ROBO CYLINDER

ROBO Cylinder
Linear Servo Type
Rod Type

Instruction Manual

Third Edition

RCL-RA1L, RA2L, RA3L

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

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

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.
The CD or DVD that comes with the product contains instruction manuals for IAI products.
When using the product, refer to the necessary portions of the applicable instruction manual by printing them out or displaying them on a PC.

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

[Important]

- This Instruction Manual is original.
- This product is not to be used for any other purpose from what is noted in this Instruction Manual. IAI shall not be liable whatsoever for any loss or damage arising from the result of using the product for any other purpose from what is noted in the manual.
- The information contained in this Instruction Manual is subject to change without notice for the purpose of production improvement.
- If you have any question or finding regarding the information contained in this Instruction Manual, contact our customer center or our sales office near you.
- Using or copying all or a part of this Instruction Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

Table of Contents

Safety Guide

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

Safety Precautions for Our Products

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

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

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

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

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

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

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

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

Caution in Handling

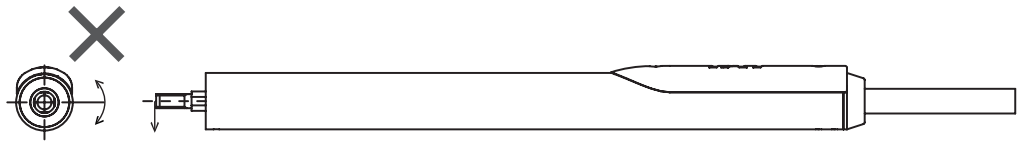
1. Ensure use of the product in the specified conditions, environments and ranges.
   Operation out of the specified conditions could cause a drop in performance or malfunction of the product.

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

3. For the wiring of the controller and actuator, use the IAI product.

4. Do not attempt to establish the settings for the speed and acceleration/deceleration above the allowable range.
   If the robot is operated at a speed or acceleration/deceleration exceeding the allowable value, abnormal noise or vibration, failure, or shorter life may result.

5. About load applied to actuator
   Avoid rotation torque from being applied to the rod.
   Install a guide so the load vertical to the rod moving directions (sideway load) would not be applied.



6. 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.

7. Pay attention to temperature rise.
   In case movement of rod is continuously conducted or pressing operation is continued for long time, the temperature on the unit body and the rod will rise. Please be careful.

8. Make sure to keep the rod in stop condition for a short while (approx. 3sec) straight after the power is turned on or software reset.
   There is a magnetic pole detection process of the motor when the power is turned on or at software reset. It may get detected as an error if the rod moves during this magnetic pole detection.

9. This actuator requires a home-return operation after startup.
   The home position is one point at the side of rod being pulled in. (Can not be changed.)
   Make sure to construct the system with no interference around the home position.

International Standards Compliances

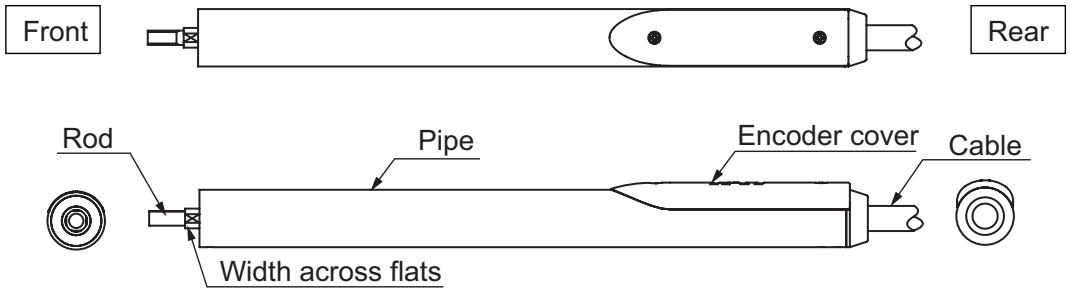
This actuator complies with the following overseas standard.
Refer to Overseas Standard Compliance Manual (ME0287) for more detailed information.

RoHS Directive	CE Marking	UL
○	×	×

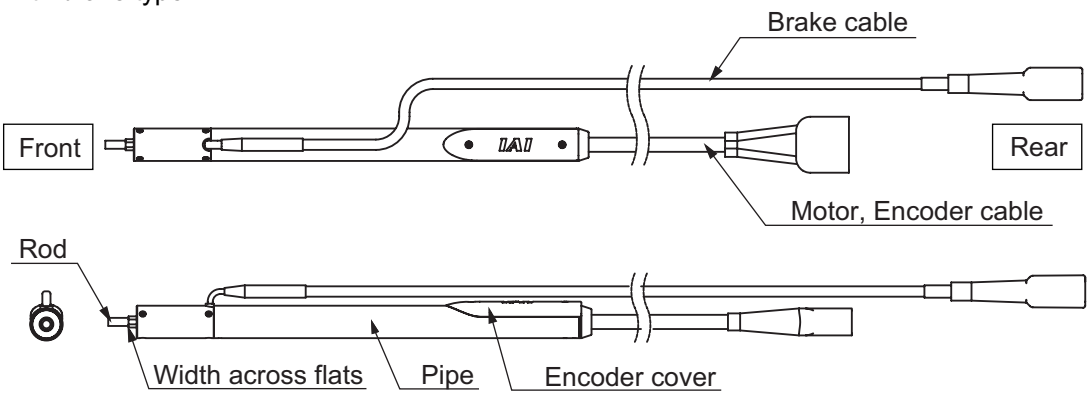
Names of the Parts

In this manual, the right and left sides of the actuator are expressed in the way it is placed horizontally as shown in the figure below, and is looked at from the motor side.

- Without brake type



- With brake type



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 broken or missing parts, contact your local IAI distributor.

1.1.1 Components

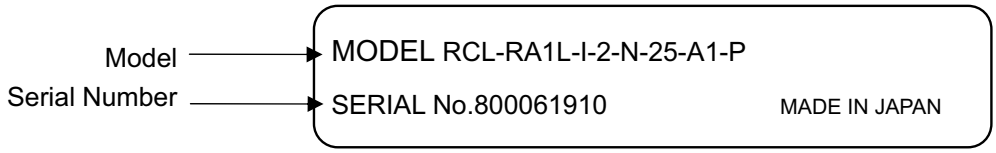
No.	Name	Model number	Quantity	Remarks
1	Main Unit	Refer to “How to Read the Model Nameplate” and “How to Read the Model Number.”	1	
Accessories				
2	Motor • encoder cables (Note 1)		1 set	
3	In-house made seals		1	
4	First Step Guide		1	
5	Instruction Manual (DVD)		1	
6	Safety Guide		1	

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

1.1.2 Operating Manuals for the Controllers Related to this Product

No.	Name	Control No.
1	Instruction Manual for ACON-C/CG Controller	ME0176
2	Instruction Manual for ACON-CY Controller	ME0167
3	Instruction Manual for ACON-SE Controller	ME0171
4	Instruction Manual for ACON-PL/PO Controller	ME0166
5	Instruction Manual for ASEL Controller	MJ0165
6	Instruction Manual for MEC Controller	ME0245
7	Instruction Manual for PSEP/ASEP/DSEP Controller	MJ0216
8	Instruction Manual for MSEP Controller	ME0299
9	Instruction Manual for PC Software IA-101-X-MW/IA-101-X-USBMW	ME0154
10	Instruction Manual for PC Software RCM-101-MW/ RCM-101-USB	ME0155
11	Instruction Manual for MEC Software	ME0248
12	Instruction Manual for Teaching Pendant CON-T/TG	ME0178
13	Instruction Manual for Teaching Pendant SEL-T/TD	ME0183
14	Instruction Manual for Touch Panel Teaching CON-PTA/PDA/PGA	ME0295
15	Instruction Manual for Teaching Pendant CON-PT/PD/PG	ME0227
16	Instruction Manual for Teaching Pendant SEP-PT	ME0217
17	Instruction Manual for Simple Teaching Pendant RCM-E	ME0174
18	Instruction Manual for Data Setter RCM-P	ME0175
19	Instruction Manual for Touch Panel Display RCM-PM-01	ME0182

1.1.3 How to Read the Model Nameplate



1.1.4 How to Read the Model Number

RCL – RA1L – I – 2 – N – 25 – A1 – P – B – **

Identification for IAI use only (Note 1)

Series

<Type>
Thin and small slim type
RA1L
RA2L
RA3L

<Encoder Type>
I : Incremental

<Motor Type>
2(2W) : RA1L
5(5W) : RA2L
10(10W) : RA3L

<Lead>
N : With no feeding screw

<Options>
B : With Brake
(with brake box)
BN : With Brake
(with no brake box)

<Cable length>
N : None
P : 1m
S : 3m
M : 5m
X□□ : Length Specification
(Example : X07=7m)

<Controller>
A1 : ACON
: RACON
: ASEL
A3 : AMEC
ASEP
MSEP

<Stroke>
[Refer to 6 “External Dimensions”]

Note 1 Identification for IAI use only : It may be displayed for IAI use. It is not a code to show the model type.

1.2 Specification

1.2.1 Speed

Type	Maximum speed [mm/s]
RA1L	300
RA2L	340
RA3L	450

1.2.2 Relationship between Transportable Weight and Acceleration Speed

The acceleration is determined by the transported weight and the duty.
From the table below, determine the acceleration from Continuous Operation (Duty 100%) when the duty is over 70% and up to 100%, and Duty 70% or less when it is 70% or below.

Type	Max. Acceleration Speed [G]	Transportable Weight [kg]			
		Continuous Operation (Duty 100%)		Duty 70% or less	
		Horizontal	Vertical	Horizontal	Vertical
RA1L	0.1	0.5	0.1	0.5	0.1
	0.3				
	0.5	0.42			
	1.0	0.2		0.25	
	1.5	0.11	–	0.15	–
	2.0	0.07	–	0.1	–
RA2L	0.1	1.0	0.2	1.0	0.2
	0.3				
	0.5	0.85			
	1.0	0.4		0.5	
	1.5	0.24	–	0.3	–
	2.0	0.15	–	0.2	–
RA3L	0.1	2.0	0.4	2.0	0.4
	0.3				
	0.5	1.6			
	1.0	0.78		1.0	
	1.5	0.46	–	0.6	–
	2.0	0.3	–	0.4	–

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

⚠ Caution: Do not have the settings of acceleration/deceleration exceeding the rated values. It may cause vibration, malfunction or shortened life.

1.2.3 Rated Thrust and Transient Maximum Thrust

Type	Rated Thrust [N]	Transient Maximum Thrust [N]
RA1L	2.5	10
RA2L	5	18
RA3L	10	30

1.2.4 Encoder Resolution

0.042mm

1.2.5 No. of Encoder Pulses

RA1L	715
RA2L	855
RA3L	1145

1.2.6 Positioning Repeatability

±0.1mm

* It does not include the consideration of time-dependent change as it is used.

1.2.7 Relationship between Current Limiting Value and Pressing Force

[Refer to 4.3 Setting of Current Limit Value at Pressing Operation]

1.3 Option

1.3.1 Brake (with brake box) (Model No. : B)

This is a function to hold the rod 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. It is to be used to avoid damaging the attached objects by the rod being dropped.

1.3.2 Brake (with no brake box) (Model No. : BN)

This is a function to hold the rod 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. It is to be used to avoid damaging the attached objects by the rod being dropped.
It is the model code that you may indicate when purchasing only the unit body equipped with a brake in such cases as repair.

Specifications Related to Brake-Equipped Type

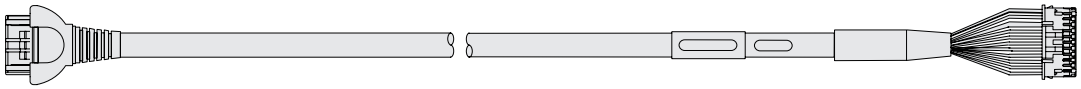
Type	Retaining Load(Note 1) (Vertical(Note 2))	Retaining Precision(Note 1)	Times of Brake for Life End
RA1L	0.1 [kg]	1mm or less	100,000 times
RA2L	0.2 [kg]		
RA3L	0.4 [kg]		

Note 1 This may change due to many causes such as the condition of rod surface. Especially in an environment that the product can involve oil or foreign objects, the values would not be guaranteed.
Note 2 Guarantee may not be performed in an installing orientation other than vertical.

1.4 Motor • Encoder Cables

1.4.1 Motor • Encoder Integrated Cables (For AMEC, ASEP)

CB-APSEP-MPA□□□



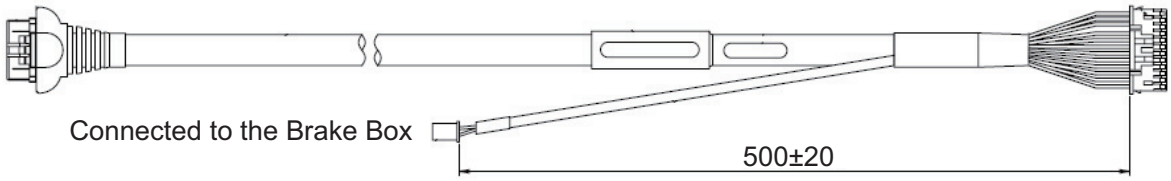
Mechanical side

Controller side

Electric wire color	Signal name	Pin No.	Pin No.	Signal name	Electric wire color
Black	U	A1	1	U	Black
White	V	B1	2	V	White
Brown	W	A2	5	W	Brown
Green	–	B2	3	–	Green
Yellow	–	A3	4	–	Yellow
Red	–	B3	6	–	Red
Orange	BK+	A4	7	BK+	Orange
Gray	BK-	B4	8	BK-	Gray
White	A+	A6	11	A+	White
Yellow	A-	B6	12	A-	Yellow
Red	B+	A7	13	B+	Red
Green	B-	B7	14	B-	Green
Black	Z+	A8	15	Z+	Black
Brown	Z-	B8	16	Z-	Brown
Black	LS+	A5	9	LS+	Black
Brown	LS-	B5	10	LS-	Brown
Green	GND_{LS}	A9	20	GND_{LS}	Green
Red	VPS	B9	18	VPS	Red
White	VCC	A10	17	VCC	White
Yellow	GND	B10	19	GND	Yellow
	–	A11	21	–	
shield	FG	B11	24	FG	shield
			22	–	
			23	–	

1.4.2 Motor • Encoder Integrated Cables (with brake cable) (For AMEC, ASEP)

CB-APSEP-MPBA□□□

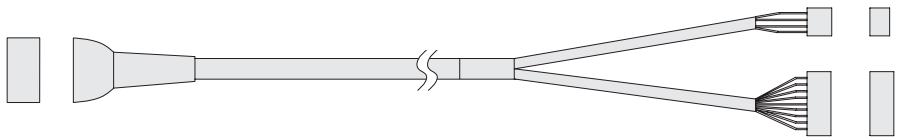


Electric wire color	Signal name	Pin No.	Pin No.	Signal name	Electric wire color
Black	U	A1	1	U	Black
White	V	B1	2	V	White
Brown	W	A2	5	W	Brown
Green	–	B2	3	–	Green
Yellow	–	A3	4	–	Yellow
Red	–	B3	6	–	Red
Orange	BK+	A4	7	BK+	Orange
Gray	BK-	B4	8	BK-	Gray
White	A+	A6	11	A+	White
Yellow	A-	B6	12	A-	Yellow
Red	B+	A7	13	B+	Red
Green	B-	B7	14	B-	Green
Black	Z+	A8	15	Z+	Black
Brown	Z-	B8	16	Z-	Brown
Black	LS+	A5	9	LS+	Black
Brown	LS-	B5	10	LS-	Brown
Green	GND_{LS}	A9	20	GND_{LS}	Green
Red	VPS	B9	18	VPS	Red
White	VCC	A10	17	VCC	White
Yellow	GND	B10	19	GND	Yellow
	–	A11	21	–	
shield	FG	B11	24	FG	shield
			22	–	
			23	–	

Brown	BK+	1	7	BK+	Brown
Blue	BK-	2	8	BK-	Blue

1.4.3 Motor • Encoder Integrated Cables (For ACON, ASEL)

CB-ACS-MPA□□□



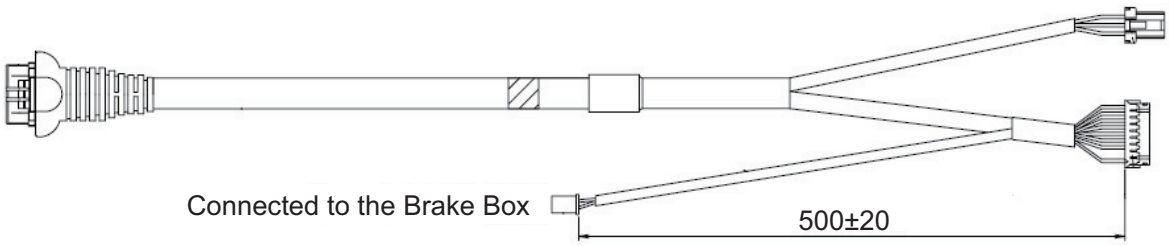
(Front View) (Front View)

Mechanical side Controller side

Electric wire color	Signal name	Pin No.	Pin No.	Signal name	Electric wire color
Red	U	A1	1	U	Red
Yellow	V	B1	2	V	Yellow
Black	W	A2	3	W	Black
	–	B2	Pin No.	Signal name	Electric wire color
	–	A3			
	–	B3	4	–	Yellow
			3	–	
			2	–	
Yellow (Red･)	BK+	A4	16	BK+	Yellow (Red･)
Yellow (Blue･)	BK-	B4	15	BK-	Yellow (Blue･)
Pink(Red･)	LS+	A5	18	LS+	Pink(Red･)
Pink(Blue･)	LS-	B5	17	LS-	Pink(Blue･)
White(Red･)	A+	A6	14	A+	White(Red･)
White(Blue･)	A-	B6	13	A-	White(Blue･)
Orange(Red･)	B+	A7	12	B+	Orange(Red･)
Orange(Blue･)	B-	B7	11	B-	Orange(Blue･)
Gray(Red･)	Z+	A8	10	Z+	Gray(Red･)
Gray(Blue･)	Z-	B8	9	Z-	Gray(Blue･)
Orange (Red･continuous)	–	A9	8	–	Orange (Red･continuous)
Orange (Blue･continuous)	/PS	B9	7	/PS	Orange (Blue･continuous)
Gray (Red･continuous)	VCC	A10	6	VCC	Gray (Red･continuous)
Gray (Blue･continuous)	GND	B10	5	GND	Gray (Blue･continuous)
	–	A11		–	
shield	FG	B11	1	FG	shield

1.4.4 Motor • Encoder Integrated Cables (with brake cable) (For ACON, ASEL)

CB-ACS-MPBA□□□



Electric wire color	Signal name	Pin No.	Pin No.	Signal name	Electric wire color
Red	U	A1	1	U	Red
Yellow	V	B1	2	V	Yellow
Black	W	A2	3	W	Black
	–	B2			
	–	A3	Pin No.	Signal name	Electric wire color
	–	B3	4	–	Yellow
			3	–	
			2	–	
Yellow (Red･)	BK+	A4	16	BK+	Yellow (Red･)
Yellow (Blue･)	BK-	B4	15	BK-	Yellow (Blue･)
Pink(Red･)	LS+	A5	18	LS+	Pink(Red･)
Pink(Blue･)	LS-	B5	17	LS-	Pink(Blue･)
White(Red･)	A+	A6	14	A+	White(Red･)
White(Blue･)	A-	B6	13	A-	White(Blue･)
Orange(Red･)	B+	A7	12	B+	Orange(Red･)
Orange(Blue･)	B-	B7	11	B-	Orange(Blue･)
Gray(Red･)	Z+	A8	10	Z+	Gray(Red･)
Gray(Blue･)	Z-	B8	9	Z-	Gray(Blue･)
Orange (Red･continuous)	–	A9	8	–	Orange (Red･continuous)
Orange (Blue･continuous)	/PS	B9	7	/PS	Orange (Blue･continuous)
Gray (Red･continuous)	VCC	A10	6	VCC	Gray (Red･continuous)
Gray (Blue･continuous)	GND	B10	5	GND	Gray (Blue･continuous)
	–	A11		–	
shield	FG	B11	1	FG	shield

Brown	BK+	1	16	BK+	Brown
Brown	BK-	2	15	BK-	Brown

2. Installation

2.1 Transportation

[1] Handling of the Robot
Unless otherwise specified, the actuators are packaged individually.

(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.
- An operator should never attempt to carry a heavy package on their own. Also, use an appropriate way 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 attempt to carry the actuator by holding a cable or move it by pulling a cable.
- Hold the base part and the bracket when transporting the actuator main body.
- Do not hit or drop the actuator during transportation.
- Do not give any excessive force to any of the sections in the actuator.

[2] Handling in the Assembled Condition

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

(1) How to Handle the Package

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

(2) How to Handle after Unpackaged

- Fix the rod(s) so they would not accidently move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shaking 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 or the connector box. Also pay attention not to pinch cables and bend or deform them forcefully.

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

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

- Fix the rod(s) so that it would not move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shaking 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 or the connector box. 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.
In general, the installation environment should be one in which an operator can work without protective gear.
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
- This actuator possesses the water durability of IP67 protection structure.
- 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 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

[2] Storage • Preservation Environment

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

2.3 How to Install

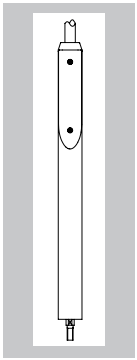
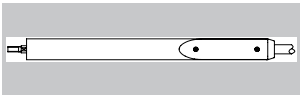
This chapter explains how to install the actuator on your mechanical system.

2.3.1 General Rules on Installation

○ : Possible × : Not possible

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

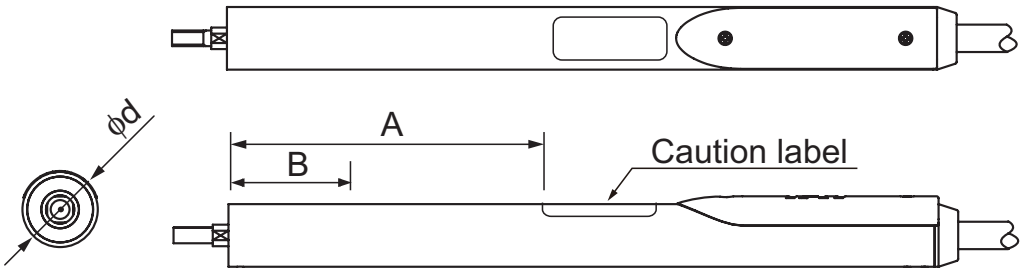
Installation Orientation

Horizontal	Vertical	Sideway	Ceiling Mount
			

2.3.2 Installing the Main Body

[1] Mounting Method

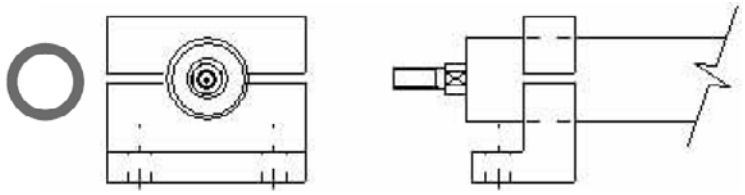
Fixation to a mating component with a profile of hole since the body is in a cylindrical profile.



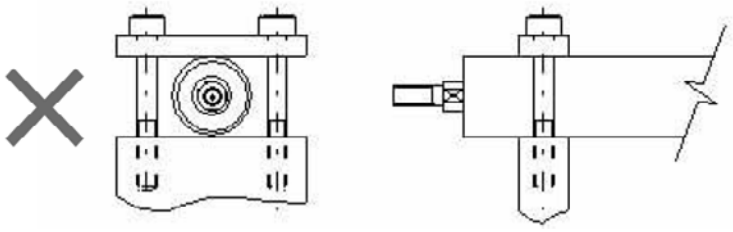
Dimensions for Body Attachment

Type	O.D. of Pipe ϕd (tolerance)	Pipe fixable range A	Available range for screw fixing type B
RA1L	16 (0/-0.1)	90	30
RA2L	20 (0/-0.1)	115	40
RA3L	25 (0/-0.1)	164	55

Recommended Fixing Method
Clamping (split clamp)
Clamp with a profile of hole that suits the pipe.



Do not attempt to clamp with a flat plate, nor a profile of the hole, because it may deform the pipe.



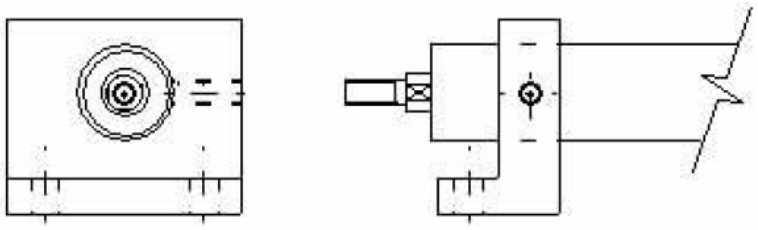
About Force to Tighten Pipe
Keep on tightening up the clamp bolts, and hold it at the tightening torque that is the minimum to retain the pipe.
The table below shows the reference of clamping force to retain the pipe. Do no attempt to clamp the pipe with force more than what is stated.
Note that the force applied to the pipe differs due to the profile or stiffness of the used bracket, size of clamping bolts or tightening torque.

Pipe Clamping Force (Reference value)

Type	Clamping force (Reference value)
RA1L	1,00 [N] (100kg) or less
RA2L	1,500 [N] (150kg) or less
RA3L	2,000 [N] (200kg) or less

⚠ Caution: With excessive force to tighten the pipe, the pipe may get deformed, which may result in an operation error or malfunction.

Other Methods to Attach
When Using Fixing Screws (set screws);



When using the fixing screws, deformation is big in spots where the screws are touching the actuator compared to clamping. Make sure to conduct attachment following Available range for screw fixing type B in “Dimensions for Body Attachment” mentioned in “2.3.2 [1] Mounting Method”.
Also select fixing screws with small dimension and affix at several points.
In case of tightening with fixing screws with big dimension, big axial force may get applied to the pipe, resulting in a big deformation.

Tightening torque of the cap screw (Reference value)

Cap screw size	Tightening torque [N•m]
M2.5	0.18 or less
M3	0.32 or less

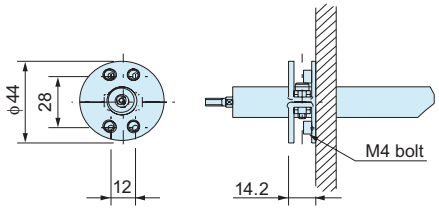
⚠ Caution: Tightening screws with excessive force may cause a deformation on the pipe, which may cause an operation error or malfunction.

[2] Mounting Bracket

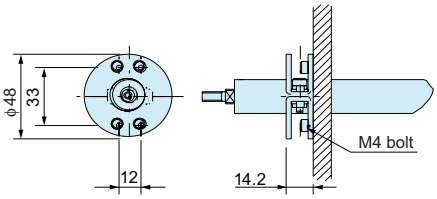
As an attachment bracket, the following general-purposed products can be used.
Please contact directly to the supplier for each bracket.

(1) Shaft Bracket
Manufacturer : IWATA MFG.CO.,LTD.

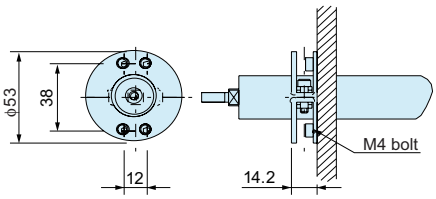
●RA1L
Model Number : B16CP4



●RA2L
Model Number : B20CP4

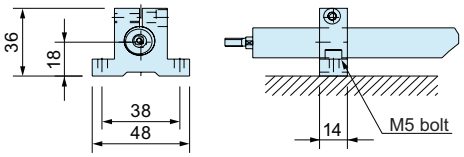


●RA3L
Model Number : B25CP4

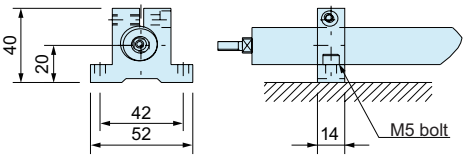


(2) Maru-Pijon
Manufacturer : MIYOSHI PIJON CO.,LTD.

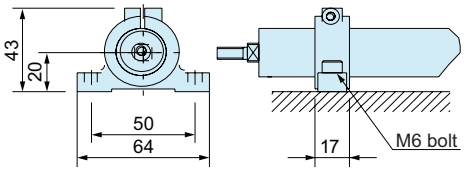
●RA1L
Model Number : PN600



●RA2L
Model Number : PQ600

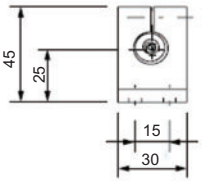


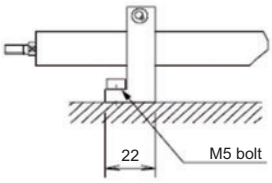
●RA3L
Model Number : PH600



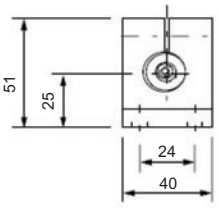
(3) Shaft Holder
Manufacturer : MISUMI Corporation

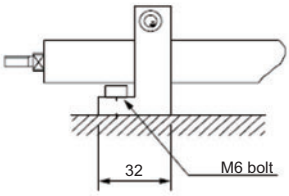
●RA1L
Model Number : SHKSBT16



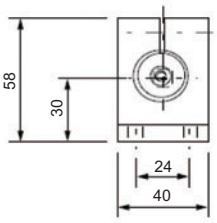


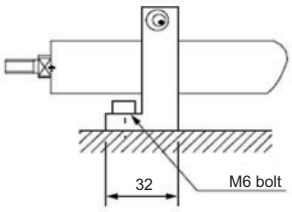
●RA2L
Model Number : SHKSBT20





●RA3L
Model Number : SHKSBT25

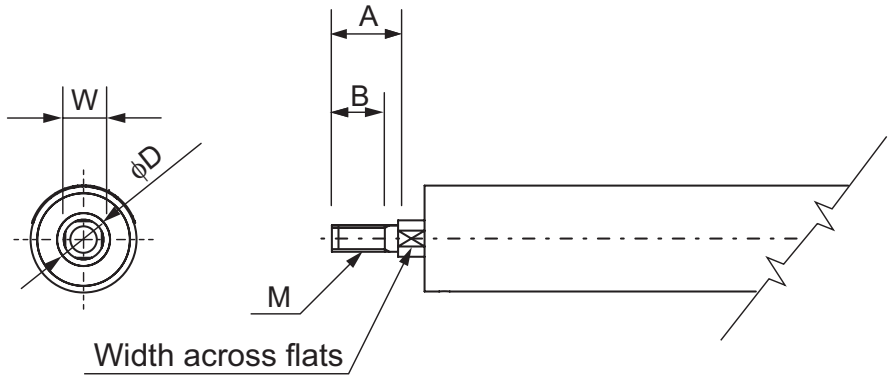




⚠ Caution: Make sure to follow the specified tightening torque when clamping the body. Not doing so may damage the actuator.

2.3.3 Attachment of Transported Objects

- Attach a transported item on the threaded area on the tip of the rod. Keep in mind of the incomplete thread.
- When tightening, hold two faces with an open-end wrench so torque would not be applied on the rod. Applying excessive torque to the rod may damage the components inside.
- The material of the rod is aluminum. Tighten the Enclosed nut with the Recommended tightening torque described below. Excessive tightening torque may damage the threaded area.



Dimensions for Attachment of Transported Objects

Type	M Screw nominal diameter	A	B Effective thread depth	ϕD 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

Enclosed Nut Recommended Tightening Torque

Type	Enclosed nut	Recommended tightening torque
RA1L	M4 nut (class 1)	0.75N·m
RA2L	M5 nut (class 1)	1.5N·m
RA3L	M6 nut (class 1)	2.6N·m

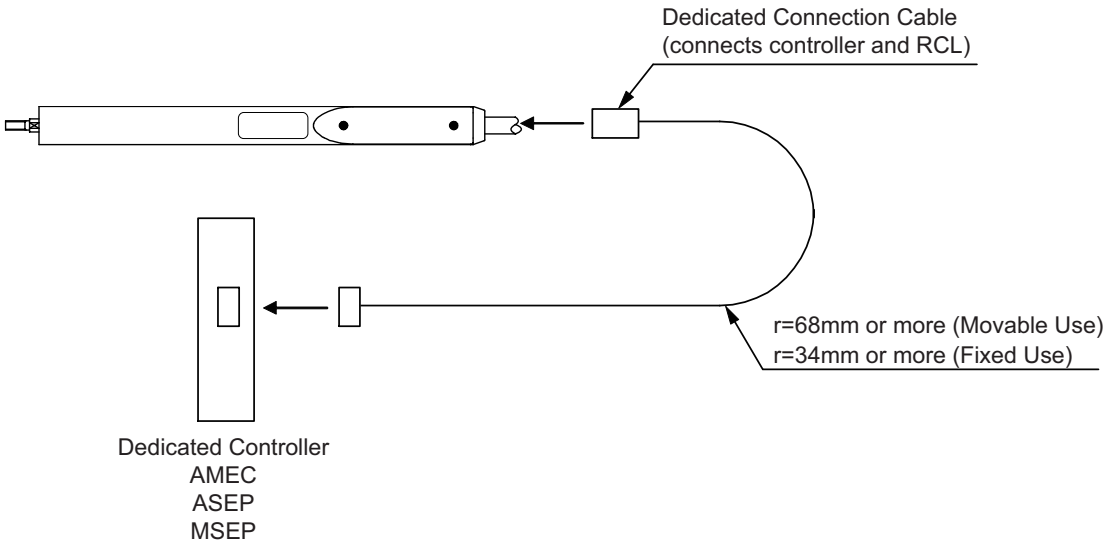
3. Connecting with the Controller

As the connection cable for the controller and the actuator, use the IAI dedicated controller and dedicated connection cable.
This section, explains how to layout wires for a single axis.

- 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.

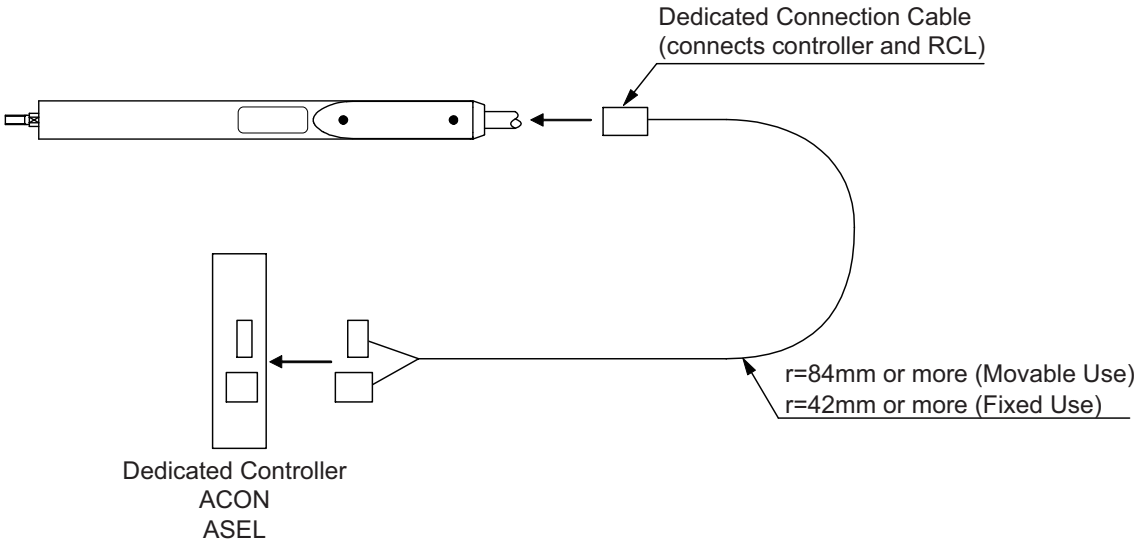
[Connecting with the AMEC, ASEP and MSEP Controller]



Dedicated cables
• Motor • Encoder Integrated Cables CB-APSEP-MPA□□□
• Motor • Encoder Integrated Cables (with brake cable) CB-APSEP-MPBA□□□
□□□ shows the cable length.
The max. length should be 10m.
Example) 080 = 8m

(Note) The simple absolute type is not applicable.

[Connecting with the ACON and ASEL Controller]



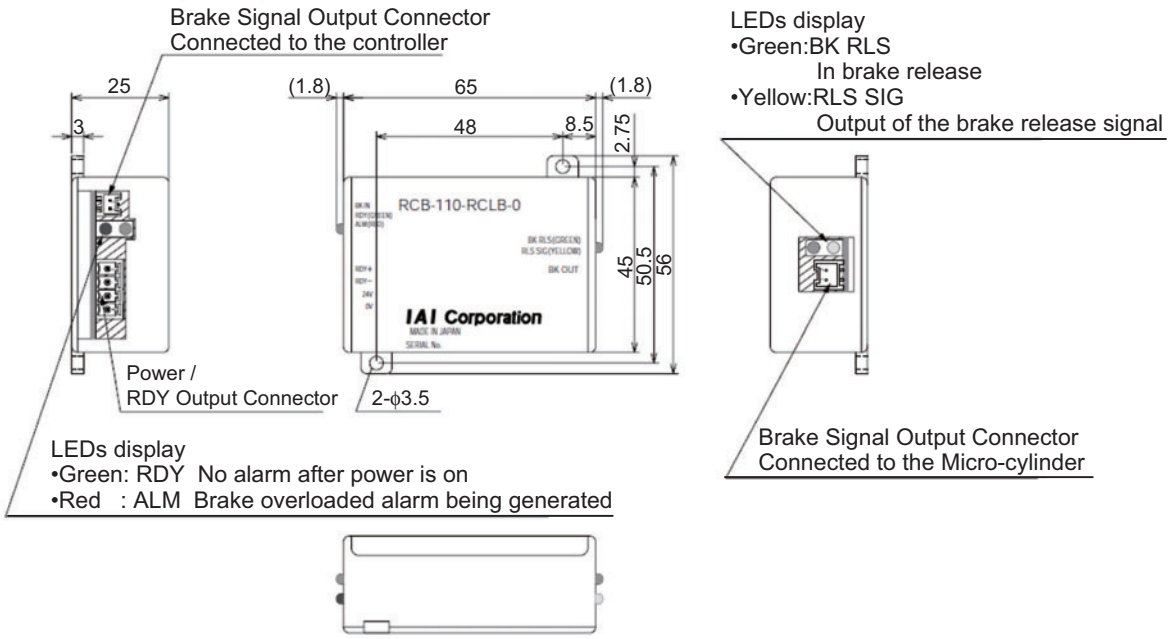
Dedicated cables
- Motor • Encoder Integrated Cables CB-ACS-MPA□□□
- Motor • Encoder Integrated Cables (with brake cable) CB-ACS-MPBA□□□

□□□ shows the cable length.
The max. length should be 10m.
Example) 080 = 8m

3.1 Brake Box Installation for Brake-Equipped Type

Attach the brake box RCB-110-RCLB-0 for brake-equipped type.

3.1.1 Brake Box RCB-110-RCLB-0



Items	Specifications
Power Voltage	24V DC±10%
Power Current	MAX2.5A (Approx. 110ms at brake release)
Weight	Approx. 35g

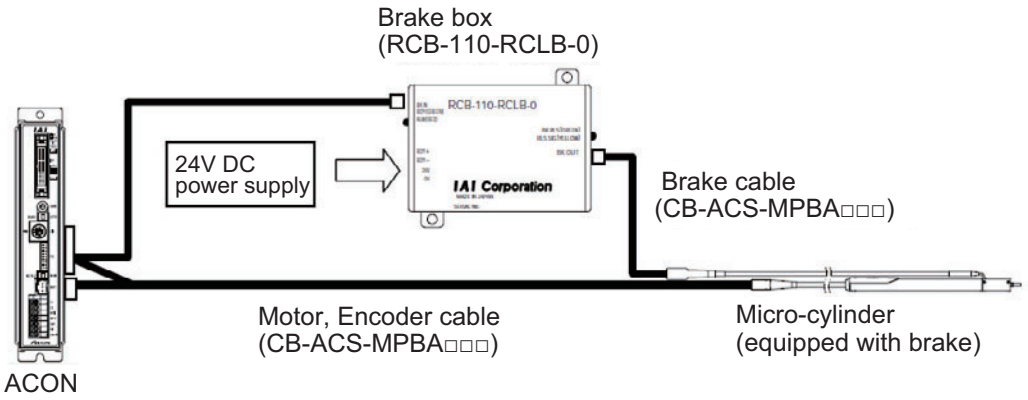
[Power / RDY Output Connector]
Applicable Cable : AWG24 to 16

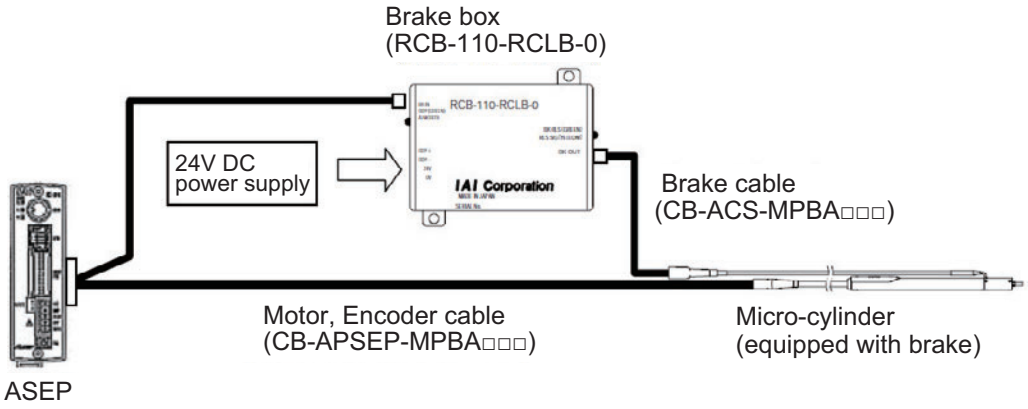
Pin No.	Signal name	Contents
1	RDY+	Ready contact Open at brake overloaded alarm
2	RDY-	
3	+24V	DC+24V Power Input
4	0V	

3.1.2 Procedures to Connect and Start Brake Box

1) Shown below are examples for how to connect to the ACON Controller and the ASEP Controller.
(The procedures to connect it are the same as the ACON Controller for the AMEC, MSEP Controllers, ASEP Controller and the ASEL Controller.)
Perform the connection following the examples below.

Examples for Connection

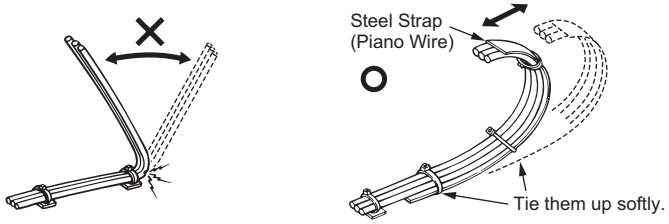




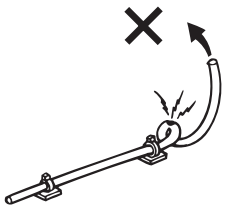
2) Connect +24V power supply and input to the brake box.
The current of 2.5A at maximum can flow for approximately 110ms at the brake release.

⚠ 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.

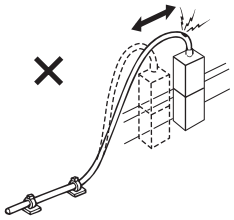
- Use dedicated cables of IAI indicated in this Instruction manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with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



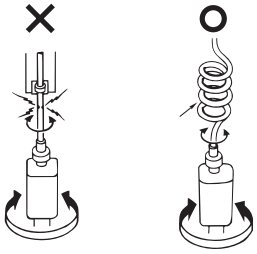
- Do not let the cable bend, kink or twist.



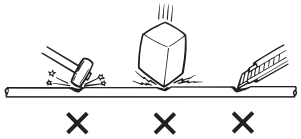
- Do not pull the cable with a strong force.



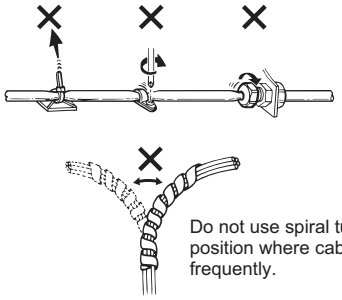
- Pay attention not to concentrate the twisting force to one point on a cable.



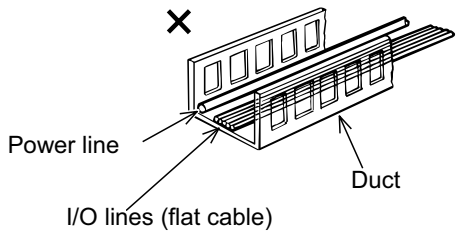
- Do not pinch, drop a heavy object onto or cut the cable.



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

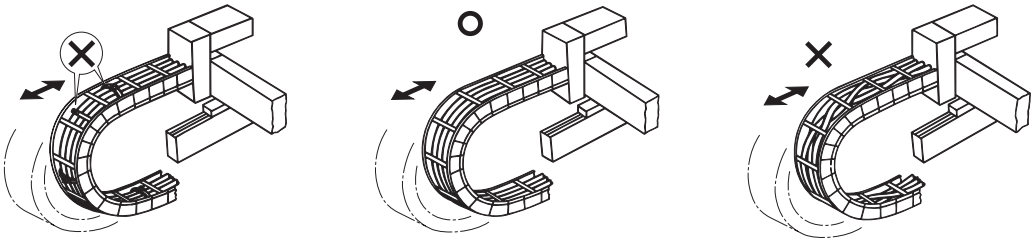


- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



Follow the instructions below when using a cable track.

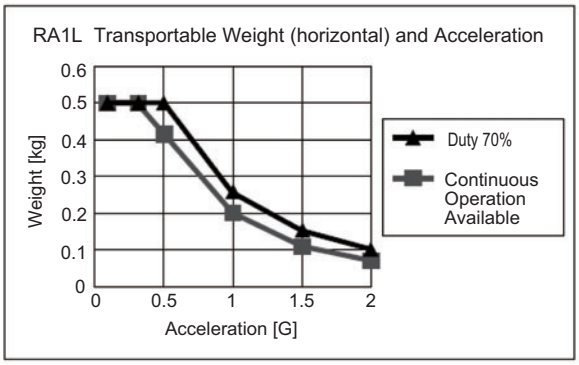
- If there is an indication to the cable for the space factor in a cable track, refer to the wiring instruction given by the supplier when storing the cable in the cable track.
- Avoid the cables to get twined or twisted in the cable track, and also to have the cables move freely and do not tie them 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.

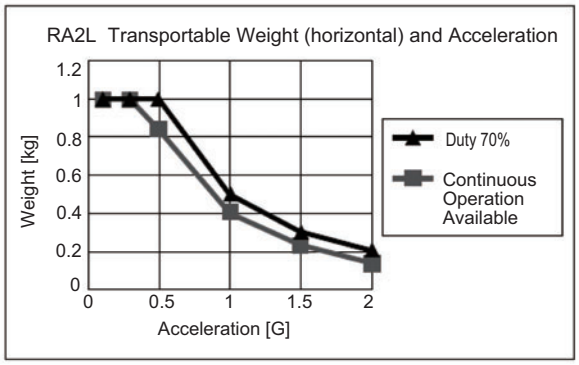


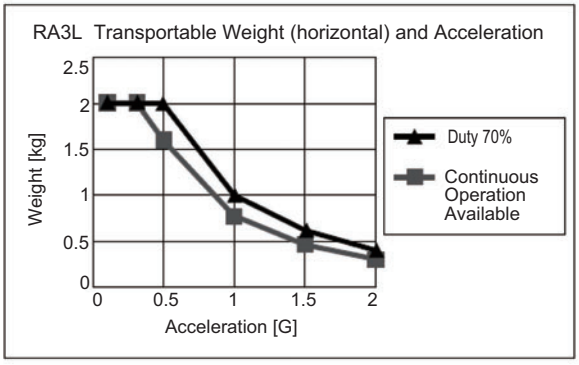
4. Operational Conditions

4.1 Acceleration of the Setting

The acceleration is determined by the transported weight and the duty.
The graphs below show the upper limit for the acceleration against the transported weight and the duty.
Set the acceleration to a value of Continuous Operation Available (100%) when the duty is over 70% and up to 100%, and set it to a value of 70% when it is 70% or below.







Transportable Weight (horizontal) and Acceleration

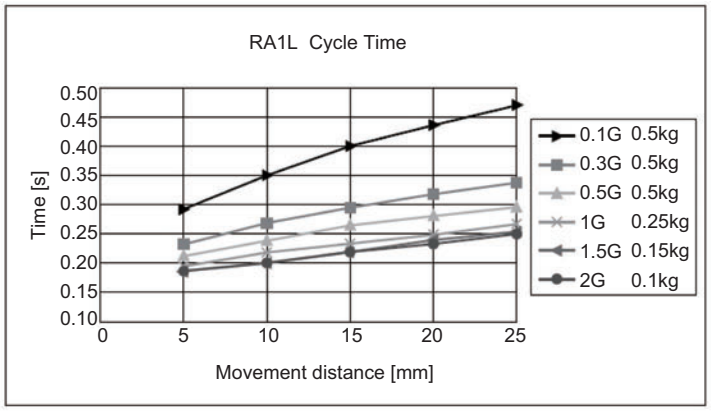
Type	RA1L		RA2L		RA3L	
Acceleration [G]	Continuous operation available	When controlling at duty 70%	Continuous operation available	When controlling at duty 70%	Continuous operation available	When controlling at duty 70%
0.1	0.5	0.5	1	1	2	2
0.3						
0.5	0.42		0.85		1.6	
1.0	0.2	0.25	0.4	0.5	0.78	1
1.5	0.11	0.15	0.24	0.3	0.46	0.6
2.0	0.07	0.1	0.15	0.2	0.3	0.4

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

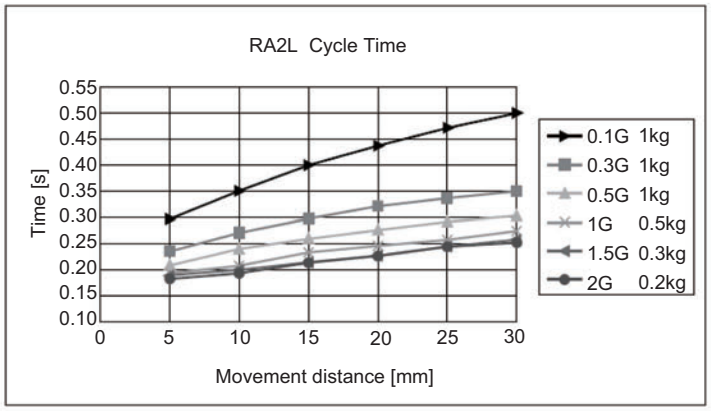
(Note) Have an external guide to receive any load so the rod would not get sideway load or rotational load to be applied.

4.2 Reference for Cycle Time

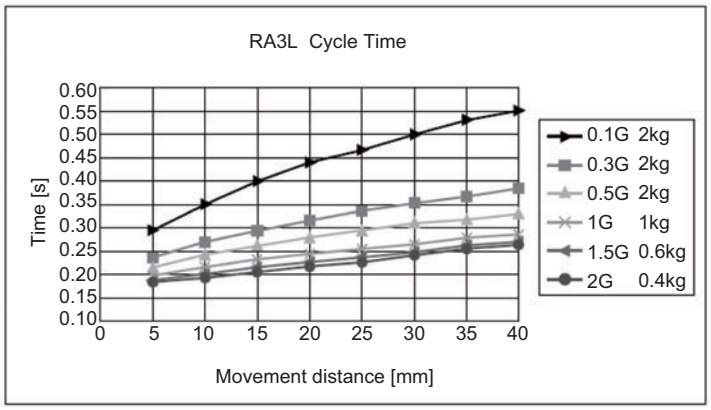
The graph below shows the cycle time in each acceleration pattern in maximum velocity.
Take this as a reference for the operation time.



Setting speed : 300mm/sec
Installation posture : Horizontal



Setting speed : 340mm/sec
Installation posture : Horizontal



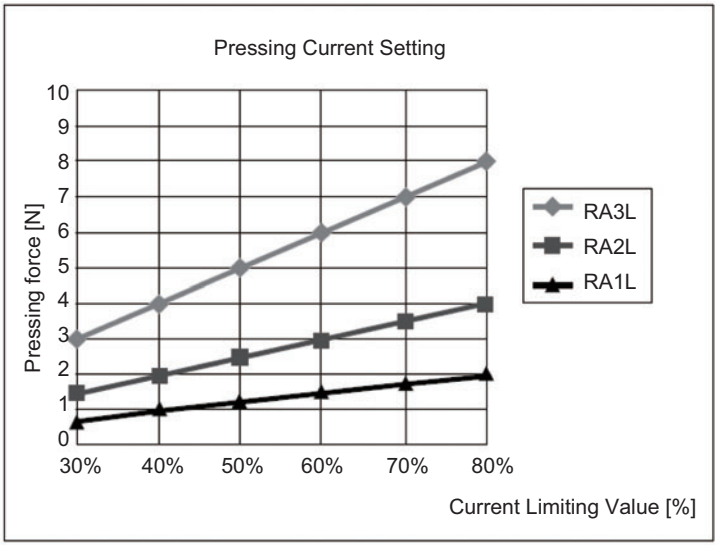
Setting speed : 450mm/sec
Installation posture : Horizontal

(Note) Have an external guide to receive any load so the rod would not get sideway load or rotational load to be applied.

4.3 Setting of Current Limiting Value at Pressing Operation

When having a pressing operation, set up the current limiting value which determines the pressing force.

The graph below shows the current against the pressing force.
Take this as a reference for when making an adjustment to the pressing force.
There is no limit to the pressing duration. Continuous pressing can be performed.



Velocity at Pressing
20mm/sec

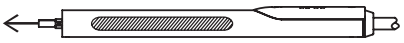
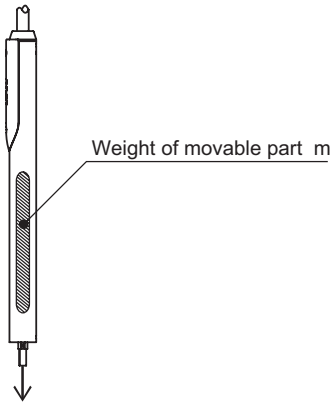
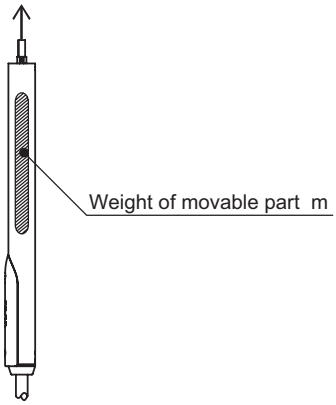
* Under condition of horizontal orientation with no load or attached on the rod

Reference for Pressing Force unit : [N]

Type	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:
- The pressing force is adjusted with the current limiting value, and the fluctuation of pressing force gets big when the current limiting value is low. It is recommended to use the product in the range from 60% to 80% if possible.
- There may be a difference in the pressing force due to the variation of each unit or a difference in the pressing position.
- Setting from 71% to 80% for the current limiting value may not be performed for some versions of the PC software and teaching pendant.

It is necessary to consider the influence of the weight of movable part as shown in the figures below when installing in vertical orientation.

Horizontal	Vertical (Downward pressing)	Vertical (Upward pressing)
		
Pressing force = Thrust F = f	Pressing force = Thrust + Weight of Movable Part F = f + m	Pressing force = Thrust – Weight of Movable Part F = f – m

Weight of Movable Part unit : [N]

Type	Weight of Movable Part
RA1L	0.5
RA2L	1
RA3L	1.8

4.4 Vibration • Resonance Noise Control

There may be a case that vibration or resonance noise is generated as an impact of load weight, operational condition, condition of installation or mechanical stiffness. In such a case, the vibration or resonance noise can be controlled by increasing the torque filter time constant (parameter) shown below.
Note that increasing this value to much may sacrifice the stableness of controllability.
For how to set or change the parameter, refer to the instruction manual of the PC software or teaching pendant that is applied to the controller.

> ⚠ Caution: Do not attempt to change the parameters except for the torque filter time constant since they are already in the optimum setting for the actuator specifications.

ACON • RACON Controller

Parameter No.	Name	Default value	Setting
33	Torque filter time constant	0	25 or 50

ASEL Controller

Parameter No.	Name	Default value	Setting
45	Torque filter time constant	0	25 or 50

5. Maintenance Inspection

5.1 Inspection Items and Schedule

Follow the maintenance inspection schedule below.
It is assumed that the equipment is operating 8 hours per day.
If the equipment is running continuously night and day or otherwise running at a high operating rate, inspect more often as needed.

	External visual inspection
Start of operation	○
After 1 month of operation	○
After 3 months of operation	○
Every 3 months thereafter	○
After 3 years of operation, or upon reaching 5,000 km in traveled distance	○
Every year thereafter	○

5.2 External Visual Inspection

An external visual inspection should check the following things.

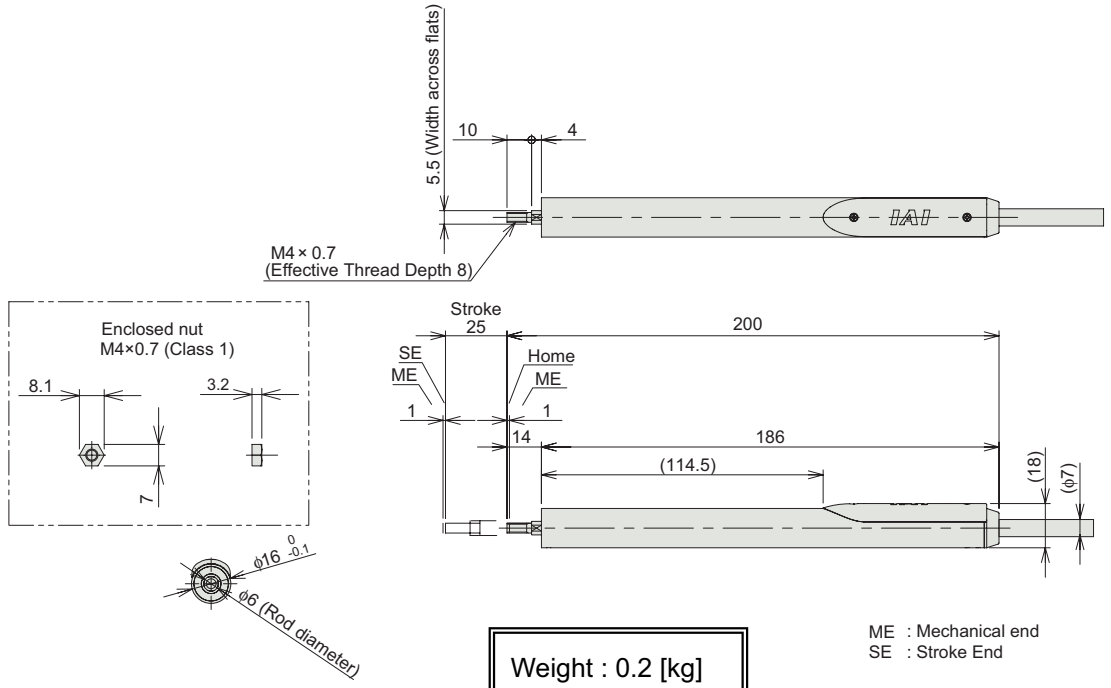
Main unit	・Loose actuator mounting bolts, other loose items ・Visual inspection on rod sliding area (should be no foreign object to be put on) ・Smooth movement of rod when moving it manually by hand
Cables	Scratches, proper connections
Overall	Irregular noise, vibration

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.

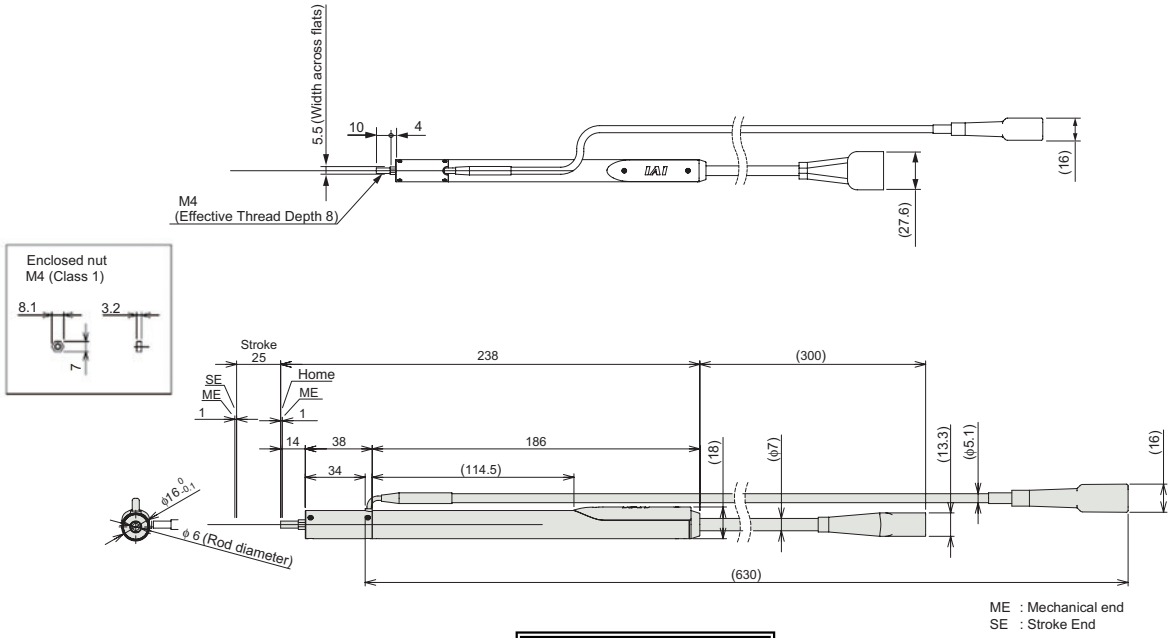
6. External Dimensions

6.1 RCL-RA1L without brake type



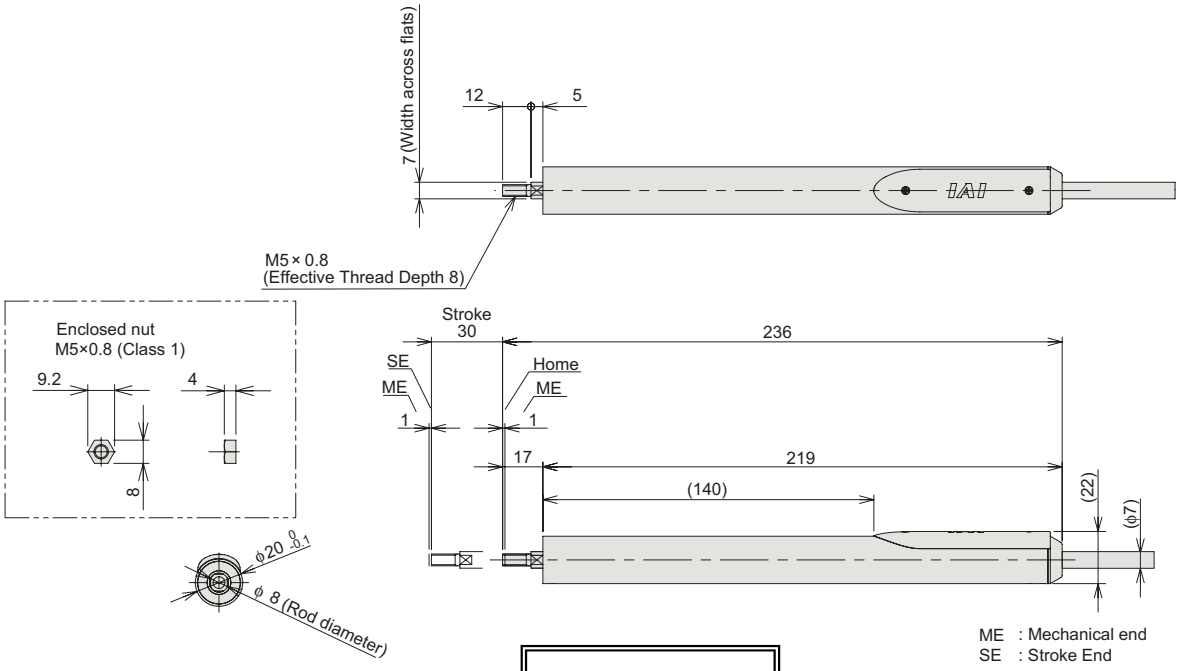
Weight : 0.2 [kg]

6.2 RCL-RA1L equipped with brake (option)



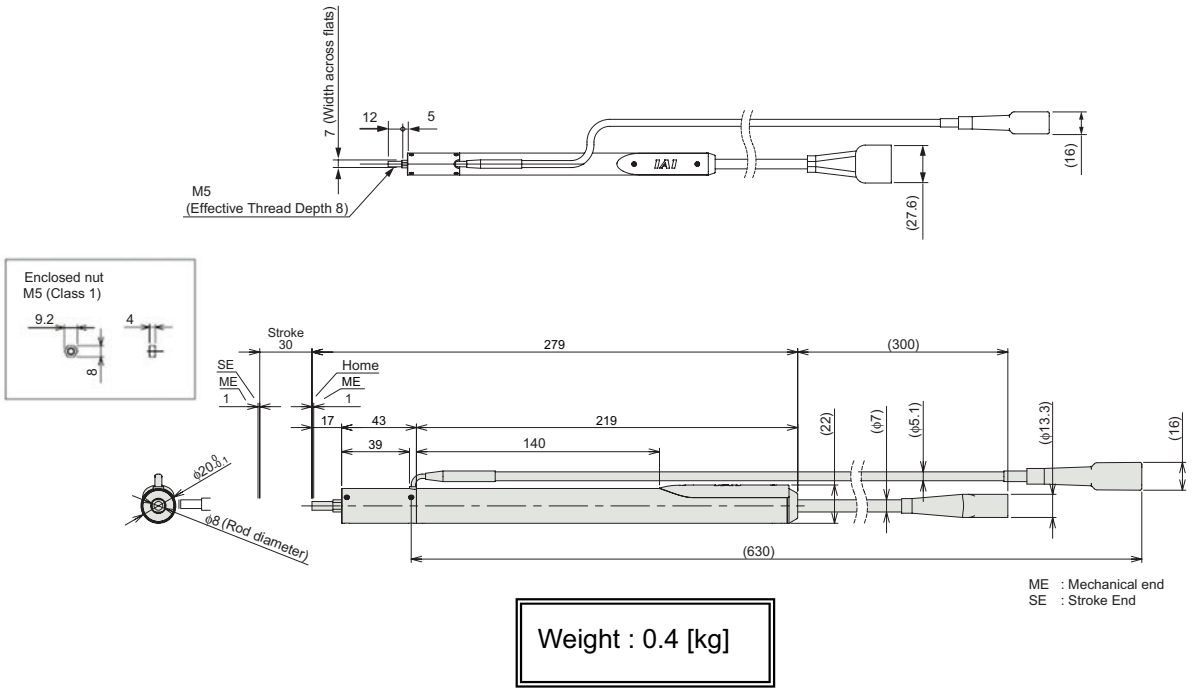
Weight : 0.25 [kg]

6.3 RCL-RA2L without brake type



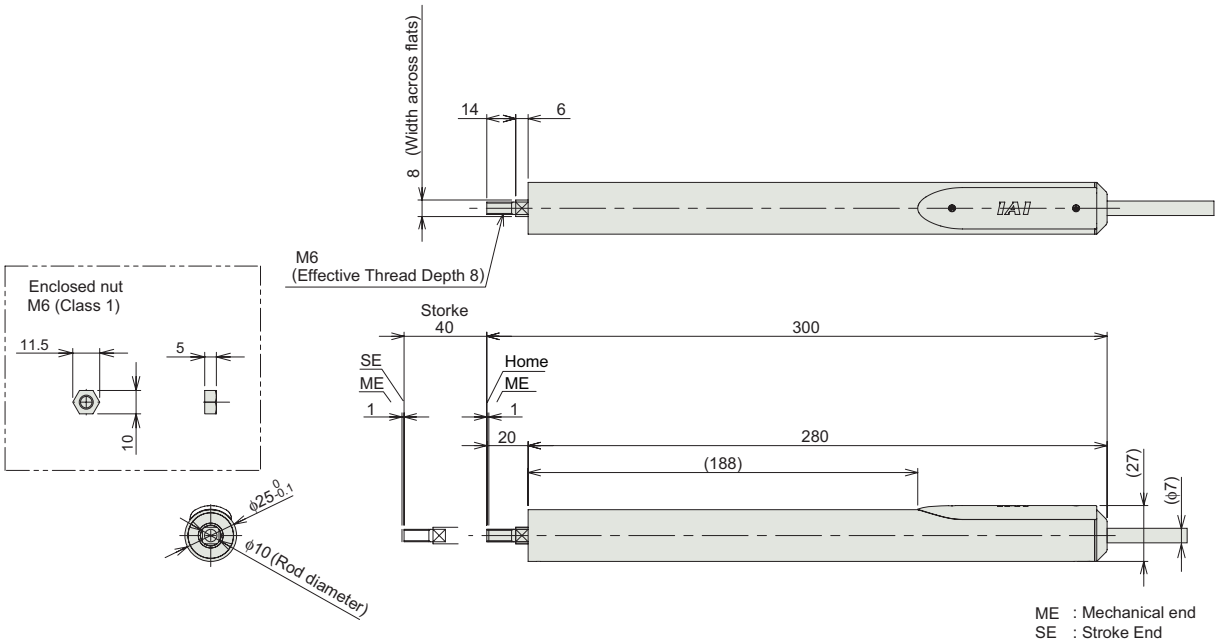
Weight : 0.33 [kg]

6.4 RCL-RA2L equipped with brake (option)



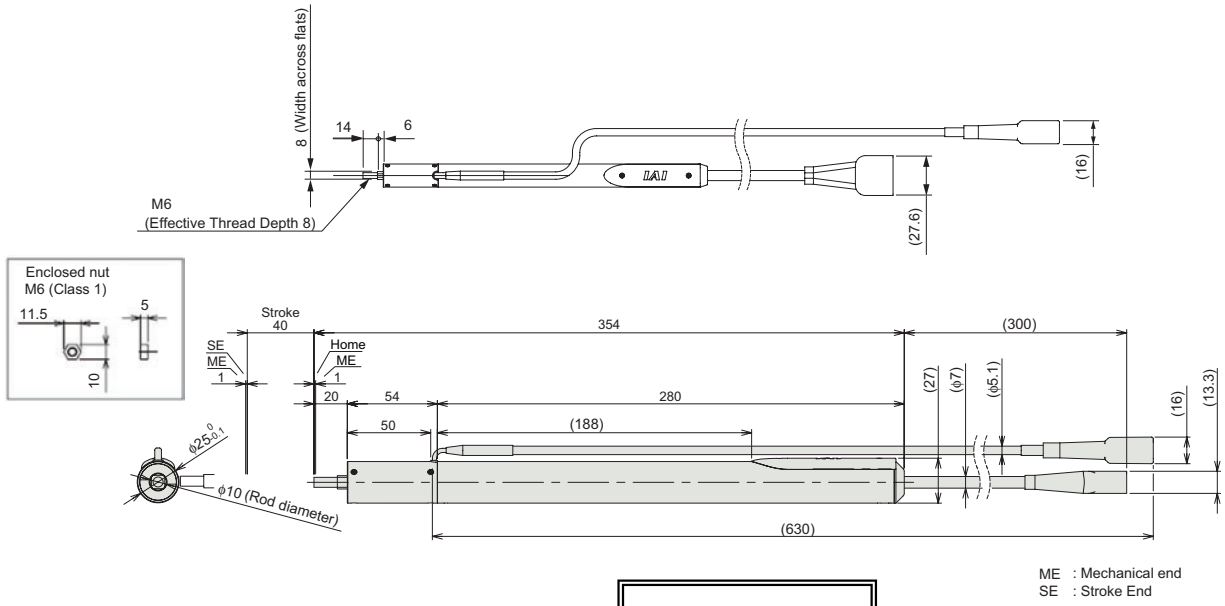
Weight : 0.4 [kg]

6.5 RCL-RA3L without brake type



Weight : 0.6 [kg]

6.6 RCL-RA3L equipped with brake (option)



Weight : 0.77 [kg]

7. Life

The product life is assumed to be 10,000km (reference) under the condition that it runs with maximum load capacity and maximum acceleration/deceleration.

8 Warranty

8.1 Warranty Period

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

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	Revision Description
	First edition
October 2009	Second edition • RCL-RA1L Brake-equipped Type, RCL-RA2L Brake-equipped Type and RCL-RA3L Brake-equipped Type are added
March 2013	Third edition • Revised overall

Manual No.: ME0192-3A (March 2013)

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