



**ROBO Cylinder
RCS2 Actuator
Rotary
Hollow Rotary**

Operating Manual



Fifth Edition



Rotary, RT6, RT6R, RT7R
Hollow Rotary, RTC8L, RTC8HL, RTC10L, RTC12L

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

This Operation Manual describes all necessary information to operate this product safely such as the operation procedure, structure and maintenance procedure.

Before operation, read this manual carefully and fully understand it to operate this product safely. The enclosed DVD in this product package includes the Operation Manual for this product.

For the operation of this product, print out the necessary sections in the Operation Manual or display them using the personal computer.

After reading through this manual, keep this Operation Manual at hand so that the operator of this product can read it whenever necessary.

[Important]

- This Operation Manual is original.
- The product cannot be operated in any way unless expressly specified in this Operation Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Operation Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
- Using or copying all or part of this Operation Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

RC ROBO
CYLINDER

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Safety Guide

“Safety Guide” has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	<ul style="list-style-type: none"> ● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. <ol style="list-style-type: none"> 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. <ol style="list-style-type: none"> 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	<ul style="list-style-type: none"> ● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the operation manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	<ul style="list-style-type: none"> ● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	<p>(1) Installation of Robot Main Body and Controller, etc.</p> <ul style="list-style-type: none"> ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. <ol style="list-style-type: none"> 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	<p>(2) Cable Wiring</p> <ul style="list-style-type: none"> ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire. <p>(3) Grounding</p> <ul style="list-style-type: none"> ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm² (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).





No.	Operation Description	Description
4	Installation and Start	<p>(4) Safety Measures</p> <ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	<ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>

No.	Operation Description	Description
6	Trial Operation	<ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	<ul style="list-style-type: none"> ● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	<ul style="list-style-type: none"> ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Operation Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. <p>Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>
9	Modification and Dismantle	<ul style="list-style-type: none"> ● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	<ul style="list-style-type: none"> ● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	<ul style="list-style-type: none"> ● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated operation manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Operation Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

Handling Precautions

1. Do not set speeds and accelerations/decelerations exceeding the respective ratings.

Do not set speeds and accelerations/decelerations exceeding the respective ratings. It may lead to vibration, failure, or shorter life.

2. Keep the inertial moment, load moment and thrust load within their respective allowable values.

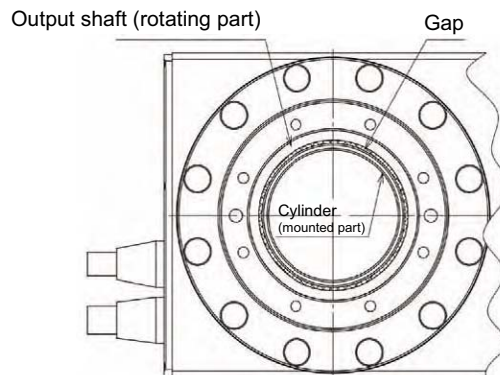
Keep the inertial moment, load moment and thrust load within their respective allowable values. If a load is applied that generates an inertial moment, load moment or thrust load exceeding its allowable value, the life of the actuator may become shorter.

3. Do not operate the hollow rotary actuator repeatedly within a small range, as it may cause grease to shift to and remain in certain areas.

If the hollow rotary actuator is operated repeatedly within a small range, grease may shift to and remain in certain areas and a uniform coating of all areas will be lost. As a result, grease lubrication problems may occur.

4. Do not let foreign matters enter between the output shaft (rotating part) and cylinder (mounted part) of the hollow rotary actuator.

There is a gap of 1 mm between the output shaft (rotating part) and cylinder (mounted part) (see the figure below), so do not let foreign matters, etc., enter this space. It may cause the actuator to fail.



5. Do not let the cylinder of the hollow rotary actuator receive a large load.

The cylinder is made of a thin-walled pipe.

So that the cylinder will not receive a large load, design a tool to be installed on the output shaft or take other appropriate measure.

6. Whenever possible, use the RTC8L and RTC8HL types at speeds of 100 deg/s or more.

If these actuators are operated at low speeds below 100 deg/s, the actuators will move slightly as they move.

Even when the operating speed is low, however, vibration will decrease as the speed increases in the low-speed range. Check the actual vibration level at the speeds you intend to use.

Take note that the larger the tool, the greater the vibration becomes at ends.

7. Transportation

7.1 Handling the Packed Actuator

When transporting the packed actuator, exercise due caution not to apply impact on the package by dropping it or hitting it against other object.

- A person should never attempt to carry a heavy package on his own.
- When setting down the package temporarily, keep it horizontal.
- Do not step onto the package.
- Do not place on the package a heavy object that may deform the package or article of a shape that allows the load to be concentrated in one area.

7.2 Handling the Unpacked Actuator

Once the actuator is unpacked, handle the actuator by its frame.

- When transporting the actuator, be careful not to hit it against other object. In particular, pay attention to the output shaft and cover.
- Do not apply an excessive force to the various parts of the actuator. Pay special attention to the cables.
- When unpacking the actuator, exercise due caution not to drop the actuator. It may cause injury or damage the machine.
- Should you find any part of the actuator missing or damaged during transportation, please contact an IAI Sales Representative immediately.

International Standards Compliances

This actuator complies with the following overseas standard.

Refer to Overseas Standard Compliance Manual (ME0287) for more detailed information.

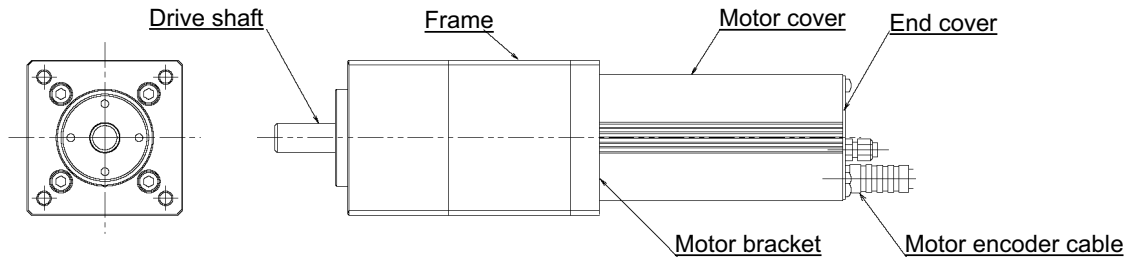
RoHS Directive	CE Marking
<input type="radio"/>	Optional

Names of the Parts

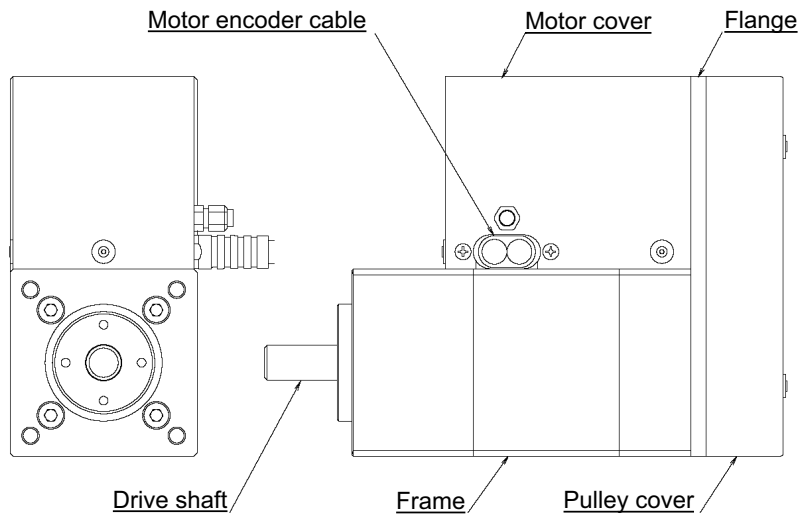
The name of each part of the actuator is shown as follows.

1. Rotary

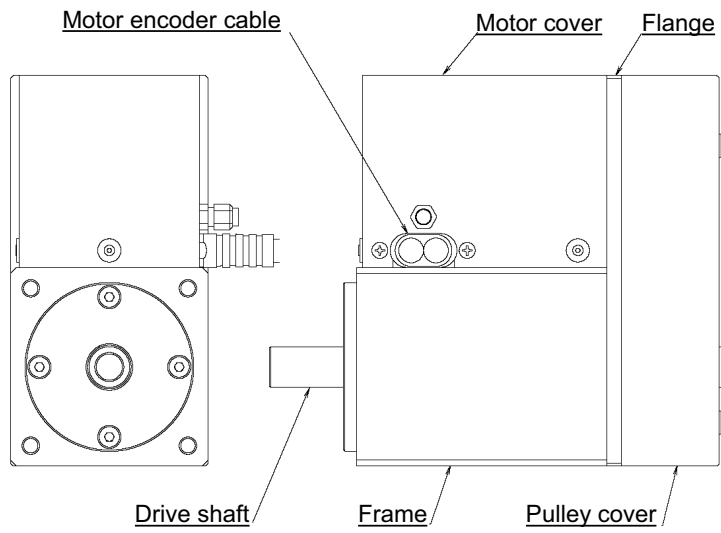
1.1 RT6



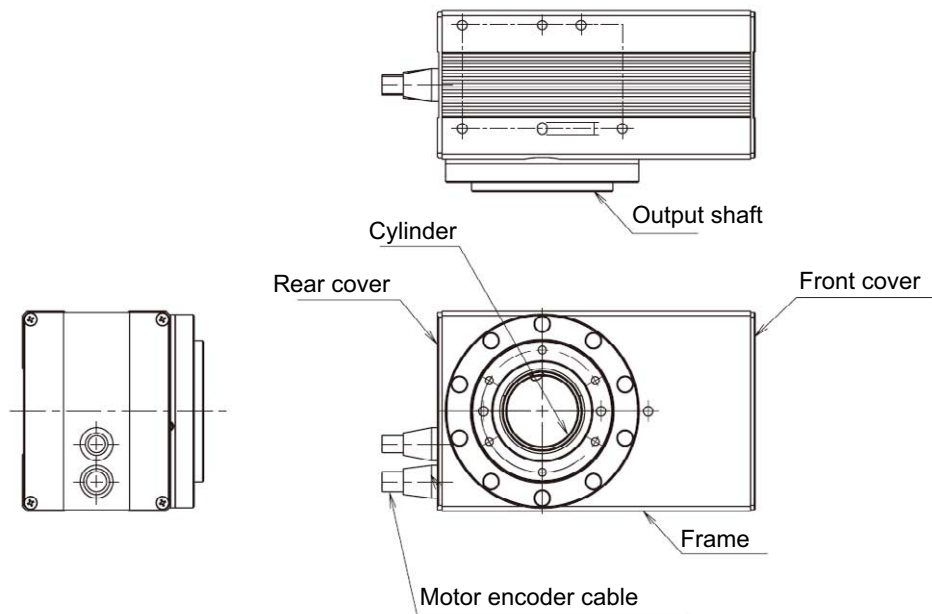
1.2 RT6R



1.3 RT7R




2. Hollow Rotary



1. Checking the Product

This product, if of a standard configuration, consists of the items specified below.

 **Caution:** Check the items included in the package by referring to the packing slip. Should you find any item missing or bearing a wrong model number, please contact IAI or your IAI dealer.

1.1 Components

No.	Item	Model number	Remarks
1	Actuator	Refer to "How to Read the Nameplate" and "How to Read the Model Number."	
Accessories			
2	Motor/encoder cables ^{*1}		
3	Quick Step Guide		
4	Operation Manual (DVD)		
5	Safety Guide		

*1 The motor cable and encoder cable supplied with the actuator vary depending on the actuator model and the controller used. [Refer to 9, "Motor/Encoder Cables."]

1.2 Operation Manuals for Controllers Relating to This Product

(1) XSEL-J/K controllers

(Note) The hollow rotary actuators cannot be operated with XSEL-J/K controllers.

No.	Name	Control number
1	Operation Manual for XSEL-J/K Controller	ME0116
2	Operation Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
3	Operation Manual for Teaching Pendant SEL-T/TD/TG	ME0183
4	Operation Manual for Teaching Pendant IA-T-X/XD	ME0160
5	Operation Manual for DeviceNet	ME0124
6	Operation Manual for CC-Link	ME0123
7	Operation Manual for PROFIBUS	ME0153
8	Operation Manual for X-SEL Ethernet	ME0140
9	Operation Manual for Multi-point I/O Board	ME0138
10	Operation Manual for Dedicated Multi-point I/O Board Terminal Block	ME0139

(2) XSEL-P/Q controllers

No.	Name	Control number
1	Operation Manual for XSEL-P/Q Controller	ME0148
2	Operation Manual for XSEL-P/Q/PX/QX - RC Gateway Function	ME0188
3	Operation Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
4	Operation Manual for Teaching Pendant SEL-T/TD/TG	ME0183
5	Operation Manual for Teaching Pendant IA-T-X/XD	ME0160
6	Operation Manual for DeviceNet	ME0124
7	Operation Manual for CC-Link	ME0123
8	Operation Manual for PROFIBUS	ME0153

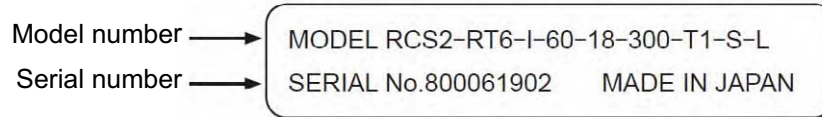
(3) SSEL controllers

No.	Name	Control number
1	Operation Manual for SSEL Controller	ME0157
2	Operation Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
3	Operation Manual for Teaching Pendant SEL-T/TD/TG	ME0183
4	Operation Manual for Teaching Pendant IA-T-X/XD	ME0160
5	Operation Manual for DeviceNet	ME0124
6	Operation Manual for CC-Link	ME0123
7	Operation Manual for PROFIBUS	ME0153

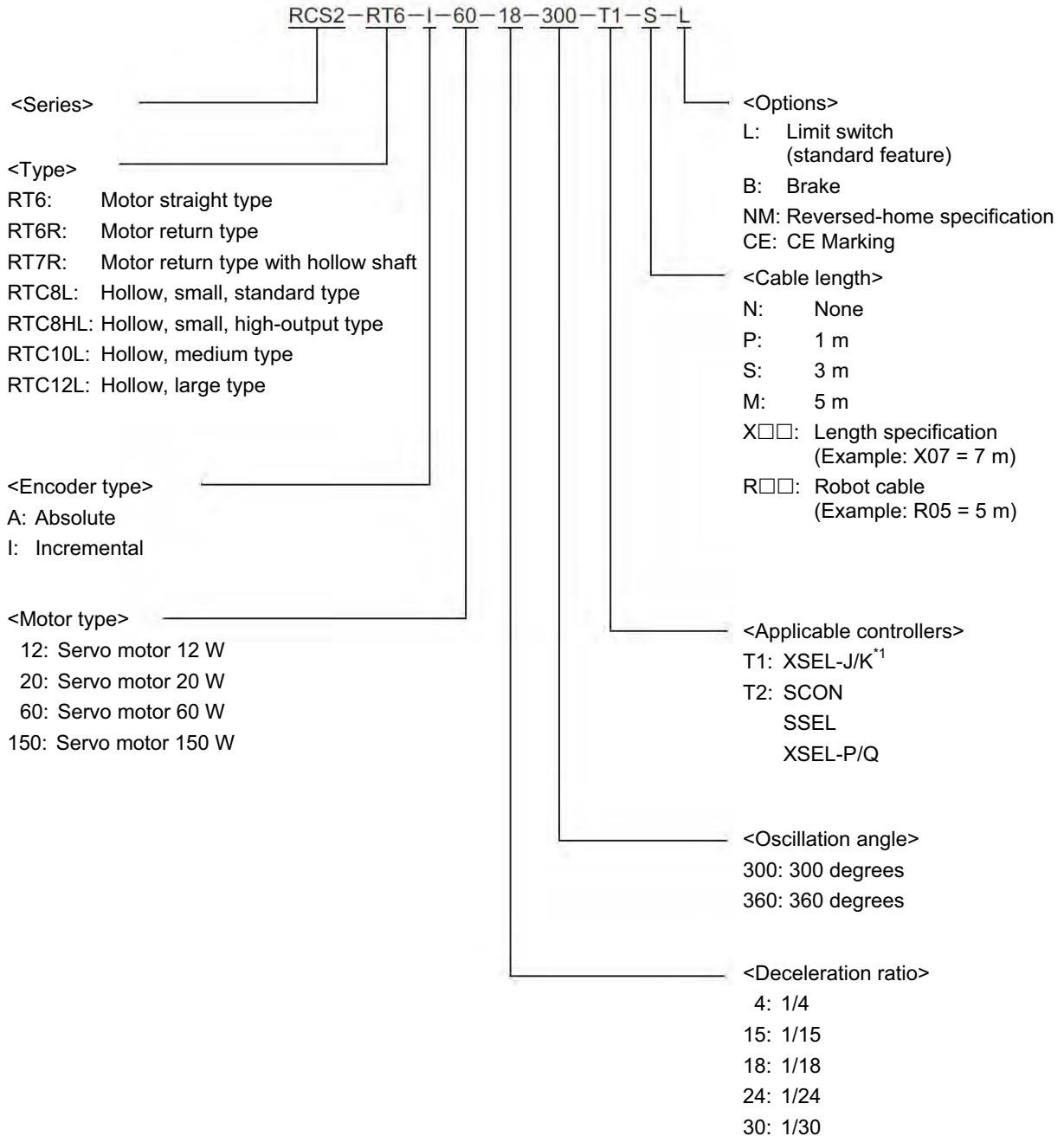
(4) SCON controllers

No.	Name	Control number
1	Operation Manual for SCON Controller	ME0161
2	Operation Manual for PC Software RCM-101-MW/RCM-101-USB	ME0155
3	Operation Manual for Teaching Pendant CON-T/TG	ME0178
4	Operation Manual for Teaching Pendant RCM-T/TD	ME0173
5	Operation Manual for Simple Teaching Pendant RCM-E	ME0174
6	Operation Manual for Data Setter RCM-P	ME0175
7	Operation Manual for Touch Panel Display RCM-PM-01	ME0182
8	Operation Manual for DeviceNet	ME0124
9	Operation Manual for CC-Link	ME0123
10	Operation Manual for PROFIBUS	ME0153

1.3 How to Read the Nameplate



1.4 How to Read the Model Number



*1 The hollow rotary actuators cannot be operated with XSEL-J/K controllers.

2. Specifications

2.1 Rotary

	RT6	RT6R	RT7R
Deceleration ratio	1/18		1/4
Oscillation angle	300 deg		
Maximum speed	500 deg/s		
Rated acceleration	0.3 G		
Rated Torque	2.4 N•m		0.764 N•m
Allowable inertial moment	2.5 × 10 ⁻² kg•m ² Max.		1.25 × 10 ⁻³ kg•m ² Max.
Driving System	Ball Speed Reducer	Ball Speed Reducer + Timing Belt	Timing Belt
Positioning Accuracy Repeatability	±0.02 mm		
Backlash	0.1 deg Max.		0.1 deg Max.
Allowable load moment/	6.8 N•m Max.		8.9 N•m Max.
Thruster Load	100 N Max.		
Encoder pulse count ^{*1}	16384		16384

*1 Number of pulses input to the controller.

2.2 Hollow Rotary

	RTC8L	RTC8HL	
Deceleration ratio	1/24	1/15	1/24
Oscillation angle	0 to 359.99 deg	0 to 359.99 deg	
Maximum speed	750 deg/s	1200 deg/s	750 deg/s
Acceleration	0.1 G to 0.3 G	0.1 G to 0.3 G	
Output torque	0.55 N•m	0.53 N•m	0.85 N•m
Allowable inertial moment	0.011 kg•m ² Max.	0.010 kg•m ² Max.	0.017 kg•m ² Max.
Driving System	Timing belt + Hypoid gear	Timing belt + Hypoid gear	
Positioning Accuracy Repeatability	±0.005 deg	±0.005 deg	
Backlash	±0.05 deg Max.	±0.05 deg Max.	
Allowable load moment/	5 N•m	5 N•m	
Thruster Load	400 N Max.	400 N Max.	
Encoder pulse count* ¹	16384	16384	

*1 Number of pulses input to the controller.

	RTC10L		RTC12L	
Deceleration ratio	1/15	1/24	1/18	1/30
Oscillation angle	0 to 359.99 deg		0 to 359.99 deg	
Maximum speed	1200 deg/s	750 deg/s	800 deg/s	600 deg/s
Acceleration	0.1 G to 0.3 G		0.1 G to 0.3 G	
Output torque	1.7 N•m	2.8 N•m	5.2 N•m	8.6 N•m
Allowable inertial moment	0.033 kg•m ² Max.	0.054 kg•m ² Max.	0.10 kg•m ² Max.	0.17 kg•m ² Max.
Driving System	Timing belt + Hypoid gear		Timing belt + Hypoid gear	
Positioning Accuracy Repeatability	±0.005 deg		±0.005 deg	
Backlash	±0.05 deg Max.		±0.05 deg Max.	
Allowable load moment/	10 N•m		25 N•m	
Thruster Load	600 N Max.		800 N Max.	
Encoder pulse count* ¹	16384		16384	

*1 Number of pulses input to the controller.

3. Installation Environment, Storage/Preservation Environment

3.1 Installation Environment

Install the actuator in an environment meeting the conditions listed below.

- not be exposed to direct sunlight.
- be free from irradiating heat coming from a heat treatment furnace or other equipment that generates a large amount of heat.
- have surrounding air temperature of 0 to 40°C.
- have humidity of 85% or below (non-condensing).
- be free from corrosive or flammable gases.
- be free from excessive dust and suitable for normal assembly work.
- be free from oil mist or cutting oil.
- be free from impact or vibration.
- be free from strong electromagnetic field, ultraviolet light or radiation.
- Chemical resistance is not considered in the design of this product.

In general, the actuator should be used in an environment where the operators can work without wearing any protective equipment or gear.

3.2 Storage Environment/Preservation

The storage/preservation environment conforms to the installation environment. If the robot is to be stored/preserved for a prolonged period of time, be sure the robot will not be exposed to condensation. Unless otherwise specified, desiccant is not placed in the carton when shipped. If the robot is to be stored/preserved in an environment subject to condensation, provide preventive measures from over the carton or directly to the robot after unpacking.

The maximum storage/preservation temperature is 60°C for a short storage period. If the robot is to be stored/preserved for more than a month, the temperature should not exceed 50°C.

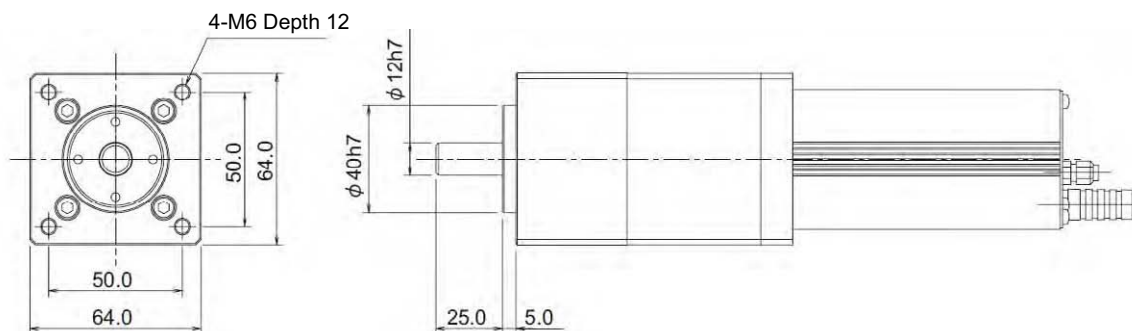
4. Installation


4.1 Rotary Type

4.1.1 Installing the Actuator

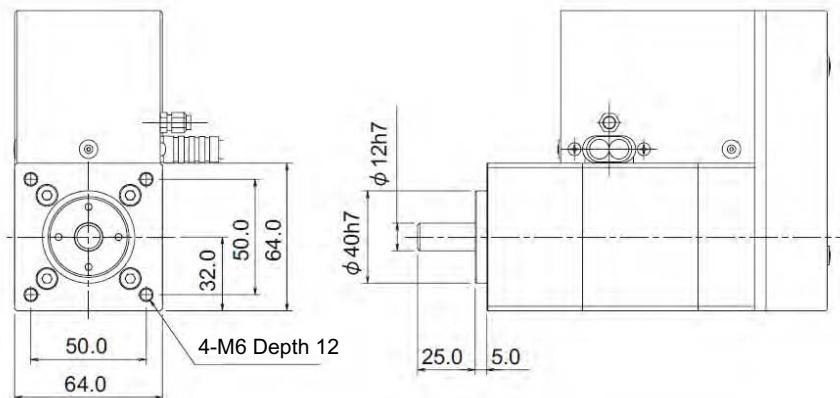
Utilize the tapped holes either on the front or on the bottom for installation. Positions of the tapped holes are as shown in the following figures.

- RT6

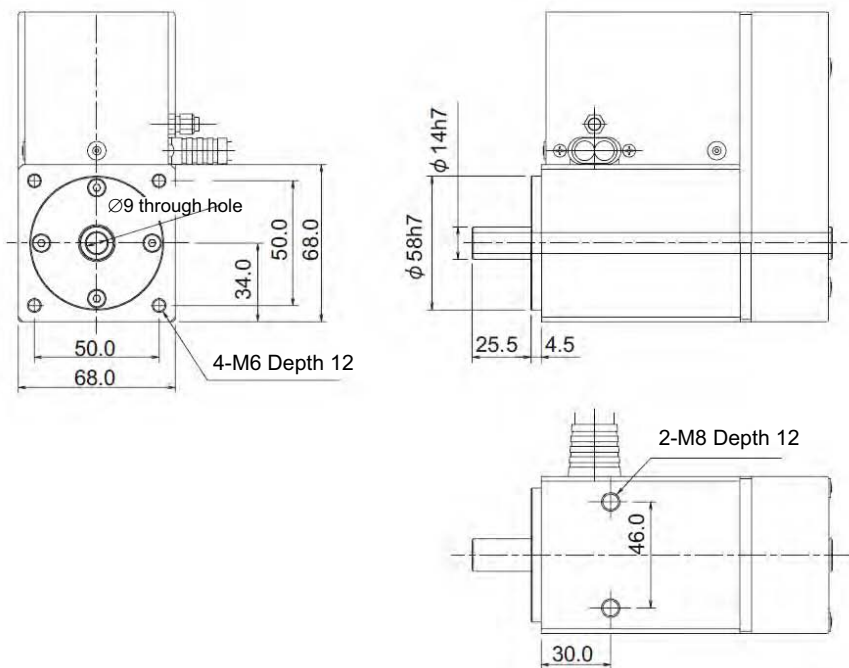


 **Caution:** Never use long screws exceeding the maximum screw-in depth. Use of such long screws may cause damage to the internal mechanisms and electrical parts.

• RT6R



• RT7R



⚠ Caution: Never use long screws exceeding the maximum screw-in depth. Use of such long screws may cause damage to the internal mechanisms and electrical parts.

4.2 Hollow Rotary

4.2.1 Installing the Actuator and a Tool on the Output Shaft

- The maximum screw-in depth varies depending on the mounting surface. Determine an appropriate screw length by referring to the figure provided below.

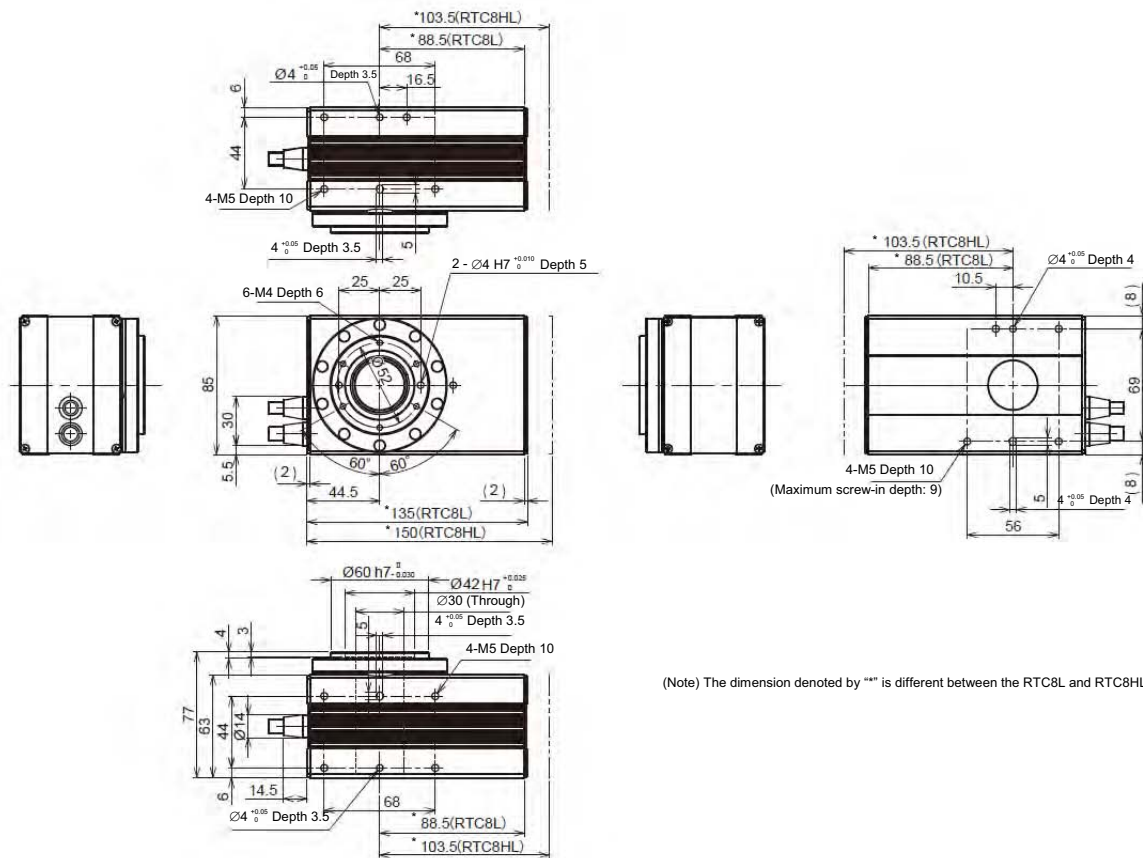
Caution: Never use long screws exceeding the maximum screw-in depth. Use of such long screws may cause damage to the internal mechanisms and electrical parts.

- Each mounting surface has circular holes and slotted holes for positioning pins. Use these holes as necessary.

(Note) The actuator has been shipped with setscrews put on the actuator mounting screws to prevent entry of foreign matters.

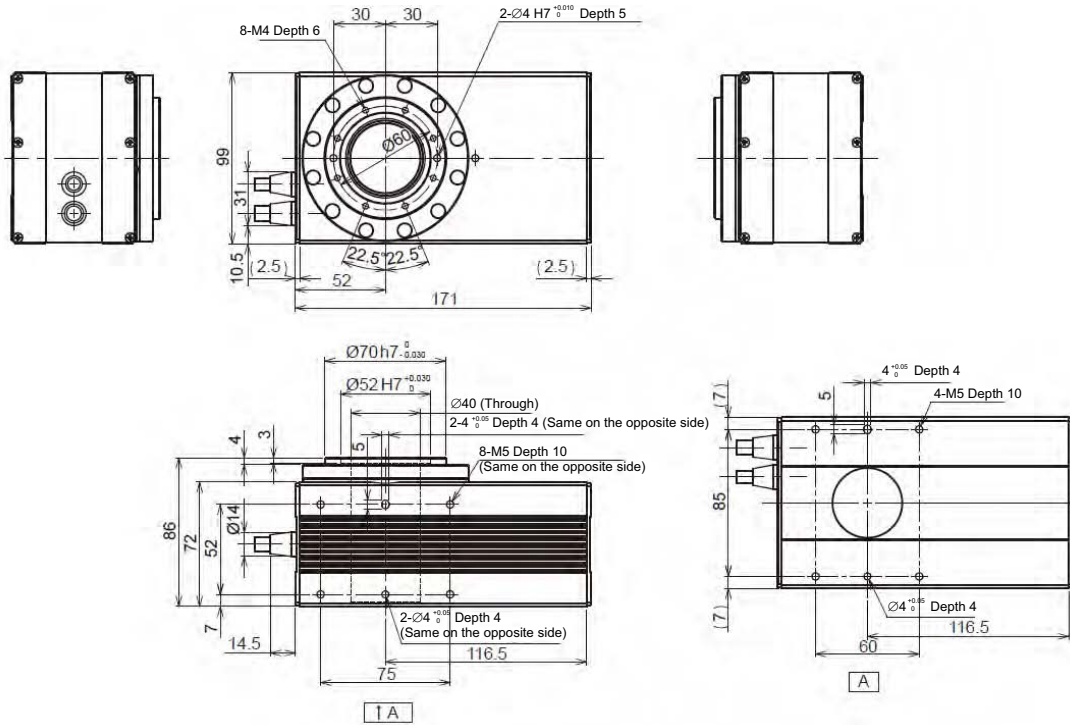
Remove the setscrews when installing the actuator.

[RTC8L, RTC8HL]

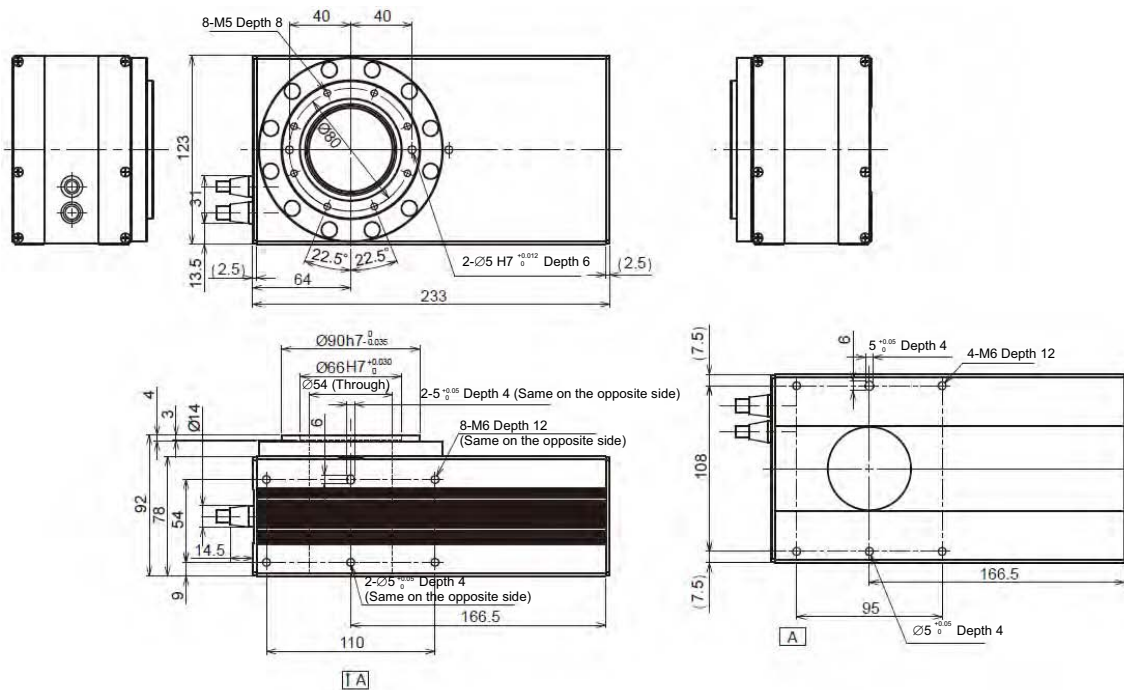


(Note) The dimension denoted by "*" is different between the RTC8L and RTC8HL.

[RTC10L]



[RTC12L]



Tightening torque

When mounting the tool or frame on the output shaft, do so according to the tightening torques listed below.

Tapped hole diameter	Recommended tightening torque N•cm (kgf•cm)	
	Bearing surface - Copper	Bearing surface - Aluminum
M4	359 (36.7)	176 (18)
M5	727 (74.2)	342 (34.9)
M6	1234 (126)	536 (54.7)

* Hexagonal socket head bolt of strength category 10.9

Tightening screws

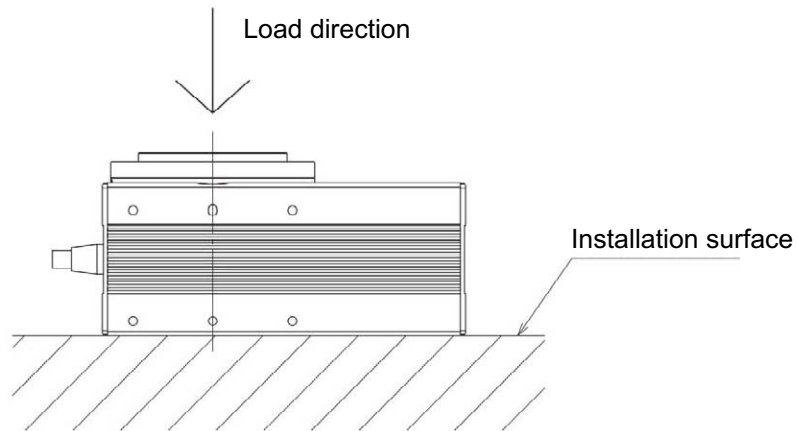
- Use high-tension bolts of ISO-10.9 or higher.
- If tapped holes are used, make sure the screws are not longer than the fitting length.
- Make sure the effective fitting length between the bolt and tapped hole used for installing the actuator is at least one of the following values, whichever is applicable:
 - When the material of the tapped through hole is steel: Same as the nominal diameter
 - When the material of the tapped through hole is aluminum: Twice the nominal diameter

4.2.2 Installation Direction and Mounting Surface

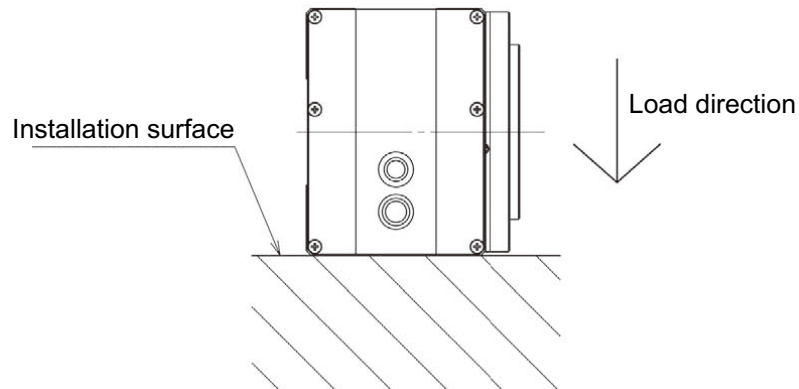
Install the actuator using the mounting surface corresponding to the load direction.

(Note) This cannot be applied for the ceiling mount.

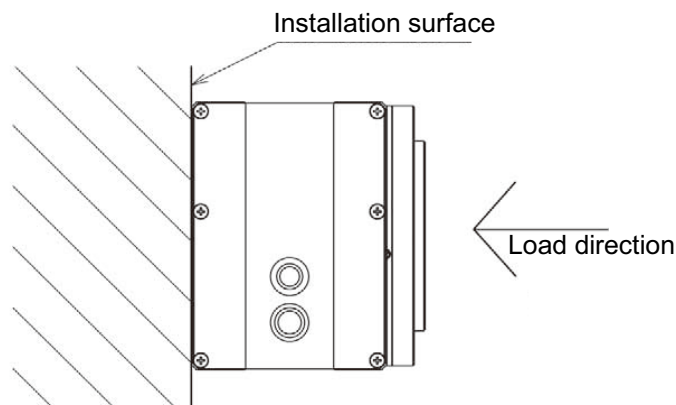
(1) Installing horizontally



(2) Installing on side



(3) Even when the actuator is installed on its side, follow this installation layout if a large load will apply in the direction shown in the figure below:



4.2.3 Load Offset Distance

Vibration tends to increase as the center of gravity of the work part becomes farther away from the center of the rotational axis. Design an appropriate tool by using the table as a guide.

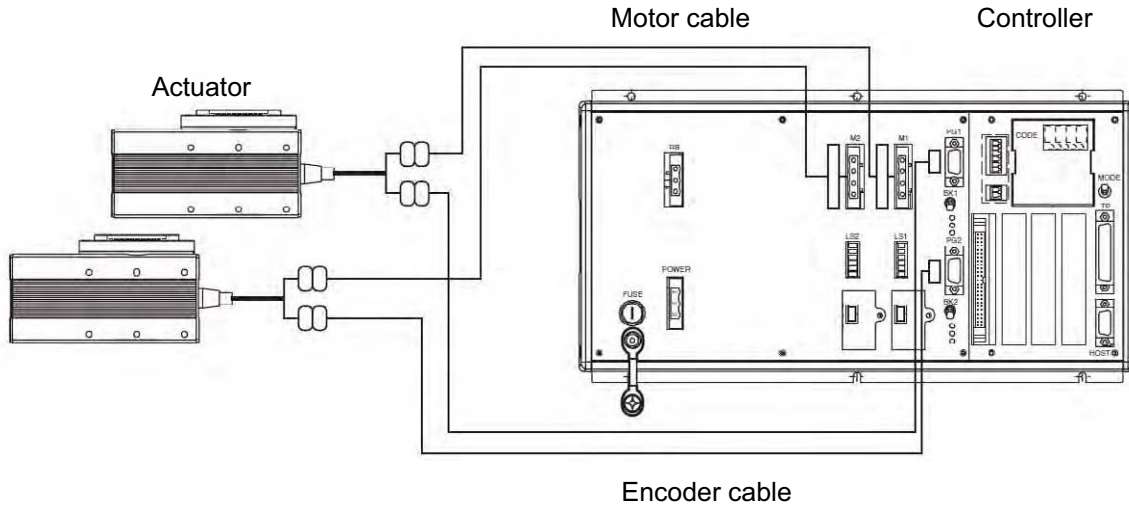
Model	Offset distance [m]
RTC8L	0.10
RTC8HL	0.12
RTC10L	0.15
RTC12L	0.20

5. Connecting to the Controller

The following explains the wiring method by assuming use of a single axis.

5.1 Wiring

The actuator and controller are connected by the motor cable and encoder cable (genuine part) via connectors.



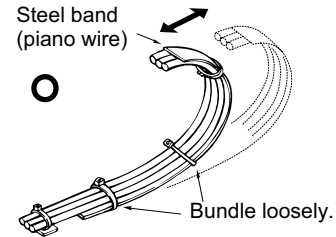
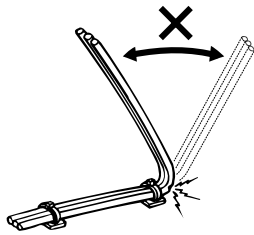
Example of Connection with XSEL Controller

[For details on the relay cables, refer to 9, "Motor/Encoder Cables."]

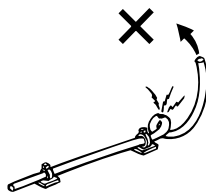
- Caution:**
- In applications where the cables cannot be secured, keep the bending radius of each cable within the range of cable deflection by the weight of the cable itself, or use a self-standing cable hose or take other measure to keep the bending radius sufficiently large, so as to minimize the load received by the cables.
 - Do not cut and extend or shorten the cables or reconnect the cut cable.
 - Do not pull or forcibly bend the cables, as the lead wires may break.

When designing an application system using actuators and controllers, incorrect wiring or connection of each cable may cause unexpected problems such as a disconnected cable or poor contact. This section explains prohibited handling of cables. Read the information carefully to connect the cables properly.

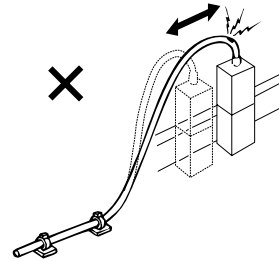
- Do not let the cable flex at a single point.



- Do not let the cable bend, kink or twist.

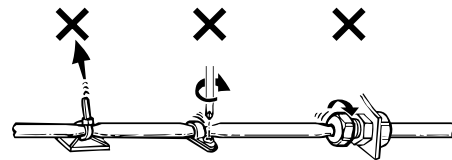
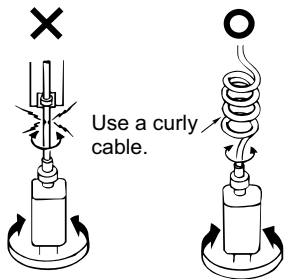


- Do not pull the cable with a strong force.

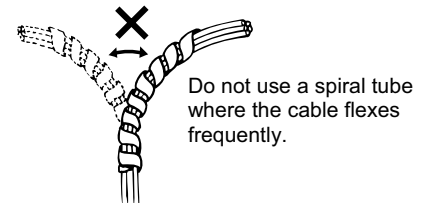
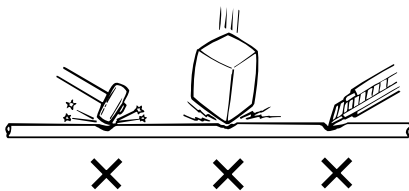


- Do not let the cable receive a turning force at a single point.

- When fixing the cable, provide a moderate slack and do not tension it too tight.

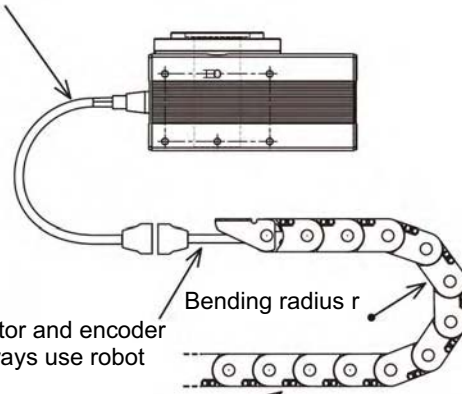


- Do not pinch, drop a heavy object onto or cut the cable.



- Cautions for use of a cable track

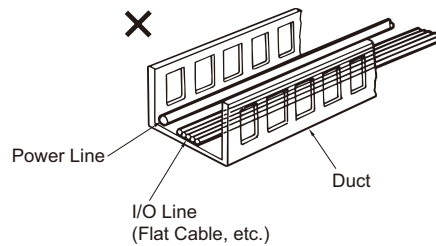
- The actuator cable is not a robot cable, so never store the actuator cable in a cable track.



- For the motor and encoder cables, always use robot cables.

- The bending radius of the cable track must not exceed the minimum bending radius of the cables. [Refer to 9, "Motor/Encoder Cables."]

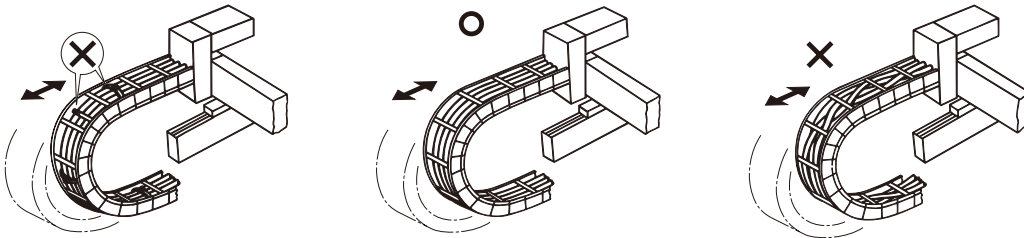
- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



Follow the instructions below when using a cable track.

If there is an indication to the cable for the space factor in a cable track, refer to the wiring instruction given by the supplier when storing the cable in the cable track.

- Avoid the cables to get twined or twisted in the cable track, and also to have the cables move freely and do not tie them up. (Avoid tension being applied when the cables are bent.) Do not pile up cables. It may cause faster abrasion of the sheaths or cable breakage.



6. Notes on Operation

6.1 Rotary

6.1.1 Backlash and Positioning Accuracy Repeatability

The rotary actuator has backlash (play). If the movement is smaller than the backlash, there may be a possibility that the drive shaft does not rotate.

In the case the equipment operates in only one way, it is able to position within the range of the positioning accuracy repeatability unless the gears in the decelerator get free, however, it may move within the range of the backlash while it is stopped, and which may cause variance in the position. Also, when the operation direction is changed, the drive amount may be shortened due to the backlash. In such a case, input the position including the drive amount and the backlash amount.

Backlash (Play) and Positioning Accuracy Repeatability

Model	Backlash (Play)	Positioning Accuracy Repeatability
RT6	0.1 deg Max.	±0.02 deg
RT6R		
RT7R	0.5 deg Max.	±0.1 deg

6.1.2 Operation Range and Home Return

(1) Range of Operation

The operation range of the rotary equipment is 300 degrees clockwise in the direction of the shaft rotation.

There is no mechanical stopper, thus the equipment may exceed the operation range if it is rotated manually by hand while the servo is off. Please note that it may return to the home position in the opposite direction if it is out of the operation range. Refer to (2), "Home Return."

Please use the marking sticker included in the package as the reference of the operation range.

Note) For RT7R, the position data will be displayed as "299.99" even if putting in "300". This is due to the encoder resolution, and the actual position will also be "299.99".

(2) Home return

When performing a home-return operation to the rotary, the rotary direction to home-return differs as shown in the figures below due to the position where the shaft is when the home-return operation starts.

- 1) If the shaft does not detect the sensor at the home-return start, it moves counterclockwise in the view of the shaft tip ([1]), and it reverses if sensor is detected ([2]), and then stops when the Z-phase is detected. (Refer to Figure 1.)

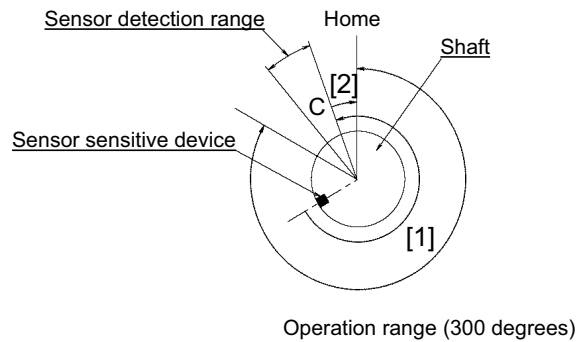


Figure 1

- 2) If the shaft detects the sensor at the home-return start (when the shaft is rotated over 300 degrees by hand at the servo off), it rotates clockwise from the stopped position ([3]), and stops when the Z-phase is detected. (Refer to Figure 2.)

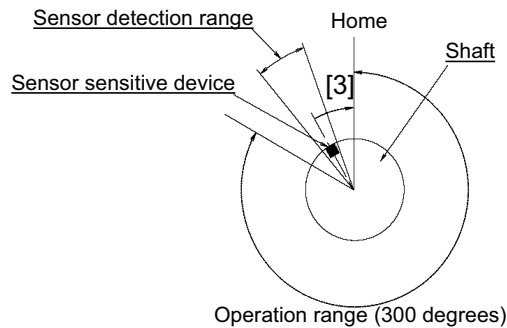


Figure 2

Operation range of the rotary is generally 300 degrees. However, in some cases it rotates 360 degrees as stated above.

Be careful of interference of the rotary to its surroundings.

6.1.3 Conditions for Loads Installable to Shaft of Rotary

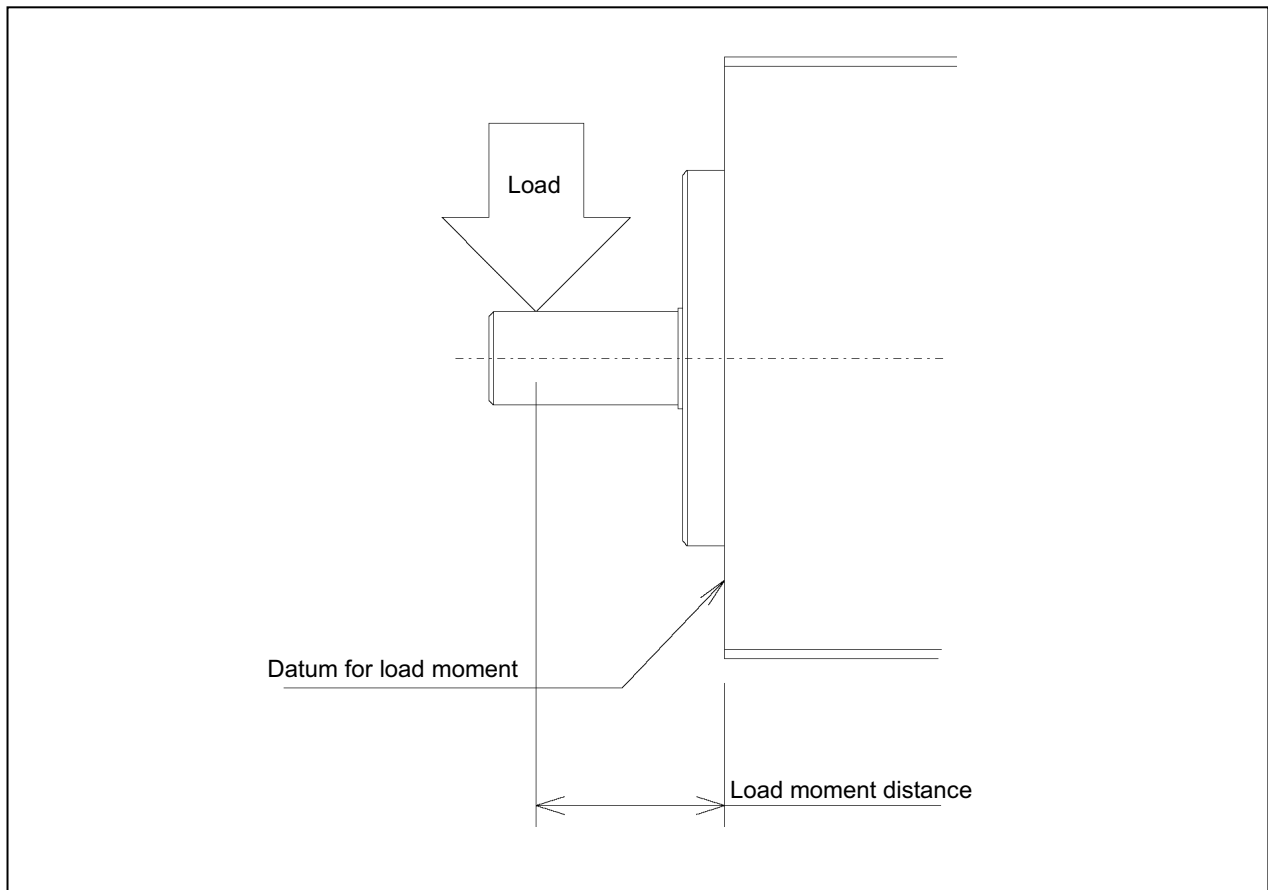
There is a limitation for the objects that are available to attach on the shaft of the rotary determined by its limit ranges of the allowable load moment, rated torque and allowable moment of inertia.

Please note that a use of the product in a condition beyond the limit range may shorten the product's life or cause malfunction.

The table below shows the allowable load moment, rated torque and allowable moment of inertia for each model. Also, shown in the figure below tells how to consider the load moment.

Conditions of Attachable Things to Shaft

Model	Allowable load moment Nm (kgfm)	Rated Torque Nm (kgfm)	Allowable Moment of Inertia kgm ² (gfcms ²)
RT6	6.8 (0.694)	2.4 (0.25)	2.5×10^{-2} (0.25)
RT6R			
RT7R	8.9 (0.907)	0.764 (0.078)	1.25×10^{-3} (0.012)



6.2 Hollow Rotary

6.2.1 Operation Range and Home Return

(1) Range of Operation

- Rotational axis/Normal mode

In the absolute position specification mode, the actuator operates in the range shown below. The maximum range of rotation varies depending on the deceleration ratio.

Deceleration ratio	Maximum range of rotation
15	0 to 9999.99
18	0 to 9999.99
24	0 to 7670.99
30	0 to 6140.99

- Rotational axis/Index mode

In the absolute position specification mode, the actuator operates in the range of 0 to 359.99 degrees.

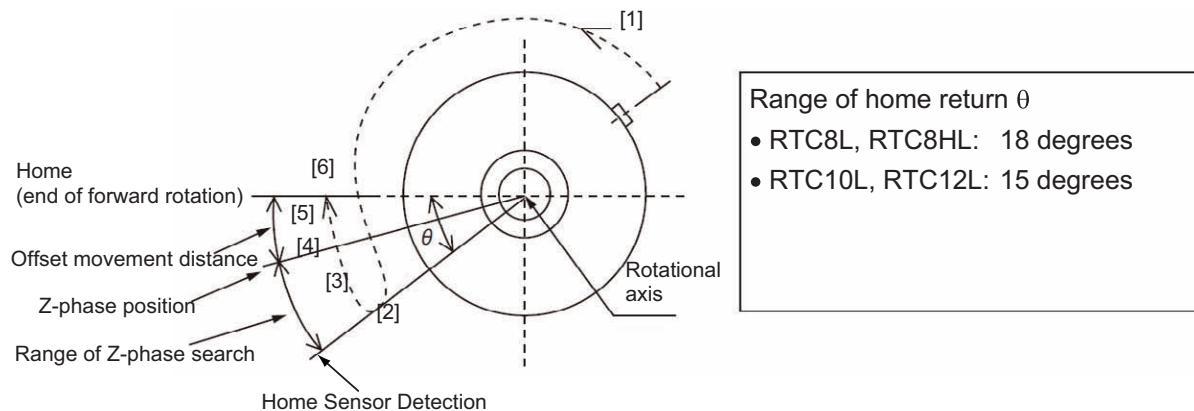
(Note) Index Mode cannot be used for Absolute Type.

* Refer to the controller specification for details.

(2) Home return

The actuator operates as follows during a home return or upon an absolute reset:

[1] Start of home return → [2] Detection of home sensor signal, reversing → [3] Search for Z-phase → [4] Detection of Z-phase → [5] Movement by offset distance → [6] Home position



⚠ Caution: The actuator always rotates in the same direction during a home return. If the actuator is of a standard specification, it always performs a home return in the counterclockwise direction from any position outside the range of Z-phase search shown in the figure. The actuator does not take a shortcut. If a cable is passed through the opening, pay attention to the load on the cable. An excessive load may sever its lead wires.

6.2.2 Brake

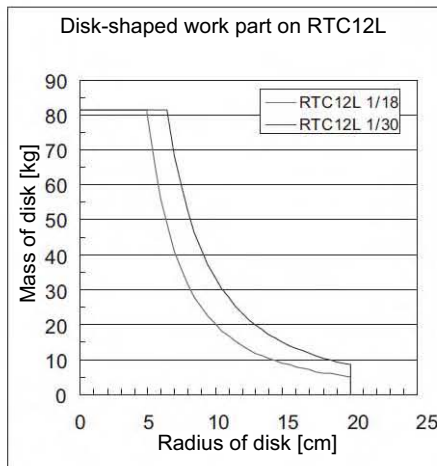
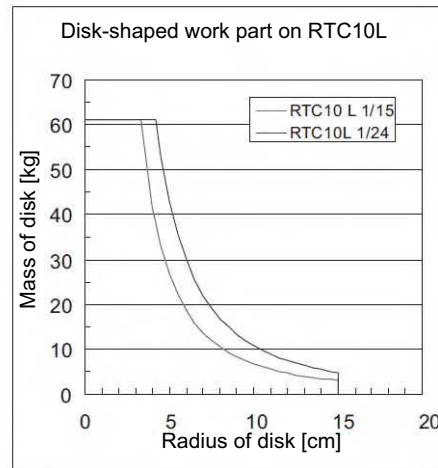
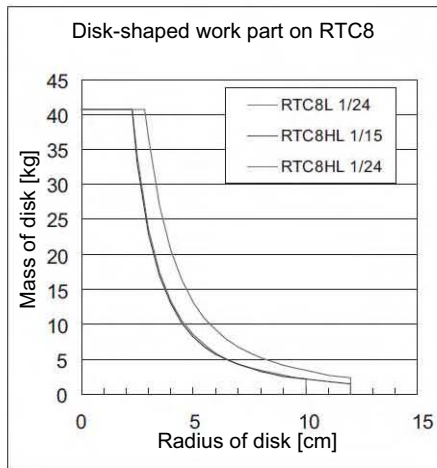
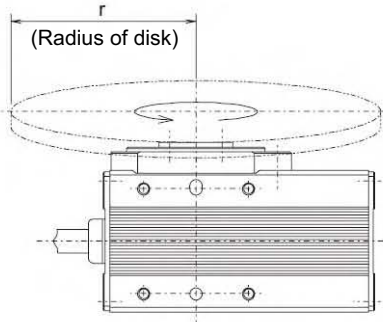
- The actuator's brake is designed to hold the work part in place. Do not use it to decelerate the actuator or actuate an emergency stop.
 - To release the brake manually, use the brake switch on the controller.
- (Note) If the actuator must hold the work part in place, check the holding torque.

7. How to Select a Hollow Rotary Actuator Model

Select an appropriate model based on the shape and mass of the work part on the output shaft, by referring to the figure and graphs shown below.

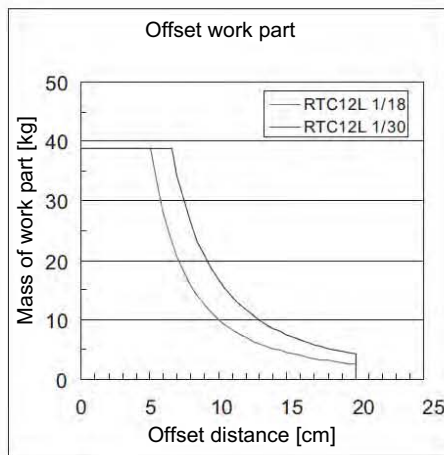
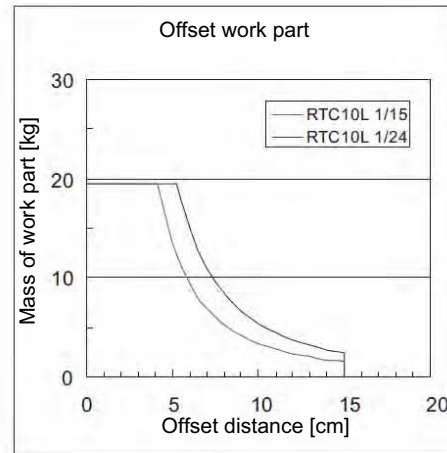
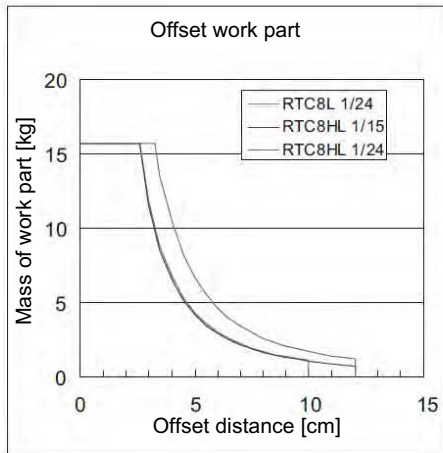
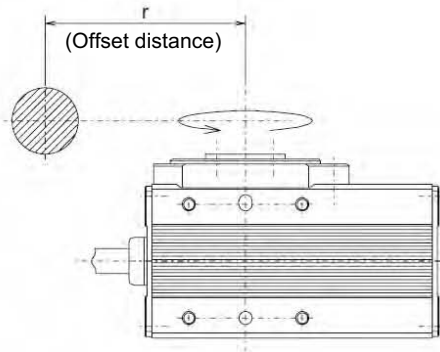
- (1) Disk-shaped work part at the center of the output shaft

$$J = M \cdot r^2 / 2$$



(2) Work part offset from the center of the output shaft

$$J = M \cdot r^2$$



* When the rotational axis is used horizontally, a load torque will generate due to the gravitational acceleration if the work part is installed at a position offset from the center of rotation. In this case, you must lower the rotational speed or reduce the mass of the work part.

8. Options

8.1 Limit Switch

Normally during the home return operation, the slider contacts the stopper and reverses, and then detect Z-phase (“push method”). The home limit switch (L) is used to cause the actuator to reverse not upon contact, but using a proximity sensor.

The limit switch is a standard feature on both the rotary type and hollow rotary type.

8.2 Brake

The brake is a mechanism to hold the work part and thereby prevent it from dropping and sustaining damage when the power or servo is turned off on the actuator installed on its side.

This brake is designed to hold the work part in place. Do not use it to decelerate the actuator or actuate an emergency stop.

The model name for the brake is “B.”

8.3 Reversed-home Specification

If the reversed-home specification is selected, the actuator rotates in the counterclockwise direction, which is opposite the direction in which the standard specification actuator would rotate, as the actuator moves to a + position. Also during a home return, the actuator rotates in the opposite direction compared to the standard specification. The model name for the reversed-home specification is “NM.”

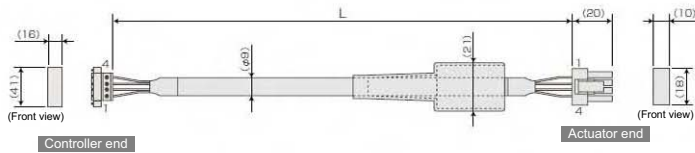
9. Motor/Encoder Cables

All cables apply commonly regardless of the actuator model name. The applicable cables vary depending on the connected controller.

Correspondence table of controllers and motor/encoder cables

	XSEL-J/K	XSEL-P/Q, SSEL, SCON
Applicable cables	[1], [2], [3]	[1], [4]

[1] Motor cable CB-X-MA□□□



* □□□ indicates the cable length (L). Up to 30 m can be specified.

Example) 080 = 8 m

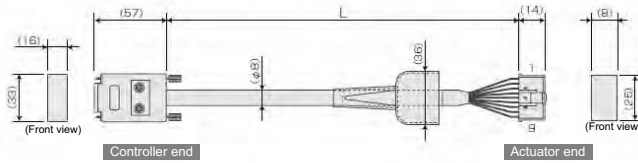
[Minimum bending radius]

Moving cable: 51 mm

Mounted cable: 34 mm

Wire	Color	Signal	No.	No.	Signal	Color	Wire
0.75sq	Green	PE	1	1	PE	Green	0.75sq
	Red	U	2	2	U	Red	
	White	V	3	3	V	White	
	Black	W	4	4	W	Black	

[2] Encoder cable CB-X-PA□□□



* □□□ indicates the cable length (L). Up to 30 m can be specified.

Example) 080 = 8 m

[Minimum bending radius]

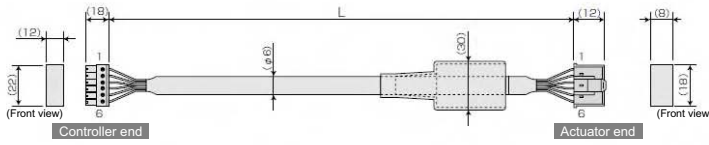
Moving cable: 44 mm

Mounted cable: 29 mm

Wire	Color	Signal	No.	No.	Signal	Color	Wire
0.15sq (Crimped)	—	—	1	1	BAT+	Black	0.15sq (Crimped)
	—	—	2	2	BAT-	Yellow	
	—	—	3	3	SD	Blue	
	—	—	4	4	SD	Orange	
	—	—	5	5	VCC	Green	
	—	—	6	6	GND	Brown	
	—	—	7	7	FIG	Ground	
	—	—	8	8	BK+	Gray	
	—	—	9	9	BK-	Red	
	Blue	SD	7	1	BAT+	Black	
	Orange	SD	8	2	BAT-	Yellow	
	Black	BAT+	9	3	SD	Blue	
	Yellow	BAT-	10	4	SD	Orange	
	Green	VCC	11	5	VCC	Green	
	Brown	GND	12	6	GND	Brown	
Gray	BK+	13	7	FIG	Ground		
Red	BK-	14	8	BK+	Gray		
—	—	15	9	BK-	Red		

Connect the shield to the hood with a clamp.
Ground and braided shield wires

[3] Limit switch cable CB-X-LC□□□



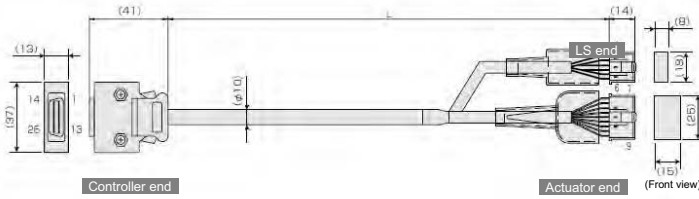
* □□□ indicates the cable length (L). Up to 30 m can be specified.

Example 080 = 8 m
 [Minimum bending radius]
 Moving cable: 33 mm
 Mounted cable: 22 mm

Wire	Color	Signal	No.	No.	Signal	Color	Wire
AWG24	Light blue	24VOUT	6	1	24VOUT	Light blue	AWG24
	Pink	N	5	2	N	Pink	
	Light green	LS	4	3	LS	Light green	
	Orange	CLEEP	3	4	CLEEP	Orange	
	Gray	OT	2	5	OT	Gray	
	Light blue	RSV	1	6	RSV	Light blue	

(Note) *1B* indicates one black dot.

[4] Encoder cable with LS CB-X2-PLA□□□



* □□□ indicates the cable length (L). Up to 30 m can be specified.

Example 080 = 8 m
 [Minimum bending radius]
 Moving cable: 58 mm
 Mounted cable: 38 mm

Wire	Color	Signal	No.	No.	Signal	Color	Wire
AWG26 (Soldered)	—	—	10	1	E24V	White/Orange	AWG26 (Crimped)
	White/Orange	E24V	12	2	OV	White/Orange	
	White/Green	OV	26	3	LS	Brown/Black	
	Brown/Blue	LS	25	4	CLEEP	Brown/Black	
	Brown/Black	CLEEP	24	5	OT	Brown/Red	
	Brown/Red	OT	23	6	RSV	Brown/Black	
	Brown/Black	RSV	9	—	—	—	AWG26 (Crimped)
	—	—	18	1	A	White/Black	
	—	—	19	2	A	White/Yellow	
	White/Blue	A+	1	3	B	White/Red	
	White/Yellow	A-	2	4	B	White/Black	
	White/Red	B+	3	5	Z	White/Purple	
	White/Black	B-	4	6	Z	White/Gray	
	White/Purple	Z+	5	7	—	—	
	White/Gray	Z-	6	8	—	—	
	Orange	SRD+	7	9	FG	Ground	
	Green	SRD-	8	10	SD	Orange	
	Purple	BAT+	14	11	SD	Green	
Gray	BAT-	15	12	BAT+	Purple		
Red	VDC	16	13	BAT-	Gray		
Black	GND	17	14	VCC	Red		
Blue	BKR+	20	15	GND	Black		
Yellow	BKR-	21	16	—	—		
—	—	22	17	BK-	Blue		
—	—	—	18	BK+	Yellow		

Connect the shield to the hood with a clamp.
 Ground and braided shield wires.
 ("White/blue" in the wire color field indicates a white band with a blue insulator band.)

10. Maintenance/Inspection

Daily and periodic inspections are essential to making sure your actuator will operate safely and efficiently. Before carrying out each inspection, check the applicable maintenance/inspection items listed below.

10.1 Inspection Items and Schedule


Conduct visual inspection and add grease at the applicable schedules specified below. The following schedule is based on eight hours of operation daily. If the actuator is operated at a higher utilization rate, including when it is operated continuously day and night, shorten the inspection intervals as necessary.

	Visual inspection	Greasing of hollow rotary actuator
At startup inspection	○	
1 month after start of operation	○	
6 months after start of operation	○	
1 year after start of operation	○	○
Every 6 months thereafter	○	
Every year thereafter	○	○

* Any adjustments requiring the following operations must be carried out at our factory. Do not disassemble the actuator or cut any of its cables in the location where the actuator is installed.

- Disassemble the motor
- Disassemble the gear
- Disassemble the bearing
- Cut a cable

If the user has disassembled any of the above components or cut any of the actuator's cables, IAI will not be responsible for any malfunction or problem that may occur thereafter.

 **Warning:**

- Performing inspection or maintenance work without a thorough understanding of the specific tasks involved may result in a serious accident.
- If inspection is not carried out regularly, the drive part may reach its life prematurely or the actuator may suddenly start malfunctioning.

10.2 Visual Inspection of the Exterior

In the visual inspection of the exterior, check the following items.

Actuator	Loosening of actuator mounting bolts, etc.
Cables	Scratches, proper connection of connectors
Overall	Noise, vibration

- With the hollow rotary type, grease that has been applied to the gears may drip depending on the environment. Clean the areas dirtied by grease or add grease, as necessary.

10.3 Exterior Cleaning

- Clean the exterior of the actuator as necessary.
- Use a soft cloth, etc., to wipe off dirt.
- Do not blow compressed air onto the actuator too strongly, in order to prevent dust from entering the actuator through small openings and gaps.
- Do not use petroleum solvent as it may damage the resin parts and coated surfaces.
- To clean stubborn soiling, moisten a soft cloth, etc., with neutral detergent and wipe gently.

10.4 Adding Grease to the Hollow Rotary Gears

On the hollow rotary actuators (RTC8L, RTC8HL, RTC10L, RTC12L), add grease to the gears periodically according to the periodic inspection intervals.

(1) Applicable grease

The actuators have been charged with the following gear grease prior to shipment from IAI.

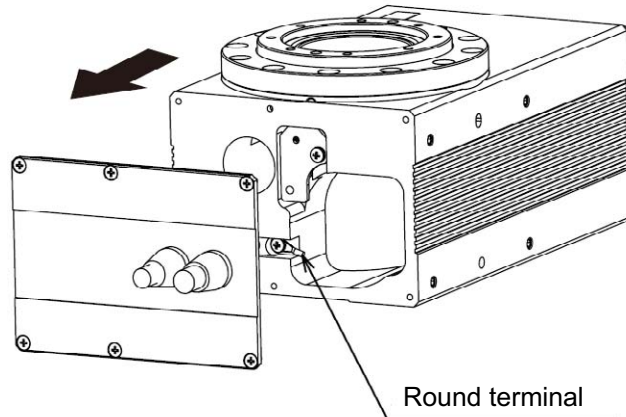
Kyodo Yushi	AC-D No.2
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During the maintenance, use lithium grease No. 2. Corresponding products include those listed below.

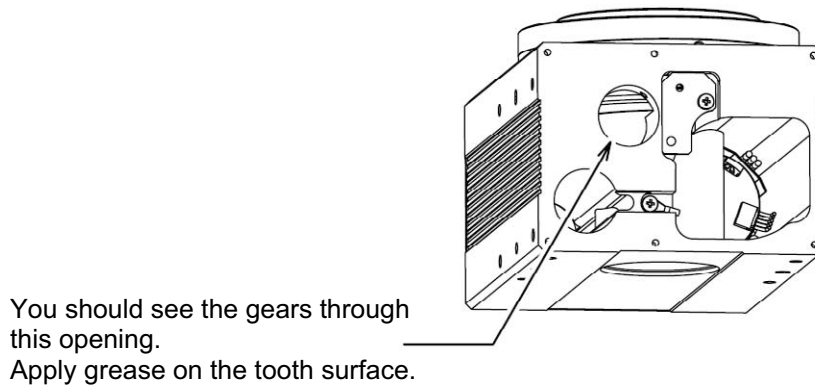
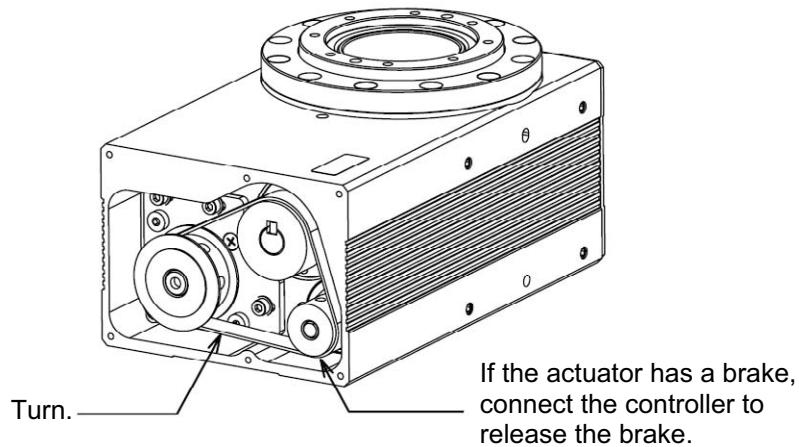
Showa Shell Sekiyu	Albania Grease S2
Mobil Sekiyu	UNIREX N2

(2) How to add grease

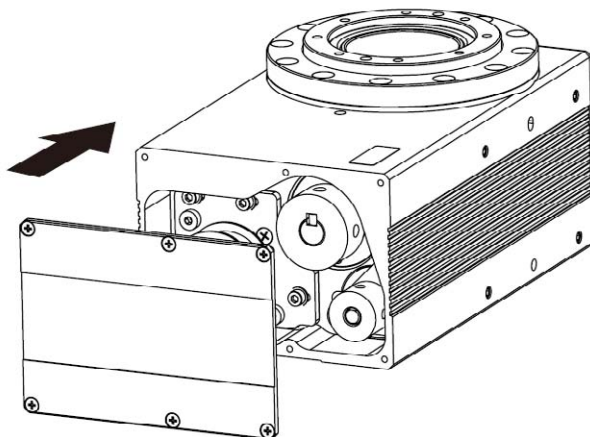
- [1] Remove the screws mounting the rear cover (countersunk machine screw M2.6 x 6). Pull the rear cover slightly from the actuator frame. (Do not forcibly pull the cables inside.)




- [2] While turning the gears, apply grease from the rear opening just enough to coat the bottom of the teeth. (As the input shaft is turned, the output gears turn.) Thereafter, turn the grease several times in both directions to let the grease spread evenly.



- [3] Install and mount the front cover and rear cover.
Be careful not to pinch the cables when mounting the rear cover.

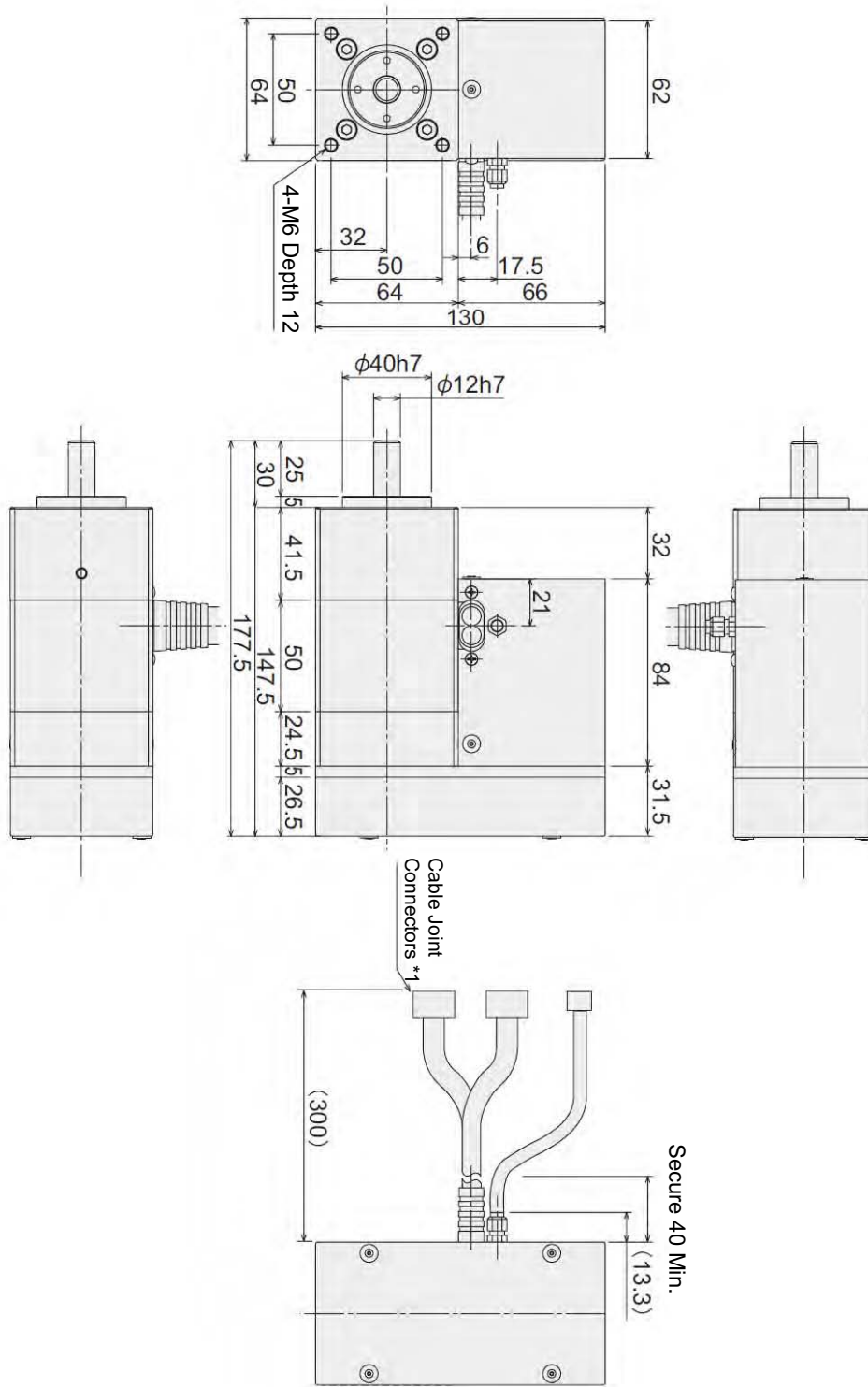


-  Warning:
- Never use fluorine grease. If fluorine grease is mixed with lithium grease, grease function will drop and the mechanical parts will be damaged.
 - Do not add grease any more than necessary. Excess grease may flow to the electronic components and cause malfunction.
 - The encoder phase has been adjusted precisely for detection of rotational angles and home signals. Never touch the encoder, as it may lead to a failure.
 - Be careful not to pinch the cables when affixing the rear cover. Store the cables neatly in the space above without them resting on top of one another. Do not forcibly tighten the screws when the panel is not fully seated.

11. Life of Hollow Rotary

Assuming the output axis turns 360deg in one way, the life is 10,000,000 times of turns in two ways (as a reference).

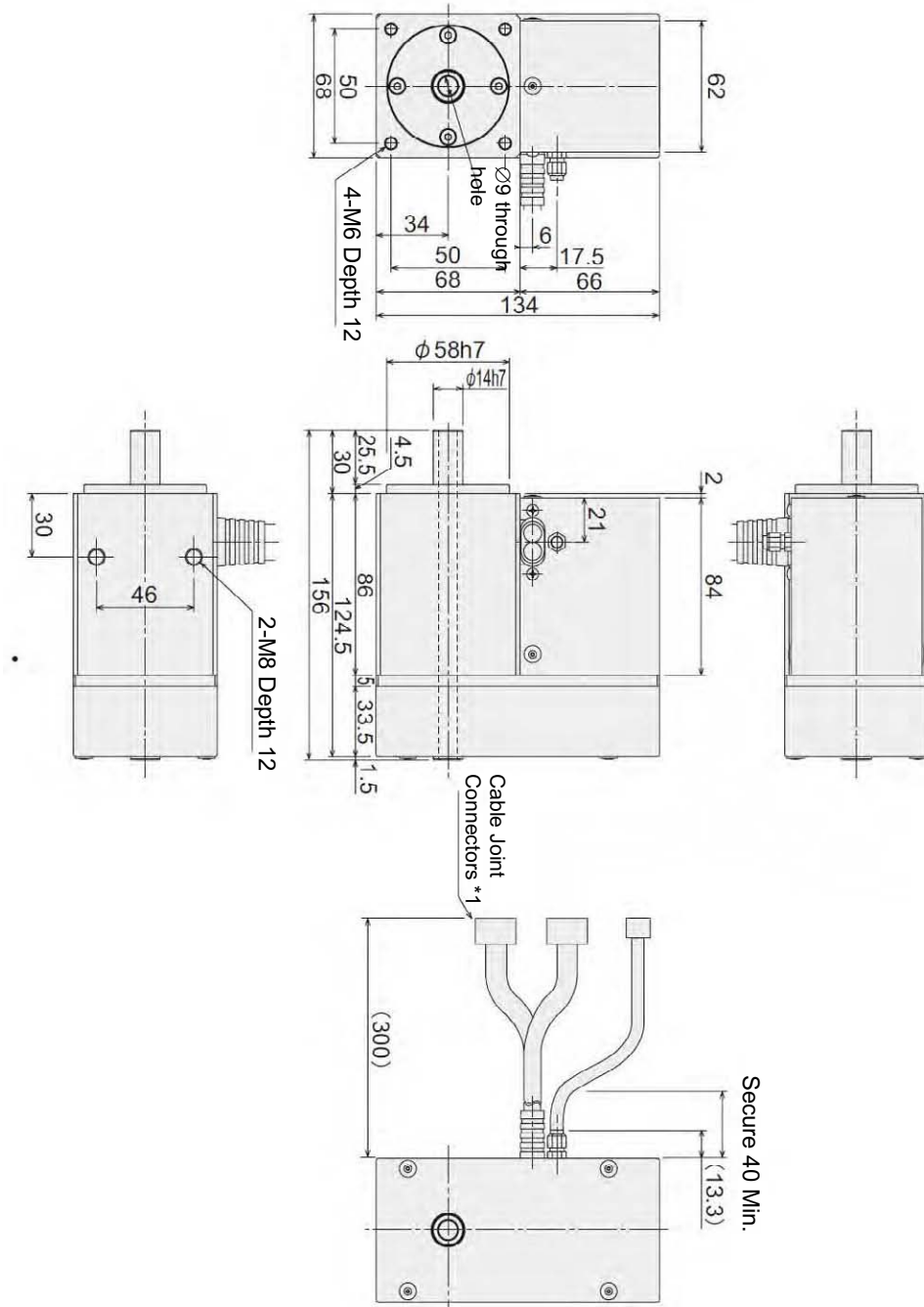
• RT6R



* For the connection to motor cable, encoder cable and limit switch cable

Weight [kg]	2.8
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• RT7R

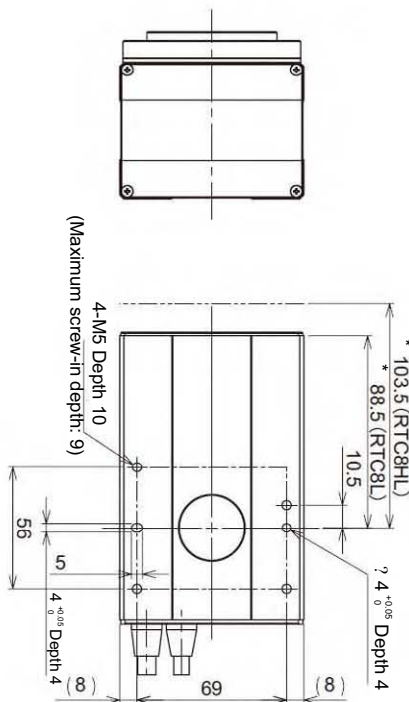
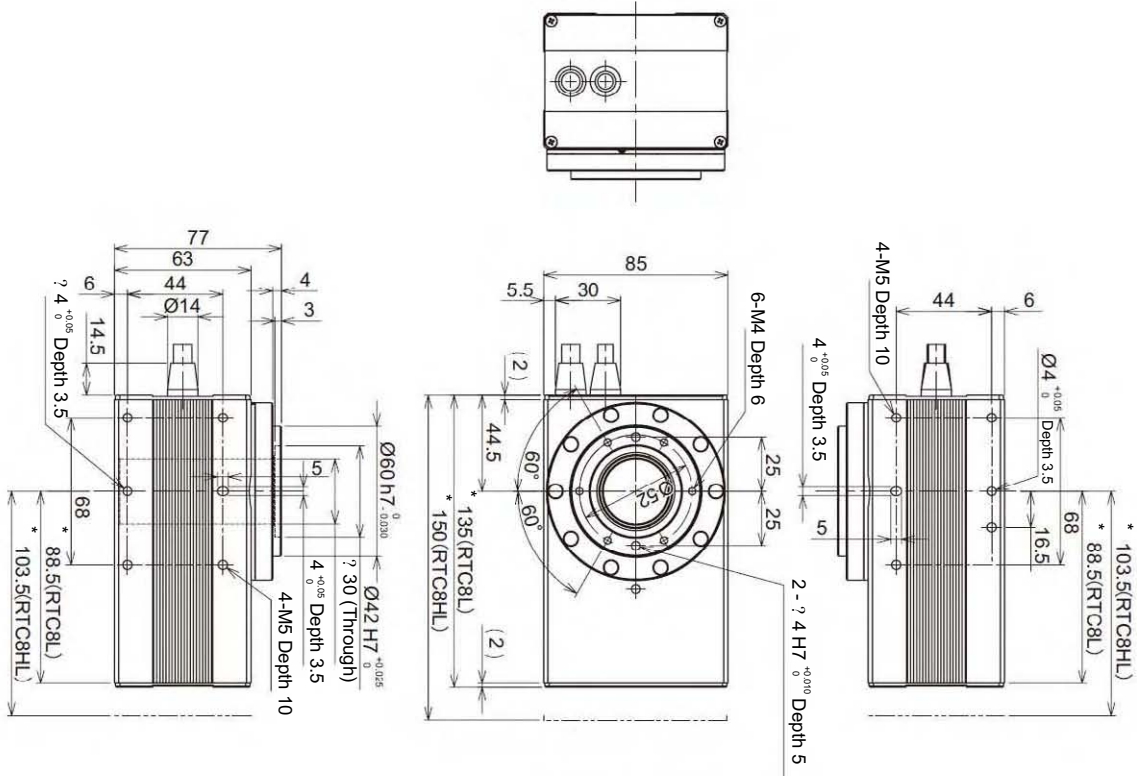


* For the connection to motor cable, encoder cable and limit switch cable

Weight [kg]	2.6
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12.2 Hollow Rotary

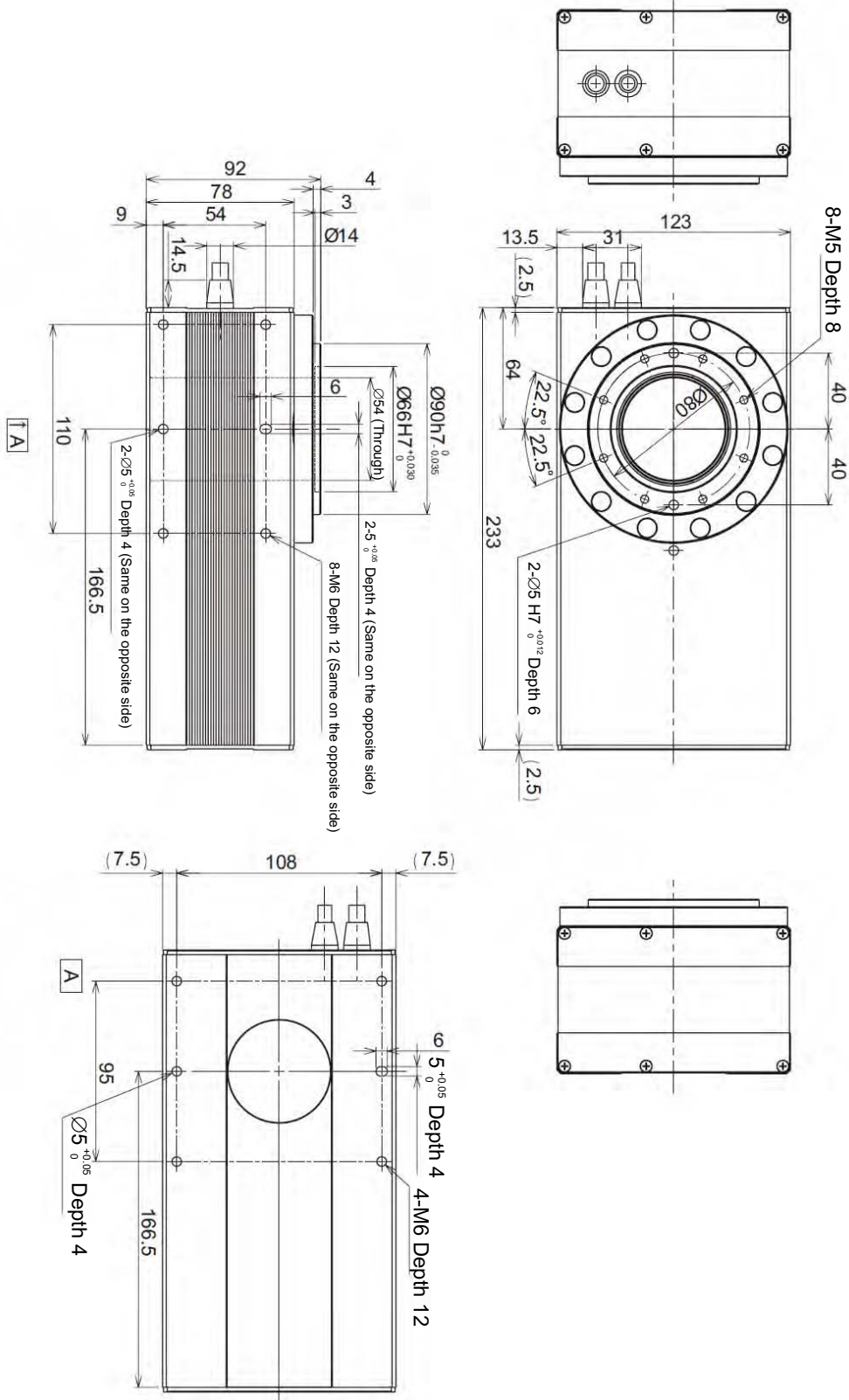
- RTC8L, RTC8HL



(Note) The dimension denoted by “*” is different between the RTC8L and RTC8HL.

Weight [kg]	RTC8L	2.3
	RTC8HL	2.4

• RTC12L



Weight [kg]	6.5
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13. Warranty

13.1 Warranty Period

One of the following periods, whichever is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to the specified location
- 2,500 hours of operation

13.2 Scope of Warranty

Our products are covered by warranty when all of the following conditions are met. Faulty products covered by warranty will be replaced or repaired free of charge:

- (1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.
- (2) The breakdown or problem in question occurred during the warranty period.
- (3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the operation manual and catalog.
- (4) The breakdown or problem in question was caused by a specification defect or problem, or by the poor quality of our product.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty:

- [1] Anything other than our product
- [2] Modification or repair performed by a party other than us (unless we have approved such modification or repair)
- [3] Anything that could not be easily predicted with the level of science and technology available at the time of shipment from our company
- [4] A natural disaster, man-made disaster, incident or accident for which we are not liable
- [5] Natural fading of paint or other symptoms of aging
- [6] Wear, depletion or other expected result of use
- [7] Operation noise, vibration or other subjective sensation not affecting function or maintenance

Note that the warranty only covers our product as delivered and that any secondary loss arising from a breakdown of our product is excluded from the scope of warranty.

13.3 Honoring Warranty

As a rule, the product must be brought to us for repair under warranty.

13.4 Limited Liability

- [1] We shall assume no liability for any special damage, consequential loss or passive loss such as a loss of expected profit arising from or in connection with our product.
- [2] We shall not be liable for any program or control method created by the customer to operate our product or for the result of such program or control method.

13.5 Conditions of Conformance with Applicable Standards/Regulations, Etc., and Applications

- (1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.
- (2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:
 - [1] Medical equipment pertaining to maintenance or management of human life or health
 - [2] A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
 - [3] Important safety parts of mechanical equipment (such as safety devices)
 - [4] Equipment used to handle cultural assets, art or other irreplaceable items
- (3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or operation manual.

13.6 Other Items Excluded from Warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:

- [1] Guidance for installation/adjustment and witnessing of test operation
- [2] Maintenance and inspection
- [3] Technical guidance and education on operating/wiring methods, etc.
- [4] Technical guidance and education on programming and other items related to programs

Change History

Revision Date	Description of Revision		
August 2010	Second Edition	P. 8	Added "Handling Precautions."
		P. 12	Added "Hollow Rotary Actuator" in "Name of Each Part."
		P. 13 to 15	Added 1, "Checking the Product"
		P. 17	Added "Hollow Rotary Actuator" in 2, "Specification."
		P. 21 to 22	Added "Hollow Rotary Actuator" in 5, "Installation."
		P. 32 to 33	Added "Hollow Rotary Actuator" in 7, "Notes on Operation."
		P. 34 to 35	Added 8, "How to Select a Hollow Rotary Actuator Model."
		P. 36	Added 9, "Options."
		P. 37 to 38	Added 10, "Motor/Encoder Cables."
		P. 46 to 48	Added "Hollow Rotary Actuator" in 12, "External Dimension."
June 2011	Third Edition	P. 9	Added a "note on speeds of RTC8L and RTC8HL types."
		P.40	Added information that "grease may drip" in 10.2, "Visual Inspection of the Exterior."
		P. 49 to 50	Contents changed in 12. Warranty
September 2012	Forth Edition	P.1 to P.7	Additions and Changes made in Safety Guide contents
		P.10	International Standards Compliances added
		P.16	CE: Complied with CE Mark added to "How to Read Model Code" option
		P.44 to 49	Weight added to "11. External Dimensions"
December 2013	Fifth Edition	P.25	Note added telling "This cannot be applied for the ceiling mount."
		P.33	Note added telling "Index Mode cannot be used for Absolute Type." Hollow Rotary Actuator's home return operation changed
		P.44	Life of Hollow Rotary added
June 2015	5C Edition	P.29	Change made in caution note for connection to controller
		P.41	Grease change due to production stop Albania Grease No.2 → Albania Grease S2 Mobilax 2 → UNIREX N2



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