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ROBO CYLINDER

ROBO Cylinder
RCA/RCACR Actuators
Slider Type

Operating Manual

Eighth Edition

Standard type	Motor Straight Type (Coupling Type)	RCA-SA4C, SA5C, SA6C
	Motor Straight Type (Built-in Type)	RCA-SA4D, SA5D, SA6D SS4D, SS5D, SS6D
	Motor Reversing Type	RCA-SA4R, SA5R, SA6R
Cleanroom type	Motor Straight Type (Coupling Type)	RCACR-SA4C, SA5C, SA6C
	Motor Straight Type (Built-in Type)	RCACR- SA5D, SA6D

IAI America, Inc.

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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 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.

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Note

Greasing Actuators of Cleanroom Specification

For ROBO Cylinder actuators of cleanroom specification, use grease of low-dust-raising type for cleanroom applications.
The grease specified in the maintenance/inspection sections of the Operating Manual is for actuators of standard specification.
Using the grease for the standard actuators on the cleanroom actuators may generate dust.

Recommended grease:	C Grease by Kuroda Precision Industries Ltd.

C Grease by Kuroda Precision Industries is applied to the cleanroom actuators before shipment from IAI.

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CE Marking

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

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Safety Guide

This “Safety Guide” is intended to ensure the correct use of this product and prevent dangers and property damage. Be sure to read this section before using your product.

Regulations and Standards Governing Industrial Robots

Safety measures on mechanical devices are generally classified into four categories under the International Industrial Standard ISO/DIS 12100, “Safety of machinery,” as follows:

Safety measures
- Inherent safety design
- Protective guards --- Safety fence, etc.
- Additional safety measures --- Emergency stop device, etc.
- Information on use --- Danger sign, warnings, operation manual

Based on this classification, various standards are established in a hierarchical manner under the International Standards ISO/IEC. The safety standards that apply to industrial robots are as follows:

Type C standards (individual safety standards)
- → ISO10218 (Manipulating industrial robots – Safety)
- → JIS B 8433 (Manipulating industrial robots – Safety)

Also, Japanese laws regulate the safety of industrial robots, as follows:

Industrial Safety and Health Law Article 59

Workers engaged in dangerous or harmful operations must receive special education.

Ordinance on Industrial Safety and Health

Article 36 --- Operations requiring special education

- No. 31 (Teaching, etc.) --- Teaching and other similar work involving industrial robots (exceptions apply)
- No. 32 (Inspection, etc.) --- Inspection, repair, adjustment and similar work involving industrial robots (exceptions apply)

Article 150 --- Measures to be taken by the user of an industrial robot

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Requirements for Industrial Robots under Ordinance on Industrial Safety and Health

Work area	Work condition	Cutoff of drive source	Measure	Article
Outside movement range	During automatic operation	Not cut off	Signs for starting operation	Article 104
			Installation of railings, enclosures, etc.	Article 150-4
Inside movement range	During teaching, etc.	Cut off (including stopping of operation)	Sign, etc., indicating that work is in progress	Article 150-3
		Not cut off	Preparation of work rules	Article 150-3
			Measures to enable immediate stopping of operation	Article 150-3
			Sign, etc., indicating that work is in progress	Article 150-3
			Provision of special education	Article 36-31
			Checkup, etc., before commencement of work	Article 151
	During inspection, etc.	Cut off	To be performed after stopping the operation	Article 150-5
			Sign, etc., indicating that work is in progress	Article 150-5
		Not cut off (when inspection, etc., must be performed during operation)	Preparation of work rules	Article 150-5
			Measures to enable immediate stopping of operation	Article 150-5
			Sign, etc., indicating that work is in progress	Article 150-5
			Provision of special education (excluding cleaning and lubrication)	Article 36-32

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Applicable Modes of IAI's Industrial Robot

Machines meeting the following conditions are not classified as industrial robots according to Notice of Ministry of Labor No. 51 and Notice of Ministry of Labor/Labor Standards Office Director (Ki-Hatsu No. 340):

(1) Single-axis robo with a motor wattage of 80 W or less
(2) Combined multi-axis robot whose X, Y and Z-axes are 300 mm or shorter and whose rotating part, if any, has the maximum movement range of within 300 mm^3 including the end of the rotating part
(3) Multi-joint robot whose movable radius and Z-axis are within 300 mm

Among the products featured in our catalogs, the following models are classified as industrial robots:

1. Single-axis ROBO Cylinders
   RCS2/RCS2CR-SS8□, RCS3/RCS3CR/RCS3P/RCS3PCR whose stroke exceeds 300 mm
2. Single-axis robots
   The following models whose stroke exceeds 300 mm and whose motor capacity also exceeds 80 W:
   ISA/ISPA, ISDA/ISPDA, ISWA/ISPWA, IF, FS, NS
3. Linear servo actuators
   All models whose stroke exceeds 300 mm
4. Cartesian robots
   Any robot that uses at least one axis corresponding to one of the models specified in 1 to 3
5. IX SCARA robots
   All models whose arm length exceeds 300 mm
   (All models excluding IX-NNN1205/1505/1805/2515, NNW2515, NNC1205/1505/1805/2515)

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Notes on Safety of Our Products

Common items you should note when performing each task on any IAI robot are explained below.

No.	Task	Note
1	Model selection	● This product is not planned or designed for uses requiring high degrees of safety. Accordingly, it cannot be used to sustain or support life and must not be used in the following applications: [1] Medical devices relating to maintenance, management, etc., of life or health [2] Mechanisms or mechanical devices (vehicles, railway facilities, aircraft facilities, etc.) intended to move or transport people [3] Important safety parts in mechanical devices (safety devices, etc.) ● Do not use this product in the following environments: [1] Place subject to flammable gases, ignitable objects, flammables, explosives, etc. [2] Place that may be exposed to radiation [3] Place where the ambient temperature or relative humidity exceeds the specified range [4] Place subject to direct sunlight or radiated heat from large heat sources [5] Place subject to sudden temperature shift and condensation [6] Place subject to corrosive gases (sulfuric acid, hydrochloric acid, etc.) [7] Place subject to excessive dust, salt or iron powder [8] Place where the product receives direct vibration or impact ● Do not use this product outside the specified ranges. Doing so may significantly shorten the life of the product or result in product failure or facility stoppage.
2	Transportation	● When transporting the product, exercise due caution not to bump or drop the product. ● Use appropriate means for transportation. ● Do not step on the package. ● Do not place on the package any heavy article that may deform the package. ● When using a crane of 1 ton or more in capacity, make sure the crane operators are qualified to operate cranes and perform slinging work. ● When using a crane, etc., never hoist articles exceeding the rated load of the crane, etc. ● Use hoisting equipment suitable for the article to be hoisted. Calculate the load needed to cut off the hoisting equipment and other loads incidental to equipment operation by considering a safety factor. Also check the hoisting equipment for damage. ● Do not climb onto the article while it is being hoisted. ● Do not keep the article hoisted for an extended period of time. ● Do not stand under the hoisted article.
3	Storage/ preservation	● The storage/preservation environment should conform to the installation environment. Among others, be careful not to cause condensation.

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No.	Task	Note
4	Installation/ startup	(1) Installing the robot, controller, etc. ● Be sure to firmly secure and affix the product (including its work part). If the product tips over, drops, malfunctions, etc., damage or injury may result. ● Do not step on the product or place any article on top. The product may tips over or the article may drop, resulting in injury, product damage, loss of/drop in product performance, shorter life, etc. ● If the product is used in any of the following places, provide sufficient shielding measures: [1] Place subject to electrical noise [2] Place subject to a strong electric or magnetic field [3] Place where power lines or drive lines are wired nearby [4] Place subject to splashed water, oil or chemicals
		(2) Wiring the cables ● Use IAI's genuine cables to connect the actuator and controller or connect a teaching tool, etc. ● Do not damage, forcibly bend, pull, loop round an object or pinch the cables or place heavy articles on top. Current leak or poor electrical continuity may occur, resulting in fire, electric shock or malfunction. ● Wire the product correctly after turning off the power. ● When wiring a DC power supply (+24 V), pay attention to the positive and negative polarities. Connecting the wires in wrong polarities may result in fire, product failure or malfunction. ● Securely connect the cables and connectors so that they will not be disconnected or come loose. Failing to do so may result in fire, electric shock or product malfunction. ● Do not cut and reconnect the cables of the product to extend or shorten the cables. Doing so may result in fire or product malfunction.
		(3) Grounding ● Be sure to provide class D (former class 3) grounding for the controller. Grounding is required to prevent electric shock and electrostatic charges, improve noise resistance and suppress unnecessary electromagnetic radiation.
		(4) Safety measures ● Implement safety measures (such as installing safety fences, etc.) to prevent entry into the movement range of the robot when the product is moving or can be moved. Contacting the moving robot may result in death or serious injury. ● Be sure to provide an emergency stop circuit so that the product can be stopped immediately in case of emergency during operation. ● Implement safety measures so that the product cannot be started only by turning on the power. If the product starts suddenly, injury or product damage may result. ● Implement safety measures so that the product will not start upon cancellation of an emergency stop or recovery of power following a power outage. Failure to do so may result in injury, equipment damage, etc. ● Put up a sign saying "WORK IN PROGRESS. DO NOT TURN ON POWER," etc., during installation, adjustment, etc. If the power is accidentally turned on, electric shock or injury may result.

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No.	Task	Note
4	Installation/ startup	● Implement measures to prevent the work part, etc., from dropping due to a power outage or emergency stop. ● Ensure safety by wearing protective gloves, protective goggles and/or safety shoes, as necessary. ● Do not insert fingers and objects into openings in the product. Doing so may result in injury, electric shock, product damage, fire, etc. ● When releasing the brake of the vertically installed actuator, be careful not to let the actuator drop due to its dead weight, causing pinched hands or damaged work part, etc.
5	Teaching	● Whenever possible, perform teaching from outside the safety fences. If teaching must be performed inside the safety fences, prepare “work rules” and make sure the operator understands the procedures thoroughly. ● When working inside the safety fences, the operator should carry a handy emergency stop switch so that the operation can be stopped any time when an abnormality occurs. ● When working inside the safety fences, appoint a safety watcher in addition to the operator so that the operation can be stopped any time when an abnormality occurs. The safety watcher must also make sure the switches are not operated inadvertently by a third party. ● Put up a sign saying “WORK IN PROGRESS” in a conspicuous location. ● When releasing the brake of the vertically installed actuator, be careful not to let the actuator drop due to its dead weight, causing pinched hands or damaged work part, etc. * Safety fences --- Indicate the movement range if safety fences are not provided.
6	Confirmation operation	● After teaching or programming, carry out step-by-step confirmation operation before switching to automatic operation. ● When carrying out confirmation operation inside the safety fences, follow the specified work procedure just like during teaching. ● When confirming the program operation, use the safety speed. Failure to do so may result in an unexpected movement due to programming errors, etc., causing injury. ● Do not touch the terminal blocks and various setting switches while the power is supplied. Touching these parts may result in electric shock or malfunction.
7	Automatic operation	● Before commencing automatic operation, make sure no one is inside the safety fences. ● Before commencing automatic operation, make sure all related peripherals are ready to operate in the auto mode and no abnormalities are displayed or indicated. ● Be sure to start automatic operation from outside the safety fences. ● If the product generated abnormal heat, smoke, odor or noise, stop the product immediately and turn off the power switch. Failure to do so may result in fire or product damage. ● If a power outage occurred, turn off the power switch. Otherwise, the product may move suddenly when the power is restored, resulting in injury or product damage.

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No.	Task	Note
8	Maintenance/ inspection	● Whenever possible, work from outside the safety fences. If work must be performed inside the safety fences, prepare “work rules” and make sure the operator understands the procedures thoroughly. ● When working inside the safety fences, turn off the power switch, as a rule. ● When working inside the safety fences, the operator should carry a handy emergency stop switch so that the operation can be stopped any time when an abnormality occurs. ● When working inside the safety fences, appoint a safety watcher in addition to the operator so that the operation can be stopped any time when an abnormality occurs. The safety watcher must also make sure the switches are not operated inadvertently by a third party. ● Put up a sign saying “WORK IN PROGRESS” in a conspicuous location. ● Use appropriate grease for the guides and ball screws by checking the operation manual for each model. ● Do not perform a withstand voltage test. Conducting this test may result in product damage. ● When releasing the brake of the vertically installed actuator, be careful not to let the actuator drop due to its dead weight, causing pinched hands or damaged work part, etc. * Safety fences --- Indicate the movement range if safety fences are not provided.
9	Modification	● The customer must not modify or disassemble/assemble the product or use maintenance parts not specified in the manual without first consulting IAI. ● Any damage or loss resulting from the above actions will be excluded from the scope of warranty.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When disposing of the product, do not throw it into fire. The product may explode or generate toxic gases.

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Indication of Cautionary Information

The operation manual for each model denotes safety precautions under “Danger,” “Warning,” “Caution” and “Note,” as specified below.

Level	Degree of danger/loss	Symbol
Danger	Failure to observe the instruction will result in an imminent danger leading to death or serious injury.	 Danger
Warning	Failure to observe the instruction may result in death or serious injury.	 Warning
Caution	Failure to observe the instruction may result in injury or property damage.	 Caution
Note	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.	 Note

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Handling Precautions

1. Do not set a speed or acceleration/deceleration exceeding the applicable rating.

Do not set a speed or acceleration/deceleration exceeding the applicable rating. Doing so may result in vibration, failure or shorter life. If an acceleration/deceleration exceeding the rating is set, creep may occur or the coupling may slip.

2. Keep the load moments to within the allowable value.

Keep the load moments to within the allowable value. If a load exceeding the allowable load moment is applied, the life of the actuator may be reduced. In an extreme case, even flaking may occur.

3. Keep the overhang length to within the allowable value.

Keep the overhang length of the load to within the allowable value. If the overhang length exceeds the allowable value, vibration or noise may occur.

4. Grease film may run out after back-and-forth operations over a short distance.

Grease film may run out if the actuator is moved back and forth continuously over a distance of 30 mm or less. As a guide, perform a back-and-forth operation five times or over a distance of 50 mm or more after a back-and-forth operation over such short distance has been repeated 5,000 to 10,000 times. This will restore oil film.

5. Turn on the servo after making sure the slider or rod is away from the mechanical end.

If the servo is turned on when the slider or rod is positioned near the mechanical end, the pole phase may not be detected and a pole non-confirmation error or excitation detection error may occur.
Accordingly, turn on the servo after making sure the slider or rod is away from the mechanical end.

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6. Use your actuator at duties not exceeding the calculated reference duty
The duty of an actuator refers to the operating rate of the actuator (time during which the actuator is operating in one cycle).
Use your actuator at duties not exceeding the reference duty calculated by the formula below. If the reference duty is exceeded, overloading may occur or the motor may generate heat. In an extreme case, the motor may be damaged, etc.

$$\text{Duty Load factor} \quad \frac{\text{Operating time}}{\text{Operating time + Stopped time}} \quad (\%)$$

⚠	Caution:	If an overload error generates, extend the stopped time to lower the duty or decrease the acceleration/deceleration

[How to Calculate Duty]
[1] Calculate the load factor LF using the formula below:

$$\text{Load factor:} \quad LF = \frac{M \times \alpha}{M_r \times \alpha_r} \quad \%$$

Maximum payload capacity at maximum acceleration :	Mr
Maximum acceleration/deceleration :	αr
Transferring mass during operation :	M
Acceleration/deceleration during operation :	α

(Note) For the maximum payload capacity at maximum acceleration, and the maximum acceleration/deceleration, refer to 2, “Performance.

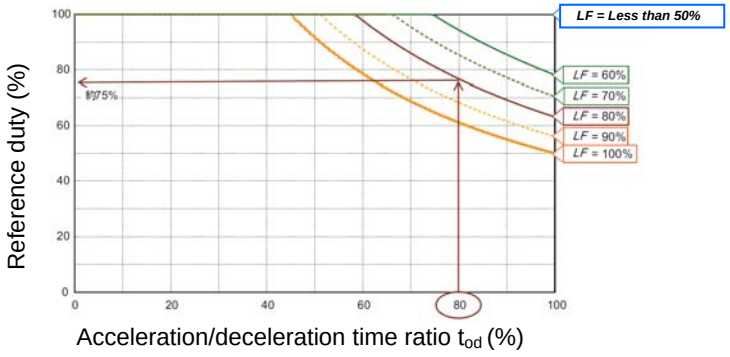
[2] Calculate the acceleration/deceleration time ratio t_{od} using the formula below:

$$\text{Acceleration/deceleration time ratio } t_{od} = \frac{\text{Acceleration time + Deceleration time}}{\text{Operating time}} \quad (\%)$$

$$\text{Acceleration time} = \frac{\text{Speed (mm/s)}}{\text{Acceleration (mm/s}^2\text{)}} \ (\text{sec}) \qquad \text{Deceleration time} = \frac{\text{Speed (mm/s)}}{\text{Deceleration (mm/s}^2\text{)}} \ (\text{sec})$$

Acceleration (mm/s^2) = Acceleration (G) x 9,800 mm/s^2 Deceleration (mm/s^2)= Deceleration (G) x 9,800 mm/s^2

[3] Read off the reference duty from the graph based on the calculated load factor LF and acceleration/deceleration time ratio t_{od}.
Example) If the load factor LF is 80% and acceleration/deceleration time ratio t_{od} is 80%, the reference duty is approx. 75%.



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7. If the actuator has a home check sensor (switch) (option), observe applicable precautions such as not bending the switch dog

   If the actuator has been ordered with a home check sensor (switch), the switch is stored inside the actuator. (Remove the side cover to access the switch.)

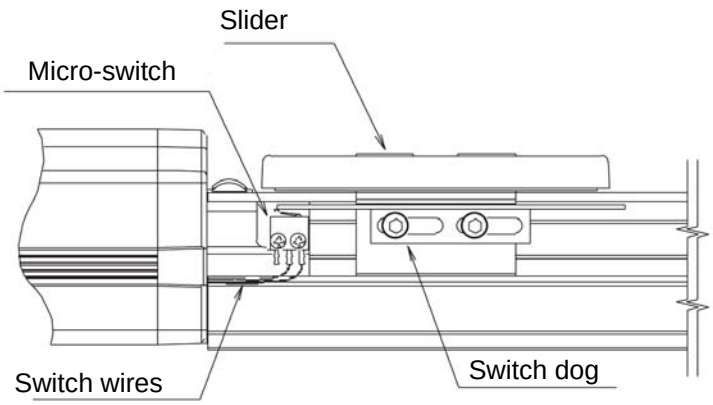
   The micro-switch and switch dog have been adjusted to optimal positions prior to shipment.
   Be careful not to loosen the mounting screw or bend the switch dog.
   If the mounting screw is loosened or switch dog is bent, the aforementioned optional positions are no longer kept and the switch may lose its designed function.

   Do not increase the home return speed beyond the factory-set default speed.
   If the home return speed is increased beyond the default speed, the switch may be damaged.

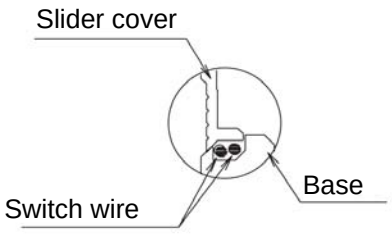
   Do not move the slider toward the mechanical end from the home position, except during home return operation.
   If the slider is moved manually or operated at high speed in the jog mode, etc., until the switch dog hits the micro-switch, the switch may be damaged.
   If the slider must be moved manually toward the mechanical end for any reason, such as replacing the motor, do so slowly.

   To change the direction of home on the shipped actuator (such as when the actuator was shipped with its home set on the standard side, but a need has arisen subsequently, such as a specification change, to move the home to the opposite side), the micro-switch position and switch dog must be readjusted.
   If you must change the direction of home, please contact the IAI sales office near you.

   When the side cover which was removed for maintenance, etc., is installed again, be careful not to pinch the switch wires.
   Especially when the home is set on the opposite side, the switch wires are stored in the space between the base and side cover, requiring you to pay extra attention.



If the actuator is of the specification where the home set on the opposite side, pay attention to proper storing of switch wires.



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8. Transpor ting and Handling

8.1 Handling the Actuator

8.1.1 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.

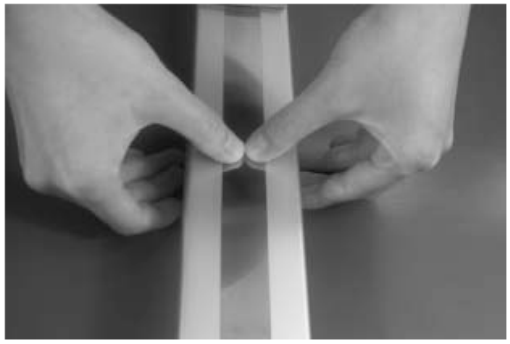
- The operator should not carry heavy shipping boxes by themselves.
- If the shipping box is left standing, it should be in a horizontal position.
- Do not climb on top of the shipping box.
- Do not place heavy objects on top of the shipping box.

8.1.2 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 front cover and motor cover.
- Do not exert excessive force on any part of the actuator.
- Be careful not to cause the cables to receive a tensile force.
- Note on handling the stainless sheet
  The stainless sheet is designed very thin (thickness: 0.1 mm) in order to ensure flexibility. Therefore, the stainless sheet is easily dented or scratched. Once dented or scratched, the stainless sheet may break during use.

⚠ Warning: Do not press the sheet directly with hands.



* Please refer to “Name of the Parts” for the names of the actuator parts.

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8.2 Handling the Actuator Assembly

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

8.2.1 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 the 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.

8.2.2 Handling after Assembly with Peripheral Equipment

When transporting the actuators that have been assembled with peripheral equipment either at IAI or on 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 0.3 G during transportation.
- When suspending the actuator-assembled peripheral equipment using ropes, etc., make sure 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 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.

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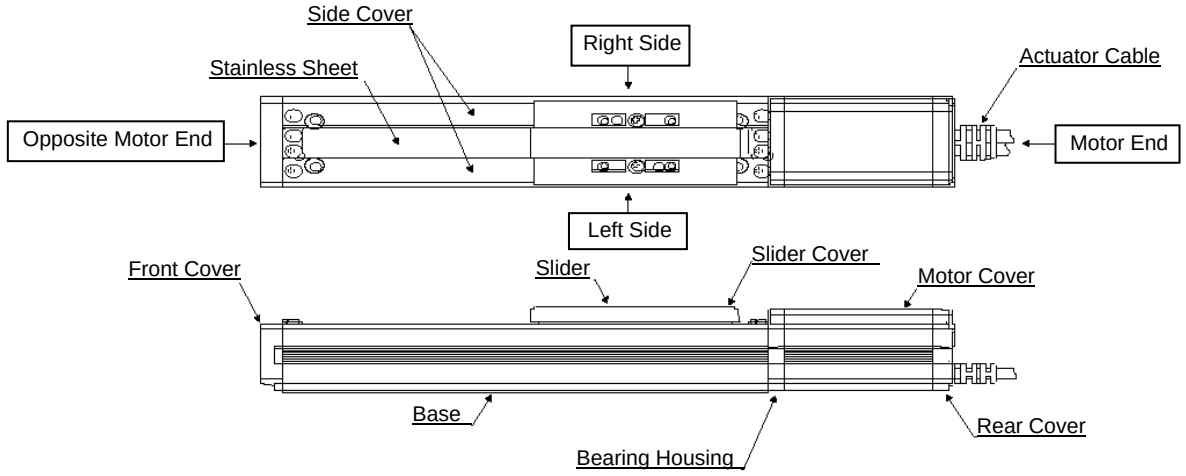
Names of the Parts

The names 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.

1. Motor Straight Type (Standard) RCA

- **Coupling Type (SA4C, SA5C, SA6C),**
  Built-in Type (SA4D, SA5D, SA6D, SS4D, SS5D, SS6D)

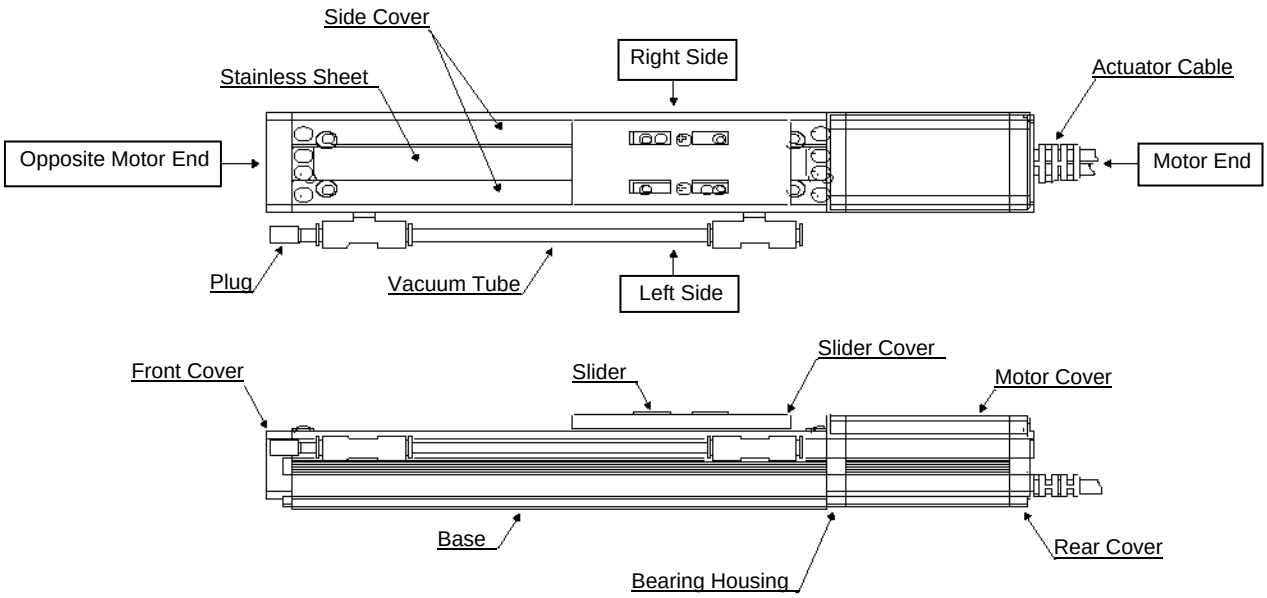


⚠Caution: The cable directly connected to the actuator is not robot cable even when ordered with robot cable option. When designing, please be sure not to give repeated bending loads to this cable. The robot cable is applicable only to the connecting cables.

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2. Motor Straight Type (Cleanroom Specification) RCACR

- **Coupling Type (SA4C, SA5C, SA6C), Built-in Type (SA5D, SA6D)**

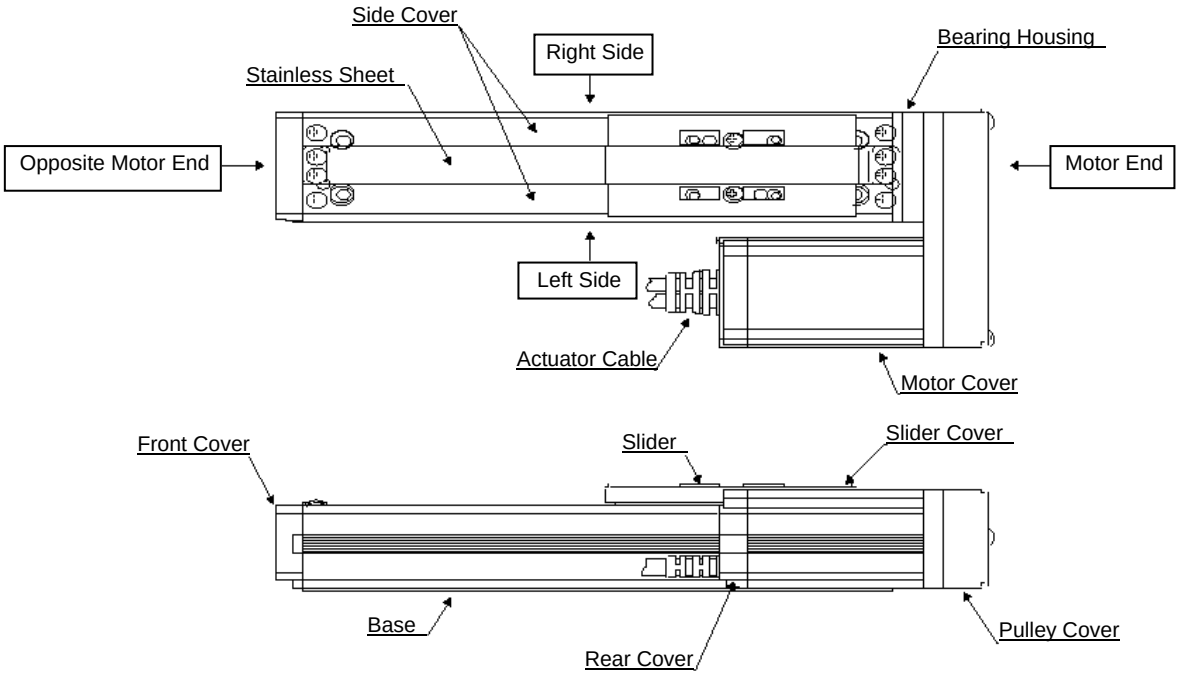


⚠ Caution: The cable directly connected to the actuator is not robot cable even when ordered with robot cable option. When designing, please be sure not to give repeated bending loads to this cable. The robot cable is applicable only to the connecting cables.

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3. Motor Reversing Type RCA

- **SA4R, SA5R, SA6R**



⚠ Caution: The cable directly connected to the actuator is not robot cable even when ordered with 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.

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1. Checking the Product

If based on a standard configuration, this product consists of the items listed below.

⚠ Caution: Check the packed items against the packing specification. Should you find a wrong model number or any missing item, please contact your IAI dealer or IAI.

1.1 Component s

No.	Name	Model number	Remarks
1	Actuator	Refer to “How to Read the Model Nameplate” and “How to Read the Model Number.”	
Accessories			
2	Motor/Encoder Cable*1		
3	Home Marking Seals		
4	Quick Step Guide		
5	Operation Manual (CD)		
6	Safety Guide		

*1 The motor cable and encoder cable that come with the actuator vary depending on the controller used. [Refer to 10, “Motor/Encoder Cables.”]

1.2 Operation Manuals for Controllers Supported by This Product

No.	Name	Control No.
1	Operation Manual for ASEL Controller	ME0165
2	Operation Manual for ACON-C/CG/CF Controller	ME0176
3	Operation Manual for ACON-CY Controller	ME0167
4	Operation Manual for ACON-SE Controller	ME0171
5	Operation Manual for ACON-PL/PO Controller	ME0166
6	Operation Manual for MEC Controller	ME0245
7	Operation Manual for ASEP/PSEP Controller	ME0216
8	Operation Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
9	Operation Manual for PC Software RCM-101-MW/RCM-101-USB	ME0155
10	Operation Manual for MEC PC Software	ME0248
11	Operation Manual for Teaching Pendant SEL-T/TD	ME0183
12	Operation Manual for Teaching Pendant CON-T/TG	ME0178
13	Operation Manual for Touch Panel Teaching Pendant CON-PT/PD/PG	ME0227
14	Operation Manual for Touch Panel Teaching Pendant SEP-PT	ME0217
15	Operation Manual for Simple Teaching Pendant RCM-E	ME0174
16	Operation Manual for Data Setter RCM-P	ME0175
17	Operation Manual for Touch Panel Display RCM-PM-01	ME0182

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1.3 How to Read Model Nameplate



1.4 How to Read Model Number

RCA – SA4C – I – 20 – 10 – 50 – A1 – P – B

<Series>
Standard type
RCA
Cleanroom type
RCACR

<Type>
Coupling type
Aluminum base
SA4C, SA5C
SA6C
Built in type
Aluminum base
SA4D, SA5D
SA6D
Iron base
SS4D, SS5D
SS6D
Aluminum base, motor reversing
SA4R, SA5R
SA6R,

<Encoder type>
I: Incremental
A: Absolute

<Motor type>
20 : 20 W,
30 : 30 W

<Lead>
2.5:2.5 mm
3:3 mm
5: 5 mm
6: 6 mm
10: 10 mm
12: 12 mm
20: 20 mm

<Stroke>

<Applicable controller>
A1: ASEL
ACON-C/CG
ACON-CY
ACON-SE
ACON-PL/PO
A3: AMEC
ASEP

<Cable length>
N: None
P: 1 m
S: 3 m
M: 5 m
X□□: Length specification
R□□: Robot cable

<Options>
B: Brake
BE: Brake
(Wirings taken out from end)
BL: Brake
(Wirings taken out from left)
BR: Brake
(Wirings taken out from right)
FT: Foot bracket
HA: High acceleration/deceleration specification
LA: Power-saving type
HS: Home check sensor
NM: Reversed-home specification
SR: Slider roller specification
SS: Slider spacer
ML: Motor reversing at left
MR: Motor reversing at right
VR: Suction joint on opposite side

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2. Specification

(1) Maximum speed

The maximum speed of the actuator is limited to prevent resonance of the ball screw shaft and also in consideration of the restrictions on motor speed.
Observe the maximum speed limits specified below.

Strokes and maximum speed limits (unit: mm/sec)

Type	Lead (mm)	Stroke (mm)											
		50	100	150	200	250	300	350	400	450	500	550	600
SA4	2.5	165								-	-	-	-
	5	330								-	-	-	-
	10	665								-	-	-	-
SS4	2.5	165						-	-	-	-	-	
	5	330						-	-	-	-	-	-
	10	665						-	-	-	-	-	-
SA5 SS5	3	200									190	-	-
	6	400									380	-	-
	12	800									760	-	-
SA5C	20	Installed horizontally: 1300 Installed vertically:800										-	-
SA6 SS6	3	200									190	160	135
	6	400									380	320	270
	12	800									760	640	540
SA6C	20	Installed horizontally: 1300 Installed vertically:800										1160	990

⚠ Caution: Do not set any speed or acceleration/deceleration exceeding the rated speed or acceleration/deceleration. Doing so may result in vibration, failure or shorter life.
When combining multiple axes and synchronizing their operations, the speed and acceleration/deceleration to be set should correspond to the highest speed and largest acceleration/deceleration among those of the combined axes.
In particular, exercise caution because setting an acceleration/deceleration exceeding the rated acceleration/deceleration may cause the actuator to suffer creep or the coupling to slip.

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(2) Maximum acceleration and maximum payload capacity

[Standard Specification/Power-saving Type]

Type	Motor output (W)	Lead (mm)	Maximum acceleration (G)	Maximum payload capacity (kg)	
				Horizontal	Vertical
SA4 SS4	20 W	2.5	0.2 G	8	4.5
		5	0.3 G	6	2.5
		10	0.3 G	4	1
SA5 SS5	20 W	3	0.2 G	12	4
		6	0.3 G	8	2
		12	0.3 G	4	1
SA5C	20 W	20	Installed horizontally : 0.3 G Installed vertically: 0.2 G	2	0.5
SA6 SS6	30 W	3	0.2 G	18	6
		6	0.3 G	12	3
		12	0.3 G	6	1.5
SA6C	30 W	20	Installed horizontally : 0.3 G Installed vertically: 0.2 G	3	0.5

[High-acceleration/deceleration Type]

Type	Motor output (W)	Lead (mm)	Maximum acceleration (G)	Maximum payload capacity (kg)	
				Horizontal	Vertical
RCA-SA4C	20 W	5	1.0 G	6	2.5
		10	1.0 G	4	1
RCA-SA5C	20 W	6	0.8 G	8	2
		12	0.8 G	4	1
		20	Installed horizontally : 0.8 G Installed vertically: 0.2 G	2	0.5
RCA-SA6C	30 W	6	1.0 G	12	3
		12	1.0 G	6	1.5
		20	Installed horizontally : 0.8 G Installed vertically: 0.2 G	3	0.5

⚠ Caution: Even when the acceleration is less than the rated acceleration, the payload capacity will not exceed the payload capacity at the rated acceleration

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(3) Rated thrust

Type	Motor output (W)	Lead (mm)	Rated thrust (N)
SA4 SS4	20 W	2.5	78.4
		5	39.2
		10	19.6
SA5 SS5	20 W	3	65.7
		6	33.3
		12	16.7
SA5C	20 W	20	10.7
SA6 SS6	30 W	3	96.8
		6	48.4
		12	24.2
SA6C	30 W	20	15.8

(4) Driving method

Type	Motor output (W)	Lead (mm)	Encoder pulses*1	Driving method	
SA4 SS4	20 W	2.5	800	Ball screw ∅ 8 mm	Rolled, C10
		5			
		10			
SA5 SS5	20 W	3		Ball screw ∅ 10 mm	Rolled, C10
		6			
		12			
SA5C	20 W	20		Ball screw ∅ 10 mm	Rolled, C10
SA6 SS6	30 W	3		Ball screw ∅ 10 mm	Rolled, C10
		6			
		12			
SA6C	30 W	20		Ball screw ∅ 10 mm	Rolled, C10

*1. Number of pulses input to the controller.
16,384 pulses are input when an absolute actuator is used with an ASEL controller.

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(5) Common specifications

Item	Specification	
	SA5C, SA6C-Lead other than 20 mm	SA5C, SA6C-Lead 20 mm
Positioning repeatability*1	±0.02 mm	±0.03 mm
Backlash*1	0.1 mm or less	0.1 mm or less
Base	Material: Aluminum with special alumite treatment	

*1. Default value.

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(6) Load on the actuator

The allowable load moments and allowable overhang load lengths of respective actuators are listed below. Make sure the allowable values applicable to your actuator are not exceeded.

Allowable dynamic moments

Model	Ma	Mb	Mc
SA4 SS4	2.7 N·m (0.27 kgf·m)	3.9 N·m (0.4 kgf·m)	6.8 N·m (0.7 kgf·m)
SA5 SS5	4.9 N·m (0.5 kgf·m)	6.8 N·m (0.7 kgf·m)	11.7 N·m (1.2 kgf·m)
SA6 SS6	8.9 N·m (0.9 kgf·m)	12.7 N·m (1.3 kgf·m)	18.6 N·m (1.9 kgf·m)

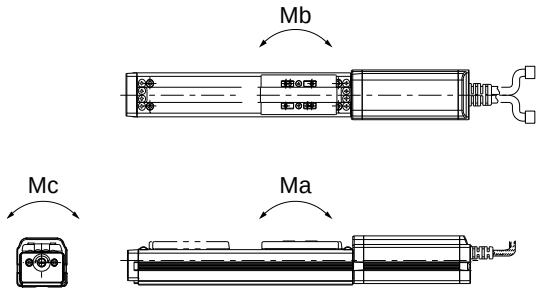
Allowable static moments

Model	Ma	Mb	Mc
SA4 SS4	6.9 N·m (0.7 kgf·m)	9.9 N·m (1.0 kgf·m)	17.0 N·m (1.73 kgf·m)
SA5 SS5	18.6 N·m (1.9 kgf·m)	26.6 N·m (2.71 kgf·m)	47.5 N·m (4.85 kgf·m)
SA6 SS6	38.3 N·m (3.91 kgf·m)	54.7 N·m (5.58 kgf·m)	81.0 N·m (8.27 kgf·m)

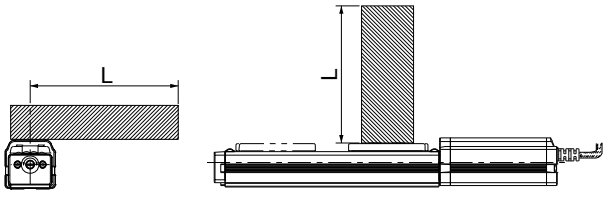
Allowable overhang lengths

Model	Ma	Mb	Mc
SA4 SS4	120 mm or less	120 mm or less	120 mm or less
SA5 SS5	150 mm or less	150 mm or less	150 mm or less
SA6 SS6	220 mm or less	220 mm or less	220 mm or less

- The allowable overhang lengths are based on a configuration where the center of gravity of the load mounted on the actuator corresponds to the center of the overhang length.



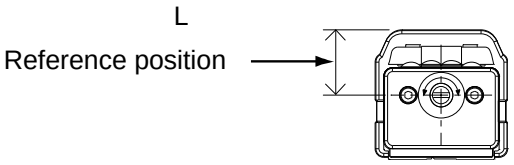
Directions of moment forces



Directions of allowable overhangs

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(Note) To calculate the moments in Ma and Mc directions, shift the reference position by L mm from the top face of the slider, as shown below.



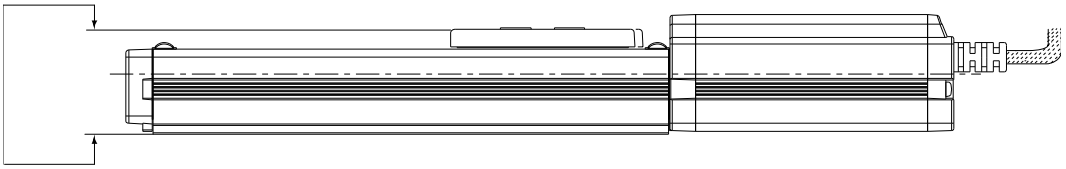
	L
SA4 SS4	31.2 mm
SA5 SS5	39 mm
SA6 SS6	40 mm

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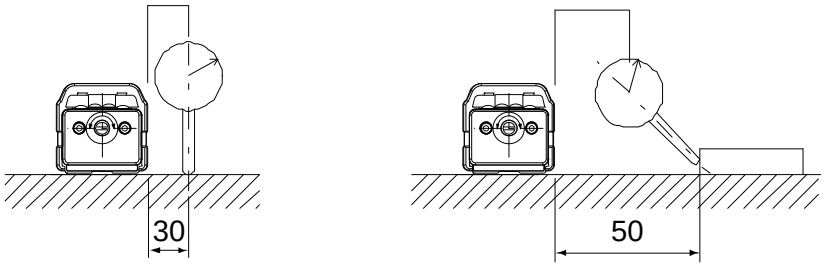
(7) Actuator accuracy

[1] Actuator installation surface

The parallelism between the actuator installation surface (bottom face of the base) and load installations surface (top face) shall be 0.1 mm/m or less at any position over the stroke.



[2] The traveling parallelism shall be 0.05 mm/m or less after the actuator has been installed (secured on a flat smooth surface[*1]).



Condition: The above values have been calculated at 20ºC.

*1 Parallelism: 0.05 mm/m or less

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3. Life

One factor that affects the traveling life of an actuator is “Rated Load.”
There are two types of rated loads: “Static Rated Load” and “Dynamic Rated Load.”

- “Static Rated Load”: Load applied while the actuator is stopped, as a result of which minor pressure marks are left on the contact surface
- “Dynamic Rated Load”: Load under which the actuator can travel for a specified distance and still meet a specified probability of survival defined by no damage to its guide.

Manufacturers of guides indicate the life of each guide by a dynamic rated load based on a probability of survival (no damage to the guide) of 90% after 50 km of traveling.
With industrial equipment, however, dynamic rated loads must be defined based on longer traveling distance of 5,000 km to 10,000 km given the moving speed, operating ratios and other operating conditions of these equipment.
Also note that guides are generally designed with a sufficient life against radial loads. Moment loads that are applied at positions away from the guide center are most damaging to guides.

The traveling life is calculated by assuming that the actuator travels 5,000 km while receiving the allowable load moment, based on a load coefficient of 1.2.
[For the allowable dynamic load moment, refer to 2, “Specifications.”]
The formula for calculating the allowable dynamic load moment corresponding to a traveling life of 5,000 km is shown below.

$$C_{IA} = \frac{M_{50}}{fw} \times \left(\frac{50\ km}{5000\ km} \right)^{\frac{1}{3}}$$

C_{IA}: Allowable dynamic load moment
fw: Load factor (= 1.2)
M_{50}: Rated dynamic moment based on a survival probability of 50% after 50 km of traveling

Calculate the life at the applicable moment using the formula below:

$$L = \left(\frac{C_{IA}}{P} \right)^{3} \times 5000\ km$$

L: Traveling life (survival probability of 90%)
C_{IA}: Allowable dynamic moment
P: Applicable moment

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4. Operating and Storage/Preservation Environment

4.1 Onst allation Environment

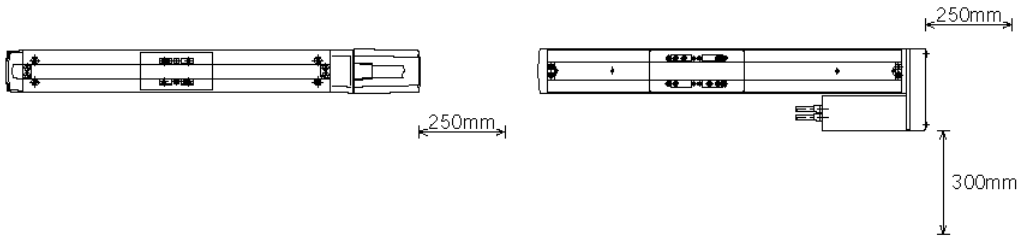
The actuator should be set up in an environment, which meets the following criteria:

- 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 operations.
- Avoid exposure to oil mist or fluids used in cutting.
- Not subject to impact or vibration.
- 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 gear.

Work space needed for maintenance/inspection

[Motor straight type] [Motor reversing type]



4.2 S torage/Preservation Environment

The storage/preservation environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored/preserved 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/preserving 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/preservation interval but only up to 50°C if the storage/preservation period is longer than one month.

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5. Installation

How to install the actuator on/in a mechanical system is explained

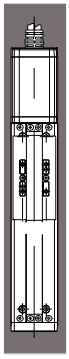
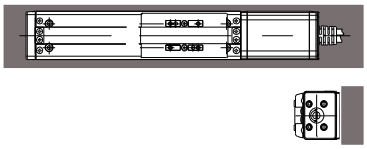
5.1 Insallation

Install the actuator as explained below, as a rule.
Pay attention to these items when installing the actuator (except for custom-order models).

○: Installable △: Daily inspection is required x: Not installable

Horizontal installation	Vertical installation	Sideway installation	Ceiling mount installation
○	○	△	△

Installation postures

Horizontal	Vertical	Sideway	Ceiling mount
			

⚠ Caution: 1. When the unit is installed vertically oriented, attempt to put the motor up unless there is a special reason. Putting the motor on the lower side would not cause a problem in an ordinary operation. However, it may rarely cause a problem, when it is not operated for a long period, depending on the surrounding environment (especially high temperature), caused by the grease being separated and the base oil flowing into the motor unit.

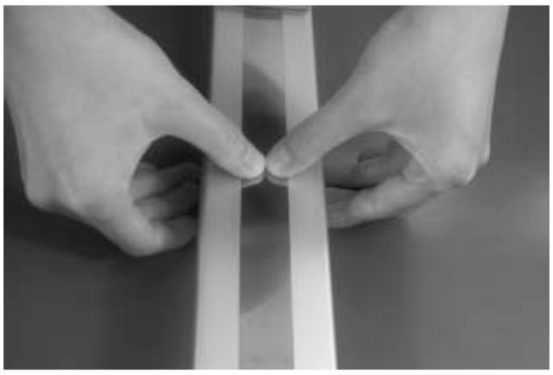
2. Can be installed sideways or ceiling mount, but the actuators must be checked daily. If the actuator is installed sideways or ceiling mount, the stainless sheet may be slacked or displaced. If the actuator is used continuously while the stainless sheet is slacked or displaced, the stainless sheet may break or other problems may occur. Check the actuator daily and if the stainless sheet is found slacked or displaced, make installation adjustment of the stainless sheet. [Refer to 11,8 “Replacing/Adjusting the Stainless Sheet.”]

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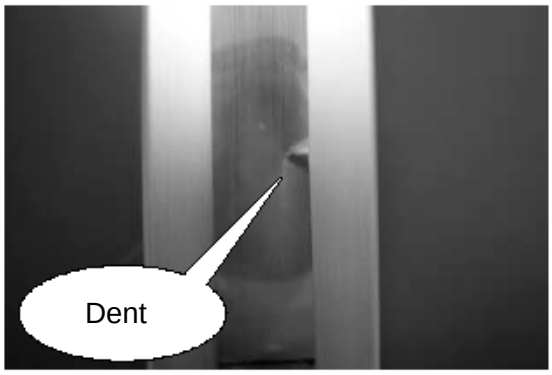
5.2 Note on Installation

The stainless sheet is designed very thin (thickness: 0.1 mm) in order to ensure flexibility. Therefore, the stainless sheet is easily dented or scratched. Once dented or scratched, the stainless sheet may break during use.
When installing the stainless sheet, pay attention to the following points:

1. Do not press the sheet directly with hands.



2. Protect the sheet from dents by paying attention not to drop tools and work parts onto the sheet.



3. Do not allow powder dust or iron powder to generate around the stainless sheet.
   If generation of powder dust/iron powder cannot be fully prevented, wipe the stainless sheet after the operation to remove all particles attached to the sheet.
   If the actuator is operated with the stainless sheet carrying foreign particles, the particles may enter the slider and damage the sheet or cause the sheet to deform, lift or present other problems.

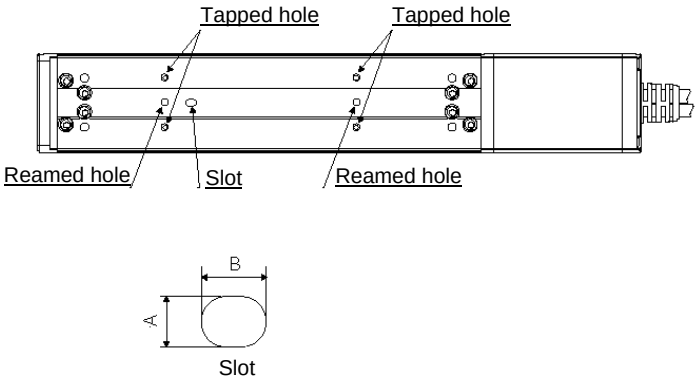
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5.3 Installing the Main Body

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

The side faces and lower surface of the base run parallel with the guides. When traveling precision is required, use these as the reference planes for mounting. Take note that the available mounting methods are different for each actuator type.

5.3.1 Using the Tapped Holes at Back of the Base (All Types Excluding SS)



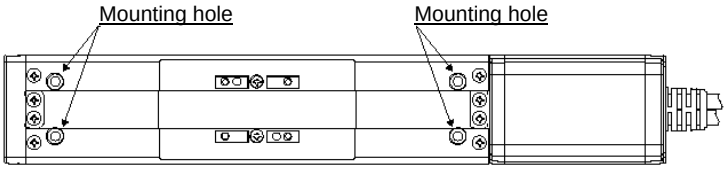
Tapped holes are provided on the back of the base for mounting the actuator. Install the actuator using these tapped holes. The sizes and effective depths of tapped holes are listed below. Be careful not to let the ends of bolts project from the holes. If necessary, use the additional reamed holes that are provided for positioning purpose.
(Two reamed holes are provided, one on the motor side and the other on the counter-motor side. One slot is provided on the counter-motor side.)

Type	Tap size	Tap depth	Reamed hole	Slot
SA4C, D	M3	5 mm	∅ 3H7, depth 5 mm or less	A: 3H7, B: 4, depth 5 mm or less
SA5C, D	M4	7 mm	∅ 4H7, depth 5 mm or less	A: 4H7, B: 5, depth 5 mm or less
SA6C	M5	8 mm	∅4H7, depth 5 mm or less	A: 4H7, B: 5, depth 5 mm or less
SA6D	M5	9 mm	∅ 4H7, depth 5 mm or less	A: 3H7, B: 4, depth 5 mm or less
SS4D	M3	5 mm	-	-
SS5D	M4	5 mm	-	-
SS6D	M5	6 mm	∅ 4H7, depth 4 mm or less	-

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5.3.2 Using the Mounting Holes on Top of the Base

(SA4 of 200 mm or Shorter Strokes/SA5 of 300 mm or Shorter Strokes)



Four through holes (two on the motor side and two on the counter-motor side) are provided in the base for installing the actuator on its top face. Use these mounting holes to install the actuator.
When installing the actuator using these mounting holes alone, take heed of the following points:

1. SA4: Applicable to models of 200 mm or shorter strokes only
2. SA5: Applicable to models of 300 mm or shorter strokes only
3. SA6: Mounting holes are not provided.

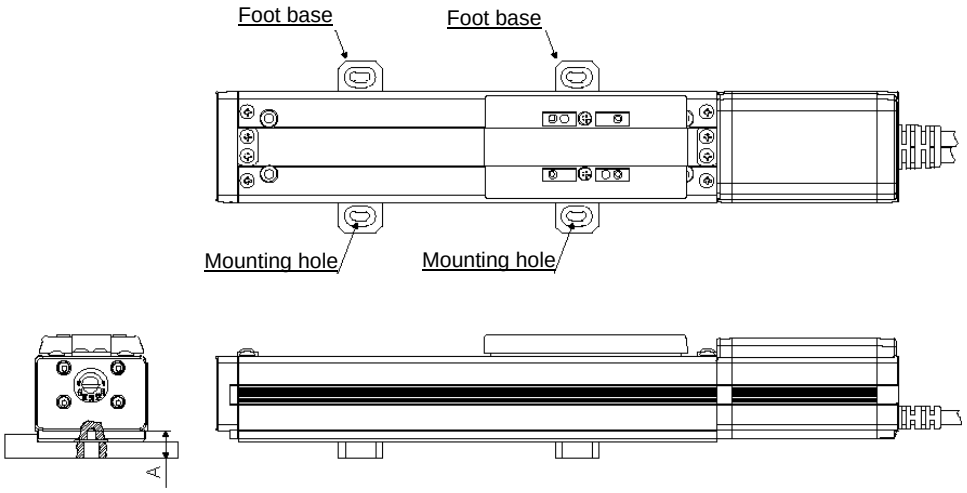
If any model other than those specified in 1 and 2 (longer stroke) is installed using the mounting holes alone, the base may deform and the slider may slide abnormally, generate noise or present other problems.

As for mounting bolts, use hexagon socket-head bolts conforming to the applicable specification in the table below in accordance with the machine frame material.
If necessary, the reamed holes/slot can be used as positioning pin holes. [Refer to 5.3.1.]

Type	Mating material is steel	Mating material is aluminum
SA4, SS4	M3, length 35 mm or more	
SA5, SS5	M4, length 40 mm or more	M4, length 45 mm or more

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5.3.3 Using Foot Bases (Optional)



By using foot bases (optional), the actuator can be installed on its top face using the mounting holes in the foot bases.
Foot bases provide an effective means for installing the SA4 models of strokes exceeding 200 mm, S5A models of strokes exceeding 300 mm, or all SA6 models.
As for mounting bolts, use hexagon socket-head bolts and flat washers conforming to the applicable specification in the table below in accordance with the machine frame material.
If necessary, the reamed holes/slot can be used as positioning pin holes. [Refer to 5.3.1.]
The depth of reamed holes/slot must conform to dimension A. (Dimension A considers the foot base thickness.)

Type	Mating material is steel	Mating material is aluminum	Flat washer	Dimension A
SA4	M4, length 8 mm or more	M4, length 12 mm or more	Nominal diameter 4	12 mm
SA5	M4, length 8 mm or more	M4, length 12 mm or more	Nominal diameter 4	13 mm
SA6	M5, length 10 mm or more	M5, length 15 mm or more	Nominal diameter 5	14 mm

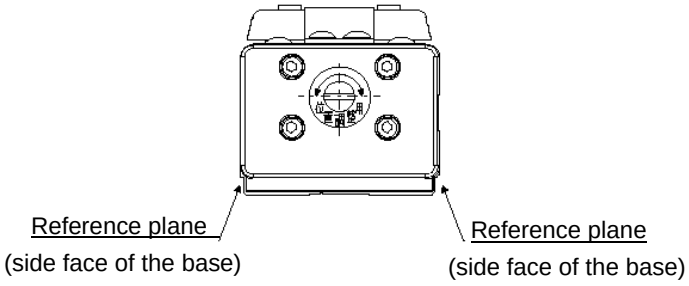
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5.4 Inst allation Surface

- The mounting table should have sufficient rigidity to avoid generating vibration.
- The surface where the actuator will be mounted should be machined or be equally level and the flatness tolerance between the actuator and the table should be within 0.05 mm.
- Provide enough space around the actuator to permit maintenance work to be done.

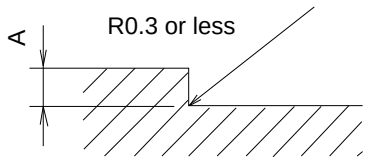
5.4.1 Using Side Faces of the Base as Reference Planes

- The side and bottom faces of the actuator base provide the reference planes for slider travel.
- When precision is required, use these surfaces as the reference planes for mounting.



⚠ Caution: As shown above, the side faces of the base provide the reference planes for slider travel. When precision is required, use these surfaces as the reference planes for mounting

When using the base as the reference planes for mounting the actuator to the machine frame, follow the machining dimensions shown below.

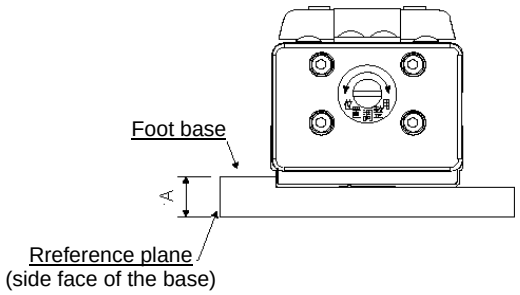


Type	Dimension A
SA4	2 to 3 mm
SA5	2 to 4.5 mm
SA6	2 to 4.5 mm
SS4	2 to 3 mm
SS5	2 to 3.5 mm
SS6	2 to 3.5 mm

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5.4.2 Using Side Faces of the Foot Base as Reference Planes (If Equipped with Optional Foot Bases)

- The side faces of the foot base provide the reference planes for slider travel.
- When precision is required, use these surfaces as the reference planes for mounting.



Type	Dimension A
SA4	9.5 mm
SA5	11 mm
SA6	12 mm

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5.5 Clamp Screws

- The male screws for mounting the base should be M3 for SA4/SS4, M4 for SA5/SS5, and M5 for SA6/SS6. (Use hexagon socket-head bolts).
- For the bolts, we recommend high strength bolts of ISO-10.9 or higher.
- When using a foot base to attach to a mounting table, use the special washer made for high strength bolts that comes with the actuator if the bolt is M8 or larger. This is unnecessary for M6 or smaller bolts. Do not use a common spring washer.

- The recommended screw torque is given below.

Screw nominal diameter	Screw Torque	
	When the bolt seating surface is steel	When the bolt seating surface is aluminum
M3	1.5 N·m (0.15 kgf·m)	0.8 N·m (0.08 kgf·m)
M4	3.6 N·m (0.38 kgf·m)	1.8 N·m (0.23 kgf·m)
M5	7.3 N·m (0.77 kgf·m)	3.4 N·m (0.44 kgf·m)

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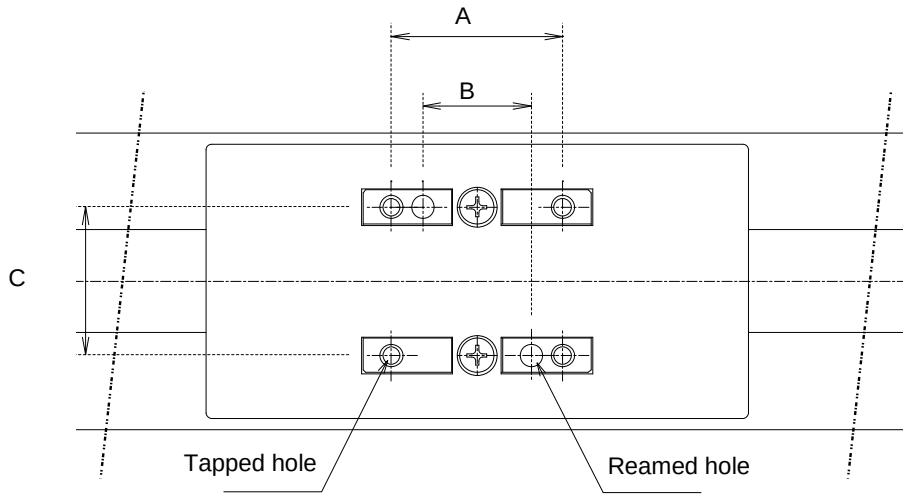
5.6 Installing the Load on the Slider

5.6.1 Using the Slider

- Tapped holes are provided on the slider for installing the load. The method of clamping varies according to how to mount the main body.
- In case of moving actuator instead of slider, use the same tapped holes on the slider.
- Please use two reamed holes on the slider when repeatability of mounting and dismounting is required. When fine adjustment of the squareness is necessary, use only one reamed hole to allow adjustment.

Sizes and depths of tapped holes and reamed holes on slider

Model	Tap size	Depth of thread	A	B	C	Hole size
SA4	M3	7 mm	24 mm	16 mm	20 mm	∅3 H7, depth 5 mm
SA5	M4	9 mm	30 mm	19 mm	26 mm	∅4 H7, depth 6 mm
SA6	M5	9 mm	50 mm	32 mm	31 mm	∅5 H7, depth 6 mm
SS4	M3	5 mm	24 mm	-	20 mm	-
SS5	M4	5 mm	30 mm	-	26 mm	-
SS6	M5	6 mm	50 mm	32 mm	31 mm	∅5 H7, depth 6 mm or less

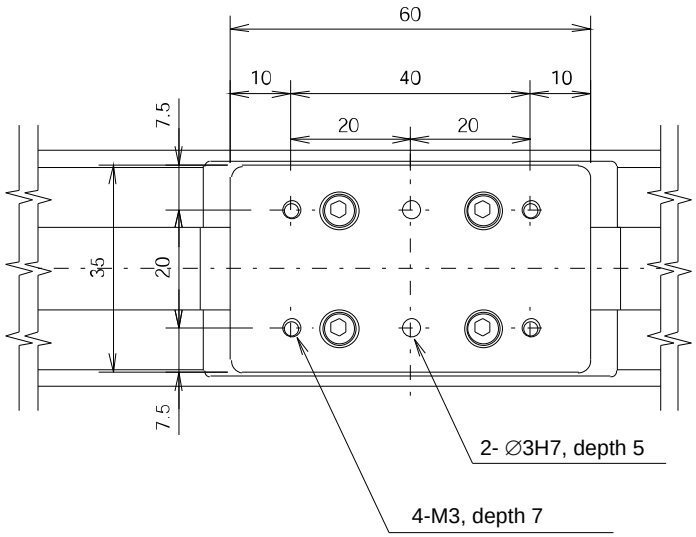


⚠ Caution: When installing the load, do not let adhesives, paints or other viscous substances attach the stainless sheet. Also, avoid applying a concentrated force that will dent the sheet. It may cause the slider to malfunction or damage the sheet.

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5.6.2 Using a Sub Slider (Optional) (Optional for SA4 Type)

For the SA4 type, a sub-slider is available as an option.
The figure below shows the positions of load-mounting holes in actuators with a sub-slider.



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5.7 Cleanroom Specification

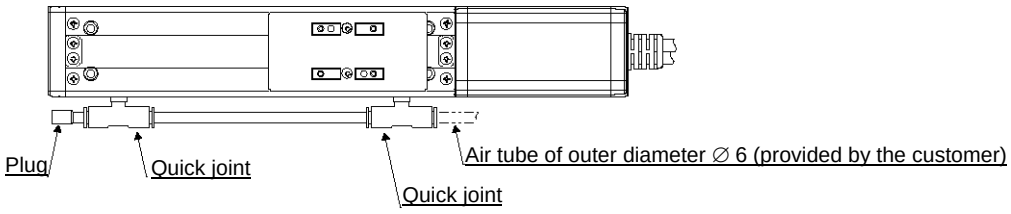
5.7.1 Suction Rate

Air inside the actuator must be suctioned to ensure that the actuator operates in conformance with the requirements of cleanliness class 10.
Provide an air tube and connect it to a quick joint (outer diameter ∅ 6) provided at the suction section, and connect the other end of the tube to a vacuum pump, blower, ejector, etc., to suction at an applicable flow rate as specified below.

Lead	Recommended suction rate
2.5 mm/3 mm	15 Nl/min
5 mm/6 mm	30 Nl/min
10 mm/12 mm	50 Nl/min
20 mm	80 Nl/min

5.7.2 Suction Joint

Remove the plug from either quick joint and insert an air tube to suction air from either the motor side or counter-motor side.
Remember to cover the unused joint with a plug.



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6. Connecting to the Controller

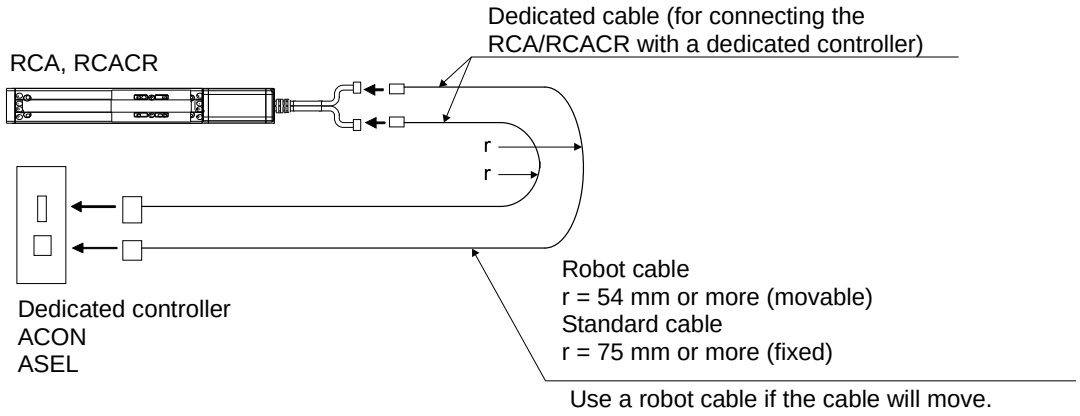
6.1 W iring

- If the cable cannot be secured in your specific application, make sure the actuator is used in such a way that the cable deflects only by its own weight, or use a self-supporting cable hose or other means to ensure a large wiring radius so as to reduce the load received by the cable.
- Do not cut to extend or shorten the cable or reconnect the cut end.
- The standard cable has excellent flexibility, but it is not a robot cable. If the cable is to be stored in a movable wiring duct (such as a cable track), use a robot cable.

  If you wish to change the cable, please contact IAI.

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[Connection with ACON/ASEL Controller]

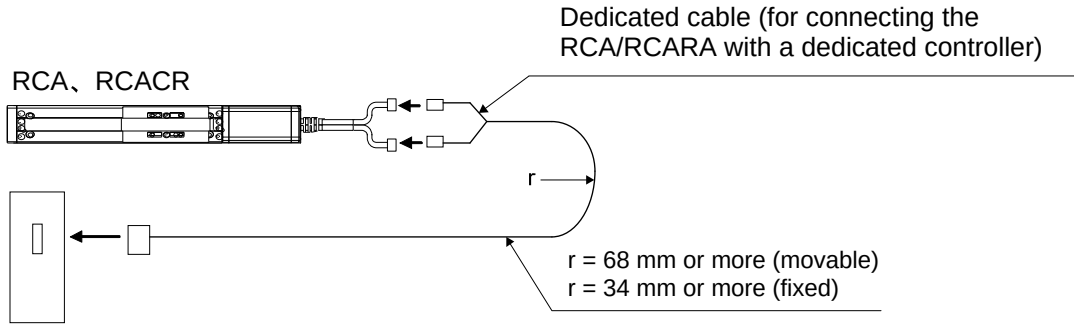


Dedicated cable

- Motor cable (Robot cable) CB-ACS-MA ***
- Encoder cable CB-ACS-PA ***/
  Encoder robot cable CB-ACS-PA *** -RB

*** represents the cable length. A desired length can be specified up to 20 m.
Example) 080 = 8 m

[Connection with AMEC/ASEP Controller]



Dedicated cable

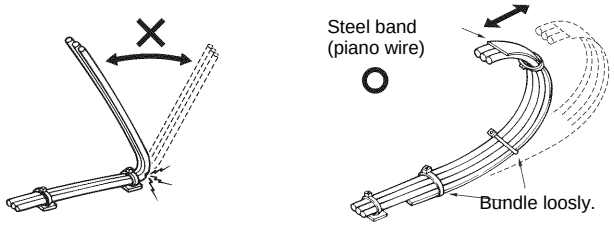
- Motor encoder cable CB-ASEP-MPA***

*** represents the cable length. A desired length can be specified up to 20 m.
Example) 080 = 8 m

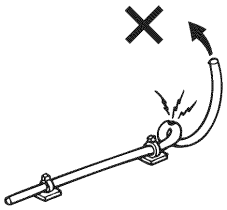
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When building an application system using the actuator and controller, incorrect wiring or connection of each cable may cause broken wire, poor contact or other unexpected problem. The prohibited items relating to cable wiring are explained below.

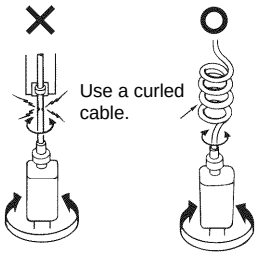
- Do not cut and reconnect the cable for extension or shorten the cable.
- If the cable cannot be secured, reduce the load on the cable by allowing it to deflect only by the weight of the cable or wire it in a self-standing cable hose, etc., having a large radius.
- Prevent the cable from bending at the same point.



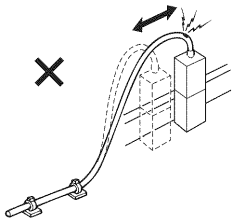
- Do not let the cable bend, kink or twist.



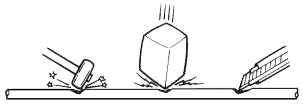
- Do not pull the cable with a strong force.



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

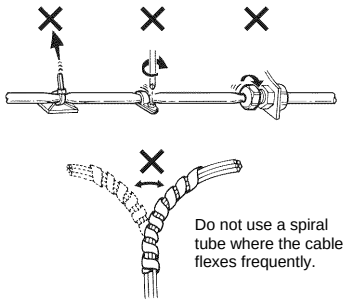


- Do not pinch, drop a heavy object onto or cut the cable.

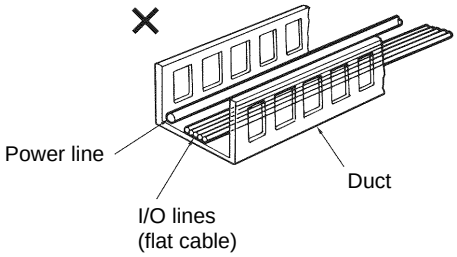


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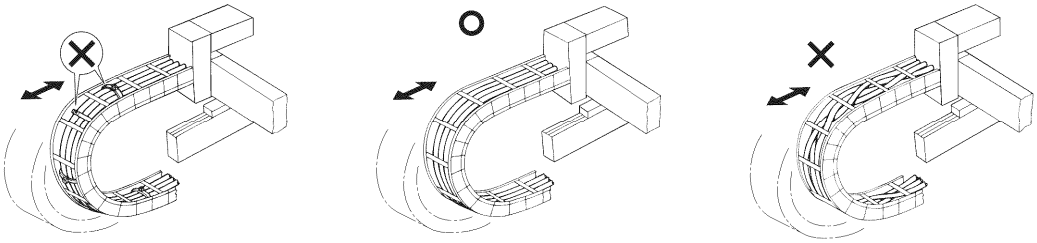
- When fixing the cable, provide a moderate slack and do not tension it too tight.



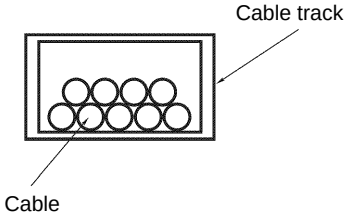
- Separate the I/O and communication lines from the power and drive lines. Do not wire them in the same duct.



- Pay attention to the following points when using a cable track.
- Do not let the cable get tangled or kinked in a cable track 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 track.



⚠ Warning:

- Always turn off the controller power before connecting/disconnecting cables. If cables are connected/disconnected while the power is still supplied, the actuator may malfunction and a serious injury or equipment damage may occur.
- Loose connectors may cause the actuator to malfunction and create a dangerous situation. Be sure to confirm that all connectors are securely connected.

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7. Setting the Home

7.1 Home Return

Home return involves the following operation sequence:
[1] When a home return command is issued, the actuator moves in the direction specified by the parameter in which the moving direction has been set.
[2] During this return operation, the mechanical end is detected by the software.
[3] The actuator reverses at the end and moves until a Z-phase signal is detected, upon which the applicable location is set as the reference point.
[4] The actuator moves further by the offset set by the parameter, and the attained position is defined as the home.

7.2 Fine-tuning the Home Position

How much the motor should turn after the stopper is contacted until a Z-phase signal generates has been adjusted prior to shipment. The table below shows, for each model, the standard distance the actuator travels after the slider contacts the stopper and reverses, until it stops at the home position.

Model name	Distance from mechanical stopper to home [mm]
SA4C, SA4R SA5C, SA5R SA6C, SA6R	Approx. 3 mm
SA4D SS4D	Approx. 2.2 mm
SA5D SS5D SA6D SS6D	Approx. 3 mm

As long as the home return direction remains the same, you can change the setting of an applicable parameter based on the above value to fine-tune the home position for each actuator.
[1] Perform home return operation to check the home.
[2] Next, move the actuator to a desired home, check the difference between the two homes, and then correct the home preset parameter when an ASEL controller is used, or home return offset parameter when an ACON controller is used.
Add or subtract the difference to/from the value currently set.
[3] If a large offset is provided, the moving range becomes smaller by the corresponding value. If an offset exceeding 1 mm is specified, readjust the stroke limits, as well.

7.3 Changing the Direction of Home

If the direction of home is changed after the actuator has been delivered, you may have to adjust the moving direction parameter, and also the encoder's Z-phase on certain models. Please contact IAI.

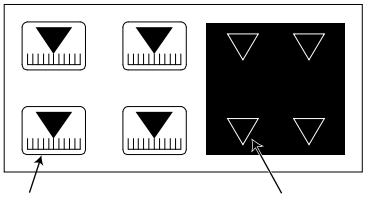
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7.4 How to use the home mark

◆ Please affix these marks to the actuator as home markers as needed.

Contents of sticker

Home mark sticker



x 1 sheet

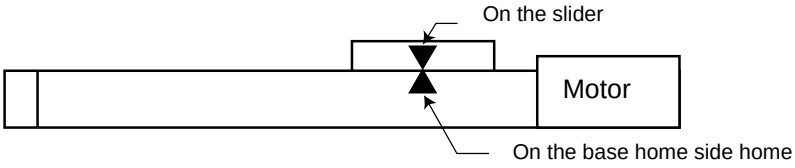
Home mark scale x 4 Home mark x 4
(Scale: 1 mm graduation mark, 10 mm width)

- Peel off the marks from the base sheet.

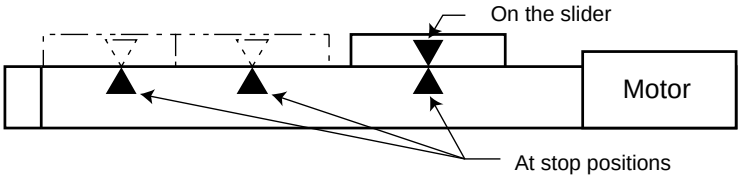
Note 1. Every mark has sticky back.
2. Remove smear and stain from the surface.
3. Avoid label or nameplate as a marking location.

Example of Use

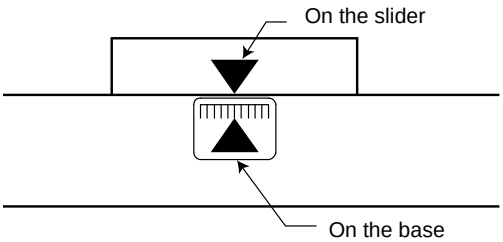
[1] Used as home position of the actuator



[2] Used as stop positions



[3] Used for position deviation check.



- Place the two markes when the actuator is stopped at home position.

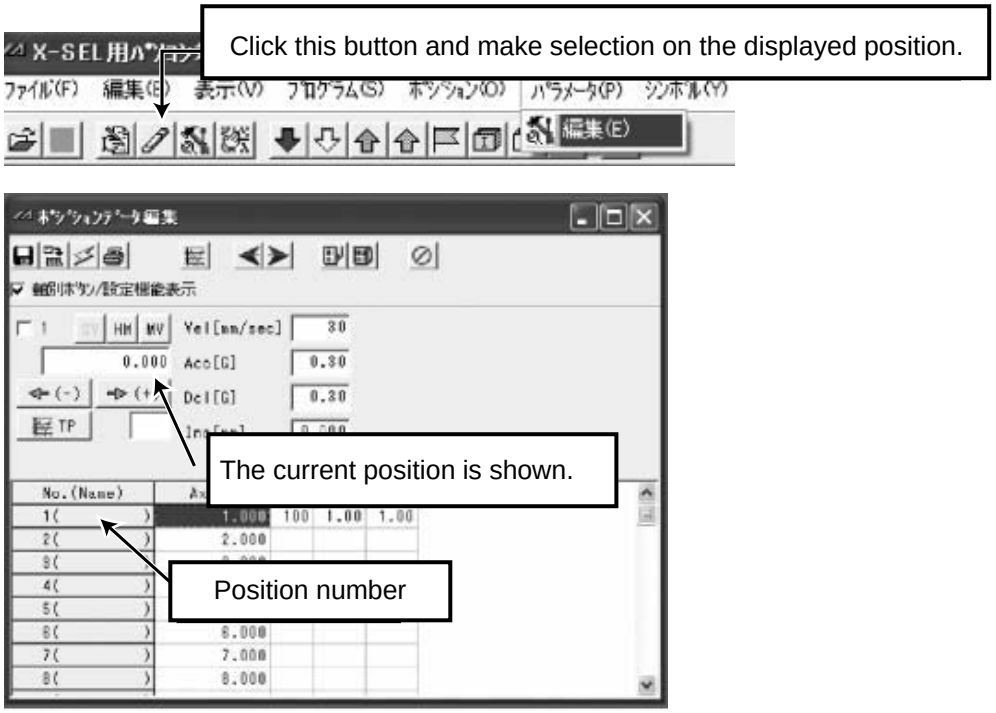
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7.5 How to Set the Home Preset and Home Return Offset

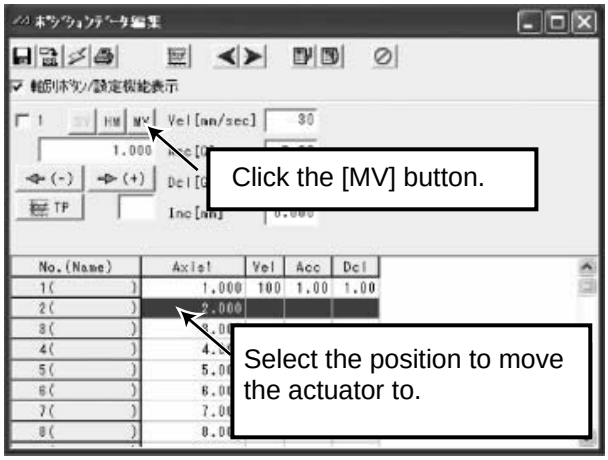
Correct any position deviation by changing the home preset parameter when an ASEL controller is used, or home return offset parameter when an ACON controller is used. How to set each parameter is explained below.

7.5.1 ASEL Controller

(1) Open the position edit screen.
Click on the the PC software screen, choose **Select Position Number**, and then click **OK**. The following screen appears.

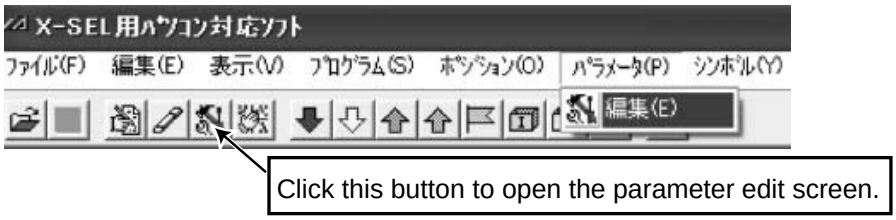


(2) Compare the value of the current position against that of the position number corresponding to the desired position to which the actuator has been moved, and check the deviation.

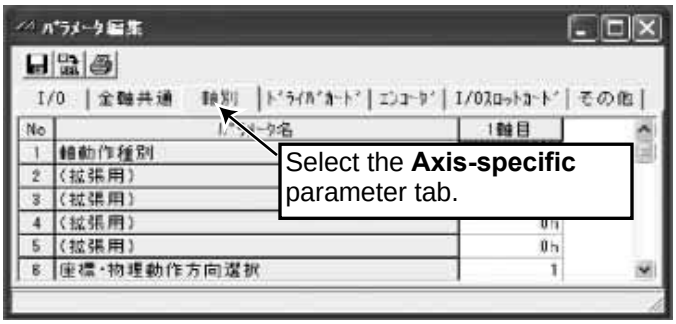


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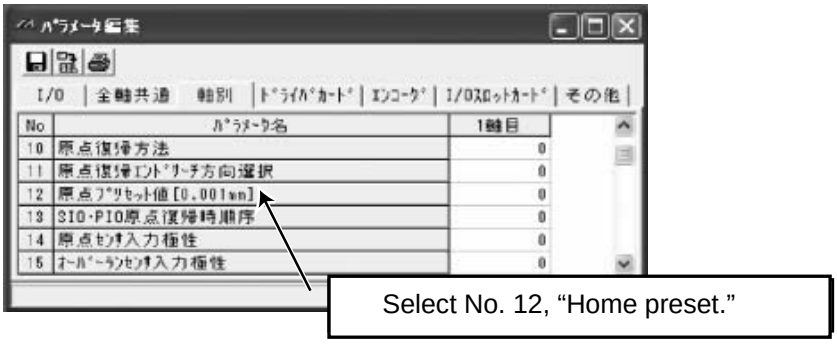
(3) Select the parameter.



(4) Select the **Axis-specific** parameter tab.

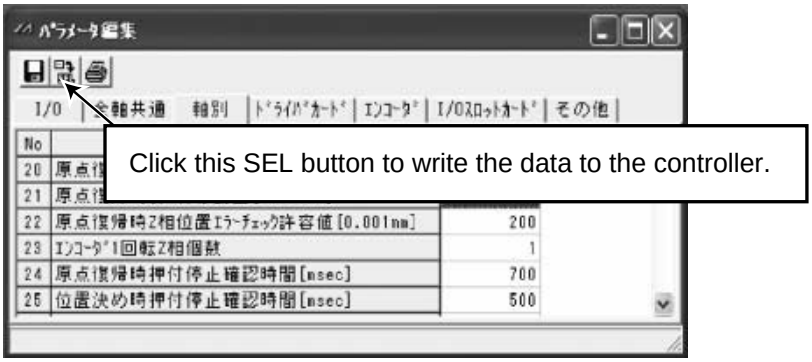


(5) When the axis-specific parameter screen appears, select No. 12, “Home preset.”



(6) Change Axis-specific Parameter No. 12 (home preset).
Add or subtract the difference measured in (2) to/from the value currently entered.
The setting unit is 0.001 mm.
Example: When the measured difference is -1 mm:
Home preset = Current setting – 1000

(7) Write the modified data.



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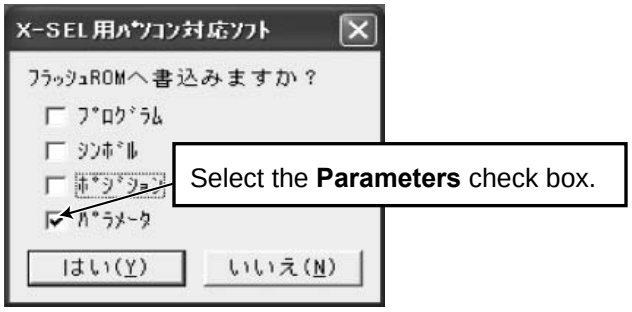
(8) The data is transferred to the controller.



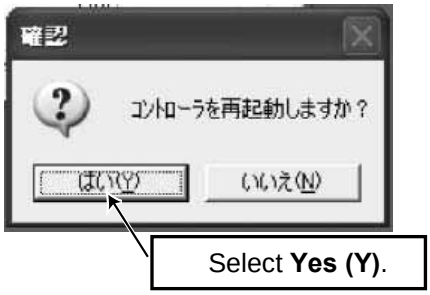
(9) Select **OK**.



(10) Write the data to the flash ROM.



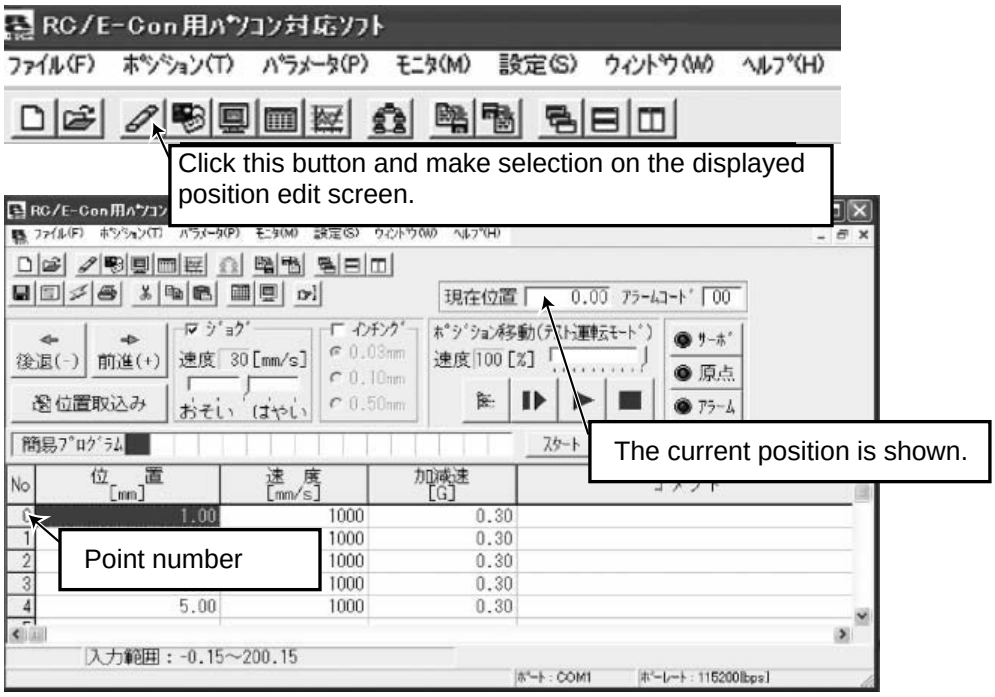
(11) Restart the controller.



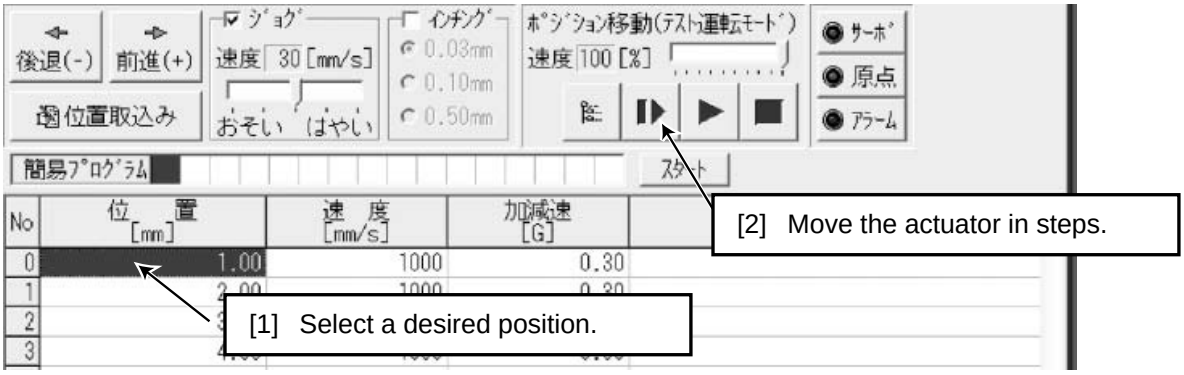
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7.5.2 ACON Controller

(1) Open the position edit screen.
Click on the PC software screen, choose **Select Position Number**, and then click **OK**. The following screen appears.



(2) Compare the value of the current position against that of the position number corresponding to the desired position to which the actuator has been moved.

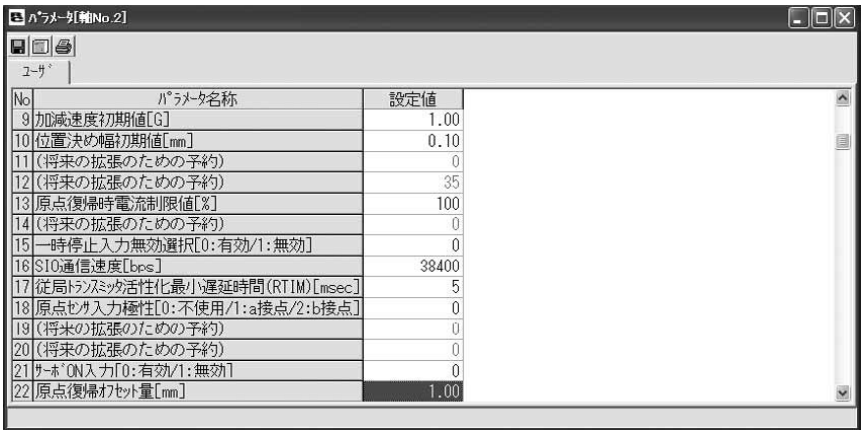


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(3) Select the parameter.



(4) Display the user parameter screen.

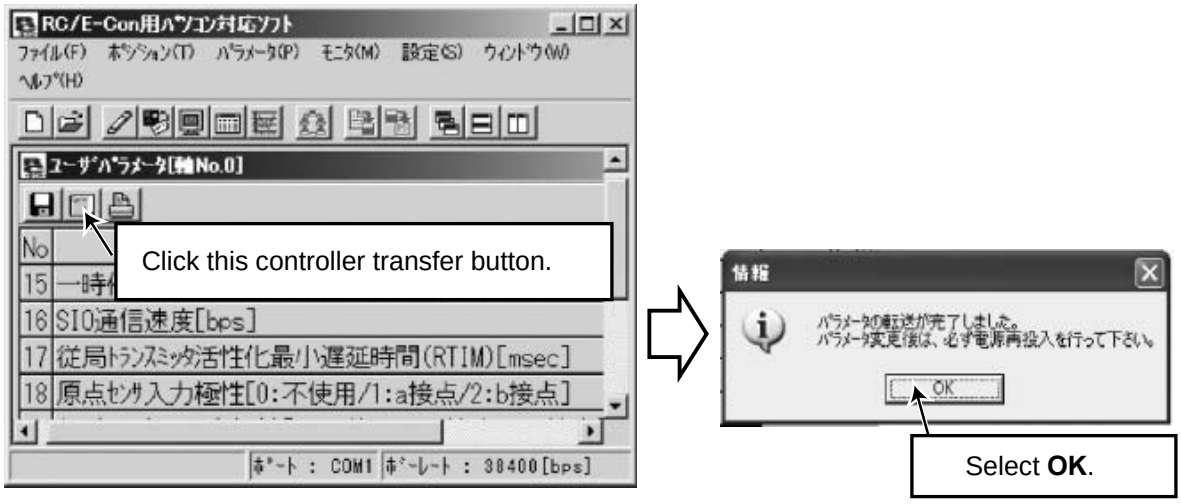


No	ﾊﾟﾗﾒｰﾀ名称	設定値
9	加減速度初期値[G]	1.00
10	位置決め幅初期値[mm]	0.10
11	(将来の拡張のための予約)	0
12	(将来の拡張のための予約)	35
13	原点復帰時電流制限値[%]	100
14	(将来の拡張のための予約)	0
15	一時停止入力無効選択[0:有効/1:無効]	0
16	SIO通信速度[bps]	38400
17	従局ﾄﾗﾝｽﾐｯｼｮﾝ活性化最小遅延時間(RTIM)[msec]	5
18	原点ｾﾝｻ入力極性[0:不使用/1:a接点/2:b接点]	0
19	(将来の拡張のための予約)	0
20	(将来の拡張のための予約)	0
21	ｻｰﾎﾞON入力[0:有効/1:無効]	0
22	原点復帰ｵﾌｾｯﾄ量[mm]	1.00

(5) Change User Parameter No. 22 (home return offset).
* The setting unit is mm.
Add or subtract the difference measured in (2) to/from the value currently entered.
Example: When the measured difference is -0.5 mm:
Home return offset = Current setting – 0.5 mm

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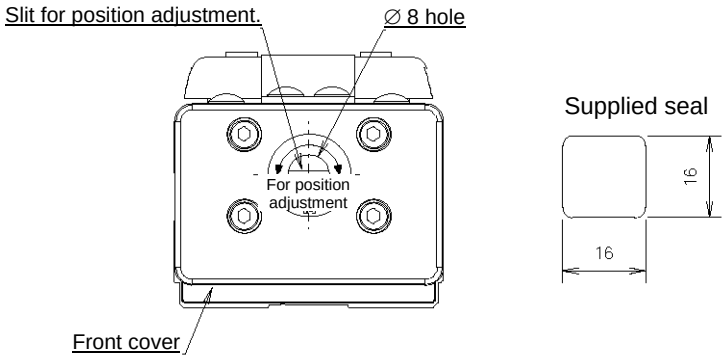
(6) Write the modified data.
Click the controller transfer button → OK.
* After the data has been written, turn off the controller power.



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8. Slit for Position Adjustment

A hole is provided in the front cover on the counter-motor side, with a slit machined on the ball screw shaft.
Use this slit if you want to fine-tune the slider position (for direct teaching, etc.).
Insert a screwdriver with an outer diameter of Ø8 mm or less into the slit, and turn the driver.



⚠ Caution: Be sure to operate the slit when the servo is off.
Do not insert a finger or object in this hole while the slider is moving, as it is very dangerous.
While the slit is not in use, attach the supplied seal or equivalent to cover the hole.
If the hole remains exposed, a finger or object may enter accidentally, creating a very dangerous situation.
With the cleanroom specification, leaving this hole open may cause dust and other particles inside the actuator to escape through the hole and affect the cleanliness of the operating room.

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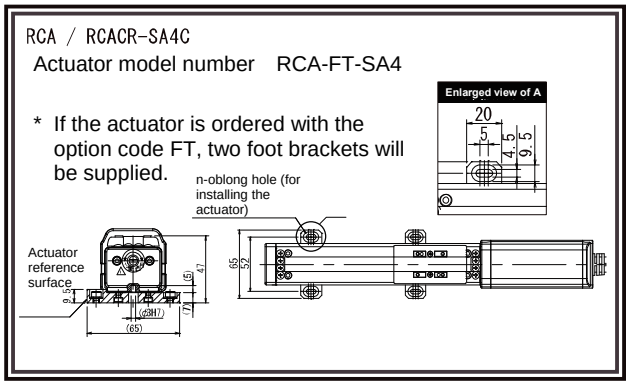
9. Options

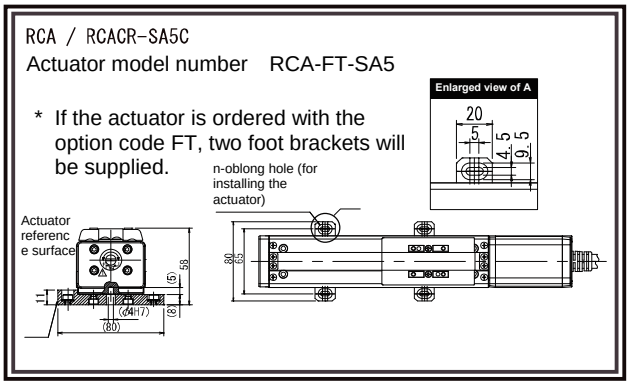
9.1 Brake

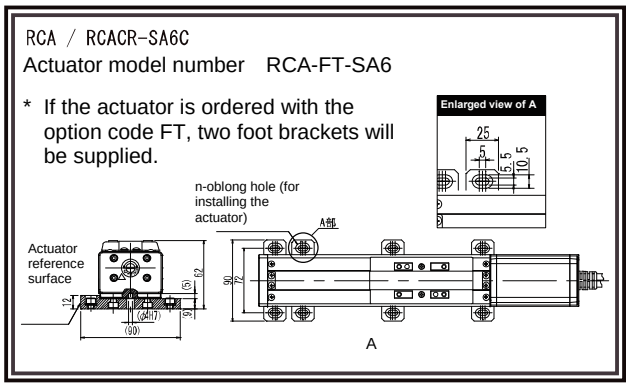
The brake is a mechanism to hold the slider in place when the actuator is used vertically, to prevent the slider from dropping and thereby damaging the work as the power or servo is turned off.
If an axis is used vertically, it needs an optional brake.
The model number for this option is “B,” “BE,” “BL” or “BR.”

9.2 Foot Bracket

This bracket is used to secure the actuator from above using bolts. The model number for this option is “FT.”
If the actuator receives large moment loads, install the actuator with foot brackets attached at all mounting holes in the actuator.
If not enough foot brackets are used, the life of the actuator may be shortened.







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9.3 High-acceleration/d eceleration Type

With this option, the maximum acceleration (0.2 G or 0.3 G) of the standard specification increases to 1.0 G (or 0.8 G on certain models).
Even at the maximum acceleration of 1.0 G (or 0.8 G on certain models), the actuator can operate by maintaining the same payload capacity as permitted for the standard specification.
To operate an actuator of high-acceleration/deceleration type, you need a controller for high-acceleration/deceleration actuator. High-acceleration/deceleration actuator controllers are different from controllers used for standard actuators. The model number for this option is “HA.”

9.4 Pow er-saving Type

With this option, the maximum current of the controller becomes lower than when the standard actuator is used. The maximum current varies depending on the model. For details, refer to the operation manual for your controller.
The model number for this option is “LA.”

9.5 Home Check Sensor

When this option is selected, the actuator comes with a sensor for checking if the slider has actually moved to the home position as a result of home return.
The model number for this option is “HS.”

9.6 Reversed-home Specification

The reversed-home specification is an option to set the home on the front side. The model number for this option is “NM.” If you wish to change the direction of home after the actuator has been delivered, please contact IAI because the moving direction parameter, etc., must be adjusted.

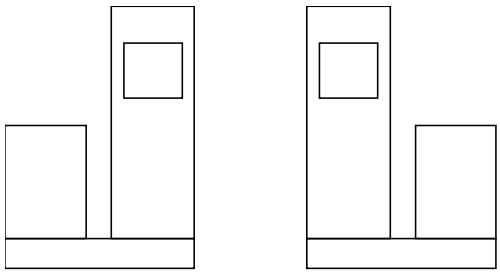
9.7 Slider Roller Specification

When this option is selected, the slider structure becomes the same as the roller structure adopted for the clean room specification.
The model number for this option is “SR.”

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9.8 Motor Reversing at Left, Motor Reversing at Right

“ML” indicates that the motor reverses on the left side as viewed from the motor, while “MR” represents motor reversing on the right side.
These options can be specified for motor reversing types including the SAR4, SA5R and SA6R.



9.9 Suction Joint on Opposite Side

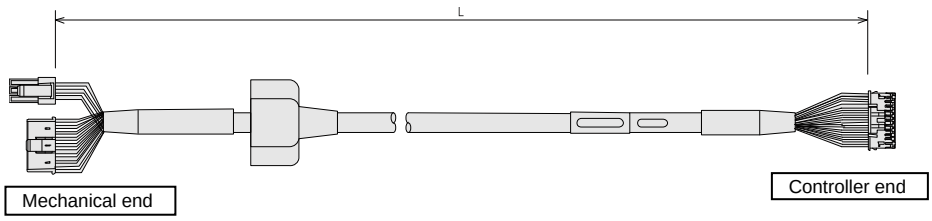
On standard clean room actuators, the suction joint is installed on the left side of the actuator as viewed from the motor side. When this option is selected, the suction joint is installed on the other (opposite) side.
The model number for this option is “VR.”

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10. Motor/Encoder Cables

10.1 AMEC/ASEP Controller Cables

[1] Integrated motor/encoder cable CB-ASEP-MPA***



Actuator end Terminal No.		Controller end Terminal No.
1	Red [U]	1
2	Yellow [V]	2
	NC	3
	NC	4
3	Black [W]	5
	NC	6
18	Orange [BK+]	7
17	Gray [BK-]	8
7	Black [LS+]	9
16	Brown [LS-]	10
1	White [A+]	11
2	Yellow [A-]	12
3	Red [B+]	13
4	Green [B-]	14
10	Black (identification tape) [Z+]	15
11	Brown (identification tape) [Z-]	16
14	White (identification tape) [VCC]	17
13	Yellow (identification tape) [VPS]	18
15	Red (identification tape) [GND]	19
6	Green (identification tape) [(Spare)]	20
5	NC	21
8	NC	22
12	NC	23
9	Shield [FG]	24

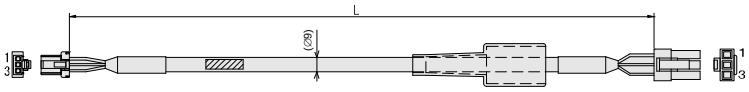
* *** indicates the cable length (L). A desired length can be specified up to 20 m.

Example) 080 = 8 m
[Minimum bending radius]
Movable: 68 mm
Fixed: 34 mm

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10.1 ACON/ASEL Controller Cables

[1] Motor cable CB-ACS-MA***



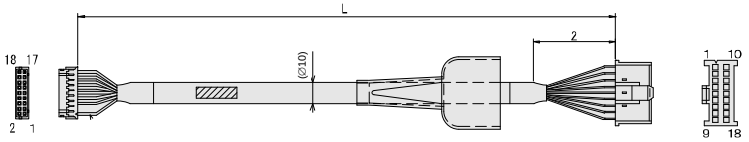
Controller end | Mechanical end

Wiring	Color	Signal	No.		No.	Signal	Color	Wiring
AWG 22 (Crinping)	Red	U	1		1	U	Red	AWG 22 (Crinping)
	White	V	2		2	V	White	
	Black	W	3		3	W	Black	

* *** indicates the cable length (L). A desired length can be specified up to 20 m.

Example) 080 = 8 m
[Minimum bending radius]
Movable: 84 mm
Fixed: 42 mm

[2] Encoder cable CB – ACS – PB ***
Encoder robot cable CB – ACS – PB *** - RB



Controller end | Mechanical end

* *** indicates the cable length (L). A desired length can be specified up to 20 m.

Example) 080 = 8 m
[Minimum bending radius]
Robot cable
Movable: 54 mm
Standard cable
Fixed: 75 mm

CN2

Cable color		Pin Number	Signal code
Robot cable	Standard cable		
White/Purple	Blue	LS+	18
White/Gray	Orange	LS−	17
Yellow	Green	BK+	16
Blue	Brown	BK−	15
White/Blue	Gray	ENA	14
White/Yellow	Red	$\overline{\text{ENA}}$	13
White/Red	Black	ENB	12
White/Black	Yellow	$\overline{\text{ENB}}$	11
Orange	Pink	ENZ	10
Green	Purple	$\overline{\text{ENZ}}$	9
Purple	White	—	8
Gray	Blue/Red	VPS	7
Red	Orange/White	5V	6
Black	Green/White	GND	5
—	—	—	4
—	—	—	3
—	—	—	2
Ground	Ground	F.G	1

Housing: PHDR – 18VR (JST)
Contact: SPHD-001T-P0.5 (JST)

CN1

Pin Number	Signal code	Cable color	
		Robot cable	Standard cable
1	ENA	Gray	White/Blue
2	$\overline{\text{ENA}}$	Red	White/Yellow
3	ENB	Black	White/Red
4	$\overline{\text{ENB}}$	Yellow	White/Black
5	—	—	—
6	—	—	—
7	LS+	Blue	White/Purple
8	—	—	—
9	FG	Ground	Ground
10	ENZ	Pink	Orange
11	$\overline{\text{ENZ}}$	Purple	Green
12	—	White	Purple
13	VPS	Blue/Red	Gray
14	5V	Orange/White	Red
15	GND	Green/White	Black
16	LS−	Orange	White/Gray
17	BK−	Brown	Blue
18	BK+	Green	Yellow

Plug housing: XMP-18V (JST)
Socket contact: BXA-00IT - P0.6 (JST)
Retainer: XMS-09V (JST)

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

	Visual inspection	Check interior	Grease supply*2
Start of operation	○		
After 1 month of operation	○		
After 6 months of operation	○	○	○*1
After 1 year of operation	○	○	○
Every 6 months thereafter	○		
Every 1 year	○	○	○

*1 If grease is found deteriorated as a result of internal check, add grease.
*2 If the actuator is operated back and forth over a distance of 30 mm or less, oil film of grease may be broken. As a rough guide, operate the actuator back and forth five times or so over a distance of at least 50 mm after every 5,000 to 10,000 cycles. This should restore oil film.

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
Stainless sheet	Damage, foreign deposit or slacks
General	Unusual noise or vibrations

- If the stainless sheet is slacked, adjust it as necessary to eliminate the slacks.
- As a rough guide, the stainless sheet will last for 5,000 km of traveling.
  However, the stainless sheet should be replaced earlier, as deemed appropriate, depending on the specific condition of use.
  As a rule, the actuator must be brought to IAI to replace the sheet, or it must be replaced on site by IAI's service personnel.
- If the actuator is secured vertically, grease applied on the guide may drip depending on the environment. If this is the case, clean the soiled areas and add grease.

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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 solvent on plastic parts or painted surfaces.
- If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth, and wipe gently.

11.4 Adjusting the Stainless Sheet

On actuators whose stroke is 400 mm or more, check the stainless sheet for slacks, etc., as necessary. If the stainless sheet is found slacked, adjust the stainless sheet.
[For the stainless sheet adjustment procedure, refer to 11.8, “Replacing/Adjusting the Stainless Sheet.”]

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11.5 Interior Inspection

Turn off the power, remove the side covers, and then visually inspect the interior.
Check the following items during interior inspection.
Internal check points

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

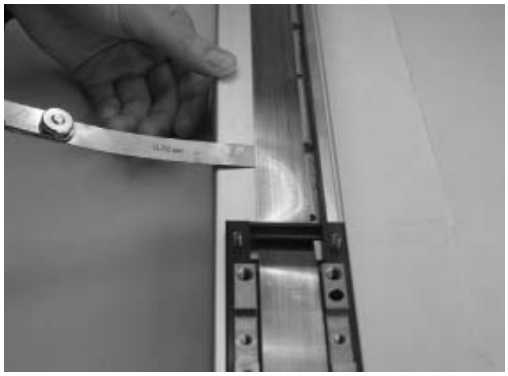
1) Remove both side covers.
   Use an Allen wrench of 1.5 mm across flats.



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 x 6 – 87.2 N·cm (8.90 kgf·cm)



When installing the side covers, do not let them contact the end faces of the stainless sheet. It may damage or bend the stainless sheet, causing the sheet to deteriorate or wear quickly. To prevent this problem, insert a shim (approx. 0.1 to 0.2 mm) between the sheet and each cover to provide an allowance, and gently push in the cover.

⚠ Caution:

- When checking the interior, be careful not to bend or scratch the stainless sheet. Wear protective gloves when handling the stainless sheet, because it has sharp edges that may cause accidental cuts.
  The front cover is supporting the ball screw; so do not disassemble the front cover.
  If the front cover is misaligned, the shaft centers may become offset, thus increasing the traveling resistance, reducing the service life of each part, or generating noise.
- If the actuator is equipped with a microswitch (optional), carefully install the side covers so that the switch cables are not pinched.

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11.6 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 large amounts of foreign substances, wipe off the dirty grease and then apply new grease.

11.7 Grease Supply

11.7.1 Applicable Grease

[Other than Cleanroom Specification]

(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

> ⚠ 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.

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[Cleanroom Specification]

(1) What grease to use on the guide and ball screw

The following grease is used when we ship the unit.
This grease is of low-dust-raising type.

Kuroda Precision Industries	C Grease

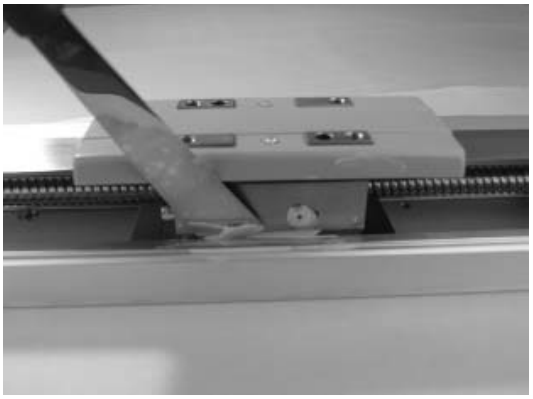
⚠ Warning: Never use any fluorine-based grease. It will cause a chemical reaction when mixed with a lithium-based grease and may cause damage to the actuator.

⚠ Caution: Never use grease for the standard specification. It may allow dust to generate.

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11.7.2 How to Apply Grease

1) When greasing the guide, use a spatula or grease applicator to squeeze or inject grease into the space between the slider and base, and then move the slider back and forth several times to let the grease spread evenly.
   Apply grease on the guides on both sides.
   Remove excess grease.





2) When greasing the ball screw, clean the ball screw, apply grease using a finger, and then move the slider back and forth several times to let the grease spread evenly.
   At this time, be careful not to deform the stainless sheet by accidentally touching the sheet.
   Remove excess grease.



3) Install the side covers.
   Tightening torque: Thin-head screw M3 x 6 – 87.2 N·cm (8.90 kgf·cm)
   Refer to 3) in 11.5, “Interior Inspection,” for notes on installing the side covers.

> ⚠ Caution: If the actuator is equipped with a microswitch (optional), carefully install the side covers so that the switch cables are not pinched.

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11.8 Replacing/Adjusting the Stainless Sheet

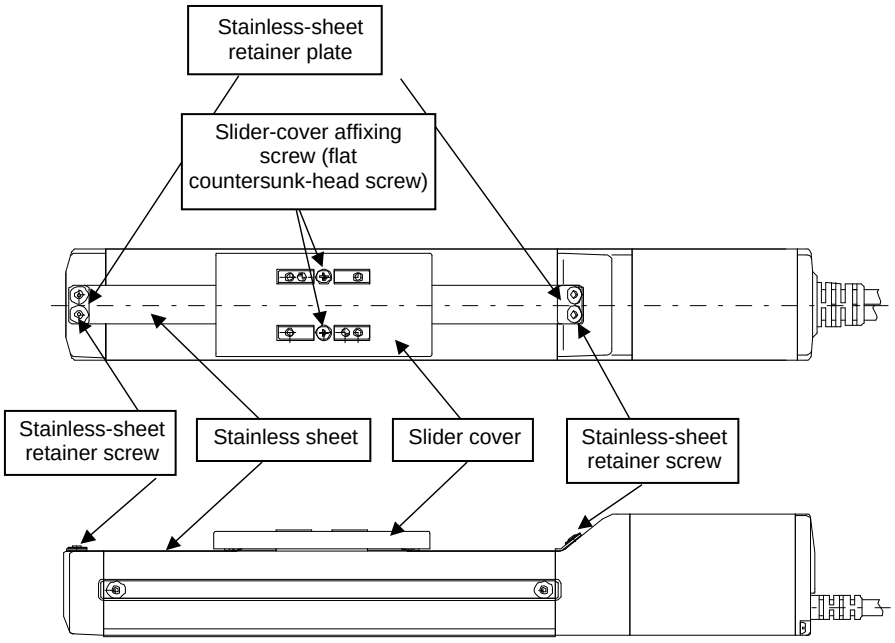
[Items Required for Replacement]

- Replacement stainless sheet
- Clearance-checking tool (a regular slider cover with holes)
  (This tool is available from IAI's Sales Engineering Section. If you are replacing the stainless sheet, please contact us to make a rental arrangement or purchase the tool.)
- Allen wrench set • Phillips screwdriver • Measure

[Note on Stainless Sheet Tension]

Deterioration and wear of the stainless sheet is affected by its tension.
If the stainless sheet is too tight, excessive clearances will be created between the sheet and slider covers and the sheet may undergo a fatigue failure.
If the stainless sheet is too loose, the sheet will contact the back of the slider covers and generate shaving.
Therefore, use a dedicated adjustment tool to properly adjust the tension of the stainless sheet so that the clearances between the stainless sheet and slider covers conform to the specified dimension.

[Name of Each Part]



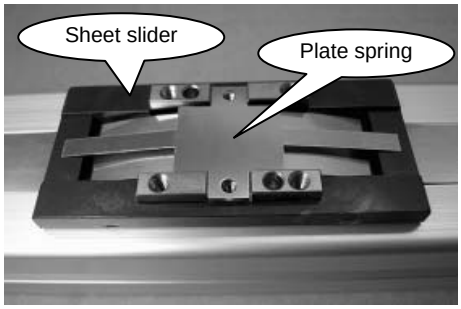
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[Procedure]

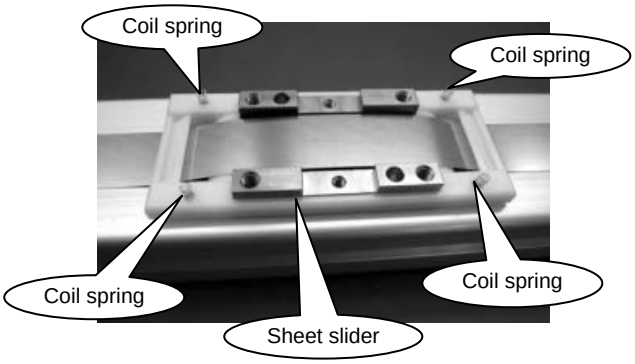
1) Remove the slider-cover affixing screws and remove the covers.
After the slider covers have been removed

[1] Standard specification (slider structure)

- RCA-SA4/SA5/SS4/SS5

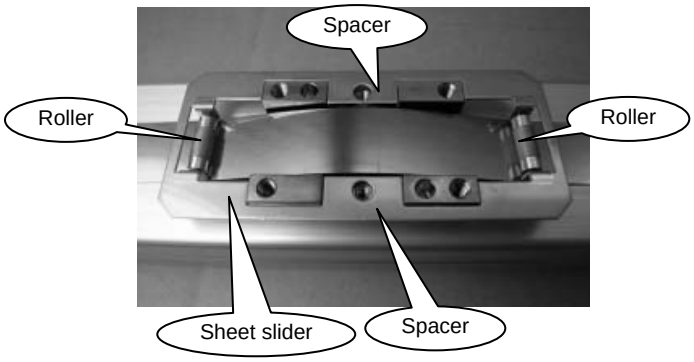


- RCA-SA6/SS6



[2] Cleanroom specification, slider roller specification (optional) (roller structure)

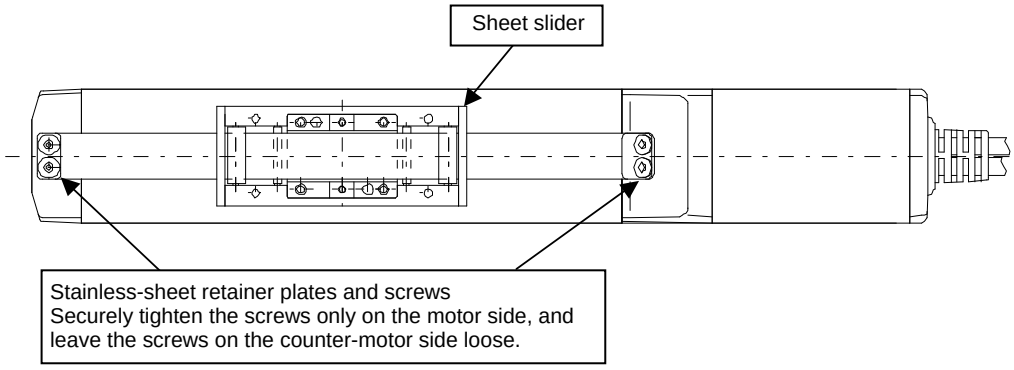
- RCACR-SA4/SA5/SA6



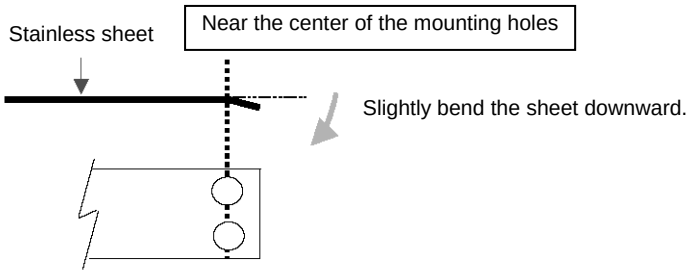
⚠ Caution: Remove the slider covers slowly and gently. If the actuator is installed on the ceiling or oriented vertically or horizontally on side, place a plastic bag, etc., underneath the slider covers so as not to lose the coil springs and spacers in case they drop off.

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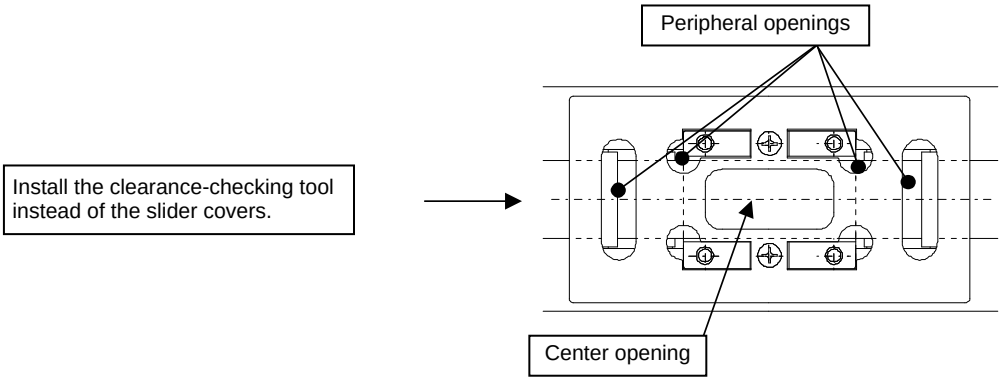
2) Remove the stainless-sheet retainer screws on both sides and pull out the stainless sheet.
3) Guide a new stainless sheet into the slider.
4) Hold the stainless sheet in place, and affix the retainer plates and screws.
   At this time, securely tighten the screws only on the motor side, and leave the screws on the counter-motor side loose.



- How to prevent the stainless sheet from lifting (SA4/SA5/SA6/SS4/SS5/SS6)
  Slightly bend the stainless sheet downward near the center of the mounting holes so that the sheet can be held securely.



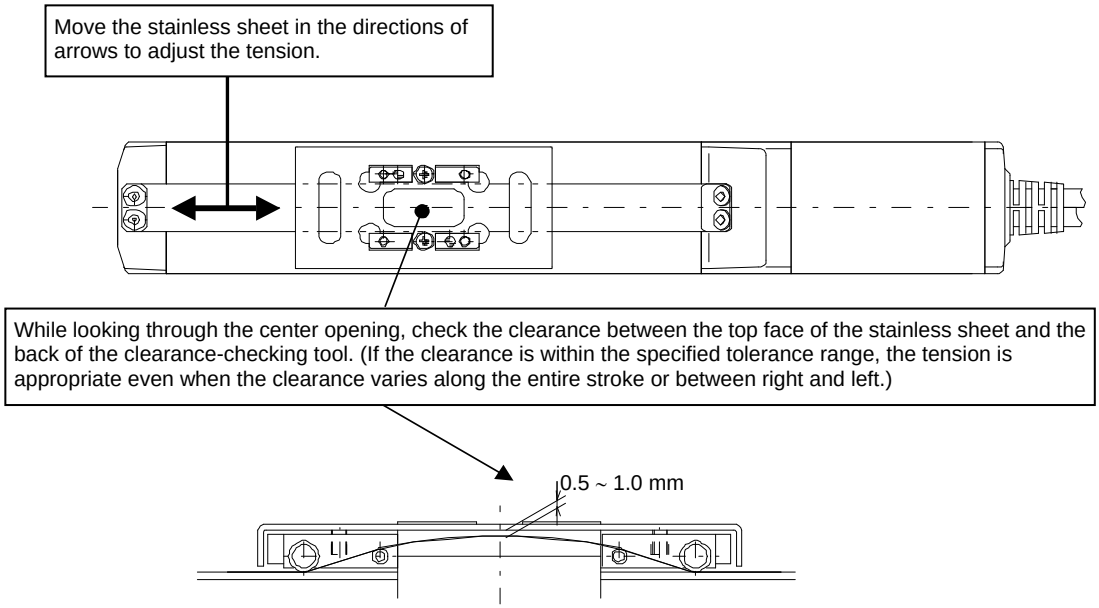
5) Install the clearance-checking tool.



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6) Adjust the tension of the stainless sheet.

[1] While looking through the center opening in the clearance-checking tool, move the stainless sheet on the loose end in the directions of arrows until the clearance between the top face of the stainless sheet and the back of the clearance-checking tool falls within the specified range.

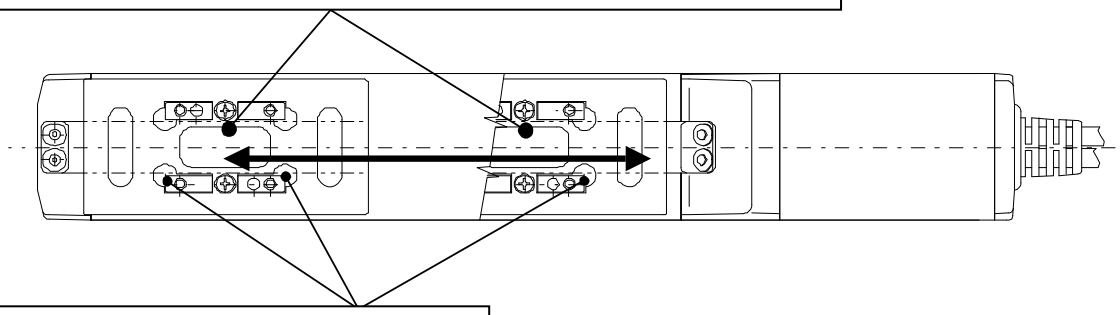


[2] When the stainless sheet has been properly positioned, tighten the screws on the loose end to a level that the stainless sheet no longer moves.

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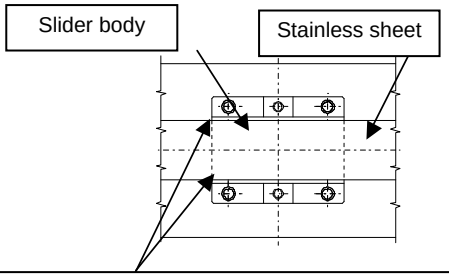
[3] Move the slider and check the tension of the stainless sheet along the entire stroke.

Checkpoint 1:
Check if the clearance between the top face of the stainless sheet and the back of the clearance-checking tool falls within the specified range along the entire stroke.



Checkpoint 2:
Look through the peripheral openings and confirm that the stainless sheet edges do not contact the slider body.
Move the slider back and forth at least three times over the entire stroke to ensure the edges do not contact the slider.
The sheet may move during the slider strokes, but slight movement is acceptable as long as the offset does not increase and the sheet does not contact the slider.
If the stainless sheet contacts the slider, repeat the adjustment from [1].

The stainless sheet is not perfectly straight, but it bends to right and left slightly.
It is impossible to adjust the right and left clearances perfectly uniform.
Slight variation in clearance in the stroke direction or between right and left is acceptable, as long as the stainless sheet edges do not contact the slider body over the entire stroke.

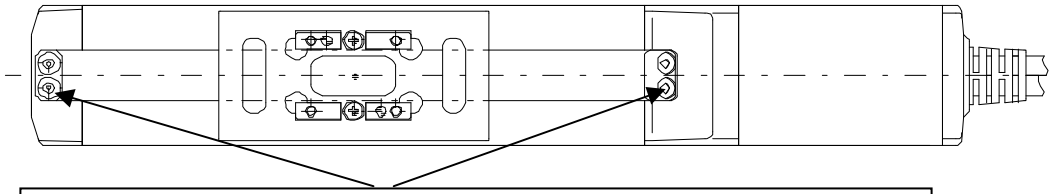


Clearances between stainless sheet edges and slider body

If the conditions in Checkpoints 1 and 2 are not satisfied, loosen the screws and readjust the position and tension of the stainless sheet again from [1].

Note) If the condition in Checkpoint 2 cannot be met after the readjustment, try installing the stainless sheet in the reverse direction or placing it upside down. If the stainless sheet is still not adjusted properly, replace it with a new sheet.

[4] When proper clearances are obtained between the slider body and stainless sheet and an absence of contact between the two is confirmed, tighten the two screws on the loose end alternately, and then finally tighten all screws to a uniform torque to securely affix the stainless sheet. If the screws are not tightened uniformly, the sheet may meander or lift.



Apply additional torque to the screws on both ends until the stainless sheet no longer moves.
Tightening torque: 87.2 N·cm (8.90 kgf·cm) [Reference value]

[5] Remove the clearance-checking tool and install the slider covers.
Note) Again, pay attention not to lose the coil springs and spacers.

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11.9 Reduction Belt [Motor Reversing Type]

11.9.1 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 is 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.

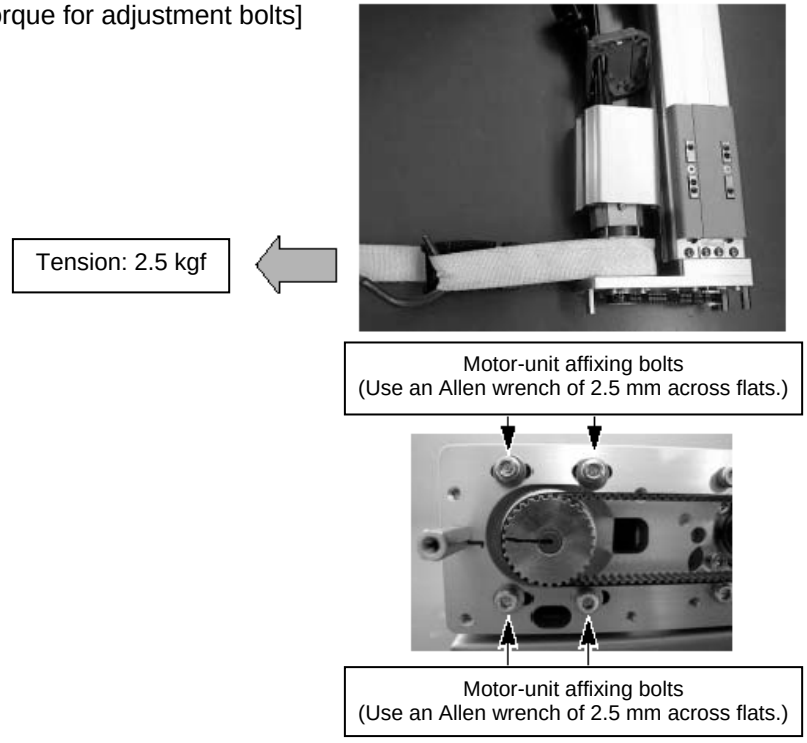
11.9.2 Applicable Belt

- SA4 - 60S2M160R Rubber, cleanroom type (Bando Chemical Industries) 6 mm wide
- SA5 - 60S2M180R Rubber, cleanroom type (Bando Chemical Industries) 6 mm wide
- SA6 - 60S2M190R Rubber, cleanroom type (Bando Chemical Industries) 6 mm wide

11.9.3 Adjusting the Belt Tension

Remove the pulley cover and motor-end cover, and loosen the four motor affixing bolts.
Pass a looped strong string (or long tie-band) around the motor cover 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 adjustment bolts]
162 N·cm (16.5 kgf·cm)



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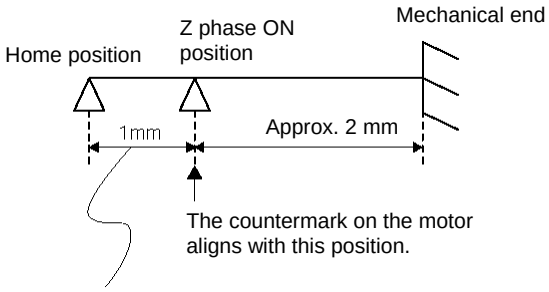
11.9.4 Replacing the Belt of the Motor Reversing Type: SA4R, SA5R, SA6R

[Items Required for Replacement]

- Replacement belt
- Allen wrenches
- Phillips screwdriver
- Tension gauge (capable of tensioning to 7 kgf 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) (2 mm from the mechanical end). In this position, loosen the motor-unit affixing bolts and replace the belt.
2) Restore the home position.
   Affix the slider at a position 2 mm from the mechanical end on the home side, 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.

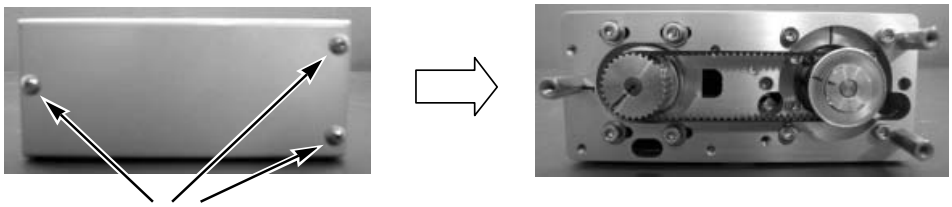


Set by the home offset parameter. (The above value is the factory setting.)

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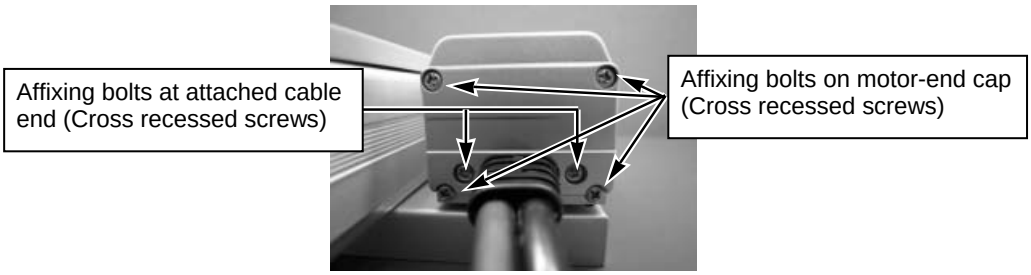
[Procedure]

1) Remove the pulley cover using a Phillips screwdriver.

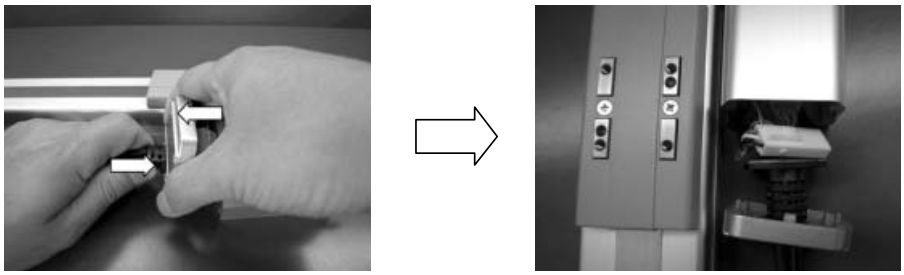


Cross recessed screws: M3

2) Use a Phillips screwdriver to remove the bolts affixing the motor-end cap and attached cables.



3) Pull out the motor-end cap.



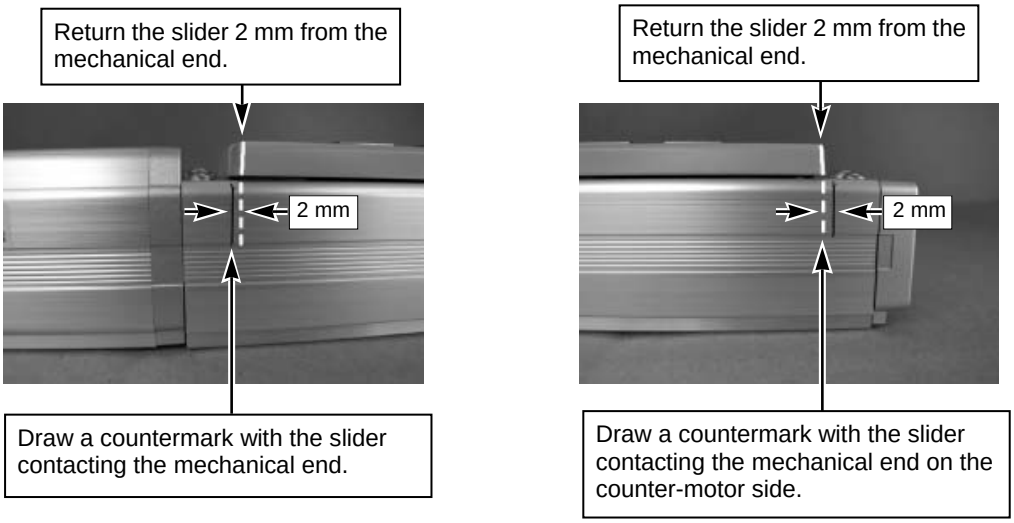
Push in the cable end while pulling out the motor-end cap.

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4) Pull out the motor-end cover to expose the motor.



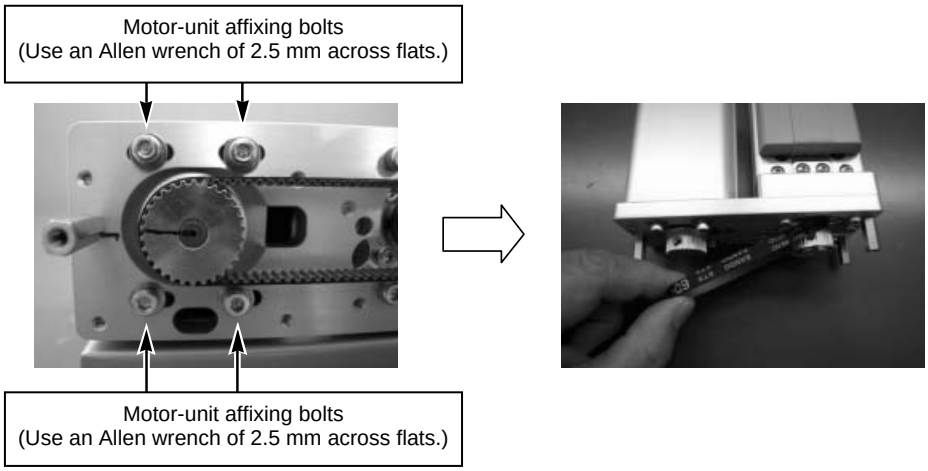
5) Move the slider to a position where Z phase turns on (home position).
On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2 mm from the mechanical end.



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 actuator hand to prevent sudden drop, so as not to pinch fingers or damage the load.

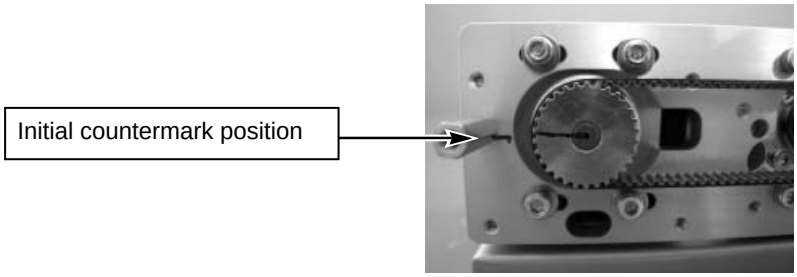
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6) Loosen the motor-unit affixing bolts using an Allen wrench of 2.5 mm across flats. Slide the motor, and loosen and remove the belt.

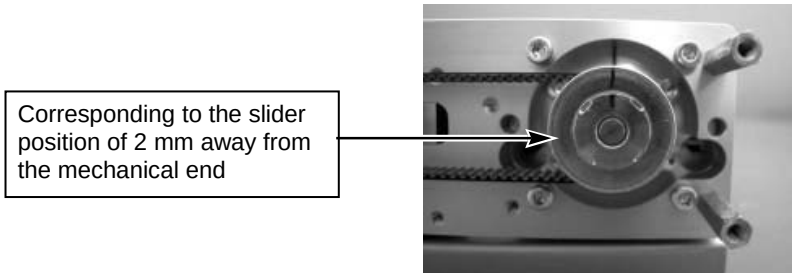


7) Check the following points before restoring the home position:
   - The motor side should be aligned with the initial countermark. If the position is offset, adjust it to achieve proper alignment.
   - The ball-screw side should be in a location corresponding to the slide position of 2 mm away from the mechanical end.

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



Motor side

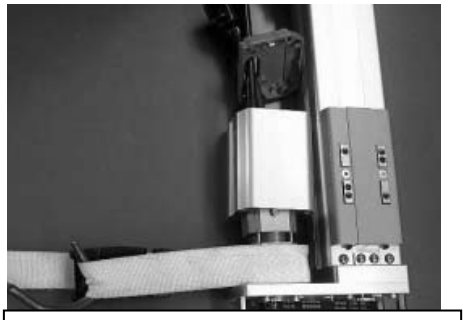


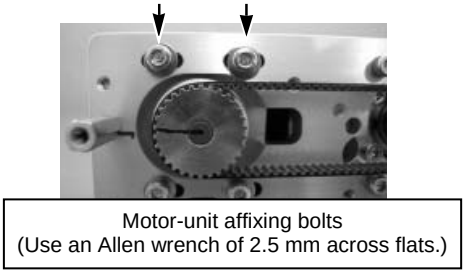
Ball-screw side

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8) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover 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 adjustment bolts]
162 N·cm (16.5 kgf·cm)





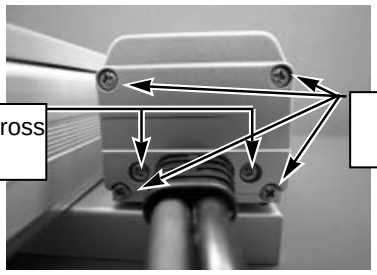
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9) Insert the motor-end cover and cap.



Pull out the cable end while pushing in the motor-end cap.

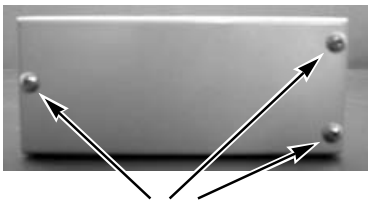
10) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



Affixing bolts at attached cable end (Cross recessed screws)

Affixing bolts on motor-end cap (Cross recessed screws).

11) Use a Phillips screwdriver to securely tighten the affixing bolts for pulley cover.



Cross recessed screws: M3

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

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11.10 Replacing the Motor

11.10.1 Replacing the Motor of the Motor Straight Type (Coupling Type): SA4C, SA5C, SA6C

[Items Required for Replacement]

- Replacement motor
- Allen wrenches
- Scale
- Grease
- Coupling (with screws)
- Phillips screwdriver
- Oil-based marker pen

Other than cleanroom specification

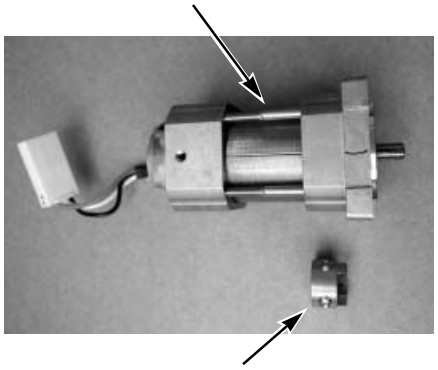
Idemitsu Kosan	Daphne Eponex Grease No.2

Cleanroom specification

Kuroda Precision Industries	C Grease

- PC or teaching pendant

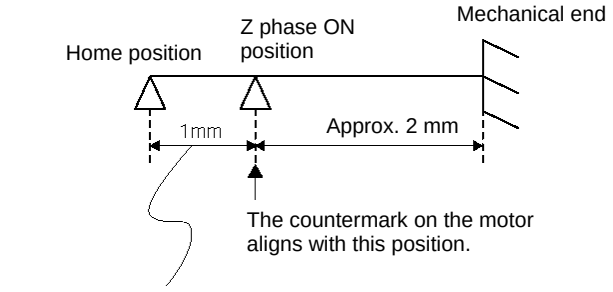
Example: Replacement motor (IAI encoder)



> ⚠ Caution: When replacing the motor, handle the replacement motor with due care. The actuator has been shipped with the encode adjusted to an optimal position, so do not crush the encoder unit. It may displace the encoder, thus impairing proper actuator operation.

[Overview of Replacement]

1) Move the slider to a position where Z phase turns on (home position) (2 mm from the mechanical end). Replace the motor in this position.
2) 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.

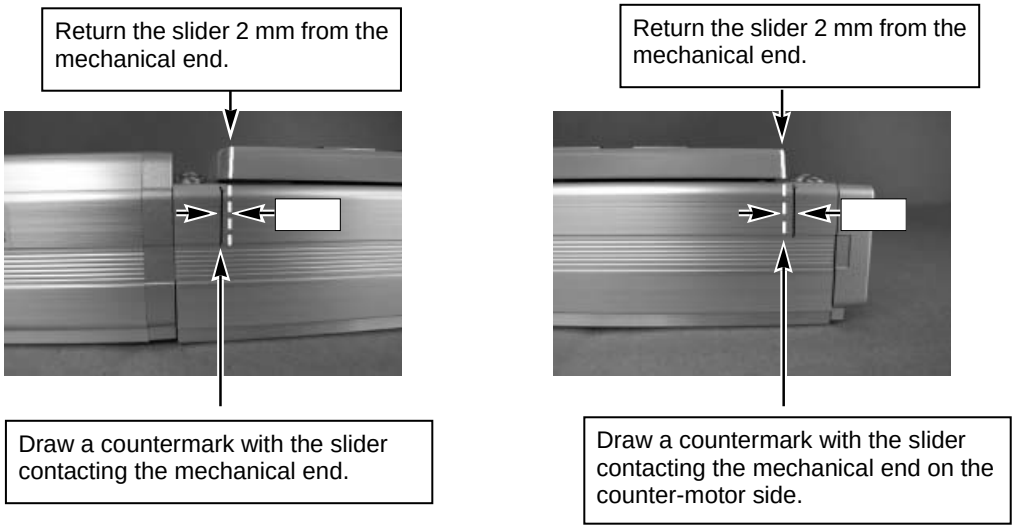


Set by the home offset parameter. (The above value is the factory setting.)

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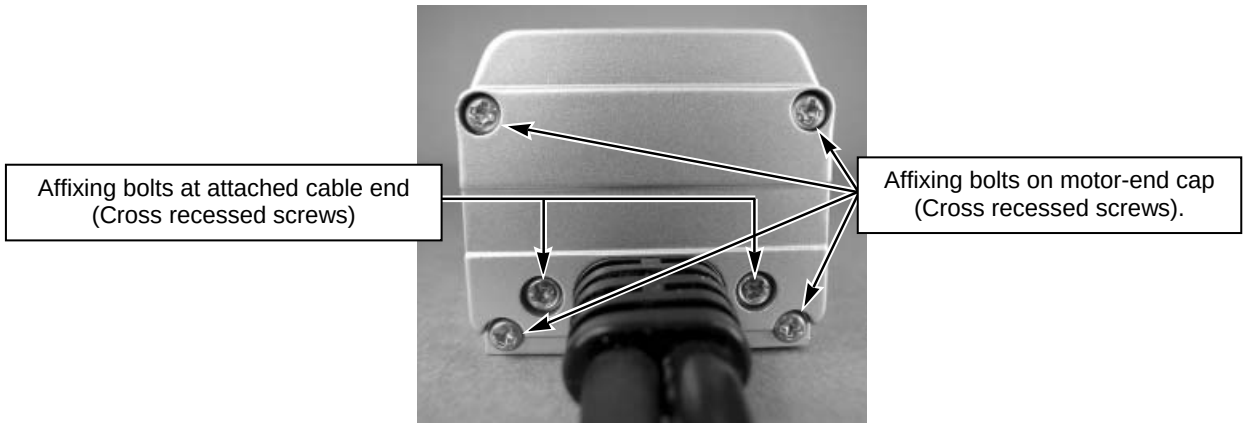
[Procedure]

1) Move the slider to a position where Z phase turns on (home position).
   On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2 mm from the mechanical end.



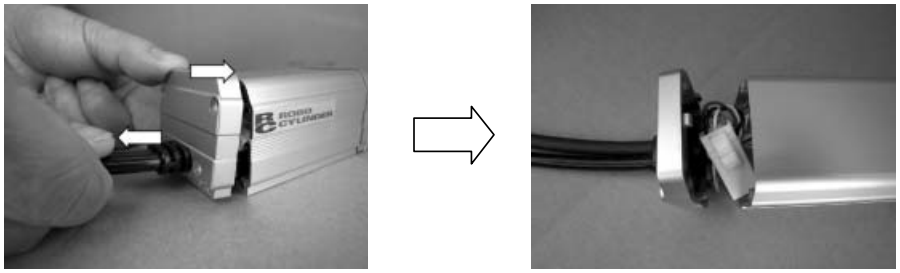
> ⚠ Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly.
> Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers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

2) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



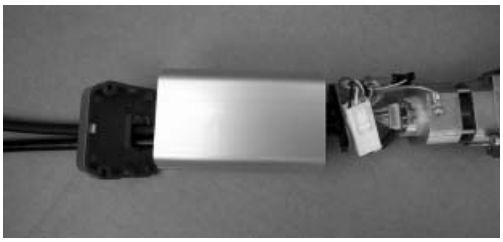
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3) Pull out the motor-end cap.



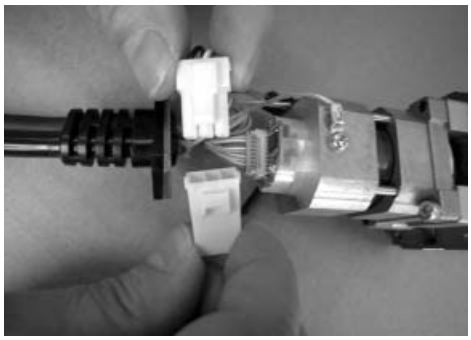
Push in the cable end while pulling out the motor-end cap.

4) Pull out the motor-end cover to expose the motor.



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5) Detach the attached cables.
• Pull out the motor connector.



• If the actuator has a brake, also detach the brake connector.

• Remove the grounding wire using a Phillips screwdriver.



• While holding the motor with one hand, pull out the encoder cable.
(The photograph bellow shows the motor (IAI encoder).)

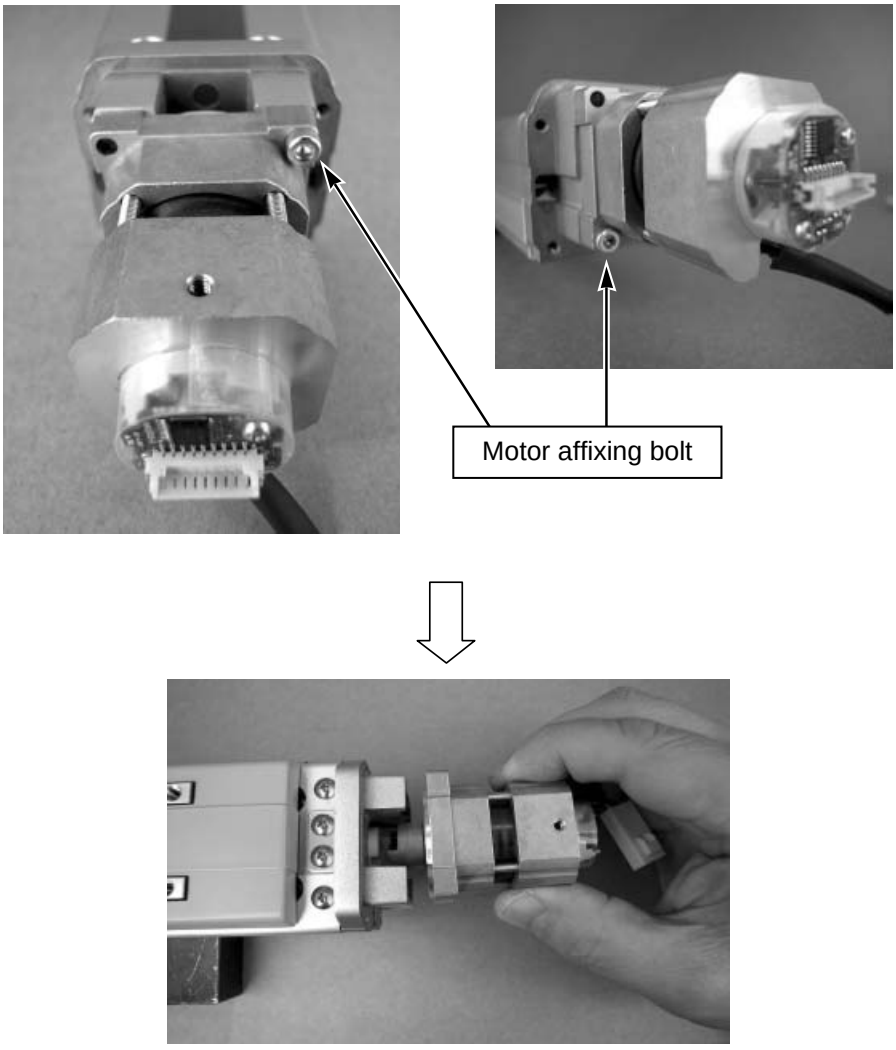


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6) Detach the attached cables.

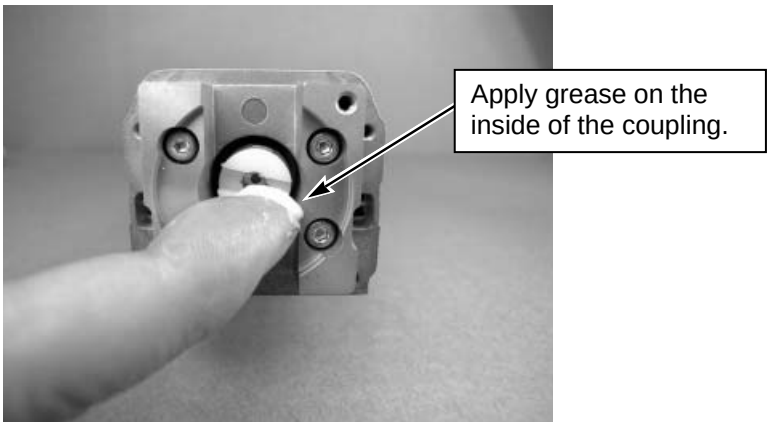


7) Take out the motor.
   • Remove the two motor affixing bolts using an Allen wrench of 2.5 mm across flats.

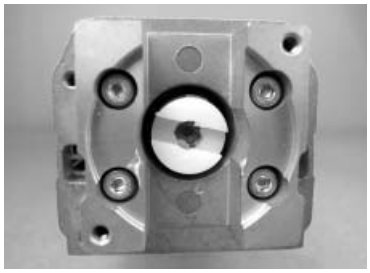


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8) Apply grease on the actuator coupling.



9) Insert the replacement coupling (with screws) by aligning it with the current orientation of the actuator coupling.



Coupling on actuator side



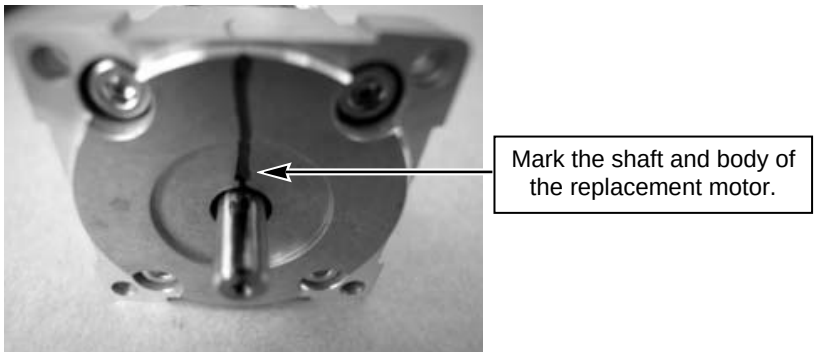
Inserting the coupling (with screws)



Inserted coupling (with screws)

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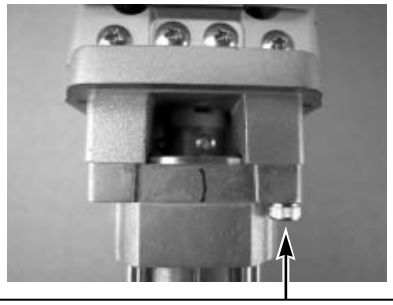
10) Mark the shaft and body of the replacement motor to prevent the motor shaft position from deviating.



11) Insert the replacement motor into the actuator coupling, and secure with two motor affixing bolts.



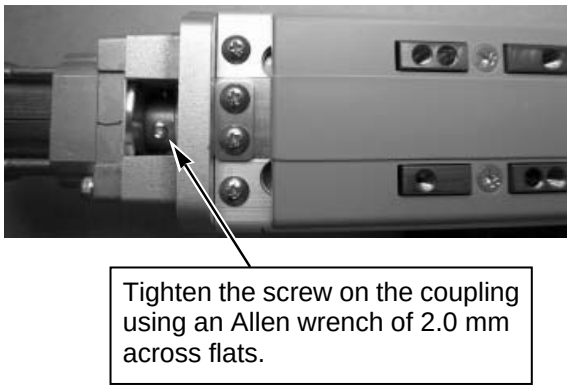
Insert the replacement motor.



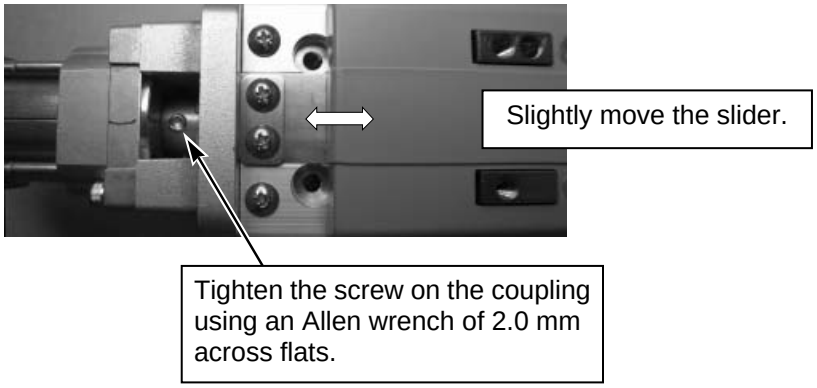
Tighten two bolts at top and bottom using an Allen wrench of 2.5 mm across flats.

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12) Tighten the screw on the coupling.



13) Slightly move the slider to expose the second screw on the coupling, and tighten the screw in the same manner.



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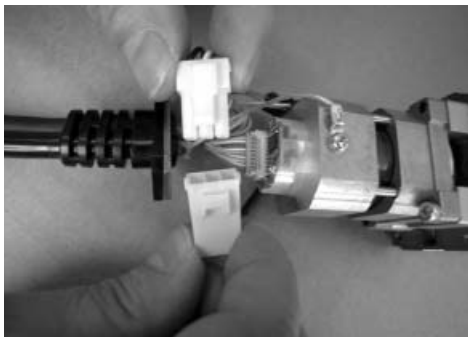
14) Install the attached cables.
- While holding the motor with one hand, insert the encoder cable. (The photograph bellow shows the motor (IAI encoder).)



- Install a grounding wire using a Phillips driver.

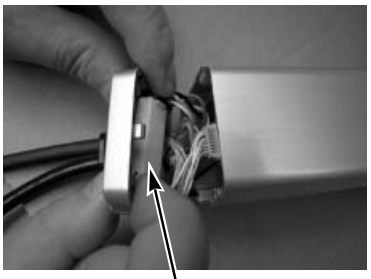


- Plug the cables into the motor.



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15) Insert the motor-end cover and cap.
Store the connector inside the motor-end cap.

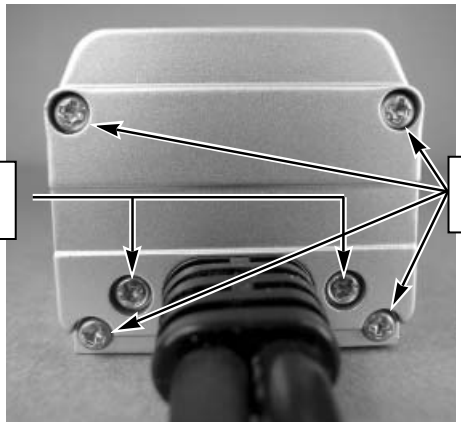


Store the connector inside the motor-end cap.



Pull out the cable end while pushing in the motor-end cap.

16) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



Affixing bolts at attached cable end (Cross recessed screws)

Affixing bolts on motor-end cap (Cross recessed screws).

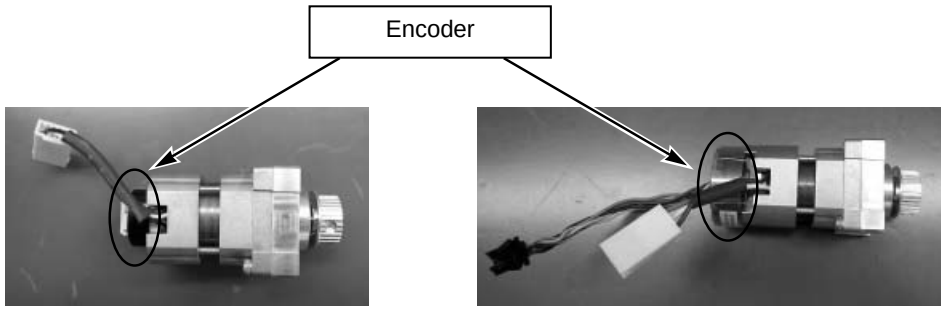
17) Connect a PC or teaching pendant to the controller to perform homing. (If the actuator is of absolute encoder specification, an absolute reset must be performed.)
Check for deviation from the initial home position. If there is a deviation, adjust the home offset parameter.

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11.10.2 Replacing the Motor of the Motor Reversing Type: SA4R, SA5R, SA6R

[Items Required for Replacement]

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



Replacement motor (IAI encoder)

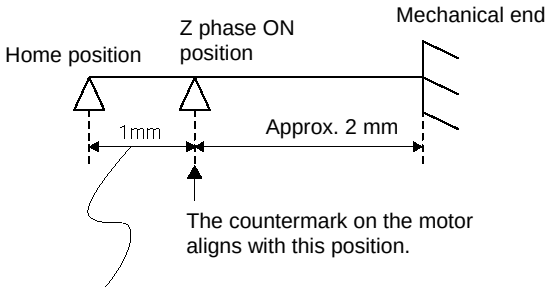
Replacement motor (Tamagawa encoder)

> ⚠ Caution: When replacing the motor, handle the replacement motor with due care. The actuator has been shipped with the encode adjusted to an optimal position, so do not crush the encoder unit. It may displace the encoder, thus impairing proper actuator operation.

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[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 2 mm from the mechanical end on the home side, 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.

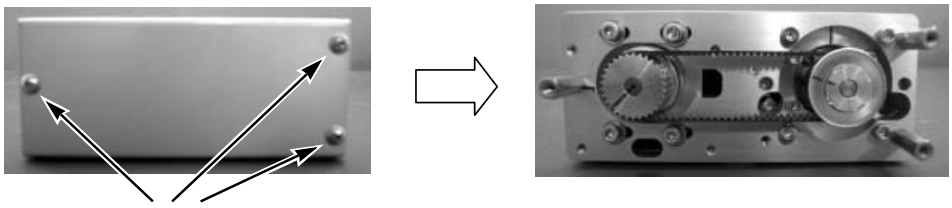


Set by the home offset parameter. (The above value is the factory setting.)

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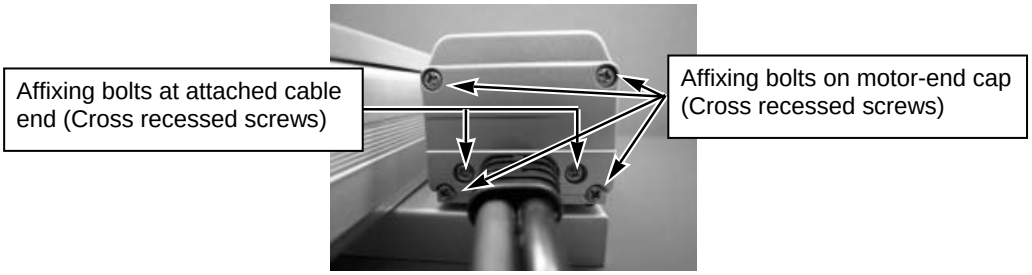
[Procedure]

1) Remove the pulley cover using a Phillips screwdriver.

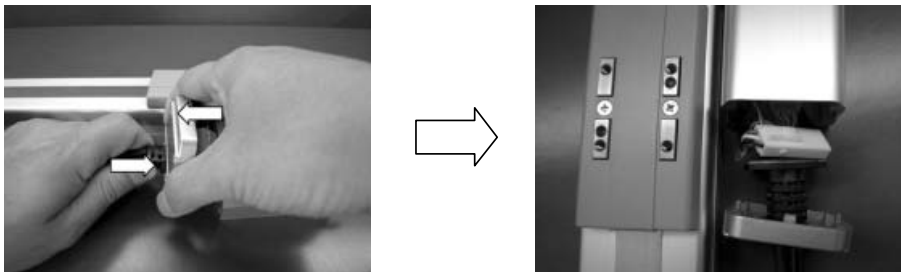


Cross recessed screws: M3

2) Use a Phillips screwdriver to remove the bolts affixing the motor-end cap and attached cables.



3) Pull out the motor-end cap.



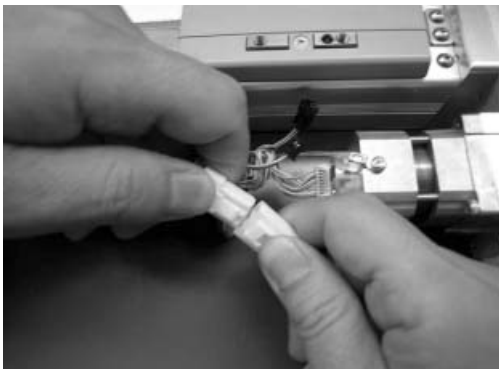
Push in the cable end while pulling out the motor-end cap.

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4) Pull out the motor-end cover to expose the motor.



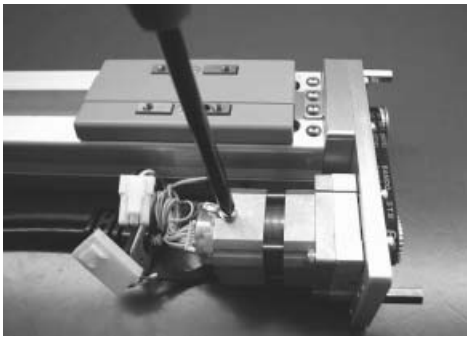
5) Detach the attached cables.
   - Pull out the motor connector.



   - If the actuator has a brake, also detach the brake connector.

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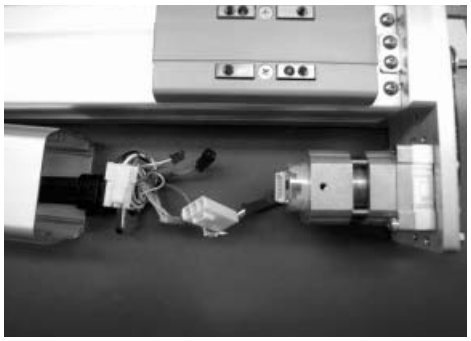
- Removethe grounding wire using a Phillips screwdriver.



- While holding the motor with one hand, pull out the encoder cable.
  (The photograph bellow shows the motor (IAI encoder).)

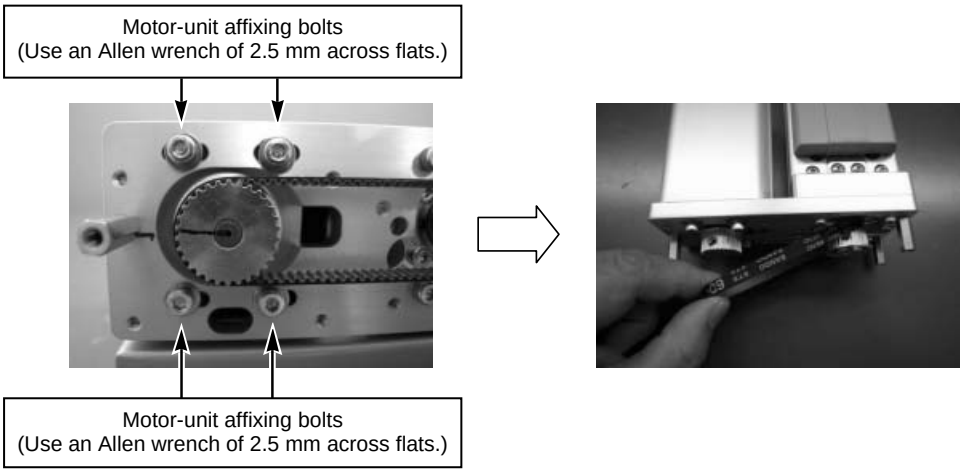


6) Detach the attached cables.

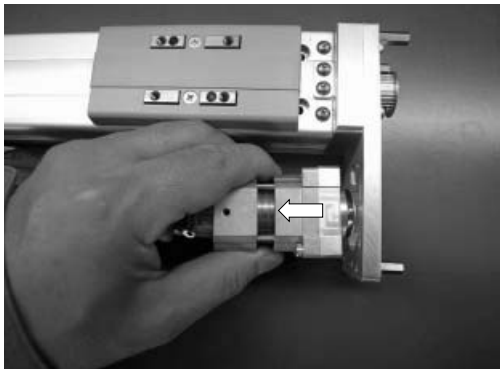


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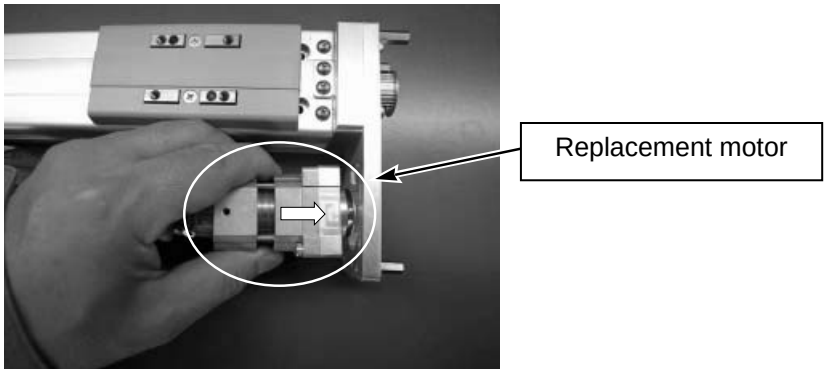
7) Loosen the motor-unit affixing bolts using an Allen wrench of 2.5 mm across flats. Slide the motor, and loosen and remove the belt. After the belt has been removed, remove the motor-unit affixing bolts.



8) Take out the motor.

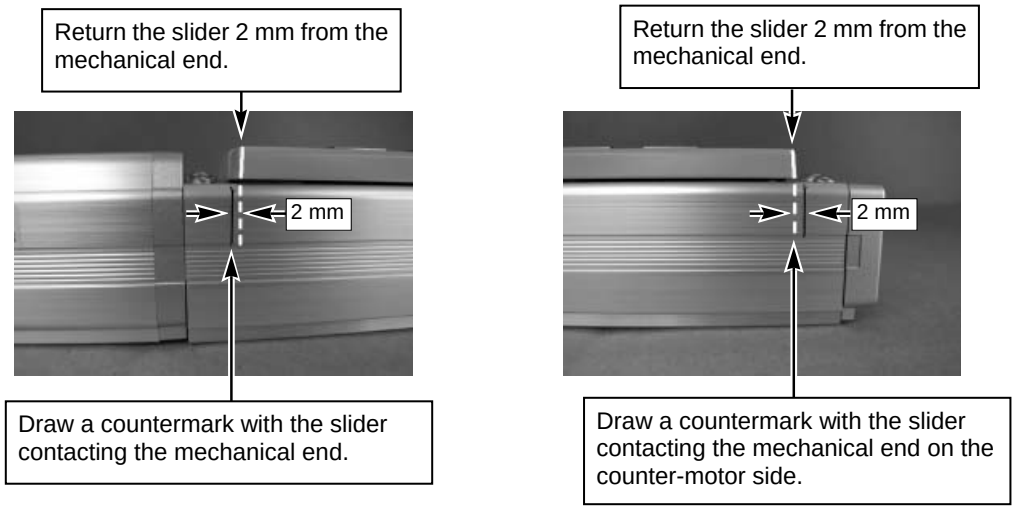


9) Install the replacement motor. Loosely tighten the motor-unit affixing bolts.



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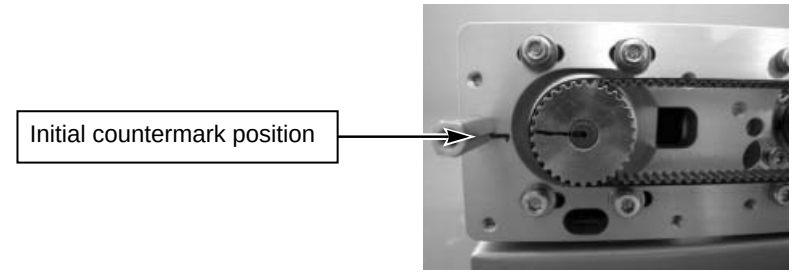
10) Move the slider to a position where Z phase turns on (home position).
On both standard actuators and actuators whose home is set on the opposite side, this position corresponds to 2 mm from the mechanical end.



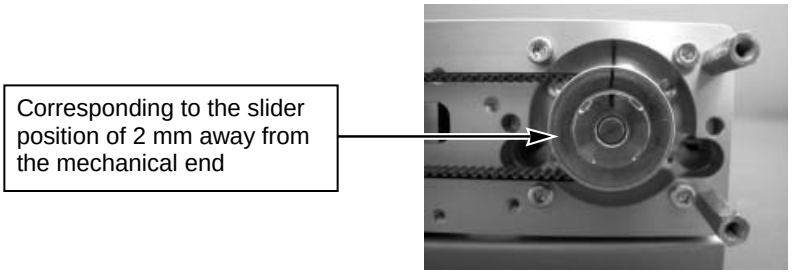
⚠ Warning: If the actuator is installed vertically, move it after turning on the controller power and forcibly releasing the brake. At this time, beware of danger as the actuator may drop suddenly. Always provide a support to brace the actuator hand to prevent sudden drop, so as not to pinch fingers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

11) 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 2 mm away from the mechanical end.

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



Motor side

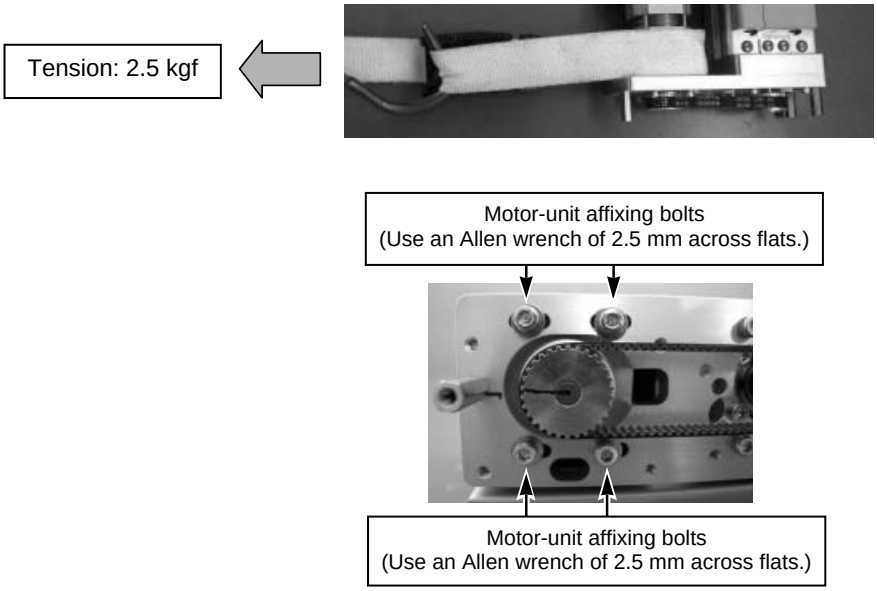


Ball-screw side

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12) Adjust the belt tension.
Pass a looped strong string (or long tie-band) around the motor cover 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 adjustment bolts]
162 N·cm (16.5 kgf·cm)

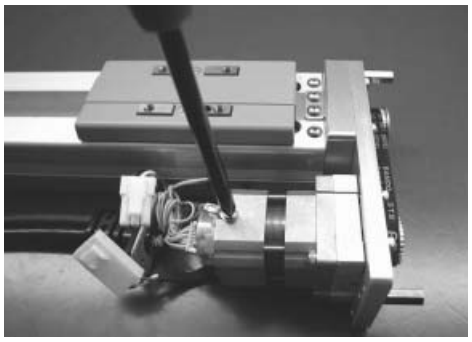


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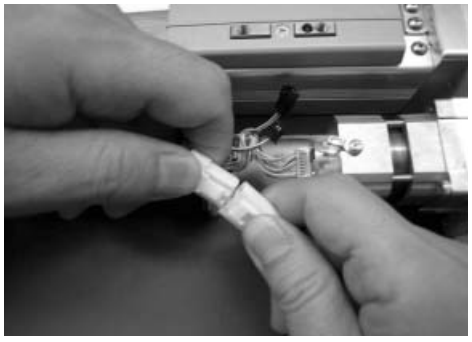
13) Install the attached cables.
- While holding the motor with one hand, insert the encoder cable. (The photograph bellow shows the motor (IAI encoder).)



- Install a grounding wire using a Phillips driver.



- Plug the cables into the motor.



- If the actuator has a brake, also plug in the brake connector.

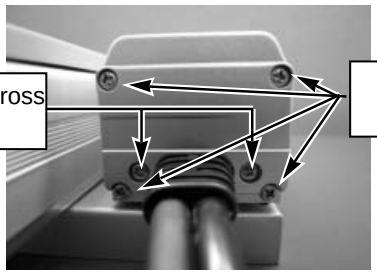
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14) Insert the motor-end cover and cap.

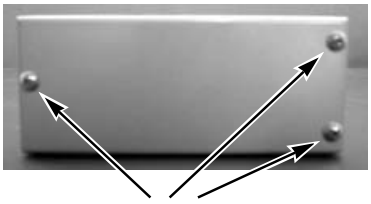


Pull out the cable end while pushing in the motor-end cap.

15) Use a Phillips screwdriver to securely tighten the affixing bolts for motor-end cap and attached cables.



16) Use a Phillips screwdriver to securely tighten the affixing bolts for pulley cover.



Cross recessed screws: M3

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

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11.10.3 Replacing the Motor – Motor Straight Type (Built-in Type) : SA4D, SA5D, SA6D, SS4D, SS5D, SS6D

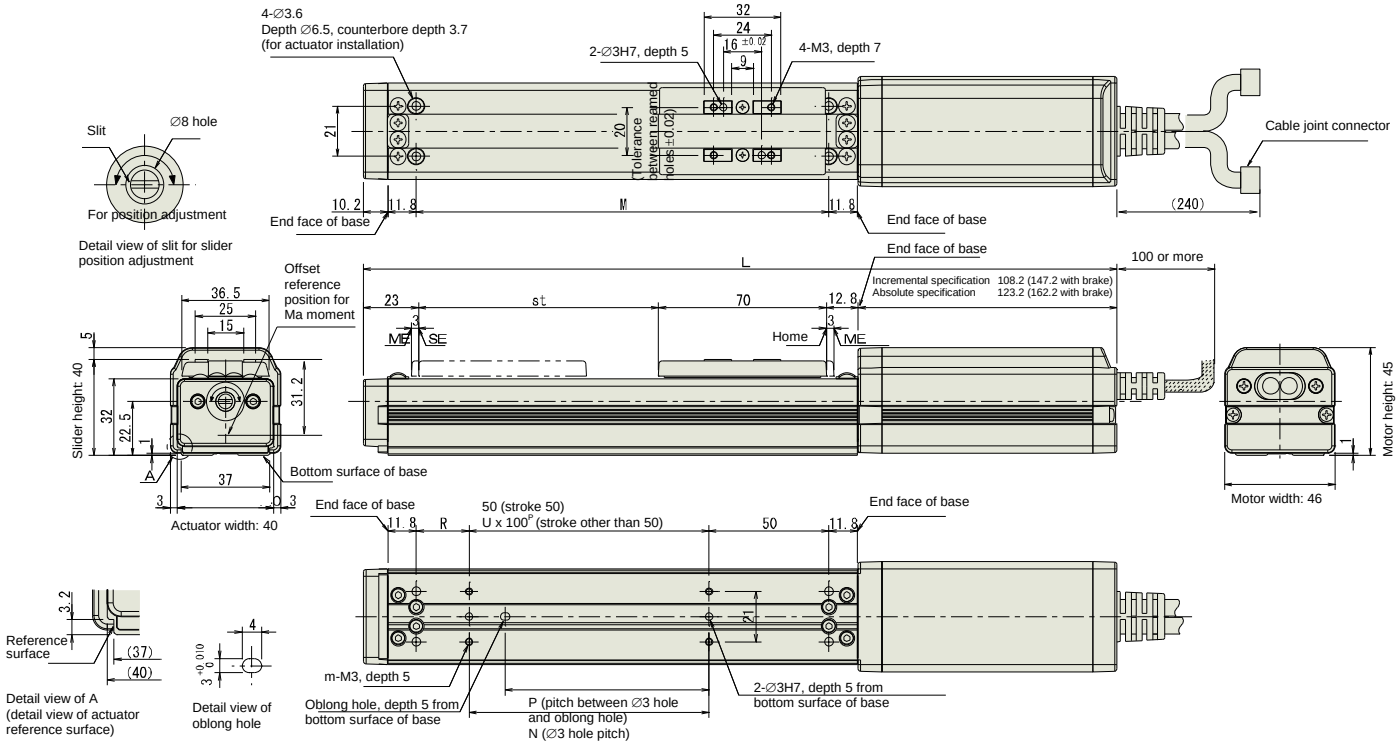
If you must replace the motor of your built-in type actuator, please contact IAI because the built-in type actuators are not designed to allow their motor to be replaced by the customer.

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12. Appendi x

12.1 External Dimensions

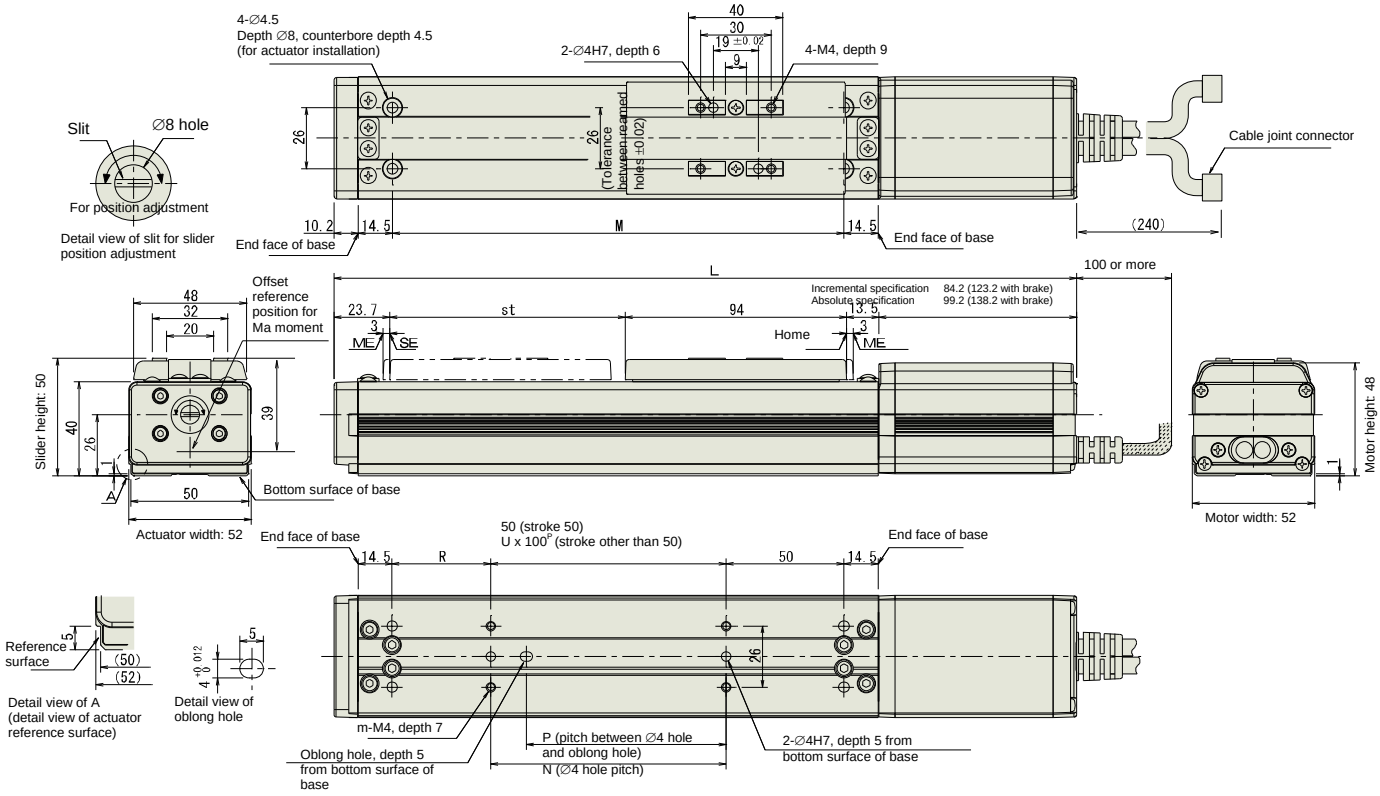
12.1.1 RCA-SA4C



Stroke			50	100	150	200	250	300	350	400
L	Incremental	Without brake	264	314	364	414	464	514	564	614
		With brake	303	353	403	453	503	553	603	653
	Absolute	Without brake	279	329	379	429	479	529	579	629
		With brake	318	368	418	468	518	568	618	668
M			122	172	222	272	322	372	422	472
N			50	100	100	200	200	300	300	400
P			35	85	85	185	185	285	285	385
R			22	22	72	22	72	22	72	22
U			-	1	1	2	2	3	3	4
m			4	4	4	8	6	8	9	10

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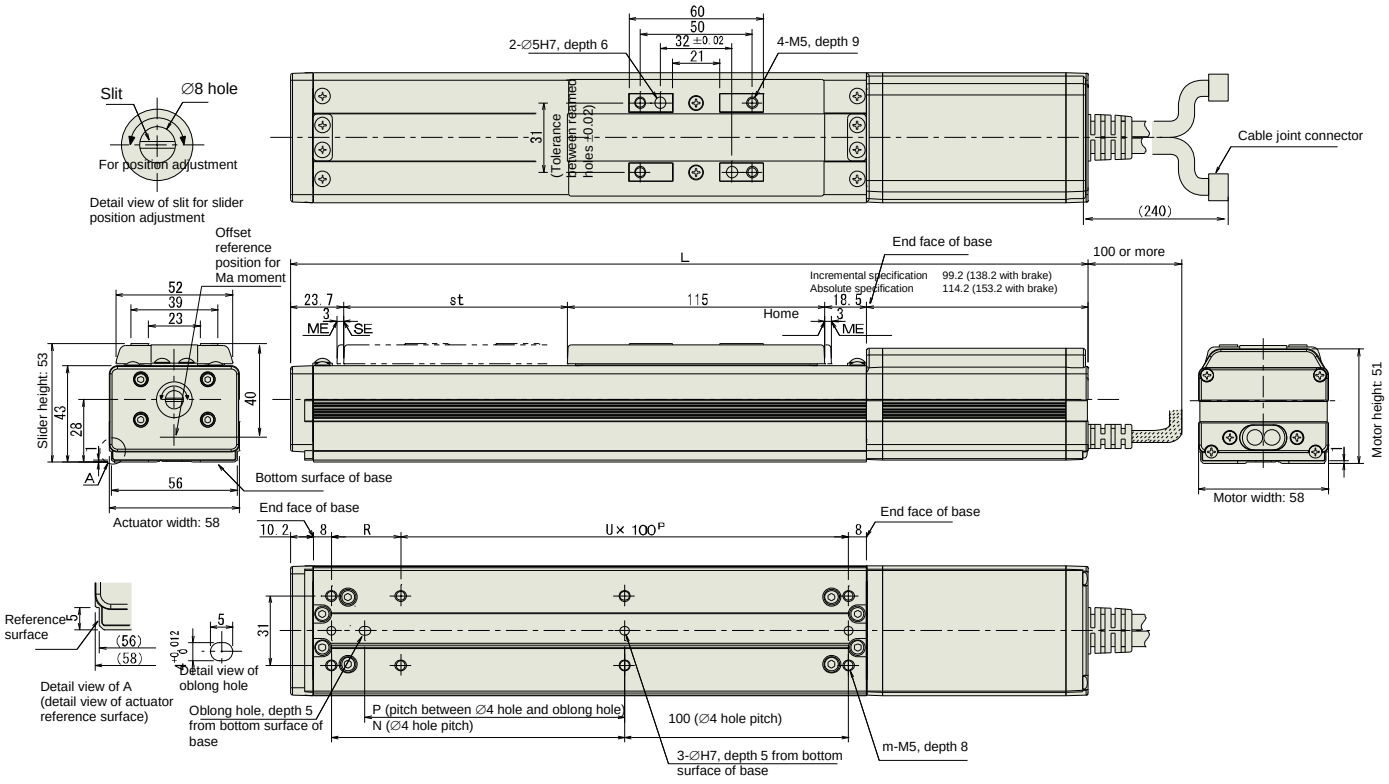
12.1.2 RCA-SA5C



Stroke			50	100	150	200	250	300	350	400	450	500
L	Incremental	Without brake	265.4	315.4	365.4	415.4	465.4	515.4	565.4	615.4	665.4	715.4
		With brake	304.4	354.4	404.4	454.4	504.4	554.4	604.4	654.4	704.4	754.4
	Absolute	Without brake	280.4	330.4	380.4	430.4	480.4	530.4	580.4	630.4	680.4	730.4
		With brake	319.4	369.4	419.4	469.4	519.4	569.4	619.4	669.4	719.4	769.4
M			142	192	242	292	342	392	442	492	542	592
N			50	100	100	200	200	300	300	400	400	500
P			35	85	85	185	185	285	285	385	385	485
R			42	42	92	42	92	42	92	42	92	42
U			-	1	1	2	2	3	3	4	4	5
m			4	4	4	6	6	8	8	10	10	12

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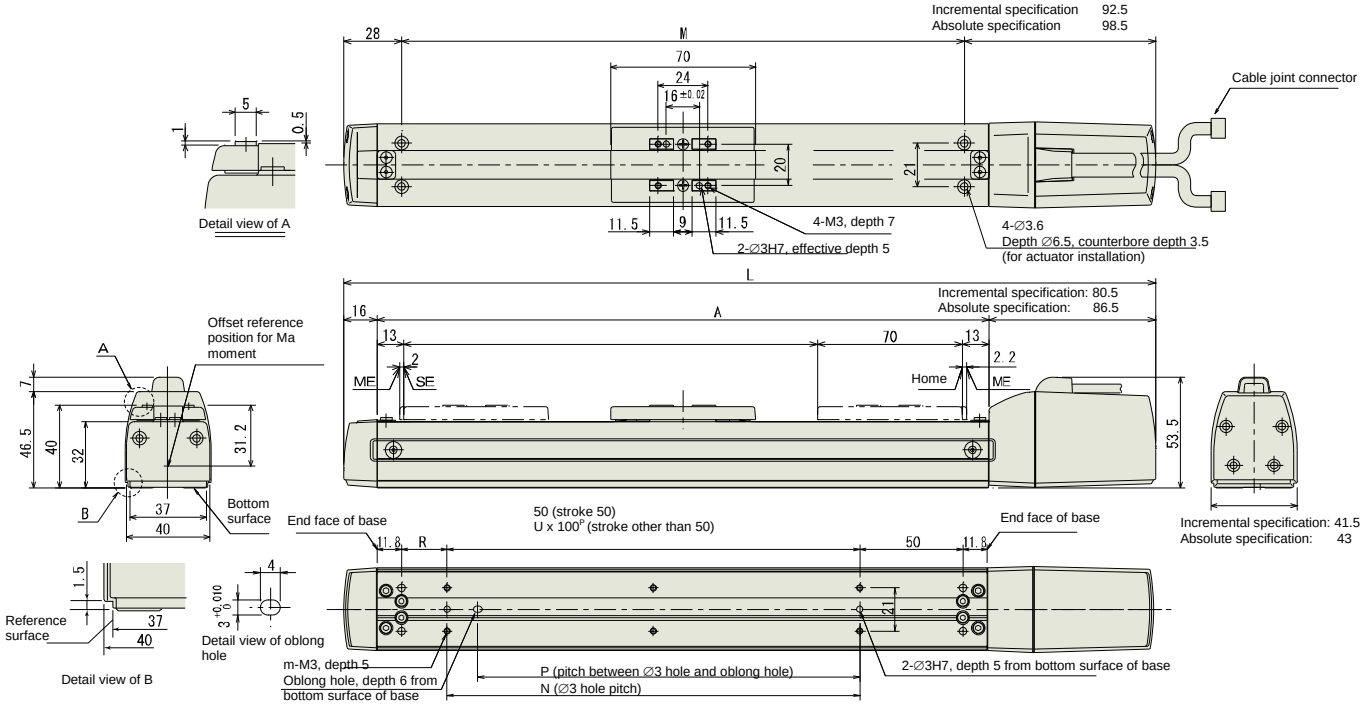
12.1.3 RCA-SA6C

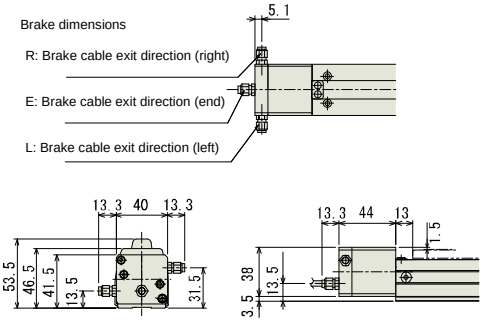


Stroke			50	100	150	200	250	300	350	400	450	500	550	600
L	Incremental	Without brake	306.4	356.4	406.4	456.4	506.4	556.4	606.4	656.4	706.4	756.4	806.4	856.4
		With brake	345.4	395.4	445.4	495.4	545.4	595.4	645.4	695.4	745.4	795.4	845.4	895.4
	Absolute	Without brake	321.4	371.4	421.4	471.4	521.4	571.4	621.4	671.4	721.4	771.4	821.4	871.4
		With brake	360.4	410.4	460.4	510.4	560.4	610.4	660.4	710.4	760.4	810.4	860.4	910.4
N			81	131	181	231	281	331	381	431	481	531	581	631
P			66	116	166	216	266	316	366	416	466	516	566	616
R			81	31	81	31	81	31	81	31	81	31	81	31
U			1	2	2	3	3	4	4	5	5	6	6	7
m			6	8	8	10	10	12	12	14	14	16	16	18

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12.1.4 RCA- SA4D

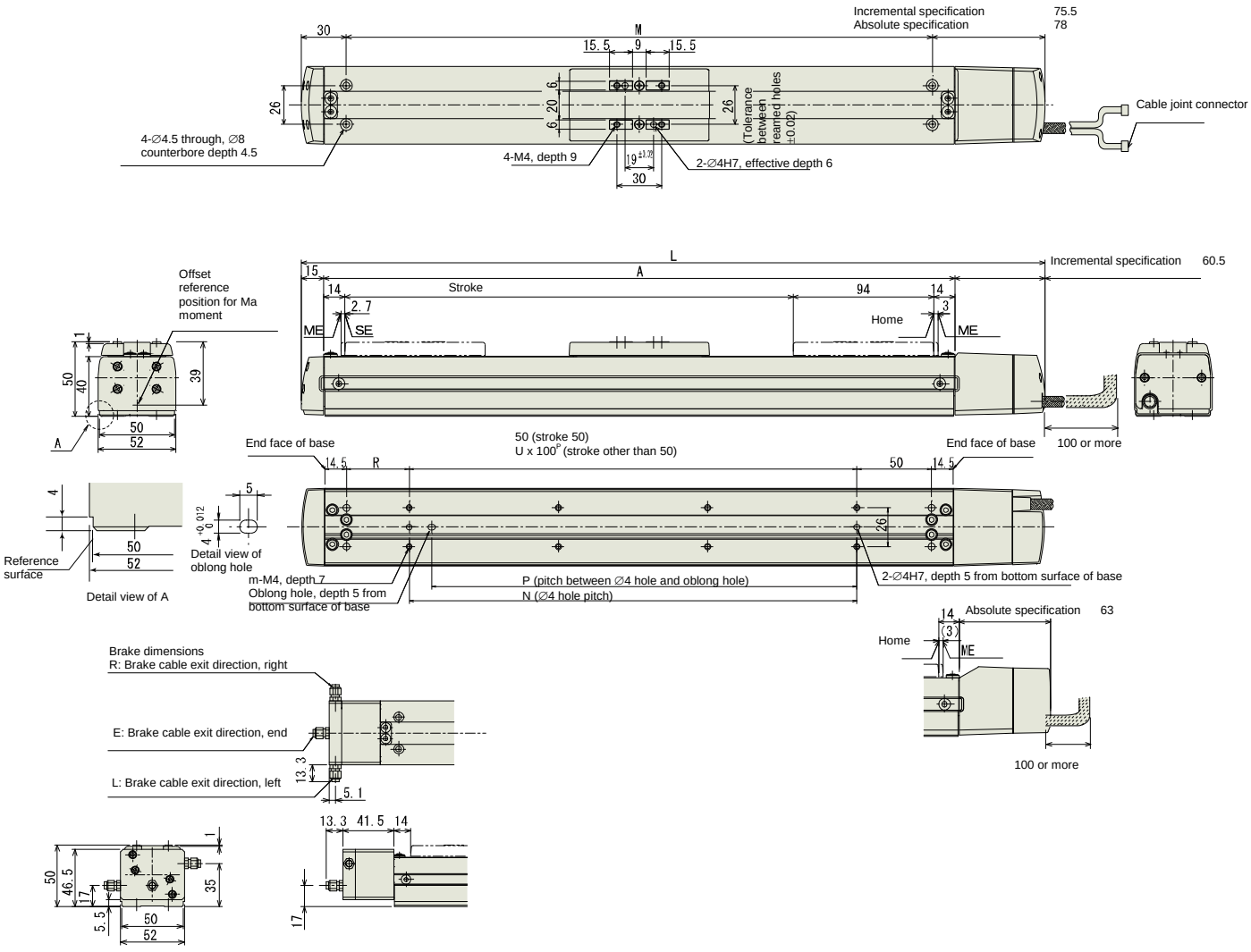




Stroke		50	100	150	200	250	300
L	Incremental	242.5	292.5	342.5	392.5	442.5	492.5
	Absolute	248.5	298.5	348.5	398.5	448.5	498.5
A		146	196	246	296	346	396
M		122	172	222	272	322	372
N		50	100	100	200	200	300
P		35	85	85	185	185	285
R		22	22	72	22	72	22
U		-	1	1	2	2	3
m		4	4	4	6	6	8

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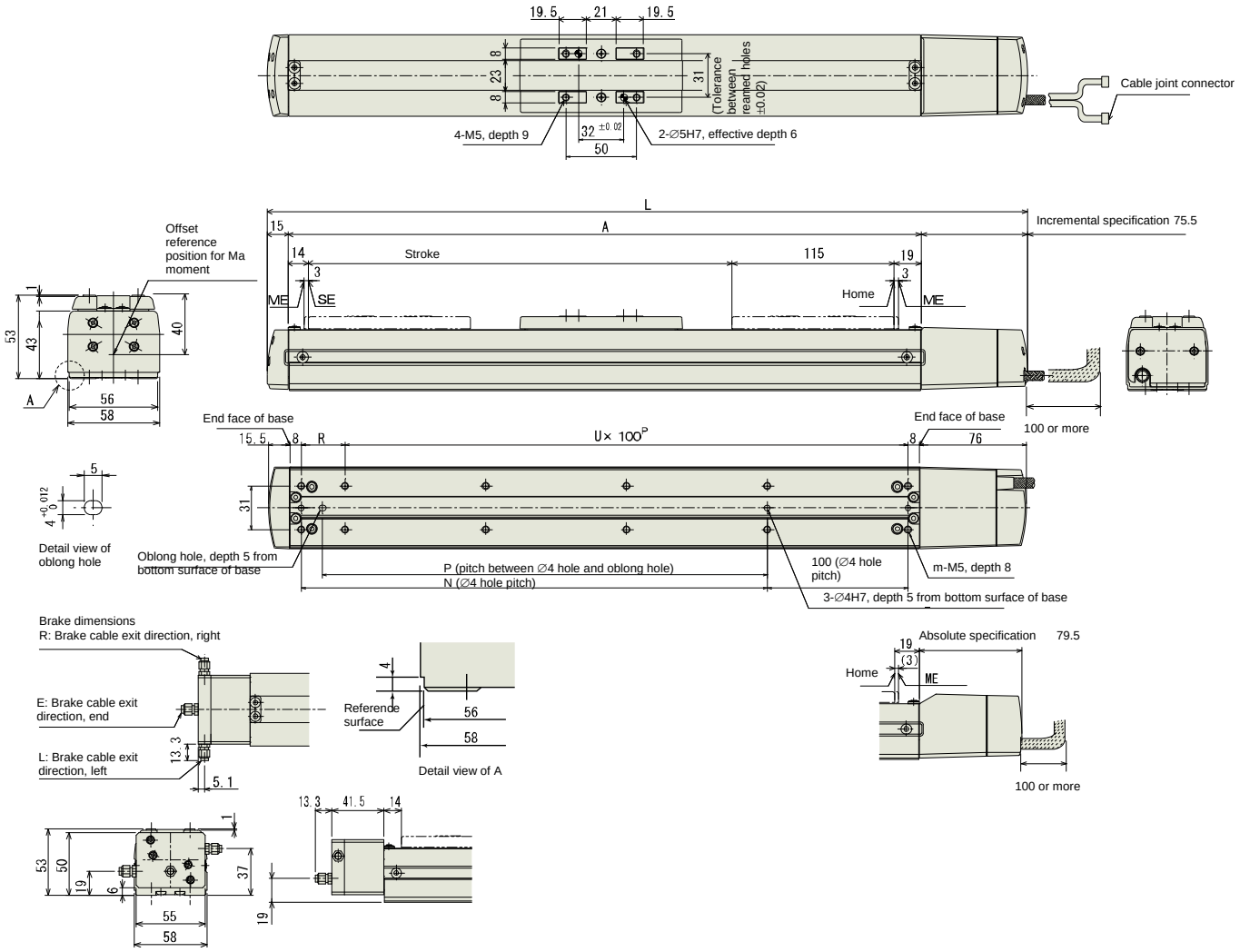
12.1.5 RCA-SA5D



Stroke		50	100	150	200	250	300	350	400	450	500
L	Incremental	247.5	297.5	347.5	397.5	447.5	497.5	547.5	597.5	647.5	697.5
	Absolute	250	300	350	400	450	500	550	600	650	700
A		172	222	272	322	372	422	472	522	572	622
M		142	192	242	292	342	392	442	492	542	592
N		50	100	100	200	200	300	300	400	400	500
P		35	85	85	185	185	285	285	385	385	485
R		42	42	92	42	92	42	92	42	92	42
U		-	1	1	2	2	3	3	4	4	5
m		4	4	4	6	6	8	8	10	10	12

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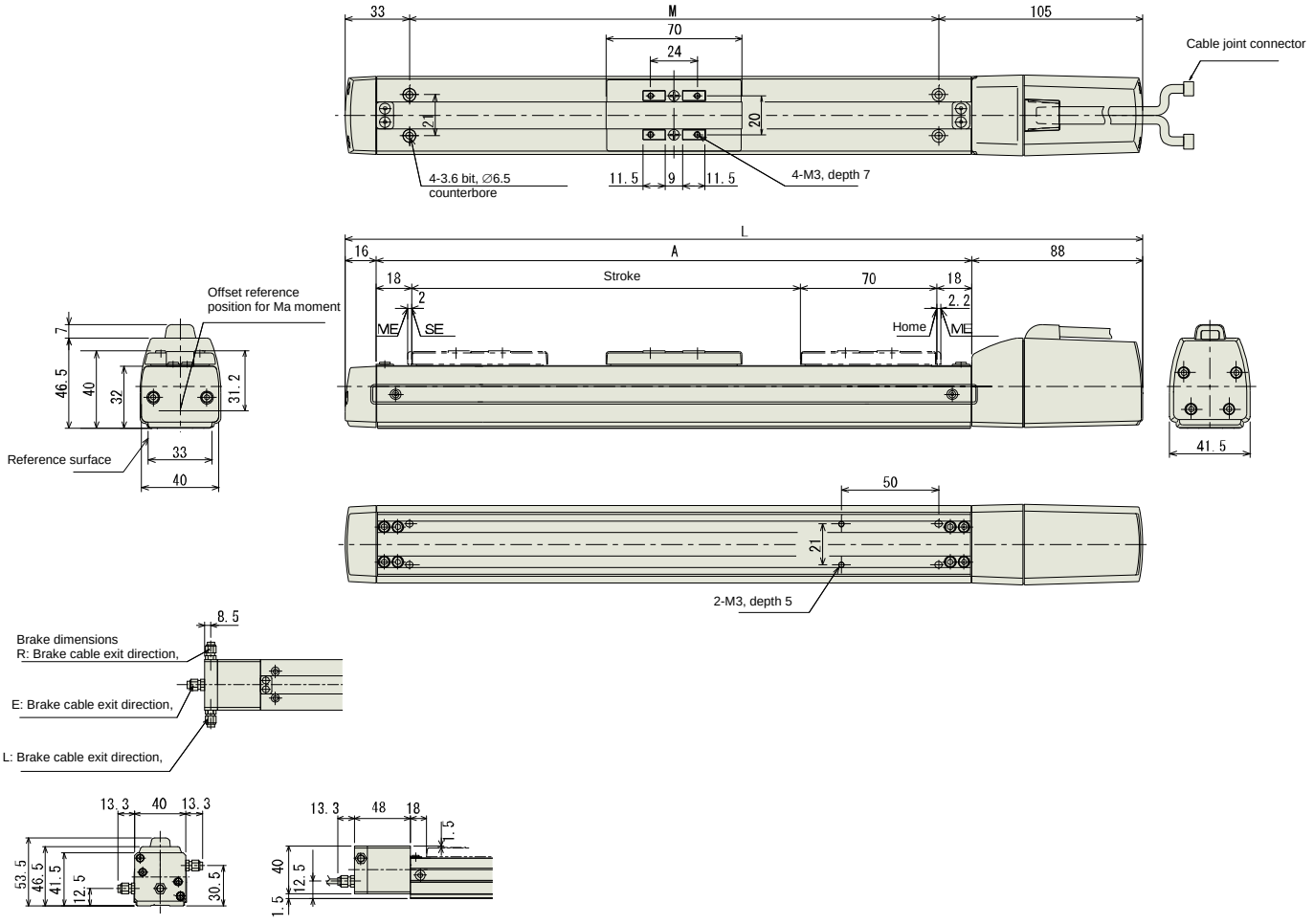
12.1.6 RCA-SA6D



Stroke		50	100	150	200	250	300	350	400	450	500	550	600
L	Incremental	288.5	338.5	388.5	438.5	488.5	538.5	588.5	638.5	688.5	738.5	788.5	838.5
	Absolute	292.5	342.5	392.5	442.5	492.5	542.5	592.5	642.5	692.5	742.5	792.5	842.5
A		198	248	298	348	398	448	498	548	598	648	698	748
N		81	131	181	231	281	331	381	431	481	531	581	631
P		66	116	166	216	266	316	366	416	466	516	566	616
R		81	31	81	31	81	31	81	31	81	31	81	31
U		1	2	2	3	3	4	4	5	5	6	6	7
m		6	8	8	10	10	12	12	14	14	16	16	16

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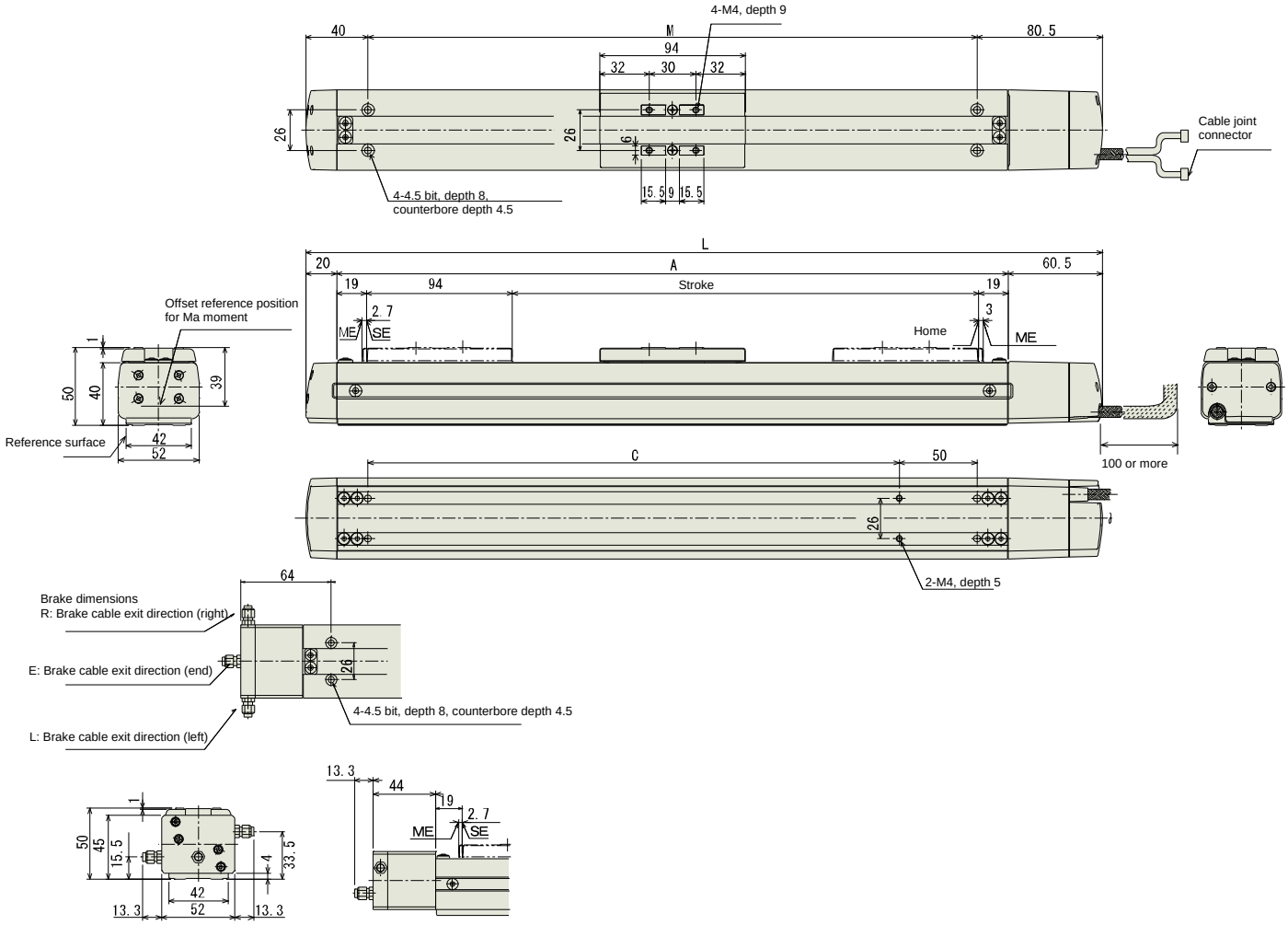
12.1.7 RCA-SS4D



Stroke	50	100	150	200	250	300
L	260	310	360	410	460	510
A	156	206	256	306	356	406
M	122	172	222	272	322	372

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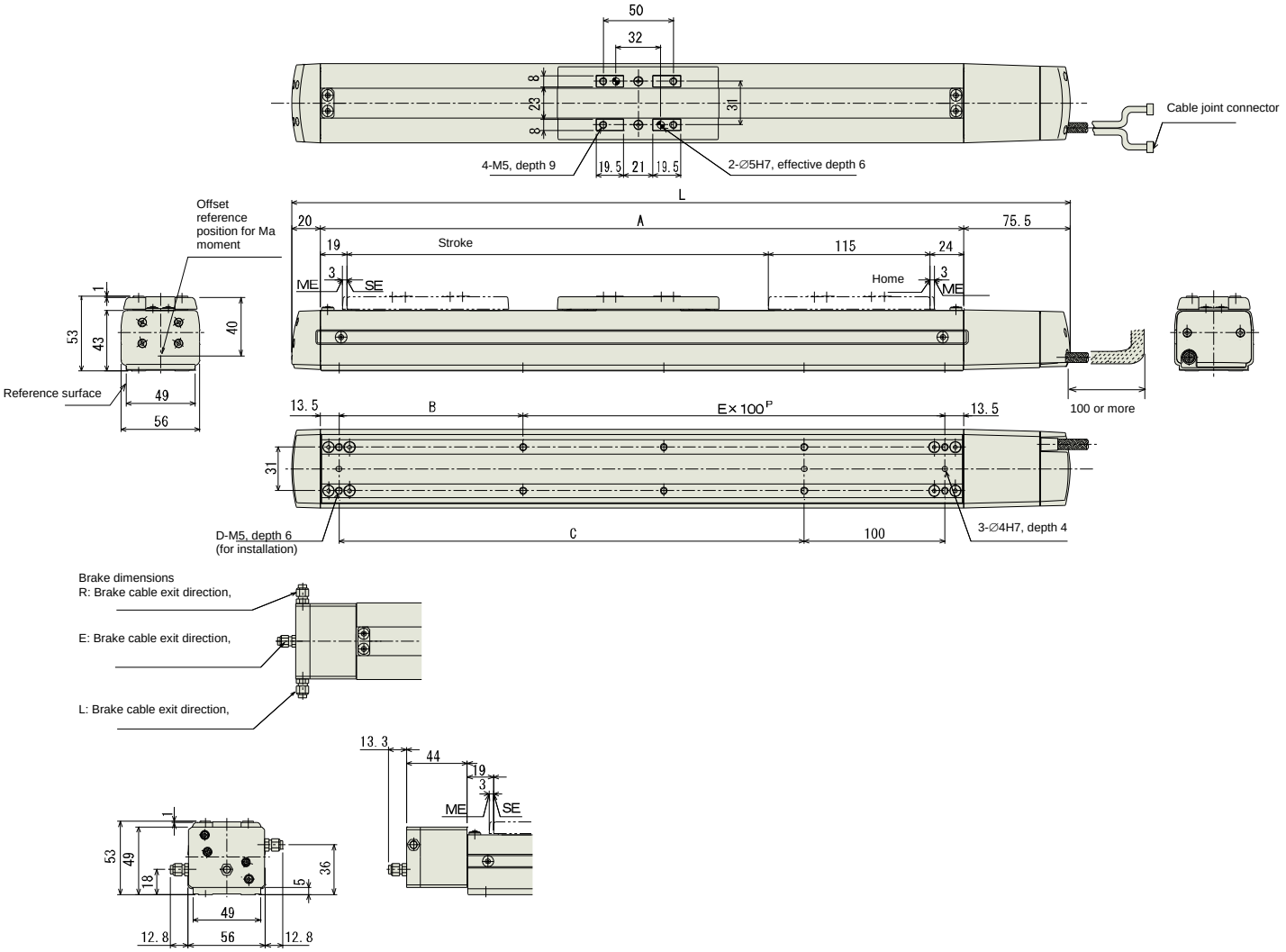
12.1.8 RCA-SS5D



Stroke	50	100	150	200	250	300	350	400	450	500
L	262.5	312.5	362.5	412.5	462.5	512.5	562.5	612.5	662.5	712.5
A	182	232	282	332	382	432	482	532	582	632
M	142	192	242	292	342	392	442	492	542	592
C	92	142	192	242	292	342	392	442	492	542

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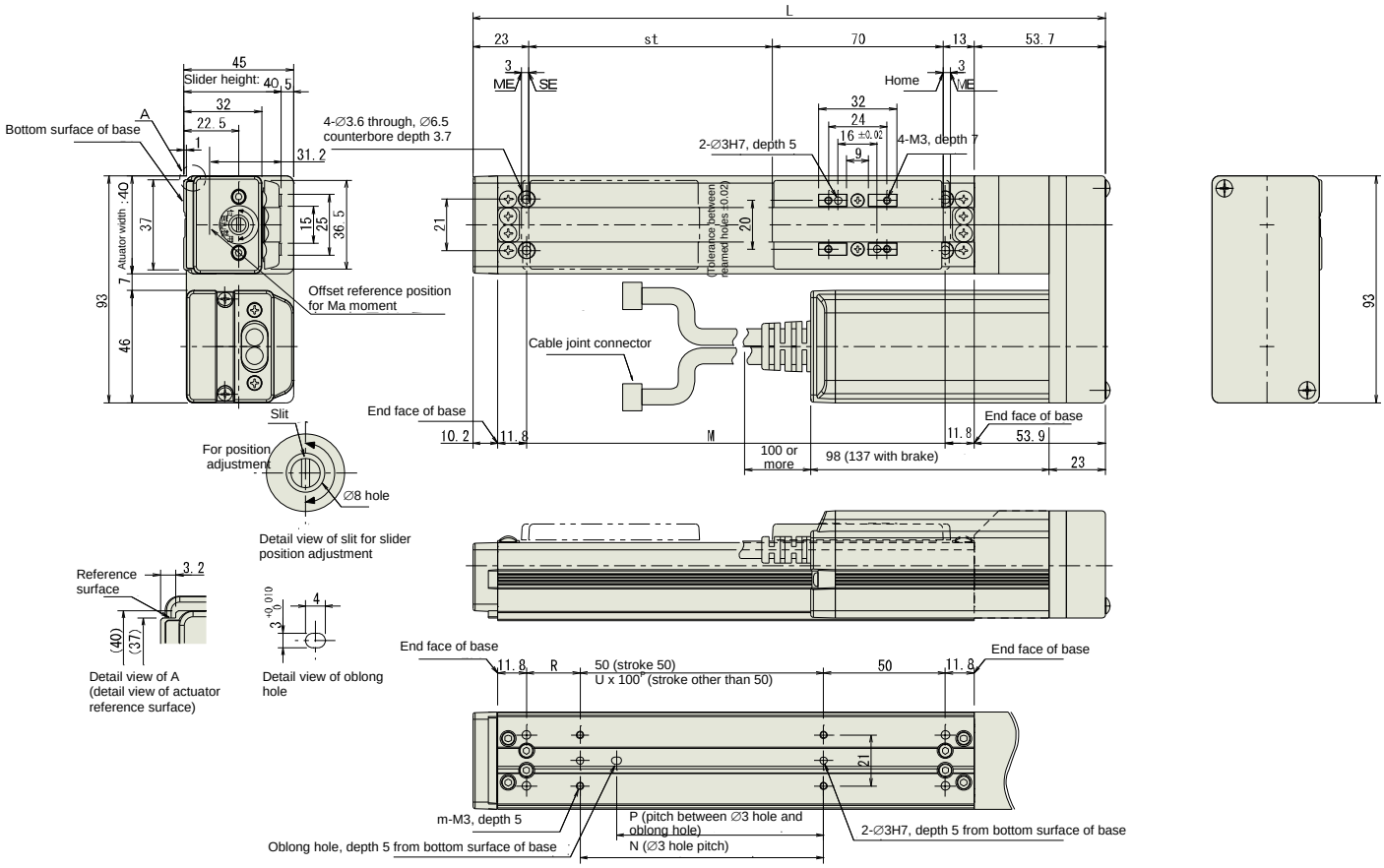
12.1.9 RCA-SS6D



Stroke	50	100	150	200	250	300	350	400	450	500	550	600
L	303.5	353.5	403.5	453.5	503.5	553.5	603.5	653.5	703.5	753.5	803.5	853.5
A	208	258	308	358	408	458	508	558	608	658	708	758
B	81	131	81	131	81	131	81	131	81	131	81	131
C	81	131	181	231	281	331	381	431	481	531	531	631
D	6	6	8	8	10	10	12	12	14	14	16	16
E	1	1	2	2	3	3	4	4	5	5	6	5

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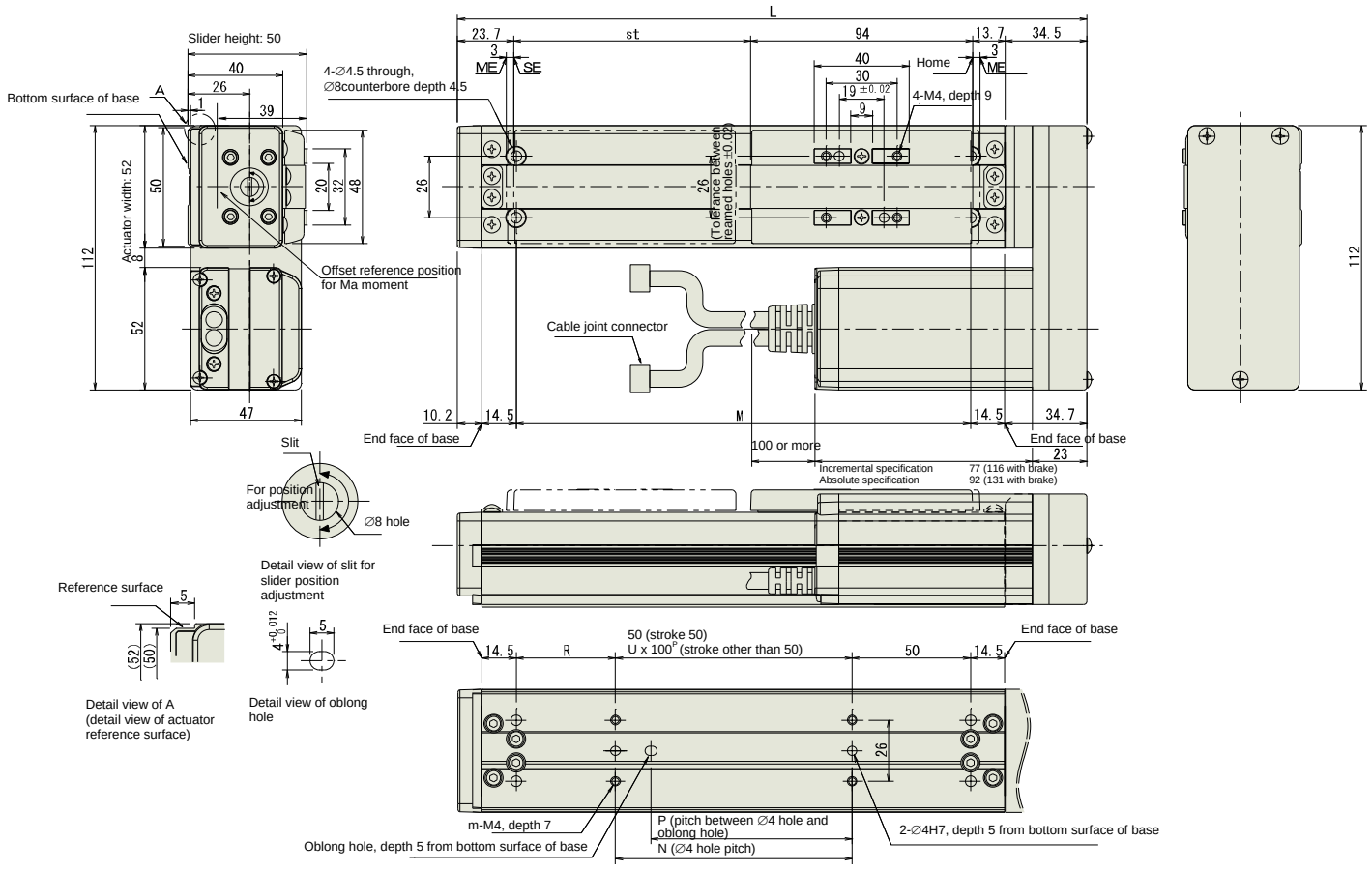
12.1.10 RCA-SA4R



Stroke	50	100	150	200	250	300	350	400
L	209.7	259.7	309.7	359.7	409.7	459.7	509.7	559.7
M	122	172	222	272	322	372	422	472
N	50	100	100	200	200	300	300	400
P	35	85	85	185	185	285	285	385
R	22	22	72	22	72	22	72	22
U	-	1	1	2	2	3	3	4
m	4	4	4	6	6	8	8	10

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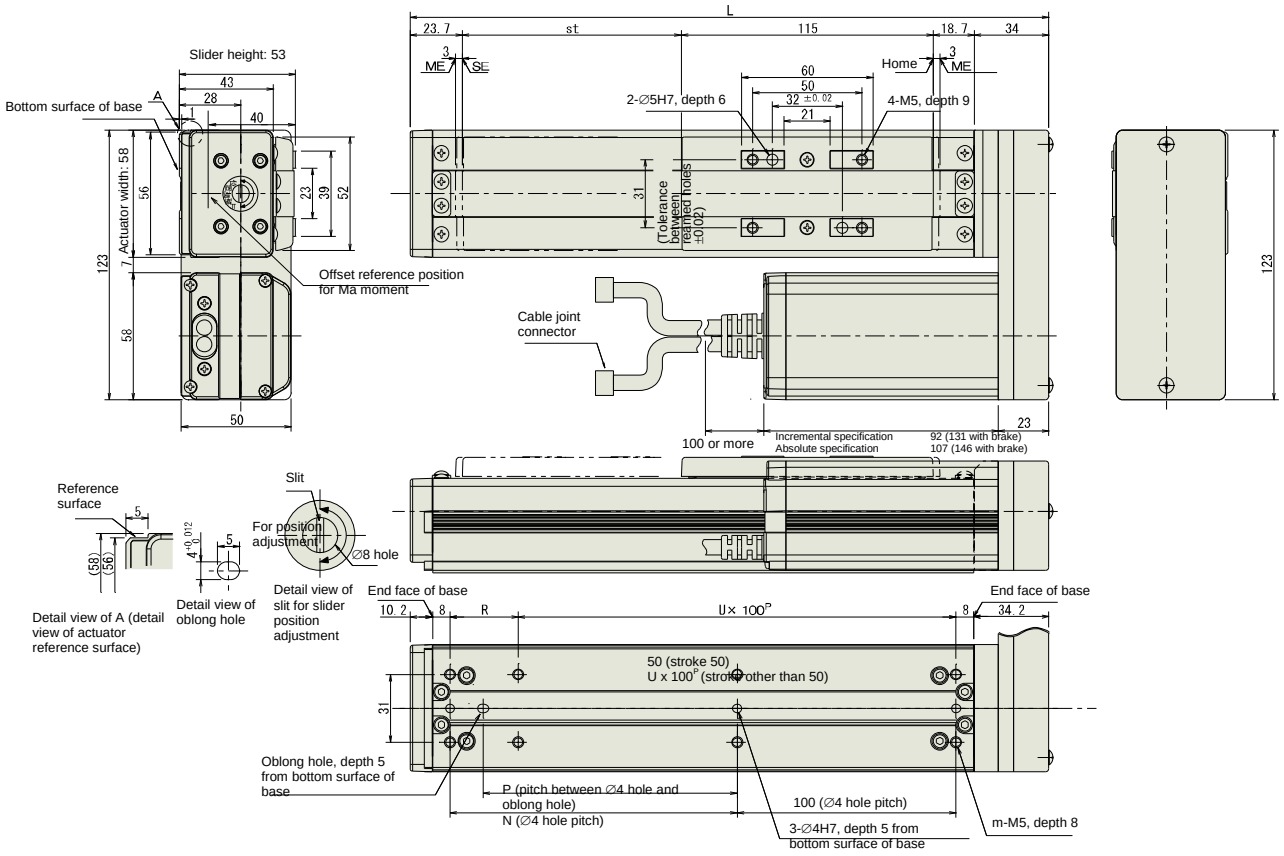
12.1.11 RCA- SA5R



Stroke	50	100	150	200	250	300	350	400	450	500
L	215.9	265.9	315.9	365.9	415.9	465.9	515.9	565.9	615.9	665.9
M	142	192	242	292	342	392	442	492	542	592
N	50	100	100	200	200	300	300	400	400	500
P	35	85	85	185	185	285	285	385	385	485
R	42	42	92	42	92	42	92	42	92	42
U	-	1	1	2	2	3	3	4	4	5
m	4	4	4	6	6	8	8	10	10	12

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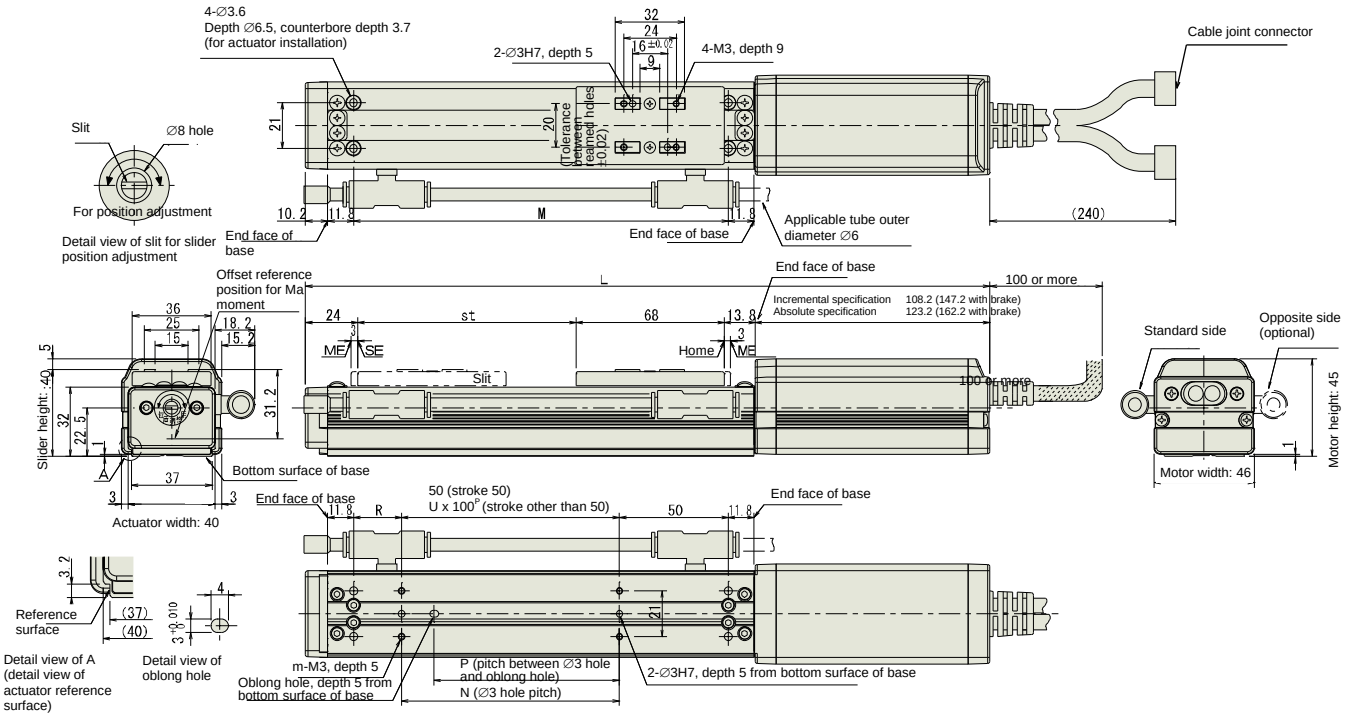
12.1.12 RCA-SA6R



Stroke	50	100	150	200	250	300	350	400	450	500	550	600
L	241.4	291.4	341.4	391.4	441.4	491.4	541.4	591.4	641.4	691.4	741.4	791.4
N	81	131	181	231	281	331	381	431	481	531	581	631
P	66	116	166	216	266	316	366	416	466	516	566	616
R	81	31	81	31	81	31	81	31	81	31	81	31
U	1	2	2	3	3	4	4	5	5	6	6	7
m	6	8	8	10	10	12	12	14	14	16	16	18

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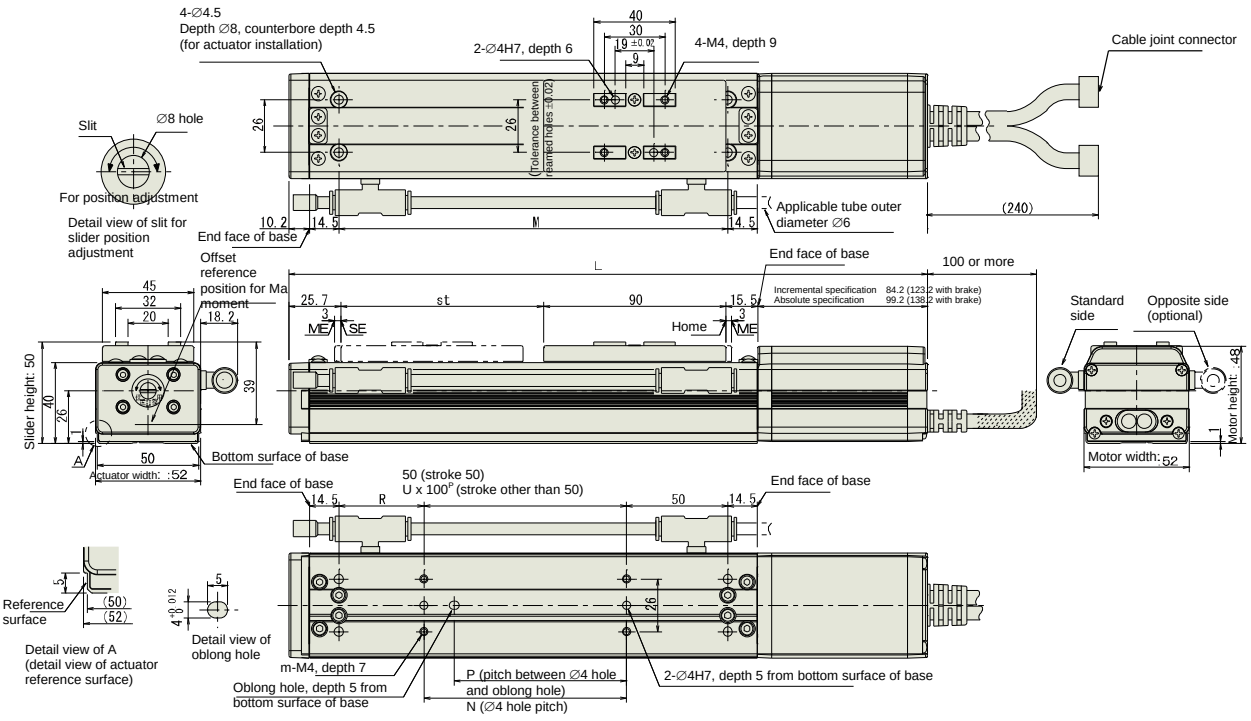
12.1.13 RCACR-SA4R



Stroke			50	100	150	200	250	300	350	400
L	Incremental	Without brake	264	314	364	414	464	514	564	614
		With brake	303	353	403	453	503	553	603	653
	Absolute	Without brake	279	329	379	429	479	529	579	629
		With brake	318	368	418	468	518	568	618	668
M			122	172	222	272	322	372	422	472
N			50	100	100	200	200	300	300	400
P			35	85	85	185	185	285	285	385
R			22	22	72	22	72	22	72	22
U			-	1	1	2	2	3	3	4
m			4	4	4	6	6	8	8	10

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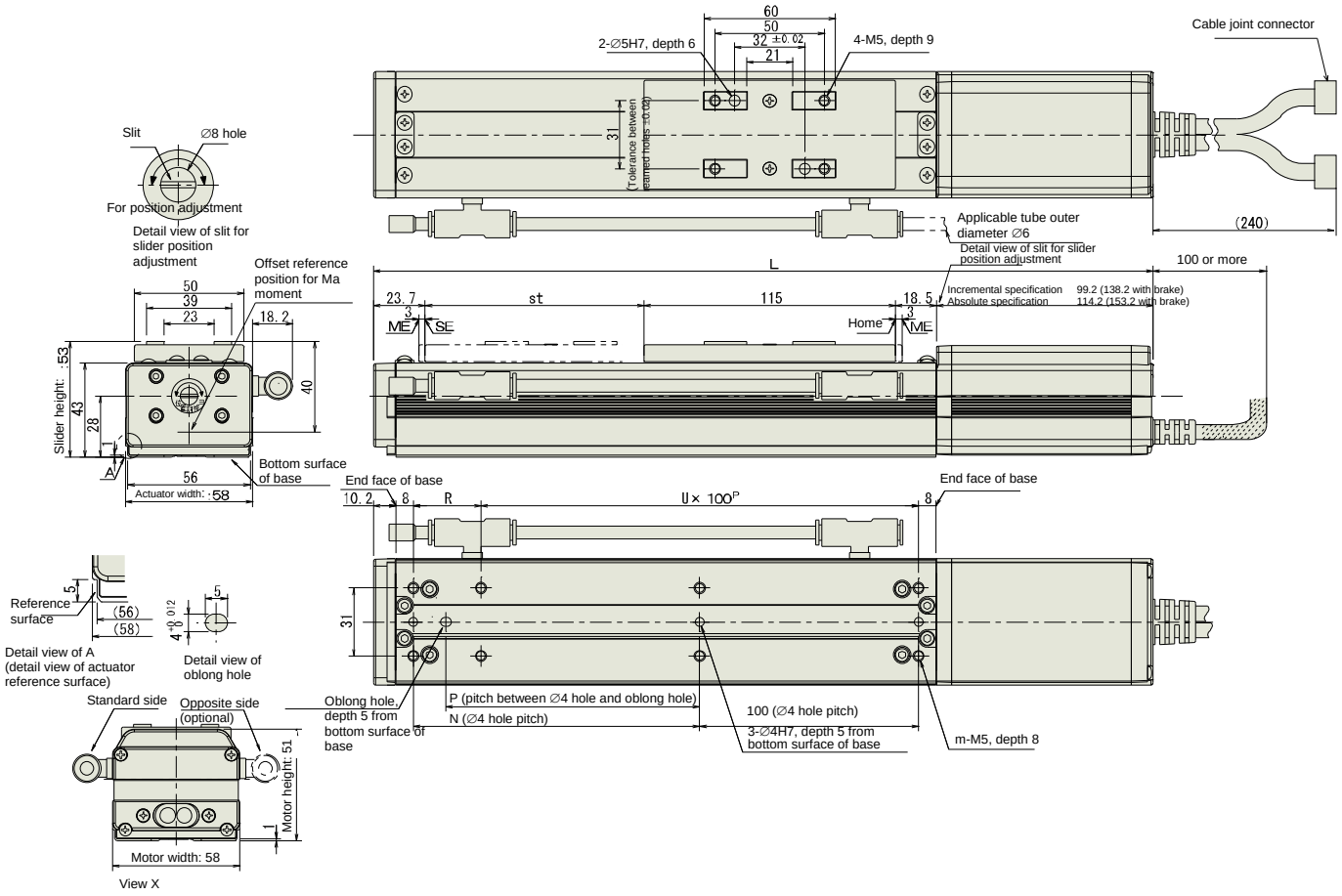
12.1.14 RCACR-SA5C



Stroke			50	100	150	200	250	300	350	400	450	500
L	Incremental	Without brake	265.4	315.4	365.4	415.4	465.4	515.4	565.4	615.4	665.4	715.4
		With brake	304.4	354.4	404.4	454.4	504.4	554.4	604.4	654.4	704.4	754.4
	Absolute	Without brake	280.4	330.4	380.4	430.4	480.4	530.4	580.4	630.4	680.4	730.4
		With brake	319.4	369.4	419.4	469.4	519.4	569.4	619.4	669.4	719.4	769.4
M			142	192	242	292	342	392	442	492	542	592
N			50	100	100	200	200	300	300	400	400	500
P			35	85	85	185	185	285	285	385	385	485
R			42	42	92	42	92	42	92	42	92	42
U			-	1	1	2	2	3	3	4	4	5
m			4	4	4	6	6	8	8	10	10	12

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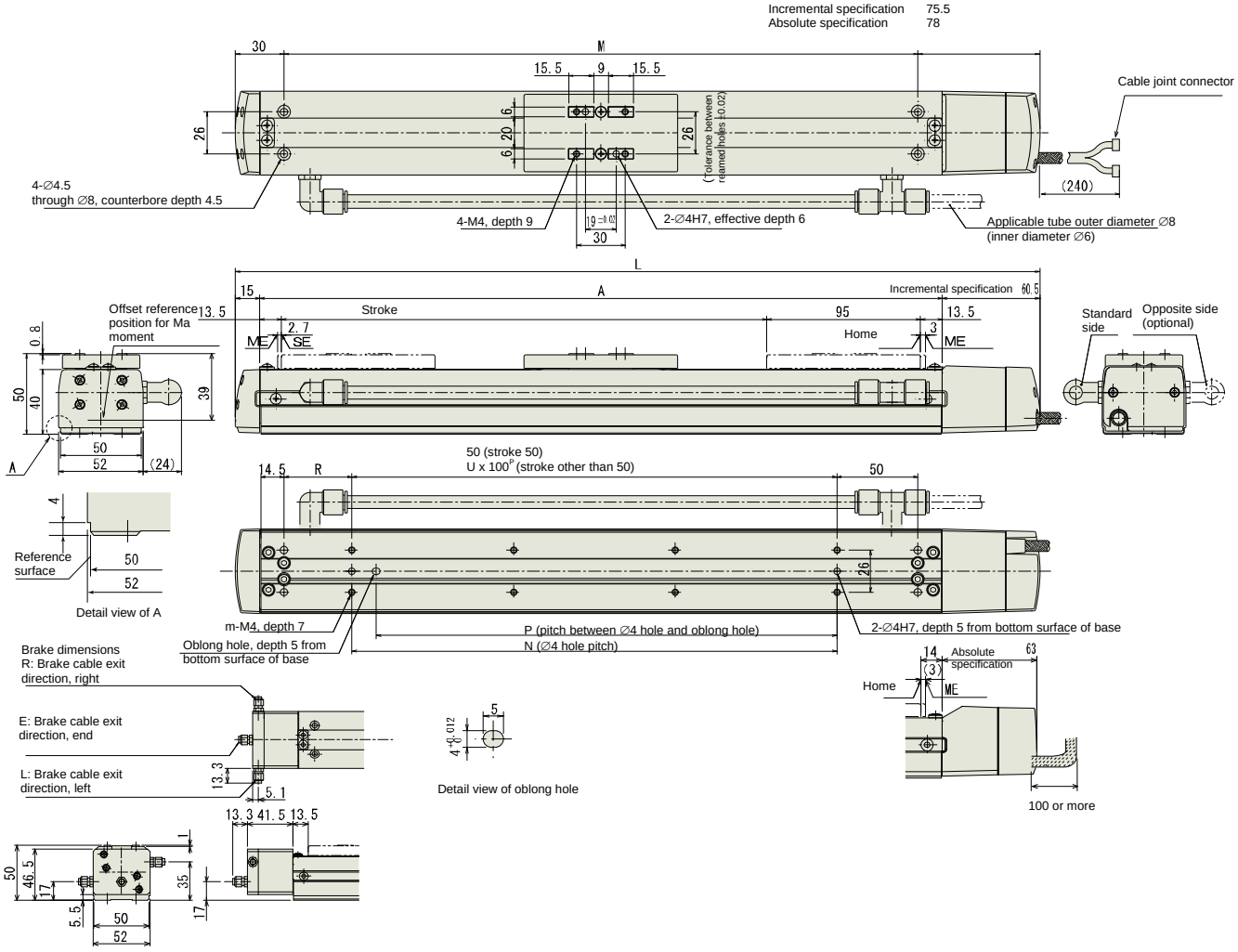
12.1.15 RCACR-SA6C



Stroke			50	100	150	200	250	300	350	400	450	500	550	600
L	Incremental	Without brake	306.4	356.4	406.4	456.4	506.4	556.4	606.4	656.4	706.4	756.4	806.4	856.4
		With brake	345.4	395.4	445.4	495.4	545.4	595.4	645.4	695.4	745.4	795.4	845.4	895.4
	Absolute	Without brake	321.4	371.4	421.4	471.4	521.4	571.4	621.4	671.4	721.4	771.4	821.4	871.4
		With brake	360.4	410.4	460.4	510.4	560.4	610.4	660.4	710.4	760.4	810.4	860.4	910.4
N			81	131	181	231	281	331	381	431	481	531	581	631
P			66	116	166	216	266	316	366	416	466	516	566	616
R			81	31	81	31	81	31	81	31	81	31	81	31
U			1	2	2	3	3	4	4	5	5	6	6	7
m			6	8	8	10	10	12	12	14	14	16	16	18

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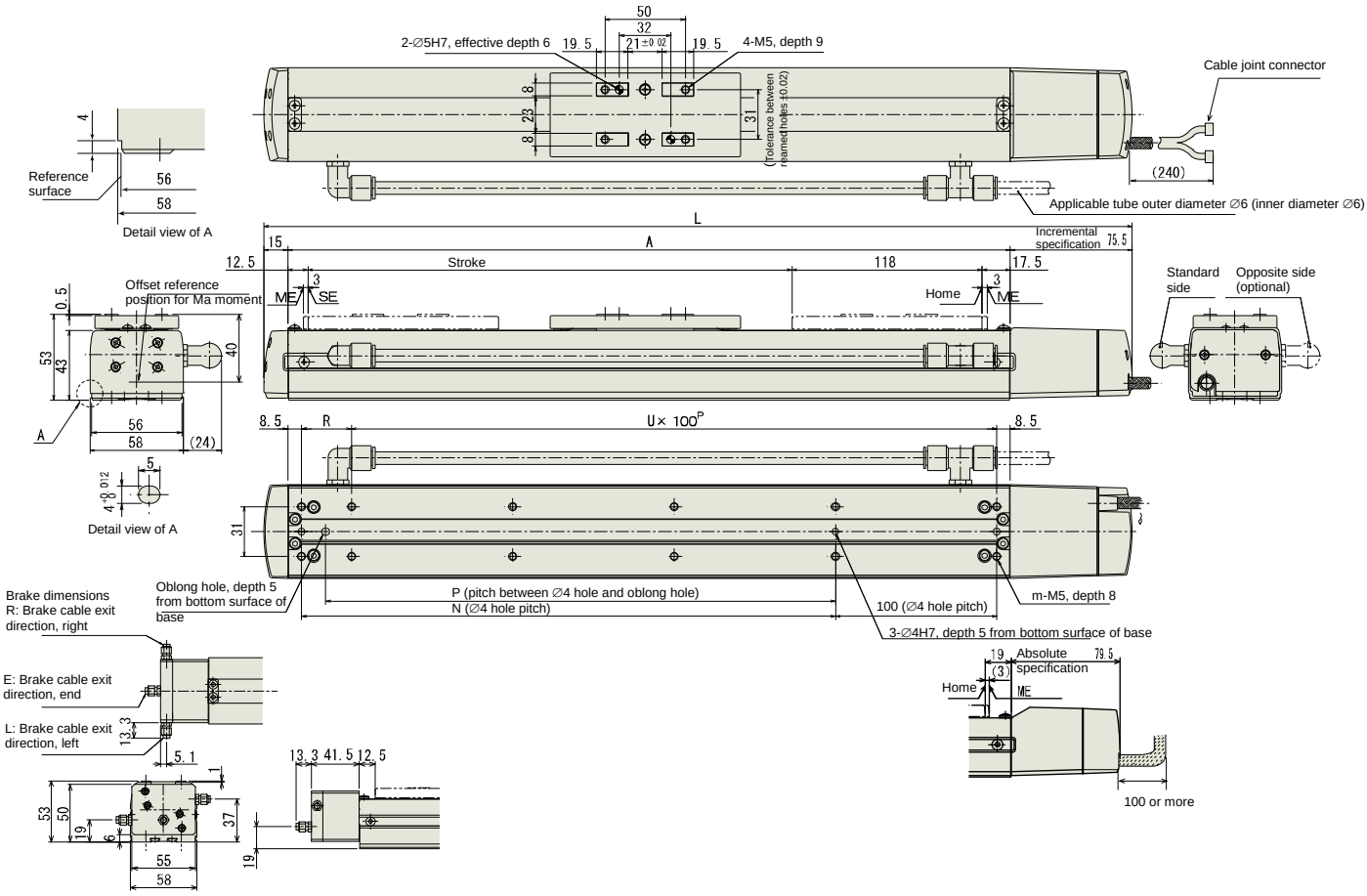
12.1.16 RCACR-SA5D



Stroke		50	100	150	200	250	300	350	400	450	500
L	Incremental	247.5	297.5	347.5	397.5	447.5	497.5	547.5	597.5	647.5	697.5
	Absolute	250	300	350	400	450	500	550	600	650	700
A		172	222	272	322	372	422	472	522	572	622
M		142	192	242	292	342	392	442	492	542	592
N		50	100	100	200	200	300	300	400	400	500
P		35	85	85	185	185	285	285	385	385	485
R		42	42	92	42	92	42	92	42	92	42
U		-	1	1	2	2	3	3	4	4	5
m		4	4	4	6	6	8	8	10	10	12

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12.1.17 RCACR-SA6D



Stroke		50	100	150	200	250	300	350	400	450	500	550	600
L	Incremental	288.5	338.5	388.5	438.5	488.5	538.5	588.5	638.5	688.5	738.5	788.5	838.5
	Absolute	292.5	342.5	392.5	442.5	492.5	542.5	592.5	642.5	692.5	742.5	792.5	842.5
A		198	248	298	348	398	448	498	548	598	648	698	748
N		81	131	181	231	281	331	381	431	481	581	531	631
P		66	116	166	216	266	316	366	416	466	516	566	616
R		81	31	81	31	81	31	81	31	81	31	81	31
U		1	2	2	3	3	4	4	5	5	6	6	7
m		6	8	8	10	10	12	12	14	14	16	16	18

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13. Warranty

13.1 Warranty Period

One of the following periods, whichever is shorter:
- 18 months after shipment from IAI
- 12 months after delivery to the specified location
- 2,500 hours of operation

13.2 Scope of Warranty

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

(1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.

(2) The breakdown or problem in question occurred during the warranty period.

(3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the operation manual and catalog.

(4) The breakdown or problem in question was caused by a specification defect or problem, or by the poor quality of our product.

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

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

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

13.3 Honoring Warranty

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

13.4 Limited Liability

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

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

(1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.

(2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:

[1] Medical equipment pertaining to maintenance or management of human life or health
[2] A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
[3] Important safety parts of mechanical equipment (such as safety devices)
[4] Equipment used to handle cultural assets, art or other irreplaceable items

(3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or operation manual.

13.6 Other Items Excluded from Warranty

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

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

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Change History

Revision Date	Description of Revision	
	First edition	
March 2007	Second edition	• Corrected clerical errors
March 2008	Third edition	• P. 25, 26: Added “high-acceleration/deceleration specification.”
July 2010	Forth edition	• Added “Notes” at the beginning.”
November 2010	Fifth edition	• “Please Read Before Use”: Entirely revised the content. • “Safety Guide”: Entirely revised the content. • P. 9: Added “Handling Precautions.” • P. 17: Added 1, “Checking the Product.” • P. 19 to 25: Added “Maximum speed,” “Acceleration and payload capacity,” “Rated thrust,” “Drive method,” “Common specifications,” and “Lead 20” under 2, “Specification.” • P. 9, 57: Added “*1 If continuous back-and-forth operations are performed over a distance of 30 mm or less, grease film may be broken. As a guide, operate the actuator back and forth five times or so over a distance of 50 mm or more after every 5,000 to 10,000 cycles. This should restore oil film.”
April 2011	Sixth edition	• A page for CE Marking added
June 2011	Seventh edition	• P.28: Contents of caution for vertically oriented mount changed.
July 2011	Eighth edition	• P.28: Change in ceiling installation availability (×: Not installable → △ : Daily inspection is requirde) • P.113 to 114: Contents changed in 13. Warranty

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