



## **ROBO Cylinder**

### **Arm Type**

#### **RCA Actuators**

[ RCA-A4R  
RCA-A5R  
RCA-A6R ]

#### **RCS2 Actuators**

[ RCS2-A4R  
RCS2-A5R  
RCS2-A6R ]

### **Operating Manual**

**Fourth Edition**



## **Please Read Before Use**

Thank you for purchasing our product.

This Operation Manual explains the handling methods, structure and maintenance of this product, among others, providing the information you need to know to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.

The CD or DVD that comes with the product contains operation manuals for IAI products.

When using the product, refer to the necessary portions of the applicable operation manual by printing them out or displaying them on a PC.

After reading the Operation Manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when 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.

## CE Marking

If a compliance with the CE Marking is required, please follow Overseas Standards Compliance Manual (ME0287) that is provided separately.

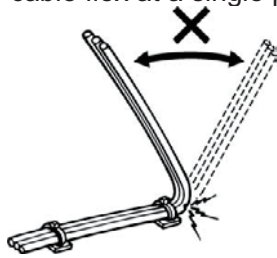
[Applicable Units]

RCA-A4R, A5R, A6R

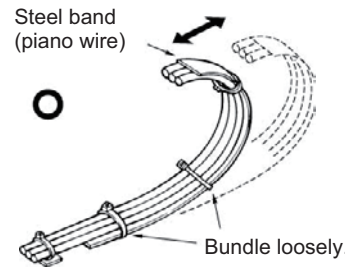
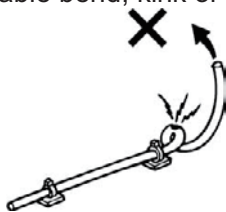
## Prohibited Handling of Cables

When designing an application system using IAI's 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.

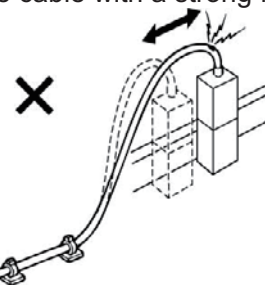
1. Do not let the cable flex at a single point.



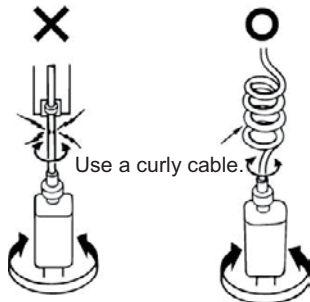
2. Do not let the cable bend, kink or twist.



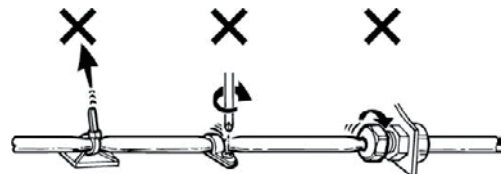
3. Do not pull the cable with a strong force.



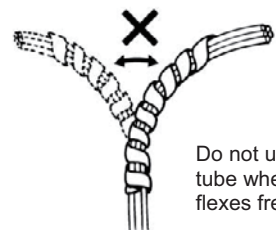
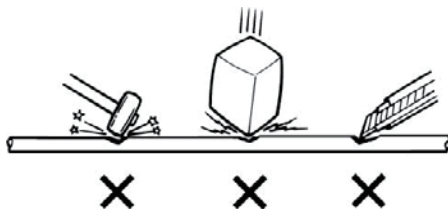
4. Do not let the cable receive a turning force at a single point.



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



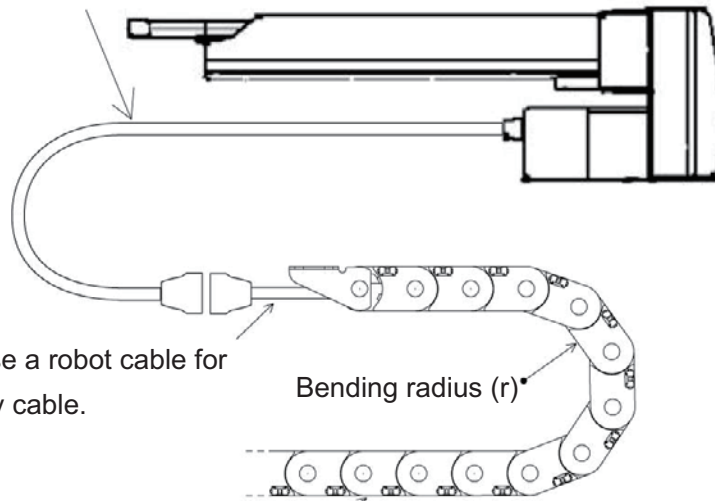
6. Do not pinch, drop a heavy object onto or cut the cable.



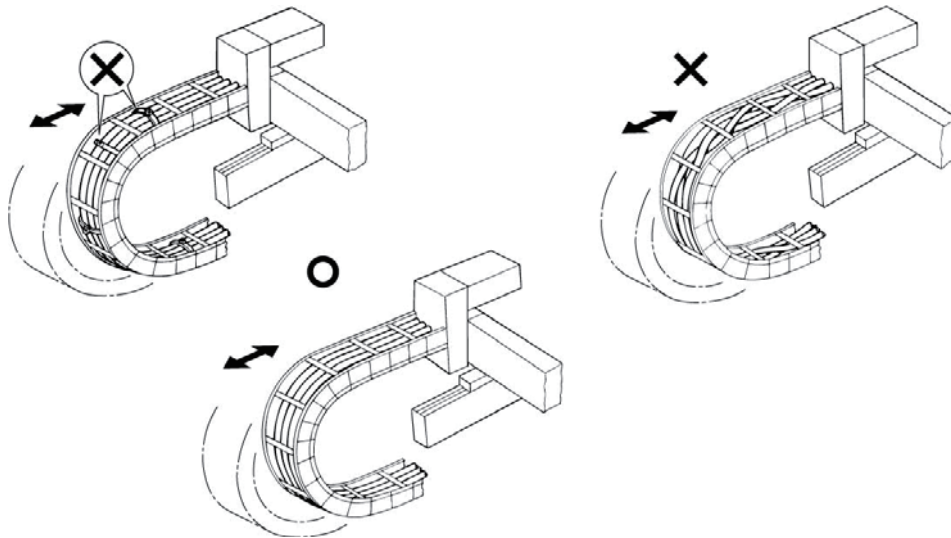
Do not use a spiral tube where the cable flexes frequently.

## 7. Notes on using cable bearers

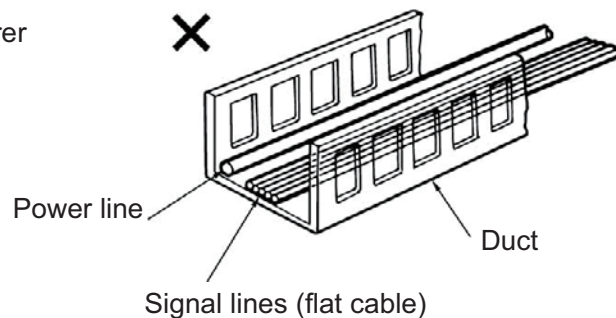
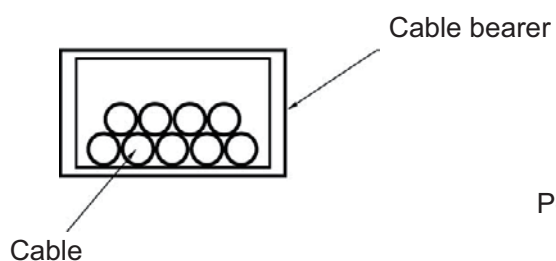
- The supplied cables are not robot cables.  
Accordingly, never store the cables in a cable bearer.



- Always use a robot cable for each relay cable.
- Use a cable bearer with a bending radius (r) of 50mm or greater.
- 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).



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



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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"><li>• 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"><li>1) Medical equipment used to maintain, control or otherwise affect human life or physical health.</li><li>2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility)</li><li>3) Important safety parts of machinery (Safety device, etc.)</li></ol></li><li>• Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product.</li><li>• Do not use it in any of the following environments.<ol style="list-style-type: none"><li>1) Location where there is any inflammable gas, inflammable object or explosive</li><li>2) Place with potential exposure to radiation</li><li>3) Location with the ambient temperature or relative humidity exceeding the specification range</li><li>4) Location where radiant heat is added from direct sunlight or other large heat source</li><li>5) Location where condensation occurs due to abrupt temperature changes</li><li>6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid)</li><li>7) Location exposed to significant amount of dust, salt or iron powder</li><li>8) Location subject to direct vibration or impact</li></ol></li><li>• 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.</li></ul>

No.	Operation Description	Description
2	Transportation	<ul style="list-style-type: none"> <li>• When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• Do not step or sit on the package.</li> <li>• Do not put any heavy thing that can deform the package, on it.</li> <li>• When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work.</li> <li>• When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit.</li> <li>• Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength.</li> <li>• Do not get on the load that is hung on a crane.</li> <li>• Do not leave a load hung up with a crane.</li> <li>• Do not stand under the load that is hung up with a crane.</li> </ul>
3	Storage and Preservation	<ul style="list-style-type: none"> <li>• The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation.</li> <li>• Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.</li> </ul>
4	Installation and Start	<p>(1) Installation of Robot Main Body and Controller, etc.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• When using the product in any of the places specified below, provide a sufficient shield.             <ol style="list-style-type: none"> <li>1) Location where electric noise is generated</li> <li>2) Location where high electrical or magnetic field is present</li> <li>3) Location with the mains or power lines passing nearby</li> <li>4) Location where the product may come in contact with water, oil or chemical droplets</li> </ol> </li> </ul>

No.	Operation Description	Description
4	Installation and Start	<p>(2) Cable Wiring</p> <ul style="list-style-type: none"> <li>• Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool.</li> <li>• 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.</li> <li>• Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> </ul> <p>(3) Grounding</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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 <math>0.5\text{mm}^2</math> (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).</li> <li>• Perform Class D Grounding (former Class 3 Grounding with ground resistance <math>100\Omega</math> or below).</li> </ul>





No.	Operation Description	Description
4	Installation and Start	<p>(4) Safety Measures</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• Take the measure so that the work part is not dropped in power failure or emergency stop.</li> <li>• Wear protection gloves, goggle or safety shoes, as necessary, to secure safety.</li> <li>• 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.</li> <li>• 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.</li> </ul>
5	Teaching	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• Place a sign "Under Operation" at the position easy to see.</li> <li>• 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.</li> </ul> <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"> <li>• 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.</li> <li>• After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> </ul>
7	Automatic Operation	<ul style="list-style-type: none"> <li>• Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence.</li> <li>• Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication.</li> <li>• Make sure to operate automatic operation start from outside of the safety protection fence.</li> <li>• 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.</li> <li>• 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.</li> </ul>

No.	Operation Description	Description
8	Maintenance and Inspection	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• When the work is to be performed inside the safety protection fence, basically turn OFF the power switch.</li> <li>• 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.</li> <li>• 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.</li> <li>• Place a sign "Under Operation" at the position easy to see.</li> <li>• For the grease for the guide or ball screw, use appropriate grease according to the Operation Manual for each model.</li> <li>• Do not perform the dielectric strength test. Failure to do so may result in a damage to the product.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> </ul> <p>Use in incomplete condition may cause damage to the product or an injury.</p> <p>* 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"> <li>• Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.</li> </ul>
10	Disposal	<ul style="list-style-type: none"> <li>• When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.</li> <li>• When removing the actuator for disposal, pay attention to drop of components when detaching screws.</li> <li>• Do not put the product in a fire when disposing of it.</li> </ul> <p>The product may burst or generate toxic gases.</p>
11	Other	<ul style="list-style-type: none"> <li>• 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.</li> <li>• See Overseas Specifications Compliance Manual to check whether complies if necessary.</li> <li>• For the handling of actuators and controllers, follow the dedicated operation manual of each unit to ensure the safety.</li> </ul>

## 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

## Caution in Handling

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1. Do not set speeds and accelerations/decelerations equal to or greater than the respective ratings.

If the actuator is operated at a speed or acceleration/deceleration exceeding the allowable value, abnormal noise or vibration, failure, or shorter life may result.

In the case of interpolated operation of combined axes, the speed and acceleration/deceleration settings should correspond to the minimum values among all combined axes.

2. Keep the load moment within the allowable value.

If the actuator is operated under a load equal to or greater than the allowable load moment, abnormal noise or vibration, failure, or shorter life may result. In an extreme case, flaking may occur.

3. Back and forth operation in a short distance may cause wear of grease.

Continuous back and forth operation within a distance less than 30mm may cause wear of grease.

It is recommended to have 5 rounds of back and forth operation in a distance more than 50mm after every 5,000 to 10,000 rounds of the short distance operation. A layer of the grease will recover.

4. Turn the servo ON after putting the actuator or rod away from the mechanical end.

Turning the servo ON near the mechanical end may disturb the magnetic pole phase detection, and may cause the magnetic pole unconfirmed error or the excitation detection error.

Put the slider or rod away from the mechanical end when performing this operation.

5. Make sure to attach the actuator properly by following this operation manual.

Using the product with the actuator not being certainly retained or affixed may cause abnormal noise, vibration, malfunction or shorten the product life.



## 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.

## 2. Safety Precautions

### 2.1 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.

### 2.2 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.

#### (Note)

- The content of this manual is subject to change without notice for the purpose of improvement.
- This manual was created with utmost attention to accuracy. Should you find any error, however, or if you have any question, please contact IAI's Sales Engineering or Technical Service Section.

## 3. Warranty

### 3.1 Warranty Period

One of the following periods, whichever is shorter:

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

### 3.2 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 of problem in question was caused by a specification defect or problem, or by a quality issue with 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.

### 3.3 Honoring the Warranty

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

### 3.4 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.

### 3.5 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.

### 3.6 Other Items Excluded from Warranty

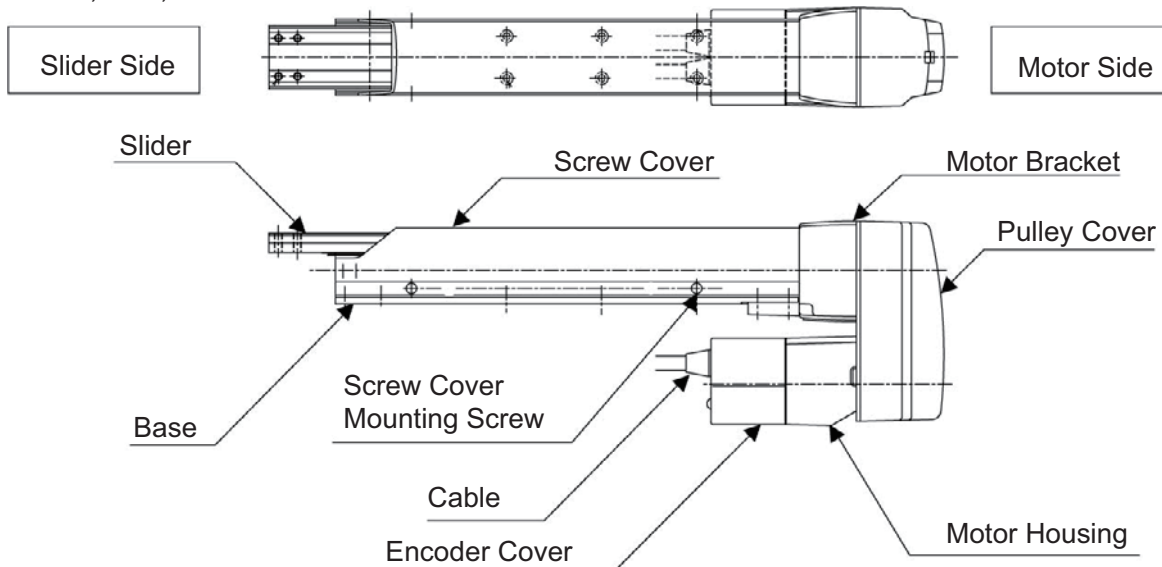
The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:

- [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

## 4. Names of the Parts

The names of the actuator parts are indicated below.

●A4R, A5R, A6R



Caution: The cable directly connected to the actuator is not a robot cable even when ordered with a robot cable option. When designing, please be sure not to give repeated bending loads to this cable.  
The robot cable is applicable only to the connecting cables.

## 5. Transporting and Handling

### 5.1 Handling the Actuator

#### 5.1.1 Handling the Packed Unit

Unless otherwise specified, each actuator (axis) is shipped individually.

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

- The operators 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 which may deform the shipping box or objects with concentrated loads on top of the box.

#### 5.1.2 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 pulley cover, motor housing and encoder cover.
- Do not exert excessive force on any part of the actuator.
- Be careful not to cause the cables to receive a tensile force.

\*Please refer to Section 4 above for the names of the actuator parts.

## 5.2 Handling the Actuator Assembly

Pay attention to the following instructions when transporting an assembly of actuator axes.

### 5.2.1 Condition of Shipment from IAI (Assembled)

The actuators you have ordered are assembled at IAI, after which the assembly receives a shipping inspection and is shipped in an outer frame with skids.

The assembly is packed with sliders securely affixed so that they will not move unexpectedly during transportation. In the case of a combined unit, the actuator ends are secured to prevent swinging due to external vibration.

- The package is not designed with special considerations for protection against impact due to dropping or collision, so please handle the package with care. Also, do not place any heavy object on the outer frame, as it is not strong enough to withstand loads.
- When suspending the package using ropes, etc., pass the ropes from underneath the reinforcement frames at the bottom of the skids. When lifting with a forklift, also place the forks underneath the skids.
- Set down the package carefully so as not to apply impact to the assembly or cause it to bounce.

After unpacking, handle the actuator assembly correctly by observing the instructions given below.

### 5.2.2 Handling after Assembly with Peripheral Equipment

When transporting the actuators that have been assembled with peripheral equipment either at IAI or at your site, observe the instructions given below.

- Secure each slider to prevent unexpected movement during transportation.
- If any actuator end is protruding, secure it to prevent swinging due to external vibration.
- If the actuator ends are not secured, do not apply any impact force exceeding 0.3G during transportation.
- When suspending the actuator-assembled peripheral equipment using ropes, etc., make sure that the ropes do not contact the actuators directly.
- Pass the ropes over appropriate cushion materials, and make sure the loads from the ropes will be received directly by the base of each actuator.
- Secure the end of the Y-axis using a separate rope to maintain the axis in a stable horizontal position. At this time, be careful not to apply loads on the screw cover.
- Be careful not to allow the brackets, covers and connector box of each actuator to receive loads. Also protect the cables from pinching or excessive deformation.

## 6. Operating and Storage Environment

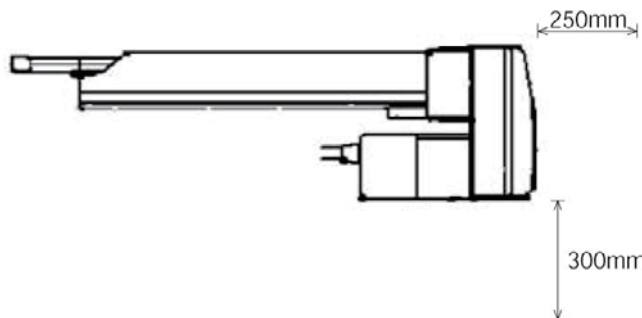
### 6.1 Operating Environment

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

- Avoid direct sunlight.
- Avoid radiant heat from strong heat sources such as a furnace.
- Ambient temperature should be 0 - 40°C.
- The humidity should be less than 85% and there should be no condensation.
- Avoid exposure to corrosive or combustible gases.
- The area should have very little dust and be suitable for normal assembly operation.
- Avoid exposure to oil mist or fluids used in cutting.
- The unit should not be subject to impact or vibrations.
- Avoid extreme electromagnetic waves, ultraviolet rays and radiation.
- 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 equipment or protective clothing.

Work space needed for maintenance/inspection



### 6.2 Storage Environment

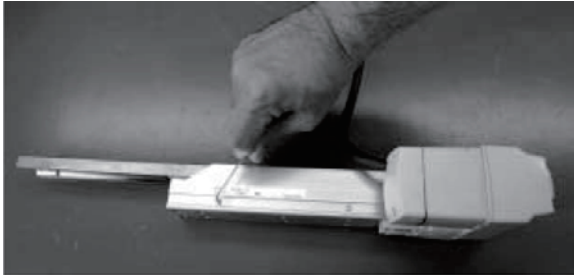
The storage environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored for a long period of time. Unless there are special instructions, we do not include moisture absorption agents when shipping the unit. If you are storing the unit where condensation might occur, then you must treat the entire package from outside of the 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.

## 7. Installation

### 7.1 Installing the Main Body

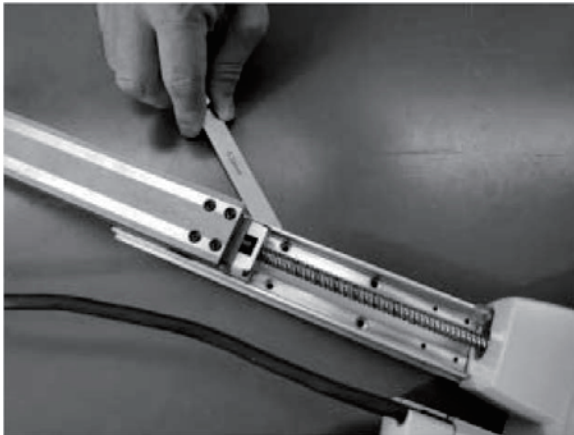
Mount the actuator to a machined surface or one of the flat surfaces of comparable precision.

Install the main body as follows:



Pull out the slider to the stroke end. Remove four screw cover mounting screws with an Allen wrench of 1.5mm across flats to remove the screw cover.

If the actuator has a brake, connect this machine to the controller and pull out the slider to the stroke end after the brake has been released with the brake release switch. Then, turn off the controller power for safety.



Check to see that a 0.1mm thick gauge cannot be inserted at the mounting holes while this machine is left standing on the mounting surface.





Secure the main body with the mounting holes on the base of this machine.

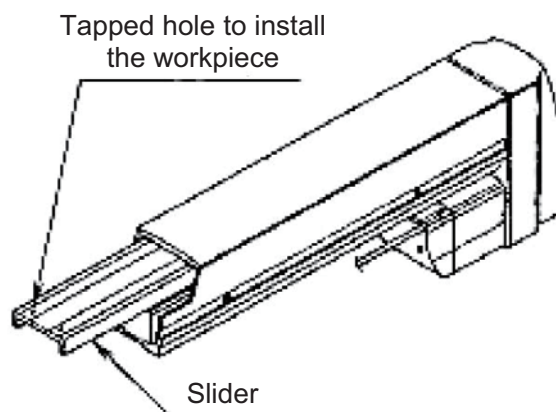
Use the hexagon socket head bolts shown below.

After securing the main body, reinstall the screw cover.

Type	When the bolt seating surface is steel	When the bolt seating surface is aluminum
A6R	M5 × 10	M5 × 15
A5R	M4 × 8	M4 × 12
A4R	M3 × 8	M3 × 12

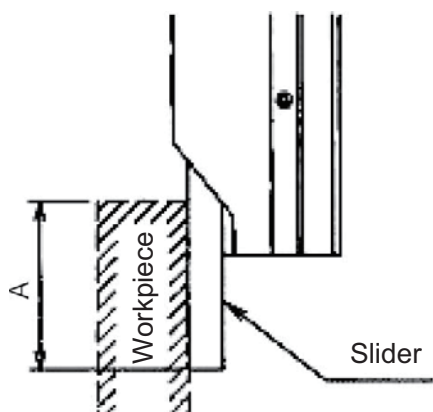
## 7.2 Installing the Workpiece

Use four M4 screws to install the workpiece to the slider.



Check to see that the workpiece seating surface is flat to prevent the slider from becoming deformed when the workpiece is installed.

Slider deformation may cause it to move rigidly or shorten its life.



Set the dimension of an overhang above the workpiece to the value shown below to prevent interference with the screw cover and workpiece.

Type	Dimension
A6R	A = 70mm
A5R	A = 65mm
A4R	A = 53mm

Do not exceed the maximum mass capacity.

Please make note of the slider moment, allowable overhang length and load weight.

## 8. Wiring Cable

- 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 a self-standing type cable as a 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.
- The cables supplied with the actuator offer excellent flexibility, but they are not robot cables. If the cables are to be stored in a movable cable duct (cable bearer, etc.), use robot cables.

For cable modification, please contact your IAI sales representatives.

## 9. Maximum Speed

The maximum speed of the actuator is limited to prevent resonance of the ball screw shaft in consideration of the instructions on motor speed.

Observe the maximum speed limits specified below.

Maximum speed limits

Type	Lead	Maximum Speed
A6R	6mm	200mm/sec.
	12mm	400mm/sec.
A5R	6mm	200mm/sec.
	12mm	400mm/sec.
A4R	5mm	165mm/sec.
	10mm	330mm/sec.

Caution: If the maximum speed limit is exceeded, noise may increase or vibration may occur due to resonance of the ball screw shaft, in which case the service life of the actuator may be significantly reduced.

If multiple actuators are used together, with each actuator operating independently, create programs where each actuator does not exceed the applicable maximum speed (see the table above). If operations of multiple actuators are synchronized, programs should be based on the lowest maximum speed among the combined actuators.

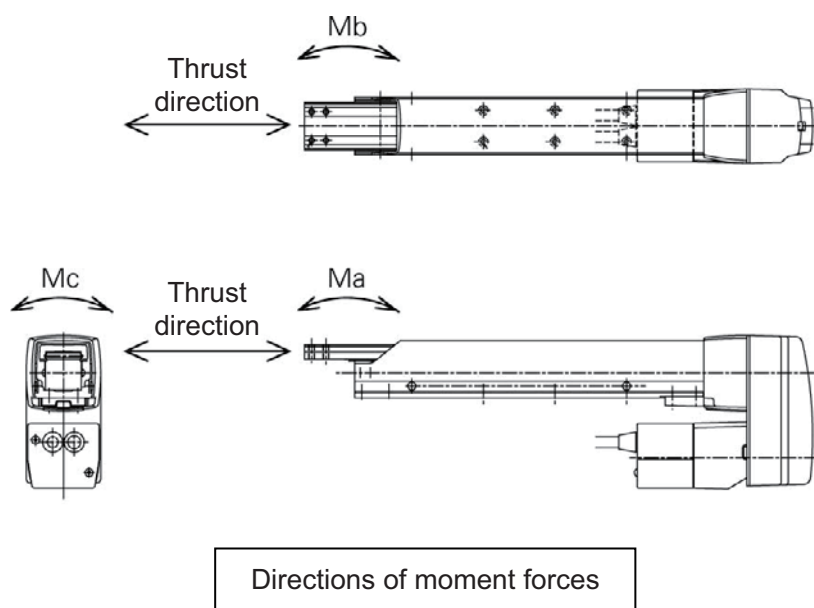
Create an appropriate program by checking the maximum speed of each actuator.

## 10. Load on the Actuator

Do not exceed the load shown in the load specification column. Please make note of the slider moment and the load weight.

Allowable load moments

Type	Ma	Mb	Mc
A6R	8.1N·m (0.83kgf·m)	10.0N·m (1.02kgf·m)	6.5N·m (0.66kgf·m)
A5R	4.5N·m (0.46kgf·m)	5.4N·m (0.55kgf·m)	4.1N·m (0.42kgf·m)
A4R	2.7N·m (0.28kgf·m)	3.1N·m (0.32kgf·m)	2.9N·m (0.30kgf·m)



Caution: Loads on the slider must be uniformly distributed. Securely hold the base to the flat frame.

## 11. Maintenance

### 11.1 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 a 24-hour operation, shorten the maintenance intervals as needed.

	Visual inspection	Check interior	Grease supply
Start of operation	○		
After 1 month of operation	○		
After 6 months of operation	○	○	
After 1 year of operation	○	○	○
Every 6 months thereafter	○		
Every 1 year	○	○	○

### 11.2 Visual Inspection of the Machine Exterior

Check the following items when carrying out visual inspection.

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

### 11.3 Cleaning

- Clean the exterior as needed.
- Wipe off dirt with a soft cloth.
- Do not use strong compressed air on the actuator as this may force dust into the crevices.
- Do not use petroleum-based solvents on plastic parts or painted surfaces since such solvents damage them.
- If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth, and wipe gently.

## 11.4 Interior Inspection

Turn off the power, remove the side covers, and then visually inspect the interior.

Check the following items during interior inspection.

Body	Loose mounting bolts?
Guides	Lubrication appropriate? Soiling?
Ball screw	Lubrication appropriate? Soiling?

### How to inspect the interior:

- 1) Remove both side covers.

Use an Allen wrench of 1.5mm across flats.



Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the traveling surface appears shiny.

- 2) If the grease becomes dirty and dull or if the grease has worn away due to extended operating time, lubricate the parts after cleaning them.

- 3) When the inspection/maintenance work is complete, install the side covers.

Tightening torque: Thin-head screw M3 × 6 87.2N·cm (8.90kgf·cm)

## 11.5 Internal Cleaning

- Wipe off dirt with a soft cloth.
- Do not use strong compressed air on the actuator as this may force dust into the crevices.
- Do not use petroleum-based solvent, neutral detergent or alcohol.

Caution: Do not use flushing oil, molybdenum grease or anti-rust lubricant.

When grease is soiled with a large amount of foreign substances, wipe off the dirty grease and then apply new grease.

## 11.6 Lubricating the Guides and Ball Screw

### 11.6.1 What Grease to Use

#### (1) What Grease to Use on the Guides

The following grease is used when we ship the unit.

Idemitsu Kosan	Daphne Eponex Grease No. 2
----------------	----------------------------

Other companies also sell a grease similar to this. If ordering from another maker, give the name of this product and request something comparable. Comparable products include the following:

Showa Shell Oil	Albania Grease No. 2
Mobil Oil	Mobilux 2

#### (2) What Grease to Use on the Ball Screw

The following grease is used when we ship the unit.

This grease offers excellent properties such as low heat generation, and is suitable for lubricating ball screws.

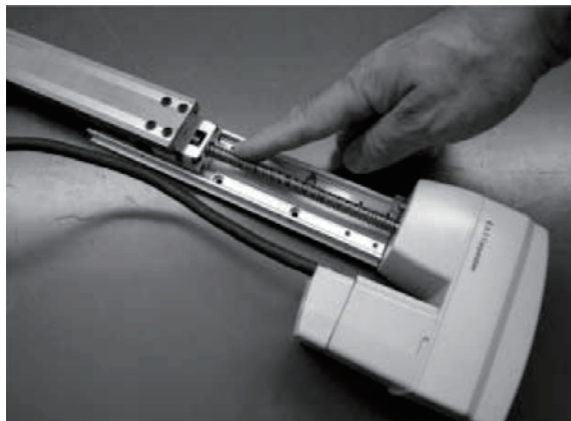
Kyodo Yushi	Multemp LRL3
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**Warning:** Never use any fluorine-based grease. It will cause a chemical reaction when mixed with a lithium-based grease and may cause damage to the actuator.

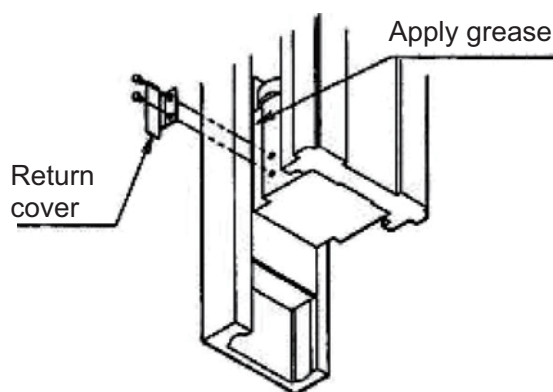


## 11.6.2 How to Apply Grease

- 1) When greasing the ball screw, apply grease using a finger and then move the slider back and forth several times to let the grease spread evenly.



- 2) When greasing the slider, apply grease directly on the bearing while the return cover is removed from the guides.



- 3) Install the side covers.

Tightening torque: Thin-head screw  $M3 \times 6$  87.2N·cm (8.90kgf·cm)

Caution: In case the grease got into your eye, immediately go to see the doctor to get an appropriate care.  
After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

## 11.7 Reduction Belt

### 11.7.1 Inspecting the Belt

Remove the pulley cover and visually inspect the belt.

Durability of the reduction belt is affected significantly by the operating condition, and there is no standard guideline as to when the belt should be replaced.

Generally, the belt is designed to withstand several millions of flexing loads.

As a practical guideline, replace the reduction belt when any of the conditions listed below are observed:

- The teeth and end faces of the belt have worn significantly.
- The belt has swollen due to deposits of oil, etc.
- Cracks and other damages are found on the teeth or back of the belt.
- The belt has broken.

### 11.7.2 Applicable Belt

A4R, A5R, A6R

...60S2M180R

Rubber cleanroom type (Bando Chemical Industries)

6mm wide

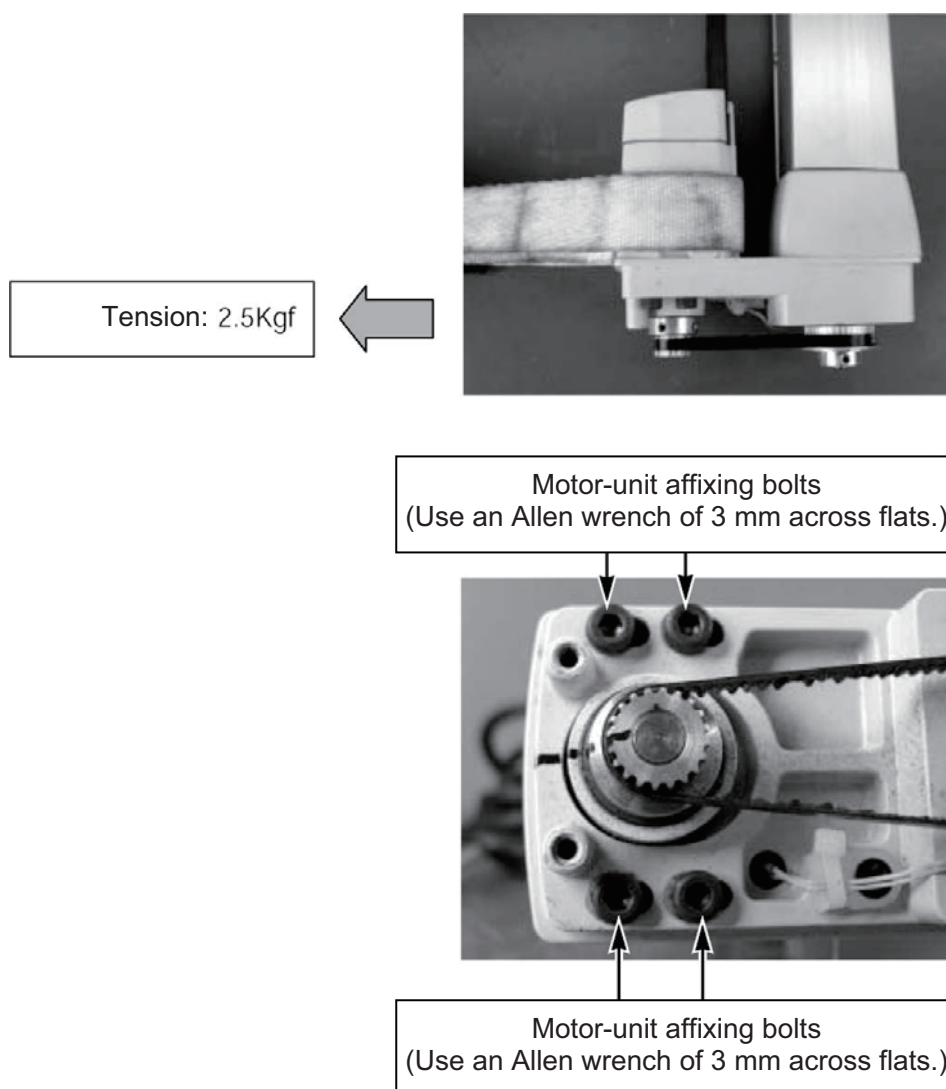
## 11.7.3 Adjusting the Belt Tension

Remove the pulley cover and loosen the four motor-unit affixing bolts.

Pass a looped string (or long tie-band) around the motor housing and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the motor-unit affixing bolts.

### [Recommended tightening force for adjusting bolts]

162N·cm (16.5kgf·cm)



## 11.7.4 Replacing the Belt of the Motor Reversing Type: A4R, A5R, A6R

### [Items Required for Replacement]

- Replacement belt

A4R, A5R, A6R

...60S2M180R

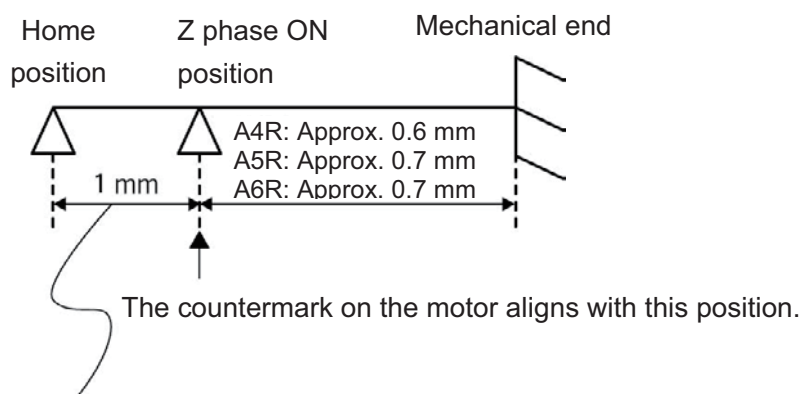
Rubber cleanroom type (Bando Chemical Industries)

6mm wide

- Allen wrenches
- Tension gauge (Capable of tensioning to 7kgf or greater)
- Strong string, looped (or long tie-band)
- Scale
- Oil-based marker pen
- PC or teaching pendant

### [Overview of Replacement]

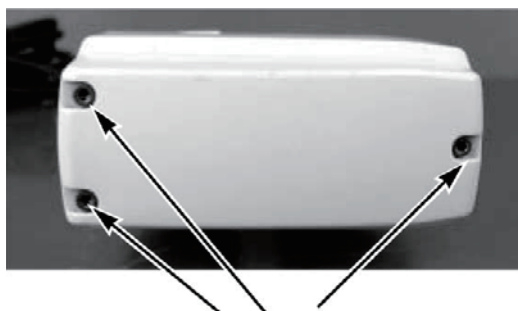
- 1) Move the slider to a position where Z phase turns on (home position) (0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R. Loosen the motor-unit affixing bolts and replace the belt in this position.
- 2) Restore the home position.  
Affix the slider at a position 0.6mm from the mechanical end on the home side for A4R or 0.7mm for A5R and A6R, pass the belt, and adjust the belt to the specified tension.
- 3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position.  
If there is a deviation, adjust the home offset parameter.



Set by the home offset parameter. (The above value is the factory setting.)

## [Procedure]

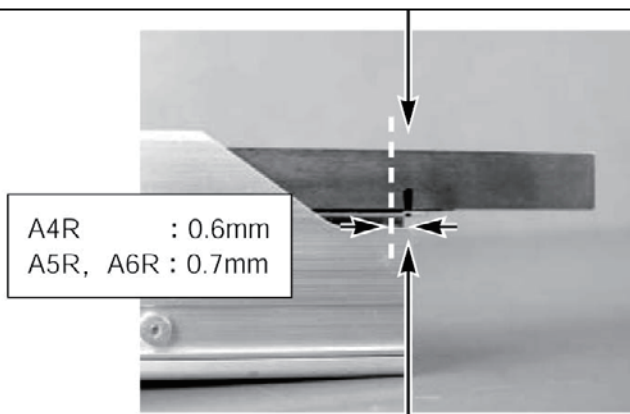
- 1) Remove the pulley cover using an Allen wrench of 2.5mm across flats.



Hexagon socket head screws: M3

- 2) Move the slider to a position where Z phase turns on (home position).  
The slider is placed at a position 0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R.  
Draw a countermark at the slider pulled-out position.

Pull out the slider 0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R.



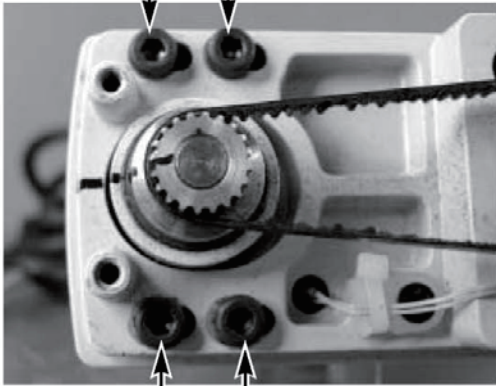
Draw a countermark at a position where the slider is pulled out 0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R.

If the actuator has a brake, connect this machine to the controller and pull out the slider to the stroke end after the brake has been released with the brake release switch. Then, turn off the controller power for safety.

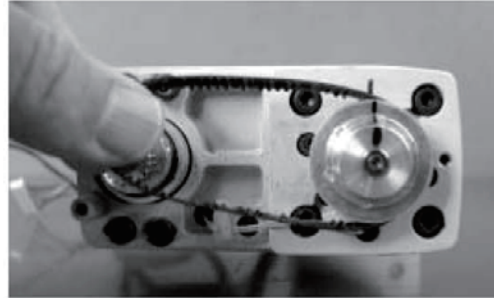
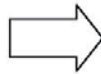
**Warning:** If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly. Always provide a support to brace the hand part and to prevent a sudden drop, so as not to pinch fingers or damage the workpiece.

- 3) Loosen the motor-unit affixing bolts using an Allen wrench of 3mm across flats. Slide the motor, and loosen and remove the belt.

Motor-unit affixing bolts  
(Use an Allen wrench of 3mm across flats.)



Motor-unit affixing bolts  
(Use an Allen wrench of 3mm across flats.)

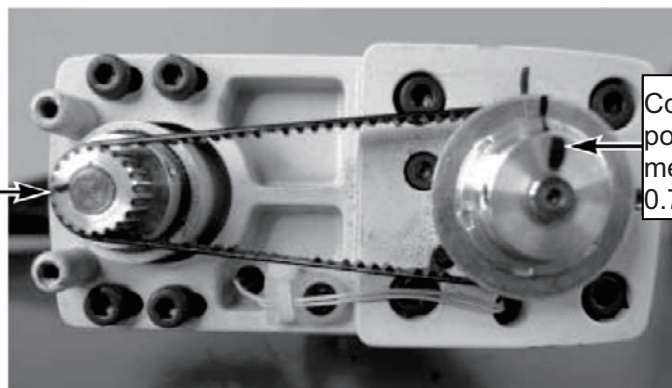


- 4) Check the following points before restoring the home position:

- The motor side should be aligned with the initial countermark. If the position is offset, adjust it to achieve proper alignment.
- The ball-screw side should be in a location corresponding to the slide position of 0.6mm away from the mechanical end for A4R or 0.7mm away for A5R and A6R.

After the check, attach a new belt while holding the pulleys on both sides in position.

Initial countermark  
position



Corresponding to the slider  
position of 0.6mm away from the  
mechanical end for A4R or  
0.7mm away for A5R and A6R

Motor side

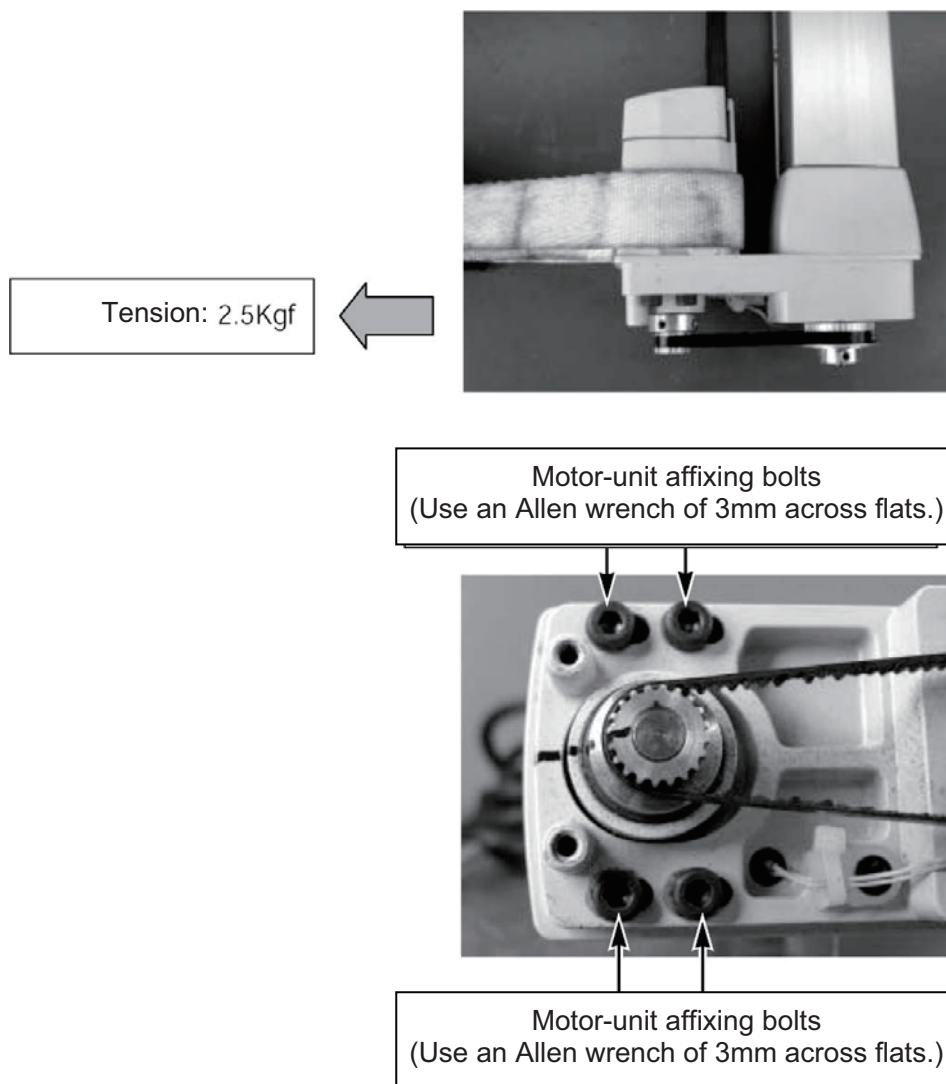
Ball-screw side

5) Adjust the belt tension.

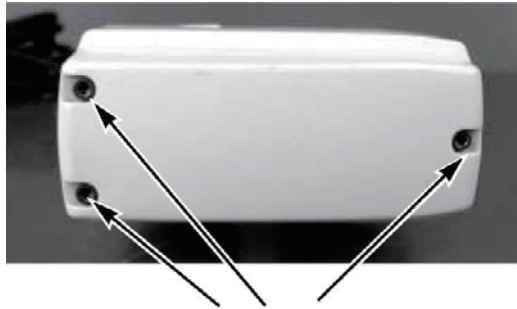
Pass a looped strong string (or long tie-band) around the motor housing and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the motor-unit affixing bolts.

[Recommended tightening torque for adjusting bolts]

162N·cm (16.5kgf·cm)



- 6) Install the pulley cover using an Allen wrench of 2.5mm across flats.



Hexagon socket head screws: M3

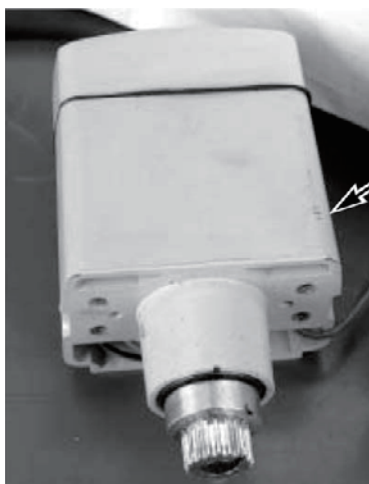
- 7) Connect a PC or teaching pendant to the controller to perform homing. (If the actuator is of absolute encoder specification, absolute reset must be performed). Check for deviation from the initial home position. If there is a deviation, adjust the home offset parameter.



## 11.8 Replacing the Motor: A4R, A5R, A6R

### [Items Required for Replacement]

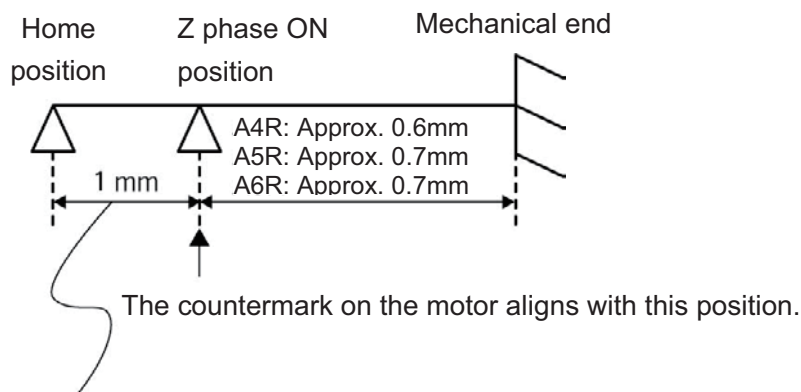
- Replacement motor unit
- Allen wrenches
- Tension gauge (Capable of tensioning to 7kgf or greater)
- Strong string, looped (or long tie-band)
- Scale
- Oil-based marker pen
- PC or teaching pendant



Replacement motor unit

### [Overview of Replacement]

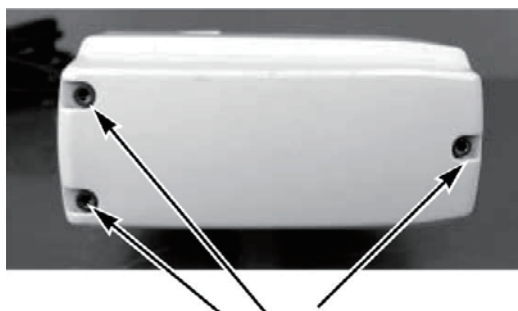
- 1) Loosen the motor-unit affixing bolts to remove the belt, and replace the motor.
- 2) Restore the home position.  
Affix the slider at a position 0.6mm from the mechanical end on the home side for A4R or 0.7mm for A5R and A6R, pass the belt, and adjust the belt to the specified tension.
- 3) Perform homing using a PC or teaching pendant and check for deviation from the initial home position.  
If there is a deviation, adjust the home offset parameter.



Set by the home offset parameter. (The above value is the factory setting.)

## [Procedure]

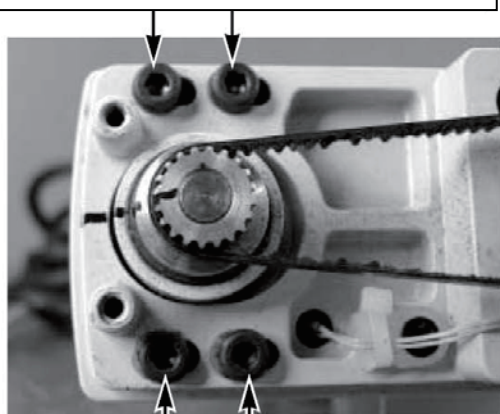
- 1) Remove the pulley cover using an Allen wrench of 2.5mm across flats.



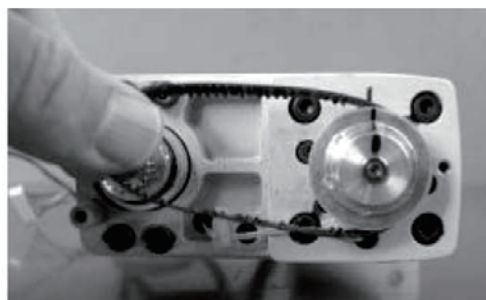
Hexagon socket head screws: M3

- 2) Loosen the motor-unit affixing bolts using an Allen wrench of 3mm across the flats. Slide the motor, and loosen and remove the belt. After the belt has been removed, remove the motor-unit affixing bolts.

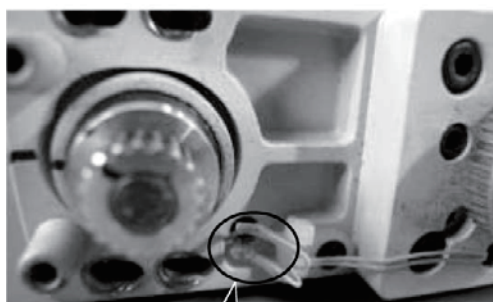
Motor-unit affixing bolts  
(Use an Allen wrench of 3mm across flats.)



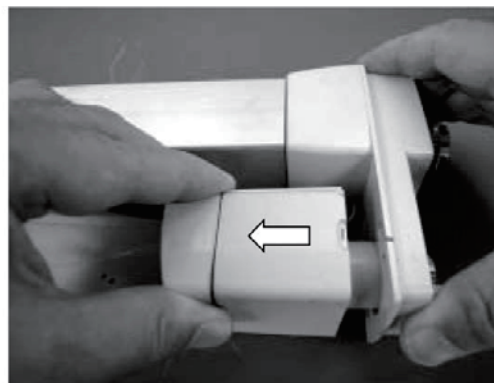
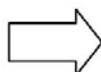
Motor-unit affixing bolts  
(Use an Allen wrench of 3mm across flats.)



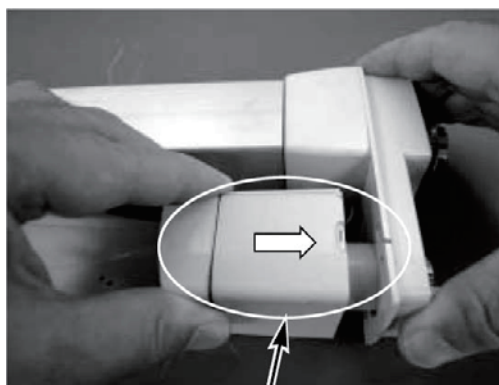
- 3) If the actuator has a brake, disconnect the brake cable and remove the motor.



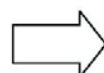
Disconnect the brake cable.



- 4) Install the replacement motor unit. If the actuator has a brake, solder and connect the brake cable. Cover the soldered portion of the cable with a vinyl tube and then temporarily secure it with the motor-unit affixing bolts.



Replacement motor

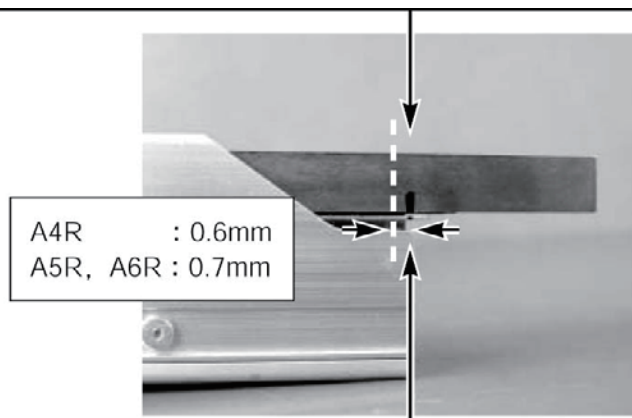


Solder and connect the brake cable

5) Move the slider to a position where Z phase turns on (home position).

The slider is placed at a position 0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R.  
Draw a countermark at the slider pulled-out position.

Pull out the slider 0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R.



Draw a countermark at a position where the slider is pulled out 0.6mm from the mechanical end for A4R or 0.7mm for A5R and A6R.

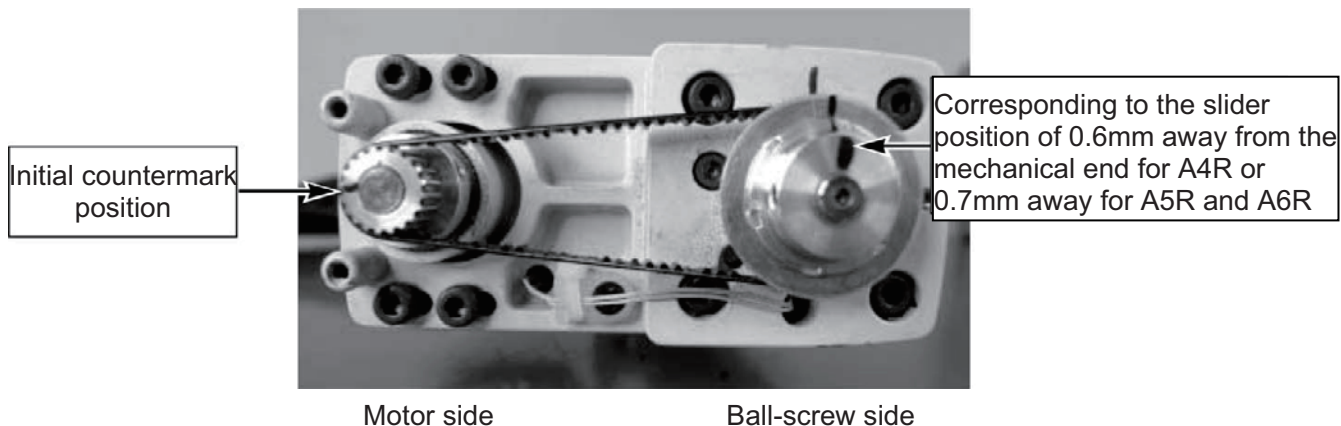
If the actuator has a brake, connect this machine to the controller and pull out the slider to the stroke end after the brake has been released with the brake release switch. Then, turn off the controller power for safety.

**Warning:** If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly. Always provide a support to brace the hand part and to prevent a sudden drop, so as not to pinch fingers or damage the work.

6) Check the following points before restoring the home position:

- The motor side should be aligned with the initial countermark.
- The ball-screw side should be in a location corresponding to the slide position of 0.6mm away from the mechanical end for A4R or 0.7mm away for A5R and A6R.

After the check, attach a new belt while holding the pulleys on both sides in position.



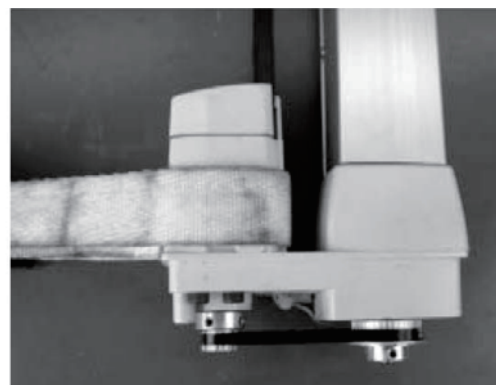
## 7) Adjust the belt tension.

Pass a looped strong string (or long tie-band) around the motor housing and pull it with a tension gauge to the specified tension. In this condition, uniformly tighten the motor-unit affixing bolts.

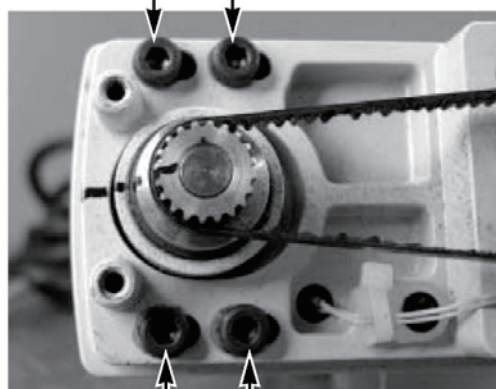
### [Recommended tightening torque for adjusting bolts]

162N·cm (16.5kgf·cm)

Tension: 2.5Kgf

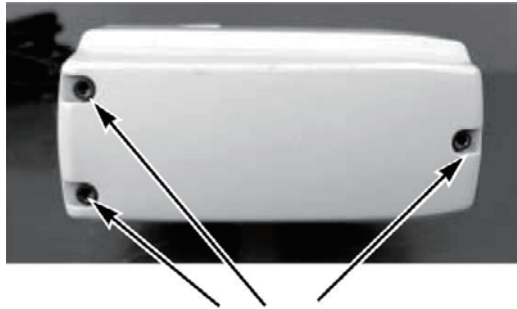


Motor-unit affixing bolts  
(Use an Allen wrench of 3 mm across flats.)



Motor-unit affixing bolts  
(Use an Allen wrench of 3 mm across flats.)

- 8) Install the pulley cover using an Allen wrench of 2.5mm across flats.



Hexagon socket head screws: M3

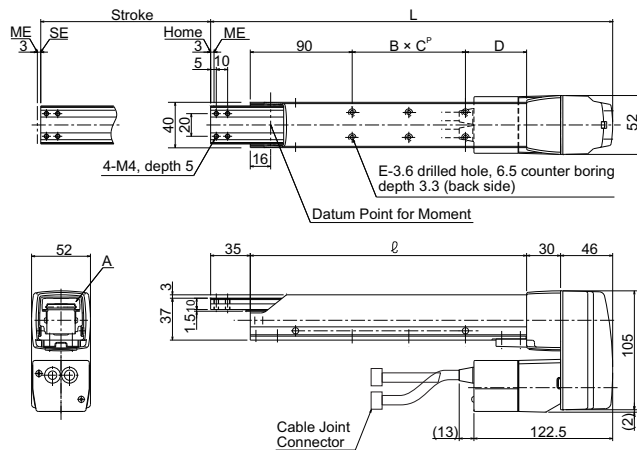
- 9) Connect a PC or teaching pendant to the controller to perform homing. (If the actuator is of absolute encoder specification, absolute reset must be performed). Check for deviation from the initial home position. If there is a deviation, adjust the home offset parameter.

## 12. Appendix

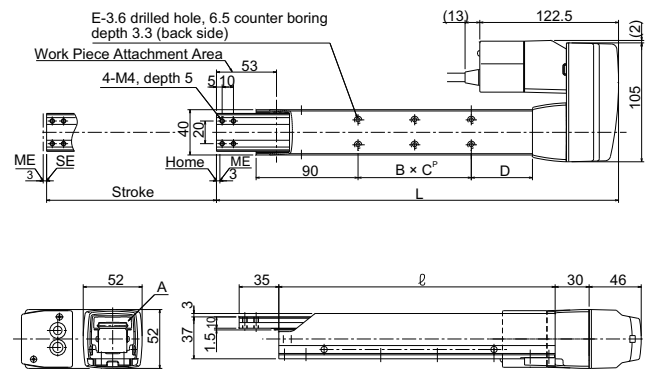
### 12.1 External Dimensions

#### 12.1.1 RCA-A4R

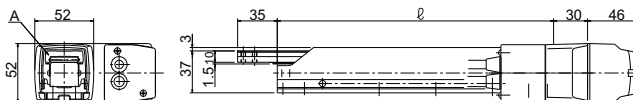
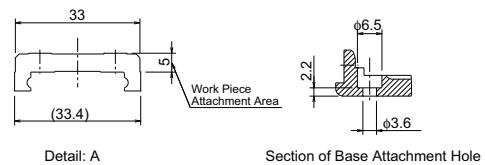
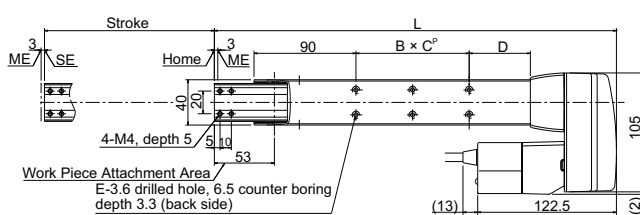
Motor Reversed on Bottom Side (Option Code: MB)



Motor Reversed on Right Side (Option Code: MR)



Motor Reversed on Left Side (Option Code: ML)



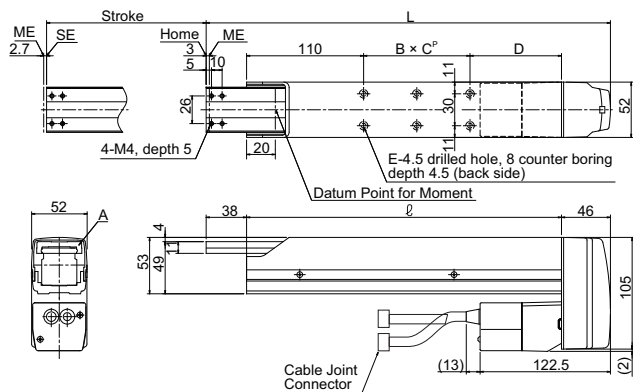
■ Dimensions and Weight by Stroke

Stroke	50	100	150	200
L	255	305	355	405
ℓ	144	194	244	294
B x C <sup>p</sup>	1x19	1x50	2x50	2x50
D	35	54	54	104
E	4	4	6	6
Weight [kg]	1.7	1.8	2.0	2.1

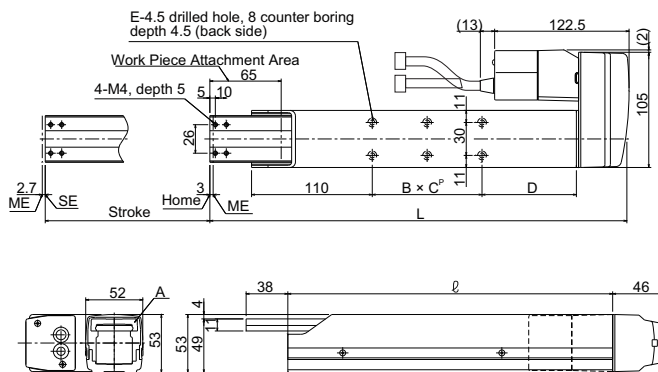


## 12.1.2 RCA-A5R

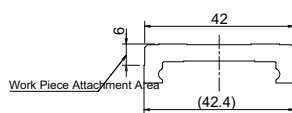
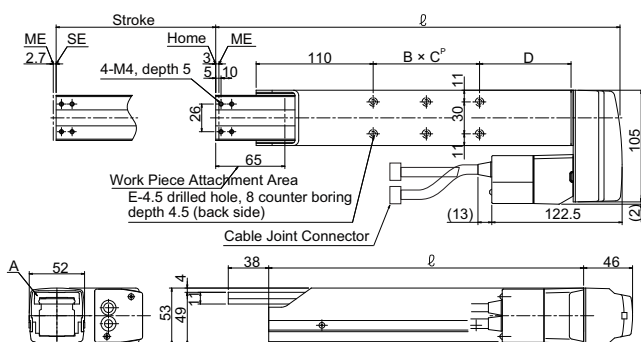
### Motor Reversed on Bottom Side (Option Code: MB)



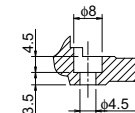
### Motor Reversed on Right Side (Option Code: MR)



### Motor Reversed on Left Side (Option Code: ML)



Detail: A



Section of Base Attachment Hole

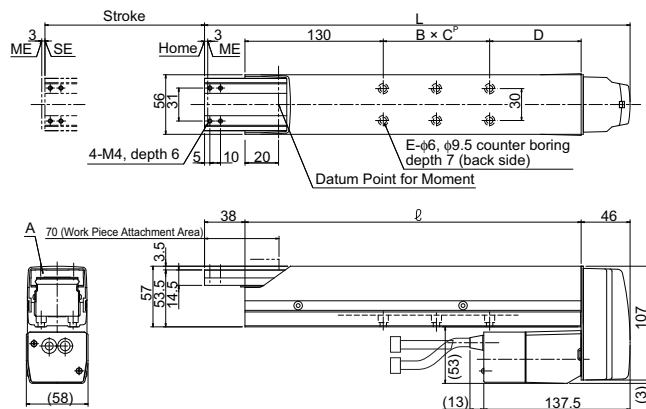
#### ■ Dimensions and Weight by Stroke

Stroke	50	100	150	200
L	280	330	380	430
ℓ	196	246	296	346
B × C <sup>p</sup>	1×30	1×50	2×50	2×50
D	56	86	86	136
E	4	4	6	6
Weight [kg]	2.2	2.4	2.6	2.8

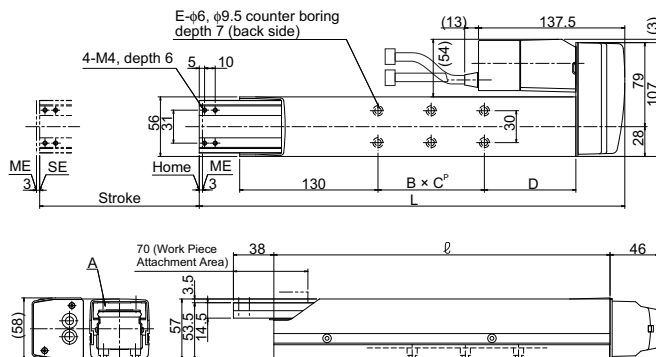
**Caution** Please note that 50st type is prepared only for right-reversed and left-reversed types. There is no 50st type for the standard type.

## 12.1.3 RCA-A6R

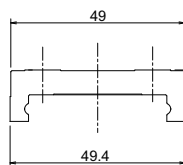
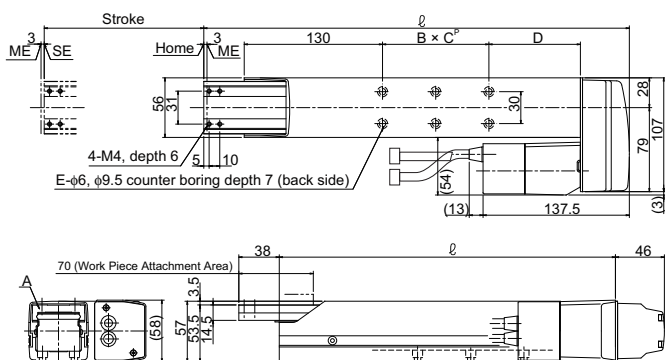
Motor Reversed on Bottom Side (Option Code: MB)



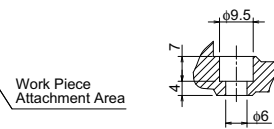
Motor Reversed on Right Side (Option Code: MR)



Motor Reversed on Left Side (Option Code: ML)



Detail: A



Section of Base Attachment Hole

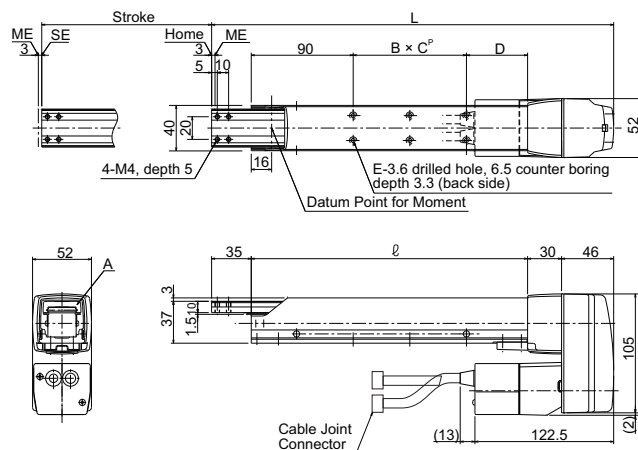
■ Dimensions and Weight by Stroke

Stroke	50	100	150	200
L	300	350	400	450
ℓ	216	266	316	366
B x C <sup>P</sup>	1×30	1×50	2×50	2×50
D	56	86	86	136
E	4	4	6	6
Weight [kg]	3.0	3.3	3.6	3.9

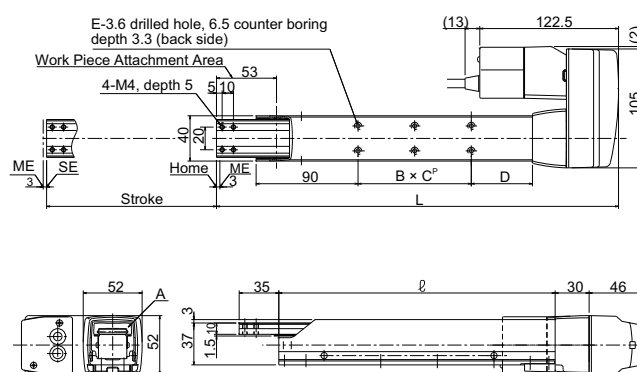
Caution Please note that 50st type is prepared only for right-reversed and left-reversed types. There is no 50st type for the standard type.

## 12.1.4 RCS2-A4R

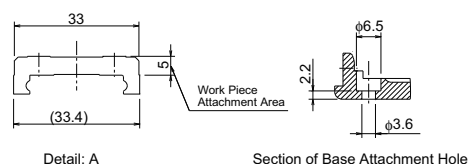
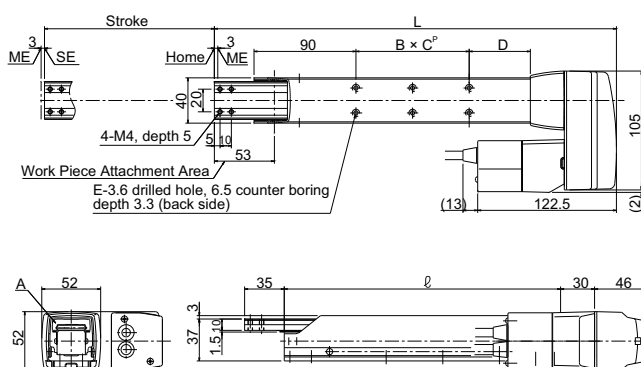
Motor Reversed on Bottom Side (Option Code: MB)



Motor Reversed on Right Side (Option Code: MR)



Motor Reversed on Left Side (Option Code: ML)



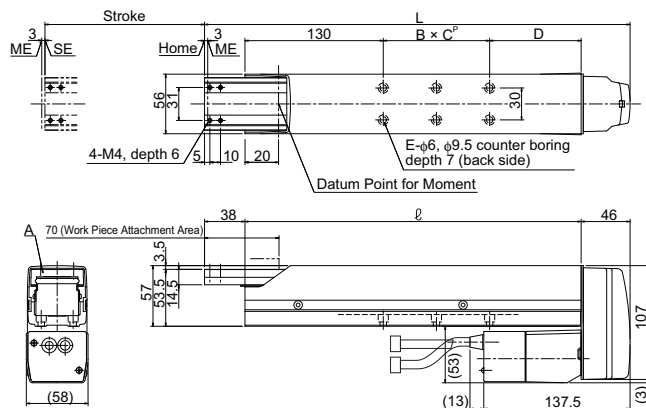
■ Dimensions and Weight by Stroke

Stroke	50	100	150	200
L	255	305	355	405
ℓ	144	194	244	294
B × C <sup>P</sup>	1×19	1×50	2×50	2×50
D	35	54	54	104
E	4	4	6	6
Weight [kg]	1.7	1.8	2.0	2.1

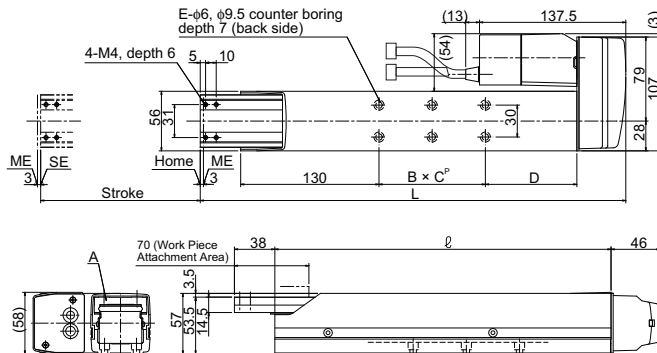


## 12.1.6 RCS2-A6R

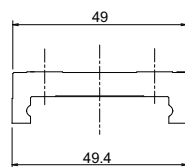
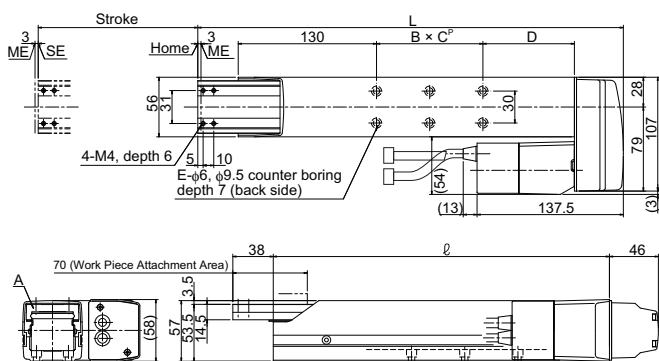
Motor Reversed on Bottom Side (Option Code: MB)



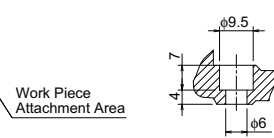
Motor Reversed on Right Side (Option Code: MR)



Motor Reversed on Left Side (Option Code: ML)



Detail: A



Section of Base Attachment Hole

■ Dimensions and Weight by Stroke

Stroke	50	100	150	200
L	300	350	400	450
ℓ	216	266	316	366
B × C <sup>P</sup>	1×30	1×50	2×50	2×50
D	56	86	86	136
E	4	4	6	6
Weight [kg]	3.0	3.3	3.6	3.9

Caution Please note that 50st type is prepared only for right-reversed and left-reversed types. There is no 50st type for the standard type.

## Change History

Revision Date	Description of Revision
April 2011	Fourth edition A page for CE Marking added
March 2012	Fifth edition CAUTION deleted Pg. 1 to 7 Contents added and changed in Safety Guide Pg. 8 Caution in Handling added Pg. 10, 11 Contents changed in 3. Warranty Pg. 25 Warning notes added such as in case the grease got into your eye, immediately go to see the doctor for an appropriate care. Pg. 40 to 45 External Dimensions added





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