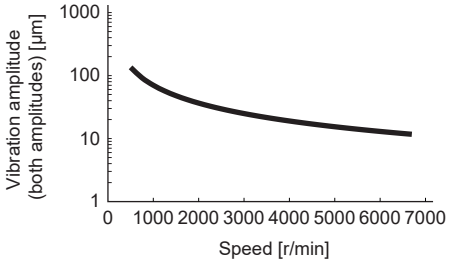
Standard specifications list

Series		HK-KN_ (Low inertia/small capacity)					
Flange size		**□40**			**□60**		
Rotary servo motor model		**053**	**13**	**1M3**	**23**	**43**	**63**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)					
Power supply voltage [V]		200 V AC (3-phase 200 V AC to 240 V AC)					
Continuous running duty *1	Rated output [kW]	0.05	0.1	0.15	0.2	0.4	0.6
	Rated torque [N•m]	0.16 *7	0.32	0.48	0.64	1.3	1.9
Maximum torque [N•m]		0.56	1.1	1.7	2.2	4.5	6.7
Rated speed *1[r/min]		3000					
Maximum speed *1[r/min]		6700					
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	6.4	14.8	23.3	19.4	39.5	61.0
	With an electromagnetic brake	5.8	14.0	22.4	16.0	36.7	58.0
Rated current [A]		1.3	1.2		1.4	2.6	4.5
Maximum current [A]		4.6		4.5	5.4	9.8	19
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	0.0394	0.0686	0.0977	0.209	0.410	0.598
	With an electromagnetic brake	0.0434	0.0725	0.102	0.254	0.442	0.629
Recommended load to motor inertia ratio *2		20 times or less *9			15 times or less *9*10	23 times or less	25 times or less
Speed/position detector		24-bit encoder common to batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)					
Type		Permanent magnet synchronous motor					
Oil seal		Not attached *11					
Thermistor		None					
Insulation class		155 (F)					
Structure		Totally enclosed, natural cooling (IP rating: IP67) *3*8					
Vibration resistance *4[m/s^2]		X: 49, Y: 49					
Vibration rank *5		V10					
Permissible load for the shaft *6	L [mm]	25			30		
	Radial [N]	88			245		
	Thrust [N]	59			98		
Mass [kg]	Without an electromagnetic brake	0.27	0.37	0.47	0.77	1.2	1.5
	With an electromagnetic brake	0.53	0.63	0.73	1.2	1.6	1.9

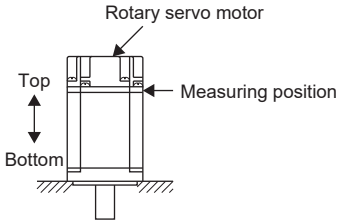
Series		HK-KN_ (Low inertia/small capacity)				
Flange size		**□80**		**□90**		
Rotary servo motor model		**7M3**	**103**	**153**	**203**	**202**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)				
Power supply voltage [V]		200 V AC (3-phase 200 V AC to 240 V AC)				
Continuous running duty *1	Rated output [kW]	0.75	1.0	1.5	2.0	
	Rated torque [N•m]	2.4	3.2	4.8	6.4	9.5
Maximum torque [N•m]		8.4	11.1	16.7	19.1	28.6
Rated speed *1[r/min]		3000				2000
Maximum speed *1[r/min]		6700	6500	6700	6000	3000
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	41.6	60.3	52.0	71.7	111
	With an electromagnetic brake	37.7	56.0	48.3	67.7	107
Rated current [A]		4.7	5.0	8.7	11	9.0
Maximum current [A]		20	21	34		30
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	1.37	1.68	4.38	5.65	8.18
	With an electromagnetic brake	1.51	1.81	4.72	5.99	8.53
Recommended load to motor inertia ratio *2		16 times or less	17 times or less	15 times or less		
Speed/position detector		24-bit encoder for batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)				
Type		Permanent magnet synchronous motor				
Oil seal		Not attached *11				
Thermistor		None				
Insulation class		155 (F)				
Structure		Totally enclosed, natural cooling (IP rating: IP67) *3*8				
Vibration resistance *4[m/s^2]		X: 49, Y: 49		X: 24.5, Y: 24.5		
Vibration rank *5		V10				
Permissible load for the shaft *6	L [mm]	40				
	Radial [N]	392				
	Thrust [N]	147				
Mass [kg]	Without an electromagnetic brake	2.2	2.4	3.6	4.4	5.9
	With an electromagnetic brake	2.9	3.1	4.7	5.5	7.0

*1 When the power supply voltage drops, the continuous running duty and the speed cannot be guaranteed.
*2 If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.
*3 Except for the shaft-through portion. IP classifies the degrees of protection provided against the intrusion of solid objects and water in electrical enclosures.
*4 The vibration directions are shown in the following figure. The value is the one at the part that indicates the maximum value (normally the opposite to load-side bracket). When the rotary servo motor stops, fretting is likely to occur at the bearing. Therefore, suppress the vibration to about half of the permissible value.





*5 V10 indicates that the amplitude of a single rotary servo motor is 10 µm or less. The following figure shows the rotary servo motor mounting position for measurement and the measuring position.



*6 Refer to the following for permissible load for the shaft.
☞ Page 130 Permissible load for the output shaft
*7 For the HK-KN053_J_ (with an oil seal), use it at a derating rate of 80 %.
*8 When IP67 cables are needed, contact your local sales office.
*9 The value in the table is the recommended load to motor inertia ratio that is applicable when the servo motor is operated at the rated speed. When the servo motor is to be operated at a speed exceeding the rated speed, check whether a regenerative option is required by using Drive System Sizing Software Motorizer.
*10 If the speed is 2900 r/min or less, the recommended load to motor inertia ratio will be 17 times or less.
*11 Servo motors with an oil seal are also compatible.

Torque characteristics

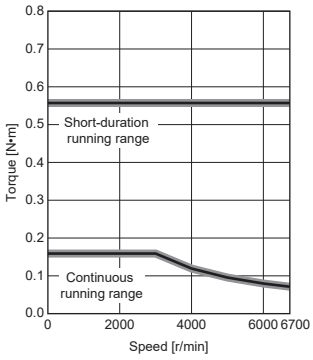
- For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque.

When the power supply voltage drops, the torque decreases. - - - -: A rough indication of the possible continuous running range for 3-phase 170 V AC

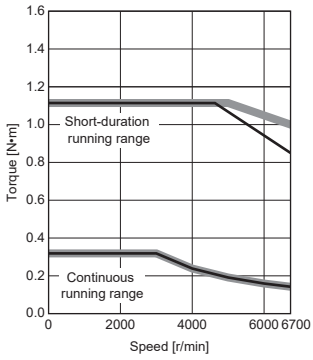
▬ : 3-phase 200 VAC
—— : 1-phase 200 VAC

HK-KN_

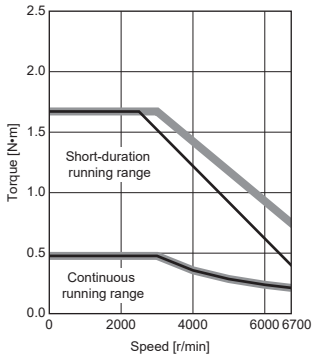
[HK-KN053] *1



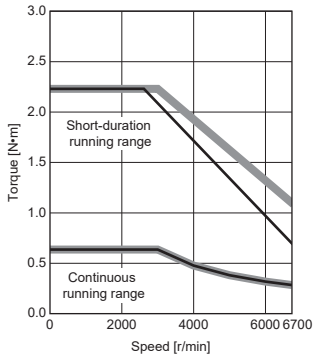
[HK-KN13]



[HK-KN1M3]



[HK-KN23]



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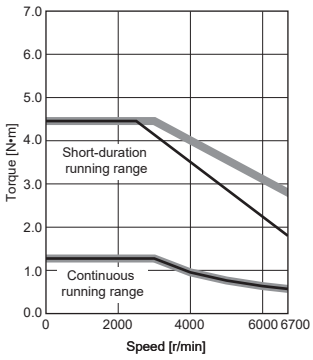

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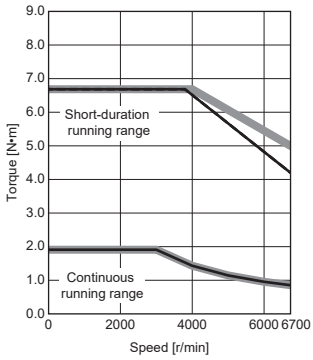
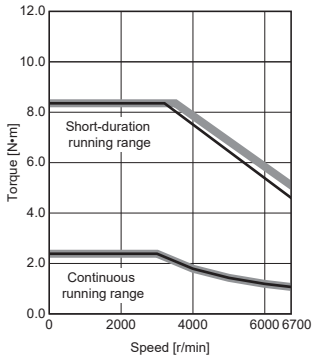
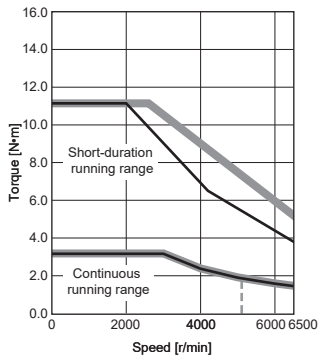


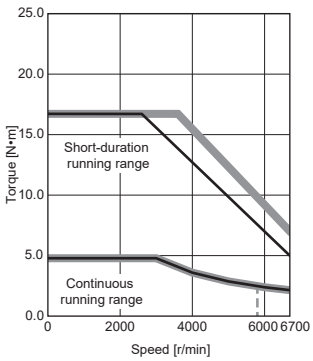
[HK-KN7M3]



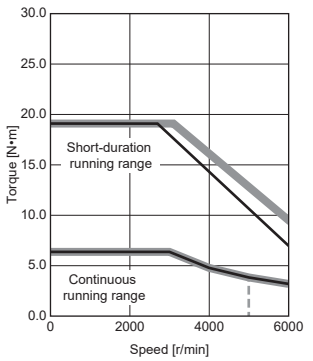
[HK-KN103]



[HK-KN153]



[HK-KN203]



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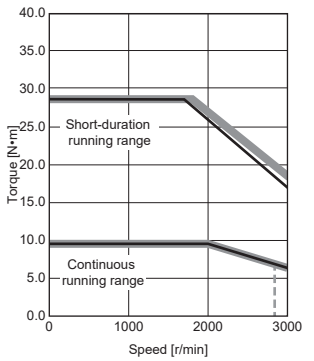
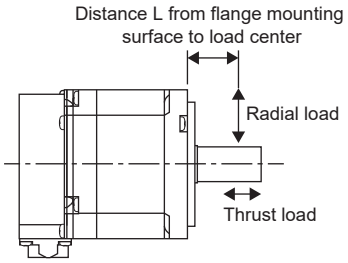


—

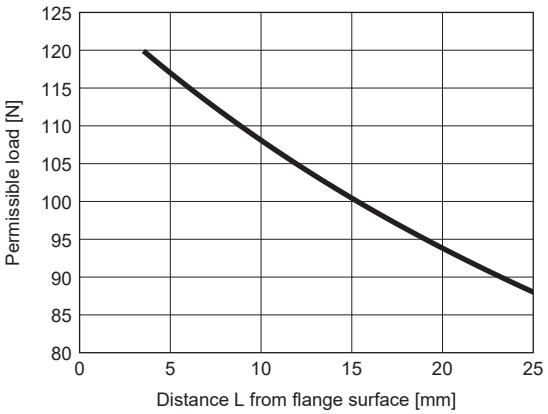
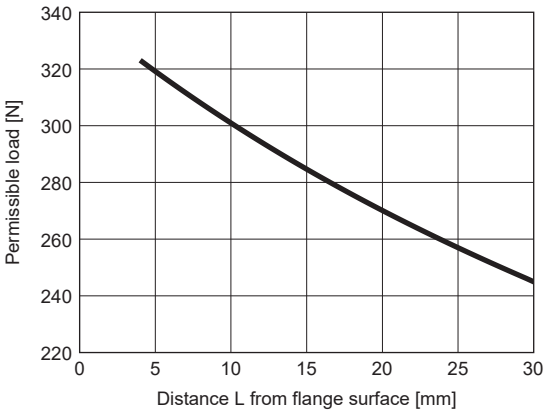
*1 For the HK-KN053_J_ (with an oil seal), use it at a derating rate of 80 %.

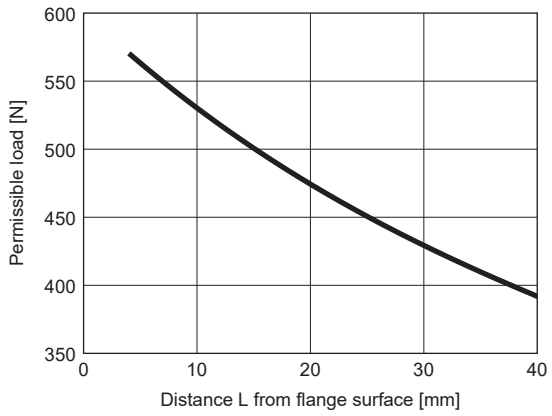
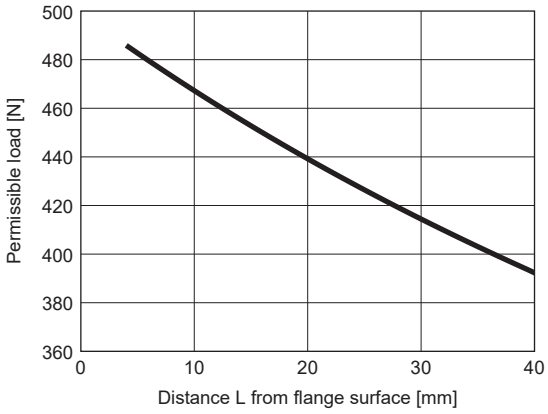
Permissible load for the output shaft

The permissible load for the shaft is shown in the following. Do not subject the shaft to loads greater than the permissible value. The value assumes that the load is applied independently.



In case where the load position changes, calculate the permissible radial load from the distance measured from the flange mounting surface to the center of the load, and make the load equal to or less than the permissible radial load, referring to the graph shown in the following.

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-KN053 HK-KN13 HK-KN1M3	25	88	59	
HK-KN23 HK-KN43 HK-KN63	30	245	98	

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-KN7M3 HK-KN103	40	392	147	
HK-KN153 HK-KN203 HK-KN202	40	392	147	

7.3 Characteristics of electromagnetic brake

Point

Before operating the servo motor, confirm that the electromagnetic brake operates properly.
The operation time of the electromagnetic brake varies depending on the power supply circuit being used. Check the operation delay time with an actual machine.

The characteristics of the electromagnetic brake provided for the rotary servo motor with an electromagnetic brake are shown below.

Item		HK-KN053B HK-KN13B HK-KN1M3B	HK-KN23B HK-KN43B HK-KN63B	HK-KN7M3B HK-KN103B	HK-KN153B HK-KN203B HK-KN202B
Type *1		Spring actuated type safety brake			
Rated voltage *4		24 V DC (-10 % to 0 %)			
Power consumption at 20 °C [W]		6.4	7.9	10	13.8
Coil resistance *5[Ω]		91	73	57	42
Inductance *5[H]		0.14	0.20	0.16	0.15
Brake static friction torque *7[N•m]		0.48 or more	1.9 or more	3.2 or more	9.5 or more
Release delay time *2[s]		0.03		0.04	0.09
Braking delay time [s]	DC off *2	0.01	0.02		0.03
Permissible braking work [J]	Per braking	5.6	22	64	
	Per hour	56	220	640	
Brake looseness at servo motor shaft *5[degree]		2.5	1.2	0.9	
Brake life *3	Number of braking times [times]	20000			5000
	Work per braking [J]	5.6	22	64	
Selection example of surge absorbers to be used *6	Suppressed voltage of 125 V	TND20V-680KB (Manufactured by Nippon Chemi-Con Corporation)			
	Suppressed voltage of 350 V	TND10V-221KB (Manufactured by Nippon Chemi-Con Corporation)			

*1 This type does not have a manual release mechanism. Use a 24 V DC power supply to release the brake electrically.
*2 The value for initial on gap at 20 °C.
*3 Brake lining wear due to braking will increase the brake gap, but the gap is not adjustable. Therefore, the brake life indicates the number of times the brake can be applied before gap adjustment becomes necessary.
*4 Prepare a power supply exclusively for the electromagnetic brake.
*5 The values are design values. These are not the guaranteed values.
*6 Select the electromagnetic brake control relay properly, in consideration of the characteristics of the electromagnetic brake and surge absorber. When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.
*7 The value of the brake static friction torque is the lower limit in the initial state at 20 °C.

7.4 Derating

The derating condition is the reference value at the rated speed. As the temperature rise value of the rotary servo motor changes depending on the operation conditions such as speed, confirm that [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] does not occur on the actual machine before use.

If [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] occurs, consider the following measures:

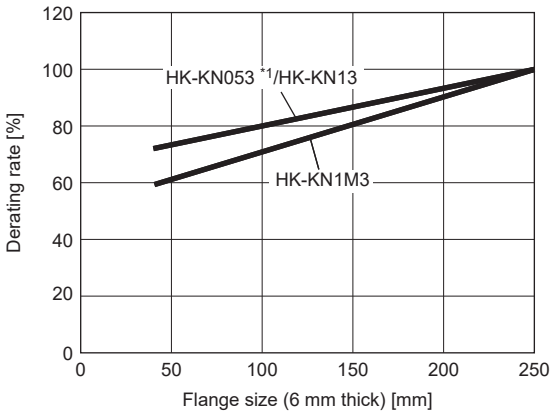
- Lower the effective load ratio of the rotary servo motor.
- Review the heat dissipation conditions.

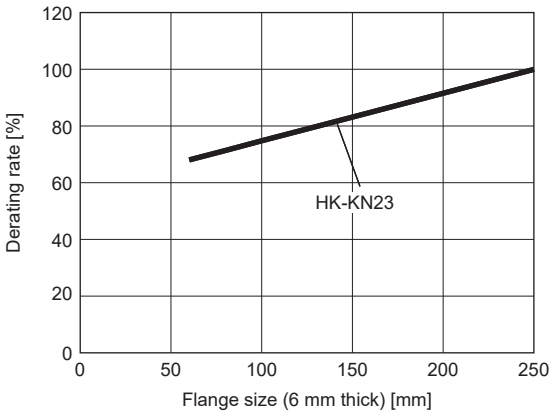
To use this product under conditions with multiple derating, calculate the multiplication of each derating rate, and use at the calculated derating rate or lower.

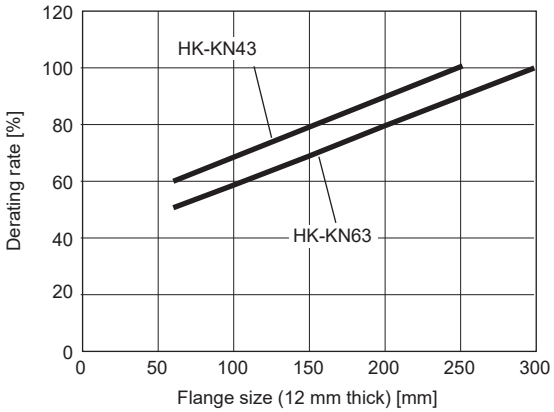
For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque. When applying the derating rate in the conditions above, calculate the multiplication of the derating rate of 70 % in the unbalanced torque and the derating rate of each condition, and use this product at the calculated derating rate or lower.

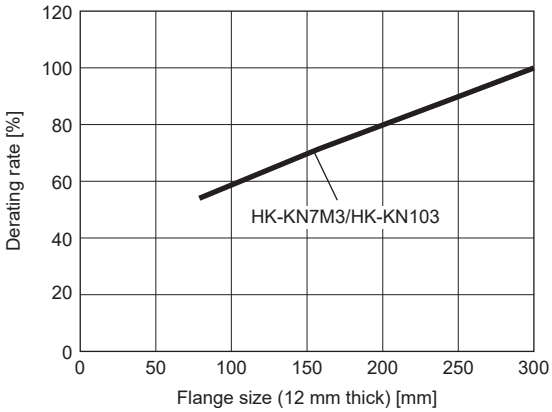
Restrictions on the flange size

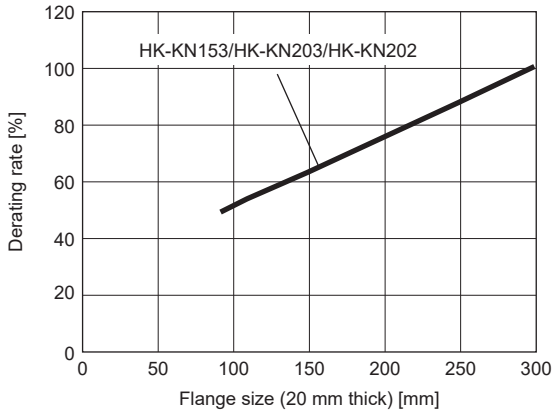
When mounting the rotary servo motor on a machine smaller than the specified aluminum flanges listed in section 2.10, derate the servo motor in accordance with the following conditions:







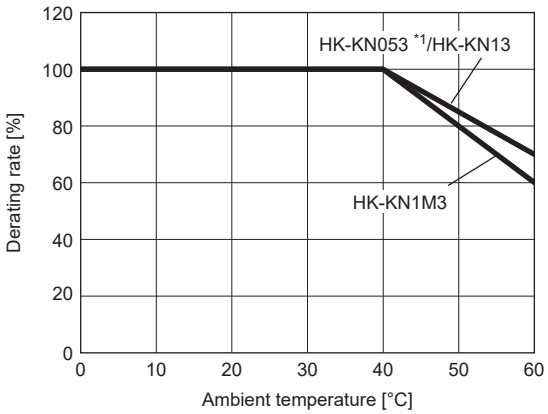


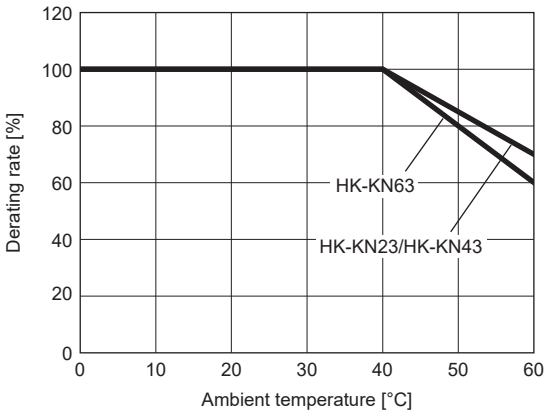


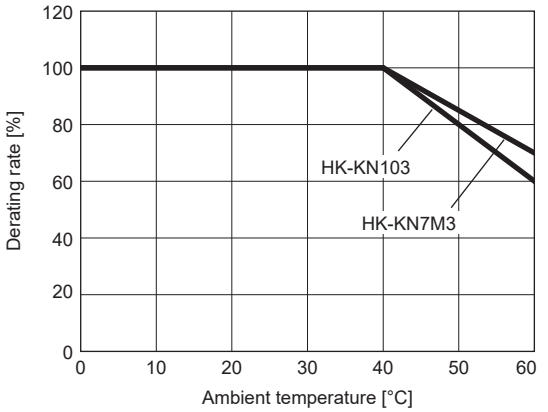
*1 For the HK-KN053_J_ (with an oil seal), use it at a derating rate of 80 %. When applying the derating in the conditions above, calculate the multiplication of the derating rate of 80 % with an oil seal and the derating rate of each condition, and use the servo motor at the calculated derating rate or lower.

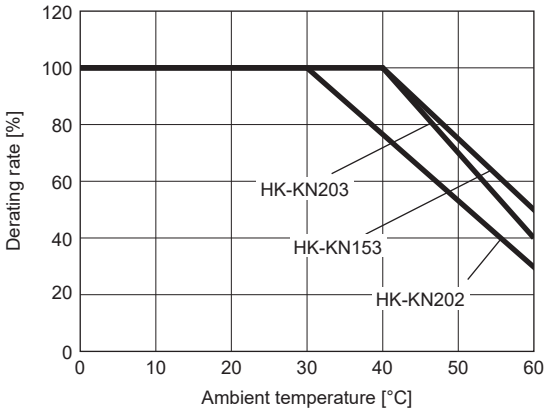
Restrictions on the ambient temperature

When using this product in an environment with a high ambient temperature, derate the product in accordance with the following conditions:





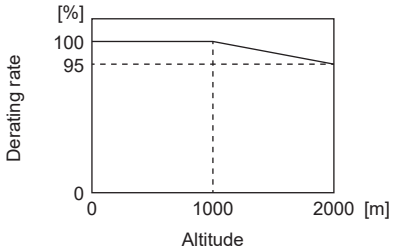




*1 For the HK-KN053_J_ (with an oil seal), use it at a derating rate of 80 %. When applying the derating in the conditions above, calculate the multiplication of the derating rate of 80 % with an oil seal and the derating rate of each condition, and use the servo motor at the calculated derating rate or lower.

Restrictions on the altitude

To use this product at an altitude between 1000 m and 2000 m, derate the product in accordance with the following conditions:

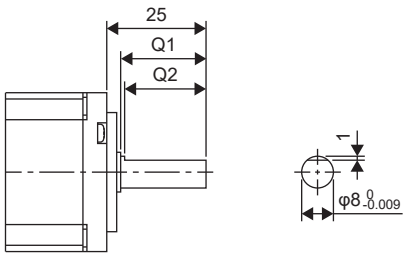


7.5 Rotary servo motors with special shafts

For rotary servo motors, there are four types of shafts: D-cut shaft, L-cut shaft, keyed shaft (with double round-ended key), and keyed shaft (without key). The keys are included as accessories and not attached to the shafts.
To prevent an accident such as motor shaft fracture, do not use a servo motor with a D-cut shaft, L-cut shaft, or keyed shaft for frequent start/stop applications.

Rotary servo motor	Shaft shape			
	D cut shaft	L-cut shaft	Keyed shaft	
			With double round-ended key	Without key
HK-KN053 HK-KN13 HK-KN1M3	D	L	K	N
HK-KN23 HK-KN43 HK-KN63 HK-KN7M3 HK-KN103 HK-KN153 HK-KN203 HK-KN202	—	—	K	N

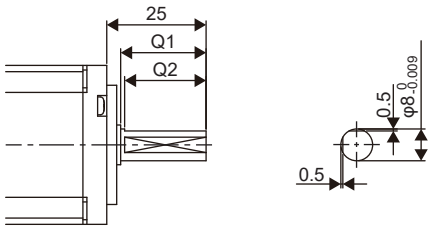
D cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HK-KN053D HK-KN13D HK-KN1M3D	21.5	20.5

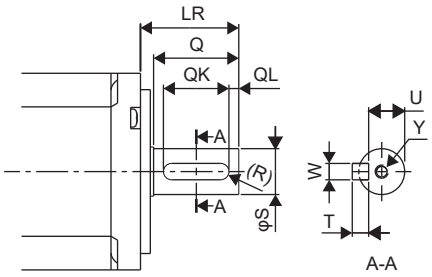
L-cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HK-KN053L HK-KN13L HK-KN1M3L	21.5	20.5

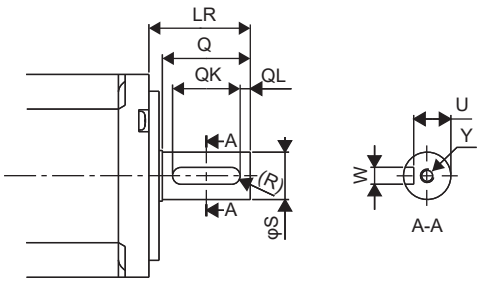
Keyed shaft (with double round-ended key)



[Unit: mm]

Rotary servo motor	Variable dimensions									
	S	LR	Q	W	QK	QL	U	R	T	Y
HK-KN053K HK-KN13K HK-KN1M3K	$8^{0}_{-0.009}$	25	21.5	3	14	5	$6.2^{0}_{-0.085}$	1.5	3	M3 × 8
HK-KN23K HK-KN43K HK-KN63K	$14^{0}_{-0.011}$	30	26	5	20	3	$11^{0}_{-0.085}$	2.5	5	M4 × 15
HK-KN7M3K HK-KN103K HK-KN153K HK-KN203K HK-KN202K	$19^{0}_{-0.013}$	40	36	6	25	5	$15.5^{0}_{-0.1}$	3	6	M5 × 20

Keyed shaft (without key)



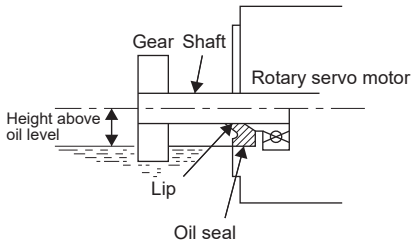
[Unit: mm]

Rotary servo motor	Variable dimensions								
	S	LR	Q	W	QK	QL	U	R	Y
HK-KN053N HK-KN13N HK-KN1M3N	$8^{0}_{-0.009}$	25	21.5	$3^{-0.004}_{-0.029}$	14	5	$6.2^{0}_{-0.085}$	1.5	M3 × 8
HK-KN23N HK-KN43N HK-KN63N	$14^{0}_{-0.011}$	30	26	$5^{0}_{-0.03}$	20	3	$11^{0}_{-0.085}$	2.5	M4 × 15
HK-KN7M3N HK-KN103N HK-KN153N HK-KN203N HK-KN202N	$19^{0}_{-0.013}$	40	36	$6^{0}_{-0.03}$	25	5	$15.5^{0}_{-0.1}$	3	M5 × 20

7.6 Rotary servo motors with an oil seal

The oil seal prevents the entry of oil into the rotary servo motor.

Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip.



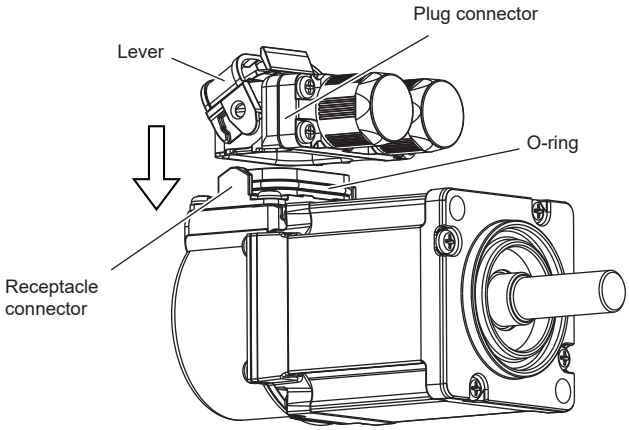
Rotary servo motor	Height (h) from the surface of the oil [mm]
HK-KN053J HK-KN13J HK-KN1M3J	10
HK-KN23J HK-KN43J HK-KN63J	12
HK-KN7M3J HK-KN103J HK-KN153J HK-KN203J HK-KN202J	16

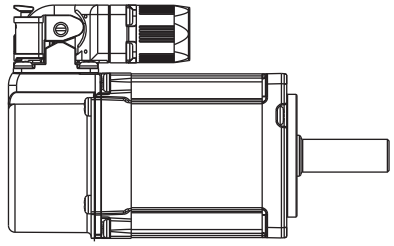
7.7 Mounting connectors

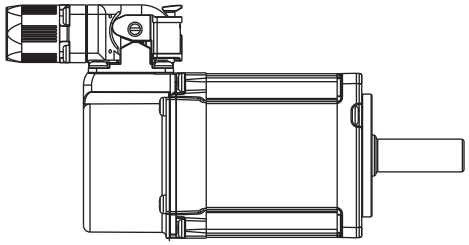
Mount the connectors in the procedure shown below. If the connector is not fixed securely, it may come off or may not produce a splash-proof effect during operation. The receptacle connector has a splash-proof seal (O-ring). When mounting, use care to prevent the seal from dropping and being pinched.
Unlocking jigs can also be used to release the lever on the plug connector. For the unlocking jigs, contact Hirose Electric co., ltd.

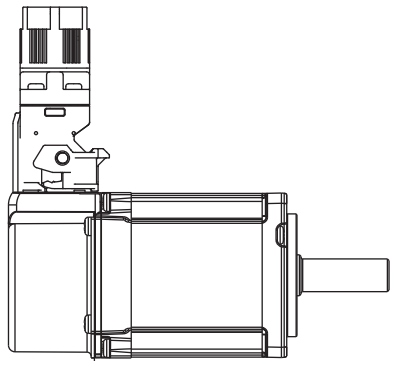
1. Insertion

The insertion direction of the plug connector varies depending on the cable direction which is the load side, opposite to load side, or vertical. Check the insertion direction of the plug connector and the fitting part before inserting the plug connector.
Insert the plug connector (cable side) into the receptacle connector (motor side). The plug connector will stop in the midway of the insertion hole if inserted in an incorrect direction. Continuing to insert the plug connector forcefully even after the stop may damage the plug connector and the receptacle connector.

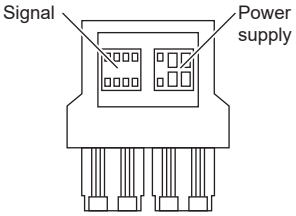



Load-side lead

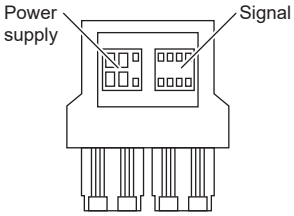

Opposite to load-side lead


Vertical lead

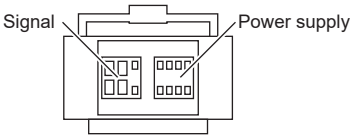
The following shows the view from the connected side.



Load-side lead



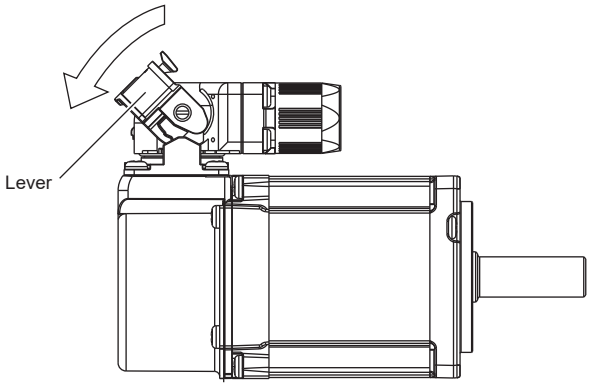
Opposite to load-side lead



Vertical lead

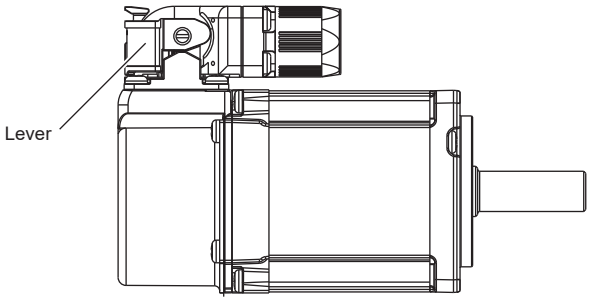
2. Starting to lock

Pull the lever. Pulling the lever firmly inserts the plug into the receptacle connector. If the plug is pushed forcefully without pulling the lever, the components may be damaged. If the plug is inserted diagonally or twisted hard while being inserted, the plug may be deformed or come off or the O-ring may be deformed, which may prevent the splash-proof effect. Insert the plug connector as straight as possible.



3. Finishing locking

Pull the lever properly until it clicks. It can be felt to the touch when the plug connector is properly locked. After pulling the lever, pull the plug connector lightly to check that the connector is firmly connected.



7.8 Dimensions

- When running the cables to the load side, take care to avoid interference with the machine.
- The dimensions are for when cables (dual cable type) are run to the load-side. When running the cables vertically or to the opposite direction of the load-side, and for the dimensions for single cable type cables, refer to the following.

☞ Page 145 Cable direction: Load side/opposite direction of the load side
☞ Page 146 Cable direction: Vertical

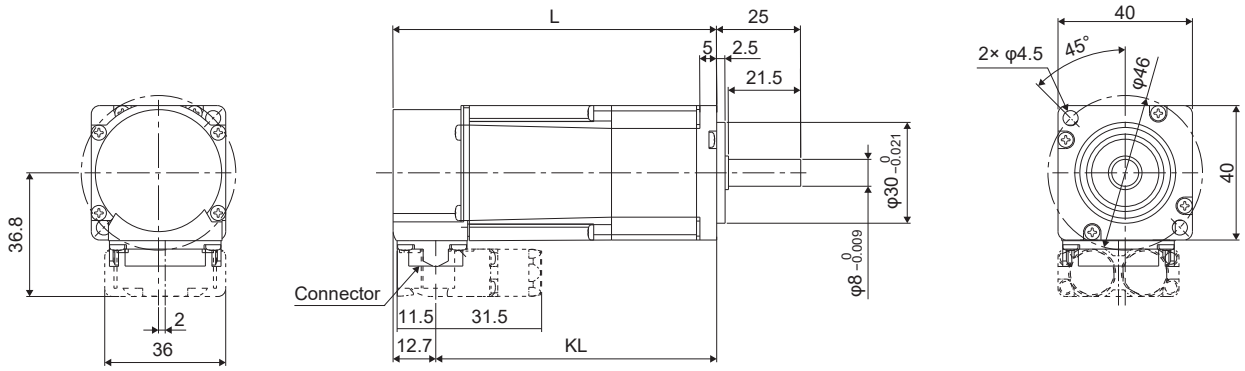
- Not all parts are created the exact same size or assembled in precisely the same manner. Therefore, the actual dimensions of rotary servo motors may be a maximum of approximately 3 mm larger than those in the drawings. In addition, the described dimensions and dimensional tolerances are the values at 20 °C. Since the values of the dimensions may vary depending on the ambient temperature, allow some margin when designing the machine side.
- Use a friction coupling for coupling the servo motor with a load.
- Use hexagon socket head cap screws to mount the rotary servo motor.

Without oil seal

HK-KN053(B)/HK-KN13(B)/HK-KN1M3(B)

Model	Variable dimensions *1	
	L	KL
HK-KN053(B)	55.5 (90.5)	42.8 (77.8)
HK-KN13(B)	68 (103)	55.3 (90.3)
HK-KN1M3(B)	80.5 (115.5)	67.8 (102.8)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

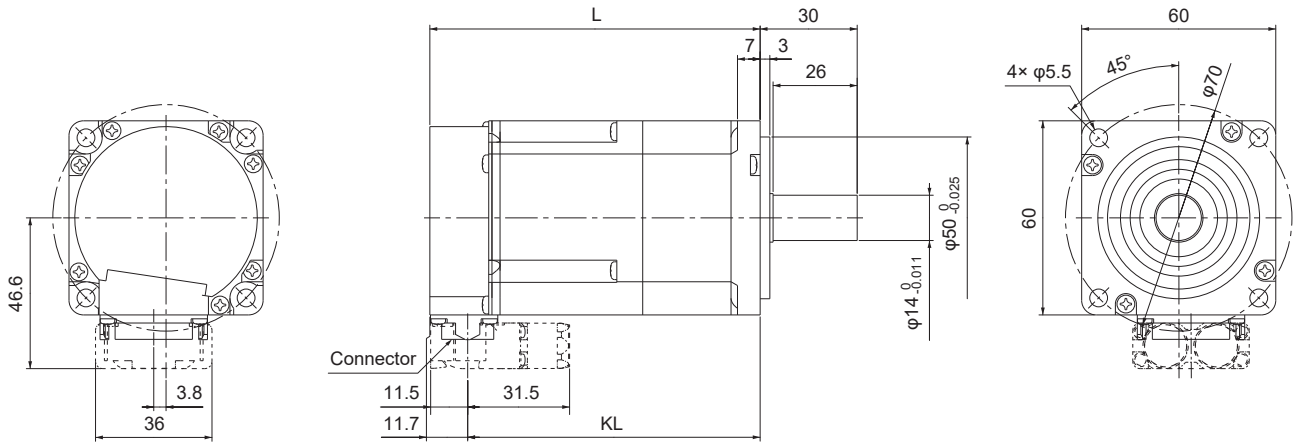


[Unit: mm]

HK-KN23(B)/HK-KN43(B)/HK-KN63(B)

Model	Variable dimensions *1	
	L	KL
HK-KN23(B)	67.5 (102.1)	55.8 (90.4)
HK-KN43(B)	85.5 (120.1)	73.8 (108.4)
HK-KN63(B)	103.5 (138.1)	91.8 (126.4)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

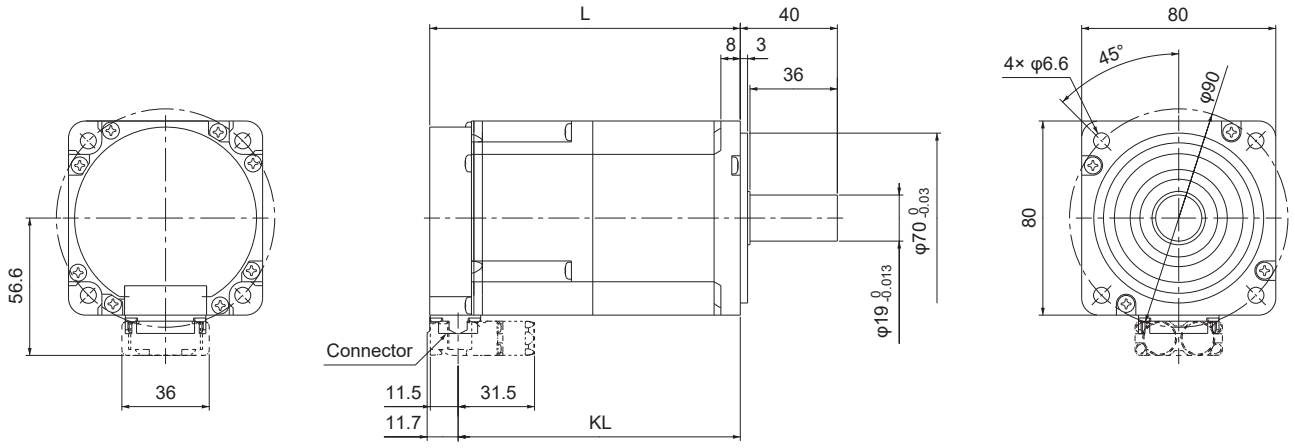


[Unit: mm]

HK-KN7M3(B)/HK-KN103(B)

Model	Variable dimensions *1	
	L	KL
HK-KN7M3(B)	92.5 (128)	80.8 (116.3)
HK-KN103(B)	101.5 (137)	89.8 (125.3)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

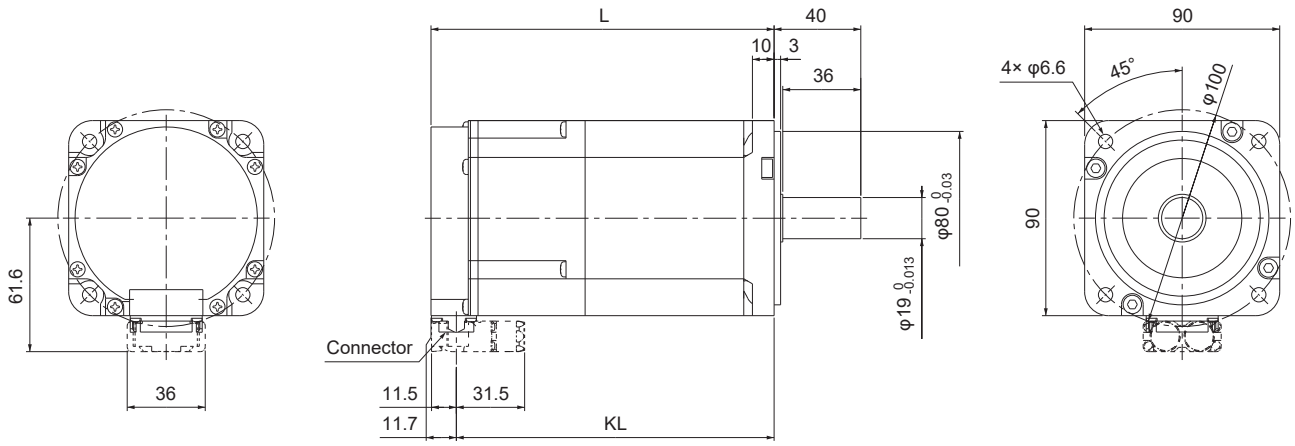


[Unit: mm]

HK-KN153(B)/HK-KN203(B)/HK-KN202(B)

Model	Variable dimensions *1	
	L	KL
HK-KN153(B)	118.9 (158.3)	107.2 (146.6)
HK-KN203(B)	136.9 (176.3)	125.2 (164.6)
HK-KN202(B)	172.9 (212.3)	161.2 (200.6)

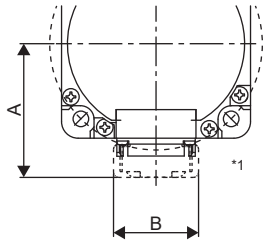
*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

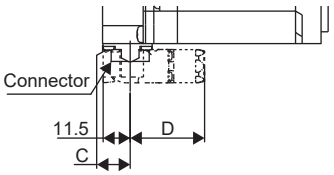


[Unit: mm]

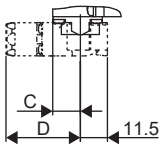
Cable direction: Load side/opposite direction of the load side

Model	Variable dimensions							
	Dual cable				Single cable			
	A	B	C	D	A	B	C	D
HK-KN053 HK-KN13 HK-KN1M3	36.8	36	12.7	31.5	39.6	32	12.7	40
HK-KN23 HK-KN43 HK-KN63	46.6		11.7		49.4		11.7	
HK-KN7M3 HK-KN103	56.6				59.4			
HK-KN153 HK-KN203 HK-KN202	61.6				64.4			





Cable direction: Load side *1



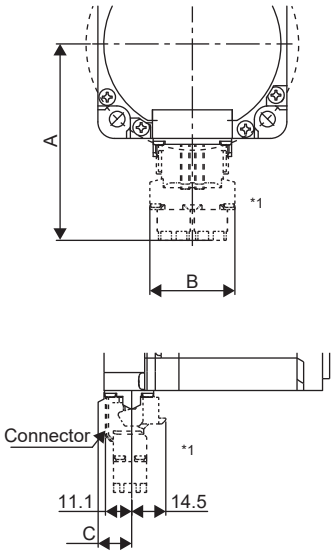
Cable direction: Opposite direction of the load side *1

[Unit: mm]

*1 The figures are for dual cable type motor cables.

Cable direction: Vertical

Model	Variable dimensions					
	Dual cable			Single cable		
	A	B	C	A	B	C
HK-KN053 HK-KN13 HK-KN1M3	63.4	36	12.7	71.9	32	12.7
HK-KN23 HK-KN43 HK-KN63	73.2		11.7	81.7		11.7
HK-KN7M3 HK-KN103	83.2			91.7		
HK-KN153 HK-KN203 HK-KN202	88.2			96.7		



[Unit: mm]

*1 The figures are for dual cable type motor cables.

8 HK-FN SERIES (200 V)

This chapter provides information on the rotary servo motor specifications and characteristics. The indicated values and those without tolerance are representative values. When using the HK-FN series (200 V) rotary servo motor, read chapter 1 to 5 and SAFETY INSTRUCTIONS at the beginning of this manual in addition to this chapter.
For the combinations of servo amplifiers and rotary servo motors, restrictions on the firmware version of the servo amplifier, and restrictions by the date of manufacture of the rotary servo motor, refer to "Servo amplifier/motor combinations" in the following manual.
MR-JET User's Manual (Hardware)

8.1 Model designation

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

HK - FN 1 3 B _ _ _

Oil seal

Symbol	Oil seal
None	Not attached
J	Attached

Electromagnetic brake

Symbol	Electromagnetic brake
None	Not attached
B	Attached

Rated speed

Symbol	Rated speed [r/min]
1M	1500
2	2000
3	3000

Rated output

Symbol	Rated output [kW]
1	0.1
2	0.2
4	0.4
7M	0.75
10	1.0
15	1.5
20	2.0
30	3.0

Shaft type

Symbol	Shaft shape
None	Standard (straight shaft)
D	D cut shaft
L	L-cut shaft
K	Keyed shaft (with key)
N	Keyed shaft (without key)

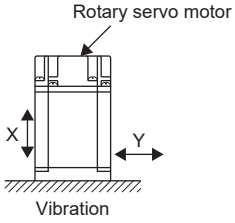
8.2 Standard specifications

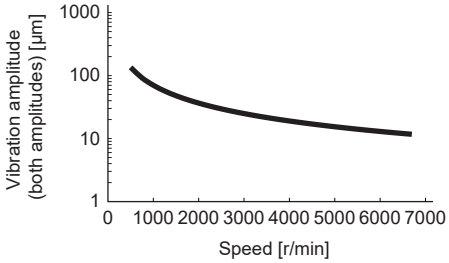
Standard specifications list

Series		HK-FN_ (High inertia/small capacity)			
Flange size		**□40**	**□60**		**□80**
Rotary servo motor model		**13**	**23**	**43**	**7M3**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)			
Power supply voltage [V]		200 V AC (3-phase 200 V AC to 240 V AC)			
Continuous running duty *1	Rated output [kW]	0.10	0.20	0.40	0.75
	Rated torque [N•m]	0.32	0.64	1.3	2.4
Maximum torque [N•m]		1.1	2.2	4.1	8.4
Rated speed *1[r/min]		3000			
Maximum speed *1[r/min]		6700			6500 *10
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	10.4	9.9	27.1	33.9
	With an electromagnetic brake	9.9	9.2	25.8	31.5
Rated current [A]		0.8	1.4	2.9	4.1
Maximum current [A]		3.0	4.9	9.8	16
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	0.0977	0.410	0.598	1.68
	With an electromagnetic brake	0.102	0.442	0.629	1.81
Recommended load to motor inertia ratio *2		23 times or less *8	8 times or less *8*9	15 times or less	20 times or less
Speed/position detector		24-bit encoder common to batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)			
Type		Permanent magnet synchronous motor			
Oil seal		Not attached *15			
Thermistor		None			
Insulation class		155 (F)			
Structure		Totally enclosed, natural cooling (IP rating: IP6 7) *3*7			
Vibration resistance *4[m/s^2]		X: 49, Y: 49			
Vibration rank *5		V10			
Permissible load for the shaft *6	L [mm]	25	30		40
	Radial [N]	88	245		392
	Thrust [N]	59	98		147
Mass [kg]	Without an electromagnetic brake	0.47	1.2	1.5	2.4
	With an electromagnetic brake	0.73	1.6	1.9	3.1

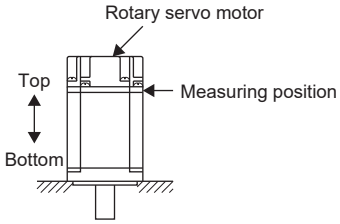
Series		HK-FN_ (High inertia/medium capacity)			
Flange size		**□130**		**□176**	
Rotary servo motor model		**102**	**152**	**202**	**301M**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)			
Power supply voltage [V]		200 V AC (3-phase 200 V AC to 240 V AC)			
Continuous running duty *1	Rated output [kW]	1.0	1.5	2.0	3.0
	Rated torque [N•m]	4.8	7.2	9.5	19.1
Maximum torque [N•m]		14.3	21.5	28.6	57.3
Rated speed *1[r/min]		2000			1500
Maximum speed *1[r/min]		4000 *11	2500 *12	3500 *13	2300 *14
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	13.5	22.9	17.0	51.5
	With an electromagnetic brake	12.0	20.9	15.6	48.1
Rated current [A]		5.4	5.3	9.0	11
Maximum current [A]		17		29	34
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	16.9	22.4	53.6	70.8
	With an electromagnetic brake	19.1	24.5	58.6	75.8
Recommended load to motor inertia ratio *2		12 times or less	30 times or less	14 times or less	25 times or less
Speed/position detector		24-bit encoder for batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)			
Type		Permanent magnet synchronous motor			
Oil seal		Not attached *15			
Thermistor		None			
Insulation class		155 (F)			
Structure		Totally enclosed, natural cooling (IP rating: IP67) *3*7			
Vibration resistance *4[m/s^2]		X: 24.5, Y: 49			X: 24.5, Y: 29.4
Vibration rank *5		V10			
Permissible load for the shaft *6	L [mm]	55		79	
	Radial [N]	980		2058	
	Thrust [N]	490		980	
Mass [kg]	Without an electromagnetic brake	9.1	11	16	20
	With an electromagnetic brake	11	13	21	25

*1 When the power supply voltage drops, the continuous running duty and the speed cannot be guaranteed.
*2 If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.
*3 Except for the shaft-through portion. IP classifies the degrees of protection provided against the intrusion of solid objects and water in electrical enclosures.
*4 The vibration directions are shown in the following figure. The value is the one at the part that indicates the maximum value (normally the opposite to load-side bracket). When the rotary servo motor stops, fretting is likely to occur at the bearing. Therefore, suppress the vibration to about half of the permissible value.





*5 V10 indicates that the amplitude of a single rotary servo motor is 10 µm or less. The following figure shows the rotary servo motor mounting position for measurement and the measuring position.



*6 Refer to the following for permissible load for the shaft.
☞ Page 152 Permissible load for the output shaft
*7 When IP67 cables are needed, contact your local sales office.
*8 The value in the table is the recommended load to motor inertia ratio that is applicable when the servo motor is operated at the rated speed. When the servo motor is to be operated at a speed exceeding the rated speed, check whether a regenerative option is required by using Drive System Sizing Software Motorizer.
*9 If the speed is 2500 r/min or less, the recommended load to motor inertia ratio will be 11 times or less.
*10 The maximum rotational speed at which continuous running is allowed is 6000 r/min.
*11 The maximum rotational speed at which continuous operation is allowed is 3500 r/min.
*12 The maximum rotational speed at which continuous operation is allowed is 2400 r/min.
*13 The maximum rotational speed at which continuous operation is allowed is 3000 r/min.
*14 The maximum rotational speed at which continuous running is allowed is 2000 r/min.
*15 Servo motors with an oil seal are also compatible.

Torque characteristics

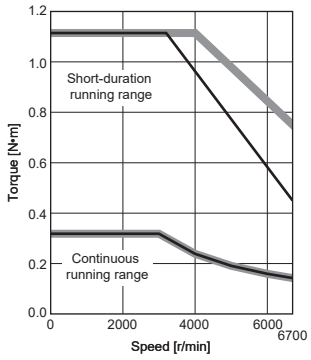
- For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque.

When the power supply voltage drops, the torque decreases.- - - -: A rough indication of the possible continuous running range for 3-phase 170 V AC

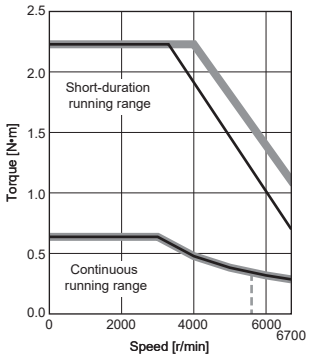
▬ : 3-phase 200 VAC
—— : 1-phase 200 VAC

HK-FN_

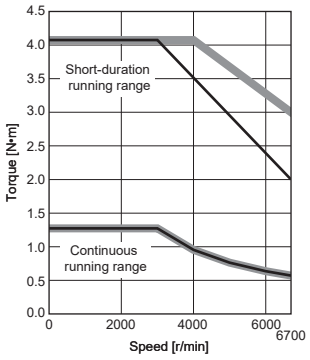
[HK-FN13]



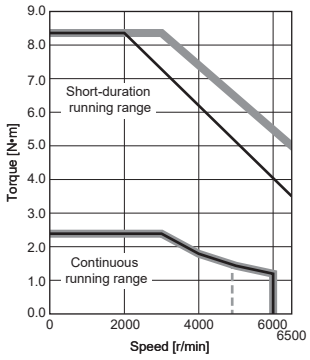
[HK-FN23]



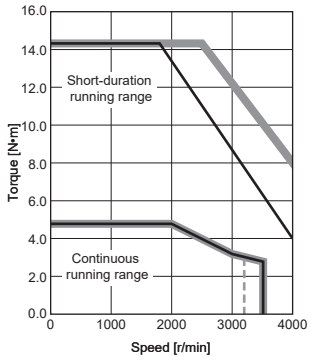
[HK-FN43]



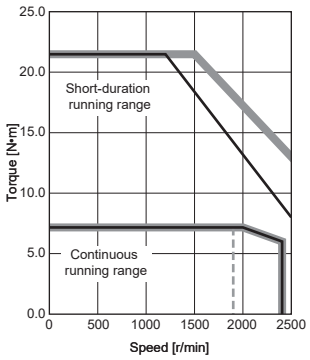
[HK-FN7M3]



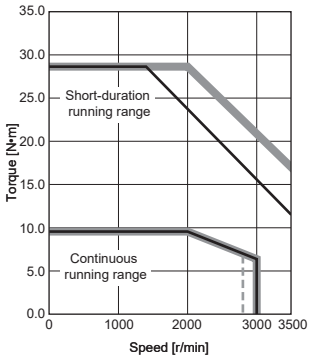
[HK-FN102]



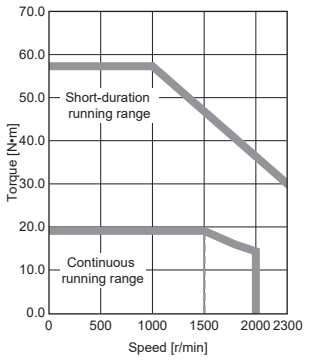
[HK-FN152]



[HK-FN202]



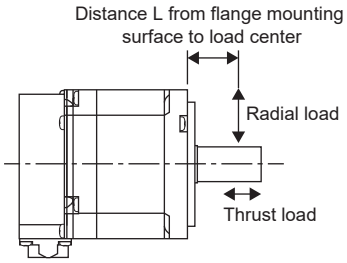
[HK-FN301M]



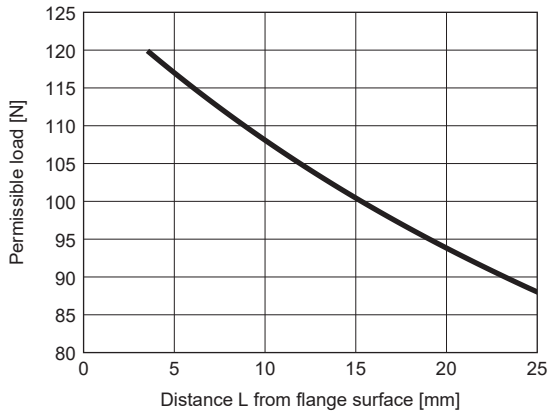
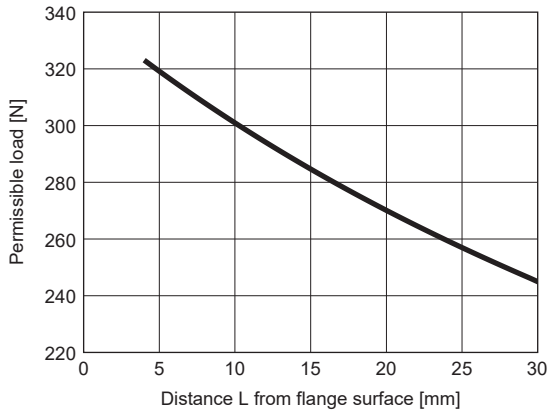
8

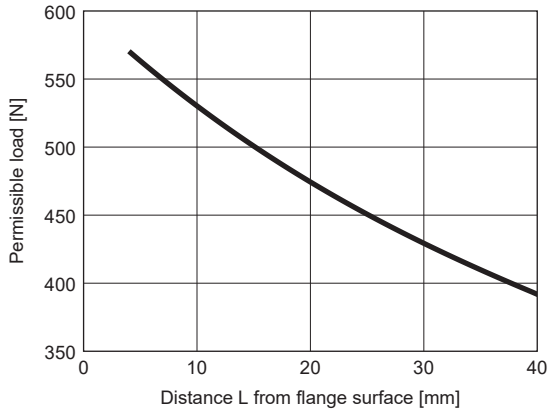
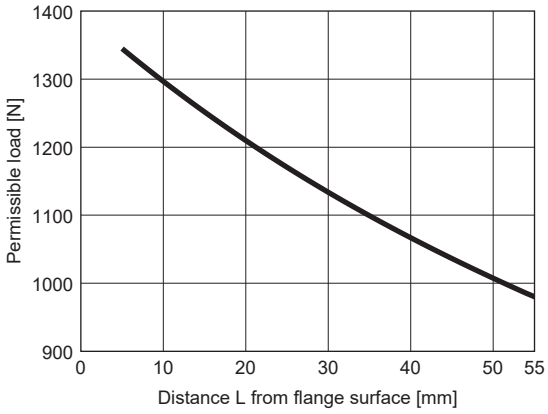
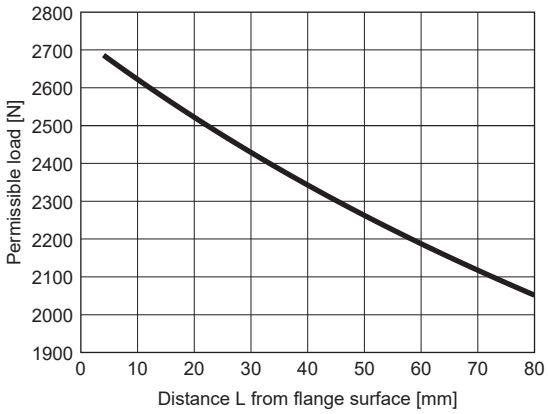
Permissible load for the output shaft

The permissible load for the shaft is shown in the following. Do not subject the shaft to loads greater than the permissible value. The value assumes that the load is applied independently.



In case where the load position changes, calculate the permissible radial load from the distance measured from the flange mounting surface to the center of the load, and make the load equal to or less than the permissible radial load, referring to the graph shown in the following.

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-FN13	25	88	59	
HK-FN23 HK-FN43	30	245	98	

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-FN7M3	40	392	147	
HK-FN102 HK-FN152	55	980	490	
HK-FN202 HK-FN301M	79	2058	980	

8.3 Characteristics of electromagnetic brake

Point

Before operating the servo motor, confirm that the electromagnetic brake operates properly.
The operation time of the electromagnetic brake varies depending on the power supply circuit being used.
Check the operation delay time with an actual machine.

The characteristics of the electromagnetic brake provided for the rotary servo motor with an electromagnetic brake are shown below.

Item		HK-FN13B	HK-FN23B HK-FN43B	HK-FN7M3B	HK-FN102B HK-FN152B	HK-FN202B HK-FN301MB
Type *1		Spring actuated type safety brake				
Rated voltage *4		24 V DC (-10 % to 0 %)				
Power consumption at 20 °C [W]		6.4	7.9	10	20	34
Coil resistance *5[Ω]		91	73	57	29	17
Inductance *5[H]		0.14	0.20	0.16	0.05	0.06
Brake static friction torque *7[N•m]		0.48 or more	1.9 or more	3.2 or more	8.5 or more	44 or more
Release delay time *2[s]		0.03		0.04		0.1
Braking delay time [s]	DC off *2	0.01	0.02		0.03	
Permissible braking work [J]	Per braking	5.6	22	64	400	4500
	Per hour	56	220	640	4000	45000
Brake looseness at servo motor shaft *5[degree]		2.5	1.2	0.9	0.6	
Brake life *3	Number of braking times [times]	20000				
	Work per braking [J]	5.6	22	64	200	1000
Selection example of surge absorbers to be used *6	Suppressed voltage of 125 V	TND20V-680KB (Manufactured by Nippon Chemi-Con Corporation)				
	Suppressed voltage of 350 V	TND10V-221KB (Manufactured by Nippon Chemi-Con Corporation)				

*1 This type does not have a manual release mechanism. Use a 24 V DC power supply to release the brake electrically.
*2 The value for initial on gap at 20 °C.
*3 Brake lining wear due to braking will increase the brake gap, but the gap is not adjustable. Therefore, the brake life indicates the number of times the brake can be applied before gap adjustment becomes necessary.
*4 Prepare a power supply exclusively for the electromagnetic brake.
*5 The values are design values. These are not the guaranteed values.
*6 Select the electromagnetic brake control relay properly, in consideration of the characteristics of the electromagnetic brake and surge absorber. When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.
*7 The value of the brake static friction torque is the lower limit in the initial state at 20 °C.

8.4 Derating

The derating condition is the reference value at the rated speed. As the temperature rise value of the rotary servo motor changes depending on the operation conditions such as speed, confirm that [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] does not occur on the actual machine before use.

If [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] occurs, consider the following measures:

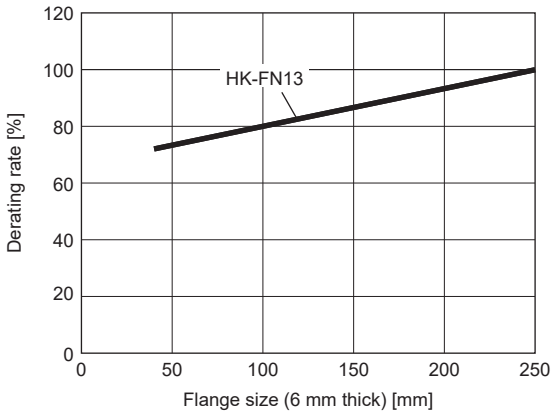
- Lower the effective load ratio of the rotary servo motor.
- Review the heat dissipation conditions.

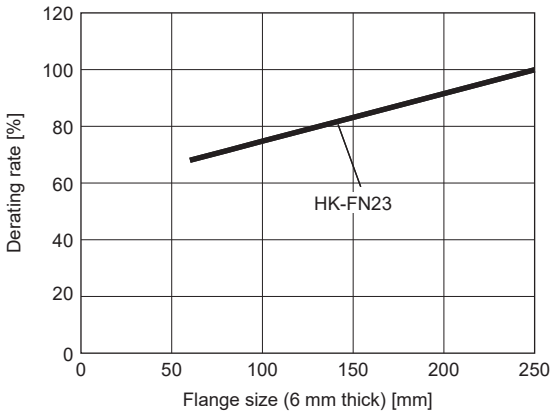
To use this product under conditions with multiple derating, calculate the multiplication of each derating rate, and use at the calculated derating rate or lower.

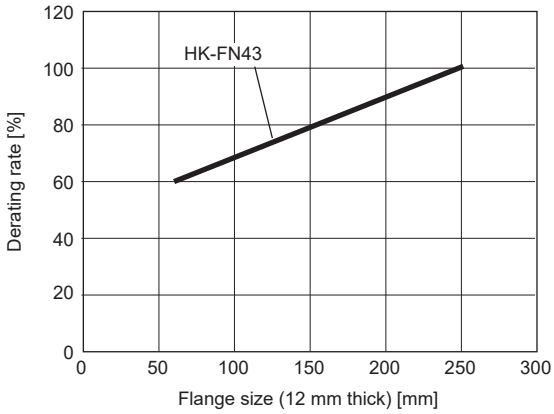
For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque. When applying the derating rate in the conditions above, calculate the multiplication of the derating rate of 70 % in the unbalanced torque and the derating rate of each condition, and use this product at the calculated derating rate or lower.

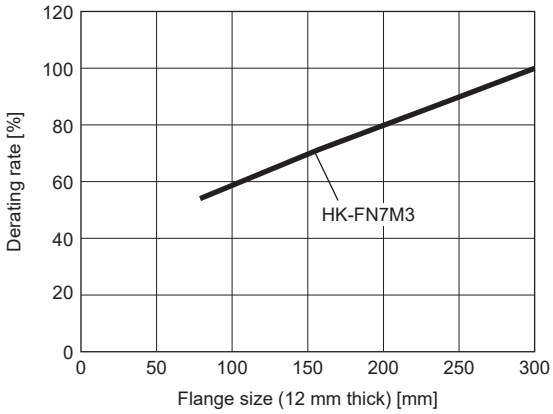
Restrictions on the flange size

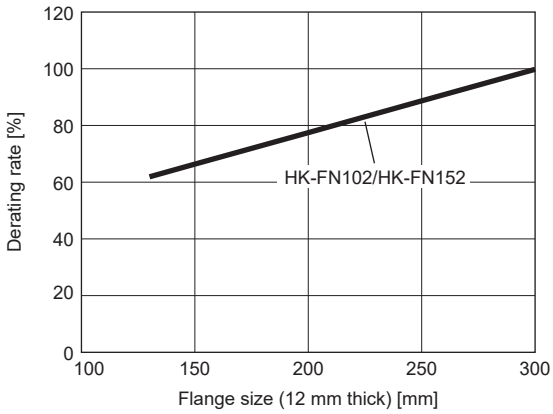
When mounting the rotary servo motor on a machine smaller than the specified aluminum flanges listed in section 2.10, derate the servo motor in accordance with the following conditions:

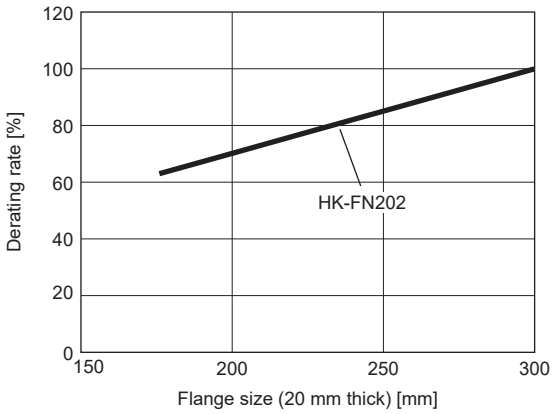


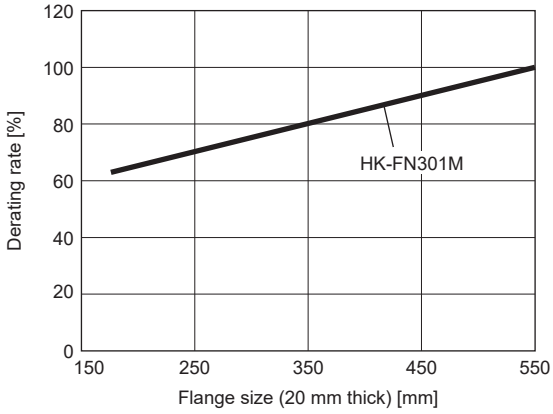






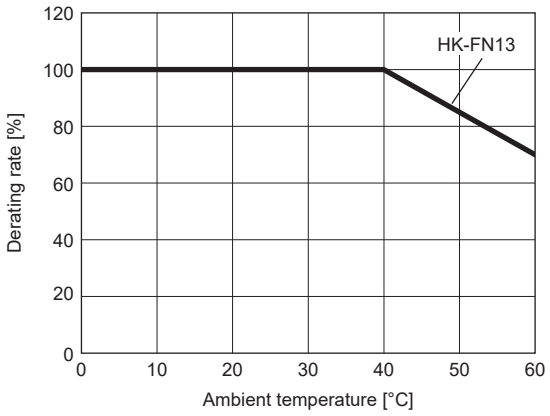


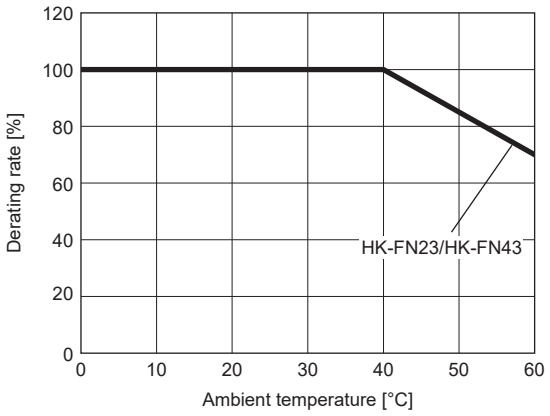


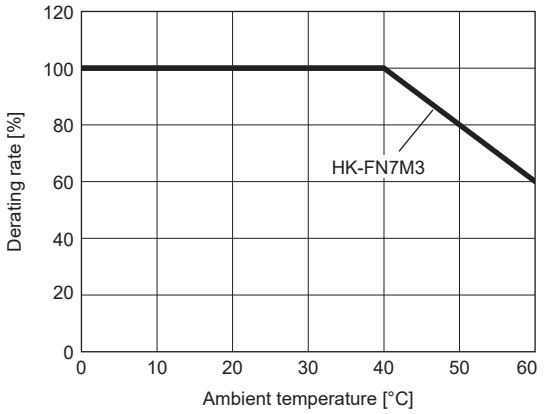


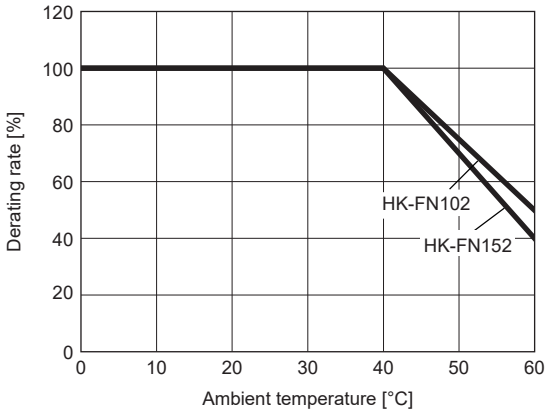
Restrictions on the ambient temperature

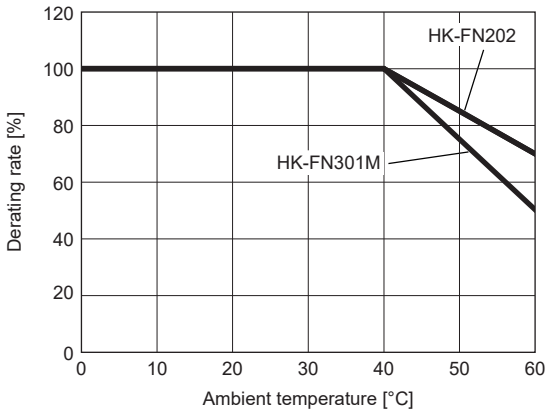
When using this product in an environment with a high ambient temperature, derate the product in accordance with the following conditions:





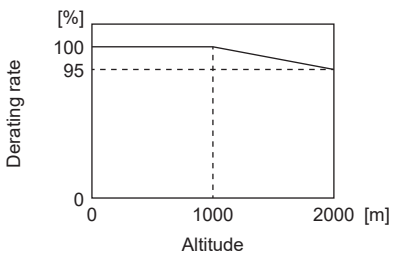






Restrictions on the altitude

To use this product at an altitude between 1000 m and 2000 m, derate the product in accordance with the following conditions:

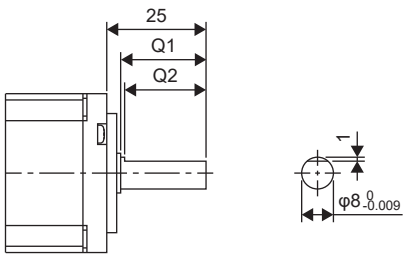


8.5 Rotary servo motors with special shafts

For rotary servo motors, there are four types of shafts: D-cut shaft, L-cut shaft, keyed shaft (with double round-ended key), and keyed shaft (without key). The keys are included as accessories and not attached to the shafts.
To prevent an accident such as motor shaft fracture, do not use a servo motor with a D-cut shaft, L-cut shaft, or keyed shaft for frequent start/stop applications.

Rotary servo motor	Shaft shape			
	D cut shaft	L-cut shaft	Keyed shaft	
			With double round-ended key	Without key
HK-FN13	D	L	K	N
HK-FN23 HK-FN43 HK-FN7M3 HK-FN102 HK-FN152 HK-FN202 HK-FN301M	—	—	K	N

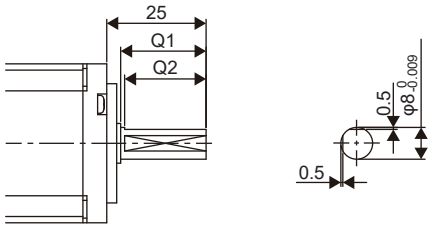
D cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HK-FN13D	21.5	20.5

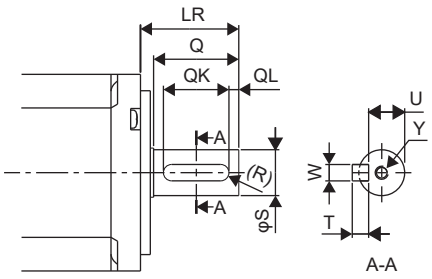
L-cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HK-FN13L	21.5	20.5

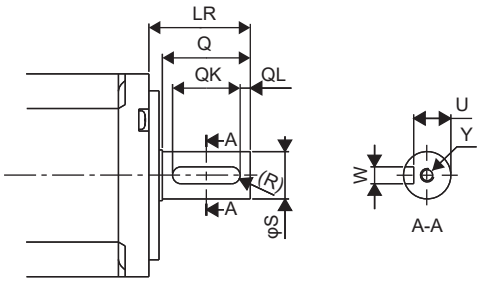
Keyed shaft (with double round-ended key)



[Unit: mm]

Rotary servo motor	Variable dimensions									
	S	LR	Q	W	QK	QL	U	R	T	Y
HK-FN13K	$8^{0}_{-0.009}$	25	21.5	3	14	5	$6.2^{0}_{-0.085}$	1.5	3	M3 × 8
HK-FN23K HK-FN43K	$14^{0}_{-0.011}$	30	26	5	20	3	$11^{0}_{-0.085}$	2.5	5	M4 × 15
HK-FN7M3K	$19^{0}_{-0.013}$	40	36	6	25	5	$15.5^{0}_{-0.1}$	3	6	M5 × 20
HK-FN102K HK-FN152K	$24^{0}_{-0.013}$	55	50	8	36	5	$20^{0}_{-0.1}$	4	7	M8 × 20
HK-FN202K HK-FN301MK	$35^{+0.010}_{0}$	79	75	10	55	5	$30^{0}_{-0.12}$	5	8	M8 × 20

Keyed shaft (without key)



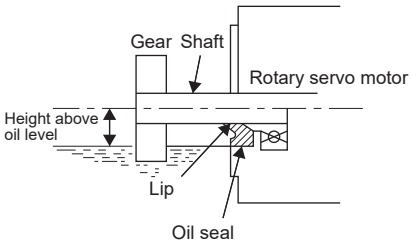
[Unit: mm]

Rotary servo motor	Variable dimensions								
	S	LR	Q	W	QK	QL	U	R	Y
HK-FN13N	$8^{0}_{-0.009}$	25	21.5	$3^{-0.004}_{-0.029}$	14	5	$6.2^{0}_{-0.085}$	1.5	M3 × 8
HK-FN23N HK-FN43N	$14^{0}_{-0.011}$	30	26	$5^{0}_{-0.03}$	20	3	$11^{0}_{-0.085}$	2.5	M4 × 15
HK-FN7M3N	$19^{0}_{-0.013}$	40	36	$6^{0}_{-0.03}$	25	5	$15.5^{0}_{-0.1}$	3	M5 × 20
HK-FN102N HK-FN152N	$24^{0}_{-0.013}$	55	50	$8^{0}_{-0.036}$	36	5	$20^{0}_{-0.1}$	4	M8 × 20
HK-FN202N HK-FN301MN	$35^{+0.010}_{0}$	79	75	$10^{0}_{-0.036}$	55	5	$30^{0}_{-0.12}$	5	M8 × 20

8.6 Rotary servo motors with an oil seal

The oil seal prevents the entry of oil into the rotary servo motor.

Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip.



Rotary servo motor	Height (h) from the surface of the oil [mm]
HK-FN13J	10
HK-FN23J HK-FN43J	12
HK-FN7M3J	16
HK-FN102J HK-FN152J	23
HK-FN202J HK-FN301MJ	30

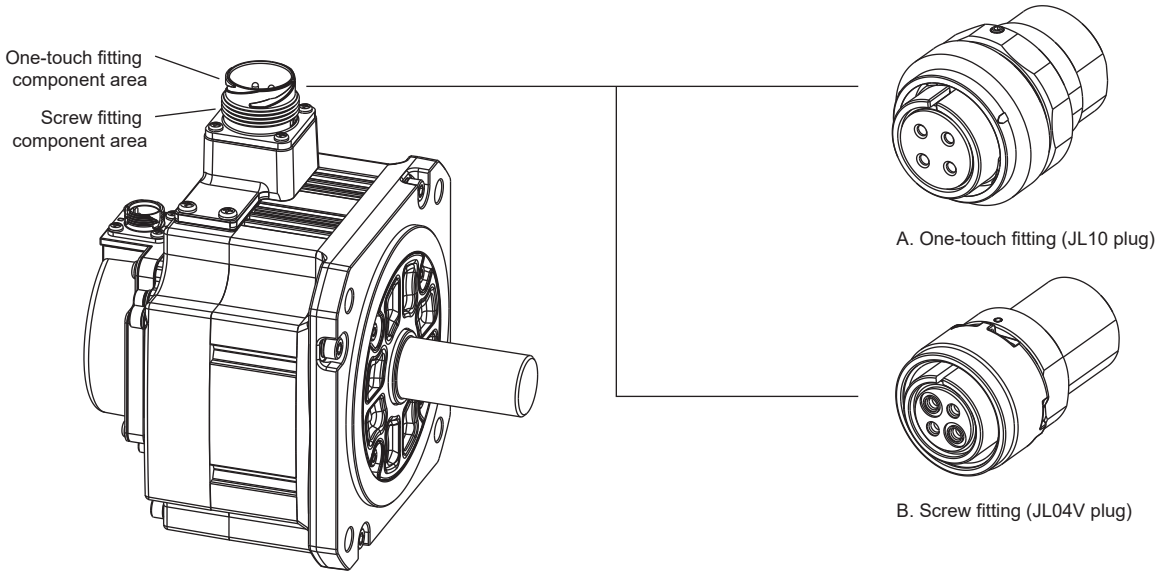
8.7 Mounting connectors

HK-FN series (0.1 kW - 0.75 KW) series

☞ Page 140 Mounting connectors

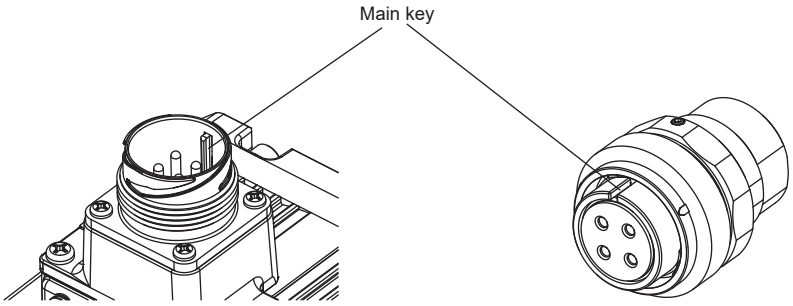
HK-FN series (1.0 kW - 3.0 KW) series

Both the one-touch lock fitting type and the screw fitting type can be used for the power connector. Mount the power connector as shown in the following procedure.



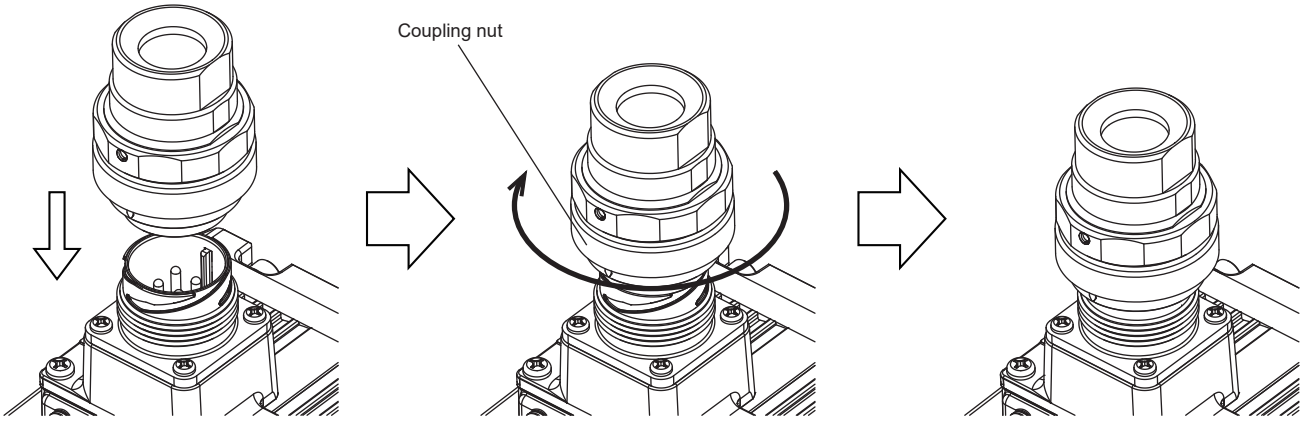
One-touch lock fitting

1. Align the main key of the receptacle connector (motor side) with its groove on the plug connector (cable side), and insert the plug into the receptacle.



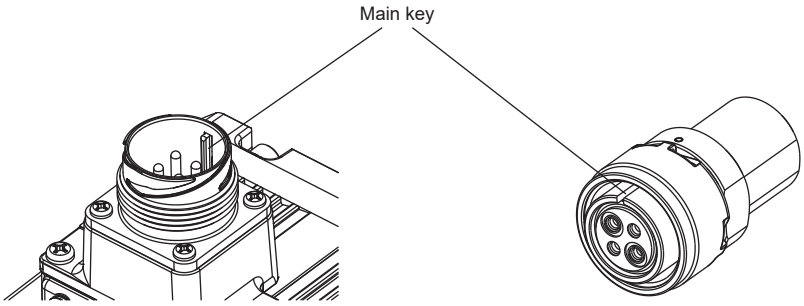
2. While pushing the plug lightly, rotate the coupling nut clockwise until it clicks.

3. Pull the plug lightly to check that the plug does not come off.



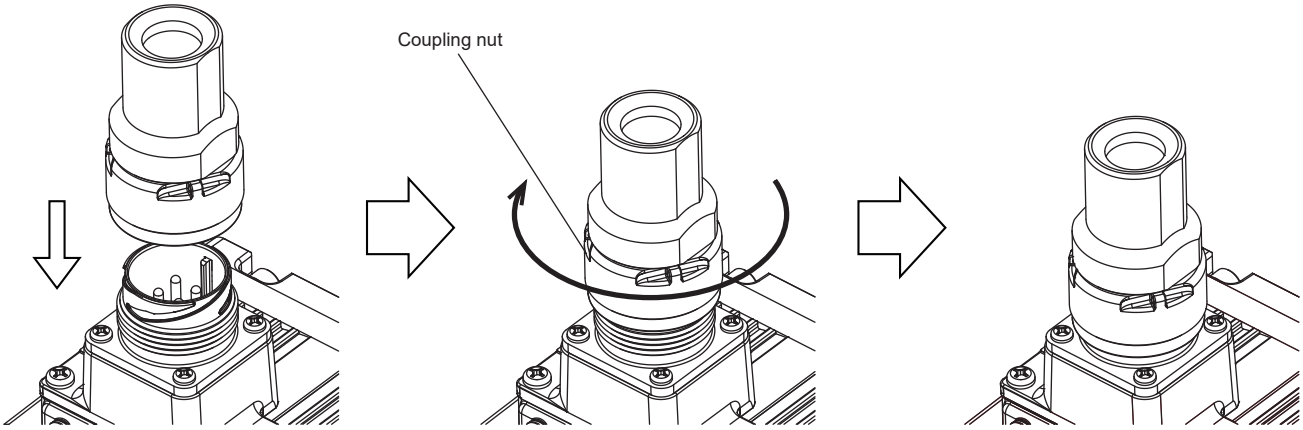
Screw fitting

1. Align the main key of the receptacle connector (motor side) with its groove on the plug connector (cable side), and insert the plug into the receptacle.



2. Push in the plug straight until the coupling nut engages with the thread of the receptacle.

3. Tighten the coupling nut with a recommended tightening torque of 4.0 to 4.5 N•m.



8.8 Dimensions

- When running the cables to the load side, take care to avoid interference with the machine.
- Not all parts are created the exact same size or assembled in precisely the same manner. Therefore, the actual dimensions of rotary servo motors may be a maximum of approximately 3 mm larger than those in the drawings. In addition, the described dimensions and dimensional tolerances are the values at 20 °C. Since the values of the dimensions may vary depending on the ambient temperature, allow some margin when designing the machine side.
- Use a friction coupling for coupling the servo motor with a load.
- Use hexagon socket head cap screws to mount the rotary servo motor.

Without oil seal

HK-FN13(B)

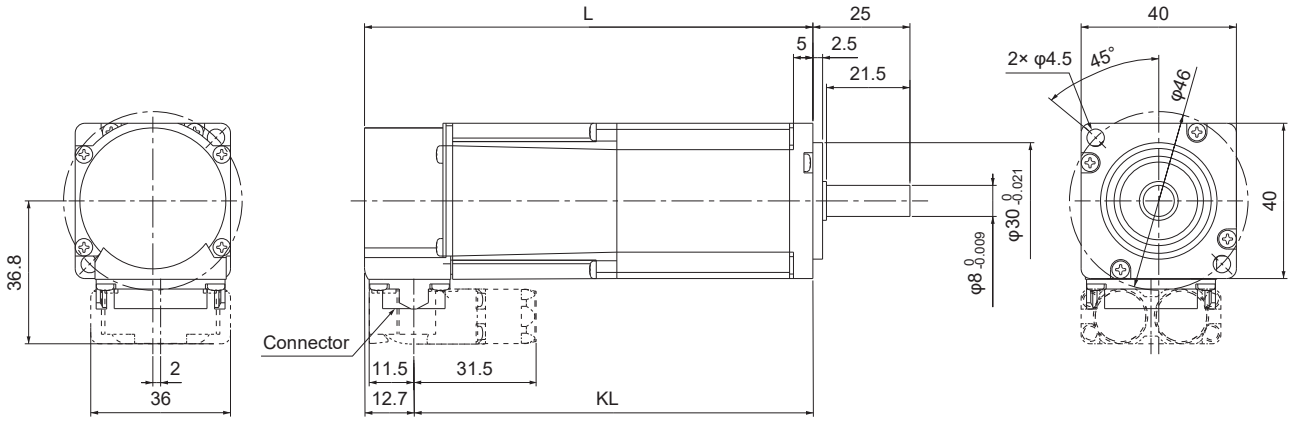
The dimensions are for when cables (dual cable type) are run to the load-side. When running the cables vertically or to the opposite direction of the load-side, and for the dimensions for single cable type cables, refer to the following.

☞ Page 168 Cable direction: Load side/opposite direction of the load side

☞ Page 169 Cable direction: Vertical

Model	Variable dimensions *1	
	L	KL
HK-FN13(B)	80.5 (115.5)	67.8 (102.8)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



[Unit: mm]

HK-FN23(B)/HK-FN43(B)

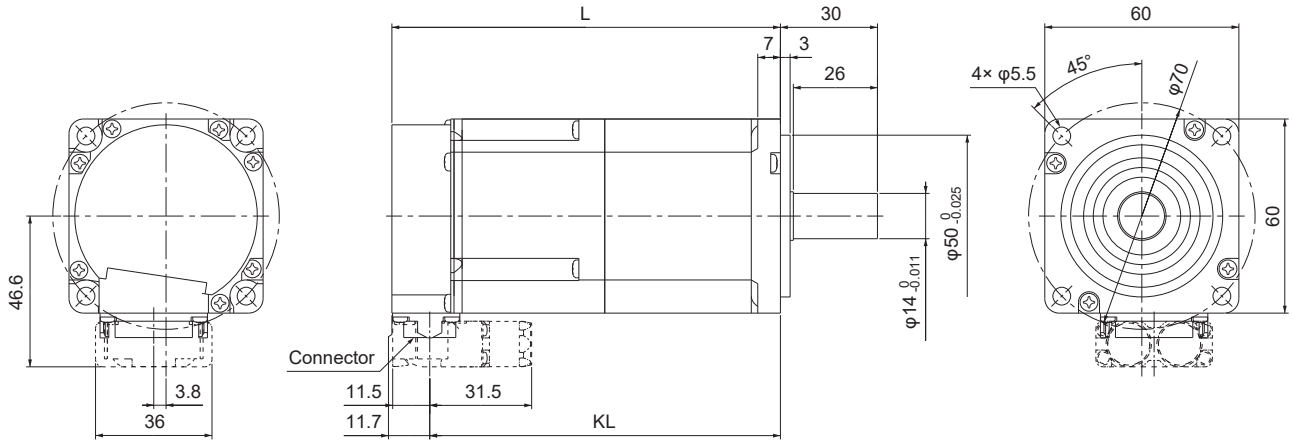
The dimensions are for when cables (dual cable type) are run to the load-side. When running the cables vertically or to the opposite direction of the load-side, and for the dimensions for single cable type cables, refer to the following.

☞ Page 168 Cable direction: Load side/opposite direction of the load side

☞ Page 169 Cable direction: Vertical

Model	Variable dimensions *1	
	L	KL
HK-FN23(B)	85.5 (120.1)	73.8 (108.4)
HK-FN43(B)	103.5 (138.1)	91.8 (126.4)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



[Unit: mm]

HK-FN7M3(B)

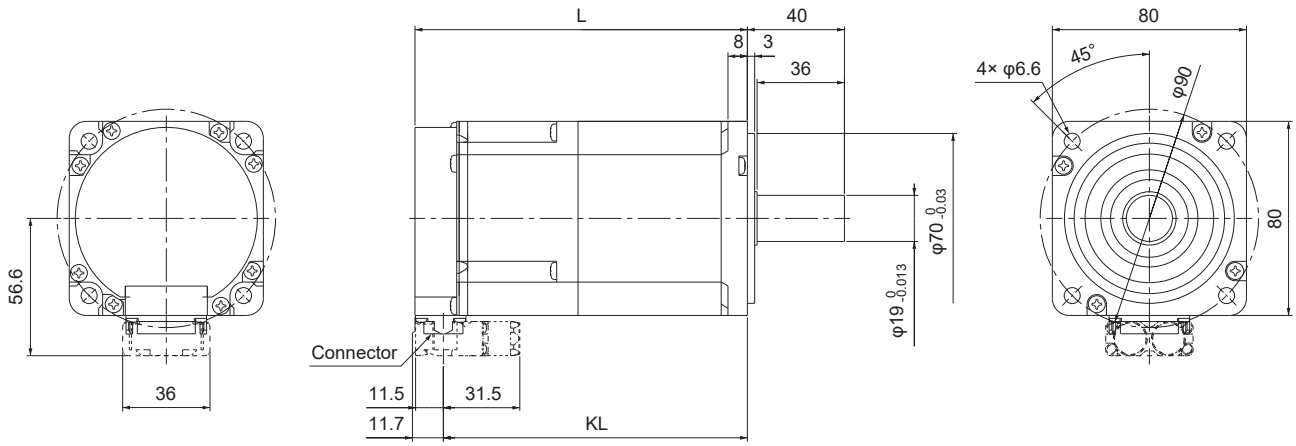
The dimensions are for when cables (dual cable type) are run to the load-side. When running the cables vertically or to the opposite direction of the load-side, and for the dimensions for single cable type cables, refer to the following.

☞ Page 168 Cable direction: Load side/opposite direction of the load side

☞ Page 169 Cable direction: Vertical

Model	Variable dimensions *1	
	L	KL
HK-FN7M3(B)	101.5 (137)	89.8 (125.3)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

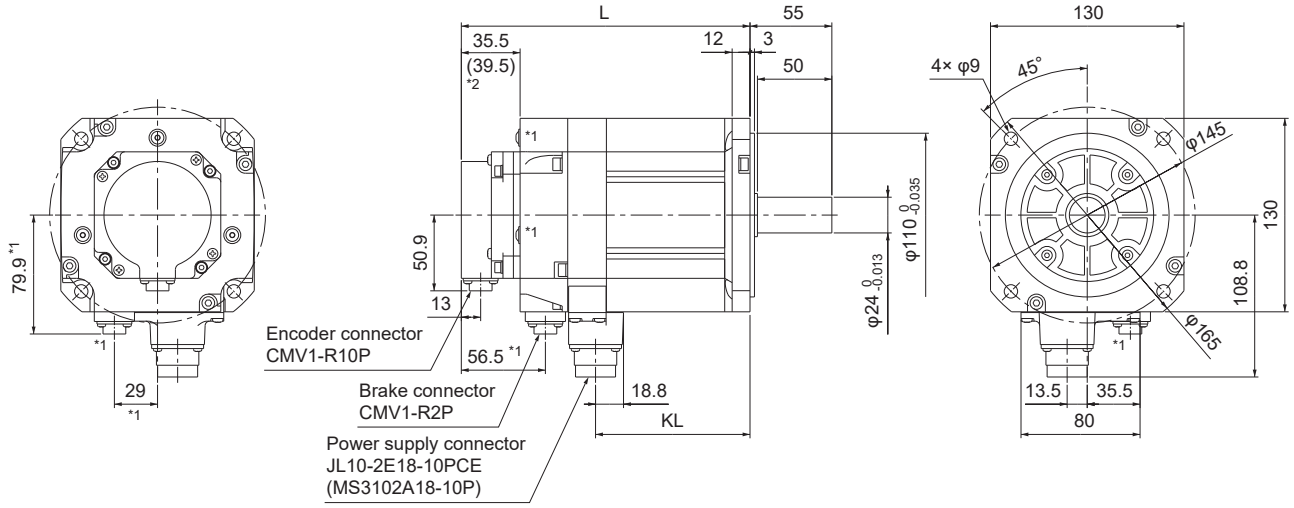


[Unit: mm]

HK-FN102(B)/HK-FN152(B)

Model	Variable dimensions *1	
	L	KL
HK-FN102(B)	159.5 (194)	103.8
HK-FN152(B)	181.5 (216)	125.8

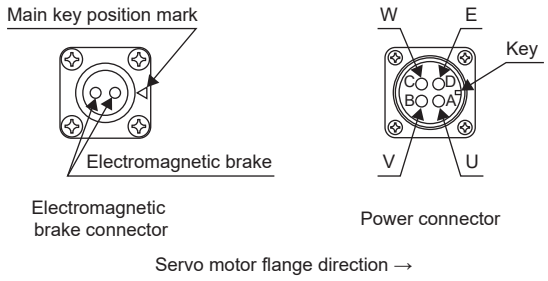
*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



[Unit: mm]

*1 For servo motors with an electromagnetic brake.

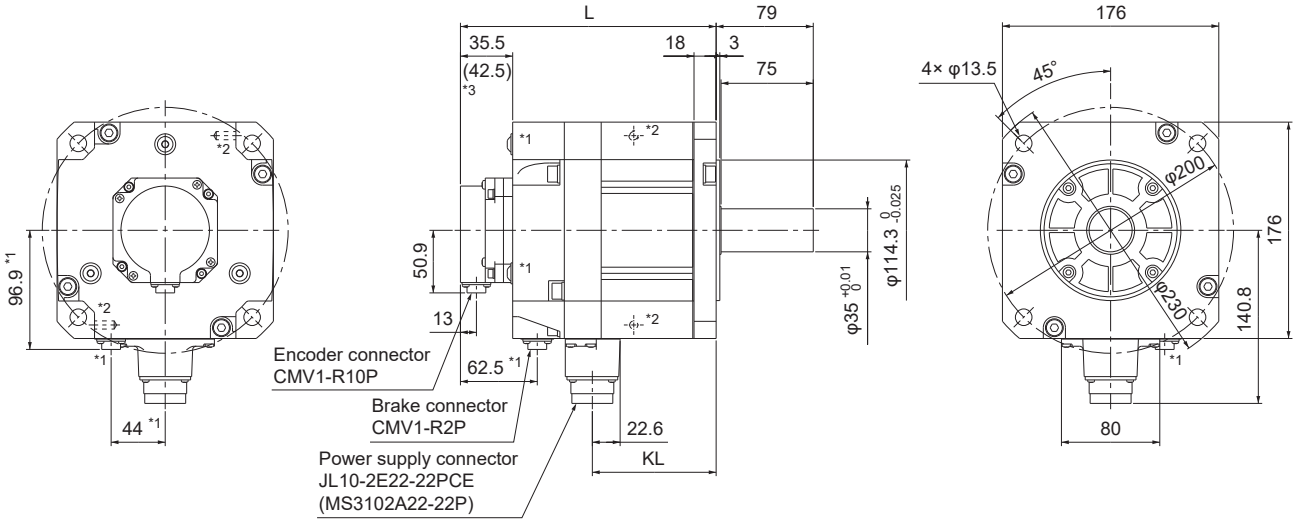
*2 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



HK-FN202(B)/HK-FN301M(B)

Model	Variable dimensions *1	
	L	KL
HK-FN202(B)	158.5 (208)	100.7
HK-FN301M(B)	178.5 (228)	120.7

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

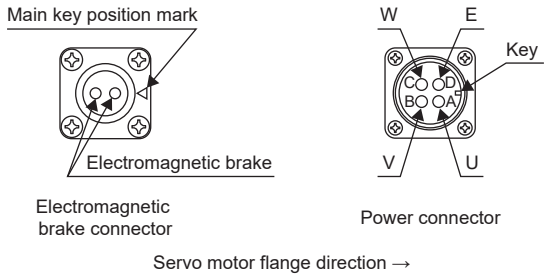


[Unit: mm]

*1 For servo motors with an electromagnetic brake.

*2 Screw hole for eyebolt (M8)

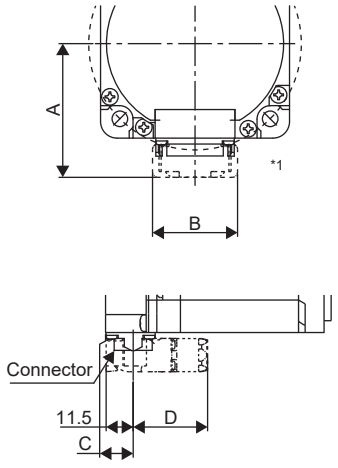
*3 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



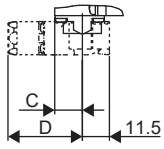
8

Cable direction: Load side/opposite direction of the load side

Model	Variable dimensions							
	Dual cable				Single cable			
	A	B	C	D	A	B	C	D
HK-FN13	36.8	36	12.7	31.5	39.6	32	12.7	40
HK-FN23 HK-FN43	46.6		11.7		49.4		11.7	
HK-FN7M3	56.6				59.4			



Cable direction: Load side *1



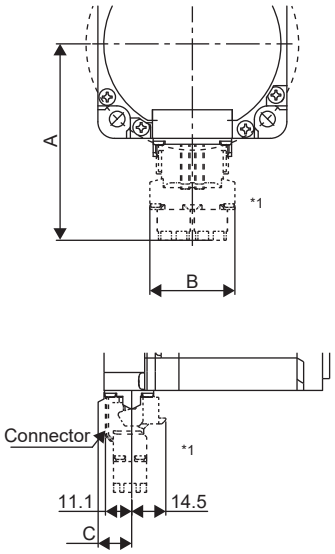
Cable direction: Opposite direction of the load side *1

[Unit: mm]

*1 The figures are for dual cable type motor cables.

Cable direction: Vertical

Model	Variable dimensions					
	Dual cable			Single cable		
	A	B	C	A	B	C
HK-FN13	63.4	36	12.7	71.9	32	12.7
HK-FN23 HK-FN43	73.2		11.7	81.7		11.7
HK-FN7M3	83.2			91.7		



[Unit: mm]

*1 The figures are for dual cable type motor cables.

9 HK-KN SERIES (400 V)

This chapter provides information on the rotary servo motor specifications and characteristics. The indicated values and those without tolerance are representative values. When using the HK-KN series (400 V) rotary servo motor, read chapter 1 to 5 and SAFETY INSTRUCTIONS at the beginning of this manual in addition to this chapter.
For the combinations of servo amplifiers and rotary servo motors, restrictions on the firmware version of the servo amplifier, and restrictions by the date of manufacture of the rotary servo motor, refer to "Servo amplifier/motor combinations" in the following manual.
MR-JET User's Manual (Hardware)

9.1 Model designation

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

HK - KN 1 3 4 B _ _

Oil seal

Symbol	Oil seal
None	Not attached
J	Attached

Electromagnetic brake

Symbol	Electromagnetic brake
None	Not attached
B	Attached

400 V

Rated speed

Symbol	Rated speed [r/min]
3	3000

Rated output

Symbol	Rated output [kW]
1	0.1
2	0.2
4	0.4
6	0.6
7M	0.75
10	1.0
15	1.5
20	2.0

Shaft type

Symbol	Shaft shape
None	Standard (straight shaft)
D	D cut shaft
L	L-cut shaft
K	Keyed shaft (with key)
N	Keyed shaft (without key)

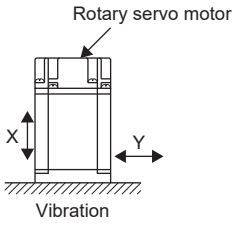
9.2 Standard specifications

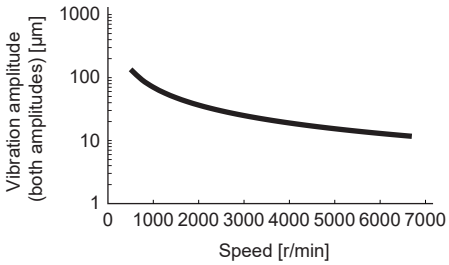
Standard specifications list

Series		HK-KN_ (Low inertia/small capacity)			
Flange size		**□40**	**□60**		
Rotary servo motor model		**134**	**234**	**434**	**634**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)			
Power supply voltage [V]		400 V AC (3-phase 380 V AC to 480 V AC)			
Continuous running duty *1	Rated output [kW]	0.1	0.2	0.4	0.6
	Rated torque [N•m]	0.32	0.64	1.3	1.9
Maximum torque [N•m]		1.1	2.2	4.5	6.7
Rated speed *1[r/min]		3000			
Maximum speed *1[r/min]		6700			
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	14.8	19.4	39.5	61.0
	With an electromagnetic brake	14.0	16.0	36.7	58.0
Rated current [A]		1.2	1.4	1.3	2.3
Maximum current [A]		4.6	5.4	4.9	9.1
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	0.0686	0.209	0.410	0.598
	With an electromagnetic brake	0.0725	0.254	0.442	0.629
Recommended load to motor inertia ratio *2		20 times or less	23 times or less *9	23 times or less	20 times or less *10
Speed/position detector		24-bit encoder common to batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)			
Type		Permanent magnet synchronous motor			
Oil seal		Not attached *12			
Thermistor		None			
Insulation class		155 (F)			
Structure		Totally enclosed, natural cooling (IP rating: IP67) *3*7			
Vibration resistance *4[m/s^2]		X: 49, Y: 49			
Vibration rank *5		V10			
Permissible load for the shaft *6	L [mm]	25	30		
	Radial [N]	88	245		
	Thrust [N]	59	98		
Mass [kg]	Without an electromagnetic brake	0.37	0.77	1.2	1.5
	With an electromagnetic brake	0.63	1.2	1.6	1.9

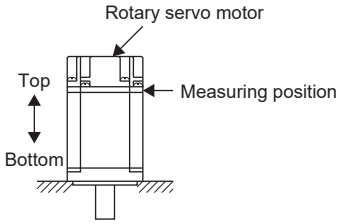
Series		HK-KN_ (Low inertia/small capacity)			
Flange size		**□80**		**□90**	
Rotary servo motor model		**7M34**	**1034**	**1534**	**2034**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)			
Power supply voltage [V]		400 V AC (3-phase 380 V AC to 480 V AC)			
Continuous running duty *1	Rated output [kW]	0.75	1.0	1.5	2.0
	Rated torque [N•m]	2.4	3.2	4.8	6.4
Maximum torque [N•m]		8.4	11.1	16.7	19.1
Rated speed *1[r/min]		3000			
Maximum speed *1[r/min]		6700	6500	6700	6000
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	41.6	60.3	52.0	71.7
	With an electromagnetic brake	37.7	56.0	48.3	67.7
Rated current [A]		2.4	2.5	4.4	5.3
Maximum current [A]		9.7	10	17	
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	1.37	1.68	4.38	5.65
	With an electromagnetic brake	1.51	1.81	4.72	5.99
Recommended load to motor inertia ratio *2		9 times or less *11	7 times or less *10	11 times or less *10	10 times or less *10
Speed/position detector		24-bit encoder for batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)			
Type		Permanent magnet synchronous motor			
Oil seal		Not attached *12			
Thermistor		None			
Insulation class		155 (F)			
Structure		Totally enclosed, natural cooling (IP rating: IP67) *3*7			
Vibration resistance *4[m/s^2]		X: 49, Y: 49		X: 24.5, Y: 24.5	
Vibration rank *5		V10			
Permissible load for the shaft *6	L [mm]	40			
	Radial [N]	392			
	Thrust [N]	147			
Mass [kg]	Without an electromagnetic brake	2.2	2.4	3.6	4.4
	With an electromagnetic brake	2.9	3.1	4.7	5.5

*1 When the power supply voltage drops, the continuous running duty and the speed cannot be guaranteed.
*2 If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.
*3 Except for the shaft-through portion. IP classifies the degrees of protection provided against the intrusion of solid objects and water in electrical enclosures.
*4 The vibration directions are shown in the following figure. The value is the one at the part that indicates the maximum value (normally the opposite to load-side bracket). When the rotary servo motor stops, fretting is likely to occur at the bearing. Therefore, suppress the vibration to about half of the permissible value.





*5 V10 indicates that the amplitude of a single rotary servo motor is 10 µm or less. The following figure shows the rotary servo motor mounting position for measurement and the measuring position.



*6 Refer to the following for permissible load for the shaft.
☞ Page 175 Permissible load for the output shaft
*7 When IP67 cables are needed, contact your local sales office.
*8 The value in the table is the recommended load to motor inertia ratio that is applicable when the servo motor is operated at the rated speed. When the servo motor is to be operated at a speed exceeding the rated speed, check whether a regenerative option is required by using Drive System Sizing Software Motorizer.
*9 If the speed is 6000 r/min or less, the recommended load to motor inertia ratio will be 28 times or less.
*10 If the speed is 3000 r/min or less, the recommended load to motor inertia ratio will be 30 times or less.
*11 If the speed is 3000 r/min or less, the recommended load to motor inertia ratio will be 20 times or less.
*12 Servo motors with an oil seal are also compatible.

Torque characteristics

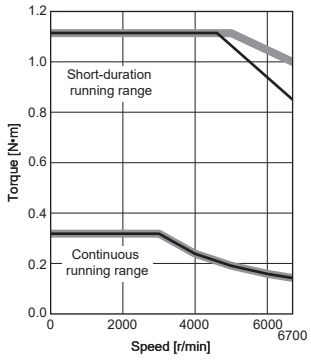
- For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque.

When the power supply voltage drops, the torque decreases. - - - - : A rough indication of the possible continuous running range for 3-phase 323 V AC

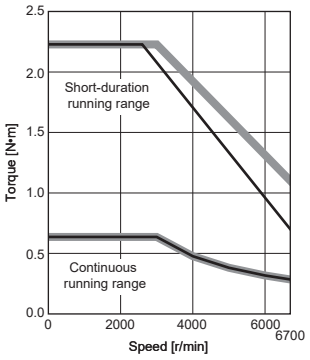
▬ : 3-phase 400 VAC
—— : 3-phase 380 VAC

HK-KN_4

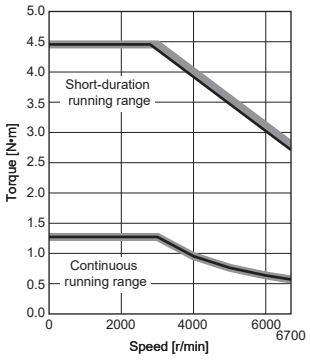
[HK-KN134]



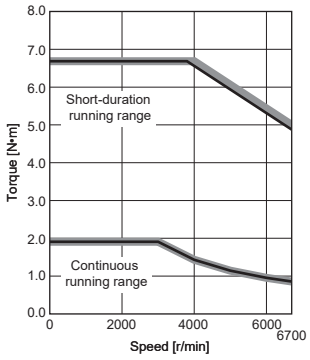
[HK-KN234]



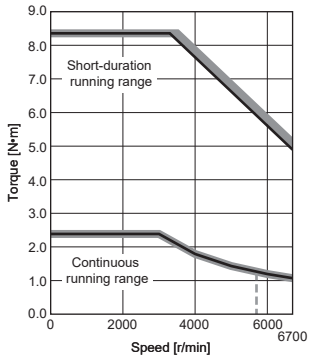
[HK-KN434]



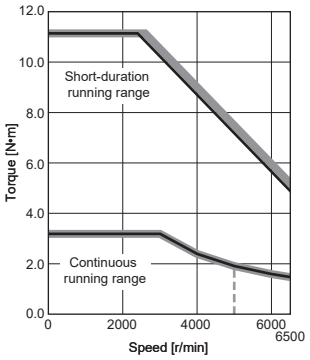
[HK-KN634]



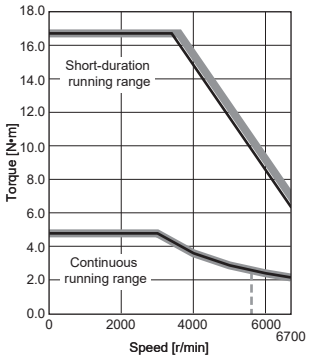
[HK-KN7M34]



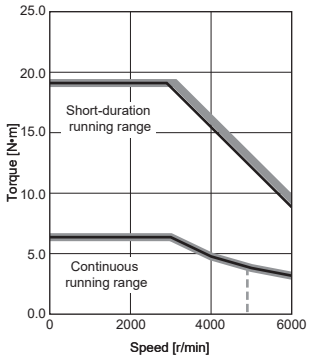
[HK-KN1034]



[HK-KN1534]

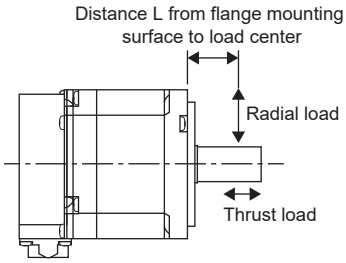


[HK-KN2034]

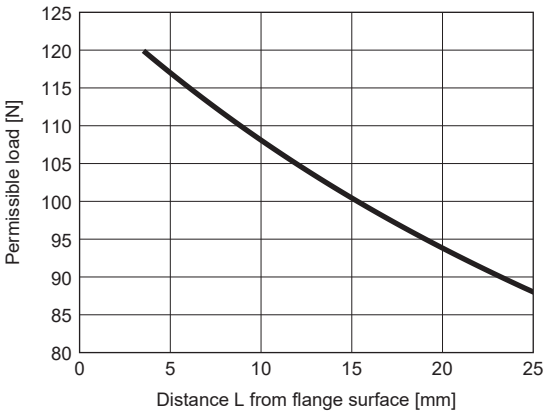
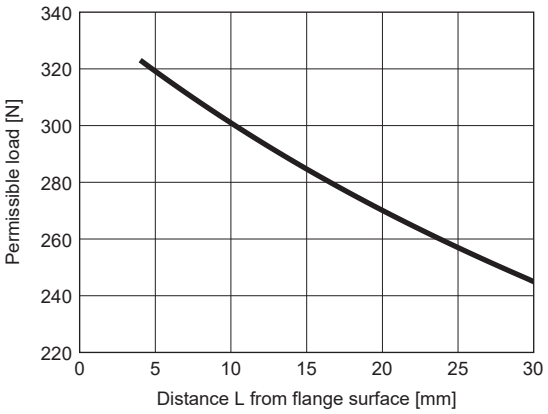


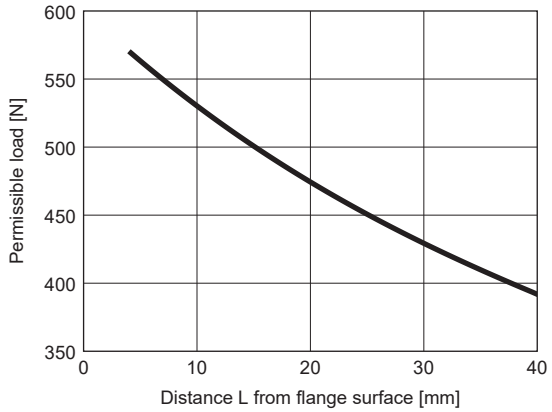
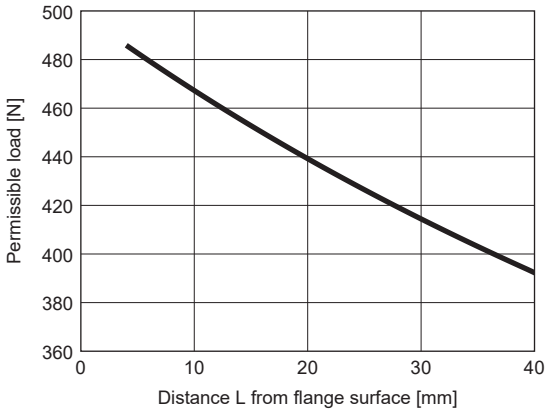
Permissible load for the output shaft

The permissible load for the shaft is shown in the following. Do not subject the shaft to loads greater than the permissible value. The value assumes that the load is applied independently.



In case where the load position changes, calculate the permissible radial load from the distance measured from the flange mounting surface to the center of the load, and make the load equal to or less than the permissible radial load, referring to the graph shown in the following.

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-KN134	25	88	59	
HK-KN234 HK-KN434 HK-KN634	30	245	98	

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-KN7M34 HK-KN1034	40	392	147	
HK-KN1534 HK-KN2034	40	392	147	

9.3 Characteristics of electromagnetic brake

Point

Before operating the servo motor, confirm that the electromagnetic brake operates properly.
The operation time of the electromagnetic brake varies depending on the power supply circuit being used.
Check the operation delay time with an actual machine.

The characteristics of the electromagnetic brake provided for the rotary servo motor with an electromagnetic brake are shown below.

Item		HK-KN134B	HK-KN234B HK-KN434B HK-KN634B	HK-KN7M34B HK-KN1034B	HK-KN1534B HK-KN2034B
Type *1		Spring actuated type safety brake			
Rated voltage *4		24 V DC (-10 % to 0 %)			
Power consumption at 20 °C [W]		6.4	7.9	10	13.8
Coil resistance *5[Ω]		91	73	57	42
Inductance *5[H]		0.14	0.20	0.16	0.15
Brake static friction torque *7[N•m]		0.48 or more	1.9 or more	3.2 or more	9.5 or more
Release delay time *2[s]		0.03		0.04	0.09
Braking delay time [s]	DC off *2	0.01	0.02		0.03
Permissible braking work [J]	Per braking	5.6	22	64	
	Per hour	56	220	640	
Brake looseness at servo motor shaft *5[degree]		2.5	1.2	0.9	
Brake life *3	Number of braking times [times]	20000			5000
	Work per braking [J]	5.6	22	64	
Selection example of surge absorbers to be used *6	Suppressed voltage of 125 V	TND20V-680KB (Manufactured by Nippon Chemi-Con Corporation)			
	Suppressed voltage of 350 V	TND10V-221KB (Manufactured by Nippon Chemi-Con Corporation)			

*1 This type does not have a manual release mechanism. Use a 24 V DC power supply to release the brake electrically.
*2 The value for initial on gap at 20 °C.
*3 Brake lining wear due to braking will increase the brake gap, but the gap is not adjustable. Therefore, the brake life indicates the number of times the brake can be applied before gap adjustment becomes necessary.
*4 Prepare a power supply exclusively for the electromagnetic brake.
*5 The values are design values. These are not the guaranteed values.
*6 Select the electromagnetic brake control relay properly, in consideration of the characteristics of the electromagnetic brake and surge absorber. When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.
*7 The value of the brake static friction torque is the lower limit in the initial state at 20 °C.

9.4 Derating

The derating condition is the reference value at the rated speed. As the temperature rise value of the rotary servo motor changes depending on the operation conditions such as speed, confirm that [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] does not occur on the actual machine before use.

If [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] occurs, consider the following measures:

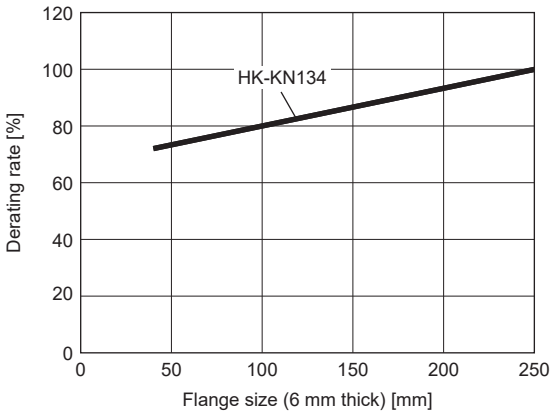
- Lower the effective load ratio of the rotary servo motor.
- Review the heat dissipation conditions.

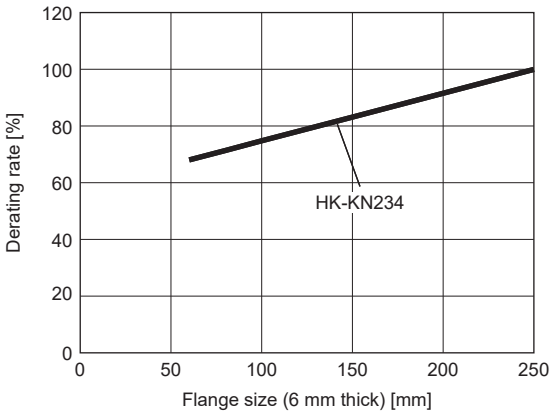
To use this product under conditions with multiple derating, calculate the multiplication of each derating rate, and use at the calculated derating rate or lower.

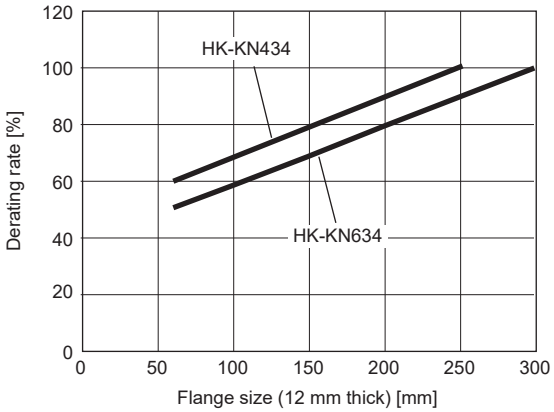
For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque. When applying the derating rate in the conditions above, calculate the multiplication of the derating rate of 70 % in the unbalanced torque and the derating rate of each condition, and use this product at the calculated derating rate or lower.

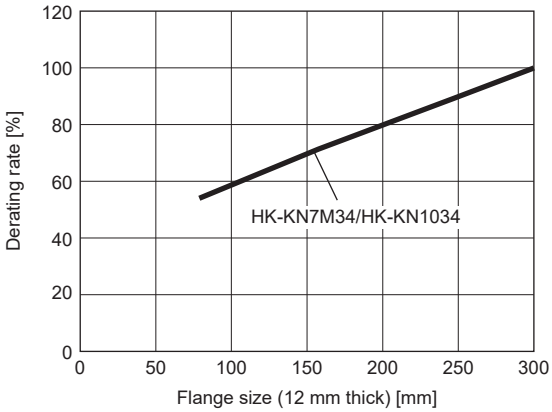
Restrictions on the flange size

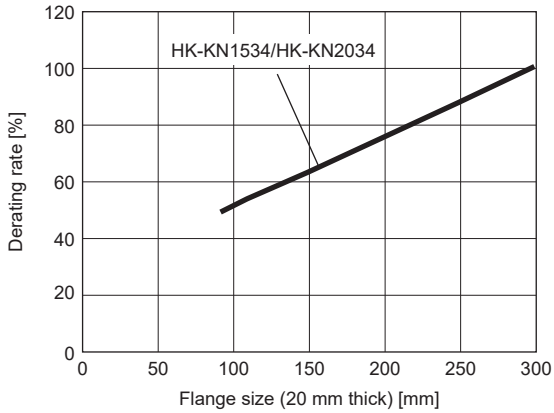
When mounting the rotary servo motor on a machine smaller than the specified aluminum flanges listed in section 2.10, derate the servo motor in accordance with the following conditions:





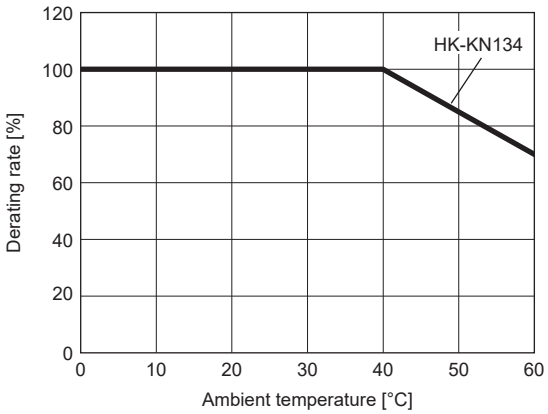


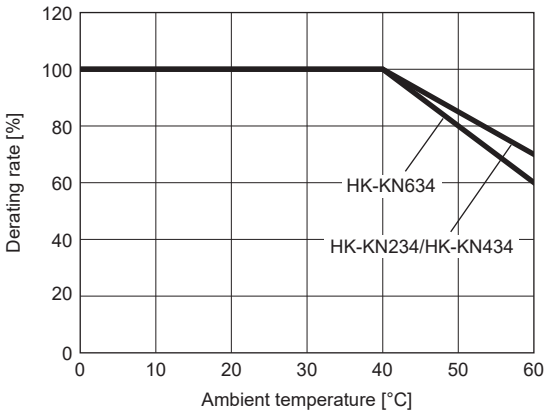


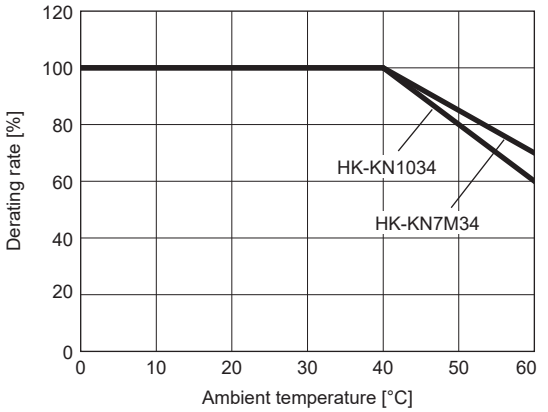


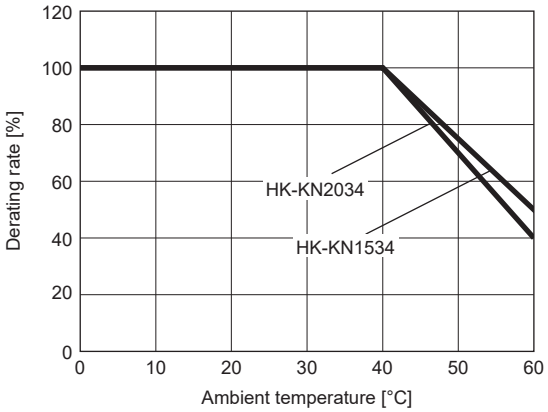
Restrictions on the ambient temperature

When using this product in an environment with a high ambient temperature, derate the product in accordance with the following conditions:



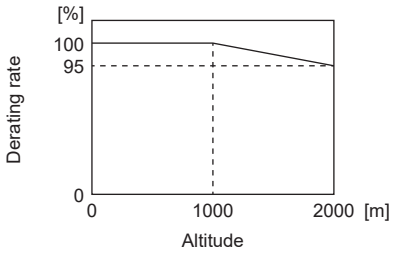






Restrictions on the altitude

To use this product at an altitude between 1000 m and 2000 m, derate the product in accordance with the following conditions:

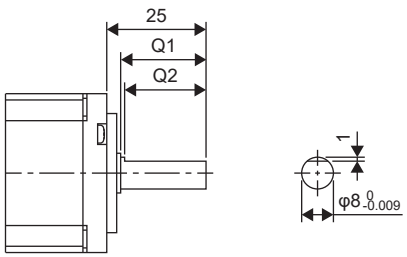


9.5 Rotary servo motors with special shafts

For rotary servo motors, there are four types of shafts: D-cut shaft, L-cut shaft, keyed shaft (with double round-ended key), and keyed shaft (without key). The keys are included as accessories and not attached to the shafts.
To prevent an accident such as motor shaft fracture, do not use a servo motor with a D-cut shaft, L-cut shaft, or keyed shaft for frequent start/stop applications.

Rotary servo motor	Shaft shape			
	D cut shaft	L-cut shaft	Keyed shaft	
			With double round-ended key	Without key
HK-KN134	D	L	K	N
HK-KN234 HK-KN434 HK-KN634 HK-KN7M34 HK-KN1034 HK-KN1534 HK-KN2034	—	—	K	N

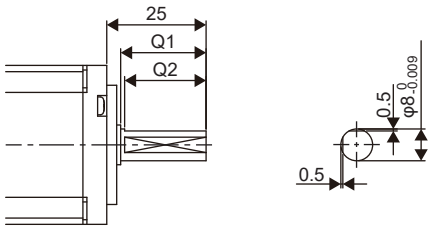
D cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HK-KN134D	21.5	20.5

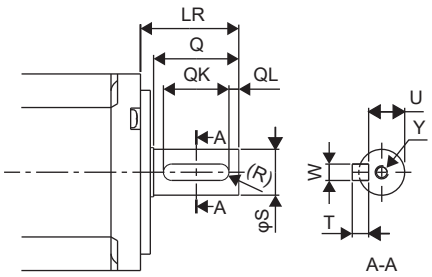
L-cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HK-KN134L	21.5	20.5

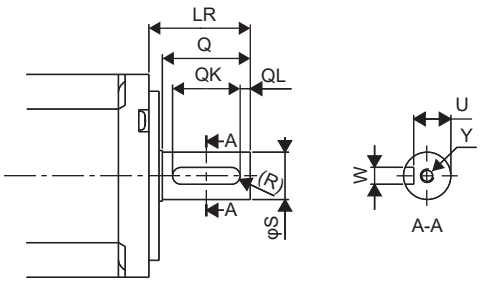
Keyed shaft (with double round-ended key)



[Unit: mm]

Rotary servo motor	Variable dimensions									
	S	LR	Q	W	QK	QL	U	R	T	Y
HK-KN134K	$8^{0}_{-0.009}$	25	21.5	3	14	5	$6.2^{0}_{-0.085}$	1.5	3	M3 × 8
HK-KN234K HK-KN434K HK-KN634K	$14^{0}_{-0.011}$	30	26	5	20	3	$11^{0}_{-0.085}$	2.5	5	M4 × 15
HK-KN7M34K HK-KN1034K HK-KN1534K HK-KN2034K	$19^{0}_{-0.013}$	40	36	6	25	5	$15.5^{0}_{-0.1}$	3	6	M5 × 20

Keyed shaft (without key)



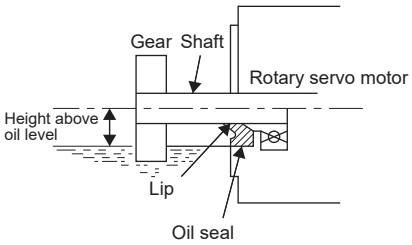
[Unit: mm]

Rotary servo motor	Variable dimensions								
	S	LR	Q	W	QK	QL	U	R	Y
HK-KN134N	$8^{0}_{-0.009}$	25	21.5	$3^{-0.004}_{-0.029}$	14	5	$6.2^{0}_{-0.085}$	1.5	M3 × 8
HK-KN234N HK-KN434N HK-KN634N	$14^{0}_{-0.011}$	30	26	$5^{0}_{-0.03}$	20	3	$11^{0}_{-0.085}$	2.5	M4 × 15
HK-KN7M34N HK-KN1034N HK-KN1534N HK-KN2034N	$19^{0}_{-0.013}$	40	36	$6^{0}_{-0.03}$	25	5	$15.5^{0}_{-0.1}$	3	M5 × 20

9.6 Rotary servo motors with an oil seal

The oil seal prevents the entry of oil into the rotary servo motor.

Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip.



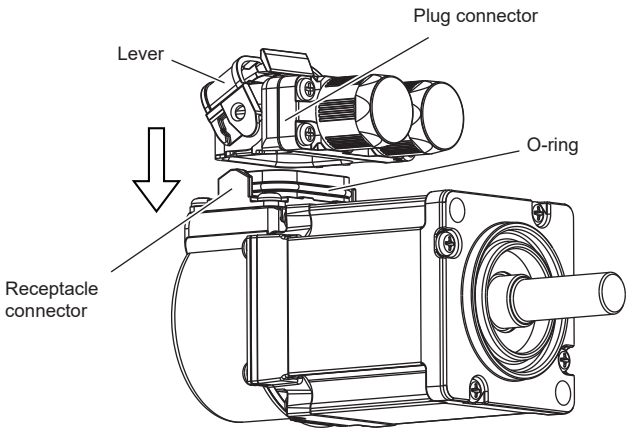
Rotary servo motor	Height (h) from the surface of the oil [mm]
HK-KN134J	10
HK-KN234J HK-KN434J HK-KN634J	12
HK-KN7M34J HK-KN1034J HK-KN1534J HK-KN2034J	16

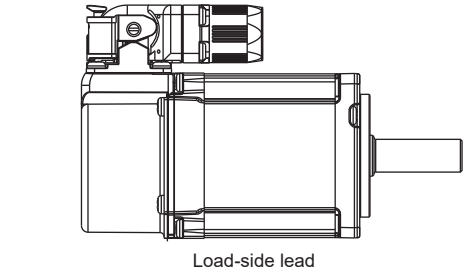
9.7 Mounting connectors

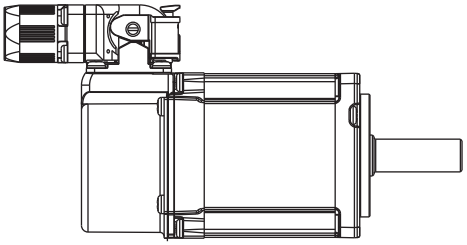
Mount the connectors in the procedure shown below. If the connector is not fixed securely, it may come off or may not produce a splash-proof effect during operation. The receptacle connector has a splash-proof seal (O-ring). When mounting, use care to prevent the seal from dropping and being pinched.
Unlocking jigs can also be used to release the lever on the plug connector. For the unlocking jigs, contact Hirose Electric co., ltd.

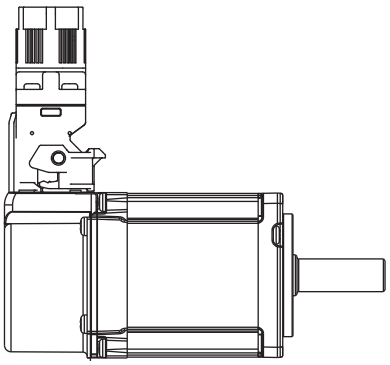
1. Insertion

The insertion direction of the plug connector varies depending on the cable direction which is the load side, opposite to load side, or vertical. Check the insertion direction of the plug connector and the fitting part before inserting the plug connector.
Insert the plug connector (cable side) into the receptacle connector (motor side). The plug connector will stop in the midway of the insertion hole if inserted in an incorrect direction. Continuing to insert the plug connector forcefully even after the stop may damage the plug connector and the receptacle connector.

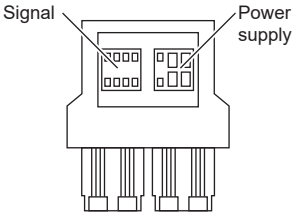



Load-side lead

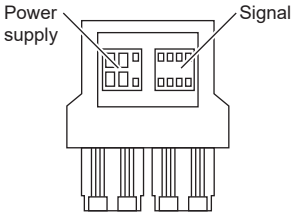

Opposite to load-side lead


Vertical lead

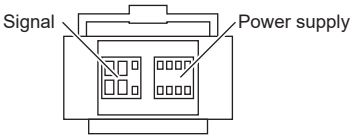
The following shows the view from the connected side.



Load-side lead



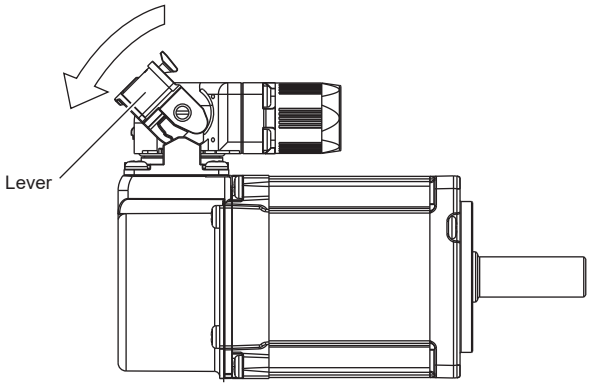
Opposite to load-side lead



Vertical lead

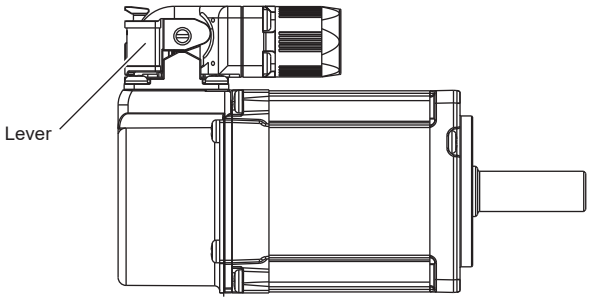
2. Starting to lock

Pull the lever. Pulling the lever firmly inserts the plug into the receptacle connector. If the plug is pushed forcefully without pulling the lever, the components may be damaged. If the plug is inserted diagonally or twisted hard while being inserted, the plug may be deformed or come off or the O-ring may be deformed, which may prevent the splash-proof effect. Insert the plug connector as straight as possible.



3. Finishing locking

Pull the lever properly until it clicks. It can be felt to the touch when the plug connector is properly locked. After pulling the lever, pull the plug connector lightly to check that the connector is firmly connected.



9.8 Dimensions

- When running the cables to the load side, take care to avoid interference with the machine.
- The dimensions are for when cables (dual cable type) are run to the load-side. When running the cables vertically or to the opposite direction of the load-side, and for the dimensions for single cable type cables, refer to the following.

☞ Page 190 Cable direction: Load side/opposite direction of the load side

☞ Page 191 Cable direction: Vertical

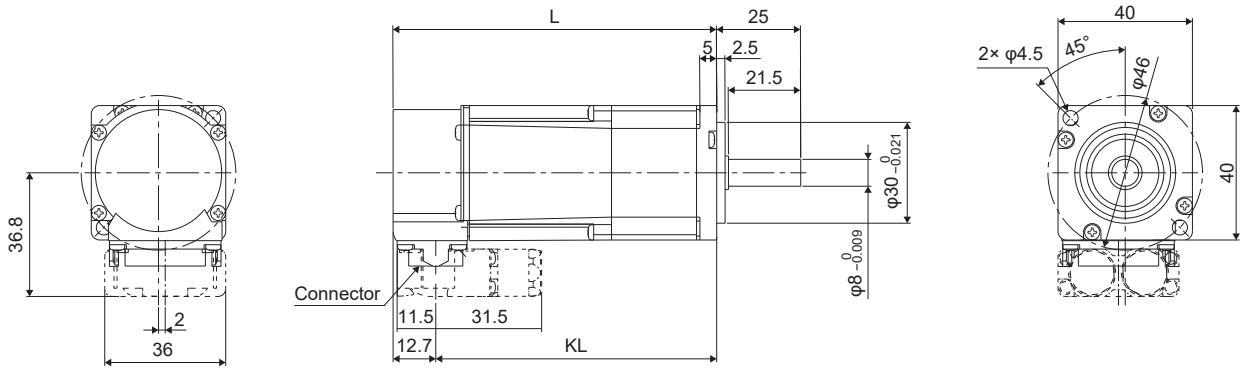
- Not all parts are created the exact same size or assembled in precisely the same manner. Therefore, the actual dimensions of rotary servo motors may be a maximum of approximately 3 mm larger than those in the drawings. In addition, the described dimensions and dimensional tolerances are the values at 20 °C. Since the values of the dimensions may vary depending on the ambient temperature, allow some margin when designing the machine side.
- Use a friction coupling for coupling the servo motor with a load.
- Use hexagon socket head cap screws to mount the rotary servo motor.

Without oil seal

HK-KN134(B)

Model	Variable dimensions *1	
	L	KL
HK-KN134(B)	68 (103)	55.3 (90.3)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

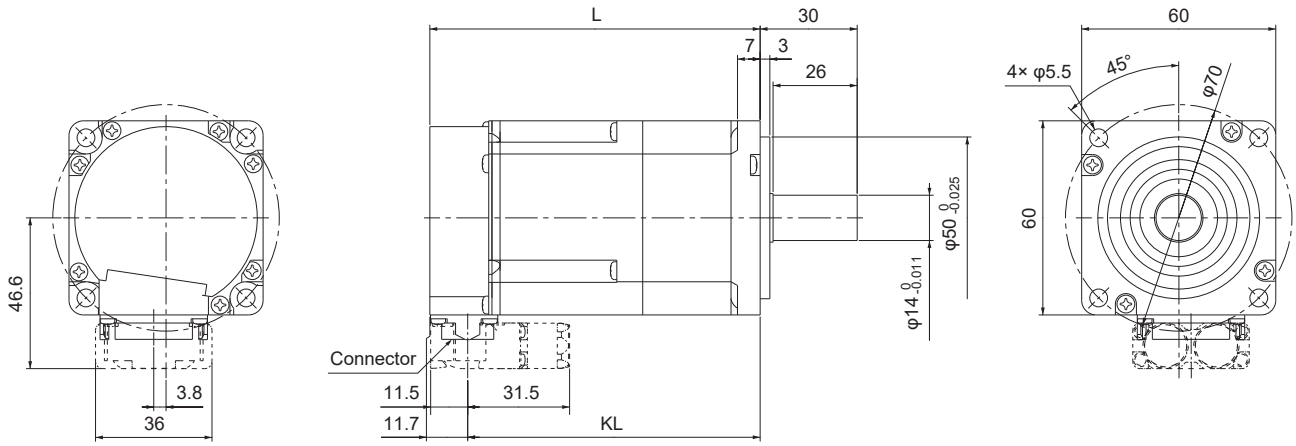


[Unit: mm]

HK-KN234(B)/HK-KN434(B)/HK-KN634(B)

Model	Variable dimensions *1	
	L	KL
HK-KN234(B)	67.5 (102.1)	55.8 (90.4)
HK-KN434(B)	85.5 (120.1)	73.8 (108.4)
HK-KN634(B)	103.5 (138.1)	91.8 (126.4)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

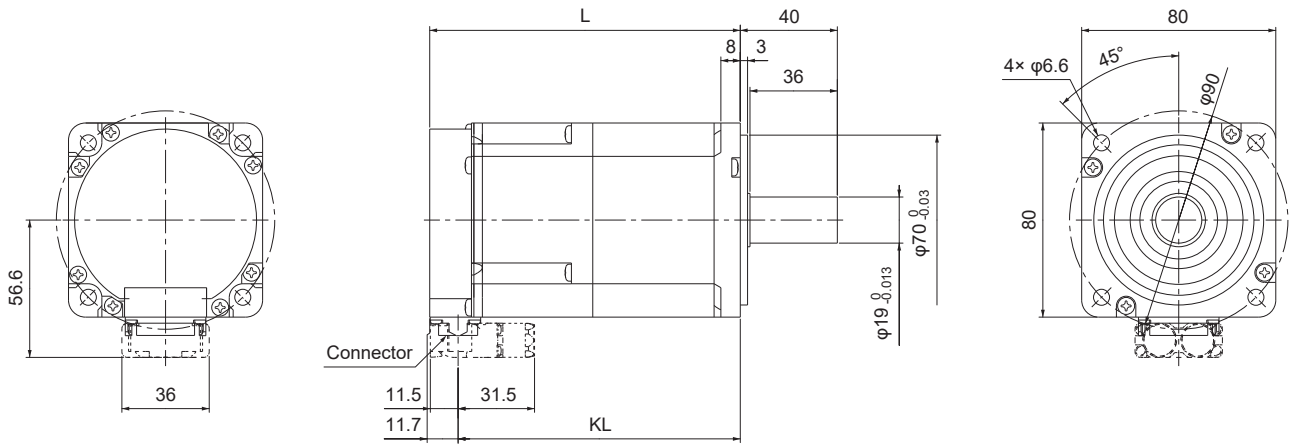


[Unit: mm]

HK-KN7M34(B)/HK-KN1034(B)

Model	Variable dimensions *1	
	L	KL
HK-KN7M34(B)	92.5 (128)	80.8 (116.3)
HK-KN1034(B)	101.5 (137)	89.8 (125.3)

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

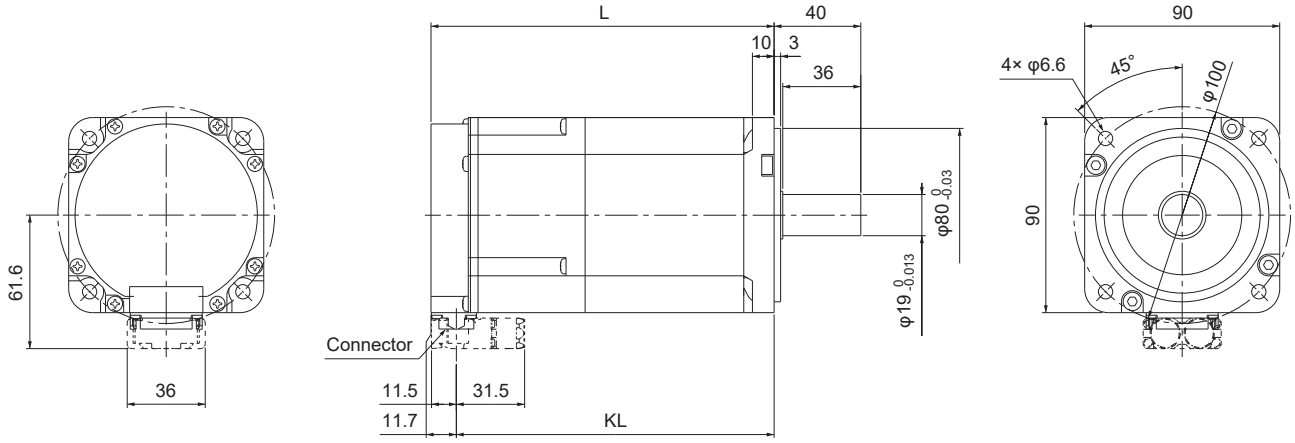


[Unit: mm]

HK-KN1534(B)/HK-KN2034(B)

Model	Variable dimensions *1	
	L	KL
HK-KN1534(B)	118.9 (158.3)	107.2 (146.6)
HK-KN2034(B)	136.9 (176.3)	125.2 (164.6)

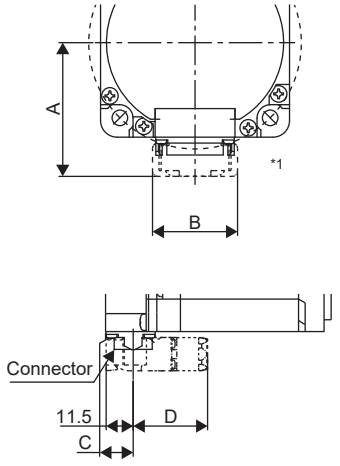
*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



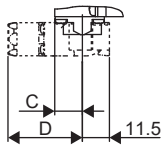
[Unit: mm]

Cable direction: Load side/opposite direction of the load side

Model	Variable dimensions							
	Dual cable				Single cable			
	A	B	C	D	A	B	C	D
HK-KN134	36.8	36	12.7	31.5	39.6	32	12.7	40
HK-KN234 HK-KN434 HK-KN634	46.6		11.7		49.4		11.7	
HK-KN7M34 HK-KN1034	56.6				59.4			
HK-KN1534 HK-KN2034	61.6				64.4			



Cable direction: Load side *1



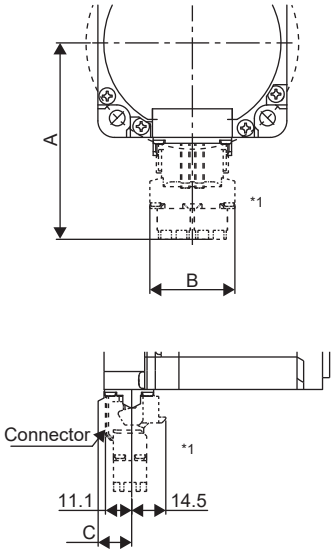
Cable direction: Opposite direction of the load side *1

[Unit: mm]

*1 The figures are for dual cable type motor cables.

Cable direction: Vertical

Model	Variable dimensions					
	Dual cable			Single cable		
	A	B	C	A	B	C
HK-KN134	63.4	36	12.7	71.9	32	12.7
HK-KN234 HK-KN434 HK-KN634	73.2		11.7	81.7		11.7
HK-KN7M34 HK-KN1034	83.2			91.7		
HK-KN1534 HK-KN2034	88.2			96.7		



[Unit: mm]

*1 The figures are for dual cable type motor cables.

10 HK-SN SERIES (400 V)

This chapter provides information on the rotary servo motor specifications and characteristics. The indicated values and those without tolerance are representative values. When using the HK-SN series (400 V) rotary servo motor, read chapter 1 to 5 and SAFETY INSTRUCTIONS at the beginning of this manual in addition to this chapter.
For the combinations of servo amplifiers and rotary servo motors, restrictions on the firmware version of the servo amplifier, and restrictions by the date of manufacture of the rotary servo motor, refer to "Servo amplifier/motor combinations" in the following manual.
MR-JET User's Manual (Hardware)

10.1 Model designation

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

HK - SN 3 5 3 4 B

Oil seal

Symbol	Oil seal
None	Not attached
J	Attached

Electromagnetic brake

Symbol	Electromagnetic brake
None	Not attached
B	Attached

400 V

Rated speed

Symbol	Rated speed [r/min]
3	3000

Rated output

Symbol	Rated output [kW]
35	3.5
50	5.0
70	7.0

Shaft type

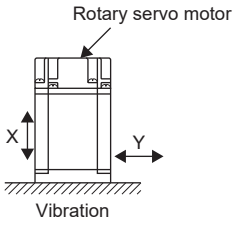
Symbol	Shaft shape
None	Standard (straight shaft)
K	Keyed shaft (with key)
N	Keyed shaft (without key)

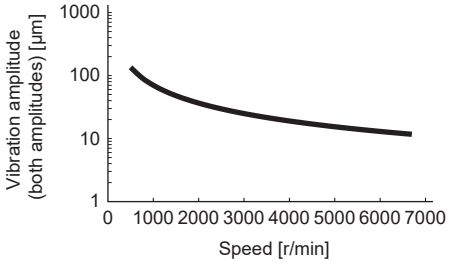
10.2 Standard specifications

Standard specifications list

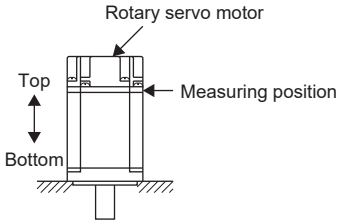
Series		HK-SN_ (Middle range/high inertia/medium capacity)		
Flange size		**□130**		**□176**
Rotary servo motor model		**3534**	**5034**	**7034**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)		
Power supply voltage [V]		400 V AC (3-phase 380 V AC to 480 V AC)		
Continuous running duty *1	Rated output [kW]	3.5	5.0	7.0
	Rated torque [N•m]	11.1	15.9	22.3
Maximum torque [N•m]		33.4	47.7	60.2
Rated speed *1[r/min]		3000		
Maximum speed *1[r/min]		5000	6000	5000
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	73.4	91.4	70.1
	With an electromagnetic brake	65.0	84.7	65.5
Rated current [A]		6.8	12	14
Maximum current [A]		23	35	41
Moment of inertia J [× 10^{-4} kg•m^2]	Without an electromagnetic brake	16.9	27.7	70.8
	With an electromagnetic brake	19.1	29.9	75.8
Recommended load to motor inertia ratio *2		10 times or less	7 times or less	6 times or less
Speed/position detector		24-bit encoder for batteryless absolute position and incremental systems (resolution per rotary servo motor revolution: 16777216 pulses/rev)		
Type		Permanent magnet synchronous motor		
Oil seal		Not attached *9		
Thermistor		None		
Insulation class		155 (F)		
Structure		Totally enclosed, natural cooling (IP rating: IP67) *3*7		
Vibration resistance *4[m/s^2]		X: 24.5, Y: 49		X: 24.5, Y: 29.4
Vibration rank *5		V10		
Permissible load for the shaft *6	L [mm]	55		79
	Radial [N]	980		2058
	Thrust [N]	490		980
Mass [kg]	Without an electromagnetic brake	9.1	13	20
	With an electromagnetic brake	11	15	25

*1 When the power supply voltage drops, the continuous running duty and the speed cannot be guaranteed.
*2 If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.
*3 Except for the shaft-through portion. IP classifies the degrees of protection provided against the intrusion of solid objects and water in electrical enclosures.
*4 The vibration directions are shown in the following figure. The value is the one at the part that indicates the maximum value (normally the opposite to load-side bracket). When the rotary servo motor stops, fretting is likely to occur at the bearing. Therefore, suppress the vibration to about half of the permissible value.





*5 V10 indicates that the amplitude of a single rotary servo motor is 10 μm or less. The following figure shows the rotary servo motor mounting position for measurement and the measuring position.



*6 Refer to the following for permissible load for the shaft.
☞ Page 196 Permissible load for the output shaft
*7 When IP67 cables are needed, contact your local sales office.
*8 The value in the table is the recommended load to motor inertia ratio that is applicable when the servo motor is operated at the rated speed. When the servo motor is to be operated at a speed exceeding the rated speed, check whether a regenerative option is required by using Drive System Sizing Software Motorizer.
*9 Servo motors with an oil seal are also compatible.

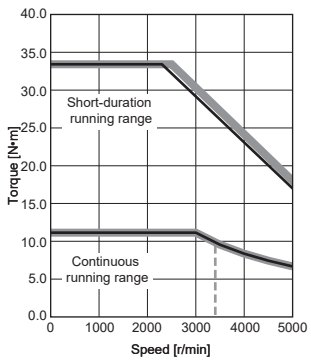
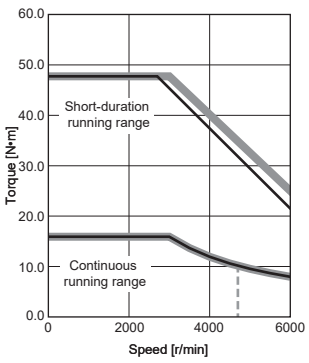
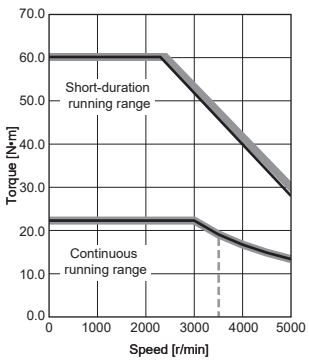
Torque characteristics

- For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque.

When the power supply voltage drops, the torque decreases. - - - - : A rough indication of the possible continuous running range for 3-phase 323 V AC

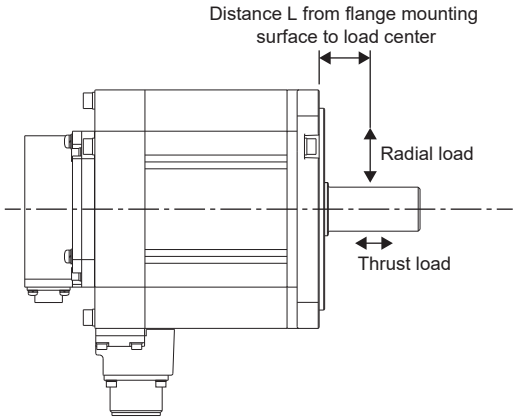
: 3-phase 400 VAC
—— : 3-phase 380 VAC

HK-SN_

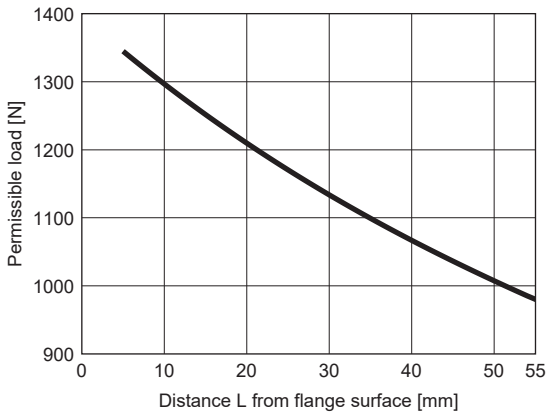
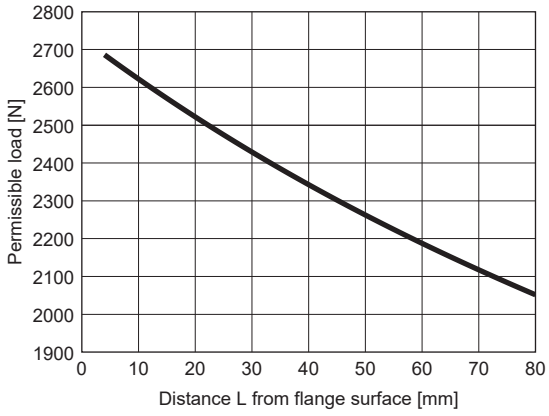
[HK-SN3534] 	[HK-SN5034] 	[HK-SN7034] 	—

Permissible load for the output shaft

The permissible load for the shaft is shown in the following. Do not subject the shaft to loads greater than the permissible value. The value assumes that the load is applied independently.



In case where the load position changes, calculate the permissible radial load from the distance measured from the flange mounting surface to the center of the load, and make the load equal to or less than the permissible radial load, referring to the graph shown in the following.

Model	Radial load		Thrust load	The graph of the relation between the load and the load position
	Load position L [mm]	Load [N]	Load [N]	
HK-SN3534 HK-SN5034	55	980	490	
HK-SN7034	79	2058	980	

10.3 Characteristics of electromagnetic brake

Point

Before operating the servo motor, confirm that the electromagnetic brake operates properly.
The operation time of the electromagnetic brake varies depending on the power supply circuit being used. Check the operation delay time with an actual machine.

The characteristics of the electromagnetic brake provided for the rotary servo motor with an electromagnetic brake are shown below.

Item		HK-SN3534B HK-SN5034B	HK-SN7034B
Type *1		Spring actuated type safety brake	
Rated voltage *4		24 V DC (-10 % to 0 %)	
Power consumption at 20 °C [W]		23	34
Coil resistance *5[Ω]		25	17
Inductance *5[H]		0.25	0.06
Brake static friction torque *7[N•m]		16 or more	44 or more
Release delay time *2[s]		0.12	0.1
Braking delay time [s]	DC off *2	0.03	0.03
Permissible braking work [J]	Per braking	400	4500
	Per hour	4000	45000
Brake looseness at servo motor shaft *5[degree]		0.6	
Brake life *3	Number of braking times [times]	5000	20000
	Work per braking [J]	400	1000
Selection example of surge absorbers to be used *6	Suppressed voltage of 125 V	TND20V-680KB (Manufactured by Nippon Chemi-Con Corporation)	
	Suppressed voltage of 350 V	TND10V-221KB (Manufactured by Nippon Chemi-Con Corporation)	

*1 This type does not have a manual release mechanism. Use a 24 V DC power supply to release the brake electrically.
*2 The value for initial on gap at 20 °C.
*3 Brake lining wear due to braking will increase the brake gap, but the gap is not adjustable. Therefore, the brake life indicates the number of times the brake can be applied before gap adjustment becomes necessary.
*4 Prepare a power supply exclusively for the electromagnetic brake.
*5 The values are design values. These are not the guaranteed values.
*6 Select the electromagnetic brake control relay properly, in consideration of the characteristics of the electromagnetic brake and surge absorber. When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.
*7 The value of the brake static friction torque is the lower limit in the initial state at 20 °C.

10.4 Derating

The derating condition is the reference value at the rated speed. As the temperature rise value of the rotary servo motor changes depending on the operation conditions such as speed, confirm that [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] does not occur on the actual machine before use.

If [AL. 0E2 Servo motor overheat warning] or [AL. 046 Servo motor overheat] occurs, consider the following measures:

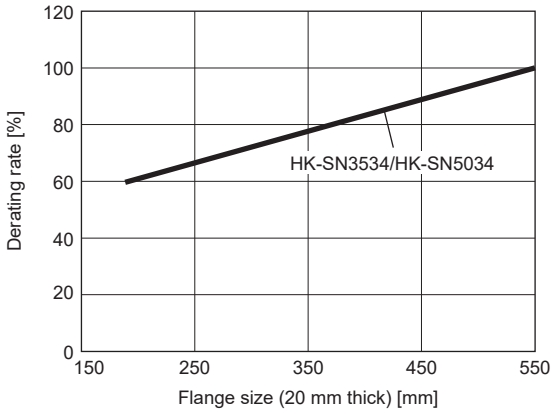
- Lower the effective load ratio of the rotary servo motor.
- Review the heat dissipation conditions.

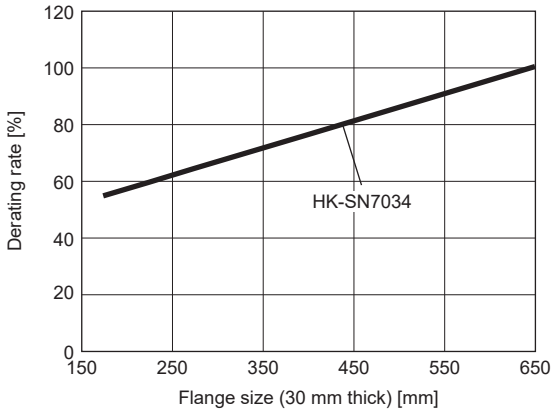
To use this product under conditions with multiple derating, calculate the multiplication of each derating rate, and use at the calculated derating rate or lower.

For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque. When applying the derating rate in the conditions above, calculate the multiplication of the derating rate of 70 % in the unbalanced torque and the derating rate of each condition, and use this product at the calculated derating rate or lower.

Restrictions on the flange size

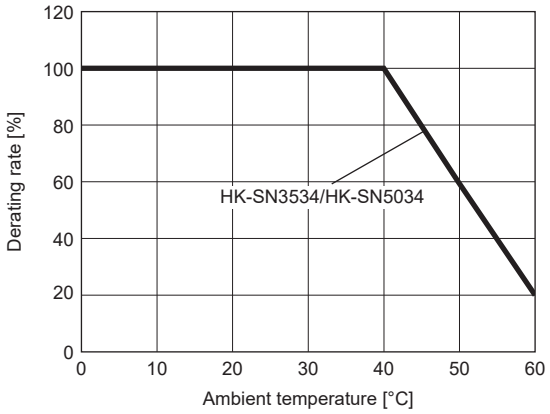
When mounting the rotary servo motor on a machine smaller than the specified aluminum flanges listed in section 2.10, derate the servo motor in accordance with the following conditions:

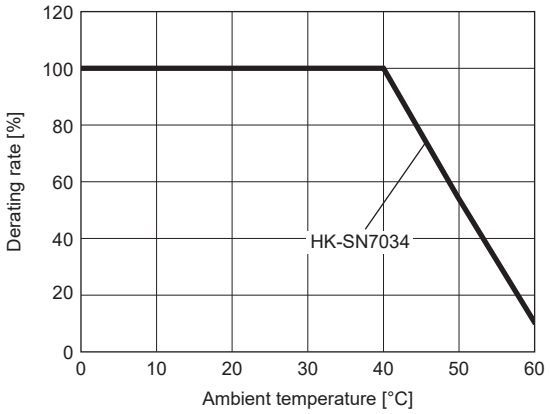




Restrictions on the ambient temperature

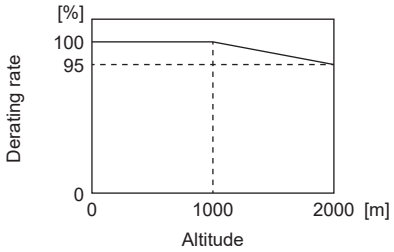
When using this product in an environment with a high ambient temperature, derate the product in accordance with the following conditions:





Restrictions on the altitude

To use this product at an altitude between 1000 m and 2000 m, derate the product in accordance with the following conditions:

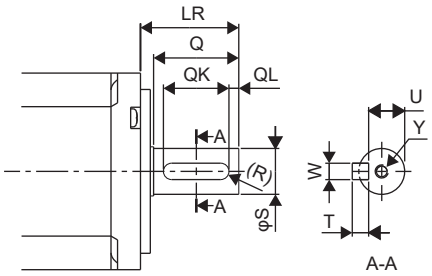


10.5 Rotary servo motors with special shafts

For rotary servo motors, there are two types of shafts: keyed shaft (with double round-ended key) and keyed shaft (without key). The keys are included as accessories and not attached to the shafts.
To prevent an accident such as motor shaft fracture, do not use a servo motor with a keyed shaft for frequent start/stop applications.

Rotary servo motor	Shaft shape	
	Keyed shaft	
	With double round-ended key	Without key
HK-SN3534 HK-SN5034	K	N
HK-SN7034	K	N

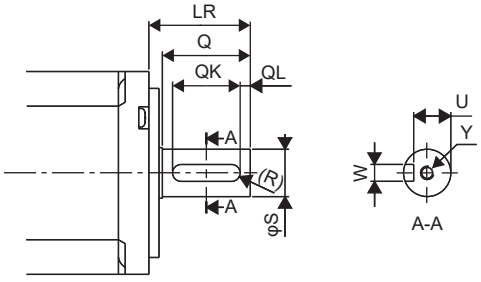
Keyed shaft (with double round-ended key)



[Unit: mm]

Rotary servo motor	Variable dimensions									
	S	LR	Q	W	QK	QL	U	R	T	Y
HK-SN3534K HK-SN5034K	$24^{0}_{-0.013}$	55	50	8	36	5	$20^{0}_{-0.1}$	4	7	M8 × 20
HK-SN7034K	$35^{+0.010}_{0}$	79	75	10	55	5	$30^{0}_{-0.12}$	5	8	M8 × 20

Keyed shaft (without key)



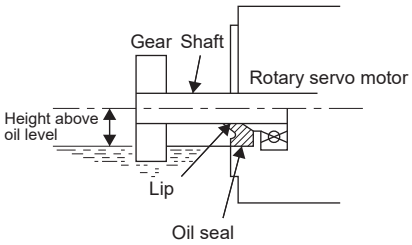
[Unit: mm]

Rotary servo motor	Variable dimensions								
	S	LR	Q	W	QK	QL	U	R	Y
HK-SN3534N HK-SN5034N	$24^{0}_{-0.013}$	55	50	$8^{0}_{-0.036}$	36	5	$20^{0}_{-0.1}$	4	M8 × 20
HK-SN7034N	$35^{+0.010}_{0}$	79	75	$10^{0}_{-0.036}$	55	5	$30^{0}_{-0.12}$	5	M8 × 20

10.6 Rotary servo motors with an oil seal

The oil seal prevents the entry of oil into the rotary servo motor.

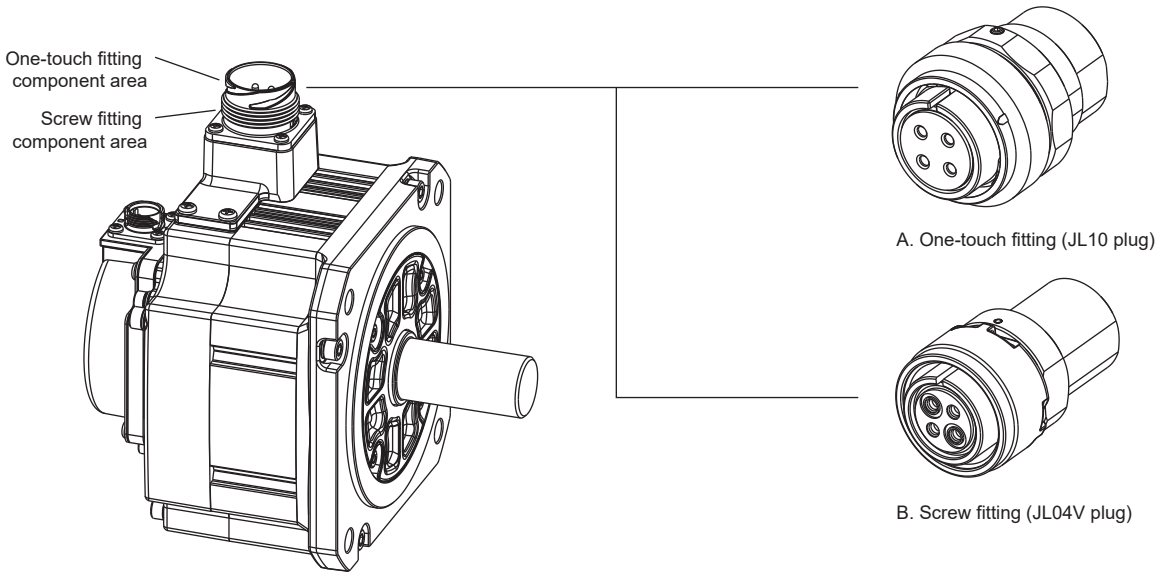
Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip.



Rotary servo motor	Height (h) from the surface of the oil [mm]
HK-SN3534J HK-SN5034J	23
HK-SN7034J	30

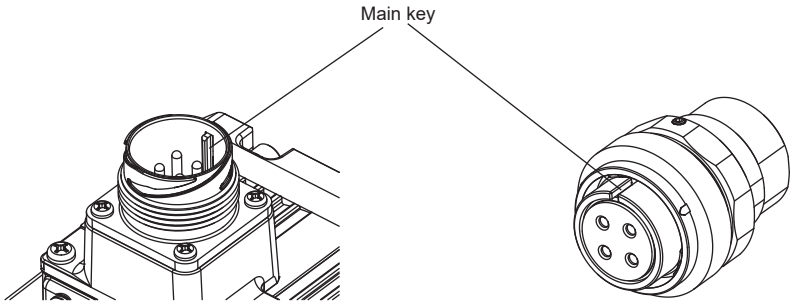
10.7 Mounting connectors

Both the one-touch lock fitting type and the screw fitting type can be used for the power connector. Mount the power connector as shown in the following procedure.



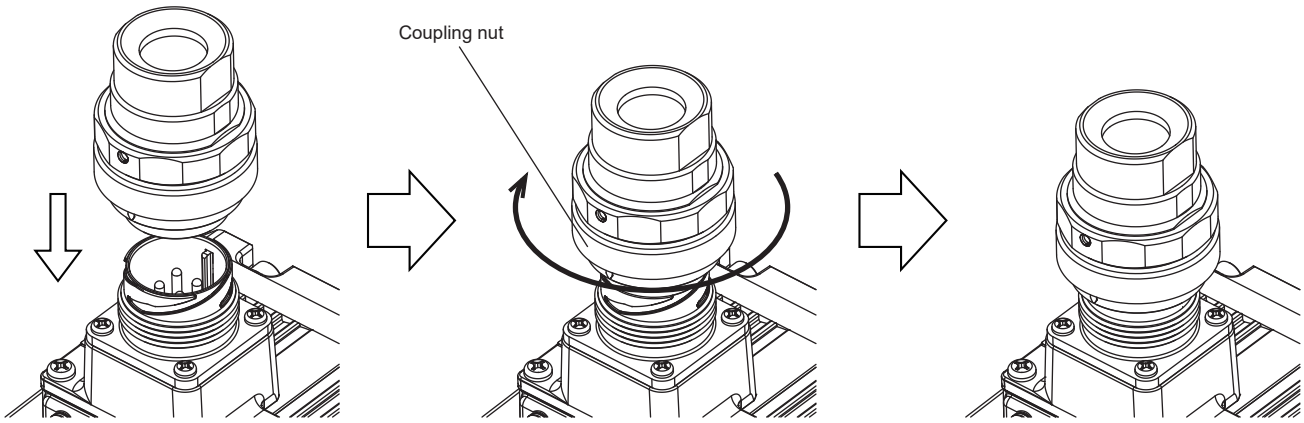
One-touch lock fitting

1. Align the main key of the receptacle connector (motor side) with its groove on the plug connector (cable side), and insert the plug into the receptacle.



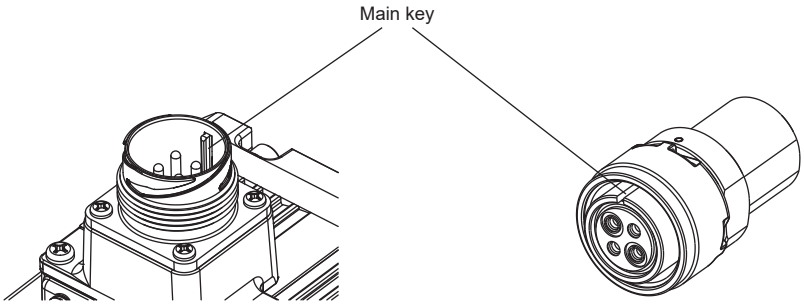
2. While pushing the plug lightly, rotate the coupling nut clockwise until it clicks.

3. Pull the plug lightly to check that the plug does not come off.



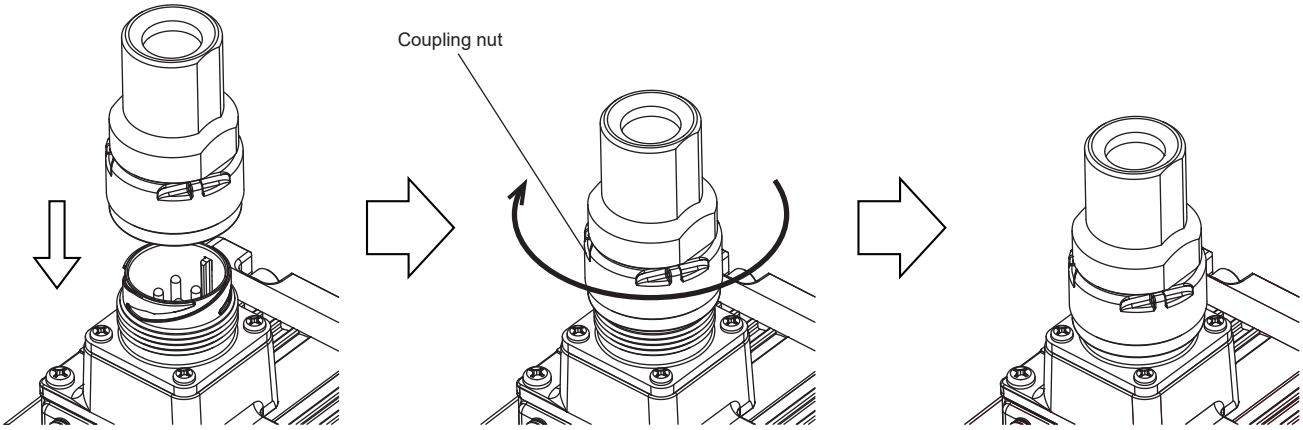
Screw fitting

1. Align the main key of the receptacle connector (motor side) with its groove on the plug connector (cable side), and insert the plug into the receptacle.



2. Push in the plug straight until the coupling nut engages with the thread of the receptacle.

3. Tighten the coupling nut with a recommended tightening torque of 4.0 to 4.5 N•m.



10.8 Dimensions

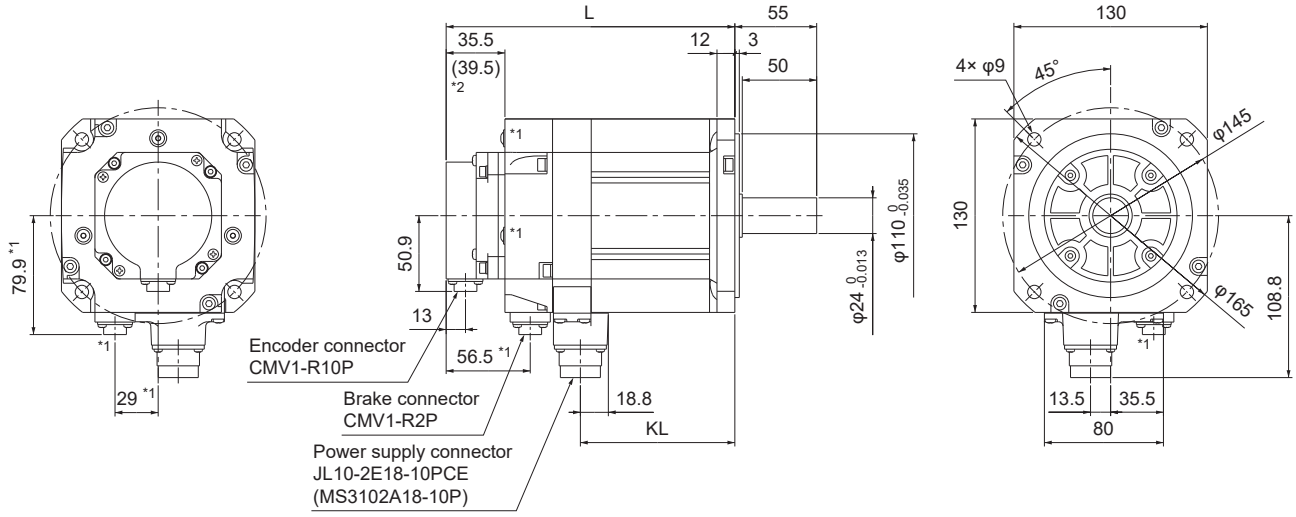
- Not all parts are created the exact same size or assembled in precisely the same manner. Therefore, the actual dimensions of rotary servo motors may be a maximum of approximately 3 mm larger than those in the drawings. In addition, the described dimensions and dimensional tolerances are the values at 20 °C. Since the values of the dimensions may vary depending on the ambient temperature, allow some margin when designing the machine side.
- Use a friction coupling for coupling the servo motor with a load.
- Use hexagon socket head cap screws to mount the rotary servo motor.

Without oil seal

HK-SN3534(B)/HK-SN5034(B)

Model	Variable dimensions *1	
	L	KL
HK-SN3534(B)	159.5 (194)	103.8
HK-SN5034(B)	203.5 (238)	147.8

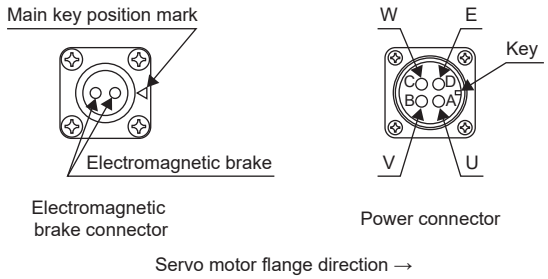
*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



[Unit: mm]

*1 For servo motors with an electromagnetic brake.

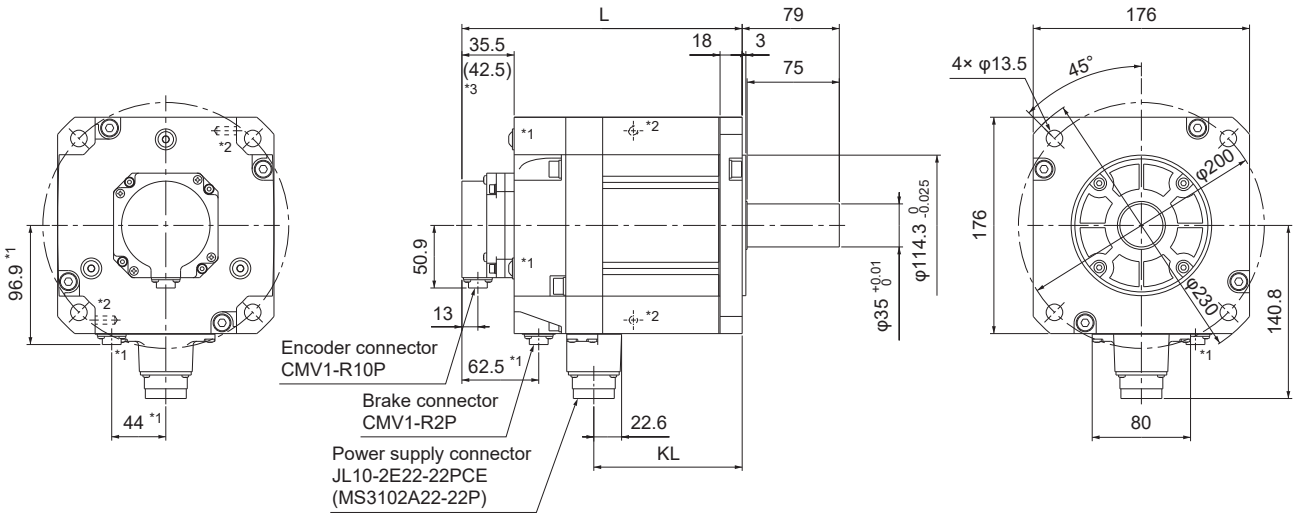
*2 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



HK-SN7034(B)

Model	Variable dimensions *1	
	L	KL
HK-SN7034(B)	178.5 (228)	120.7

*1 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.

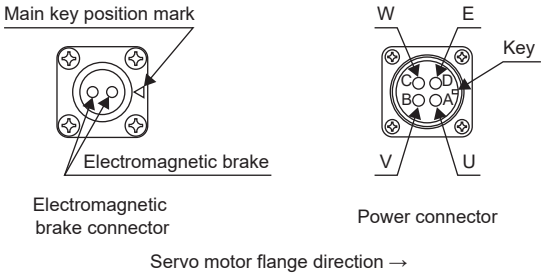


[Unit: mm]

*1 For servo motors with an electromagnetic brake.

*2 Screw hole for eyebolt (M8)

*3 The values in ( ) of the dimensions are for the servo motors with an electromagnetic brake.



11 HG-KNS SERIES (200 V)

This chapter provides information on the rotary servo motor specifications and characteristics. The indicated values and those without tolerance are representative values. When using the HG-KNS series (200 V) rotary servo motor, read chapter 1 to 4, chapter 6, and SAFETY INSTRUCTIONS at the beginning of this manual in addition to this chapter.
For the combinations of servo amplifiers and rotary servo motors, restrictions on the firmware version of the servo amplifier, and restrictions by the date of manufacture of the rotary servo motor, refer to "Servo amplifier/motor combinations" in the following manual.
MR-JET User's Manual (Hardware)

11.1 Model designation

The following describes model designation. Not all combinations of the symbols are available.

HG - KNS 1 3 B J

Shaft type

Symbol	Shaft shape
None	Standard (straight shaft)
D	D cut shaft
K	Keyed shaft (with key)

Oil seal

Symbol	Oil seal
J	Attached
None	Not attached

Electromagnetic brake

Symbol	Electromagnetic brake
None	Not attached
B	Attached

Rated speed

Symbol	Rated speed [r/min]
3	3000

Rated output

Symbol	Rated output [kW]
1	0.1
2	0.2
4	0.4
7	0.75

11.2 Standard specifications

Standard specifications list

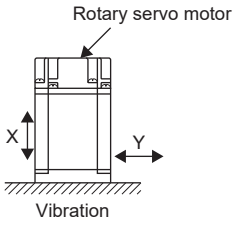
Series		HG-KNS_ (Low inertia/small capacity)			
Flange size		**□40**	**□60**		**□80**
Rotary servo motor model		**13J**	**23J**	**43J**	**73J**
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)			
Power supply voltage [V]		200 V AC (3-phase 200 V AC to 240 V AC)			
Continuous running duty *1	Rated output [kW]	0.1	0.2	0.4	0.75
	Rated torque [N•m]	0.32	0.64	1.3	2.4
Maximum torque [N•m]		0.95	1.9	3.8	7.2
Rated speed *1[r/min]		3000			
Maximum speed *1[r/min]		6000			
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	12.9	18.0	43.2	44.5
	With an electromagnetic brake	12.0	16.4	40.8	41.0
Rated current [A]		0.8	1.3	2.6	4.8
Maximum current [A]		2.4	3.9	7.8	14
Moment of inertia J [$\times 10^{-4}$ kg•m^2]	Without an electromagnetic brake	0.0783	0.225	0.375	1.28
	With an electromagnetic brake	0.0843	0.247	0.397	1.39
Recommended load to motor inertia ratio *2		15 times or less *8			
Speed/position detector		22-bit encoder common to absolute position and incremental detection systems (resolution per rotary servo motor revolution: 4194304 pulses/rev)			
Type		Permanent magnet synchronous motor			
Oil seal		Attached *7			
Thermistor		None			
Insulation class		130 (B)			
Structure		Totally enclosed, natural cooling (IP rating: IP65) *3			
Vibration resistance *4[m/s^2]		X: 49, Y: 49			
Vibration rank *5		V10			
Permissible load for the shaft *6	L [mm]	25	30		40
	Radial [N]	88	245		392
	Thrust [N]	59	98		147
Mass [kg] (With oil seal)	Without an electromagnetic brake	0.57	0.98	1.5	3.0
	With an electromagnetic brake	0.77	1.4	1.9	4.0
Mass [kg] (Without oil seal)	Without an electromagnetic brake	0.54	0.91	1.4	2.8
	With an electromagnetic brake	0.74	1.3	1.8	3.8

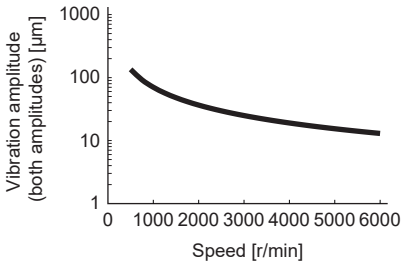
*1 When the power supply voltage drops, the continuous running duty and the speed cannot be guaranteed.

*2 If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.

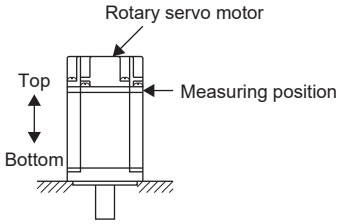
*3 Except for the shaft-through portion. IP classifies the degrees of protection provided against the intrusion of solid objects and water in electrical enclosures.

*4 The vibration directions are shown in the following figure. The value is the one at the part that indicates the maximum value (normally the opposite to load-side bracket). When the rotary servo motor stops, fretting is likely to occur at the bearing. Therefore, suppress the vibration to about half of the permissible value.

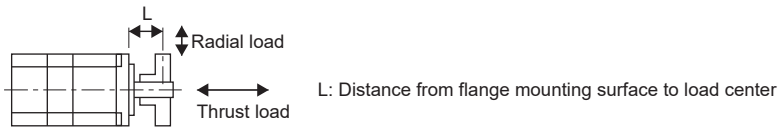




*5 V10 indicates that the amplitude of a single rotary servo motor is 10 μm or less. The following figure shows the rotary servo motor mounting position for measurement and the measuring position.



*6 The following shows permissible load for the shaft. Do not subject the shaft to loads greater than the value in the specifications list. The value assumes that the load is applied independently.



*7 Servo motors without an oil seal are also compatible.

*8 For HG-KNS13_J_ and HG-KNS23_J_, the value in the table is the recommended load to motor inertia ratio that is applicable when the servo motor is operated at the rated speed. When the servo motor is to be operated at a speed exceeding the rated speed, check whether a regenerative option is required by using Drive System Sizing Software Motorizer.

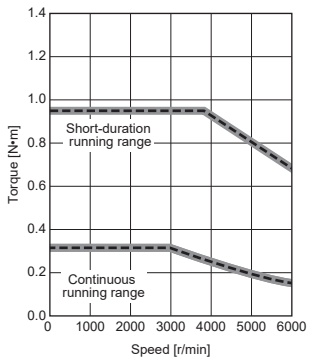
Torque characteristics

- For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque.

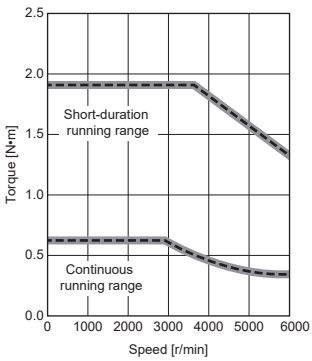
When the power supply voltage drops, the torque decreases.

: 3-phase 200 VAC
: 1-phase 200 VAC

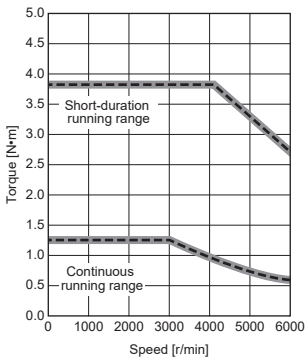
[HG-KNS13J]



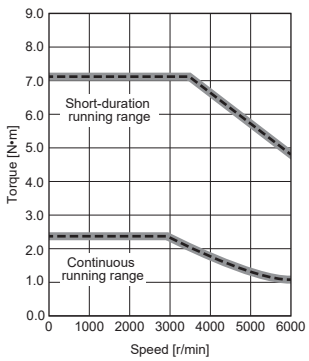
[HG-KNS23J]



[HG-KNS43J]



[HG-KNS73J]



11.3 Characteristics of electromagnetic brake

Point

Before operating the servo motor, confirm that the electromagnetic brake operates properly.
The operation time of the electromagnetic brake varies depending on the power supply circuit being used. Check the operation delay time with an actual machine.

The characteristics of the electromagnetic brake provided for the rotary servo motor with an electromagnetic brake are shown below.

Item		HG-KNS series			
		13BJ	23BJ	43BJ	73BJ
Type *1		Spring actuated type safety brake			
Rated voltage *4		24 V DC (-10 % to 0 %)			
Power consumption at 20 °C [W]		6.3	7.9		10
Coil resistance *5[Ω]		91.0	73.0		57.0
Inductance *5[H]		0.15	0.18		0.13
Brake static friction torque *7[N•m]		0.32 or more	1.3 or more		2.4 or more
Release delay time *2[s]		0.03			0.04
Braking delay time [s]	DC off *2	0.01	0.02		
Permissible braking work [J]	Per braking	5.6	22		64
	Per hour	56	220		640
Brake looseness at servo motor shaft *5[degree]		2.5	1.2		0.9
Brake life *3	Number of braking times [times]	20000			
	Work per braking [J]	5.6	22		64
Selection example of surge absorbers to be used *6	Suppressed voltage of 125 V	TND20V-680KB (Manufactured by Nippon Chemi-Con Corporation)			
	Suppressed voltage of 350 V	TND10V-221KB (Manufactured by Nippon Chemi-Con Corporation)			

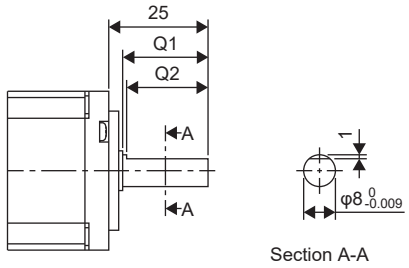
*1 This type does not have a manual release mechanism. Use a 24 V DC power supply to release the brake electrically.
*2 The value for initial on gap at 20 °C.
*3 Brake lining wear due to braking will increase the brake gap, but the gap is not adjustable. Therefore, the brake life indicates the number of times the brake can be applied before gap adjustment becomes necessary.
*4 Prepare a power supply exclusively for the electromagnetic brake.
*5 The values are design values. These are not the guaranteed values.
*6 Select the electromagnetic brake control relay properly, in consideration of the characteristics of the electromagnetic brake and surge absorber. When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.
*7 The value of the brake static friction torque is the lower limit in the initial state at 20 °C.

11.4 Rotary servo motors with special shafts

There are two shaft shape types for the rotary servo motor: D cut shaft and keyed shaft (with double round-ended key). The keys are included as accessories and not attached to the shafts.

Rotary servo motor	Shaft shape	
	D cut shaft	Keyed shaft (with double round-ended key)
HG-KNS13	D	—
HG-KNS23 HG-KNS43 HG-KNS73	—	K

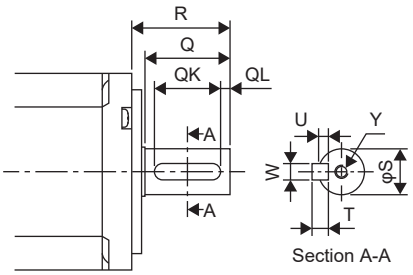
D cut shaft



[Unit: mm]

Rotary servo motor	Variable dimensions	
	Q1	Q2
HG-KNS13D	21.5	20.5

Keyed shaft (with double round-ended key)



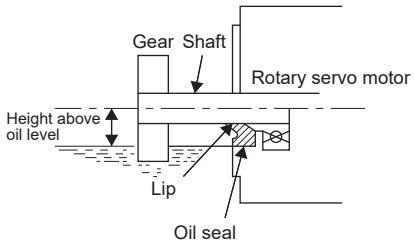
[Unit: mm]

Rotary servo motor	Variable dimensions								
	S	R	Q	W	QK	QL	U	T	Y
HG-KNS23K HG-KNS43K	14 0 -0.011	30	26	5	20	3	3	5	M4 Screw hole depth 15
HG-KNS73K	19 0 -0.013	40	36	6	25	5	3.5	6	M5 Screw hole depth 20

11.5 Rotary servo motors with an oil seal

The oil seal prevents the entry of oil into the rotary servo motor.

Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip.



Rotary servo motor	Height (h) from the surface of the oil [mm]
HG-KNS13J	10
HG-KNS23J HG-KNS43J HG-KNS73J	19

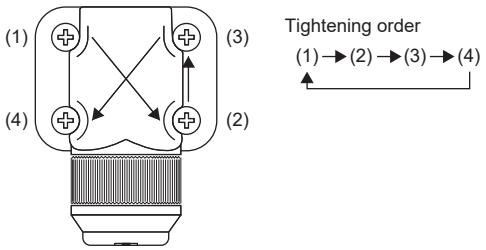
11.6 Mounting connectors

If the connector is not fixed securely, it may come off or may not produce a splash-proof effect during operation.

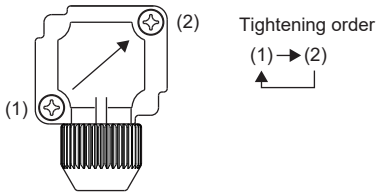
To achieve the IP rating IP65, pay attention to the following points when installing the connectors.

- When screwing the connector, hold the connector still and gradually tighten the screws in a crisscross pattern.

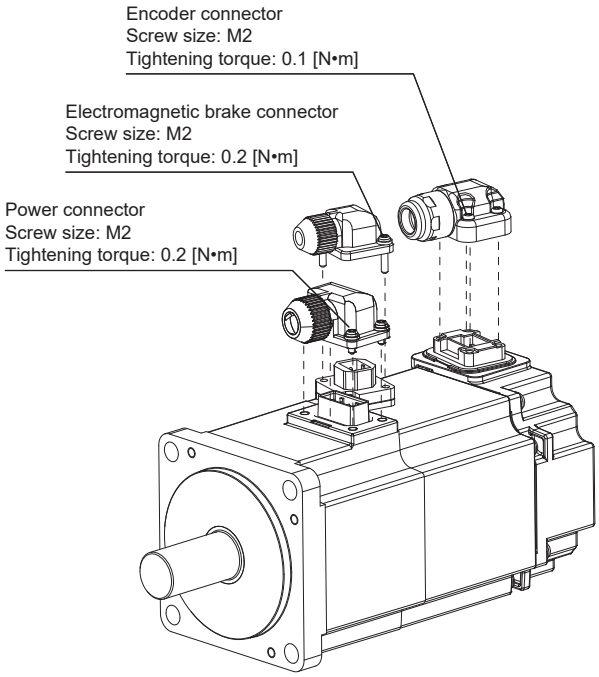
Connector for power, connector for encoder



Connector for electromagnetic brake



- Tighten the screws evenly. Tightening torques are as indicated below.



- The rotating servo motor fitting part of each connector is provided with a splash-proof seal (O ring). When mounting a connector, use care to prevent the seal (O ring) from dropping and being pinched. If the seal (O ring) has dropped or is pinched, a splash-proof effect is not produced.

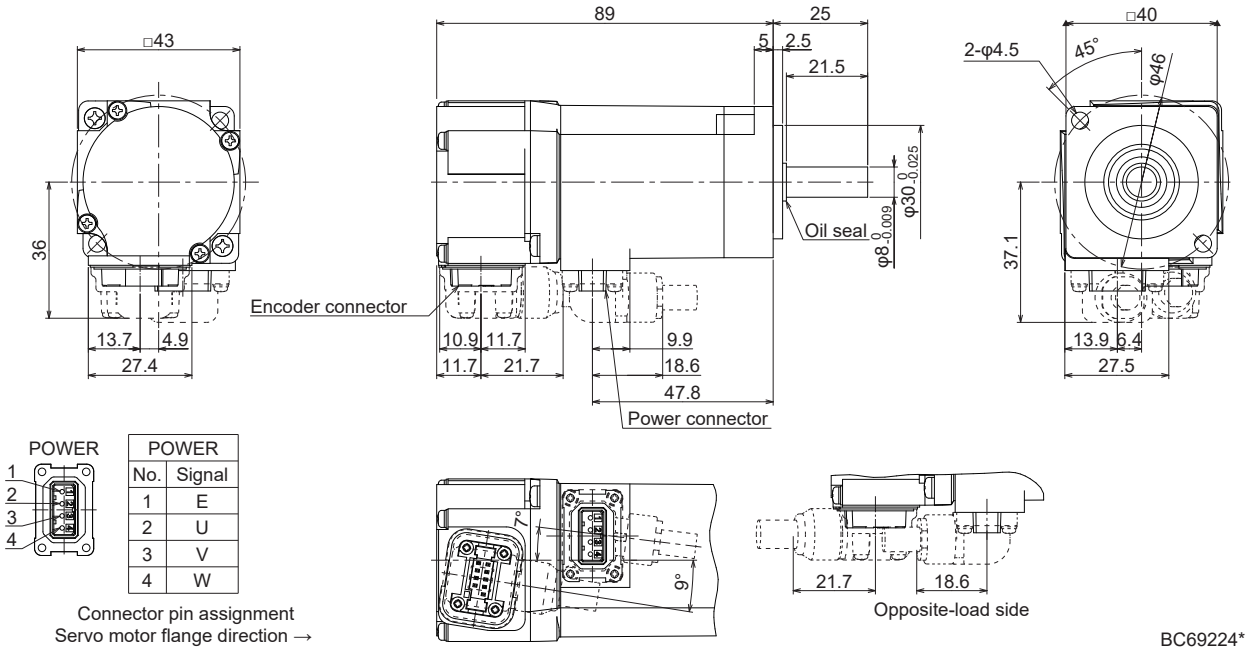
11.7 Dimensions

- When running the cables to the load side, take care to avoid interference with the machine.
- Not all parts are created the exact same size or assembled in precisely the same manner. Therefore, the actual dimensions of rotary servo motors may be a maximum of approximately 3 mm larger than those in the drawings. In addition, the described dimensions and dimensional tolerances are the values at 20 °C. Since the values of the dimensions may vary depending on the ambient temperature, allow some margin when designing the machine side.
- Use a friction coupling for coupling the servo motor with a load.
- Use hexagon socket head cap screws to mount the rotary servo motor.

Without an electromagnetic brake

With oil seal

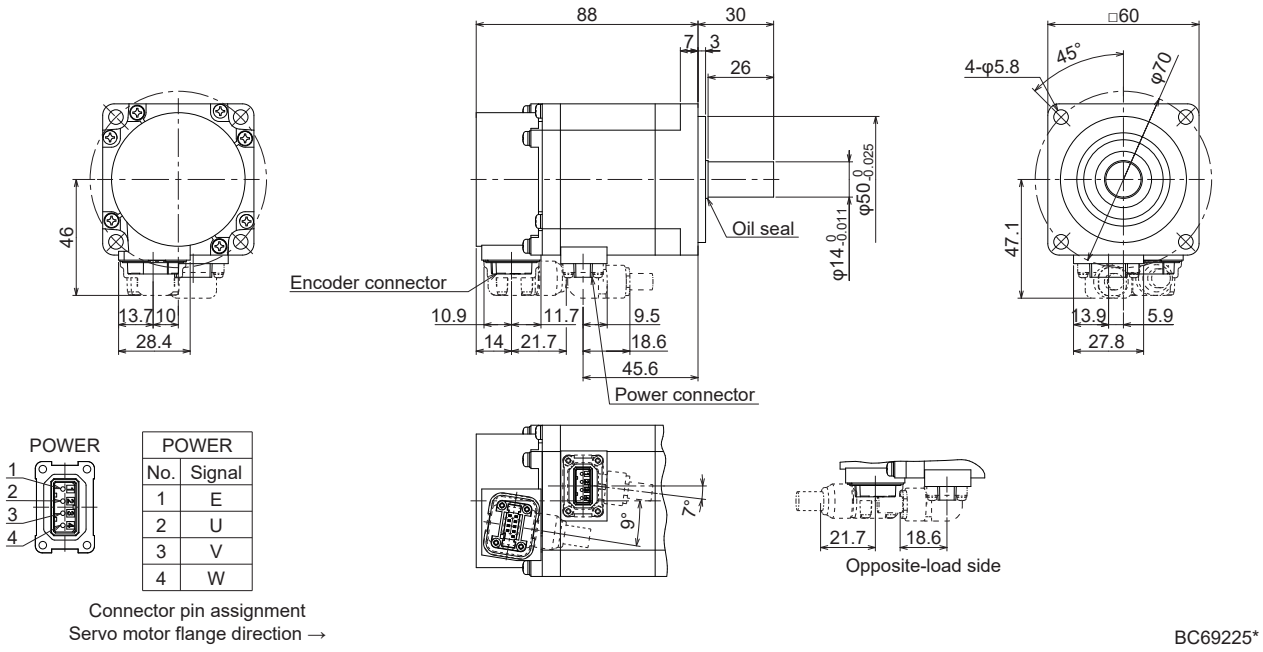
■HG-KNS13J



POWER	
No.	Signal
1	E
2	U
3	V
4	W

[Unit: mm]

■HG-KNS23J



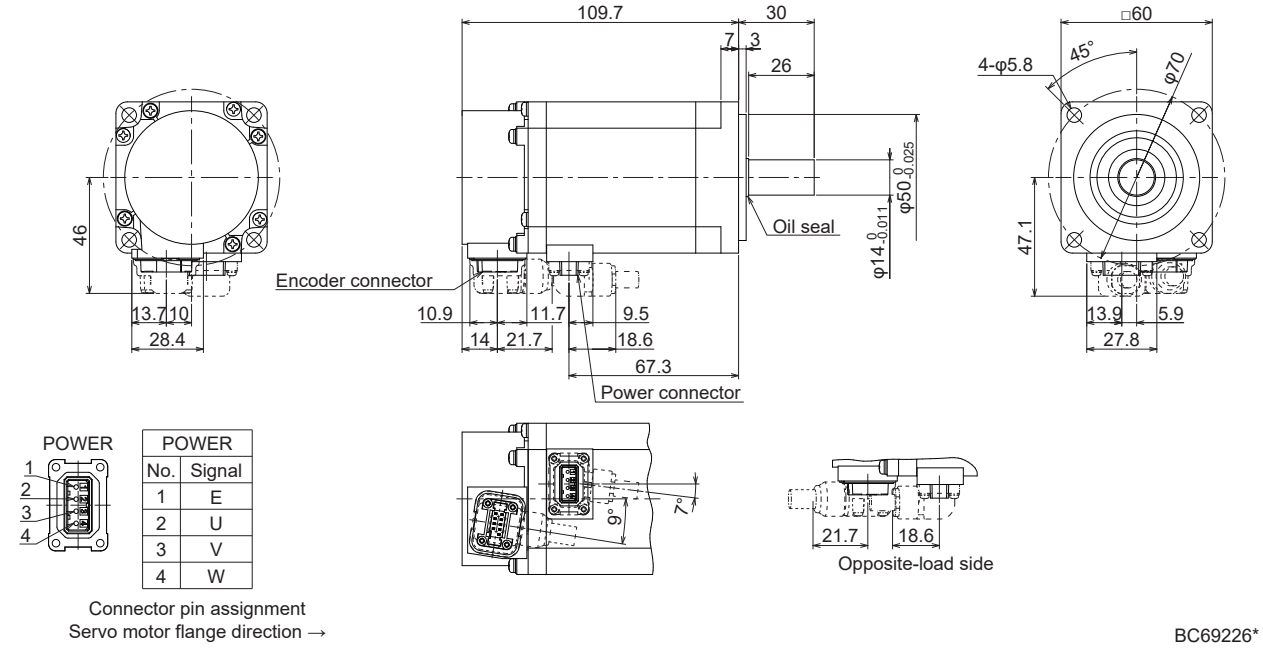
POWER	
No.	Signal
1	E
2	U
3	V
4	W

Connector pin assignment
Servo motor flange direction →

BC69225*

[Unit: mm]

■HG-KNS43J



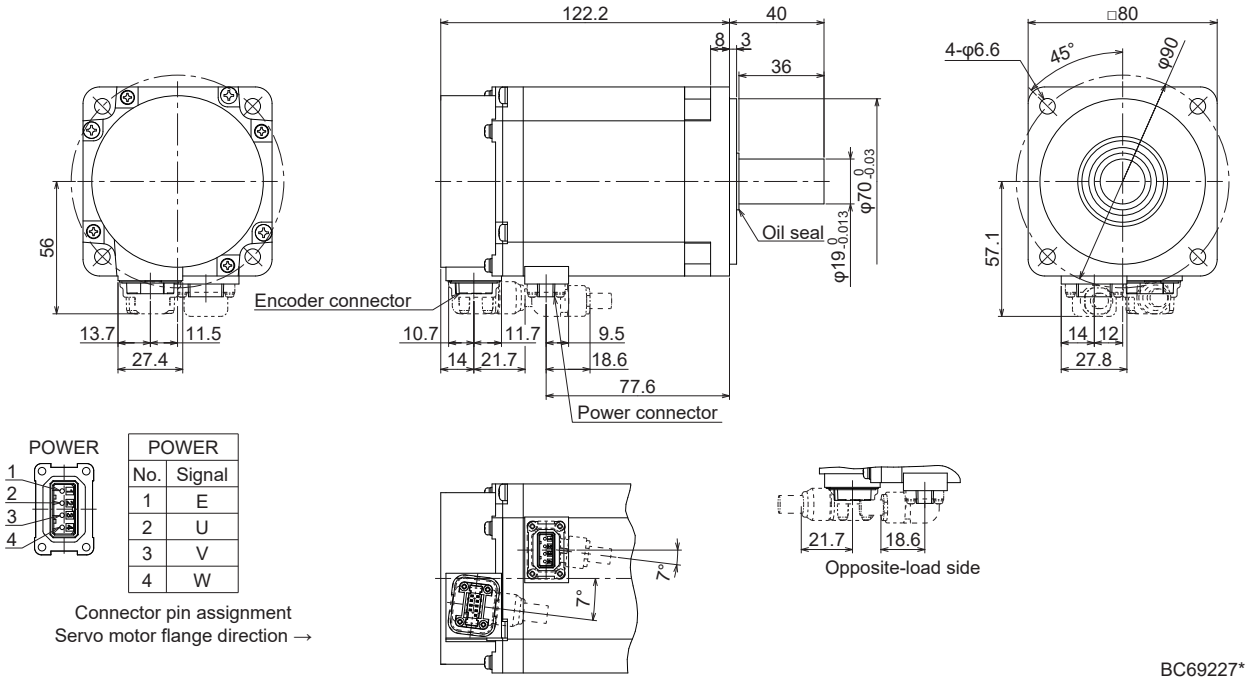
POWER	
No.	Signal
1	E
2	U
3	V
4	W

Connector pin assignment
Servo motor flange direction →

BC69226*

[Unit: mm]

■HG-KNS73J

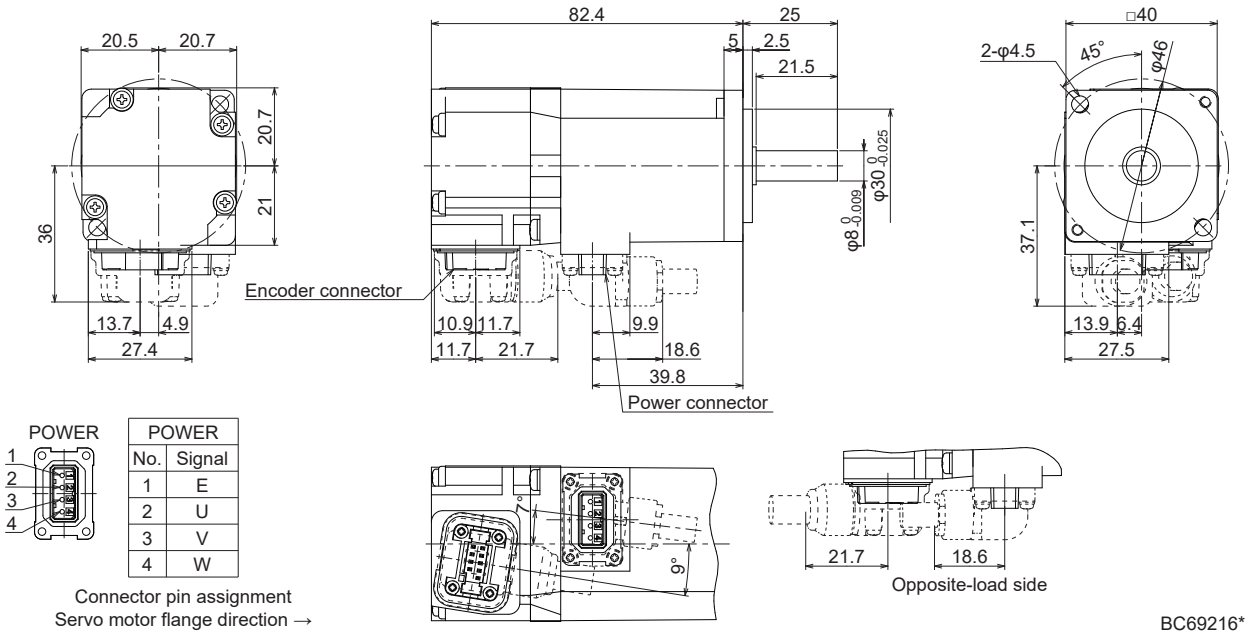


POWER	
No.	Signal
1	E
2	U
3	V
4	W

[Unit: mm]

Without oil seal

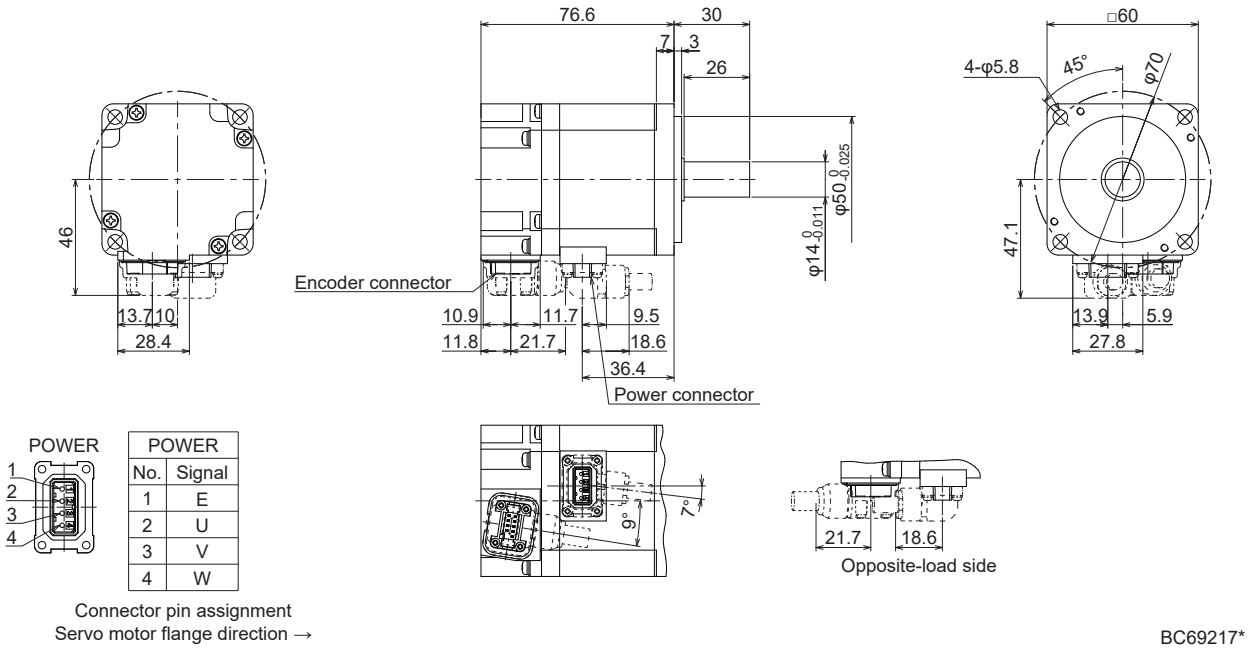
■HG-KNS13



POWER	
No.	Signal
1	E
2	U
3	V
4	W

[Unit: mm]

■HG-KNS23



POWER

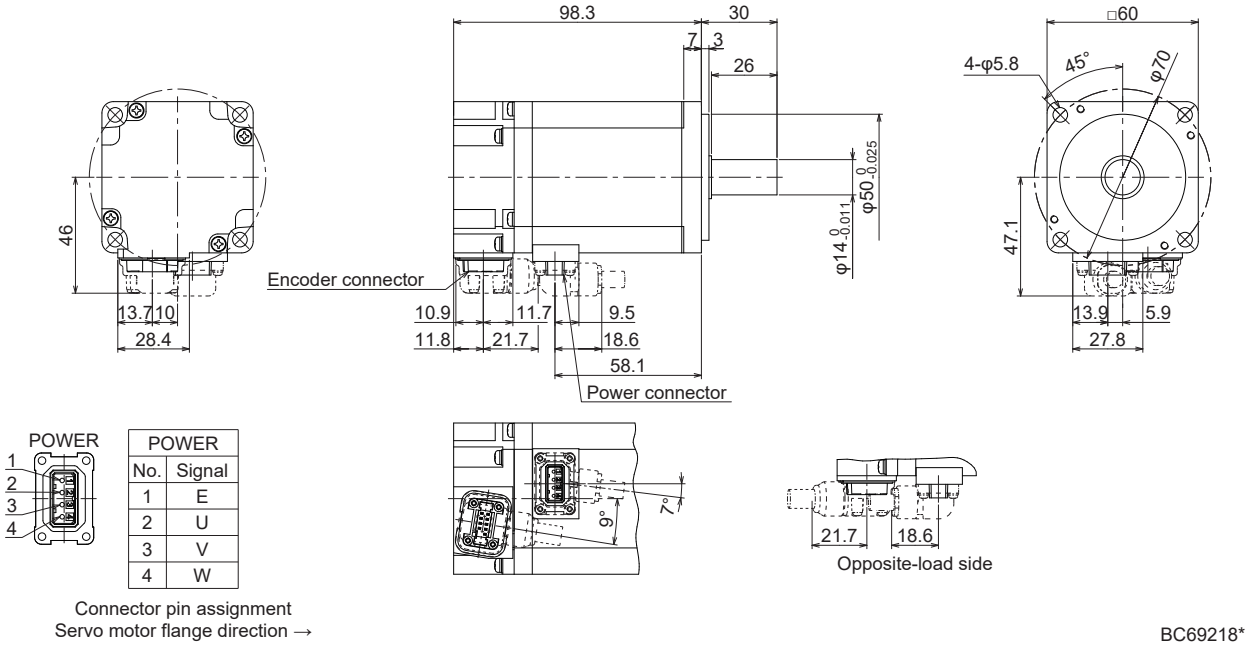
POWER	
No.	Signal
1	E
2	U
3	V
4	W

Connector pin assignment
Servo motor flange direction →

BC69217*

[Unit: mm]

■HG-KNS43



POWER

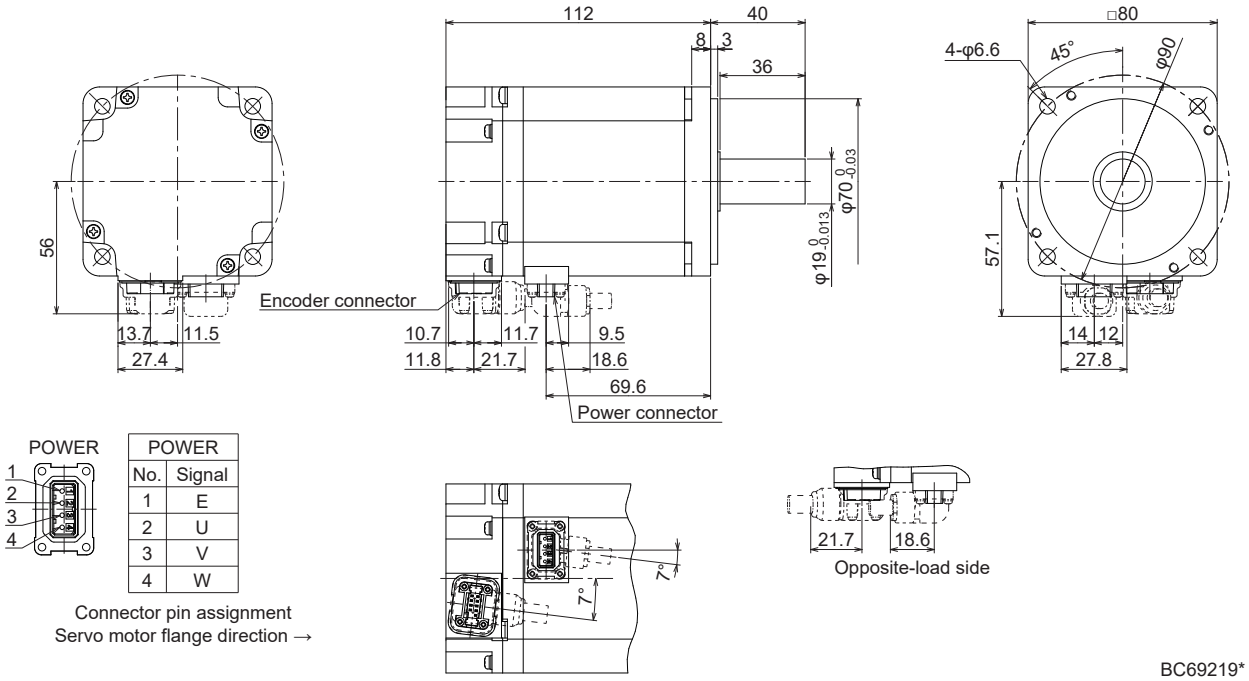
POWER	
No.	Signal
1	E
2	U
3	V
4	W

Connector pin assignment
Servo motor flange direction →

BC69218*

[Unit: mm]

■HG-KNS73



POWER	
No.	Signal
1	E
2	U
3	V
4	W

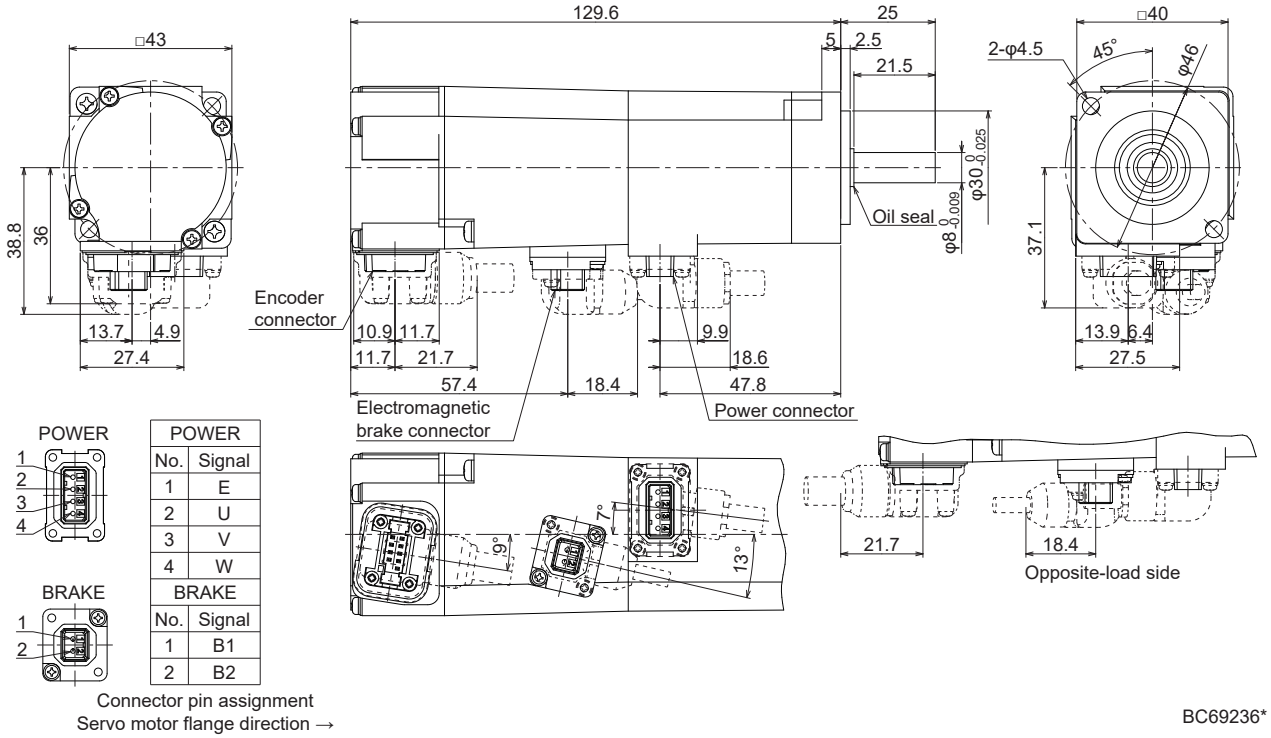
Connector pin assignment
Servo motor flange direction →

[Unit: mm]

With an electromagnetic brake

With oil seal

■HG-KNS13BJ



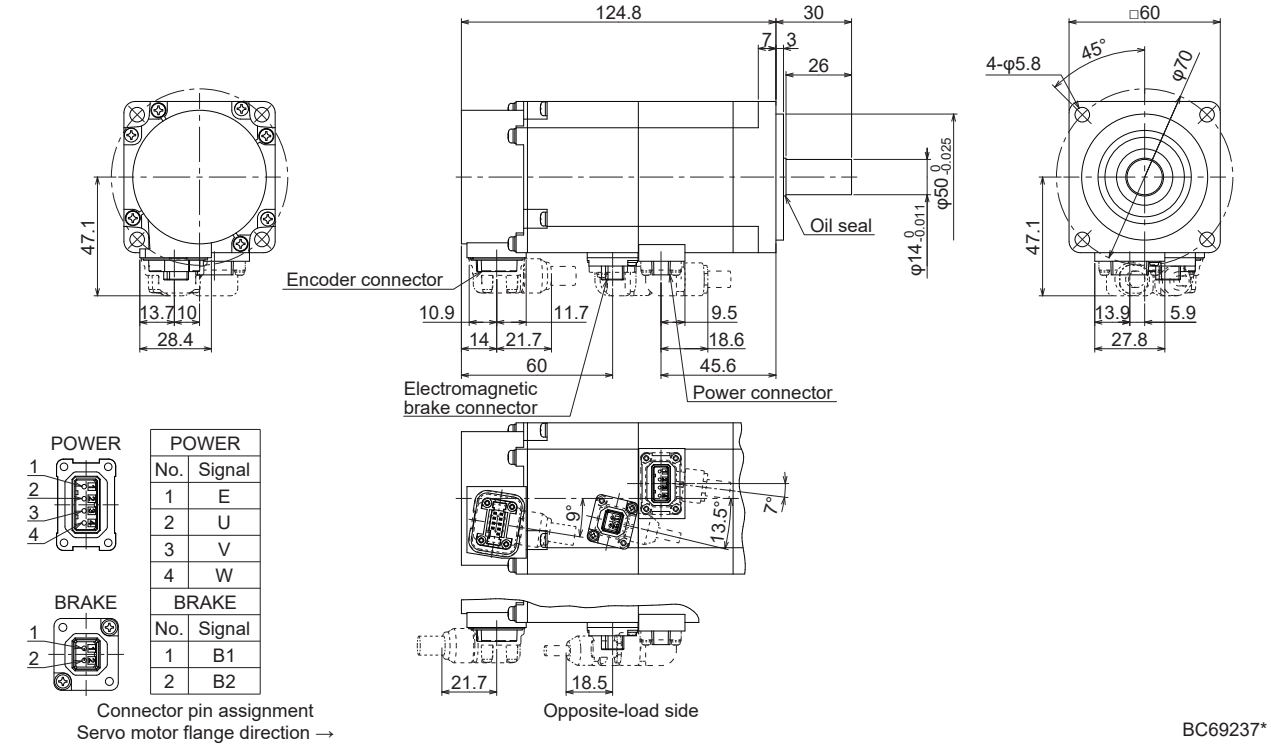
POWER	
No.	Signal
1	E
2	U
3	V
4	W
BRAKE	
No.	Signal
1	B1
2	B2

Connector pin assignment
Servo motor flange direction →

BC69236*

[Unit: mm]

■HG-KNS23BJ



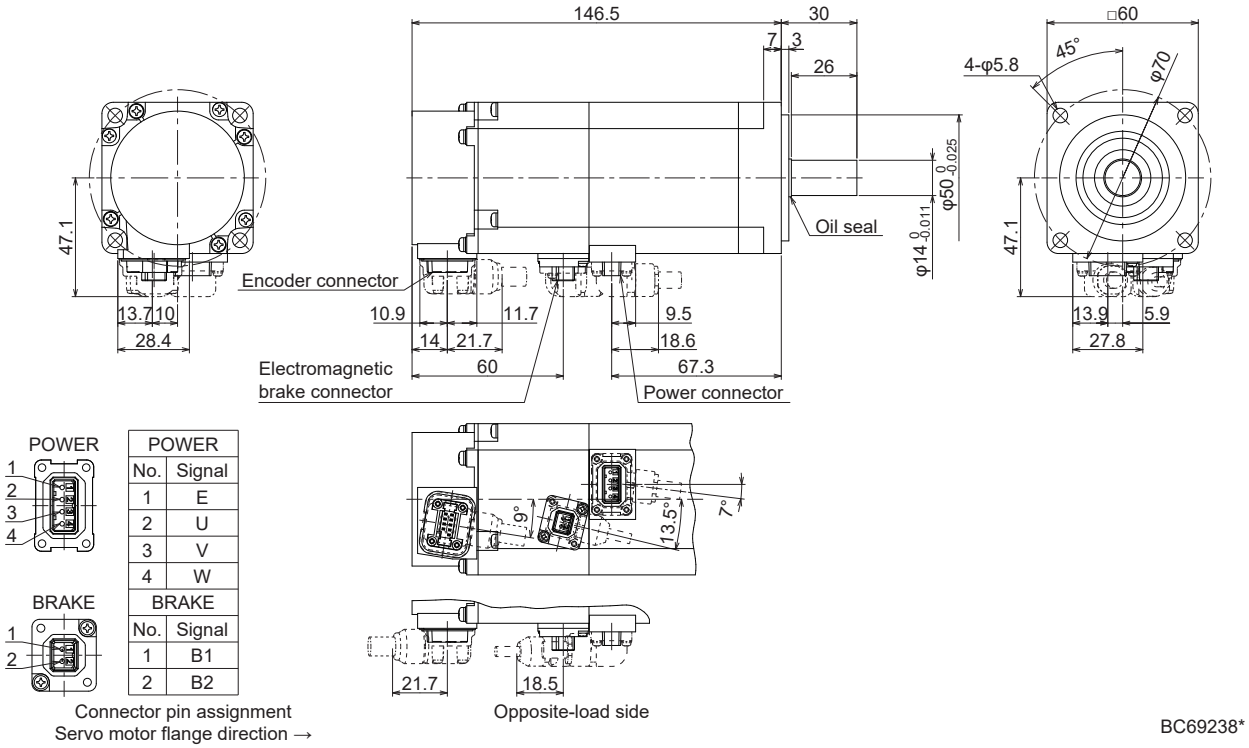
POWER	
No.	Signal
1	E
2	U
3	V
4	W
BRAKE	
No.	Signal
1	B1
2	B2

Connector pin assignment
Servo motor flange direction →

BC69237*

[Unit: mm]

■HG-KNS43BJ

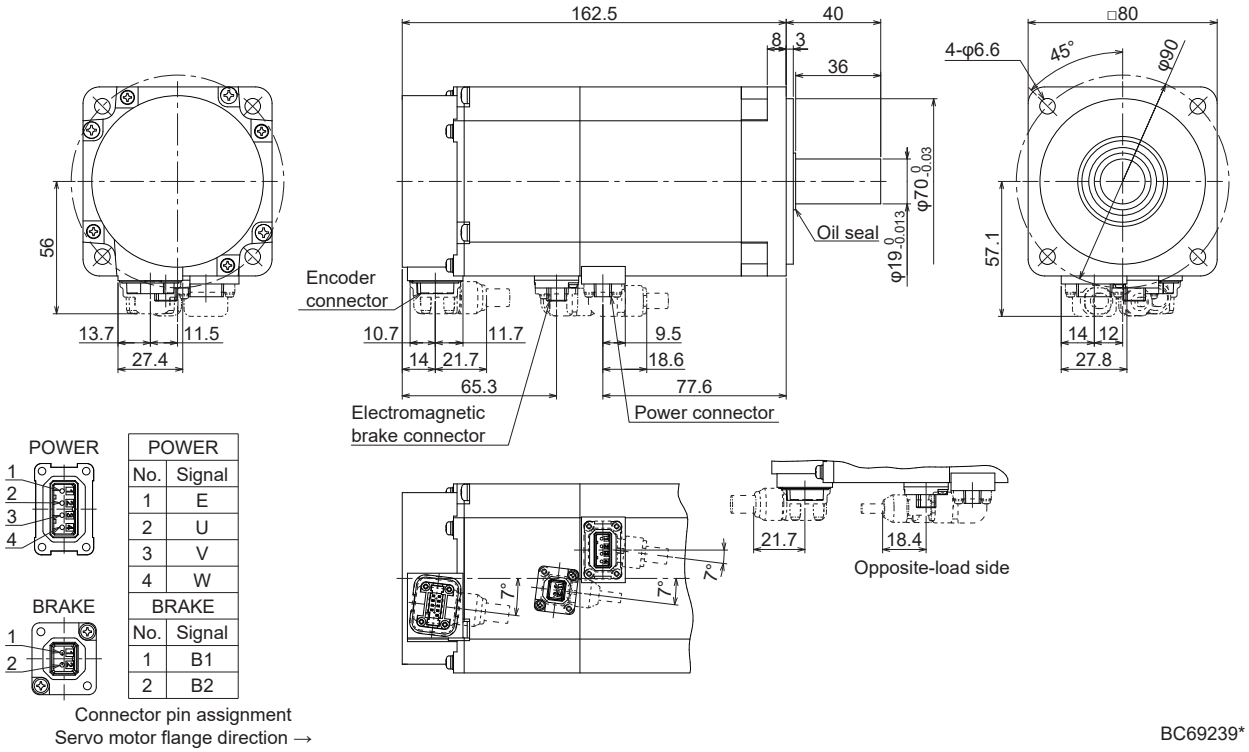


POWER	
No.	Signal
1	E
2	U
3	V
4	W

BRAKE	
No.	Signal
1	B1
2	B2

[Unit: mm]

■HG-KNS73BJ



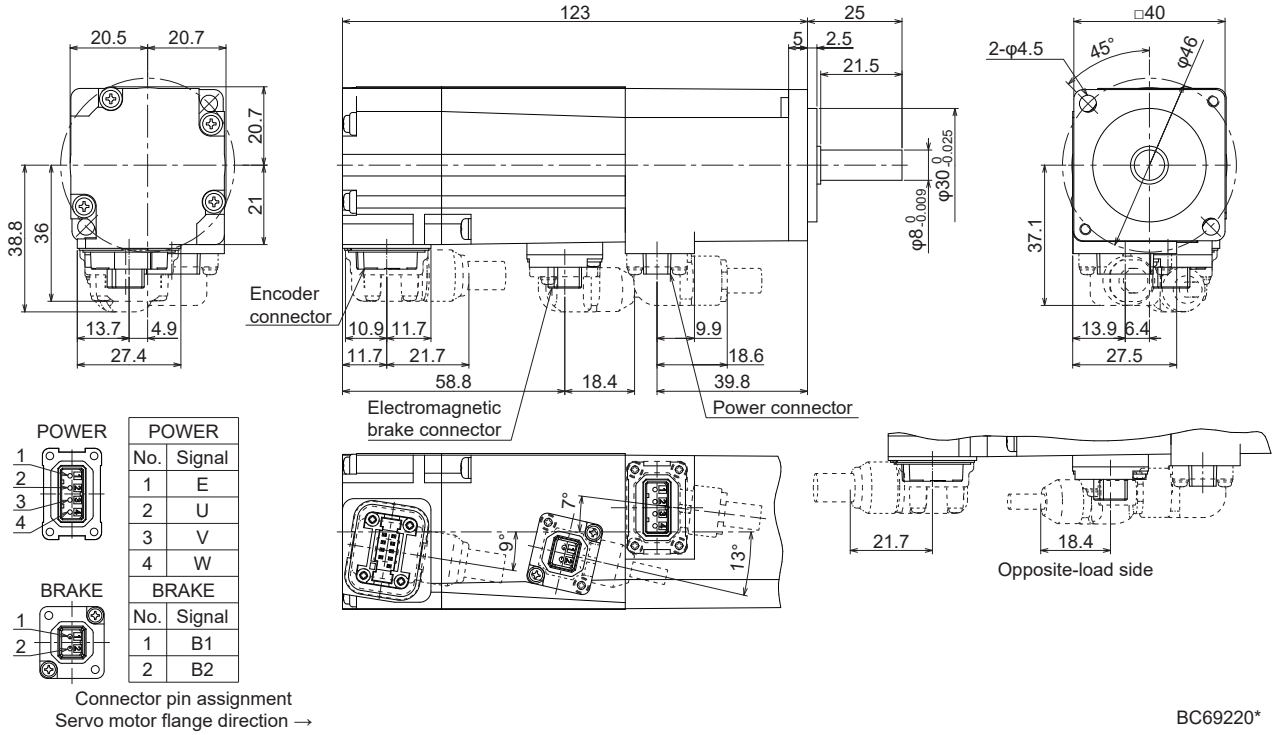
POWER	
No.	Signal
1	E
2	U
3	V
4	W

BRAKE	
No.	Signal
1	B1
2	B2

[Unit: mm]

Without oil seal

■HG-KNS13B

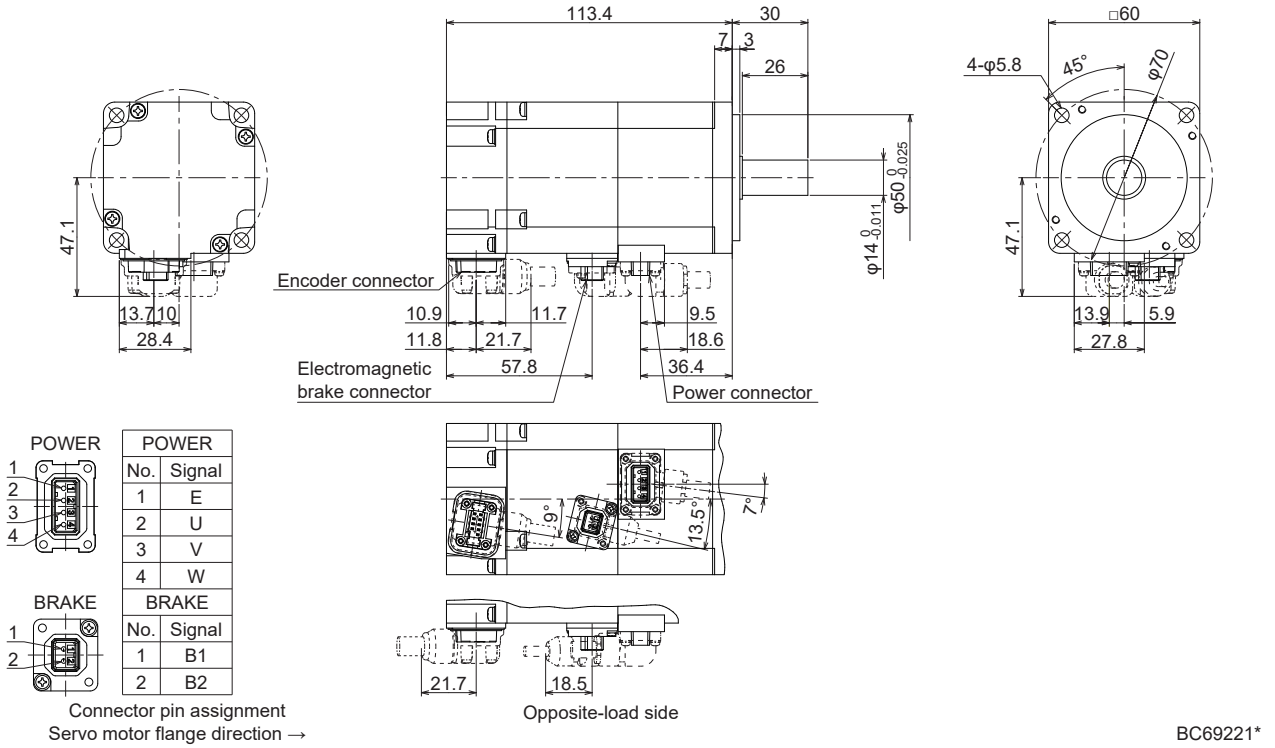


POWER	
No.	Signal
1	E
2	U
3	V
4	W

BRAKE	
No.	Signal
1	B1
2	B2

[Unit: mm]

■HG-KNS23B

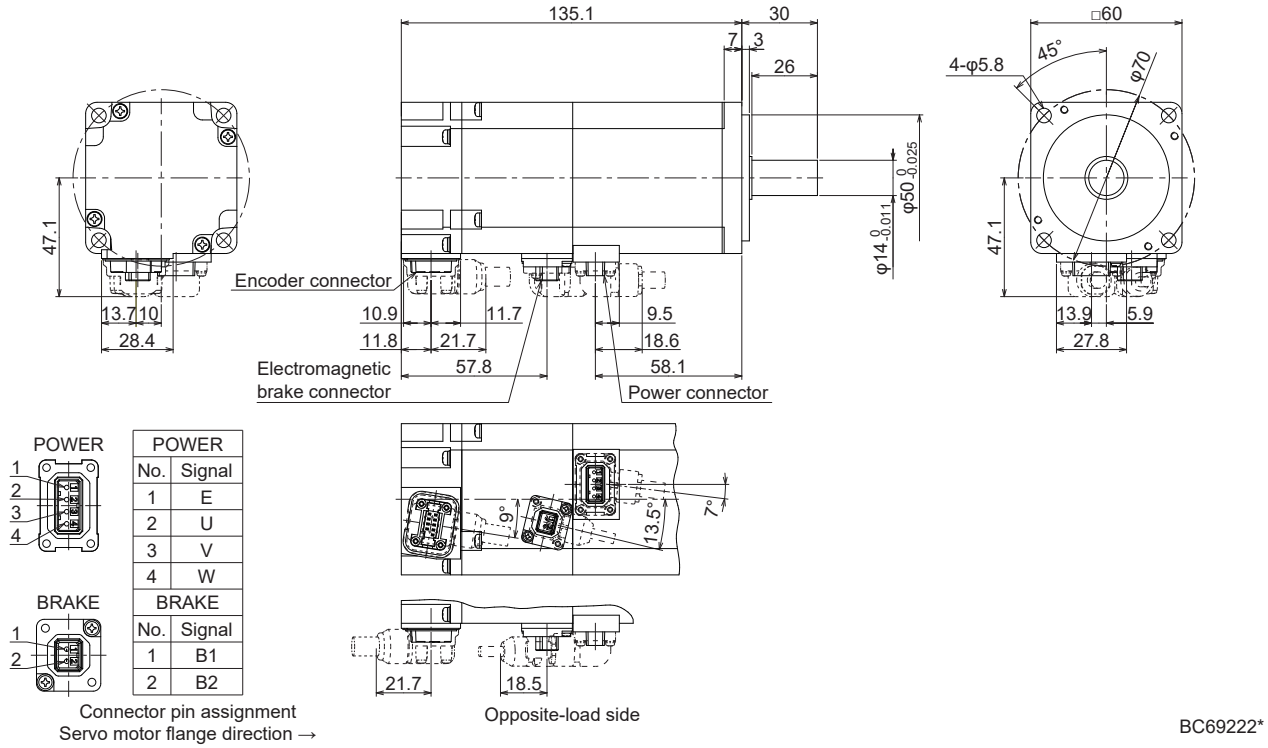


POWER	
No.	Signal
1	E
2	U
3	V
4	W

BRAKE	
No.	Signal
1	B1
2	B2

[Unit: mm]

■HG-KNS43B

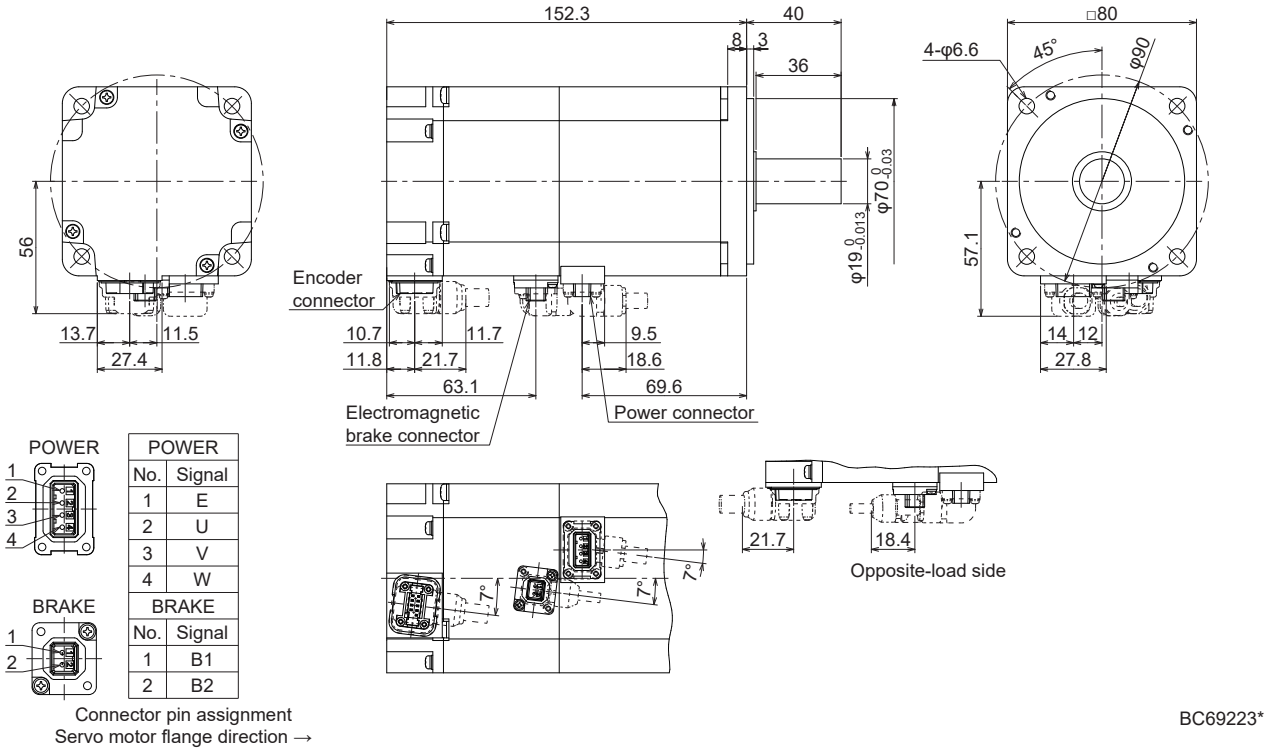


POWER	
No.	Signal
1	E
2	U
3	V
4	W

BRAKE	
No.	Signal
1	B1
2	B2

[Unit: mm]

■HG-KNS73B



POWER	
No.	Signal
1	E
2	U
3	V
4	W

BRAKE	
No.	Signal
1	B1
2	B2

[Unit: mm]

12 HG-SNS SERIES (200 V)

This chapter provides information on the rotary servo motor specifications and characteristics. The indicated values and those without tolerance are representative values. When using the HG-SNS series (200 V) rotary servo motor, read chapter 1 to 4, chapter 6, and SAFETY INSTRUCTIONS at the beginning of this manual in addition to this chapter.
For the combinations of servo amplifiers and rotary servo motors, restrictions on the firmware version of the servo amplifier, and restrictions by the date of manufacture of the servo motor, refer to "Servo amplifier/motor combinations" in the following manuals.
MR-JET User's Manual (Hardware)

12.1 Model designation

The following describes model designation. Not all combinations of the symbols are available.

HG - SNS 5 2 B J

Shaft type

Symbol	Shaft shape
None	Standard (straight shaft)
K	Keyed shaft *1

Oil seal

Symbol	Oil seal
J	Attached
None	Not attached

Electromagnetic brake

Symbol	Electromagnetic brake
None	Not attached
B	Attached

Rated speed

Symbol	Rated speed [r/min]
2	2000

Rated output

Symbol	Rated output [kW]
5	0.5
10	1.0
15	1.5
20	2.0
30	3.0

*1 For the HG-SNS series, the key is not included.

12.2 Standard specifications

Standard specifications list

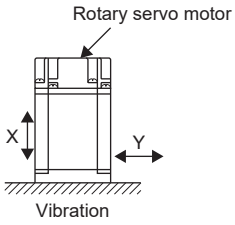
Series		HG-SNS_ (Medium inertia/medium capacity)				
Flange size		□130			□176	
Rotary servo motor model		52J	102J	152J	202J	302J
Power supply capacity		Refer to "Power supply capacity and generated loss" in the following manual. 📖MR-JET User's Manual (Hardware)				
Power supply voltage [V]		200 V AC (3-phase 200 V AC to 240 V AC)				
Continuous running duty [*1]	Rated output [kW]	0.5	1.0	1.5	2.0	3.0
	Rated torque [N•m]	2.39	4.77	7.16	9.55	14.3
Maximum torque [N•m]		7.16	14.3	21.5	28.6	42.9
Rated speed [*1][r/min]		2000				
Maximum speed [*1][r/min]		3000				2500
Power rate at continuous rated torque [kW/s]	Without an electromagnetic brake	7.85	19.7	32.1	19.5	26.1
	With an electromagnetic brake	6.01	16.5	28.2	16.1	23.3
Rated current [A]		2.9	5.6	9.4	9.6	11.0
Maximum current [A]		9.0	17	29	31	33
Moment of inertia J [$\times 10^{-4}$ kg•m^2]	Without an electromagnetic brake	7.26	11.6	16.0	46.8	78.6
	With an electromagnetic brake	9.48	13.8	18.2	56.5	88.2
Recommended load to motor inertia ratio [*2]		15 times or less				
Speed/position detector		22-bit encoder common to absolute position and incremental detection systems (battery backup type) (resolution per rotary servo motor revolution: 4194304 pulses/rev)				
Type		Permanent magnet synchronous motor				
Oil seal		Attached [*7]				
Thermistor		None				
Insulation class		155 (F)				
Structure		Totally enclosed, natural cooling (IP rating: IP67) [*3]				
Vibration resistance [*4][m/s^2]		X: 24.5, Y: 24.5			X: 24.5, Y: 49	
Vibration rank [*5]		V10				
Permissible load for the shaft [*6]	L [mm]	55			79	
	Radial [N]	980			2058	
	Thrust [N]	490			980	
Mass [kg]	Without an electromagnetic brake	4.8	6.2	7.3	11	16
	With an electromagnetic brake	6.7	8.2	9.3	17	22

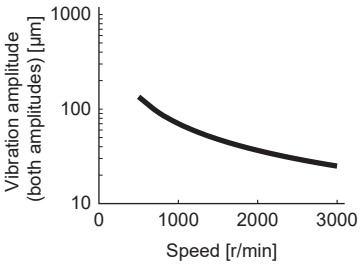
*1 When the power supply voltage drops, the continuous running duty and the speed cannot be guaranteed.

*2 If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.

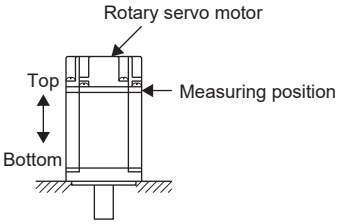
*3 Except for the shaft-through portion. IP classifies the degrees of protection provided against the intrusion of solid objects and water in electrical enclosures.

*4 The vibration directions are shown in the following figure. The value is the one at the part that indicates the maximum value (normally the opposite to load-side bracket). When the rotary servo motor stops, fretting is likely to occur at the bearing. Therefore, suppress the vibration to about half of the permissible value.

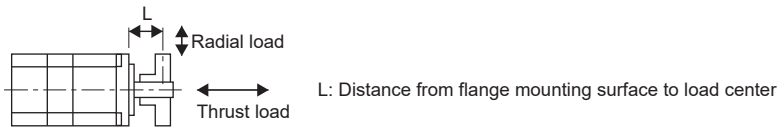




*5 V10 indicates that the amplitude of a single rotary servo motor is 10 µm or less. The following figure shows the rotary servo motor mounting position for measurement and the measuring position.



*6 The following shows permissible load for the shaft. Do not subject the shaft to loads greater than the value in the specifications list. The value assumes that the load is applied independently.



*7 Servo motors without an oil seal are also compatible.

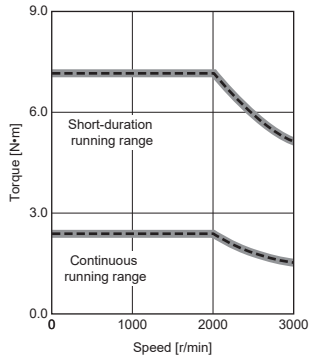
Torque characteristics

- For the system where the unbalanced torque occurs, such as a vertical axis, the unbalanced torque of the machine should be kept at 70 % or lower of the rated torque.

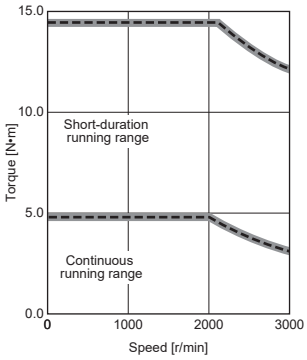
When the power supply voltage drops, the torque decreases.

: 3-phase 200 VAC
- - - - : 1-phase 200 VAC

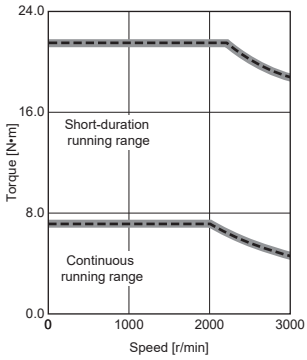
[HG-SNS52J]



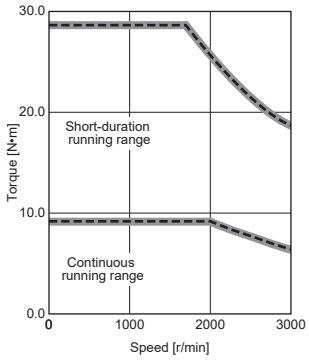
[HG-SNS102J]



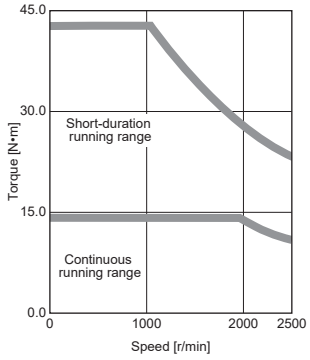
[HG-SNS152J]



[HG-SNS202J]



[HG-SNS302J]



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12.3 Characteristics of electromagnetic brake

Point

Before operating the servo motor, confirm that the electromagnetic brake operates properly.
The operation time of the electromagnetic brake varies depending on the power supply circuit being used.
Check the operation delay time with an actual machine.

The characteristics of the electromagnetic brake provided for the rotary servo motor with an electromagnetic brake are shown below.

Item		HG-SNS series	
		52BJ/102BJ/152BJ	202BJ/302BJ
Type *1		Spring actuated type safety brake	
Rated voltage *4		24 V DC (-10 % to 0 %)	
Power consumption at 20 °C [W]		20	34
Coil resistance *5[Ω]		29.0	16.8
Inductance *5[H]		0.80	1.10
Brake static friction torque *7[N•m]		8.5 or more	44.0 or more
Release delay time *2[s]		0.04	0.1
Braking delay time [s]	DC off *2	0.03	
Permissible braking work	Per braking [J]	400	4500
	Per hour [J]	4000	45000
Brake looseness at servo motor shaft *5[degree]		0.6	
Brake life *3	Number of braking times [times]	20000	
	Work per braking [J]	200	1000
Selection example of surge absorbers to be used *6	Suppressed voltage of 125 V	TND20V-680KB (Manufactured by Nippon Chemi-Con Corporation)	
	Suppressed voltage of 350 V	TND10V-221KB (Manufactured by Nippon Chemi-Con Corporation)	

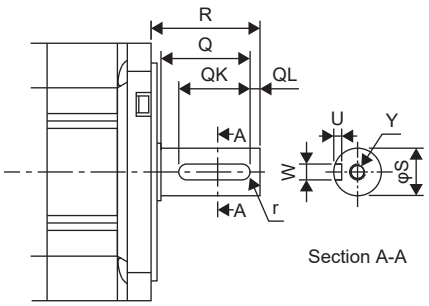
*1 This type does not have a manual release mechanism. Use a 24 V DC power supply to release the brake electrically.
*2 The value for initial on gap at 20 °C.
*3 Brake lining wear due to braking will increase the brake gap, but the gap is not adjustable. Therefore, the brake life indicates the number of times the brake can be applied before gap adjustment becomes necessary.
*4 Prepare a power supply exclusively for the electromagnetic brake.
*5 The values are design values. These are not the guaranteed values.
*6 Select the electromagnetic brake control relay properly, in consideration of the characteristics of the electromagnetic brake and surge absorber. When a diode is used as a surge absorber, the electromagnetic braking time becomes longer.
*7 The value of the brake static friction torque is the lower limit in the initial state at 20 °C.

12.4 Rotary servo motors with special shafts

The shaft shape for the rotary servo motor is keyed shaft (without key)-type.

Rotary servo motor	Shaft shape
	Keyed shaft (without key)
HG-SNS_	K

Keyed shaft (without key)



Section A-A

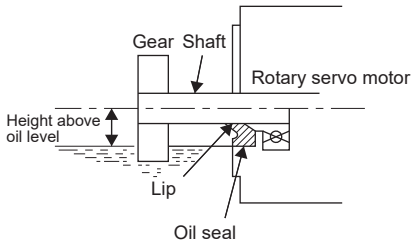
[Unit: mm]

Rotary servo motor	Variable dimensions								
	S	R	Q	W	QK	QL	U	r	Y
HG-SNS52K HG-SNS102K HG-SNS152K	$24^{0}_{-0.013}$	55	50	$8^{0}_{-0.036}$	36	5	$4^{+0.2}_{0}$	4	M8 Screw hole depth 20
HG-SNS202K HG-SNS302K	$35^{+0.010}_{0}$	79	75	$10^{0}_{-0.036}$	55	5	$5^{+0.2}_{0}$	5	M8 Screw hole depth 20

12.5 Rotary servo motors with an oil seal

The oil seal prevents the entry of oil into the rotary servo motor.

Install the rotary servo motor horizontally, and set the oil level in the gear box to be always lower than the oil seal lip.



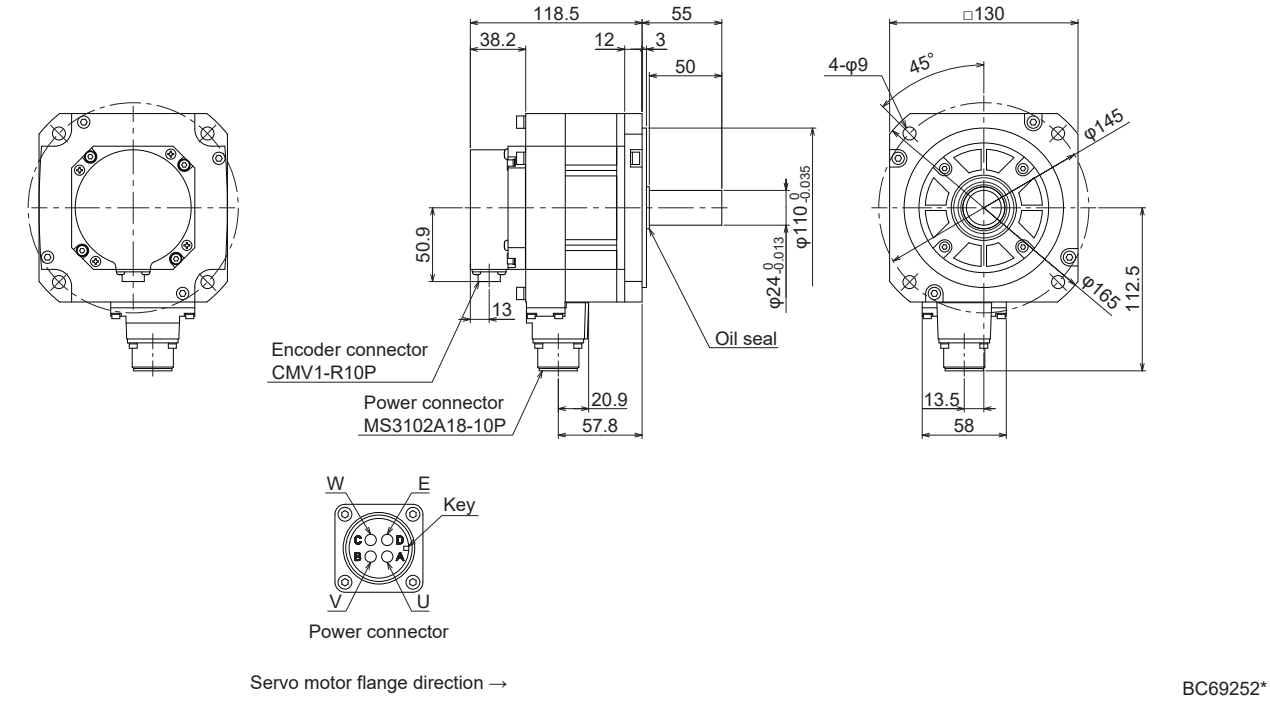
Rotary servo motor	Height (h) from the surface of the oil [mm]
HG-SNS52J HG-SNS102J HG-SNS152J	23
HG-SNS202J HG-SNS302J	31

12.6 Dimensions

- Not all parts are created the exact same size or assembled in precisely the same manner. Therefore, the actual dimensions of rotary servo motors may be a maximum of approximately 3 mm larger than those in the drawings. In addition, the described dimensions and dimensional tolerances are the values at 20 °C. Since the values of the dimensions may vary depending on the ambient temperature, allow some margin when designing the machine side.
- Use a friction coupling for coupling the servo motor with a load.
- Use hexagon socket head cap screws to mount the rotary servo motor.
- The dimensions of the HG-SNS series are the same, regardless of whether the servo motor has an oil seal or not.

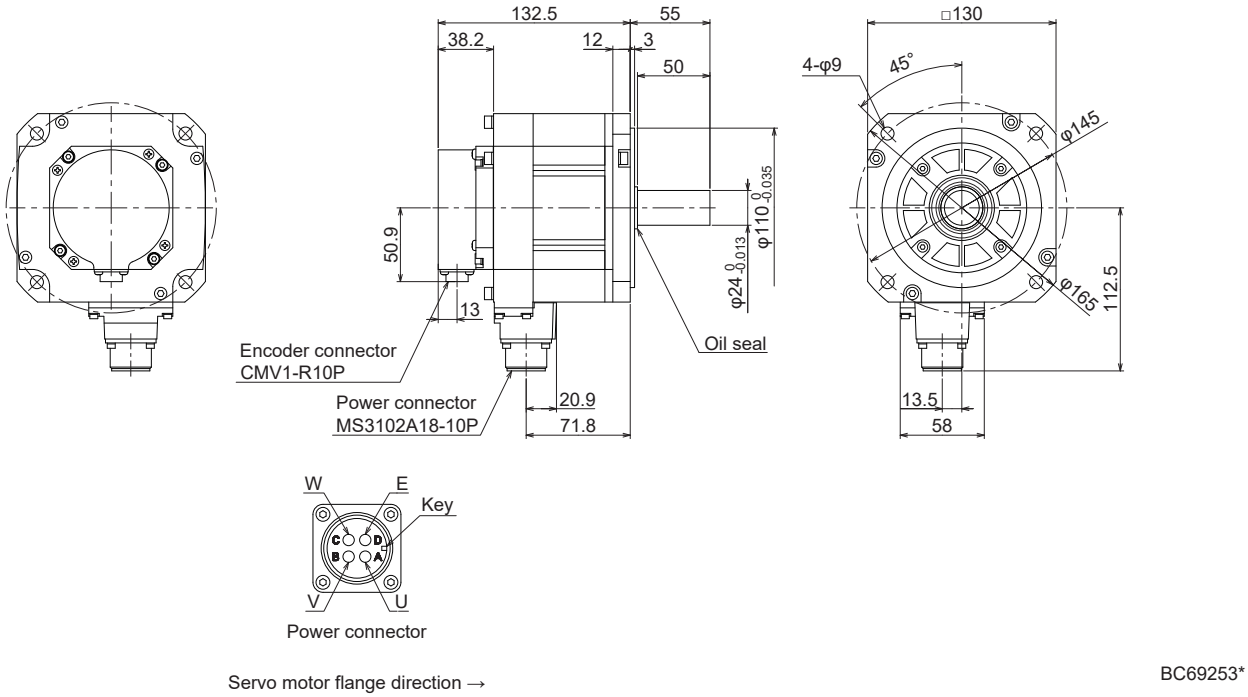
Without an electromagnetic brake

HG-SNS52J



[Unit: mm]

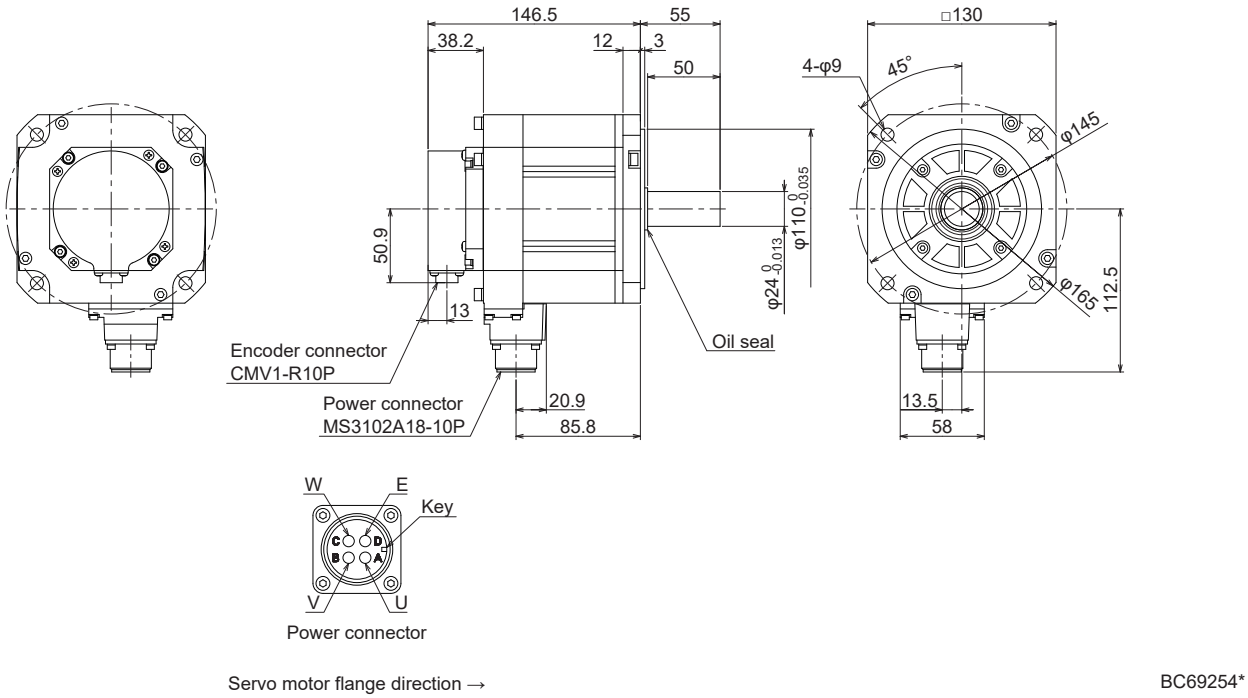
HG-SNS102J



BC69253*

[Unit: mm]

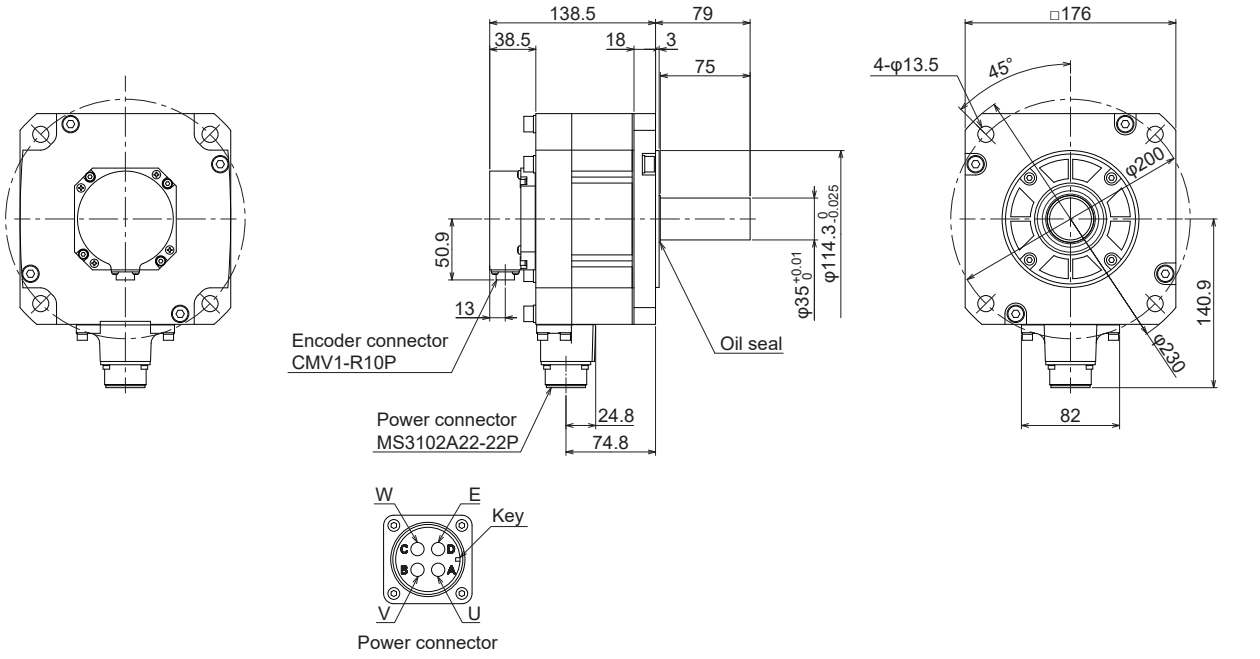
HG-SNS152J



BC69254*

[Unit: mm]

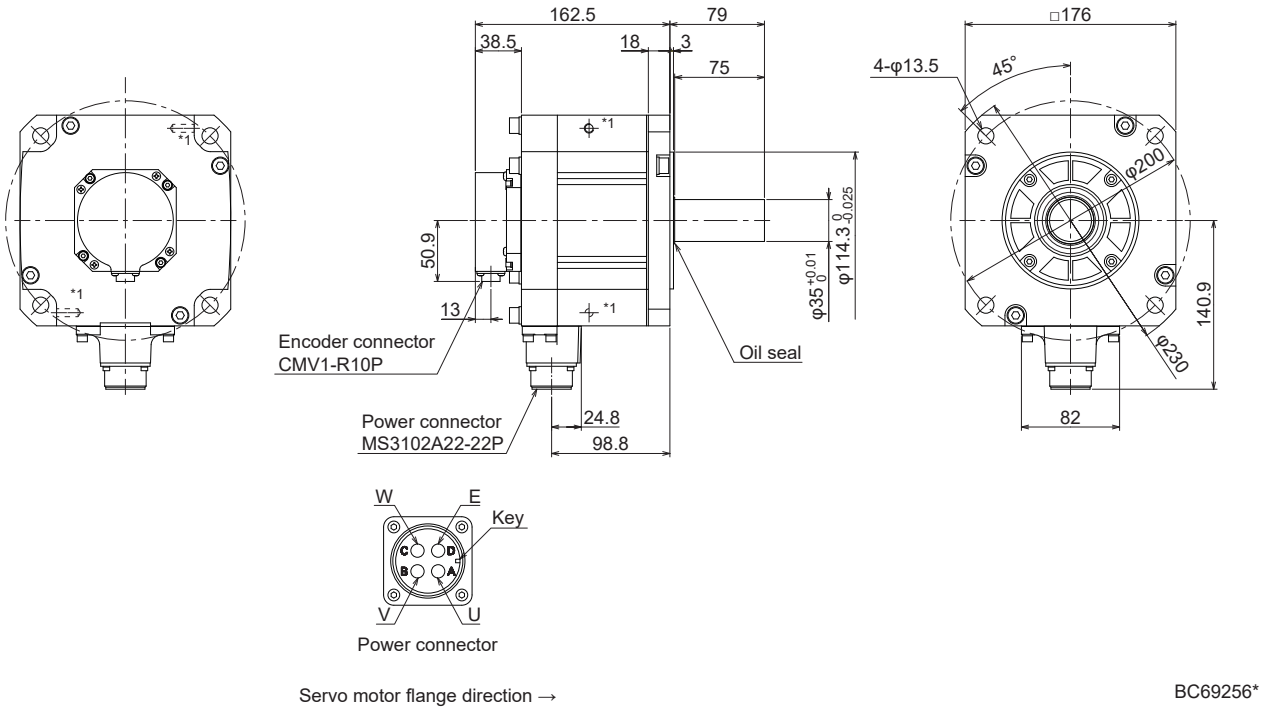
HG-SNS202J



BC69255*

[Unit: mm]

HG-SNS302J



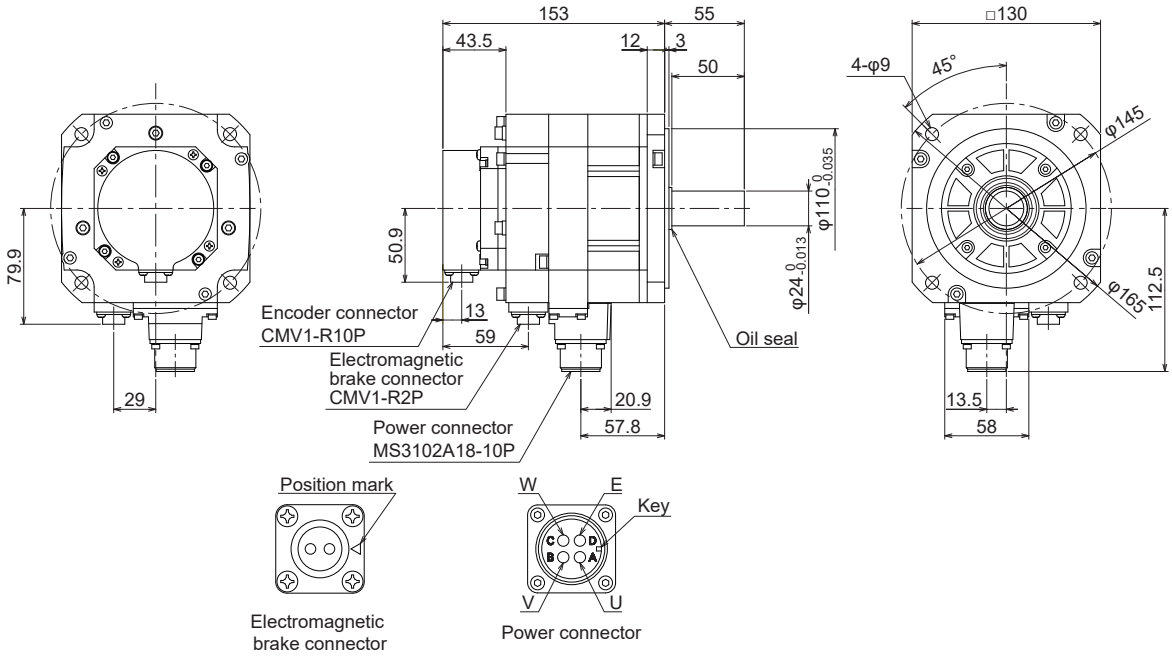
BC69256*

[Unit: mm]

*1 Screw hole for eyebolt (M8)

With an electromagnetic brake

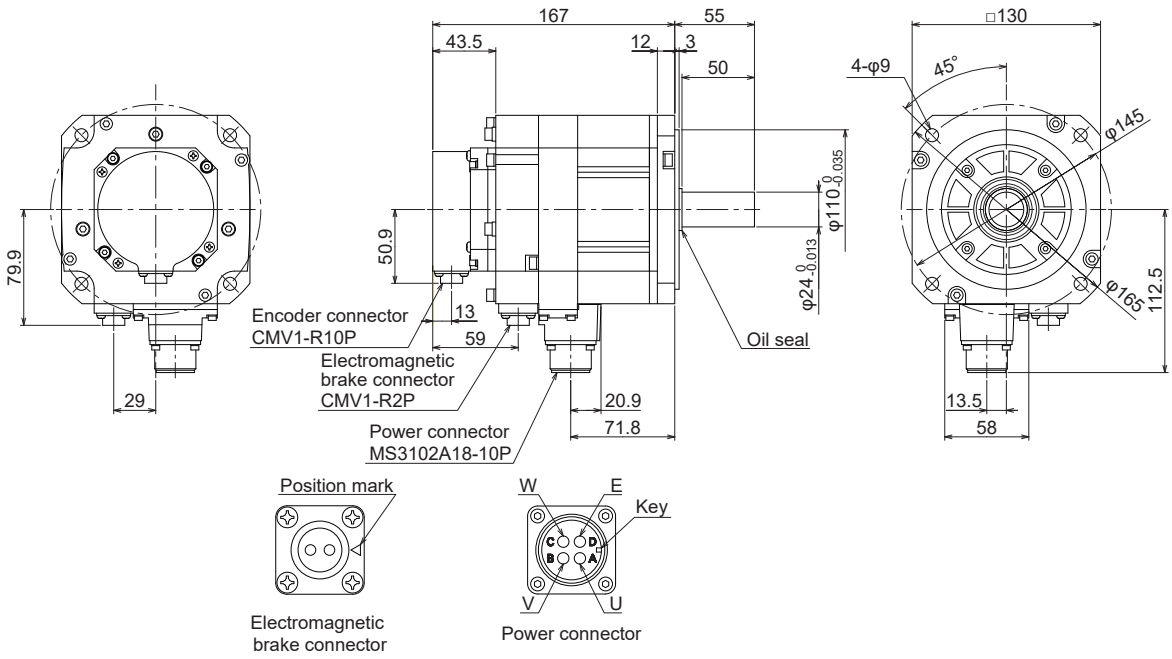
HG-SNS52BJ



BC69257*

[Unit: mm]

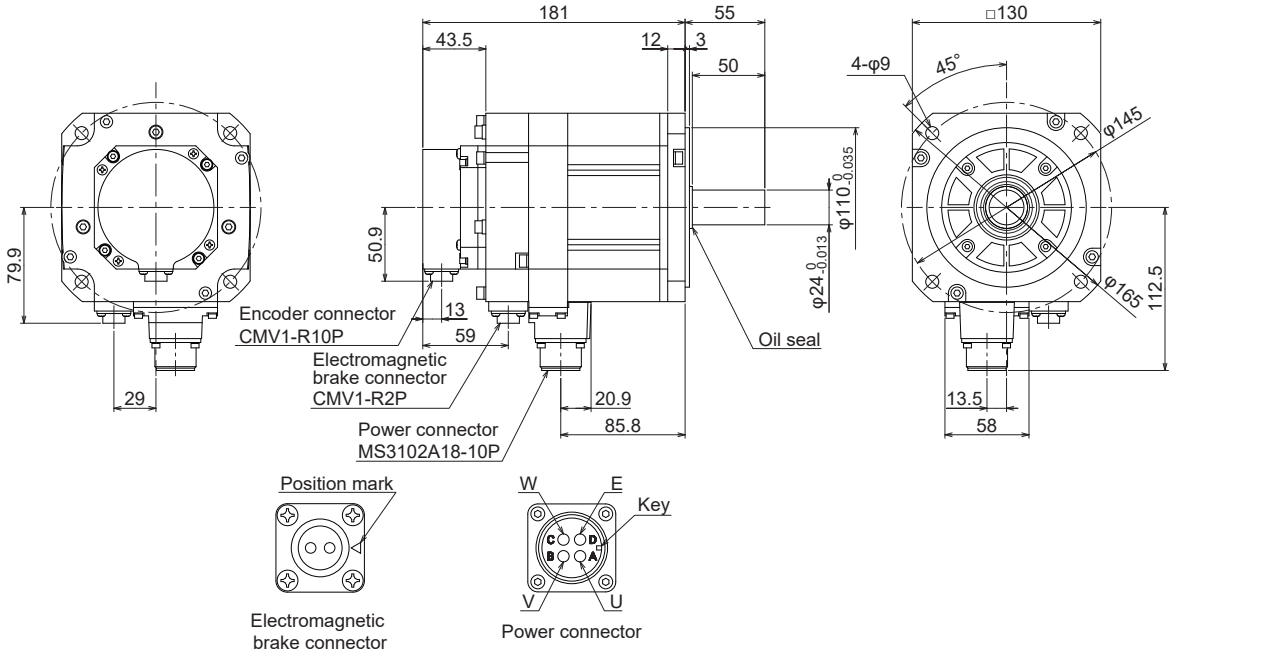
HG-SNS102BJ



BC69258*

[Unit: mm]

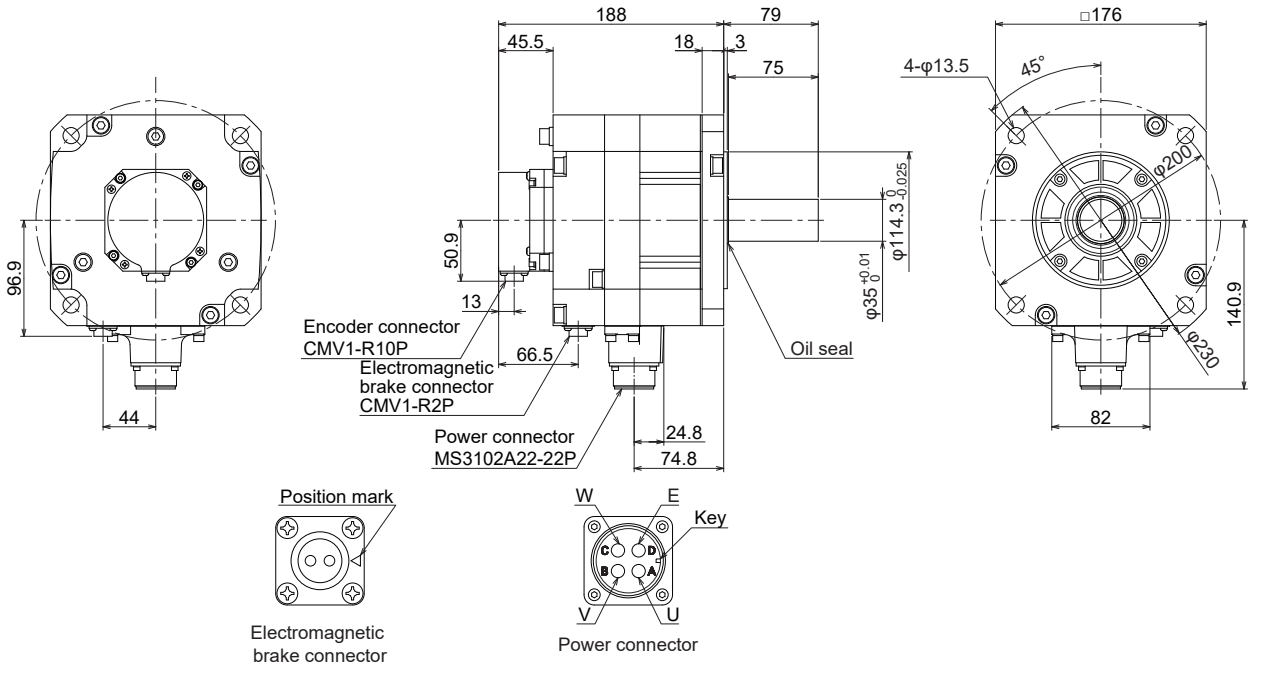
HG-SNS152BJ



BC69259*

[Unit: mm]

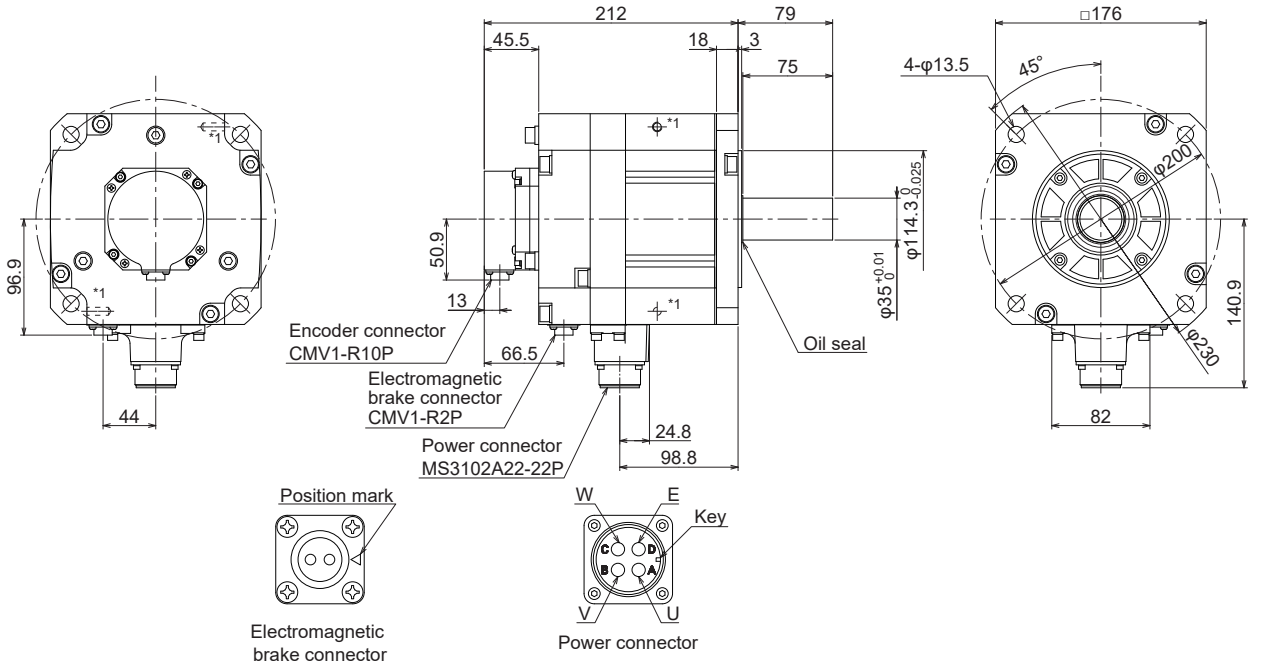
HG-SNS202BJ



BC69260*

[Unit: mm]

HG-SNS302BJ



[Unit: mm]

*1 Screw hole for eyebolt (M8)

13 COMPLIANCE WITH EACH REGION

13.1 Compliance with CE/UKCA marking

CE/UKCA marking

The CE/UKCA marking is mandatory and must be affixed to specific products placed on the European Union area and the United Kingdom. When a product conforms to the requirements by category as defined in the EU directive, UK rules, etc., the CE/UKCA marking must be affixed to the product.
The CE/UKCA marking also applies to the machines and equipment that are for sale with the servo motors in the European Union area and the United Kingdom.
Each manual is available in different languages. For details, refer to our website or contact our local sales office.

EMC directive

The EMC directive applies to the rotary servo motor alone. Therefore, the rotary servo motor is designed to comply with the EMC directive. The EMC directive also applies to machines and equipment incorporating rotary servo motors. The HK-KN series, HK-FN series, HK-SN series, HG-KNS series, and HG-SNS series comply with EN 61800-3 Category 3. These series are not intended to be used on a low-voltage public network which supplies domestic premises; When used on such a network, radio frequency interference may occur. The installer must provide a guide for installation and use, including the recommended mitigation devices.

Low voltage directive

The low voltage directive also applies to the rotary servo motor alone. The rotary servo motor is designed to comply with the low voltage directive.

Machinery directive

The rotary servo motor as a single unit does not comply with the Machinery directive due to correspondence with Article 1.2 (k). However, the Machinery directive applies to machines and equipment incorporating rotary servo motors. Please check if the machines and equipment as a whole are in conformity.

For compliance

Be sure to perform an appearance inspection of every unit before installation. In addition, have a final performance inspection on the entire machine, and keep the inspection record.

Wiring

Use wiring which complies with EN for the rotary servo motor power. Products in compliance with EN are available as options. For options, refer to the following.
☞ Page 52 WIRING OPTION (HK-KN SERIES/HK-FN SERIES/HK-SN SERIES)
☞ Page 96 WIRING OPTION (HG-KNS SERIES/HG-SNS SERIES)

Performing EMC tests

When EMC tests are run on a machine and equipment into which the servo amplifier and rotary servo motor have been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment and electrical equipment specifications. For EMC directive conforming methods about servo amplifiers and rotary servo motors, refer to "EMC Installation Guidelines".

13.2 Compliance with UL/CSA standard

Use the UL/CSA standard-compliant model of rotary servo motor. For the latest information of compliance, contact your local sales office. Unless otherwise specified, the handling, performance, specifications, etc., of the UL/CSA compliant products are the same as those of the standard models.

Flange size

The rotary servo motor is compliant with the UL/CSA standard when it is mounted on the flanges made of aluminum whose sizes are indicated in the following table. The rated torque of the rotary servo motor under the UL/CSA standard indicates the continuous permissible torque value that can be generated when the motor is mounted on the flange specified in this table, and used in the environment of specified ambient temperature (0 °C to 40 °C). Therefore, to conform to the UL/CSA standard, mount the direct drive motor on a machine with a heat radiating effect equivalent to that of this flange.

HK-KN series/HK-FN series/HK-SN series

■Insulation class 155 (F)

Flange size [mm]	Rotary servo motor			
	HK-KN (200 V)	HK-FN (200 V)	HK-KN (400 V)	HK-SN (400 V)
250 × 250 × 6	053 13 1M3 23	13 23	134 234	—
250 × 250 × 12	43	43	434	—
300 × 300 × 12	63 7M3 103	7M3 102 152	634 7M34 1034	—
300 × 300 × 20	153 203 202	202	1534 2034	—
550 × 550 × 30	—	301M	—	3534 5034
650 × 650 × 35	—	—	—	7034

HG-KNS series/HG-SNS series

■Insulation class 105 (A) [UL]

Flange size [mm]	HG-KNS (200 V)
500 × 500 × 20	13J 23J 43J
600 × 600 × 30	73J

■Insulation class 155 (F)

Flange size [mm]	HG-SNS (200 V)
250 × 250 × 12	52J 102J 152J
300 × 300 × 20	202J 302J

Selection example of wires

To comply with the UL/CSA standard, use UL-approved copper wires rated at 75 °C for wiring.
The following table shows wires [AWG] rated at 75 °C.

HK-KN series (200 V)

Rotary servo motor	Wire [AWG]	
	U/V/W/E	B1/B2
HK-KN053	14 *1	16 *1
HK-KN13		
HK-KN1M3		
HK-KN23		
HK-KN43		
HK-KN63		
HK-KN7M3		
HK-KN103		
HK-KN153		
HK-KN203		
HK-KN202		

*1 This is used for fabricating extension cables. Use options when wiring the servo motor.

HK-FN series (200 V)

Rotary servo motor	Wire [AWG]	
	U/V/W/E	B1/B2
HK-FN13	14 *1	16 *1
HK-FN23		
HK-FN43		
HK-FN7M3		
HK-FN102	14	16
HK-FN152		
HK-FN202		
HK-FN301M		

*1 This is used for fabricating extension cables. Use options when wiring the servo motor.

HK-KN SERIES (400 V)

Rotary servo motor	Wire [AWG]	
	U/V/W/E	B1/B2
HK-KN134	14 *1	16 *1
HK-KN234		
HK-KN434		
HK-KN634		
HK-KN7M34		
HK-KN1034		
HK-KN1534		
HK-KN2034		

*1 This is used for fabricating extension cables. Use options when wiring the servo motor.

HK-SN series (400 V)

Rotary servo motor	Wire [AWG]	
	U/V/W/E	B1/B2
HK-SN3534	14	16
HK-SN5034		
HK-SN7034	12	

HG-KNS series (200 V)/HG-SNS series (200 V)

Rotary servo motor	Wire [AWG]	
	U/V/W/E	B1/B2
HG-KNS13J	14 *1	16 *1
HG-KNS23J		
HG-KNS43J		
HG-KNS73J		
HG-SNS52J	14	16
HG-SNS102J		
HG-SNS152J		
HG-SNS202J		
HG-SNS302J	12	

*1 This is used for fabricating extension cables.

14 APPENDIX

14.1 Rotary servo motor ID codes

HK-KN series/HK-FN series/HK-SN series

Rotary servo motor series ID	Rotary servo motor type ID	Rotary servo motor encoder ID	Rotary servo motor
0314	0053	F002	HK-KN053
	FF13		HK-KN13
	0153		HK-KN1M3
	FF23		HK-KN23
	FF43		HK-KN43
	FF63		HK-KN63
	0753		HK-KN7M3
	F103		HK-KN103
	F153		HK-KN153
	F203		HK-KN203
	F202		HK-KN202
319	FF13		HK-KN134
	FF23		HK-KN234
	FF43		HK-KN434
	FF63		HK-KN634
	0753		HK-KN7M34
	F103		HK-KN1034
	F153		HK-KN1534
	F203		HK-KN2034
0351	FF13		HK-FN13
	FF23		HK-FN23
	FF43		HK-FN43
	0753		HK-FN7M3
	F102		HK-FN102
	F152		HK-FN152
	F202		HK-FN202
	F301		HK-FN301M
032A	F353		HK-SN3534
	F503		HK-SN5034
	F703		HK-SN7034

HG-KNS series/HG-SNS series

Rotary servo motor series ID	Rotary servo motor type ID	Rotary servo motor encoder ID	Rotary servo motor
0117	FF13	0044	HG-KNS13J
	FF23		HG-KNS23J
	FF43		HG-KNS43J
	FF73		HG-KNS73J
012B	FF52		HG-SNS52J
	F102		HG-SNS102J
	F152		HG-SNS152J
	F202		HG-SNS202J
	F302		HG-SNS302J

14.2 Selection example of rotary servo motor power cable

When cables are fabricated by the customer, wires should be selected in accordance with the application.

Point

Selection conditions of wire size are as follows.
Wiring length: 30 m or less
As some cables do not fit in the optional or recommended cable clamp, select cable clamps applicable to the cable diameters.

Selection example when using the 600 V grade EP rubber insulated chloroprene sheath cab-tire cable (2PNCT) for rotary servo motor power (U/V/W) is indicated below.

HK-FN series (200 V)

Rotary servo motor	Wire size [mm^2]
HK-FN102	2
HK-FN152	2
HK-FN202	2
HK-FN301M	2

HK-SN series (400 V)

Rotary servo motor	Wire size [mm^2]
HK-SN3534	2
HK-SN5034	2
HK-SN7034	3.5

HG-SNS series (200 V)

Rotary servo motor	Wire size [mm^2]
HG-SNS52J	1.25
HG-SNS102J	1.25
HG-SNS152J	2
HG-SNS202J	2
HG-SNS302J	3.5

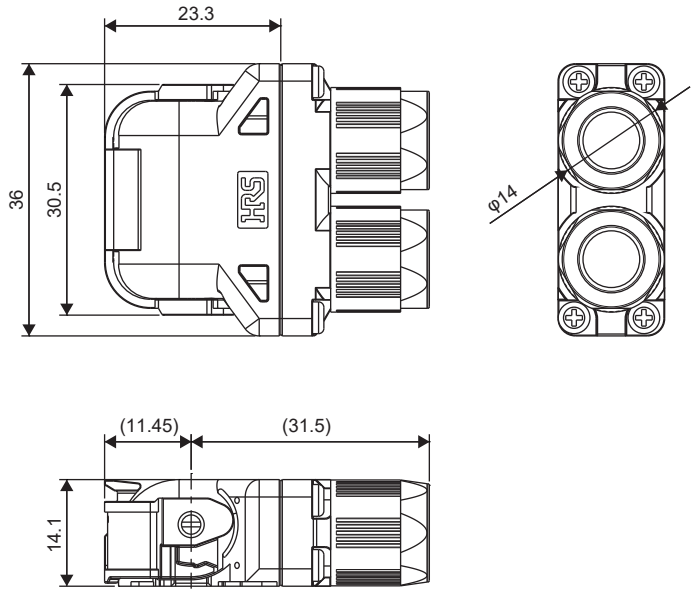
14.3 Connector dimensions

The connector dimensions for wiring the rotary servo motor are shown below.

HK-KN series/HK-FN series

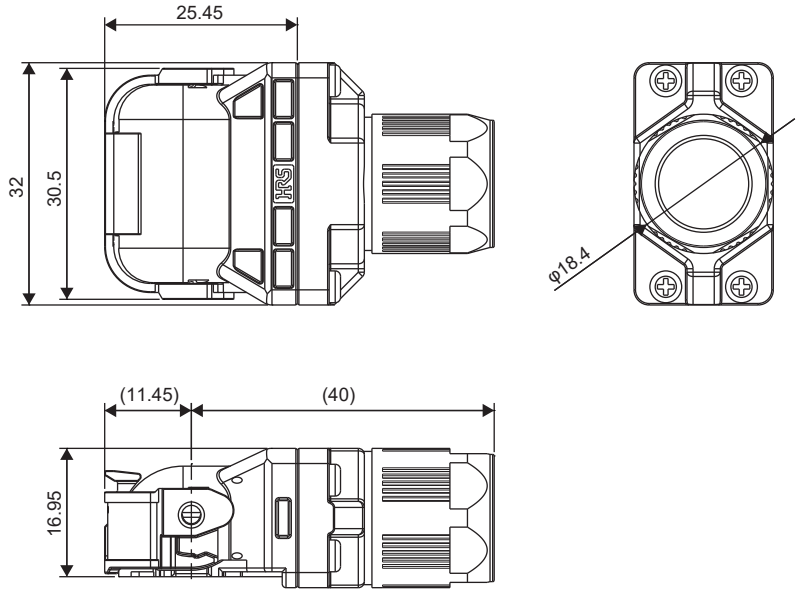
Rotary servo motor series			Type	Model	Manufacturer	Dimensions
HK-KN series/HK-FN (0.1 kW - 0.75 kW) series			Horizontal lead, dual cable	MT50W-8D/2D4ES-CVLD(7.5)	Hirose Electric	☞ Page 244 MT50W-8D/2D4ES-CVLD(7.5)
			Horizontal lead, single cable	MT50W-8D/2D4ES-CVL(11.9)		☞ Page 244 MT50W-8D/2D4ES-CVL(11.9)
			Vertical lead, dual cable	MT50W-8D/2D4ES-CVSD(7.5)		☞ Page 245 MT50W-8D/2D4ES-CVSD(7.5)
			Vertical lead, single cable	MT50W-8D/2D4ES-CVS(11.9)		☞ Page 245 MT50W-8D/2D4ES-CVS(11.9)
HK-FN (1.0 kW - 3.0 kW) series	For electromagnetic brake/ encoder		One-touch connection, straight	CMV1-SP10S-M_/CMV1-SP2S-_	DDK	☞ Page 246 CMV1-SP10S-M_/CMV1-SP2S-_
			One-touch connection, angle	CMV1-AP10S-M_/CMV1-AP2S-_		☞ Page 246 CMV1-AP10S-M_/CMV1-AP2S-_
			Screw type, straight	CMV1S-SP10S-M_/CMV1S-SP2S-_		☞ Page 246 CMV1S-SP10S-M_/CMV1S-SP2S-_
			Screw type, angle	CMV1S-AP10S-M_/CMV1S-AP2S-_		☞ Page 247 CMV1S-AP10S-M_/CMV1S-AP2S-_
	For power supply	Plug connector	One-touch connection, straight	JL10-6A_-_SE-EB	JAE	☞ Page 247 JL10-6A_-_SE-EB
			One-touch connection, angle	JL10-8A_-_SE-EB		☞ Page 248 JL10-8A_-_SE-EB
			Screw type, straight	JL04V-6A_-_SE-EB-R		☞ Page 248 JL04V-6A_-_SE-EB-R
			Screw type, angle	JL04V-8A_-_SE-EBH-R		☞ Page 249 JL04V-8A_-_SE-EBH-R
		Cable clamp	—	JL04-_CK(_)-_-R		☞ Page 249 JL04-_CK(_)-_-R

MT50W-8D/2D4ES-CVLD(7.5)



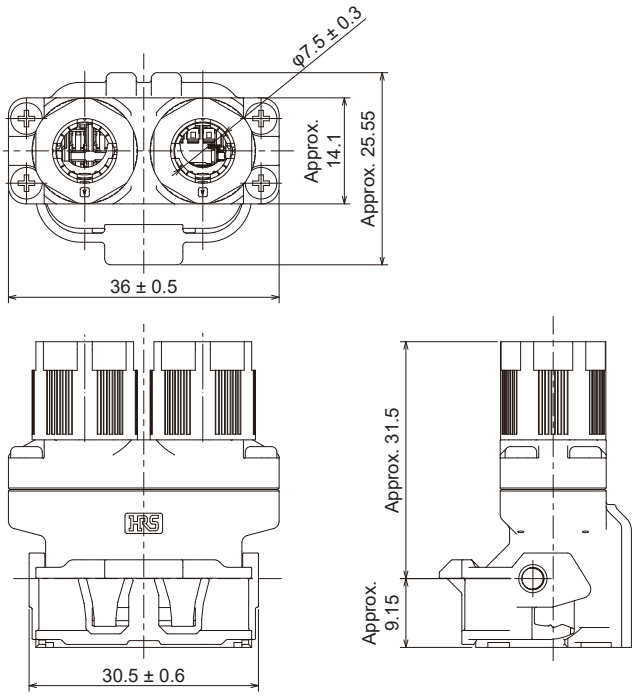
[Unit: mm]

MT50W-8D/2D4ES-CVL(11.9)



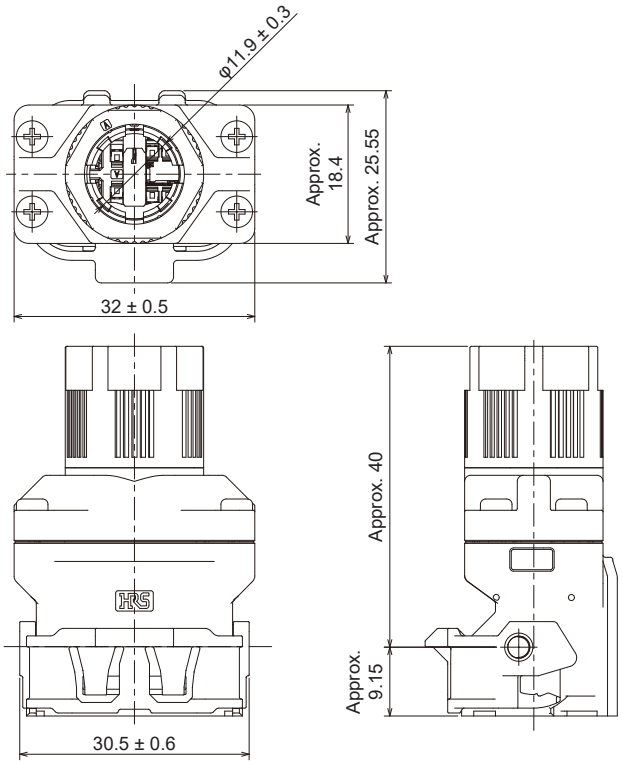
[Unit: mm]

MT50W-8D/2D4ES-CVSD(7.5)



[Unit: mm]

MT50W-8D/2D4ES-CVS(11.9)

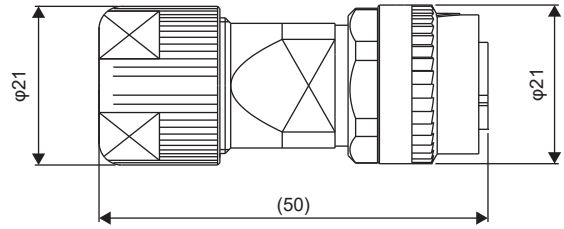


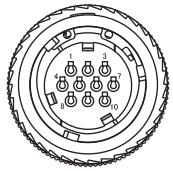
[Unit: mm]

CMV1-SP10S-M_/CMV1-SP2S-_

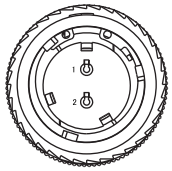
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





For CMV1-SP10S-M_



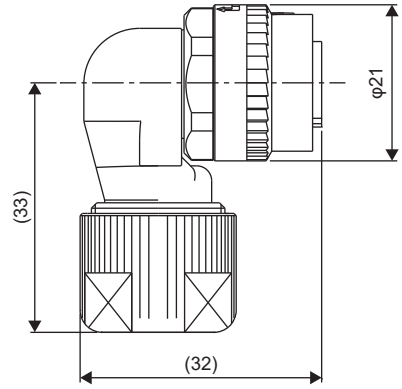
For CMV1-SP2S-_

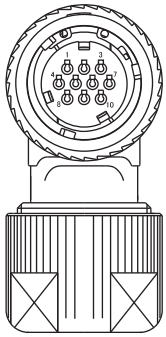
[Unit: mm]

CMV1-AP10S-M_/CMV1-AP2S-_

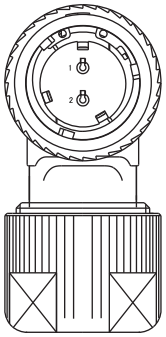
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





For CMV1-AP10S-M_



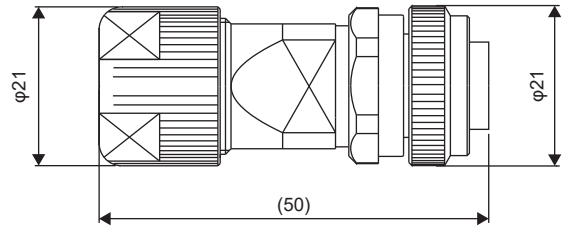
For CMV1-AP2S-_

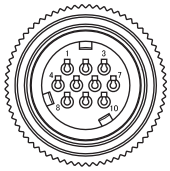
[Unit: mm]

CMV1S-SP10S-M_/CMV1S-SP2S-_

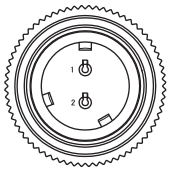
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





For CMV1S-SP10S-M_



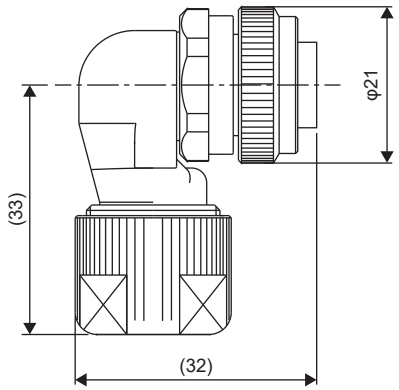
For CMV1S-SP2S-_

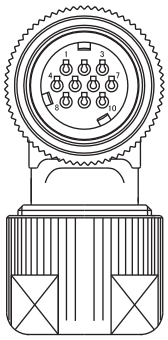
[Unit: mm]

CMV1S-AP10S-M_/CMV1S-AP2S-_

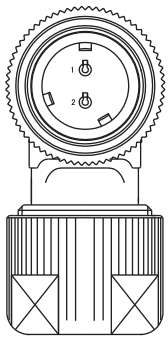
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





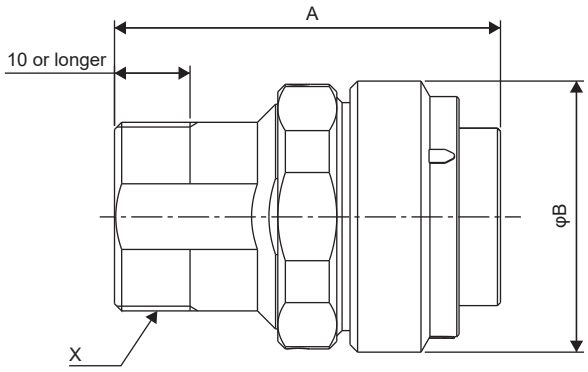
For CMV1S-AP10S-M_

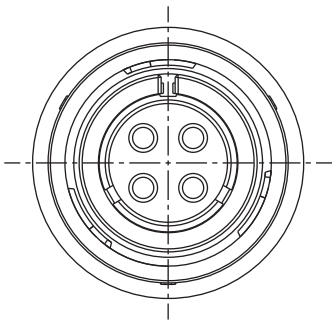


For CMV1S-AP2S-_

[Unit: mm]

JL10-6A_-_SE-EB

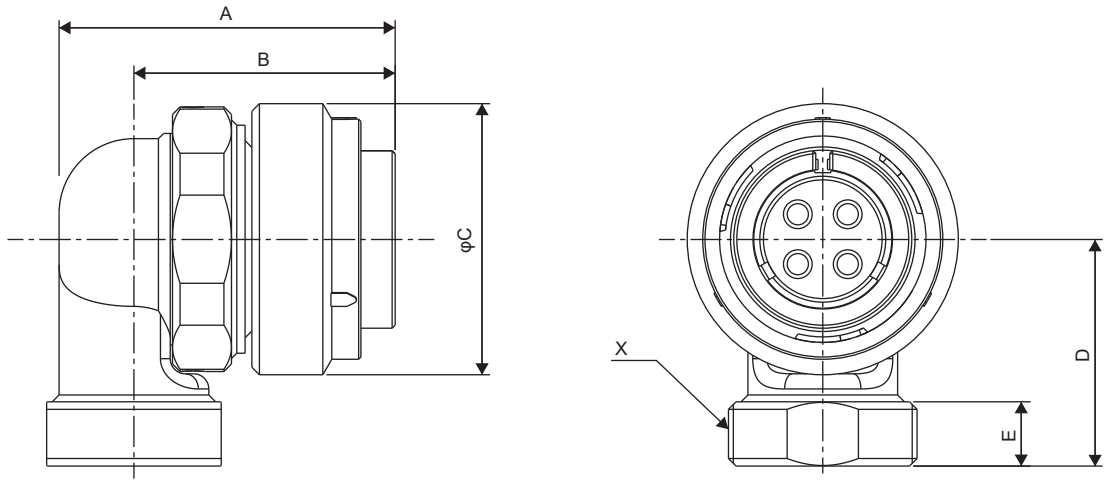




[Unit: mm]

Model	A	B	X
JL10-6A18-10SE-EB	51.05	35.85	1-20UNEF-2A
JL10-6A22-22SE-EB	58.65	42.2	1 3/16-18UNEF-2A

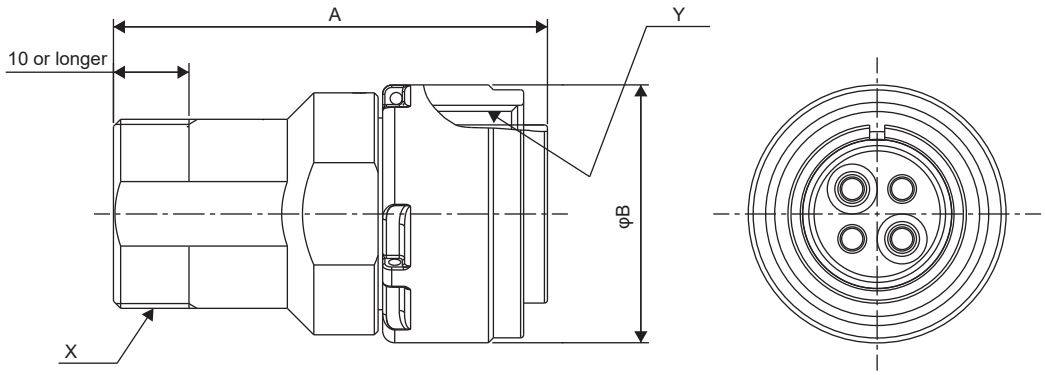
JL10-8A_-_SE-EB



[Unit: mm]

Model	A	B	C	D	E	X
JL10-8A18-10SE-EB	44.45	34.55	35.85	30	8.5	1-20UNEF-2A
JL10-8A22-22SE-EB	51.85	40.65	42.2	37.4	10	1 3/16-18UNEF-2A

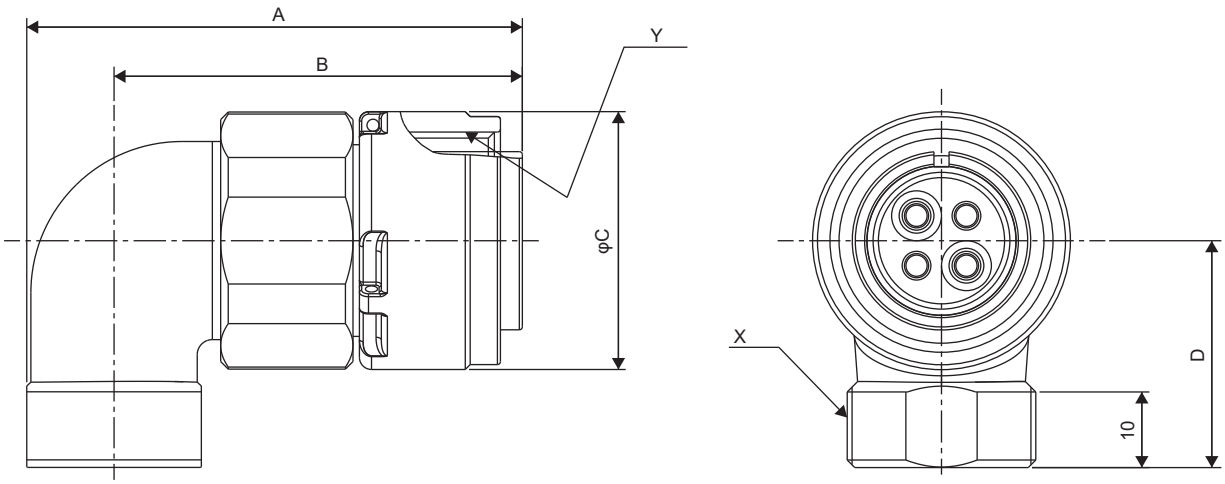
JL04V-6A_-_SE-EB-R



[Unit: mm]

Model	A	B	X	Y
JL04V-6A18-10SE-EB-R	57.4	34.1	1-20UNEF-2A	1 1/8-18UNEF-2B
JL04V-6A22-22SE-EB-R	67.63	40.5	1 3/16-18UNEF-2A	1 3/8-18UNEF-2B

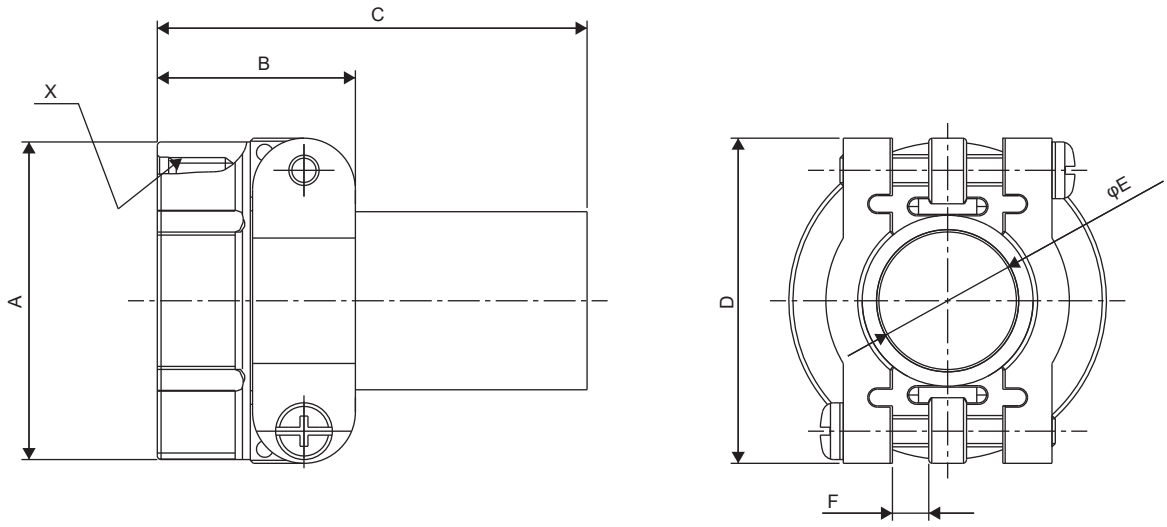
JL04V-8A_-_SE-EBH-R



[Unit: mm]

Model	A	B	C	D	X	Y
JL04V-8A18-10SE-EBH-R	65.6	54	34.1	30	1-20UNEF-2A	1 1/8-18UNEF-2B
JL04V-8A22-22SE-EBH-R	73	59	40.5	32	1 3/16-18UNEF-2A	1 3/8-18UNEF-2B

JL04-_CK(_)-_-R



[Unit: mm]

Model	Shell size	A	B	C	D	E	F	X	Cable OD (reference)
JL04-18CK(10)-_-R	18	30.2	24.1	53.8	31.8	11	3.2	1-20UNEF-2B	φ8 to 11
JL04-18CK(13)-_-R						14.1			φ11 to 14.1
JL04-2022CK(12)-_-R	22	34.9	24.3	53.8	37.3	13	4	1 3/16-18UNEF-2B	φ9.5 to 13
JL04-2022CK(14)-_-R						16			φ12.9 to 16

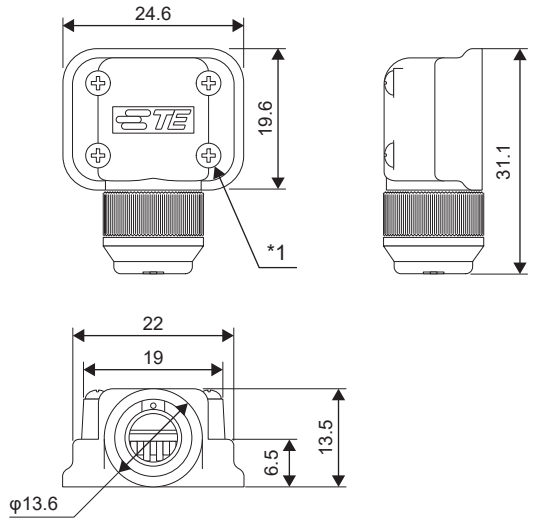
HG-KNS series/HG-SNS series

TE Connectivity

■2174053-1

Crimping tool: 1596970-1 (for ground clip)

1596847-1 (for receptacle contact)



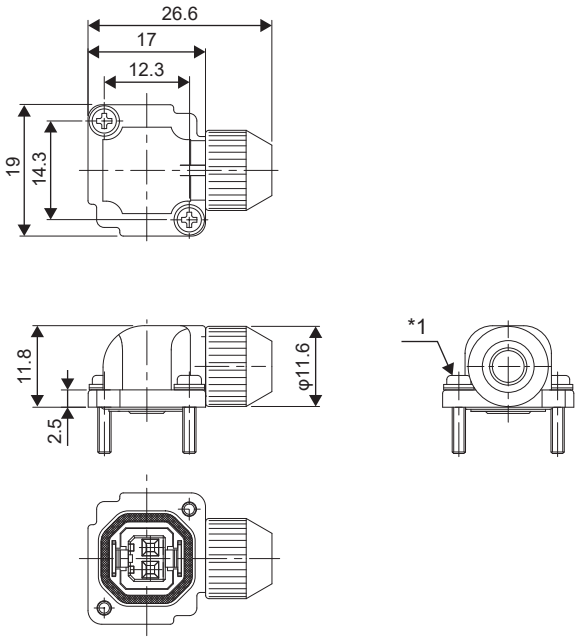
[Unit: mm]

*1 The recommended screw tightening torque is 0.1 N•m.

JAE

■JN4FT02SJ1-R

Crimping tool: CT170-14-TMH5B

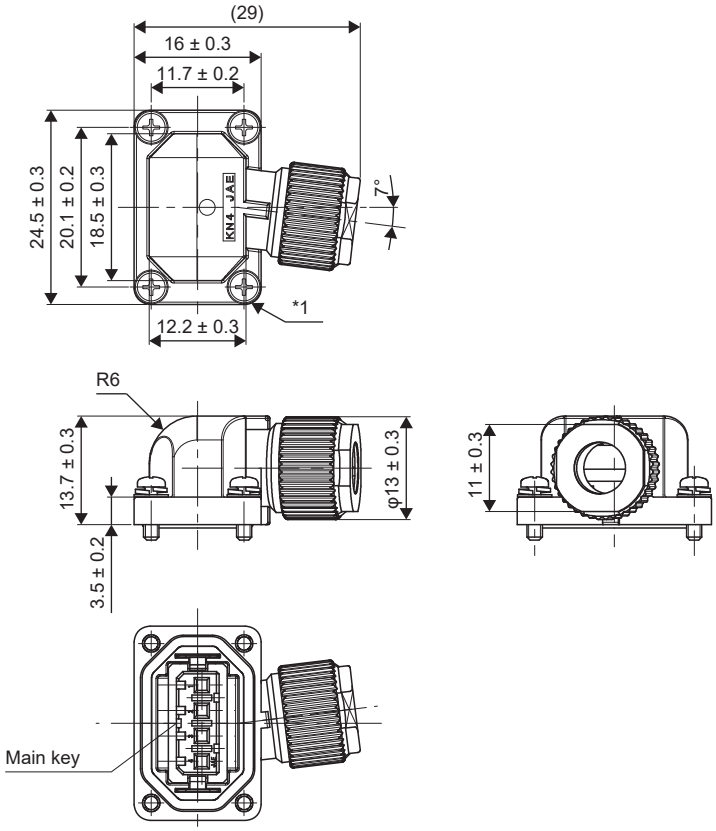


[Unit: mm]

*1 The recommended screw tightening torque is 0.2 N•m.

■KN4FT04SJ1-R

Crimping tool: CT170-14-TMH5B



[Unit: mm]

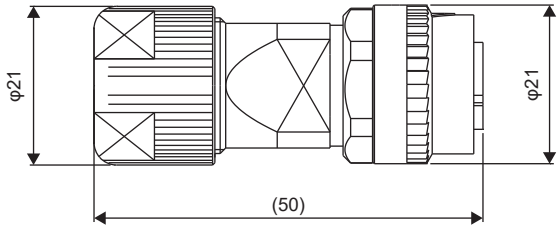
*1 The recommended screw tightening torque is 0.2 N•m.

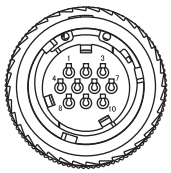
DDK

■CMV1-SP10S-M_/CMV1-SP2S-_

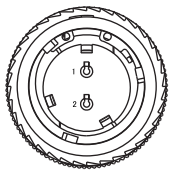
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





For CMV1-SP10S-M_



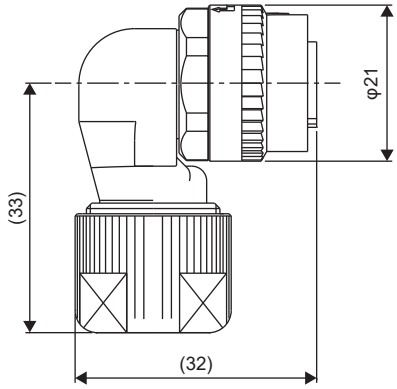
For CMV1-SP2S-_

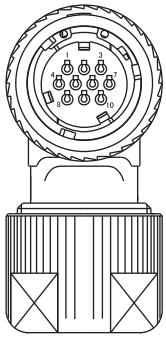
[Unit: mm]

■CMV1-AP10S-M_/CMV1-AP2S-_

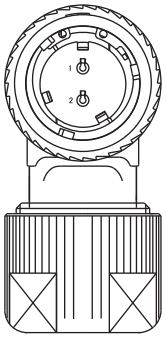
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





For CMV1-AP10S-M_



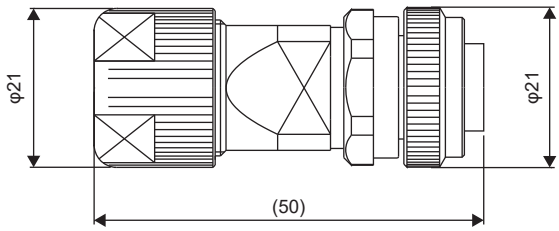
For CMV1-AP2S-_

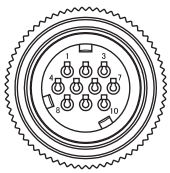
[Unit: mm]

■CMV1S-SP10S-M_/CMV1S-SP2S-_

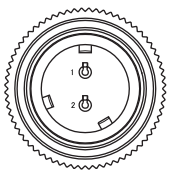
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





For CMV1S-SP10S-M_



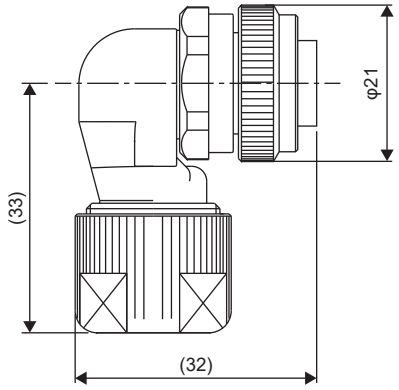
For CMV1S-SP2S-_

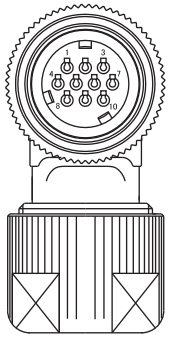
[Unit: mm]

■CMV1S-AP10S-M_/CMV1S-AP2S-_

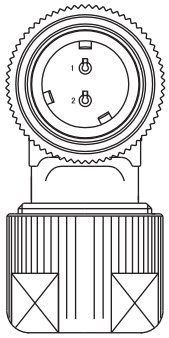
Refer to the following for details of the crimping tool.

☞ Page 28 Wiring connectors (connector configurations D/E/F/G/I/J)





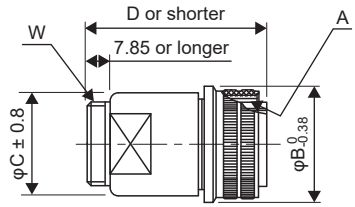
For CMV1S-AP10S-M_



For CMV1S-AP2S-_

[Unit: mm]

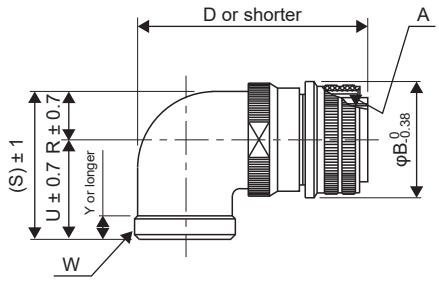
■CE05-6A_-_SD-D-BSS



[Unit: mm]

Model	A	B	C	D	W
CE05-6A18-10SD-D-BSS	1 1/8-18UNEF-2B	34.13	32.1	57	1-20UNEF-2A
CE05-6A22-22SD-D-BSS	1 3/8-18UNEF-2B	40.48	38.3	61	1 3/16-18UNEF-2A

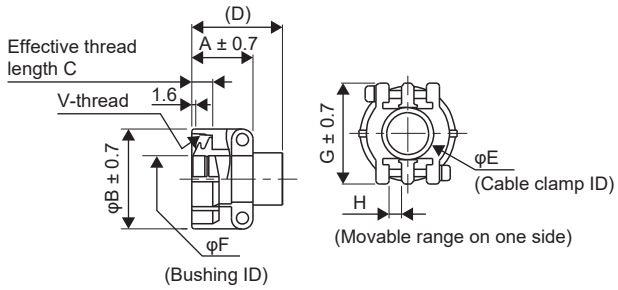
■CE05-8A_-_SD-D-BAS



[Unit: mm]

Model	A	B	D	W	R	U	(S)	Y
CE05-8A18-10SD-D-BAS	1 1/8-18UNEF-2B	34.13	69.5	1-20UNEF-2A	13.2	30.2	43.4	7.5
CE05-8A22-22SD-D-BAS	1 3/8-18UNEF-2B	40.48	75.5	1 3/16-18UNEF-2A	16.3	33.3	49.6	7.5

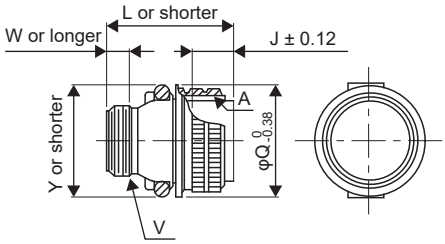
■CE3057-_A-_-D



[Unit: mm]

Model	Shell size	A	B	C	D	E	F	G	H	V	Bushing	Cable OD
CE3057-10A-1-D	18	23.8	30.1	10.3	41.3	15.9	14.1	31.7	3.2	1-20UNEF-2B	CE3420-10-1	10.5 to 14.1
CE3057-10A-2-D							11.0				CE3420-10-2	8.5 to 11
CE3057-12A-1-D	22	23.8	35	10.3	41.3	19	16.0	37.3	4.0	1 3/16-18UNEF-2B	CE342012-1	12.5 to 16
CE3057-12A-2-D							13.0				CE342012-2	9.5 to 13

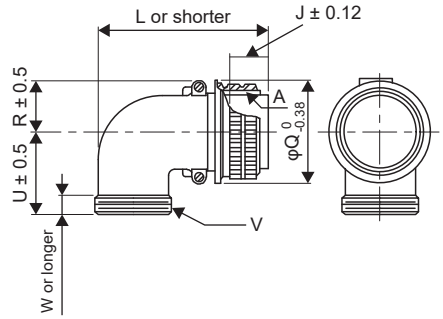
■D/MS3106B_-_S



[Unit: mm]

Model	A	J	L	Q	V	W	Y
D/MS3106B18-10S	1 1/8-18UNEF	18.26	52.37	34.13	1-20UNEF	9.53	42
D/MS3106B22-22S	1 3/8-18UNEF	18.26	56.57	40.48	1 3/16-18UNEF	9.53	50

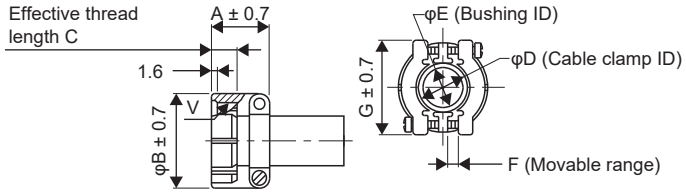
■D/MS3108B_-_S



[Unit: mm]

Model	A	J	L	Q	R	U	V	W
D/MS3108B18-10S	1 1/8-18UNEF	18.26	68.27	34.13	20.5	30.2	1-20UNEF	9.53
D/MS3108B22-22S	1 3/8-18UNEF	18.26	76.98	40.48	24.1	33.3	1 3/16-18UNEF-2A	9.53

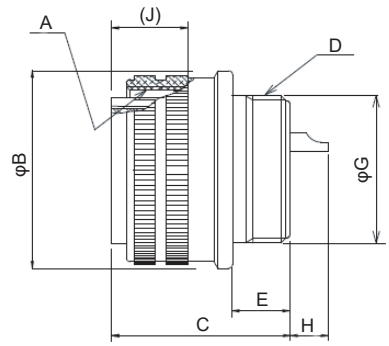
■D/MS3057-_A



[Unit: mm]

Model	Shell size	A	B	C	D	E	F	G	V	Bushing
D/MS3057-10A	18	23.8	30.1	10.3	15.9	14.3	3.2	31.7	1-20UNEF	AN3420-10
D/MS3057-12A	22	23.8	35.0	10.3	19.0	15.9	4.0	37.3	1 3/16-18UNEF-2A	AN3420-12

■CE05-6A32-17SD-D



[Unit: mm]

Model	A	B	C	D	E	G	H	J
CE05-6A32-17SD-D	2-18UNS-2B	56.33	37.0	1 7/8-16UN-2A	13.14	45.3	9.2	19.4

14.4 Fabrication of the encoder cable

Point

It is recommended to use options indicated in the following section for the encoder cable.

☞ Page 52 WIRING OPTION (HK-KN SERIES/HK-FN SERIES/HK-SN SERIES)
☞ Page 96 WIRING OPTION (HG-KNS SERIES/HG-SNS SERIES)

When fabricating an encoder cable, use the recommended products described in the following sections.

☞ Page 25 CONNECTORS USED FOR ROTARY SERVO MOTOR WIRING
☞ Page 34 CONNECTION OF SERVO AMPLIFIER AND ROTARY SERVO MOTOR
☞ Page 52 WIRING OPTION (HK-KN SERIES/HK-FN SERIES/HK-SN SERIES)
☞ Page 96 WIRING OPTION (HG-KNS SERIES/HG-SNS SERIES)

When fabricating encoder cables, note the descriptions in this section, in order to ensure the reliability of communication. Fabricate cables with the following procedure.

1. Selection of connectors

- Check the cable clamp size.

☞ Page 25 CONNECTORS USED FOR ROTARY SERVO MOTOR WIRING
☞ Page 34 CONNECTION OF SERVO AMPLIFIER AND ROTARY SERVO MOTOR

- Obtain the specification, wiring guide for the connector, and other documents from the manufacturer.
- Purchase assembly jigs and similar parts as necessary.

2. Selection of cables

- For the HK-KN series/HK-FN series/HK-SN series, select a recommended wire described in chapter 5. For the MR-J3ENSCBL_M-_ (10 m or less), a recommended wire or equivalent wires can be used.
- For the HG-KNS series/HG-SNS series, select a recommended wire or equivalent described in chapter 6.
- Select a shielded cable.
- Select a cable with a diameter that can be clamped with the connector cable clamp.
- Select a cable whose length, diameter, and bending life are appropriate.

3. Assembly of the cable

- Check the wiring guide of the connector manufacturer to connect the connector properly.
- Check internal wiring described in chapter 5 and 6 to connect it properly.
- Perform a shielding process on the encoder cable properly.
- Do not connect anything to unused pins.
- When wiring the CN2 side connector, connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
- When wiring the connector on the rotary servo motor-side, connect the external conductor of the shielded cable to the SHD terminal.
- Check if the pin arrangement is correct.
- Connect the twisted pair cable in correct combination.
- Check if the number of pairs of P5/LG wiring connected in parallel is correct.
- Fix the cable to the connector with a proper clamping torque.

4. Inspection

- After assembly, perform conduction, insulation, and other inspections to check if the connection is correct.
- Check the surface for scratches and contamination.
- Check the connector pins for a distortion, bending, dent, and other problems.
- Check the connector pins for foreign matter adhesion, contamination, and discoloration.

5. Complete

MEMO

REVISIONS

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

Revision date	*Manual number	Description
November 2019	IB(NA)-0300488ENG-A	First edition
October 2024	IB(NA)-0300488ENG-B	■HK-KN series servo motors are added. ■HK-FN series servo motors are added. ■HK-SN series servo motors are added. ■Added/edited: Section 1.1, Section 1.2, Section 1.3, Section 1.5, Section 1.6, Section 1.7, Section 2.1, Section 2.2, Section 2.7, Section 2.8, Section 2.10, Section 2.11, Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8, Chapter 9, Chapter 10, Section 11.1, Section 11.2, Section 12.1, Section 12.2, Section 12.6, Chapter 13, Chapter 14

WARRANTY

Warranty

1. Warranty period and coverage

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

[Term]

For terms of warranty, please contact your original place of purchase.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;

1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7. a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8. any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

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

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

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

6. Application and use of the Product

(1) For the use of our AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in AC Servo, and a backup or fail-safe function should operate on an external system to AC Servo when any failure or malfunction occurs.

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

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

TRADEMARKS

MELSERVO is a trademark or registered trademark of Mitsubishi Electric Corporation in Japan and/or other countries.
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