Oriental motor

HL-80002

DG Ⅱ Series

Hollow Rotary Actuator

OPERATING MANUAL

Thank you for purchasing an Oriental Motor product.
This Operating Manual describes product handling procedures and safety precautions.

- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

Table of contents

1 Introduction

1.1 Introduction

Only qualified personnel should work with the product. Use the product correctly after thoroughly reading the separate operating manual "Motorized Actuators BEFORE USING THE PRODUCT."
The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe the warning listed in the "BEFORE USING THE PRODUCT."

1.2 Notation on this manual

Note	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

1.3 Type and description for operating manuals

This document is an operating manual of hollow rotary actuators.
Before operating the hollow rotary actuator, it is necessary to set up the hollow rotary actuator and driver. Operating manuals enclosed with the product vary depending on the product type which has been purchased. Read the following operating manuals and follow the instructions.

Type of operating manual	Description	How to obtain
DGⅡ Series Hollow Rotary Actuator OPERATING MANUAL (this document)	This manual explains the installation of the hollow rotary actuator and load as well as the maintenance method and others.	Supplied with the product
Motorized Actuators BEFORE USING THE PRODUCT	This manual explains safety precautions for the motorized actuator.	Supplied with the product
Driver OPERATING MANUAL ∗1	This manual explains the function, installation method, connector pin assignment, safety precautions and others for the driver.	Supplied with the product
USER MANUAL ∗2	This manual explains the function, installation/connection method, operating method and others for the driver.	Supplied with the product (CD-ROM)

The motors of the **RK**Ⅱ Series or **AR** Series are used for the **DG**Ⅱ Series.

∗1 The Driver OPERATING MANUAL enclosed with the product varies depending on the motor that the actuator has equipped.

∗2 Refer to the USER MANUAL for the motor that the actuator has equipped.

1.4 Checking the product

Verify that the items listed below are included. Report any missing or damaged items to the branch or sales office from which you purchased the product.

When purchasing a hollow rotary actuator and driver package	When purchasing a hollow rotary actuator only
• Hollow rotary actuator • Driver • Motorized Actuators BEFORE USING THE PRODUCT • Hollow Rotary Actuator OPERATING MANUAL (this document) • Driver OPERATING MANUAL • USER MANUAL (CD-ROM) • Cable for motor	• Hollow rotary actuator • Motorized Actuators BEFORE USING THE PRODUCT • Hollow Rotary Actuator OPERATING MANUAL (this document)

1.5 How to identify the product model

■ Hollow rotary actuator and driver package model

- Light-duty type Models equipped the **RK**Ⅱ Series

Actuator type / Motor type / Driver type / Cable

D G 1 3 0 - **R K S A C D** - **3**

① ② ③ ④ ⑤ ⑥ ⑦

1	Series name	**DG**: **DG**Ⅱ Series
2	Frame size	**85**: 85 mm (3.35 in.) **130**: 130 mm (5.12 in.)
3	Motor	**RKS**: **RK**Ⅱ Series
4	Motor type	**A**: Single shaft
5	Power supply input	**A**: Single-phase 100-120 VAC **C**: Single-phase 200-240 VAC
6	Driver	**D**: Built-in controller type Blank: Pulse input type
7	Length of supplied cable	**1**: 1 m (3.3 ft.) **2**: 2 m (6.6 ft.) **3**: 3 m (9.8 ft.) Blank: Without cable

- Light-duty type/Standard type Models equipped the **AR** Series

Actuator type / Motor type / Driver type / Cable

D G 1 3 0 R - **A R A C D 2** - **3**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

1	Series name	**DG**: **DG**Ⅱ Series
2	Frame size	**60**: 60 mm (2.36 in.) **85**: 85 mm (3.35 in.) **130**: 130 mm (5.12 in.) **200**: 200 mm (7.87 in.)
3	Output table supporting bearing type	**R**: Cross-roller bearing Blank: Deep-groove ball bearing
4	Motor	**AR**: **AR** Series
5	Motor type	**A**: Single shaft **B**: Double shaft **M**: With electromagnetic brake
6	Power supply input	Built-in controller type **K**: 24 VDC **A**: Single-phase 100-120 VAC **C**: Single-phase 200-240 VAC Pulse input type **K**: 24 VDC **A**: Single-phase 100-115 VAC **C**: Single-phase 200-230 VAC **S**: Three-phase 200-230 VAC
7	Driver	**D**: Built-in controller type Blank: Pulse input type
8	Reference number	**2**: Combination with the ARD driver Blank: Combination with the LSD driver
9	Length of supplied cable	**1**: 1 m (3.3 ft.) **2**: 2 m (6.6 ft.) **3**: 3 m (9.8 ft.) Blank: Without cable

■ Hollow rotary actuator model

- Light-duty type Models equipped the **RK**Ⅱ Series

D G M 1 3 0 - 5 P K E A C

① ② ③ ④ ⑤

1	Series name	DGM: **DG**Ⅱ Series
2	Frame size	85: 85 mm (3.35 in.) 130: 130 mm (5.12 in.)
3	Motor	5PKE: 5-phase PKE motor
4	Motor type	A: Single shaft
5	Power supply input	C: AC power input

- Light-duty type/Standard type Models equipped the **AR** Series

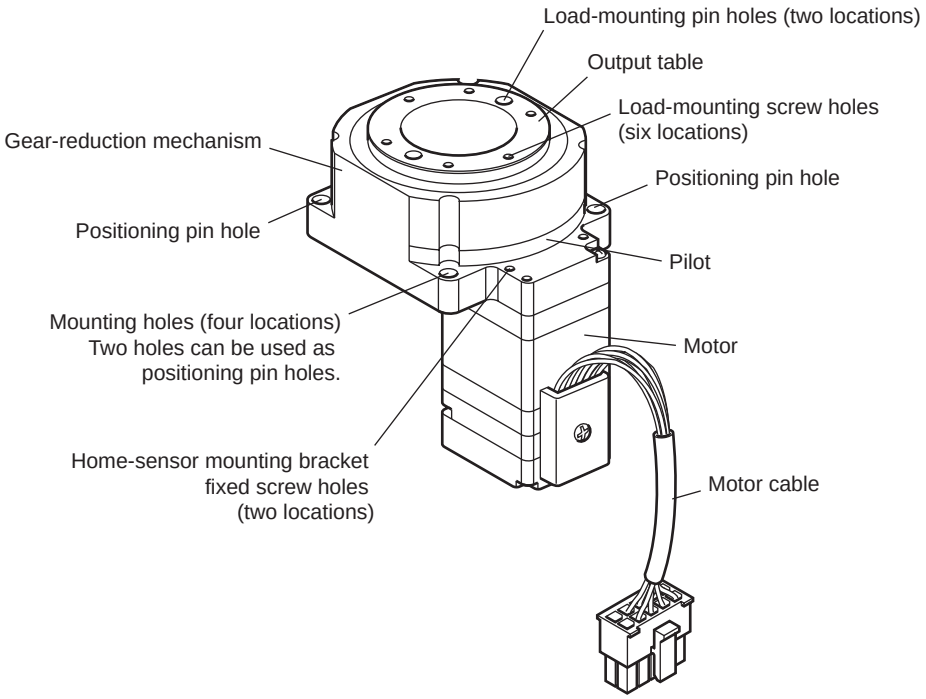
D G M 1 3 0 R - A R A C

① ② ③ ④ ⑤ ⑥

1	Series name	DGM: **DG**Ⅱ Series
2	Frame size	60: 60 mm (2.36 in.) 85: 85 mm (3.35 in.) 130: 130 mm (5.12 in.) 200: 200 mm (7.87 in.)
3	Output table supporting bearing type	R: Cross-roller bearing Blank: Deep-groove ball bearing
4	Motor	AR: AR Mortor
5	Motor type	A: Single shaft B: Double shaft M: With electromagnetic brake
6	Power supply input	K: DC power input C: AC power input

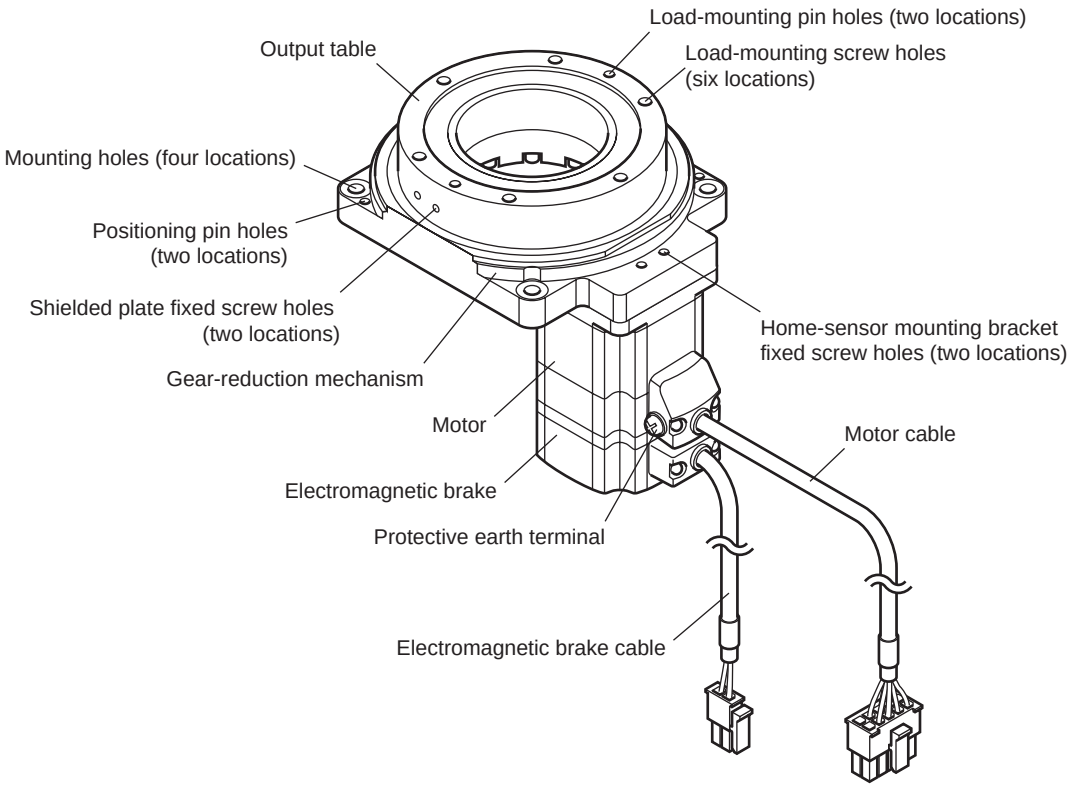
1.6 Names of parts

■ DG60



■ DG85, DG130, DG200

This figure shows the DGM130R-ARAC.



1.7 Precautions for use

- Operate the hollow rotary actuator below the permissible torque.

  Operating the product at torque outside the permissible torque range or keeping the output table locked may damage the gear-reduction mechanism. Be sure to operate the hollow rotary actuator below the permissible torque.

- Do not apply a moment load or axial load in excess of the specified permissible limit.

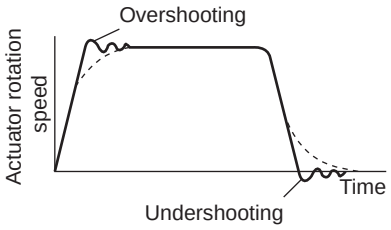
  Operating the hollow rotary actuator under an excessive moment load or axial load may damage the bearings. Be sure to operate the actuator below the specified permissible limits of the moment load and axial load.

- Do not make an impact with the hollow rotary actuator.

  Do not drop the hollow rotary actuator. Also, do not hit the motor or gear-reduction mechanism on something hard. Doing so may cause the positioning accuracy decrease, the motor section damage or the product service life reduction.

- Do not perform an operation to cause overshooting or undershooting.

  Operating the hollow rotary actuator under the condition that overshooting or undershooting occurs may cause damage to the gear-reduction mechanism. Review the operating condition or adjust the speed filter (built-in controller type only).



- M2.5 screw holes for installing the home-sensor set

  The M2.5 screw holes provided in the gear-reduction mechanism or output table side position of the hollow rotary actuator are used for installing the home-sensor set (sold separately). Do not use for any other purpose.

- Holding torque at standstill

  When the hollow rotary actuator stops, the holding torque of the output table will be reduced by the current cutback function of the driver. When selecting the hollow rotary actuator, make sure the holding torque at standstill by checking the catalog specification.

- Rated speed

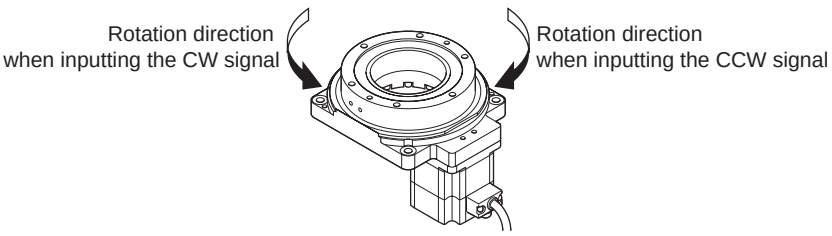
  Operate the hollow rotary actuator below the rated speed. The rated speed represents the rated speed (r/min) of the output table. Operating the hollow rotary actuator in excess of the rated speed may result in shorter service life.

- When the motor is the double shaft type

  The **DG**Ⅱ series includes models of the double shaft type for the motor. With these models, do not apply load torque, radial load or axial load to the back shaft of the motor.

- Rotation direction of hollow rotary actuator

  The rotation directions of the driver input signals (CW and CCW) are opposite the actual rotation directions of the output table. When the CW signal is input, the output table rotates in the counterclockwise direction. When the CCW signal is input, the output table rotates in the clockwise direction.



- Hollow hole section

  If the pipe or cable installed in the hollow hole section is rotated together with the output table, take measures not to rub or disconnect in contact with the inner wall of the hollow hole section.

2 Installation

2.1 Location for installation

The hollow rotary actuator has been designed and manufactured to be incorporated in general industrial equipment. Install it in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature
  When the home-sensor is not used：0 to +50 °C (+32 to +122 °F)（Non-freezing）
  When the home-sensor is used：0 to +40 °C (+32 to +104 °F)（Non-freezing）
- Operating ambient humidity: 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1000 m (3300 ft.) above sea level

2.2 Installation direction

The hollow rotary actuator can be installed in any direction.

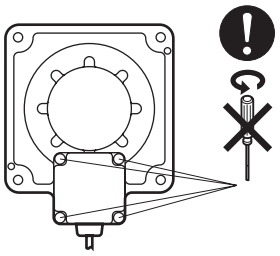
Note On rare occasions, a small amount of grease may ooze out from the hollow rotary actuator. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the user's equipment or products.

2.3 Installing the hollow rotary actuator

To prevent vibration, install the hollow rotary actuator on a metal surface of sufficient strength.

Note

- Do not diagonally insert or forcibly assemble the hollow rotary actuator into the hole in the mounting plate. The pilot section may be scratched, resulting in damage to the actuator.
- Do not loosen or remove the screws of the hollow rotary actuator. Doing so may cause the positioning accuracy to drop or damage to the actuator.



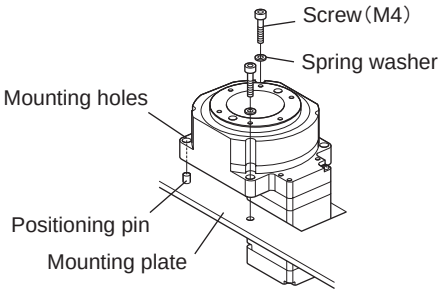
- Be sure the positioning pins are secured to the mounting plate. Driving the pins into the hollow rotary actuator may damage the actuator due to impact.
- Do not drop the hollow rotary actuator. Also, do not hit the motor or gear-reduction mechanism on something hard. Doing so may cause the positioning accuracy decrease, the motor section damage or the product service life reduction.

■ DG60

- When installing from above the mounting plate

Provide a motor relief hole in the mounting plate.
The figure illustrates the use of two mounting holes for accurate positioning in combination with the positioning pins.
All four mounting holes can be used to secure the actuator to the mounting plate with screws.

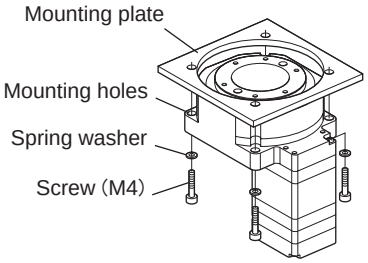
When an accessory mounting base (sold separately) is used, the motor relief hole is not required.



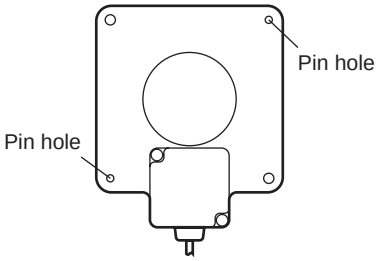
- When installing from below the mounting plate

Fit the pilot section of the actuator into the pilot-receiving cutout.

Note When an accessory home-sensor set (sold separately) is used, the actuator cannot be installed from below the mounting plate.



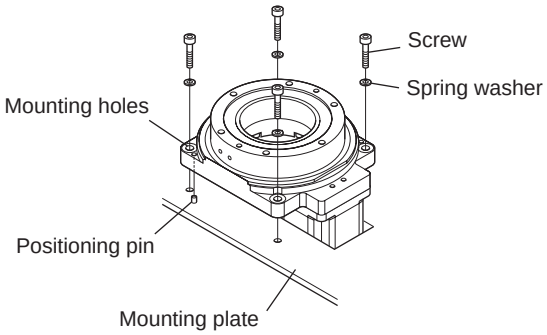
- Positioning pin holes (when viewing from the mounting face of the hollow rotary actuator)



Screw size	M4
Tightening torque [N·m (oz-in)]	2 (280)
Mounting plate thickness [mm (in.)]	5 (0.20) or more
Material of mounting plate	Steel plate or aluminum plate
Pin hole [mm (in.)]	Ø5 $^{+0.012}_{0}$ (H7) (Ø0.1969 $^{+0.0005}_{0}$)
Pin hole depth [mm (in.)]	10 (0.39), Through hole

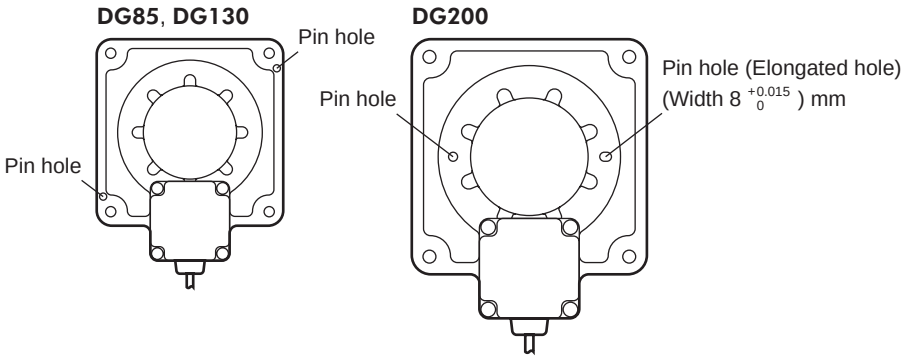
■ DG85, DG130, DG200

Install the hollow rotary actuator onto the mounting plate from the direction shown in the figure. Using four mounting holes, secure the hollow rotary actuator with screws on the mounting plate. Provide a motor relief hole in the mounting plate. In the case of **DG85** and **DG130** types, the motor relief hole does not required when an accessory mounting base (sold separately) is used. The positioning pin holes are provided on the mounting face of the hollow rotary actuator. Use these positioning pin holes to determine the actuator position to be installed in the equipment by the positioning pins.



Note The **DG85**, **DG130** and **DG200** types cannot be installed from below the mounting plate.

- Positioning pin holes (when viewing from the mounting face of the hollow rotary actuator)



Model	Output table supporting bearing	Screw size	Tightening torque [N·m (lb-in)]	Mounting plate thickness [mm (in.)]	Material of mounting plate	Pin hole diameter [mm (in.)]	Pin hole depth [mm (in.)]
DG85	Deep-groove ball bearing	M6	6 (53)	8 (0.31) or more	Steel or aluminum	Ø5 +0.012 0 (H7) (Ø0.1969 +0.0005 0)	10.5 (0.41), Through hole
DG85R	Cross-roller bearing						
DG130	Deep-groove ball bearing	M8	13 (115)	10 (0.39) or more			12 (0.47), Through hole
DG130R	Cross-roller bearing						
DG200R	Cross-roller bearing	M10	25 (220)	15 (0.59) or more		Ø8 +0.015 0 (H7) (Ø0.3150 +0.0006 0)	8 (0.31), blind hole

2.4 How to install a load

Install a load with screws using the load-mounting screw holes (six locations) onto the output table.
The load-mounting pin holes (two locations) are provided in the output table. Use these holes to determine the position of the load by the positioning pins.

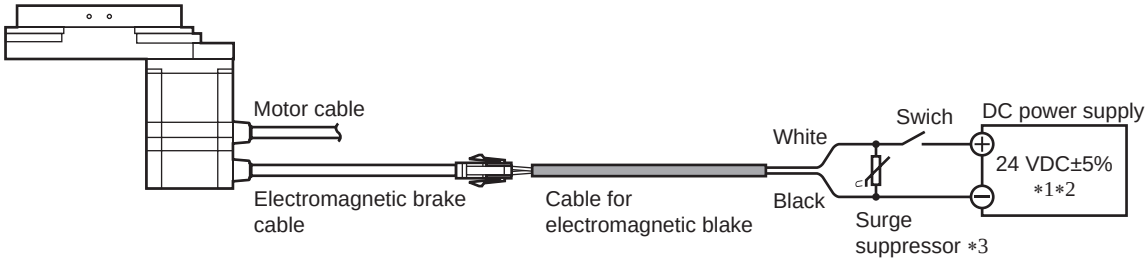
Model	Output table supporting bearing	Screw size	Tightening torque [N·m (oz-in)]	Effective depth of screw [mm (in.)]	Material of load	Pin hole diameter [mm (in.)]	Pin hole depth [mm (in.)]
DG60	Deep-groove ball bearing	M3	1 (142)	8 (0.31)	Steel or aluminum	Ø5 +0.012 0 (H7) (Ø0.1969 +0.0005 0)	6 (0.24)
DG85	Deep-groove ball bearing	M4	2 (280)	6 (0.24)			
DG85R	Cross-roller bearing			8 (0.31)			
DG130	Deep-groove ball bearing	M5	3.5 (490)	8 (0.31)			
DG130R	Cross-roller bearing						
DG200R	Cross-roller bearing	M6	6 (850)	10 (0.39)		Ø8 +0.015 0 (H7) (Ø0.3150 +0.0006 0)	8 (0.31)

Note Be sure the positioning pins are secured to the load. Driving the pins into the output table may damage the bearing due to impact or an excessive moment of inertia.

■ When the electromagnetic brake type is used (Models equipped the AR Series)

When the hollow rotary actuator with an electromagnetic brake is used, the table cannot move unless the electromagnetic brake is released. To release the electromagnetic brake, a DC power supply is required.

1. Connect the "electromagnetic brake cable" and supplied "cable for electromagnetic brake."
2. Connect the 24 VDC power supply to "cable for electromagnetic brake." Connect the white lead wire to the +24 VDC terminal, and the black lead wire to the GND terminal.
   When turning on the power, the electromagnetic brake will be released and the table will be able to move by hand.



∗1 Power supply capacity 0.3 A or more
∗2 If the distance between a hollow rotary actuator with an electromagnetic brake and driver is extended to 20 m (65.6 ft.) or longer, use a power supply of 24±4% VDC.
∗3 Provide the surge suppressor to protect the contact of the switch or to prevent electrical noise. [Recommended surge suppressor: Z15D121 (SEMITEC Corporation)]

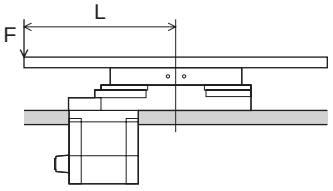
2.5 Permissible moment load, permissible axial load

The permissible moment load and permissible axial load should not exceed the permissible value specified in the table below.

Model	Output table supporting bearing	Permissible moment load [N·m (lb-in.)]	Permissible axial load [N (lb.)]
DG60	Deep-groove ball bearing	2 (17.7)	100 (22)
DG85	Deep-groove ball bearing	6 (53)	200 (45)
DG85R	Cross-roller bearing	10 (88)	500 (112)
DG130	Deep-groove ball bearing	20 (177)	300 (67)
DG130R	Cross-roller bearing	50 (440)	2000 (450)
DG200R	Cross-roller bearing	100 (880)	4000 (900)

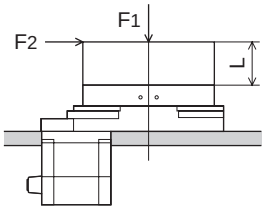
Example 1: When external force F is applied at distance L from the center of the output table

Moment load [N·m (lb-in)]: M = F × L
Axial load [N (lb.)]: Fs = F + load mass × g (gravitational acceleration)



Example 2: When external forces F1 and F2 are applied at distance L from the mounting face of the output table

Moment load [N·m (lb-in)]: M = F2 × (L + a)
Axial load [N (lb.)]: Fs = F1 + mass of jig and load × g (gravitational acceleration)



Model	**DG60**	**DG85**	**DG85R**	**DG130**	**DG130R**	**DG200R**
Output table supporting bearing	Deep-groove ball bearing	Deep-groove ball bearing	Cross-roller bearing	Deep-groove ball bearing	Cross-roller bearing	Cross-roller bearing
a [m (in.)]	0.01 (0.39)	0.015 (0.59)	0.02 (0.79)	0.016 (0.63)	0.03 (1.18)	0.04 (1.57)

3 Connection

3.1 Connecting the driver

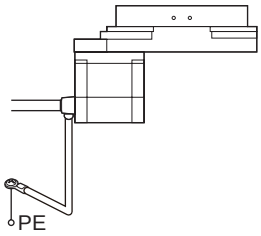
Refer to the Driver OPERATING MANUAL or USER MANUAL for connection method.

3.2 Grounding the hollow rotary actuator

Securely ground the protective earth terminal of the motor (screw size: M4).

- Grounding wire : AWG18 (0.75 mm^2) or more
- Tightening torque : 1.2 N·m (170 oz-in)

When grounding use a round terminal and secure it with a screw over an inner clip washer. A grounding wire and crimp terminal do not come with the hollow rotary actuator.



3.3 Connection for home-sensor set

Installation method of an accessory home-sensor set (sold separately) and connection method of the driver are explained here.
Refer to the Driver OPERATING MANUAL for details.

■ Home-sensor set description

The following parts are used for the accessory home-sensor set.

Sensor type	For **DG60**	For **DG85**, **DG130** and **DG200** type
NPN output	• Home-sensor set model : **PADG-SA** • Photomicrosensor model : EE-SX672A (OMRON Corporation)	• Home-sensor set model : **PADG-SB** • Photomicrosensor model : EE-SX673A (OMRON Corporation)
PNP output	• Home-sensor set model : **PADG-SAY** • Photomicrosensor model EE-SX672R (OMRON Corporation)	• Home-sensor set model : **PADG-SBY** • Photomicrosensor model : EE-SX673R (OMRON Corporation)

- Photomicrosensor.....1 pc
- Flexible cable with connector.....1 pc
  EE-1010-R (OMRON Corporation) length 2 m (6.6 ft.)
- Sensor mounting bracket.....1 pc
- Shielded plate.....1 pc
- Screw (M3, spring washer, plain washer).....2 pc
- Hexagonal socket head screw (M2.5).....4 pc

■ Installing the sensor

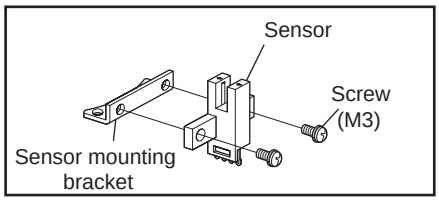
Note

- Do not install the home-sensor set while the power is being supplied. Doing so may result in injury or damage to equipment.
- Be sure to install the sensor and shielded plate in the direction shown in the figure. Installing them in the wrong direction may disable sensor detection or cause the shielded plate to contact the sensor, resulting in sensor damage.
- When installing the sensor bracket and shielded plate to the actuator, be sure to use the supplied screws.

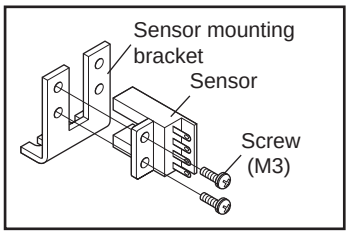
1. Secure the sensor to the sensor bracket using the supplied screws (M3 × 2).
   Tightening torque : 0.6 N·m (85 oz-in)

   For the **DG85**, **DG130** and **DG200** types, the screw holes are provided on two places (right and left) of the sensor bracket. The sensor can be installed to either of the screw holes (right or left).
   Install it to the position in which an indicating light can be seen.

DG60

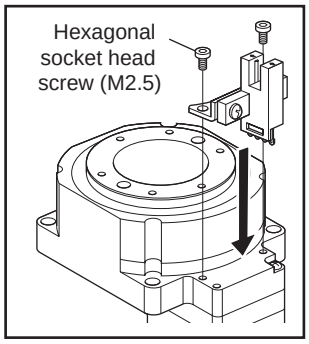


DG85, 130, 200

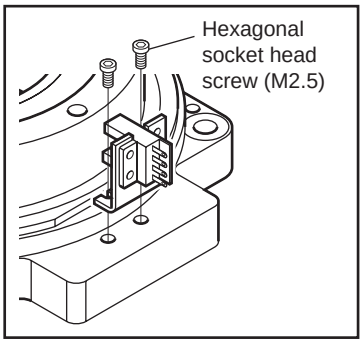


2. Secure the bracket and sensor assembly to the gear-reduction mechanism of the actuator using the supplied hexagonal socket head screws (M2.5 × 2).
Tightening torque : 0.5 N·m (71 oz-in)

DG60



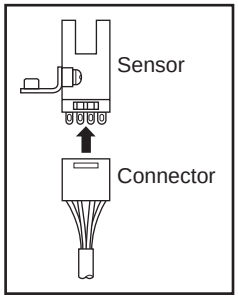
DG85, 130, 200



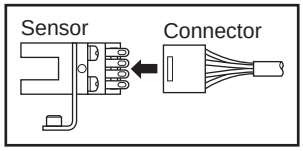
Note Do not use the screw holes (M2.5) for the home-sensor of the actuator for any other purpose.

3. Connect the flexible cable with connector to the sensor.

DG60



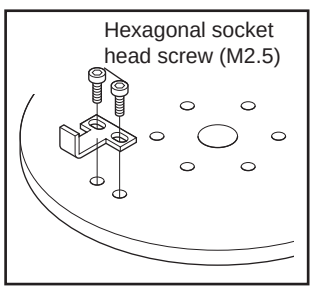
DG85, 130, 200



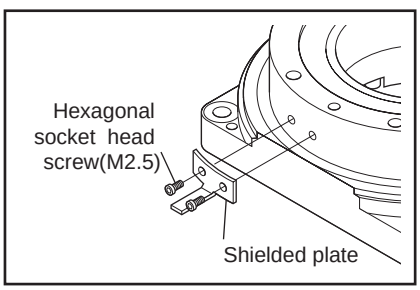
Note
- Do not connect or remove the flexible cable with connector while the power is being supplied. Doing so may cause damage to the sensor.
- When removing the flexible cable with connector, pull out the connector while pressing it firmly from the top and bottom.
- Wire the flexible cable in such a way that it will not contact the actuator.

4. Secure the shielded plate using the supplied hexagonal socket head screws (M2.5 × 2).
For the **DG60** type, secure the shielded plate to the load.
For the **DG85**, **DG130** and **DG200** types, secure the shielded plate to the output table.
Tightening torque : 0.5 N·m (71 oz-in)

DG60

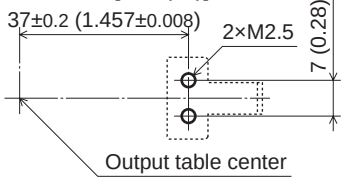


DG85, 130, 200

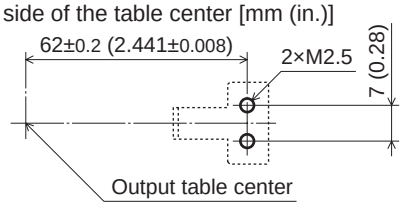


5. In the case of the **DG60** type, secure the load being attached the shielded plate onto the output table. Machining dimensions of shielded plate for installation (for the **DG60** type only)

- When providing mounting holes on the table center side [mm (in.)]



- When providing mounting holes on the opposite side of the table center [mm (in.)]



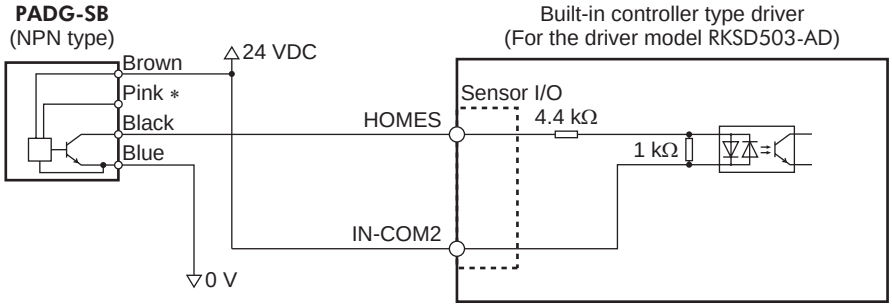
Note

- The photomicrosensor is designed for use inside equipment and therefore has no special means of protection against disturbance light. If the actuator is to be used under an incandescent lamp or in conditions that are subject to disturbances from external light, provide the means to prevent such interference.
- Use the product after checking the sensor is installed securely.
- Place the power cables such as the motor cable or power supply cable as far apart as possible from the sensor cable. If the power cables and signal cables have to cross, cross them at a right angle.
- To prevent sensor deterioration due to heat, operate the actuator in conditions where the ambient operating temperature keeps at 0 to +40 °C (+32 to +104 °F) and the motor surface temperature does not exceed 90 °C (194 °F).
- Adhesion of dust on the sensor may cause actuator malfunction. Clean and/or replace the sensor regularly.
- Use a common GND for the sensor power and user's controller power. Any difference in GND potential will result in a sensor malfunction.

■ Connection example for the home-sensor set PADG-SB (NPN type)

The connection example is shown based on the following conditions.

- Return-to-home mode: 3-sensor mode
- HOMES output logic: Normally open

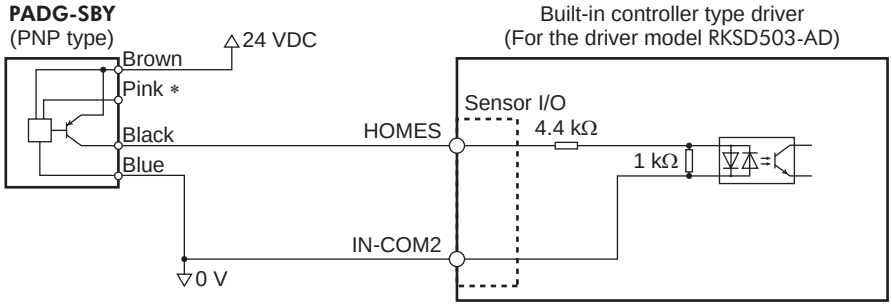


* The logic of the sensor varies depending on the connection method. When the pink color lead is connected to the brown color lead, the sensor logic will be "normally closed."

■ Connection example for the home-sensor set PADG-SBY (PNP type)

The connection example is shown based on the following conditions.

- Return-to-home mode: 3-sensor mode
- HOMES output logic: Normally open



* The logic of the sensor varies depending on the connection method. When the pink color lead is connected to the brown color lead, the sensor logic will be "normally closed."

4 Maintenance

This chapter explains the maintenance items in order to operate a hollow rotary actuator safely and efficiently. If an abnormal condition is noted on the hollow rotary actuator, discontinue any use and contact your nearest Oriental Motor sales office.

4.1 Inspection item and timing

If the hollow rotary actuator is operated eight hours a day, perform maintenance according to the applicable period specified in the table below.
Reduce maintenance intervals accordingly if the operating rate is high such as continuous operation for twenty-four hours.

Maintenance timing	External inspection
When operated for the first time	○
Six months after initial operation	○
Every six months thereafter	○

■ External inspection

Check the items specified in table below.

Item	Description	Remedial action
Hollow rotary actuator	• Are there any loose screws which have mounted the hollow rotary actuator? • Are there any loose screws which have mounted the load?	Tighten the screws securely.
Cables	• Are there any scratches or areas under stress on the cable? • Are there any loose connections on the actuator or driver?	Disconnect and reconnect the connector or replace the cable.
Operation	Is there any abnormal noise or vibration from the bearings, etc.?	Check the installation of the load and operation speed again.

■ External cleaning

- Clean the exterior surface of the hollow rotary actuator whenever necessary.
- Wipe off any dirt and stains using a soft cloth.
- Do not apply compressed air.
- Dust may enter through gaps.
- Do not use petroleum solvents, since they will damage the coated surface.
- To remove stubborn stains, wipe the area using a soft cloth moistened with neutral detergent.

5 Standard, general specifications

5.1 Standard

■ UL Standard and CSA Standard

The motors of the **DG** Ⅱ Series that are combined with the **AR** Series AC power input type drivers are recognized by UL under the UL/CSA standards (except for the DGM200R-ARMC).

Applied Standards

Applied Standards	Certification Body	File No.
UL 1004-1, UL 1004-2, UL 1004-6 CSA C22.2 No.100, CSA C22.2 No.77	UL	E64199

AR series motor (AC power input type) is recognized under UL 1004-1, UL 1004-6 based on the condition shown herein.
The following table shows the stepping motor specifications (maximum voltage, maximum current, holding torque and maximum speed).

Specifications

Motor model ∗1	Maximum voltage [V]	Maximum current [A]	Heat sink size [mm (in.)] ∗2	Holding torque [N·m (oz-in)]	Maximum speed [r/min]
ARM46□C	340	0.49	115×115×5 (4.53×4.53×0.2)	0.3 (42)	4000
ARM66□C		0.74	250×250×6 (9.84×9.84×0.24)	1.2 (170)	
ARM911□C		1.27		4 (560)	

□: Enter the motor type "A" (standard/single shaft), "B" (standard/double shaft) or "M" (with electromagnetic brake) in the box (□) within the model name.
∗1 All models may or may not be followed by a hyphen and any letters and/or any numbers.
∗2 The material of the heat sink is aluminum.

■ EU Directives

- CE MARKING

The motors of the **DG** Ⅱ Series that are combined with the **AR** Series AC power input type drivers are affixed the CE Marking under the Low Voltage Directive and EMC Directive.

Low Voltage Directive

Applied Standards	EN 60034-1, EN 60034-5, EN 60664-1

- This product is certified by TÜV Rheinland under the EN 60034-1 (except for the DGM200R-ARMC).
- Securely ground the protective earth terminal of the motor.

■ Hazardous substances

The products do not contain the substances exceeding the restriction values of RoHS Directive (2011/65/EU).

5.2 General specifications

■ Installation conditions

The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment.

	Models equipped the **RK**Ⅱ Series	Models equipped the **AR** Series	
Input power supply	AC power supply	DC power supply	AC power supply
Overvoltage category	Ⅱ		
Protection against electric shock	Class Ⅰ appliance		
Pollution degree	2		
Degree of protection	Single shaft: IP40 (IP20 for the motor connector)	• Single shaft: IP40 (IP20 for the motor connector) • Double shaft: IP20	• Single shaft, with electromagnetic brake: IP40 (IP20 for the motor connector) • Double shaft: IP20

■ Environmental conditions

	Operating environment	Storage environment	Shipping environment
Ambient temperature	When the home-sensor is not used: 0 to +50 °C (+32 to 122 °F) (Non-freezing) When the home-sensor is used: 0 to +40 °C (+32 to +104 °F) (Non-freezing)	−20 to +60 °C (−4 to 140°F) (When the home-sensor is not used)	
Ambient humidity	85% or less (Non-condensing)		
Altitude	Up to 1000 m (3300 ft.) above sea level	Up to 3000 m (10000 ft.) above sea level	Up to 3000 m (10000 ft.) above sea level

6 Before starting operation

6.1 Setting for operating the hollow rotary actuator

The following calculation is required for setting the minimum step angle to the driver.

■ Minimum step angle

The minimum step angle can be changed using the driver parameters (electronic gear A, electronic gear B) or switches.

Note The minimum step angle of the output table is a theoretical value.

● Models equipped the RKⅡ Series

- Setting example of parameters (driver model: RKSD50□-AD, RKSD50□-CD)

The minimum step angle can be set using the driver parameters (electronic gear A, electronic gear B).
The following calculation is required when setting the minimum step angle of the output table to 0.1 (°).
(The output table of the hollow rotary actuator is gear ratio 18.)

$$\text{Minimum step angle of output table (°)} = \frac{360\ (°)}{18\ (\text{Gear ratio}) \times 500^{*} \times \left(\frac{\text{Electronic gear B}}{\text{Electronic gear A}}\right)} = 0.1\ (°)$$

∗ 500:5-phase stepping motor

$\frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{2}{5}$ When setting the minimum step angle of the output table to 0.1 (°), set the electronic gear A to 5 and the electronic gear B to 2.

- Setting example of driver switches (driver model: RKSD50□-A, RKSD50□-C)

Using both the step angle setting switch (STEP) and function setting switch (SW1), the minimum step angle from among the 32 preset levels can be set.
(The output table of the hollow rotary actuator is gear ratio 18.)

$$\text{Minimum step angle of output table (°)} = \frac{\text{Motor step angle (°)}}{18\ (\text{Gear ratio})}$$

See the following tables for the step angles that can be set.

• Function setting switch (SW1) : When setting to R1

Step angle setting switch (STEP) dial setting	Minimum step angle of output table [°]	Motor resolution [P/R]	Motor step angle [°]
0	0.04	500	0.72
1	0.02	1000	0.36
2	0.016	1250	0.288
3	0.01	2000	0.18
4	0.008	2500	0.144
5	0.005	4000	0.09
6	0.004	5000	0.072
7	0.002	10000	0.036
8	0.0016	12500	0.0288
9	0.001	20000	0.018
A	0.0008	25000	0.0144
B	0.0005	40000	0.009
C	0.0004	50000	0.0072
D	0.00032	62500	0.00576
E	0.0002	100000	0.0036
F	0.00016	125000	0.00288

• Function setting switch (SW1) : When setting to R2

Step angle setting switch (STEP) dial setting	Minimum step angle of output table [°]	Motor resolution [P/R]	Motor step angle [°]
0	0.1	200	1.8
1	0.05	400	0.9
2	$\frac{0.6}{18}$ (0.0333…)	600	0.6
3	0.025	800	0.45
4	$\frac{0.3}{18}$ (0.0166…)	1200	0.3
5	0.0125	1600	0.225
6	0.00625	3200	0.1125
7	$\frac{0.06}{18}$ (0.00333…)	6000	0.06
8	0.003125	6400	0.05625
9	$\frac{0.05}{18}$ (0.00277…)	7200	0.05
A	0.0025	8000	0.045
B	$\frac{0.03}{18}$ (0.00166…)	12000	0.03
C	0.0015625	12800	0.028125
D	0.00125	16000	0.0225
E	0.00078125	25600	0.0140625
F	0.0001	200000	0.0018

● **Models equipped the AR Series**

• Setting example of parameters

The minimum step angle can be set using the driver parameters (electronic gear A, electronic gear B).
The following calculation is required when setting the minimum step angle of the output table to 0.1 (°).
(The output table of the hollow rotary actuator is gear ratio 18.)

$$\text{Minimum step angle of output table (°)} = \frac{360\ (°)}{18\ (\text{Gear ratio}) \times 1000^{*} \times \left(\frac{\text{Electronic gear B}}{\text{Electronic gear A}}\right)} = 0.1\ (°)$$

∗ 1000: **AR** Motor

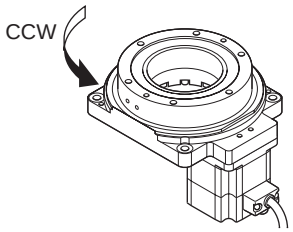
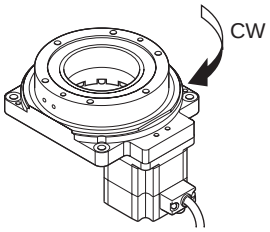
$\frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{1}{5}$ When setting the minimum step angle of the output table to 0.1 (°), set the electronic gear A to 5 and the electronic gear B to 1.

6.2 Rotation direction of output table

The rotation direction of the output table is set as follows at the time of shipment.

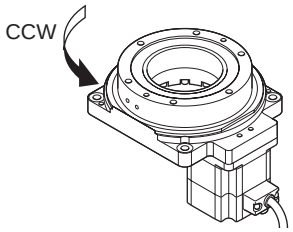
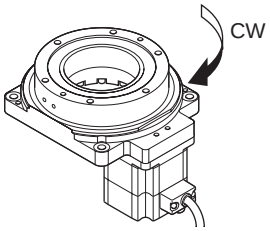
■ Built-in controller type

The rotation direction varies depending on the setting of plus/minus for the step angle.

	Rotation direction of output table
When setting the step angle to the plus side	
When setting the step angle to the minus side	

■ Pulse input type

The rotation direction varies depending on the input method of the pulse signal.

	Rotation direction of output table
• 2-pulse input mode When inputting the pulse signal to the CW input • 1-pulse input mode When inputting the pulse signal to the PLS input while the DIR input is OFF	
• 2-pulse input mode When inputting the pulse signal to the CCW input • 1-pulse input mode When inputting the pulse signal to the PLS input while the DIR input is ON	

6.3 Data setter, data setting software

The minimum step angle or operation data can be set using an accessory data setter **OPX-2A** (sold separately) or data setting software **MEXE02**.
Provide it if necessary. (except for the **RK Ⅱ** Series pulse input type drivers RKSD50□-A and RKSD50□-C).

■ Notes about using the data setter OPX-2A

The **OPX-2A** can be used to save operation data and parameters in addition to setting them.
Data can be saved (uploaded) by a driver basis. The saved data can be written to drivers which model names are the same. Refer to the operating manual of the **OPX-2A** for details.

■ Notes about using the data setting software MEXE02

Create or edit data using the **MEXE02** after selecting the series name of the equipped motor or the driver model name.

- For the **DG Ⅱ** Series which equipped the **AR** Series, there are two types of products: One is the product combined the LSD driver (driver model: LSD-○○), and the other is the product combined the ARD driver (driver model: ARD-○○). When setting operation data or parameters to the driver using the **MEXE02**, select the product series from the product selection screen based on the table below. If you have any questions, contact your nearest Oriental Motor sales office.

Driver	**MEXE02** version	Series to be selected
LSD driver	2.6	**DG Ⅱ** ／ **EAS**
	3.00 or later	**AR**
ARD driver	2.6	**AR**
	3.00 or later	**AR**

- Data can be saved by a driver basis. It is possible to read or write data among drivers which model names are the same.

6.4 Parameter setting list

■ RKSD50□-AD, RKSD50□-CD

A setting example of the parameter when setting the minimum step angle to 0.1° is shown below. ▒ represents parameters to be changed.

Setting item		Setting example	Initial value ∗
Step angle per revolution [°]		360	360
Resolution (minimum step angle [°])		3600 (0.1)	9000 (0.04)
Gear ratio		18	18
Coordination	Electronic gear A	5	1
	Electronic gear B	2	1
	Motor rotation direction	Positive direction=CCW (The output table rotates in the CW direction)	Positive direction=CW (The output table rotates in the CCW direction)

∗ The values are the factory setting data or initialized data.

■ ARD-□D, ARD-□, LSD-□D, LSD-□

Setting item		Setting example	Initial value ∗1
Step angle per revolution [°]		360	360
Resolution (minimum step angle [°])		3600 (0.1)	18000 (0.02)
Gear ratio		18	18
Electronic gear	Electronic gear A1 ∗2	5	10
	Electronic gear B	1	10
Operation setting	Motor rotation direction	Positive direction=CCW (The output table rotates in the CW direction)	Positive direction=CW (The output table rotates in the CCW direction)

∗1 The values are the factory setting data or initialized data.
∗2 The electronic gear A1 will be the electronic gear "A" for the driver model ARD-□D.

6.5 Power supply current capacity

■ DC power input type

Model	Hollow rotary actuator model	Driver		
		Driver model	Power supply input voltage	Power supply current capacity
DG60-ARAK○-○	DGM60-ARAK	ARD-K, LSD-K	DC24 V±10%	0.9 A or more
DG60-ARAKD○-○	DGM60-ARAK	ARD-KD, LSD-KD	DC24 V±5%	1.3 A or more

■ AC power input type

- Models equipped the **RK**Ⅱ Series

Model	Hollow rotary actuator model	Driver			Control power supply
		Driver model	Power supply input voltage	Power supply current capacity	DC24 V
DG85-RKSAA-○	DGM85-5PKEAC	RKSD503-A	Single-phase 100-120 VAC −15 to +10%	1.9 A or more	—
DG130-RKSAA-○	DGM130-5PKEAC	RKSD507-A		3.8 A or more	
DG85-RKSAC-○	DGM85-5PKEAC	RKSD503-C	Single-phase 200-240 VAC −15 to +10%	1.2 A or more	
DG130-RKSAC-○	DGM130-5PKEAC	RKSD507-C		2.4 A or more	
DG85-RKSAAD-○	DGM85-5PKEAC	RKSD503-AD	Single-phase 100-120 VAC −15 to +10%	1.9 A or more	24 VDC ±5% ∗ 0.7 A or more
DG130-RKSAAD-○	DGM130-5PKEAC	RKSD507-AD		3.8 A or more	
DG85-RKSACD-○	DGM85-5PKEAC	RKSD503-CD	Single-phase 200-240 VAC −15 to +10%	1.2 A or more	
DG130-RKSACD-○	DGM130-5PKEAC	RKSD507-CD		2.4 A or more	

∗ If the distance between a hollow rotary actuator and driver is extended to 15 m (49.2 ft.) or longer, use a power supply of 24 VDC±4%.

- Models equipped the **AR** Series

Model	Hollow rotary actuator model	Driver			Control power supply
		Driver model	Power supply input voltage	Power supply current capacity	24VDC
DG85R-AR○A○-○	DGM85R-AR○C	ARD-A LSD-A	Single-phase 100-115 VAC −15 to +10%	2.9 A or more	24 VDC ±5% ∗1∗3 0.75 A or more
DG130R-AR○A○-○	DGM130R-AR○C			4.4 A or more	
DG200R-AR○A○-○	DGM200R-AR○C			6.5 A or more	
DG85R-AR○C○-○	DGM85R-AR○C	ARD-C LSD-C	Single-phase 200-230 VAC −15 to +10%	1.9 A or more	
DG130R-AR○C○-○	DGM130R-AR○C			2.7 A or more	
DG200R-AR○C○-○	DGM200R-AR○C			4.1 A or more	
DG85R-AR○S○-○	DGM85R-AR○C	ARD-S LSD-S	Three-phase 200-230 VAC −15 to +10%	1.0 A or more	
DG130R-AR○S○-○	DGM130R-AR○C			1.4 A or more	
DG200R-AR○S○-○	DGM200R-AR○C			2.2 A or more	
DG85R-AR○AD○-○	DGM85R-AR○C	ARD-AD LSD-AD	Single-phase 100-120 VAC −15 to +6%	2.4 A or more	24 VDC±5% ∗2∗3 0.5 A or more
DG130R-AR○AD○-○	DGM130R-AR○C			3.6 A or more	
DG200R-AR○AD○-○	DGM200R-AR○C			5.9 A or more	
DG85R-AR○CD○-○	DGM85R-AR○C	ARD-CD LSD-CD	Single-phase 200-240 VAC −15 to +6%	1.5 A or more	
DG130R-AR○CD○-○	DGM130R-AR○C			2.3 A or more	
DG200R-AR○CD○-○	DGM200R-AR○C			3.7 A or more	

∗1 If a hollow rotary actuator with an electromagnetic brake is used, be sure to connect a 24 VDC power supply as the electromagnetic brake power.

∗2 The 24 VDC power supply is the power supply for the control circuit. Be sure to connect it.

∗3 If the distance between a hollow rotary actuator and driver is extended to 20 m (65.6 ft.) or longer, use a power supply of 24±4% VDC.

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