



ROBO Cylinder RCA2 Actuator Table Type

Operating Manual

Fourteenth Edition

Motor unit types:

Motor coupling types: [Slim Small ROBO Cylinder] TA4C
TA5C, TA6C, TA7C

Motor reversing types: [Slim Small ROBO Cylinder] TA4R
TA5R, TA6R, TA7R

[Slim Small ROBO Cylinders] Short types:

Compact types: TCA3NA, TCA4NA, TCA3N, TCA4N

Wide types: TWA3NA, TWA4NA, TWA3N, TWA4N

Flat types: TFA3NA, TFA4NA, TFA3N, TFA4N

Please Read Before Use

Thank you for purchasing our product.

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

Before operation, read this manual carefully and fully understand it to operate this product safely. The enclosed DVD in this product package includes the 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.
- Using or copying all or part of this Operating Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

RC **ROBO** **CYLINDER**

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RC **ROBO** **CYLINDER**

Safety Guide

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

Safety Precautions for Our Products

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

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

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

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





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

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

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

Alert Indication

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

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

Handling Precautions

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

In case it is not secured, it may cause a drop in performance or malfunction of the product.

2. Do not conduct any treatment or operation that is not stated in this instruction manual.

3. It is recommended to apply our products for the wiring between the actuator and the controller.

4. Do not attempt to establish the settings for the speed and acceleration/deceleration above the maximum specification.

An operation with speed and acceleration/deceleration beyond the allowable range may cause an abnormal noise, vibration, malfunction or shortened life. If acceleration/deceleration higher than the rated value is set, creeping phenomenon or coupling slide may occur.

5. The Allowable Moment Must be Within the Tolerance.

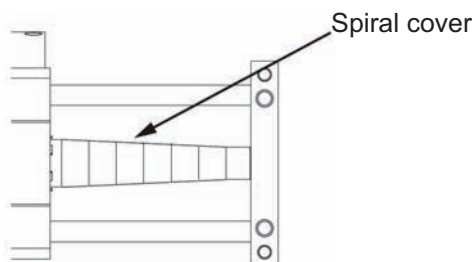
The allowable moment must be within the tolerance value. If a load exceeding the allowable moment is applied, the life may be shortened. If an extreme load is applied, flaking may occur.

6. Oil Film of Grease May Run Out If Short-distance Reciprocating Operation is Performed.

Grease film may run out if the actuator is moved back and forth continuously over a distance of 30mm or less. As a guide, perform a back-and-forth operation five times or so over a distance of 50mm or more after a back-and-forth operation over such short distance has been repeated 5,000 to 10,000 times. (For ROBO Cylinder with its stroke less than 50mm, have a back-and-forth operation with using the whole distance of the stroke length.) This will restore oil film.

7. Handling of Spiral Cover

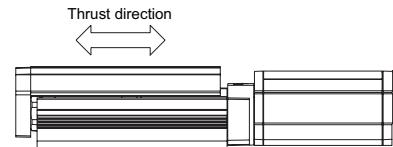
The spiral covers used on short types (TC3N, TC4N, TW3N, TW4N, TF3N, TF4N) are each made of a thin sheet rolled into a spiral form. Exercise caution not to bump the spiral sheet or press it strongly with fingers, because the spiral sheet may deform.



8. Be careful not to subject the actuator to an external force or an impact load in the axial or thrust direction in excess of allowable capacity.

Subjecting the actuator to an external force or an impact load at levels above the allowable capacity may damage or destroy internal components.

Model	Allowable external force in thrust direction [N (kgf)]
TA5	160 (16.3)
TA6	220 (22.4)
TA7	220 (22.4)



9. Sometimes the table may not move even when an external force is applied. In this case, do not forcibly move the table, but use the PC software or teaching pendant to jog the slider.

actuator damage may occur such as broken nut.

For lead screw type in Short Type, move the actuator following the instruction below;


- Low lead type table would not move with an external force applied to it.
Use the PC software or teaching pendant to have JOG operation to move the table.
Or, stick a tool such as a screwdriver into the slit on the end of the shaft and turn the shaft.
- For Mid Lead and High Lead Types, use the PC software or teaching pendant and have JOG operation as much as possible to move the table.

For the types equipped with no brake, move the table by turning on the slit on the shaft end with the position adjustment knob (option) or a screwdriver. [Refer to the 4.3 “How to Move Table by Hand”]

For the brake-equipped types, there is no slit on the shaft. Connect the controller and move the table.

10. For the brake-equipped (option), there is a risk of the body temperature getting high during operation.

The surface temperature on the aluminum frame rises in approximately 30degC to the ambient temperature.

 Caution: Be careful not to get burnt when touching the actuator.

11. If it is necessary to change the orientation of cable ejection of the connector after the product has already been delivered, please contact IAI.

In case that you change the orientation of cable ejection by your own, we will not be able to guarantee the product as there is a concern of malfunction due to a reason such as pinching of wire inside the motor unit.

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

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

International Standards Compliances

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

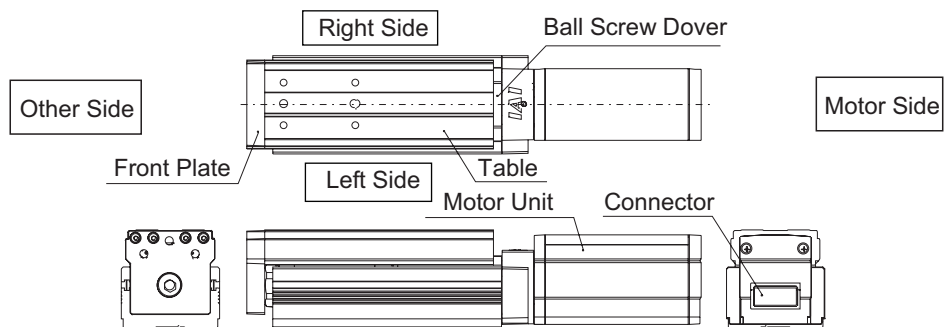
RoHS Directive	CE Marking
<input type="checkbox"/>	<input type="checkbox"/>

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.

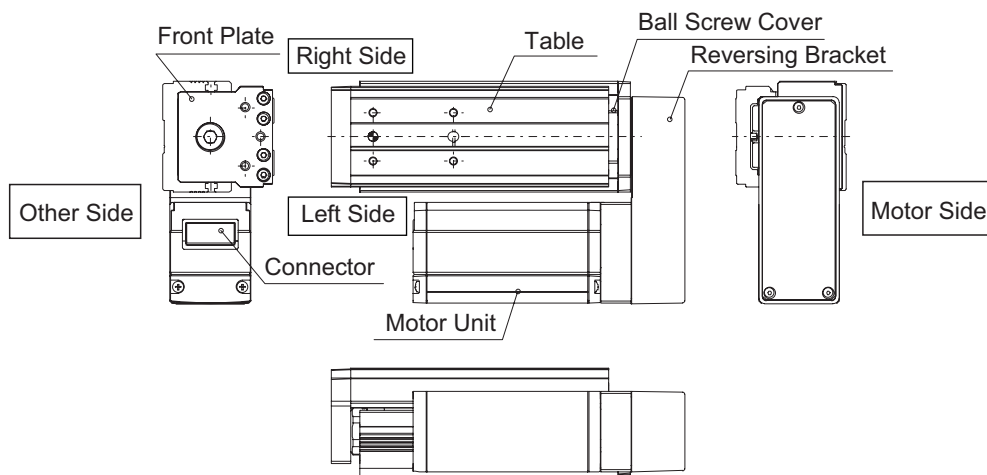
1. Motor Unit Types

1.1 Motor coupling types: RCA2-TA4C, TA5C, TA6C, TA7C



(Note) The connector position shown above is for when cable exit direction is not changed.

1.2 Motor reversing types: RCA2-TA4R, TA5R, TA6R, TA7R (AC Servo Motor)



Caution: When the table has moved away from its home position, there is a gap between the table and the motor unit. Keep hands clear of gap.

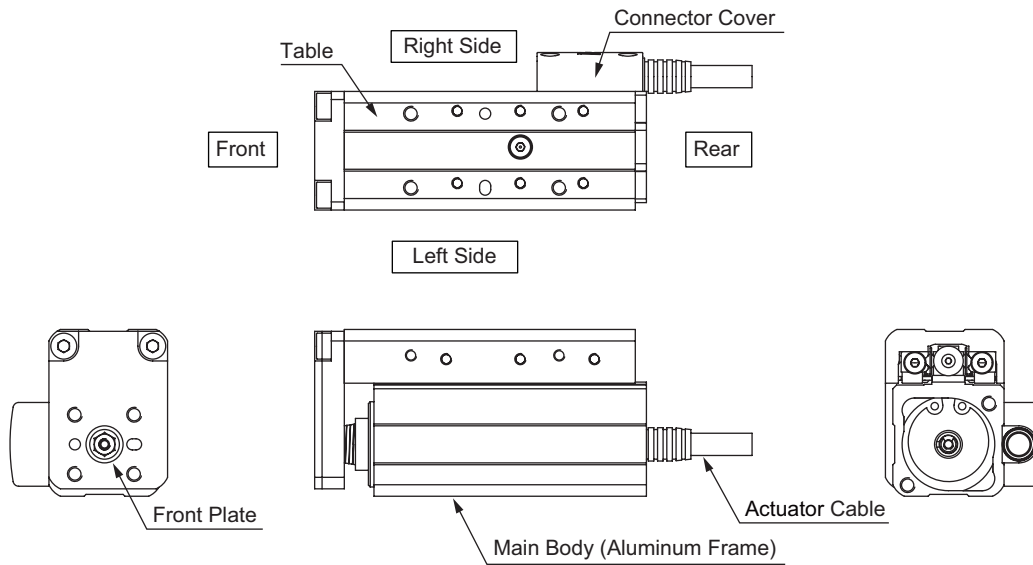
2. Short Types

2.1 Compact types:

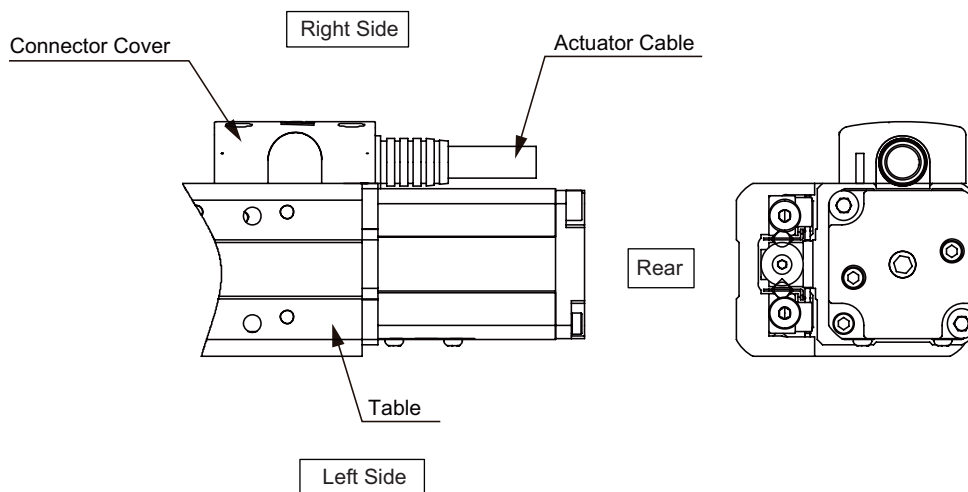
RCA2-TCA3NA, TCA3N (Lead screw, Ball screw)

TCA4NA, TCA4N (Lead screw, Ball screw)

• w/o Brake



• With Brake

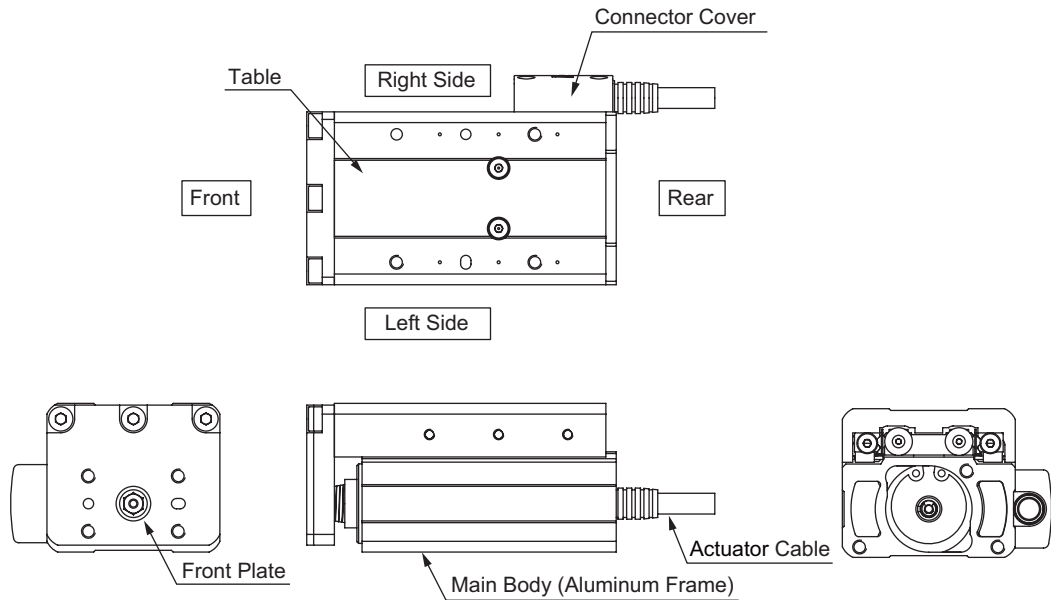


2.2 Wide types:

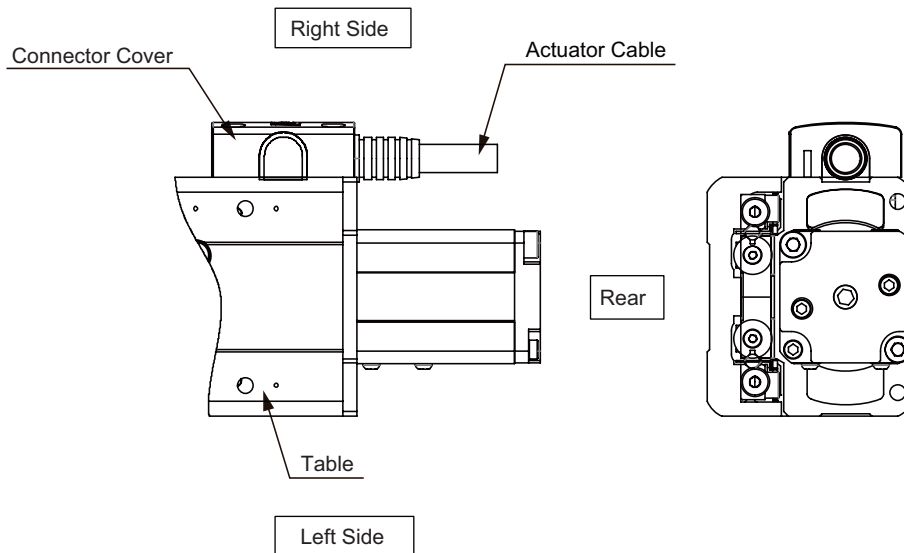
RCA2-TWA3NA, TWA3N (Lead screw, Ball screw)

TWA4NA, TWA4N (Lead screw, Ball screw)

- w/o Brake



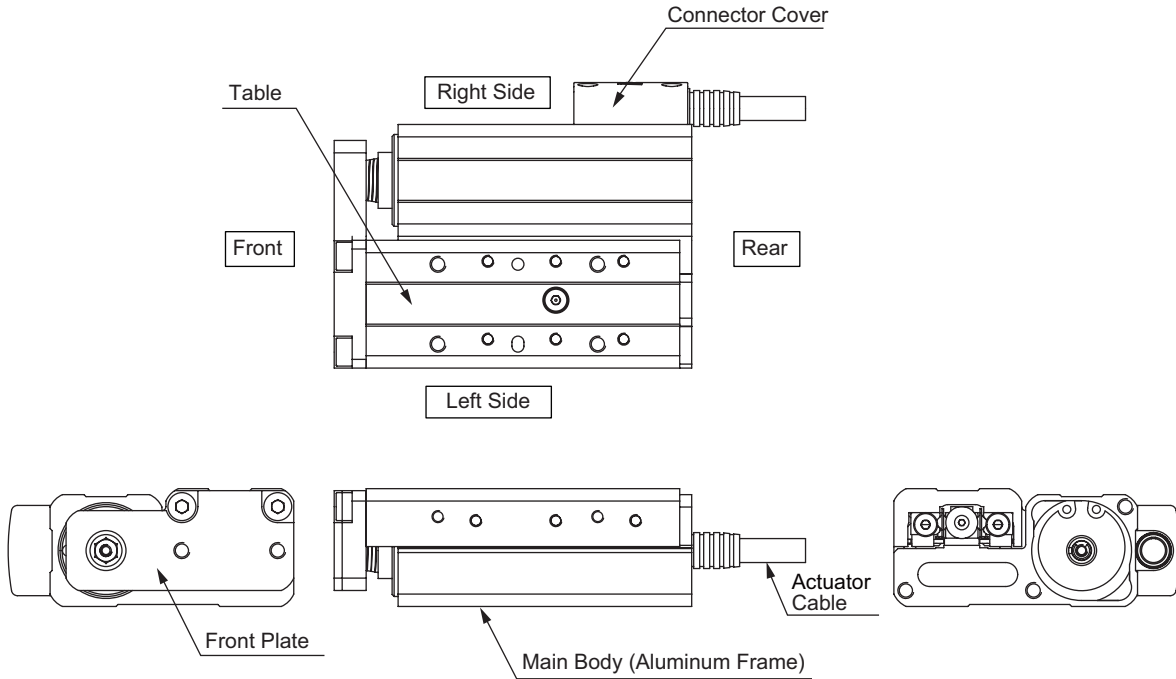
- With Brake



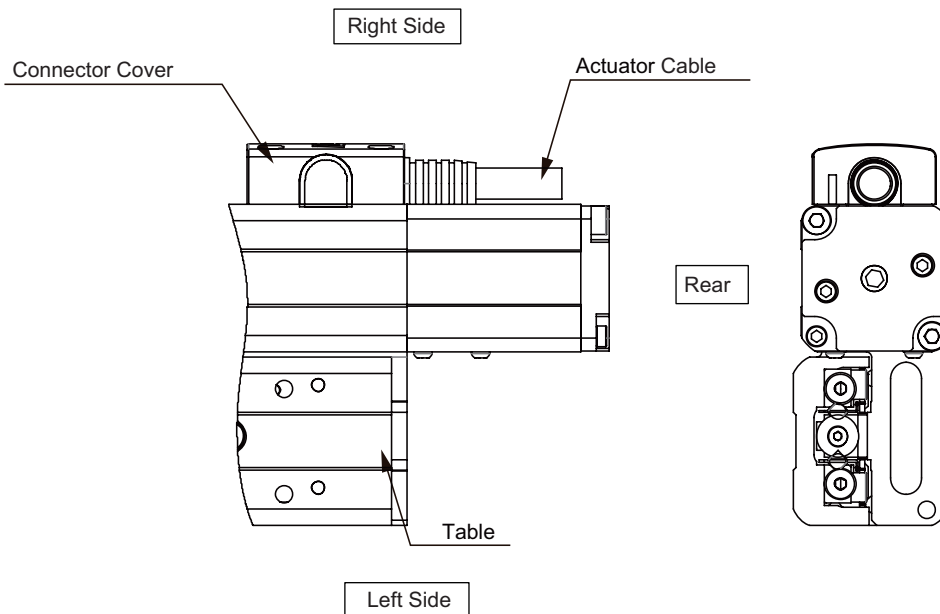
2.3 Flat types

**RCA2-TFA3NA, TFA3N (Lead screw, Ball screw),
TFA4NA, TFA4N (Lead screw, Ball screw)**

• w/o Brake



• With Brake



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	Home Mark Sticker		1	Supplied with TA4C, TA5C, TA6C, TA7C, TA4R, TA5R, TA6R, and TA7R
4	First Step Guide		1	
5	Operating Manual (DVD)		1	
6	Safety Guide		1	

Note1 The motor • encoder cables differ between the standard model and robot cable.
[Refer to 1.5 "Motor • Encoder Cables."]

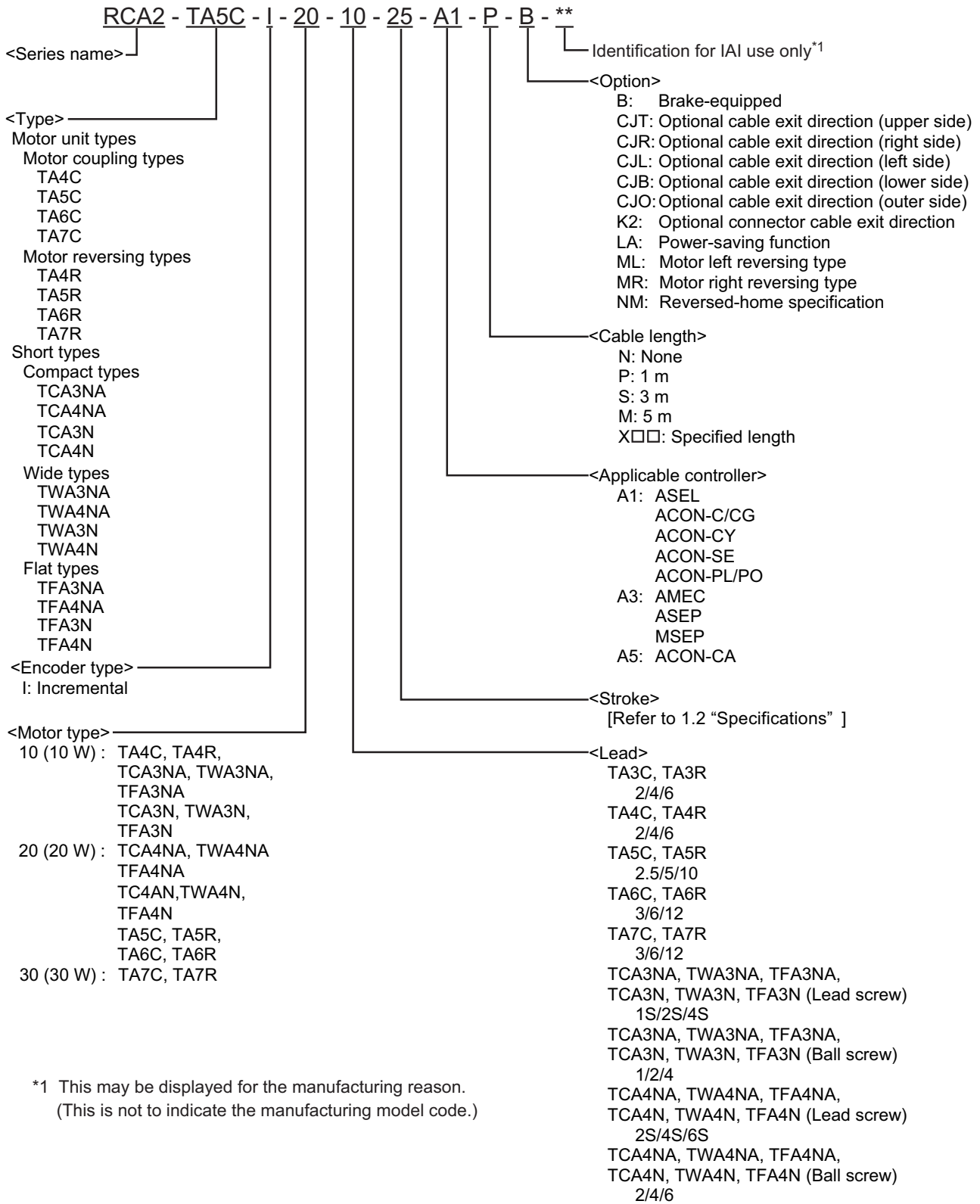
1.1.2 Operating Manuals for the Controllers Related to this Product

No.	Name	Control No.
1	Operating Manual for ASEL Controller	ME0165
2	Operating Manual for ACON-C/CG/CF Controller	ME0176
3	Operating Manual for ACON-CY Controller	ME0167
4	Operating Manual for ACON-SE Controller	ME0171
5	Operating Manual for ACON-PL/PO Controller	ME0166
6	Operating Manual for MEC Controller	ME0245
7	Operating Manual for PSEP/ASEP/DSEP Controller	ME0267
8	Operating Manual for MSEP Controller	ME0299
9	Operating Manual for ROBONET	ME0208
10	Operating Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
11	Operating Manual for Software RCM-101-MW/RCM-101-USB	ME0155
12	Operating Manual for MEC PC Software	ME0248
13	Operating Manual for Teaching Pendant SEL-T/TD	ME0183
14	Operating Manual for Teaching Pendant CON-T/TG	ME0178
15	Operating Manual for Touch Panel Teaching Pendant CON-PT/PD/PG	ME 0227
16	Operating Manual for Touch Panel Teaching CON-PTA/PDA/PGA	ME0295
17	Operating Manual for Dedicated ASEP/PSEP Touch Panel Teaching SEP-PT	ME0217
18	Operating Manual for Simple Teaching Pendant RCM-E	ME0174
19	Operating Manual for Data Setter RCM-P	ME0175
20	Operating Manual for Touch Panel Display RCM-PM-01	ME0182

1.1.3 How to Read the Model Nameplate



1.1.4 How to Read Model



1.2 Specifications

1.2.1 Speed

Speed limits (Unit: mm/s)

Model name	Motor type	Lead [mm]	Minimum Speed	Stroke [mm]								
				20	30	40	50	60	70	80	90	100
TA4	10W	2	2.5	100								
		4	5	200								
		6	7.5	300								

(Note) The maximum speed may not be reached depending on the acceleration/deceleration setting.

Speed limits (Unit: mm/s)

Model name	Motor type	Lead [mm]	Minimum Speed	Stroke [mm]			
				25	50	75	100
TA5	20W	2.5	3.12	125			
		5	6.25	250			
		10	12.5	465 <400>			

(Note) The maximum speed may not be reached depending on the acceleration/deceleration setting.
Values in < > are for when mounted vertically.

Speed limits (Unit: mm/s)

Model name	Motor type	Lead [mm]	Minimum Speed	Stroke [mm]					
				25	50	75	100	125	150
TA6	20W	3	3.75	150					
		6	7.5	300					
		12	15	560 <500>					

(Note) The maximum speed may not be reached depending on the acceleration/deceleration setting.
Values in < > are for when mounted vertically.

Speed limits (Unit: mm/s)


Model name	Motor type	Lead [mm]	Minimum Speed	Stroke [mm]						
				25	50	75	100	125	150	175
TA7	30W	3	3.75	150						
		6	7.5	300						
		12	15	600 <580>						

(Note) The maximum speed may not be reached depending on the acceleration/deceleration setting.
Values in < > are for when mounted vertically.

Speed limits (Unit: mm/s)

Model name	Motor type	Lead [mm]	Minimum Speed	Stroke [mm]	
				30	50
TCA3NA (Lead screw)	10W	1	0.95	50	-
		2	1.90	100	-
		4	3.81	200	-
TCA3NA (Ball screw)	10W	1	0.95	50	50
		2	1.90	100	100
		4	3.81	200	200
TCA4NA (Lead screw)	20W	2	1.90	100	-
		4	3.81	200	-
		6	5.72	220	-
TCA4NA (Ball screw)	20W	2	1.90	100	100
		4	3.81	200	200
		6	5.72	270 <220>	300
TWA3NA (Lead screw)	10W	1	0.95	50	-
		2	1.90	100	-
		4	3.81	200	-
TWA3NA (Ball screw)	10W	1	0.95	50	50
		2	1.90	100	100
		4	3.81	200	200
TWA4NA (Lead screw)	20W	2	1.90	100	-
		4	3.81	200	-
		6	5.72	220	-
TWA4NA (Ball screw)	20W	2	1.90	100	100
		4	3.81	200	200
		6	5.72	270 <220>	300
TFA3NA (Lead screw)	10W	1	0.95	50	-
		2	1.90	100	-
		4	3.81	200	-
TFA3NA (Ball screw)	10W	1	0.95	50	50
		2	1.90	100	100
		4	3.81	200	200
TFA4NA (Lead screw)	20W	2	1.90	100	-
		4	3.81	200	-
		6	5.72	220	-
TFA4NA (Ball screw)	20W	2	1.90	100	100
		4	3.81	200	200
		6	5.72	270 <220>	300

(Note) Values in < > are for when mounted vertically.

 Note : Do not set a speed or acceleration/deceleration exceeding the applicable rating. Doing so may result in vibration, failure or shorter life.
Setting the acceleration/deceleration exceeding the applicable rating may also cause creep.

Speed limits (Unit: mm/s)

Model name	Motor type	Lead [mm]	Minimum Speed	Stroke [mm]
				30
TCA3N TC3N (Option BG) (Lead screw)	10W	1	0.95	50
		2	1.90	100
		4	3.81	200
TCA3N (Ball screw)	10W	1	0.95	50
		2	1.90	100
		4	3.81	200
TCA4N TC4N (Option BG) (Lead screw)	20W	2	1.90	100
		4	3.81	200
		6	5.72	220
TCA4N TC4N (Option BG) (Ball screw)	20W	2	1.90	100
		4	3.81	200
		6	5.72	270 <220>
TWA3N TW3N (Option BG) (Lead screw)	10W	1	0.95	50
		2	1.90	100
		4	3.81	200
TWA3N (Ball screw)	10W	1	0.95	50
		2	1.90	100
		4	3.81	200
TWA4N TW4N (Option BG) (Lead screw)	20W	2	1.90	100
		4	3.81	200
		6	5.72	220
TWA4N TW4N (Option BG) (Ball screw)	20W	2	1.90	100
		4	3.81	200
		6	5.72	270 <220>
TFA3N TF3N (Option BG) (Lead screw)	10W	1	0.95	50
		2	1.90	100
		4	3.81	200
TFA3N (Ball screw)	10W	1	0.95	50
		2	1.90	100
		4	3.81	200
TFA4N TF4N (Option BG) (Lead screw)	20W	2	1.90	100
		4	3.81	200
		6	5.72	220
TFA4N TF4N (Option BG) (Ball screw)	20W	2	1.90	100
		4	3.81	200
		6	5.72	270 <220>

(Note) Values in < > are for when mounted vertically.

⚠ Note : Do not set a speed or acceleration/deceleration exceeding the applicable rating. Doing so may result in vibration, failure or shorter life.
Setting the acceleration/deceleration exceeding the applicable rating may also cause creep.

1.2.2 Acceleration and load capacity

Model name	Motor type	Lead [mm]	Rated acceleration [G]		Load capacity [kg]	Rated thrust [N]
TA4	10W	2	Horizontal	0.2	3	85
			Vertical	0.2	1.5	
		4	Horizontal	0.3	2	43
			Vertical	0.2	1	
		6	Horizontal	0.3	1	28
			Vertical	0.2	0.5	
TA5	20W	2.5	Horizontal	0.2	5	137
			Vertical	0.2	3	
		5	Horizontal	0.3	3.5	68
			Vertical	0.2	2	
		10	Horizontal	0.3	2	34
			Vertical	0.2	1	
TA6	20W	3	Horizontal	0.2	6	68
			Vertical	0.2	3	
		6	Horizontal	0.3	4	34
			Vertical	0.2	1.5	
		12	Horizontal	0.3	2	17
			Vertical	0.2	0.5	
TA7	30W	3	Horizontal	0.2	8	105
			Vertical	0.2	4	
		6	Horizontal	0.3	6	53
			Vertical	0.2	2.5	
		12	Horizontal	0.3	4	26
			Vertical	0.2	1	

Model name	Motor type	Lead [mm]	Rated acceleration [G]		Load capacity [kg]	Rated thrust [N]
TCA3NA TCA3N TC3N (Option BG) (Lead screw)	10W	1	Horizontal	0.2	1	100.5
			Vertical	0.2	0.5	
		2	Horizontal	0.2	0.5	50.3
			Vertical	0.2	0.25	
		4	Horizontal	0.2	0.25	25.1
			Vertical	0.2	0.125	
TCA3NA TCA3N (Ball screw)	10W	1	Horizontal	0.2	3	170.9
			Vertical	0.2	1	
		2	Horizontal	0.3	1.5	85.5
			Vertical	0.2	0.5	
		4	Horizontal	0.3	0.75	42.7
			Vertical	0.2	0.25	
TCA4NA TCA4N TC4N (Option BG) (Lead screw)	20W	2	Horizontal	0.2	1	59.7
			Vertical	0.2	0.5	
		4	Horizontal	0.2	0.5	29.8
			Vertical	0.2	0.25	
		6	Horizontal	0.2	0.25	19.9
			Vertical	0.2	0.125	
TCA4NA TCA4N TC4N (Option BG) (Ball screw)	20W	2	Horizontal	0.2	6	101.5
			Vertical	0.2	1.5	
		4	Horizontal	0.3	3	50.7
			Vertical	0.2	0.75	
		6	Horizontal	0.3	2	33.8
			Vertical	0.2	0.5	
TWA3NA TWA3N TW3N (Option BG) (Lead screw)	10W	1	Horizontal	0.2	1	100.5
			Vertical	0.2	0.5	
		2	Horizontal	0.2	0.5	50.3
			Vertical	0.2	0.25	
		4	Horizontal	0.2	0.25	25.1
			Vertical	0.2	0.125	
TWA3NA TWA3N (Ball screw)	10W	1	Horizontal	0.2	3	170.9
			Vertical	0.2	1	
		2	Horizontal	0.3	1.5	85.5
			Vertical	0.2	0.5	
		4	Horizontal	0.3	0.75	42.7
			Vertical	0.2	0.25	

Model name	Motor type	Lead [mm]	Rated acceleration [G]		Load capacity [kg]	Rated thrust [N]
TWA4NA TWA4N TW4N (Option BG) (Lead screw)	20W	2	Horizontal	0.2	1	59.7
			Vertical	0.2	0.5	
		4	Horizontal	0.2	0.5	29.8
			Vertical	0.2	0.25	
		6	Horizontal	0.2	0.25	19.9
			Vertical	0.2	0.125	
TWA4NA TWA4N TW4N (Option BG) (Ball screw)	20W	2	Horizontal	0.2	6	101.5
			Vertical	0.2	1.5	
		4	Horizontal	0.3	3	50.7
			Vertical	0.2	0.75	
		6	Horizontal	0.3	2	33.8
			Vertical	0.2	0.5	
TFA3NA TFA3N TF3N (Option BG) (Lead screw)	10W	1	Horizontal	0.2	1	100.5
			Vertical	0.2	0.5	
		2	Horizontal	0.2	0.5	50.3
			Vertical	0.2	0.25	
		4	Horizontal	0.2	0.25	25.1
			Vertical	0.2	0.125	
TFA3NA TFA3N (Ball screw)	10W	1	Horizontal	0.2	3	170.9
			Vertical	0.2	1	
		2	Horizontal	0.3	1.5	85.5
			Vertical	0.2	0.5	
		4	Horizontal	0.3	0.75	42.7
			Vertical	0.2	0.25	
TFA4NA TFA4N TF4N (Option BG) (Lead screw)	20W	2	Horizontal	0.2	1	59.7
			Vertical	0.2	0.5	
		4	Horizontal	0.2	0.5	29.8
			Vertical	0.2	0.25	
		6	Horizontal	0.2	0.25	19.9
			Vertical	0.2	0.125	
TFA4NA TFA4N TF4N (Option BG) (Ball screw)	20W	2	Horizontal	0.2	6	101.5
			Vertical	0.2	1.5	
		4	Horizontal	0.3	3	50.7
			Vertical	0.2	0.75	
		6	Horizontal	0.3	2	33.8
			Vertical	0.2	0.5	

1.2.3 Driving System and Position Detector

Model name	Motor type	Lead [mm]	No. of encoder pulses	Drive system							
				Type	Diameter	Accuracy					
TA4	10W	2	800	Ball screw Rolled	φ6mm	C10					
		4									
		6									
TA5	20W	2.5		800	Ball screw Rolled	φ8mm	C10				
		5									
		10									
TA6	20W	3			800	Ball screw Rolled	φ10mm	C10			
		6									
		12									
TA7	20W	3				800	Ball screw Rolled	φ10mm	C10		
		6									
		12									
TCA3NA TCA3N TC3N (Option BG) (Lead screw)	10W	1	1048				Lead screw Rolled	φ4mm	C10		
		2									
		4									
TCA3NA TCA3N (Ball screw)	10W	1		1048			Ball screw Rolled	φ4mm	C10		
		2									
		4									
TCA4NA TCA4N TC4N (Option BG) (Lead screw)	20W	2			1048		Lead screw Rolled	φ6mm	C10		
		4									
		6									
TCA4NA TCA4N TC4N (Option BG) (Ball screw)	20W	2				1048	Ball screw Rolled	φ6mm	C10		
		4									
		6									
TWA3NA TWA3N TW3N (Option BG) (Lead screw)	10W	1					1048	Lead screw Rolled	φ4mm	C10	
		2									
		4									
TWA3NA TWA3N (Ball screw)	10W	1						1048	Ball screw Rolled	φ4mm	C10
		2									
		4									

Model name	Motor type	Lead [mm]	No. of encoder pulses	Drive system		
				Type	Diameter	Accuracy
TWA4NA TWA4N TW4N (Option BG) (Lead screw)	20W	2	1048	Lead screw Rolled	φ6mm	C10
		4				
		6				
TWA4NA TWA4N TW4N (Option BG) (Ball screw)	20W	2		Ball screw Rolled	φ6mm	C10
		4				
		6				
TFA3NA TFA3N TF3N (Option BG) (Lead screw)	10W	1		Lead screw Rolled	φ4mm	C10
		2				
		4				
TFA3NA TFA3N (Ball screw)	10W	1		Ball screw Rolled	φ4mm	C10
		2				
		4				
TFA4NA TFA4N TF4N (Option BG) (Lead screw)	20W	2	Lead screw Rolled	φ6mm	C10	
		4				
		6				
TFA4NA TFA4N TF4N (Option BG) (Ball screw)	20W	2	Ball screw Rolled	φ6mm	C10	
		4				
		6				

1.2.4 Common

Item	Specifications	
	Lead screw	Ball screw
Positioning repeatability [mm] (Note1)	±0.05	±0.02
Lost motion [mm] (Note1)	0.1 or less	0.3 or less
Base	Other than TA5C, TA5R, TA6C, TA6R, TA7C, TA7R	TA5C, TA5R, TA6C, TA6R, TA7C, TA7R
	Material : Aluminum with white anodizing treatment	Material : Aluminum with special anodizing 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 Duty in Continuous Operation

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

The duty may differ depending on the load ratio and the acceleration/deceleration time ratio.
[Refer to 4.1 “Duty in Continuous Operation”]

1.2.6 Allowable Moment

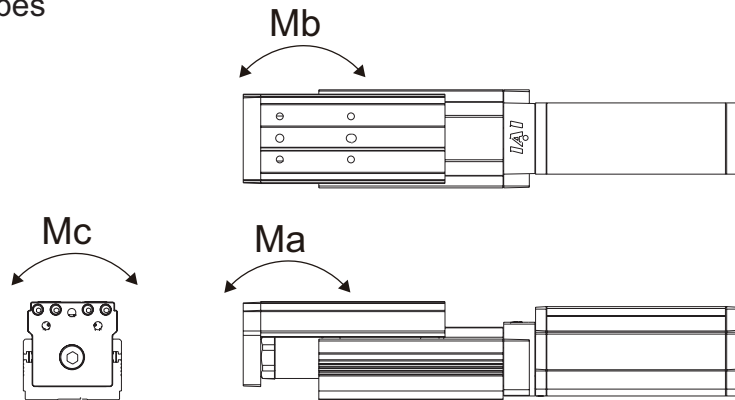
Motor unit type	Dynamic Allowable Moment [N•m (kgf•m)]			Static Allowable Moment [N•m (kgf•m)]			Allowable overhang load L
	Ma	Mb	Mc	Ma	Mb	Mc	
TA4	4.98 (0.51)	7.11 (0.73)	9.68 (0.99)	17.2 (1.8)	24.5 (2.5)	33.3 (3.4)	within the ranges of load moments
TA5	7.56 (0.77)	10.8 (1.10)	16.6 (1.69)	25.5 (2.60)	36.5 (3.72)	56.1 (5.72)	
TA6	8.52 (0.87)	12.2 (1.24)	21.5 (2.19)	29.4 (3.00)	42.0 (4.29)	74.1 (7.56)	
TA7	11.6 (1.18)	16.6 (1.69)	33.7 (3.44)	42.6 (4.35)	60.8 (6.20)	123.2 (12.57)	

Short type	Dynamic Allowable Moment [N•m (kgf•m)]			Static Allowable Moment [N•m (kgf•m)]			Allowable overhang load L [mm]
	Ma	Mb	Mc	Ma	Mb	Mc	
TCA3NA, TCA3N (Lead screw) TFA3NA, TFA3N (Lead screw) TCA3NA, TCA3N (Ball screw) TFA3NA, TFA3N (Ball screw) TCA4NA, TCA4N (Lead screw) TFA4NA, TFA4N (Lead screw) TCA4NA, TCA4N (Ball screw) TFA4NA, TFA43N (Ball screw)	9.9 (1.01)	9.9 (1.01)	3.3 (0.34)	14.1 (1.44)	14.1 (1.44)	6.7 (0.68)	Ma direction: 100 or less Mb or Mc direction: 100 or less
TWA3NA, TWA3N (Lead screw) TWA3NA, TWA3N (Ball screw)	9.9 (1.01)	9.9 (1.01)	9.4 (0.96)	14.1 (1.44)	14.1 (1.44)	19.1 (1.95)	
TWA4NA, TWA4N (Lead screw) TWA4NA, TWA4N (Ball screw)	9.9 (1.01)	9.9 (1.01)	12.2 (1.24)	14.1 (1.44)	14.1 (1.44)	24.8 (2.53)	

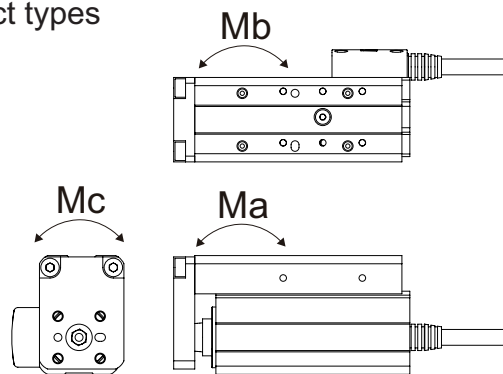
Short type	Dynamic Allowable Moment [N•m (kgf•m)]			Static Allowable Moment [N•m (kgf•m)]			Allowable overhang load L [mm]	
	Ma	Mb	Mc	Ma	Mb	Mc		
Ball Guide Type (Option: Model Code BG)	TC3N (Lead screw)	0.86 (0.087)	0.68 (0.069)	0.92 (0.094)	4.6 (0.47)	3.8 (0.39)	6.4 (0.65)	Ma direction: 100 or less Mb or Mc direction: 100 or less
	TF3N (Lead screw)	0.75 (0.077)	0.55 (0.056)	0.88 (0.09)	4.6 (0.47)	3.8 (0.39)	6.4 (0.65)	
	TW3N (Lead screw)	1.74 (0.18)	1.50 (0.15)	2.85 (0.29)	8.8 (0.90)	7.4 (0.76)	23.2 (2.37)	
	TC4N (Lead screw) TC4N (Ball screw)	1.65 (0.17)	1.28 (0.13)	1.77 (0.18)	10.5 (1.07)	8.8 (0.90)	14.9 (1.52)	
	TF4N (Lead screw) TF4N (Ball screw)	1.42 (0.14)	1.07 (0.11)	1.69 (0.17)	10.5 (1.07)	8.8 (0.90)	14.9 (1.52)	
	TW4N (Lead screw) TW4N (Ball screw)	3.46 (0.36)	2.93 (0.30)	5.63 (0.57)	18.7 (1.91)	15.7 (1.60)	44.3 (4.52)	

Load moment direction

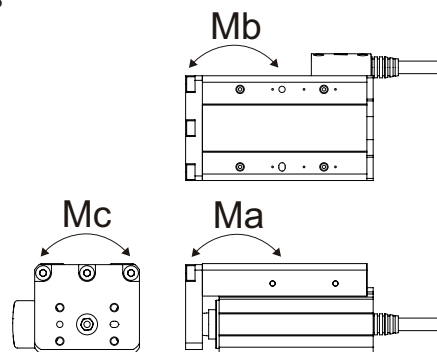
- Motor coupling types



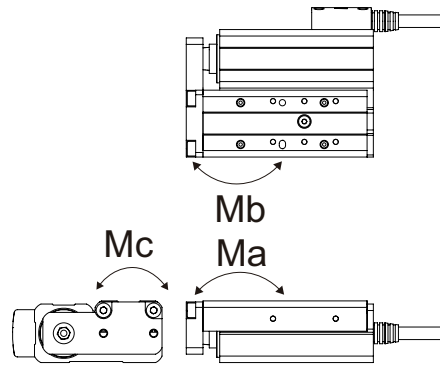
- Short compact types



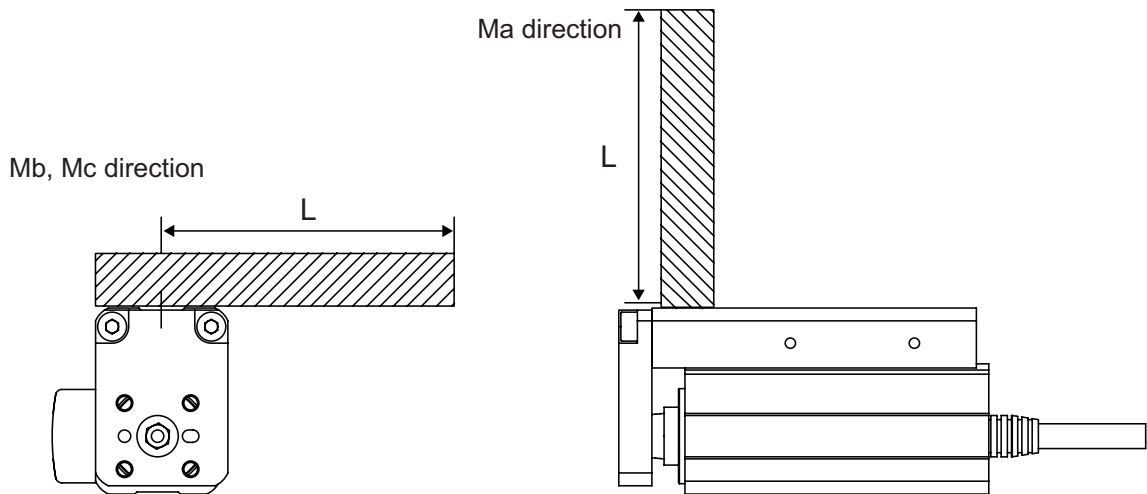
- Short wide types



- Short flat types

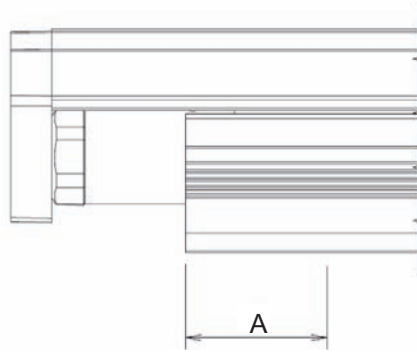


Overhang load length direction



Calculate with a consideration of the working point below when calculating the moment in Ma direction. Please note that extension length may vary depending on the stroke of a particular table type.

Motor unit types



Ma moment operating position

Model	TA4	TA5	TA6	TA7
A (mm)	30.0	34.5	37	42

⚠ Caution: An operation beyond the allowable moment and overhang load length would not only generate abnormal noise and vibration, but also may shorten the life of actuator extremely.

1.3 Operation

1.3.1 Operational Conditions for Positioning Operation

By following the procedures below, check whether the operation is available.

[1] Usage conditions

Check the operational conditions [1] to [6].

[1] Load installation orientation (horizontal, upright, vertical)

[2] Stroke L (mm)

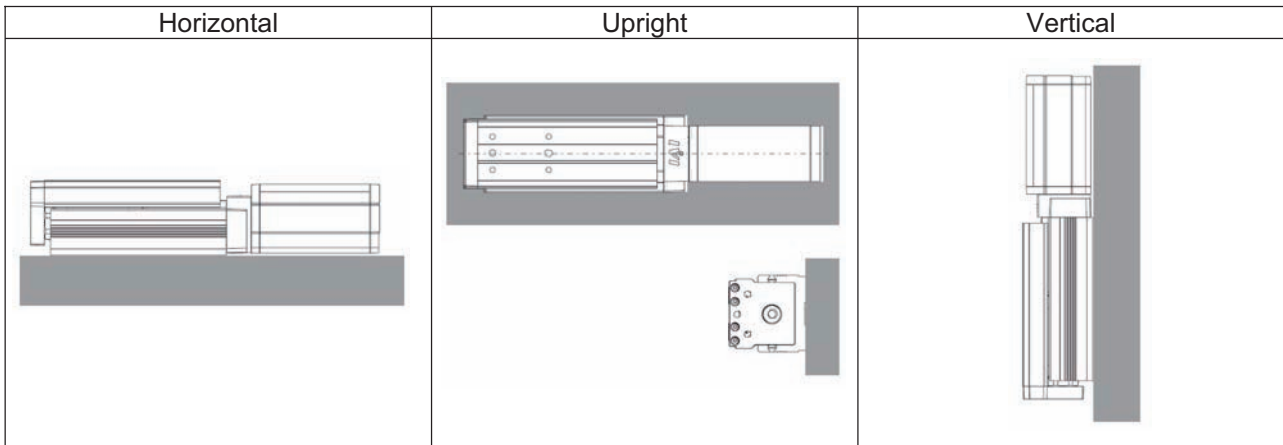
[3] Maximum speed V (mm/s)

[4] Acceleration a (G)

[5] Loading capacity W (kg)

[6] Overhang T (mm): Distance from the end face of the table to the center of gravity of the load

Installation orientation Figure 1



[2] Stroke, maximum speed, acceleration

Check whether the operation is available by [2] stroke, [3] maximum speed and [4] acceleration.

Table 1

Installation orientation	Model	Lead [mm]	Acceleration [G]	Max speed [mm/s]	Max stroke [mm]
Horizontal	TA4	2	0.2	100	100
		4	0.3	200	
		6	0.3	300	
	TA5	2.5	0.2	125	100
		5	0.3	250	
		10	0.3	465	
	TA6	3	0.2	150	150
		6	0.3	300	
		12	0.3	600	
	TA7	3	0.2	150	200
		6	0.3	300	
		12	0.3	600	
	TCA3NA TWA3NA TFA3NA TCA3N TWA3N TFA3N TC3N (Option BG) TW3N (Option BG) TF3N (Option BG) (Lead screw)	1	0.2	50	30
		2	0.2	100	
		4	0.2	200	
	TCA3NA TWA3NA TFA3NA TCA3N TWA3N TFA3N (Ball screw)	1	0.2	50	30
		2	0.3	100	
		4	0.3	200	
	TCA4NA TWA4NA TFA4NA TCA4N TWA4N TFA4N TC4N (Option BG) TW4N (Option BG) TF4N (Option BG) (Lead screw)	2	0.2	100	30
		4	0.2	200	
		6	0.2	220	

Installation orientation	Model	Lead [mm]	Acceleration [G]	Max speed [mm/s]	Max stroke [mm]	
Horizontal	TCA4NA TWA4NA TFA4NA	2	0.2	100	30	
	TCA4N TWA4N TFA4N	4	0.3	200		
	TC4N (Option BG) TW4N (Option BG) TF4N (Option BG) (Ball screw)	6	0.3	270		
Vertical	TA4	2	0.2	100	100	
		4	0.3	200		
		6	0.3	300		
	TA5	2.5	0.2	125	100	
		5	0.2	250		
		10	0.2	400		
	TA6	3	0.2	150	150	
		6	0.2	300		
		12	0.2	500		
	TA7	3	0.2	150	200	
		6	0.2	300		
		12	0.2	580		
	Vertical	TCA3NA TWA3NA TFA3NA	1	0.2	50	30
			2	0.2	100	
		TC3N (Option BG) TW3N (Option BG) TF3N (Option BG) (Lead screw)	4	0.2	200	
TCA3NA TWA3NA TFA3NA		1	0.2	50	30	
		2	0.2	100		
		4	0.2	200		
TCA3N TWA3N TFA3N (Ball screw)		1	0.2	50	30	
		2	0.2	100		
		4	0.2	200		

Installation orientation	Model	Lead [mm]	Acceleration [G]	Max speed [mm/s]	Max stroke [mm]		
Vertical	TCA4NA TWA4NA TFA4NA TCA4N TWA4N TFA4N	2	0.2	100	30		
	TC4N (Option BG) TW4N (Option BG) TF4N (Option BG) (Lead screw)	4	0.2	200			
		6	0.2	220			
	TCA4NA TWA4NA TFA4NA TCA4N TWA4N TFA4N	2	0.2	100		30	
	TC4N (Option BG) TW4N (Option BG) TF4N (Option BG) (Ball screw)	4	0.2	200			
		6	0.2	220			
	Horizontal	TCA3NA TWA3NA TFA3NA (Ball screw)	1	0.2	50		50
			2	0.2	100		
			4	0.2	200		
		TCA4NA TWA4NA TFA4NA (Ball screw)	2	0.2	100	50	
			4	0.2	200		
			6	0.2	300		
Vertical	TCA3NA TWA3NA TFA3NA (Ball screw)	1	0.2	50	50		
		2	0.3	100			
		4	0.3	200			
	TCA4NA TWA4NA TFA4NA (Ball screw)	2	0.2	100	50		
		4	0.3	200			
		6	0.3	300			

How to decide: [2] Desired stroke ≤ model stroke

[3] Desired maximum speed ≤ maximum speed for selected stroke

[4] Desired acceleration ≤ 0.2G or 0.3G (Refer to Table 1)

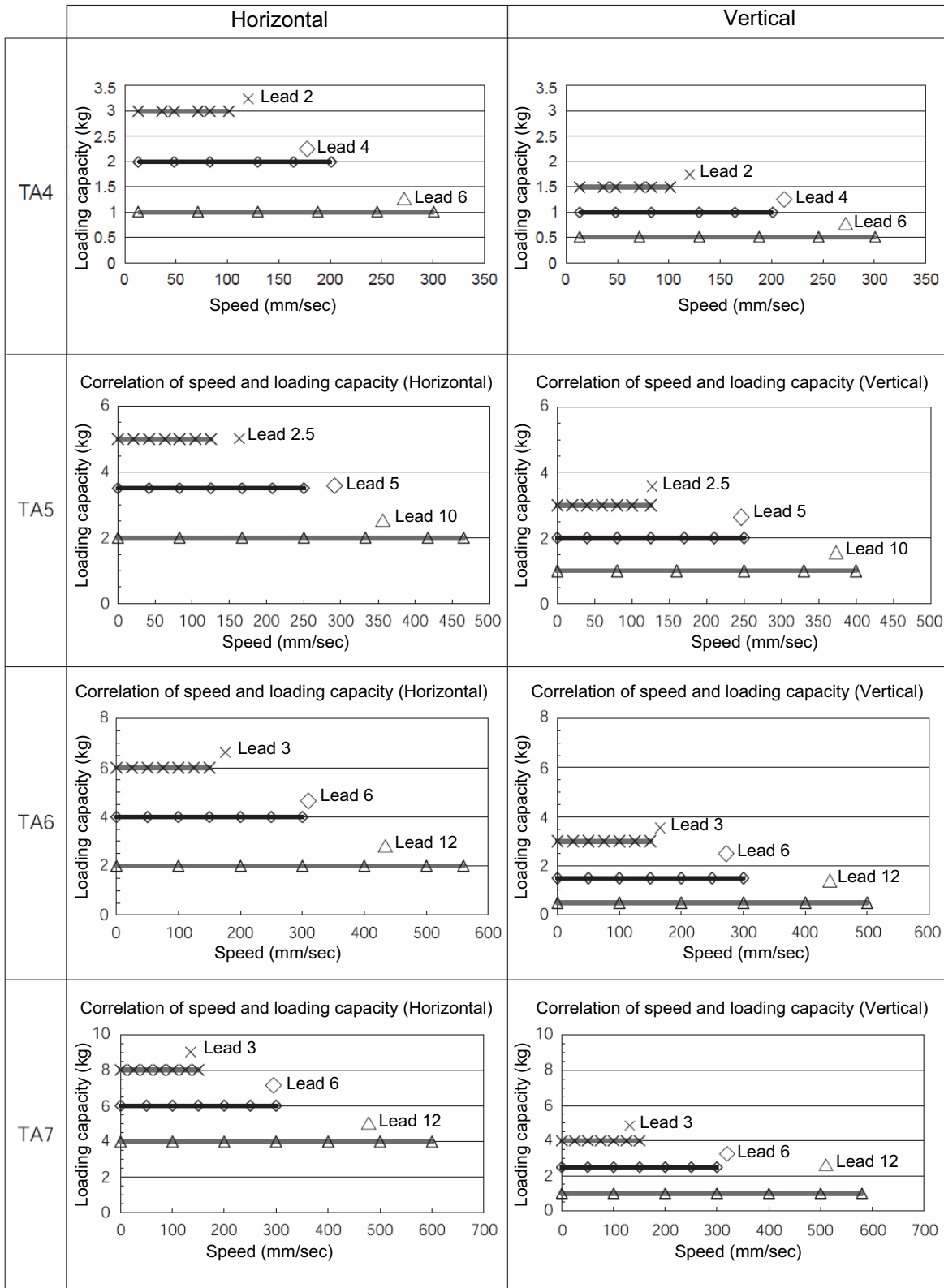
[3] Maximum speed, loading capacity

Check whether the operation is available by [3] maximum speed and [5] loading capacity.

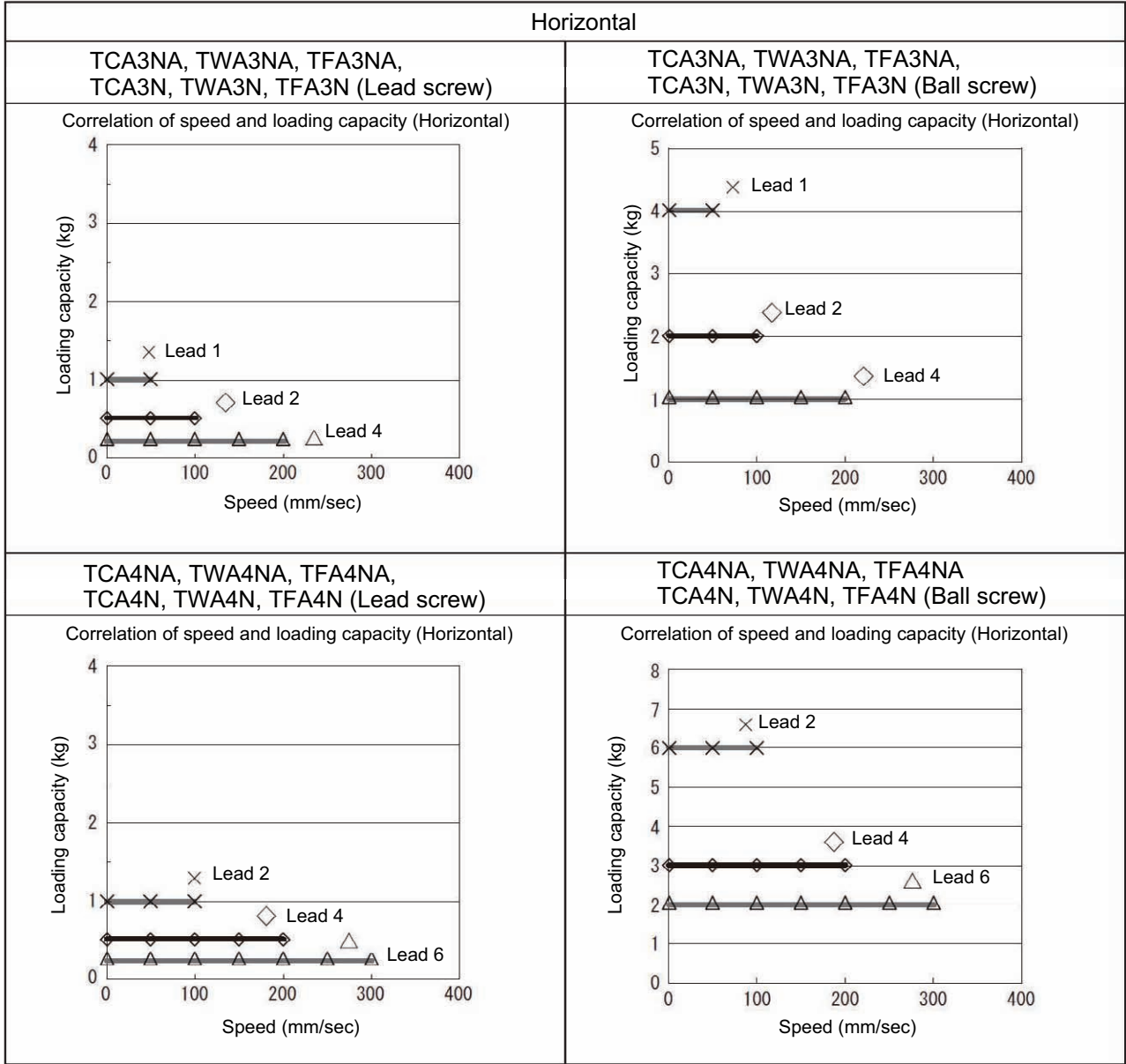
• AC Servo motor (RCA2) (Graph 1, Graph 2)

How to decide: You can use any model that has a [3] maximum speed and [4] loading capacity that is within usage range in the graph.

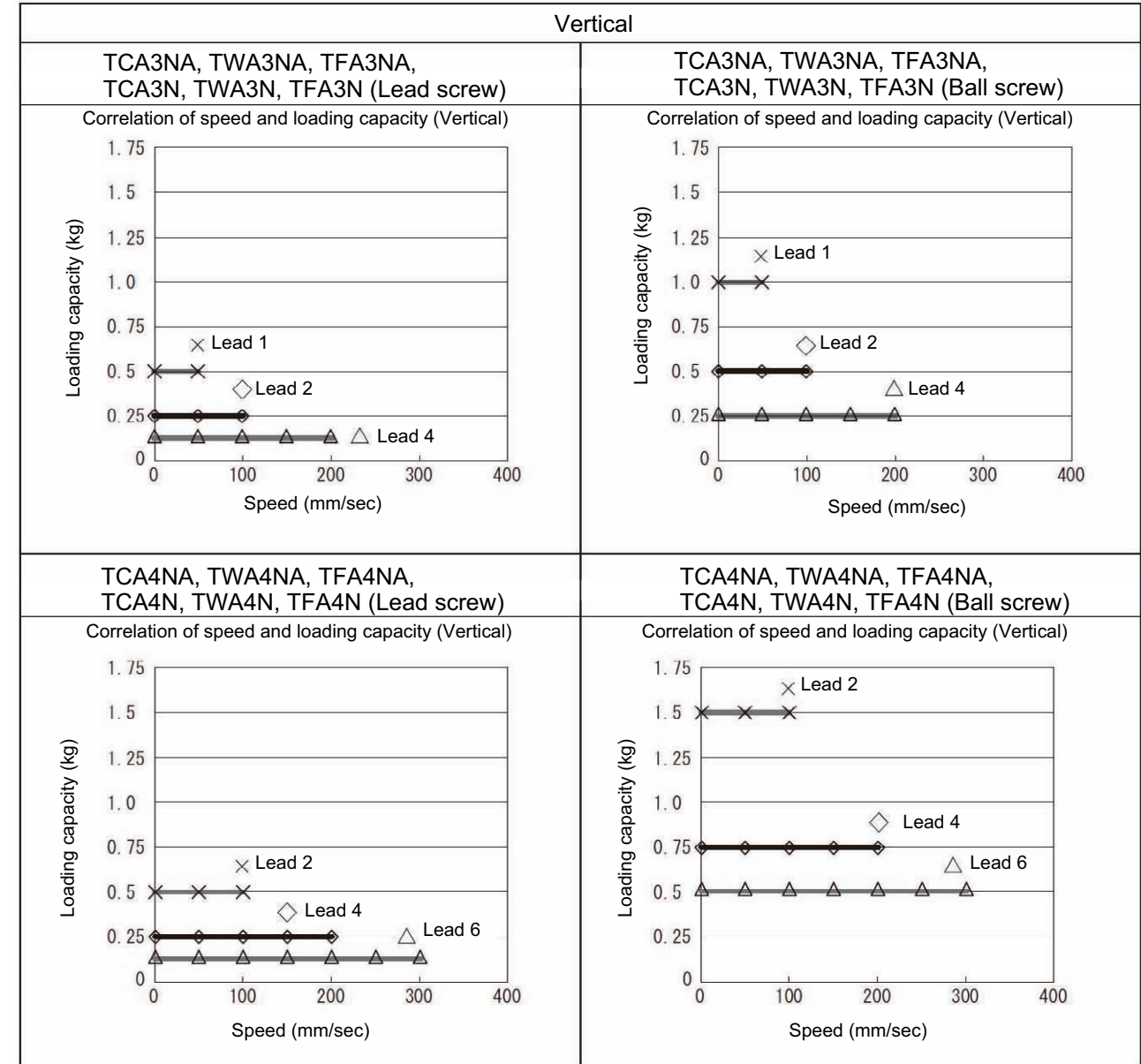
Graph 1 AC Servo Motor: RCA2



Graph 2 AC Servo Motor: RCA2
Short types (TCA, TWA, TFA)



Graph 2 AC Servo Motor: RCA2
Short types (TCA, TWA, TFA)



[4] Moment

Check whether the operation is available by [2] moment, [4] acceleration, [5] loading capacity, and [6] overhang.

- Static moment (M1) calculation

Static moment equation

$M1 = W \times L \times 9.8/1000$ (Nm); L (mm): Distance from the operation point to load center of gravity

Stroke consideration: $L = T + Hn + \text{stroke}$ (Patterns A and B)

No stroke consideration: $L = T + Hn$ (Patterns C, D, and E)

Use Figure 2 and Table 2 to select an Hn measurement based on the installation orientation of the load.

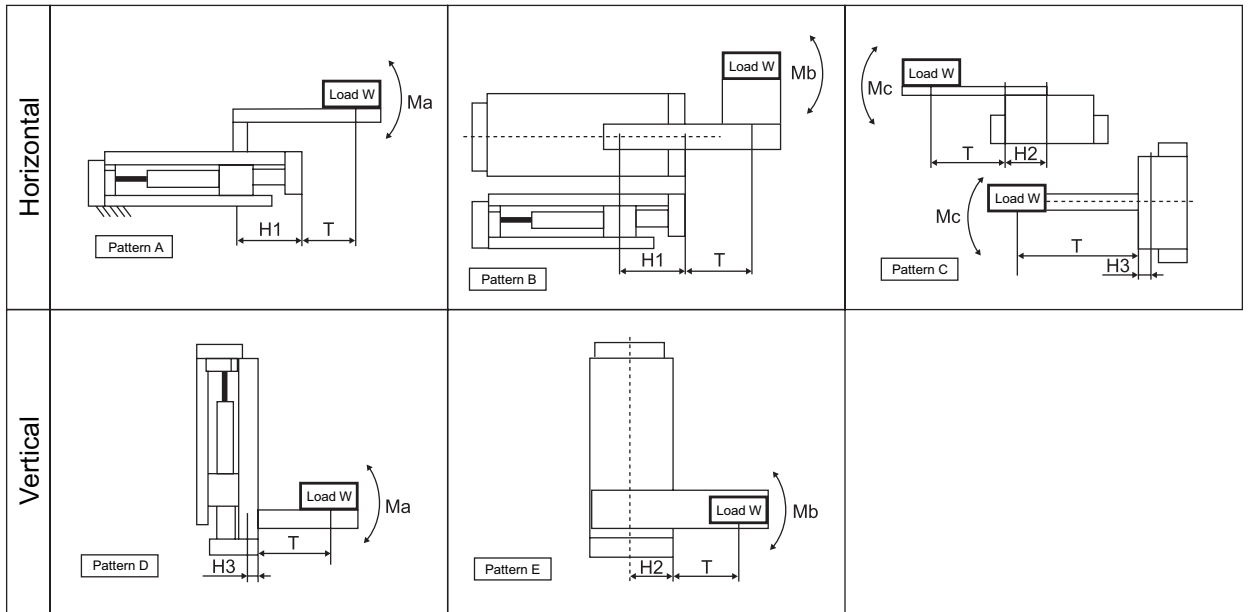
Table 2: Hn measurement (distance from the operation point to end of table)

	TA4	TA5	TA6	TA7
H1 (mm)	30	49	54.5	61.5
H2 (mm)	20	25	30	37
H3 (mm)	11.5	13.5	15.5	17.5

	TCA3NA, TFA3NA TCA3N, TFA3N (Lead screw) (Ball screw)	TWA3NA TWA3N (Lead screw) (Ball screw)	TCA4NA, TFA4NA TCA4N, TFA4N (Lead screw) (Ball screw)	TWA4NA TWA4N (Lead screw) (Ball screw)
H1 (mm)	64	64	66	66
H2 (mm)	16	25	18	29
H3 (mm)	9.5	10.5	9.5	11

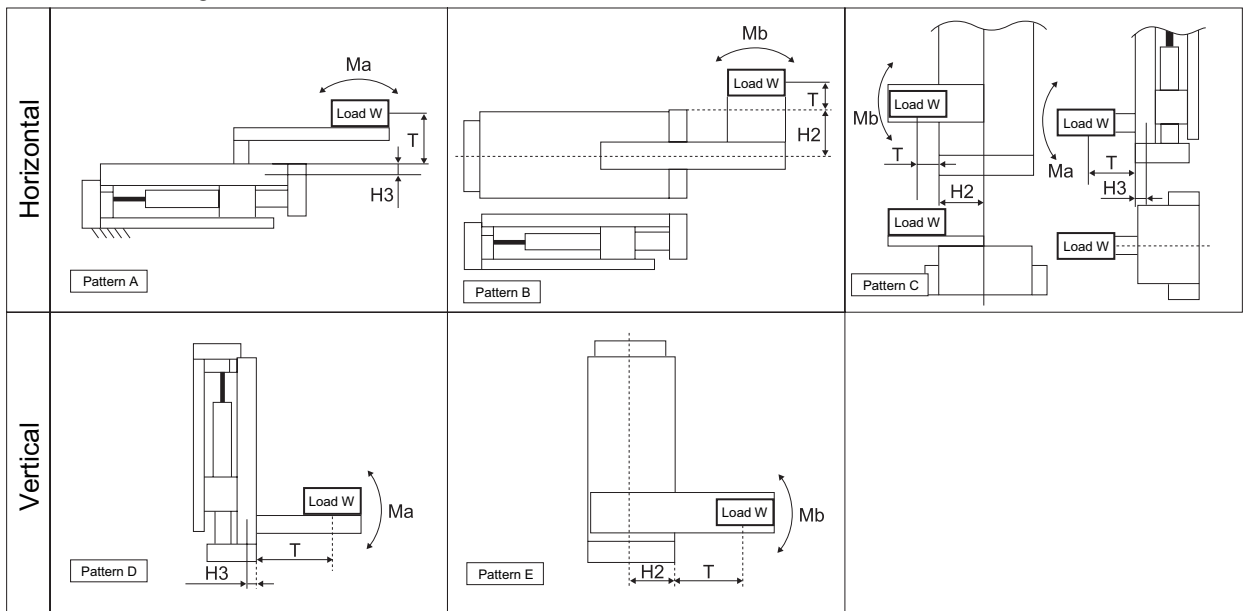
Ball Guide Type (Option: Model Code BG)						
	TC3N, TF3N (Lead screw)	TW3N (Lead screw)	TC4N, TF4N (Lead screw)	TW4N (Lead screw)	TC4N, TF4N (Ball screw)	TW4N (Ball screw)
H1 (mm)	71.5	68	73.5	74.5	73.5	74.5
H2 (mm)	17	25	19	29	19	29
H3 (mm)	16	12.5	16	15.5	16	15.5

Static Moment Figure 2



- Dynamic moment (M2) calculation
 Dynamic moment equation
 $M2 = W \times L \times a \times 9.8/1000 \text{ (Nm)}$
 $L = T + Hn$
 From Figure 3 and Table 2, select the Hn measurement based on the installation orientation of the load.

Dynamic moment Figure 3



- Generated moment (M) calculation
 Generated moment equation
 $M = M1 + M2 \text{ (Nm)}$
 * Pattern C has different directions for the static moment and the dynamic moment, so set whichever is larger as M.
 From Table 3, select an allowable moment based on the generated moment calculated above.

Table 3: Allowable moments

	TA4	TA5	TA6	TA7
Allowable moment: Ma (Nm)	4.98	7.56	8.52	11.6
Allowable moment: Mb (Nm)	7.11	10.8	12.2	16.6
Allowable moment: Mc (Nm)	9.68	16.6	21.5	33.7

	TCA3NA, TFA3NA TCA3N, TFA3N (Lead screw) (Ball screw)	TWA3NA TWA3N (Lead screw) (Ball screw)	TCA4NA, TFA4NA TCA4N, TFA4N (Lead screw) (Ball screw)	TWA4NA TWA4N (Lead screw) (Ball screw)
Allowable moment: Ma (Nm)	9.9	9.9	9.9	9.9
Allowable moment: Mb (Nm)	9.9	9.9	9.9	9.9
Allowable moment: Mc (Nm)	3.3	9.4	3.3	12.2

	Ball Guide Type (Option: Model Code BG)					
	TC3N (Lead screw)	TF3N (Lead screw)	TW3N (Lead screw)	TC4N (Lead screw)	TF4N (Lead screw)	TW4N (Lead screw)
Allowable moment: Ma (Nm)	0.86	0.75	1.74	1.65	1.42	3.46
Allowable moment: Mb (Nm)	0.68	0.55	1.50	1.28	1.07	2.93
Allowable moment: Mc (Nm)	0.92	0.88	2.85	1.77	1.69	5.63

	Ball Guide Type (Option: Model Code BG)		
	TC4N (Ball screw)	TF4N (Ball screw)	TW4N (Ball screw)
Allowable moment: Ma (Nm)	1.65	1.42	3.46
Allowable moment: Mb (Nm)	1.28	1.07	2.93
Allowable moment: Mc (Nm)	1.77	1.69	5.63

How to decide: You can use any model for which the generated moment (M) < allowable moment for all three of Ma, Mb, Mc.

Operation is available when all the items are below the specified values.

1.4 Options

1.4.1 Optional Connector Cable Exit Direction (Model: K2)

There are directions of the front of the body for the orientation of cable exit. Set it in such a case as that the cable is desired to be ejected in the front plate side due to the layout of the system. In the standard specification, the cable exit direction is opposite to the rod and guide bracket.

1.4.2 Power-saving Function (Model: LA)

This option reduces the maximum current of the controller compared to actuator of the standard specification.

The maximum current varies depending on the model.

Please refer to the power supply capacity in the catalog or each operation manual of ACON, ASEL, ASEP, AMEC or MSEP controller.

1.4.3 Brake-equipped (Model: B)

This is a function to hold the table so it would not drop when the power or the servo is turned OFF in the condition that the actuator is installed in the vertical orientation.

Use the brake to prevent the installed load, etc., from being damaged due to the falling table.

The brake can be applied as an option only on TA5C, TA6C, TA7C, TA5R, TA6R, TA7R, TCA3NA, TCA4NA, TWA3NA, TWA4NA, TFA3NA and TFA4NA.

1.4.4 Reversed-home Specification (Model: NM)

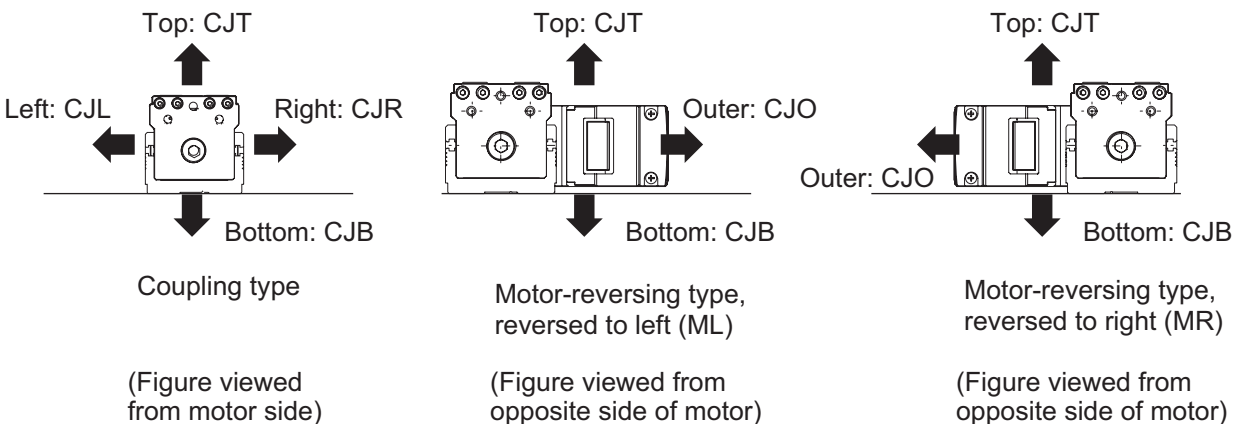
On motor unit types (TA**), the standard home position is on the motor side. However, you can specify an option to reverse the home direction if it is desirable due to the layout of the system, etc.

(Note) Since the home position is adjusted at the factory before shipment, you must return your actuator to IAI for adjustment if you wish to change the home direction after the delivery of your actuator.

1.4.5 Changing the Cable Exit Direction (Model: CJT, CJR, CJL, CJO, CJB)

If the cable exit direction is changed, the applicable part of the model number must also be changed.

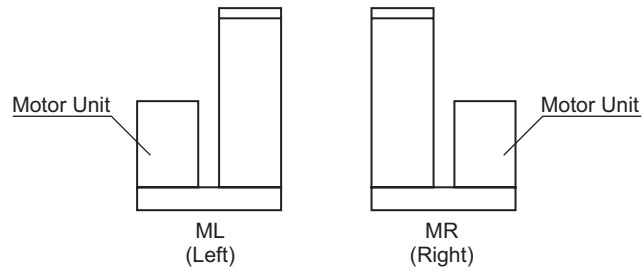
A desired direction can be selected from among the five options of top (CJT in the model number), right (CJR), left (CJL), bottom (CJB) and outer (CJO).



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

The reversing direction changes in each model code for the motor reversing types TA4R, TA5R, TA6R and TA7R.

From the view of motor side, reversing to the left is ML and reversing to the right is MR.

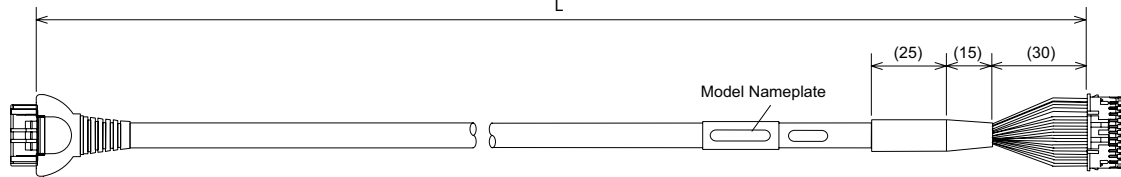


1.5 Motor • Encoder Cables

1.5.1 ACON-CA, AMEC, ASEP or MSEP Controller Cables

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

□□□ indicates the cable length L. Up to 10m can be specified.
(Example: 080=8m)



Actuator Side

Electric Wire Color	Symbol	Pin No.
Black	U	A1
White	V	B1
Brown	W	A2
Green	-	B2
Yellow	-	A3
Red	-	B3
Orange	BK+	A4
Gray	BK-	B4
White	A+	A6
Yellow	A-	B6
Red	B+	A7
Green	B-	B7
Black	Z+	A8
Brown	Z-	B8
Black (Identification tape)	LS+	A5
Brown (Identification tape)	LS-	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

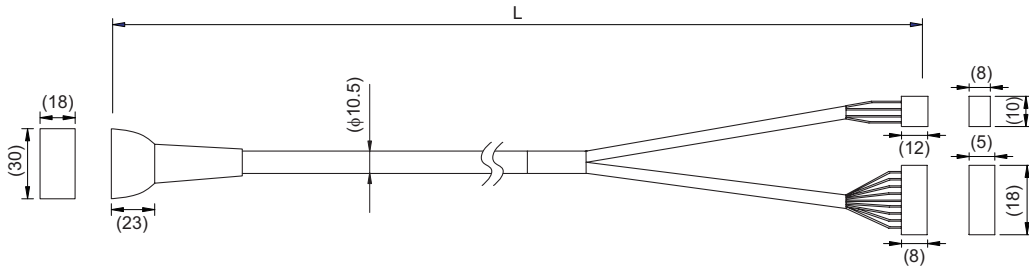
Controller Side

Pin No.	Symbol	Electric Wire Color
1	U	Black
2	V	White
5	W	Brown
3	-	Green
4	-	Yellow
6	-	Red
7	BK+	Orange
8	BK-	Gray
11	A+	White
12	A-	Yellow
13	B+	Red
14	B-	Green
15	Z+	Black
16	Z-	Brown
9	LS+	Black (Identification tape)
10	LS-	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	-	-

1.5.2 ACON (Except for ACON-CA), RACON, ASEL Controller Cables

Motor • Encoder Integrated Cables For RCA2
(CB-ACS-MPA□□□)

□□□ indicates the cable length L. Up to 10m can be specified.
(Example: 080=8m)



Actuator Side

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

Controller Side

Pin No.	Symbol	Electric Wire Color
1	U	Red
2	V	Yellow
3	W	Black
4	NC	-
3	NC	-
2	NC	-
16	BK+	Yellow (Red•)
15	BK-	Yellow (Blue•)
18	LS+	Pink (Red•)
17	LS-	Pink (Blue•)
14	A+	White (Red•)
13	A-	White (Blue•)
12	B+	Orange (Red•)
11	B-	Orange (Blue•)
10	Z+	Gray (Red•)
9	Z-	Gray (Blue•)
8	-	Orange (Red• continuous)
7	/PS	Orange (Blue• continuous)
6	VCC	Gray (Red• continuous)
5	GND	Gray (Blue• continuous)
	NC	-
1	Shield, FG	-

2. Installation

2.1 Transportation

[1] Handling of the Actuator

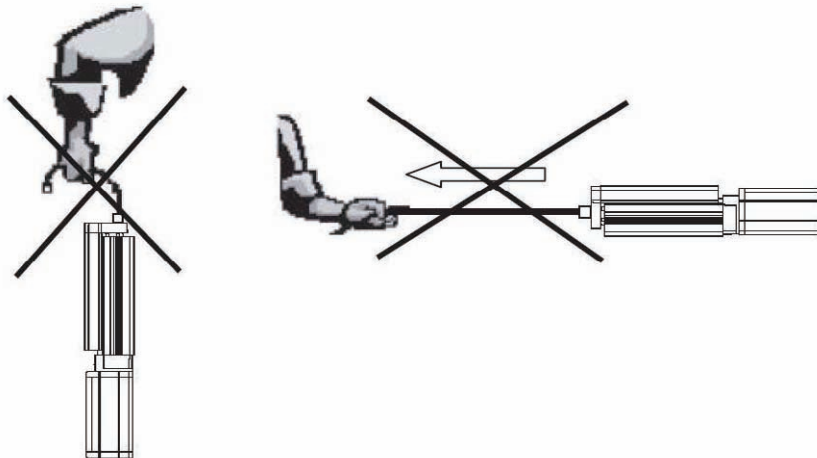
Unless otherwise specified, the actuator is shipped with 1 axis unit packaged separately.

(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 an actuator by a 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 tables are fixed so they would not accidentally 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 table so they would not accidentally 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 table 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

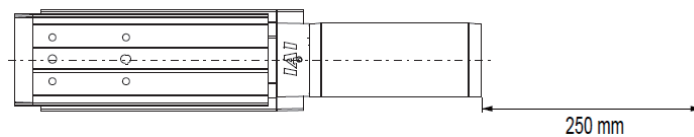
The actuator should be installed in a location other than those specified below.
Also provide sufficient work space required for maintenance inspection.

- 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 Specifications

Install the main unit only on a machined surface, or other a surface that is highly flat. Also, the platform should have a structure stiff enough to install the unit so it would not generate vibration or other abnormality.

2.3.1 Installation of Actuator

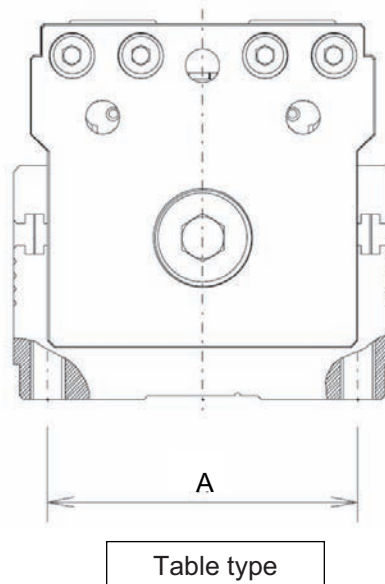
[1] Motor unit types TA4, TA5, TA6, TA7

Make sure to have the flatness on the surface that the unit body is to be installed to be 0.05mm/m or less.

This actuator contains installation tapped holes which allow it to be secured from the rear.

(Note that tapped hole size depends on model. Please see diagrams below and 7. "External Dimensions".)


The actuator also contains reamed holes for use with positioning pins.



Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		A (mm)	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TA4	M4, depth 7.5	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	31	φ4H7, depth 4.5
TA5	M5, depth 10	M5	7.27 N-m (0.74 kgf-m)	3.42 N-m (0.35 kgf-m)	45	φ5H7, depth 5
TA6	M5, depth 10	M5	7.27 N-m (0.74 kgf-m)	3.42 N-m (0.35 kgf-m)	55	φ5H7, depth 5
TA7	M6, depth 12	M6	12.34 N-m (1.26 kgf-m)	5.36 N-m (0.55 kgf-m)	64	φ6H7, depth 6

Tightening screws

- For the male threads for installing the base, use hexagonal socket head bolts.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.
- The length of thread engagement should be 1.8 times more than the nominal diameter, and pay attention not to stick the screw out inside the actuator.

 **Caution:** Exercise caution when selecting the bolt length. Use of bolts of inappropriate lengths may cause damage to tapped holes, insufficient mounting strength of the actuator and/or interference with driving parts, resulting in lower precision or unexpected accidents.

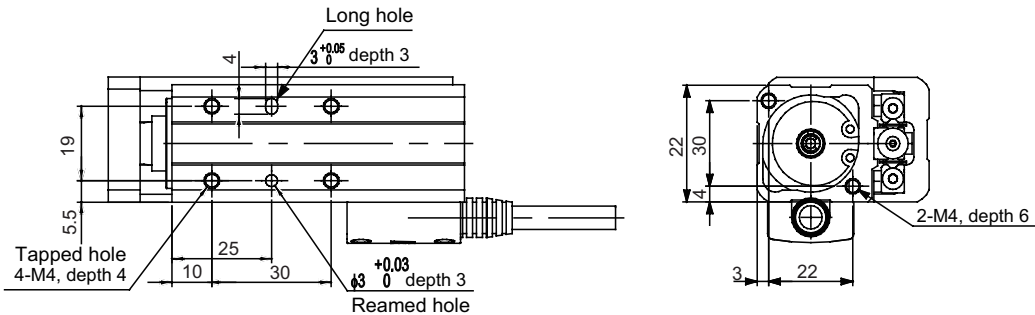
[2] Short types

⚠ Caution: For Ball Guide Type (option: model code BG), the grease may separate and the base oil may be gathered on the edges of the guide rail (around the end of the frame on the front side and end of the frame on the rear side) in vertically oriented and horizontally oriented installations. Use a soft cloth to wipe away dirt and buildup. The grease may flow out and drop if leaving it without wiping away. Have something to receive the grease in the case that the grease (base oil) can give a bad impact.

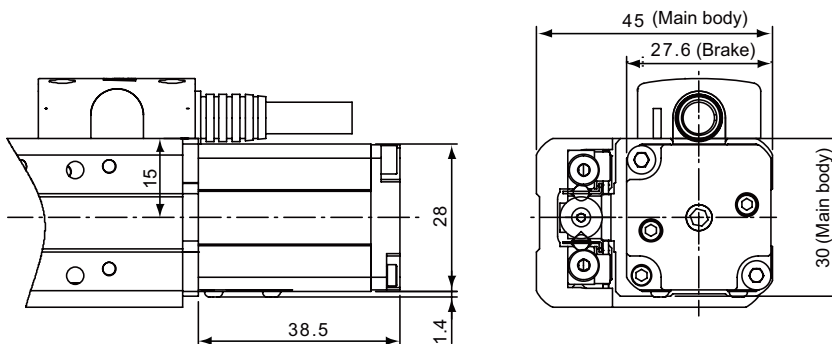
(1) TCA3NA, TCA3N (Lead screw, Ball screw), TCA4NA, TCA4N (Lead screw, Ball screw)

This actuator contains installation tapped holes which allow it to be secured from the rear. The actuator also contains long holes and reamed holes for use with positioning pins.

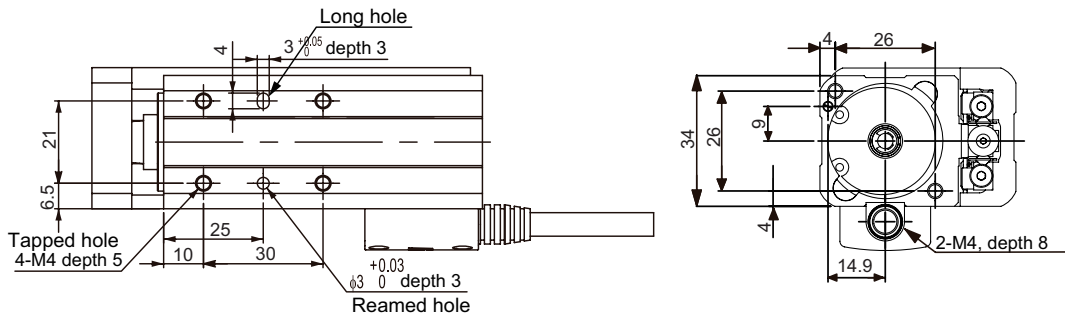
(TCA3NA, TCA3N (Lead screw, Ball screw))



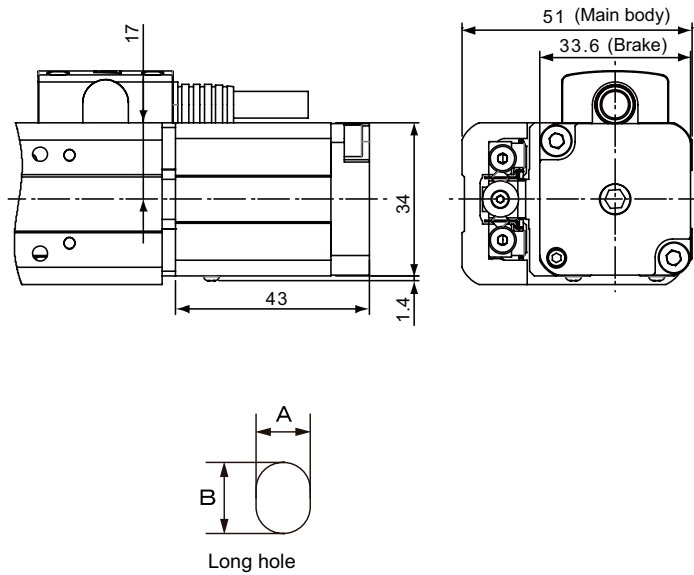
With Brake Type (TCA3NA (Lead screw, Ball screw)) External Dimension (Reference)



(TCA4NA, TCA4N (Lead screw, Ball screw))

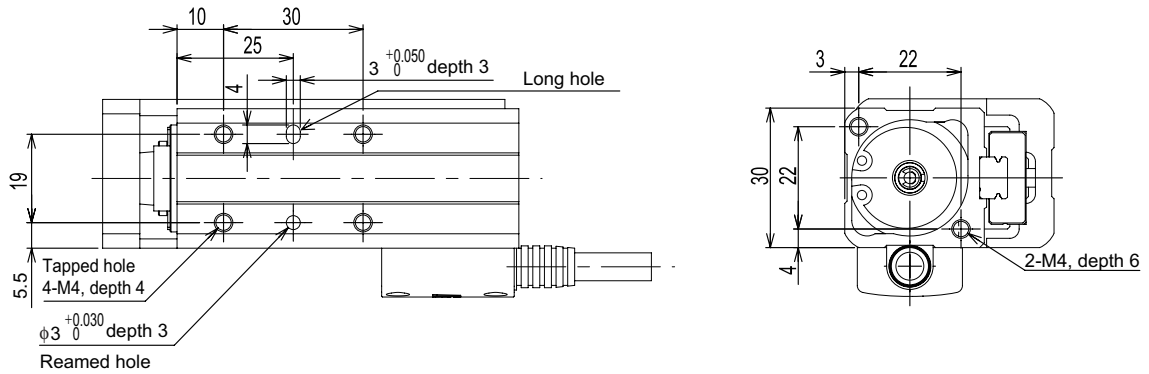


With Brake type (TCA4NA (Lead screw, Ball screw)) External Dimension (Reference)

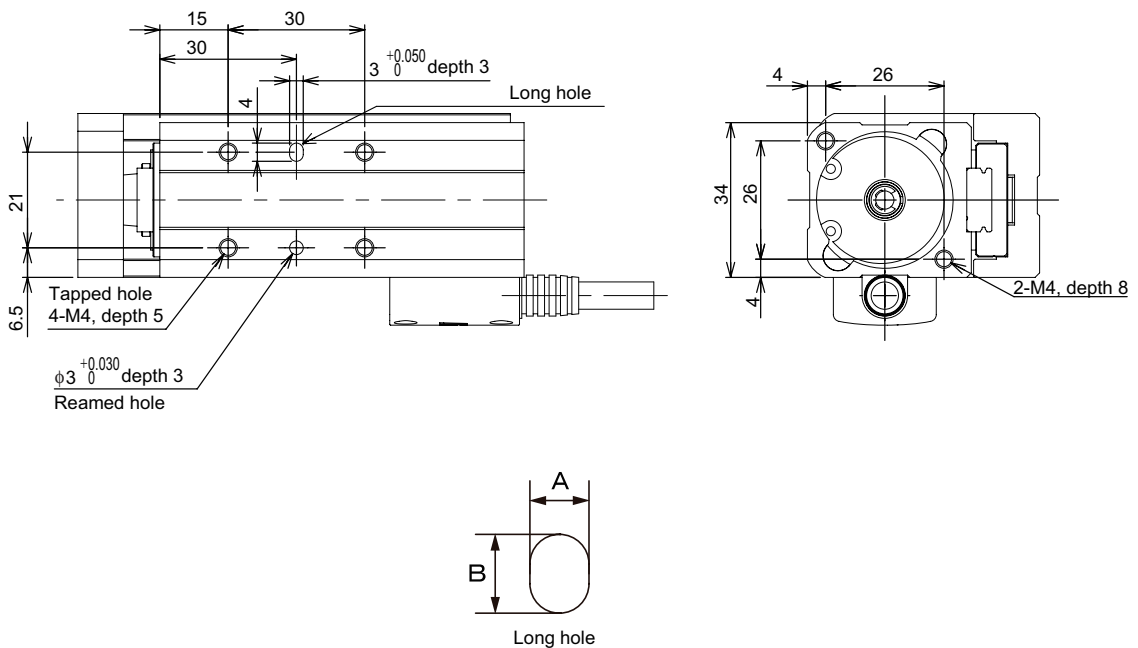


Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Long hole	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TCA3NA TCA3N (Lead screw) (Ball screw)	M4, depth 4 or 6	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	A: 3, B: 4, depth 3	φ 3, depth 3
TCA4NA TCA4N (Lead screw) (Ball screw)	M4, depth 5 or 8	M4	3.59 N-m (0.74 kgf-m)	1.76 N-m (0.35 kgf-m)	A: 3, B: 4, depth 3	φ 3, depth 3

(TC3N (Lead screw) Ball Guide Type (Option: Model Code BG))




(TC4N (Lead screw), TC4N (Ball screw) Ball Guide Type (Option: Model Code BG))



Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Long hole	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TC3N (Lead screw)	M4, depth 4 or 6	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	A: 3, B: 4, depth 3	φ3, depth 3
TC4N (Lead screw) TC4N (Ball screw)	M4, depth 5 or 8	M4	3.59 N-m (0.74 kgf-m)	1.76 N-m (0.35 kgf-m)	A: 3, B: 4, depth 3	φ3, depth 3

Tightening screws

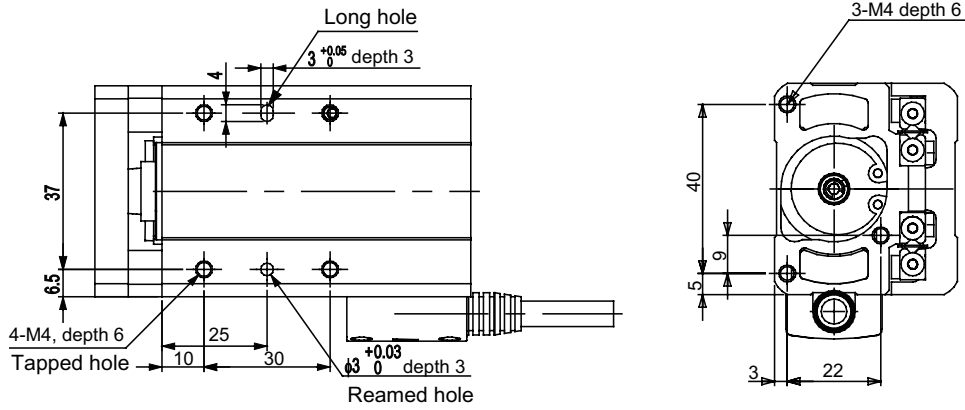
- For the male threads for installing the base, use hexagonal socket head bolts.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.

 Caution: The tap hole of the mounting part is a through hole. Never use a screw longer than the effective screw length. Internal mechanisms and electric components may be damaged.

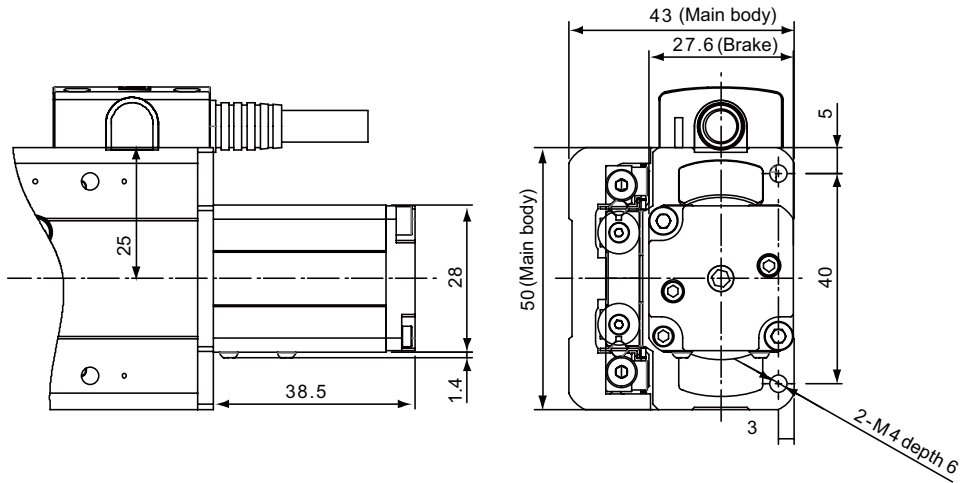
(2) TWA3NA, TWA3N (Lead screw, Ball screw), TWA4NA, TWA4N (Lead screw, Ball screw)

This actuator contains installation tapped holes which allow it to be secured from the rear. The actuator also contains long holes and reamed holes for use with positioning pins.

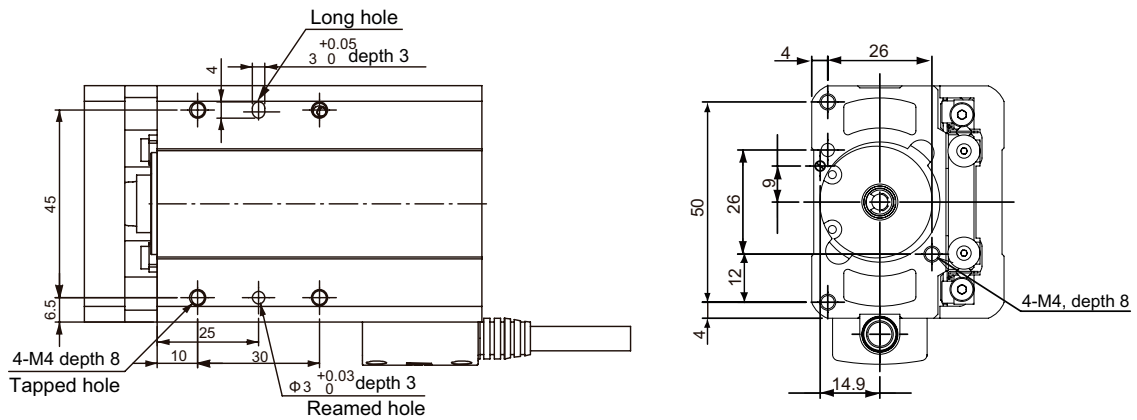
(TWA3NA, TWA3N (Lead screw, Ball screw))



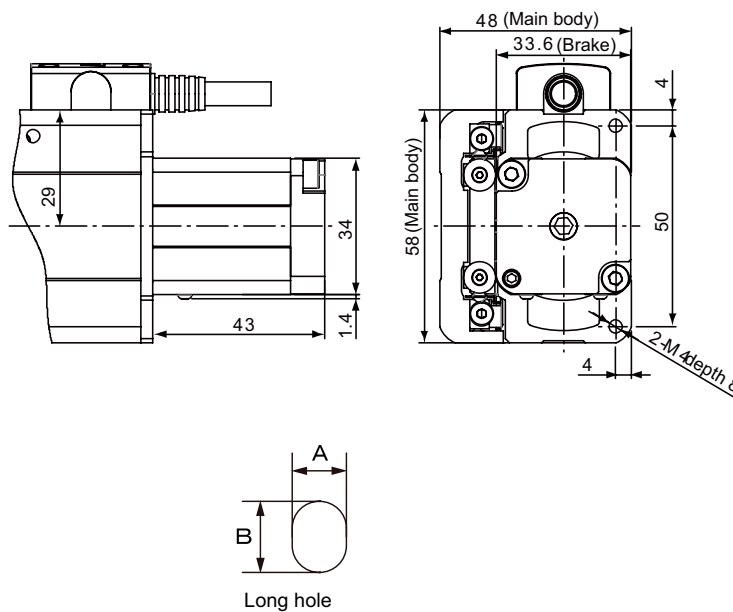
With Brake Type (TWA3NA (Lead screw, Ball screw)) External Dimension (Reference)



(TWA4NA, TWA4N (Lead screw, Ball screw))

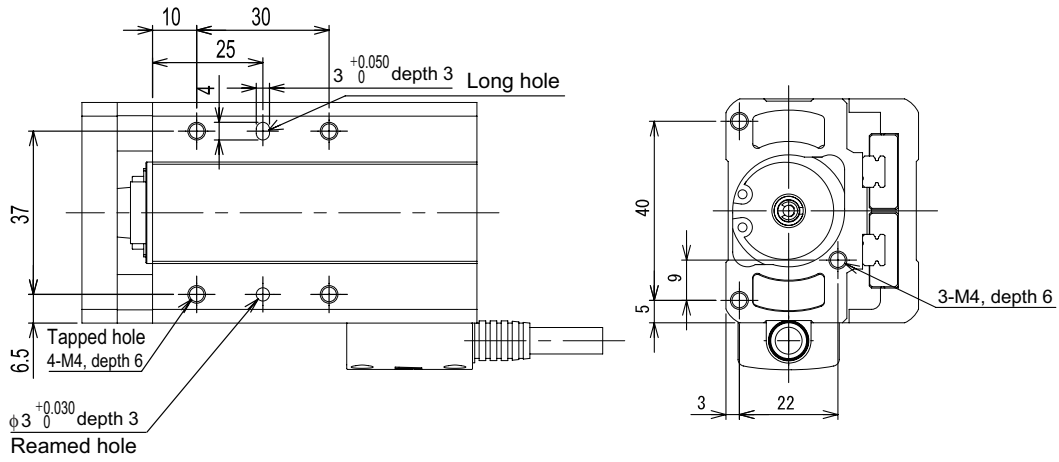


With Brake Type (TWA4NA (Lead screw, Ball screw)) External Dimension (Reference)

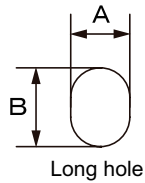
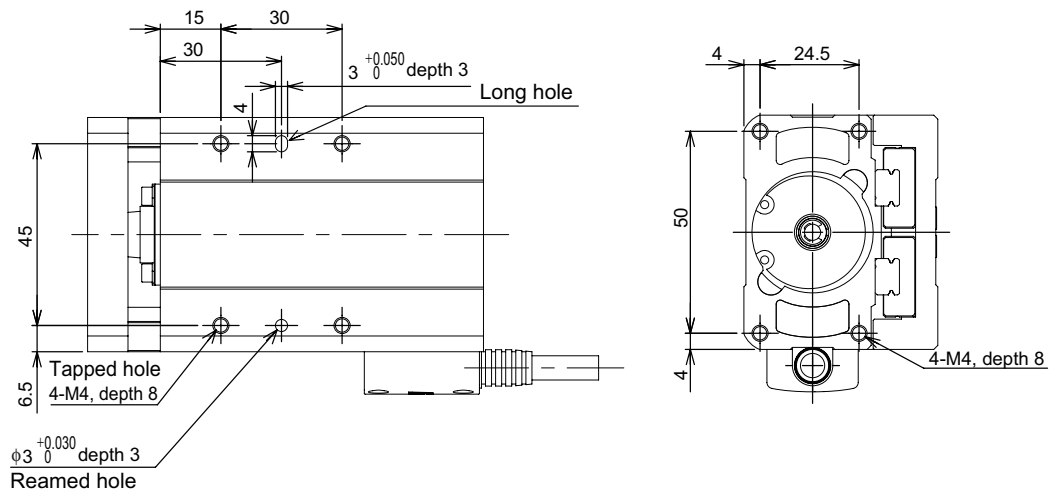


Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Long hole	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TWA3NA TWA3N (Lead screw) (Ball screw)	M4, depth 6	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	A: 3, B: 4, depth 3	φ 3, depth 3
TWA4NA TWA4N (Lead screw) (Ball screw)	M4, depth 8	M4	3.59 N-m (0.74 kgf-m)	1.76 N-m (0.35 kgf-m)	A: 3, B: 4, depth 3	φ 3, depth 3

(TW3N (Lead screw) Ball Guide Type (Option: Model Code BG))




(TW4N (Lead screw), TW4N (Ball screw) Ball Guide Type (Option: Model Code BG))



Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Long hole	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TW3N (Lead screw)	M4, depth 6	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	A: 3, B: 4, depth 3	$\phi 3$, depth 3
TW4N (Lead screw) TW4N (Ball screw)	M4, depth 8	M4	3.59 N-m (0.74 kgf-m)	1.76 N-m (0.35 kgf-m)	A: 3, B: 4, depth 3	$\phi 3$, depth 3

Tightening screws

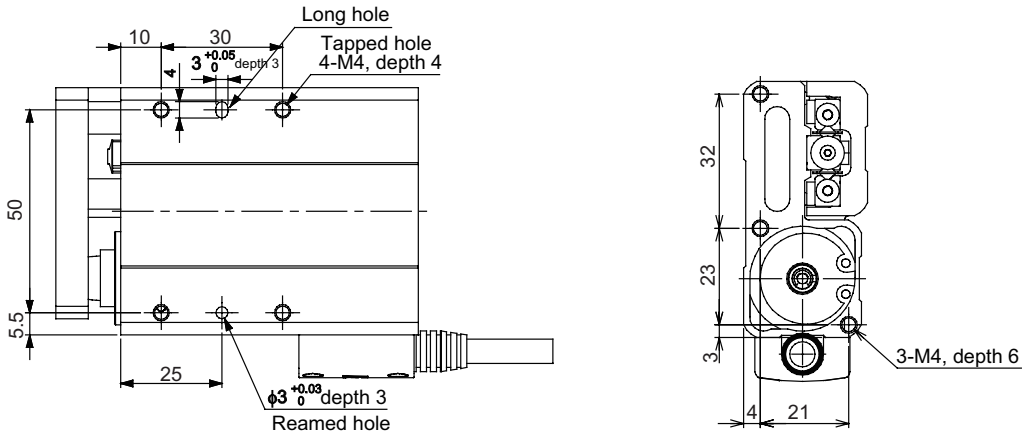
- For the male threads for installing the base, use hexagonal socket head bolts.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.

 Caution: The tap hole of the mounting part is a through hole. Never use a screw longer than the effective screw length. Internal mechanisms and electric components may be damaged.

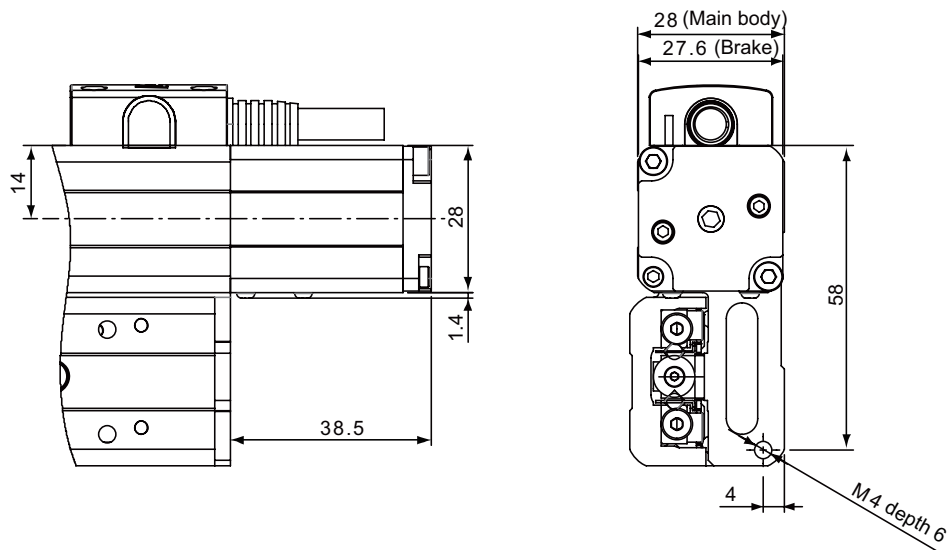
(3) TFA3NA, TFA3N (Lead screw, Ball screw), TFA4NA, TFA4N (Lead screw, Ball screw)

This actuator contains installation tapped holes which allow it to be secured from the rear. The actuator also contains long holes and reamed holes for use with positioning pins.

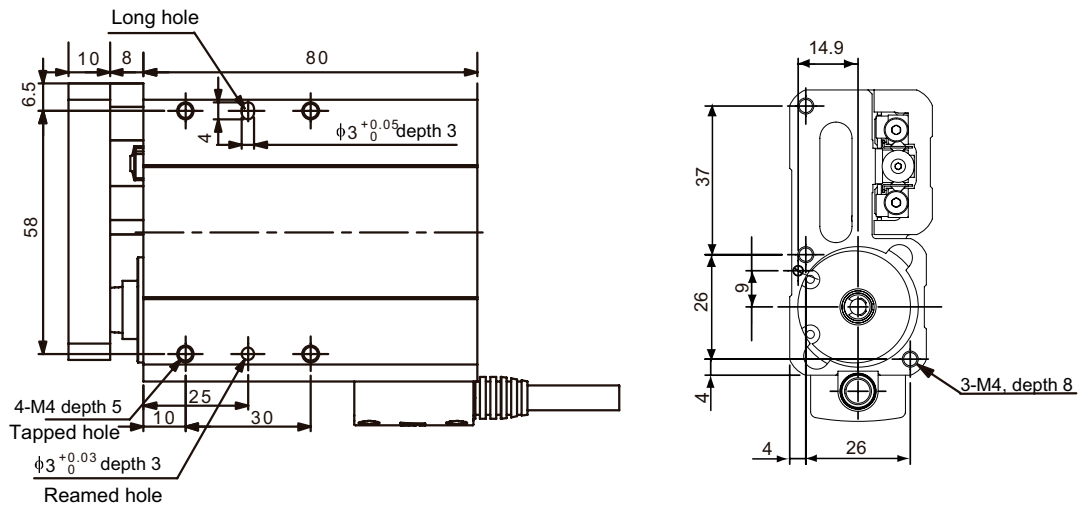
(TFA3NA, TFA3N (Lead screw, Ball screw))



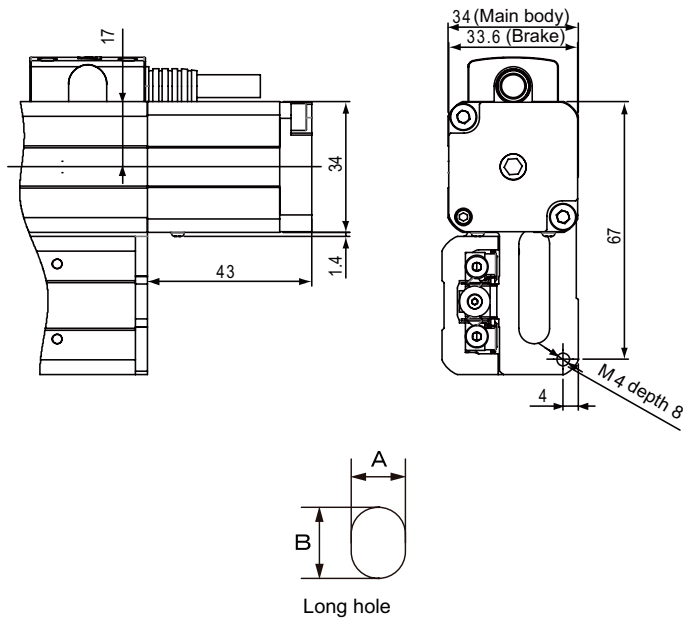
With Brake Type (TFA3NA (Lead screw, Ball screw)) External Dimension (Reference)



(TFA4NA, TFA4N (Lead screw, Ball screw))

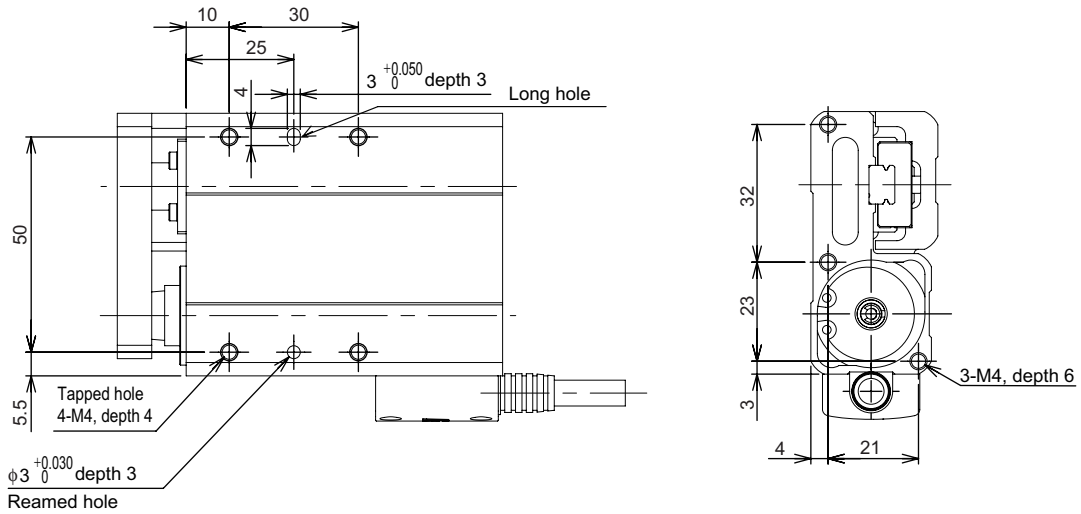


With Brake Type (TFA4NA (Lead screw, Ball screw)) External Dimension (Reference)

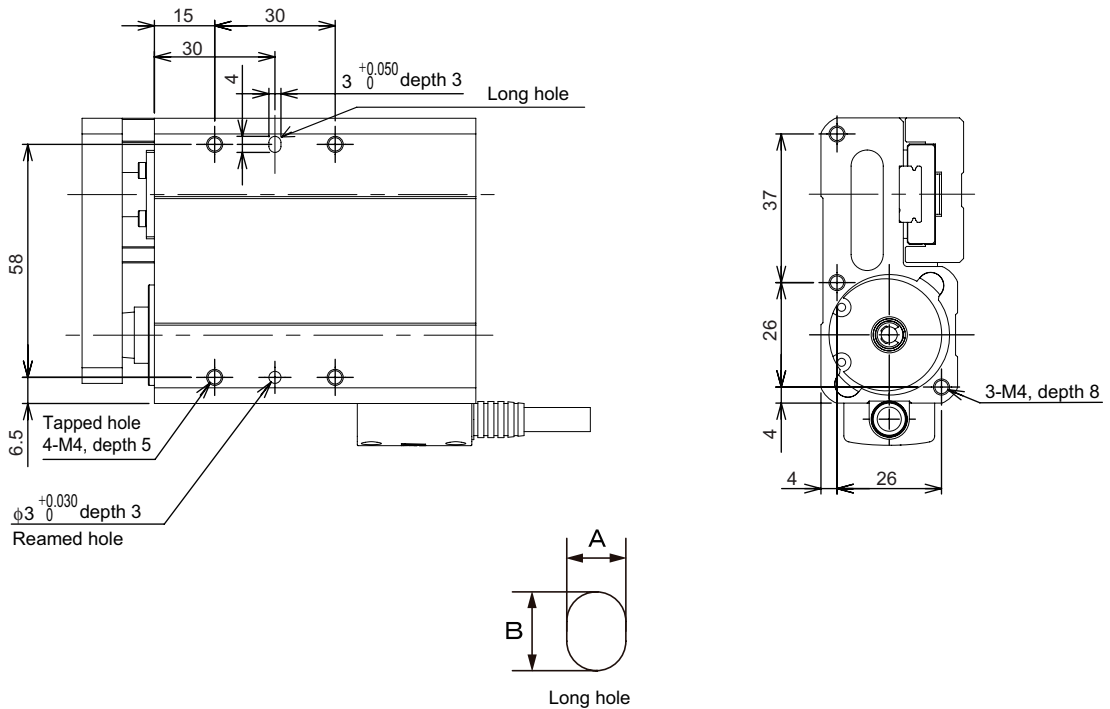


Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Long hole	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TFA3NA TFA3N (Lead screw) (Ball screw)	M4, depth 4 or 6	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	A: 3, B: 4, depth 3	$\phi 3$, depth 3
TFA4NA TFA4N (Lead screw) (Ball screw)	M4, depth 5 or 8	M4	3.59 N-m (0.74 kgf-m)	1.76 N-m (0.35 kgf-m)	A: 3, B: 4, depth 3	$\phi 3$, depth 3

(TF3N (Lead screw) Ball Guide Type (Option: Model Code BG))




(TF4N (Lead screw), TF4N (Ball screw) Ball Guide Type (Option: Model Code BG))



Model	Tap size and maximum screw-in depth	Applicable bolt	Tightening torque		Long hole	Reamed hole (mm)
			Bolt bearing surface is steel	Bolt bearing surface is aluminum		
TF3N (Lead screw)	M4, depth 4 or 6	M4	3.59 N-m (0.37 kgf-m)	1.76 N-m (0.18 kgf-m)	A: 3, B: 4, depth 3	φ3, depth 3
TF4N (Lead screw) TF4N (Ball screw)	M4, depth 5 or 8	M4	3.59 N-m (0.74 kgf-m)	1.76 N-m (0.35 kgf-m)	A: 3, B: 4, depth 3	φ3, depth 3

Tightening screws

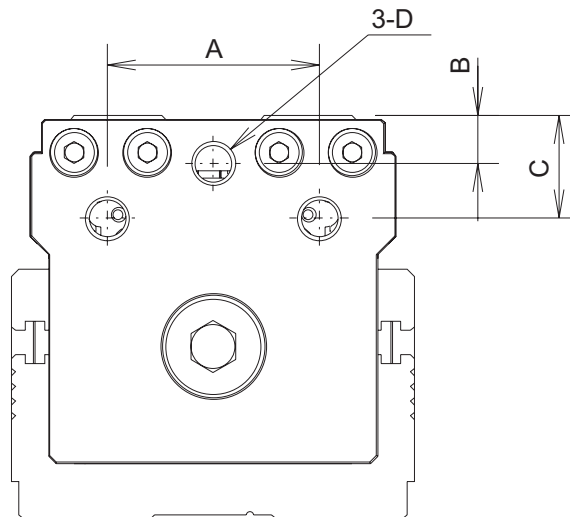
- For the male threads for installing the base, use hexagonal socket head bolts.
- Use of high-tension bolts meeting at least ISO 10.9 is recommended.

 Caution: The tap hole of the mounting part is a through hole. Never use a screw longer than the effective screw length. Internal mechanisms and electric components may be damaged.

2.3.2 Installation of the Load

[1] Motor unit types TA4, TA5, TA6, TA7

- Please attach the load to the device using the tapped holes in the front plate of the table type.
- There are also tapped holes and reamed holes in the top surface of the table. Please use these to attach the load.
- There are two reamed holes on the slider in the top surface of the table, so if you need to be able to secure and detach the load multiple times, please use these holes. Also, if you require precision in your attachment, such as a right angle, use one of the reamed holes to make fine adjustments.
- The process for attaching these to the main unit is similar to the installation process of the main unit. The mounting screws and tightening torque required are also similar to the installation process of the main unit. (Refer to 2.3.1 [1].)
- For exact screw-in depth, please see the table below.
- Do not screw in screws deeper than indicated in the table below, as this can interfere with internal parts and damage the actuator.

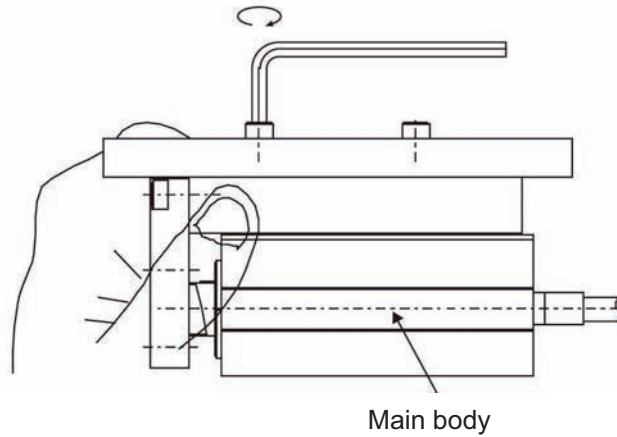


Model	A	B	C	D
TA4	29	5	13	M6, depth 10
TA5	29	6.5	14	M6, depth 10
TA6	35	7	18	M6, depth 13
TA7	44	6.5	21.5	M8, depth 15

[2] Short types

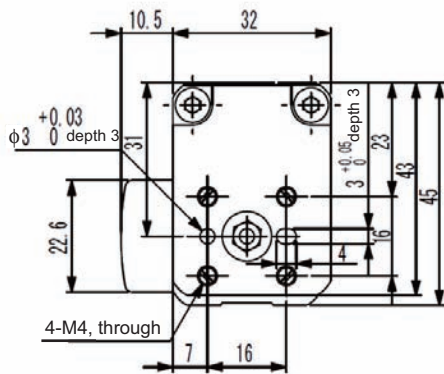
(1) TCA3NA, TCA3N (Lead screw, Ball screw), TCA4NA, TCA4N (Lead screw, Ball screw)

- Please attach the load to the device using the tapped holes in the front plate of the table type.
- There are also tapped holes and reamed holes in the top surface of the table. Please use these to attach the load.
- There is one reamed hole on the slider in the top surface of the table, so if you need to be able to secure and detach the load multiple times, please use this hole. Also, if you require precision in your attachment, such as a right angle, use one reamed hole to make fine adjustments.
- The process for attaching these to the main unit is similar to the installation process of the main unit. The mounting screws and tightening torque required are also similar to the installation process of the main unit. (Refer to 2.3.1 [2].)
- Mount a work part by holding the table as shown in the figure. If you hold only the main body and tighten the work part, excessive moment is applied to the guide area and play may be generated.



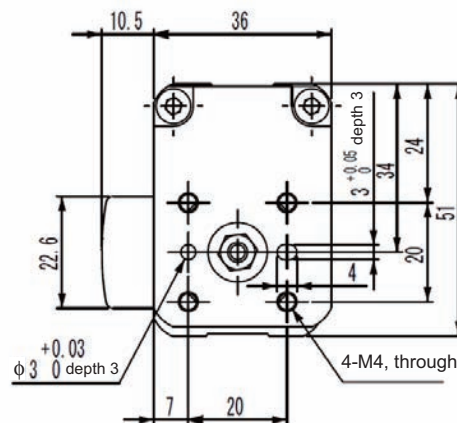
- Pay attention to the thread length, because the threaded holes on the front table are through holes.

(TCA3NA, TCA3N (Lead screw, Ball screw))



Front plate

(TCA4NA, TCA4N (Lead screw, Ball screw))



Front plate

(TCA3NA, TCA3N (Lead screw, Ball screw))

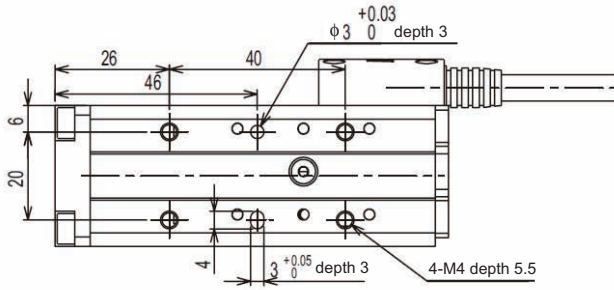


Table upper surface

(TCA4NA, TCA4N (Lead screw, Ball screw))

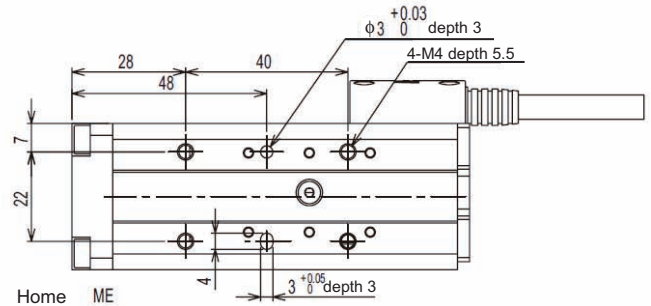


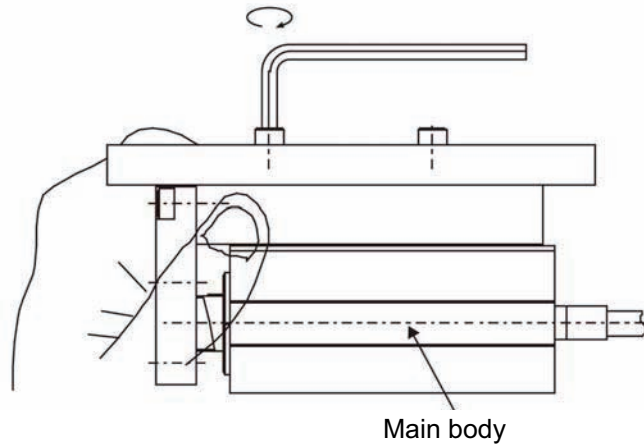
Table upper surface

⚠ Caution:

- A work part shall be mounted on a machined plane or a plane with equivalent precision, and the flatness shall be 0.01 mm/m or less. If sufficient flatness is not secured, the table is deformed when mounting and fixing a work part, causing malfunction. Flatness refers to the height difference between the maximum value (peak) and minimum value (trough) of surface distortion.
- The length of screws used to mount a work part must be the effective screw depth described here or less. If a screw is screwed in more than the effective screw depth, the end may get into contact with the guide rail and the table may be deformed, causing malfunction.

(2) TWA3NA, TWA3N (Lead screw, Ball screw), TWA4NA, TWA4N (Lead screw, Ball screw)

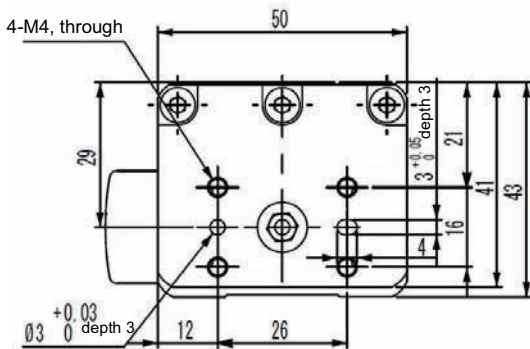
- Please attach the load to the device using the tapped holes in the front plate of the table type.
- There are also tapped holes and reamed holes in the top surface of the table. Please use these to attach the load.
- There is one reamed hole on the slider in the top surface of the table, so if you need to be able to secure and detach the load multiple times, please use this hole. Also, if you require precision in your attachment, such as a right angle, use one reamed hole to make fine adjustments.
- The process for attaching these to the main unit is similar to the installation process of the main unit. The mounting screws and tightening torque required are also similar to the installation process of the main unit. (Refer to 2.3.1 [2].)
- Mount a work part by holding the table as shown in the figure. If you hold only the main body and tighten the work part, excessive moment is applied to the guide area and play may be generated.



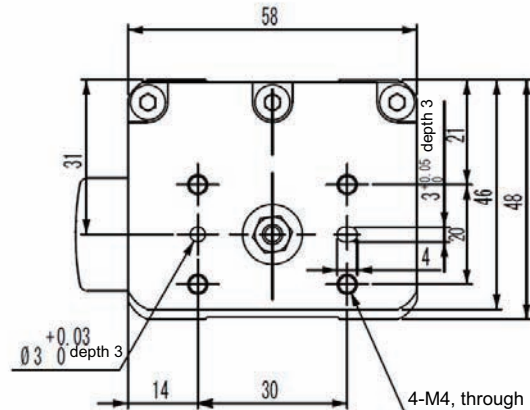
- Pay attention to the thread length, because the threaded holes on the front table are through holes.

(TWA3NA, TWA3N (Lead screw, Ball screw))

(TWA4NA, TWA4N (Lead screw, Ball screw))



Front plate



Front plate

(TWA3NA, TWA3N (Lead screw, Ball screw))

(TWA4NA, TWA4N (Lead screw, Ball screw))

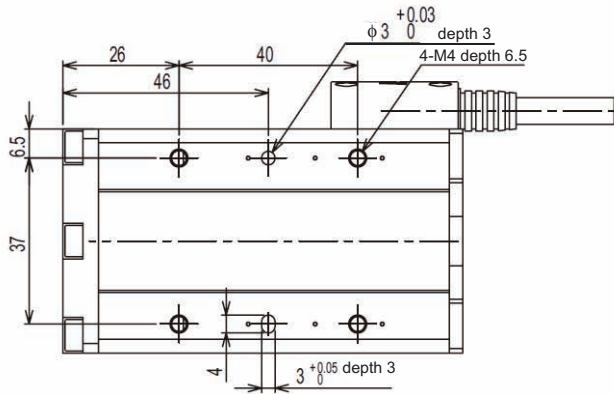


Table upper surface

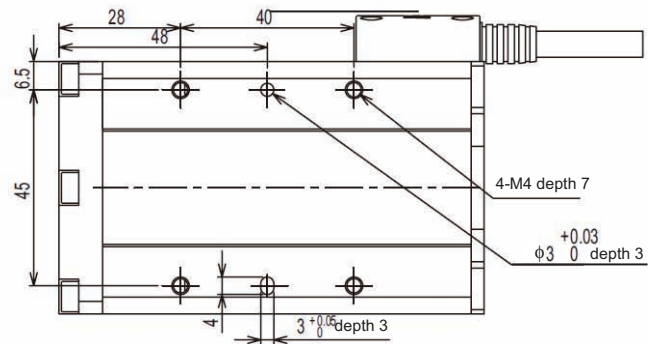
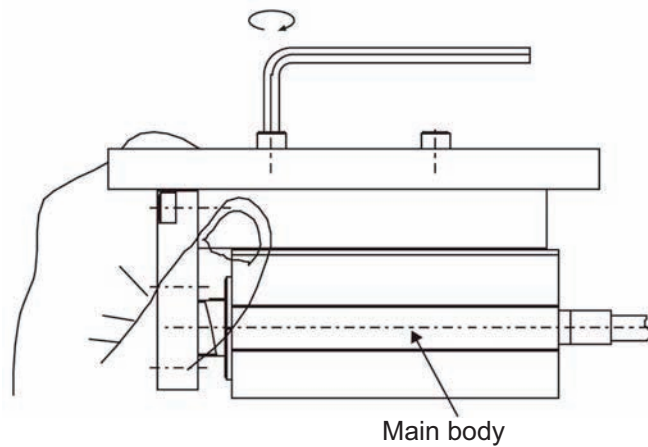


Table upper surface

- ⚠ Caution:
- A work part shall be mounted on a machined plane or a plane with equivalent precision, and the flatness shall be 0.01 mm/m or less. If sufficient flatness is not secured, the table is deformed when mounting and fixing a work part, causing malfunction. Flatness refers to the height difference between the maximum value (peak) and minimum value (trough) of surface distortion.
 - The length of screws used to mount a work part must be the effective screw depth described here or less. If a screw is screwed in more than the effective screw depth, the end may get into contact with the guide rail and the table may be deformed, causing malfunction.

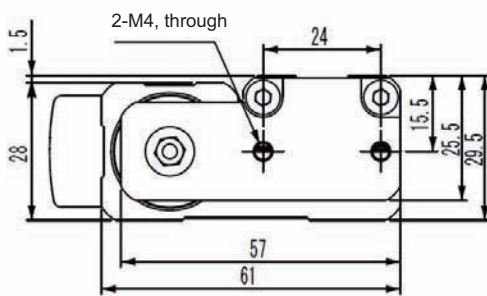
(3) TFA3NA, TFA3N (Lead screw, Ball screw), TFA4NA, TFA4N (Lead screw, Ball screw),

- Please attach the load to the device using the tapped holes in the front plate of the table type.
- There are also tapped holes and reamed holes in the top surface of the table. Please use these to attach the load.
- There is one reamed hole on the slider in the top surface of the table, so if you need to be able to secure and detach the load multiple times, please use this hole. Also, if you require precision in your attachment, such as a right angle, use one reamed hole to make fine adjustments.
- The process for attaching these to the main unit is similar to the installation process of the main unit. The mounting screws and tightening torque required are also similar to the installation process of the main unit. (Refer to 2.3.1 [2].)
- Mount a work part by holding the table as shown in the figure. If you hold only the main body and tighten the work part, excessive moment is applied to the guide area and play may be generated.



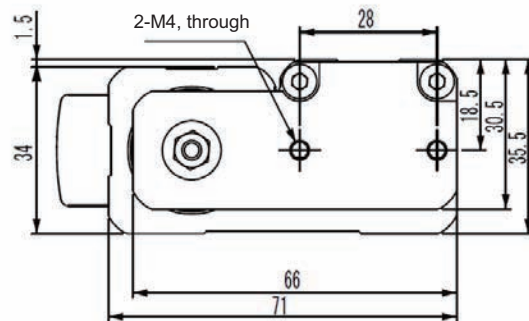
- Pay attention to the thread length, because the threaded holes on the front table are through holes.

(TFA3NA, TFA3N (Lead screw, Ball screw))



Front plate

(TFA4NA, TFA4N (Lead screw, Ball screw))



Front plate

(TFA3NA, TFA3N (Lead screw, Ball screw))

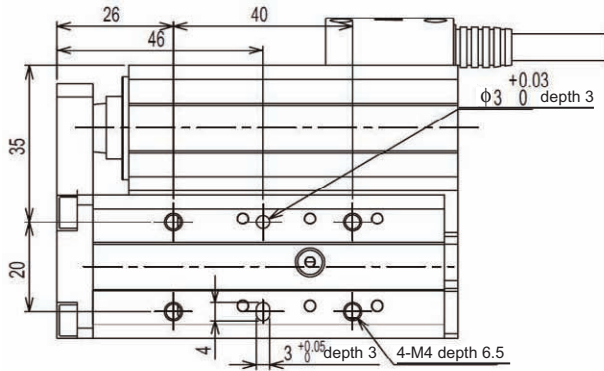


Table upper surface

(TFA4NA, TFA4N (Lead screw, Ball screw))

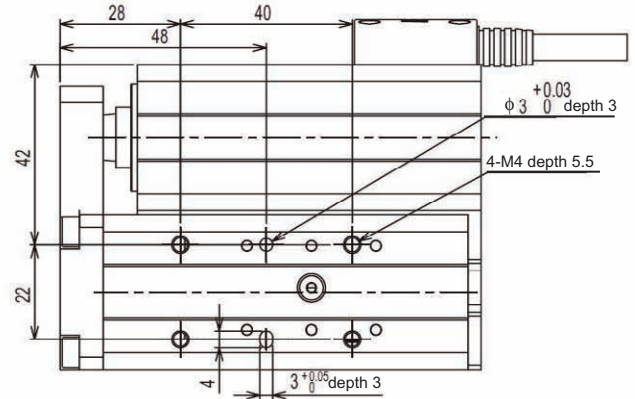


Table upper surface

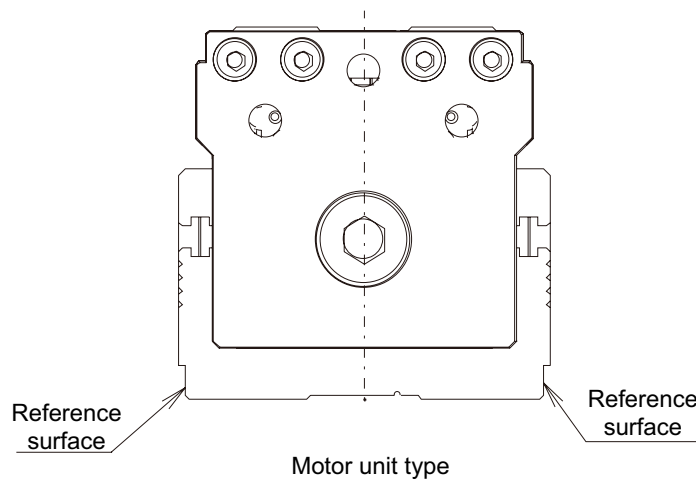
- ⚠ Caution:
- A work part shall be mounted on a machined plane or a plane with equivalent precision, and the flatness shall be 0.01 mm/m or less. If sufficient flatness is not secured, the table is deformed when mounting and fixing a work part, causing malfunction. Flatness refers to the height difference between the maximum value (peak) and minimum value (trough) of surface distortion.
 - The length of screws used to mount a work part must be the effective screw depth described here or less. If a screw is screwed in more than the effective screw depth, the end may get into contact with the guide rail and the table may be deformed, causing malfunction.

2.3.3 Installation Surface

Motor unit types TA4, TA5, TA6, TA7

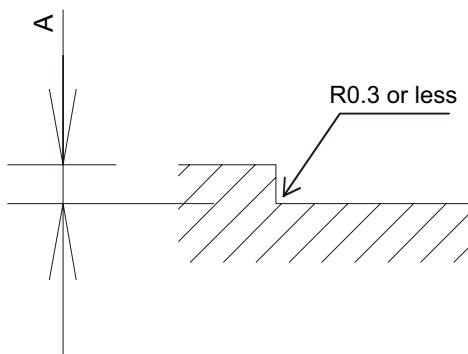
- For the platform to install the actuator, ensure the structure that possesses enough stiffness to avoid vibration being generated.
- Install the main unit only on a machined surface, or other surface that is highly flat, within 0.05 mm/m.
- Provide adequate space around the device to allow for future maintenance.
- On the motor unit type (TA**) actuator, the side and bottom faces of the base provide reference surfaces for table's travel.

When it is necessary that the slider or table move in a highly precise fashion, please ensure that the device is installed at an orientation that is based on the position of these surfaces.



Caution: Because the side and bottom faces of the base provide reference surfaces for table travel as shown in the above diagram, conduct installation based on the position of this side when precision is required.

Follow the diagram below when installing the device using the reference surface.



Model	Length of A (mm)
Motor unit type	2 to 4 or less

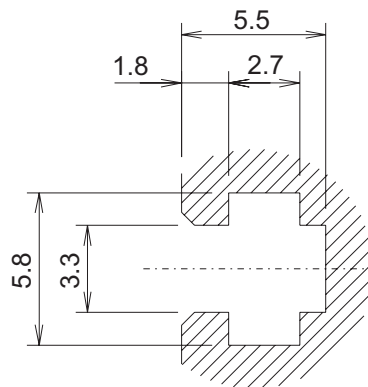
2.3.4 Attachment of sensor and so on

The main unit surface side of TA5C, 6C, 7C and TR type contains T grooves (M3 size) for attaching external devices.

These grooves are to be used for whatever needs may arise, such as installing sensors, fastening wiring, etc.

T groove measurements are shown below.

- A use of square nut is recommended for the T grooves, but a hex nut can also be used.
- Pay careful attention to the length so that the edge of the bolt won't contact the base of T grooves during installation.

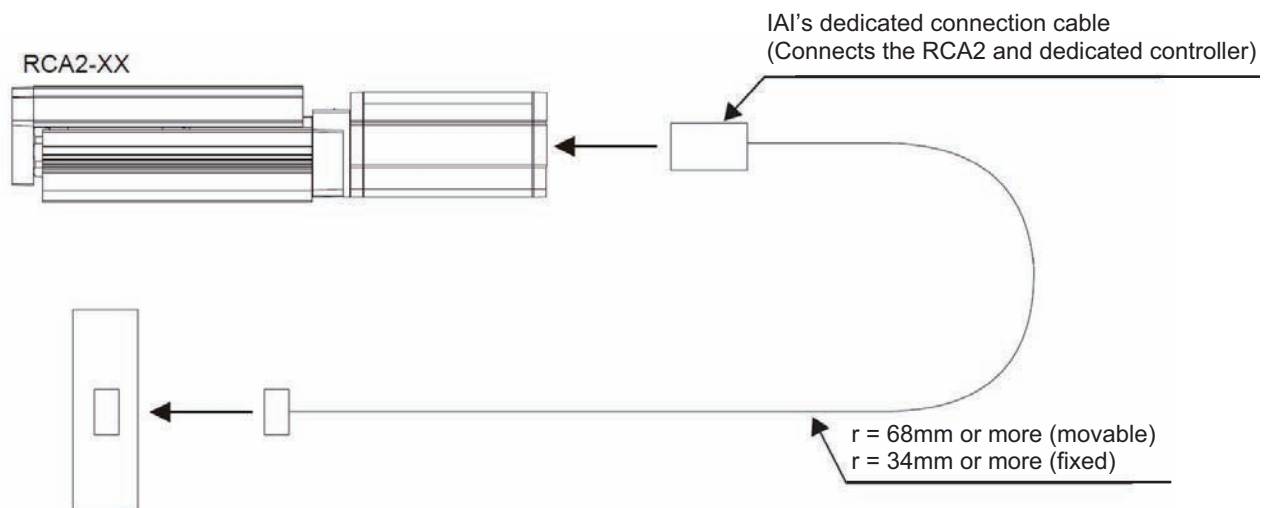


3. Connecting with the Controller

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 coming out of the motor unit is not meant to be bent. Fix the cable so it would not be bent repeatedly.

Please consult with IAI if you require a different kind of cable than the one supplied.



Dedicated controller

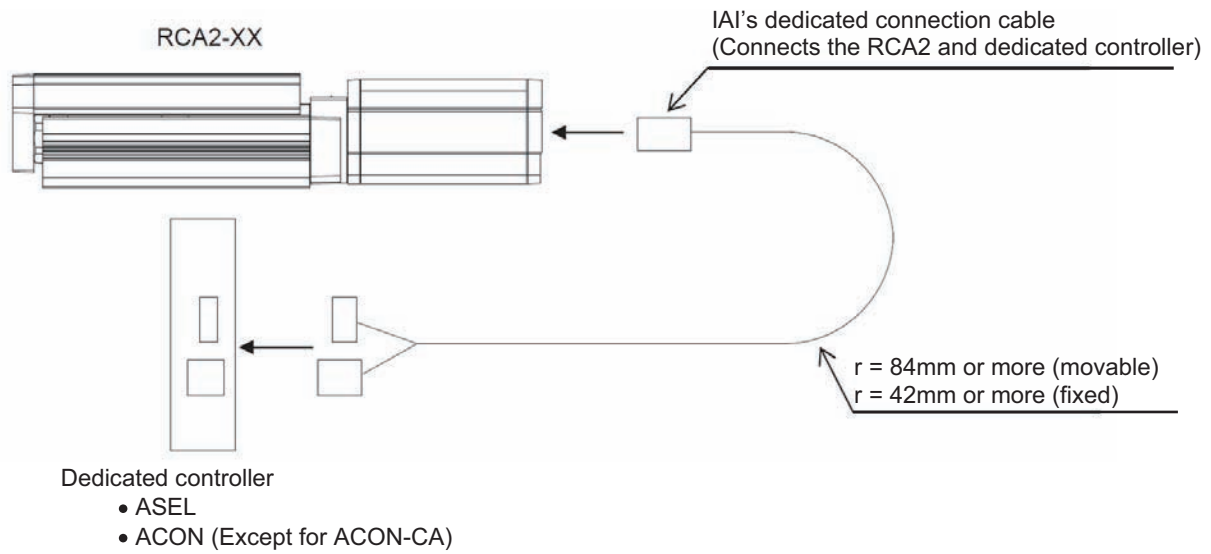
- ACON-CA
- AMEC
- ASEP
- MSEP

Dedicated connection cable

- Servo motor cable : CB-APSEP-MPA□□□

*) □□□ indicates the cable length. Up to 20m can be specified.

Example) 080 = 8m



Dedicated connection cable

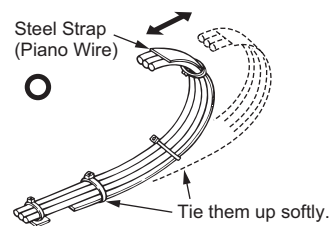
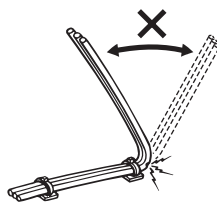
- Servo motor cable : CB-ACS-MPA□□□

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

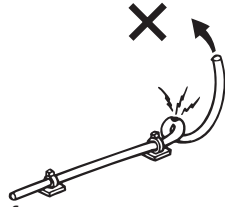


Warning: For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause not only a malfunction such as cable breakage or connection failure,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

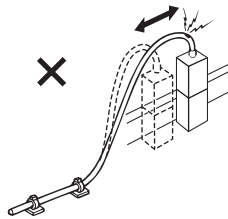
- Use dedicated cables of IAI indicated in this operating manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with 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.



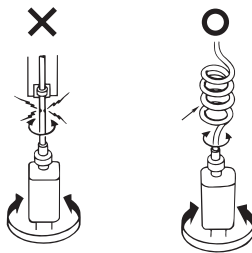
- Do not let the cable bend, kink or twist.



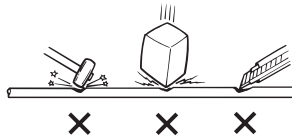
- Do not pull the cable with a strong force.



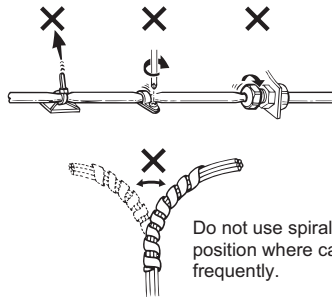
- Pay attention not to concentrate the twisting force to one point on a cable.



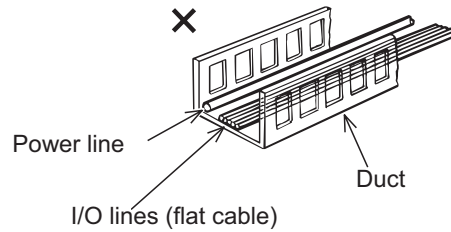
- Do not pinch, drop a heavy object onto or cut the cable.



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



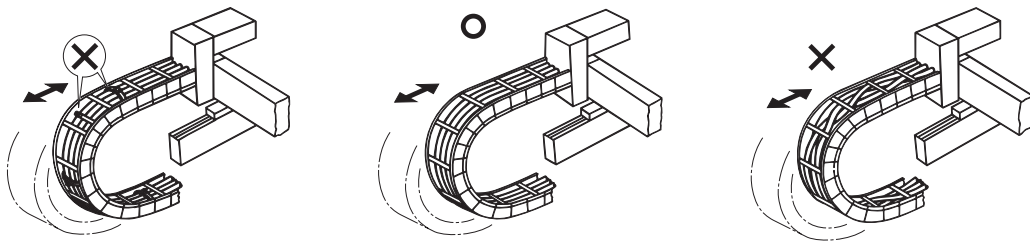
- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



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. Operations

4.1 Duty in Continuous Operation

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

Perform an operation with the duty below the allowable range.

Caution: If the overload error occurs, try either to reduce the duty by extending the stop time or to reduce the acceleration/deceleration speed.

[How to Calculation Duty]

Figure out the load ratio and acceleration/deceleration time ratio, and read the duty from the graph. If the load ratio is less than 50%, operation with 100% of the duty (continuous operation) is available.

1) Duty ratio LF

The maximum transportable weight at the rated acceleration and the rated acceleration/deceleration speed are described in 1.2 "Specifications."

$$\text{Duty ratio: LF} = \frac{M \times \alpha}{M_r \times \alpha_r} \quad [\%]$$

- Max. Transportable Weight at Rated Acceleration : M_r [kg]
- Rated Acceleration/Deceleration Speed : α_r [G]
- Transported Weight during Operation : M [kg]
- Acceleration/Deceleration Speed during Operation : α [G]

2) Acceleration/Deceleration Time Ratio t_{od}

$$\text{Acceleration/Deceleration Time Ratio } t_{od} = \frac{\text{Acceleration Time during Operation} + \text{Deceleration Time during Operation}}{\text{Deceleration time}} \quad [\%]$$

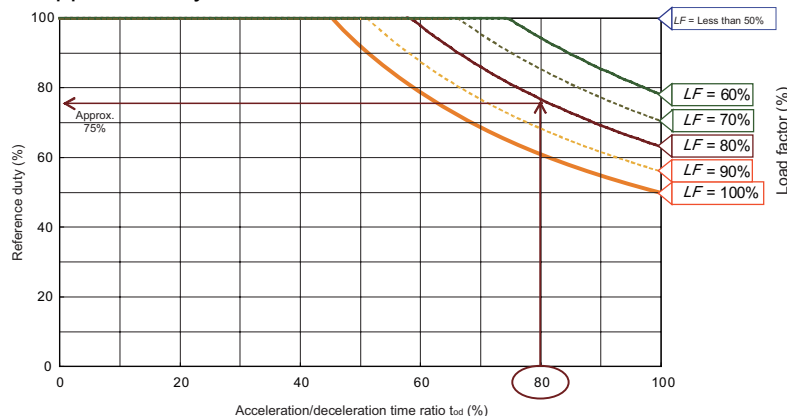
$$\text{Acceleration time} = \frac{\text{Speed during Operation} [\text{mm/s}]}{\text{Acceleration during Operation} [\text{mm/s}^2]} \quad [\text{Sec}]$$

$$\text{Deceleration time} = \frac{\text{Speed during Operation} [\text{mm/s}]}{\text{Deceleration during Operation} [\text{mm/s}^2]} \quad [\text{Sec}]$$

$$\text{Acceleration} [\text{mm/s}^2] = \text{Acceleration} [\text{G}] \times 9,800 \text{mm/s}^2$$

$$\text{Deceleration} [\text{mm/s}^2] = \text{Deceleration} [\text{G}] \times 9,800 \text{mm/s}^2$$

3) Duty: It is read out from the load ratio LF and the acceleration time ratio t_{od} that were used to figure it out. e.g.) When the load ratio LF = 80% and the acceleration/deceleration time ratio t_{od} = 80%, the reference for the duty is approximately 75%.



4.2 Home Return

4.2.1 Adjusting the Home Position

The actuator home position can be adjusted by changing parameter ^{*1}. In order to make adjustments, please do the following.

- [1] Verify the home position by performing a home return operation.
- [2] Move the actuator to the desired position, verify the distance between the old and new positions, and adjust the parameter accordingly. The parameter can be set to a positive value in the direction of movement. (It cannot be set to a negative value.)
- [3] Increasing the offset amount restricts the movement range by the amount of the increase. If you set an offset greater than 1 mm, please reset the stroke soft limit.

- *1 ACON controller: No. 22, home return offset distance
- ASEL controller: Parameter No. 12 for each axis, home preset value
- ASEP controller: Parameter No. 16, home return offset distance
- MSEP controller: Parameter No. 16, home return offset distance

4.2.2 Changing the Home Position Direction

To change the home position direction after delivery, it is necessary to change the movement direction parameter. Please contact with IAI if you need to do this.



Warning:

The encoder serves not only to detect the actuator's position and the home position signal, it also plays a crucial role in phase switching for the AC servo power line, and is calibrated at a high level of precision for that purpose. Never touch the encoder in order to change the home position.

4.2.3 How to use the home mark

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

Contents of sticker

Home mark sticker

× 1 sheet

Home mark sticker × 4 Home sticker × 4
(Scale: 1 mm graduation mark, 10 mm width)

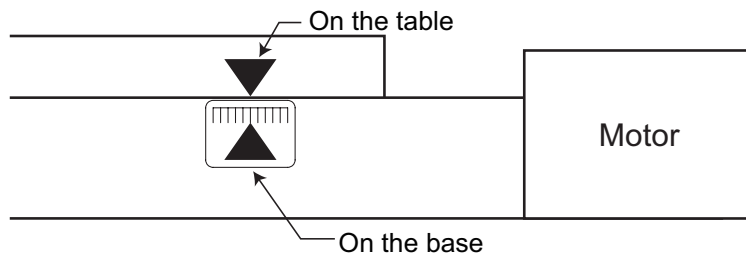
- Peel off the marks from the base sheet.

Note

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

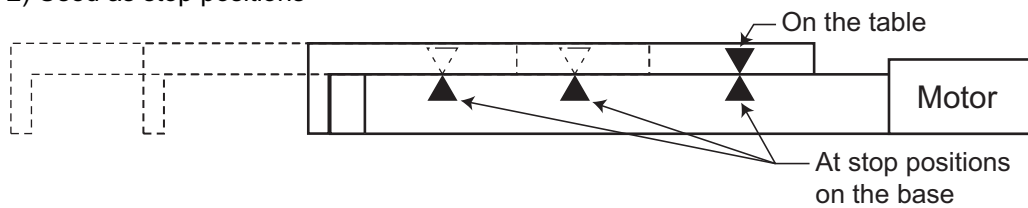
Example of Use

1) Used to indicate the direction of actuator home



- Attach both stickers when actuator is stopped in home position

2) Used as stop positions



4.3 How to Move Table by Hand

[1] For Without Brake

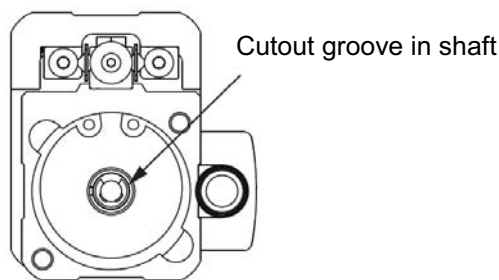
On low-lead types with a lead of 1, 2, etc., the table is too heavy to slide and cannot be moved by hand.

Also, although Lead 4 and 6 can be moved manually, large force on the mechanical end may apply impact to the ball screw and slide screw, which may cause operation error or damage on them.

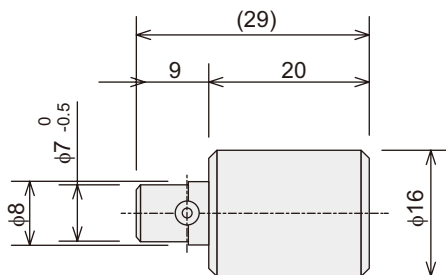
To move the table on these models, insert a screwdriver, etc., into the cutout groove provided in the shaft on the rear side and turn the groove.

When moving the table, make sure to insert the position adjustment knob to the slit groove on the shaft on the rear end no matter of the lead.

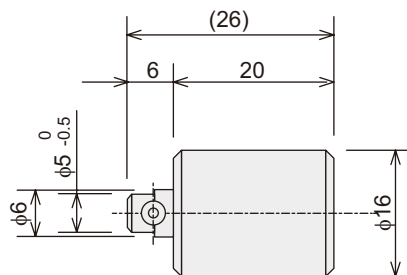
A slotted screw is also available when you do not have a position adjustment knob.



[Position Adjustment Knob]



For four series
Model : RCA2-AK-R4



For three series
Model : RCA2-AK-R3

[2] For Brake Type

There is no slit on the shaft for the brake types.

Have the controller connected to make an operation.

Moving forcefully with hand would help abrasion on the brake, which could shorten its life.



Caution: Do not attempt to have a back and forth operation by hand from the table end. Moving it forcefully would apply too much load to the feed screw and may result in the cause of operational failure or destruction of the product.

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.

(Lead screw types)

Schedule	External visual inspection	Internal inspection	Greasing ^(Note 1)
Start of work inspection	○		
1 month inspection	○		
3 month inspection	○	○	
6 months inspection	○	○	○
Every 6 month thereafter	○	○	○

(Ball screw types)

Schedule	External visual inspection	Internal inspection	Greasing ^(Note 1)
Start of work inspection	○		
1 month inspection	○		
3 month inspection			○
3 months after starting operation			Depends on grease supply timing (reference)
6 months inspection	○	○ ^(Note 2)	
Every 6 month thereafter	○	○ ^(Note 2)	

Note 1 Grease film may run out if the actuator is moved back and forth continuously over a distance of 30mm or less. As a guide, perform a back-and-forth operation five times or so over a distance of 50mm 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.

Note 2 Check the condition of grease and wipe it off in case it is extremely dirty before supplying new grease.

[Period of Grease Supply (reference)]

Supply grease in the earlier timing of either the operation distance or months described in the table below.

Max. velocity of use [mm/s]	Period of grease supply (reference)	
	Operation distance	Months described
0 to 600 or less	1,250km	12 months



Warning:

- The grease may be degraded if the actuator has got stored for 6 months or more. Supply grease before starting to use. [Reference to 5.5 Grease Supply]
- The speed of grease degradation differs depending on the environment of use (temperature, humidity and ambient environment). It is recommended to shorten the period of grease supply in case of use in bad environment with high temperature, high humidity, high rate of dust and so on. Also, it is recommended to improve the environment in case the color of the grease changes remarkably due to bad environmental condition.

5.2 Visual Inspection of Exterior

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

Actuator	Loose actuator mounting bolts, other loose items, buildup
Cables	Scratches, connection at connectors
Spiral Cover	Scratches, dents, foreign object attached on cover
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.
- The spiral cover is a consumable part. Its life is 2,000,000 cycles of back and forth operation as a reference. Refer to 5.9 How to Replace Spiral Cover when replacing the spiral cover.

(Note) The life of the spiral cover varies due to the environment of use. Foreign object (dust, high-viscosity oil) attached on the surface could disturb the expansion and contraction operation, which leads to a shorter life. To obtain a longer life, clean the surface regularly.

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 Internal Inspections

5.4.1 Motor unit types

Turn off the power, remove the ball screw cover, and inspect visually.
 On motor reversing types, remove the reversing bracket and inspect visually.
 When inspecting the interior, check the items specified below.

Main unit	Loose actuator mounting bolts, other loose items
Guide section	Lubrication, buildup
Belt (reversing types)	Belt wear and damage

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 does not have a shiny appearance, or if the grease has lost its efficacy due to prolonged use, then clean each section and reapply grease.

The procedure for internal inspections is outlined below. Refer to 5.7 for inspection and adjustment of the belt.

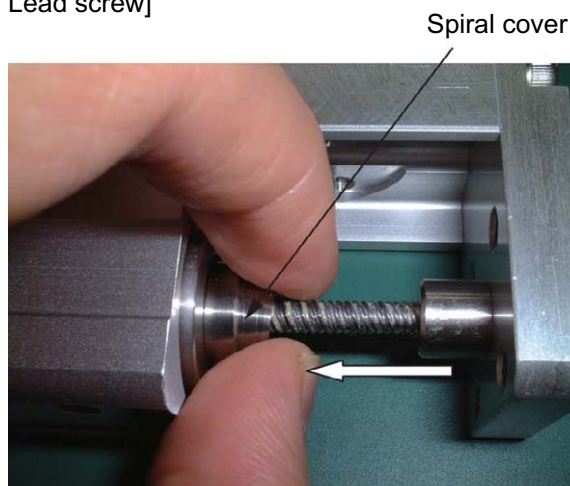
- [1] Move the table to the home position side.
- [2] Remove the ball screw cover.
- [3] Check the interior.
- [4] When you have completed the inspection, reassemble by doing the reverse of the above.

5.4.2 Short types

When inspecting the interior, check the items specified below.

Main unit	Loose bolts, other loose items
Slid screw/guide rail	Lubrication, buildup

[Internal inspection of Lead screw]



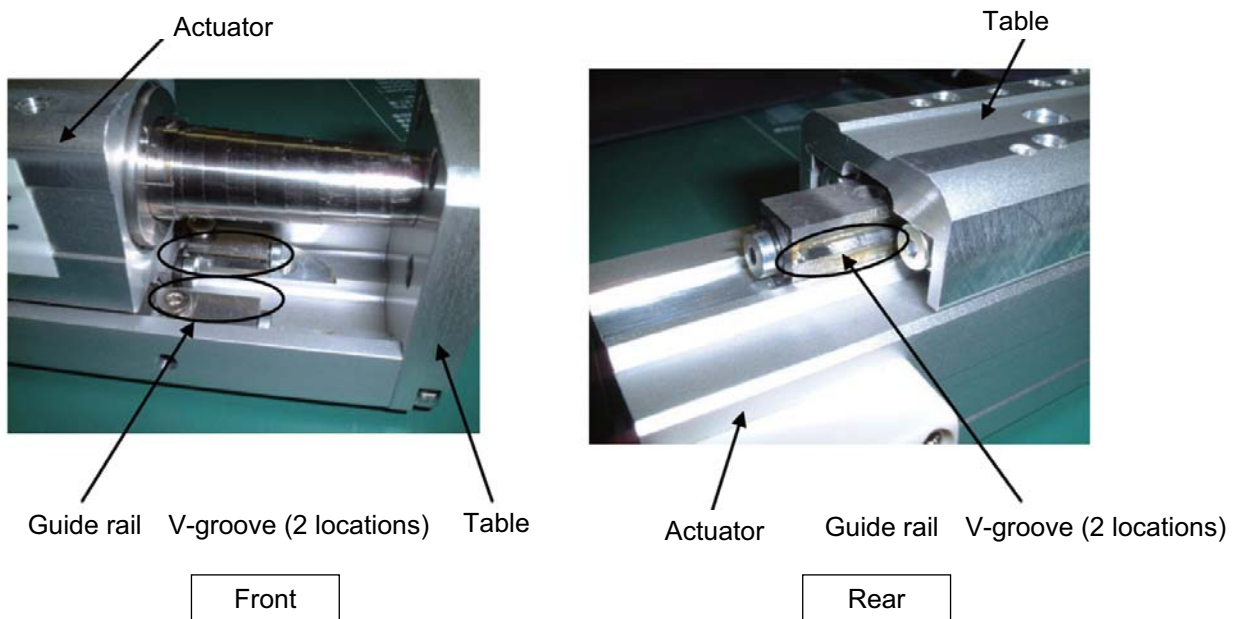
To check the lead screw or ball screw, turn off the power, extend the table, and pull the narrower end of the spiral cover toward the wider end (in the direction of the arrow) to expose the screw shaft and inspect the shaft visually.

If the lead is too small and the table does not move, insert a slotted screwdriver, etc., into the cutout groove provided in the shaft on the rear side and turn. [Refer to 4.3, "How to Move Table by Hand."]

Visually check the lubrication condition of the lead screw or ball screw.

Even when the grease is brown, the screw is lubricated properly as long as the traveling surface looks wet and shining. 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, clean the applicable area and then replenish grease.

[Internal inspection of guide rail]



Turn off the power and pull out the table.

If the lead is too small to move the table, insert a screwdriver, etc., into the cutout groove provided in the shaft on the rear side and turn. [Refer to 4.3 "How to Move Table by Hand."]

Visually check the table and actuator's guide rail for lubrication condition.

Even when the grease is brown, the screw is lubricated properly as long as the traveling surface looks wet and shining. 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, clean the applicable area and then replenish grease.

5.5 Grease Supply

5.5.1 Applicable greases for guide

(1) Models other than Ball Guide Type

The grease initially used is lithium-based grease.
IAI uses the following grease in our plant.

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

Other companies also sell similar types of grease. For details, give the grease name to the manufacturer you want to purchase from and ask what corresponding product they have available. Here are some examples of similar products.

Showa Shell Oil	Albania Grease S2
Mobil Oil	UNIREX N2

(2) Ball Guide Type (Option: Model Code BG)

The grease initially used is lithium-based grease.
IAI uses the following grease in our plant.

Kyodo Yushi Co., LTD.	Multemp PS No.2
-----------------------	-----------------



Warning:

Never use fluorine-based grease. Mixing fluorine-based grease with lithium-based grease not only reduces the performance of the grease, it may even cause damage to the actuator.

5.5.2 Applicable grease for ball screw and lead screw

[Lead screw types]

All lead screw products have been shipped with synthetic poly- α olefin grease applied to the lead screw. IAI uses the following grease in our plant.

Location	Manufacturer	Model number
Lead screw	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 used is lithium-based grease.

IAI uses the following grease in our plant.

Motor unit types TA5C, TA6C, TA7C TA5R, TA6R, TA7R	Kyodo Yushi Co., LTD.	Multemp LRL 3
Motor unit types TA4C, TA4R Short types TCA3NA, TCA4NA, TWA3NA, TWA4NA, TFA3NA, TFA4NA, TCA3N, TCA4N, TWA3N, TWA4N, TFA3N, TFA4N	Idemitsu Kosan Co., Ltd.	Daphne Eponex Grease No. 2



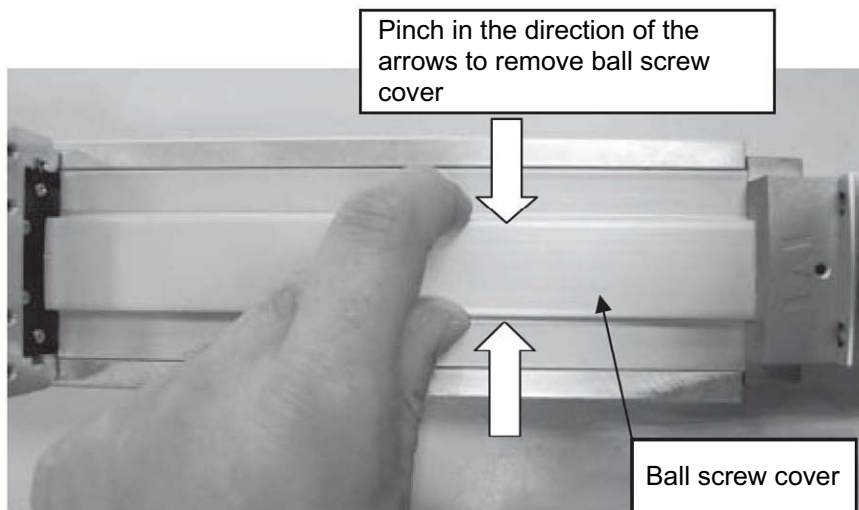
Warning:

Never use fluorine-based grease. Mixing fluorine-based grease with lithium-based grease not only reduces the performance of the grease, it may even cause damage to the actuator.

5.5.3 How to apply grease

[1] Motor unit types

Pull the table all the way out before removing the ball screw cover.



- (1) For the guide section, apply the grease by moving the table back and forth and spreading it out, either by pushing a scraper between the table and base or by lubricating with a grease injector. Grease the guides on both sides. When complete, wipe away any excess grease.



- (2) To grease ball screws, first clean, then put some grease on your finger and apply while moving the table back and forth.
When finished, wipe off excess grease.



For the table type, put the ball screw cover back on.

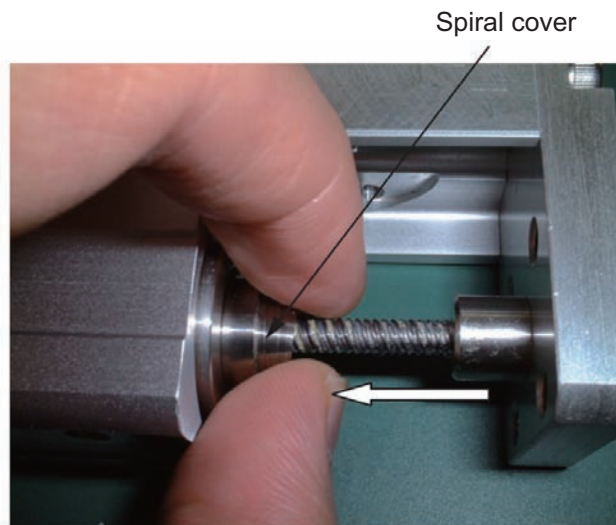


- Caution:**
- Make sure not to exceed the value stated in “Caution in Handling” for the external force applied in the thrust direction when moving the tables back and forth manually by hand on TA4, TA5 and TA6.
(If the slider will not move, operate it using a jog function.)
 - In case the grease got 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.


[2] Short types

[How to apply grease for ball screw]

- [1] Turn off the power and check the surface of the spiral cover for shavings, powder dust, etc. Use a waste cloth, etc., to wipe off shavings, powder dust, if any.
- [2] Pull the table and pull the narrower end of the spiral cover toward the wider end (in the direction of the arrow) to expose the screw shaft. If the lead is too small and the table does not move, insert a slotted screwdriver, etc., into the cutout groove provided in the shaft on the rear side and turn. [Refer to 4.3, "How to Move Table by Hand."]

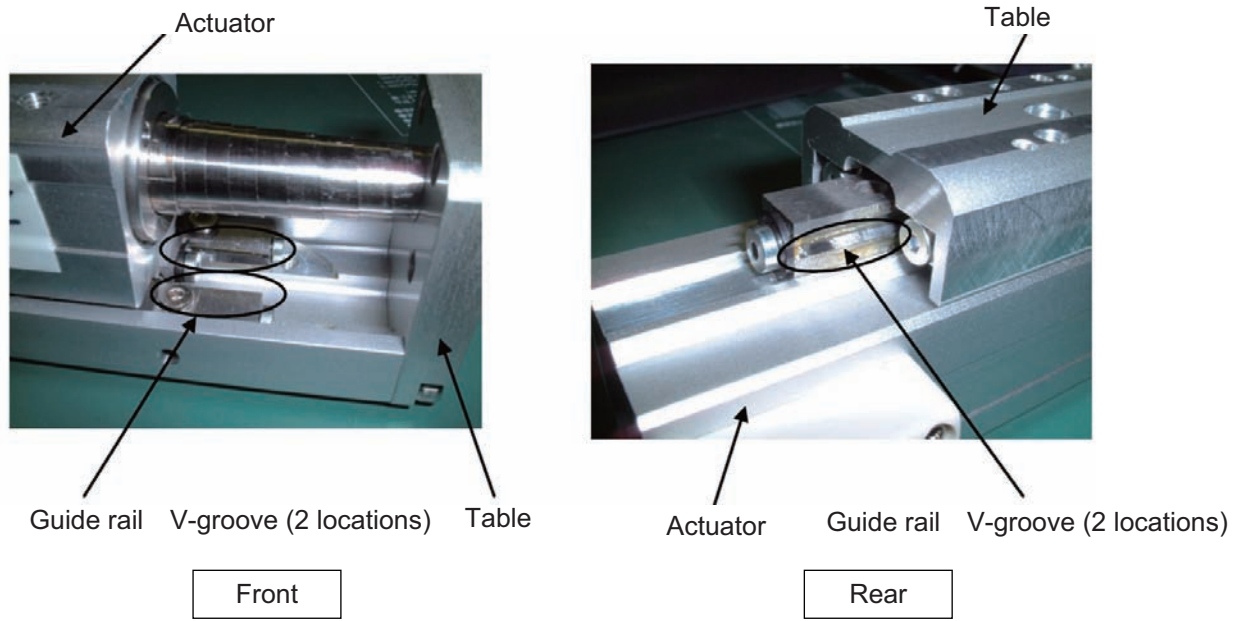


- [3] Wipe off grease attached to the lead screw or ball screw and then apply the specified grease.
- [4] Install the spiral cover in the original condition and move the table to spread the grease evenly.

 **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.

[How to apply grease for guide rail]

- [1] Turn off the power and pull out the table.
If the lead is too small to move the table, insert a screwdriver, etc., into the cutout groove provided in the shaft on the rear side and turn. [Refer to 4.3, "How to Move Table by Hand."]



- [2] Wipe off the grease attached to the V-groove in the guide rail and apply the specified grease.
[3] Move the table to spread the grease evenly.

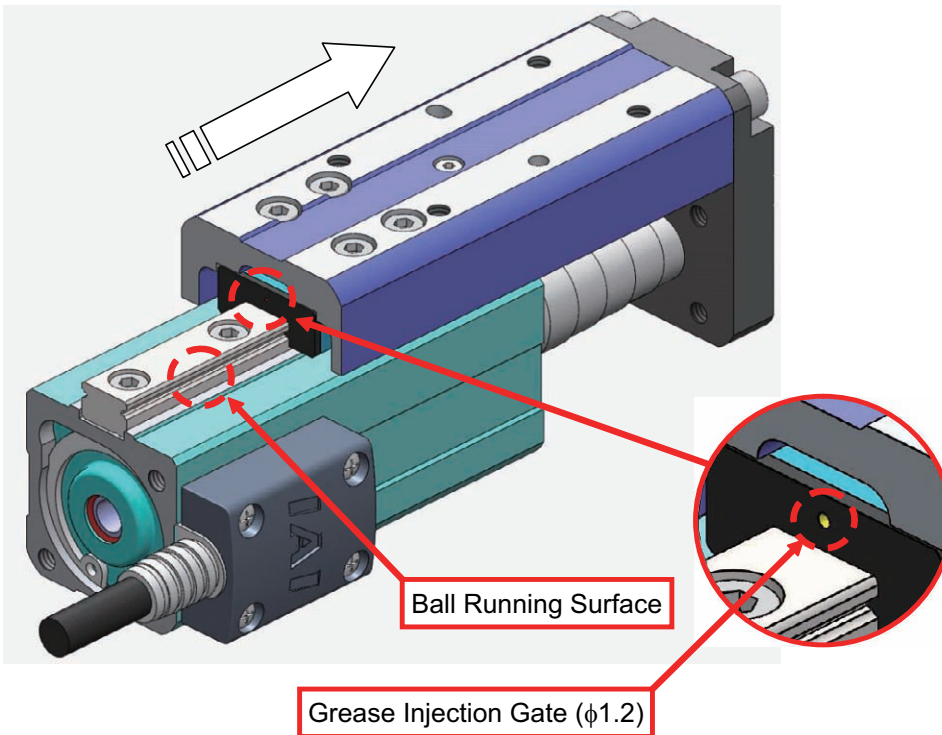
⚠ Caution: In case the grease got into your eye, immediately go to see the doctor to get an appropriate care.
After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

[3] Short types Ball Guide Type (Option: Model Code BG)

[How to apply grease for guide rail]

- To apply grease, supply it from the grease injection gate ($\phi 1.2$) shown in the figure below with using an injector.
The following table shows the volumes of grease application for each model as a reference.
There is a tendency that the resistance in sliding operation increases after grease is supplied.
Remove excessive grease and then run the actuator back and forth for 10 to 20 times for a break-in.

Grease Apply Volume (1 block)	
TC3N	40mm ³
TF3N	40mm ³
TW3N	30mm ³
TC4N	45mm ³
TF4N	45mm ³
TW4N	50mm ³



- ⚠ Caution:**
- The guide constructed in the Ball Guide Type is equipped with a built-in lubrication system, however, in a short distance travel, the lubricant may not get spread out evenly. Check the lubricant condition regularly, and supply grease if necessary.
 - 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.

5.6 Belt

5.6.1 Inspection of Belt

Visually inspect the belt after removing the pulley cover.

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 of when the belt should be actually replaced, 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

5.6.2 Applicable Belt

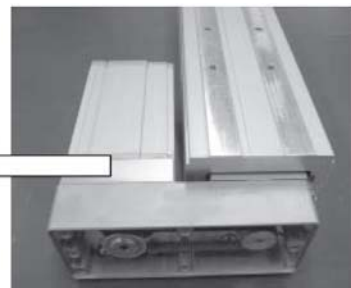
Manufacturer: Bando Chemical Industries, Ltd.

Belt model (type)	Model
40S2M138R, 4-mm wide (clean rubber type)	TA4R
60S2M168R, 6-mm wide (clean rubber type)	TA5R
60S2M198R, 6-mm wide (clean rubber type)	TA6R
60S2M198R, 6-mm wide (clean rubber type)	TA7R

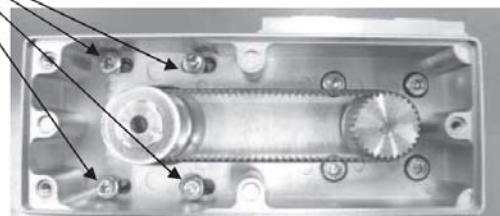
5.6.3 Adjustment of Belt Tension

Remove the pulley cover, loosen the tension adjustment bolts (4 locations), and move the motor to the left as shown below to tension the belt. After the adjustment is finished, tighten the tension adjustment bolts.

Tension	
TA4R:	1.5 ± 0.1 kgf
TA5R/6R/7R:	2.5 ± 0.1 kgf



Tension adjustment bolt		
Model	Nominal thread size	Tightening torque
TA4R	M2.6	0.46 N-m (0.047 kgf-m)
TA5R	M3	0.83 N-m (0.085 kgf-m)
TA6R/TA7R	M4	1.76 N-m (0.18 kgf-m)



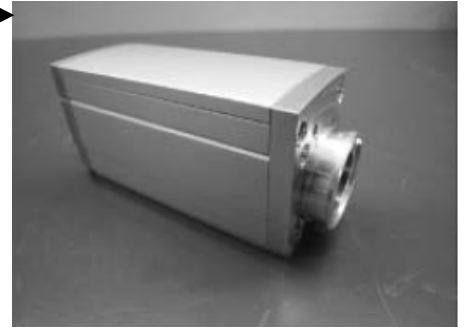
5.7 Procedures for Replacement of Motor

* Refer to 5.9 for the reversing types.

[Items required for replacing the motor]

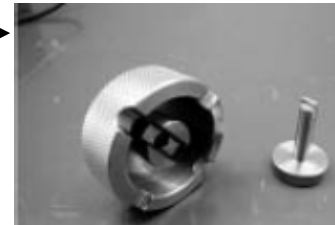
Replacement motor unit

Axis type			Model	
			Without brake	Brake type
RCA2 (brown encoder cable connector)	Table type	TA4C	RCA2-MU1A	RCA2-MU1A-B
		TA5C	RCA2-MU2A	RCA2-MU2A-B
		TA6C	RCA2-MU3A	RCA2-MU3A-B
		TA7C	RCA2-MU4A	RCA2-MU4A-B



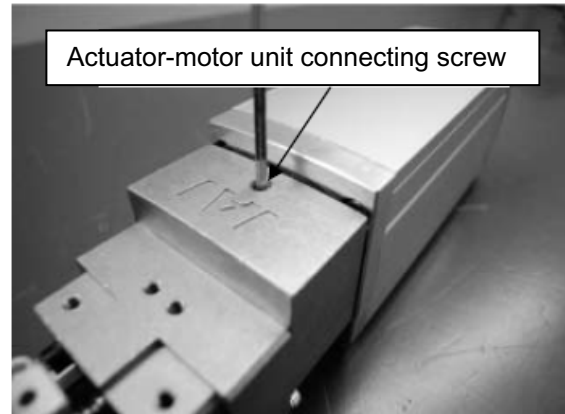
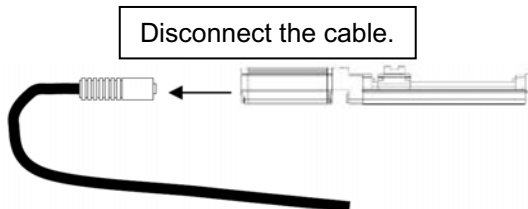
- Hex wrench set
- Special replacement jigs
(Option)

Model	Applicable model
RCA2-JG-1	TA4
RCA2-JG-2	TA5
RCA2-JG-3	RCA2-SA5/SA6/TA6/TA7

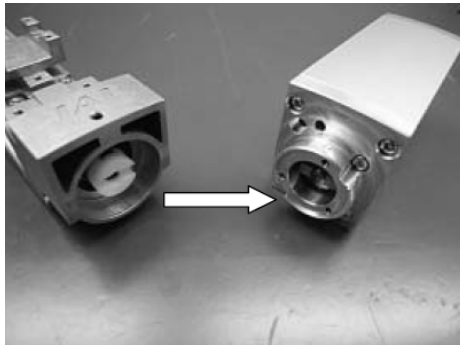


[Procedure]

- [1] Disconnect the cable from the motor unit, then use a 2 mm hex wrench to remove the screw fastening the actuator unit and the motor unit.



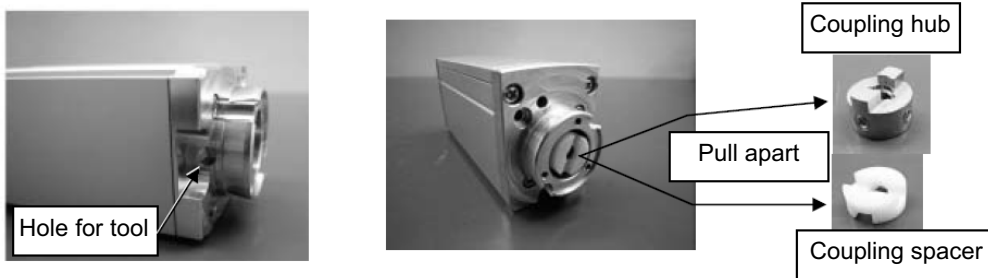
- [2] Detach the motor unit.



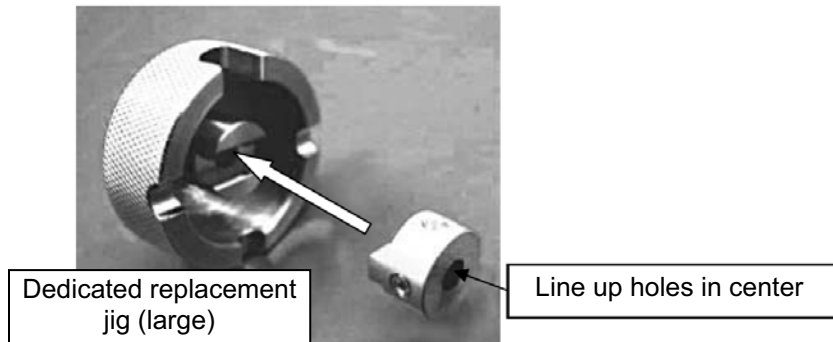
- [3] Take out the coupling hub and coupling spacer from the detached motor unit. Twist the coupling hub or coupling spacer on the motor side to align the screw holes with the hole for the tool to go through. Then remove two screws with a 2 mm hex wrench.

Note If there is only a coupling hub on the motor unit side, then there is a coupling spacer on the actuator side which can be removed by pulling.

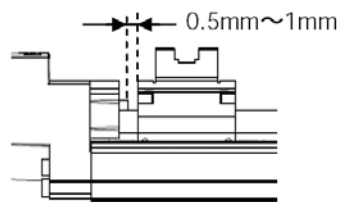
Note If both coupling hub and coupling spacer are present, pull them apart. (They should separate with a gentle pull.)



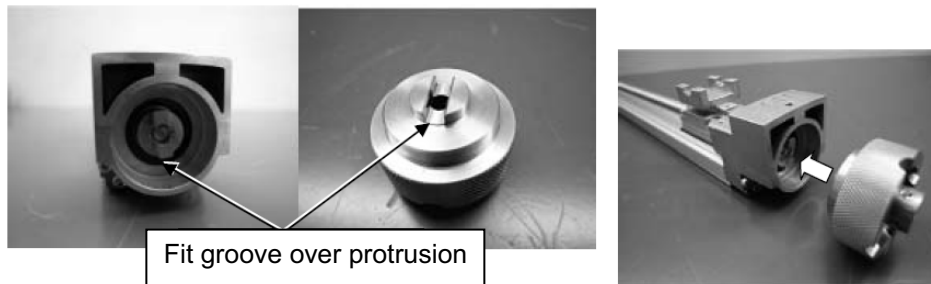
- [4] Fit the protruding part of the coupling hub into the groove of the dedicated replacement jig (large), and temporarily hold them together with two M3x3 Hex screws (tighten just enough so that the coupling hub does not fall off).



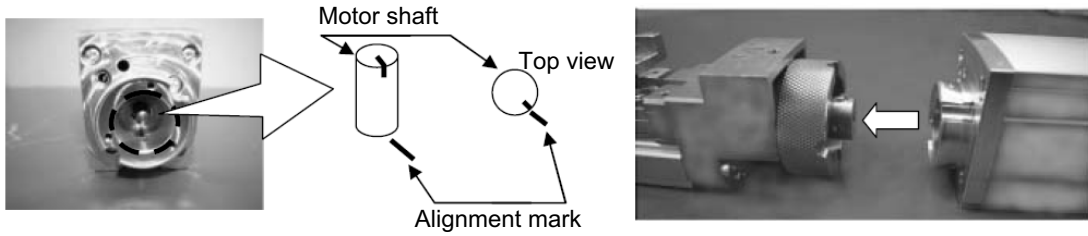
- [5] Turn the shaft to move the table about 0.5 mm to 1 mm from the mechanical end on the home position side.



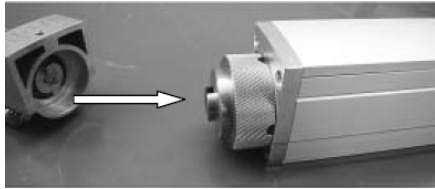
- [6] Fit the groove of the dedicated replacement jig (large) assembled in [4] over the protrusion of the actuator.



- [7] Align the marking on the motor shaft with the point indicated and insert the replacement motor unit into the actuator.



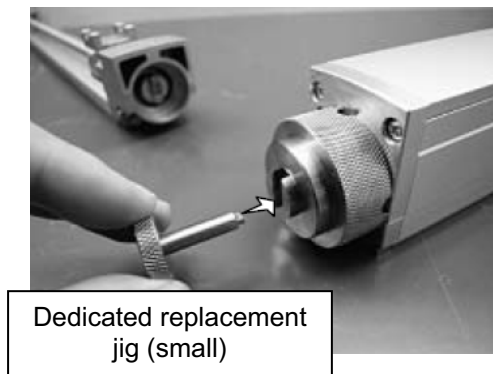
- [8] Take out the motor unit and the dedicated replacement jig (large). (Do not allow the jig (large) to turn.)



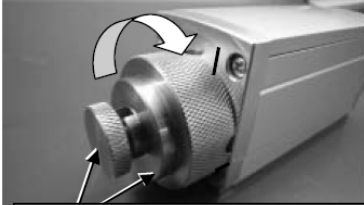
- [9] In order to keep the jig (large) from turning, draw a mark using a pen or marker.



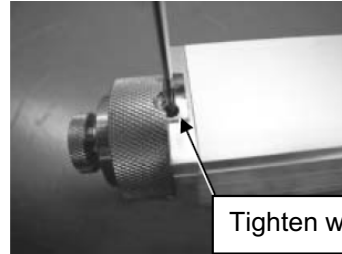
- [10] Insert the dedicated replacement jig (small) in such a way that its protrusion is aligned with the groove in the motor shaft.



- [11] Turn the dedicated replacement jig (large) and the replacement jig (small) by the same amount. When the coupling fastening screws appear through the tool holes, tighten them with a 2 mm hex wrench. (There are two fastening screws.)

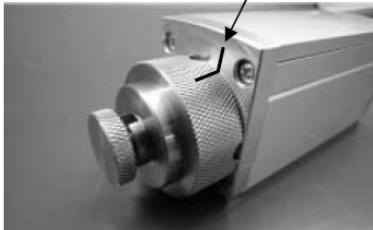


Rotate same amount to keep aligned

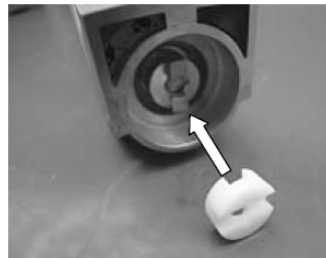


Tighten with hex wrench

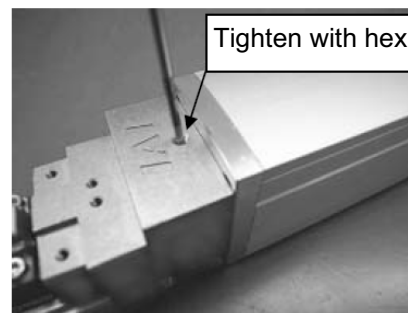
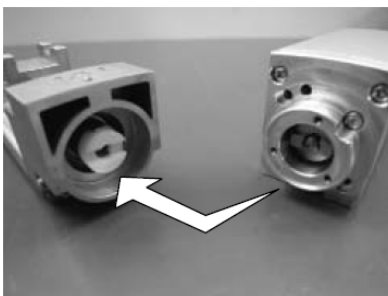
- [12] Align the marks made in [9]. After the marks are aligned, remove the dedicated replacement jig (large) and the dedicated replacement jig (small).



- [13] Apply the specified grease (TL101Y grease made by NOK) to the coupling spacer (front and rear), then install the coupling spacer on the actuator side.



- [14] Install the replacement motor unit on the actuator side, then tighten the fastening screws with a 2 mm hex wrench. (The actuator side groove and replacement motor unit protrusion should have been aligned in [12], but if not, align them here.)



Tighten with hex wrench

5.8 Procedures for Replacement of Belt and Motor for Reversing Type

[Items required for replacement]

- Replacement motor unit of reversing type



Axis Type		Model		
			Without Brake	With Brake
RCA2 (brown encoder cable connector)	Table type	TA4R	RCA2-MU1B	RCA2-MU1B-B
		TA5R	RCA2-MU2B	RCA2-MU2B-B
		TA6R	RCA2-MU3B	RCA2-MU3B-B
		TA7R	RCA2-MU4B	RCA2-MU4B-B

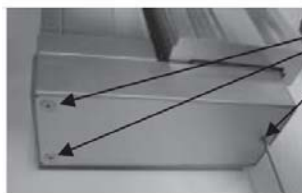
- Belt
Manufacturer: Bando Chemical Industries, Ltd.

Belt model (type)	Model
40S2M138R, 4-mm wide (clean rubber type)	TA4R
60S2M168R, 6-mm wide (clean rubber type)	TA5R
60S2M198R, 6-mm wide (clean rubber type)	TA6R
60S2M198R, 6-mm wide (clean rubber type)	TA7R

- Tension gauge
- Hex wrench set

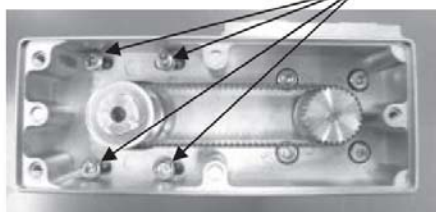
[Procedure]

- [1] Remove the pulley cover.
Remove the mounting screws (TA4R: 2 pcs, other: 3 pcs).



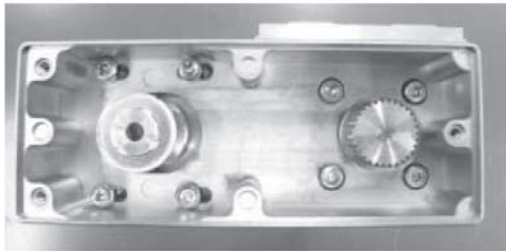
Mounting screw		
Model	Nominal thread size	Applicable Hex wrench
TA4R/TA5R	M2.5	1.5 mm across flats
TA7R/TA7R	M3	2 mm across flats

- [2] Loosen the tension adjustment bolts (4 pcs) and slacken the belt.

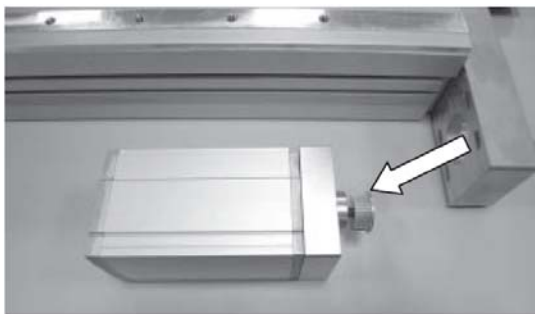


Tension adjustment bolt		
Model	Nominal thread size	Applicable Hex wrench
TA4R	M2.6	2 mm across flats
TA5R	M3	2.5 mm across flats
TA6R/TA7R	M4	3 mm across flats

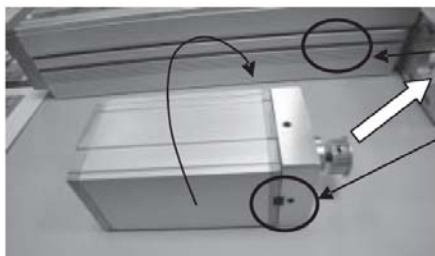
[3] Remove the belt from the pulleys. When replacing the belt, proceed to step [7].



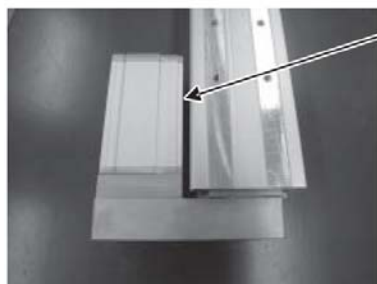
[4] Remove the tension adjustment bolts and pull out the motor unit.



[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.

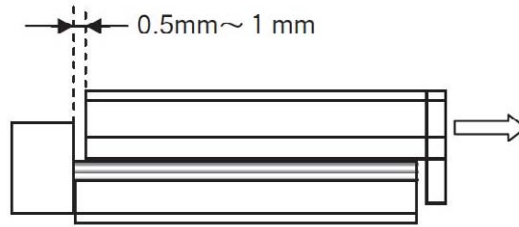


Install the motor unit by making sure the base surface of the actuator faces the motor unit surface having two holes.

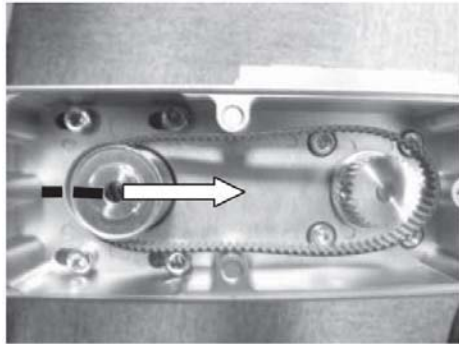


The surface with no gaps must face the motor unit surface having two holes.

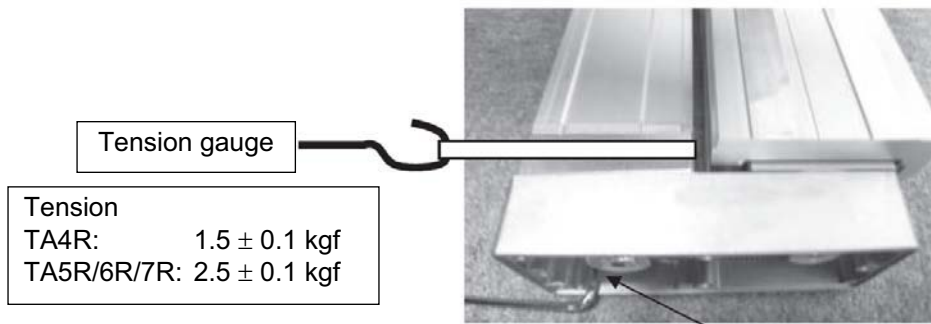
[6] Move the table by 0.5 to 1 mm from the mechanical end on the home side.



[7] Move the motor unit in the direction of the arrow shown below, and then install the belt. Align the motor unit with the countermark on the actuator. When replacing the belt, install the replacement belt.

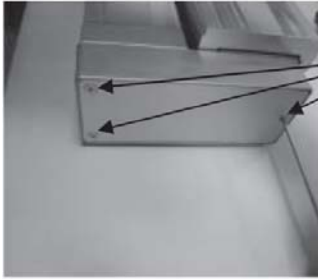


[8] Pass around the base of the unit a strong string (or long tie band) that has been looped into a ring shape, and pull the ring with a tension gauge. After confirming that the tension gauge is indicating the specified tension, tighten the tension adjustment bolts uniformly.



Tension adjustment bolt		
Model	Nominal thread size	Tightening Torque
TA5R	M3	0.83 N-m (0.085 kgf-m)
TA6R/TA7R	M4	1.76 N-m (0.18 kgf-m)

[9] Install the pulley cover.



Mounting screws (TA4R: 2 pcs, other: 3 pcs)

[10] Connect a PC or teaching pendant to the controller to perform a home return. Check for displacement from the original home position and if the home position is displaced, correct the position using the following parameters:

ACON controller: No. 22: Home return offset distance
ASEL controller: Parameter No. 12 for each axis, home preset value
ASEP controller: Parameter No. 16, home return offset distance
MSEP controller: Parameter No. 16, home return offset distance

If the actuator is of absolute encoder specification, change the parameters and then perform a home return, followed by an absolute reset.

5.9 How to Replace Spiral Cover

[Required Item for Replacement]

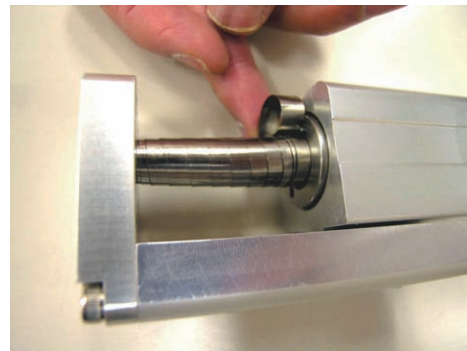
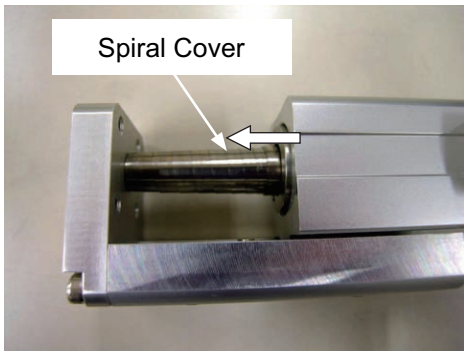
- New spiral cover for replacement

Model
RCA2-SPC-30

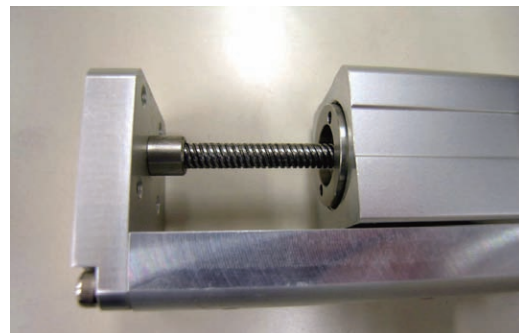
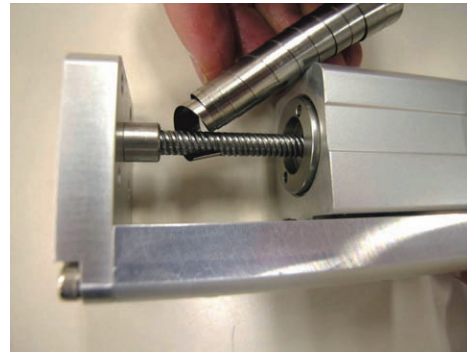


[Procedure]

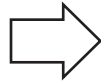
- 1) Take off the spiral cover.
Pull out the root of the spiral cover and curl the end of the cover.



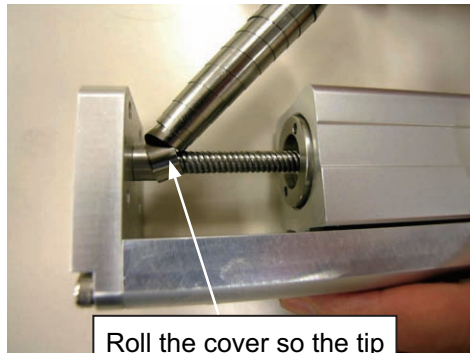
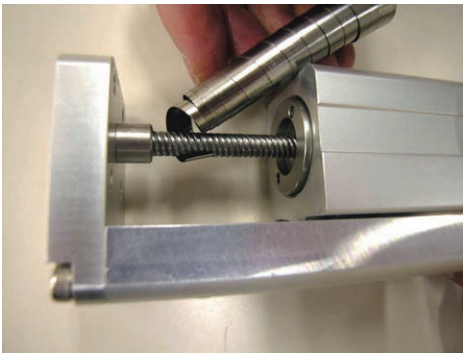
- 2) Roll up the spiral cover to take it off the shaft.



- 3) Grab the new spiral cover for replacement and pull the thinner side of it to get its tip inside out.

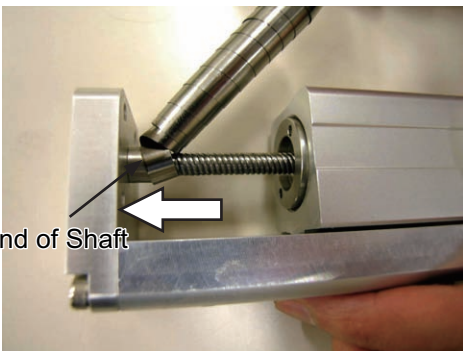


- 4) Attach the spiral cover to replace.
Hook the tip of the spiral cover that was pulled out to the shaft. After the tip is hooked, roll it around the shaft so the tip comes inside the cover.



Roll the cover so the tip comes inside.

- 5) Push the cover towards the end of the shaft after winding the cover a little.

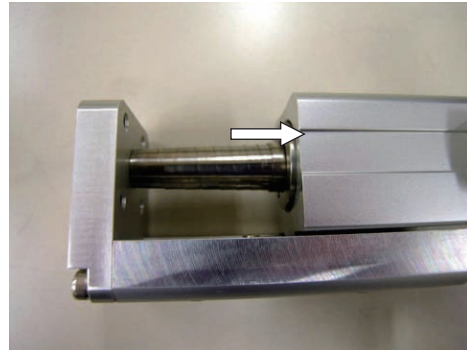
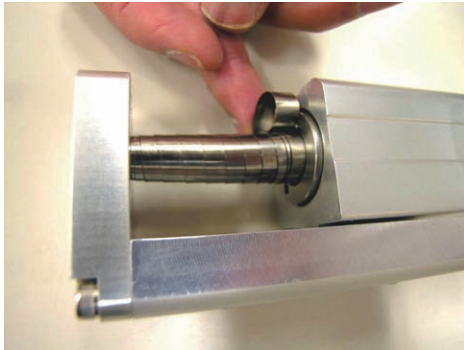


End of Shaft

6) Keep winding the spiral cover around the shaft.



7) Put the tip of the cover outside and push it into the groove on the actuator.



6. Life

6.1 Life of Actuator Using Ball Screws

Refer to the following for the product life of the ball screw type actuator assuming it was operated under the condition of maximum transportable weight, maximum acceleration and deceleration.

Model		Product Life (Reference)
TA4, TA5, TA6, TA7		5000km
TCA3NA, TWA3NA, TFA3NA, TCA3N, TWA3N, TFA3N	Lead 1mm	3000km
TCA3NA, TWA3NA, TFA3NA, TCA3N, TWA3N, TFA3N	Lead 2mm, 4mm	5000km
TCA4NA, TWA4NA, TFA4NA, TCA4N, TWA4N, TFA4N, TC4N (Option BG), TW4N (Option BG), TF4N (Option BG)		5000km

6.2 Life of Actuator Using Lead screws

The lead screw actuators adopt a lead screw and their 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.

(Lead screw actuators)

TCA3N (Lead screw), TCA4N (Lead screw), TWA3N (Lead screw), TWA4N (Lead screw), TFA3N

(Lead screw), TFA4N (Lead screw)

(Reference product life of lead screw types)

Horizontal application 10 million back-and-forth operations

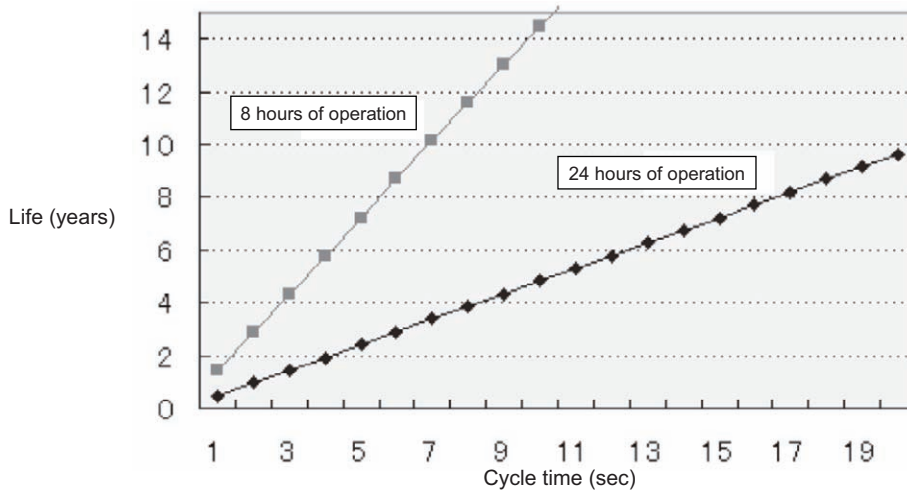
Vertical application 5 million back-and-forth operations

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).

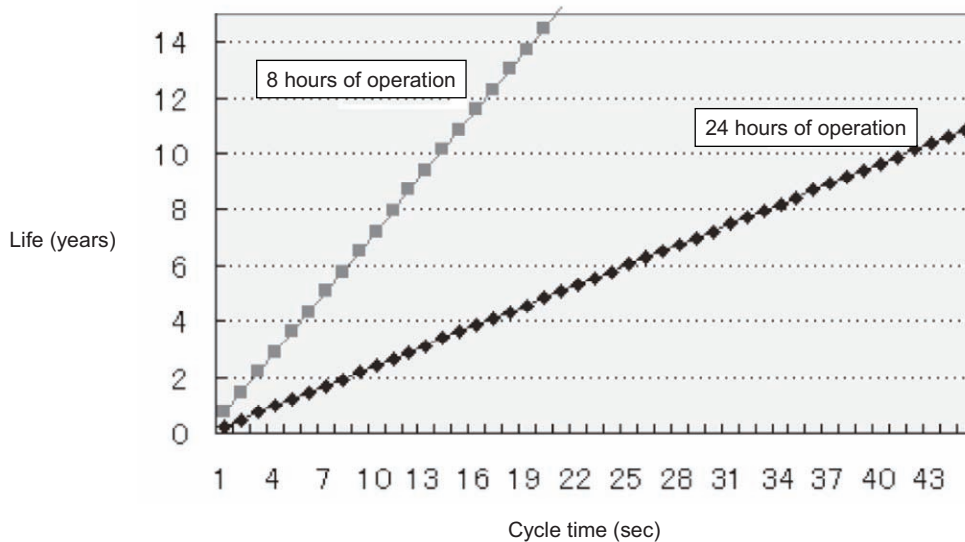
The lines based on 8 hours of operation and 24 hours operations a day, for 240 days a year, are shown. Use this graph as a reference when determining the product life.



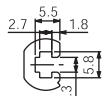
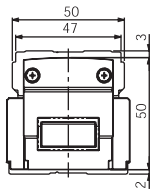
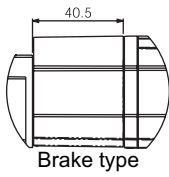
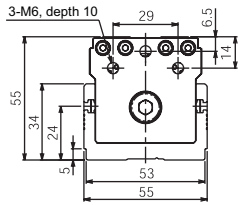
(2) Vertical application

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: 5 million back-and-forth operations).

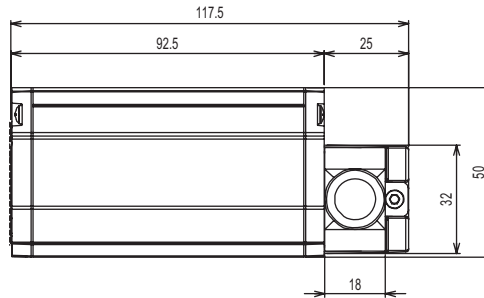
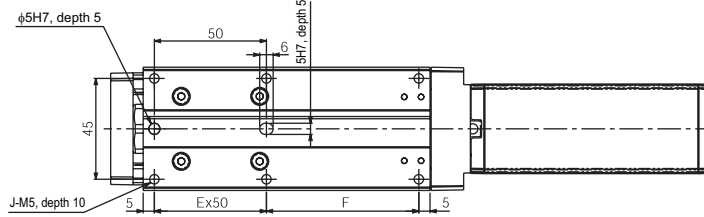
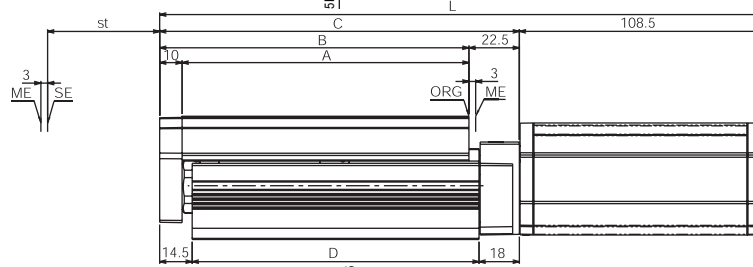
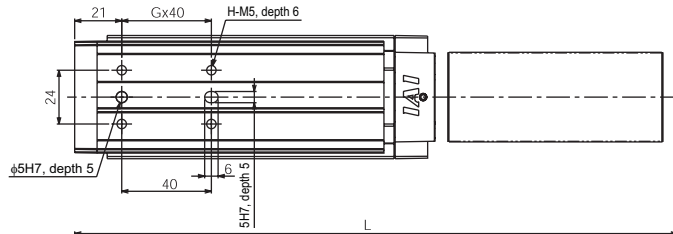
The lines based on 8 hours of operation and 24 hours operations a day, for 240 days a year, are shown. Use this graph as a reference when determining the product life.



7.2 RCA2-TA5C



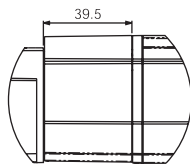
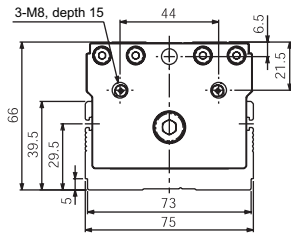
Detail view of T-groove (2:1)



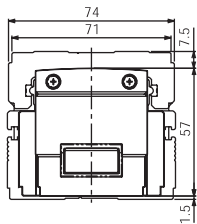
(Side view of motor unit when cable exit direction is changed (option))

ST	L		A	B	C	D	E	F	G	H	J	Weight [kg]	
	Without brake	With brake										Without brake	With brake
25	244	284.5	103	113	135.5	103	1	43	1	4	6	1.2	1.5
50	269	309.5	128	138	160.5	128	1	68	1	4	6	1.4	1.7
75	294	334.5	153	163	185.5	153	2	43	2	6	8	1.5	1.8
100	319	359.5	178	188	210.5	178	2	68	2	6	8	1.7	2.0

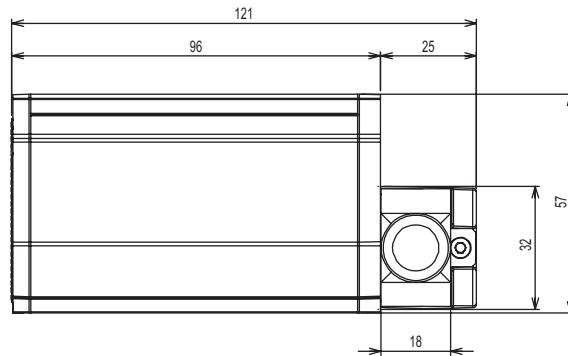
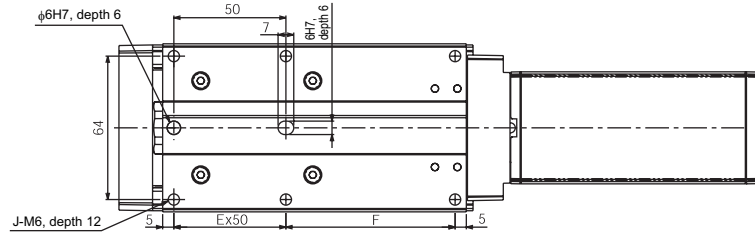
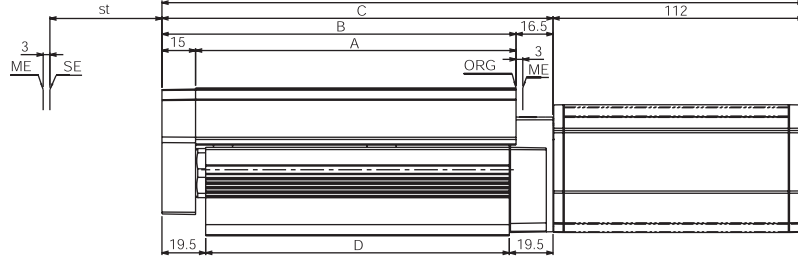
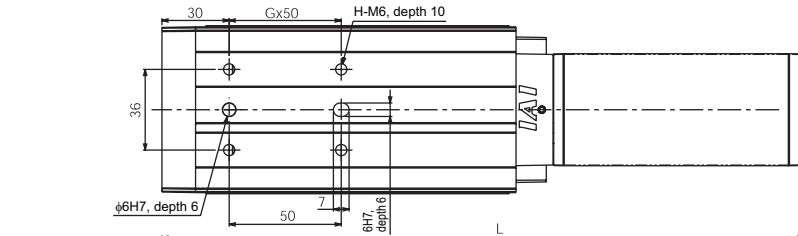
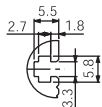
7.4 RCA2-TA7C



Brake type



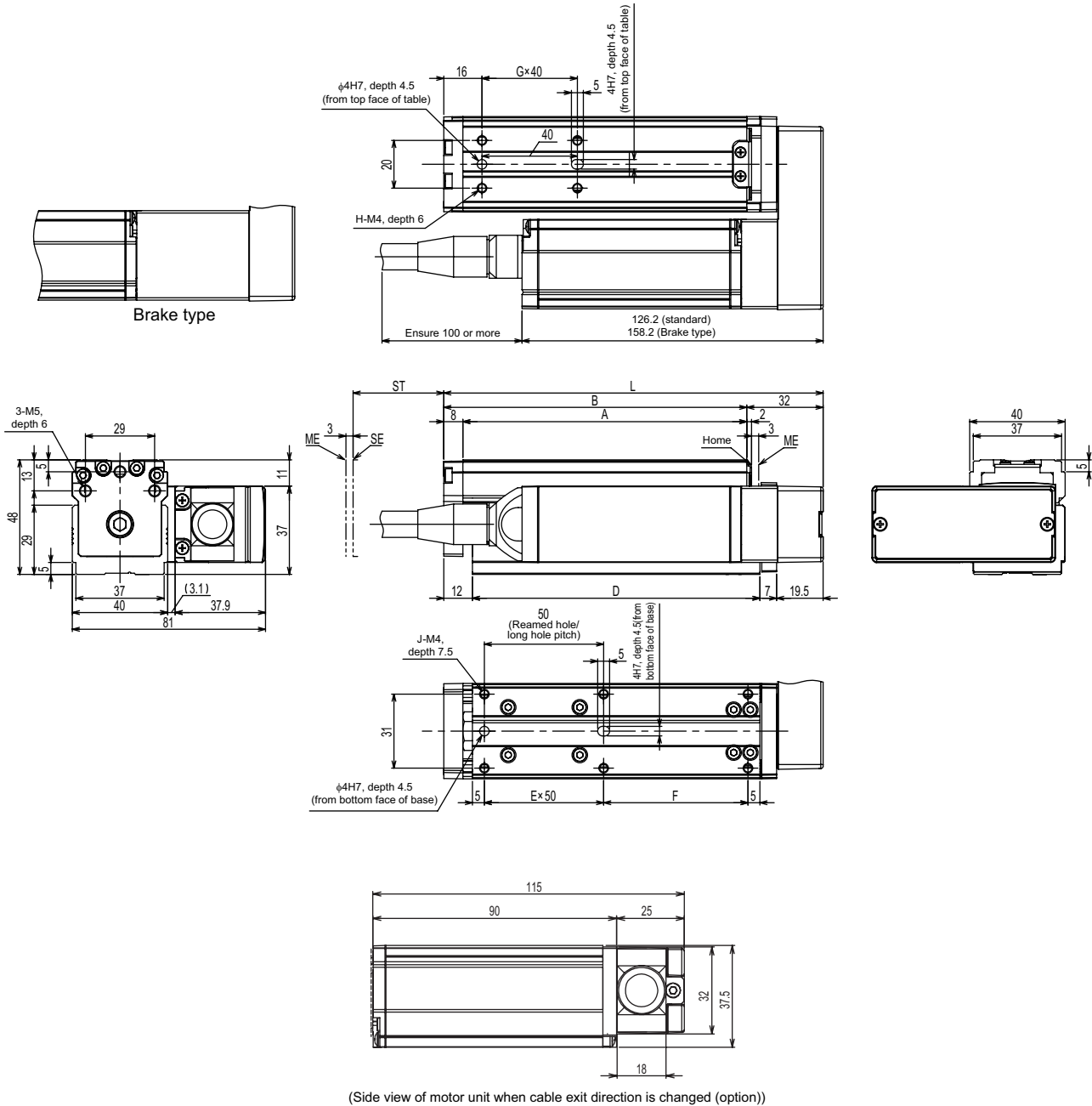
Detail view of T-groove (2:1)



(Side view of motor unit when cable exit direction is changed (option))

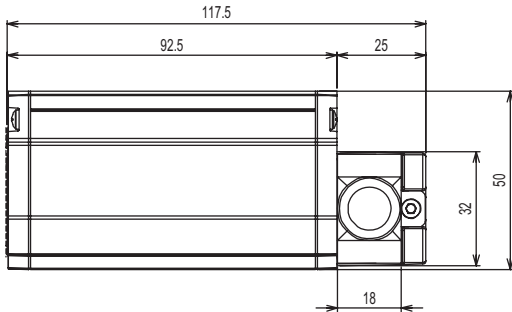
ST	L		A	B	C	D	E	F	G	H	J	Weight [kg]	
	Without brake	With brake										Without brake	With brake
25	261.5	301	118	133	149.5	110.5	1	50.5	1	4	6	2.1	2.5
50	286.5	328	143	158	174.5	135.5	1	75.5	1	4	6	2.3	2.7
75	311.5	351	168	183	199.5	160.5	2	50.5	2	6	8	2.5	2.9
100	336.5	376	193	208	224.5	185.5	2	75.5	2	6	8	2.8	3.2
125	361.5	401	218	233	249.5	210.5	3	50.5	3	8	10	3.0	3.4
150	386.5	426	243	258	274.5	235.5	3	75.5	3	8	10	3.2	3.6
175	411.5	451	268	283	299.5	260.5	4	50.5	4	10	12	3.4	3.8
200	436.5	476	293	308	324.5	285.5	4	75.5	4	10	12	3.6	4.0

7.5 RCA2-TA4R



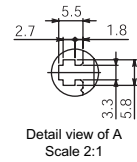
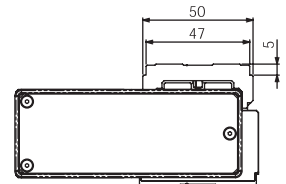
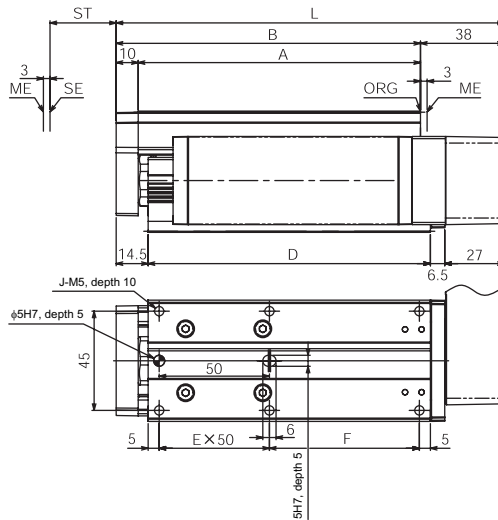
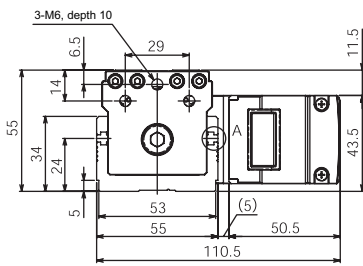
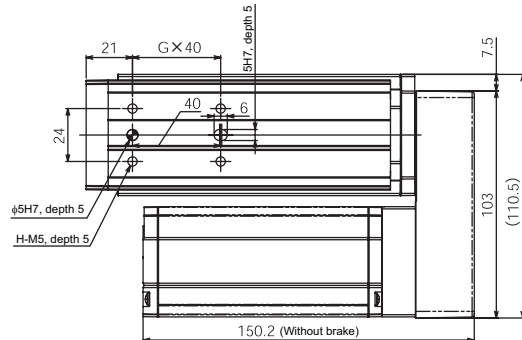
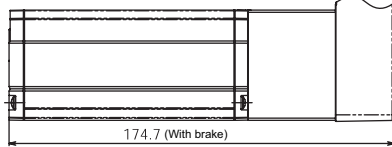
ST	L	A	B	D	E	F	G	H	J	Weight [kg]	
										Without brake	With brake
20	129	89	97	90.5	1	30.5	1	4	6	0.8	1.0
30	139	99	107	100.5	1	40.5	1	4	6	0.9	1.1
40	149	109	117	110.5	1	50.5	1	4	6	0.9	1.1
50	159	119	127	120.5	1	60.5	1	4	6	0.9	1.1
60	169	129	137	130.5	2	20.5	2	6	8	1.0	1.2
70	179	139	147	140.5	2	30.5	2	6	8	1.0	1.2
80	189	149	157	150.5	2	40.5	2	6	8	1.0	1.2
90	199	159	167	160.5	2	50.5	2	6	8	1.1	1.3
100	209	169	177	170.5	2	60.5	2	6	8	1.1	1.3

7.6 RCA2-TA5R, Reversing to Left (Right)



(Side view of motor unit when cable exit direction is changed (option))

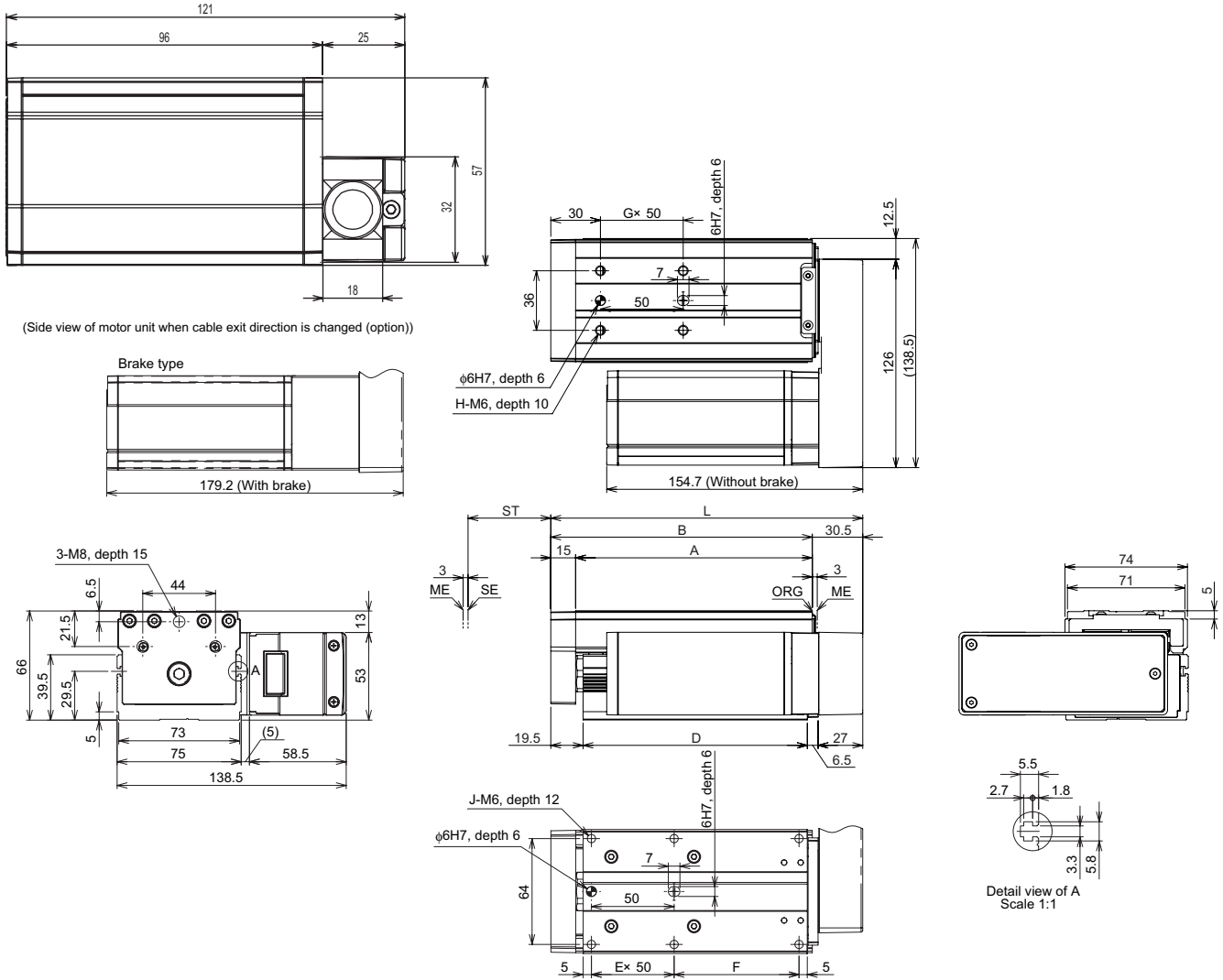
Brake type



ST	L	A	B	D	E	F	G	H	J	Weight [kg]	
										Without brake	With brake
25	151	103	113	103	1	43	1	4	6	1.4	1.7
50	176	128	138	128	1	68	1	4	6	1.6	1.9
75	201	153	163	153	2	43	2	6	8	1.7	2.0
100	226	178	188	178	2	68	2	6	8	1.9	2.2

(*) On ST-25 models brake types, the motor unit projects from the tip of the table (at the home position).

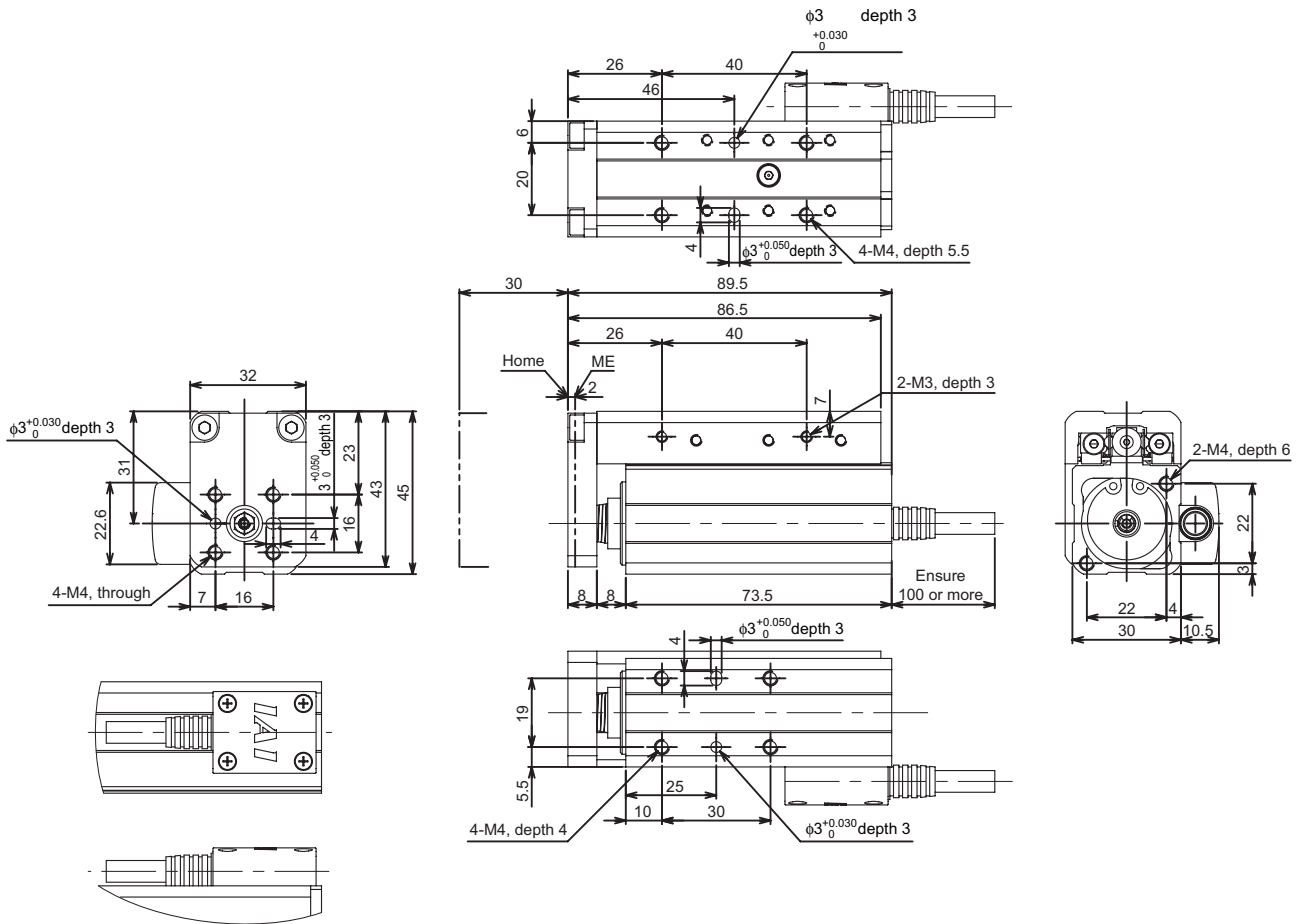
7.8 RCA2-TA7R, Reversing to Left (Right)



ST	L	A	B	D	E	F	G	H	J	Weight [kg]	
										Without brake	With brake
25	163.5	118	133	110.5	1	50.5	1	4	6	2.4	2.8
50	188.5	143	158	135.5	1	75.5	1	4	6	2.6	3.0
75	213.5	168	183	160.5	2	50.5	2	6	8	2.8	3.2
100	238.5	193	208	185.5	2	75.5	2	6	8	3.1	3.5
125	263.5	218	233	210.5	3	50.5	3	8	10	3.3	3.7
150	288.5	243	258	235.5	3	75.5	3	8	10	3.5	3.9
175	313.5	268	283	260.5	4	50.5	4	10	12	3.7	4.1
200	338.5	293	308	285.5	4	75.5	4	10	12	3.9	4.3

(*) On ST-25 models brake type, the motor unit projects from the tip of the table (at the home position).

7.9 RCA2-TCA3NA, TCA3N (Lead screw, Ball screw)



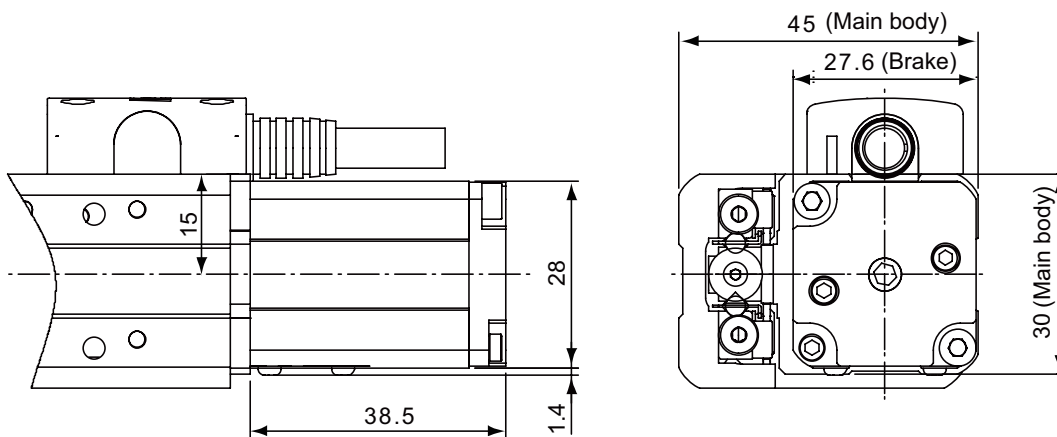
Connector Cable exit direction: K2

ST	L	A	B	Without brake Weight [kg]
30	89.5	86.5	73.5	0.37
50	109.5	106.5	93.5	0.44

(Note) Only 30mm is available for the stroke of Lead Screw TCA3N Type.

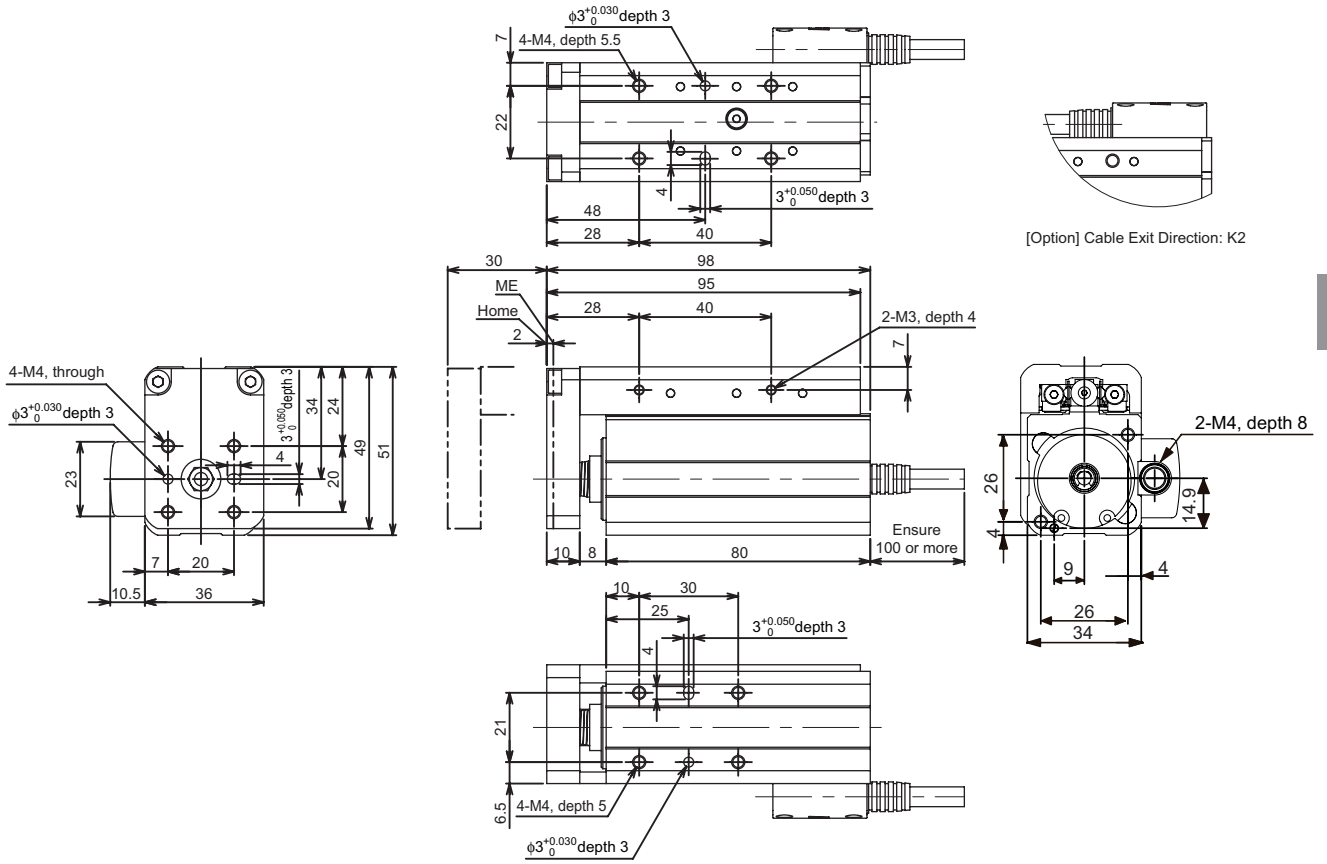
Equipped with Gauge Slippage Protection Function

• For Brake Type



ST	Brake Type Weight [kg]
30	0.47
50	0.54

7.10 RCA2-TCA4NA, TCA4N (Lead screw, Ball screw)

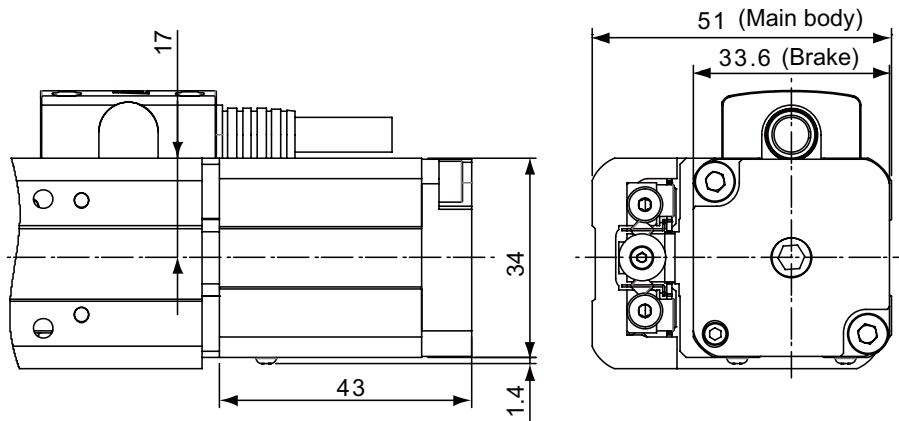


ST	L	A	B	Without brake Weight [kg]
30	98	95	80	0.48
50	118	115	100	0.60

(Note) Only 30mm is available for the stroke of Lead Screw TCA4N Type.

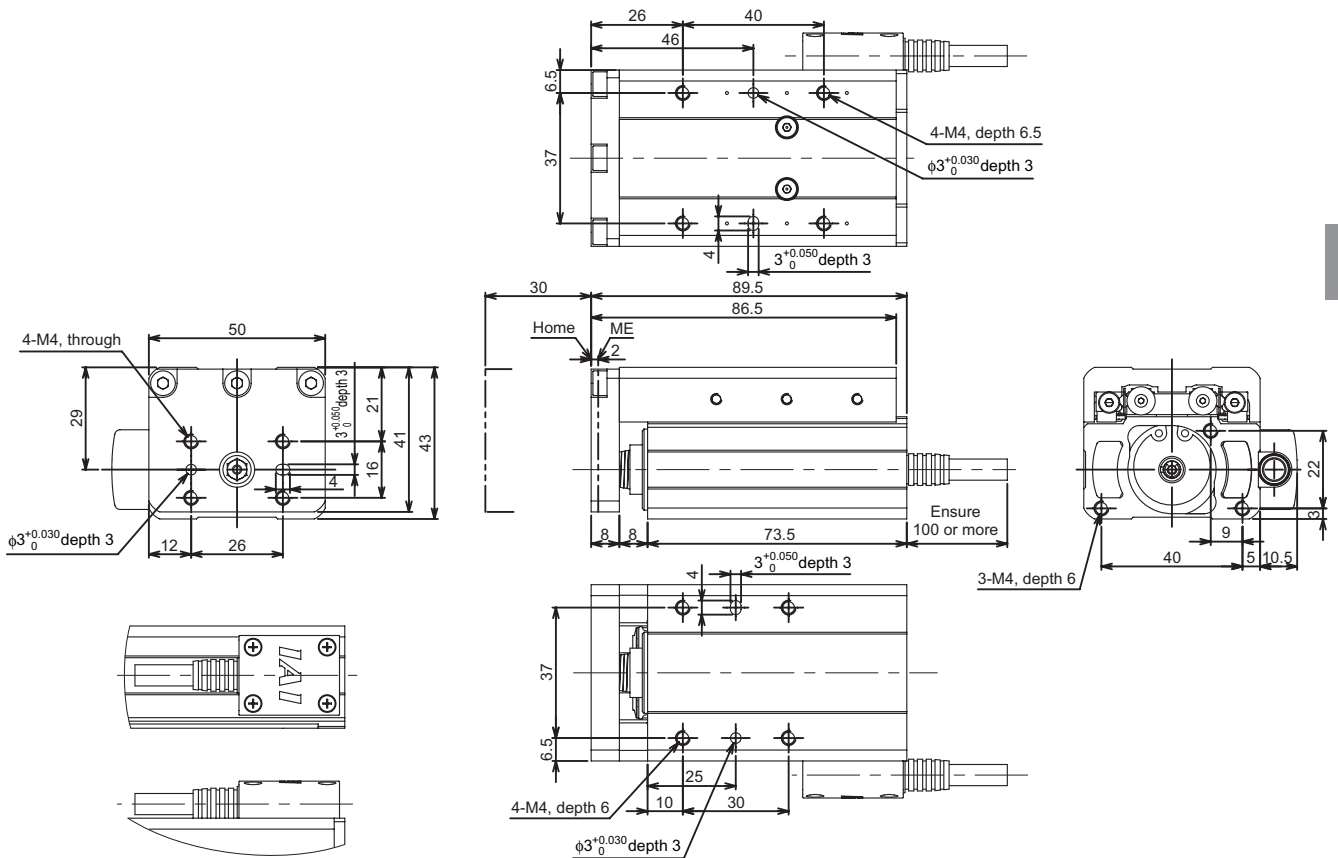
Equipped with Gauge Slippage Protection Function

• For Brake Type



ST	Brake Type Weight [kg]
30	0.61
50	0.75

7.11 RCA2-TWA3NA, TWA3N (Lead screw, Ball screw)



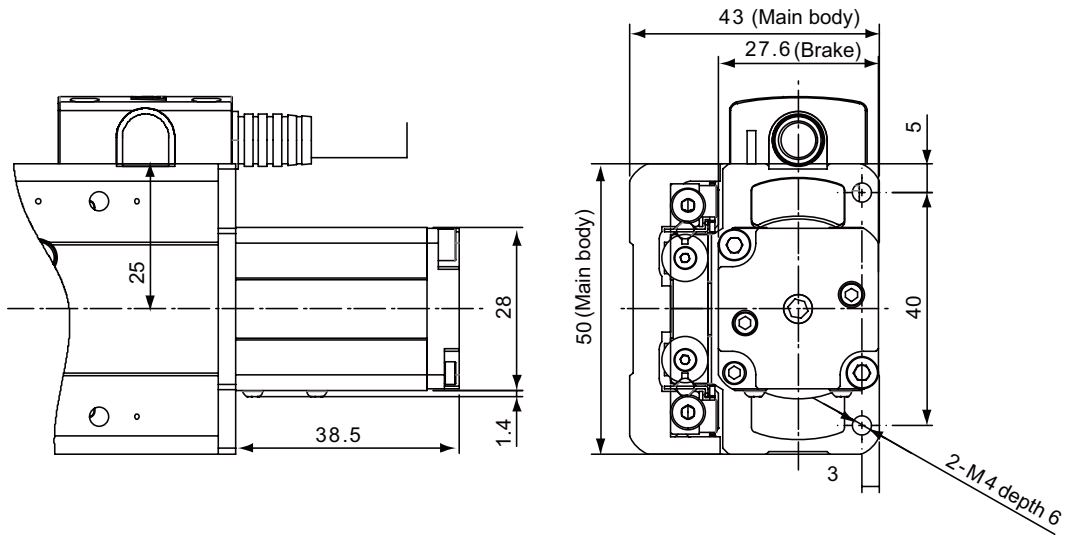
Connector Cable exit direction: K2

ST	L	A	B	Without brake Weight [kg]
30	89.5	86.5	73.5	0.52
50	109.5	106.5	93.5	0.58

(Note) Only 30mm is available for the stroke of Lead Screw TWA3N Type.

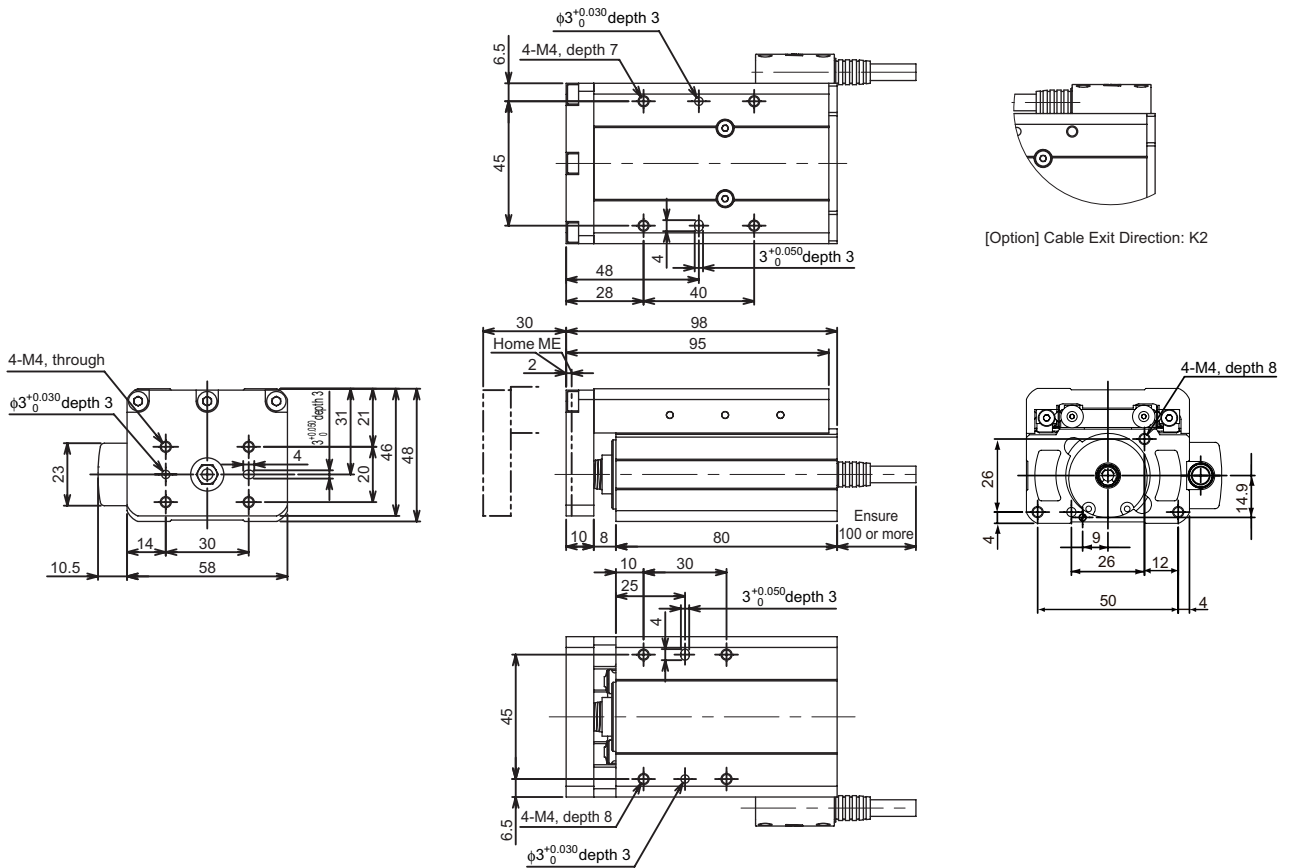
Equipped with Gauge Slippage Protection Function

• For Brake Type



ST	Brake Type Weight [kg]
30	0.62
50	0.82

7.12 RCA2-TWA4NA, TWA4N (Lead screw, Ball screw)

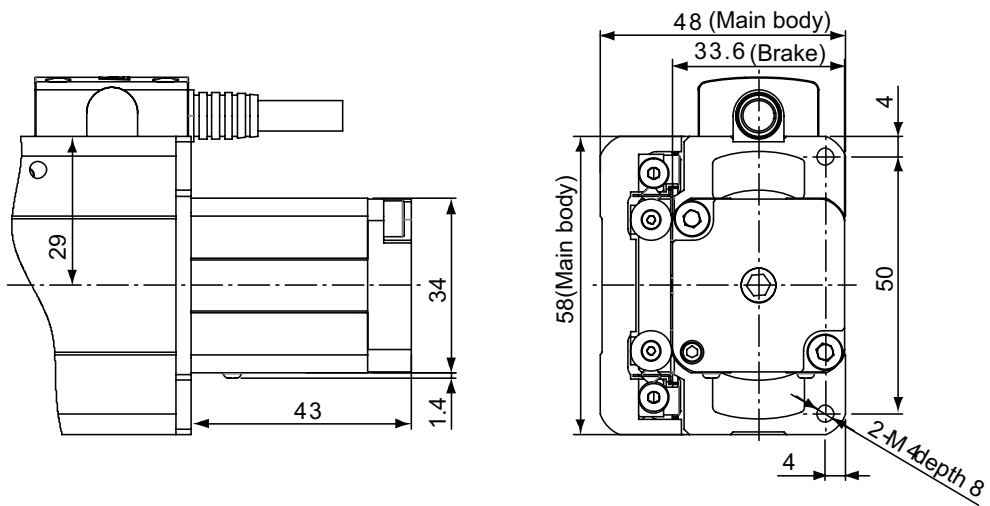


ST	L	A	B	Without brake Weight [kg]
30	98	95	80	0.65
50	118	115	100	0.77

(Note) Only 30mm is available for the stroke of Lead Screw TWA4N Type.

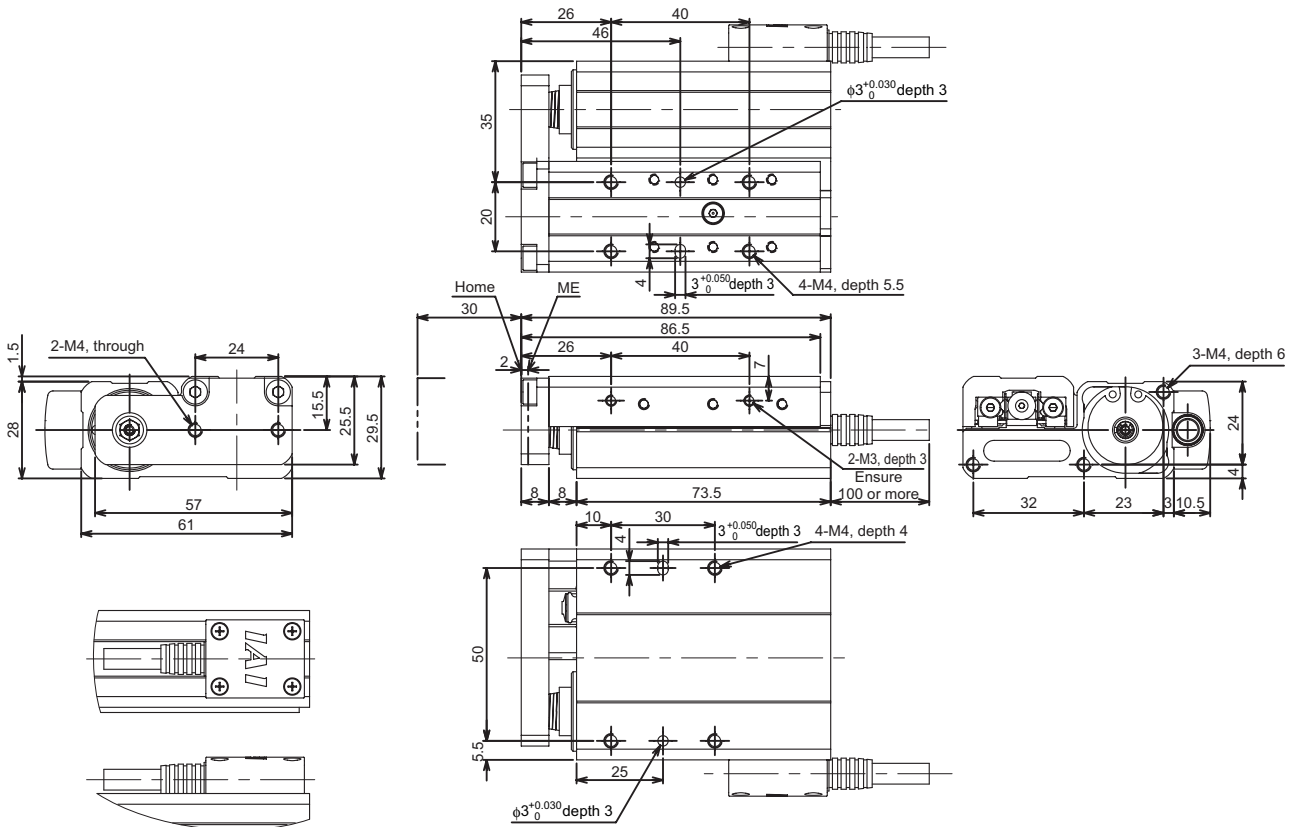
Equipped with Gauge Slippage Protection Function

• For Brake Type



ST	Brake Type Weight [kg]
30	0.78
50	0.92

7.13 RCA2-TFA3NA, TFA3N (Lead screw, Ball screw)



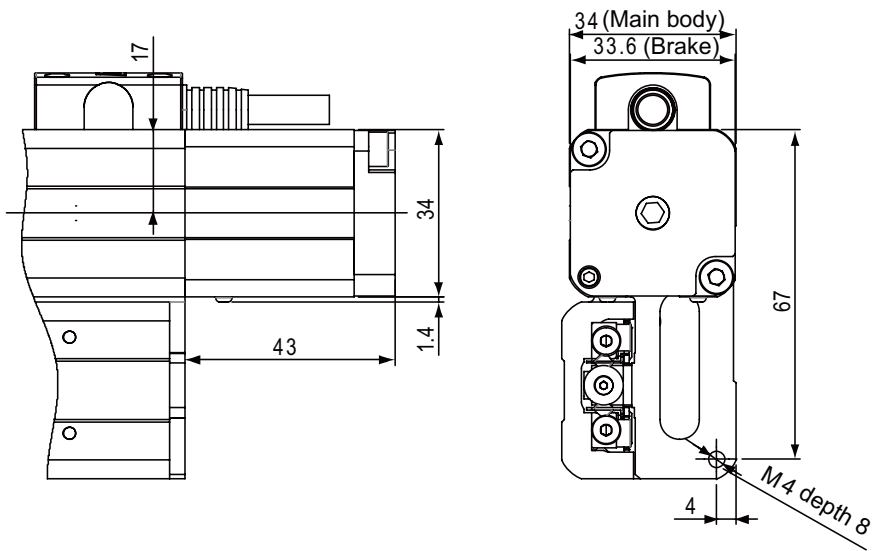
Connector Cable exit direction: K2

ST	L	A	B	Without brake Weight [kg]
30	89.5	86.5	73.5	0.40
50	109.5	106.5	93.5	0.48

(Note) Only 30mm is available for the stroke of Lead Screw TFA3N Type.

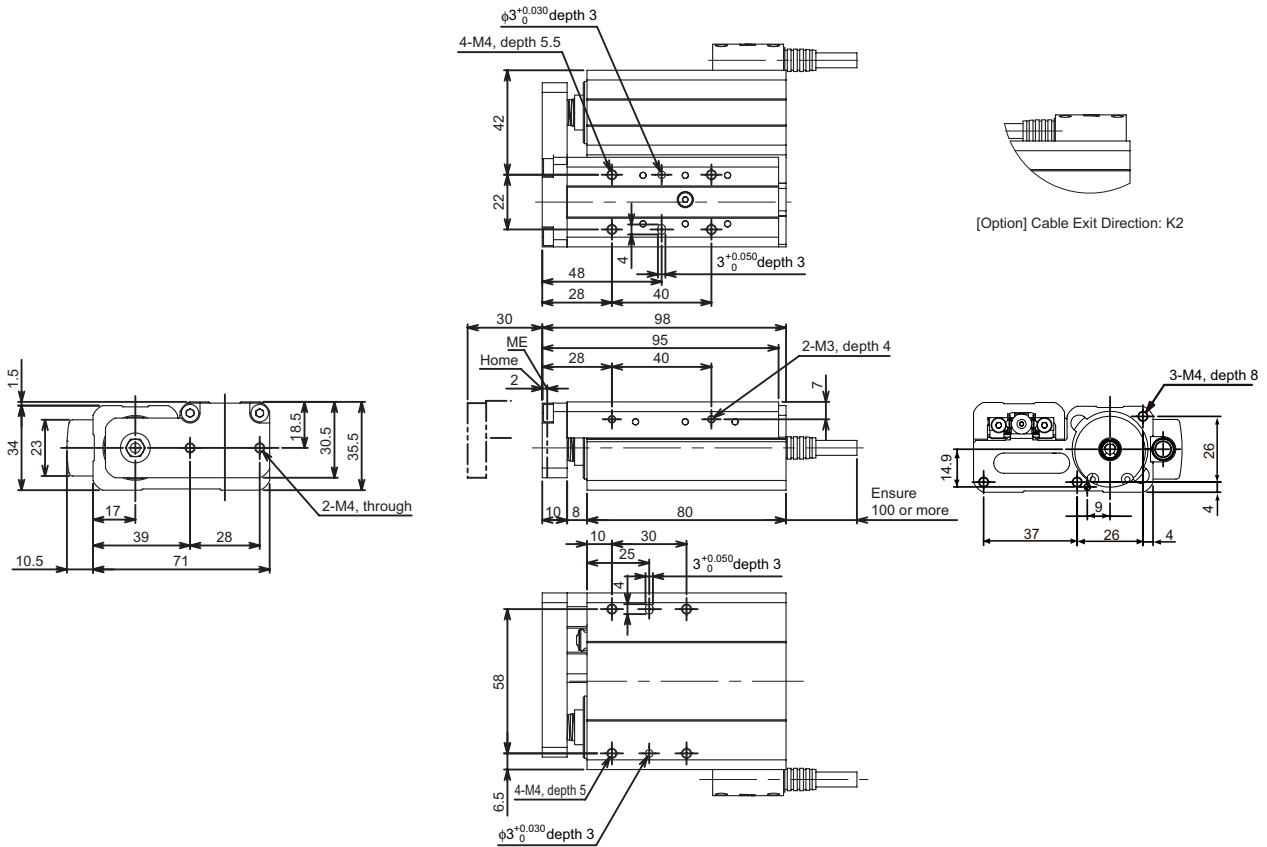
Equipped with Gauge Slippage Protection Function

• For Brake Type



ST	Brake Type Weight [kg]
30	0.5
50	0.58

7.14 RCA2-TFA4NA, TFA4N (Lead screw, Ball screw)

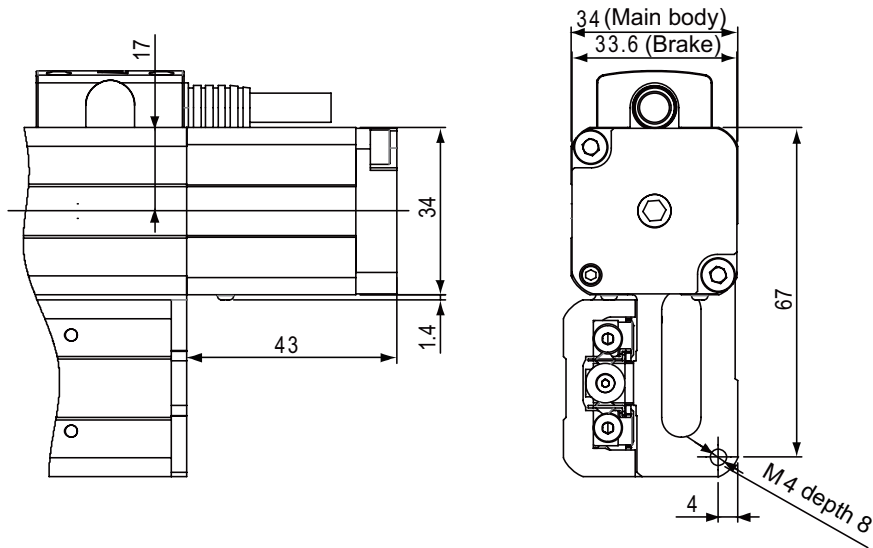


ST	L	A	B	Without brake Weight [kg]
30	98	95	80	0.60
50	118	115	100	0.72

(Note) Only 30mm is available for the stroke of Lead Screw TFA4N Type.

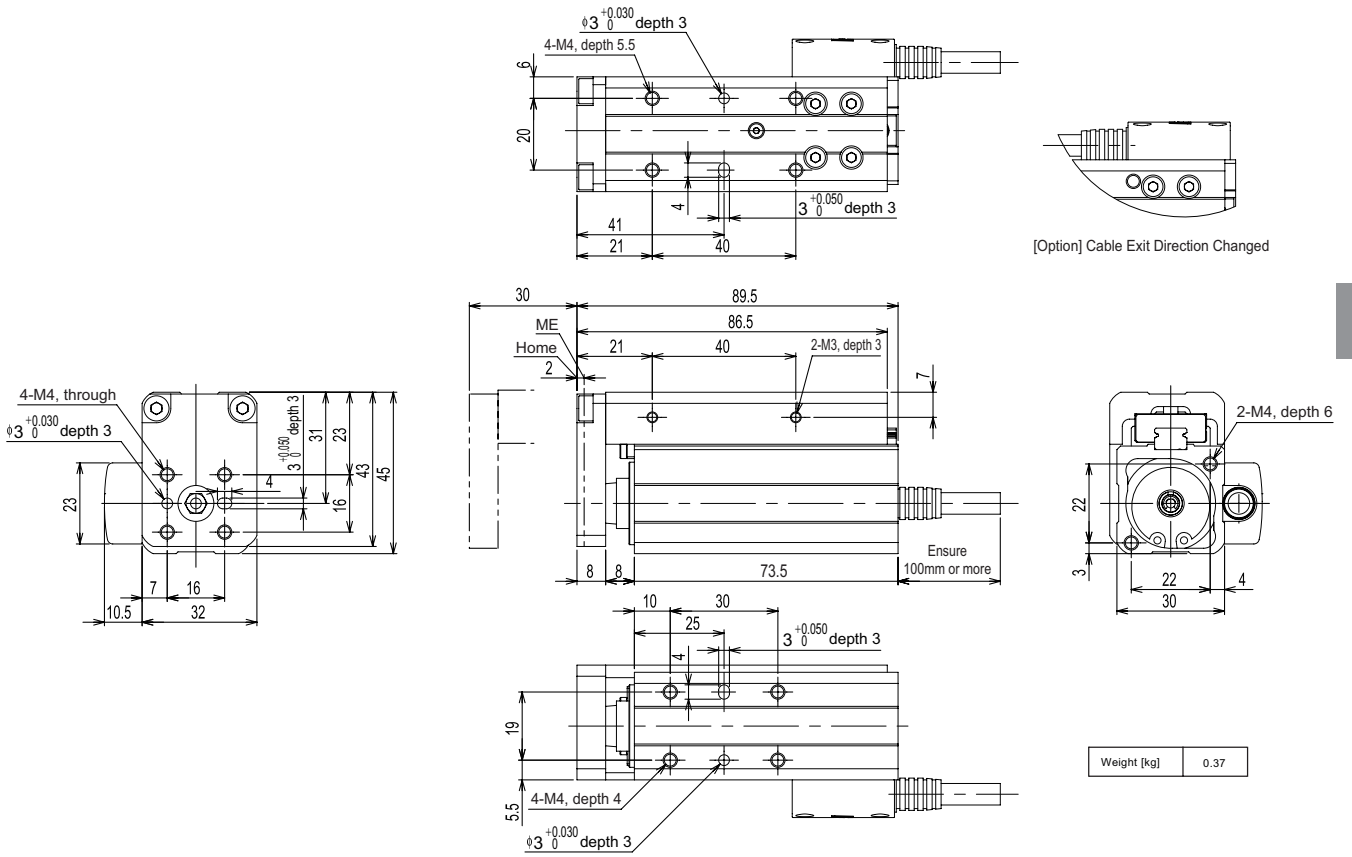
Equipped with Gauge Slippage Protection Function

• For Brake Type

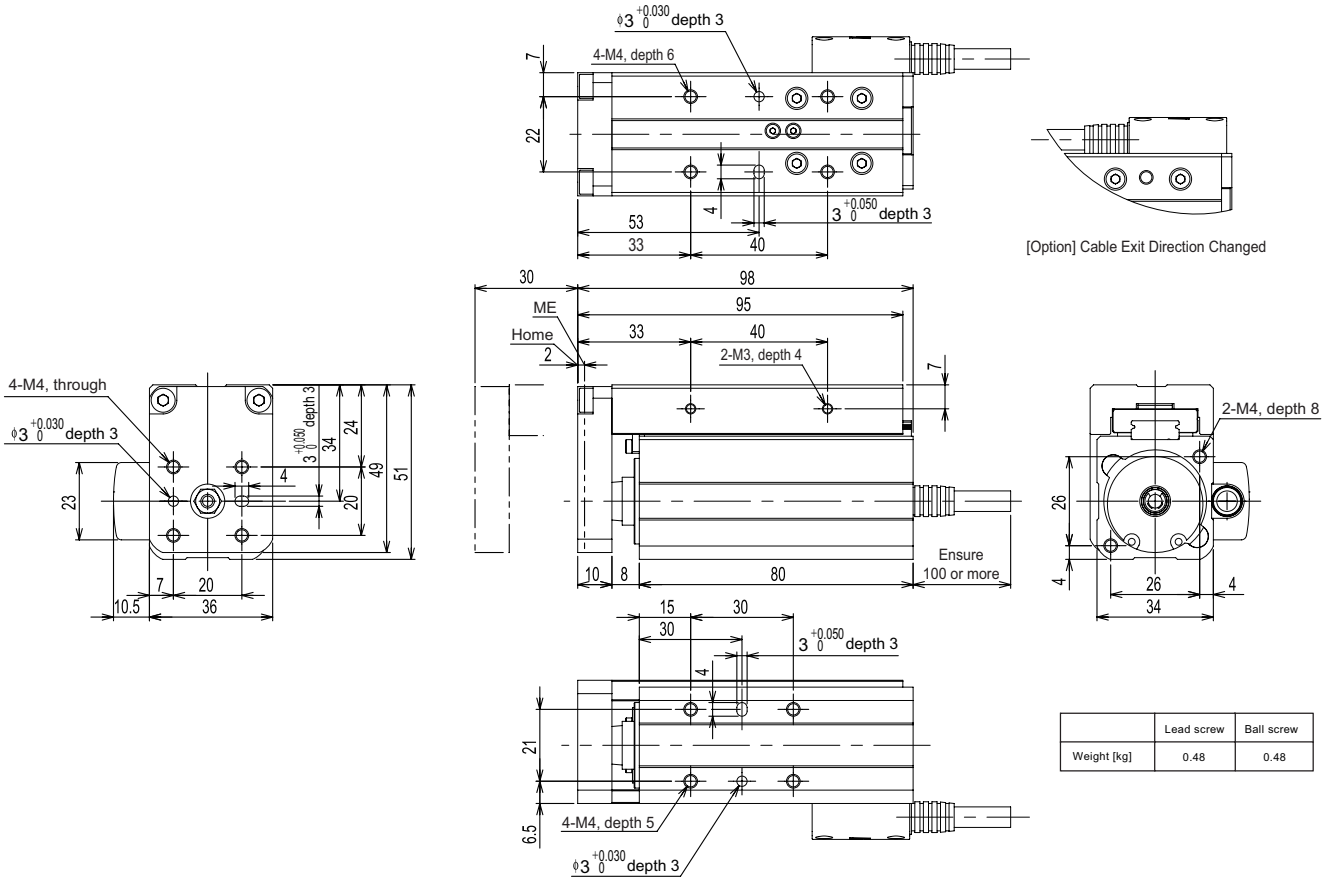


ST	Brake Type Weight [kg]
30	0.73
50	0.85

**7.15 RCA2-TC3N (Lead screw)
Ball Guide Type (Option: Model Code BG)**

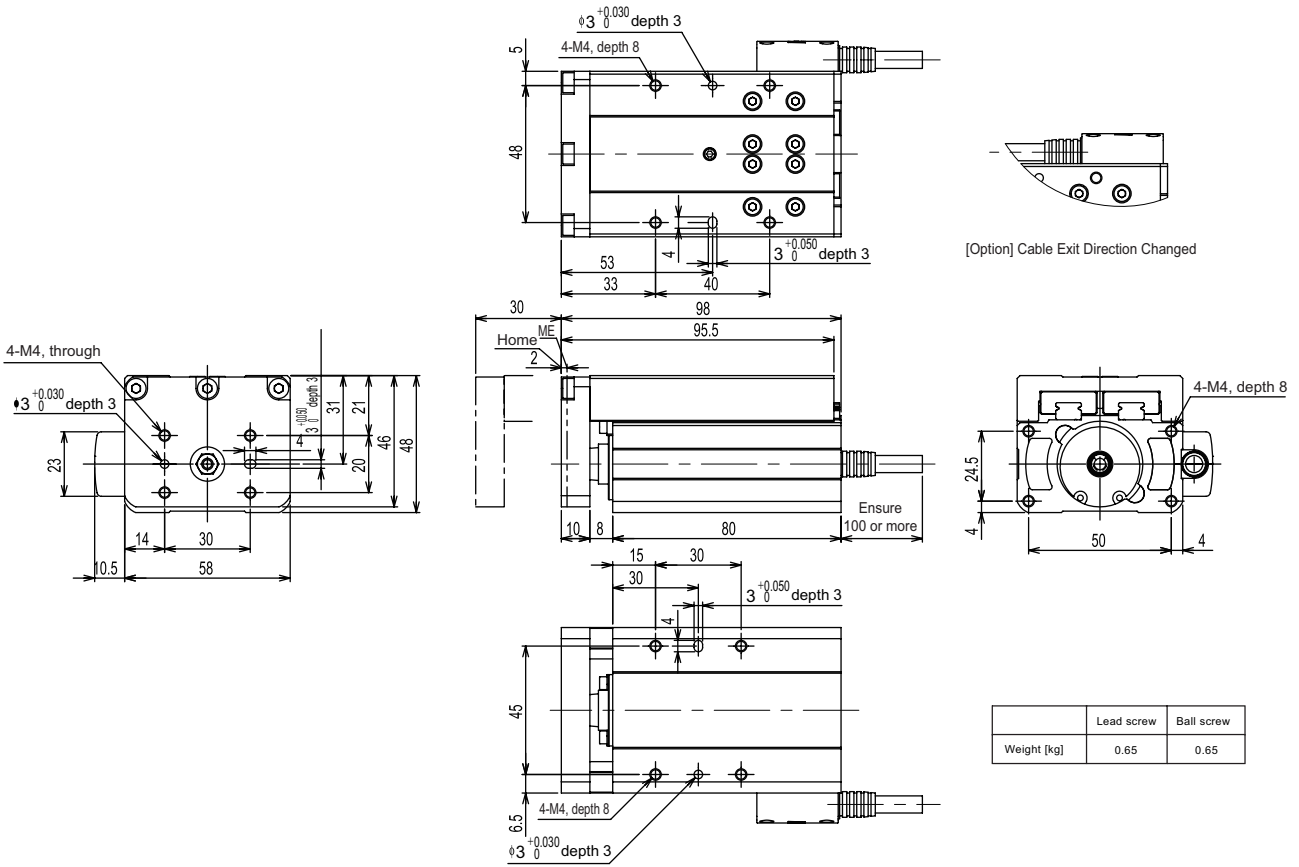


7.16 RCA2-TC4N (Lead screw, Ball screw) Ball Guide Type (Option: Model Code BG)



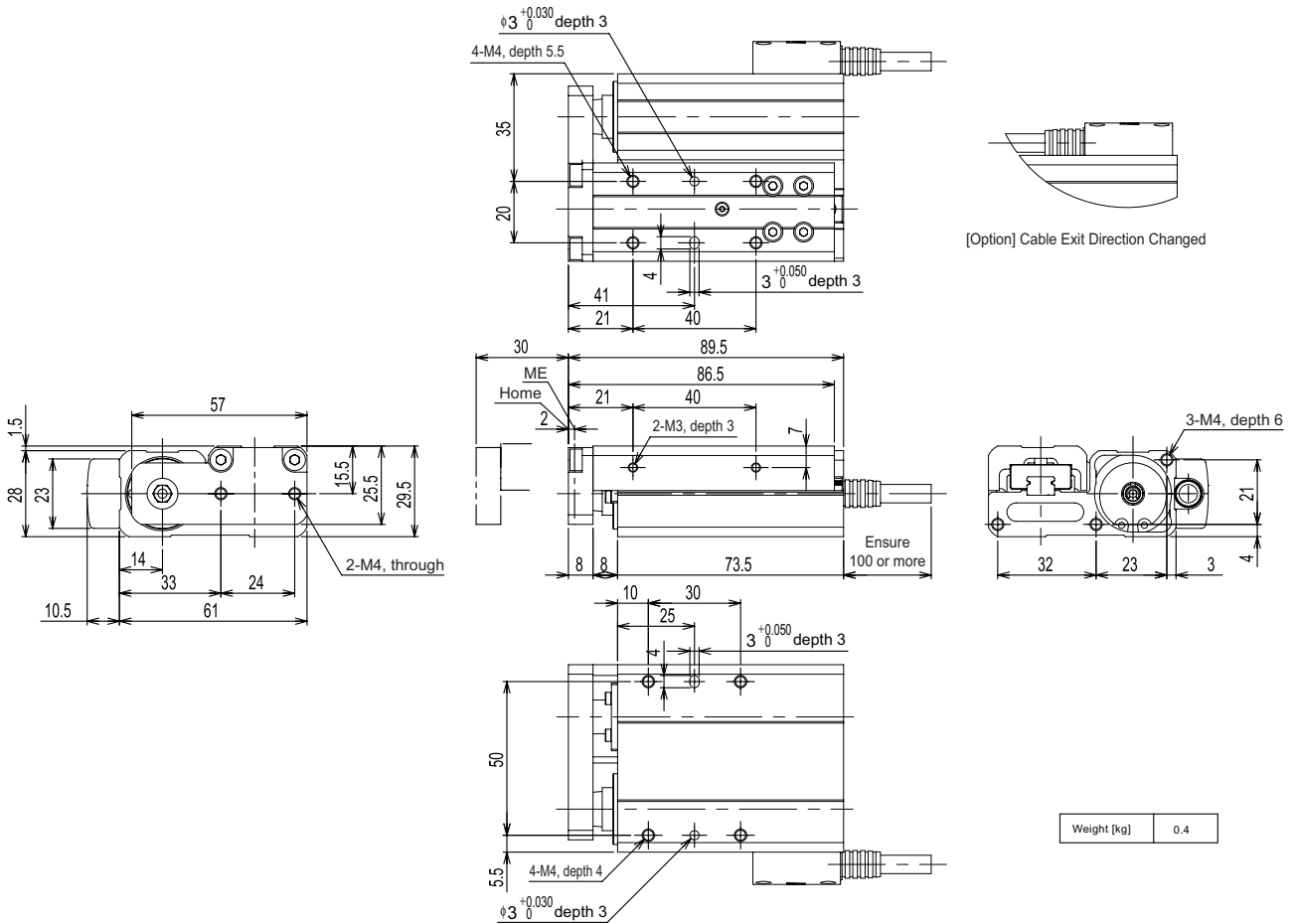
	Lead screw	Ball screw
Weight [kg]	0.48	0.48

**7.18 RCA2-TW4N (Lead screw, Ball screw)
Ball Guide Type (Option: Model Code BG)**

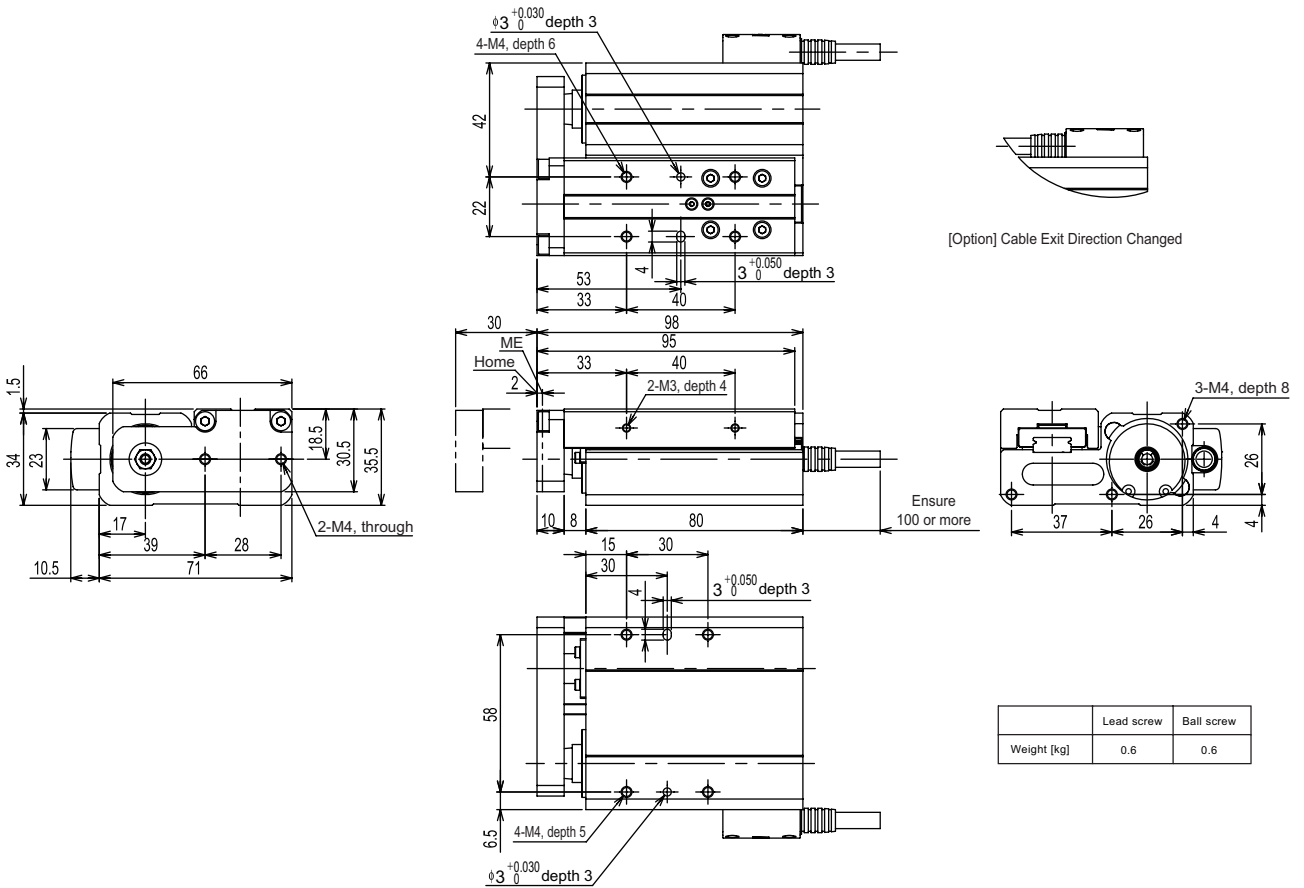


	Lead screw	Ball screw
Weight [kg]	0.65	0.65

**7.19 RCA2-TF3N (Lead screw)
Ball Guide Type (Option: Model Code BG)**



7.20 RCA2-TF4N (Lead screw, Ball screw) Ball Guide Type (Option: Model Code BG)



	Lead screw	Ball screw
Weight [kg]	0.6	0.6

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
- 1,500 hours of operation TCA3NA, TCA3N (Lead screw), TCA4NA, TCA4N (Lead screw), TWA3NA, TWA3N (Lead screw), TWA4NA, TWA4N (Lead screw), TFA3NA, TFA3N (Lead screw), TFA4NA, TFA4N (Lead screw)
- 2,500 hours of operation TA4C, TA5C, TA6C, TA7C, TA4R, TA5R, TA6R, TA7R, TCA3NA, TCA3N (Ball screw), TWA3NA, TWA3N (Ball screw), TFA3NA, TFA3N (Ball screw), TCA4NA, TCA4N (Ball screw), TWA4NA, TWA4N (Ball screw), TFA4NA, TFA4N (Ball screw)
Ball Guide Type (Option: model / BG)

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 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.

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 operation 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
February 2011	Second edition <ul style="list-style-type: none"> • 11.1 Placing a Load on the Actuator; TA5, TA6 and TA7 static allowable moments added • 13.10 How to Replace Spiral Cover; new section added • Contents regarding change in cable exit direction (option) added
February 2011	Third edition <ul style="list-style-type: none"> • 5.4 How to Read Model; BG Ball Guide Type added to options • 2. External Dimensions; Ball Guide Type added • 7. Selection Conditions; Moment for Ball Guide Type added to [4] Moment • 9. Installation; Ball Guide Type added to 9.1.2 Short types • 11.1 Placing a Load on the Actuator; Dynamic allowable moment for Ball Guide Type added • 13.6.3 How to apply grease; Instruction for grease supply to the guide rails on Ball Guide Type added
April 2011	Fourth edition <ul style="list-style-type: none"> • Model names changed. Ball Guide Type excluded. Appearance features changed <ul style="list-style-type: none"> • TC3N → TCA3N • TC4N → TCA4N • TW3N → TWA3N • TW4N → TWA4N • TF3N → TFA3N • TF4N → TFA4N
May 2011	Fifth edition <ul style="list-style-type: none"> • A page for CE Marking added
July 2011	Sixth edition <ul style="list-style-type: none"> • Added Handling Precautions on pages 7 to 8 • Contents changed in 5. Transportation in pages 8 to 9 • Added "1, Part Names" in page 11, "2, External Dimensions" on page 14, "5.4, How to Read Model Number" on page 38, "6, Specifications" on page 40, "7.1, Selection Conditions" on page 44, "11.1, Placing a Load on the Actuator" on page 78 and TCA3N (ball screw), and TWA3N (ball screw), and TFA3N (ball screw) to "14, Warranty" on page 110. • Page 87 Spiral Cover added to 13.2 Visual Inspection of Exterior • Contents changed in 14. Warranty in pages 116 to 117
March 2012	Seventh edition <ul style="list-style-type: none"> • Contents changed in Safety Guide <ul style="list-style-type: none"> • Caution notes added for when working with two or more persons • P.63 Note added to tell platform should have a structure with enough stiffness • P.64 Note changed to 1.8 times more of the nominal diameter for the length of thread engagement on aluminum
March 2012	Eighth edition <ul style="list-style-type: none"> • Model codes TCA3NA, TCA4NA, TWA3NA, TWA4NA, TFA3NA and TFA4NA are added.

Revision Date	Description of Revision
March 2012	Ninth edition <ul style="list-style-type: none"> • Contents added and changed in Safety Guide on 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 in pages 14 to 33 • Warning notes added such as in case the grease got into your eye, immediately go to see the doctor for an appropriate care in page 104 to 106
May 2013	Tenth edition Revised overall
August 2013	Eleventh edition Equipped with brake type added
October 2014	Twelfth edition Caution note added for when changing orientation of cable ejection of connector in page 9
March 2015	12B edition Correction made Pin number of controller side signal name W changed from 3 to 5 in page 42
April 2015	Thirteenth edition <ul style="list-style-type: none"> • Dynamic allowable moment value changed on pages 26, 39 • Dedicated controller added in page 17, 42, 43, 70, 71 • Change made to inspection schedule on page 79 to 80
June 2015	Fourteenth edition Contents changed for how to move table manually on page 78 Grease change due to production stop in page 84 Albania Grease No.2 → Albania Grease S2 Mobilax 2 → UNIREX N2



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