



# RCP2

## ROBO Cylinder Actuator Operating Manual

RPA, RXA, RSA, RMA, RSGS, RMGS,  
RSGD, RMGD, RSW and RMW Types

===== Fifth Edition =====

**IAI**  
Quality and Innovation





***IAI America, Inc.***

## Safety Precautions (Actuator)

Please read the information in “Safety Precautions” carefully before selecting a model and using the product.

The precautions described below are designed to help you use the product safely and avoid bodily injury and/or property damage.

Directions are classified as “danger,” “warning,” “caution” and “note,” according to the degree of risk.

 <b>Danger</b>	Failure to observe the instruction will result in an imminent danger leading to death or serious injury.
 <b>Warning</b>	Failure to observe the instruction may result in death or serious injury.
 <b>Caution</b>	Failure to observe the instruction may result in injury or property damage.
 <b>Note</b>	The user should take heed of this information to ensure the proper use of the product, although failure to do so will not result in injury.

This product has been designed and manufactured as a component for use in general industrial machinery.

Devices must be selected and handled by a system designer, personnel in charge of the actual operation using the product or similar individual with sufficient knowledge and experience, who has read both the catalog and operation manual (particularly the “Safety Precautions” section). Mishandling of the product poses a risk.

Please read the operation manuals for all devices, including the main unit and controller.

It is the user’s responsibility to verify and determine the compatibility of this product with the user’s system, and to use them properly.

After reading the catalog, operation manual and other materials, be sure to keep them in a convenient place easily accessible to the personnel using this product.

When transferring or loaning this product to a third party, be sure to attach the catalog, operation manual and other materials in a conspicuous location on the product, so that the new owner or user can understand its safe and proper use.

The danger, warning and caution directions in this “Safety Precautions” do not cover every possible case. Please read the catalog and operation manual for the given device, particularly for descriptions unique to it, to ensure its safe and proper handling.



### [General]

- Do not use this product for the following applications:
  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
  3. Important safety parts of machineryThis product has not been planned or designed for applications requiring high levels of safety. Use of this product in such applications may jeopardize the safety of human life. The warranty covers only the product as it is delivered.

## [Installation]

- Do not use this product in a place exposed to ignitable, inflammable or explosive substances. The product may ignite, burn or explode.
- When installing the product, be sure to securely support and affix it (including the work). Failure to do so may cause the product to tip over, drop or malfunction, resulting in injury.
- Avoid using the product in a place where the main unit or controller may come in contact with water or oil droplets.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Doing so may result in fire.

## [Operation]

- Do not enter the machine's range of operation while the product is operating or standing by. The actuator may move suddenly, causing injury.
- If you are using a pace maker or other mechanical implant, do not come within one meter of the product. The strong magnetic field generated by the product may cause the pace maker, etc., to malfunction.
- Do not pour water onto the product. Spraying water over the product, washing it with water or using it in water may cause the product to malfunction, resulting in injury, electric shock, fire, etc.

## [Maintenance, Inspection, Repair]

- Never modify the product. Unauthorized modification may cause the product to malfunction, resulting in injury, electric shock, fire, etc.
- Do not disassemble and reassemble the components relating to the basic structure of the product or its performance and function. Doing so may result in injury, electric shock, fire, etc.



## [General]

- Do not use the product outside the specifications. Using the product outside the specifications may cause it to fail, stop functioning or sustain damage. It may also significantly reduce the service life of the product. In particular, observe the maximum loading capacity and speed.

## [Installation]

- If the machine will stop in the case of system problem such as emergency stop or power failure, design a safety circuit or other device that will prevent equipment damage or injury.
- Be sure to provide Class D grounding for the controller and actuator (formerly Class 3 grounding: Grounding resistance at 100  $\Omega$  or less). Leakage current may cause electric shock or malfunction.
- Before supplying power to and operating the product, always check the operation area of the equipment to ensure safety. Supplying power to the product carelessly may cause electric shock or injury due to contact with the moving parts.
- Wire the product correctly by referring to the operation manual. Securely connect the cables and connectors so that they will not be disconnected or come loose. Failure to do so may cause the product to malfunction or cause fire.

## [Operation]

- Before operating the moving parts of the product by hand (for the purpose of manual positioning, etc.), confirm that the servo is turned off (using the teaching pendant). Failure to observe this instruction may result in injury.
- The cables supplied with the product are flexible, but they are not robot cables. Do not store the cables in a movable cable duct (cable bearer, etc.) that bends more than the specified bending radius.
- Do not scratch the cables. Scratching, forcibly bending, pulling, winding, crushing with heavy object or pinching a cable may cause it to leak current or lose continuity, resulting in fire, electric shock, malfunction, etc.
- Turn off the power to the product in the event of power failure. Failure to do so may cause the product to suddenly start moving when the power is restored, thus resulting in injury or product damage.

- If the product is generating heat, smoke or a strange smell, turn off the power immediately. Continuing to use the product may result in product damage or fire.
- If noise or abnormally high vibration is detected, stop the operation immediately. Continuing to use the product may result in product damage, malfunction due to damage, runaway machine, etc.
- If any of the internal protective devices (alarms) of the product has actuated, turn off the power immediately. Continuing to use the product may result in product damage or injury due to malfunction. Once the power supply is cut off, investigate and remove the cause and then turn on the power again.
- Do not step on the product, use it as a footstool or place any object on it. You may lose your footing or the product may tip over, resulting in a fall and consequent injury, product damage, malfunction due to damage, runaway machine, etc.

#### [Maintenance, Inspection, Repair]

- Before conducting maintenance/inspection, parts replacement or other operations on the product, completely shut down the power supply. At this time, take the following measures:
  1. Display a sign that reads, "WORK IN PROGRESS. DO NOT TURN ON POWER" at a conspicuous place, in order to prevent a person other than the operator from accidentally turning on the power while the operation is working.
  2. When two or more operators are to perform maintenance/inspection together, always call out every time the power is turned on/off or an axis is moved in order to ensure safety.

#### [Disposal]

- Do not throw the product into fire. The product may burst or generate toxic gases.



#### [Installation]

- Do not use the product under direct sunlight (ultraviolet ray), in a place exposed to dust, salt or iron powder, in a humid place, or in an atmosphere of organic solvent, phosphate-ester machine oil, etc. The product may lose its function over a short period of time, or exhibit a sudden drop in performance or its service life may be significantly reduced.
- Do not use the product in an atmosphere of corrosive gases (sulfuric acid or hydrochloric acid). Rust may form and reduce the structural strength of the product.
- When using the product in any of the places specified below, provide a sufficient shield. Failure to do so may result in malfunction:
  1. Place where large current or high magnetic field is present
  2. Place where welding or other operations are performed that cause arc discharge
  3. Place subject to electrostatic noise
  4. Place with potential exposure to radiation
- Install the main unit and controller in a place subject to as little dust as possible. Installing them in a dusty place may result in malfunction.
- Do not install the product in a place subject to large vibration or impact ( $4.9 \text{ m/s}^2$  or more). Doing so may result in the malfunctioning of the product.
- Provide an emergency-stop device in a readily accessible position so the device can be actuated immediately upon occurrence of a dangerous situation during operation. Lack of such device in an appropriate position may result in injury.
- Provide sufficient maintenance space when installing the product. Routine inspection and maintenance cannot be performed without sufficient space, which will eventually cause the equipment to stop or the product to sustain damage.
- When transporting or installing the product, exercise due caution to prevent injury. For example, securely hold the product using a lift or support or engage multiple operators to carry the product.
- Do not hold the moving parts of the product or its cables during installation. It may result in injury.
- Always use IAI's genuine cables for connection between the controller and the actuator. Also use IAI's genuine products for the key component units such as the actuator, controller and teaching pendant.
- The brake mechanism is designed to prevent the slider from dropping when the power to the vertical axis is turned off. Do not use it as a safety brake, etc.

- Before installing or adjusting the product or performing other operations on the product, display a sign that reads, "WORK IN PROGRESS. DO NOT TURN ON POWER." If the power is turned on inadvertently, injury may result due to electric shock or sudden activation of an actuator.

## [Operation]

- Turn on the power to individual equipment one by one, starting from the equipment at the highest level in the system hierarchy. Failure to do so may cause the product to start suddenly, resulting in injury or product damage.
- Do not insert a finger or object in the openings in the product. It may cause fire, electric shock or injury.
- Do not bring a floppy disk or other magnetic media within one meter of the product. The magnetic field generated by the magnet may destroy the data in the floppy disk, etc.
- Do not step on the product, use it as a footstool or place any object on it. It may cause scoring, dents or deformation of the driving part, resulting in product damage, unintended stopping due to damage, or performance drop.

## [Maintenance, Inspection, Repair]

- Wear protective goggles when applying grease to the actuator. Failure to do so may result in eye inflammation due to splattered grease.



## Note

## [General]

- If you are planning to use the product under a condition or environment not specified in the catalogs or operation manual, or in an application requiring strict safety such as aircraft facility, combustion system, clean room, entertainment machine, safety device or other equipment having significant impact on human life or property, design operating ranges with ample margins from the ratings and design specifications or provide sufficient safety measures such as fail-safes. Whatever you do, always consult IAI's sales representatives.

## [Installation]

- If the product is used in a vertical setup, be sure to use the vertical specification (with brake).
- Protection covers or other guards must be provided for the moving parts of the equipment to avoid direct contact with the operators.
- Do not configure a control circuit that will cause the work to drop in case of power failure. Configure a control circuit that will prevent the table or work from dropping when the power to the machine is cut off or an emergency stop is actuated.
- The following conditions must be met in order to improve the straightness of the table movement and ensure the smooth movement of the ball screw and linear guides:
  1. Flatness of the mounting surface must be within 0.05 mm.
  2. The mounting surface area must be large enough to ensure the rigidity of the actuator.

## [Installation, Operation, Maintenance]

- When handling the product, wear protective gloves, protective goggles, safety shoes or other necessary gear to ensure safety.

## [Disposal]

- When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.

## Others

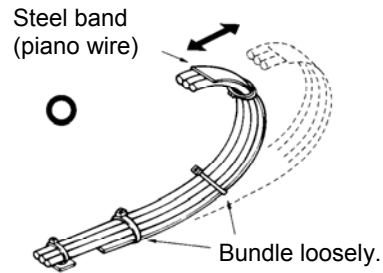
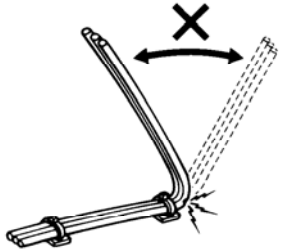
- IAI shall not be liable whatsoever for any loss or damage arising from a failure to observe the items specified in "Safety Precautions."
- If you have any question regarding the product, please contact your nearest IAI sales office. The addresses and phone numbers of our sales offices are provided at the end of this operation manual.

## Prohibited Handling of Cables

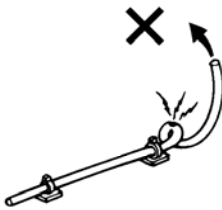
When designing an application system using actuators and controllers, incorrect wiring or connection of each cable may cause unexpected problems such as a disconnected cable or poor contact, or even a runaway system. This section explains prohibited handling of cables. Read the information carefully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

### Ten Rules for Handling Cables (Must be Observed!)

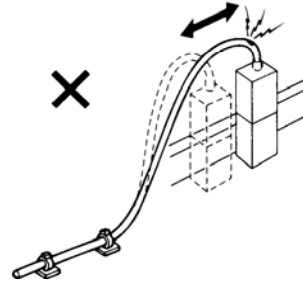
1. Do not let the cable flex at a single point.



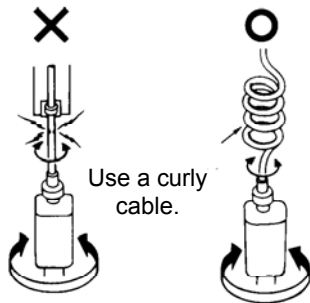
2. Do not let the cable bend, kink or twist.



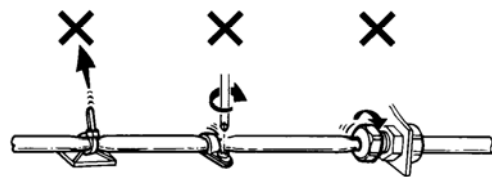
3. Do not pull the cable with a strong force.



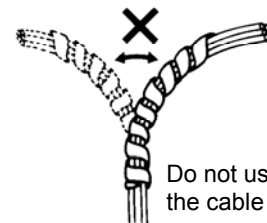
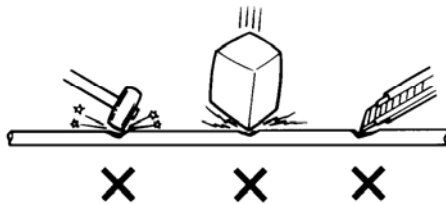
4. Do not let the cable receive a turning force at a single point.



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

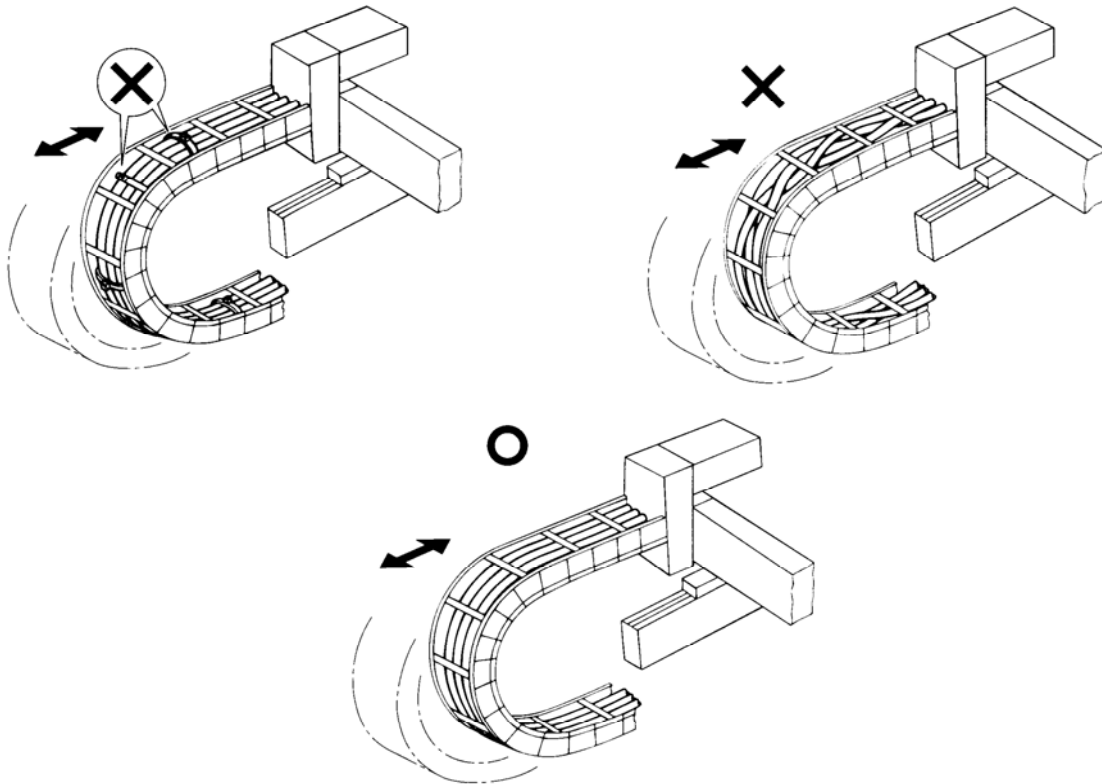


6. Do not pinch, drop a heavy object onto or cut the cable.

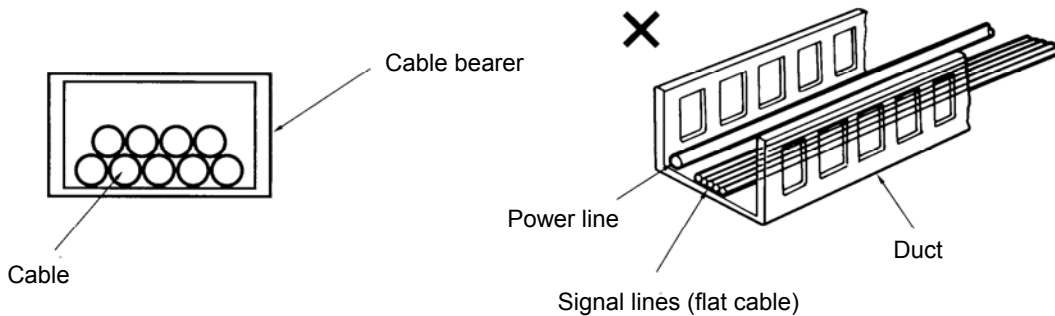


Do not use a spiral tube where the cable flexes frequently.

7. Do not let the cable get tangled or kinked in a cable bearer or flexible tube. When bundling the cable, keep a certain degree of flexibility (so that the cable will not become too taut when bent).

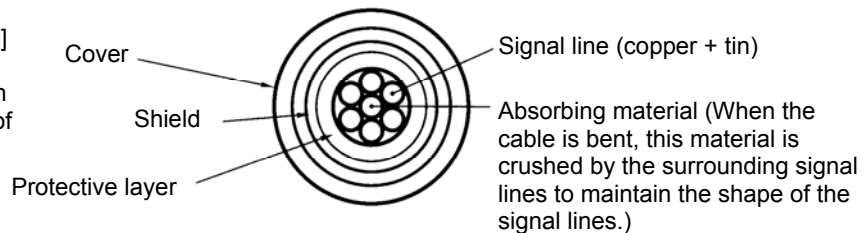


8. Do not cause the cables to occupy more than 60% of the space in the cable bearer.
9. Do not lay signal lines together with circuit lines that create a strong electric field.



10. Always use a robot cable if the cable is likely to flex significantly.

[Standard structure of cable]  
The standard structure of cable will vary depending on the manufacturer and type of cable.



★ Need for Robot Cables

A cable connected to a moving part of an actuator system will inevitably receive repeated bending loads at the base of the cable. As a result, the cores in the cable may break over time. To minimize the risk of cable breakage, we strongly recommend that a robot cable offering significantly higher flexibility be used in this type of application.

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## **1. Foreword**

Thank you for purchasing the Robo Cylinder Actuator. This manual explains the structure, correct operation and maintenance of the Robo Cylinder Actuator. Please read this manual carefully before using the actuator. For more complete information on operating the actuator, please refer to the controller operating manual.

**Never disassemble the actuator as it may result in damage to the actuator**

## **2. Safety Precautions**

### **Basic Operating Instructions**

- Please do not attempt to use or operate the actuator in any manner not indicated in this manual or the controller manual.
- Please be sure to use only the cable provided by IAI to connect the actuator and controller.
- Please do not allow people within the moving range of the unit when it is in operation or when the power is ON since this is dangerous.

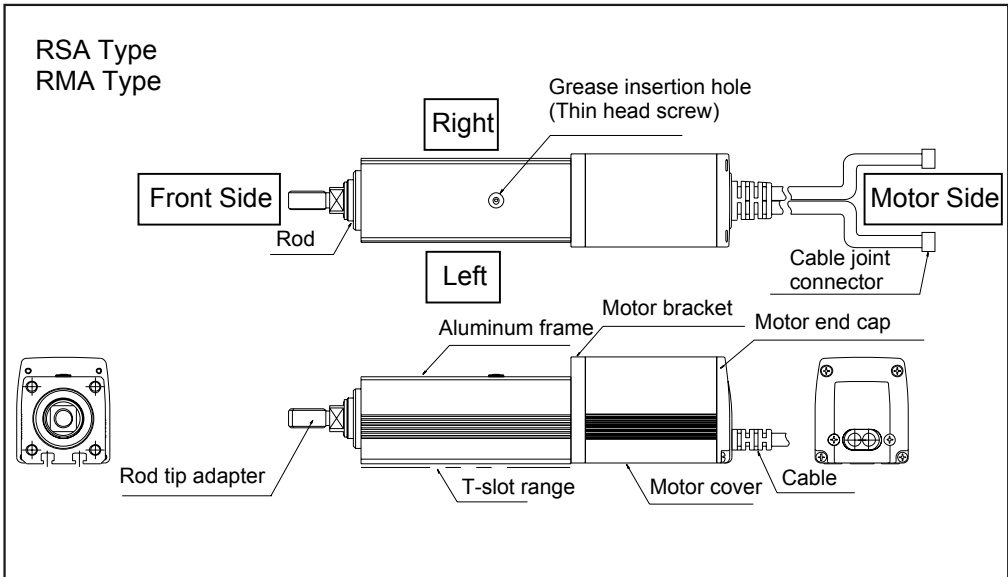
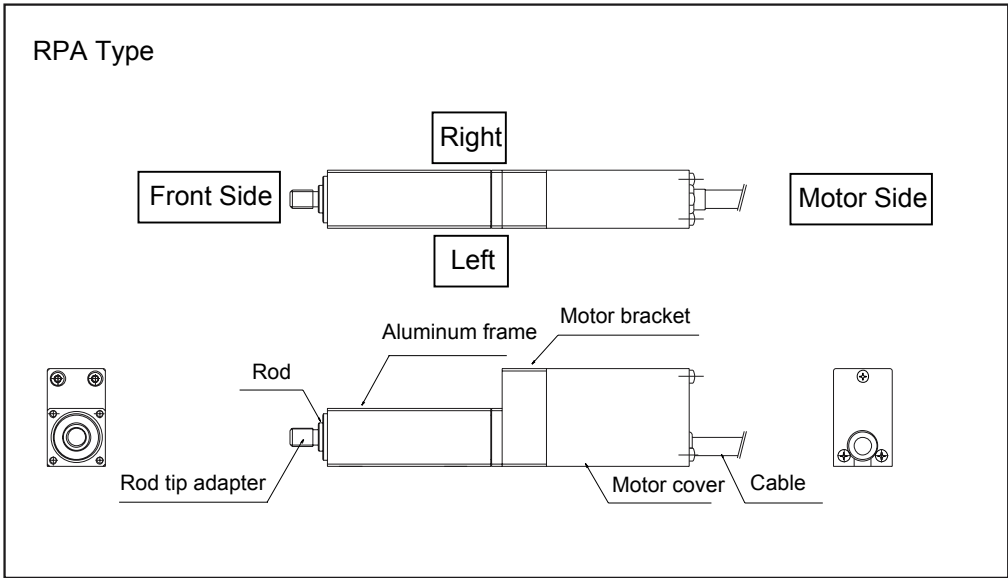
### **Maintenance and Inspection**

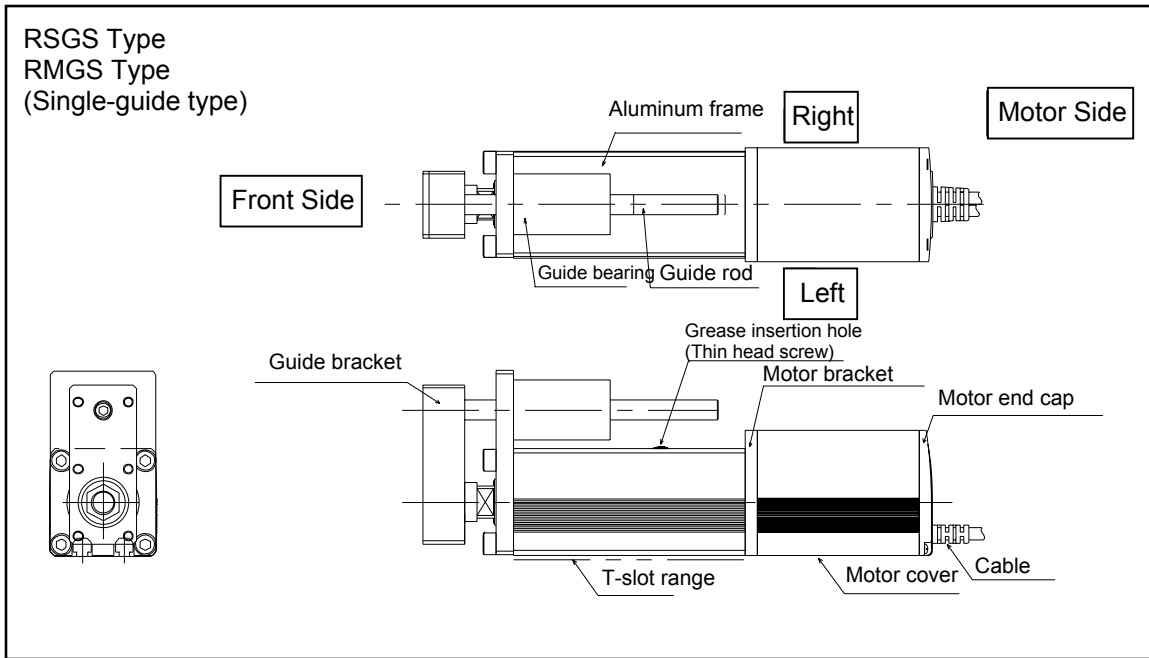
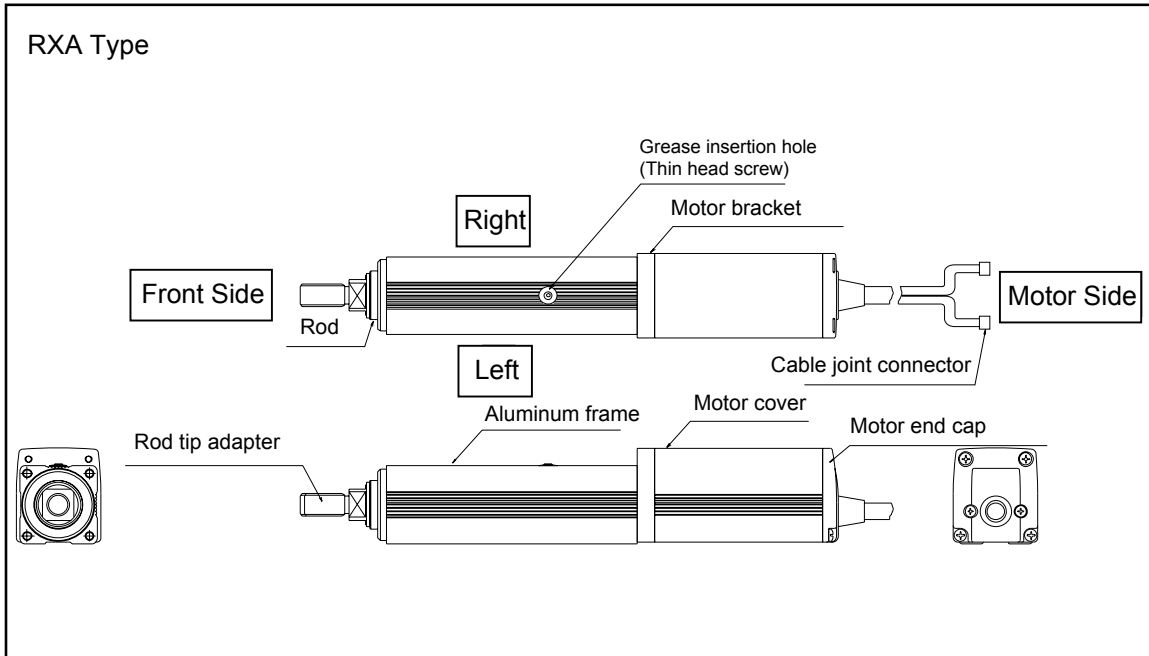
- When doing maintenance and inspection work, always shut down the controller power first.
- When doing inspection, make sure that no one can inadvertently turn the power ON.
- Make sure that a sign indicating work in progress is clearly visible.
- If several persons are working, be sure to watch out for each other's safety. In particular, check before turning power ON or OFF and let others know if you are doing work involving axis movement.

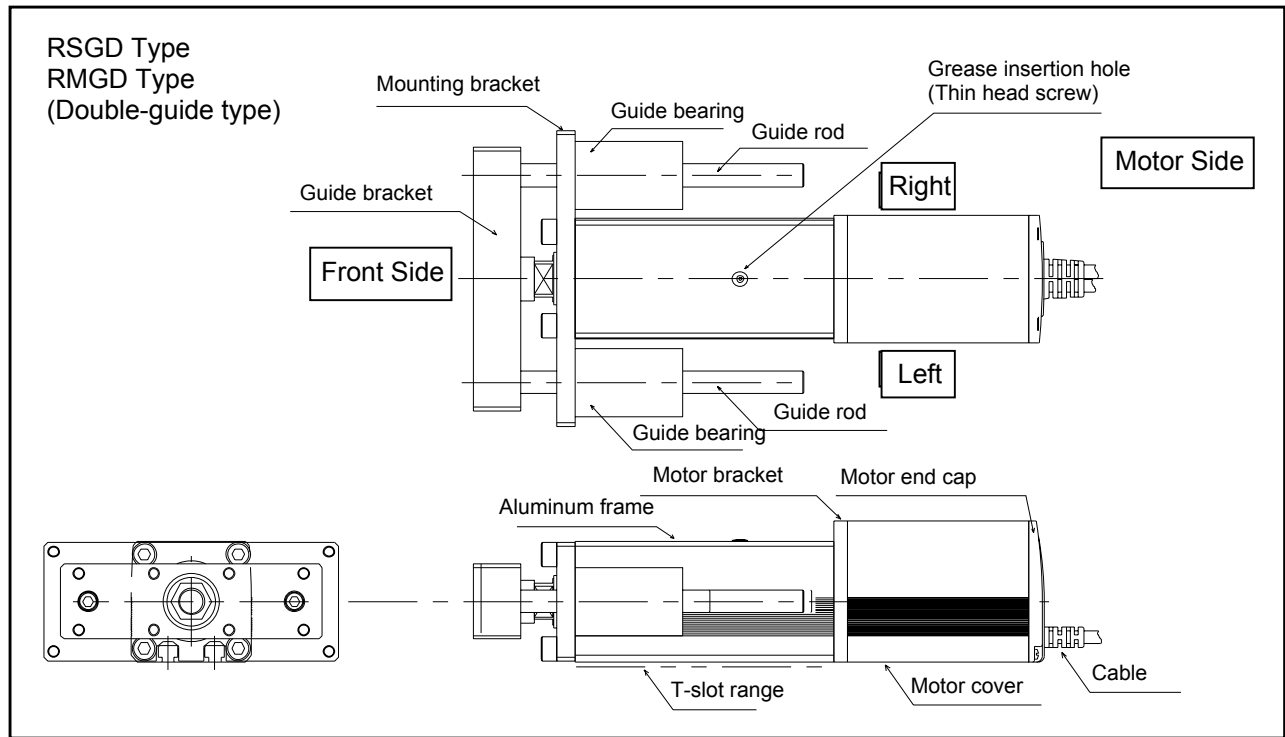
\* For more details, please contact our sales engineering or technical service section.

## 3. Names of the Parts

The name of the actuator parts are indicated below. The left and right sides are indicated by looking at the actuator from the motor end with the actuator set down horizontally. Front end means the side opposite the motor end.







Dustproof/splash-proof type

RSW Type  
RMW Type

- Connect one end of a tube to the intake/exhaust port and extend the other end to a place not exposed to water or other foreign matters that may enter the tube.

**Internal structure of intake/exhaust port**

- Push in the tube all the way to the gasket (② in the figure at left). If the tube is not fully inserted, its tip will stop at the chuck (④), thereby causing water or other foreign matters to enter through the gap and cause the actuator to malfunction.

No.	Name	Material
①	Actuator	PBT
②	Gasket	NBR
③	Holder	C3604BD
④	Chuck	SUS301
⑤	Outer ring	C3604BD
⑥	Push ring	Polyacetal
⑦	O-ring	NBR
⑧	Driven nipple	C3604BD

**Intake/exhaust port**

Coupling CL-061 by Aoi

Applicable tube (Aoi)

Model number	O.D. x I.D. (mm)	Material
U-9506	6 × 4	Polyurethane

## **4. Transporting and Handling**

### 4.1 Handling the Packed Unit

Please take care that the shipping box is not dropped or subjected to strong impact during transport.

- The operator should not carry heavy shipping boxes by themselves.
- If the shipping box is left standing, it should be in a horizontal position.
- Do not climb on top of the shipping box.
- Do not place heavy objects on top of the shipping box.

### 4.2 Handling the Actuator After It is Unpacked

Lift the actuator up by the base to remove it from the packing.

- When carrying the actuator, take care not to bump it. Take particular care with the motor bracket and motor cover.
- Do not exert excessive force on any part of the actuator. Take particular care with the motor cover and cables.
- Please handle with care when unpacking to avoid injury and damage by dropping the product.
- When damage due to transportation or shortage of items is found, please contact IAI immediately.

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\* Please refer to Section 3 above for the names of the actuator parts.

## 5. Operating and Storage Environment

### 5.1 Operating Environment

The actuator should be set up in an environment which meets the following criteria:

No.	Operating environment conditions
1	Avoid direct sunlight.
2	Avoid radiant heat from strong heat sources such as a furnace.
3	Ambient temperature should be 0 ~ 40°C.
4	The humidity should be less than 85% and there should be no condensation.
5	Avoid exposure to corrosive or combustible gases.
6	The area should have very little dust and be suitable for normal assembly operations.
7	Avoid exposure to oil mist or fluids using in cutting.
8	The unit should not be subject to vibrations greater than 0.3G.
9	Avoid extreme electromagnetic waves, ultraviolet rays and radiation.
10	This product is not intended to be used in a chemical environment.

In general, the environment should be one in which an operator can work without protective gear.

\* Please contact our office for dust and drip proof type (RSW & RMW) models.

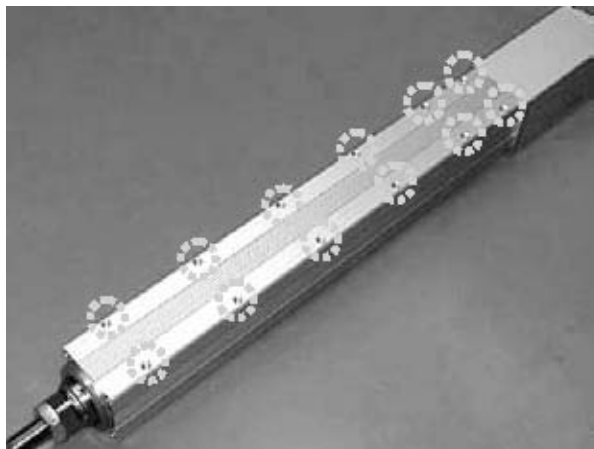
### 5.2 Storage Environment

The storage environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored for a long period of time. Unless there are special instructions, we do not include moisture absorption agents when shipping the unit. If you are storing the unit where condensation might occur, then you must treat the entire package or treat the unit itself after it is unpacked to prevent condensation. The unit can withstand up to 60°C during a short storage interval but only up to 50°C if the storage period is longer than one month.

## 6. Installation

### 6.1 Installing the Main Body

- (1) The method to use tapped holes in the back.  
Applicable to RPA ·RXA

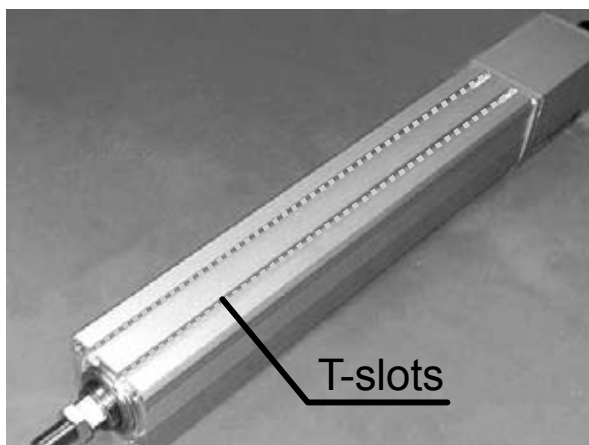


Please use tapped holes in the backside for mounting the actuator.

The depth of the tapped holes is as follows. Please be sure not to use the longer bolts to avoid penetration.

Model	Tap size	Depth of thread
RPA	M3	5 mm
RXA	M4	6 mm

- (2) The method to use T-slot and square nuts.  
Applicable to RSA, RMA, RSGS, RMGS, RSGD, RMGD, RSW, RMW

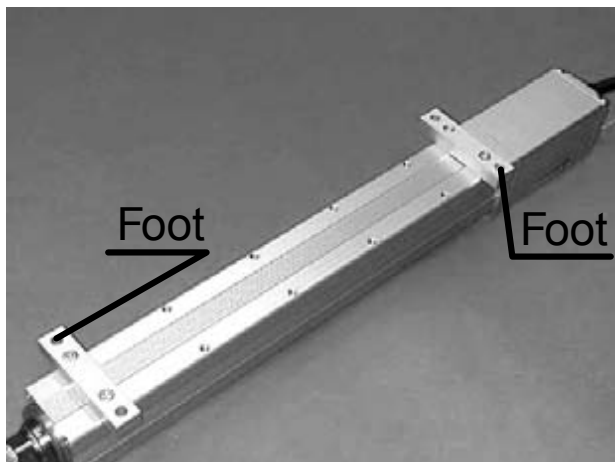


Please use square nuts inserted in the T-slots to clamp the actuator.

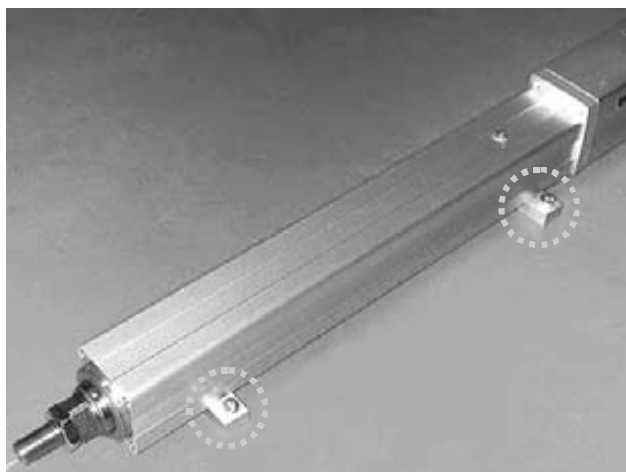


(3) Foot mounting method.

A: Applicable to RPA , RXA

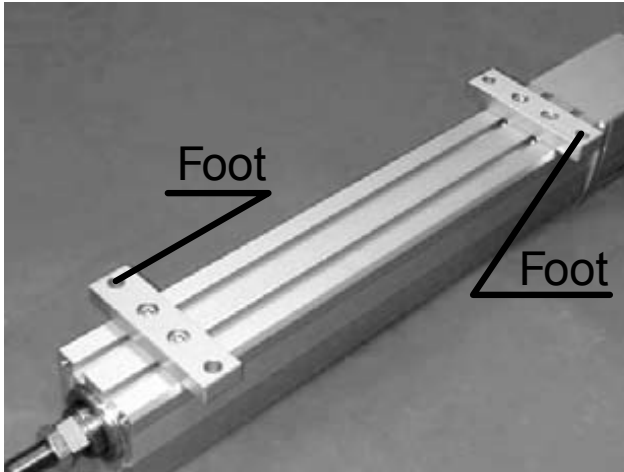


① For RXA model, use the tapped holes in the back to mount the feet.

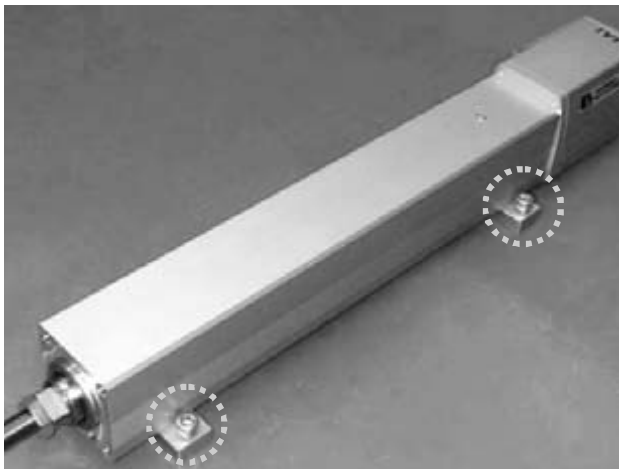


② Clamp the feet with bolts to the machine frame.

B: Applicable to RSA, RMA, RSGS, RMGS, RSGD, RMGD, RSW, RMW

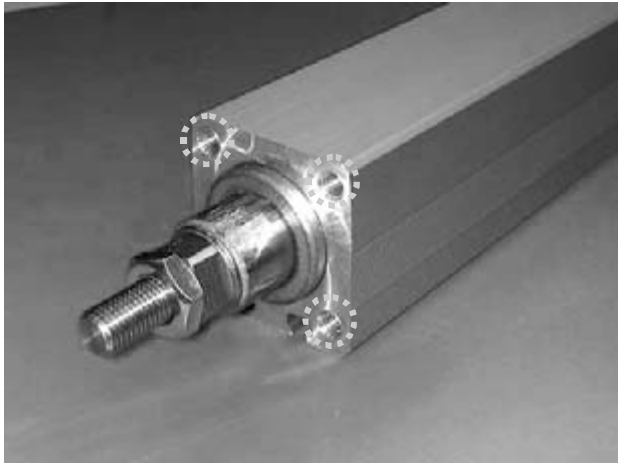


- ① Square nuts, inserted in the T-slots, are used to mount the feet to the body.



- ② Clamp the feet with bolts to the machine frame.

- (4) The method to use tapped holes in the front surface.  
Applicable to RPA, RXA, RSA, RMA, RSW, RMW (except for the models with guides)

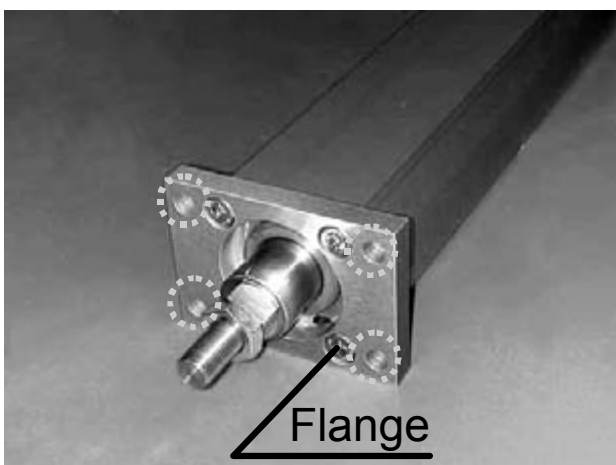


Use tapped holes on the front surface for mounting.

The size and the depth of the holes are as follows.

Model	Tap size	Depth of thread
RPA	M3	6 mm
RXA	M4	10 mm
RSA	M6	12 mm
RMA	M8	15 mm
RSW	M8	12 mm
RMW	M8	15 mm

- (5) The method to use mounting flange.  
Applicable to RXA, RSA, RMA, RSGD, RMGD, RSW, RMW



Attach the mounting flange to the front surface of the body with bolts (excluding the guide type).  
Clamp the flange (or mounting bracket in the case of the double-guide type) with bolts to the machine frame.

## 7. Wiring Cable

### 7.1 Wiring the Standard Specification

Please connect the cables from the actuator to the controller with connectors.

- The actuator cable is resistant to bending fatigue but it is not a robot cable. Avoid housing the cable in movable wire duct with a small radius.
- In an application where the cable cannot be anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable as large radial wire duct to limit the load on the cable.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length.

For cable modification, please contact your IA sales representative.

## 8. Load on the Actuator

- Do not exceed the load shown in the load specification column.
- Make sure that the rod axis center and load transfer direction are the same.

- When side load exists, there is a chance that an actuator breakdown will occur so please be careful.
- When a side load exists, please use guide on the load transfer direction.



- Do not apply the rotating force to the rod (slide shaft).  
\* It may cause damage to the inside.

When tighten the nut at the top of the rod, hold the rod by the wrench with 14mm (RS type) or 19mm (RM type) width to prevent rotating force to the actuator.

## 9. Maintenance

### 9.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

The schedule is set assuming eight hours of operation a day. When the operation time is long such as 24-hour operation, shorten the maintenance intervals as needed.

	Visual inspection	Grease supply	
Start of operation	○		
After 1 month of operation	○		
After 3 months of operation	○	○ (Rod slide surface)	*1
Every 3 months thereafter	○	○ (Rod slide surface)	*1
After 3 years of operation or 5000 km travel distance	○	○ (Ball screw)	*2
Every 1 year thereafter	○	○ (Ball screw)	*2

\*1 Apply the grease to the rod slide surface when dried surface is observed at the start of the operation or every three months of operation.

\*2 With the RPA type, grease need not be applied to the ball screw.

### 9.2 Visual Inspection of the Machine Exterior

Check the following when doing the visual inspection.

<b>Body</b>	Loose mounting bolts?
<b>Cables</b>	Damage to cables or connection to connector box?
<b>General</b>	Unusual noise or vibrations?

### 9.3 Cleaning

- Wipe off dirt with a soft cloth.
- Wipe the dust shield gently so that it does not bend.
- Do not use strong compressed air on the actuator as this may force dust into the crevices.
- Do not use petroleum-based solvents.
- If the unit is badly soiled, apply a neutral deter or alcohol to a soft cloth and wipe lightly.

## 9.4 Grease Supply to Ball Screw and Rod Slide Surface

### 9.4.1 Grease for ball screw

The following grease is used when we ship the unit.

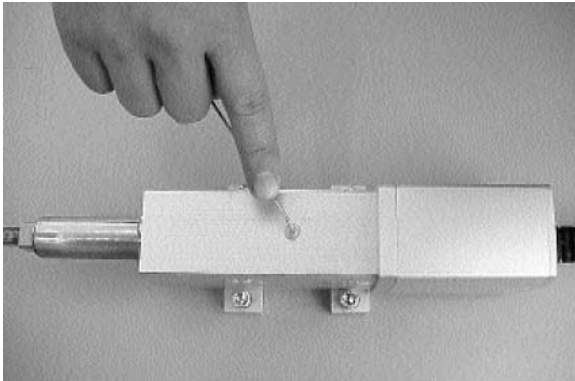
KYODO USHI CO., LTD	Multemp LRL3
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This grease is well suited for the ball screws and has excellent properties such as low heat generation. Please use the lithium based grease spray. Spray the grease within one second only.

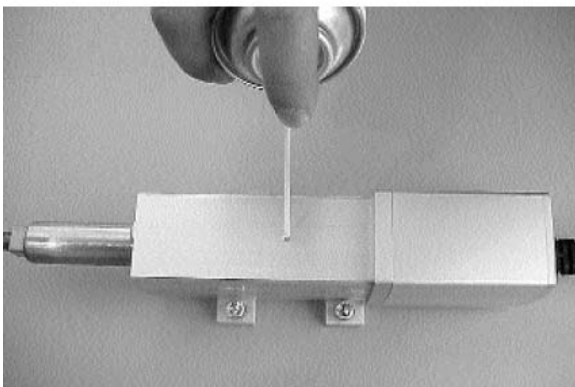


**Warning:** Never use any fluorine based grease. It will cause a chemical reaction when mixed with a lithium based grease and may cause damage to the actuator. The spray must be within one second and no more at a time. Oversupply may create the problem.

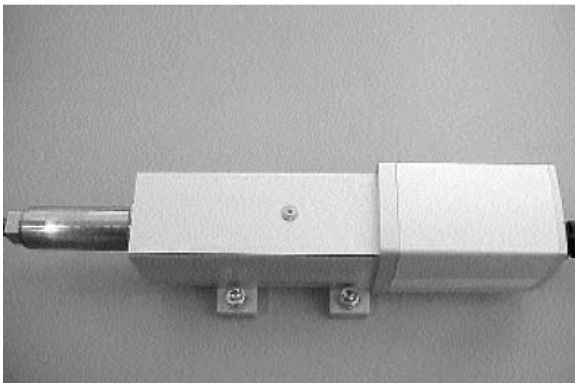
## 9.4.2 How to replenish the grease. (Spray within one second at a time)



- ① Remove the thin head screw as shown in the photo.



- ② Pull out the rod over half of its stroke. Use spray grease through the hole to lubricate the ball screw. (One second or less). Apply the grease to the rod slide surface by hand.



- ③ Move the rod back and forth several times to pervade the grease.

- ④ Apply the silicon on the thread where the screw was removed and tighten the screw back in place.

**Caution:** Be sure to use spray GREASE for grease replenishment. Never use the spray OIL instead of spray grease. The spray must be within one second and no more at a time. Oversupply may cause the malfunction of the electronic parts by excessive oil.

## **10. Warranty**

### 10.1 Warranty Period

Warranty period shall be either of the following periods whichever ends first:

- 18 months after shipment from our factory
- 12 months after delivery to a specified location
- 2500 hours of operation time

### 10.2 Scope of Warranty

If a breakdown occurs within the period specified above and is due to the manufacturer's error, we will repair the unit at no cost. However, the following items are not covered by this warranty.

- Faded paint or other changes that occur naturally over time.
- Consumable components that wear out with use.
- Unit seems to be noisy or similar impressions that do not affect machinery performance.
- Damage resulting from improper handling by the user or lack of proper maintenance.
- Any alterations made by other than IAI or its representatives.
- Breakdowns caused by using controllers made by other manufacturers.
- Any damages caused by fire and other natural disasters or accidents.

The warranty pertains to the purchased product itself and does not cover any damages that might arise from a breakdown of the supplied product. Any repairs will be done at our factory. Even if the product is still covered under the warranty period, we will assess a separate charge for sending technicians to the customer's site.





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