



**Micro-cylinder
Rod Type
RCL Actuators**

[RA1L, RA2L and RA3L]

Operating Manual

===== **Second Edition** =====



IAI America, Inc.



CAUTION

Applicable Controller Versions

RCL micro-cylinder actuators support various controllers of the versions shown in the table below. They do not operate with older versions of these controllers. Even if they operate, increasing the push-motion current may cause the actuator to generate heat and eventually suffer breakdown.

Never connect RCL actuators to controllers older than the versions specified below.

If you wish to upgrade your existing controller, contact IAI.

ACON/RACON Controllers

Controller type	Version
ACON-CY/SE/PO/PL	V0012 or later
RACON (ROBONET)	V0012 or later
ACON-C/CG (DIO specification)	V0015 or later
ACON-C/CG (Fieldbus specification)	V0001 or later

ASEL Controllers

Controller type	Version
ASEL	V0.17 or later

Applicable PC Software and Teaching Pendant Versions for Push-motion Operation

The current-limiting values of 71 to 80% for push-motion operation can be set using PC software and teaching pendants of the versions specified in the table below.

Take note that with older versions, only current-limiting values up to 70% can be set.





If you wish to upgrade your existing PC software or teaching pendant, contact IAI.



Controller type	PC software	
ACON-CY/SE/PO/PL RACON (ROBONET) ACON-C/CG (DIO specification) ACON-C/CG (Fieldbus specification)	V6.00.05.00 or later	CON-T: V1.03 RCM-E: V2.09 RCM-P: V2.09 RCM-PM-01: V1.00 RCM-T: V2.09

Safety Precautions (Please read before using the product.)

Before installing, operating, maintaining or inspecting this product, please peruse this operating manual as well as the operating manuals and other related documentations for all equipment and peripheral devices connected to this product in order to ensure the correct use of this product and connected equipment/devices. Those performing installation, operation, maintenance and inspection of the product must have sufficient knowledge of the relevant equipment and their safety. The precautions provided below are designed to help you use the product safely and avoid bodily injury and/or property damage.

In this operating manual, safety precautions are classified as “Danger,” “Warning,” “Caution” and “Note,” according to the degree of risk.

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

It should be noted that the instructions under the  **Caution** and  **Note** headings may also lead to serious consequences, if unheeded, depending on the situation.

All instructions contained herein provide vital information for ensuring safety. Please read the contents carefully and handle the product with due caution.

Please keep this operating manual in a convenient place for quick reference whenever needed, and also make sure that the manual will get to the end-user.

Danger

[General]

- Do not use this product for the following applications:
 1. Medical equipment used to maintain, control or otherwise affect human life or physical health
 2. Mechanisms and machinery designed for the purpose of moving or transporting people
 3. Important safety parts of machineryThis product has not been planned or designed for applications requiring high levels of safety. Use of this product in such applications may jeopardize the safety of human life. The warranty covers only the product as it is delivered.

[Installation]

- Do not use this product in a place exposed to ignitable, inflammable or explosive substances. The product may ignite, burn or explode.
- When installing the product, be sure to securely support and affix it (including the load). Failure to do so may cause the product to tip over, drop or malfunction, resulting in injury.

- Avoid using the product in a place where the main unit or controller may come in contact with water or oil droplets.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Doing so may result in fire.

[Operation]

- Do not enter the machine's range of operation while the product is operating or standing by. The actuator may move suddenly, causing injury.
- Do not pour water onto the product. Spraying water over the product, washing it with water or using it in water may cause the product to malfunction, resulting in injury, electric shock, fire, etc.

[Maintenance, Inspection, Repair]

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



Warning

[General]

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

[Installation]

- If the machine will stop in the case of system problem such as emergency stop or power failure, design a safety circuit or other device that will prevent equipment damage or injury.
- Before supplying power to and operating the product, always check the operation area of the equipment to ensure safety. Supplying power to the product carelessly may cause electric shock or injury due to contact with the moving parts.
- Wire the product correctly by referring to the operation manual. Securely connect the cables and connectors so that they will not be disconnected or come loose. Failure to do so may cause the product to malfunction or cause fire.

[Operation]

- Before operating the moving parts of the product by hand (for the purpose of manual positioning, etc.), confirm that the servo is turned off (using the teaching pendant). Failure to observe this instruction may result in injury.
- Do not scratch the cables. Scratching, forcibly bending, pulling, winding, crushing with heavy object or pinching a cable may cause it to leak current or lose continuity, resulting in fire, electric shock, malfunction, etc.
- Turn off the power to the product in the event of power failure. Failure to do so may cause the product to suddenly start moving when the power is restored, thus resulting in injury or product damage.
- If the product is generating heat, smoke or a strange smell, turn off the power immediately. Continuing to use the product may result in product damage or fire.
- If noise or abnormally high vibration is detected, stop the operation immediately. Continuing to use the product may result in product damage, malfunction due to damage, runaway machine, etc.
- If any of the product's protective functions (alarms) has actuated, turn off the power immediately. Continuing to use the product may result in injury due to product malfunction, or cause product breakdown or damage. After the power has been cut off, identify and remove the cause of the problem, and then reconnect the power.
- Do not step on the product, use it as a footstool or place any object on it. You may slip and fall or the product may tip over or drop, resulting in injury. Malfunction, runaway product, etc., may also result due to product breakdown or damage.

[Maintenance, Inspection, Repair]

- Before commencing maintenance/inspection, servicing, replacement or any other work on the product, be sure to completely cut off the power supply to the product. Also take heed of the following precautions:
 1. Put up a sign bearing "WORK IN PROGRESS. DO NOT TURN ON POWER" or other warning statement to that effect, to prevent a bystander from accidentally turning on the power.
 2. If multiple operators work together to perform maintenance/inspection work, the operators should always give verbal cues to one another to ensure safety before turning on/off the power or moving any axis.

[Disposal]

- Do not throw the product into flames. The product may explode or toxic gases may generate.



[Installation]

- Do not use the product in a place exposed to direct sunlight (ultraviolet ray), dusty place or place where air contains salt or iron powder, humid place, or in any ambience where the product may come in contact with organic solvent, hydraulic oil containing phosphate ester, etc. If used in these places/ambiences, the product may lose its function over a short period of time or suffer rapid performance deterioration, or the service life of the product may be reduced.
- Do not use the product in an ambience where it may come in contact with corrosive gases (sulfuric acid, hydrochloric acid, etc.). The product may lose its strength due to rust.
- Provide sufficient shielding measures if the product is used in any of the following places. If proper measures are not taken, the product may malfunction:
 1. Place where large current or strong magnetic field generates
 2. Place where arc discharge occurs due to welding work, etc.
 3. Place where noise generates due to electrostatic, etc.
 4. Place where the product may come in contact with radiation
- Do not install the product in a place subject to vibration or shock.
- Provide an emergency stop device in an easily accessible position so the device can be immediately actuated should danger occur during operation. Failure to do so may result in injury.
- Provide sufficient maintenance space when installing the product. If sufficient space is not available, daily inspection, maintenance and other necessary work cannot be carried out, resulting in system shutdown or product damage.
- When transporting or installing the product, support the product using a lift or suspension equipment or carry it with multiple operators working together, and exercise due caution to ensure safety.
- When installing the product, do not hold the moving parts or cables of the product. Doing so may result in injury.
- Use IAI's genuine cables to connect the actuator and controller. Also use IAI's genuine components for the actuator, controller, teaching pendant, etc.
- The brake mechanism is designed to prevent the slider from dropping upon turning off the power when the actuator is installed vertically. Do not use the brake mechanism as a safety brake.
- When installing, adjusting or carrying out any other work on the actuator, put up a sign bearing "WORK IN PROGRESS. DO NOT TURN ON POWER" or other warning statement to that effect, to prevent the product from being powered on accidentally. If the power is turned on accidentally, injury may result due to electric shock or sudden movement of the actuator.

[Operation]

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

[Maintenance, Inspection, Repair]

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



Note

[Installation]

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

[Installation, Operation, Maintenance]

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

[Maintenance, Inspection, Repair]

- When maintaining the produce, use the specified grease for the guide and ball screw grease. In particular, mixing the fluorine grease and lithium grease may cause damage to the equipment due to lubrication failure or increased resistance, etc.

[Disposal]

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

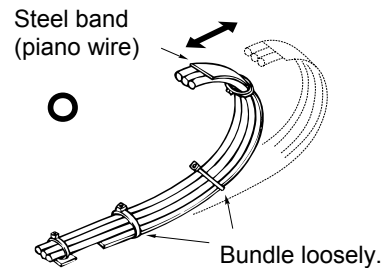
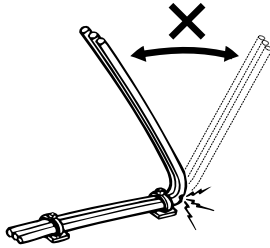
Others

- IAI shall not be liable whatsoever for any loss or damage arising from a failure to observe the items specified in "Safety Precautions."

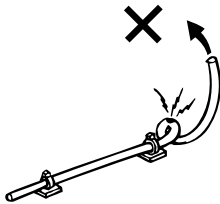
Prohibited Handling of Cables

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

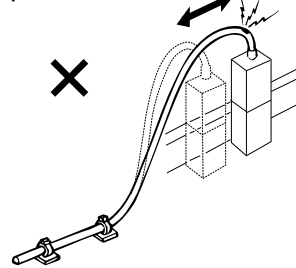
1. Do not let the cable flex at a single point.



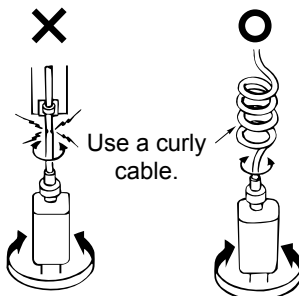
2. Do not let the cable bend, kink or twist.



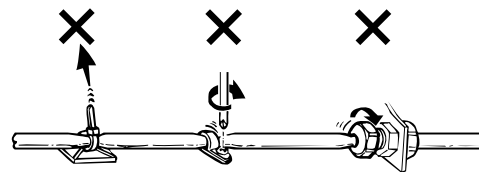
3. Do not pull the cable with a strong force.



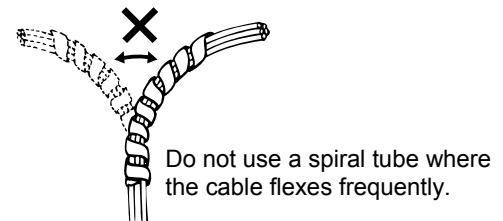
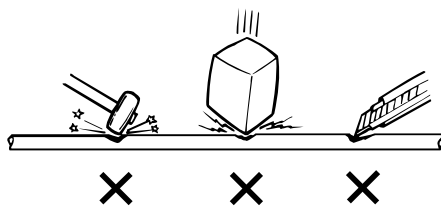
4. Do not let the cable receive a turning force at a single point.



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

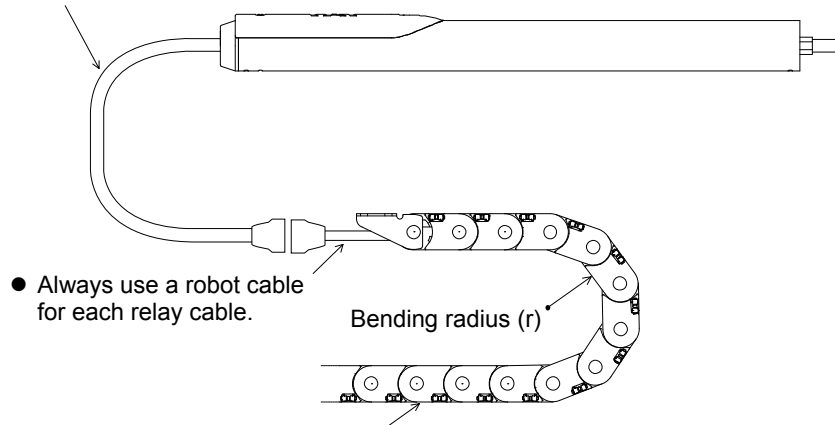


6. Do not pinch, drop a heavy object onto or cut the cable.



7. Notes on using cable tracks

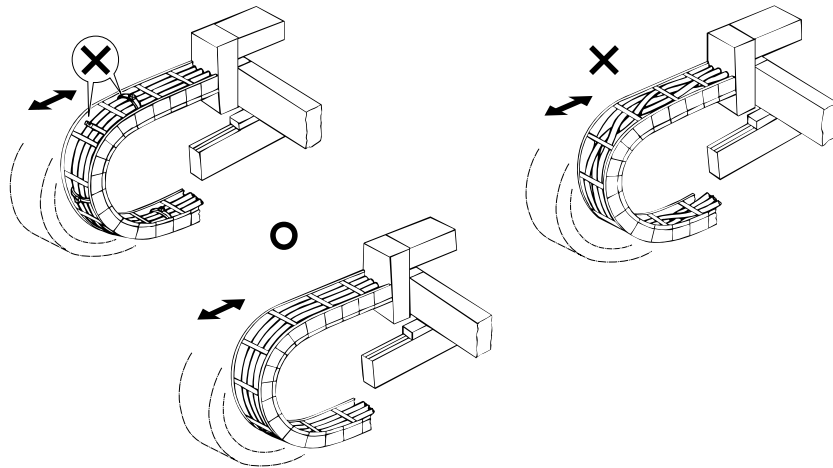
- The supplied cables are not robot cables. Accordingly, never store the cables in a cable track.



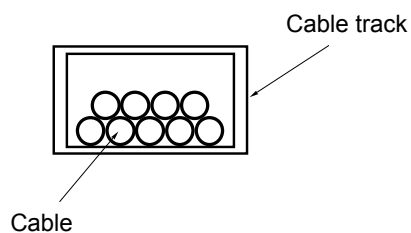
- Always use a robot cable for each relay cable.

- Use a cable track with a bending radius (r) of 50 mm or greater.

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



- Do not cause the cables to occupy more than 60% of the space in the cable track.



- Do not lay signal lines together with circuit lines that create a strong electric field.

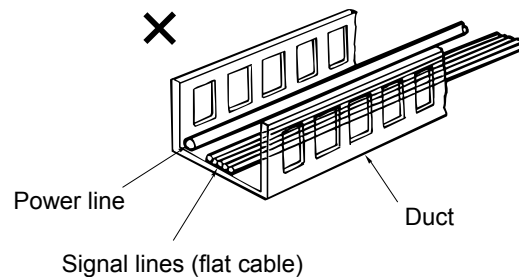


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1. Foreword

Thank you for purchasing an IAI product.

This manual explains the structure, correct operation and maintenance of the actuator.

Please read this manual carefully before using the product.

For more complete information on operating the actuator, please also refer to the controller operating manual.

2. Safety Precautions

2.1 Basic Operating Instructions

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

2.2 Maintenance and Inspection

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

(Note)

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

3. Warranty

3.1 Warranty Period

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

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

3.2 Scope of Warranty

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

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

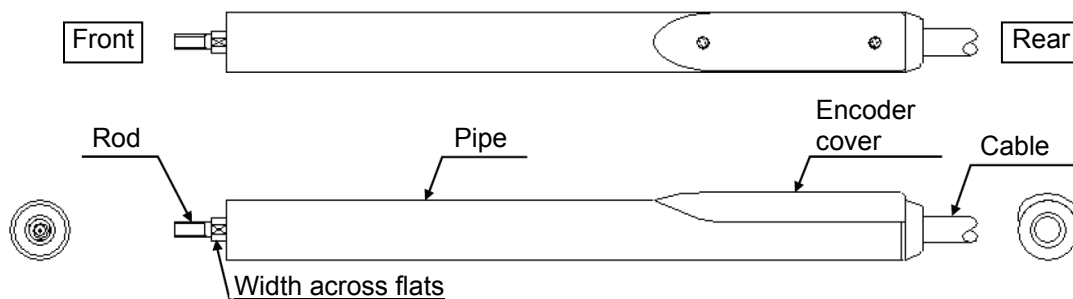
The warranty pertains to the purchased product itself and does not cover any damages that might arise from a breakdown of the supplied product.

Any repairs will be done at our factory. Even if the product is still covered under the warranty period, we will assess a separate charge for sending technicians to the customer's site.

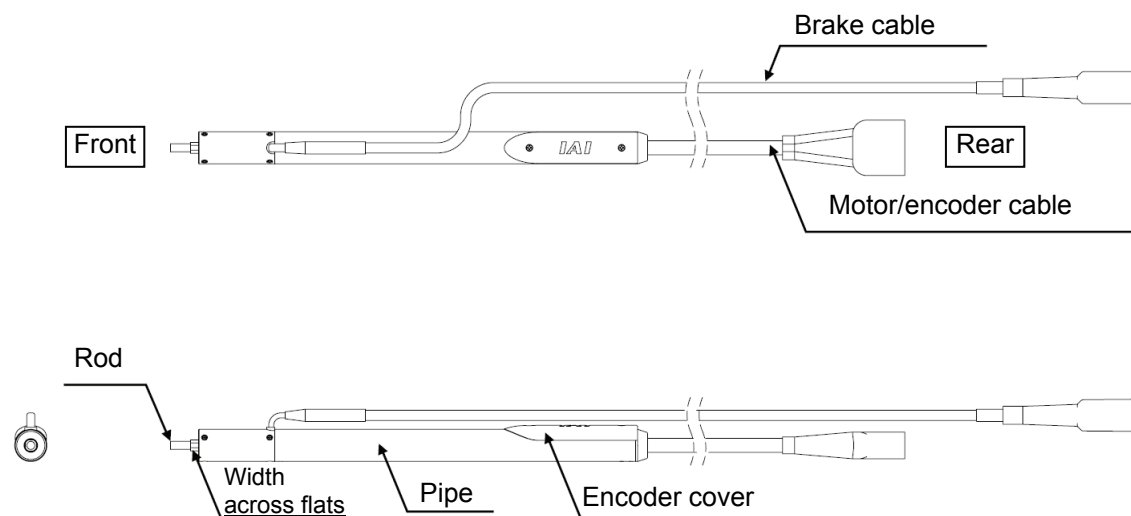
4. Names of the Parts

The names of the actuator parts are indicated below.

- Specification without brake



- Specification with brake



5. Transporting and Handling

5.1 Handling the Packed Unit

Unless otherwise specified, the actuator specified for single-axis use is packed individually and shipped. Exercise due caution when transporting the actuator to prevent bumping or dropping.

- If the shipping box is left standing, it should be in a horizontal position.
- Do not climb on top of the shipping box.
- Do not place heavy objects that might deform the shipping box or objects with concentrated on top.

5.2 Handling the Actuator After It is Unpacked

After unpacking the actuator, handle it by holding the pipe section.

- Transport the actuator with caution to prevent bumping or dropping. In particular, exercise caution to prevent the rod from receiving an impact or excessive force.
- Do not carry the actuator by holding the cables or move it by pulling the cables.



- Do not press the encoder cover strongly or otherwise apply impact on the encoder cover. The cover and internal parts will be damaged.



Supplement) Please refer to Section 4 above for the names of the actuator parts.

5.3 Handling the Actuator Assembly

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

5.3.1 Condition of Shipment from IAI (Assembled)

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

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

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

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

5.3.2 Handling after Assembly with Peripheral Equipment

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

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

6. Operating and Storage Environment

6.1 Operating Environment

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

- Avoid direct sunlight.
- Avoid radiant heat from strong heat sources such as a furnace.
- Surrounding air temperature should be 0 ~ 40°C.
- The humidity should be less than 85% and there should be no condensation.
- Avoid exposure to corrosive or combustible gases.
- The area should have very little dust and be suitable for normal assembly operations.
- Not exposed to splashed water, oil mist or cutting fluid.
- The unit should not be subject to impact or vibration.
- Avoid extreme electromagnetic waves, ultraviolet rays and radiation.
- This product is not intended to be used in a chemical environment.

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

6.2 Storage Environment

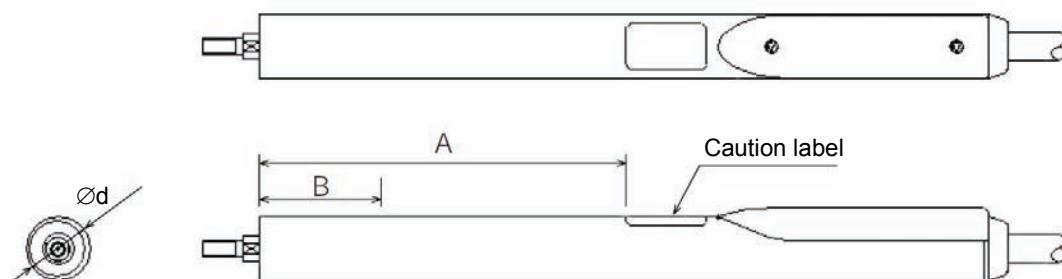
The storage environment should be similar to the operating environment. In addition, you must take precautions against condensation if the unit is to be stored for a long period of time. Unless there are special instructions, we do not include moisture absorption agents when shipping the unit. If you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

7. Installation

7.1 Installing the Actuator

7.1.1 Installation Method

This actuator has a cylindrical shape. The actuator can be affixed with a mating part of a hole shape.



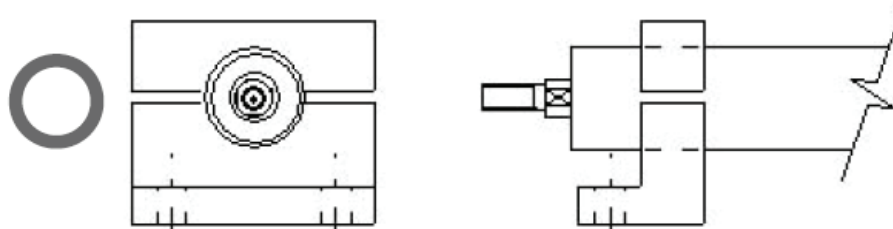
Dimensions of Actuator Installation Section

Model	Outer pipe diameter $\varnothing d$ (dimensional tolerance)	Allowable range for securing pipe A	Allowable range for securing with setscrews B
RA1L	16 (0/-0.1)	90	30
RA2L	20 (0/-0.1)	115	40
RA3L	25 (0/-0.1)	164	55

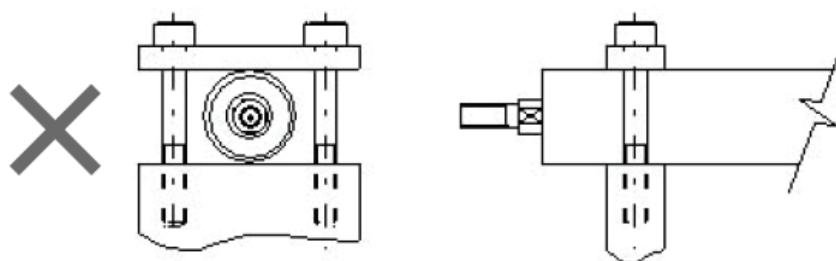
Recommended Installation Method

Clamping (split-clamping) method

Clamp the actuator using a hole shape corresponding to the pipe.



Do not use a sheet or other shape other than a hole to clamp the actuator, because the pipe will deform.



About Pipe Tightening Force

Tighten the clamp bolts gradually to secure the actuator with the minimum tightening torque needed to retain the pipe.

The table below lists the reference forces for clamping the pipes of different RCL models.

Do not tighten the clamp bolts with a force greater than the applicable value in the table.

Exercise caution because the force received by the pipe varies depending on the shape and rigidity of the bracket used, size of the clamp bolt, and tightening torque, among others.

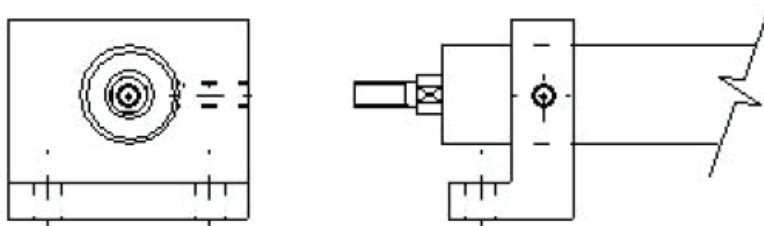
Pipe Clamping Forces (Reference Values)

Model	Clamping force (reference value)
RA1L	1,000 [N] (100 kg) or less
RA2L	1,500 [N] (150 kg) or less
RA3L	2,000 [N] (200 kg) or less

Note: Applying an excessive tightening force on the pipe may deform the pipe and cause malfunction or breakdown of the actuator.

Other Installation Method

Setscrew method



When the setscrew method is used, the locations where the actuator contacts the screws deform significantly. To protect the internal parts, secure the actuator by observing “Allowable range for securing with setscrews B” shown in the table, “Dimensions of Actuator Installation Section” in 7.1, “Installing the Actuator.”

Select a setscrew of a small diameter and secure the actuator by applying setscrews at multiple locations. If larger setscrews are used to tighten the actuator, the pipe will receive a greater axial torque and deform more.

Setscrew Tightening Torques (Reference Values)

Setscrew size	Tightening torque [N-m]
M2.5	0.18 or less
M3	0.32 or less

Note: Applying an excessive tightening force on the pipe may deform the pipe and cause malfunction or breakdown of the actuator.

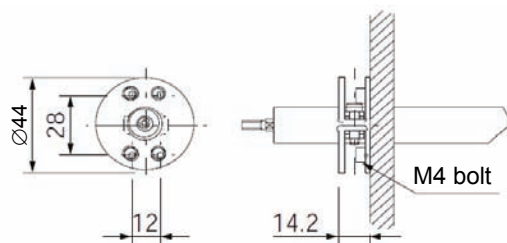
7.1.2 Mounting Bracket

General-purpose mounting brackets like the products shown below can be used.
For details on each bracket, contact the manufacturer of the bracket directly.

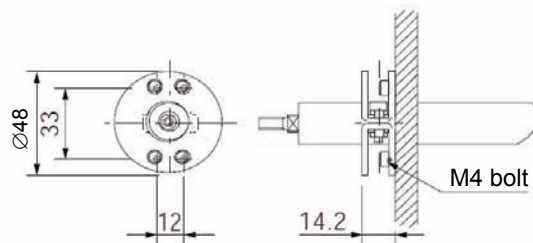
(1) Shaft bracket

Manufacturer: Iwata Mfg.

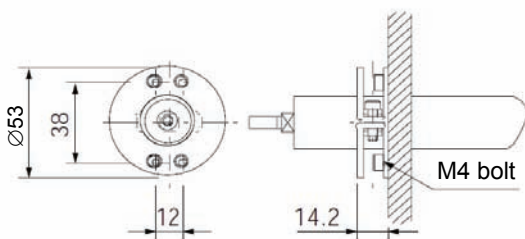
- RA1L
Model: B16CP4



- RA2L
Model: B206CP4



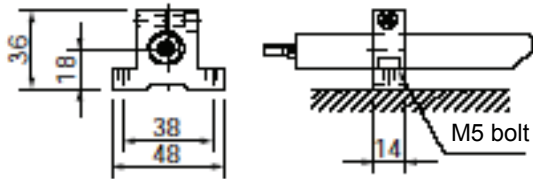
- RA3L
Model: B25CP4



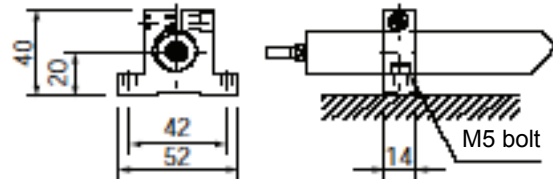
**⚠ Caution: When clamping the actuator, strictly observe the specified tightening torque.
Failure to do so may damage the actuator.**

(2) Round Pijon
Manufacturer: Miyoshi Pijon

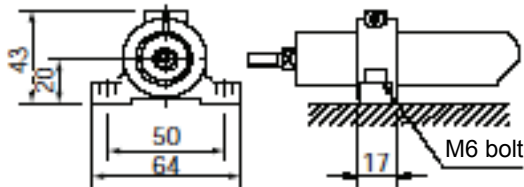
- RA1L
Model: PN600



- RA2L
Model: PQ600

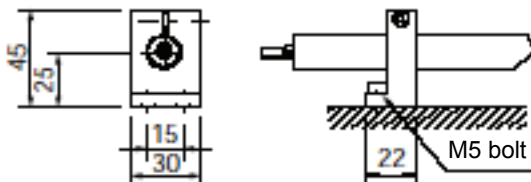


- RA3L
Model: PH600

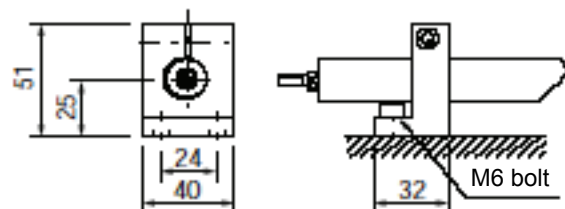


(3) Shaft holder
Manufacturer: Misumi

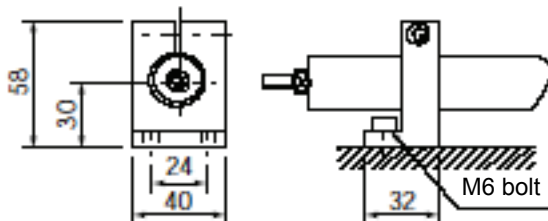
- RA1L
Model: SHKSBT16



- RA2L
Model: SHKSBT20



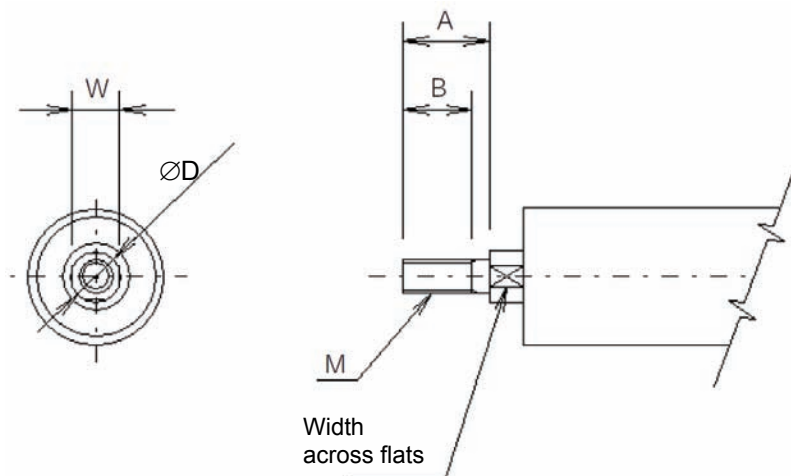
- RA3L
Model: SHKSBT25



**⚠ Caution: When clamping the actuator, strictly observe the specified tightening torque.
Failure to do so may damage the actuator.**

7.2 Installing the Load

- Install the load on the threaded part at the tip of the rod. Pay attention to the section of incomplete thread.
- When installing the load, fasten the nut while holding the width across flats with a spanner to prevent the rod from receiving torque. If an excessive torque applies to the torque, the interior parts will be damaged.
- The rod is made of aluminum. Fasten the supplied nut to the recommended tightening torque specified below. An excessive tightening torque will damage the thread.



Dimensions of Load Installation Section

Model	M Nominal thread size	A	B Effective thread length	ØD Rod diameter	W Width across flats
RA1L	M4	10	8	6	5.5
RA2L	M5	12	10	8	7
RA3L	M6	14	12	10	8

Recommended Tightening Torque for Supplied Nut

Model	Supplied nut	Recommended tightening torque
RA1L	M4 nut (type 1)	0.75 N-m
RA2L	M5 nut (type 1)	1.5 N-m
RA3L	M6 nut (type 1)	2.6 N-m

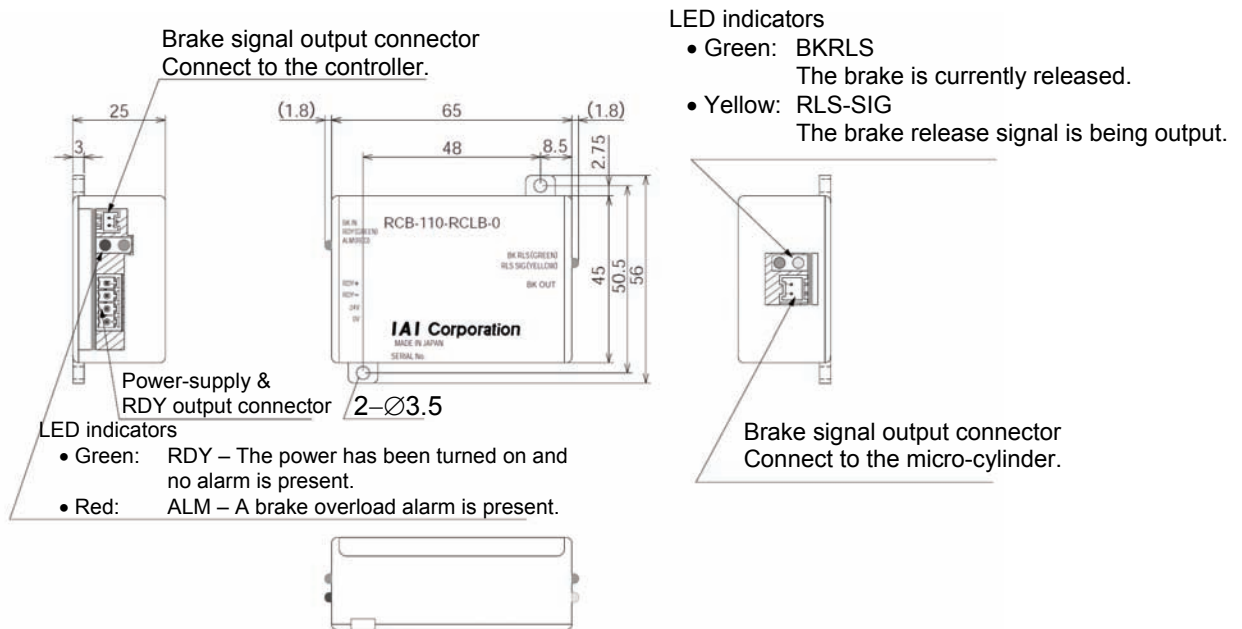
8. Wiring Cable

- In an application where the cable cannot be anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable as large radial wire duct to limit the load on the cable.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length.
- Do not pull the cables or bend them forcibly.

8.1 Installing the Brake Box for Specification with Brake

When using the specification with brake, the brake box RCB-110-RCLB-0 must be installed.

8.1.1 Brake Box RCB-110-RCLB-0



Item	Specification
Power-supply voltage	24 VDC±10%
Power-supply current	MAX 2.5 A (for approx. 110 ms when the brake is released)
Weight	Approx. 35 g

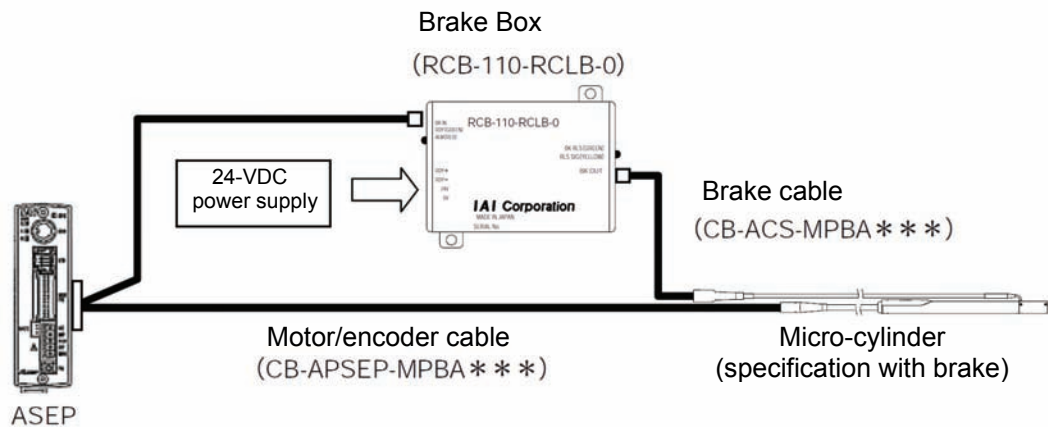
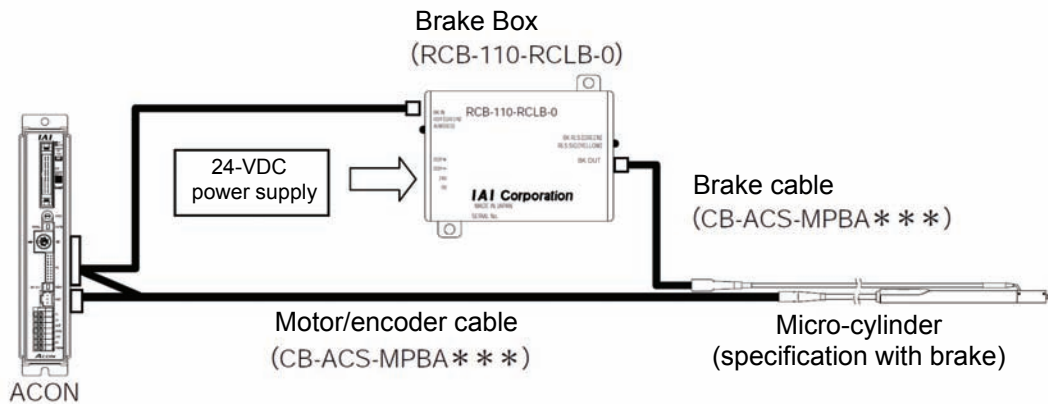
[Power-supply & RDY output connector]
Corresponding wire: AWG 24 to 16

Pin no.	Signal name	Description
1	RDY+	Ready contacts
2	RDY -	These contacts open when a brake overload alarm generates.
3	+24 V	+24-VDC power-supply inputs
4	0 V	

8.1.2 Connecting and Starting Up the Brake Box

- [1] Examples of connecting the brake box to an ACON controller and an ASEP controller, respectively, are shown below. (Connection to an ASEL controller is the same as when connecting to an ACON controller.)
Make connections according to an applicable connection example.
- [2] Connect a +24-V power supply to the brake box so that +24-V power will be input to the box. When the brake is released, a maximum of 2.5 A of current will flow for approx. 110 ms.

Connection Examples



9. Notes on Use

9.1 Load on the Actuator

- The maximum load specified in the catalog must not be exceeded.
- Prevent the rod from receiving a rotational torque.
- Provide a guide, etc., to prevent application of a load (lateral load) in the direction of rod movement.



9.2 Temperature Rise

- Exercise caution if the rod is moved continuously or a push-motion operation is continued for a long period of time, because both the actuator and rod will become hot.

9.3 Item to Note at Power On and Software Reset

When the power is turned on or a software reset is performed, the excited motor pole is detected. If the rod moves during this excited-pole detection period, the actuator may operate abnormally. Keep the rod stationary for a brief period (approx. 3 seconds) immediately after the power is turned on or a software reset is performed.

9.4 Home Position

Home return must be performed after the actuator is started.
One home is provided on the retracting side of the rod. (The home position cannot be changed.)
Configure the system so that there are no interferences that may contact the actuator near the home position.

9.5 Suppression of Vibration/Resonance Noise

Vibration or resonance noise may generate depending on the load size, operating conditions, installation condition, mechanical rigidity, etc.

Vibration or resonance noise, should it occur, may be suppressed by increasing the torque filter time constant (parameter) specified below.

Take note, however, that increasing the setting of this parameter excessively may affect the stability of the actuator.

For the method to set or change parameters, refer to the operation manual for the PC software or teaching pendant used with the controller.

Caution: The parameters other than the torque filter time constant have been set to appropriate values according to the actuator specification. Do not change the parameters other than the torque filter time constant.

ACON/RACON Controllers

Parameter number	Name	Default value	Set value
33	Torque filter time constant	0	25 or 50

ASEL Controllers

Driver parameter number	Name	Default value	Set value
45	Torque filter time constant	0	25 or 50

10. Operating Conditions

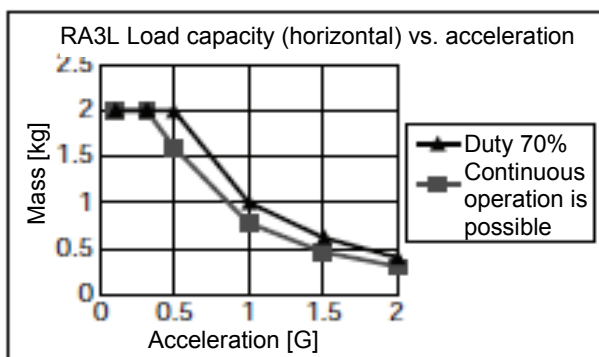
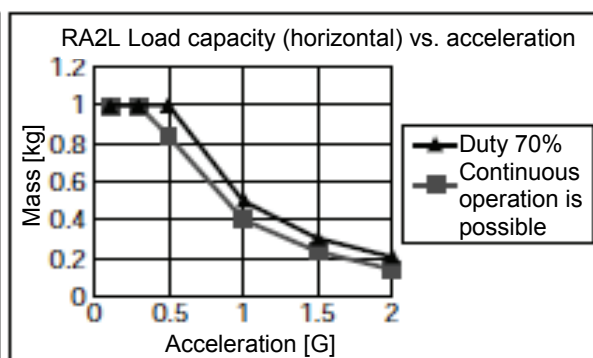
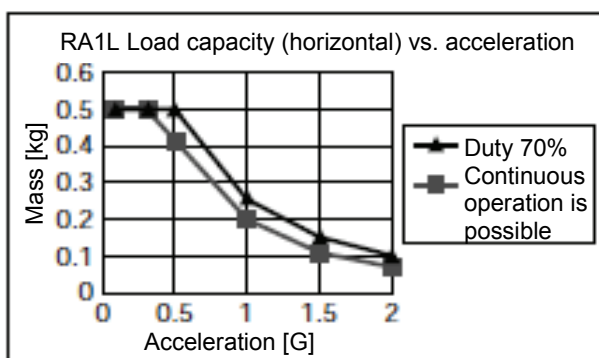
Set the items specified below when using your micro-cylinder.

10.1 Setting the Acceleration

(1) Horizontal installation

The acceleration is determined by the load capacity and duty.

The graphs below show the maximum accelerations at different load capacities and duties calculated for When the duty exceeds 70% and is below 100%, set the acceleration by the value in which the continuous operation is possible. When the duty is less than 70%, set the acceleration by the value in 70%.



Load capacity (horizontal) vs. acceleration

[kg]

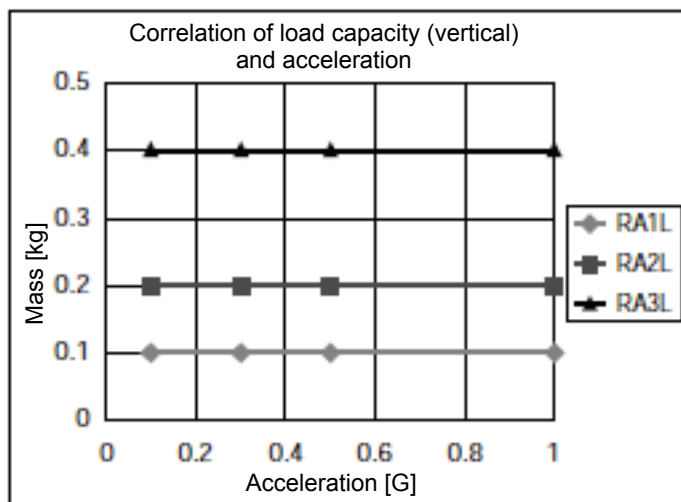
Model	RA1L		RA2L		RA3L	
Acceleration [G]	Continuous operation is possible	Duty 70%	Continuous operation is possible	Duty 70%	Continuous operation is possible	Duty 70%
0.1	0.5	0.5	1	1	2	2
0.3						
0.5	0.42	0.25	0.85	0.5	1.6	1
1	0.2		0.4		0.78	
1.5	0.11	0.15	0.24	0.3	0.46	0.6
2	0.07	0.1	0.15	0.2	0.3	0.4

$$\text{Duty} = \frac{\text{Operating time}}{\text{Operating time} + \text{Stopped time}} \times 100$$

* To prevent the rod from receiving a lateral load or rotational load, provide an external guide, etc., to receive the load.

(2) Vertical installation

The graph and table below show the maximum accelerations for different RCL models at their load capacities. The actuator can be operated continuously as long as the correlation of its acceleration and load capacity meets the condition specified below.

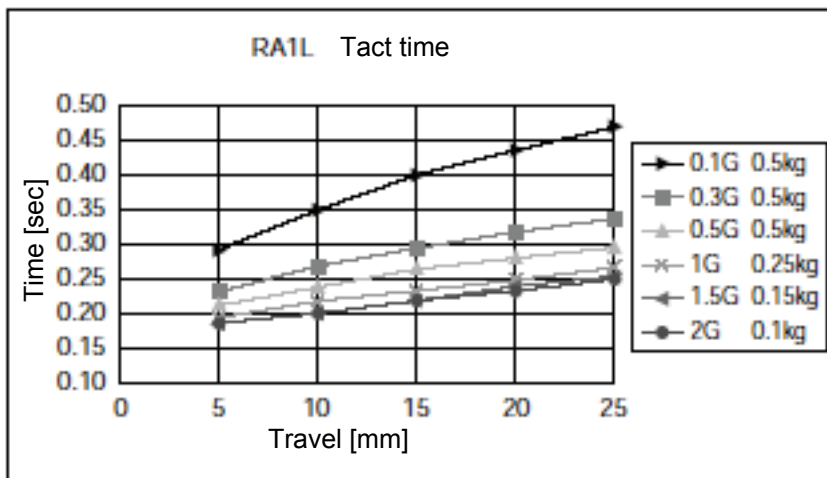


Load capacities (vertical) and accelerations [kg]			
Acceleration [G]	RA1L	RA2L	RA3L
0.1	0.1	0.2	0.4
0.3			
0.5			
1			

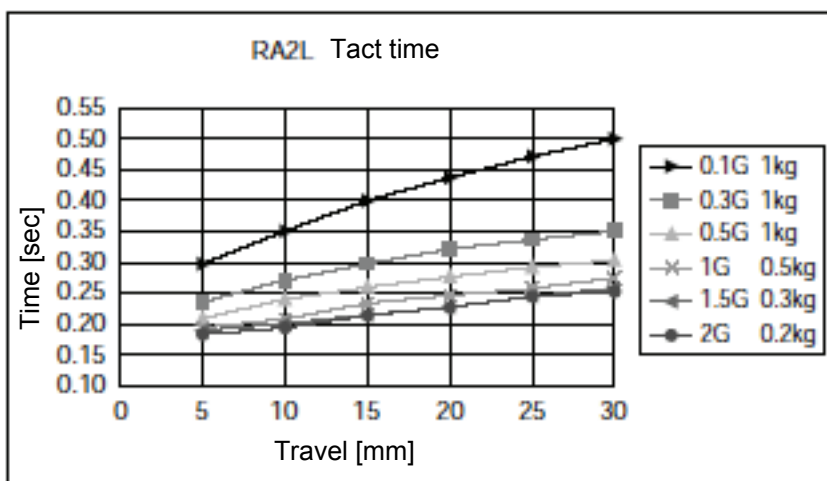
* To prevent the rod from receiving a lateral load or rotational load, provide an external guide, etc., to receive the load.

(3) Guide for tact time

The graph below shows the tact times at different accelerations when the actuator is operated at the maximum speed. Use this graph as a guide when determining the travel time.

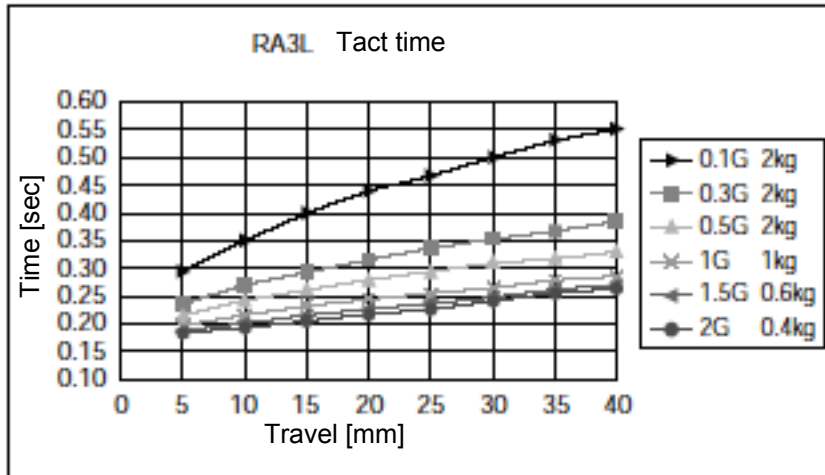


Set speed: 300 mm/sec
Installation position: Horizontal



Set speed: 340 mm/sec
Installation position: Horizontal

* To prevent the rod from receiving a lateral load or rotational load, provide an external guide, etc., to receive the load.



Set speed: 450 mm/sec
Installation position: Horizontal

- * To prevent the rod from receiving a lateral load or rotational load, provide an external guide, etc., to receive the load.

10.2 Setting the Current-limiting Value for Push-motion Operation

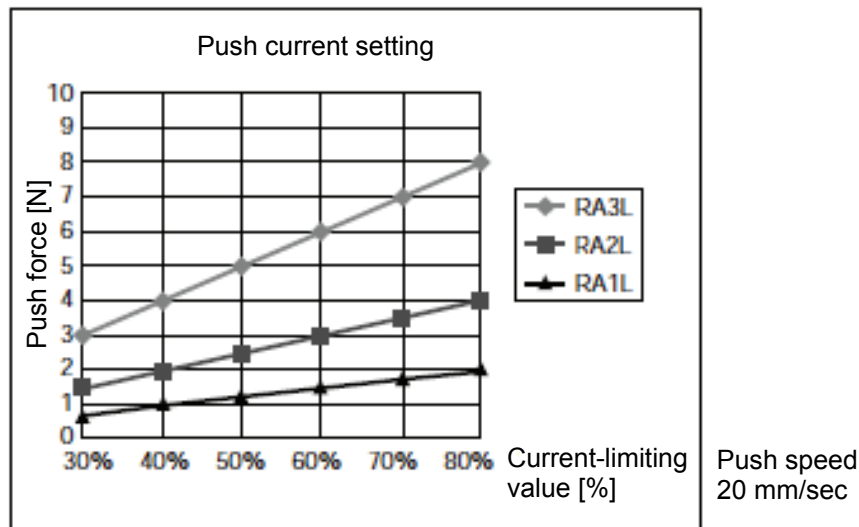
If push-motion operation is performed, set the current-limiting value that determines the push force.

The graph below shows the current-limiting values corresponding to different push forces.

Use this graph as a guide when adjusting the push force.

* The push time is not limited. The actuator can perform push motion continuously.

- ⚠ Caution:**
- The push force is adjusted by the current-limiting value. If the current-limiting value is lower, the push force fluctuates more. Keep the current-limiting value within a range of 60 to 80% whenever possible.
 - The push force varies depending on the individual difference of the micro-cylinder and the position at which the actuator pushes the load.



* The above graph assumes that the rod is installed horizontally and operated under no load and without anything installed on the actuator.

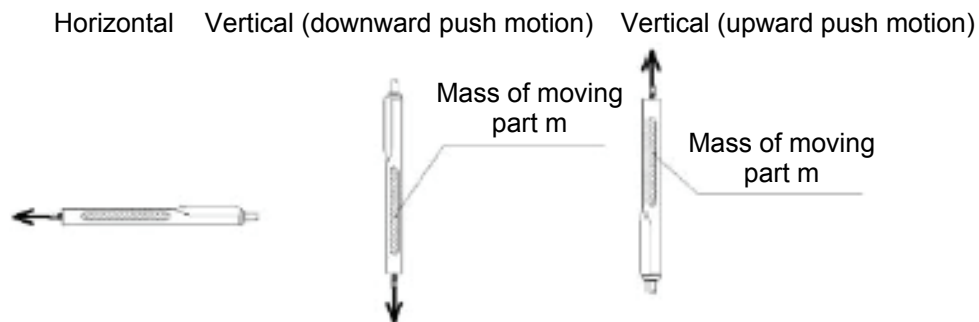
Guide for Push Force

Current-limiting value	30%	40%	50%	60%	70%	80%
RA1L	0.75	1	1.25	1.5	1.75	2
RA2L	1.5	2	2.5	3	3.5	4
RA3L	3	4	5	6	7	8

- ⚠ Caution:** You may not be able to set the current-limiting values of 71 to 80% depending on the version of the PC software or teaching pendant. Check the “CAUTION” page at the beginning of the manual.

Effect of Push-motion Direction

As shown below, how the mass of the moving part affects the operation must be considered when the actuator is installed vertically.



Push force = Thrust
 $F=f$

Push force = Thrust
+ Mass of moving part
 $F=f + m$

Push force = Thrust
– Mass of moving part
 $F=f - m$

Mass of moving part

Model	Mass of moving part [N]
RA1L	0.5
RA2L	1
RA3L	1.8

11. Maintenance and Inspection

11.1 Inspection Items and Intervals

	Visual inspection of exterior
Inspection at initial startup	○
1 month after start of operation	○
3 months after start of operation	○
Every 3 months thereafter	○
3 years of operation or 5,000 km of traveled distance	○
Every year thereafter	○

11.2 Visual Inspection of Exterior

Visually check the following items.

Actuator	<ul style="list-style-type: none">• Check the actuator mounting bolts, etc., for looseness.• Visually inspect the sliding section of the rod. (The surface must be free from attachment of foreign matters.)• Move the rod by hand to confirm smooth operation.
Cables	Check the cables for scratches and proper engagement of connectors.
Overall	Noise, vibration

11.3 Cleaning

- Clean the exterior surface as needed.
- Remove soiling using a soft cloth, etc.
- Do not blow compressed air onto the actuator too strongly, because dust may enter through the gaps and openings.
- Do not use petroleum solvents because they damage resin and coated surfaces.
- To remove excessive soiling, moisten a soft cloth, etc., with neutral detergent or alcohol and wipe the area gently.

12. Specifications

12.1 Actuator

Item		Unit	RA1L	RA2L	RA3L
Stroke		mm	25	30	40
Rated thrust ^{*1}		N	2.5	5	10
Maximum load capacity	Horizontal	kg	Refer to the table below.		
	Vertical ^{*2}	kg	0.1	0.2	0.4
Instantaneous maximum thrust		N	10	18	30
Maximum acceleration		G	Horizontal: 2 G / Vertical 1 G		
Maximum speed		mm/s	300	340	450
Positioning repeatability		mm	±0.1		
Weight (without brake)		kg	0.2	0.33	0.6

*1 When the duty is 70%.

Load capacity (horizontal) vs. acceleration [kg]

Acceleration [G]	RA1L	RA2L	RA3L
0.1	0.5	1	2
0.3			
0.5			
1	0.25	0.5	1
1.5	0.15	0.3	0.6
2	0.1	0.2	0.4

(Note) *2: Take note that if the actuator has no brake, using it in a vertical position will result in the rod dropping due to gravity when the servo or power is turned off.

[Brake (Optional) Specifications]

Item	Unit	RA1L	RA2L	RA3L
Holding load ^{*3}	kg	0.1	0.2	0.4
Holding precision ^{*3}	mm	1 mm or less		
Lifetime brake actuations	—	100,000 times		
Weight (with brake)	kg	0.25	0.4	0.77

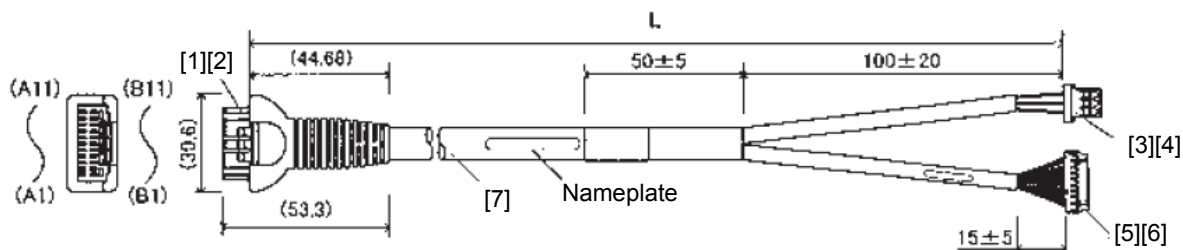
*3 The holding load changes according to the rod surface condition and various other factors. In particular, the specified holding load cannot be guaranteed in an environment subject to attachment of oil, foreign matter, etc.

*4 The holding load may not be guaranteed if the actuator is installed in an orientation other than vertical.

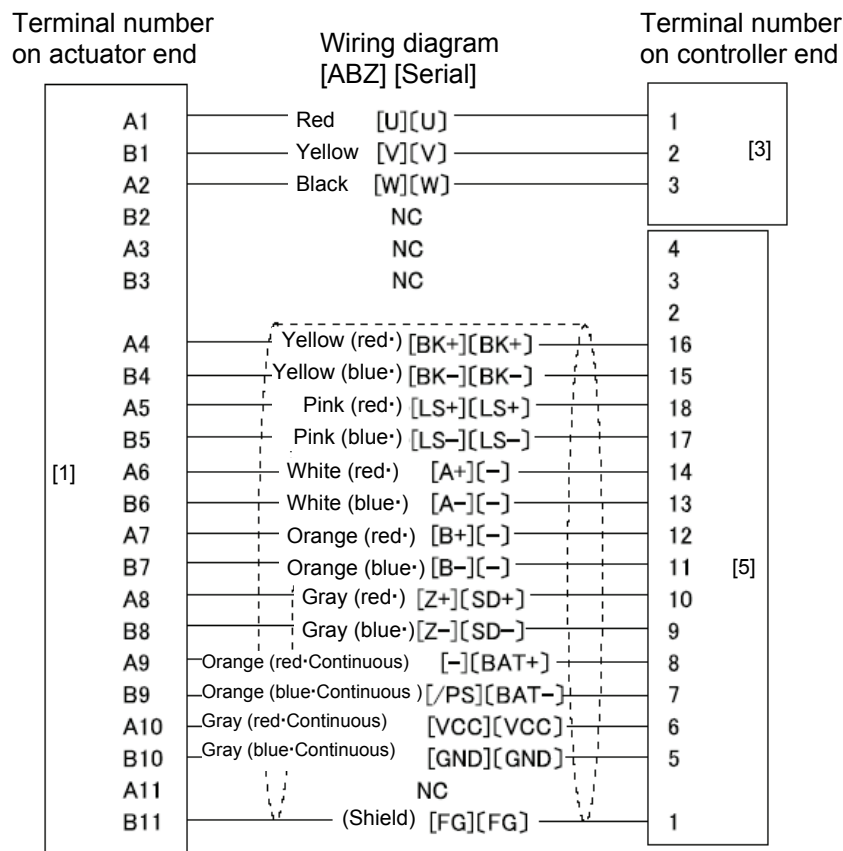
12.2 Cable Drawing

12.2.1 Servo Motor Cable: CB-MPA***

*** indicates the cable length.

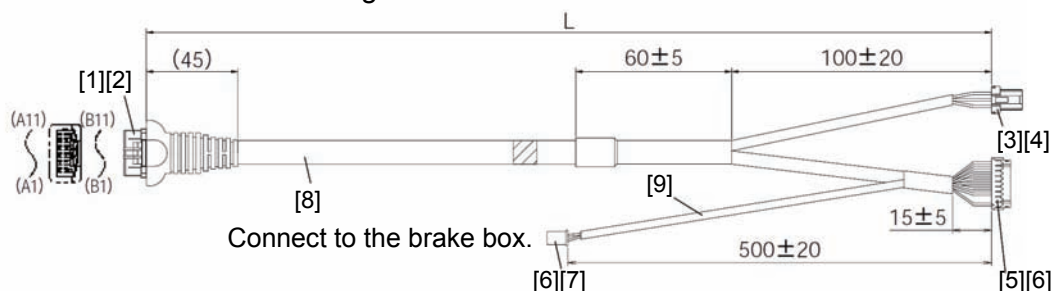


No.	Item	Model	Manufacturer
[1]	Receptacle/housing	D-1100D 1-1827863-1	AMP
[2]	Receptacle/contact	D-1 1827570-2	AMP
[3]	Socket	DF1E-3S-2.5C	Hirose
[4]	Socket contact	DF1E-2022SCF	Hirose
[5]	Housing	PHDR-18VR	JST
[6]	Contact	SPHD-001T-P0.5	JST
[7]	UL2854-VVSWKA	TS06V1200 (25AWG X 7P + 22AWG X 6C)	Tatsuta Electric Wire & Cable



12.2.2 Servo Motor Cable (with Brake Cable): CB-ACS-MPBA***

*** indicates the cable length.

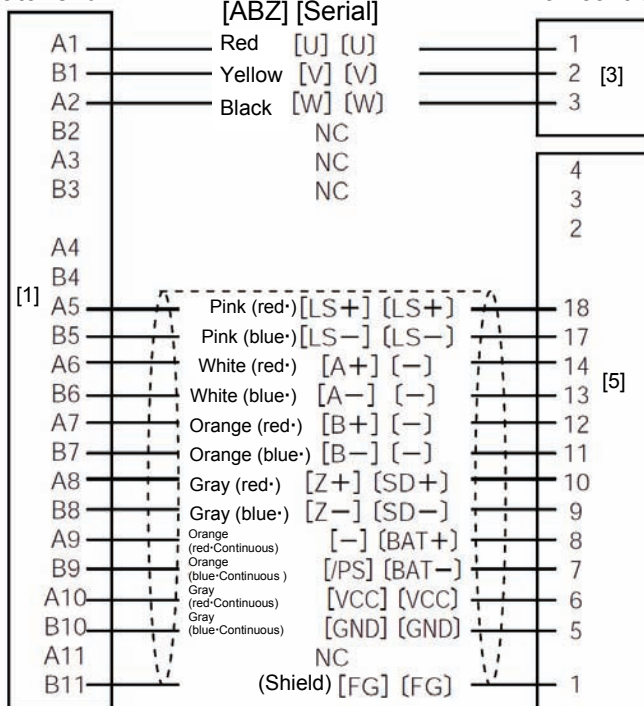


No.	Item	Model	Manufacturer
[1]	Receptacle/housing	D-1100D 1-1827863-1	AMP
[2]	Receptacle/contact	D-1 1827670-2	AMP
[3]	Socket	DF1E-3S-2.5C	Hirose
[4]	Socket contact	DF1E-2022SCF	Hirose
[5]	Housing	PHDR-18VR	JST
[6]	Contact	SPHD-001T-P0.5	JST
[7]	Housing	PAP-02V-S	JST
[8]	UL2854-VVSWKA	TS06V1200 (25AWG X 7P + 22AWG X 6C)	Tatsuta Electric Wire & Cable
[9]	UL2854-OHRPCVV	TS07V0640 (25AWG X 2C)	Tatsuta Electric Wire & Cable

Terminal number
on actuator end

Wiring diagram
[ABZ] [Serial]

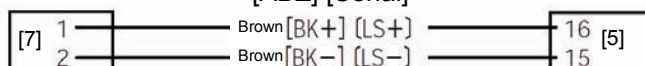
Terminal number
on controller end



Terminal number on
brake box end

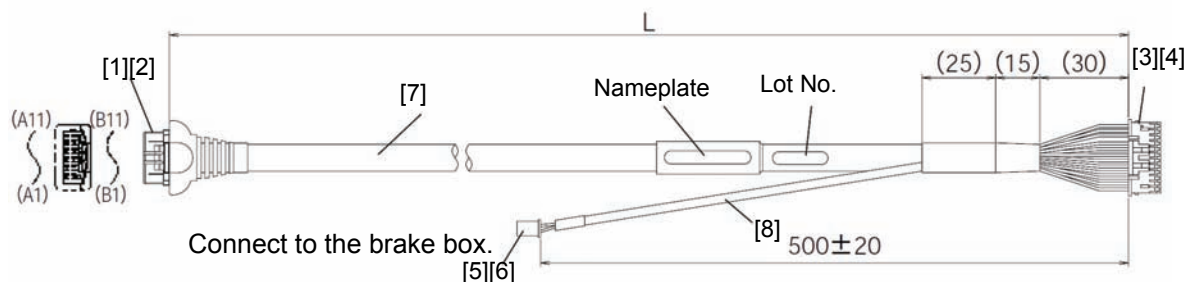
Wiring diagram
[ABZ] [Serial]

Terminal number
on controller end



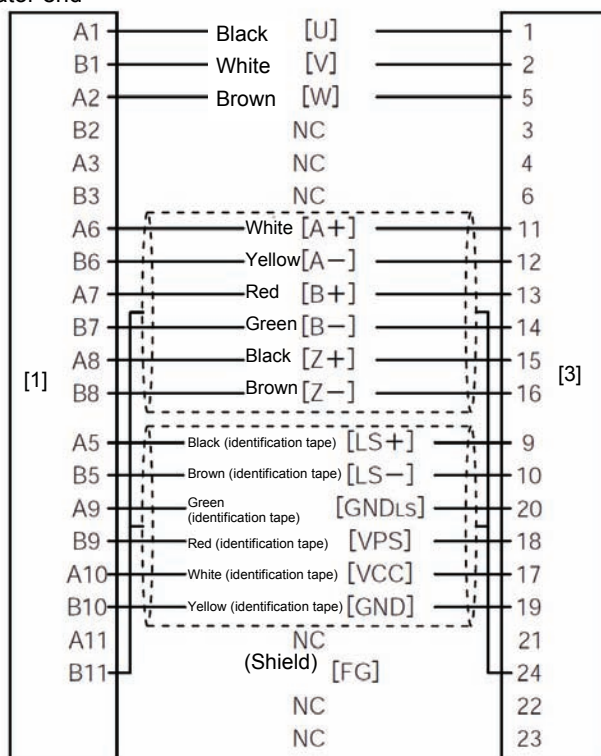
12.2.3 Servo Motor Cable (with Brake Cable): CB-APSEP-MPBA***

*** indicates the cable length.

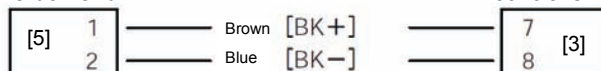


No.	Item	Model	Manufacturer
[1]	Housing	D-1100D 1-1827863-1	AMP
[2]	Contact	D-1 1827570-2	AMP
[3]	Housing	PADP-24V-1-S	JST Mfg
[4]	Contact	SPND-001T-CP0.5	JST Mfg
[5]	Housing (C side)	PAP-02V-S	JST Mfg
[6]	Contact (C side)	SPHD-001T-P0.5	JST Mfg
[7]	UL2854-OHFRPCVWSW	25AWG X 6p + 25AWG X 2C + 22 AWG X 6C, TS08V0350	Tatsuta Electric Wire & Cable
[8]	UL2854-OHRPCVV	TS07V0640 (25AWG X 2C)	Tatsuta Electric Wire & Cable

Terminal number on actuator end Wiring diagram Terminal number on controller end



Terminal number on brake box end Wiring diagram Terminal number on controller end



12.2.4 Brake Relay Cable: CB-RCLB-BJ***

*** indicates the cable length.



No.	Item	Model	Manufacturer
[1]	Housing	XAP-02V-1	JST
[2]	Contact	SXA-01T-P06	JST
[3]	Plug housing	SLP-02V	JST
[4]	Contact	SSF-21T-P14	JST
[5]	Electronics wiring cable	EXT-2/20276LF (AWG20 X 2C)	Taiyo Cabletec

Terminal number on
brake box end

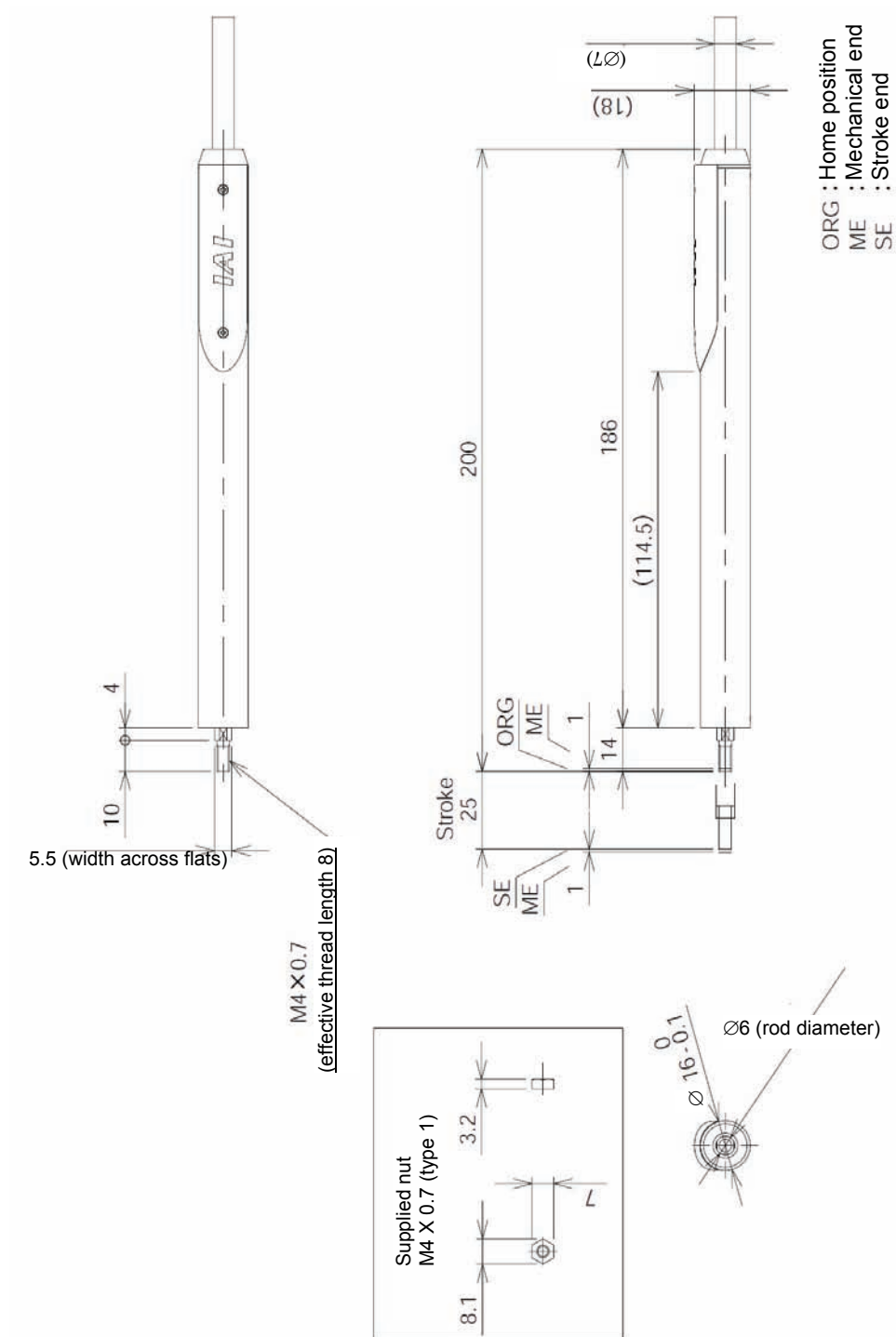
Wiring diagram

Terminal number on
actuator end

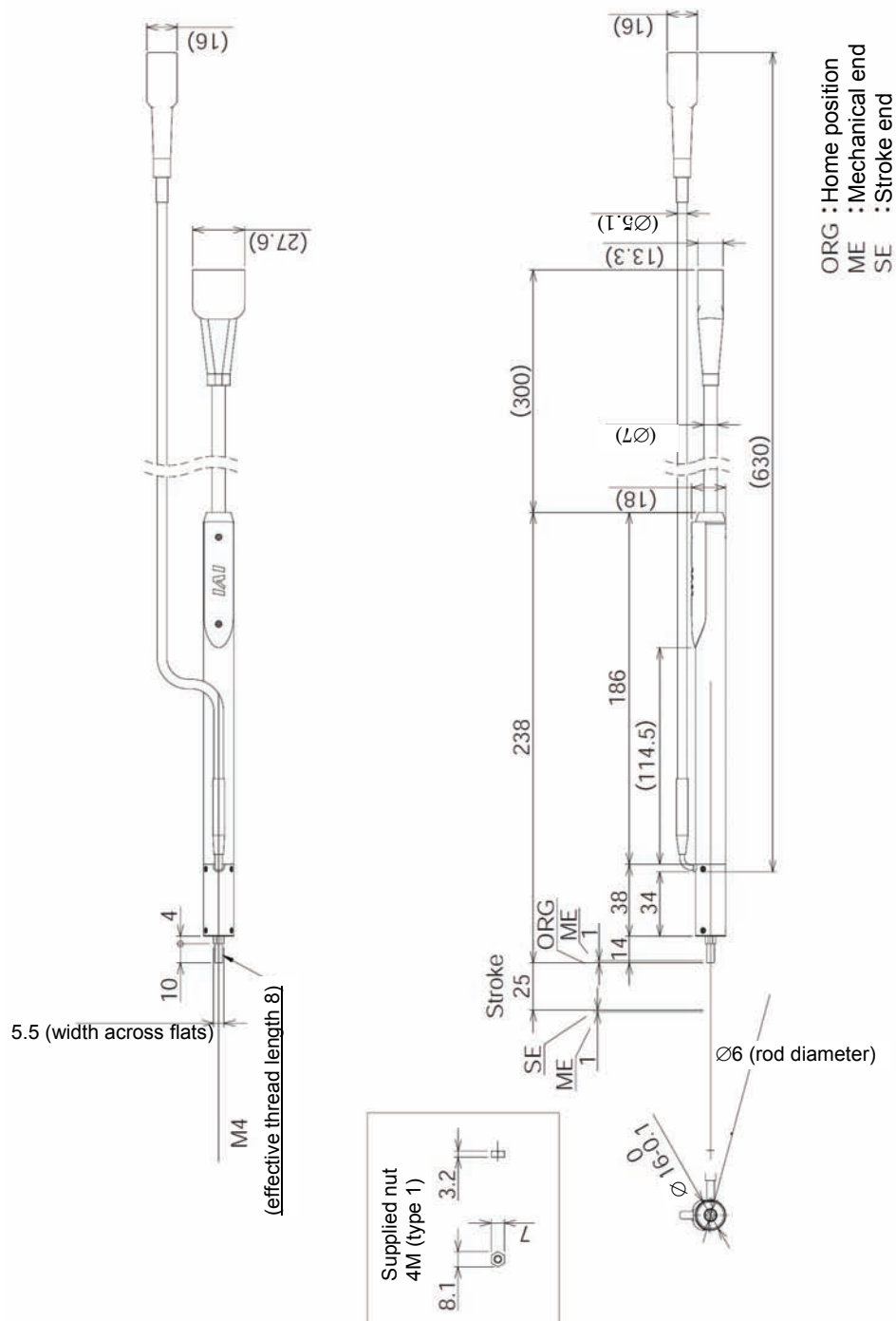


12.3 External Dimensions

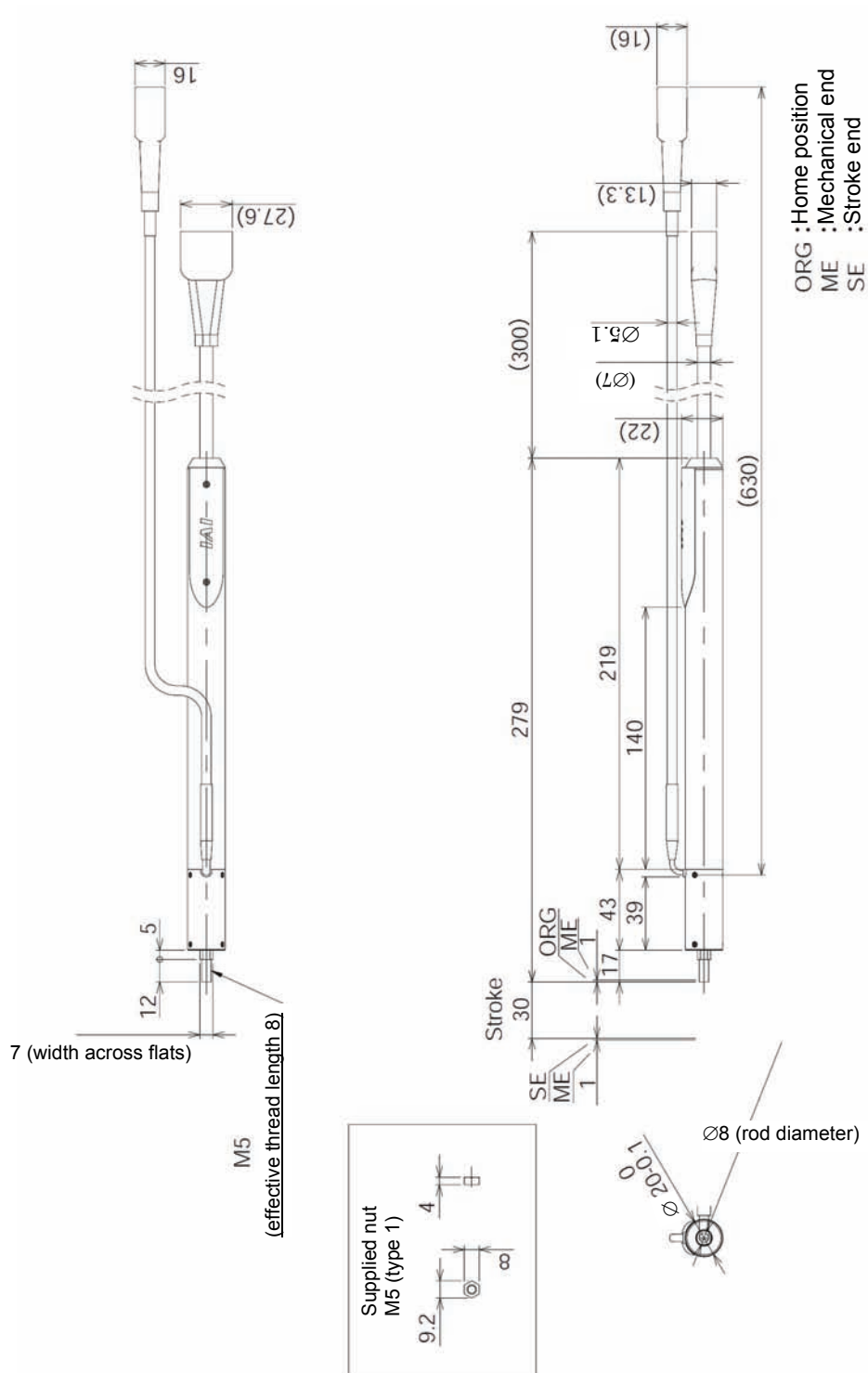
12.3.1 RCL-RA1L Specification without brake



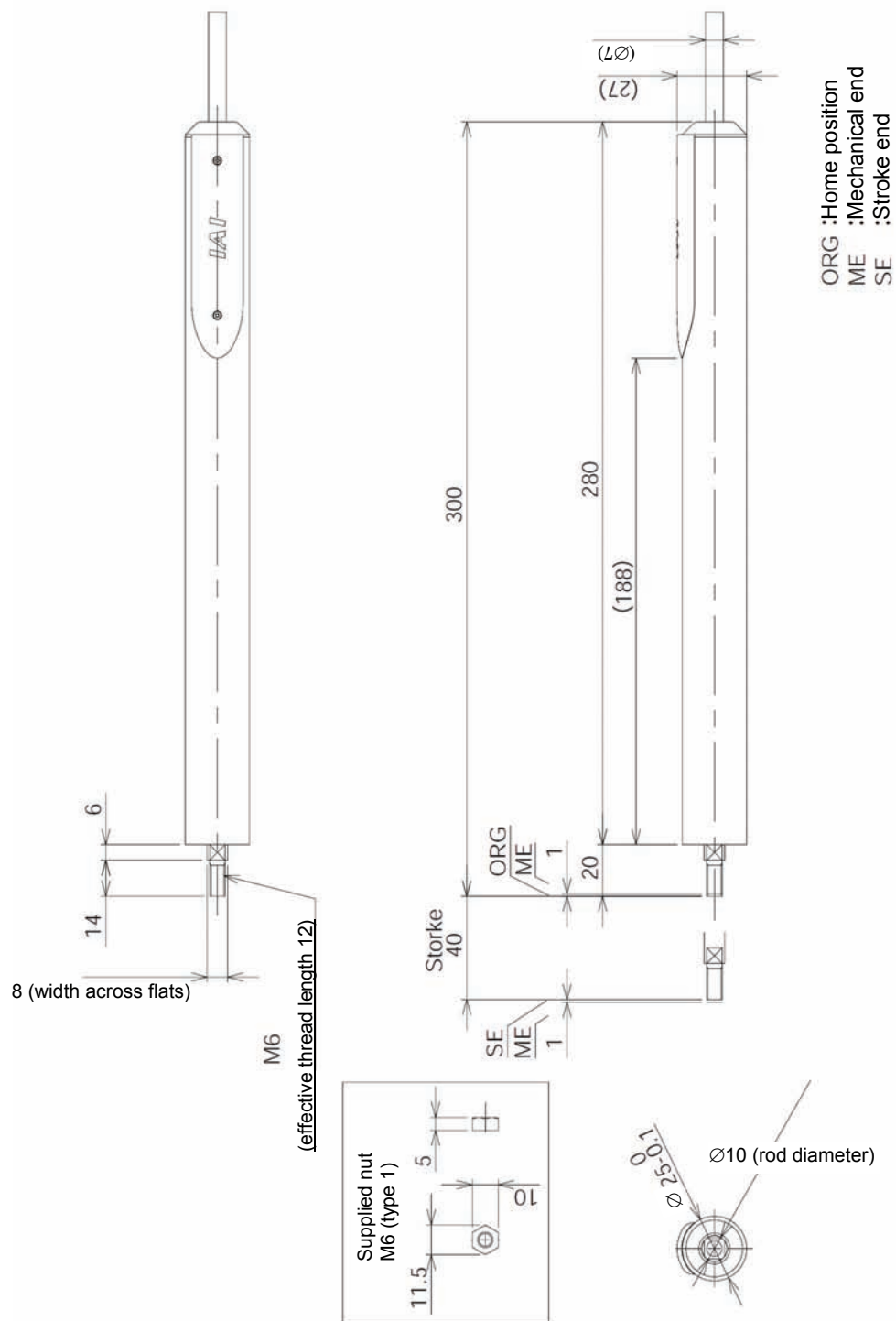
12.3.2 RCL-RA1L Specification with brake (Option)



12.3.4 RCL-RA2L Specification with brake (Option)



12.3.5 RCL-RA3L Specification without brake



13. Change History

Revision Date	Description of Revision
October, 2009	<p>Second Edition Added the RCL-RA1L specification with brake, RCL-RA2L specification with brake and RCL-RA3L specification with brake.</p>

MEMO



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