ROBO CYLINDER

ROBO Cylinder
RCP3 Actuator
Rod Type
Operating Manual

Sixth Edition

Motor coupling types:	[Slim Small ROBO Cylinders] RA2AC/RA2BC
Motor reversing types:	[Slim Small ROBO Cylinders] RA2AR/RA2BR

IAI America, Inc.

ROBO CYLINDER

Please Read Before Use

Thank you for purchasing our product.

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

Before the operation, read this manual carefully and fully understand it to operate this product safely. The enclosed CD or DVD in this product package includes the operating manual for this product.
For the operation of this product, print out the necessary sections in the operating manual or display them using the personal computer.

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

[Important]

- This operating manual is original.
- The product cannot be operated in any way unless expressly specified in this operating manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this operating 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.
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Safety Guide

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

Safety Precautions for Our Products

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

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the operating manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm^2 (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the operating manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated operating manual of each unit to ensure the safety.

Alert Indication

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

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

Caution in Handling

1. Make sure to follow the usage condition, environment and specification range of the product.

Operation out of the guarantee could cause a drop in performance or malfunction of the product.

2. Do not set speed and acceleration/deceleration higher than the rated values.

Do not set speed and acceleration/deceleration higher than the rated values. It causes vibration, failure, or shortening of life. If acceleration/deceleration higher than the rated value is set, creeping phenomenon or coupling slide may occur.

3. Set the allowable load moment within the allowable range.

Use the product within the allowable range of the load moment. If the robot is operated under a load equal to or greater than the allowable load moment, abnormal noise or vibration, failure, or shorter life may result. If an extreme load is applied, flaking may occur.

4. Do not apply external force on the rod from directions other than the rod traveling direction.

Do not apply external force (radial load) on the rod from directions other than the rod traveling direction. If force in the perpendicular or rotating direction is applied on the rod, the actuator may be damaged or malfunction.
If external force from directions other than the traveling direction is applied, mount external guide or similar.

5. Do not attempt to apply external force or impact load that exceeds the allowable value to the thrust direction.

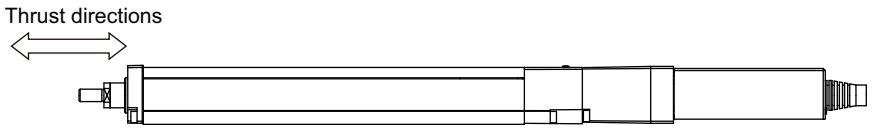
- Subjecting the actuator to levels of external force or impact load above the allowable capacity may damage or destroy internal components.
- Low lead type rod would not move with an external force applied to it.
  To move the rod, perform JOG operation or move it by twisting the slit on the end of the shaft with using a screwdriver.
  If an excessive external force is applied, the nut may be damaged.

<External forces in thrust directions>
Thrust direction external force capacity
The external force in thrust direction must not exceed the maximum push force for each model.

Model	Thrust direction external force capacity [N]		
RA2AC, RA2AR (Lead screw)	Lead: 1	Lead: 2	Lead: 4
	39.5	28.3	16.1
RA2BC, RA2BR (Lead screw)	Lead: 2	Lead: 4	Lead: 6
	28.3	16.1	11.9

Model	Motor	Thrust direction external force capacity [N]			
RA2AC, RA2AR (Ball screw)	20P	Lead: 1	Lead: 2	Lead: 4	-
		82.8	42.0	20.9	-
RA2BC, RA2BR (Ball screw)		Lead: 1	Lead: 2	Lead: 4	Lead: 6
		82.8	42.0	20.9	14.3

Model	Motor	Thrust direction external force capacity [N]			
RA2AC, RA2AR (Ball screw)	20SP	Lead: 1	Lead: 2	Lead: 4	-
		142.9	70.6	35.7	-
RA2BC, RA2BR (Ball screw)		Lead: 1	Lead: 2	Lead: 4	Lead: 6
		142.9	70.6	35.7	24.1



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

Back and forth operation in a distance of 30mm or less, may cause wear of grease.
As a guide, move the actuators back and forth repeatedly for around 5 cycles over a distance of 50mm or more after every 5,000 to 10,000 cycles (For ROBO Cylinder with its stroke less than 50mm, have a back-and-forth operation with using the whole distance of the stroke length.) A layer of the grease will recover.

7. Make sure to attach the actuator properly by following this operating manual.

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

International Standards Compliances

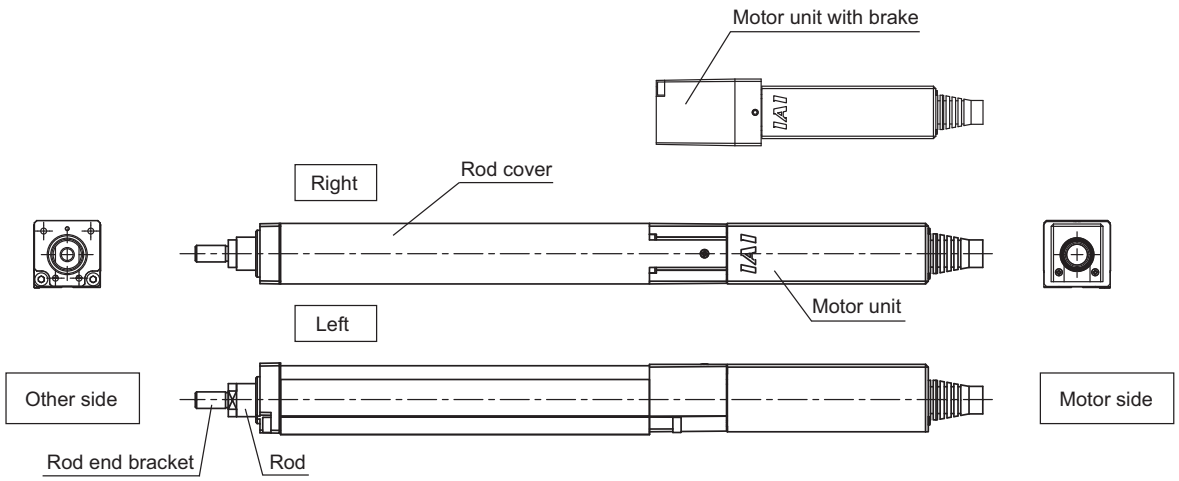
This actuator complies with the following overseas standard.
Refer to Overseas Standard Compliance Manual (ME0287) for more detailed information.

RoHS Directive	CE Marking
○	○

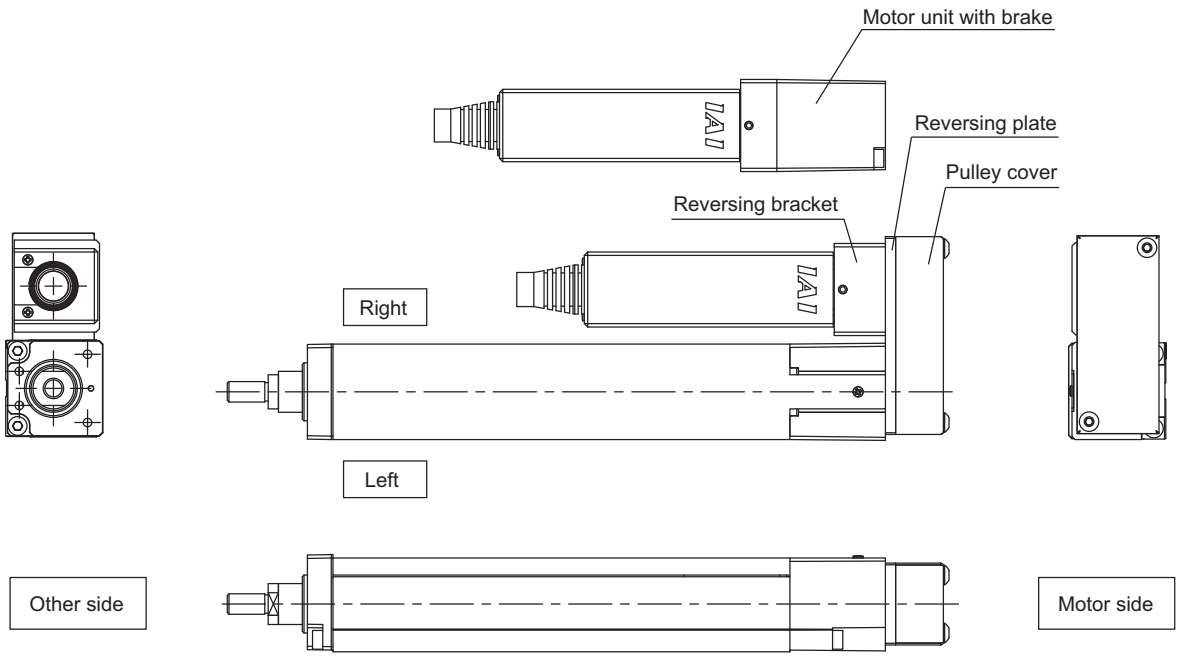
Names of the Parts

In this Operation Manual, the left and right sides are indicated by looking at the actuator from the motor end, with the actuator placed horizontally, as shown in the figure below.

● Motor coupling types　RA2AC/RA2BC (Lead screw, ball screw)



● Motor reversing types　RA2AR/RA2BR (Lead screw, ball screw)



1. Specifications Check

1.1 Checking the Product

The standard configuration of this product is comprised of the following parts.
See the component list for the details of the enclosed components. If you find any faulty or missing parts, contact your local IAI distributor.

1.1.1 Parts

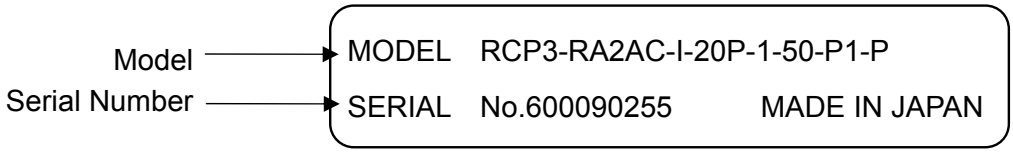
No.	Name	Model number	Quantity	Remarks
1	Actuator	Refer to “How to Read the Model Nameplate” and “How to Read the Model Number.”	1	
Accessories				
2	Motor • Encoder Cables (Note1)		1	
3	First Step Guide		1	
4	Operating Manual (DVD)		1	
5	Safety Guide		1	

Note1 The motor • encoder cables differ between the standard model and robot cable.
[Refer to 1.4 “Motor • Encoder Cables.”]

1.1.2 Operating Manuals for the Controllers Related to this Product

No.	Name	Control No.
1	Operating Manual for PSEL Controller	ME0172
2	Operating Manual for PCON-CA/CFA Controller	ME0289
3	Operating Manual for PCON-C/CG/CF Controller	ME0170
4	Operating Manual for PCON-CY Controller	ME0156
5	Operating Manual for PCON-SE Controller	ME0163
6	Operating Manual for PCON-PL/PO Controller	ME0164
7	Operating Manual for MEC Controller	ME0245
8	Operating Manual for PSEP/ASEP/DSEP Controller	ME0267
9	Operating Manual for MSEP Controller	ME0299
10	Operating Manual for ROBONET	ME0208
11	Operating Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
12	Operating Manual for Software RCM-101-MW/RCM-101-USB	ME0155
13	Operating Manual for MEC PC Software	ME0248
14	Operating Manual for Teaching Pendant SEL-T/TD	ME0183
15	Operating Manual for Teaching Pendant CON-T/TG	ME0178
16	Operating Manual for Touch Panel Teaching Pendant CON-PT/PD/PG	ME0227
17	Operating Manual for Touch Panel Teaching CON-PTA/PDA/PGA	ME0295
18	Operating Manual for Dedicated ASEP/PSEP Touch Panel Teaching SEP-PT	ME0217
19	Operating Manual for Simple Teaching Pendant RCM-E	ME0174
20	Operating Manual for Data Setter RCM-P	ME0175
21	Operating Manual for Touch Panel Display RCM-PM-01	ME0182

1.1.3 How to Read Model Nameplate



1.1.4 How to Read Model

RCP3 – RA2AC – I – 20P – 1 – 50 - P1 – P – B – **

<Series name>

<Type>
Motor coupling types
RA2AC
RA2BC
Motor reversing types
RA2AR
RA2BR

<Encoder type>
I: Incremental

<Motor type>
20P (20 square), 20SP (20 square),
RA2AC, RA2BC,
RA2AR, RA2BR

<Lead>
RA2AC, RA2AR,
1/2/4
1S/2S/4S
RA2BC, RA2BR
1/2/4/6
2S/4S/6S

Identification for IAI use only (Note 1)

<Option>
B : Brake type
ML : Motor reversing to left
(Motor reversing type only)
MR : Motor reversing to right
(Motor reversing type only)
NM : Reversed-home specification

<Cable length>
N : None
P : 1m
S : 3m
M : 5m
X□□ : Specified length

<Applicable controller>
P : PSEL
PCON-C/CG
PCON-CY
PCON-SE
PCON-PL/PO
RPCON
P3 : PCON-CA
PMEC
PSEP
MSEP

<Stroke>
[Refer to “1.2 Specifications”]

Note 1 This may be displayed for the manufacturing reason.
(This is not to indicate the manufacturing model code.)

1.2 Specifications

1.2.1 Speed

Speed limits (Unit: mm/s)

Model	Motor Type	Lead [mm]	Horizontal/ Vertical	Minimum Speed	Stroke [mm]					
					25	50	75	100	125	150
RA2AC RA2AR (Lead screw)	20P	1	Horizontal	1.25	50				-	-
			Vertical	1.25	50				-	-
		2	Horizontal	2.5	100				-	-
			Vertical	2.5	100				-	-
		4	Horizontal	5.0	180	200			-	-
			Vertical	5.0	180	200			-	-
RA2AC RA2AR (Ball screw)	20P	1	Horizontal	1.25	50				-	-
			Vertical	1.25	50				-	-
		2	Horizontal	2.5	100				-	-
			Vertical	2.5	100				-	-
		4	Horizontal	5.0	180	200			-	-
			Vertical	5.0	180	200			-	-
RA2AC RA2AR (Ball screw)	20SP	1	Horizontal	1.25	50				-	-
			Vertical	1.25	50				-	-
		2	Horizontal	2.5	100				-	-
			Vertical	2.5	100				-	-
		4	Horizontal	5.0	180	200			-	-
			Vertical	5.0	180	200			-	-
RA2BC RA2BR (Lead screw)	20P	2	Horizontal	2.5	100					
			Vertical	2.5	100					
		4	Horizontal	5.0	180	200				
			Vertical	5.0	180	200				
		6	Horizontal	7.5	180	280	300			
			Vertical	7.5	180	280	300			
RA2BC RA2BR (Ball screw)	20P	1	Horizontal	1.25	50					
			Vertical	1.25	50					
		2	Horizontal	2.5	100					
			Vertical	2.5	100					
		4	Horizontal	5.0	180	200				
			Vertical	5.0	180	200				
		6	Horizontal	7.5	180	280	300			
			Vertical	7.5	180	280	300			
RA2BC RA2BR (Ball screw)	20SP	1	Horizontal	1.25	50					
			Vertical	1.25	50					
		2	Horizontal	2.5	100					
			Vertical	2.5	100					
		4	Horizontal	5.0	180	200				
			Vertical	5.0	180	200				
		6	Horizontal	7.5	180	280	300			
			Vertical	7.5	180	280	300			

1.2.2 Acceleration and payloads

Model	Motor type	Lead [mm]	Rated acceleration [G]		Maximum speed [mm/s]	Payload [kg]
RA2AC RA2AR (Lead screw)	20P	1	Horizontal	0.2	50	1
			Vertical	0.2	50	0.5
		2	Horizontal	0.2	100	0.5
			Vertical	0.2	100	0.25
		4	Horizontal	0.2	200	0.25
			Vertical	0.2	200	0.125
RA2AC RA2AR (Ball screw)	20P	1	Horizontal	0.3	50	2
			Vertical	0.2	50	0.75
		2	Horizontal	0.3	100	1
			Vertical	0.2	100	0.375
		4	Horizontal	0.3	200	0.5
			Vertical	0.2	200	0.2
RA2AC RA2AR (Ball screw)	20SP	1	Horizontal	0.3	50	4
			Vertical	0.2	50	1.25
		2	Horizontal	0.3	100	2
			Vertical	0.2	100	0.625
		4	Horizontal	0.3	200	1
			Vertical	0.2	200	0.325
RA2BC RA2BR (Lead screw)	20P	2	Horizontal	0.2	100	1
			Vertical	0.2	100	0.5
		4	Horizontal	0.2	200	0.5
			Vertical	0.2	200	0.25
		6	Horizontal	0.2	300	0.25
			Vertical	0.2	300	0.125
RA2BC RA2BR (Ball screw)	20P	1	Horizontal	0.3	50	4
			Vertical	0.2	50	1.5
		2	Horizontal	0.3	100	2
			Vertical	0.2	100	0.75
		4	Horizontal	0.3	200	1
			Vertical	0.2	200	0.375
		6	Horizontal	0.3	300	0.5
			Vertical	0.2	300	0.2
RA2BC RA2BR (Ball screw)	20SP	1	Horizontal	0.3	50	8
			Vertical	0.2	50	2.5
		2	Horizontal	0.3	100	4
			Vertical	0.2	100	1.25
		4	Horizontal	0.3	200	2
			Vertical	0.2	200	0.625
		6	Horizontal	0.3	300	1
			Vertical	0.2	300	0.325

The speed is less than the maximum values stated in the table for short stroke types.
[Refer to 1.2.1, “Speed”]

1.2.3 Driving System and Position Detector

Model	Motor type	Lead	Encoder pulses	Boll screw and lead screw type		
				Type	Diameter	Accuracy
RA2AC RA2AR (Lead screw)	20P	1 2 4	800	Lead screw Rolled	ϕ4	C10
RA2AC RA2AR (Ball screw)	20P	1 2 4		Ball screw Rolled	ϕ4	C10
RA2AC RA2AR (Ball screw)	20SP	1 2 4		Ball screw Rolled	ϕ4	C10
RA2BC RA2BR (Lead screw)	20P	2 4 6		Lead screw Rolled	ϕ6	C10
RA2BC RA2BR (Ball screw)	20P	1 2 4 6		Ball screw Rolled	ϕ6	C10
RA2BC RA2BR (Ball screw)	20SP	1 2 4 6		Ball screw Rolled	ϕ6	C10

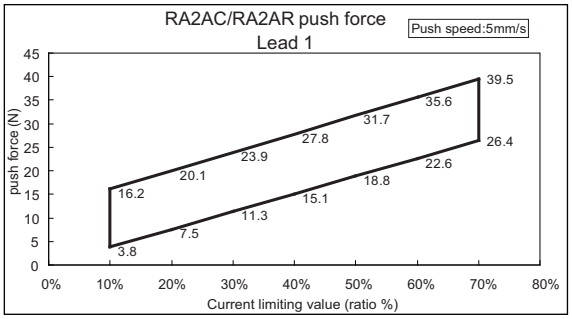
1.2.4 Positioning Accuracy

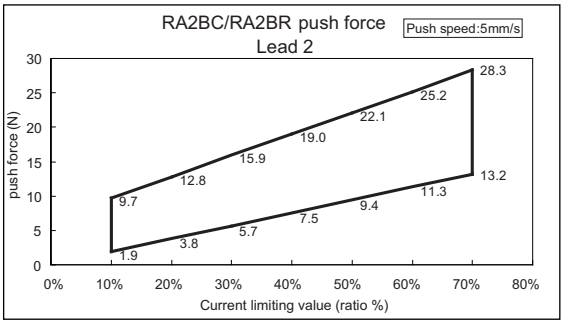
Model	Motor type	Item	Performance
RA2AC RA2AR (Lead screw)	20P	Positioning Repeatability (Note 1)	±0.05mm
		Lost Motion (Note 1)	0.3mm or less
		Base	Material: Aluminum with white alumite treatment
RA2AC RA2AR (Ball screw)	20P	Positioning Repeatability (Note 1)	±0.02mm
		Lost Motion (Note 1)	0.1mm or less
		Base	Material: Aluminum with white alumite treatment
RA2AC RA2AR (Ball screw)	20SP	Positioning Repeatability (Note 1)	±0.02mm
		Lost Motion (Note 1)	0.1mm or less
		Base	Material: Aluminum with white alumite treatment
RA2BC RA2BR (Lead screw)	20P	Positioning Repeatability (Note 1)	±0.05mm
		Lost Motion(Note 1)	0.3mm or less
		Base	Material: Aluminum with white alumite treatment
RA2BC RA2BR (Ball screw)	20P	Positioning Repeatability (Note 1)	±0.02mm
		Lost Motion (Note 1)	0.1mm or less
		Base	Material: Aluminum with white alumite treatment
RA2BC RA2BR (Ball screw)	20P	Positioning Repeatability (Note 1)	±0.02mm
		Lost Motion (Note 1)	0.1mm or less
		Base	Material: Aluminum with white alumite treatment

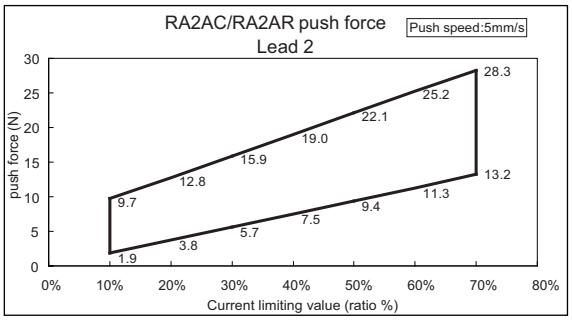
Note 1 The values shown above are the accuracy at the delivery from the factory.
It does not include the consideration of time-dependent change as it is used.

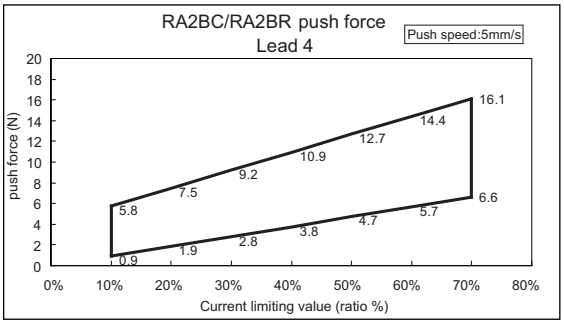
1.2.5 Relation between Current Limit Value and Push Force

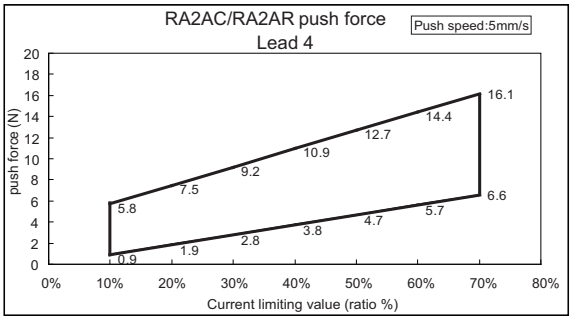
[1] RA2AC, RA2AR, RA2BC, RA2BR (Lead screw)

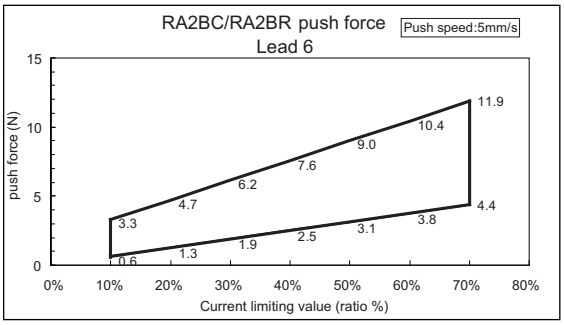




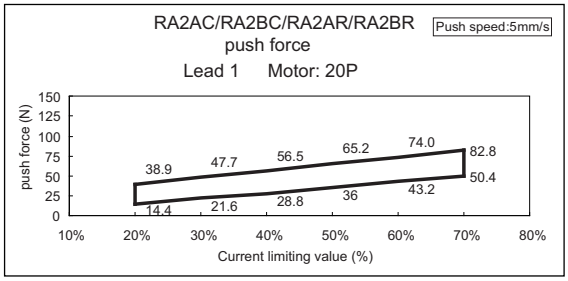


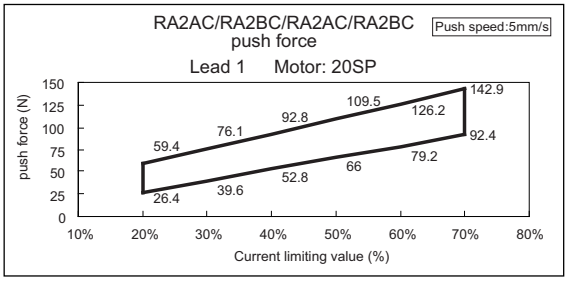


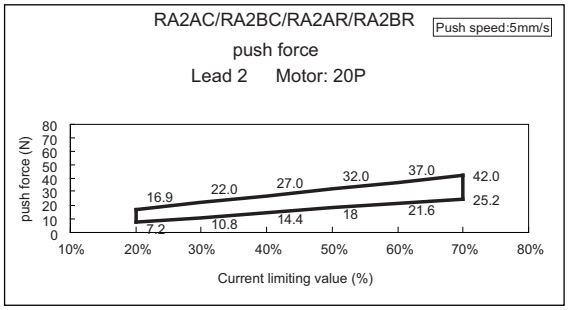


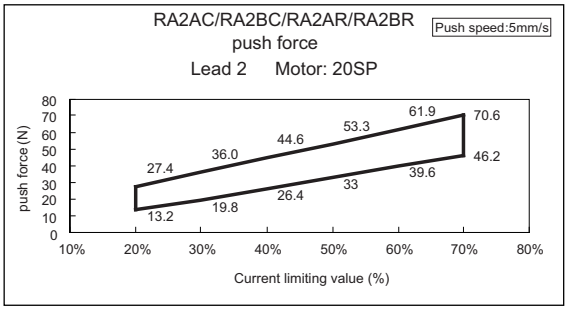


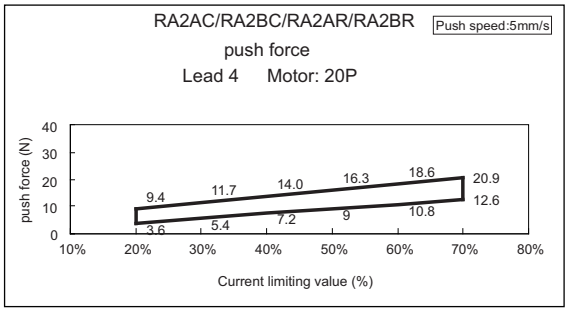
[2] RA2AC, RA2AR, RA2BC, RA2BR (Ball screw)

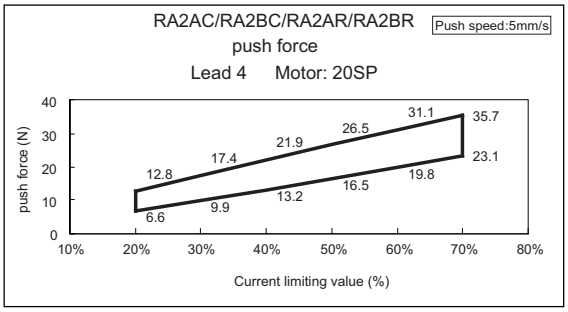


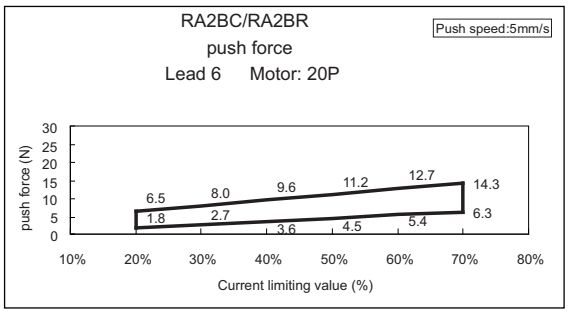


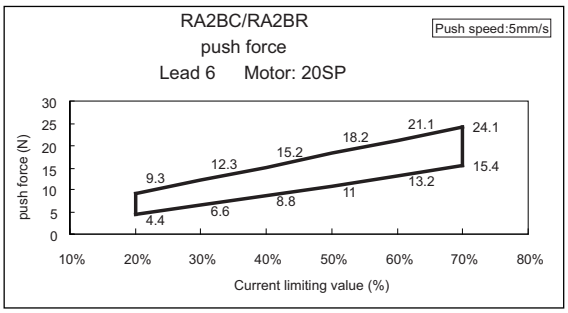












⚠ Caution : (1) The relation of the current limit and the push force is a reference when assuming the speed is 5mm/s.
(2) There is a little variance in the actual push force. The variance of the push force becomes large when the current limit value is low.
(3) Use the product within the range in the graph for the current limit value. Push force will not be stable if used below 20%. even a case that it would not operate. The product cannot be used above 70%. Doing so may cause degradation in the motor coil insulation by heat radiation, which results in shortening the product life.
(4) When the approach speed to the push start position (setting in the position table) is 5mm/s or less, push will be performed with the approach speed. In such a case also the push force will be unstable. In such cases, check in advance that the actuator can be used with no problem before omit using.

1.2.6 Duty Ratio in Continuous Operation

Continuous operation is available with the duty ratio 100%.
The duty ratio is the ratio of operation expressed in % to show the duration when the actuator is operating in 1 cycle.

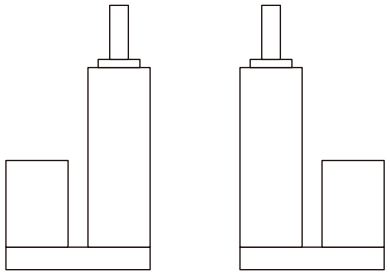
1.3 Options

1.3.1 Brake Type (Model: B)

The brake is a mechanism designed to prevent the rod from dropping on a vertically installed actuator when the power or servo is turned OFF.
Use the brake to prevent the installed work part, etc., from being damaged due to the falling rod.

1.3.2 Motor Reversing to Left, Motor Reversing to Right (Model: ML, MR)

The motor reversing direction can be specified for the motor reversing types RA2AR and RA2BR. “ML” indicates reversing to the left, while “MR” indicates reversing to the right, as viewed from the motor side.



1.3.3 Reversed-home Specification (Model: NM)

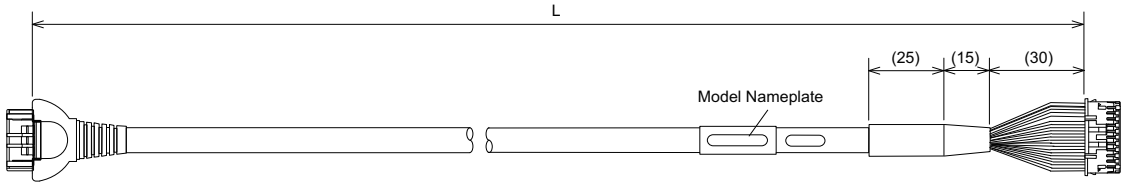
The standard home position is on the motor side. However, the motor position will be reversed if it is desirable in view of the layout of the system, etc.
(Note) The home position is adjusted at the factory before shipment. If you wish to change the home after the delivery of your actuator, you must return the actuator to IAI for adjustment.

1.4 Motor • Encoder Cables

1.4.1 PMEC, PSEP, MSEP Controller Cables

Motor • Encoder Integrated Cables
(CB-APSEP-MPA□□□)

□□□ indicates the cable length L. Up to 20m can be specified.
(Example: 080=8m)



Actuator Side

Electric Wire Color	Symbol	Pin No.
Black	ϕA	A1
White	VMM	B1
Brown	ϕ/A	A2
Green	ϕB	B2
Yellow	VMM	A3
Red	ϕ/B	B3
Orange	LS+	A4
Gray	LS-	B4
White	-	A6
Yellow	-	B6
Red	A+	A7
Green	A-	B7
Black	B+	A8
Brown	B-	B8
Black (Identification tape)	BK+	A5
Brown (Identification tape)	BK-	B5
Green (Identification tape)	GND_{LS}	A9
Red (Identification tape)	VPS	B9
White (Identification tape)	VCC	A10
Yellow (Identification tape)	GND	B10
-	NC	A11
-	Shield, FG	B11

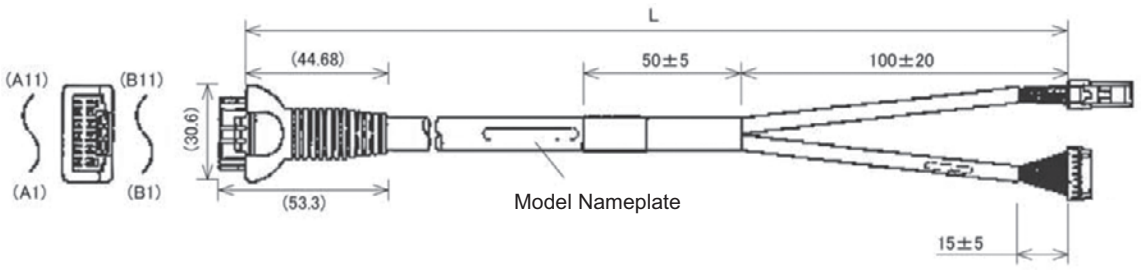
Controller Side

Pin No.	Symbol	Electric Wire Color
1	ϕA	Black
2	VMM	White
3	ϕ/A	Brown
4	ϕB	Green
5	VMM	Yellow
6	ϕ/B	Red
7	LS+	Orange
8	LS-	Gray
11	-	White
12	-	Yellow
13	A+	Red
14	A-	Green
15	B+	Black
16	B-	Brown
9	BK+	Black (Identification tape)
10	BK-	Brown (Identification tape)
20	GND_{LS}	Green (Identification tape)
18	VPS	Red (Identification tape)
17	VCC	White (Identification tape)
19	GND	Yellow (Identification tape)
21	NC	-
24	Shield, FG	-
22	-	-
23	-	-

1.4.2 PCON, PSEL Controller Cables

Motor • Encoder Integrated Cables For RCP3
(CB-PCS-MPA□□□)

□□□ indicates the cable length L. Up to 20m can be specified.
(Example: 080=8m)



Actuator Side

Electric Wire Color	Symbol	Pin No.
Black	ϕA	A1
White	VMM	B1
Red	ϕ/A	A2
Green	ϕB	B2
Yellow	VMM	A3
Brown	ϕ/B	B3
-	NC	A4
-	NC	B4
Pink (Red •)	BK+	A5
Pink (Blue •)	BK-	B5
White (Red •)	LS+	A6
White (Blue •)	LS-	B6
Orange (Red •)	A+	A7
Orange (Blue •)	A-	B7
Gray (Red •)	B+	A8
Gray (Blue •)	B-	B8
-	NC	A9
Orange (Blue • continuous)	VPS	B9
Gray (Red • continuous)	VCC	A10
Gray (Blue • continuous)	GND	B10
-	NC	A11
-	Shield, FG	B11

Controller Side

Pin No.	Symbol	Electric Wire Color
B1	ϕA	Black
A2	VMM	White
A1	ϕ/A	Red
B3	ϕB	Green
B2	VMM	Yellow
A3	ϕ/B	Brown
3	NC	-
2	NC	-
14	BK+	Pink (Red •)
13	BK-	Pink (Blue •)
16	LS+	White (Red •)
15	LS-	White (Blue •)
12	A+	Orange (Red •)
11	A-	Orange (Blue •)
10	B+	Gray (Red •)
9	B-	Gray (Blue •)
8	NC	Orange (Red • continuous)
7	VPS	Orange (Blue • continuous)
6	VCC	Gray (Red • continuous)
5	GND	Gray (Blue • continuous)
4	NC	-
1	Shield, FG	-

2. Installation

2.1 Handling of the Actuator

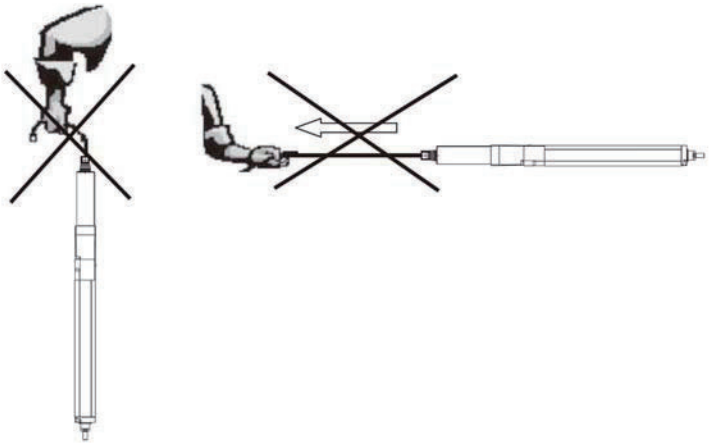
Unless otherwise specified, the actuator is shipped with 1 axis unit packaged separately.

(1) Handling the Packed Unit

- Do not damage or drop. The package is not applied with any special treatment that enables it to resist an impact caused by a drop or crash.
- Transport a heavy package with at least more than two operators. Consider an appropriate method for transportation.
- Keep the unit in a horizontal orientation when placing it on the ground or transporting. Follow the instruction if there is any for the packaging condition.
- Do not step or sit on the package.
- Do not put any load that may cause a deformation or breakage of the package.

(2) Handling the Actuator After Unpacking

- Do not carry the actuator by its motor unit or its cable or attempt to move it by pulling the cable.



- Hold the base part or bracket part of the body when transporting the actuator main body.
- Do not hit or drop the actuator during transportation.
- Do not attempt to force any part of the actuator.

[2] Handling in the Assembled Condition

This is the case when the product is delivered from our factory under a condition that it is assembled with other actuators. The combined axes are delivered in a package that the frame is nailed on the lumber base. The rods are fixed so they would not accidently move. The actuators are also fixed so the tip of it would not shake due to the external vibration.

(1) How to Handle the Package

- Do not hit or drop the package. No special treatment is conducted on this package to endure a drop or impact on it.
- Do not attempt to carry a heavy package with only one worker. Also, have an appropriate method for transportation.
- When hanging up with ropes, support on the reinforcement frame on the bottom of the lumber base. When bringing up the package with a forklift, also support on the bottom of the lumber base.
- Handle with care when putting the package down to avoid impact or bounce.
- Do not step on the package.
- Do not put anything on the package that could deform or damage it.

(2) How to Handle after Unpackaged

- Fix the rod so they would not accidently move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up with ropes, have appropriate cushioning to avoid any deformation of the actuator body. Also keep it in stable horizontal orientation. Make a fixture utilizing the attachment holes and the tapped holes on the actuator body if necessary.
- Do not attempt to apply load on the actuators. Also pay attention not to pinch cables and bend or deform them forcefully.

[3] Handling in Condition of being assembled in Machinery Equipment (System)

There are some caution notes for when transporting the actuator being assembled in the machinery equipment (system):

- Fix the rod so it would not move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up the machinery equipment (system) with ropes, do not attempt to apply load on the actuators. Also pay attention not to pinch cables and bend or deform them forcefully.

2.2 Installation and Storage • Preservation Environment

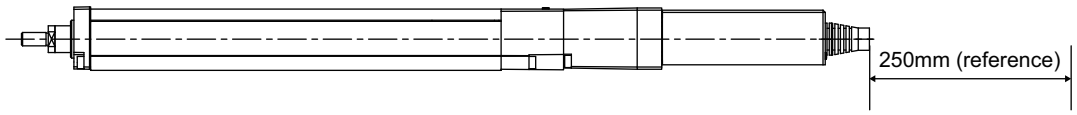
[1] Installation Environment

The actuator should be installed in a location other than those specified below.
Also provide sufficient work space required for maintenance inspection.

- Where the actuator receives radiant heat from strong heat sources such as heat treatment furnaces
- Where the ambient temperature exceeds the range of 0 to 40°C
- Where the temperature changes rapidly and condensation occurs
- Where the relative humidity exceeds 85% RH
- Where the actuator receives direct sunlight
- Where the actuator is exposed to corrosive or combustible gases
- Where the ambient air contains a large amount of powder dust, salt or iron (at level exceeding what is normally expected in an assembly plant)
- Where the actuator is subject to splashed water, oil (including oil mist or cutting fluid) or chemical solutions
- Where the actuator receives impact or vibration

If the actuator is used in any of the following locations, provide sufficient shielding measures:
- Where noise generates due to static electricity, etc.
- Where the actuator is subject to a strong electric or magnetic field
- Where the actuator is subject to ultraviolet ray or radiation

Open space required for maintenance inspection



[2] Storage • Preservation Environment

- The storage and preservation environment should comply with the same standards as those for the installation environment. In particular, when the machine is to be stored for a long time, pay close attention to environmental conditions so that no dew condensation forms.
- Unless specially specified, moisture absorbency protection is not included in the package when the machine is delivered. In the case that the machine is to be stored and preserved in an environment where dew condensation is anticipated, take the condensation preventive measures from outside of the entire package, or directly after opening the package.
- For storage and preservation temperature, the machine withstands temperatures up to 60°C for a short time, but in the case of the storage and preservation period of 1 month or more, control the temperature to 50°C or less.
- Storage and preservation should be performed in the horizontal condition. In the case it is stored in the packaged condition, follow the posture instruction if any displayed on the package.

2.3 How to Install

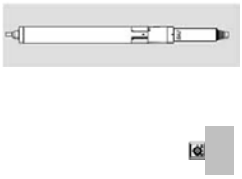
This chapter explains how to install the actuator on your mechanical system.

2.3.1 Installation

○ : Available × : Not available

Horizontal Installation	Vertical Installation	Sideways Installation	Ceiling Mount Installation
○	○	○	○

Installation Orientation

Horizontal	Vertical	Sideways	Ceiling Mount
			

2.3.2 Installation of Actuator

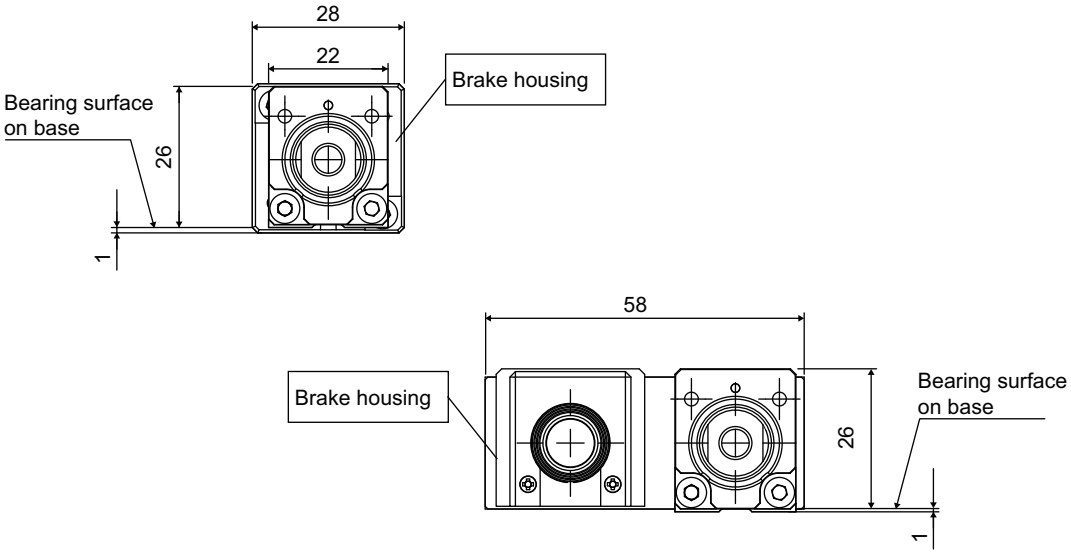
This actuator contains installation tap holes which allow it to be secured from the rear.
(Note that tap hole size depends on model. Please see 7, “External Dimensions.”
The actuator also contains reamed holes for use with positioning pins.

Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Reamed hole (mm)
		Bolt bearing surface is steel	Bolt bearing surface is aluminum	
M3, depth 5	M3	1.54 N•m (0.16 kgf•m)	0.83 N•m (0.085 kgf•m)	ϕ2H7, depth 3 from base surface

Tightening screws
- Use hexagonal socket bolts for the male threads used to install the base.
- Use of high-tension bolts meeting at least ISO-10.9 is recommended.
- Ensure at least the applicable value specified below for the effective engagement length between the bolt and female thread:
  Female thread is made of steel material → Same length as the nominal diameter
  If female screws are made of aluminum → Maximum screw-in depth

> ⚠ Caution: Select bolt length carefully. Using a bolt with inappropriate length can damage tap holes, result in insecure installation of actuator, interfere with the operation of the drive section, reduce the precision of the device, and cause unexpected accidents.

(Notes on installation)
With the RA2AC and RA2BC, the brake project from the bearing surface by 1mm.
When installing by using the base surface, have an action such as lifting the lift up by using a foot bracket.



2.3.3 Installation Surface

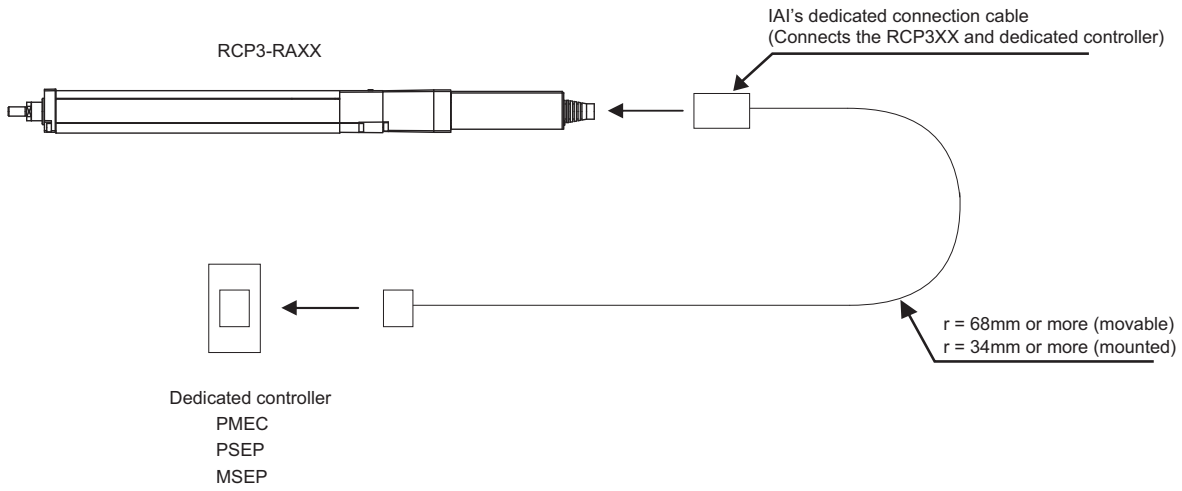
- Mount on a strong, rigid structure to prevent vibration.
- The actuator mounting surface should be machined or otherwise processed to a smooth surface of equivalent precision, within ±0.05mm/m.
- Provide adequate space around the device to allow for future maintenance.

3. Connecting with the Controller

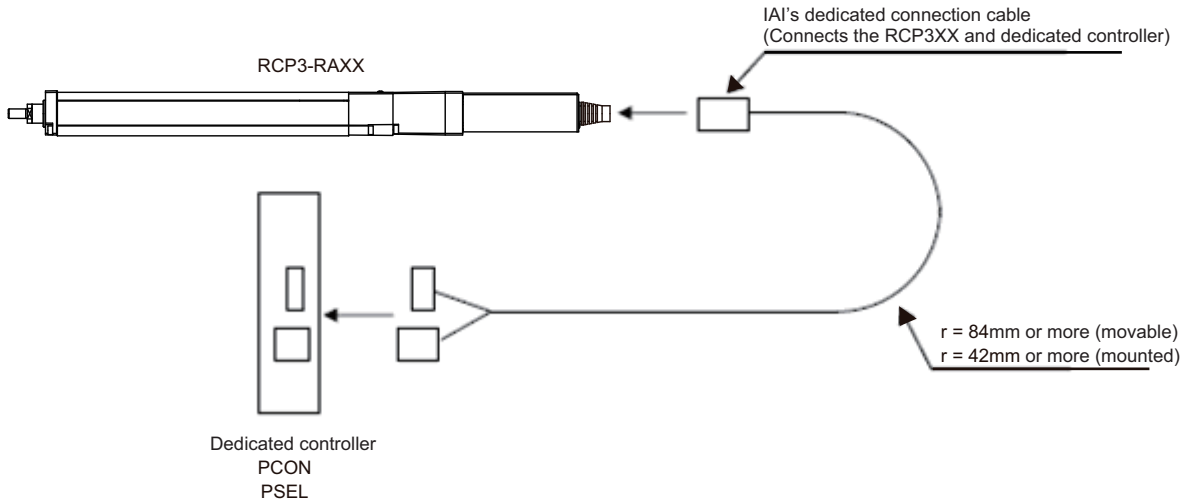
Use the IAI dedicated connection cable for the connection of the actuator to the controller.

- If the dedicated connection 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.
- Do not cut and reconnect the dedicated connection cable for extension or shorten the cable.
- Do not pull on the dedicated connection cable or bend it forcibly.
- The actuator cable out of the motor unit is a fixed type cable. Fix the cable so it would not be bent repeatedly.

If you wish to change the cable, consult IAI.



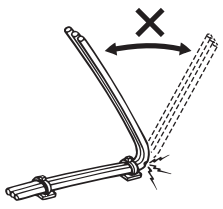
Dedicated connection cable
Pulse motor cable : CB-APSEP-MPA□□□
*) □□□ indicates the cable length. Up to 20m can be specified.
Example) 080 = 8m

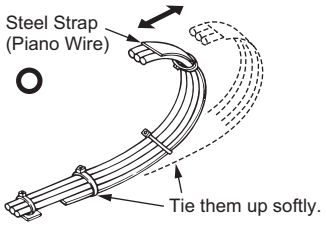


Dedicated connection cable
Pulse motor cable : CB-PCS-MPA□□□
*) □□□ indicates the cable length. Up to 20m can be specified.
Example) 080 = 8m

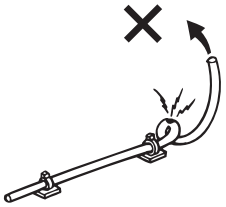
⚠ Warning: For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause not only a malfunction such as cable breakage or connection failure, or an operation error, but also electric shock or electric leakage, or may even cause a fire.

- Use dedicated cables of IAI indicated in this operating manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with connectors on both ends to extend, shorten or re-joint it.
- Hold the dedicated cable to avoid mechanical force being applied to the terminals and connectors.
- Use a cable pipe or duct to have an appropriate protection when there is a possibility of mechanical damage on a dedicated cable.
- In case a dedicated cable is to be used at a moving part, make sure to lay out the cable without applying any force to pull the connector or extreme bend on the cable. Do not attempt to use the cable with a bending radius below the allowable value.
- Make certain that the connectors are plugged properly. Insufficient connection may cause an operation error, thus it is extremely risky.
- Do not lay out the cables to where the machine runs over them.
- Pay attention to the cable layout so it would not hit peripherals during an operation. In case it does, have an appropriate protection such as a cable track.
- When a cable is used hanging on the ceiling, prevent an environment that the cable swings with acceleration or wind velocity.
- Make sure there is not too much friction inside the cable storage equipment.
- Do not apply radiated heat to power line or cables.
- Have a sufficient radius for bending, and avoid a bend concentrating on one point.

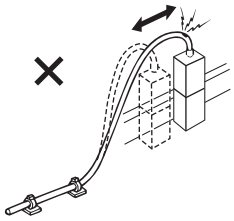




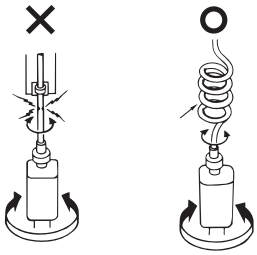
- Do not let the cable bend, kink or twist.



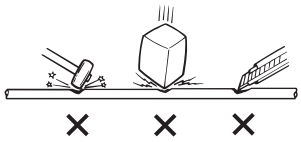
- Do not pull the cable with a strong force.



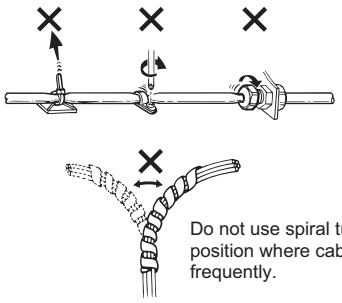
- Pay attention not to concentrate the twisting force to one point on a cable.



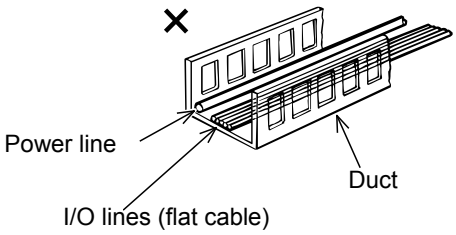
- Do not pinch, drop a heavy object onto or cut the cable.



- When a cable is fastened to affix, make sure to have an appropriate force and do not tighten too much.

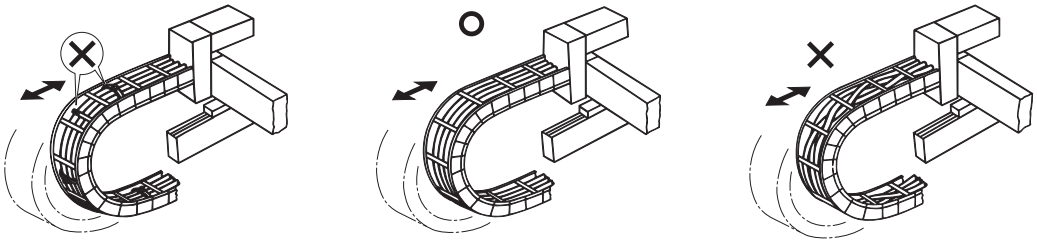


- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



Follow the instructions below when using a cable track.

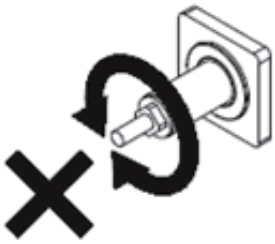
- If there is an indication to the cable for the space factor in a cable track, refer to the wiring instruction given by the supplier when storing the cable in the cable track.
- Avoid the cables to get twined or twisted in the cable track, and also to have the cables move freely and do not tie them up. (Avoid tension being applied when the cables are bent.)
  Do not pile up cables. It may cause faster abrasion of the sheaths or cable breakage.



4. Operation

4.1 Loads Received by the Actuator

- Align the shaft center of the rod with the moving direction of the load.
- Application of a lateral load may cause actuator damage or malfunction.
- If the rod receives a lateral load, provide a guide, etc., in the moving direction of the load.
- Do not apply a rotational torque to the rod. If the rod receives a rotational torque, actuator damage or malfunction may occur.



Note: When installing the load, clamp the width across flats to prevent the rod from turning.

5. Maintenance and Inspection

5.1 Inspection Items and Schedule

Perform maintenance and inspection at the intervals specified below.
This schedule assumes that the actuator is operated eight hours a day.
If the actuator is operated at a higher utilization, such as when the machine is used continuously day and night, reduce the inspection intervals accordingly.

	Visual inspection of exterior	Inspection of interior	Greasing (Note 1)
Startup inspection	○		
1 month after startup	○		
3 months after startup	○	○	
6 months after startup	○	○	○
Every 6 months thereafter	○	○	○

Note 1 Back and forth operation in a distance of 30mm or less, may cause wear of grease. As a guide, move the actuators back and forth repeatedly for around 5 cycles over a distance of 50mm or more after every 5,000 to 10,000 cycles (For ROBO Cylinder with its stroke less than 50mm, have a back-and-forth operation with using the whole distance of the stroke length.) A layer of the grease will recover.

5.2 Visually Inspecting the Exterior

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

Actuator	Loose actuator mounting bolts, etc.
Cables	Scratches, connection at connectors
Overall	Abnormal noise, vibration

If the actuator is fixed vertically, grease on the guide may drip depending on the environment. In this case, clean the dirtied areas and add grease.

5.3 Cleaning

- Clean exterior surfaces as necessary.
- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air as it may cause dust to get in through the gaps.
- Do not use oil-based solvents as they can harm lacquered and painted surfaces.
- To remove severe buildup, wipe gently with a soft cloth soaked in a neutral detergent or alcohol.

5.4 Inspection of Interior

Inspect the interior with the power turned off.
Remove the rod cover.
When inspecting the interior, check the items specified below.

Main unit	Loose actuator mounting bolts, other loose items
Guide section	Lubrication, buildup

Visually inspect the interior of the equipment. Check whether dust or other foreign matter has gotten inside and check the lubrication state.
The lubrication may have turned brown. This is not a problem as long as the travel surfaces shine as though they are wet.
If the grease is mixed with dust and dirty or has no shiny appearance, or if the grease has lost its efficacy due to prolonged use, use a soft cloth, etc., to gently wipe the sliding parts of the lead guide and detent and then replenish grease.

5.5 Internal Cleaning

- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air as it may cause dust to get in through the gaps.
- Do not use oil-based solvents, neutral detergent or alcohol.

5.6 Greasing

5.6.1 Applicable Grease

[Lead screw types]
The grease initially applied in the slide screw type products is poly-α-olefin based synthetic grease on both slide screw and slide guide parts.
IAI uses the following grease in our plant.

Location	Manufacturer	Model number
Lead screw / Lead guide	Sumico Lubricant Co., Ltd.	Sumitec 308

Equivalent greases are also available from other manufacturers, but exercise caution when selecting the grease because the life of the product may be affected.

⚠ Warning :
Never use anything other than synthetic poly-α olefin grease. Mixing poly-α grease with other grease not only reduces the performance of the grease, it may even cause damage to the actuator.

[Ball screw types]
The grease initially applied on the ball screw in the ball screw type products is lithium based synthetic grease.
IAI uses the following grease in our plant.

Location	Manufacturer	Model number
Ball screw	Idemitsu Kosan Co., Ltd.	Daphne Eponex Grease No. 2
Lead guide	Sumico Lubricant Co., Ltd.	Sumitec 308

⚠ Warning :
- When applying grease on the lead guide, do not apply grease except for the poly-α olefin based synthetic grease. Mixing poly-α grease with other grease not only reduces the performance of the grease, it may even cause damage to the actuator.
- Do not attempt to use fluorine based grease on the ball screw. Mixing fluorine-based grease with lithium-based grease not only reduces the performance of the grease, it may even cause damage to the actuator.

5.6.2 How to Apply Grease

For the guide, use a grease syringe to apply grease between the rod and base (guide-piece retention groove) and then move the rod back and forth to spread the grease evenly.
For the lead screw, pull out the rod and clean the lead screw, and apply grease manually and then move the rod back and forth to spread the grease evenly.

(Caution) When moving the rod back and forth, do not move the rod directly by hand, but operate it using the jog function, etc.

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

5.7 Belt

5.7.1 Inspection of Belt

When inspecting the belt, remove the pulley cover and check the condition visually.
Although the durability of the belt is affected significantly by the operating conditions, generally the belt has a flex life of several million times.
As a reference on when to replace the belt, replace the belt if any of the following conditions is observed:

- Significant wear of the teeth or end face of the belt
- Swelling of the belt due to attached oil, etc.
- Cracking or other damage to the belt teeth or back
- Breaking of the belt

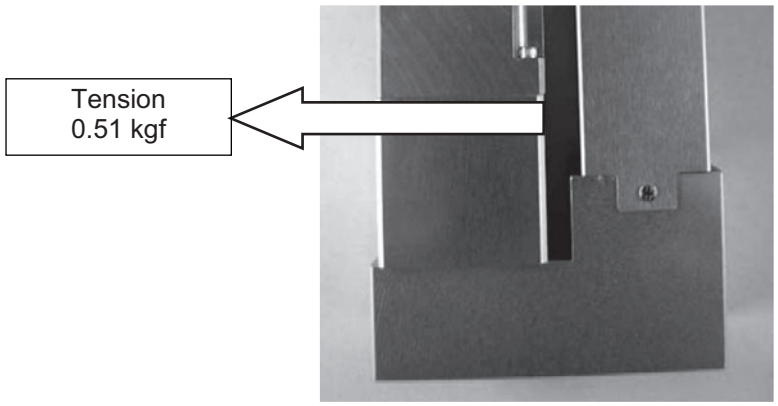
5.7.2 Applicable Belt

Manufacturer: Mitsuboshi Belting Ltd.

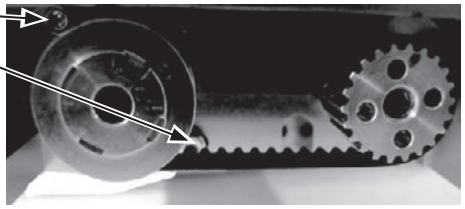
Belt model number (type)
40S2M104G (clean rubber type)

5.7.3 Applicable Belt

Remove the pulley cover, loosen the tension adjustment bolts (2 locations), and then move the motor to the left as shown below to tension the belt. When the adjustment is finished, tighten the tension adjustment bolts.



Tension adjustment bolts	
Nominal thread size	Tightening torque
M3	0.83 N•m (0.085 kgf•m)



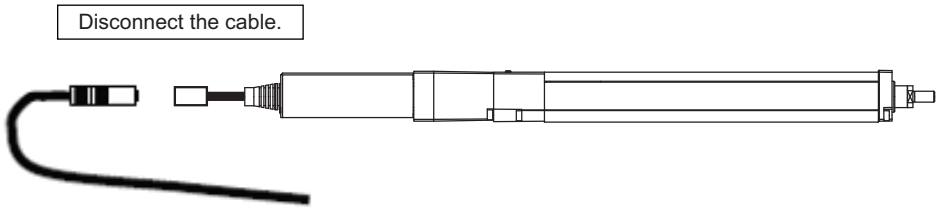
5.8 Procedure for Replacement of Belt and Motor for Motor coupling Type

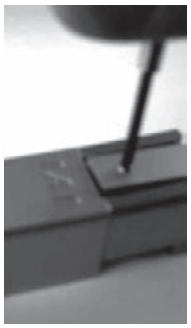
• Refer to 5.9 for the reversing types.
[Required Items]
• Replacement motor unit

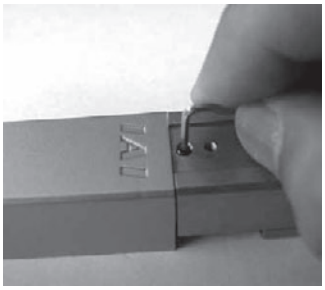
Model number	
Without Brake	With Brake
RCP3-MU00A	RCP3-MU00A-B

• Hex wrench set

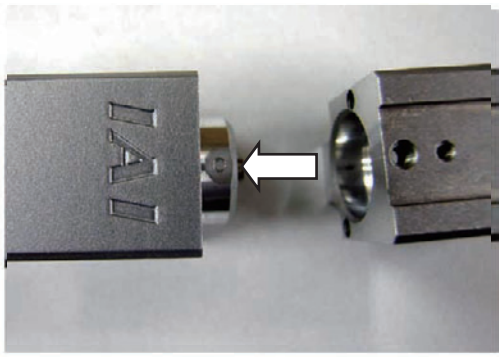
[Procedure]
[1] Remove the cable connecting the actuator and controller and the motor unit cable.
Remove the cross-recessed socket screws on the cover to expose the screws affixing the motor.
Remove the affixing screws using a hex wrench of 2mm across flats.



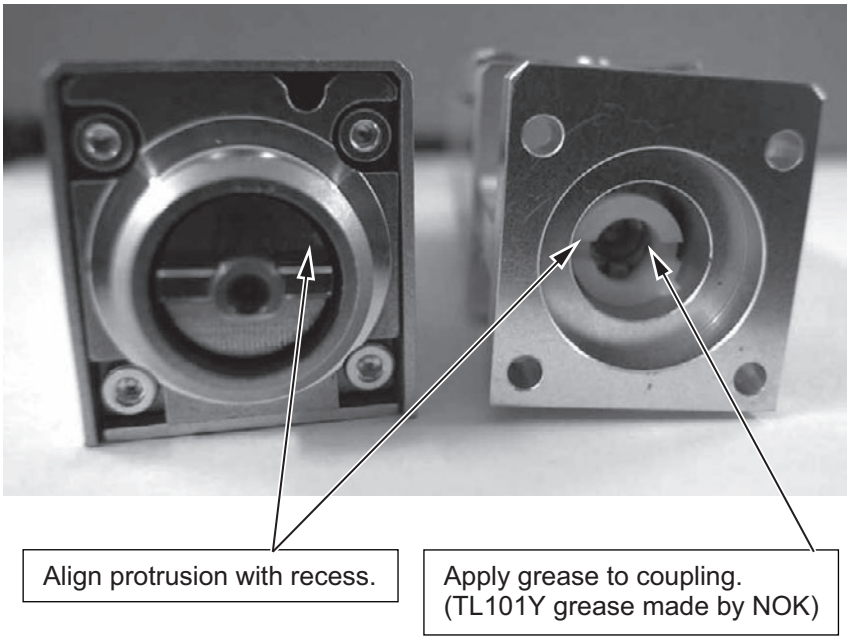




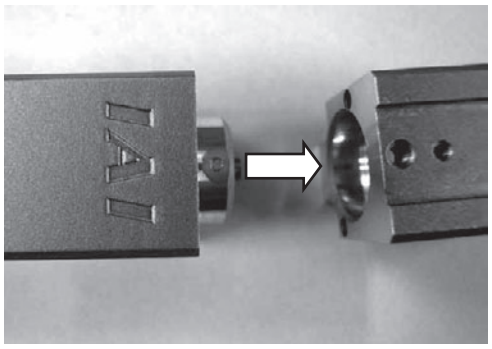
[2] Detach the motor unit.



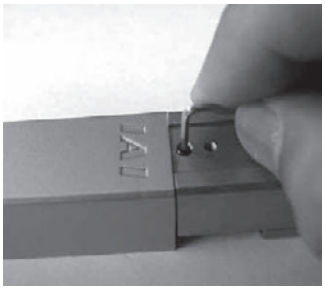
[3] Align the actuator side and replacement motor unit side projection section and the slit orientation.

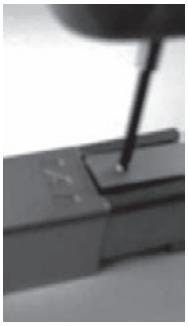


[4] Install the replacement motor by fitting the protrusion of one unit in the recess of the other.

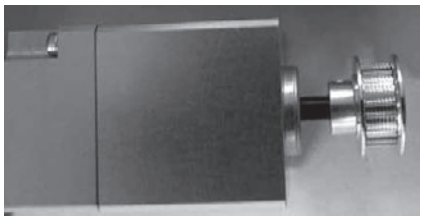


[5] Secure the affixing screws using a hex wrench of 2mm across flats. Install the cover and tighten the cross-recessed socket screws.





5.9 Procedure for Replacement of Belt and Motor for Reversing Type



[Required Items]
- Replacement motor unit of reversing type

Model number	
Without Brake	With Brake
RCP3-MU00B	RCP3-MU00B-B

- Belt

Manufacturer: Mitsuboshi Belting Ltd.

Belt model number (type)
40S2M104G (clean rubber type)

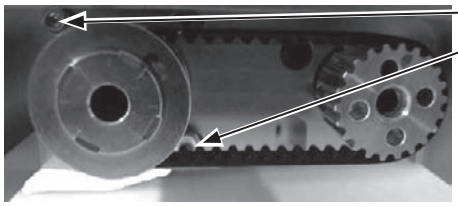
- Tension gauge
- Hex wrench set

[Procedure]

[1] Remove the pulley cover.
Remove the mounting screws (2 pcs).

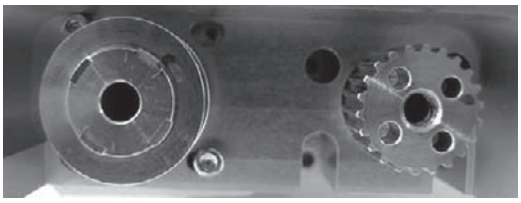
Mounting screw	
Nominal thread size	Applicable hex wrench
M3	2.5mm across flats

[2] Loosen the tension adjustment bolts (2 pcs) and slack the belt.

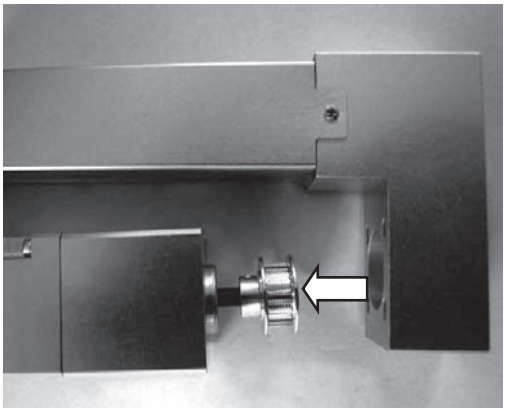


Tension adjustment bolt	
Nominal thread size	Applicable hex wrench
M3	2.5mm across flats

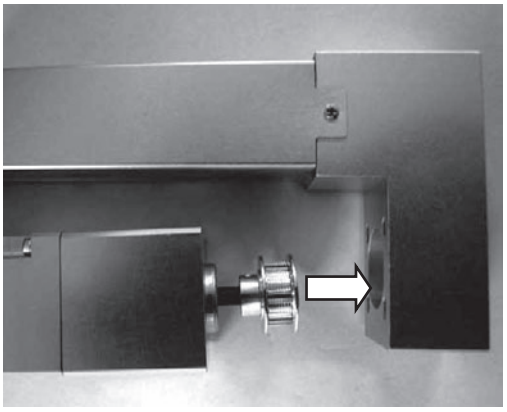
[3] Remove the belt from the pulleys. When replacing the belt, proceed to step [6].



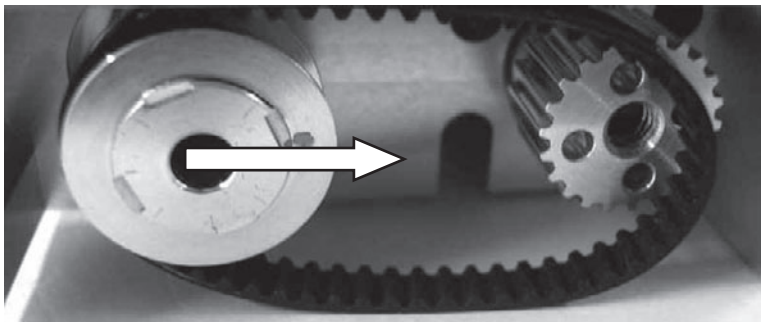
[4] Remove the tension adjustment bolts and pull out the motor unit.



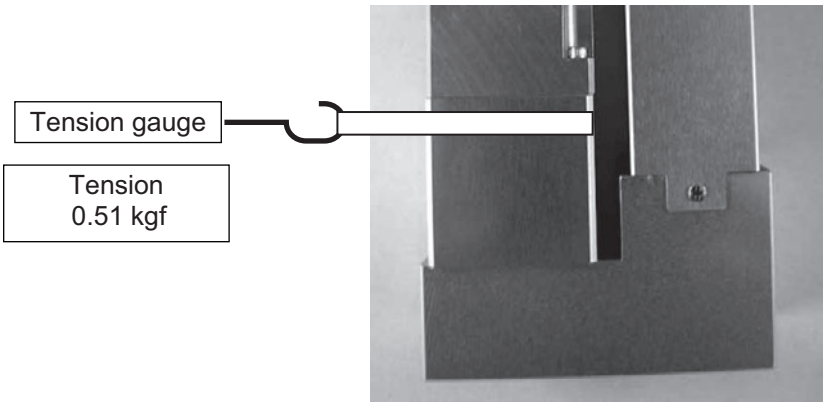
[5] Install the replacement motor unit.
As shown below, install the motor unit so that its specified surface faces the actuator base.
Use the tension adjustment bolts to loosely secure the motor unit.



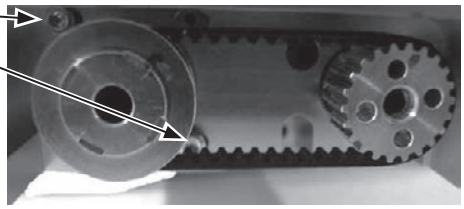
[6] Move the motor unit in the direction of the arrow shown below, and then install the belt. When replacing the belt, install the replacement belt.



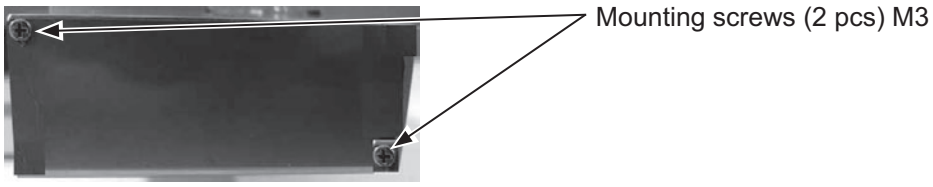
[7] Pass around the base of the unit a strong string (or long tie band) that has been looped into a ring shape, and pull the ring with a tension gauge. After confirming that



Tension adjustment bolts	
Nominal thread size	Tightening torque
M3	0.83 N•m (0.085 kgf•m)



[8] Install the pulley cover.



6. Life

6.1 Life of Actuator Using Ball Screws

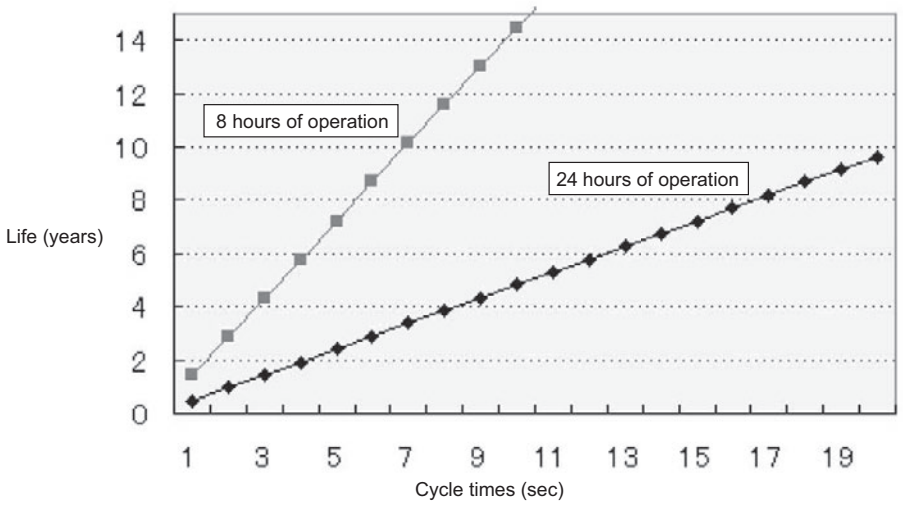
The life of actuator using ball screws is set to 5,000km (guideline), assuming it is operated with the maximum loading capacity and maximum acceleration/deceleration.

6.2 Life of Actuator Using Lead Screws

The lead screw type actuator uses a lead screw and its nut wears over time.
A reference for product life is presented based on the wear amount of the nut.
The positioning precision of this product, such as lost motion, will drop as the wear of the nut progresses.
(Reference product life)
Horizontal application 10 million back-and-forth operations
Vertical application 5 million back-and-forth operations

6.2.1 Relationship of Cycle Time and Product Life

(1) Horizontal application
The graph below shows the relationship between the cycle time for one back-and-forth operation and the life of the product in a horizontal application (product life: 10 million back-and-forth operations).
The lines based on 8 hours of operation and 24 hours operations a day, for 240 days a year, are shown.
Use this graph as a reference when determining the product life.

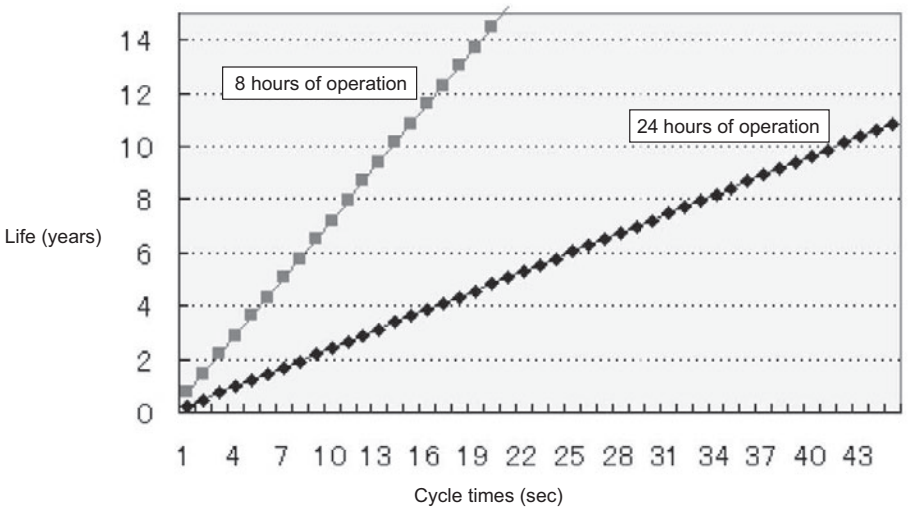


(2) Vertical application

The graph below shows the relationship between the cycle time for one back-and-forth operation and the life of the product in a vertical application (product life: 50 million back-and-forth operations).

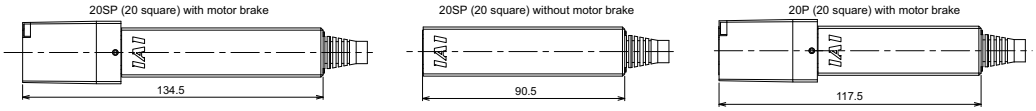
The lines based on 8 hours of operation and 24 hours operations a day, for 240 days a year, are shown.

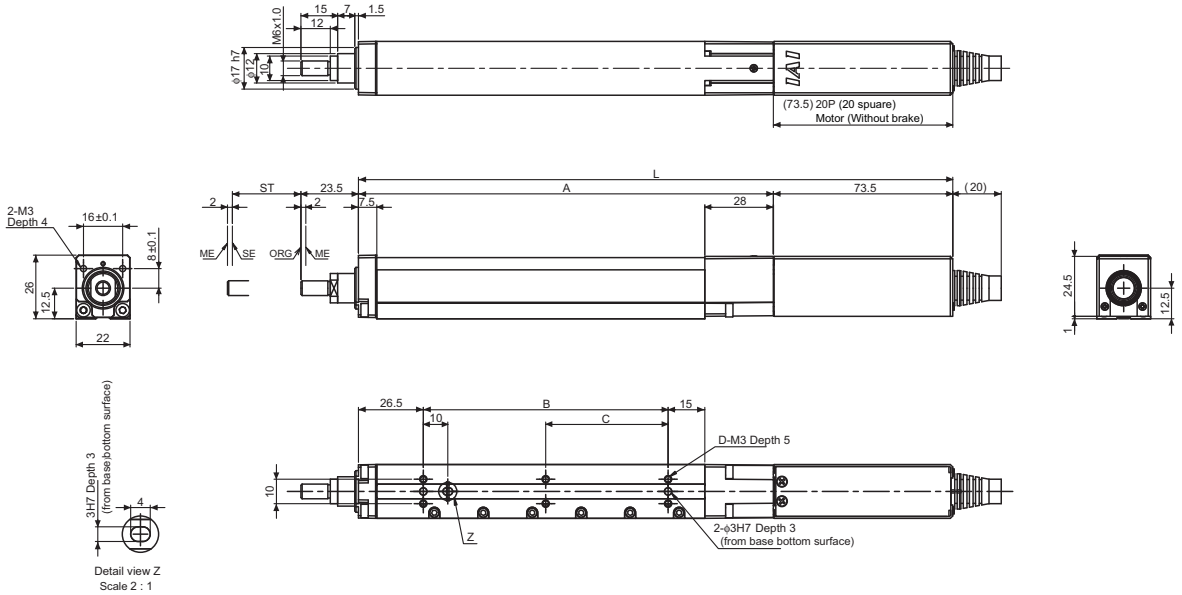
Use this graph as a reference when determining the product life.



7. External Diagrams

7.1 RCP3-RA2AC (Lead Screw, Ball Screw)



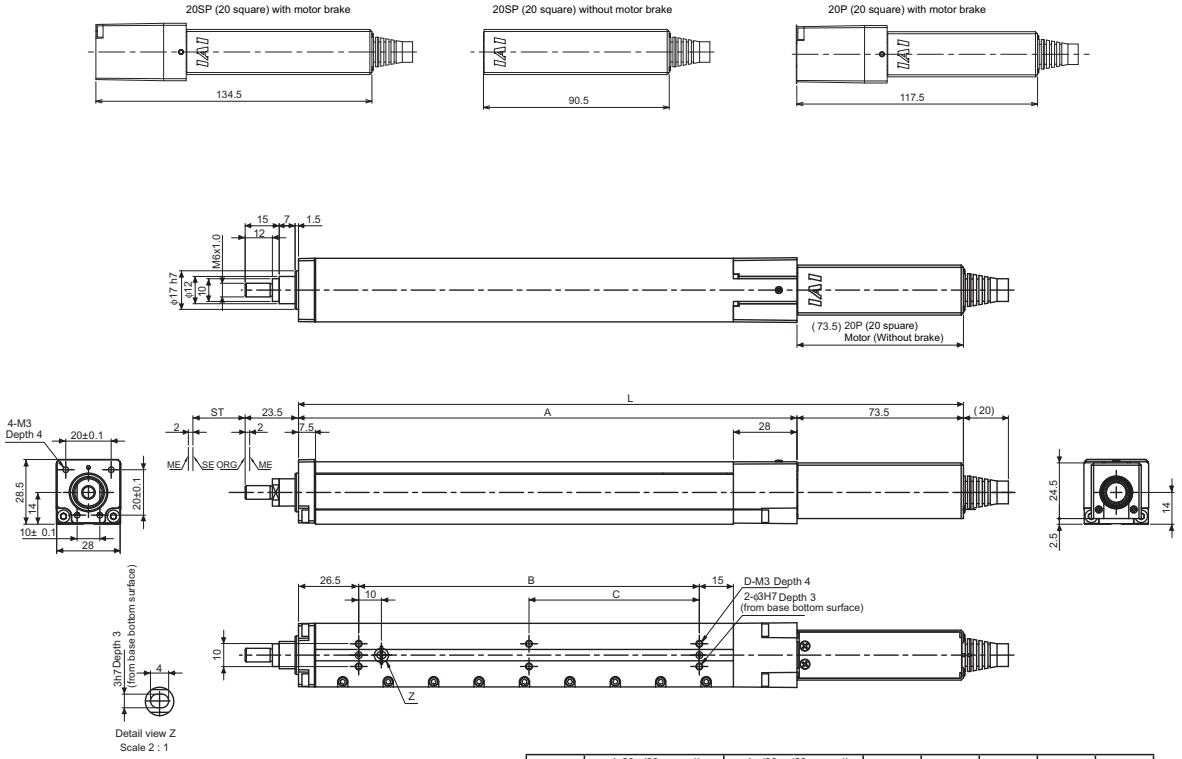


ORG : Home
ME : Mechanical end
SE : Stroke end

ST	L 20p (20 square))		L (20sp (20 square))		A	B	C	D	Mass [kg]
	Without brake	With brake	Without brake	With brake					
25	168	212	185	229	94.5	25	0	4	0.31
50	193	237	210	254	119.5	50	0	4	0.33
75	218	262	235	279	144.5	75	0	4	0.36
100	243	287	260	304	169.5	100	50	6	0.37

*For those with brake , the mass increases by 0.1kg.

7.2 RCP3-RA2BC (Lead Screw, Ball Screw)

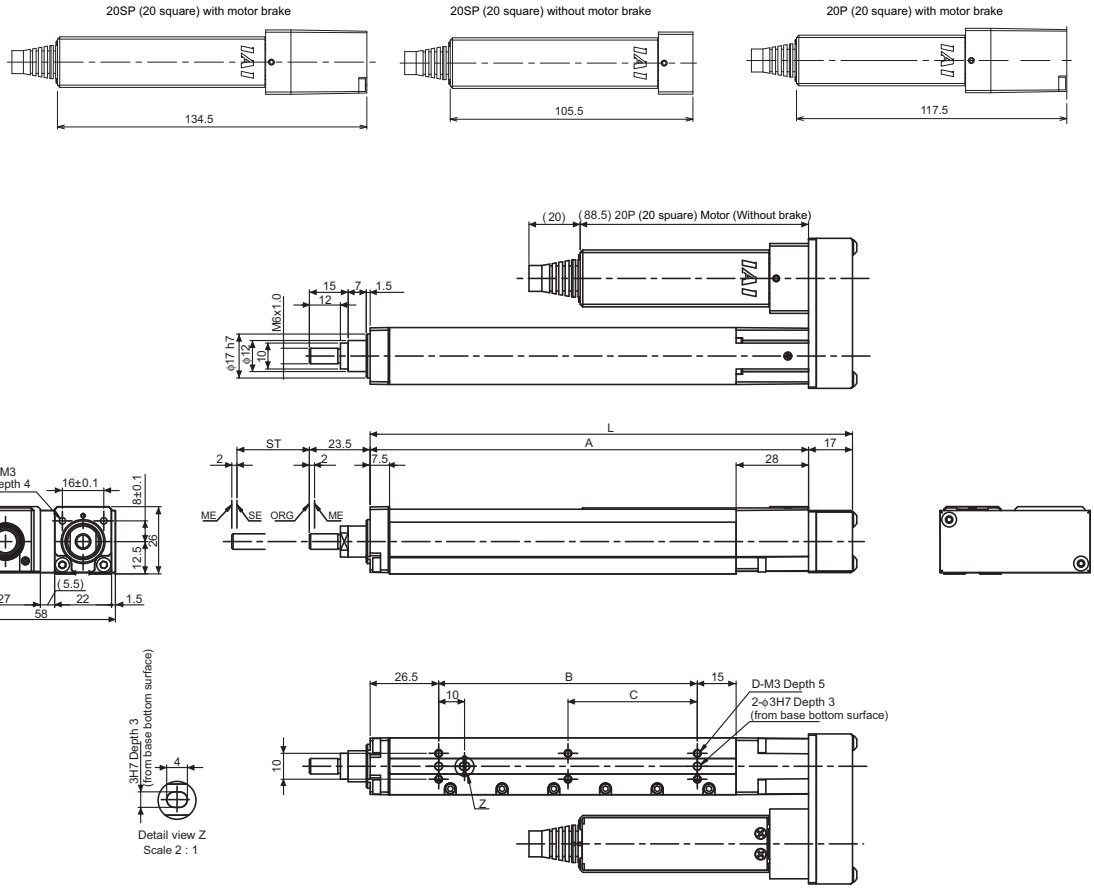


ORG : Home
ME : Mechanical end
SE : Stroke end

ST	L 20p (20 square))		L (20sp (20 square))		A	B	C	D	Mass [kg]
	Without brake	With brake	Without brake	With brake					
25	168	212	185	229	94.5	25	0	4	0.36
50	193	237	210	254	119.5	50	0	4	0.39
75	218	262	235	279	144.5	75	0	4	0.42
100	243	287	260	304	169.5	100	50	6	0.45
125	268	312	285	329	194.5	125	62.5	6	0.48
150	293	337	310	354	219.5	150	75	6	0.51

*For those with brake , the mass increases by 0.1kg.

7.3 RCP3-RA2AR, Reversing to Right (Lead Screw, Ball Screw)

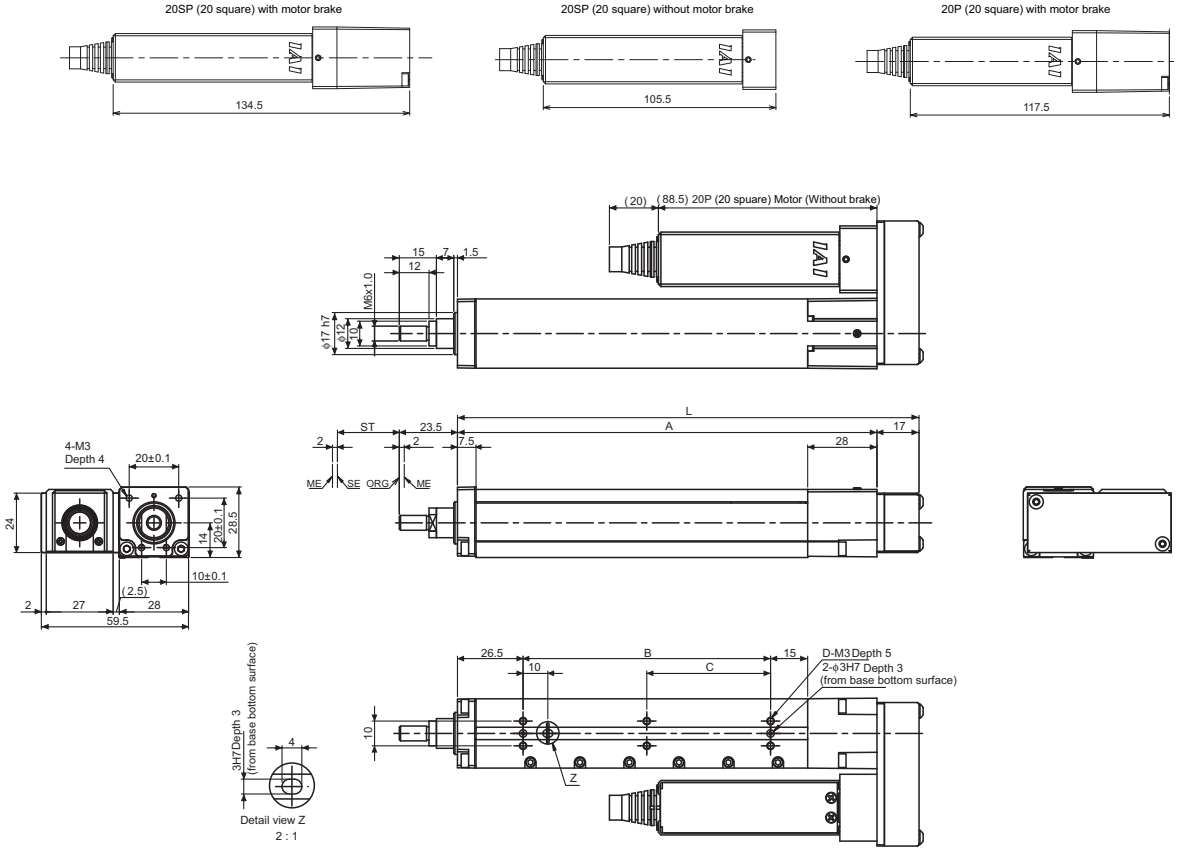


ORG : Home
ME : Mechanical end
SE : Stroke end

ST	L	A	B	C	D	Mass [kg]
25	111.5	94.5	25	0	4	0.34
50	136.5	119.5	50	0	4	0.36
75	161.5	144.5	75	0	4	0.39
100	186.5	169.5	100	50	6	0.4

*For those with brake , the mass increases by 0.1kg.

7.4 RCP3-RA2BR, Reversing to Right (Lead Screw, Ball Screw)



ST	L	A	B	C	D	Mass [kg]
25	111.5	94.5	25	0	4	0.38
50	136.5	119.5	50	0	4	0.41
75	161.5	144.5	75	0	4	0.4
100	186.5	169.5	100	50	6	0.47
125	211.5	194.5	125	62.5	6	0.5
150	236.5	219.5	150	75	6	0.53

ORG : Home
ME : Mechanical end
SE : Stroke end

*For those with brake , the mass increases by 0.1kg.

8. Warranty

8.1 Warranty Period

One of the following periods, whichever is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to the specified location

8.2 Scope of the 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 operating 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.

8.3 Honoring the Warranty

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

8.4 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.

8.5 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 operating manual.

8.6 Other Items Excluded from Warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:
   [1] Guidance for installation/adjustment and witnessing of test operation
   [2] Maintenance and inspection
   [3] Technical guidance and education on operating/wiring methods, etc.
   [4] Technical guidance and education on programming and other items related to programs

Change History

Revision Date	Description of Revision	
May 2009	First edition	
April 2010	Second edition	A page for CE Marking added
July 2011	Third edition	Added “Handing Precautions” on page 8. Contents changed in 4. Transportation in pages 9 to 10 Added ball screw type for the external dimensions on pages 13 to 16 Added ball screw type and 20SP (20 square) motor specification to How to Read Model Number on page 21 Added ball screw type and 20SP (20 square) motor specification to the specification on pages 22 to 23 Added ball screw type and 20SP (20 square) motor specification to the maximum loading capacity on pages 22 to 23 Added the maximum speed and loading mass graphs of ball screw type on pages 26 to 27 Added ball screw grease to the grease used on page 43 Added the warranty period of ball screw type to Warranty on page 50 Contents changed in 14. Warranty in pages 50 to 51
March 2012	Fourth edition	Contents added and changed in Safety Guide in pages 1 to 7 Note “Make sure to attach the actuator properly by following this operation manual.” added in Caution in Handling in page 8 Weight added to appearance drawing on pages 13 to 16 Warning notes added such as in case the grease got into your eye, immediately go to see the doctor for an. Warranty in pages 50 to 51
June 2013	Fifth edition	Revised overall
December 2013	Sixth edition	Note corrected Page 13 PCON-CA P1 → P3

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