



ROBO Cylinder RCP2 Actuator Gripper Type Standard Specification

Instruction Manual

===== Eleventh Edition =====

Small Slim Two-finger Slide Type:	GRSS
Small Slim Two-finger Lever Type:	GRLS
Small and Medium Two-finger Type:	GRS / GRM
Two-finger Type with High Gripping Force:	GRHM / GRHB
Two-finger Long-stroke Type:	GRST
Three-finger Slide Type:	GR3SS / GR3SM
Three-finger Lever Type:	GR3LS / GR3LM

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 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	1
Caution in Handling	8
International Standards Compliances	11
1. Specifications Check.....	19
1.1 Checking the Product.....	19
1.1.1 Parts	19
1.1.2 Instruction Manuals for the Controllers Related to this Product.....	19
1.1.3 How to Read the Model Nameplate	20
1.1.4 How to Read the Model Number.....	20
1.2 Specifications	21
1.2.1 Common.....	21
1.2.2 Relation between the Current Limit Value and the Grip Force.....	23
1.2.3 Duty in Continuous Operation	30
1.3 Operating Conditions.....	31
1.3.1 Gripping Force.....	31
1.4 Option.....	40
1.4.1 Reversed-home Specification (Model: NM)	40
1.4.2 Shaft Bracket (Model: SB).....	40
1.4.3 Flange Bracket (Model: FB)	41
1.4.4 Cable Eject Direction Changed (Model: CJT, CJR, CJL, CJB).....	43
1.4.5 Cable Exit from Bottom and Cable Exit from Side (Model: A0, A1)	43
1.5 Motor • Encoder Cables	44
1.5.1 Small Slim Two-finger Slide Type (GRSS), Small Slim Two-finger Lever Type (GRLS), Two-finger Long-stroke Type (GRST), Two-finger Type with High Gripping Force (GRHM/GRHB).....	44
1.5.2 Small and Medium Two-finger Type (GRS/GRM), Three-finger Slide Type (GR3SS/GR3SM), Three-finger Lever Type (GR3LS/GR3LM).....	46
2. Installation.....	48
2.1 Transportation	48
2.2 Installation and Storage • Preservation Environment.....	50
2.3 How to Install.....	51
2.3.1 Installation	51
2.3.2 Installation of the Main Unit.....	52
2.3.3 Gripper Brackets (Optional)	63
2.3.4 Installation of Finger Attachments	67
3. Connecting with the Controller.....	80
4. Operation.....	85
4.1 Operation of the Fingers.....	85
4.2 Removal of Gripped Work Part	87

5. Maintenance and Inspection	89
5.1 Inspection Items and Schedule	89
5.2 Visually Inspecting the Exterior	90
5.3 Exterior Cleaning	90
5.4 Grease Supply for Two-Fingered Small Slim Type, Small Type and Medium Type	90
5.4.1 Guide	90
5.5 Feed Screw Small and Medium Two-finger Type (GRS/GRM)	94
5.6 Two-finger Type with High Gripping Force (GRHM/GRHB)	97
5.7 Greasing the Two-finger Long-stroke Type (GRST)	99
5.7.1 Greasing to the Feed Screw (Worm/Rack Gears)	99
5.7.2 Greasing to the Guide	100
5.8 Grease Supply for Three-Fingered Slide Type (GR3SS/GR3SM)	103
5.8.1 Greasing the Guide	103
5.8.2 Greasing the Gears	104
5.9 Grease Supply for Three-Fingered Lever Type (GR3LS/GR3LM)	105
5.9.1 Greasing the Gears	105
6. External Dimensions	106
6.1 GRSS	106
6.2 GRLS	107
6.3 GRS	108
6.4 GRM	109
6.5 GRHM	110
6.6 GRHB	111
6.7 GRST	112
6.8 GR3SS	113
6.9 GR3SM	114
6.10 GR3LS	115
6.11 GR3LM	116
7. Warranty	117
7.1 Warranty Period	117
7.2 Scope of the Warranty	117
7.3 Honoring the Warranty	117
7.4 Limited Liability	117
7.5 Conditions of Conformance with Applicable Standards/Regulations, Etc., and Applications	118
7.6 Other Items Excluded from Warranty	118
Change History	119

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 1before the operation of this product.

Safety Precautions for Our Products

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

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

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

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





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

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

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

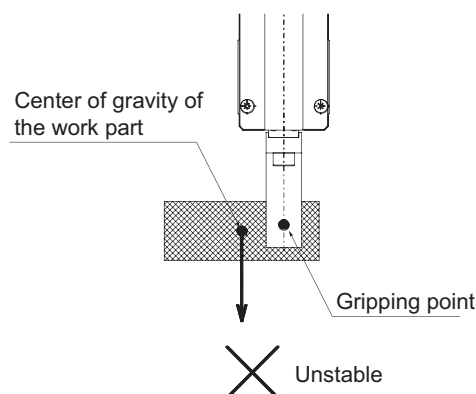
Alert Indication

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.

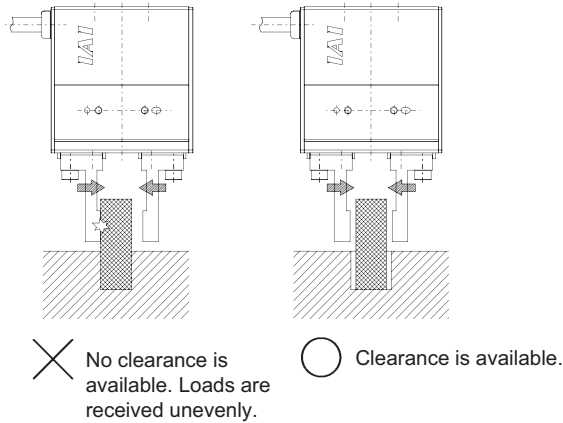
Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could 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

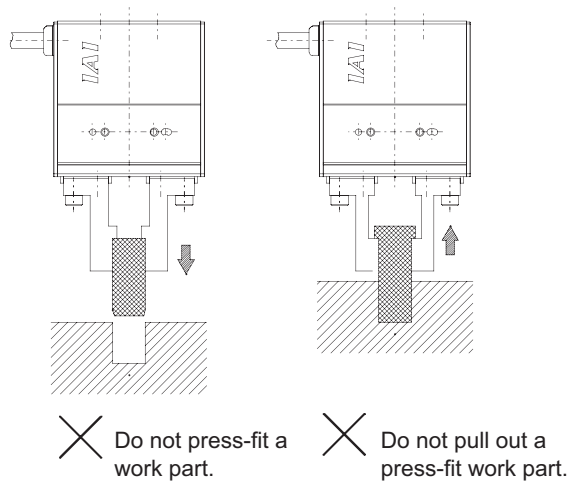
1. Ensure use of the product in the specified conditions, environments and ranges.
An operation out of the specified conditions may cause a drop in performance or malfunction of the product.
2. Do not attempt to have any handling or operation that is not stated in this instruction manual.
3. It is recommended to apply our products for the wiring between the actuator and the controller.
4. Do not attempt to establish the settings for the speed and acceleration/ deceleration above the allowable range.
An operation with speed and acceleration/deceleration beyond the allowable range may cause an abnormal noise, vibration, malfunction or shortened life.
5. Set the allowable moment within the allowable range.
An operation with the load beyond the allowable moment may cause an abnormal noise, vibration, malfunction or shortened life. If it is extreme, flaking may occur on the guide.
6. Make sure to attach the actuator properly by following this instruction 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. Make sure to follow the cautions listed below when transferring a work piece.
If the fingers receive a strong force or impact other than the gripping force when transferring work parts, the finger positions may deviate, looseness may occur or damage may result. Accordingly, pay due attention to the points listed below.
 - ◆ Cause the center of gravity of the work part to match the gripping point as much as possible. If the two are not aligned, gravitational moments will force the work part to assume an unstable posture.



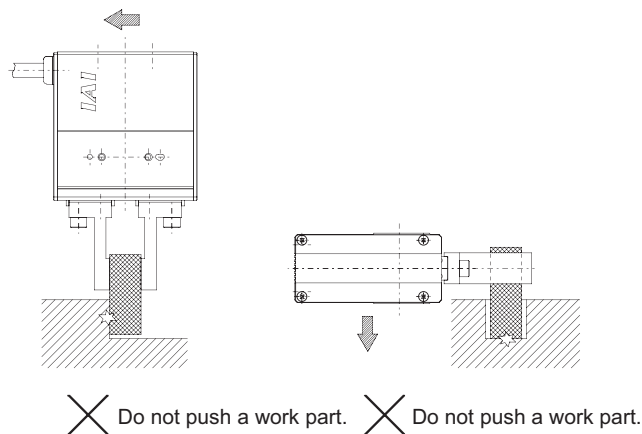
- ◆ While being gripped, the work part should have play (clearance) in the gripping direction. Also perform thorough alignment and avoid using the gripper in a manner where loads concentrate on one finger alone when a work part is gripped.



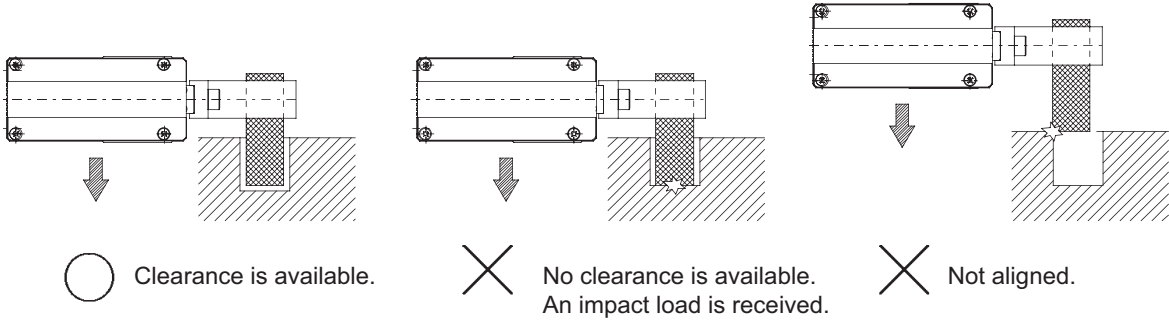
- ◆ Avoid using the gripper in a manner where it press-fits a gripped work part into a hole or pulls out a work part that has been press-fit.



- ◆ Avoid pushing a work part against a jig, etc., at the end of the movement stroke when the work part is moved or reversed.



◆ When inserting a work part into a hole, provide a sufficient clearance by anticipating positional variation. Also perform thorough alignment. (Pay attention to contact at the time of insertion.)



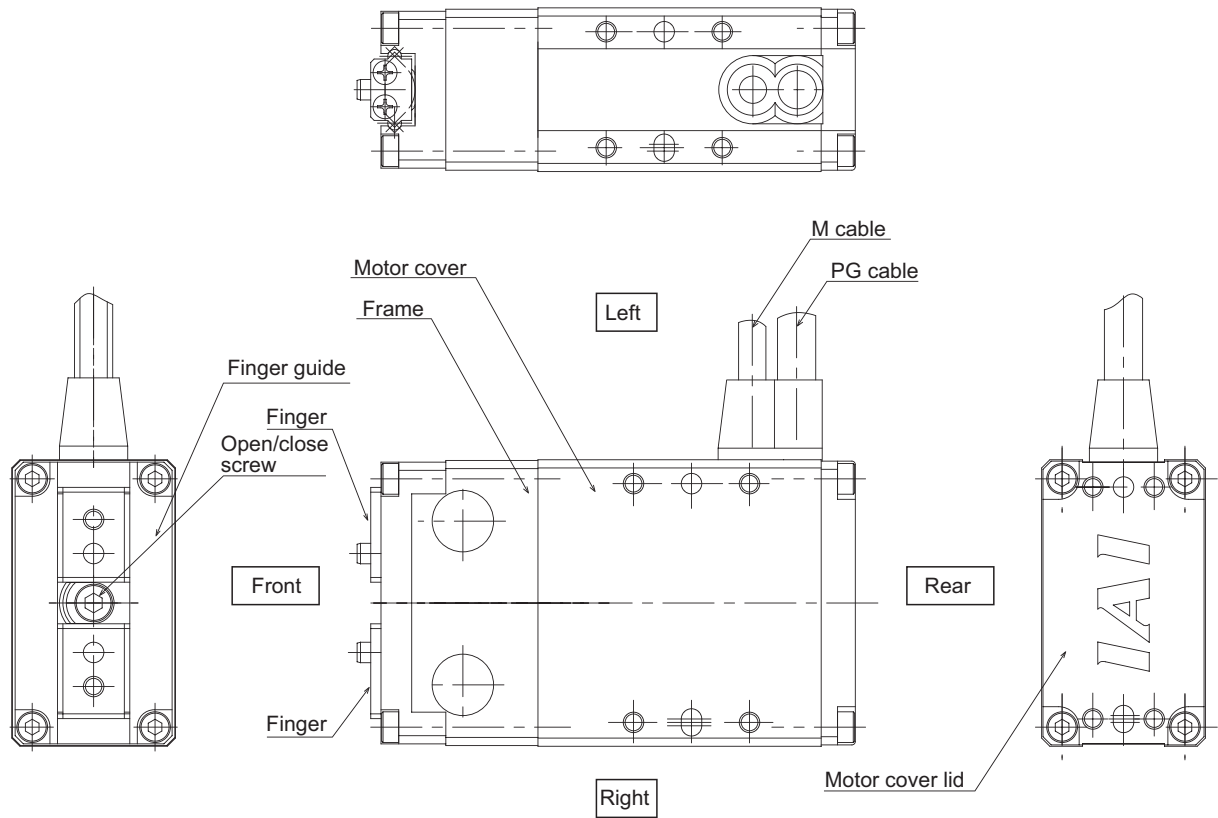
International Standards Compliances

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

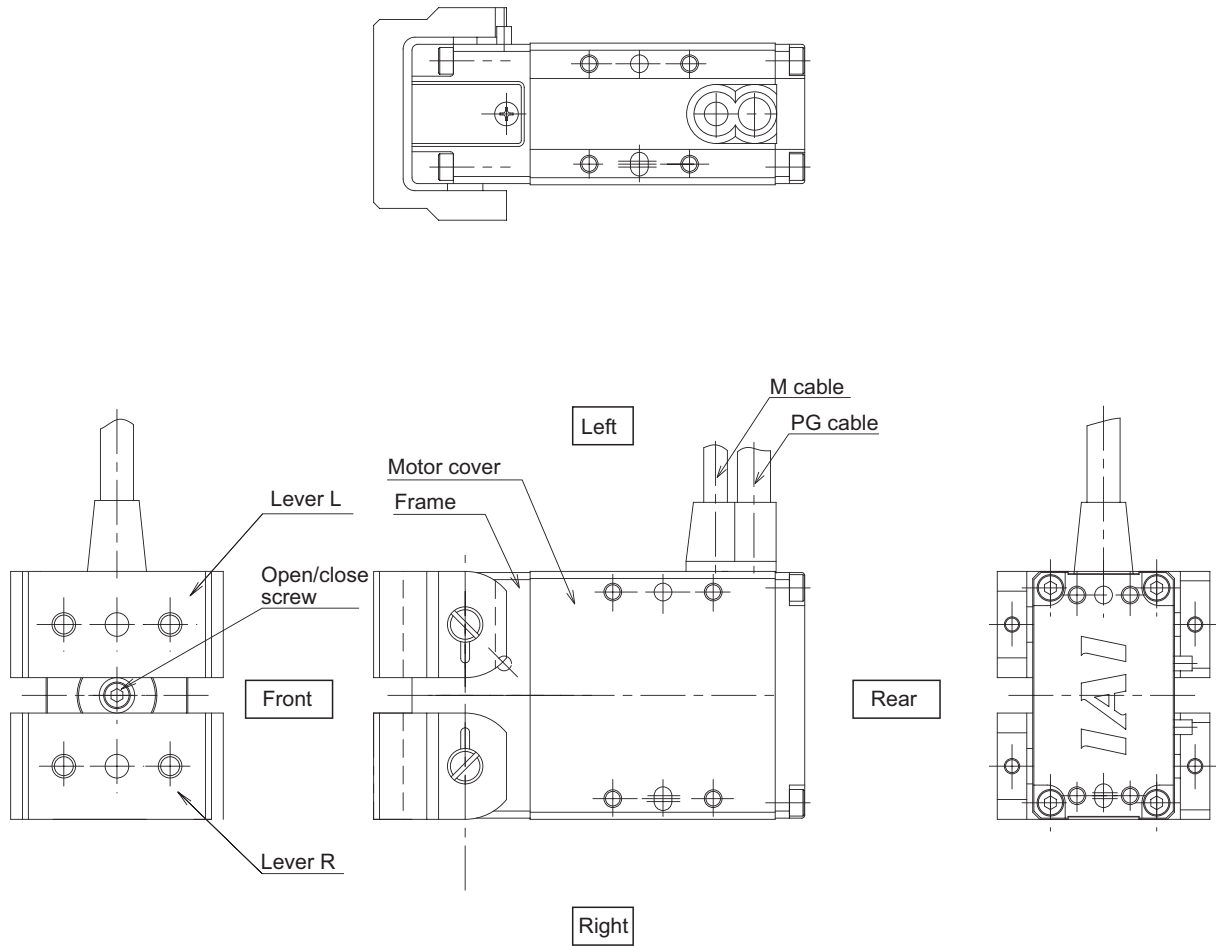
RoHS Directive	CE Marking
<input type="checkbox"/>	<input type="checkbox"/>

Names of the Parts

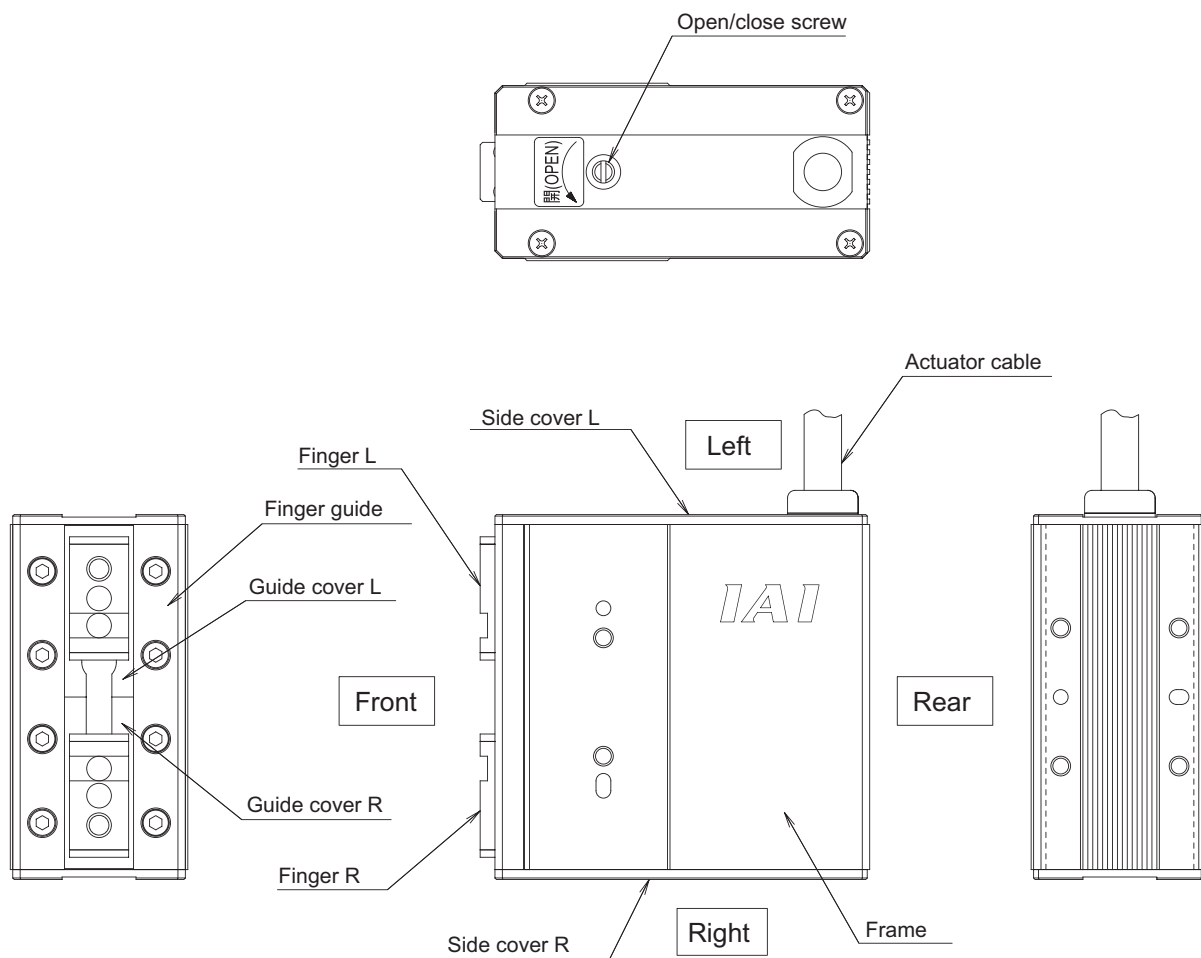
1. Small Slim Two-finger Slide Type: GRSS



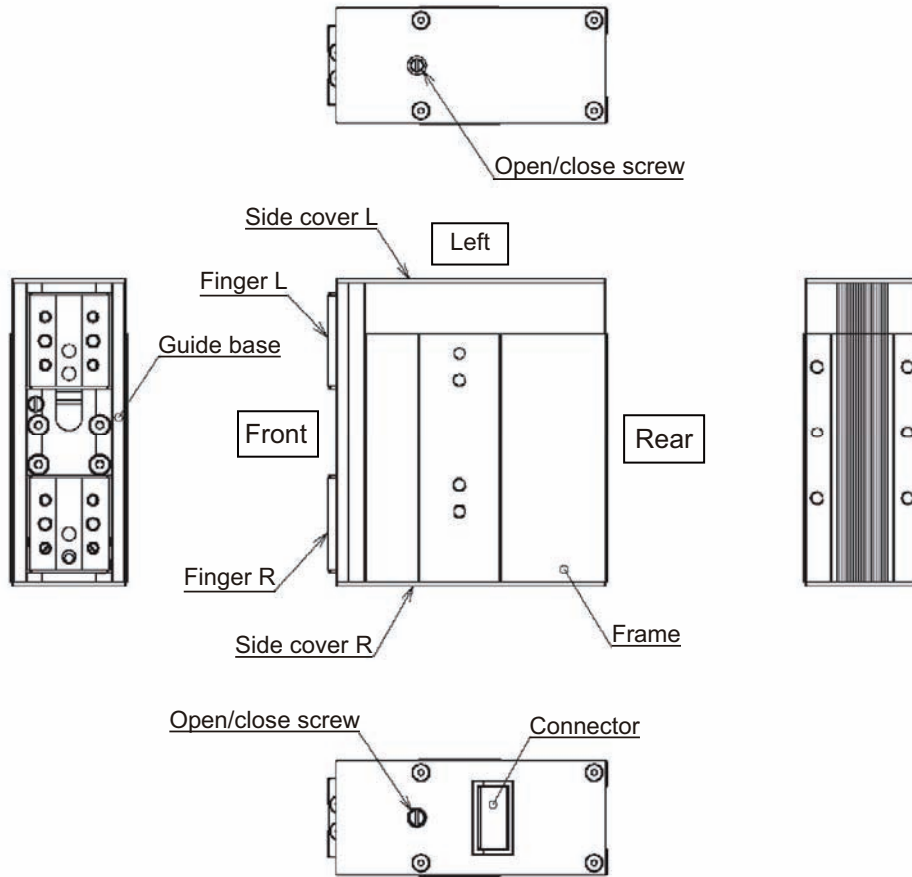
2. Small Slim Two-finger Slide Type: GRLS



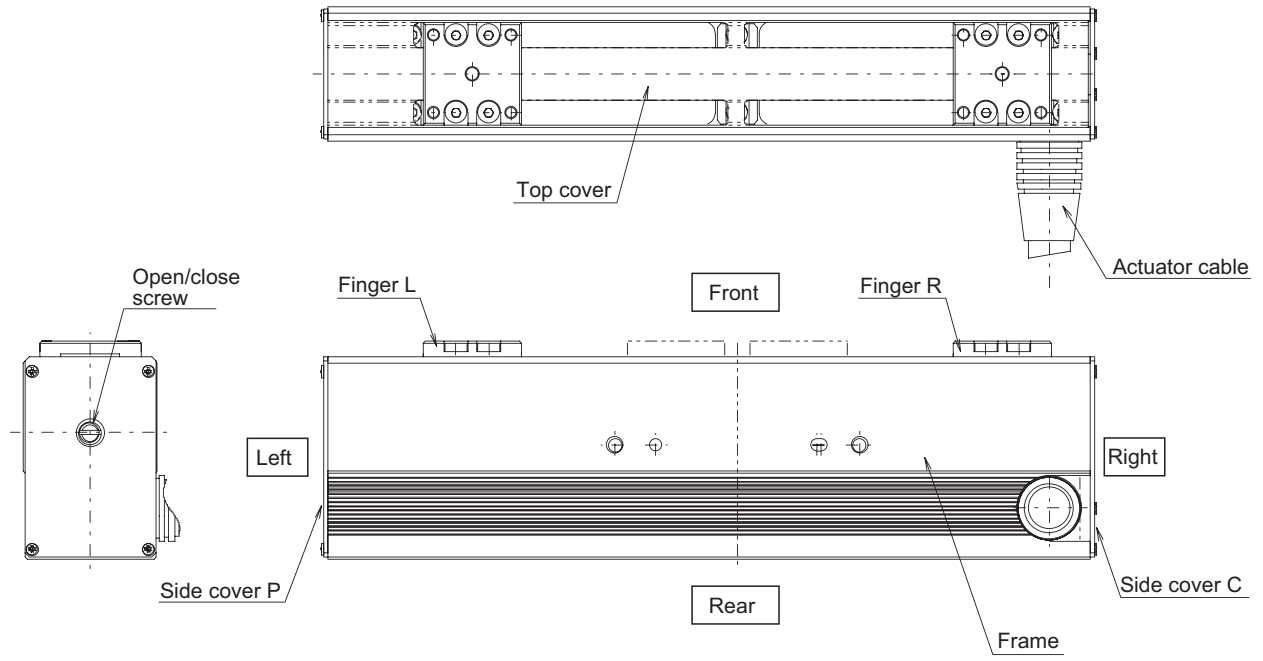
3. Small and Medium Two-finger Type: GRS/GRM



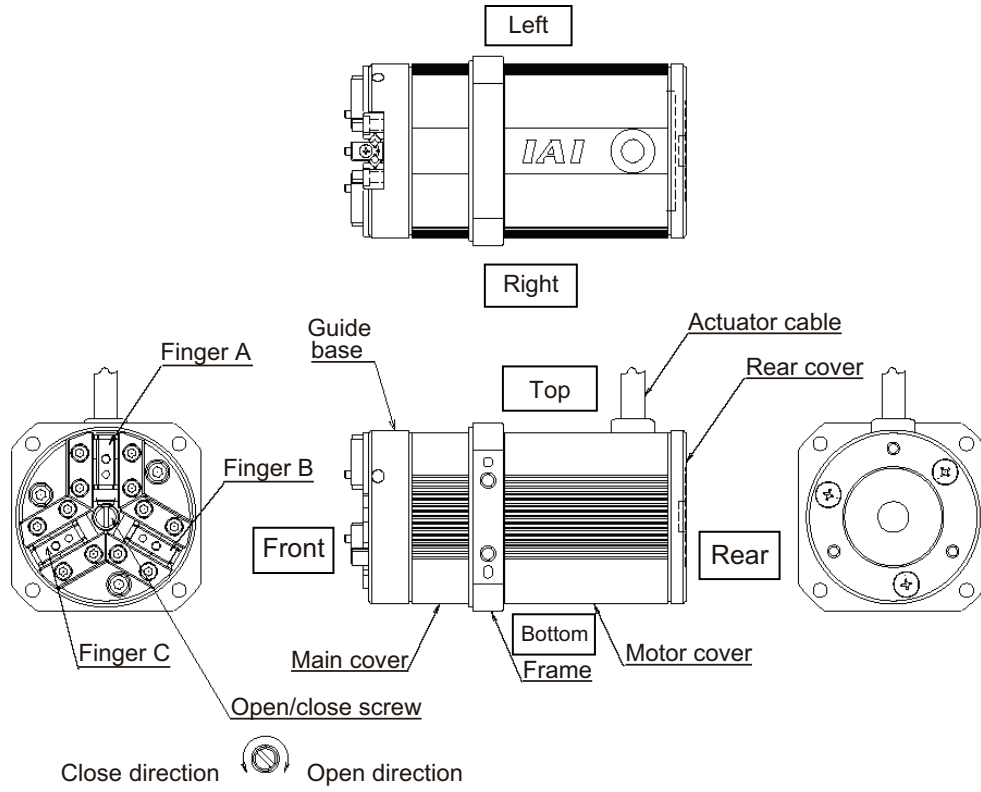
4. Two-finger Type with High Gripping Force: GRHM/GRHB



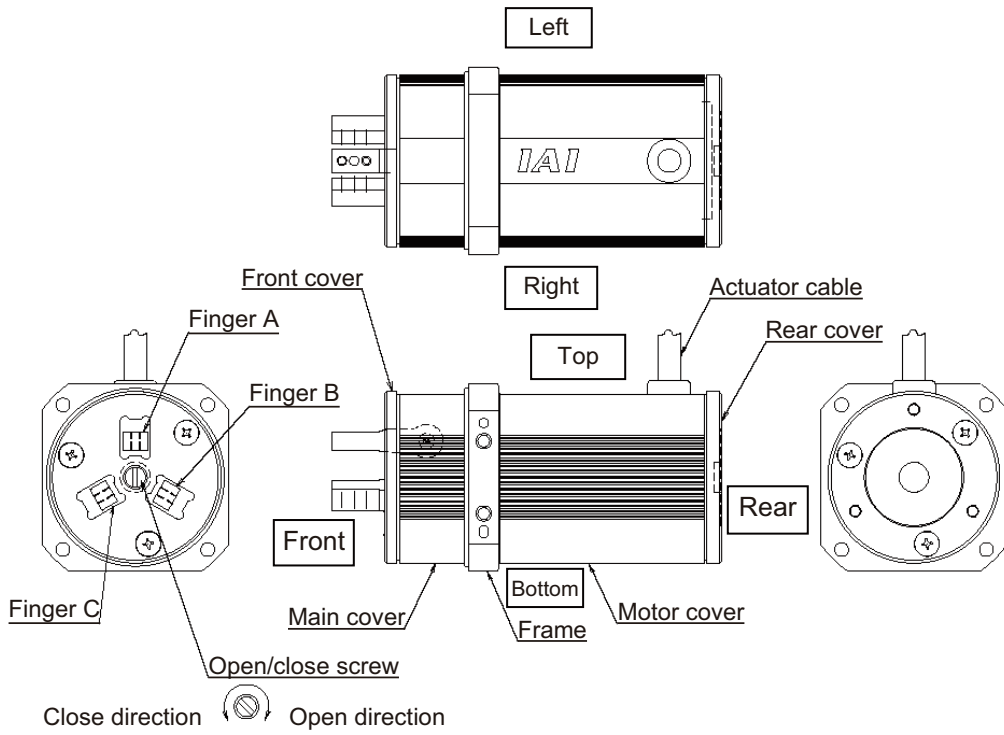
5. Two-finger Long-stroke Type: GRST



6. Three-finger Slide Type: GR3SS/GR3SM



7. Three-finger Lever Type: GR3LS/GR3LM



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 fault or missing parts, contact your local IAI distributor.

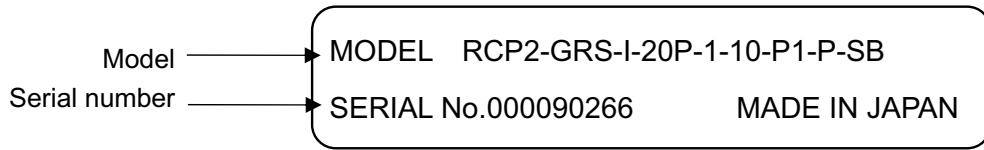
1.1.1 Parts

No.	Name	Model number	Quantity	Remarks
1	Actuator	Refer to "How to Read the Model Nameplate" and "How to Read the Model Number."	1	
Accessories				
2	First Step Guide		1	
3	Instruction Manual (DVD)		1	
4	Safety Guide		1	

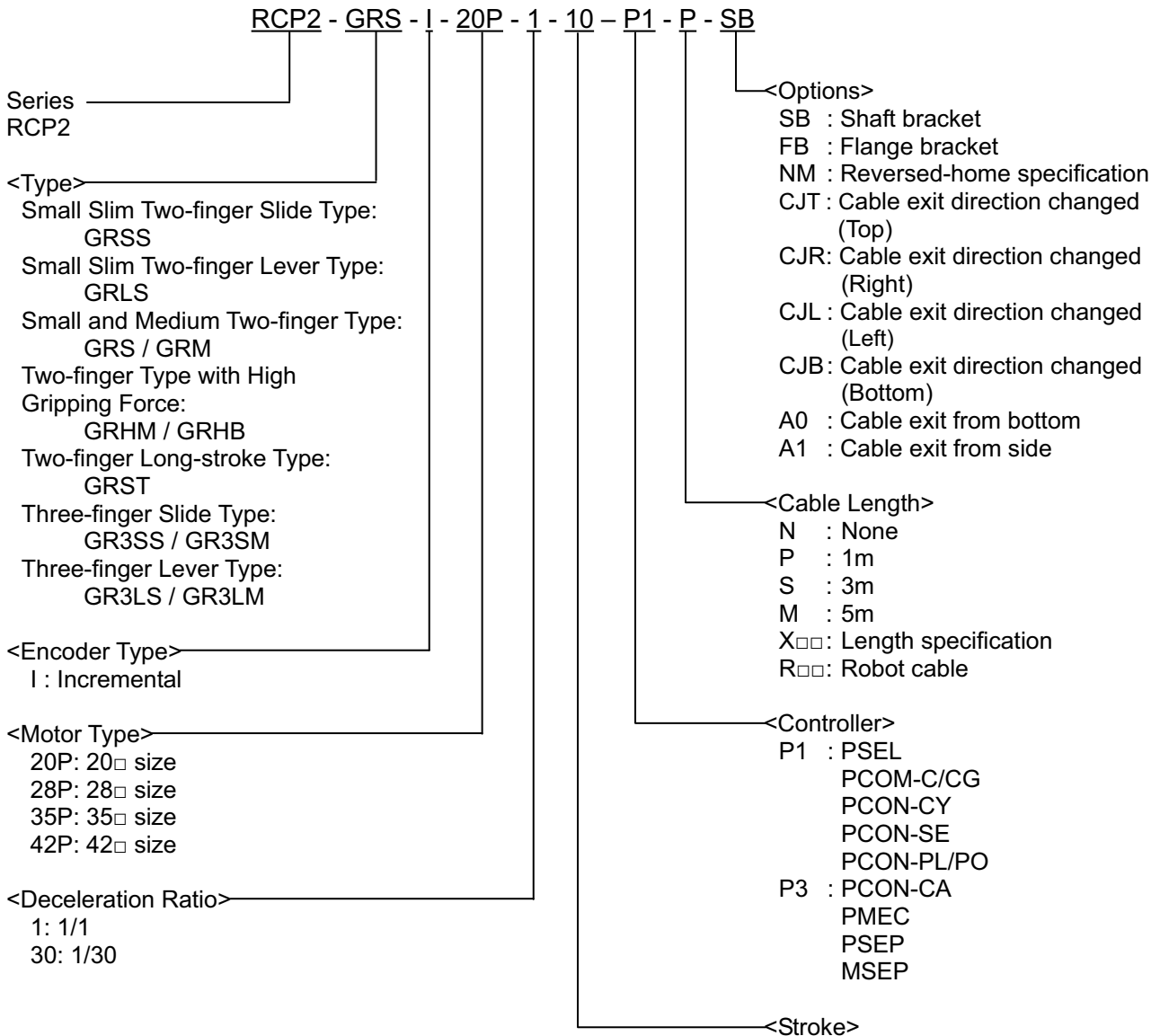
1.1.2 Instruction Manuals for the Controllers Related to this Product

No.	Name	Control No.
1	Instruction Manual for PSEL Controller	ME0172
2	Instruction Manual for PCON-CA/CFA Controller	ME0289
3	Instruction Manual for PCON-C/CG/CF Controller	ME0170
4	Instruction Manual for PCON-CY Controller	ME0156
5	Instruction Manual for PCON-SE Controller	ME0163
6	Instruction Manual for PCON-PL/PO Controller	ME0164
7	Instruction Manual for MSEP Controller	ME0299
8	Instruction Manual for ASEP/PSEP Controller	ME0216
9	Instruction Manual for PC Software IA-101-X-MW/IA-101-TT-USB	ME0154
10	Instruction Manual for PC Software RCM-101MW/RCM-101-USB	ME0155
11	Instruction Manual for Teaching Pendant CON-T/TD/TG	ME0183
12	Instruction Manual for Teaching Pendant CON-T/TD/TGS	ME0178
13	Instruction Manual for Touch Panel Teaching Pendant CON-PTA/PDA/PGA	ME0295
14	Instruction Manual for Touch Panel Teaching Pendant CON-PT/PD/PG	ME0227
15	Instruction Manual for Touch Panel Teaching Pendant SEP-PT	ME0217
16	Instruction Manual for Simple Teaching Pendant RCM-E	ME0174
17	Instruction Manual for Data Setter RCM-P	ME0175
18	Instruction Manual for Touch Panel Display RCM-PM-01	ME0182
19	Instruction Manual for Touch Panel Teaching TB-01/01D/01DR (Applicable for Program Controller)	ME0325
20	Instruction Manual for Touch Panel Teaching TB-01/01D/01DR (Applicable for Position Controller)	ME0324

1.1.3 How to Read the Model Nameplate



1.1.4 How to Read the Model Number



1.2 Specifications

1.2.1 Common

	Small Slim Two-finger Type		Small Two-finger Type	Medium Two-finger Type
	Slide type	Lever type	Slide type	
	GRSS	GRLS	GRS	GRM
Open/Close Stroke	8 mm (4 mm per side)	180 deg (90 deg per side)	10 mm (5 mm per side)	14 mm (7 mm per side)
Maximum Gripping Force	14 N	6.4 N	21 N	80 N
Maximum Open/Close Speed	78 mm/sec (Per side)	600 deg/sec (Per side)	33 mm/sec (Per side)	36 mm/sec (Per side)
Read	1.57 mm	12 mm	1 mm	1.1 mm
No. of Encoder Pulses	800	800	800	800
Stopping Repeatability	±0.01 mm	±0.01 deg	±0.01 mm	±0.01 mm
Backlash	0.2 mm max. on each side (Note 1)	1 deg max. on each side (Note 1)	0.15 mm max. on each side (Note 1)	0.15 mm max. on each side (Note 1)
Lost Motion	0.05 mm max. on each side	0.1 deg max. on each side	0.1 mm max. on each side	0.1 mm max. on each side
Allowable Load Moment (Note 2)	Ma: 0.5 N•m Mb: 0.5 N•m Mc: 1.5 N•m	/	Ma: 6.3 N•m Mb: 6.3 N•m Mc: 7.0 N•m	Ma: 6.3 N•m Mb: 6.3 N•m Mc: 8.3 N•m
Finger Drive Method	Worm gear + Spiral bevel gear + Spiral bevel rack	Worm gear + Spiral bevel gear	Timing belt + Trapezoid screw	
Finger Guide Structure	Linear guide (ball)	---	Cross roller guide	

Note 1 Constantly pushed toward the opening side by a spring.

Note 2 Moments generated in a standstill state

	Two-finger Type with High Gripping Force	
	Slide type	
	GRHM (Gear ratio 1:1)	GRHB (Gear ratio 1:1)
Open/Close Stroke	32 mm (16 mm per finger)	40 mm (20 mm per finger)
Maximum Gripping Force	125 N	200 N
Maximum Open/Close Speed	100 mm/s (on each side)	
Read	2 mm	
No. of Encoder Pulses	800	
Stopping Repeatability	±0.01 mm	
Backlash	0.2 mm	
Lost Motion	0.15 mm max.	
Allowable Load Moment	Ma: 11.7N•m Mb: 16.7N•m Mc: 46.5N•m	Ma: 15.7N•m Mb: 26.4N•m Mc: 59.8N•m
Finger Drive Method	Stepping motor + Timing belt + Trapezoidal lead screw	
Finger Guide Structure	Linear limited-rotation rolling ball bearing	

	Long-stroke Type			
	Slide type			
	GRST (Gear ratio: 2.27)		GRST (Gear ratio: 1.05)	
Open/Close Stroke	40 mm (20 mm per finger)	60 mm (30 mm per finger)	80 mm (40 mm per finger)	100 mm (50 mm per finger)
Maximum Gripping Force	20 N		40 N	
Maximum Open/Close Speed	75 mm/s		34 mm/s	
Read	2.27 mm		1.05 mm	
No. of Encoder Pulses	800			
Stopping Repeatability	±0.01 mm			
Backlash	0.2 mm max. on each side			
Lost Motion	Ma: 2.93 N•m Mb: 2.93 N•m Mc: 5.0 N•m			
Allowable Load Moment	Stepping motor + Timing belt + Worm/rack gears			
Finger Drive Method	Linear guide (ball)			

	Three-finger Type			
	Slide type		Lever type	
	GR3SS	GR3SM	GR3LS	GR3LM
Open/Close Stroke	5 mm (per finger)	7 mm (per finger)	19 deg (-14 to +5)	19 deg (-14 to +5)
Maximum Gripping Force	22 N	102 N	18 N	51 N
Maximum Open/Close Speed	400 mm/s (Per side)	40 mm/s (Per side)	200 deg/s (Per side)	200 deg/s (Per side)
Read	2.5 mm	3 mm	12 mm	12 mm
No. of Encoder Pulses	800	800	800	800
Stopping Repeatability	±0.01 mm	±0.01 mm	±0.01 deg	±0.01 deg
Backlash	0.3 mm max. on each side (Note 1)	0.3 mm max. on each side (Note 1)	1.0 deg max. on each side (Note 1)	1.0 deg max. on each side (Note 1)
Lost Motion	0.1 mm max. on each side	0.1 mm max. on each side	0.15 deg max. on each side	0.15 deg max. on each side
Allowable Load Moment (Note 2)	Ma: 3.8 N•m Mb: 3.8 N•m Mc: 3.0 N•m	Ma: 6.3 N•m Mb: 6.3 N•m Mc: 5.7 N•m	---	---
Finger Drive Method	Worm gear + Worm wheel gear			
Finger Guide Structure	Cross roller guide			

Note 1 Constantly pushed toward the opening side by a spring.

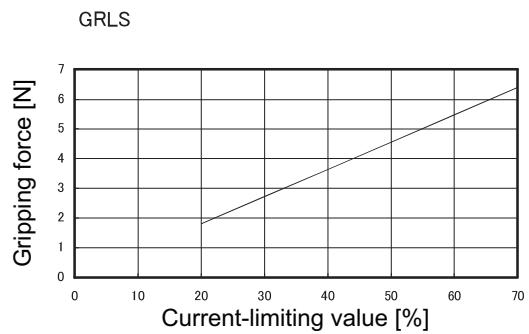
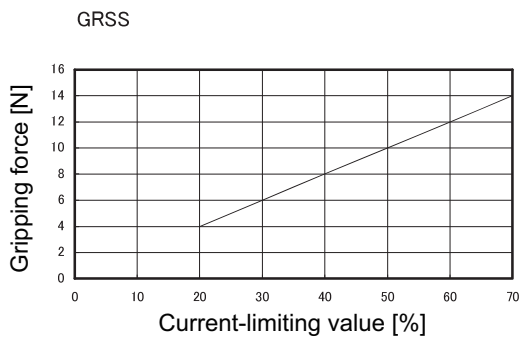
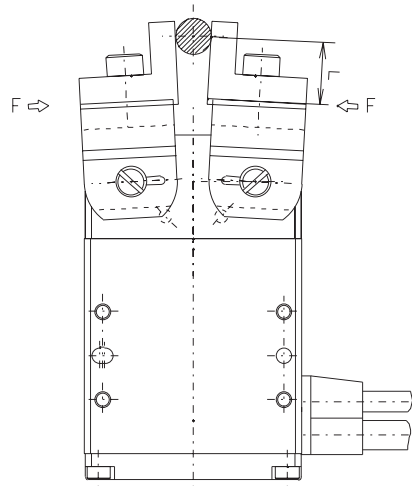
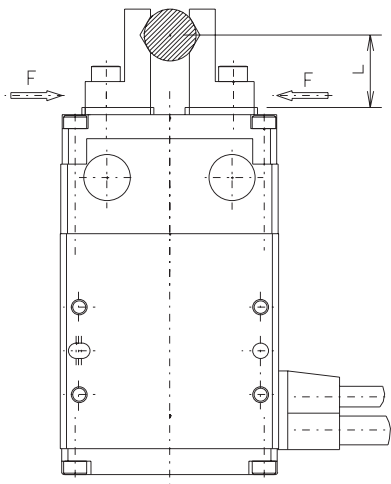
Note 2 Moments generated in a standstill state

1.2.2 Relation between the Current Limit Value and the Grip Force

The gripping force is freely adjustable via push-motion setting within a range of 20 to 70% of the currentlimiting value of the controller.

* The gripping force shown in the graphs below indicates a sum of gripping forces of both fingers.

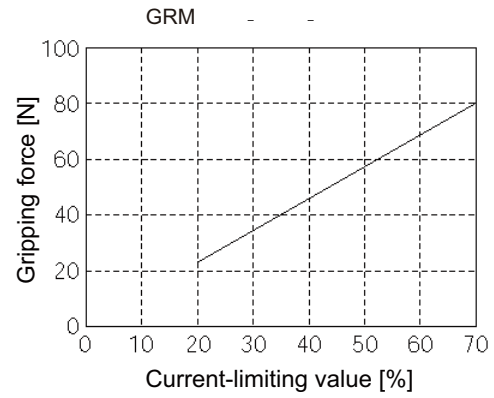
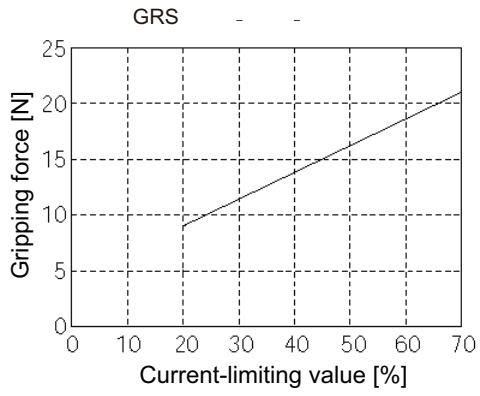
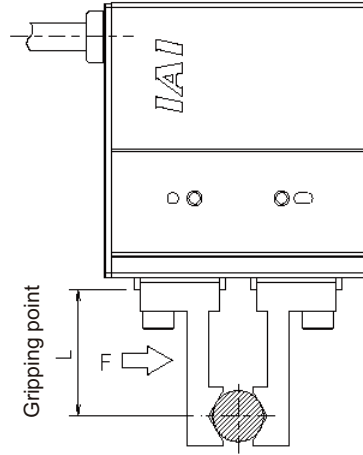
- Small Slim Two-finger Slide Type (GRSS)
- Small Slim Two-finger Lever Type (GRLS)



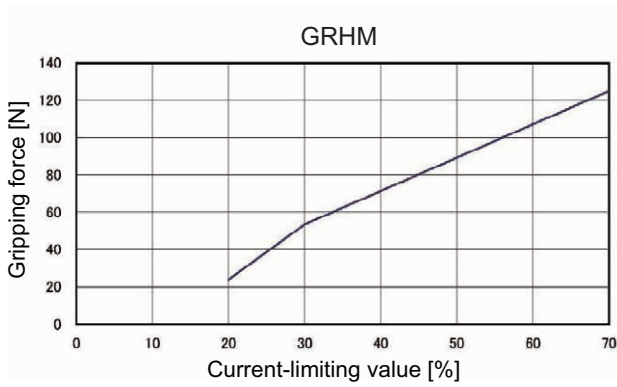
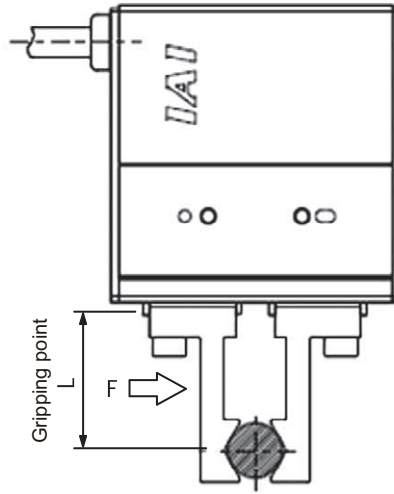
* The gripping force of the GRLS is measured on the top face of the lever. The actual gripping force drops in inverse proportion to the distance from the opening/closing fulcrum. Calculate the effective gripping force using the formula below.

$$\text{Effective gripping force (GRLS)} = F \times 15.5 / (L + 15.5)$$

- Small and Medium Two-finger Type (GRS/GRM)

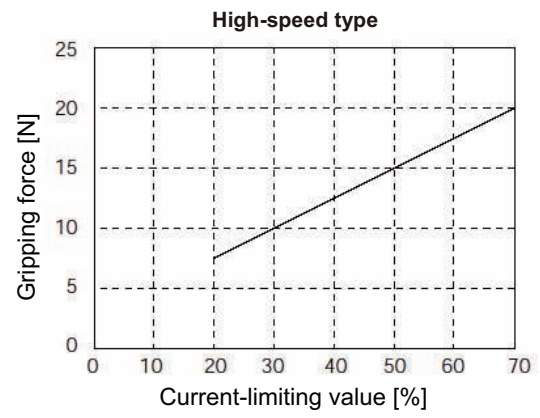
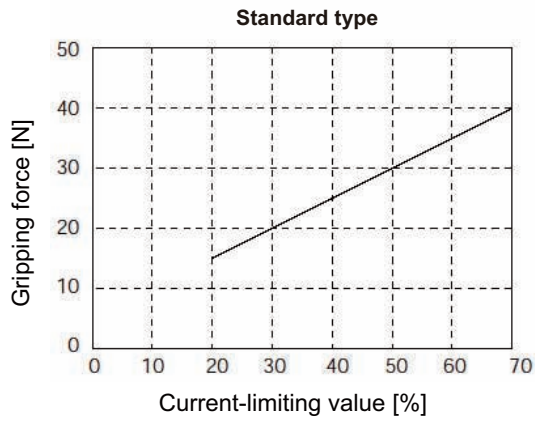
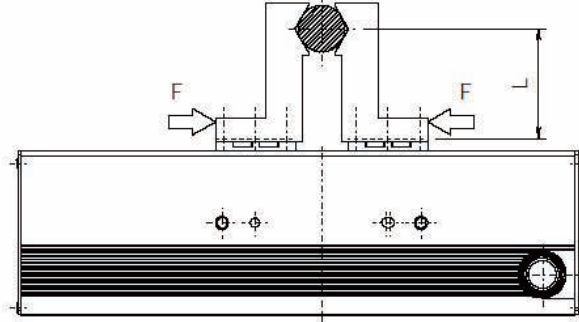


- Two-finger Type with High Gripping Force (GRHM/GRHB)

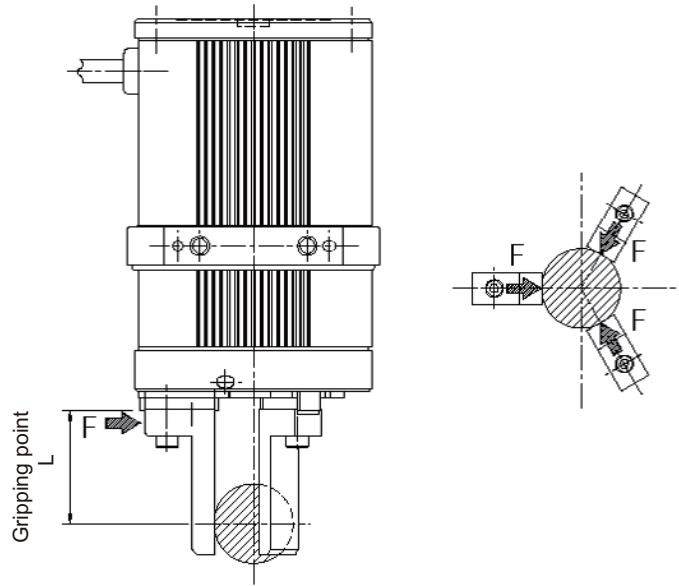


• Two-finger Long-stroke Type (GRST)

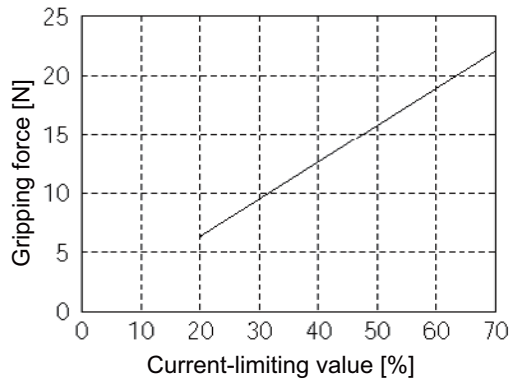
* The gripping force shown in the graphs below indicates a sum of gripping forces of both fingers.



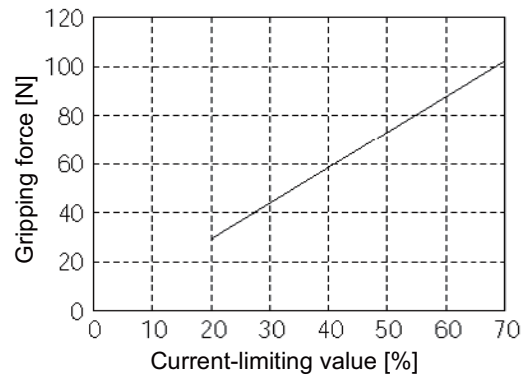
• Three-finger Slide Type (GR3SS/GR3SM)



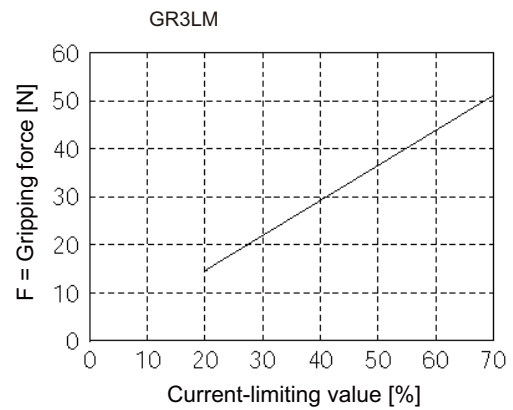
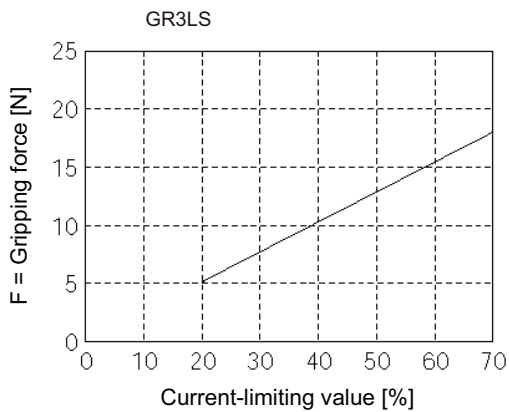
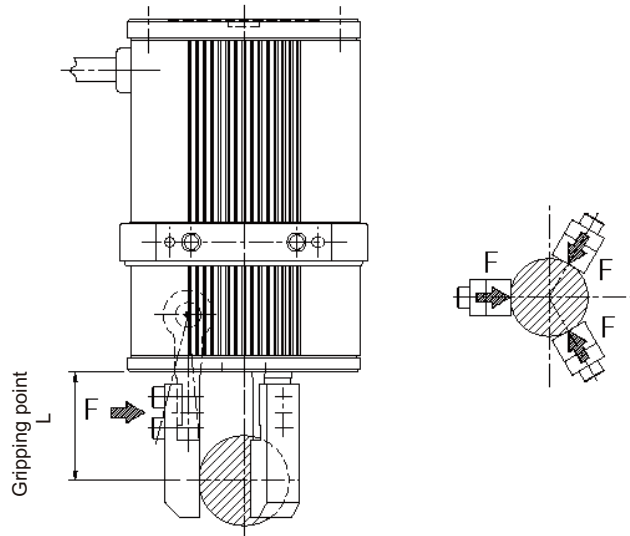
GR3SS



GR3SM



• Three-finger Lever Type (GR3LS/GR3LM)



* The above values are calculated at a gripping point of 10 mm. The actual gripping force decreases in inverse proportion to the distance from the open/close fulcrum. Calculate the actual gripping force using the formula below:

Effective gripping force (GR3LS) = $F \times 24 / (L + 14)$
 Effective gripping force (GR3LM) = $F \times 28.5 / (L + 18.5)$



Caution:

(1) It is a reference when pressing performed with speed 5mm/s for Slide Type, and with 5deg/s for Lever Type.

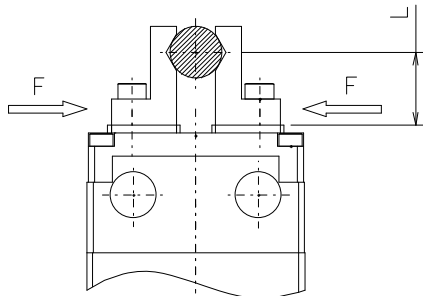
(2) The grip force is the values under the conditions stated below.

• Two-finger Type

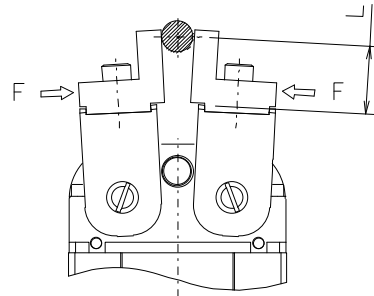
Slide Type: Total value of grip force of both slides at the top surface of the slides (gripping point = 0mm, overhang = 0mm)

Lever Type: Total value of grip force of both slides at the top surface of the Levers (gripping point = 0mm, overhang = 0mm)

The actual grip force drops in inverse proportion to the distance from the fulcrum of open and close.



Slide Type



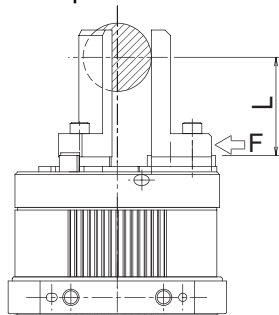
Lever Type

• Three-finger Type

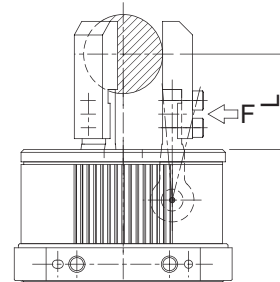
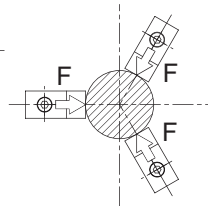
Slide Type: Total value of grip force of both slides at the top surface of the slides (gripping point = 0mm, overhang = 0mm)

Lever Type: Total value of grip force of both slides at the top surface of the Levers (gripping point = 10mm, overhang = 0mm)

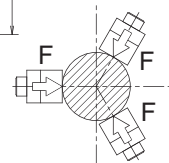
The actual grip force drops in inverse proportion to the distance from the fulcrum of open and close.



Slide Type



Lever Type



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

1.2.3 Duty in Continuous Operation

Continuous operation is available with the duty 100%.

Duty is the rate of operation expressed in % that represents the time of the actuator being operated in 1 cycle of operation.

1.3 Operating Conditions

It is necessary to satisfy the conditions stated below to use the product. Conduct the following calculation to make sure it is satisfied.

1.3.1 Gripping Force

[1] Slide Types

Procedure 1 : Check for the necessary grip force and transportable work piece mass



Procedure 2 : Check for the vertical allowable load of the fingers and allowable moment

Procedure 1 : Check for the necessary grip force and transportable work piece mass

If a work piece is to be gripped on the fingers with the friction force created by the grip force, the formula to calculate the necessary grip force is as follows;

(1) In case of ordinary transportation

- F : Grip Force [N].....Sum of pressing force on each finger
- μ : Coefficient of static friction between finger attachment and work piece
- m : Mass of work piece [kg]
- g : Gravitational acceleration [= 9.8m/s²]

The condition to grip the work piece statically and that the work piece would not drop is;

$$F\mu > W$$

$$F > \frac{mg}{\mu}$$

The necessary grip force assuming the safety factor recommended for ordinary transportation is 2 should be;

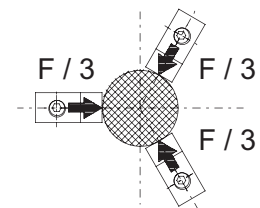
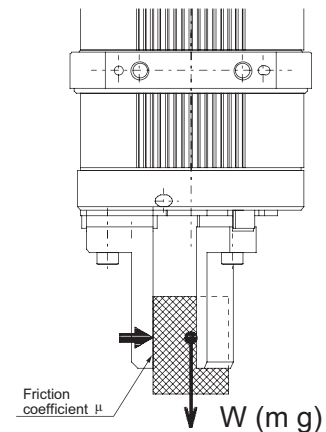
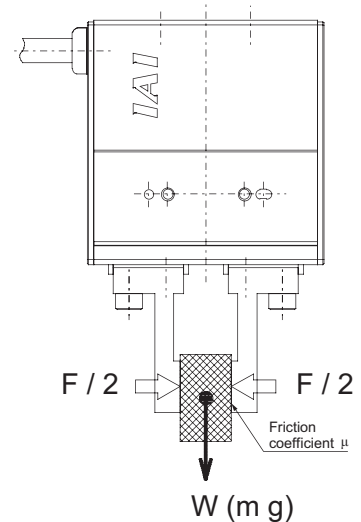
$$F > \frac{mg}{\mu} \times 2 \text{ (safety factor)}$$

When coefficient of friction is μ 0.1 to 0.2;

$$F > \frac{mg}{0.1 \text{ to } 0.2} \times 2 = (10 \text{ to } 20) \times mg$$

* The mass of a transportable work piece will get higher as the coefficient of static friction is higher. However it is necessary to that enables it to obtain a grip force of 10 to 20 times or more to ensure the safety.

For ordinary work piece transportation;
 Necessary grip force \Rightarrow 10 to 20 times or more of work piece mass
 Transportable work piece mass \Rightarrow 1/10 to 1/20 or less of grip force

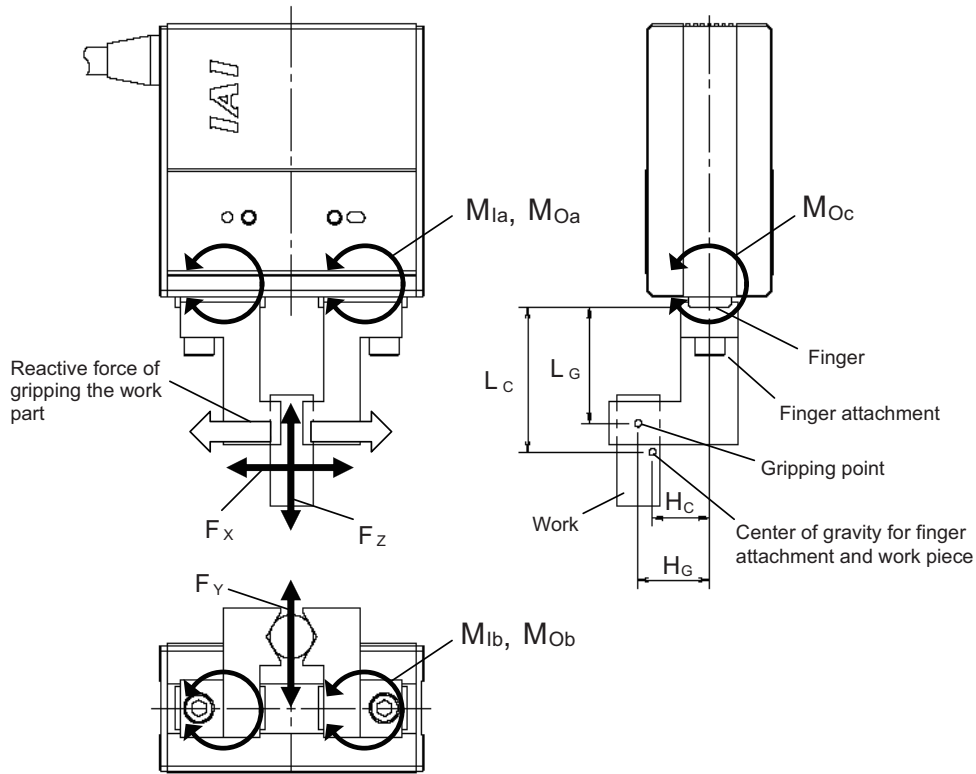


- (2) In case of high acceleration/deceleration speed or a big impact is applied to the work piece during transportation
High inertial force, in addition to the gravity, will be applied to the work piece. In such cases, consider an even higher safety factor if it is necessary.

When high acceleration/deceleration speed or a big impact is applied;
Necessary grip force \Rightarrow 30 to 50 times or more of the work piece mass
Transportable work piece mass \Rightarrow 1/30 to 1/50 or less of the grip force

Procedure 2 : Check for the vertical allowable load of the fingers and allowable moment
 Check the vertical load and the moment applicable to the finger. Figure out F_z , M_a , M_b and M_c by referring to (1) to (3) described below, and it is necessary to select a suitable model considering not to exceed the allowable values.

Fig. 1 Load and the moment applicable to the finger



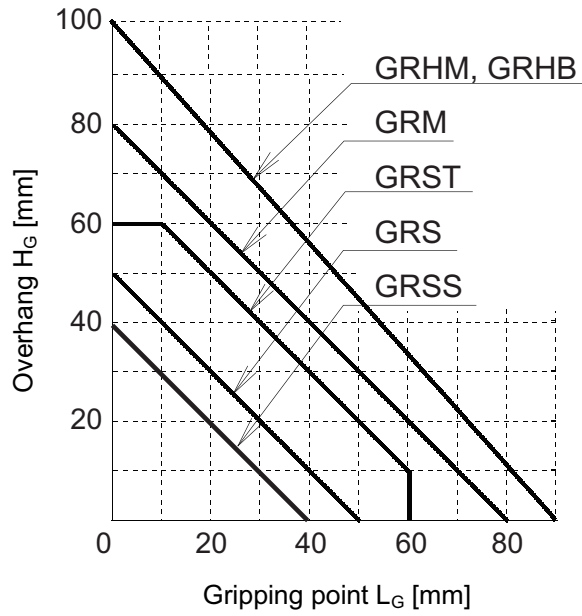
F_x : External force in X direction applied to work piece and finger [N]
 F_y : External force in Y direction applied to work piece and finger [N]
 F_z : External force in Z direction applied to work piece and finger [N]
 L_g : Distance from finger attachment surface to gripping point (Gripping point) [mm] ^(Note 1)
 L_c : Distance from center of fingers to gripping point (Overhang) [mm] ^(Note 1)
 H_c : Distance from finger attachment surface to center of gravity for work piece and finger attachment [mm]
 H_g : Distance from center of fingers to center of gravity for work piece and finger attachment [mm]

M_{la} : Moment in M_a direction generated on fingers due to grip force [N·m]
 M_{lb} : Moment in M_b direction generated on fingers due to grip force [N·m]
 M_{Oa} : Moment in M_a direction generated on fingers due to external force [N·m]
 M_{Ob} : Moment in M_b direction generated on fingers due to external force [N·m]
 M_{Oc} : Moment in M_c direction generated on fingers due to external force [N·m]
 M_a : All moments in M_a direction generated on fingers [N·m]
 M_b : All moments in M_b direction generated on fingers [N·m]
 M_c : All moments in M_c direction generated on fingers [N·m]

Note1 For L_g and H_g , have the values next page as the upper limit. Exceeding the allowable range may generate an excessive moment on the finger sliding mechanism, which may be a cause of a bad impact to the product life.

◆ Two-finger Gripper

Fig. 2 Upper Limits of Gripping Point L_G and Overhang H_G of Two-finger Gripper



◆ Three-finger Gripper

GR3SS \Rightarrow L50 mm or less
 GR3SM \Rightarrow L80 mm or less

Fig. 3 Upper Limit of Gripping Point L_G of Three-finger Gripper

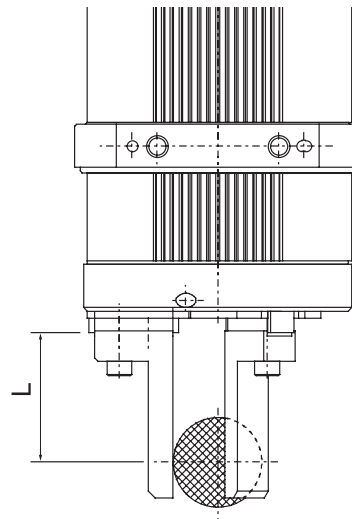


Table 1: Allowable Load and Allowable Moment on the Fingers (Note 1)

Model	Allowable Load in Vertical [N] F_{Zmax}	Max. Allowable Moment [N·m] (Note 2)		
		M_{amax}	M_{bmax}	M_{cmax}
GRSS	60	0.5	0.5	1.5
GRS	253	6.3	6.3	7.0
GRM	253	6.3	6.3	8.3
GRHM	390	11.7	16.7	46.5
GRHB	502	15.7	26.4	59.8
GRST	275	2.93	2.93	5.0
GR3SS	169	3.8	3.8	3.0
GR3SM	253	6.3	6.3	5.7

Note 1 The graphs show the values for allowable load and allowable moment in static on one finger.

Note 2 The values for the allowable moment are those when the load is applied in one direction only.

- The values become one half when the load is applied from in two directions.
- The values become 1/3 when the load is applied from in three directions.

(1) Moment generated on fingers due to gripping force

1) Moment in M_a direction [$M_{|a}$]

- Two-finger type
$$M_{|a} = L_G \frac{1.5F_G}{2} \times 10^{-3}$$

- Three-finger type
$$M_{|a} = L_G \frac{1.5F_G}{3} \times 10^{-3}$$

F_G : Grip force of gripper [N]

2) Moment in M_b direction [$M_{|b}$]

- Two-finger type
$$M_{|b} = H_G \frac{1.5F_G}{2} \times 10^{-3}$$

- Three-finger type: Need not be calculated.

F_G : Grip force of gripper [N]

Refer to “1.2.2 Relation between Current Limit Value and Grip Force” for gripping force F_G .

As the gripping force is a reference value, it is multiplied by 1.5 for the safety margin in the moment calculation.

(2) Moment generated on the fingers due to an external force

External force as well as gripping force will be applied to the work piece and the finger attachment in the movements such as moving straight or turning in the condition of the gripper being attached on a Cartesian Robot, Articulated Robot or other actuators.
Have the following calculation.

- ◆ External force applied on the work piece and finger attachment [F_x, F_y, F_z]
Figure out the following types of external forces in three directions, X, Y and Z, applied on the work piece and finger attachment considering the condition of the gripper use, and sum up all the values to determine F_x, F_y and F_z .
 - a) Weight of the work piece and finger attachment

$$F = mg$$
 m : mass of the work piece and finger attachment [kg],
 g : gravitational acceleration [=9.8m/s²]
 - b) Inertial force in the gripper moving straight

$$F = ma$$
 a : Acceleration/deceleration during transportation [m/s²]
 - c) Centrifugal force in gripper turning

$$F = mr \omega^2$$
 r : Radius of turning [m], ω : Angular velocity [deg/s]

Confirm that F_z is below the allowable load vertical direction, F_{zmax} in Table 1.

- ◆ Moment generated on the fingers due to an external force
Figure out the moment in each direction due to external forces F_x, F_y and F_z calculated above.
 - 1) Moment in Ma direction [M_{oa}]

$$M_{oa} = L_c F_x \times 10^{-3}$$
 - 2) Moment in Mb direction [M_{ob}]

$$M_{ob} = H_c F_x \times 10^{-3}$$
 - 3) Moment in Mc direction [M_{oc}]

$$M_{oc} = L_c F_y \times 10^{-3} + H_c F_z \times 10^{-3}$$

(3) All moments in each direction generated to the fingers

- Two-finger type

$$M_a = M_{la} + M_{oa}, \quad M_b = M_{lb} + M_{ob}, \quad M_c = M_{oc}$$
- Three-finger type

$$M_a = M_{la} + M_{oa}, \quad M_b = M_{ob}, \quad M_c = M_{oc}$$

Confirm that the value figured out in the calculation above is below the allowable moment stated in Table 1.

(Note) Select finger attachments that are as small and light as possible within the allowable ranges. If the fingers are long and large or heavy, moments may generate due to impact upon gripping of the work part and consequently the actuator performance may drop or guide may be negatively affected.

[2] Lever Types

Procedure 1 : Check for the necessary gripping force and transportable work piece mass



Procedure 2 : Check for the moment of inertia on the finger attachment

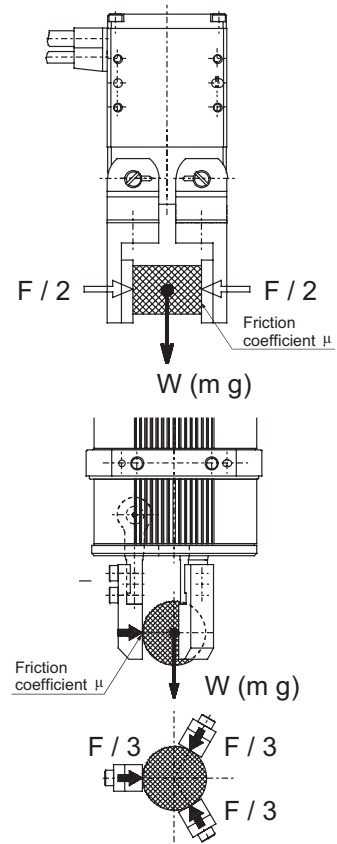


Procedure 3 : Check for the external force applied on finger

Procedure 1 : Check for the necessary gripping force and the transportable work piece mass
 In the same manner as Procedure 1 for Slide types, figure out the necessary grip force and confirm that the requirement is satisfied.
 Figure out the effective grip force on the gripping point by referring to “1.2.2 Relation between the Current Limit Value and the Gripping Force”.

For ordinary work piece transportation;
 Necessary gripping force ⇒ 10 to 20 times or more of the work piece mass
 Transportable work piece mass ⇒ 1/10 to 1/20 or less of the gripping force

When high acceleration/deceleration speed or a big impact is applied;
 Necessary gripping force ⇒ 30 to 50 times or more of the work piece mass
 Transportable work piece mass ⇒ 1/30 to 1/50 or less of the gripping

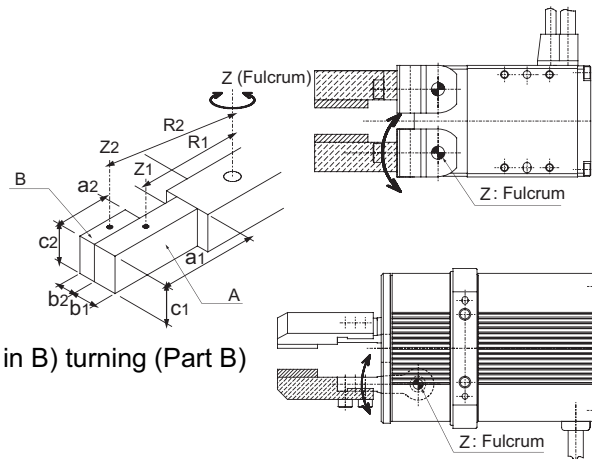


Procedure 2 : Check for the moment of inertia on the finger attachment
 Make sure all the moments of inertia for the Z-axis (fulcrum) turning on the finger attachment are within the allowable range. Figure out by dividing to several equations considering the structure and profile of the finger attachment. For reference, shown below is an example how to figure out by dividing to two equations.

(1) Moment of inertia for Z1-axis (center of gravity in A) turning (Part A)

m_1 : Mass of A [kg]
 a, b, c : Dimensions of A [mm]
 m_1 [kg] = $a_1 \times b_1 \times c_1 \times \text{Specific gravity} \times 10^{-6}$

$$I_{z1} [\text{kg} \cdot \text{m}^2] = \frac{m_1 (a_1^2 + b_1^2)}{12} \times 10^{-6}$$



(2) Moment of inertia for Z2-axis (center of gravity in B) turning (Part B)

$$I_{z2} [\text{kg} \cdot \text{m}^2] = \frac{m_2 (a_2^2 + b_2^2)}{12} \times 10^{-6}$$

- (3) All Moments of inertia for Z-axis (fulcrum) Turning
 R_1 : Distance from center of gravity of A to the finger open/close fulcrum [mm]
 R_2 : Distance from center of gravity of B to the finger open/close fulcrum [mm]

$$I [\text{kg}\cdot\text{m}^2] = (I_{Z1} + m_1 R_1^2 \times 10^{-6}) + (I_{Z2} + m_2 R_2^2 \times 10^{-6})$$

Confirm that the value figured out in the calculation above is below the allowable moment of inertia stated in Table 2.

Table 2: Allowable Moment of Inertia on the Finger (Note 1)

Model	Allowable Moment of Inertia $I_{\text{max}} [\text{kg}\cdot\text{m}^2]$	Mass (Reference) Max [kg]
GRLS	1.5×10^{-4}	0.05
GR3LS	3.0×10^{-4}	0.1
GR3LM	9.0×10^{-4}	0.2

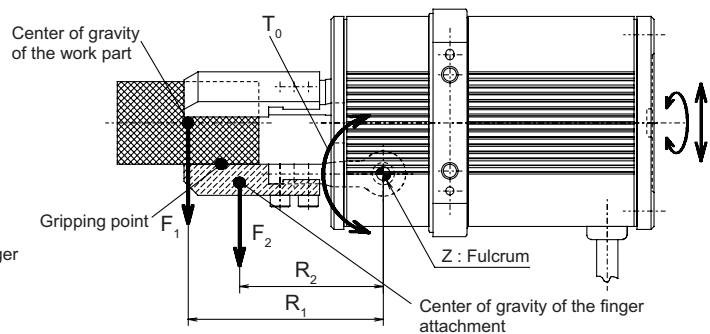
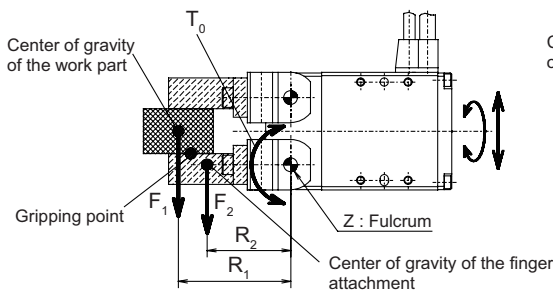
(Note 1) The table shows the values for allowable moment of inertia, allowable load torque and allowable thrust load for the static condition on one finger.

Procedure 3 : Check for the external force applied on the finger

External force as well as grip force will be applied to the work piece and the finger attachment in the movements such as moving straight or turning in the condition of the gripper being attached on a Cartesian Robot, Articulated Robot or other actuators.

(1) Allowable Load Torque

Use the product in a condition that the load torque applied to the fingers is below the maximum allowable load torque.



- m_1 : Mass of the work piece [kg]
- m_2 : Mass of the finger attachment [kg]
- R_1 : Distance from the center of gravity for the work piece to the finger open/close fulcrum [mm]
- R_2 : Distance from the center of gravity for the finger attachment to the finger open/close fulcrum [mm]
- F_1 : External force applied on the work piece [N]
- F_2 : External force applied on the finger attachment [N]
- T_0 : Torque generated on the fingers due to an external force [N·m]

◆ External force applied on the work piece and the finger attachment

Figure out the following types of external forces applied on the work piece and finger attachment considering the condition of the gripper use, and sum up all the values.

- a) Weight of the work piece and finger attachment

$$F = mg \quad m : \text{mass of the work piece and finger attachment [kg],}$$

$$g : \text{gravitational acceleration [=9.8m/s}^2]$$

- b) Inertial force in gripper moving straight

$$F = ma \quad a : \text{Acceleration/deceleration during transportation [m/s}^2]$$

- c) Centrifugal force in gripper turning

$$F = mr \omega^2 \quad r : \text{Radius of turning [m], } \omega : \text{Angular velocity [deg/s]}$$

Total External Force

$$F_1 = m_1 g + m_1 a + m_1 r \omega^2 \quad \dots \text{ External force applied on the work piece}$$

$$F_2 = m_2 g + m_2 a + m_2 r \omega^2 \quad \dots \text{ External force applied on the finger attachment}$$

- ◆ Torque generated on the fingers due to an external force

$$T_0 = F_1 R_1 \times 10^{-6} + F_2 R_2 \times 10^{-6}$$

Confirm that the value figured out with the formula above is below the maximum allowable load torque stated in Table 3.

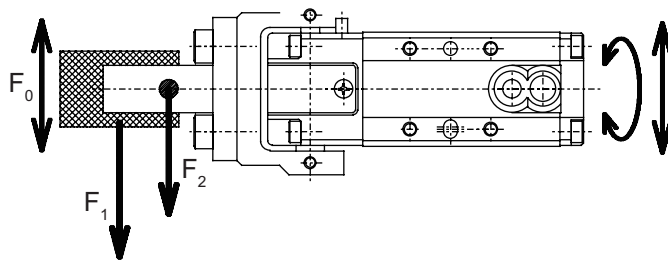
Table 3: Allowable Load Torque on the Finger ^(Note 1)

Model	Max. Allowable Load Torque T_{max} [N·m]
GRLS	0.05
GR3LS	0.1
GR3LM	0.3

Note 1 The table shows the values for allowable moment of inertia, allowable load torque and allowable thrust load for the static condition on one finger.

(2) Allowable Thrust Load

Use the product in a condition that the load torque applied to the fingers is below the maximum allowable load torque.



- m_1 : Mass of the work piece [kg]
- m_2 : Mass of the finger attachment [kg]
- F_1 : External force applied on the work piece [N]
- F_2 : External force applied on the finger attachment [N]
- F_0 : Load generated on the finger attachment [N]

Table 4: Allowable Thrust Load on Finger ^(Note 1)

Model	Allowable Thrust Load F_{max} [N]
GRLS	15
GR3LS	-
GR3LM	-

Note 1 The table shows the values for allowable moment of inertia, allowable load torque and allowable thrust load in static on one finger.

- ◆ External force applied on the work piece and the finger attachment

Figure out the following types of external forces applied on the work piece and the finger attachment considering the condition of the gripper use, and sum up all the values.

- a) Weight of the work piece and the finger attachment

$$F = mg \quad m : \text{mass of the work piece and the finger attachment [kg],} \\ g : \text{gravitational acceleration [=9.8m/s}^2]$$

- b) Inertial force in the gripper moving straight

$$F = ma \quad a : \text{Acceleration/deceleration during transportation [m/s}^2]$$

- c) Centrifugal force in the gripper turning

$$F = mr \omega^2 \quad r : \text{Radius of turning [m], } \omega : \text{Angular velocity [deg/s]}$$

Total External Force

$$F1 = m_1 g + m_1 a + m_1 r \omega^2 \quad \dots \text{ External force applied on the work piece}$$

$$F2 = m_2 g + m_2 a + m_2 r \omega^2 \quad \dots \text{ External force applied on the finger attachment}$$

- ◆ Load generated on the Finger due to an External Force

$$F_0 = F_1 + F_2$$

Confirm that the value figured out with the formula above is below the allowable thrust load stated in Table 4.

(Note) Attempt to have the finger attachment minimized in size and weight even if it is in the allowable range. If the fingers are long and big in size and heavy in mass, the moment caused by an impact at gripping may cause a performance drop or give a bad impact to the structural area.

1.4 Option

1.4.1 Reversed-home Specification (Model: NM)

In standard, the direction described in “4.1 Operation of Finger Part in 4. Operation” is the home-return direction. It can be on the opposite side in case the home position is set on the other side due to such reasons as layout of equipment.

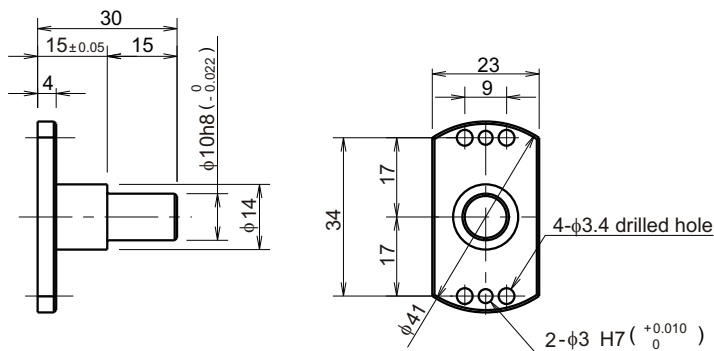
(Note) The home position is adjusted at the factory before shipment. If you wish to change the home after the delivery of your actuator, you must return the actuator to IAI for adjustment.

1.4.2 Shaft Bracket (Model: SB)

It is a fixing bracket to attach the gripper body.

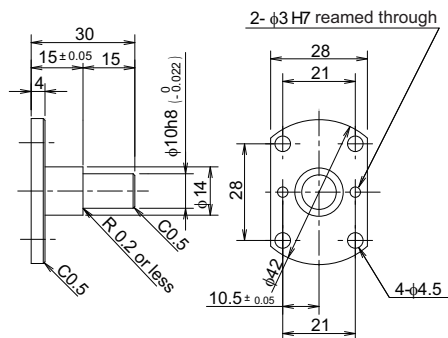
For GRSS/GRLS

Model code of single product : RCP2-SB-GRSS



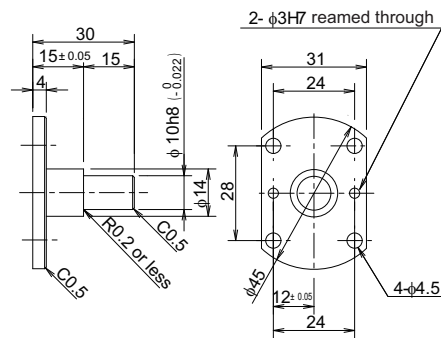
For GRS

Model code of single product : RCP2-SB-GRS



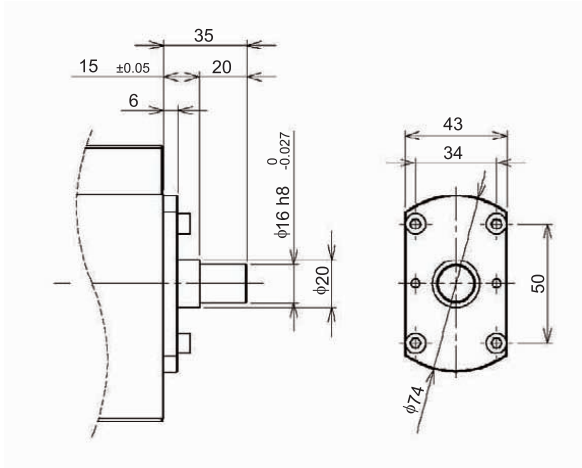
For GRM

Model code of single product : RCP2-SB-GRM



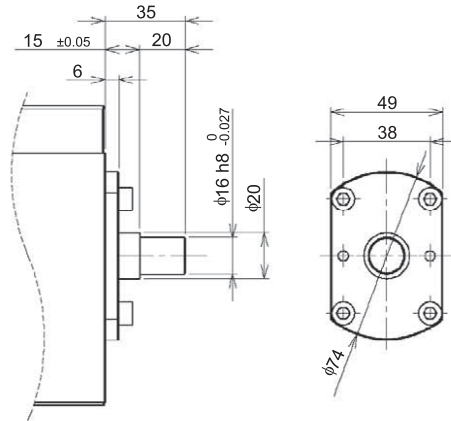
For GRHM

Model code of single product : RCP2-SB-GRHM



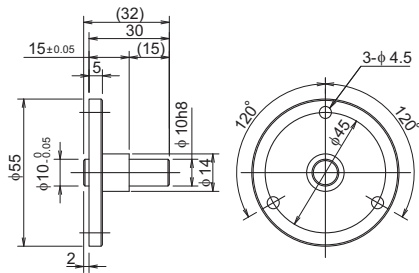
For GRHB

Model code of single product : RCP2-SB-GRHB



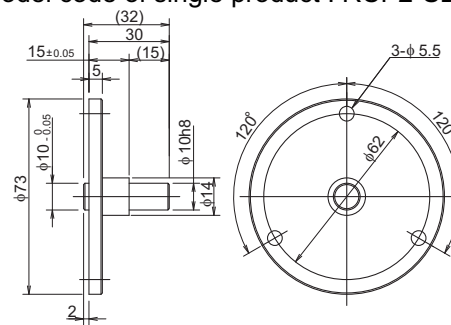
For GR3SS/GR3LS

Model code of single product : RCP2-SB-GR3S



For GR3SM/GR3LM

Model code of single product : RCP2-SB-GR3M

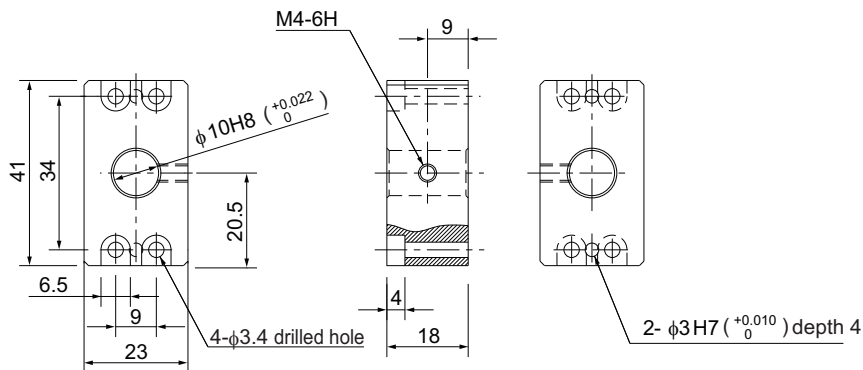


1.4.3 Flange Bracket (Model: FB)

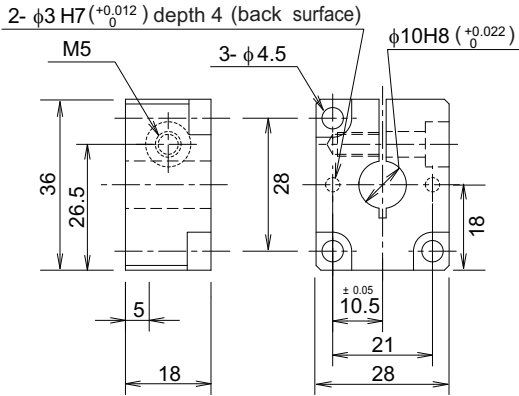
It is a bracket to fix the gripper body.

For GRSS/GRLS

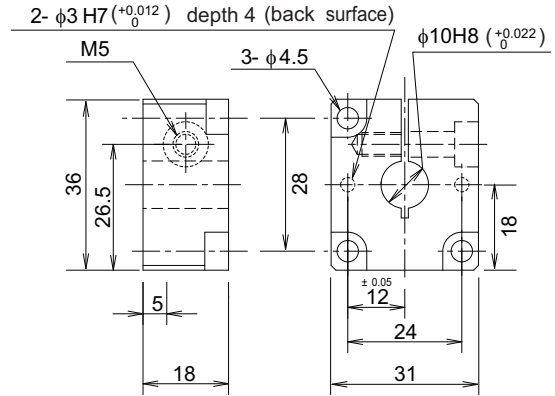
Model code of single product : RCP2-FB-GRSS



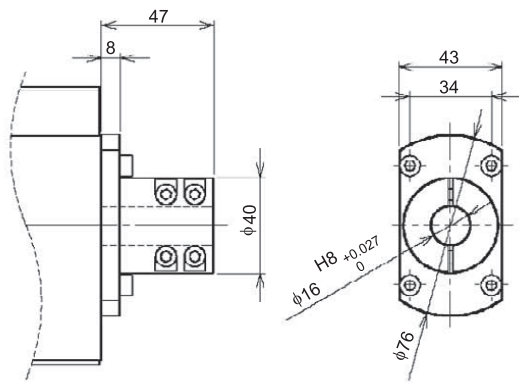
For GRS
Model code of single product : RCP2-FB-GRS



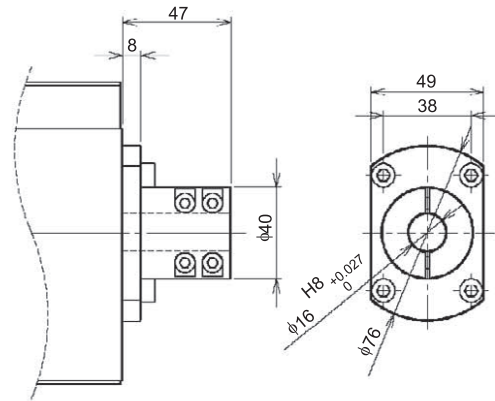
For GRM
Model code of single product : RCP2-FB-GRM



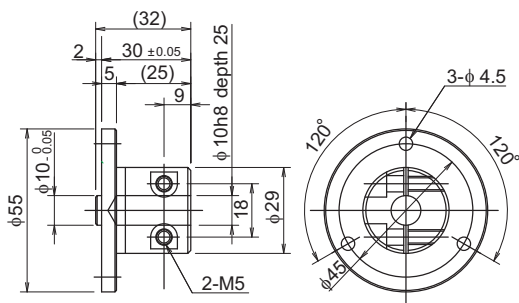
For GRHM
Model code of single product : RCP2-FB-GRHM



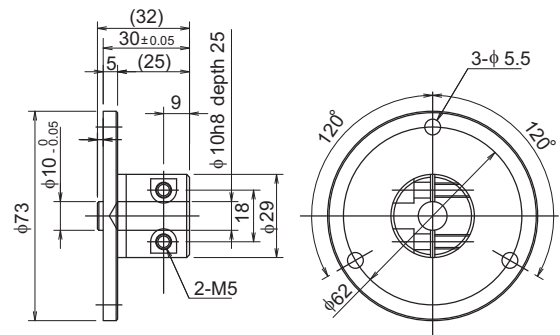
For GRHB
Model code of single product : RCP2-FB-GRHB



For GR3SS
Model code of single product : RCP2-FB-GRS



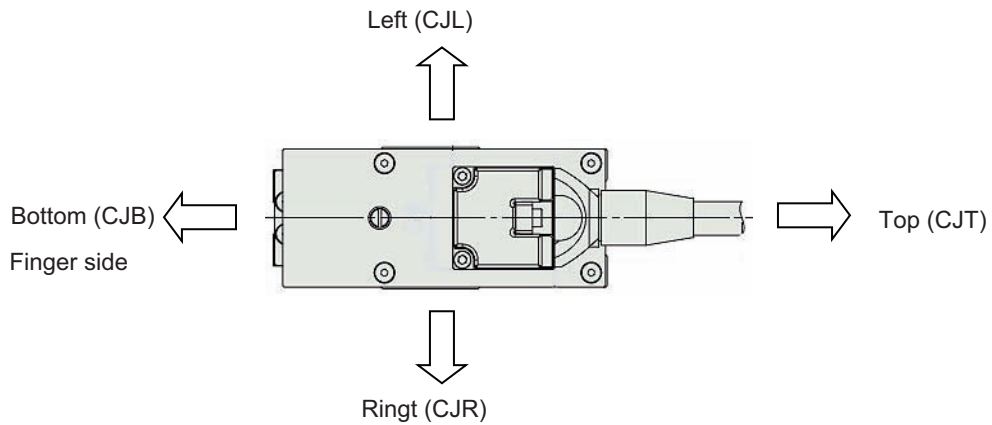
For GR3SM
Model code of single product : RCP2-FB-GRM



1.4.4 Cable Eject Direction Changed (Model: CJT, CJR, CJL, CJB)

Application: GRHM/GRHB

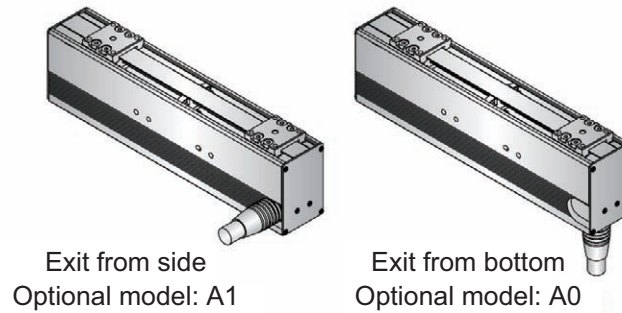
If a change in the cable ejection direction is made, the direction of cable ejection will be changed. There are four types of ejection directions, top (model code: CJT), right (model code: CJR), left (model code: CJL) and bottom (model code: CJB).



1.4.5 Cable Exit from Bottom and Cable Exit from Side (Model: A0, A1)

Application: GRST

If a change in the cable ejection direction is made, the direction of cable ejection will be changed. There are two types for the direction change, bottom (model: A0) and side (model: A1).



1.5 Motor • Encoder Cables

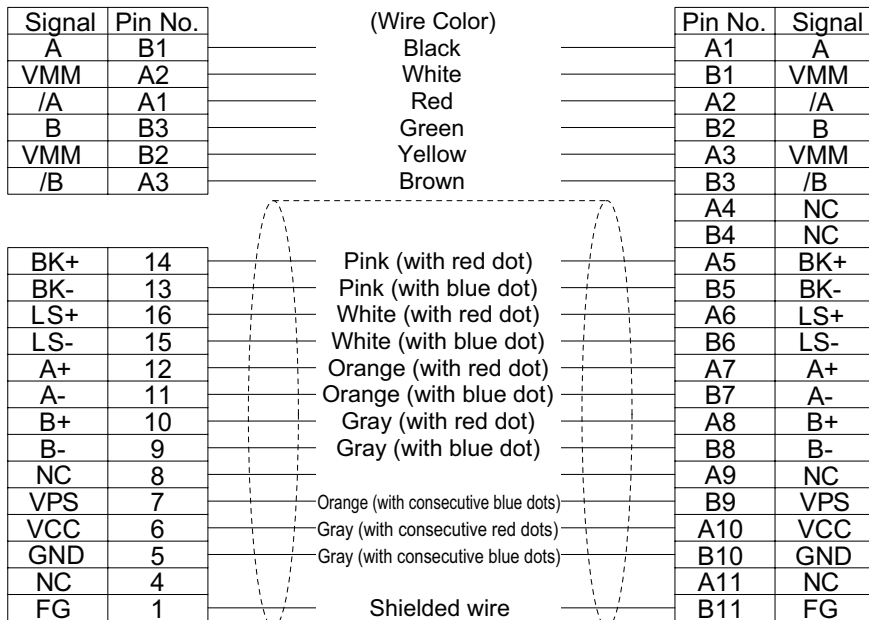
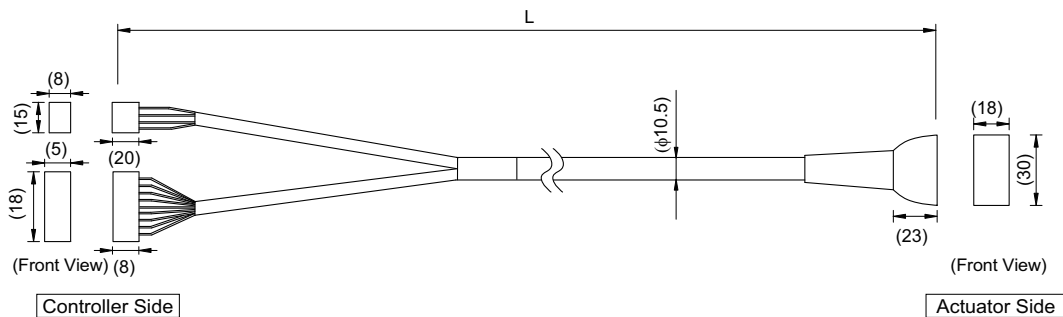
1.5.1 Small Slim Two-finger Slide Type (GRSS), Small Slim Two-finger Lever Type (GRLS), Two-finger Long-stroke Type (GRST), Two-finger Type with High Gripping Force (GRHM/GRHB)

[PSEL and PCON Controller (Except for PCON-CA)]

1) Motor • Encoder Integrated Cables Robot Type

Model: CB-PCS-MPA□□□

(□□□ indicates the cable length L Example: 020 = 2m), up to 20m

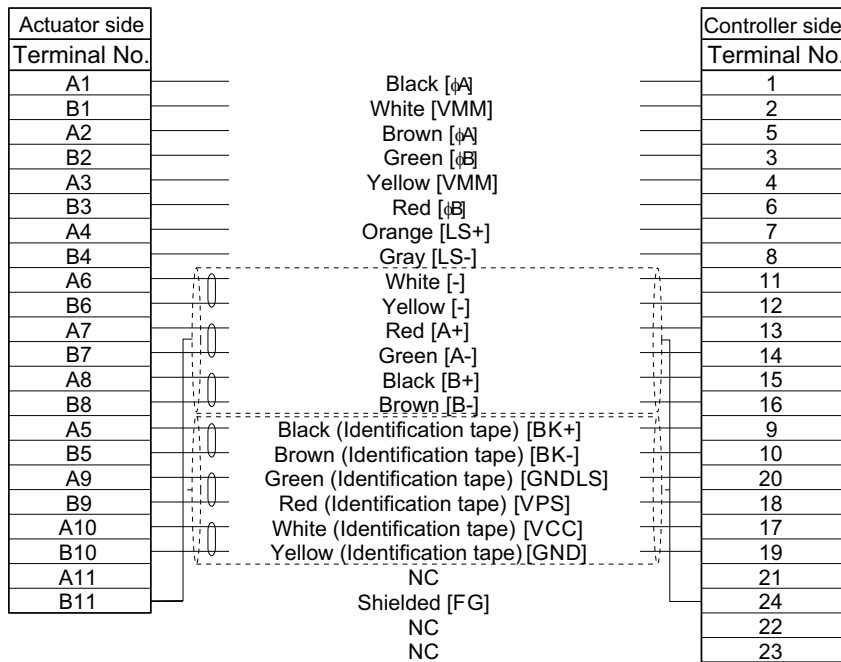
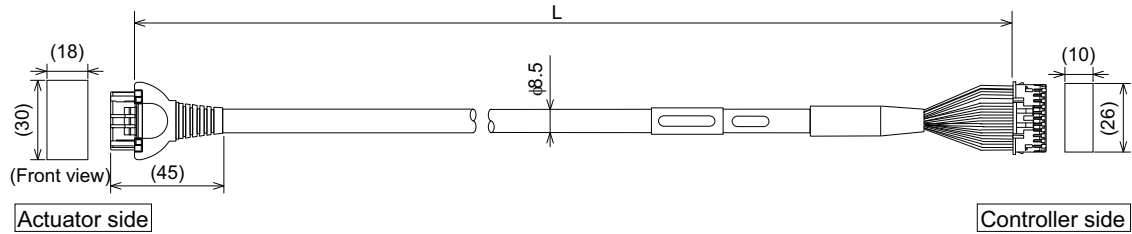


[PCON-CA, PMEC, PSEP and MSEP Controller]

1) Motor • Encoder Integrated Cables Robot Type

Model: CB-APSEP-MPA□□□ / CB-APSEP-MPA□□□-LC

(□□□ indicates the cable length L Example: 020 = 2m), up to 20m



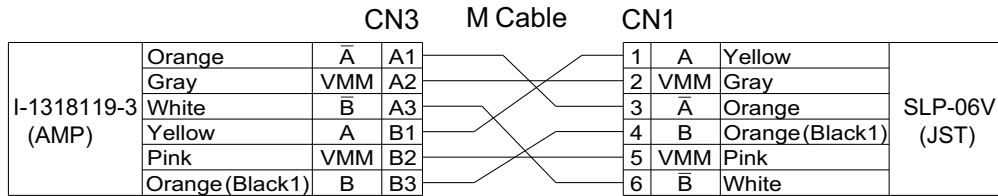
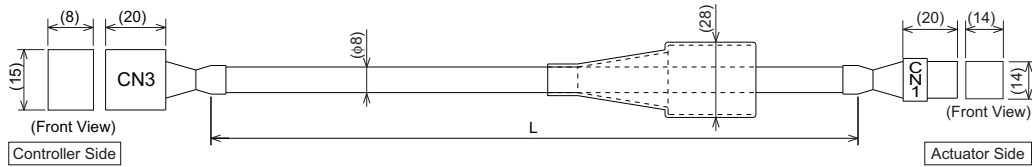
1.5.2 Small and Medium Two-finger Type (GRS/GRM), Three-finger Slide Type (GR3SS/GR3SM), Three-finger Lever Type (GR3LS/GR3LM)

[PSEL, PCON controller (Except for PCON-CA)]

1) Motor Cable

Model: CB-RCP2-MA□□□

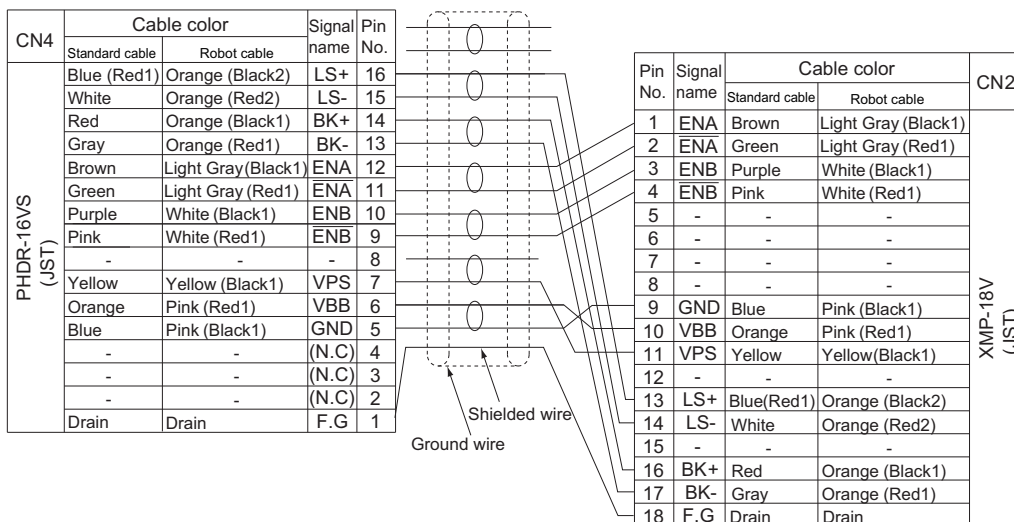
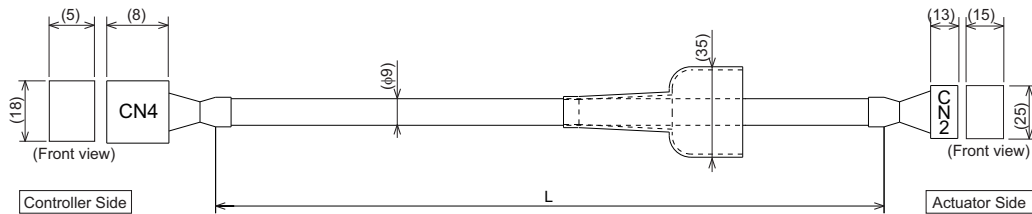
(□□□ indicates the cable length L Example: 020 = 2m), up to 20m



2) Encoder Cable / Encoder Cable Robot Type

Model: CB-RCP2-PB□□□ / CB-RCP2-PB□□□-RB

(□□□ indicates the cable length L Example: 020 = 2m), up to 20m

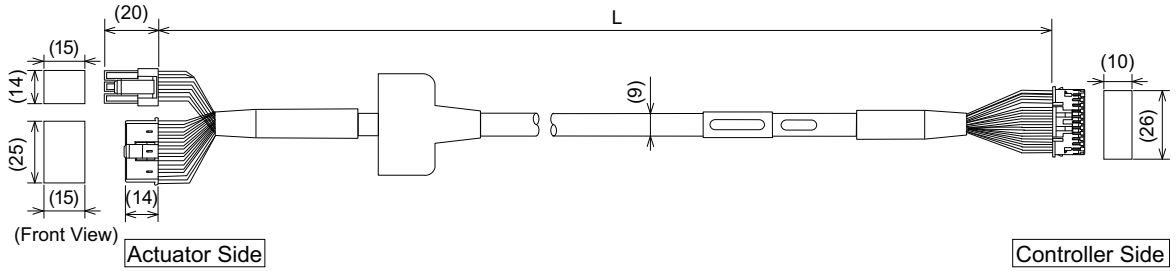


[PCON-CA, PMEC, PSEP and MSEP Controller]

1) Motor • Encoder Integrated Cables

Model: CB-PSEP-MPA□□□

(□□□ indicates the cable length L Example: 020 = 2m), up to 20m



Actuator Side Terminal No.		Controller Side Terminal No.
1	Black [ϕ A]	1
2	White [VMM]	2
4	Red [ϕ B]	3
5	Green [VMM]	4
3	Brown [ϕ /A]	5
6	Yellow [ϕ /B]	6
16	Orange [BK+]	9
17	Gray [BK-]	10
5	NC	11
6	NC	12
13	Black [LS+]	7
14	Brown [LS-]	8
1	White [A+]	13
2	Yellow [A-]	14
3	Red [B+]	15
4	Green [B-]	16
10	White (Identification tape) [VCC]	17
11	Yellow (Identification tape) [VPS]	18
9	Red (Identification tape) [GND]	19
12	Green (Identification tape) [(Spare)]	20
15	NC	21
7	NC	22
8	NC	23
18	Shielded wire [FG]	24

2. Installation

2.1 Transportation

[1] Handling of the Actuator

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

(1) Handling the Packed Unit

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

(2) Handling the Actuator After Unpacking

- Do not carry the actuator by its motor unit or its cable or attempt to move it by pulling the cable.
- Hold the frame or motor cover section of the body when transporting the actuator main body.
- Do not hit or drop the actuator during transportation.
- Do not attempt to force any part of the actuator. Do not apply excess force especially on the fingers, finger guide and levers.

[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.

(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 finger so they would not accidentally move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up with ropes, have appropriate cushioning to avoid any deformation of the actuator body. Also keep it in stable horizontal orientation. Make a fixture utilizing the attachment holes and the tapped holes on the actuator body if necessary.
- Do not attempt to apply load on the actuators 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 finger so it would not move during transportation.
- If the tip of an actuator is overhanging, have an appropriate way to fix it to avoid shake due to the external vibration. In the transportation without the tip being fixed, do not apply any impact with 0.3G or more.
- When hanging up the machinery equipment (system) with ropes, do not attempt to apply load on the actuators 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. 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 relative humidity larger than 85%RH
- Where the actuator receives direct sunlight
- Where the actuator is exposed to corrosive or combustible gases
- Where the ambient air contains a large amount of powder dust, salt or iron (at level exceeding what is normally expected in an assembly plant)
- Where the actuator is subject to splashed water, oil (including oil mist or cutting fluid) or chemical solutions
- Where the actuator receives impact or vibration
- Place with an altitude of 2,000m or more

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


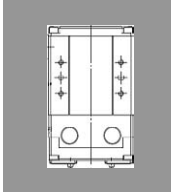
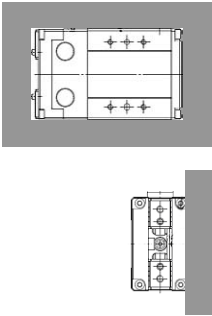

This chapter explains how to install the actuator on your mechanical system.

2.3.1 Installation

○ : Possible × : Not possible

Horizontal installation	Vertical installation	Sideways installation	Ceiling Mount installation
○	○	○	○

Installation Orientation

Horizontal	Vertical	Sideways	Ceiling Mount
			

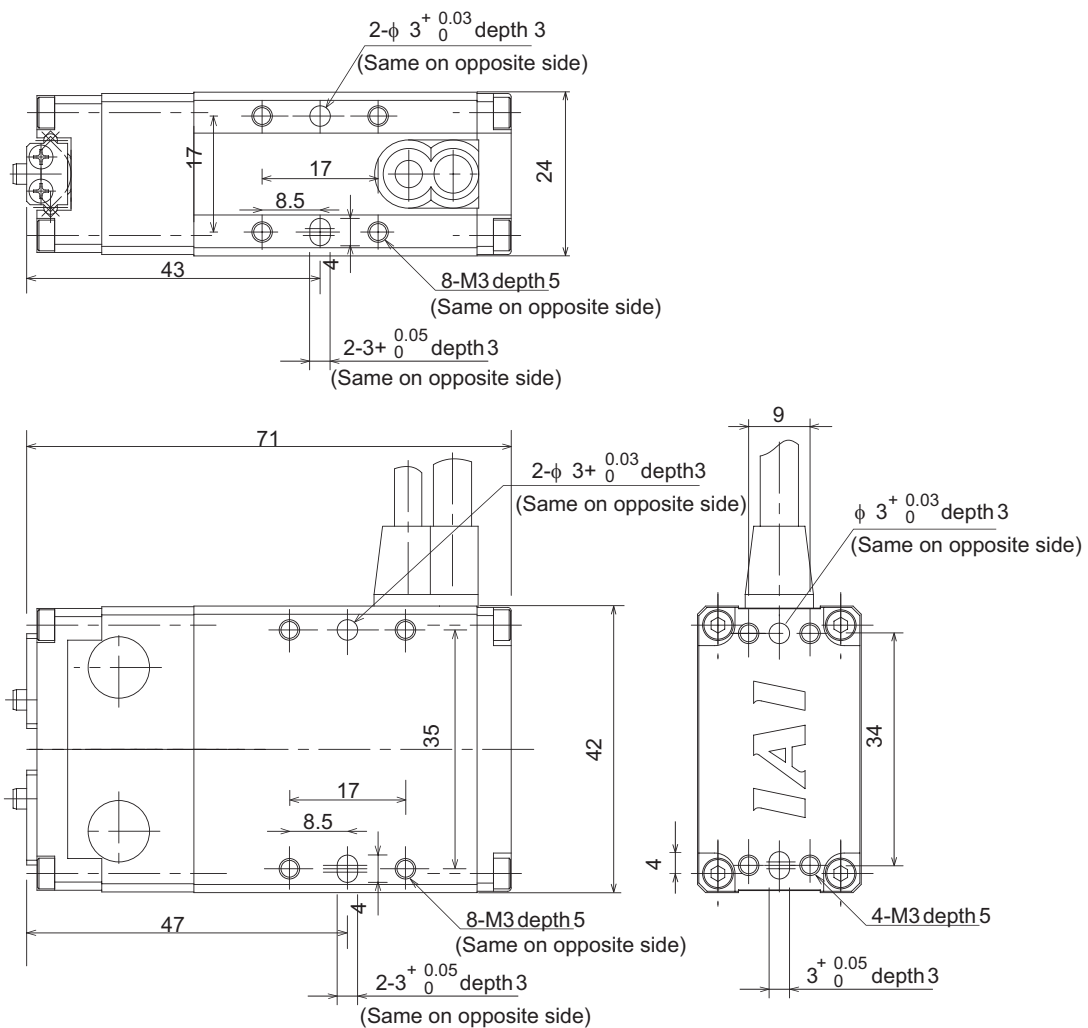
2.3.2 Installation of the Main Unit

The surface on which the gripper is installed must be machined or otherwise have a flat surface of equivalent precision.

- The effective thread depths of holes will vary depending on the gripper model and installation surface. Determine the lengths of screws to be used by referring to the figure below. (Never use long screws exceeding the effective thread depth. They may damage the mechanical or electrical parts inside the gripper.)
- Round and elongated holes are provided in each mounting surface for receiving positioning pins. Use these holes as necessary.

[1] GRSS

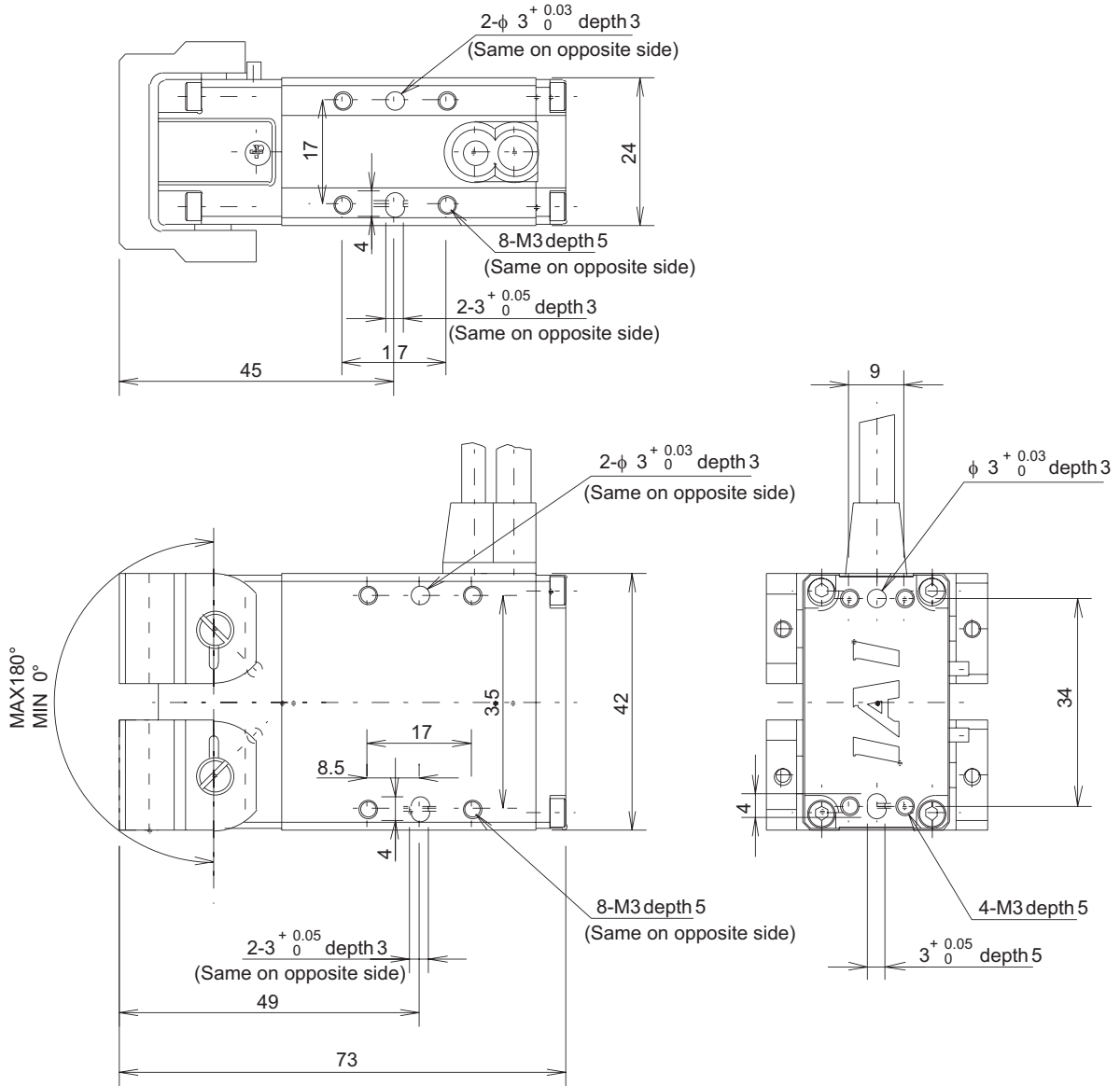
The actuator can be mounted and affixed on five surfaces.



 **Caution:** Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

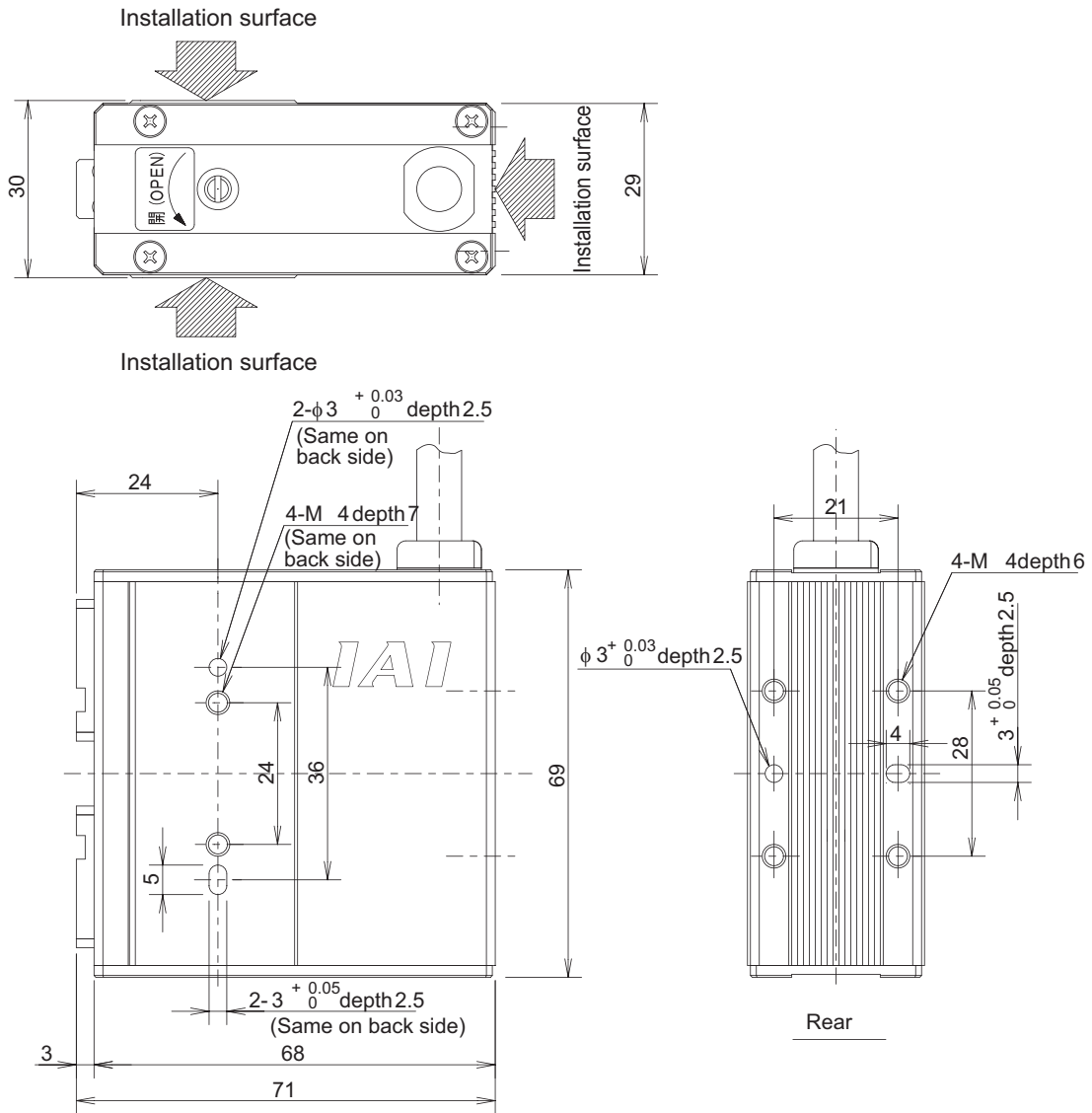
[2] GRLS

The actuator can be mounted and affixed on five surfaces.



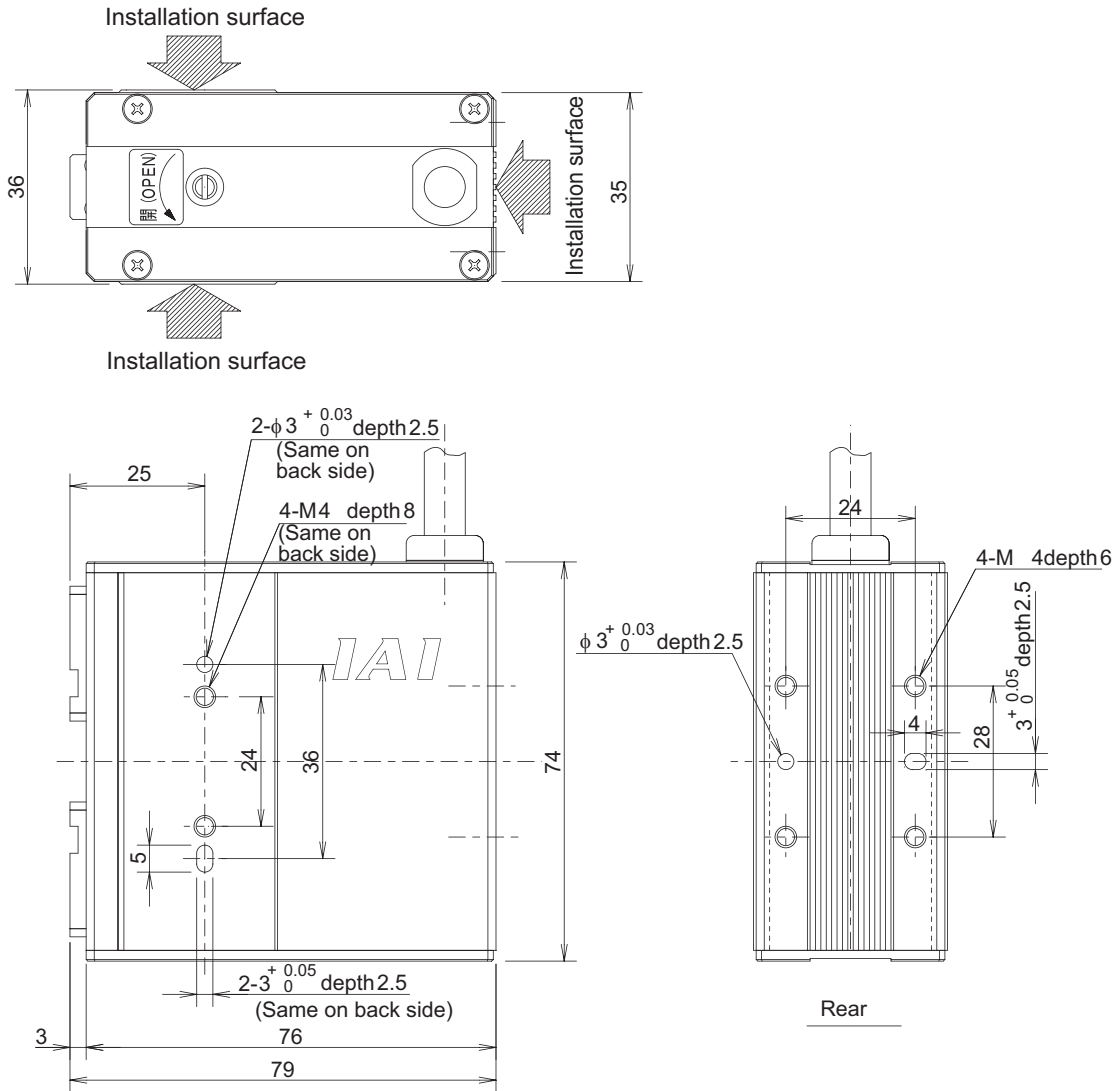
Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

[3] GRS



⚠ Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

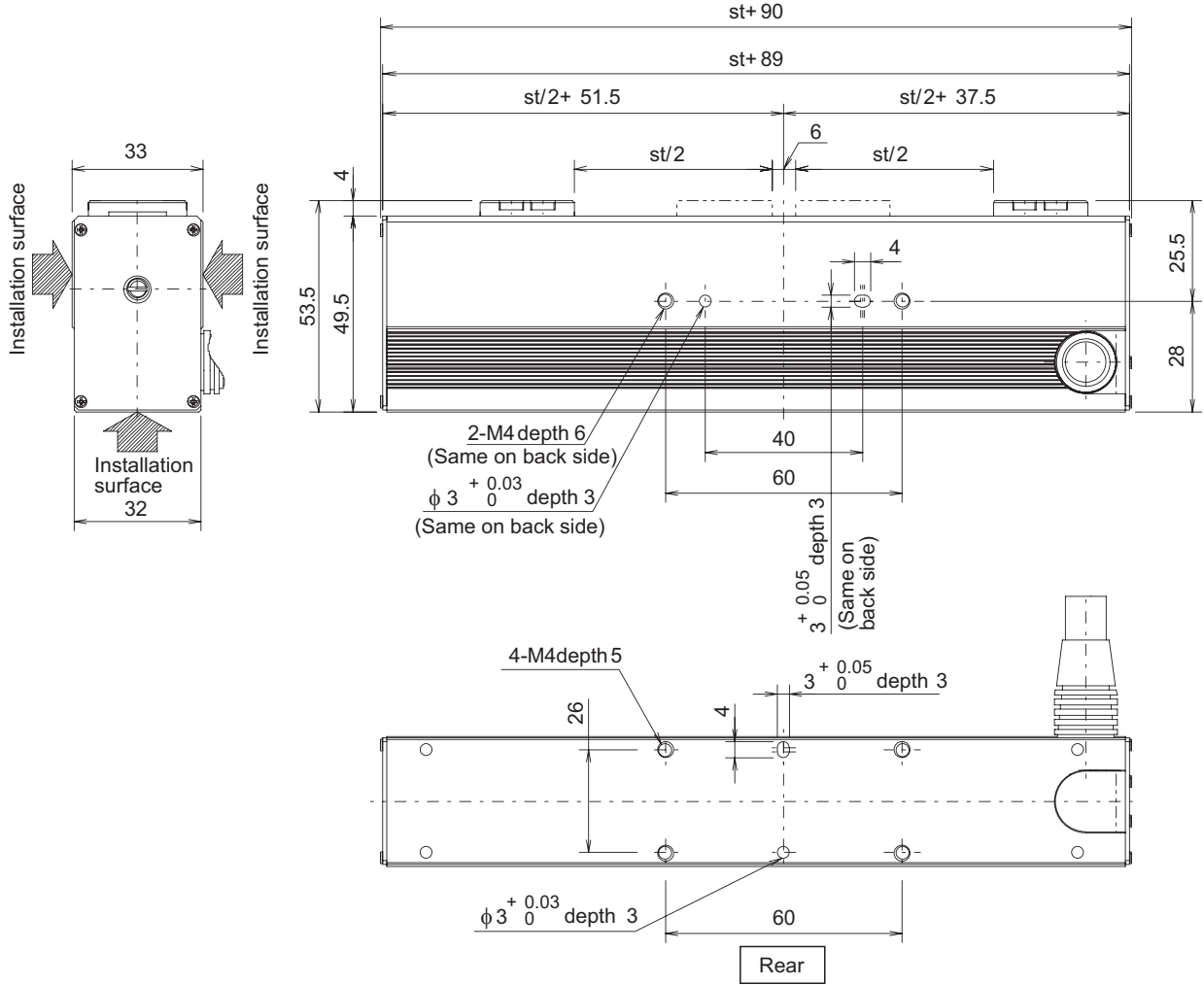
[4] GRM



Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

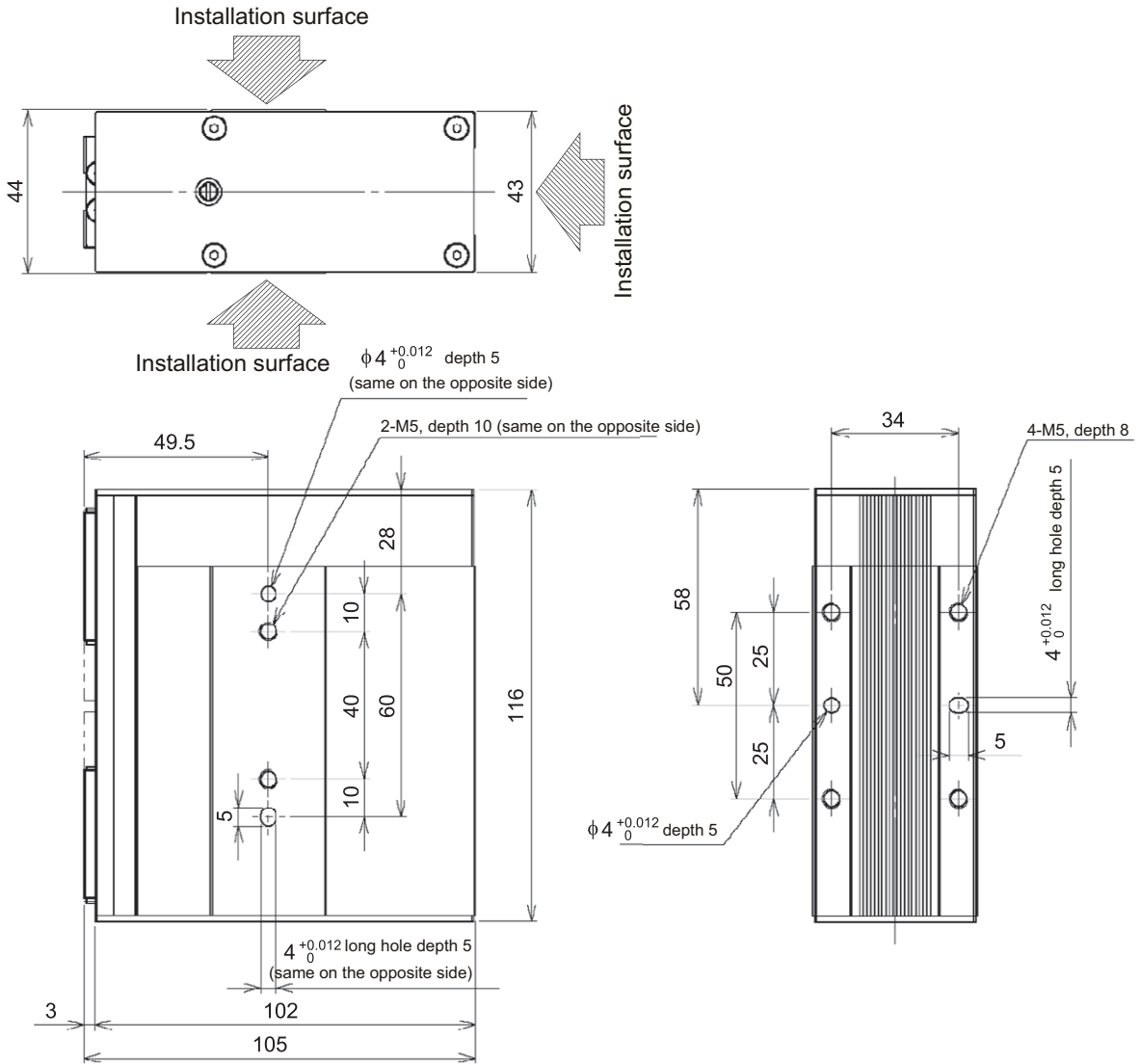
[7] GRST

st: Stroke 40, 60, 80, 100



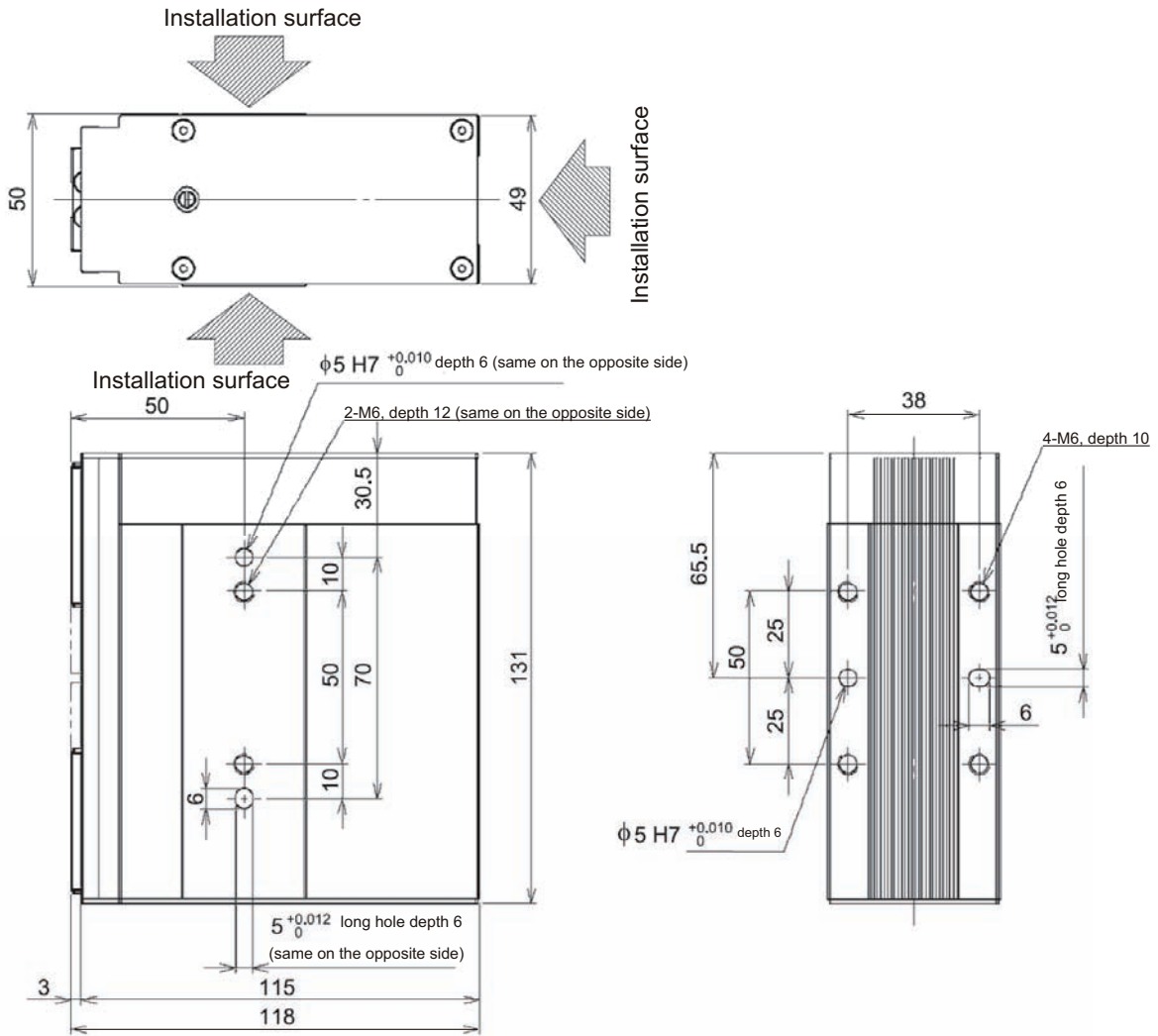
Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

[5] GRHM



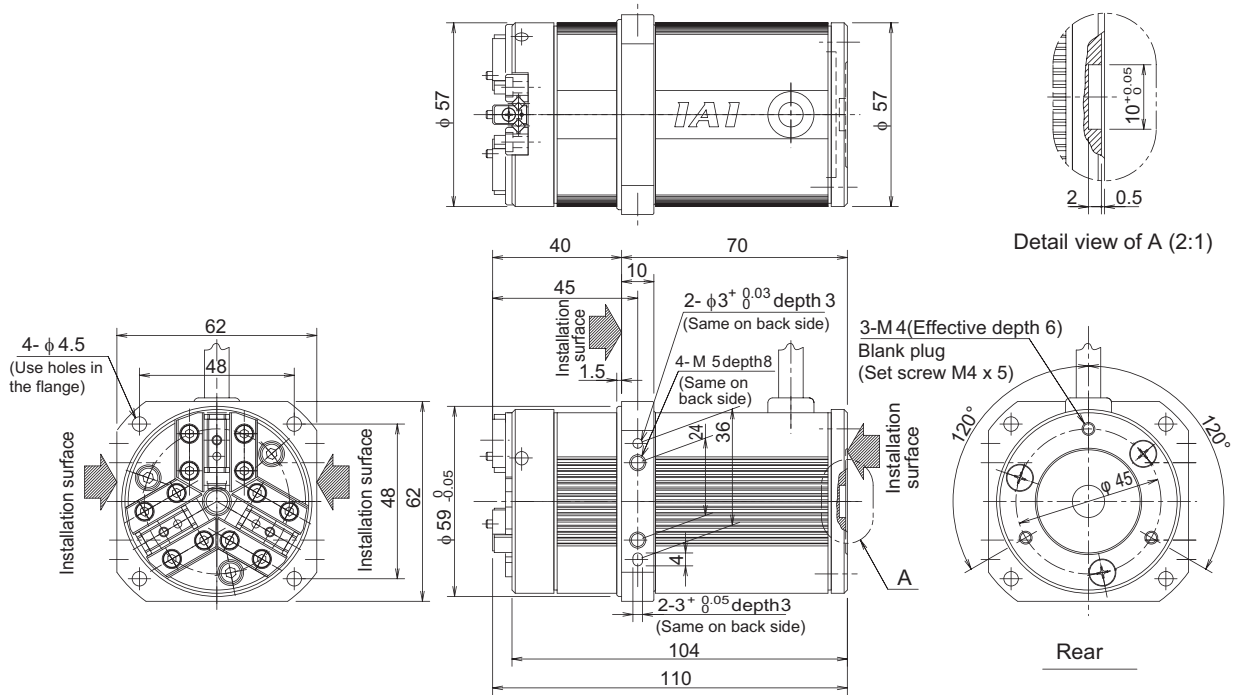
⚠ Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

[6] GRHB



⚠ Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

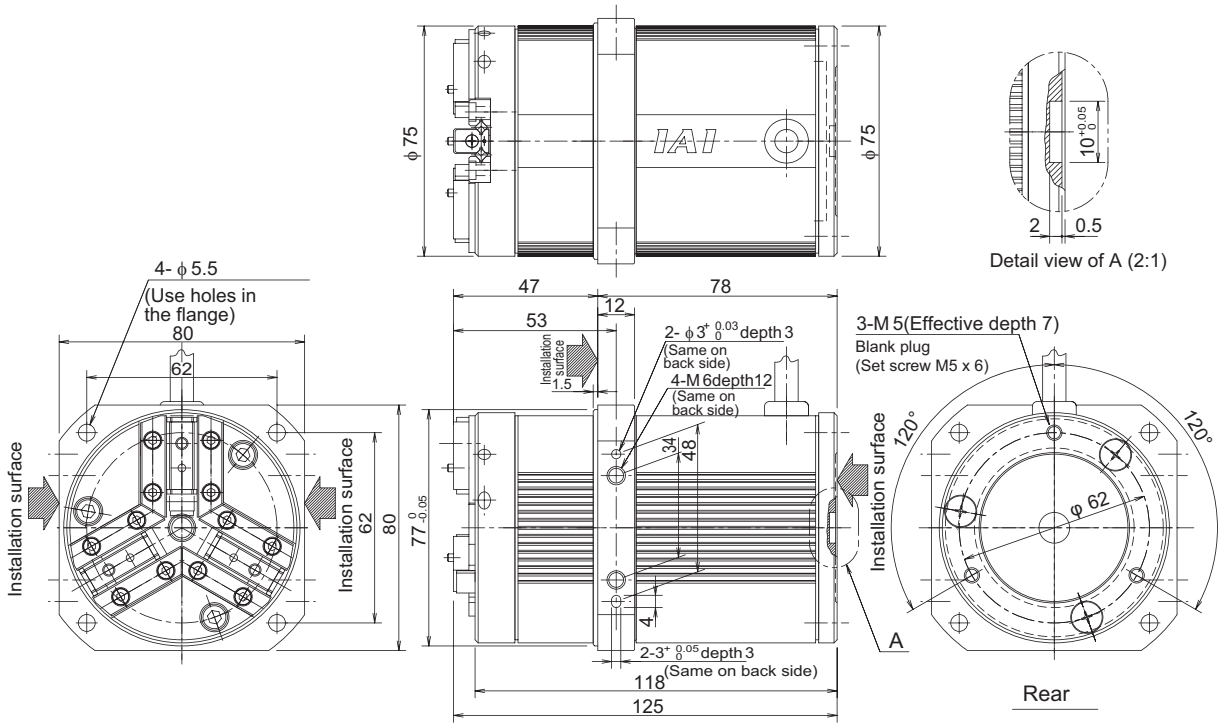
[8] GR3SS



(Note) If the gripper is installed from the rear side, remove the blank plugs from the tapped holes.

Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

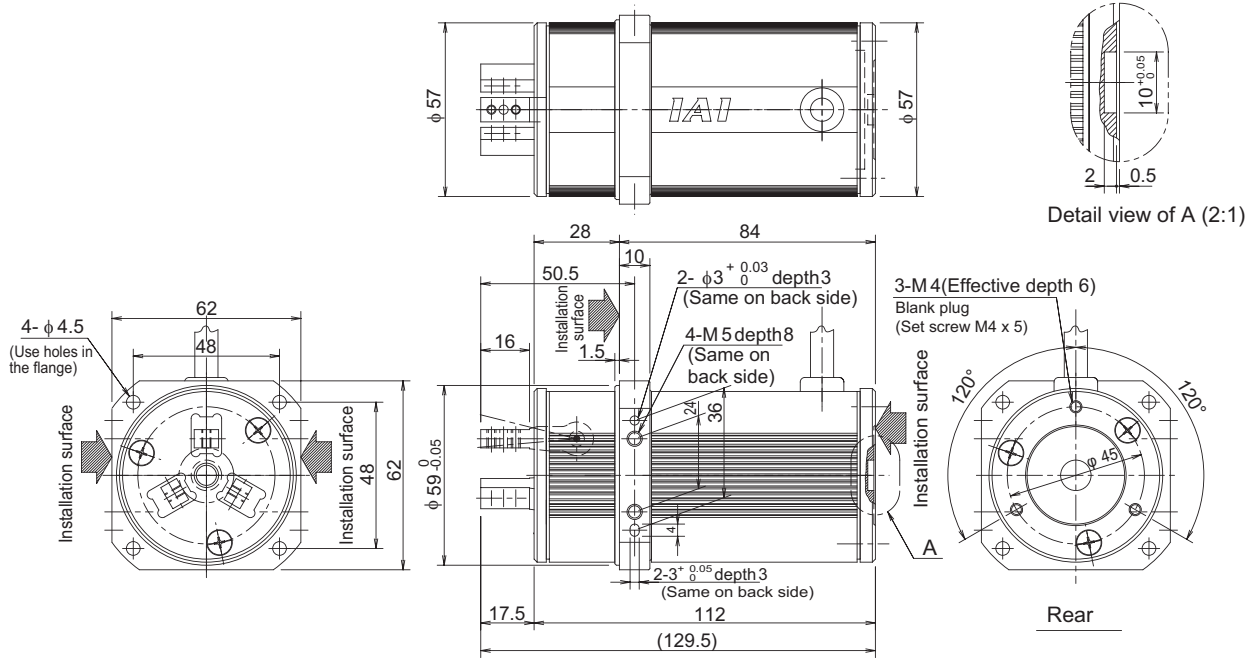
[9] GR3SM



(Note) If the gripper is installed from the rear side, remove the blank plugs from the tapped holes.

Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

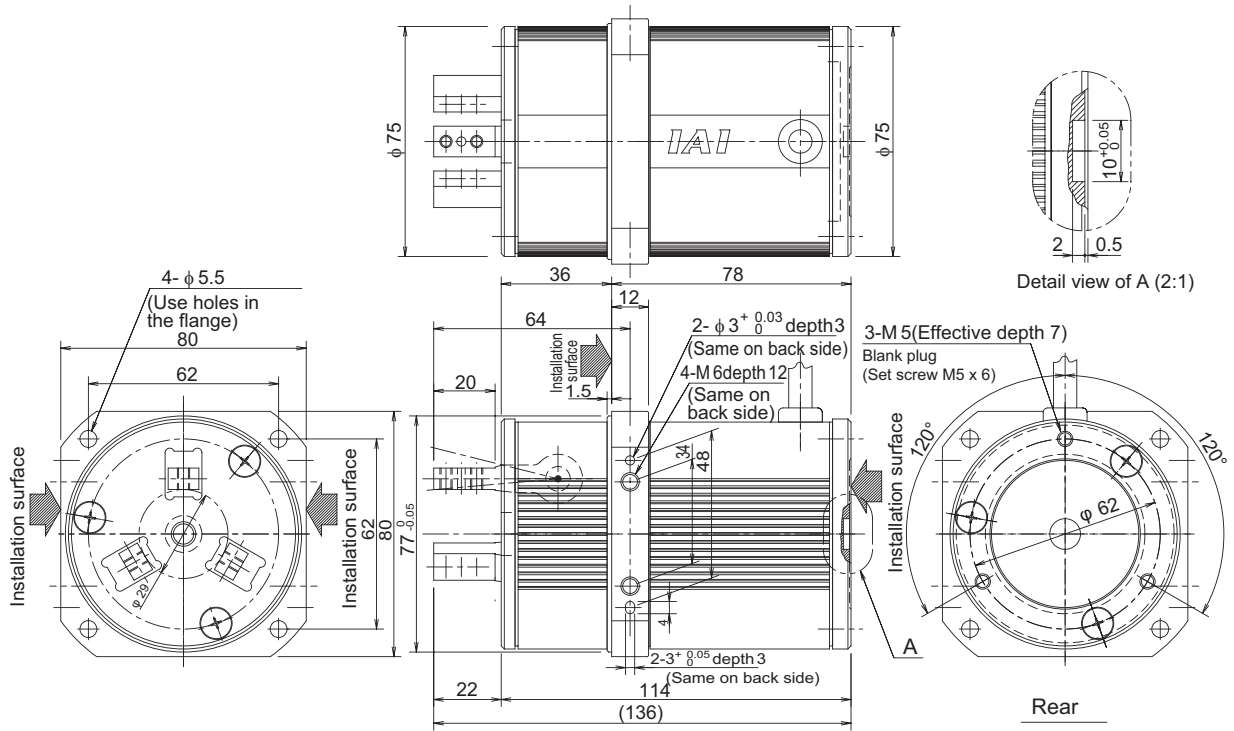
[10] GR3LS



(Note) If the gripper is installed from the rear side, remove the blank plugs from the tapped holes.

Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

[11] GR3LM



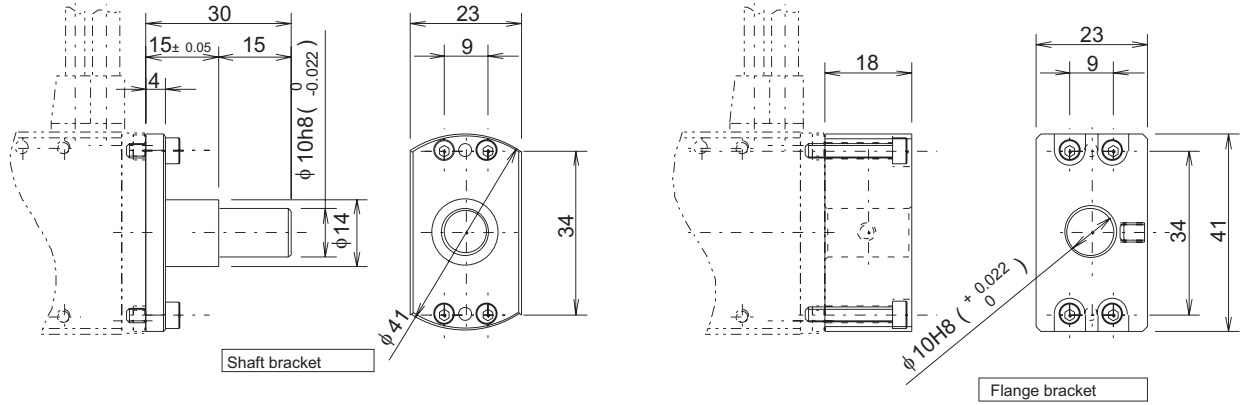
(Note) If the gripper is installed from the rear side, remove the blank plugs from the tapped holes.

Caution: Some of the tapped holes used for installing the gripper are through holes. Therefore, never use long screws exceeding

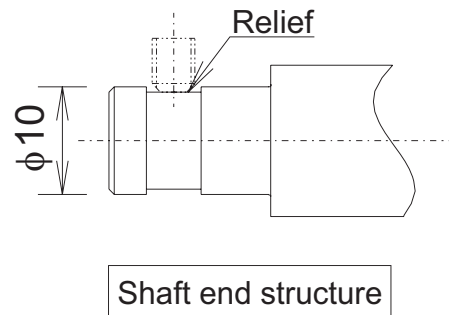
2.3.3 Gripper Brackets (Optional)

Optional brackets that can be installed on the rear face of the gripper are available. The external dimensions of each optional bracket are shown below.

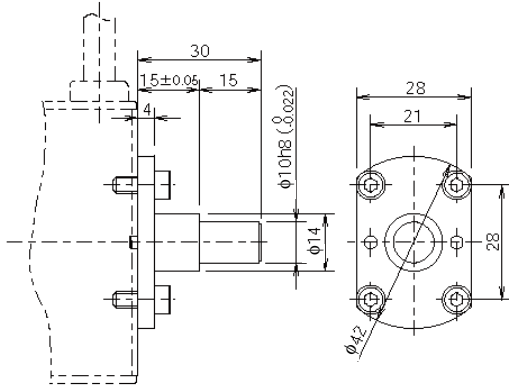
[1] GRSS/GRLS



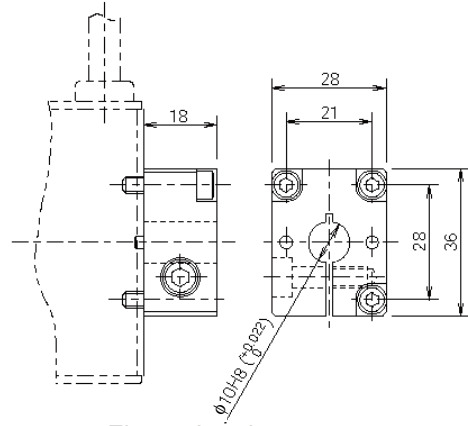
* If a flange bracket is used, it is recommended that a relief space be provided at the shaft end structure of the mating part as shown in the figure on the right.



[2] GRS

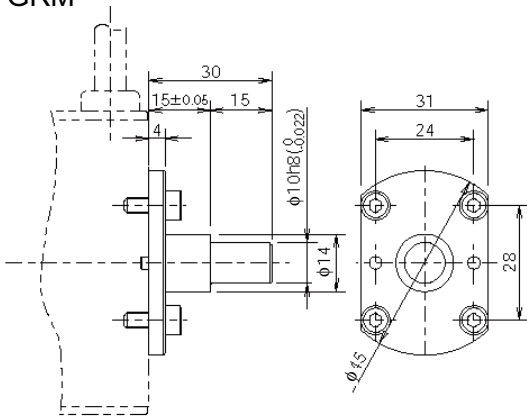


Shaft bracket

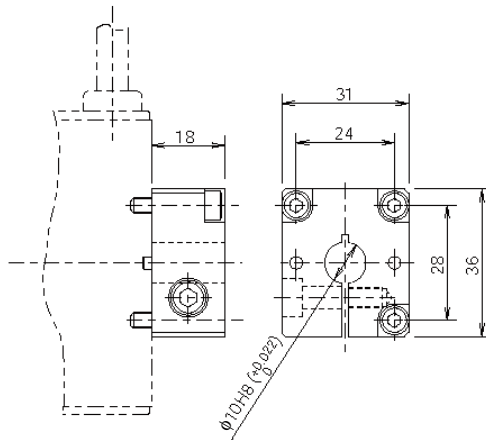


Flange bracket

[3] GRM

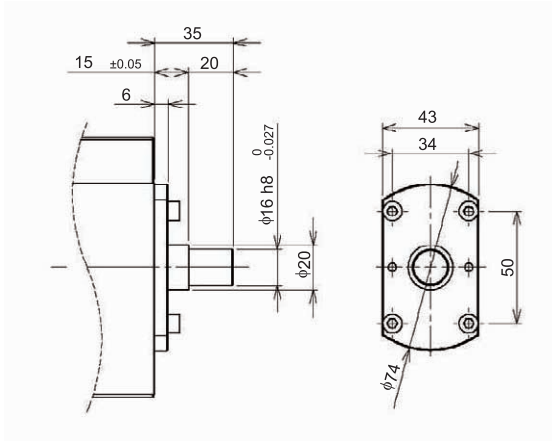


Shaft bracket

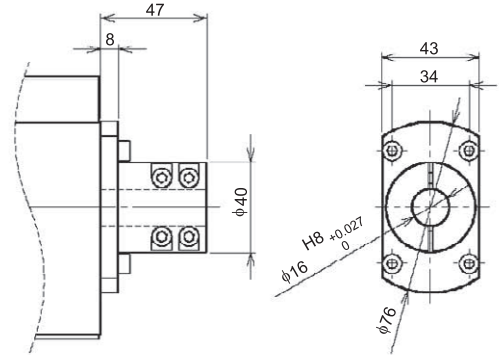


Flange bracket

[4] GRHM

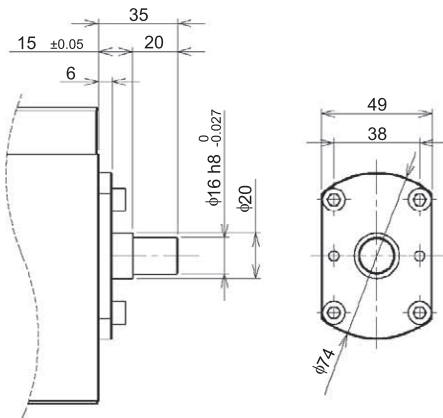


Shaft bracket

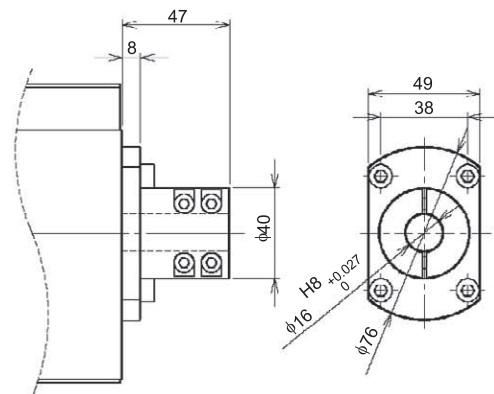


Flange bracket

[5] GRHB

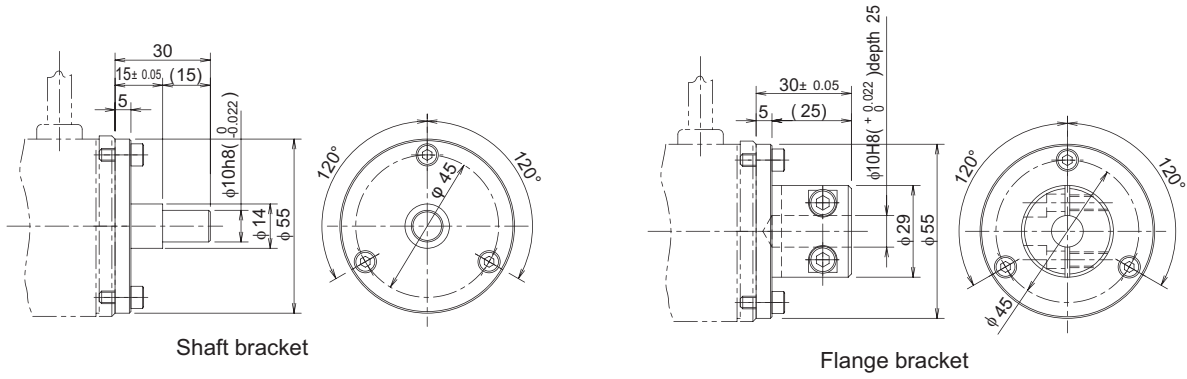


Shaft bracket



Flange bracket

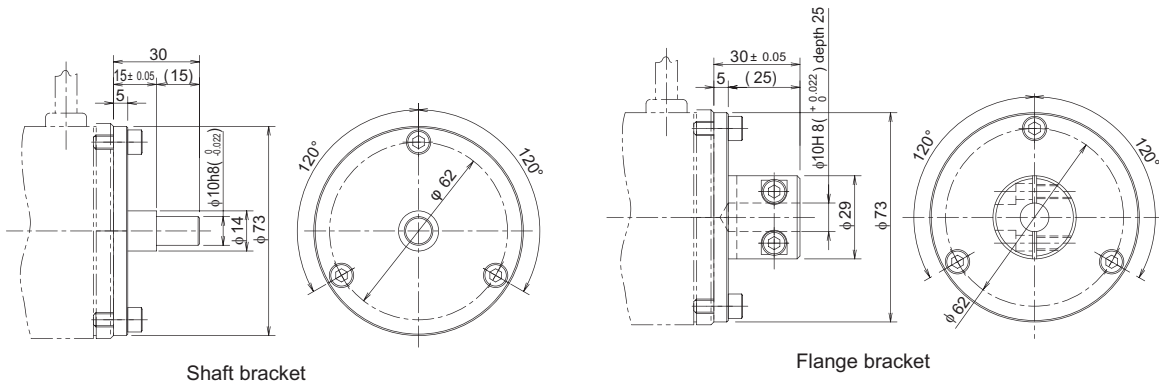
[6] GR3SS/GR3LS



Shaft bracket

Flange bracket

[7] GR3SM/GR3LM



Shaft bracket

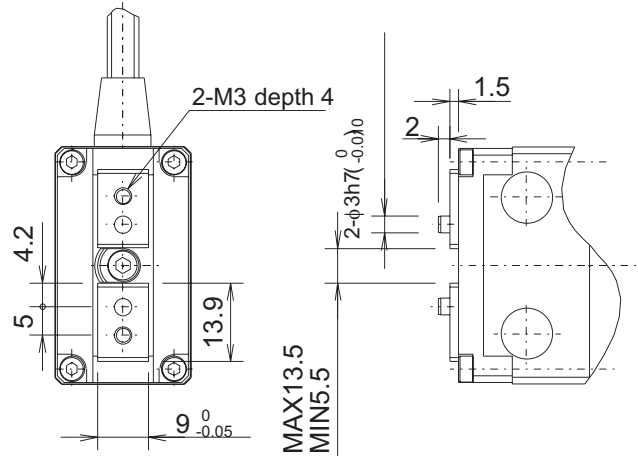
Flange bracket

2.3.4 Installation of Finger Attachments

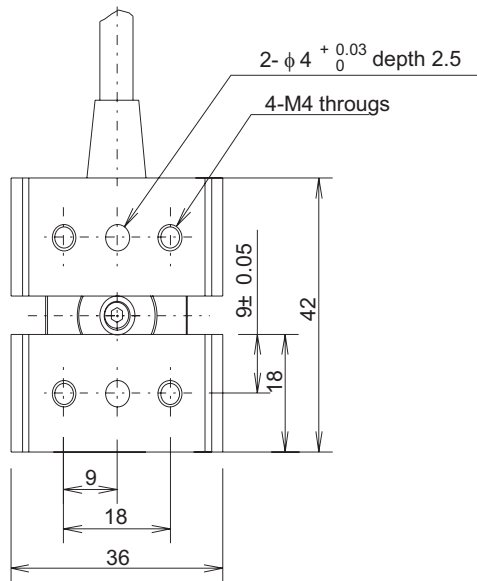
The finger attachments are provided by the customer.

[1] Installation dimensions for finger attachments

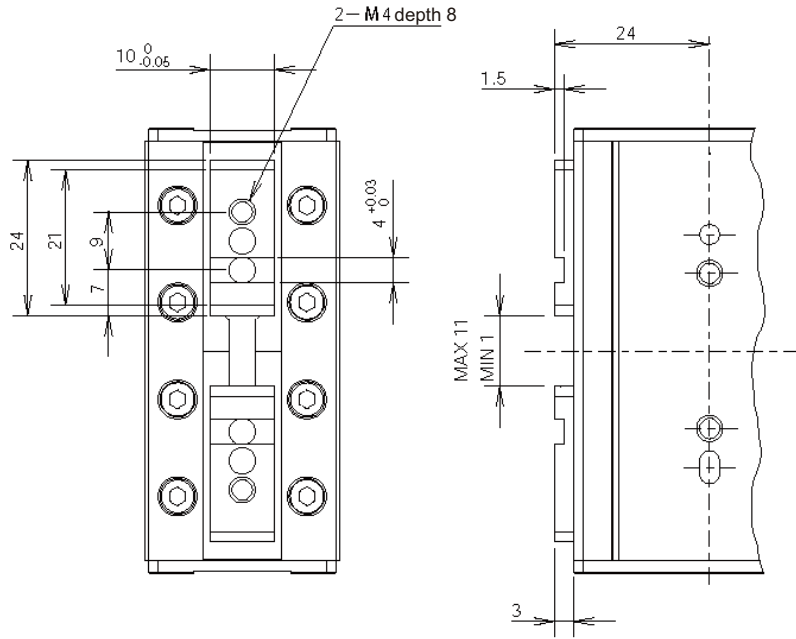
• GRSS



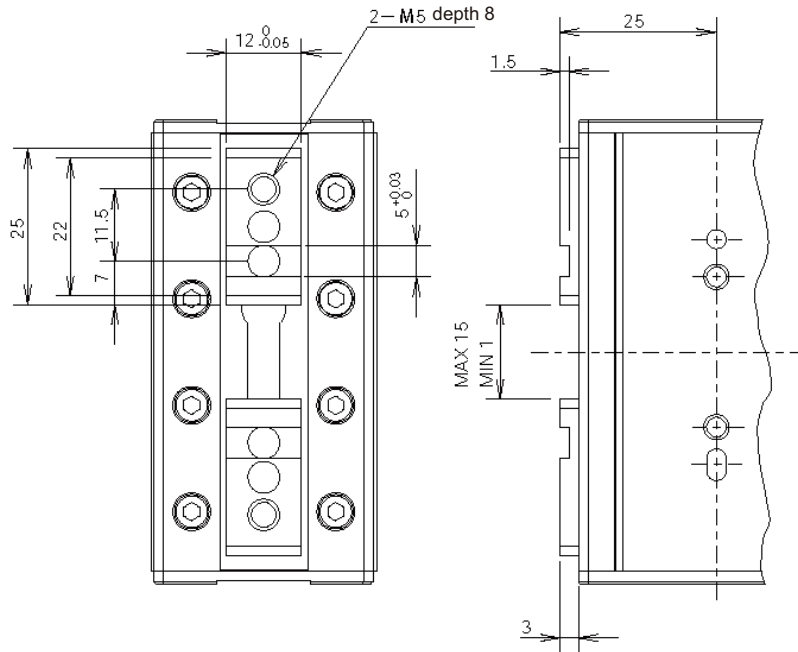
• GRLS



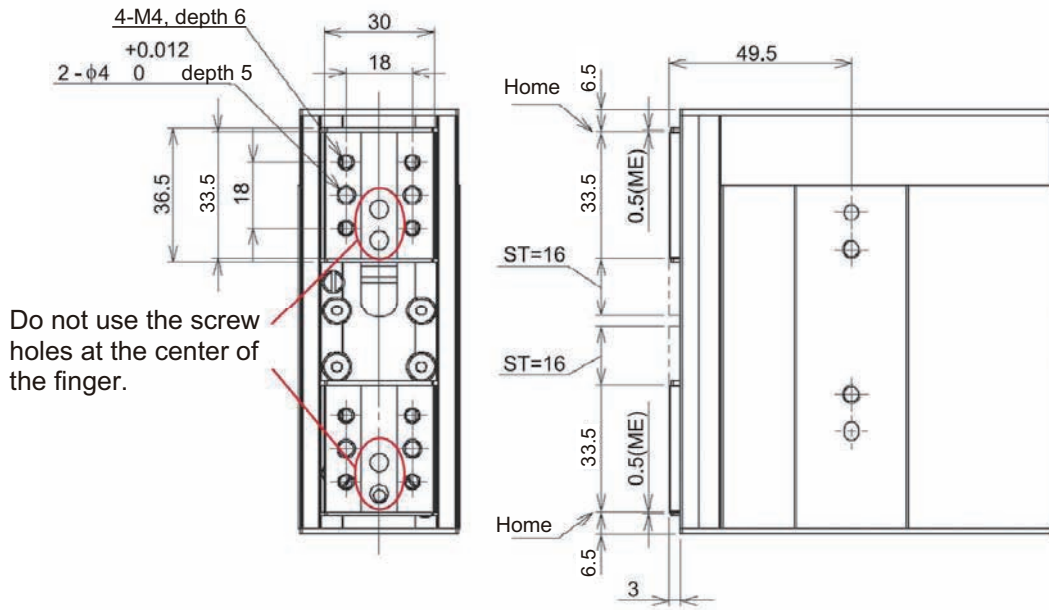
• GRS



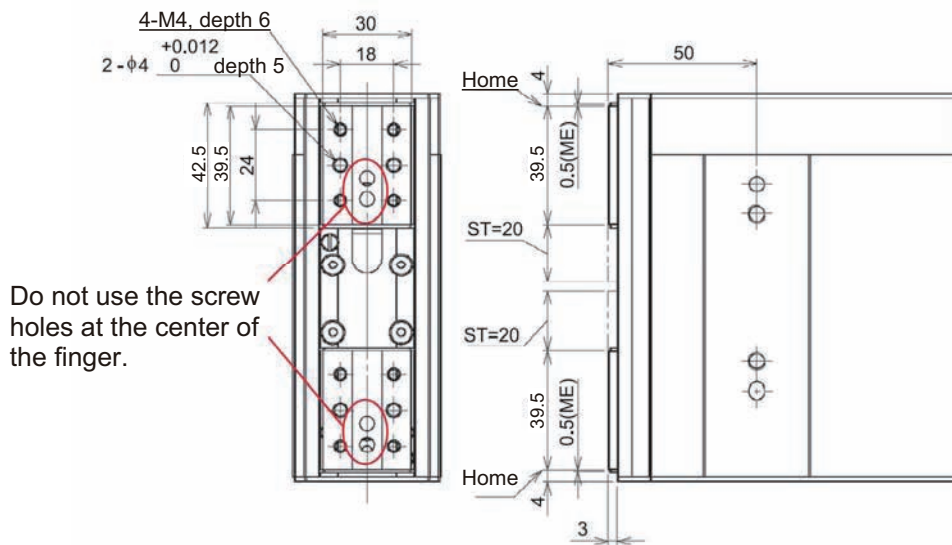
• GRM



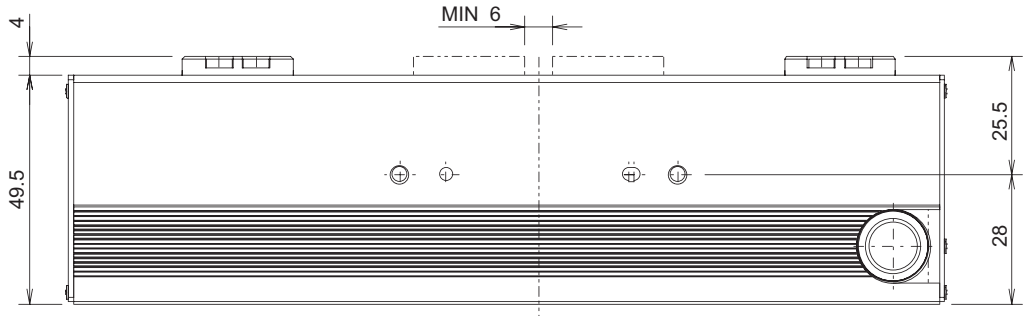
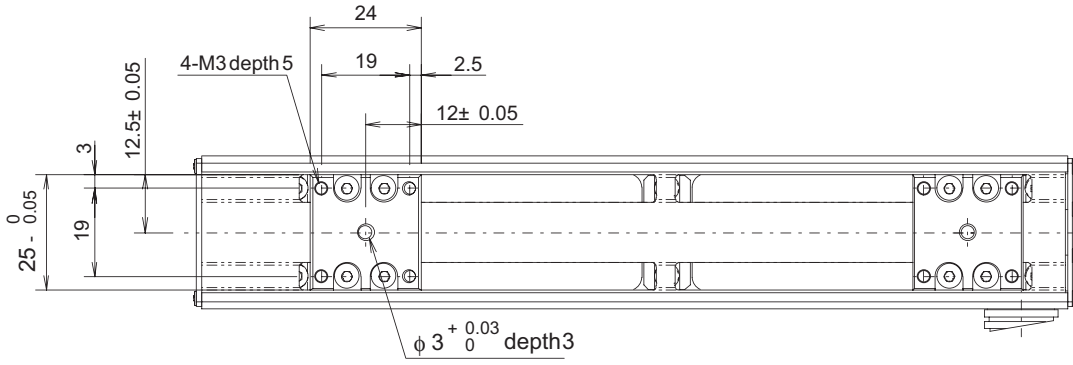
• GRHM



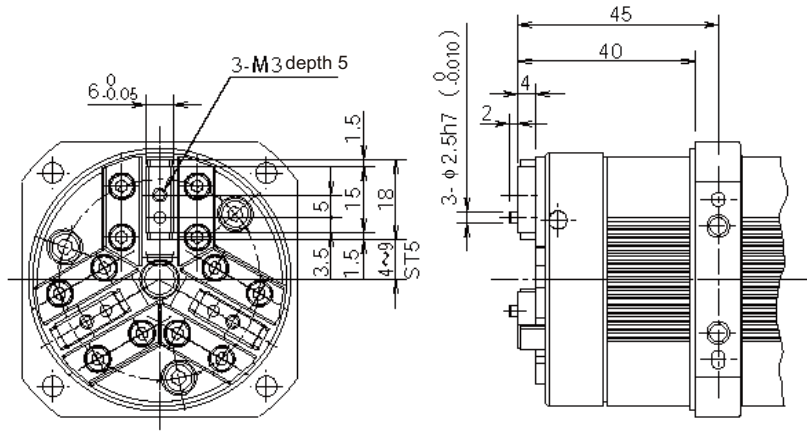
• GRHB



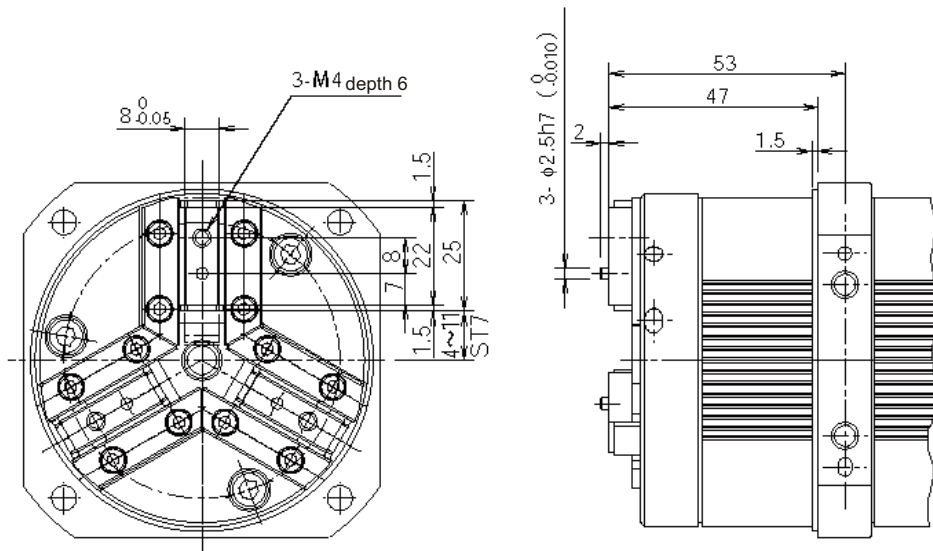
• GRST



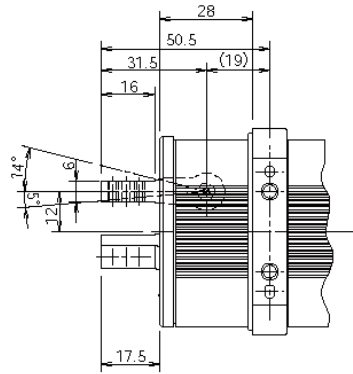
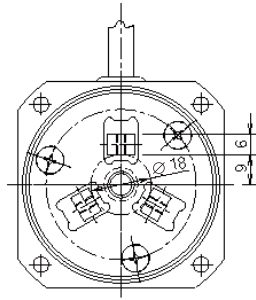
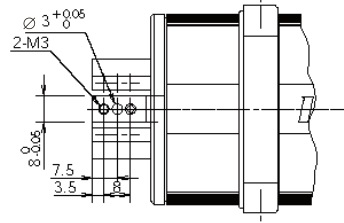
• GR3SS



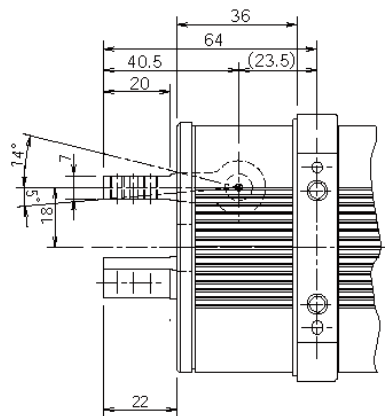
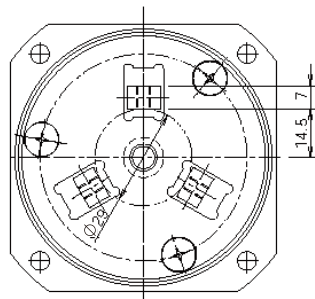
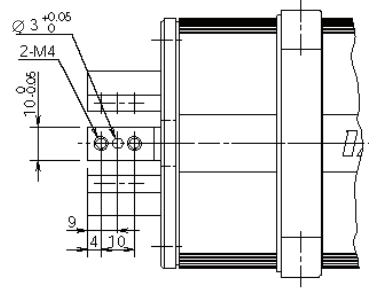
• GR3SM



• GR3LS



• GR3LM

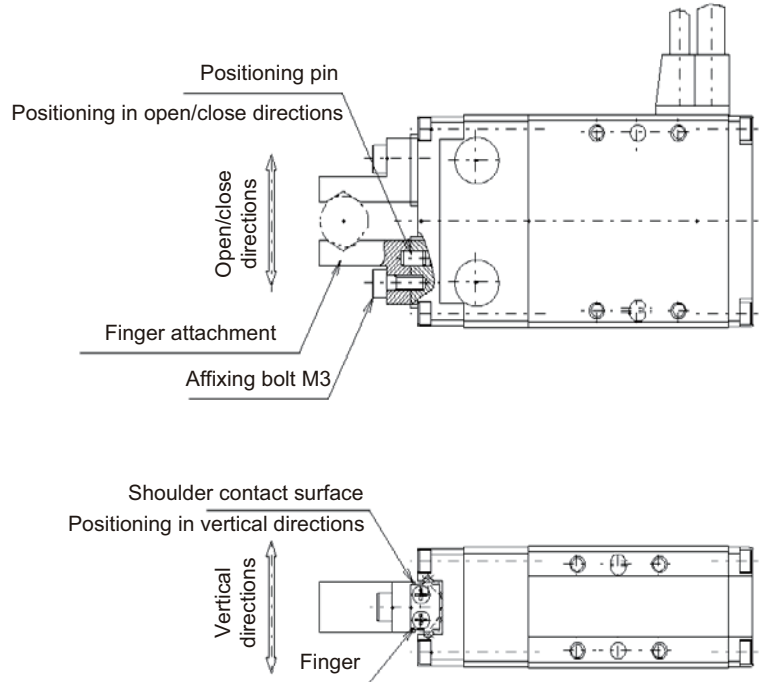


[2] Positioning in open/close and vertical directions

To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

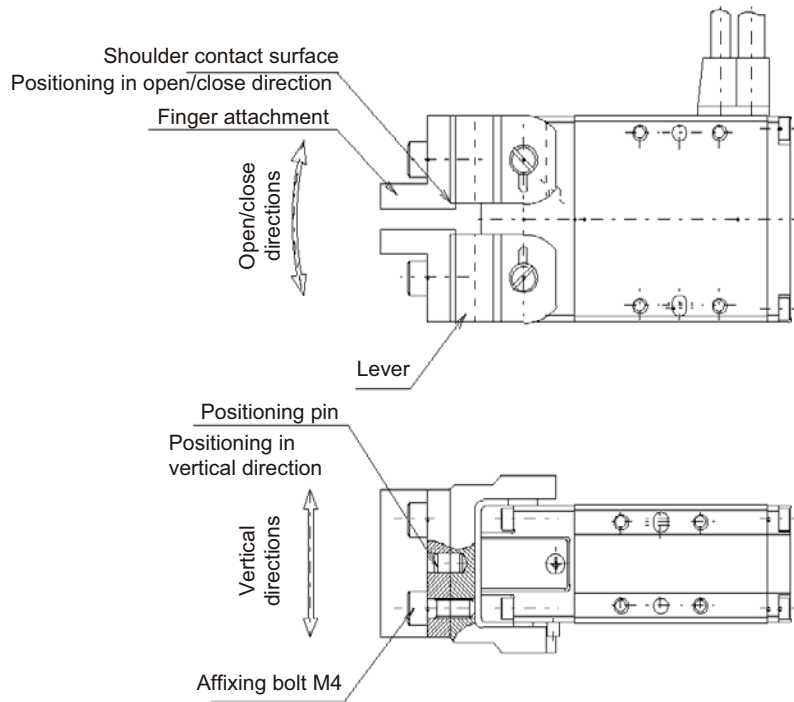
It is also recommended that a clearance of 3 mm or more be provided between the attachments so that the gripped work part can be removed by turning the opening/closing screw in the event of power outage.

- GRSS

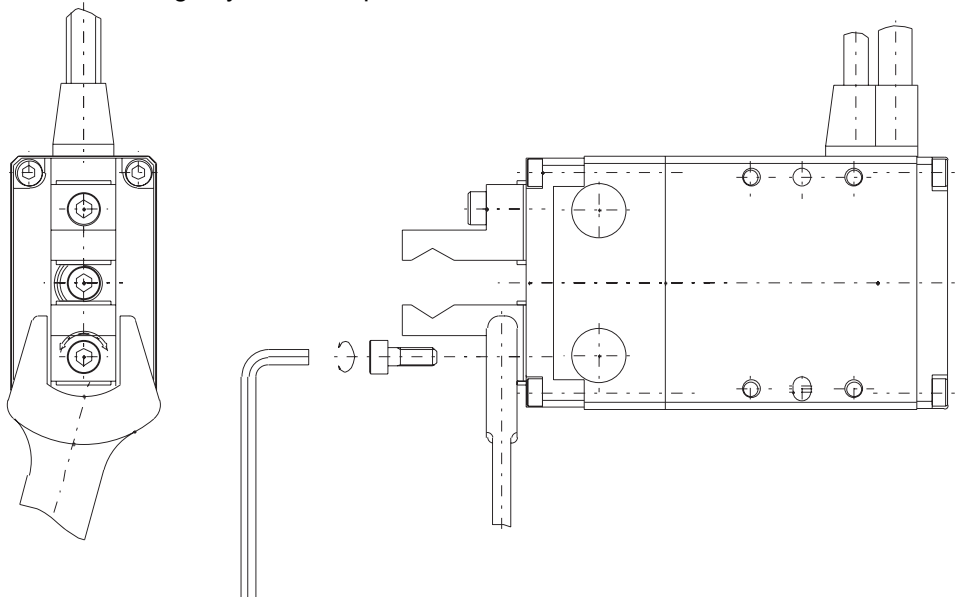


To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

- GRLS

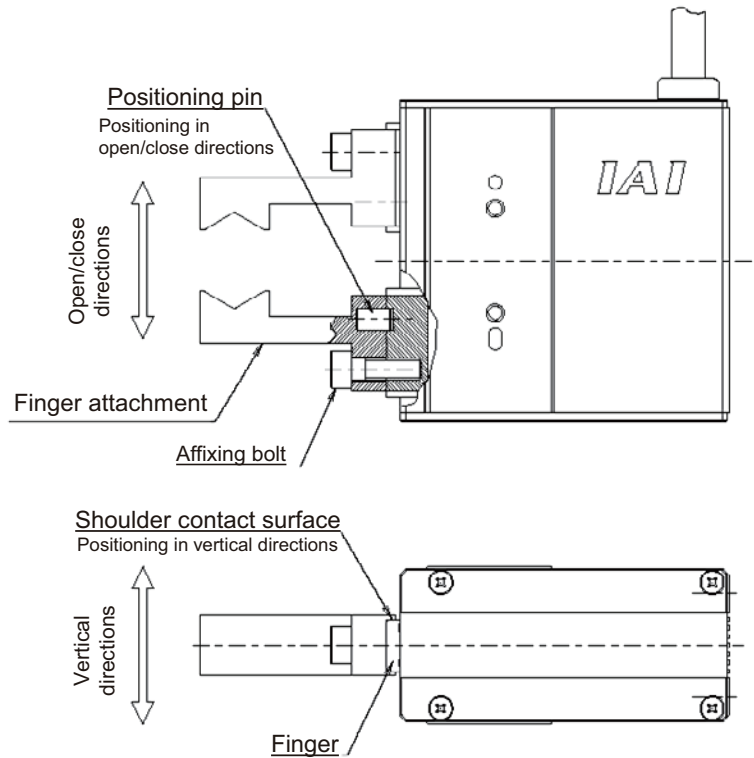


⚠ Caution: When installing or removing an attachment to/from a finger, tighten the mounting bolts while securely holding the attachment with a spanner wrench, etc., to prevent the guide from receiving any load or impact.



To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

- GRS/GRM

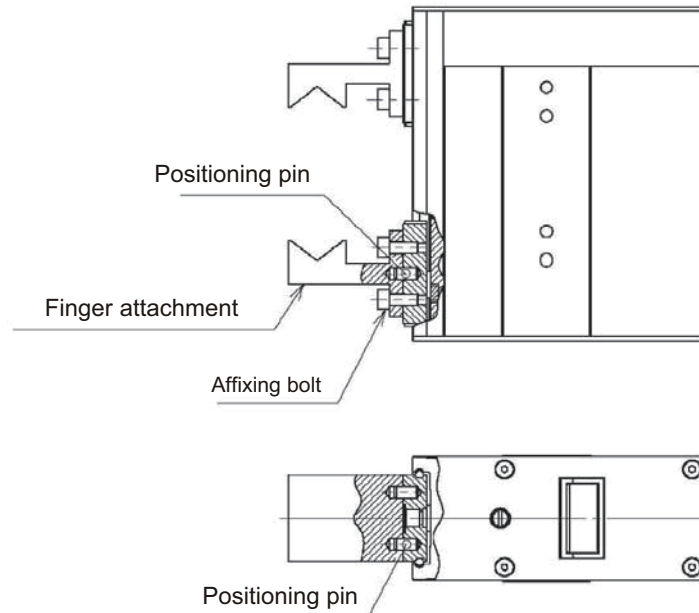


Caution:

- When installing or removing the attachment to/from the finger, tighten the screw while holding the attachment with a spanner wrench, etc., so that the guide will not receive any load or impact.
- The tapping holes are through holes. Never use long screws exceeding the effective thread length. The screws may contact the internal structure, resulting in gripper malfunction or damage to the internal structure.

To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

- GRHM/GRHB

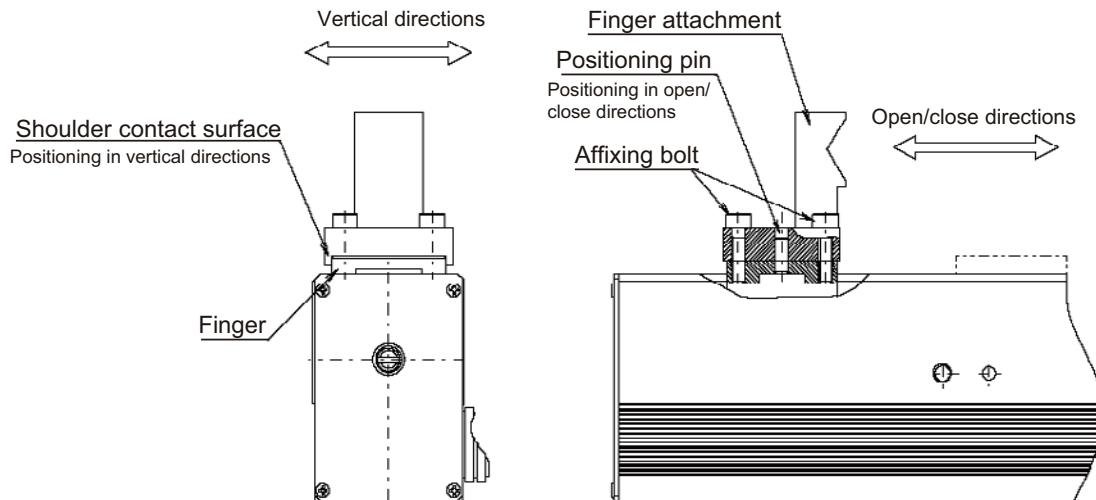


Caution:

- When installing or removing the attachment to/from the finger, tighten the screw while holding the attachment with a spanner wrench, etc., so that the guide will not receive any load or impact.
- The tapping holes are through holes. Never use long screws exceeding the effective thread length. The screws may contact the internal structure, resulting in gripper malfunction or damage to the internal structure.

To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

• GRST

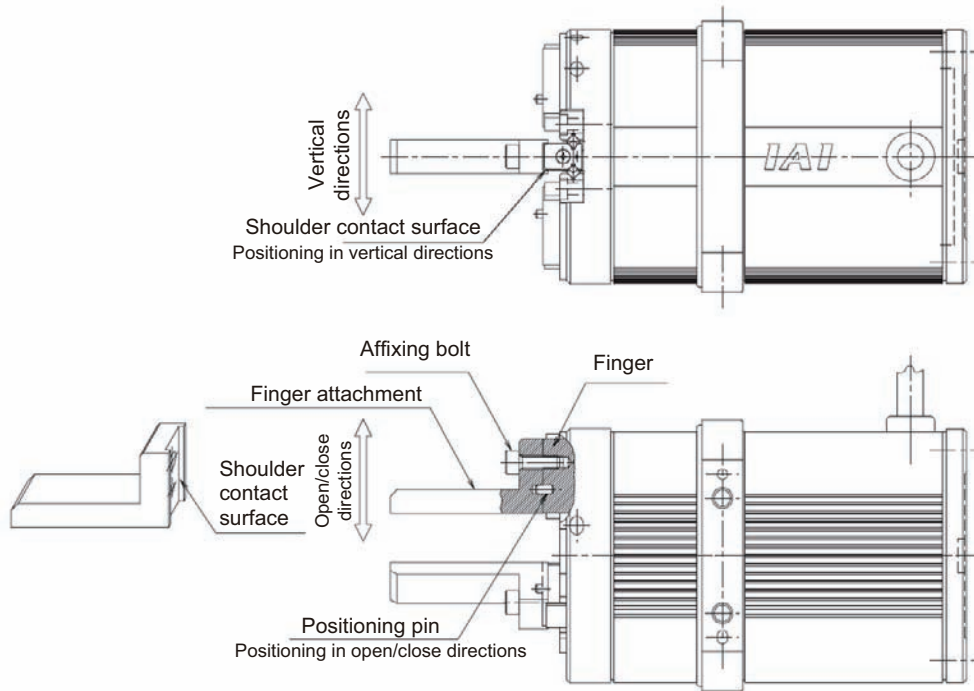


Caution:

- When installing or removing the attachment to/from the finger, tighten the screw while holding the attachment with a spanner wrench, etc., so that the guide will not receive any load or impact.
- The tapping holes are through holes. Never use long screws exceeding the effective thread length. The screws may contact the internal structure, resulting in gripper malfunction or damage to the internal structure.

To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

- GR3SS/GR3SM

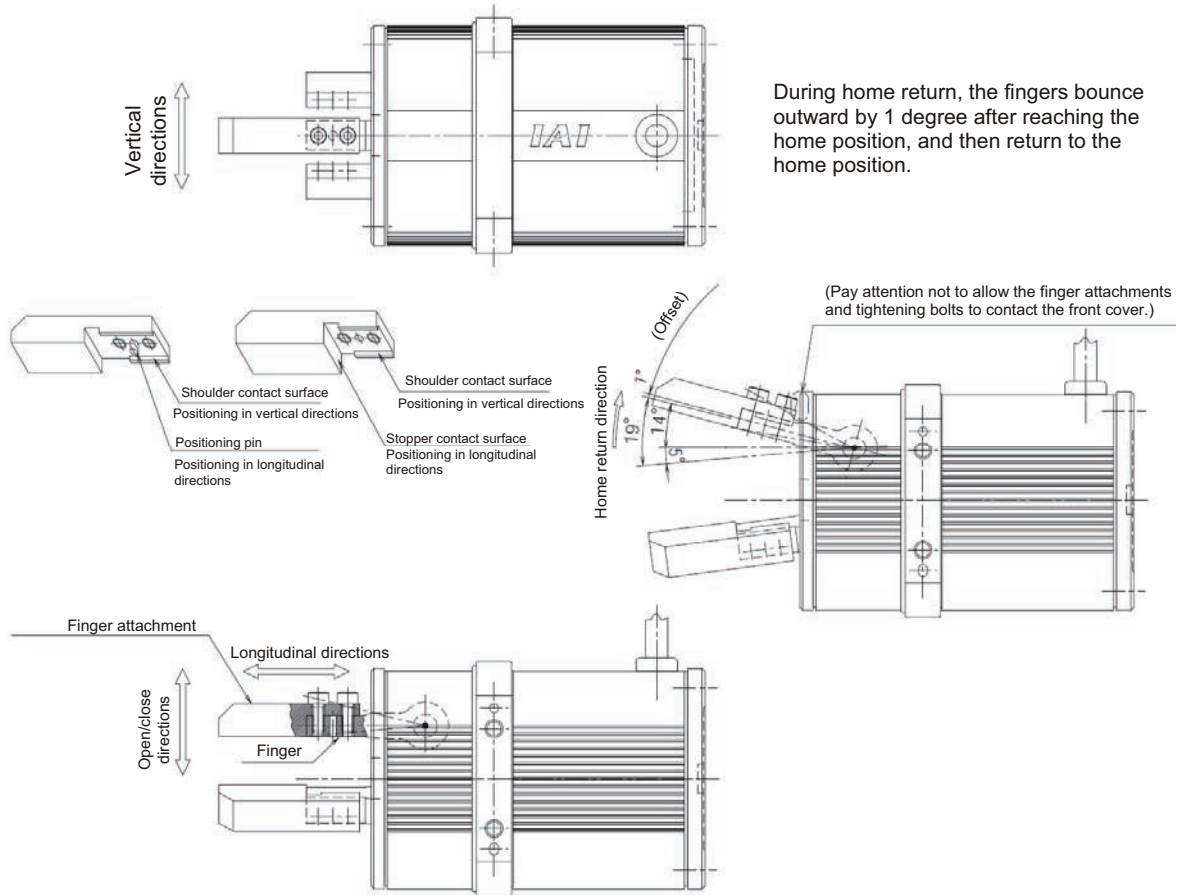


Caution:

- When installing or removing the attachment to/from the finger, tighten the screw while holding the attachment with a spanner wrench, etc., so that the guide will not receive any load or impact.

To achieve higher installation precision and repeatability for finger attachments, it is recommended that each finger attachment be positioned by sandwiching the attachment between the positioning pin and the side face of the finger, as illustrated below.

• GR3LS/GR3LM



⚠ Caution:

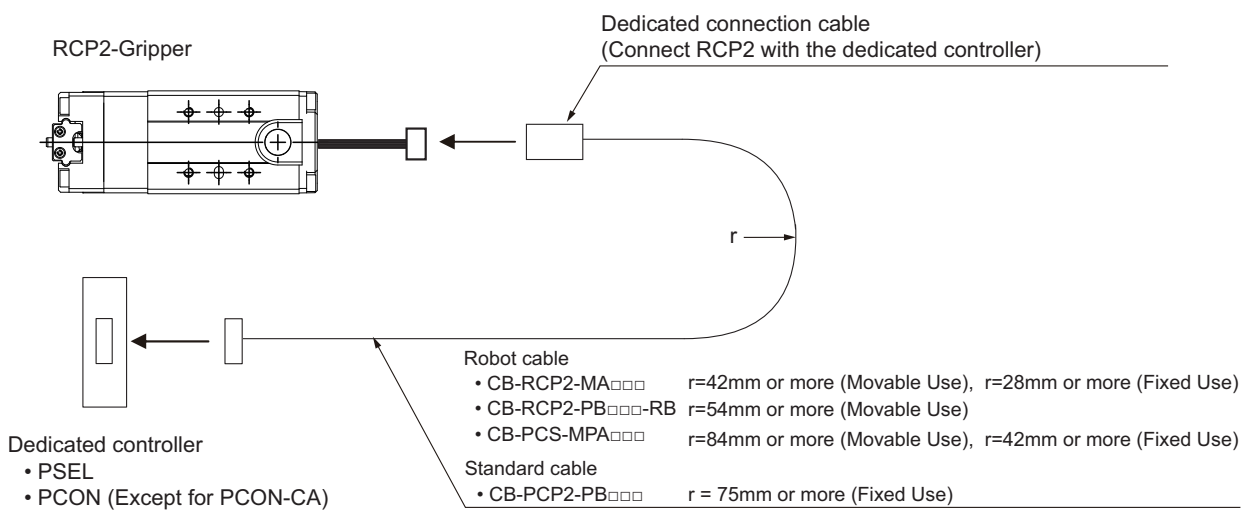
- When installing or removing the attachment to/from the finger, tighten the screw while holding the attachment with a spanner wrench, etc., so that the guide will not receive any load or impact.

3. Connecting with the Controller

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

- If the dedicated connection cable cannot be secured, reduce the load on the cable by allowing it to deflect only by the weight of the cable or wire it in a self-standing cable hose, etc., having a large radius.
- Do not cut and reconnect the dedicated connection cable for extension or shorten the cable.
- Do not pull on the dedicated connection cable or bend it forcibly.
- The actuator cable is for fixed use. Fix the cable so it would not be bent repeatedly.

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



Dedicated connection cable

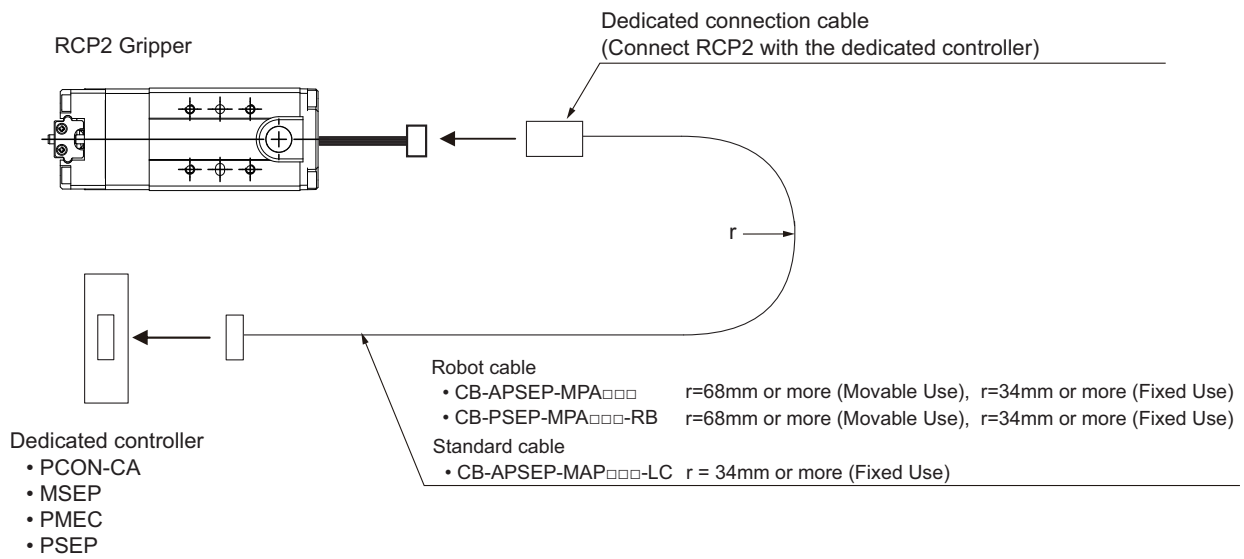
GRSS/GRLS

- Motor • Encoder Integrated Cables : CB-PCS-MPA□□□

GRS/GRM/GR3SS/GR3SM/GRLS/GRLM

- Motor cable : CB-RCP2-MA□□□
- Encoder cable : CB-RCP2-PB□□□
- Encoder robot cable : CB-RCP2-PB□□□-RB

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



Dedicated connection cable

RCP2-GRSS/GRLS

- Motor • Encoder Integrated Robot Cables : CB-APSEP-MPA□□□
- Motor • Encoder Integrated Cables : CB-APSEP-MPA□□□-LC

GRS/GRM/GR3SS/GR3SM/GR3LS/GR3LM

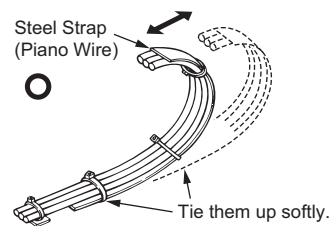
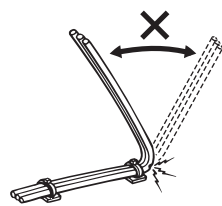
- Motor • Encoder Integrated Robot Cables : CB-PSEP-MPA□□□

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

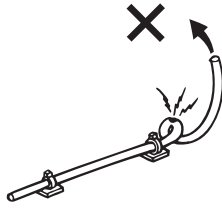


Warning: For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause not only a malfunction such as cable breakage or connection failure,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

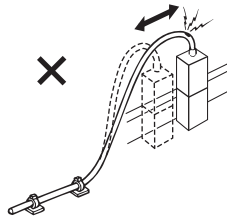
- Use dedicated cables of IAI indicated in this instruction manual. Contact us if you wish to have a change to the specifications of the dedicated cables.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Do not attempt to cut a dedicated cable with 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.
- Have a sufficient radius for bending, and avoid a bend concentrating on one point.



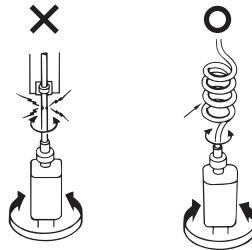
- Do not let the cable bend, kink or twist.



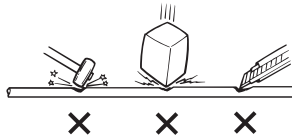
- Do not pull the cable with a strong force.



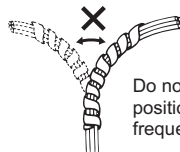
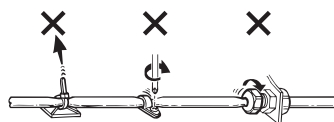
- Pay attention not to concentrate the twisting force to one point on a cable.



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

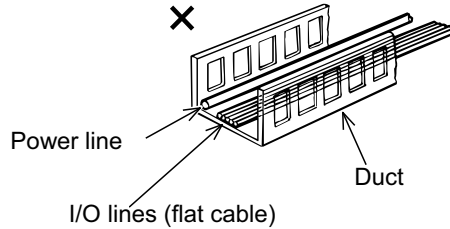


- When a cable is fastened to affix, make sure to have an appropriate force and do not tighten too much.



Do not use spiral tube in any position where cables are bent frequently.

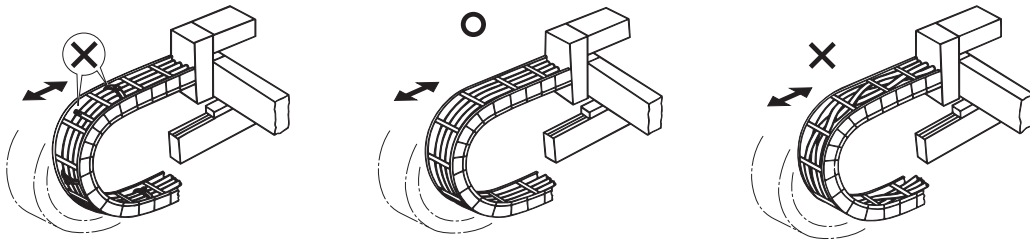
- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.



Follow the instructions below when using a cable track.

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

Do not pile up cables. It may cause faster abrasion of the sheaths or cable breakage.



4. Operation

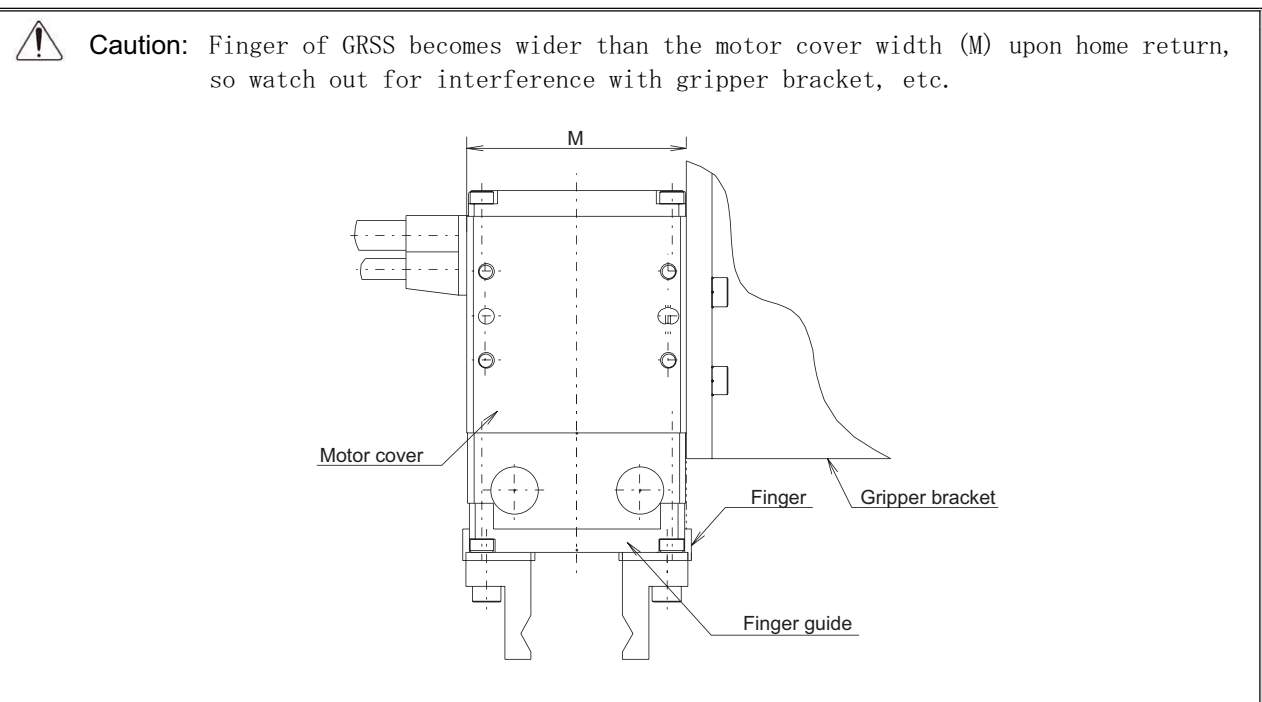
4.1 Operation of the Fingers

[1] Movement Stroke

The design stroke of the two-finger type is a sum of travel distances of both fingers. The travel distance of one finger is one-half the design stroke.

[2] Home Return Direction

The open side moving end of the finger is the home position. The home position is on the closing end for the home reversed type (NM).



[3] Position Indication

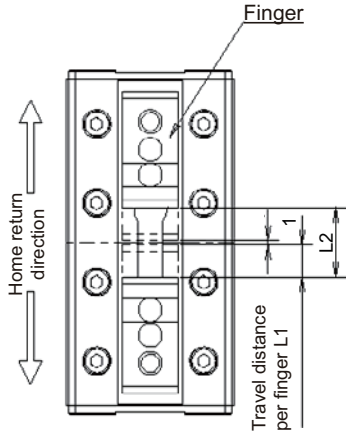
The movement distance from the home position of one finger to the closing side is the position value.

(In the case of Two-finger Type : indication of max. position value = 1/2 of stroke)

[4] Indication of Speed and Acceleration

Speed/acceleration commands are specified based on a value per finger. The relative speed/acceleration of the two-finger type is twice the command value.

• Two-finger Type

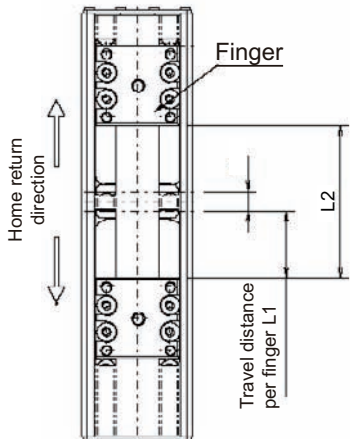


	GRSS	GRLS
Stroke	8 mm	180°
Travel distance per side L1/Angle	4 mm	90°
Distance between fingers L2/Angle	Max. 13.5 mm/ Min. 5.5 mm	Max. 180°/ Min. 0°

	GRM	GRS
Stroke	14 mm	10 mm
Travel distance per side L1	7 mm	5 mm
Distance between fingers L2	Max. 15 mm/ Min. 1 mm	Max. 10 mm/ Min. 1 mm

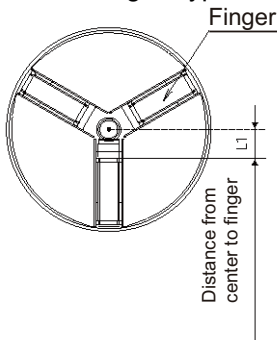
	GRHM	GRHB
Stroke	32 mm	40 mm
Travel distance per side L1	16 mm	20 mm
Distance between fingers L2	Max. 33 mm/ Min. 1 mm	Max. 41 mm/ Min. 1 mm

• Two-finger Long-stroke Type



	GRST
Stroke	40, 60, 80, 100
Travel distance per side L1	20, 30, 40, 50
Distance between fingers L2	Max. 106/ Min. 6

• Three-finger Type



	GR3SM	GR3SS
Stroke	7 mm	5 mm
Distance between fingers	4 mm to 11 mm	4 mm to 9 mm

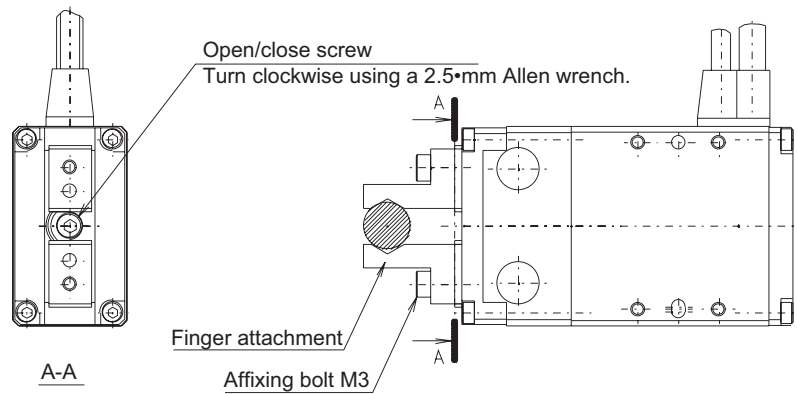
4.2 Removal of Gripped Work Part

This gripper is structured in such a way that the work part-gripping force will be maintained by means of self-lock even after the controller power is cut off.

If the gripped work part must be removed while the controller power is cut off, turn the opening/closing screw or remove the finger attachment on one side to release the work part.

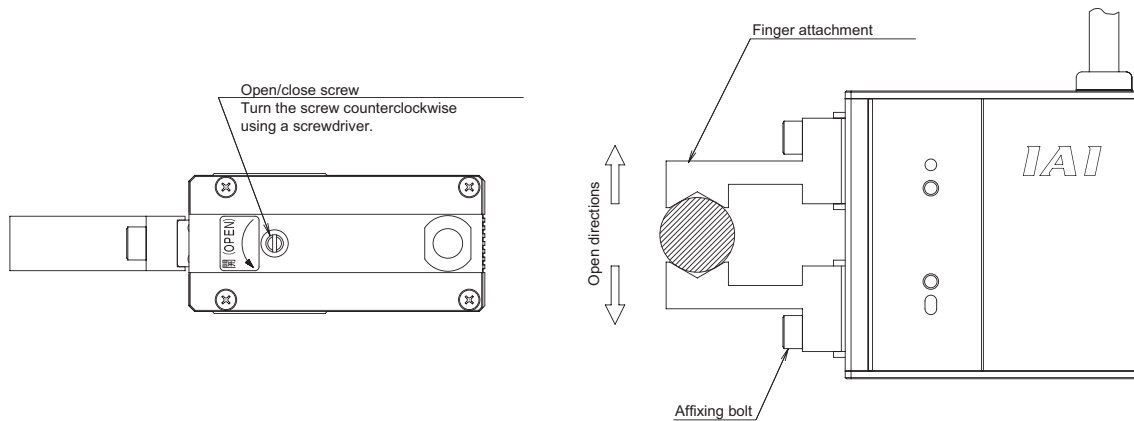
- Small Slim Two-finger Slide Type (GRSS)
- Small Slim Two-finger Lever Type (GRLS)

Turn the opening/closing screw clockwise or remove the finger attachment on one side.



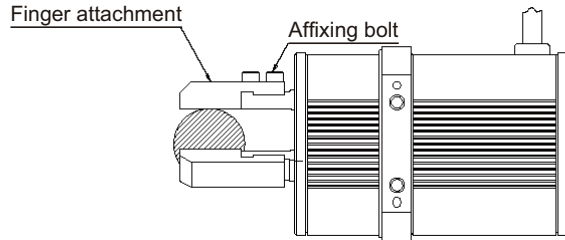
- Small and Medium Two-finger Type (GRS/GRM)
- Two-finger Type with High Gripping Force (GRHM/GRHB)

Turn the opening/closing screw or remove the finger attachment on one side.

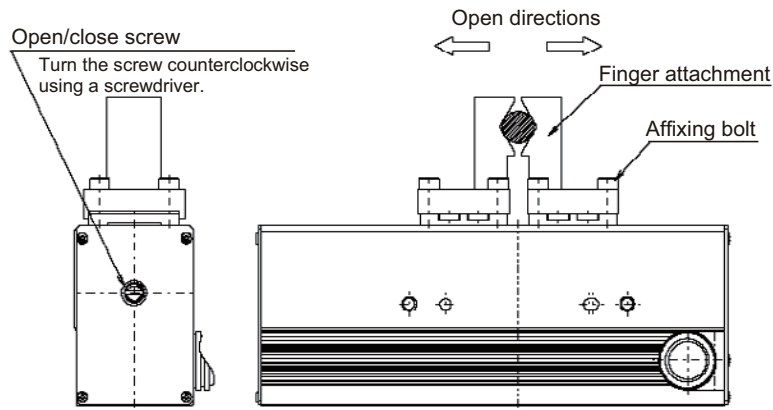


- Three-finger Type (GR3SS/GR3SM, GR3LS/GR3LM)

Remove one finger attachment.



- Two-finger Long-stroke Type (GRST)



Caution:

- If the gripped work part must be removed while the controller power is cut off, turn the opening/closing screw or remove the finger attachment on one side to release the work part. Forcibly pulling the work part out of the fingers may damage the machine.
- Remove the gripped work part if the machine will not be operated for a prolonged period. If the gripper remains stationary for a prolonged period with a work part gripped, the gripper performance may drop or its guide function may be negatively affected.

5. Maintenance and Inspection

5.1 Inspection Items and Schedule

Perform maintenance and inspection at the intervals specified below.

This schedule assumes that the actuator is operated eight hours a day.

If the actuator is operated at a higher utilization, such as when the machine is used continuously day and night, reduce the inspection intervals accordingly.

	Visual inspection of exterior	Greasing
Start-up inspection	○	
After 1 month of operation	○	
After 6 months of operation	○	○
After 1 year of operation	○	
Every 6 months thereafter	○	○
Every 1 year	○	

* Any adjustments requiring the following operations must be carried out at our factory. Do not disassemble the gripper or cut any of its cables in the location where the gripper is installed.

- Disassemble the motor
- Disassembly of guide
- Disassembly of finger feed mechanism
- Disassemble the bearing
- Cut a cable

If the user has disassembled any of the above components or cut any of the gripper's cables, IAI will not be responsible for any malfunction or problem that may occur thereafter.



Caution:

- Performing inspection or maintenance work part without a thorough understanding of the specific tasks involved may result in a serious accident.
- If inspection is not carried out regularly, the drive part may reach its life prematurely.

5.2 Visually Inspecting the Exterior

Visually check the exterior of the following items.

Actuator	Loosening of actuator mounting screws
Cables	Scratches, connector engagement
Overall	Noise, vibration

5.3 Exterior Cleaning

- Clean the exterior surface as necessary.
- Wipe dirty areas using a soft cloth, etc.
- Do not blow highly compressed air onto the actuator, as it may cause dust to enter the actuator through gaps between parts.
- Do not use petroleum-based solvent as it damages resin and coated surfaces.
- To remove stubborn stains, take neutral detergent or alcohol into a soft cloth, etc., and wipe the area gently.

5.4 Grease Supply for Two-Fingered Small Slim Type, Small Type and Medium Type

5.4.1 Guide

[1] Applicable Greases

IAI uses the following grease in our plant.

Idemitsu Kosan	Daphne Eponex Grease No. 2
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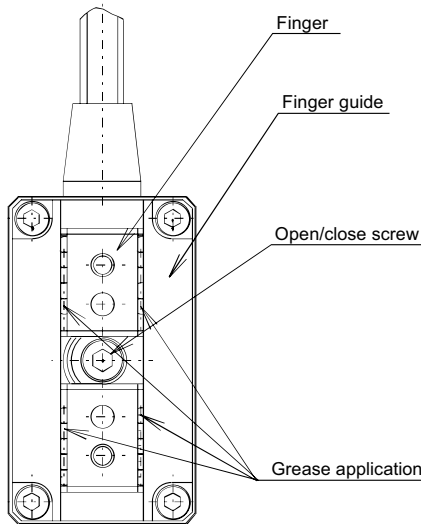
Other companies also sell similar types of grease. For details, give the above grease name to the manufacturer you want to purchase from and ask what corresponding product they have available.

Use lithium spray grease during maintenance. Take note that grease should not be sprayed for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
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[2] How to Apply Grease

- Small Slim Two-finger Slide Type (GRSS)
- Small Slim Two-finger Lever Type (GRLS)

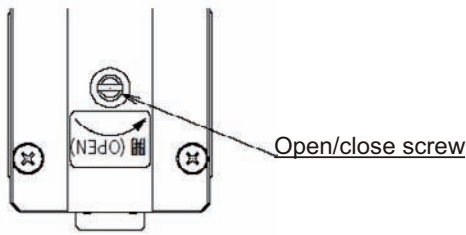


- 1) Using a 2.5-mm Allen wrench, turn the opening/closing screw at the center of the fingers to move the fingers toward the stroke center.
- 2) Using a grease spray gun, apply grease (on the steel balls) between the fingers and finger guides. (Spray grease in four locations for less than 1 second each.) After spraying, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly. Remove excess grease or grease spatters in surrounding areas.

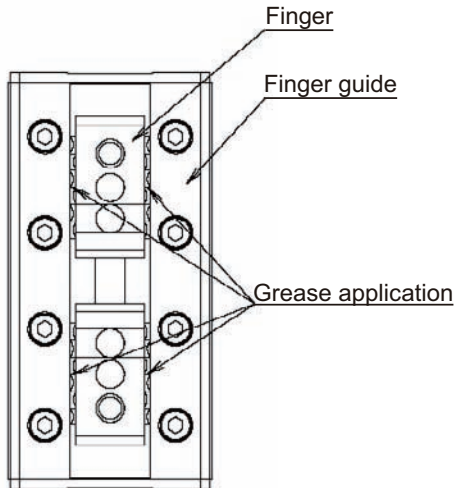


Caution: In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

• Small and Medium Two-finger Type (GRS/GRM)



- 1) Use a flathead screwdriver to turn the opening/closing screw on side cover L to move the fingers toward the stroke center.



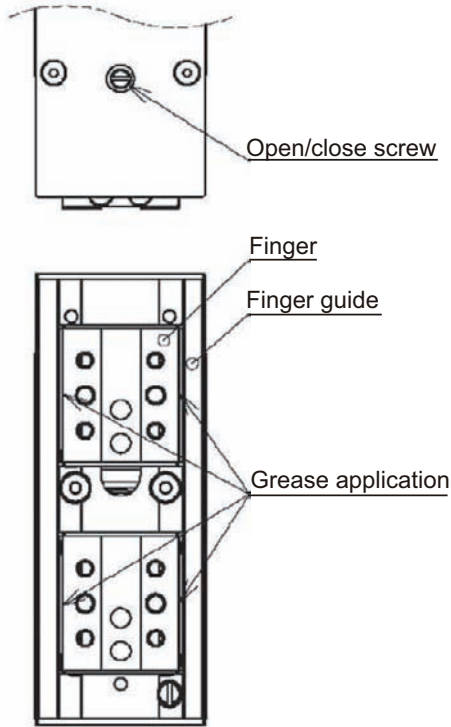
- 2) Spray grease in the gap (on the steel balls) between the finger and finger guide (4 locations; keep the spray time to a maximum of 1 second at each location). After spraying, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly. Remove excess grease or grease spatters in surrounding areas.



Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

• Two-finger Type with High Gripping Force (GRHM/GRHB)



- 1) Use a flathead screwdriver to turn the opening/closing screw on side cover to move the fingers toward the stroke center.
- 2) Spray grease in the gap (on the steel balls) between the finger and finger guide (4 locations; keep the spray time to a maximum of 1 second at each location). After spraying, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly. Remove excess grease or grease spatters in surrounding areas.



Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

5.5 Feed Screw Small and Medium Two-finger Type (GRS/GRM)

[1] Applicable Greases

IAI uses the following grease in our plant.

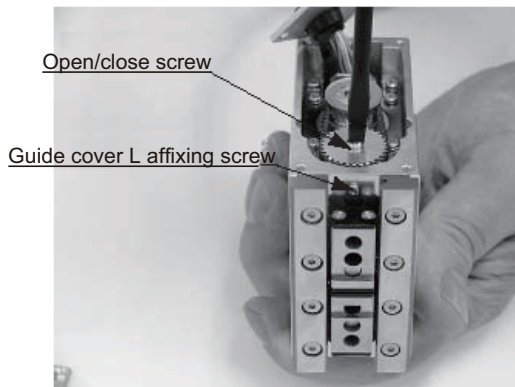
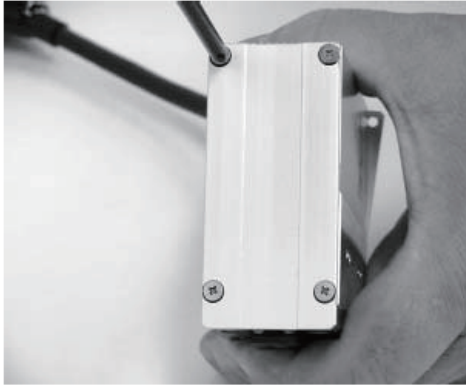
Idemitsu Kosan	Daphne Eponex Grease No. 2
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Use lithium spray grease during maintenance. Take note that grease should not be sprayed for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
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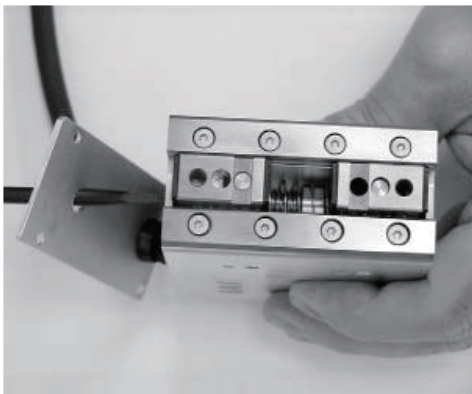
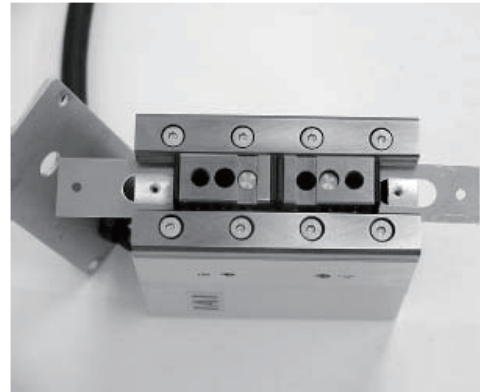
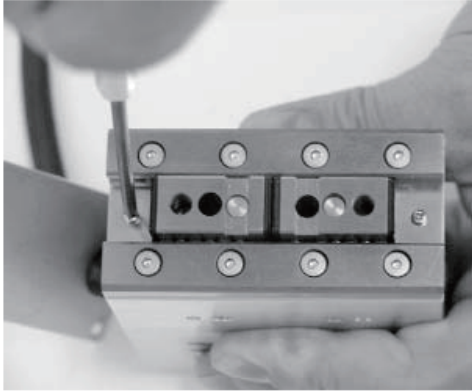
[2] How to Apply Grease

- 1) Remove the screws affixing side cover R and side cover L (countersunk head screw M2.6 × 6).
Remove side cover R.
Separate side cover L from the gripper frame. (The cover is still connected via internal cables. Do not pull the internal cables.)



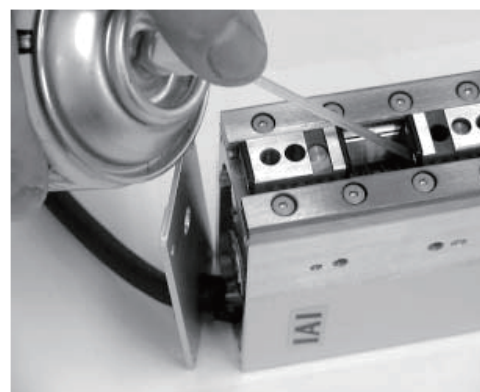
- 2) Turn the opening/closing screw on side cover L to move the fingers toward the closing side until the guide cover R/L affixing screws are visible.

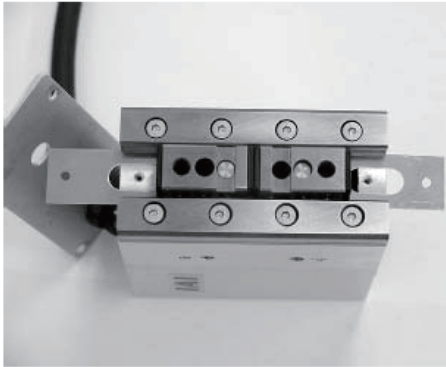
- 3) Remove screws affixing guide covers R and L (2 pieces on each side). Slide the guide covers horizontally to the opening side and remove. (Countersunk head screw M2 × 3)
Note: The cutout dimensions are different between guide covers R and L. Keep the removed guide covers properly so that they will not be mixed up when installed.



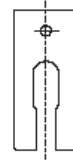
- 4) Use a flathead screwdriver to turn the opening/closing screw on side cover L to move the fingers toward the opening side.

- 5) From the opening, spray grease over the feed screw at 2 locations through the springs (keep the spray time to a maximum of 1 second). After spraying, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly.

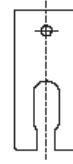




- 6) Move the fingers to the closing side. Insert the guide covers from sides and affix with screws. Insert guide covers R and L on the correct sides.



Guide cover R



Guide cover L



- 7) Install and securely affix side covers R and L. When affixing side cover L, be careful not to pinch the cables.



Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

5.6 Two-finger Type with High Gripping Force (GRHM/GRHB)

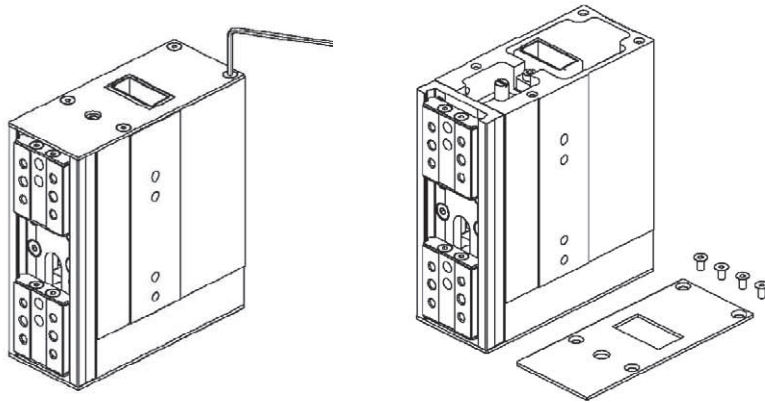
[1] Applicable Greases

Synthetic poly- α olefin grease has been charged to the feed screw prior to shipment. The following grease is applied to the feed screw before the gripper is shipped from the factory.

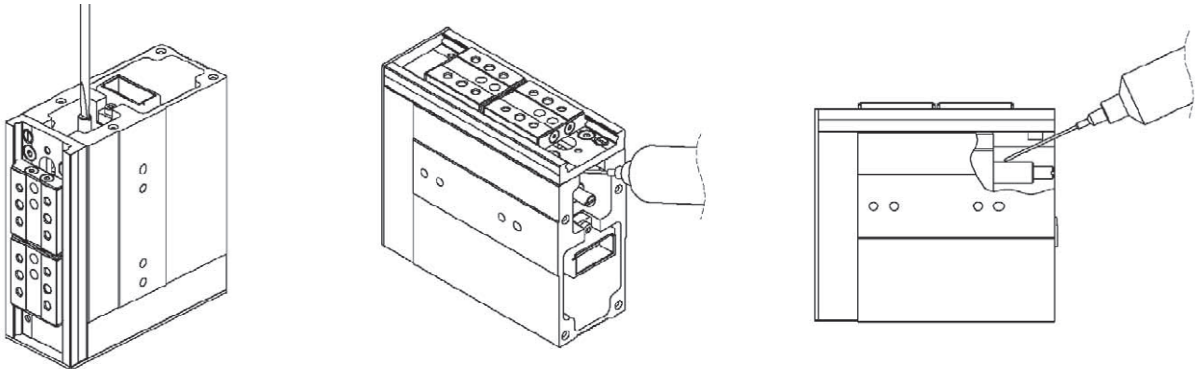
Lubricant by Sumitomo Metal Mining	Sumitec 308
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Other manufacturers also offer equivalent products, but exercise caution when using a different product because the life of the actuator may be affected depending on the selected grease.

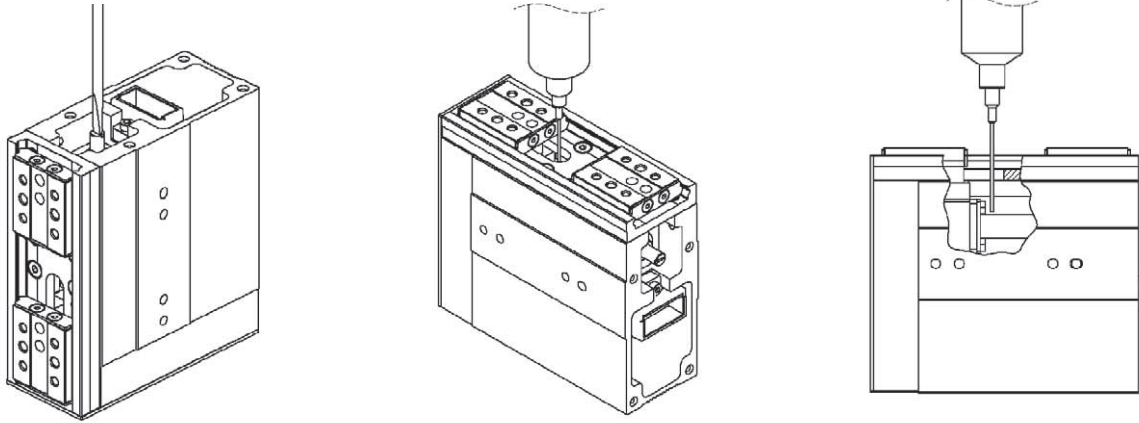
[2] How to apply grease



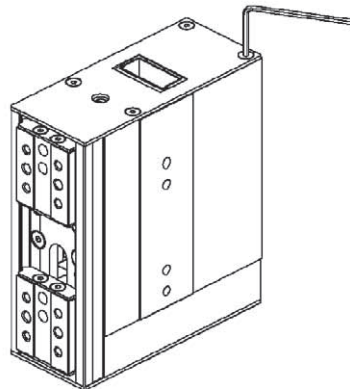
- 1) Remove the screws affixing side cover R and side cover R (countersunk head screw M3 × 6).



- 2) Turn the opening/closing screw to move the fingers to their stroke ends on the closed side.
- 3) Use a grease syringe to charge grease from the opening on the right side so as to coat the feed screw with grease. After the feed screw has been coated with grease roughly, turn the opening/closing screw to move the fingers back and forth several times to spread grease evenly.



- 4) Turn the opening/closing screw to move the fingers to their stroke ends on the open side.
- 5) Use a grease syringe to charge grease from the opening on the bottom face of the guide base so as to coat the feed screw with grease. After the feed screw has been coated with grease roughly, turn the opening/closing screw to move the fingers back and forth several times to spread grease evenly.



- 6) Install and securely affix side cover R.



Caution:

- Never use grease other than synthetic poly- α olefin grease. If synthetic poly- α olefin grease is mixed with other type of grease, not only the mixed grease will lose its intended function, but the actuator may also suffer damage depending on the situation.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

5.7 Greasing the Two-finger Long-stroke Type (GRST)

5.7.1 Greasing to the Feed Screw (Worm/Rack Gears)

[1] Applicable Greases

The following grease is applied to the guide before the gripper is shipped from the factory.

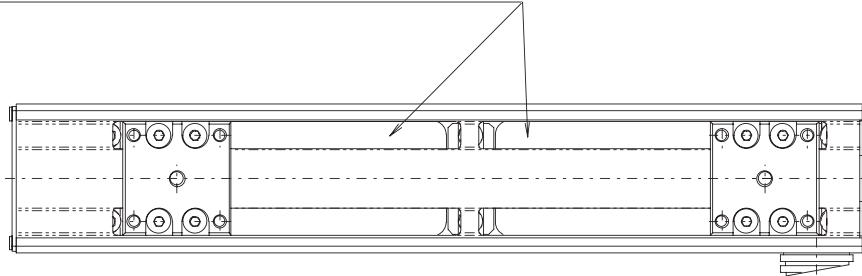
Idemitsu Kosan	Daphne Eponex Grease No. 2
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During maintenance, use spray-type lithium grease. Do not spray grease for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
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[2] How to Apply Grease

Apply grease through gaps along the top cover.



- 1) Turn the opening/closing screw with a screwdriver to move the fingers toward their homes.
- 2) Spray grease toward the worm gears through gaps along the top cover. (Do not spray more than 1 second on the left and right.)
- 3) Turn the opening/closing screw using a screwdriver to move the fingers in the directions opposite their homes (toward the stroke center).
- 4) Spray grease in the same manner as in 2).
- 5) After grease has been applied, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly



Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

5.7.2 Greasing to the Guide

[1] Applicable Greases

The following grease is applied to the guide before the gripper is shipped from the factory.

Idemitsu Kosan	Daphne Eponex Grease No. 2
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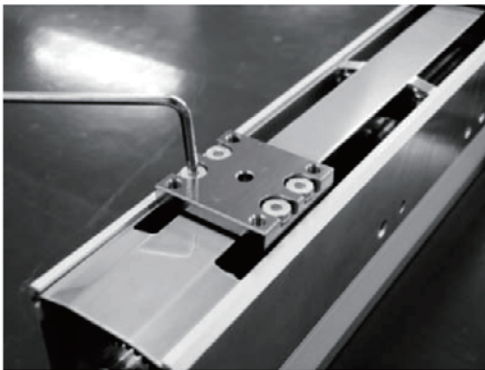
During maintenance, use spray-type lithium grease. Do not spray grease for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
---------------------	-------------------------------------

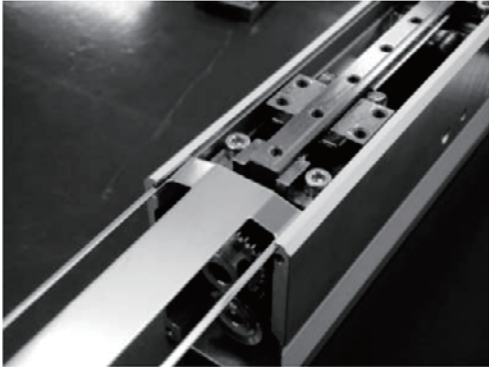
[2] How to Apply Grease



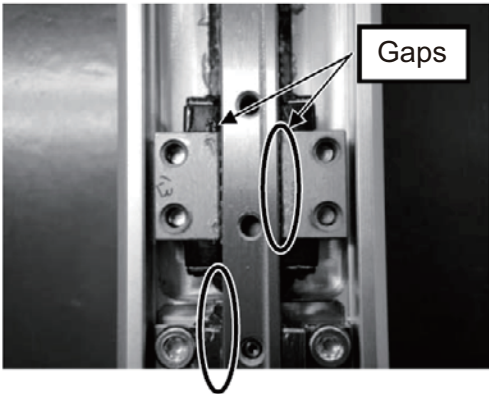
- 1) Remove the affixing screws from the side cover P.
(Cross-recessed head machine screw for precision equipment M2 × 4)



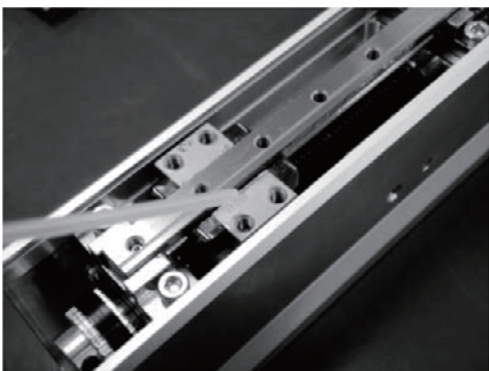
- 2) Remove the affixing screws from the fingers L/R.
(Low hexagonal head socket bolts M3 × 6)



- 3) Slide the top cover and pull it out.



- 4) Spray grease into the gaps along the LM guide. Apply grease at a total of four locations on the left and right guide blocks. Do not spray grease for more than 1 second in each location.



- 5) After grease has been applied, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly. Wipe off excess grease or grease that has scattered.
- 6) Install the top cover, fingers L/R and side cover P you have removed earlier.



Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

5.8 Grease Supply for Three-Fingered Slide Type (GR3SS/GR3SM)

5.8.1 Greasing the Guide

[1] Applicable Greases

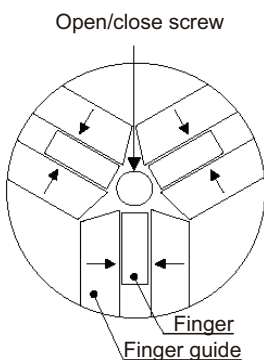
IAI uses the following grease in our plant.

Idemitsu Kosan	Daphne Eponex Grease No. 2
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Use lithium spray grease. Take note that grease should not be sprayed for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
---------------------	-------------------------------------

[2] How to apply grease



- 1) Use a flathead screwdriver to turn the opening/closing screw located deep at the center clockwise to move the levers toward the ends of their respective strokes.
- 2) Spray grease in the gap (on the steel balls) between the finger and finger guide (6 locations; keep the spray time to a maximum of 1 second at each location). After spraying, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly.
Remove excess grease or grease spatters in surrounding areas.

5.8.2 Greasing the Gears

[1] Applicable Greases

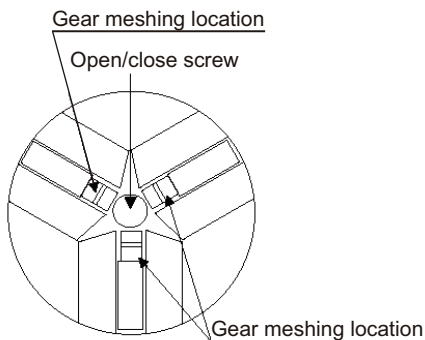
IAI uses the following grease in our plant.

GearsKyodo Yushi	Multemp AC-D No. 2
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Use lithium spray grease. Take note that grease should not be sprayed for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
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[2] How to apply grease



- 1) Use a flathead screwdriver to turn the opening/closing screw located deep at the center clockwise to move the fingers toward the ends of their respective strokes.
- 2) Spray grease at the gear meshing locations (3 locations; keep the spray time to a maximum of 1 second at each location).
After spraying, turn the opening/closing screw to move the fingers back and forth several times to spread the grease evenly. Remove excess grease or grease spatters in surrounding areas.



Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

5.9 Grease Supply for Three-Fingered Lever Type (GR3LS/GR3LM)

5.9.1 Greasing the Gears

[1] Applicable Greases

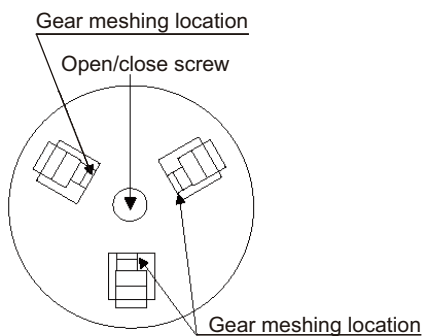
IAI uses the following grease in our plant.

GearsKyodo Yushi	Multemp AC-D No. 2
------------------	--------------------

Use lithium spray grease. Take note that grease should not be sprayed for more than 1 second.

WAKO CHEMICAL, LTD.	Spray Grease No. A161 or equivalent
---------------------	-------------------------------------

[2] How to apply grease



- 1) Use a flathead screwdriver to turn the opening/closing screw located deep at the center clockwise to move the levers toward the ends of their respective strokes.
- 2) Spray grease at the gear meshing locations (3 locations; keep the spray time to a maximum of 1 second at each location).
After spraying, turn the opening/closing screw to move the levers back and forth several times to spread the grease evenly. Remove excess grease or grease spatters in surrounding areas.

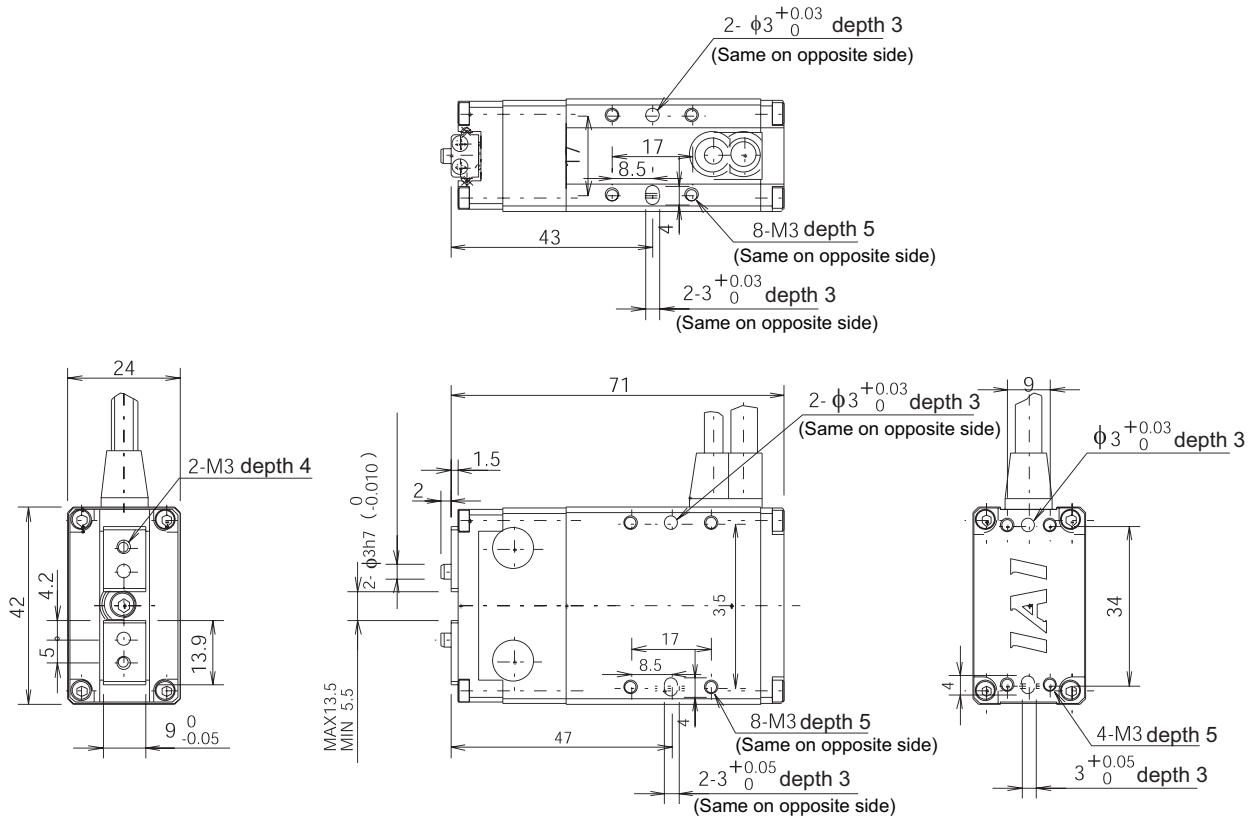


Caution:

- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage due to increased friction.
- Do not use spray oil. Be sure to use spray grease. Keep the spray time to a maximum of 1 second, and never spray more than once. If too much grease is applied, excess grease may flow into the electronic components and cause malfunction.
- In case the grease got into your eye, immediately go to see the doctor to get an appropriate care. After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease off.

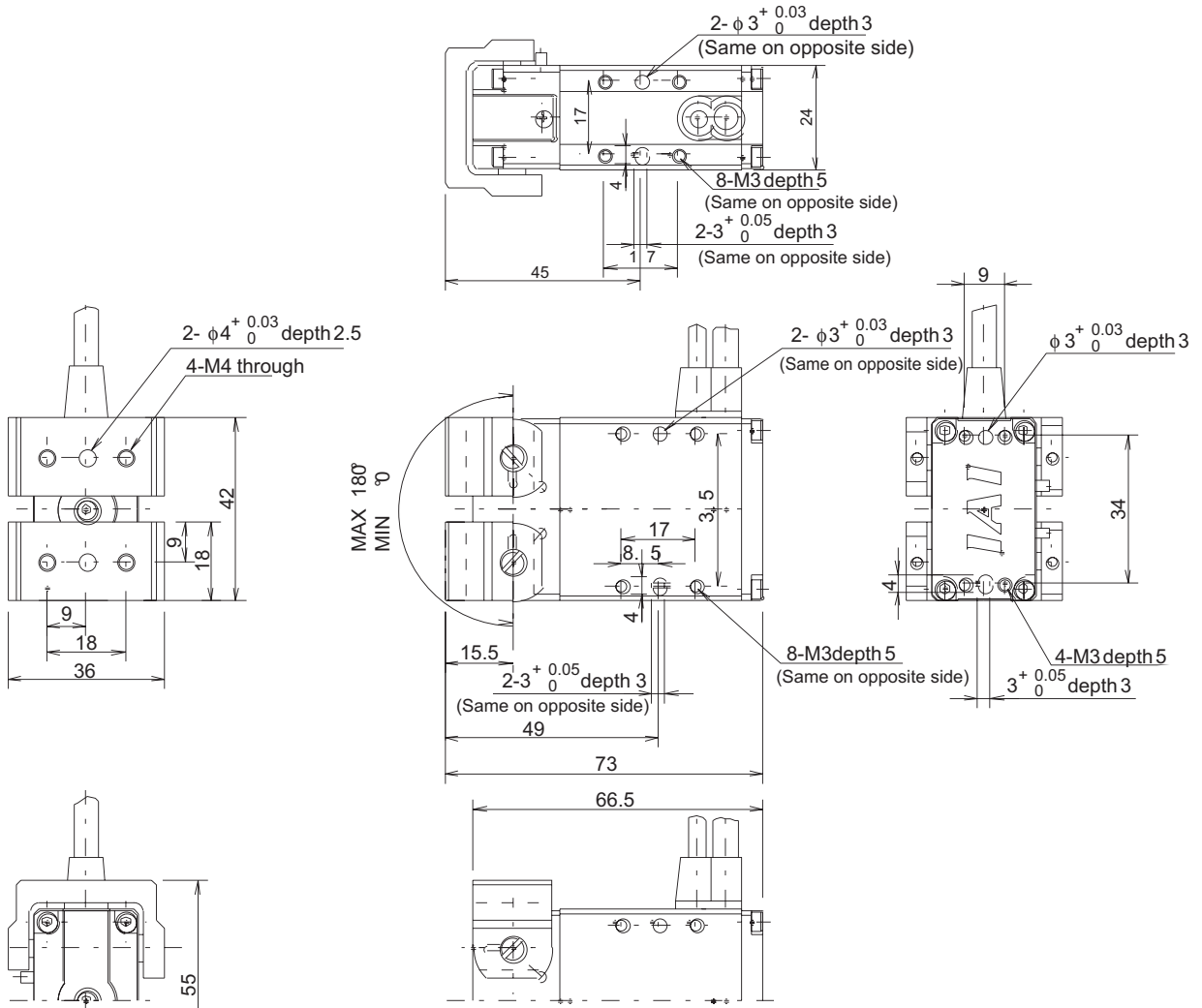
6. External Dimensions

6.1 GRSS



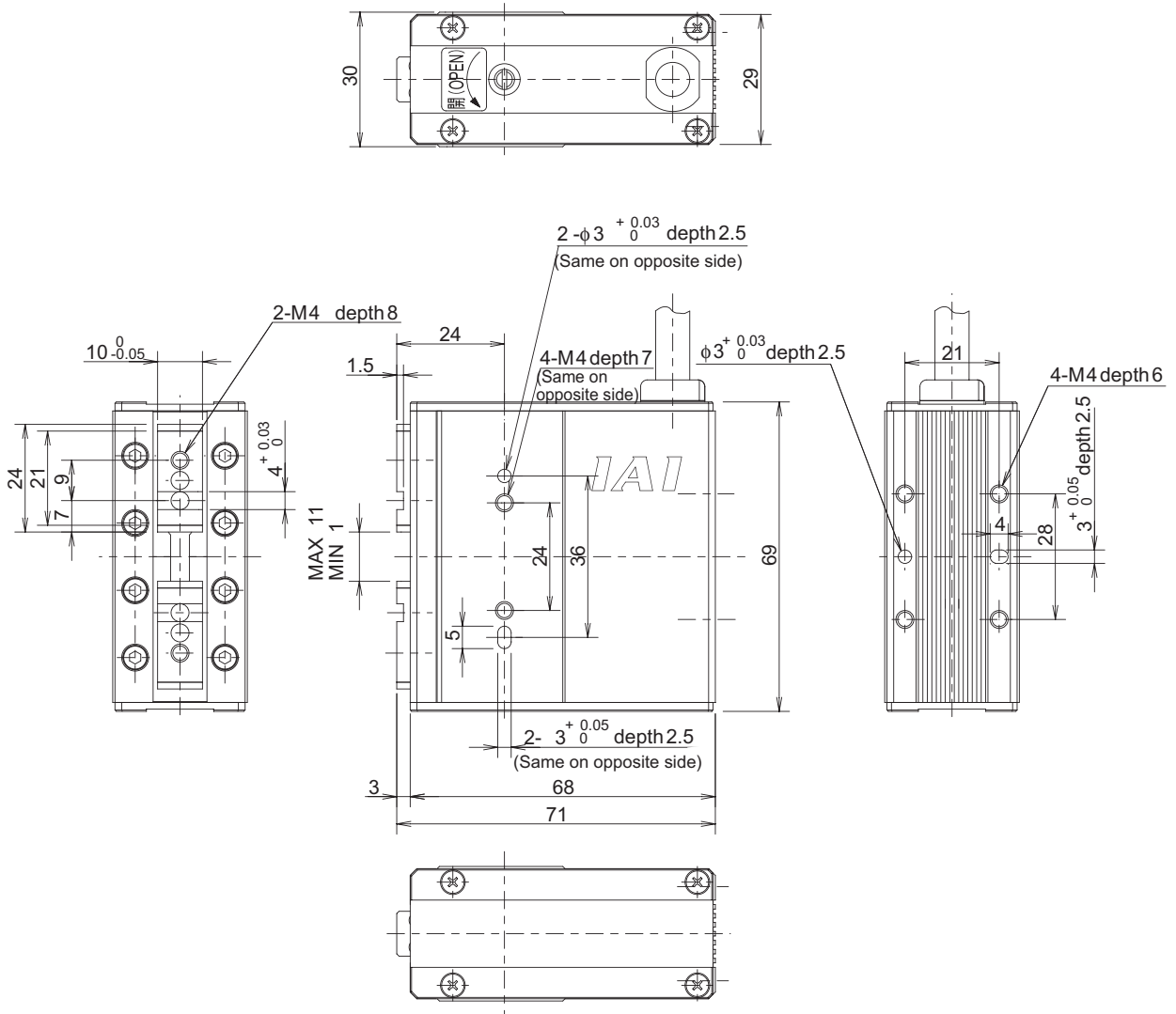
Mass[kg]	0.2
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6.2 GRLS



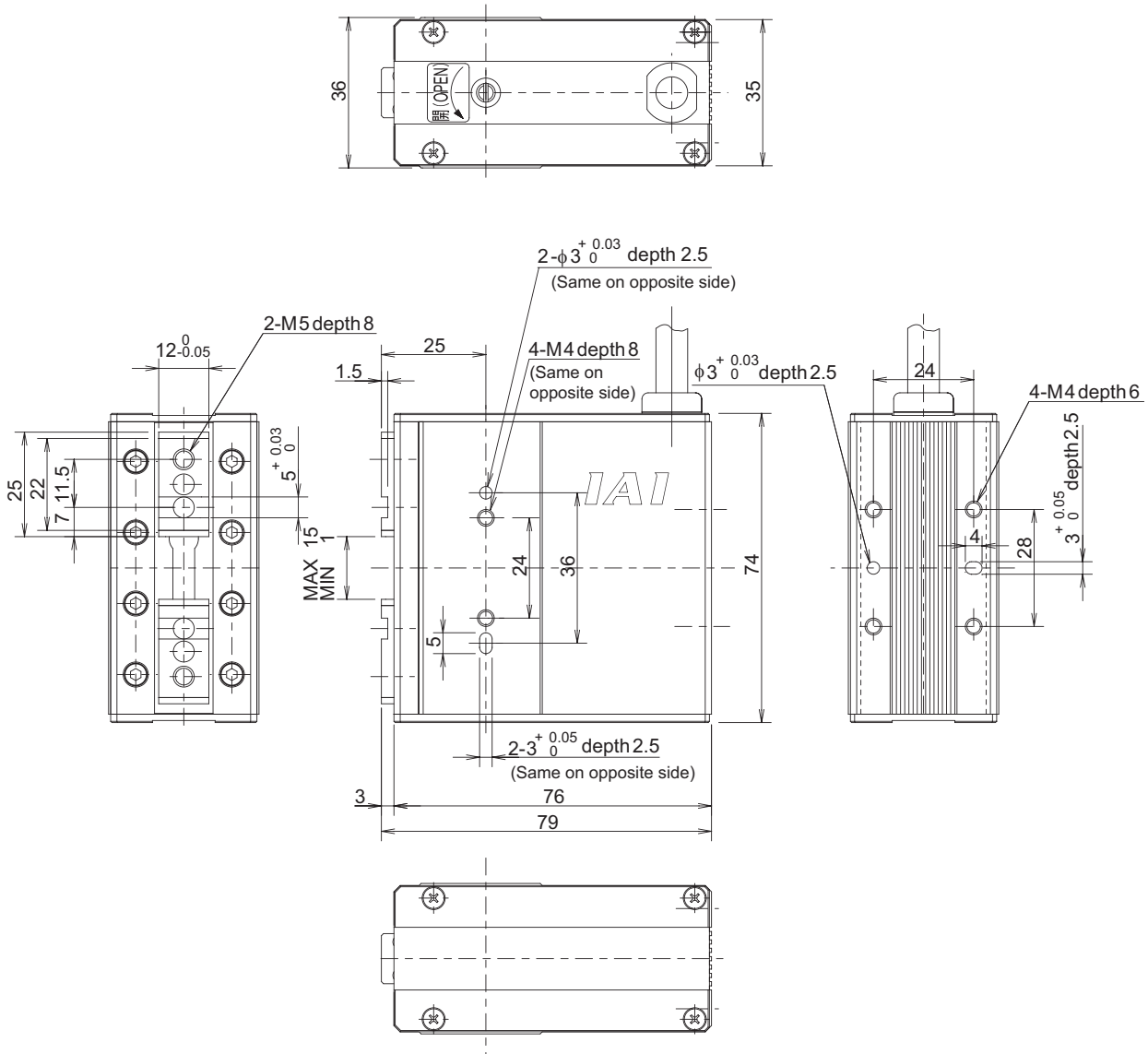
Mass[kg]	0.2
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6.3 GRS



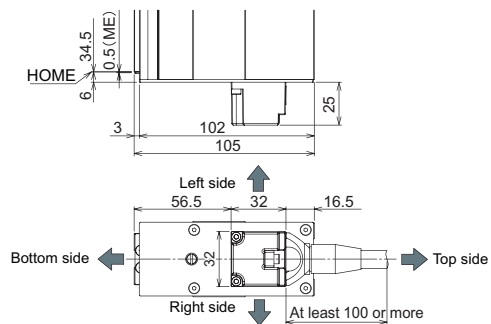
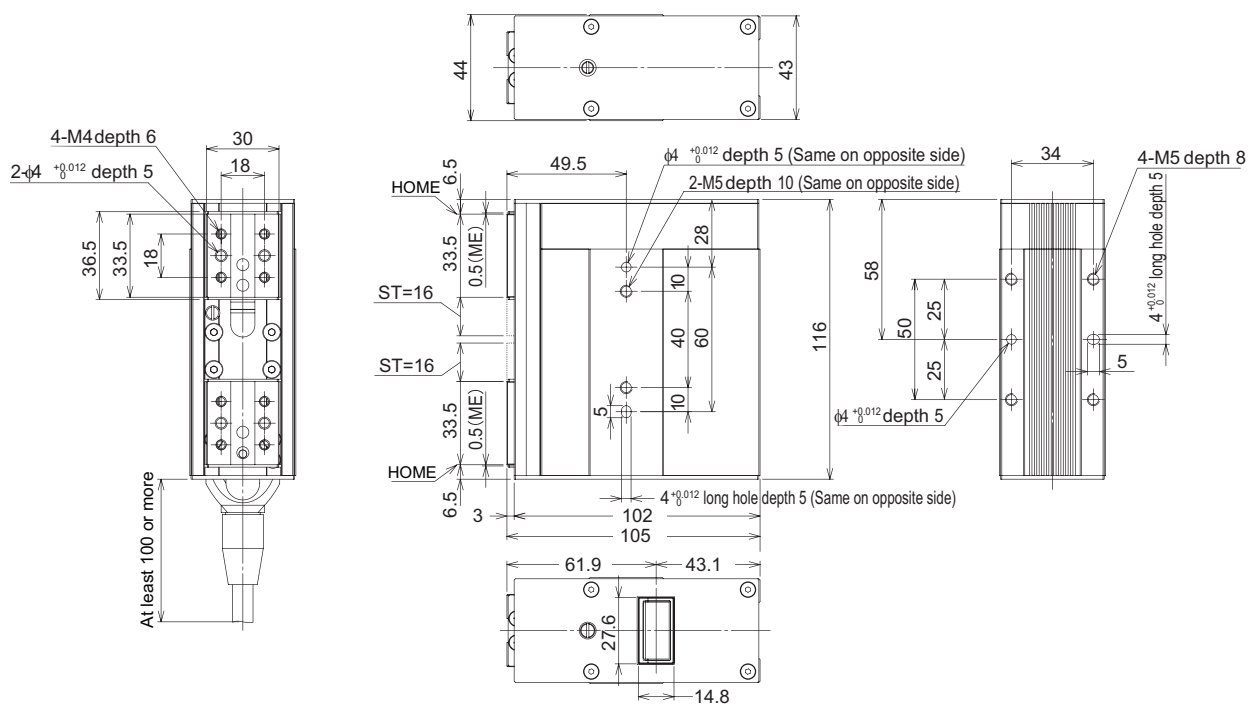
Mass[kg]	0.4
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6.4 GRM



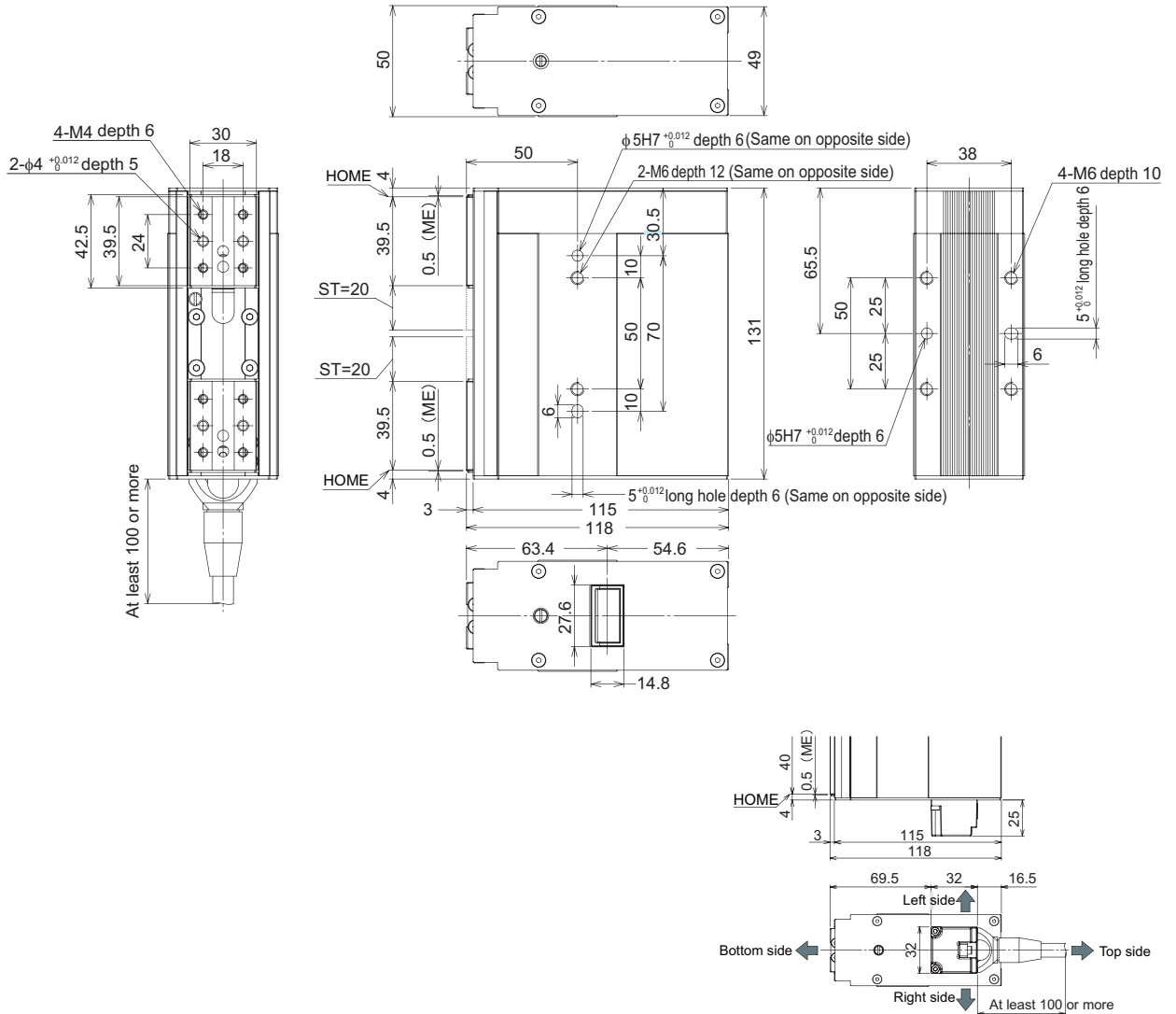
Mass[kg]	0.58
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6.5 GRHM



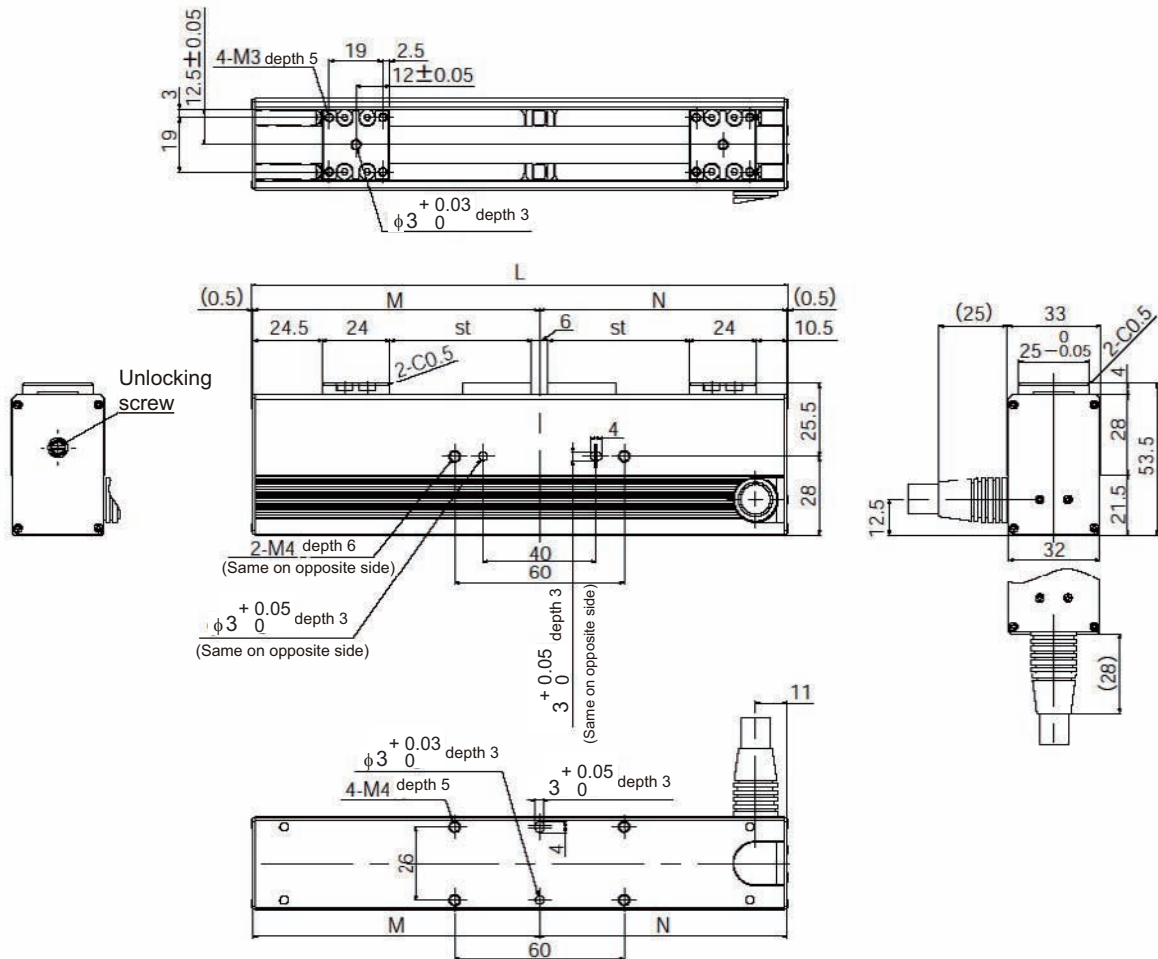
Mass[kg]	1.14
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6.6 GRHB



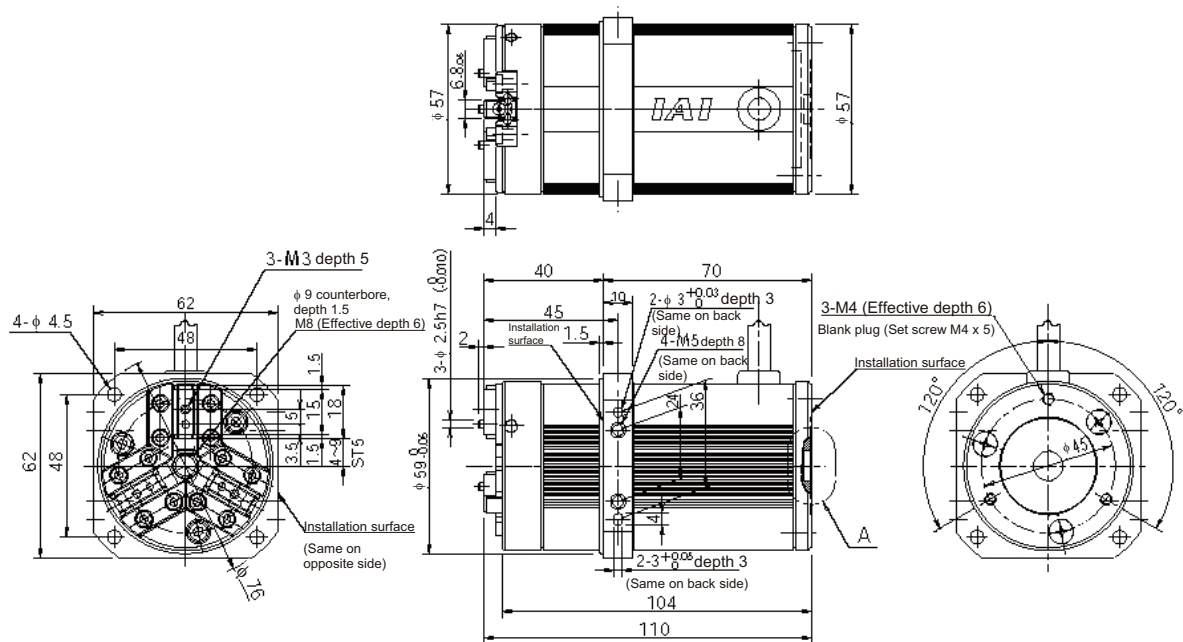
Mass[kg]	1.5
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6.7 GRST



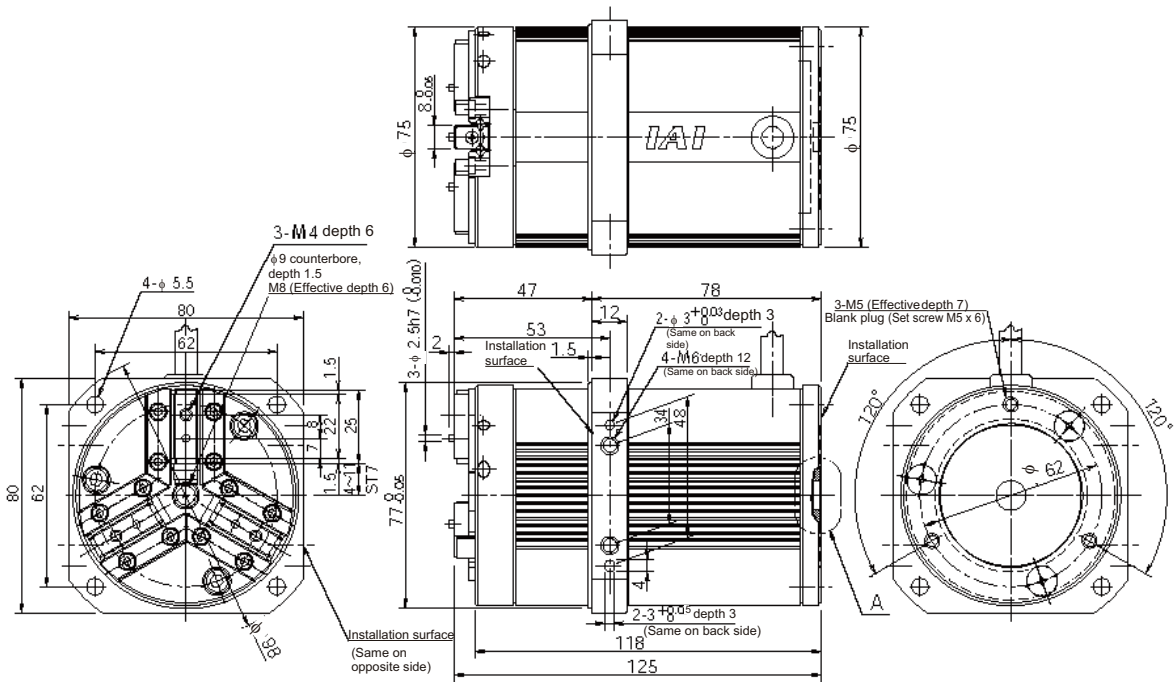
Stroke	40	60	80	100
L	130	150	170	190
M	71.5	81.5	91.5	101.5
N	57.5	67.5	77.5	87.5
Mass [kg]	0.51	0.56	0.61	0.66

6.8 GR3SS



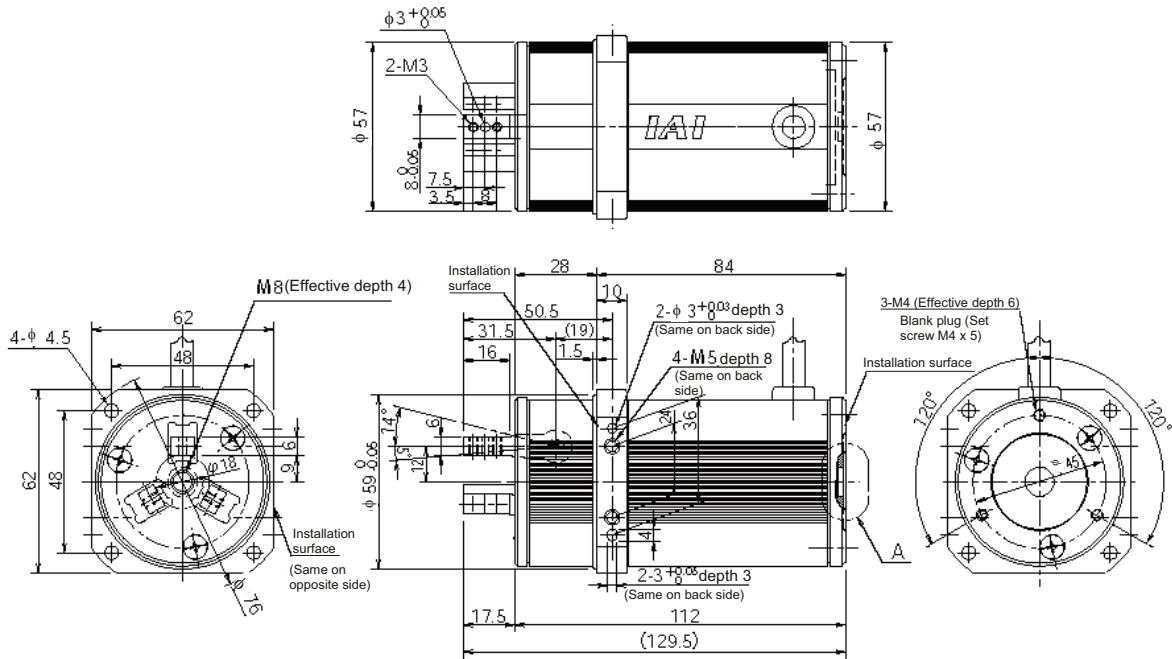
Mass[kg]	0.6
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6.9 GR3SM



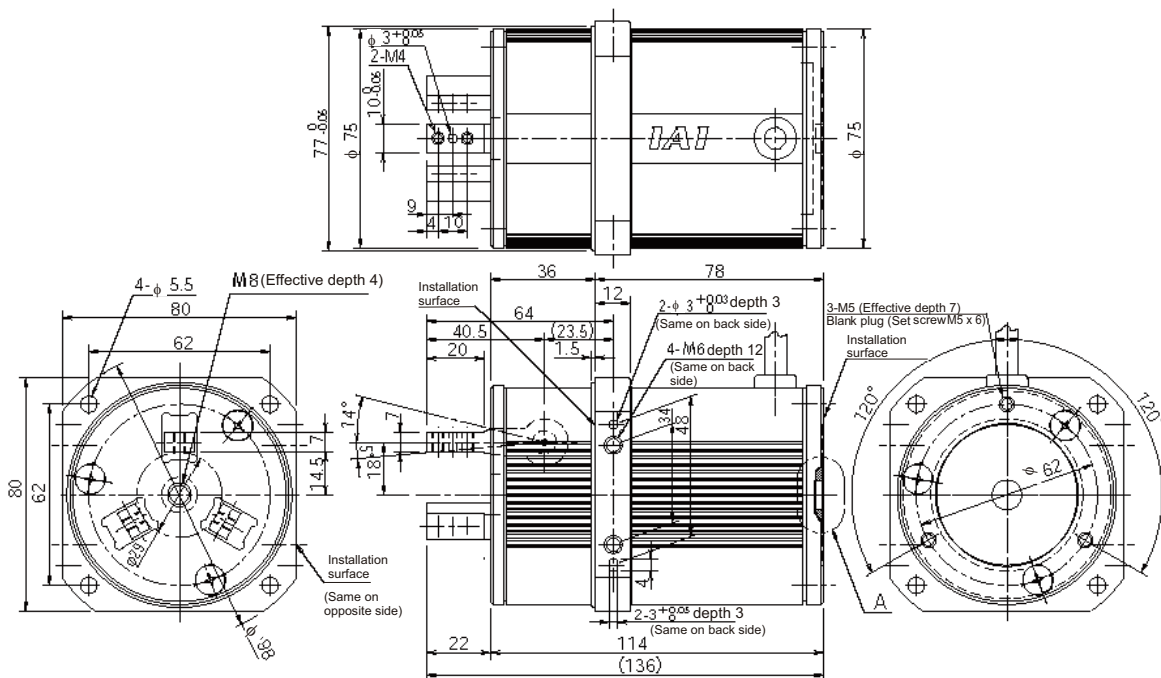
Mass[kg]	1.2
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6.10 GR3LS



Mass[kg]	0.6
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6.11 GR3LM



Mass[kg]	1.1
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7. Warranty

7.1 Warranty Period

One of the following periods, whichever is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to the specified location
- 2,500 hours of operation

7.2 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 instruction manual and catalog.
- (4) The breakdown of problem in question was caused by a specification defect or problem, or by a quality issue with 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.

7.3 Honoring the Warranty

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

7.4 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.

7.5 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 instruction manual.

7.6 Other Items Excluded from Warranty

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

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

Change History

Revision Date	Description of Revision
November 2008	<p>Fifth edition</p> <p>Descriptions for the following grippers have been added.</p> <ul style="list-style-type: none"> • Cleanroom specification <ul style="list-style-type: none"> • Small two-finger slide type RCP2CR-GRSS • Small two-finger lever type RCP2CR-GRLS • Dust-proof specification <ul style="list-style-type: none"> • Small two-finger slide type RCP2W-GRSS • Small two-finger lever type RCP2W-GRLS
December 2008	<p>Sixth edition</p> <p>Descriptions for the following grippers have been added.</p> <ul style="list-style-type: none"> • Two-finger long-stroke type RCP2-GRST
April 2010	<p>Seventh edition</p> <p>Added information regarding the following grippers:</p> <ul style="list-style-type: none"> • Two-finger type with high gripping force: RCP2-GRHM, GRHB
October 2010	<p>Eighth edition</p> <p>Page 45 Change in dimensions on finger area for RCP2-GRHM and GRHB</p> <p>Page 90 and 110 Change in allowable load moment for GRHM and GRHB</p> <ul style="list-style-type: none"> • GRHM Ma : 15.2 N•m → 11.7 N•m Mb : 21.7 N•m → 16.7 N•m Mc : 60.5 N•m → 46.5 N•m • GRHB Ma : 20.4 N•m → 15.7 N•m Mb : 34.3 N•m → 26.4 N•m Mc : 77.8 N•m → 59.8 N•m
April 2011	<p>Ninth edition</p> <p>A page for CE Marking added</p>
March 2012	<p>Tenth edition</p> <p>Page 1 to 7 Contents added and changed in Safety Guide</p> <p>Page 8 Note “Make sure to attach the actuator properly by following this instruction manual.” added in Caution in Handling</p> <p>Page 72 to 74, 76, 79, 81, 82, 85 to 87 Warning notes added such as in case the grease got into your eye, immediately go to see the doctor for an appropriate care.</p> <p>Page 92 to 106 Mass added to appearance drawing</p> <p>Page 116 to 117 Contents changed in 12. Warranty</p>
May 2014	<p>Eleventh edition</p> <p>Revised overall</p> <p>Cleanroom Specification and Dust-proof Specification deleted</p>
June 2015	<p>Edition 11C</p> <p>Change made to GRS, GRM max. open/close velocity</p> <p>GRS 33.3mm/s → 33mm/s</p> <p>GRM 36.7mm/s → 36mm/s</p>



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