

Solenoid Gripper

GRS-SEG, SIG
GRS-MEG, MIG

Instruction Manual

First Edition

ME3788-1F



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Please Read Before Use

Thank you for purchasing our product.

This instruction manual explains the handling methods, structure and maintenance of this product, providing the information you need in order 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.

Please download the user's manual from our website.

You can download it free of charge. User registration is required for the first time downloading.

URL : www.iai-robot.co.jp/data_dl/CAD_MANUAL/

When using the product, print out of the necessary portions of the relevant manual, or please display it on your computer, tablet terminal, etc. so that you can check it immediately.

After reading the instruction manual, keep it in a convenient place so that whoever is handling the product can refer to it quickly when necessary.

[Important]

- This instruction manual is an original document dedicated for this product.
- This product cannot be used in ways not shown in this instruction manual. IAI shall not be liable for any result whatsoever arising from the use of the product in any other way than what is noted in the manual.
- The information contained in this instruction manual is subject to change without notice for the purpose of product improvement.
- If any issues arise regarding the information contained in this instruction manual, contact our customer center or the nearest sales office.
- Use or reproduction of this instruction manual in full or in part without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the text are registered trademarks.

GRS Gripper Instruction Manual Configuration

Product Name	Instruction Manual Name	Control Number
GRS Solenoid Gripper	First Step Guide	ME3789
GRS Solenoid Gripper	Instruction Manual (this document)	ME3788

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Safety Guide

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

Safety Precautions for Our Products

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

No.	Operation Description	Description
1	Model Selection	<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. <ul 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. <ul 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.

No.	Operation Description	Description
4	Installation and Startup	<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 <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.

No.	Operation Description	Description
4	Installation and Startup	<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 (PE) on the AC power cable of the controller and the grounding plate in the control panel, make sure 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 standards and criteria). For detail, follow the description in [an instruction manual of each controller or controller built-in actuator].• Conduct functional grounding on the FG terminal for a controller supplying 24V DC or a controller built-in type actuator. In order to minimize influence to mechanical operation given by electromagnetic interference (noise) to an electrical device or insulation failure, conduct grounding on a terminal or a conductor that is electrically stable. The reference impedance should be Type D (Former Class 3, ground resistance 100Ω or less).

No.	Operation Description	Description
4	Installation and Startup	<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.





No.	Operation Description	Description
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>
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.

No.	Operation Description	Description
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.
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 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 removed cover or screws, and make sure to put the product back to the original condition after maintenance and inspection works. <p>Use in incomplete condition may cause damage to the product or an injury.</p> <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
9	Modification and Disassembly	<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.• Using the devise in a way not indicated by IAI may lose the protection performance equipped to the device.

Precaution Indications

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

Precautions for Handling

1. The Safety Guide attached with the product is intended to permit safe use of the product and thus to prevent risks and property damage. Be sure to read it before handling the product.
2. Do not attempt any handling or operation that is not indicated in this instruction manual.
3. Make sure to secure the actuator properly in accordance with this instruction manual.
If the actuator is not securely fixed, this may lead to abnormal noise, vibration, breakdown or shortened product life.
4. Make sure to observe the usage conditions and environment of the product.
Operation outside the warranty could cause decreased performance or product breakdown.
Use within the allowable range for each item.

Item	Cautions for use	Problems or breakdowns which may occur if the allowable range is exceeded
operation	Use within the allowable range	May lead to abnormal noise, vibration, breakdown, or shortened product life.
Allowable moment	Use within the allowable range	May lead to abnormal noise, vibration, breakdown, or shortened product life.
Overhang		

5. Avoid contamination from getting into the moving part of the fingers.
Contamination may get pinched and may cause malfunction.
6. In some conditions of environment of use, postures of installation and conditions of operation, the base oil separated from the grease may come out.
It is recommended to have a protection in case the peripheral devices could get influence of the base oil.

7. When it is necessary to open the fingers manually with hand, make sure to open both fingers at the same time.

Opening fingers on only one side would give excess force to the internal cam feature and could damage it.

8. Do not put anything that is magnetic close to the position sensor.

It may cause wrong detection.

9. Do not attempt to change the direction of cable ejection after the product is delivered.

International Standard Compliance

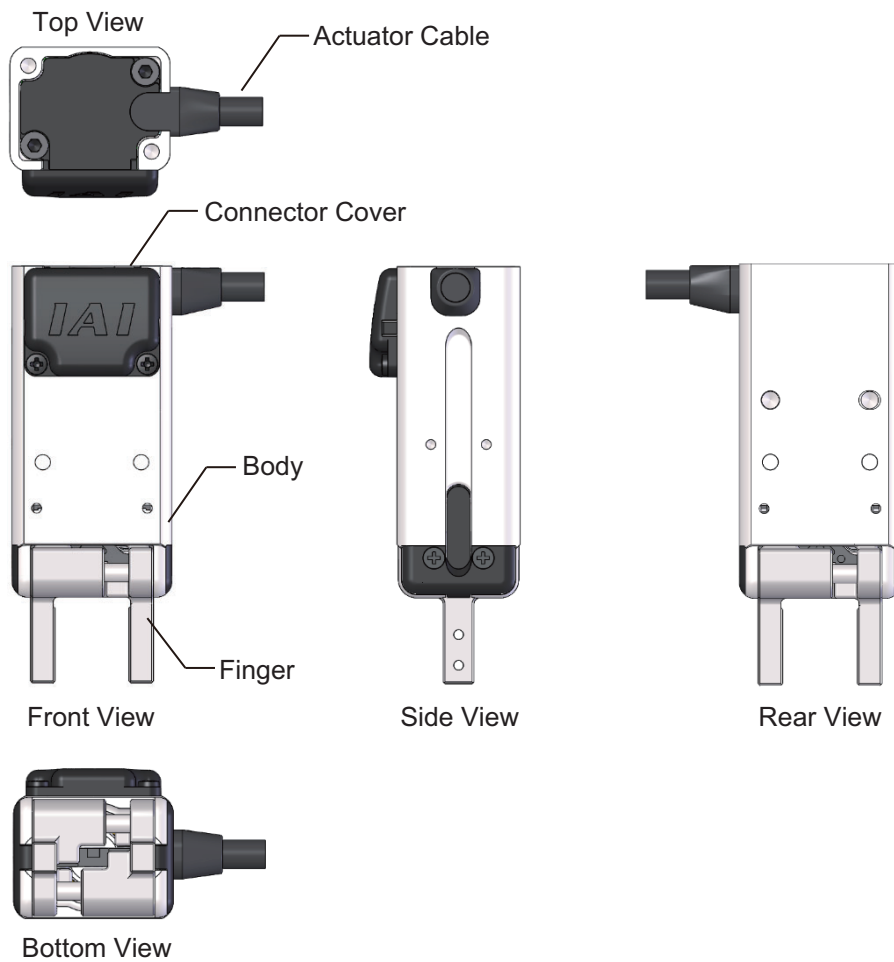
The solenoid gripper complies with the following overseas standards.

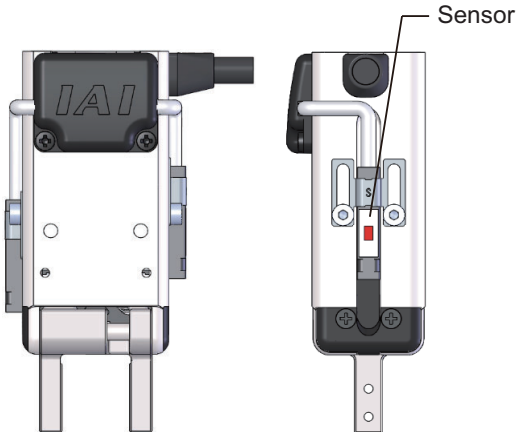
Refer to the Overseas Standard Compliance Manual (ME0287) for more detailed information.

CE Marking	RoHS3 Directive
○	○

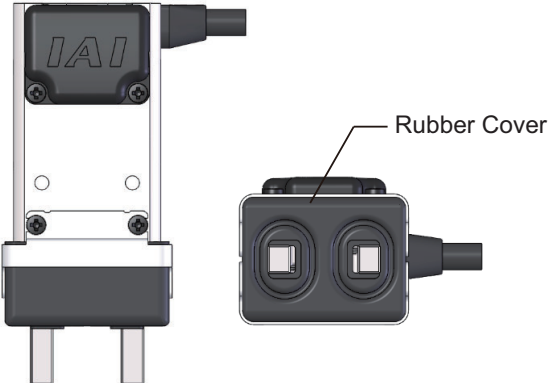
Names of the Parts

Solenoid Gripper



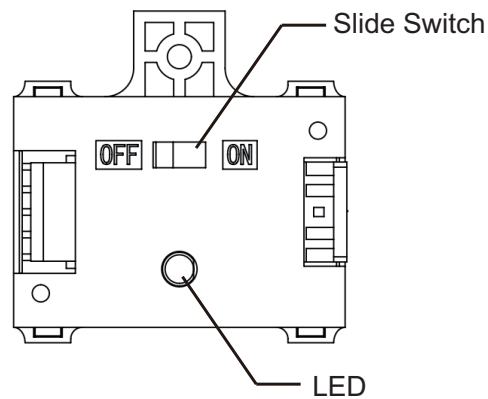


Attaching Sensor (Option)



Rubber Cover (Option)

Driver Box



[Slide Switch]

Set this switch to “ON” side and the fingers on the solenoid gripper should get released. For the outer gripping type, fingers can be compulsorily open.

For the inner gripping type, it should be compulsorily close.

While the switch is on, the LED lamp should be on.

(However, it cannot be turned OFF compulsorily when Release Signal is ON.)

Turn the slide switch OFF when in normal use.

[LED]

It is an LED lamp that turns on and off in accordance with the operation open and close (signal ON/OFF) of the solenoid gripper fingers.

Chapter 1


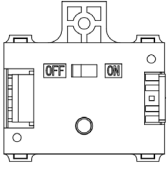


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1.1 Checking the Product

1.1.1 Components

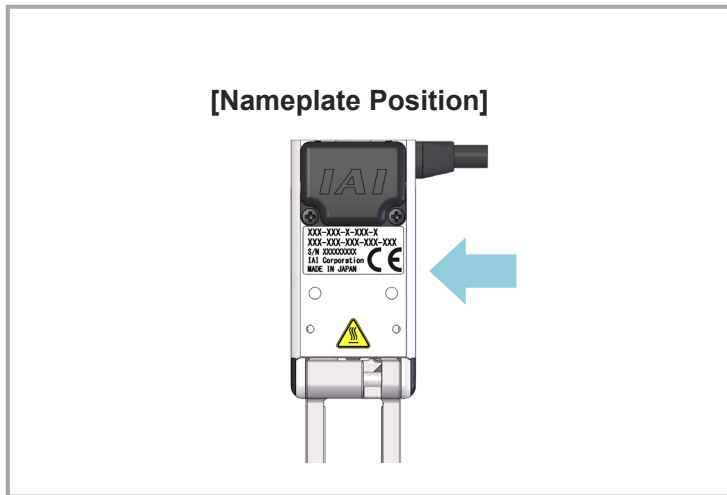

The following table shows the product configuration for the standard specification. See the packing list for the details of the enclosed components. In the unlikely case that any model number errors or missing parts come to light, contact your local IAI distributor.

Item	Shape	Quantity	Remarks
Body		1	
Driver Box		1	
Solenoid Driver Cable		1	
Safety Guide		1	

1.1.2 How to Read the Model Nameplate

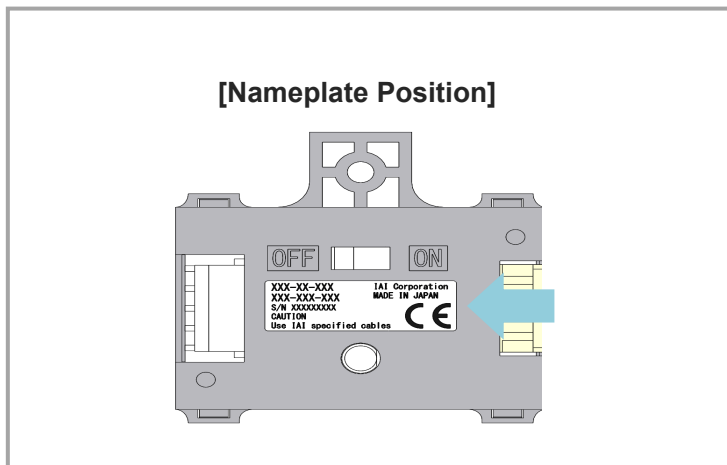

[Main Body]

Model Number → GRS-SEG-4-DBN-AC2
Serial Number → S/N A70631980
IAI Corporation
MADE IN JAPAN

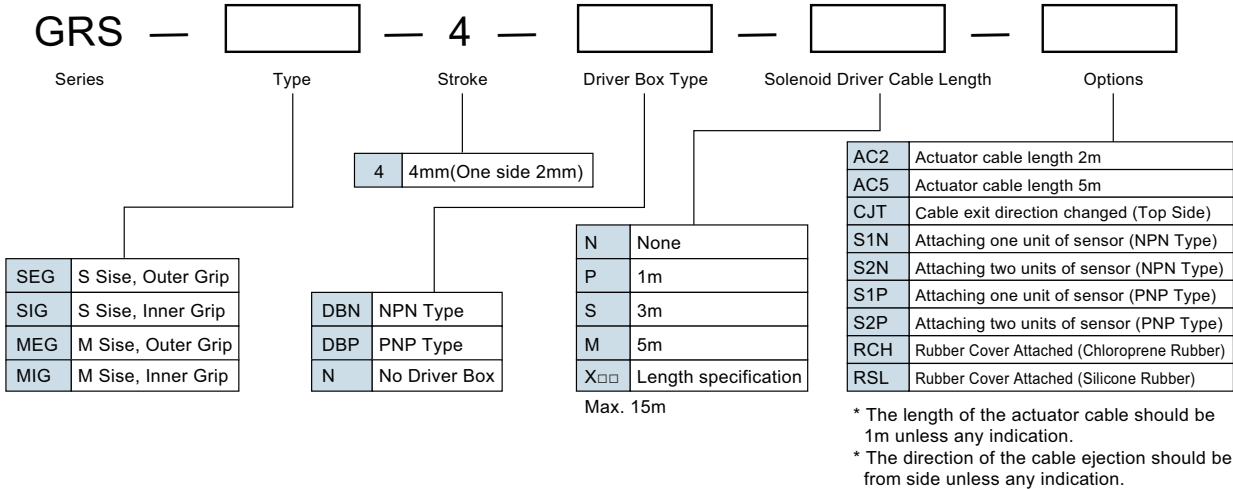


[Driver Box]

Model Number → GRS-DB-NPN IAI Corporation
MADE IN JAPAN
Serial Number → S/N A70631979
CAUTION
Use IAI specified cables



1.1.3 How to Read the Model Number



1.2 Specifications

1.2.1 Specifications

[1] GRS-SEG, SIG

[Max. Grip Force and Stroke]

Model	Max. Grip Force *1 (N)	Stroke (mm)
GRS-1)-4-2)-3)-4)	10 (One side 5)	4 (One side 2)

Legend 1) Type 2) Driver Box Type 3) Cable Length 4) Option

*1 It is the grip force of the fingers at 2mm on one side when the grip point at 12.5mm and overhang distance 0mm. The grip force should vary depending on the position on the stroke when a workpiece is gripped.

[Refer to relation between the finger stroke and the grip force in the next page]



[Open Operation Time / Close Operation Time, Max Operation Frequency]

Stroke	4 (mm)
Open Operation Time / Close Operation Time	0.03 seconds or less
Max. Operation Frequency	120 (CPM)

CPM : cycle per minute

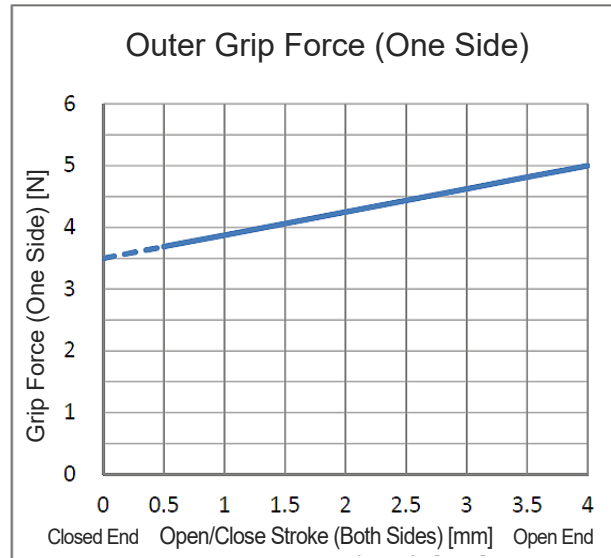
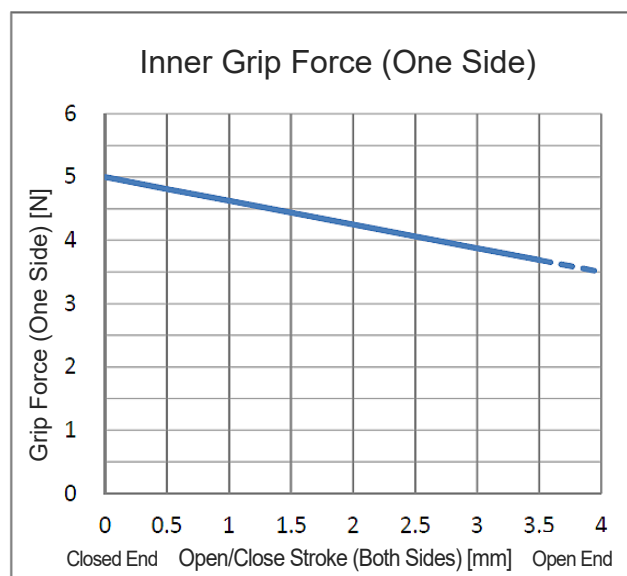
[Actuator Specifications]

Item	Contents
Gripping Function	Compression Spring + Cam Feature
Releasing Function	Solenoid Electromagnetic Force + Cam Feature
Repeatability Accuracy *2	±0.1mm
Backlash	One side 0.5mm or less
Ambient Operating Temperature/Humidity	0 to 40°C, 85% RH or less (Non-condensing)

*2 It is the repeatability Accuracy for gripping. Be aware it is not the repeatability accuracy for releasing operation.

[Relation between the Finger Stroke and the Grip Force]

The graph shows the grip force on one finger.

GRS-SEG**GRS-SIG**

[2] GRS-MEG, MIG

[Max. Grip Force and Stroke]

Model	Max. Grip Force *1 (N)	Stroke (mm)
GRS-1)-4-2)-3)-4)	20 (One side 10)	4 (One side 2)

Legend 1) Type 2) Driver Box Type 3) Cable Length 4) Option

*1 It is the grip force of the fingers at 2mm on one side when the grip point at 15mm and overhang distance 0mm. The grip force should vary depending on the position on the stroke when a workpiece is gripped.
[Refer to relation between the finger stroke and the grip force in the next page]



[Open Operation Time / Close Operation Time, Max Operation Frequency]

Stroke	4 (mm)
Open Operation Time / Close Operation Time	0.03 seconds or less
Max. Operation Frequency	120 (CPM)

CPM : cycle per minute

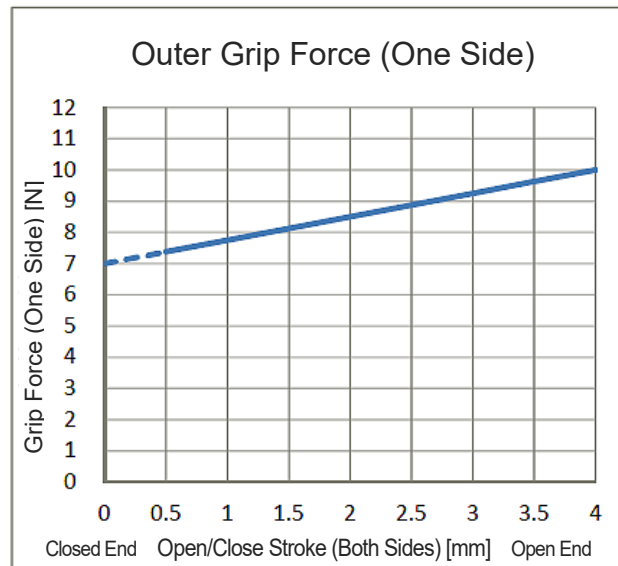
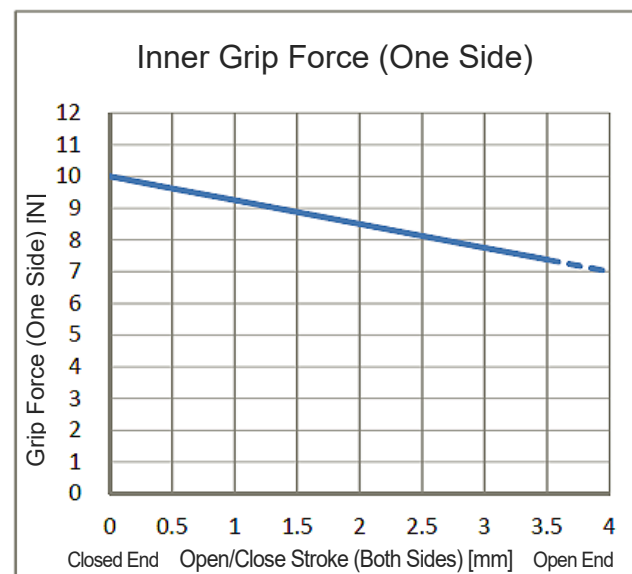
[Actuator Specifications]

Item	Contents
Gripping Function	Compression Spring + Cam Feature
Releasing Function	Solenoid Electromagnetic Force + Cam Feature
Repeatability Accuracy *2	±0.1mm
Backlash	One side 0.5mm or less
Ambient Operating Temperature/Humidity	0 to 40°C, 85% RH or less (Non-condensing)

*2 It is the repeatability Accuracy for gripping. Be aware it is not the repeatability accuracy for releasing operation.

[Relation between the Finger Stroke and the Grip Force]

The graph shows the grip force on one finger.

GRS-MEG**GRS-MIG**

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.

Procedure 1 Check for the necessary grip force and transportable workpiece mass

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

1.3.1 Procedure 1 Check for the necessary grip force and transportable workpiece mass

If a workpiece 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 workpiece

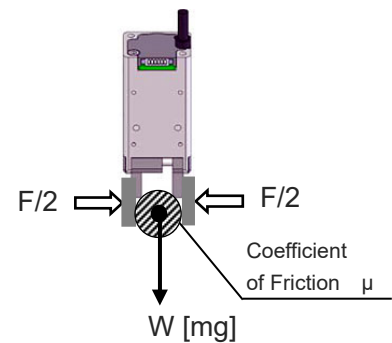
m : Mass of workpiece [kg]

g : Gravitational acceleration [= 9.8m/s²]

The condition to grip the workpiece statically and that the workpiece 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 workpiece 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 workpiece transportation;

Necessary grip force \Rightarrow 10 to 20 times or more of workpiece mass

Transportable workpiece 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 workpiece during transportation
High inertial force, in addition to the gravity, will be applied to the workpiece. In such cases, consider an even higher safety factor if it is necessary.

When high acceleration/deceleration speed or a big impact is applied;

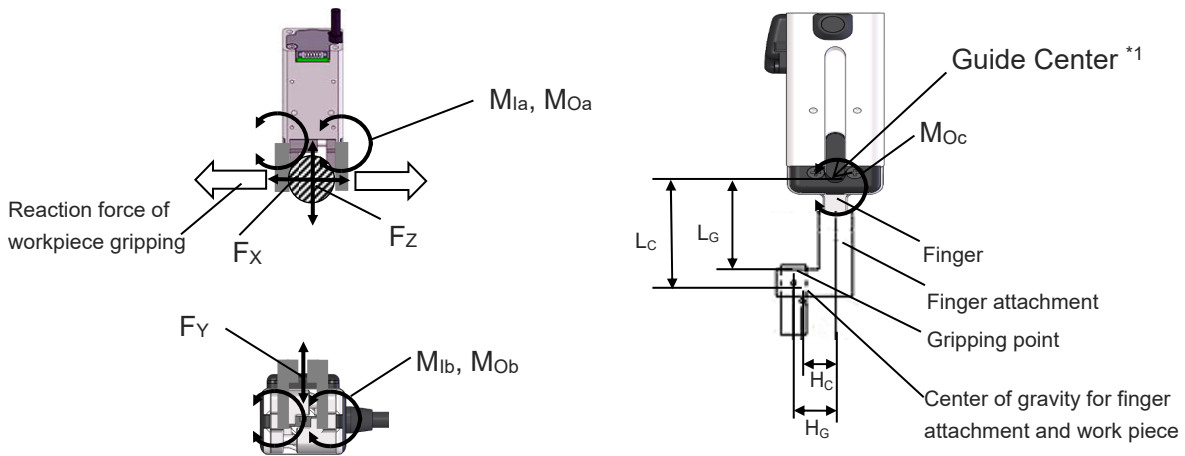
Necessary grip force \Rightarrow 30 to 50 times or more of the workpiece mass

Transportable workpiece mass \Rightarrow 1/30 to 1/50 or less of the grip force

1.3.2 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. Calculate F_z , M_a , M_b and M_c by referring to (1) to (3) described below, and select a model considering not to exceed the allowable value. Or, consider to make the overhang smaller at the gripping point so it would not exceed the allowable value.

Load and the moment applicable to the finger



*1 Refer to 1.2 Specifications for the position of guide center

F_x : External force in X direction applied to workpiece and finger [N]

F_y : External force in Y direction applied to workpiece and finger [N]

F_z : External force in Z direction applied to workpiece and finger [N]

L_g : Distance from finger attachment surface to gripping point [mm] ^(Note1)

H_g : Distance from center of fingers to gripping point (Overhang) [mm] ^(Note1)

L_c : Distance from finger attachment surface to center of gravity for workpiece and finger attachment [mm]

H_c : Distance from center of fingers to center of gravity for workpiece and finger attachment [mm]

M_{Ia} : Moment in M_a direction generated on fingers due to grip force [N•m]

M_{Ib} : 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]

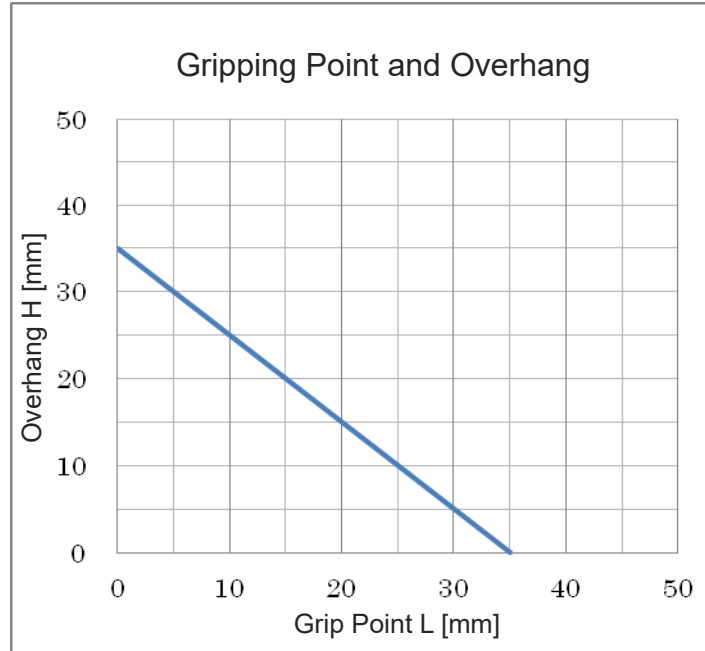
M_b : All moments in M_b direction generated on fingers [N•m]

M_c : All moments in M_c direction generated on fingers [N•m]

Note 1 For L_g and H_g , have the values below 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.

Upper Limit for Gripping Point L_G and Overhang H_G

[SEG/SIG]



[MEG/MIG]

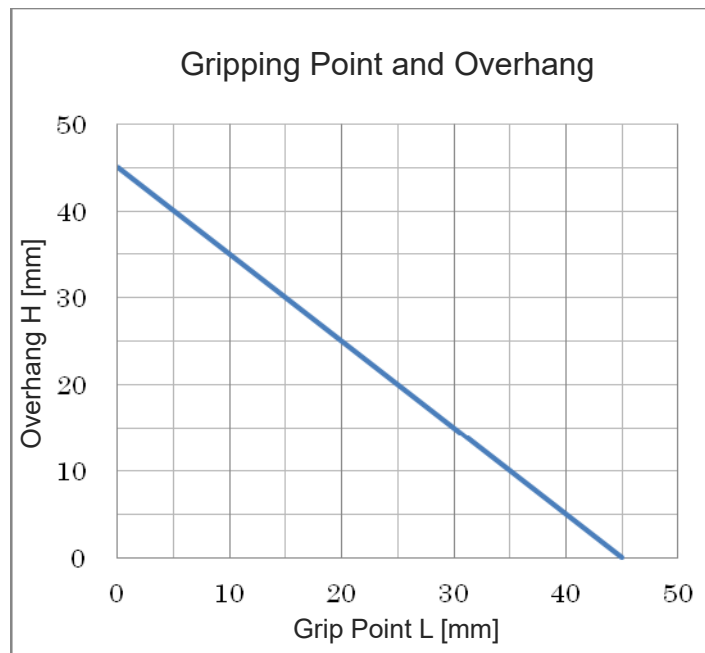


Table 1: Allowable Load and Allowable Moment on the Fingers (Note 1)

Model	Allowable Load in Vertical [N] F_{Zmax}	Max. Allowable Moment [N•m](Note2)		
		M_{amax}	M_{bmax}	M_{cmax}
SEG/SIG	150	0.62	0.62	0.99
MEG/MIG	240	1.08	1.08	2.64

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.

(1) Moment generated on fingers due to grip force

1) Moment in M_{a} direction [M_{a}]

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

F_G : Grip force of gripper (N)

2) Moment in M_{b} direction [M_{b}]

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

F_G : Grip force of gripper (N)

Refer to “1.2 Specifications Relation between the Finger Stroke and the Grip Force” for grip force F_G .
As the grip 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 grip force will be applied to the workpiece 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 workpiece 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 workpiece 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 workpiece and finger attachment

$$F = mg$$

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

b) Inertial force in the gripper moving straight

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

c) Centrifugal force in gripper turning

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

Confirm that F_Z is below the allowable load vertical direction, $F_{Z\text{max}}$ 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.

$$1) \text{ Moment in } M_a \text{ direction [} M_{oa} \text{]} \quad M_{oa} = LcF_X \times 10^{-3}$$

$$2) \text{ Moment in } M_b \text{ direction [} M_{ob} \text{]} \quad M_{ob} = HcF_X \times 10^{-3}$$

$$3) \text{ Moment in } M_c \text{ direction [} M_{oc} \text{]} \quad M_{oc} = LcF_Y \times 10^{-3} + HcF_Z \times 10^{-3}$$

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

$$M_a = M_{Ia} + M_{oa}, \quad b = M_{Ib} + M_{ob}, \quad M_c = M_{oc}$$

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

(Note) 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 guide area.

1.4 Options

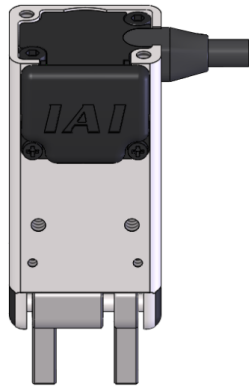
1.4.1 Changing Actuator Cable Length (Model Code: AC2, AC5)

It is 1m in standard. If it is necessary to have a longer actuator cable, you can indicate the length from the following variations.

- AC2 : 2m
- AC5 : 5m

1.4.2 Cable Exit Direction Changed Side Cable Ejection (Model Code: CJT)

The orientation of the motor / encoder cable to be installed on the actuator unit can be changed to top side. The ejection should be from side unless an option is ordered.



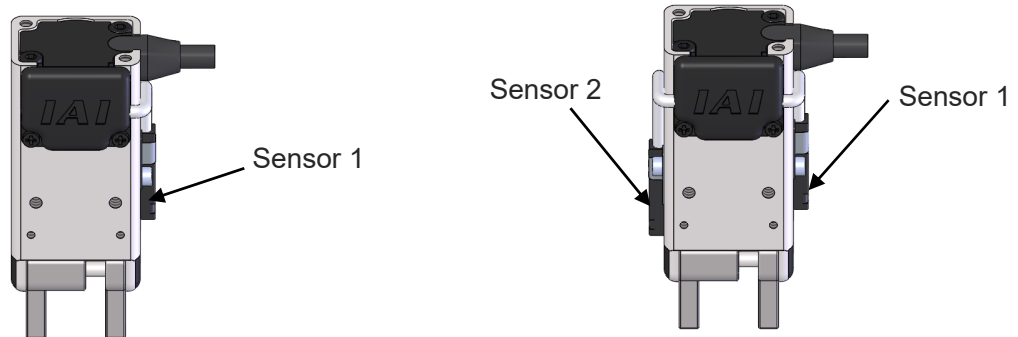
Side Ejection: No Option Selected



Upward Ejection: CJT

1.4.3 Attaching Sensor (Model Code: S1N, S2N, S1P and S2P)

One or two units of a sensor to detect the operation open and close of the fingers can be attached. NPN type and PNP type are available to select for a sensor.



Attaching one unit of sensor (NPN Type): S1N
Attaching one unit of sensor (PNP Type): S1P

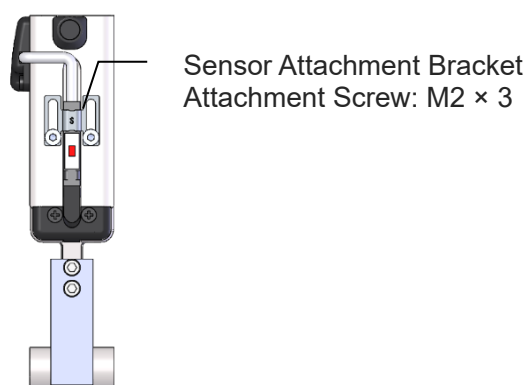
Attaching two units of sensor (NPN Type): S2N
Attaching two units of sensor (PNP Type): S2P

Sensor 1 and Sensor 2 should be adjusted as shown below at delivery.

* For attaching one unit of sensor (S1N, S1P), only a sensor 1 that turns ON when releasing should be available.

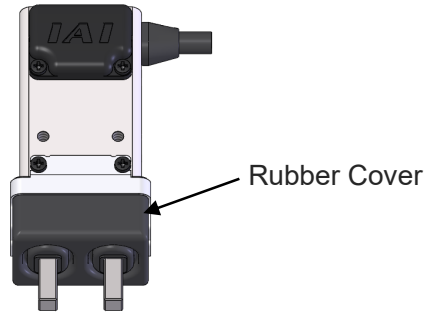
operation	Release	Gripped workpiece existed	No gripped workpiece
Sensor 1	ON	OFF	
Sensor 2	OFF		ON

When you use the sensor, check the operation of gripping a workpiece, and adjust the position of the sensor by loosening the screw on the sensor attachment bracket if necessary.



1.4.4 Rubber Cover Attached (Chloroprene Rubber) (Model Code: RCH)

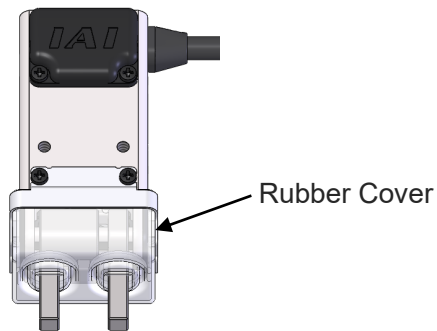
A rubber cover made of chloroprene rubber can be attached on the fingers.



Rubber Cover Attached (Chloroprene Rubber): RCH

1.4.5 Rubber Cover Attached (Silicone Rubber) (Model Code: RSL)

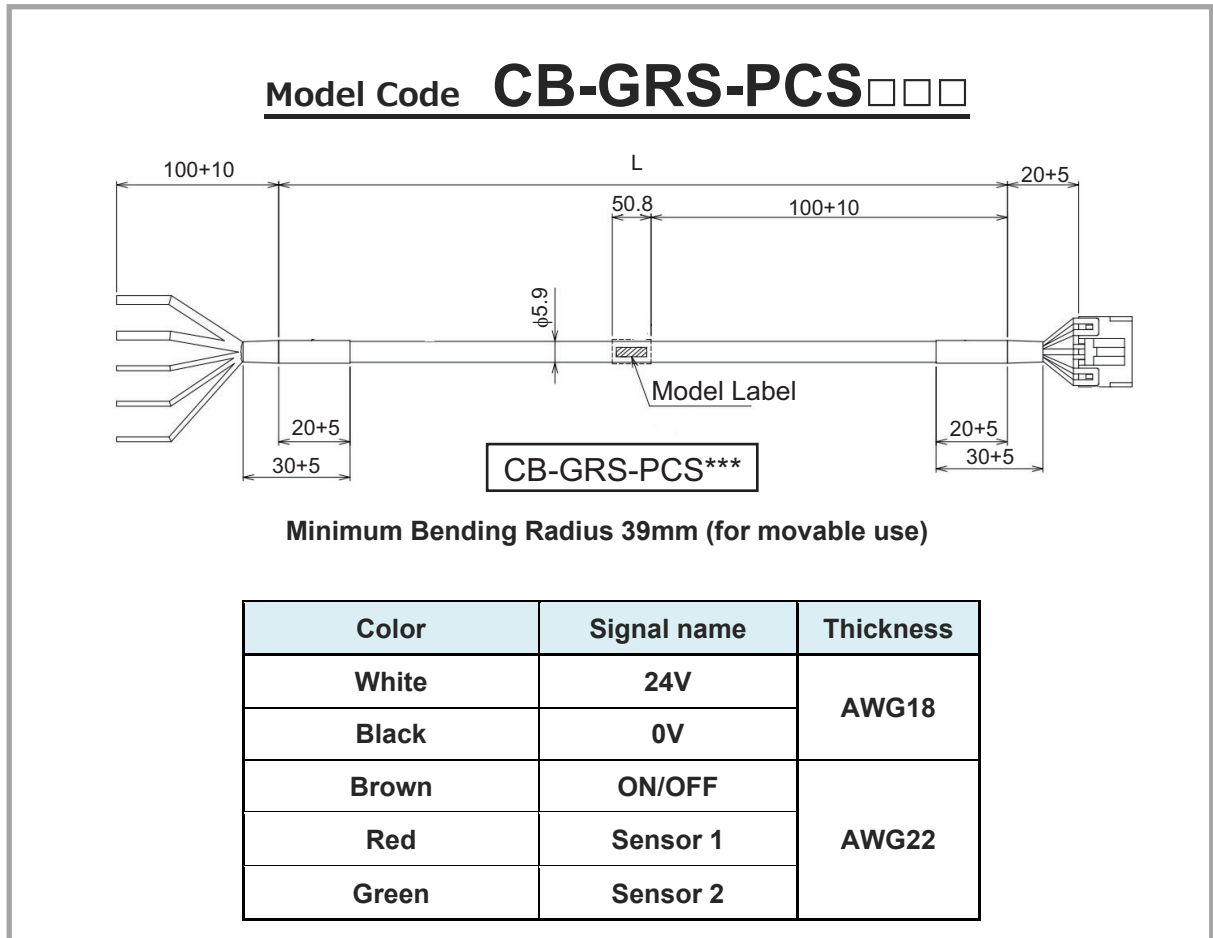
A rubber cover made of silicone rubber can be attached on the fingers.



Rubber Cover Attached (Silicone Rubber): RSL

1.5 Accessories

1.5.1 Solenoid Driver Cable (Cable Not for Robot Use)



- The cable length is available from 1m to 15m.
Specify the length in increments of 1m.
- The following shows a sample model number.
 - Cable length 1m → CB-GRS-PCS 010
 - Cable length 3m → CB-GRS-PCS 030
 - Cable length 10m → CB-GRS-PCS 100

Chapter 2

Installation

- 2.1 Precautions for Transportation2-1
- 2.2 Installation and Storage/Preservation Environment2-2
 - 2.2.1 Installation Environment 2-2
 - 2.2.2 Storage/Preservation Environment 2-3
- 2.3 Installation 2-4
 - 2.3.1 Mounting Orientation 2-4
 - 2.3.2 Notice for Attachment 2-5
 - 2.3.3 Main Body Mounting 2-6
 - [Finger Attachment Mounting] 2-8
 - [Driver Box Mounting] 2-9

2.1 Precautions for Transportation

[Handling the package]

- Do not damage or drop the package.
The package is not specially designed to withstand dropping or shock due to collision.
- Keep the unit in horizontal orientation for stationary positioning or transportation.
- Do not climb onto the package.
- Do not put anything that could deform the package on it.

[Handling after unpacking]

- Hold the body part when you carry the unit.
- Do not attempt to transfer the unit by holding cables. Do not attempt to transfer the unit by pulling cables.
- Do not damage or drop the package during transportation.
- Do not apply excessive force to any part
→ For the names of each part, refer to “Names of the Parts” on page Intro-13 to 15.

[Handling when assembled into machinery (system)]

- Secure finger to prevent sudden movement during transport.
- If the body or any moving part is overhanging, fix it appropriately to avoid large wobbles due to external vibration. When transporting without fixing the tip, do not apply impact of 0.3G or more.
- When suspending machinery (system) with ropes, be careful not to catch the rope on the body or cable.

2.2 Installation and Storage/Preservation Environment

Usage is possible in environments of pollution degree 3 or equivalent.

Pollution degree 3: Conductive pollution or dry nonconductive pollution, which could become conductive due to expected condensation. (IEC 60664-1)

2.2.1 Installation Environment

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

Avoid the following locations for installation.

- Where the unit receives radiant heat from strong heat sources such as heat treatment furnaces
- Where the ambient temperature exceeds the range of 0 to 40°C
- Where the temperature changes rapidly and condensation occurs
- Where the relative humidity exceeds 85% RH
- Where the unit receives direct sunlight
- Where the unit is exposed to corrosive or combustible gases
- Where the ambient air contains a large amount of dust, salt or iron (at levels exceeding those typical of an assembly plant)
- Where the unit is subject to splashed water or oil (including oil mist or cutting fluid) or chemical solutions
- Where the body receives impact or vibration
- Where the altitude is more than 2000m

Also, provide sufficient work space for the following maintenance and inspection:

- Space to replenish grease

If the unit is used in any of the following locations, provide sufficient shielding measures:

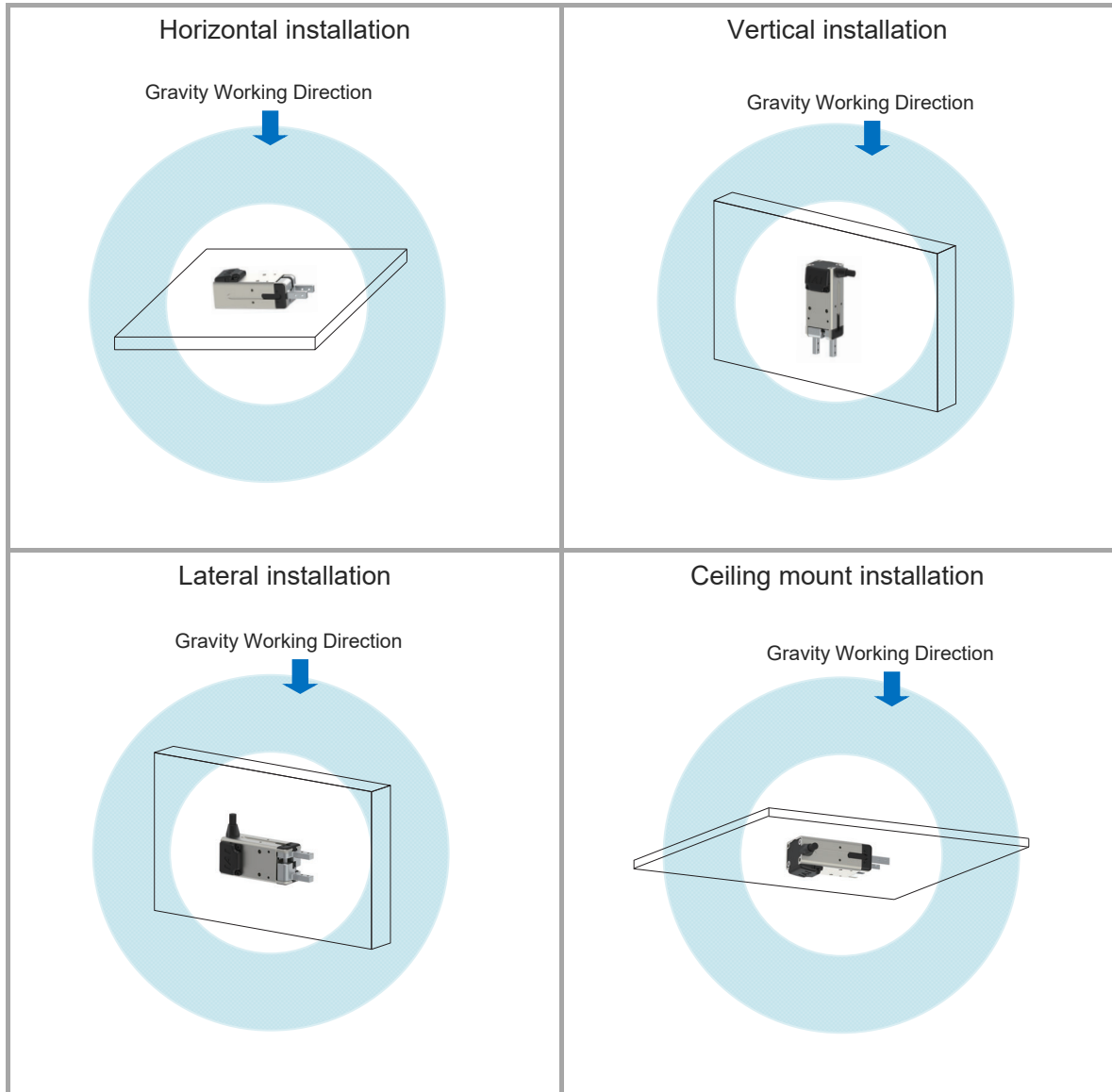
- Where noise is generated due to static electricity, etc.
- Where the unit is subject to a strong electric or magnetic field
- Where the unit is subject to ultraviolet or radiation

2.2.2 Storage/Preservation Environment

- For the storage and preservation environment, see the installation environment.
However, give especial consideration to the prevention of condensation during long-term storage/preservation.
- Unless especially specified, desiccant is not included in the package at shipping.
If the product is to be stored/preserved in an environment where condensation is anticipated, take condensation preventive measures.
- For short-term storage, it can be stored at 60°C or below.
For storage of one month or more, make sure that the temperature does not exceed 50°C.
- The product should be placed horizontally for storage and preservation.
If storing in the packaged condition, observe the conditions, if any, regarding storage orientation.

2.3 Installation

2.3.1 Mounting Orientation Type: GRS-SEG/SIG, GRS-MEG/MIG



2.3.2 Notice for Attachment

Temperature goes up when in releasing operation as the current flows.

The temperature increase could vary depending on the frequency of open and close operation, condition of unit installation, attachment material and so on.

→Refer to [Temperature Increase Measurement Data \(Reference\)](#) in Appendix 8.1.

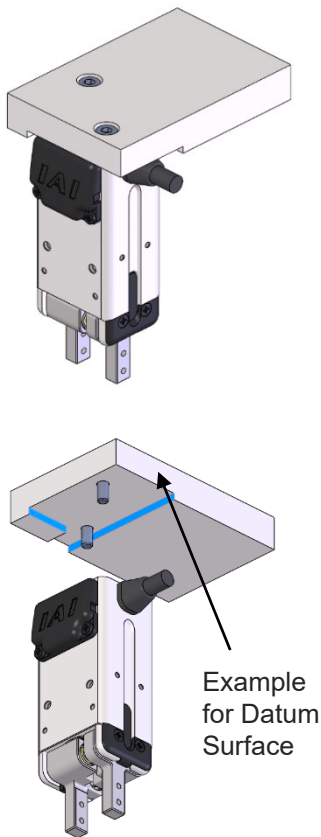
Notice

- In case there is a concern of temperature influence on a workpiece, use a material which possesses high heat conduction performance such as aluminum for attachment of the unit.
 - In case there is a concern of temperature influence on a workpiece, use a material which possesses low heat conduction performance such as plastic for finger attachment.
-

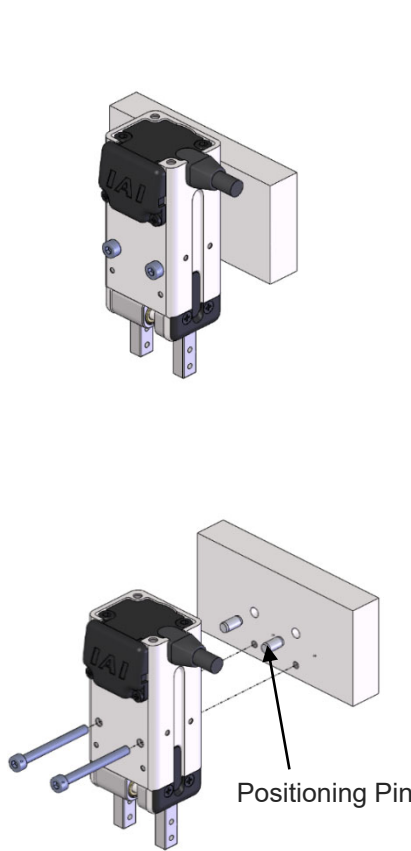
2.3.3 Main Body Mounting

- The main body can be installed in three ways (Top Side, Front Side and Rear Side).
- There are a positioning reamed hole and an oblong hole equipped on the back side of the body. In case of installation on top side, prepare a datum surface as shown in the figure below.
- Pay attention to the size of the rubber cover (option) when it is attached as it has some area that overhangs from the body installation surface.

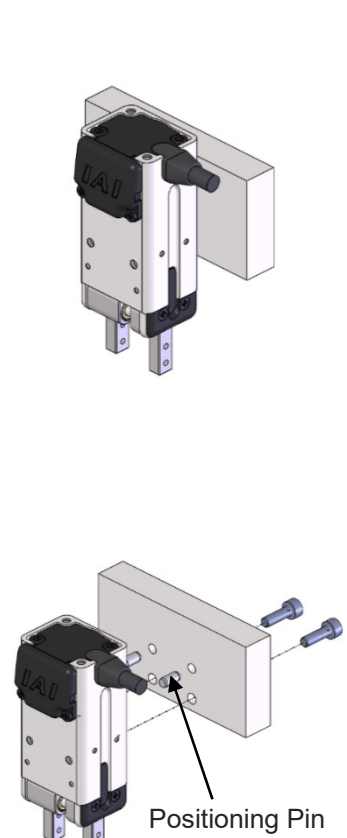
Installation on Top Side

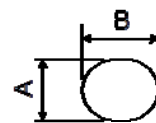


Installation on Front Side



Installation on Rear Side





Oblong Hole

Model Name	Installation Surface	Mounting Bolt	Tapped Hole	Through Hole	Reamed Hole [mm]	Oblong Hole
SEG/SIG	Top Side	M3	2×M3 Depth 6	-	-	-
	Front Side	M2.5	-	2×φ2.6	-	-
	Rear Side	M3	2×M3 Depth 6	-	φ3 ^{+0.025} ₀ H9 Depth 2	A:3 ^{+0.025} ₀ H9 B:3.5 Depth 2
MEG/MIG	Top Side	M4	2×M4 Depth 6	-	-	-
	Front Side	M3	-	2×φ3.3	-	-
	Rear Side	M4	2×M4 Depth 6	-	φ3 ^{+0.025} ₀ H9 Depth 3	A:3 ^{+0.025} ₀ H9 B:3.5 Depth 2

[Tightening Torque]

Model Name	Installation Surface	Tapped Hole	Tightening Torque	
			In the case that steel is used for the screw seating surface	In the case that aluminum is used for the screw seating surface
SEG/SIG	Top Side	M3	1.54N·m(0.16kgf·m)	0.83N·m(0.08kgf·m)
	Front Side	M2.5	0.87N·m(0.09f·m)	-
	Rear Side	M3	1.54N·m(0.16kgf·m)	-
MEG/MIG	Top Side	M4	3.59N·m(0.37kgf·m)	1.76N·m(0.18kgf·m)
	Front Side	M3	1.54N·m(0.16kgf·m)	-
	Rear Side	M4	3.59N·m(0.37kgf·m)	-

**Caution**

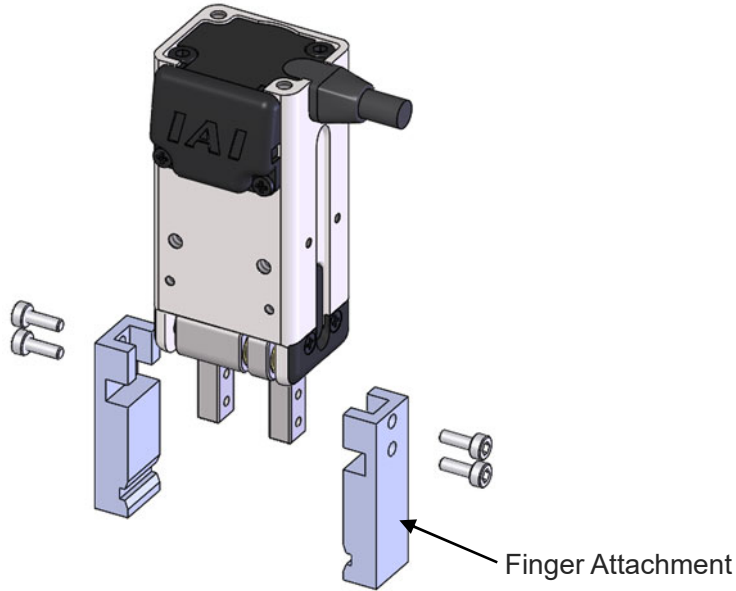
- Pay attention to screw depth and positioning hole depth. Having the length too long could deform components and damage them.

Notice

- The use of high-strength bolts of ISO-10.9 or higher is recommended.
- Make sure the internal thread and bolt effective engagement length is approximately 1 time the nominal diameter or more.

[Finger Attachment Mounting]

- The finger attachment are to be prepared by the customer.
- Avoid applying excess force on fingers when attaching the attachments.



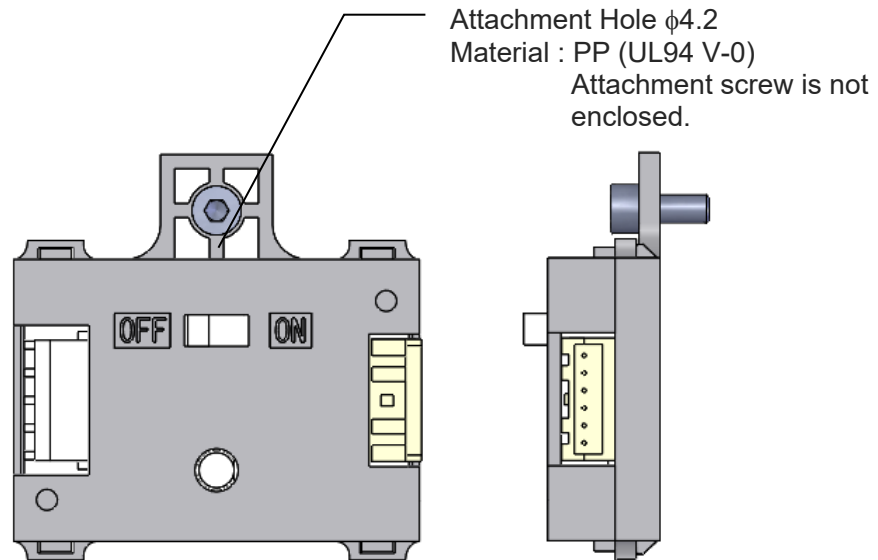
Model Name	Mounting Bolt	Tapped Hole	Tightening Torque		
			In the case that steel is used for the screw seating surface	In the case that aluminum is used for the screw seating surface	When screw seat is made of plastic
SEG/SIG	M2	4-M2 Through	0.42N·m (0.04kgf·m)	0.25N·m (0.03kgf·m)	0.17N·m (0.02kgf·m)
MEG/MIG	M3	4-M3 Through	1.54N·m (0.16kgf·m)	0.83N·m (0.08kgf·m)	0.54N·m (0.06kgf·m)

Notice

- The use of high-strength bolts of ISO-10.9 or higher is recommended.
- Make sure the internal thread and bolt effective engagement length is approximately 1 time the nominal diameter or more.

[Driver Box Mounting]

Utilize the attachment hole when attaching the driver box.



Mounting Bolt	Tightening Torque
M4	0.75N·m 0.08kgf·m)



2. Installation

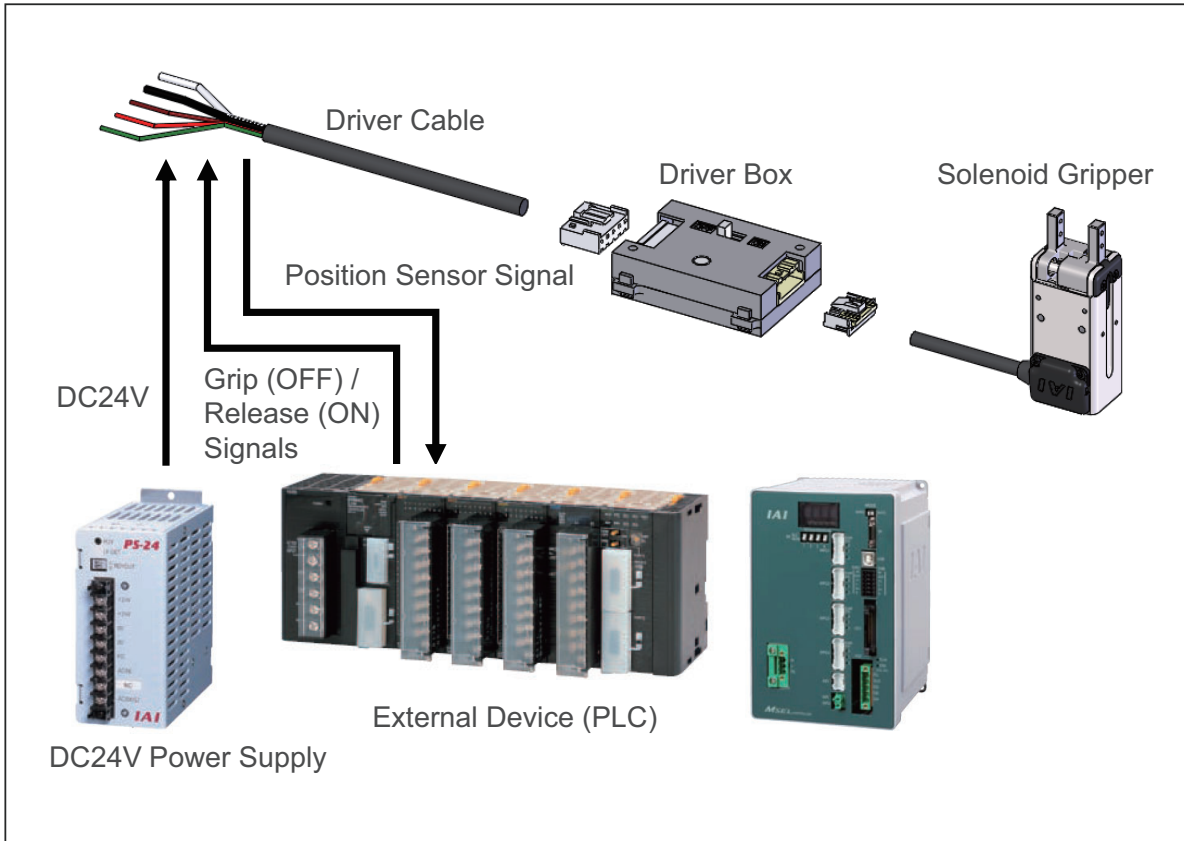
Chapter 3

Wiring

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 - 3.2.2 Interface Specifications 3-3
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 - 3.2.4 Sensor Signal Output Specifications 3-6
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3.1 System Configuration

The following shows the system configuration.



Supply 24V DC to the solenoid gripper and Open / Close signals from the master device to the driver box in the solenoid gripper, and the fingers can be operated.

3.2 Electrical Specifications

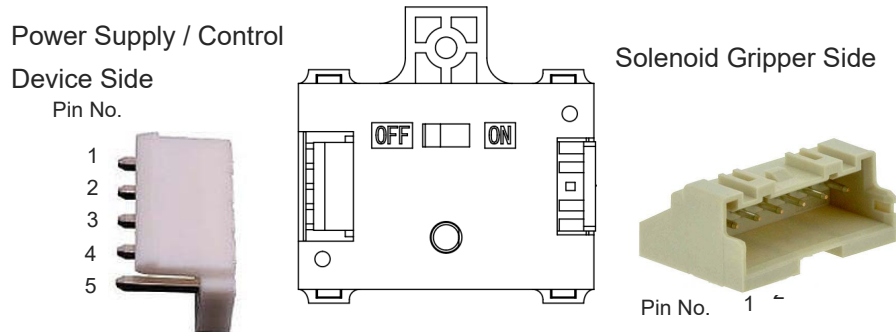
3.2.1 Driver Box Specifications

Item	Contents	
	Controlled Subject	GRS-SEG, SIG
Power-supply Voltage	DC24V±10%	
Max. Output Current (Release Initial Peak 40ms)	2.8A	3.7A
Max. Power Consumption (Release Initial Peak 40ms)	74W	97W
Release Retained Power Consumption (Resealed Condition Retained)	2.0W	2.1W
Power Consumption in Gripping Condition	0W	0W
Open / Close Signals Input	24V DC dedicated signal input (select NPN or PNP)	
Position Sensor Signal Input	24V DC dedicated signal output (select NPN or PNP)	
Overcurrent Input Protection	Overcurrent 6.3A 1sec or more, by semiconductor fuse	
LED Display	In Releasing Operation: On (Green) In Gripping Operation: Off	
Manual Switch	OFF when in normal operation Manual switch available to turn ON only when Open / Close Signal input is OFF	
Temperature	0 to 40°C	
Humidity	85% RH or less (non-condensing)	
Surrounding Environment	Should be no corrosive gas	
Surrounding Storage Temperature	-10 to 65°C	
Surrounding Storage Humidity	90% RH or less (non-condensing)	
Cooling Method	Natural air-cooling	
Degree of Protection	IP20	
Mass	22g	
External dimensions	58mm (W) × 58.1mm (H) × 16mm (T)	

* Conditions for Output Current and Power Consumption : 25°C Power-supply Voltage DC24V±10%

3.2.2 Interface Specifications

The specifications of the interface in the driver box is as shown below.



[Power Supply / Control Device Side]

Connector : B5PS-VH (JST)

Pin No.	Name	Contents	Remarks
1	24V	Power input of 24V DC $\pm 10\%$ for solenoid gripper, driver box and sensors	Use ground of master device (PLC, controller) in common
2	0V	0V (GND)	
3	ON/OFF	Grip (OFF) / Release (ON) signals input to solenoid gripper	
4	Sensor1	Through input for Sensor 1 for open/close status monitor for solenoid gripper	
5	Sensor2	Through input for Sensor 2 for open/close status monitor for solenoid gripper	

[Solenoid Gripper Side]

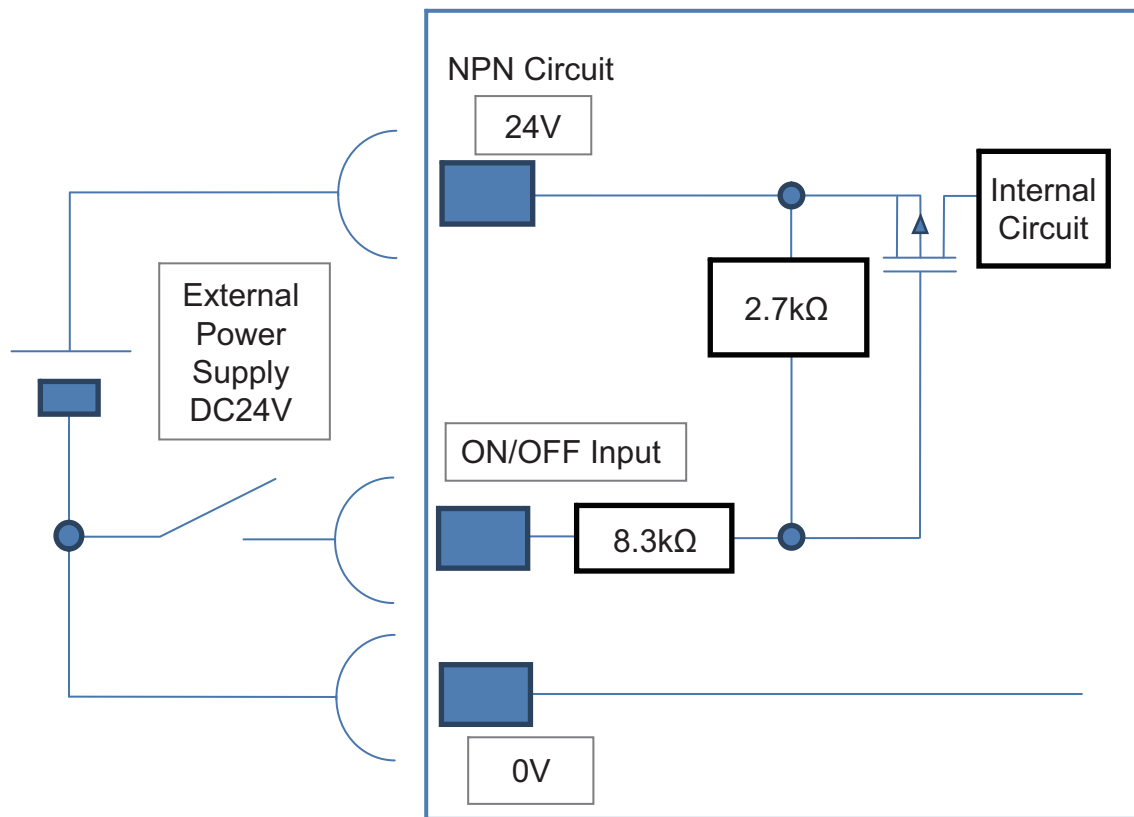
Connector : S06B-XASK-1 (JST)

Pin No.	Name	Contents	Remarks
6	SOL+	Drive output for solenoid gripper	
5	SOL-		
4	24V	Power supply 24V DC $\pm 10\%$ output for sensor	Output directly the input 24V DC
3	0V	0V output for sensor	
2	Sensor1	Through input for Sensor 1 for open/close status monitor for solenoid gripper	
1	Sensor2	Through input for Sensor 2 for open/close status monitor for solenoid gripper	

3.2.3 Grip (OFF) / Release (ON) Signals Specifications

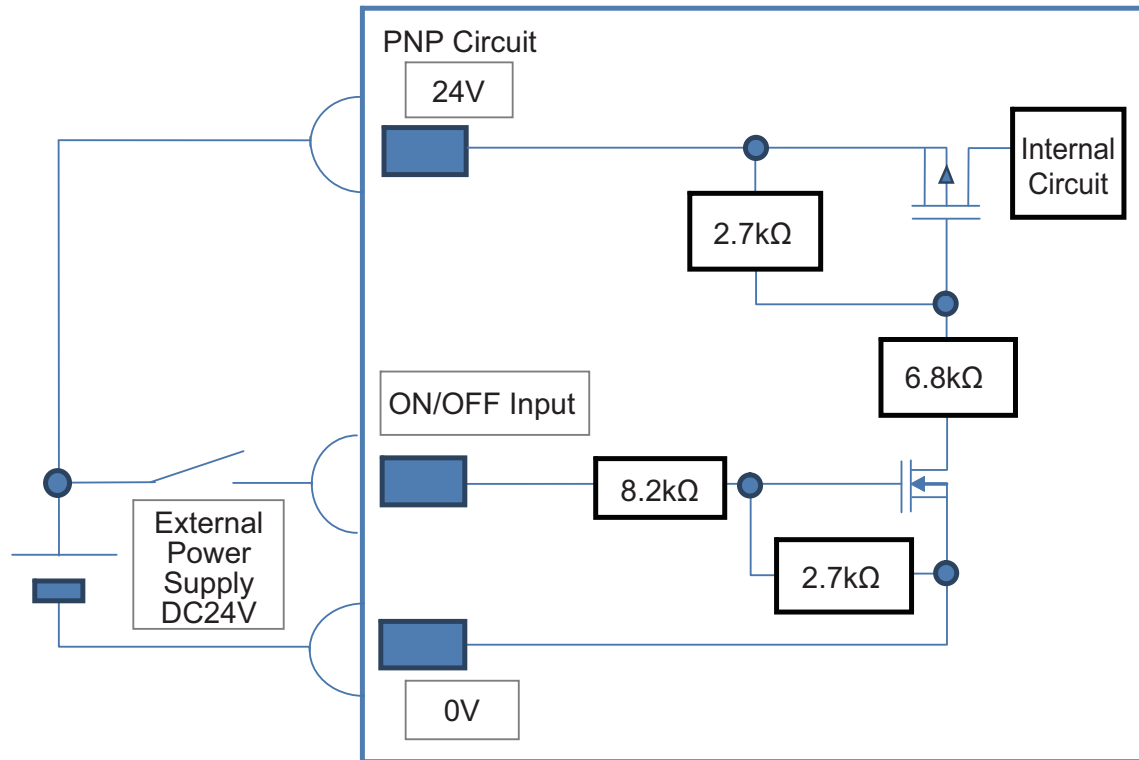
[NPN Type]

Item	Specifications
Input voltage	DC24V±10%
Input current	2mA
Leakage current	Max. 0.25mA
Operation Voltage	ON voltage : 6.0V or less
	OFF voltage : Input voltage -3.0V or more
Isolation type	Non-isolated



[PNP Type]

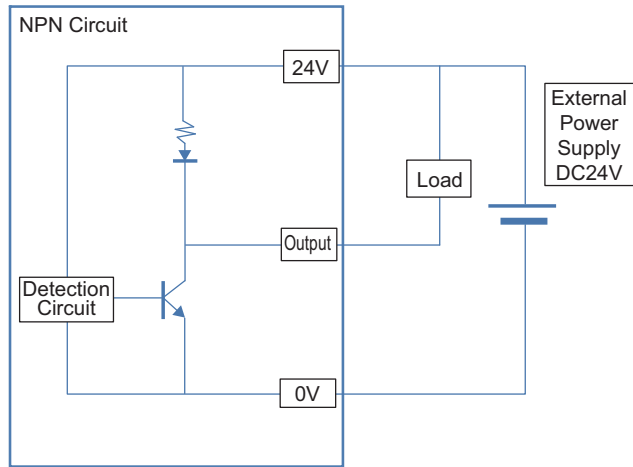
Item	Specifications
Input voltage	DC24V±10%
Input current	2mA
Leakage current	Max. 0.25mA
Operation Voltage	ON voltage : 18.0V or more
	OFF voltage : Input voltage 3.0V or less
Isolation type	Non-isolated



3.2.4 Sensor Signal Output Specifications

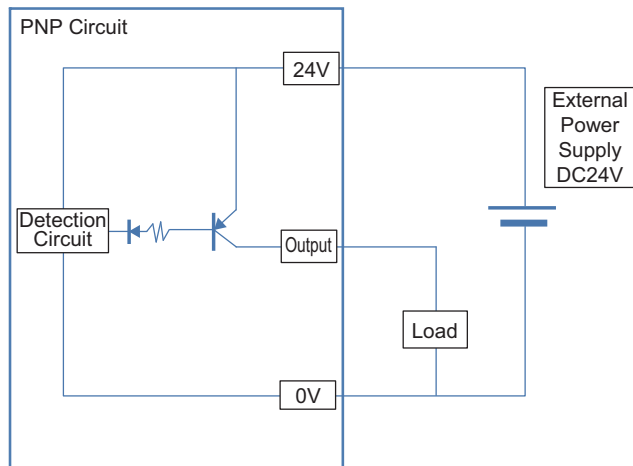
[NPN Type]

Item	Specifications
Power-supply Voltage	DC24V±10% Power source in common with solenoid driver
Wiring System	Three-wire system
Output Current	15mA MAX
Power Consumption	4mA MAX



[PNP Type]

Item	Specifications
Power-supply Voltage	DC24V±10% Power source in common with solenoid driver
Wiring System	Three-wire system
Output Current	80mA MAX
Power Consumption	12mA MAX



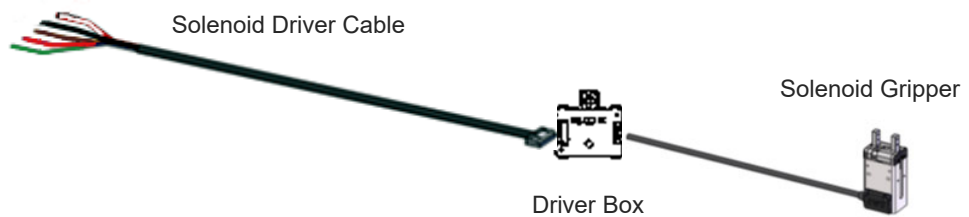
3.2.5 Solenoid Driver Cable Specifications

Solenoid gripper supplies the power to the solenoid driver cable and makes the fingers grip and release with Grip (OFF) / Release (ON) Signals.

The outer grip type opens fingers once ON signal gets input. And it closes fingers once OFF signal gets input.

The inner grip type works in the other way.

Below shows the wiring table for the solenoid cable.



Color	Signal name	Contents	Thickness
White	24V	Power input of 24V DC +/-10% for solenoid gripper, driver box and sensors	AWG18
Black	0V		
Brown	ON/OFF	Grip (OFF) / Release (ON) signals input to outer gripping type of solenoid gripper	AWG22
Red	Sensor 1	Through input for Sensor 1 for open/close status monitor for solenoid gripper	
Green	Sensor 2	Through input for Sensor 2 for open/close status monitor for solenoid gripper	

3.3 Wiring Connection

Below introduces how to connect the wires.

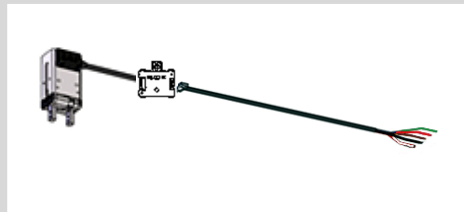
3.3.1 24VDC Power Supply Wiring

Connect the power wiring to the solenoid driver cable.

After applying terminals on 24V and 0V in the solenoid driver cable, connect them to a terminal block for 24V DC power supply.

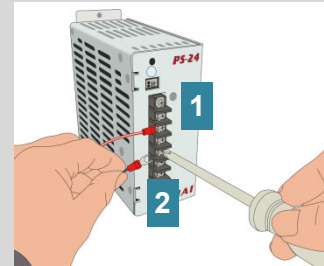
- 1 Connect the wire for 24V (wire color: white) to +24V terminal on 24V DC power supply.
- 2 Connect the wire for 0V (wire color: black) to 0V terminal on 24V DC power supply.

24VDC power supply connection diagram



Solenoid Driver Cable

24VDC Power Supply



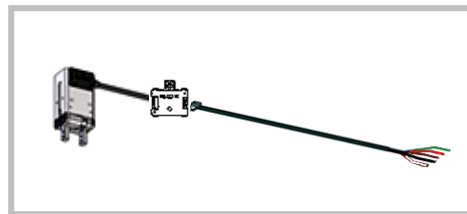
Color	Signal abbreviation	Function overview	Required specifications
White	24V	Power supply Input	Power supply voltage: 24VDC \pm 10% Max. Output Current GRS-SEG, SIG : 2.8A GRS-MEG, MIG : 3.7A
Black	0V	Ground	

3.3.2 Wiring to Master Device such as PLC

In order to input and output each type of signals from and to a master device such as PLC, it is necessary to connect each wire in the solenoid drive cable to PLC.

Connect the **3** to **5** wiring to the connector terminal block while referring to the connection diagram.

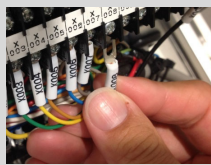
- 3** Connect a brown wire in the cable to the output terminal for “Open (ON) / Close (OFF)”.
- 4** Connect a red wire in the cable to the input terminal for “Sensor 1 (Option)”.
- 5** Connect a green wire in the cable to the input terminal for “Sensor 2 (Option)”.



Solenoid Driver Cable

PLC connection diagram

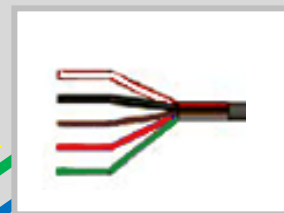
Process the terminals in accordance with PLC specifications in order to conduct wiring.



PLC



Solenoid Driver Cable Detail View of Solenoid Driver Cable End



3.4 Precautions for Wiring

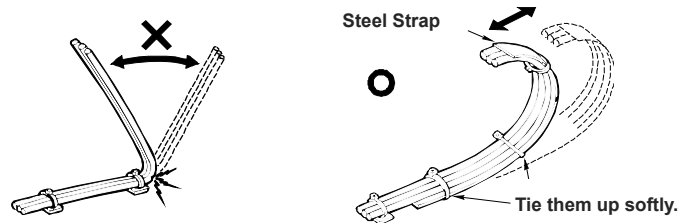


Caution

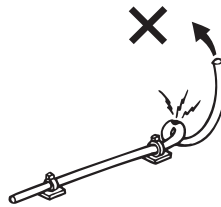
- For the connection cable, make sure you use one dedicated for IAI products.
- For wiring, please follow the warnings stated below. When constructing a system as the machinery equipment, pay attention to the wiring and connection of each cable so they are conducted properly. Not following them may cause 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.
- Make sure to turn the power off in the process of power line or cable connection or disconnection.
- Except for the bare cut without connectors on the solenoid driver cable, do not attempt to cut and extend, make short-circuit or reconnect the actuator cable or solenoid driver cable (hereafter stated as the dedicated cables).
- 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 carrier.
- When a cable is used hanging on the ceiling, prevent an environment that the cable swings with acceleration or wind velocity.
- Make sure there is not too much friction inside the cable storage equipment.
- Do not apply radiated heat to power line or cables.

Caution

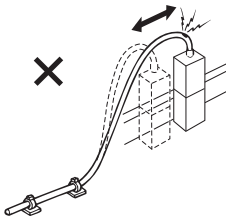
- Have a sufficient radius for bending, and avoid a bend concentrating on one point.



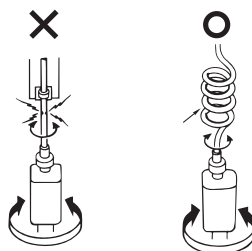
- Do not let the cable bend, kink or twist.



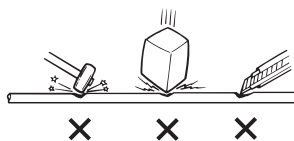
- Do not pull the cable with a strong force.



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



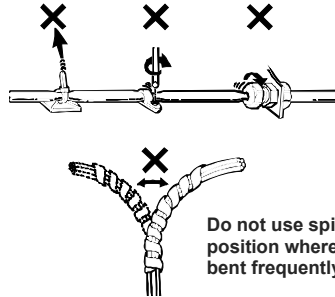
- Do not pinch, drop a heavy object onto or cut the cable.





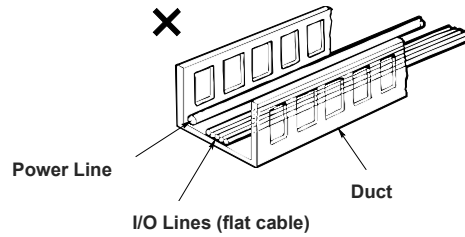
Caution

- 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.

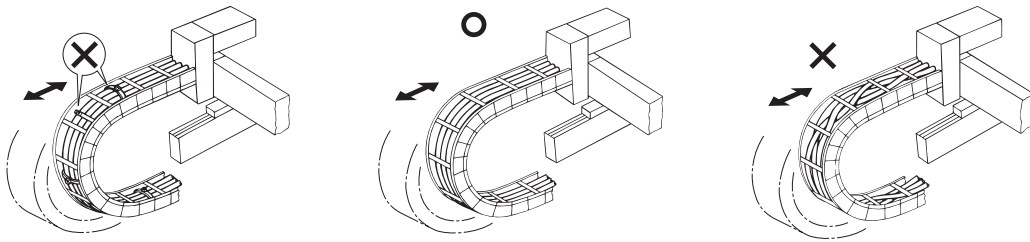
- PIO line, communication line, power and driving lines are to be put separately from each other and do not tie them together. Arrange so that such lines are independently routed in the duct.





Caution

- Follow the instructions below when using a cable carrier.
- If there is an indication to the cable for the space factor in a cable carrier, refer to the wiring instruction given by the supplier when storing the cable in the cable carrier.
- Avoid the cables to get twined or twisted in the cable carrier, 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.





3. Wiring

Chapter 4

Operation

- 4.1 Basic Operation4-1
- 4.2 I/O Signals4-2
 - 4.2.1 I/O Signal List 4-2
- 4.3 How to Operate on Master Device such as PLC4-3
 - 4.3.1 Open / Close Operation : Grip (OFF) / Release (ON) Signals..... 4-3
 - 4.3.2 Operation of Sensors (Option)..... 4-4
- 4.4 Removing Gripped Workpiece4-5

4.1 Basic Operation

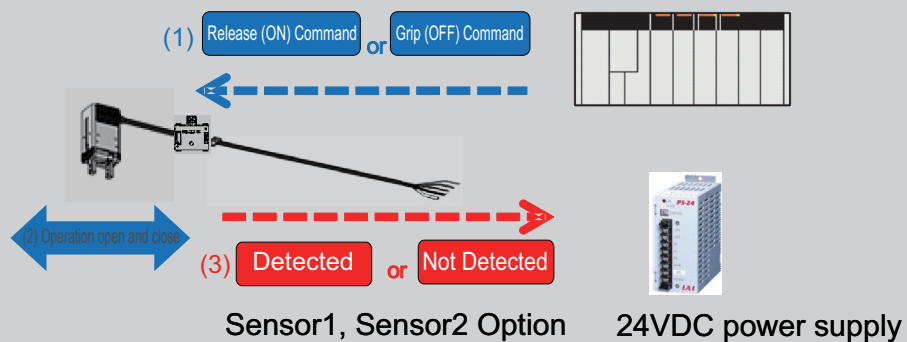
By inputting signals to the solenoid gripper from the master device, the fingers operate open and close.

Also, by the master device receiving signals output from optional Sensor 1 and Sensor 2, the condition whether the fingers are open or close should be able to be recognized.

Control is just as simple as when using a solenoid valve (SOL valve) and air cylinder drive. This manual introduces an example using a PLC connected as the master device.

Connection image PLC/Solenoid Gripper connection

- (1) Input Release (ON) Signal or Grip (OFF) Signal from the PLC.
- (2) The solenoid operates open and close.
- (3) Signals of detected and not detected get output from Sensor 1 and Sensor 2 (option).



Reference

The outer gripping type of the solenoid gripper continues open while Release (ON) Signal is being input.

Fingers close with springs once Grip (OFF) Signal gets input.

The inner gripping type works in the opposite way, closes with signal ON and opens with OFF.

4.2 I/O Signals

4.2.1 I/O Signal List

Solenoid Gripper I/O signals are as follows.

Category	Signal name	Function overview
Input	Grip (OFF) / Release (ON)	Outer gripping type (SEG and MEG) open fingers with Release (ON).
		The fingers should be kept open while Release (ON) is being input.
		The fingers close with force of springs once Grip (OFF) gets input.
Output	Sensor1	Detected / not detected signals for Sensor 1 for open/close monitoring
	Sensor2	Detected / not detected signals for Sensor 2 for open/close monitoring

(Note) Inner gripping type (SIG and MIG) should be other way around for open and close.

4.3 How to Operate on Master Device such as PLC

4.3.1 Open / Close Operation : Grip (OFF) / Release (ON) Signals

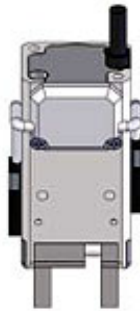
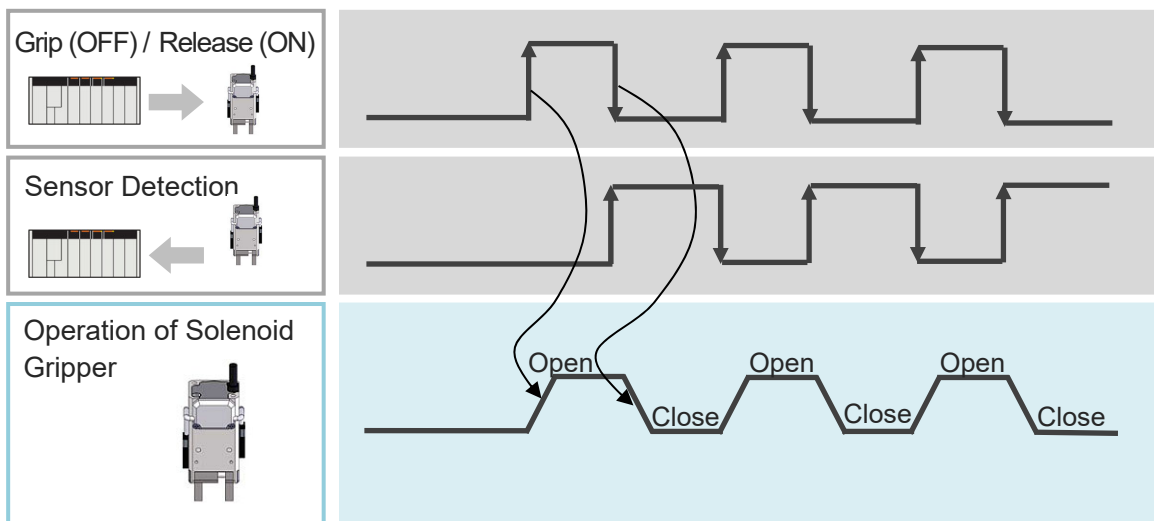
Outer gripping type (SEG and MEG) open fingers with Release (ON).

The fingers should be kept open while Release (ON) is being input.

The fingers close with Grip (OFF).

In the figure below shows an example for when Sensor 1 and Sensor 2 (Option) are adjusted to detect when the fingers are closed.

(Note) Inner gripping type (SIG and MIG) should be other way around for open and close.



Open ← →
Close → ←



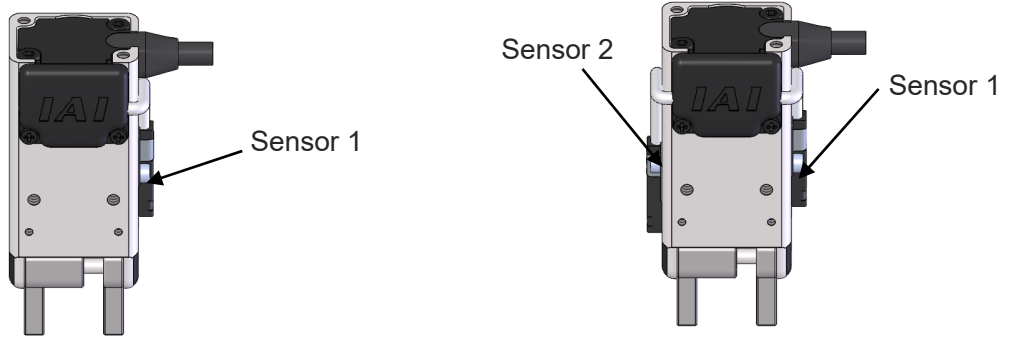
Caution

- Make sure that the frequency of operation open and close in one minute is 120 times or less.

4.3.2 Operation of Sensors (Option)

One or two units of a sensor to detect the operation open and close of the fingers can be attached (Option).

There are two types of sensors, NPN type and PNP type.

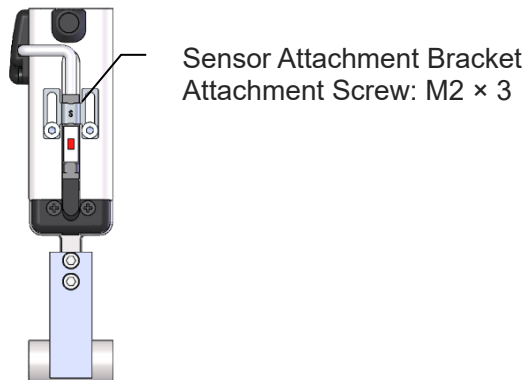


Sensor 1 and Sensor 2 should be adjusted as shown below at delivery.

* For attaching one unit of sensor (S1N, S1P), only a sensor that turns on when releasing should be available.

operation	Release	Gripped workpiece existed	No gripped workpiece
Sensor 1	ON	OFF	
Sensor 2	OFF		ON

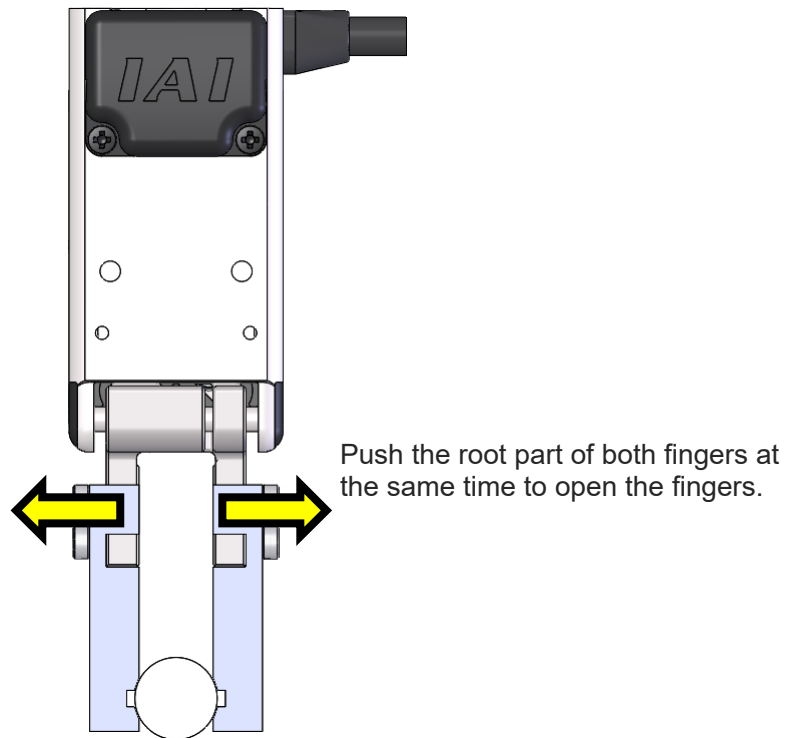
When you use the sensor, check the operation of gripping a workpiece, and adjust the position of the sensor by loosening the screw on the sensor attachment bracket if necessary.



4.4 Removing Grippped Workpiece

In order to remove a workpiece that is gripped, open the both fingers at the same time at the root part of them.

Do not attempt to open only on one finger or open the fingers at the tip of them.





4. Operation

Chapter 5

Maintenance and Inspection

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- 5.2 Inspection Items and Schedule5-3
 - 5.2.1 Solenoid Gripper Type 5-3
- 5.3 Visual Inspection Items5-4
 - 5.3.1 External Visual Inspection 5-4
- 5.4 Cleaning5-5
 - 5.4.1 External Cleaning 5-5
- 5.5 Greasing Method5-6
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 - [2] Greasing Method 5-6
- 5.6 How to Replace Components5-7
 - 5.6.1 Attaching and Replacing Sensors (Option)..... 5-7

5.1 Precautions for Maintenance and Inspection Work

Make sure to read the following precautions before conducting any maintenance or inspection work.



Caution

- Do not climb on or put anything on the actuator.
It may cause damage on the product, loss of product function, performance drop or drop of production life.
Before releasing the brake, make sure to check there is nothing that will interfere with moving parts within the operation range.
- Check that the power to the actuator is OFF before conducting any maintenance or inspections.
- Be careful not to lose the cover or any removed screws.
Be sure to return the product to the original condition after maintenance and inspection work.
Mounting in an incomplete state may cause injuries or damage to the product.
- Do not attempt to replace the actuator cable, change the direction of cable ejection or cut the cable.
- Do not modify, disassemble/assemble, or use maintenance parts not specified on your own discretion under any circumstances.

Notice

- First, be sure to wipe off the old grease, and then supply new grease.
- The degradation speed of grease may differ depending on the operating environment (temperature, humidity and ambient atmosphere).

It is recommended to shorten the grease supply period if the actuator is used under poor environmental conditions such as high temperatures, high humidity or dusty atmospheres.

- Also, it is recommended to improve the environmental conditions in case the grease changes color notably due to poor operating conditions.
- Base oil may separate from the grease due to the mounting orientation or operating conditions.

Base oil may also leak from the inside of the actuator to the exterior through gaps.

Check visually for oil drips when supplying grease.

- An actuator stored for 6 months or more may suffer from grease degradation.
Supply grease before the start of use.
→ For details, refer to “5.5 Greasing method”.
-

5.2 Inspection Items and Schedule

Follow the maintenance inspection schedule below.

It is assumed that the equipment is operating 8 hours per day.

If the equipment is running continuously night and day or otherwise running at a high operating rate, inspect more often as needed.

5.2.1 Solenoid Gripper Type

Inspection period	External inspection	Greasing
Start of work inspection	○	
1-month inspection	○	
6-month inspection	○	
1-year inspection	○	○
Every 6 months thereafter	○	
Every 1 year thereafter	○	○

5.3 Visual Inspection Items

Refer to “5.6 How to replace components” for detailed information about specific component replacement and adjustment methods.

5.3.1 External Visual Inspection

Inspection items	Maintenance work
Is abnormal noise or vibration generated?	Many cases can be considered as a cause such as the condition of load, condition of installation and stiffness of equipment to install.
Are actuator mounting bolts loose?	Tighten them further.
Is the cable scratched?	Replace if the damage is severe.
Is the connector loose?	Re-insert correctly.
Is grease dripping out? (especially if vertically mounted)	Clean up any drips. Replenish the grease.

5.4 Cleaning

5.4.1 External Cleaning

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

5.5 Greasing Method

[1] **Grease Used** : Use an equivalent product

Application Location	During Maintenance (recommended product)	Default (reference)
Finger Guide	Kyodo Yushi/Multemp AC-D	Kyodo Yushi/Multemp AC-D

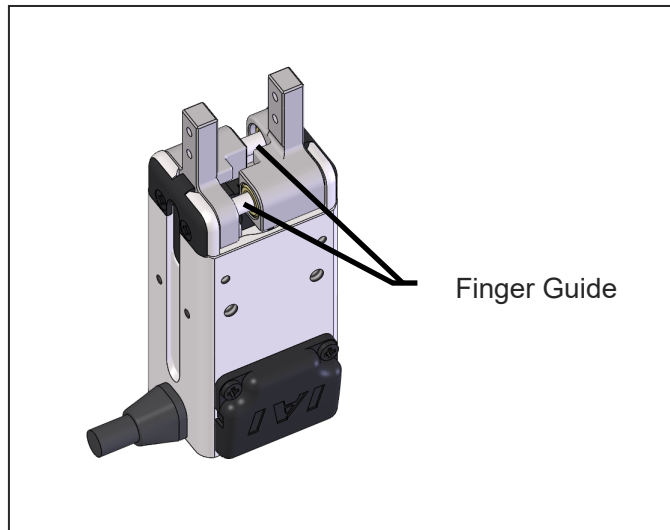


Caution

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

[2] Greasing Method

- 1 Apply grease directly on the finger guides using a tool such as a cotton swab.



Caution

- In case the grease got into your eye, wash it with clean water for 15 minutes and immediately go see the doctor to get appropriate care.
- After finishing the grease supply work, wash your hands carefully with water and soap to rinse the grease OFF.

5.6 How to Replace Components

5.6.1 Attaching and Replacing Sensors (Option)

[How to Replace and Attached]

Items required for Attaching and replacing

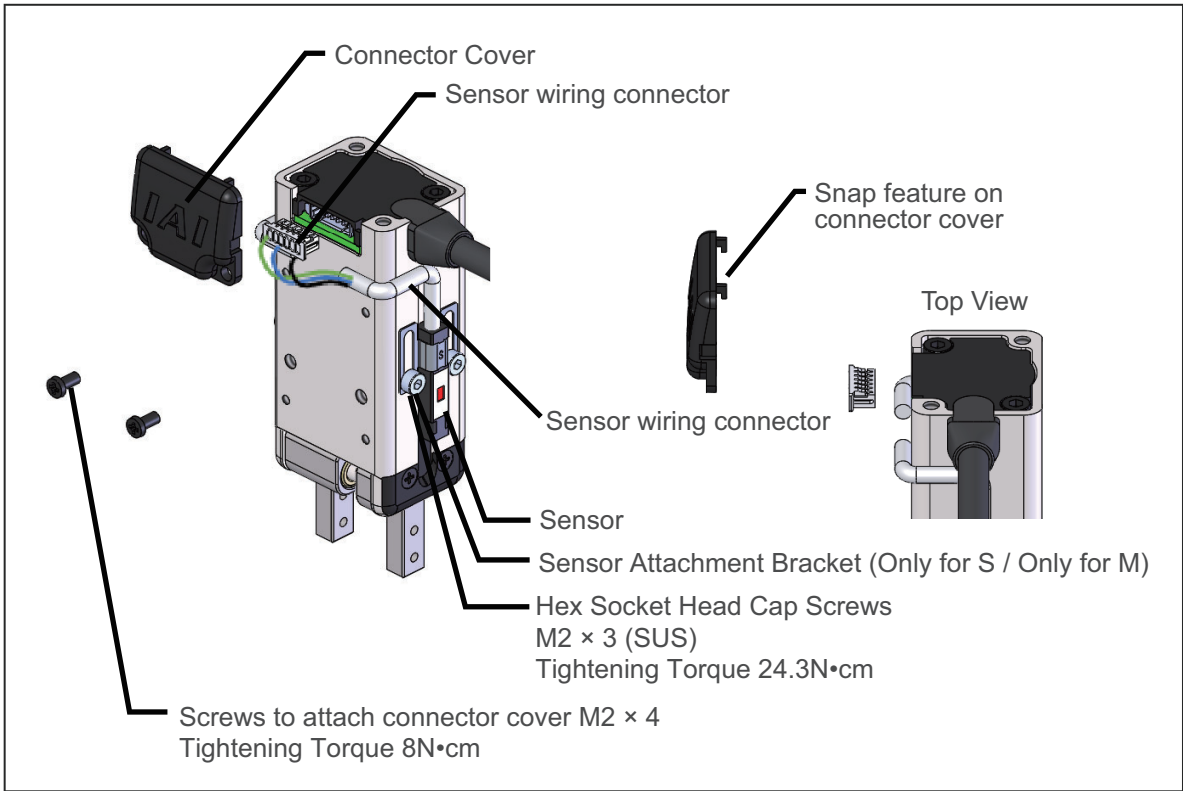
- Hex wrench 1.5mm (for Hexagon socket head cap screw)
- + Screwdriver (for screws for precision instruments (panhead))

1 Use hex socket head cap screws (M2 × 3) to attach the sensors.

For wiring, take off the connector cover and insert the sensor connector.

As there is a snap feature on the connector cover, if there is something attached on the top of the body, it is necessary to take it off once.

Put the connector cover back on once the work is finished.





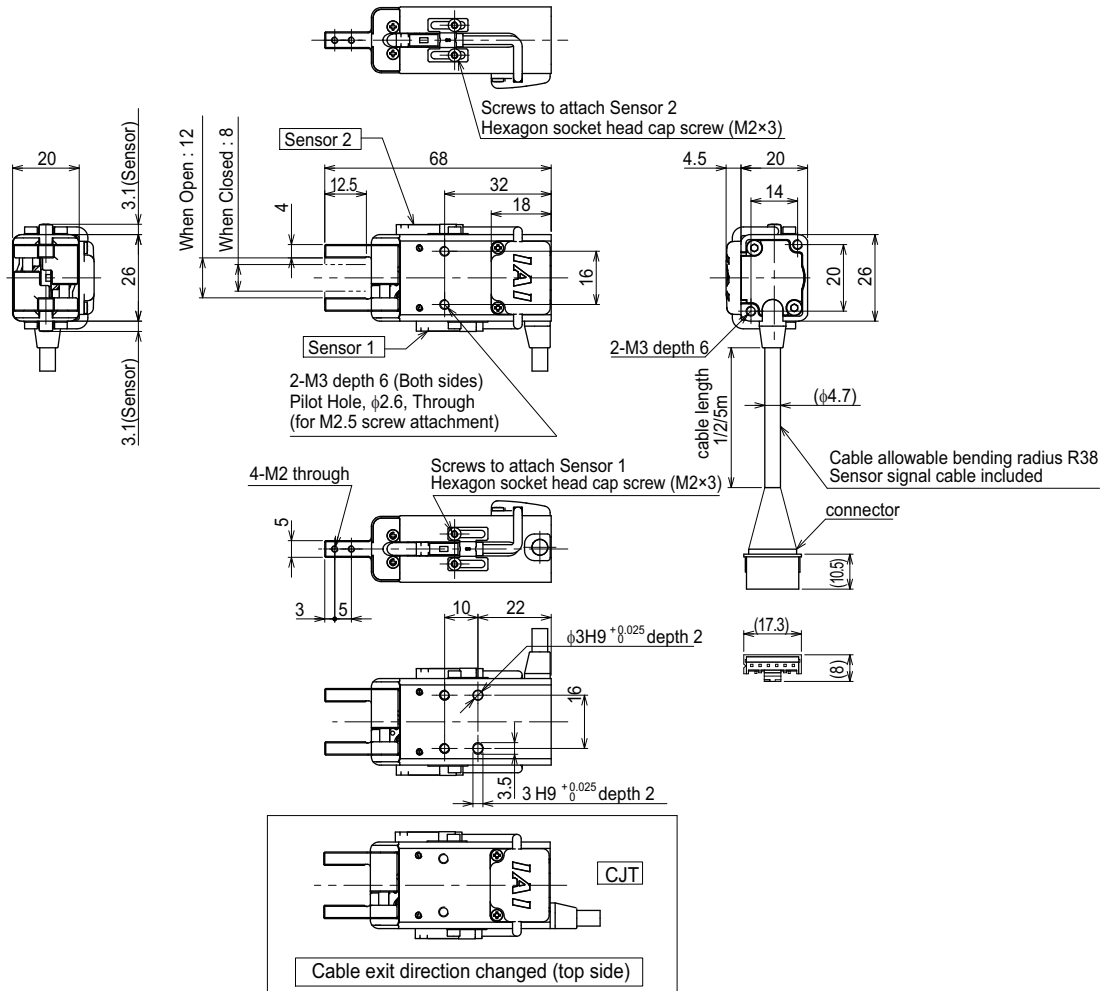
5. Maintenance and Inspection

Chapter 6

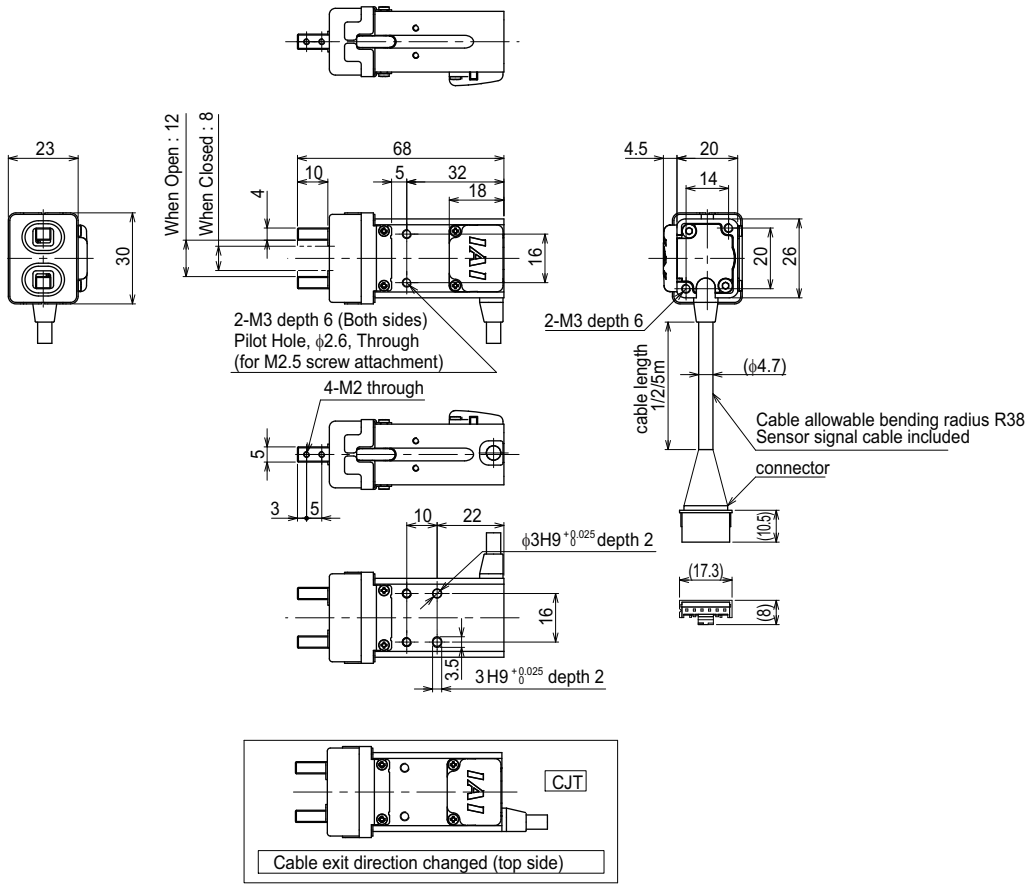
External Dimensions

- 6.1 External Dimensions6-1
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 - 6.1.2 GRS-SEG/SIG (With Sensor) 6-2
 - 6.1.3 GRS-SEG/SIG (With Rubber Cover) 6-3
 - 6.1.4 GRS-MEG/MIG 6-4
 - 6.1.5 GRS-MEG/MIG (With Sensor) 6-5
 - 6.1.6 GRS-MEG/MIG (With Rubber Cover) 6-6

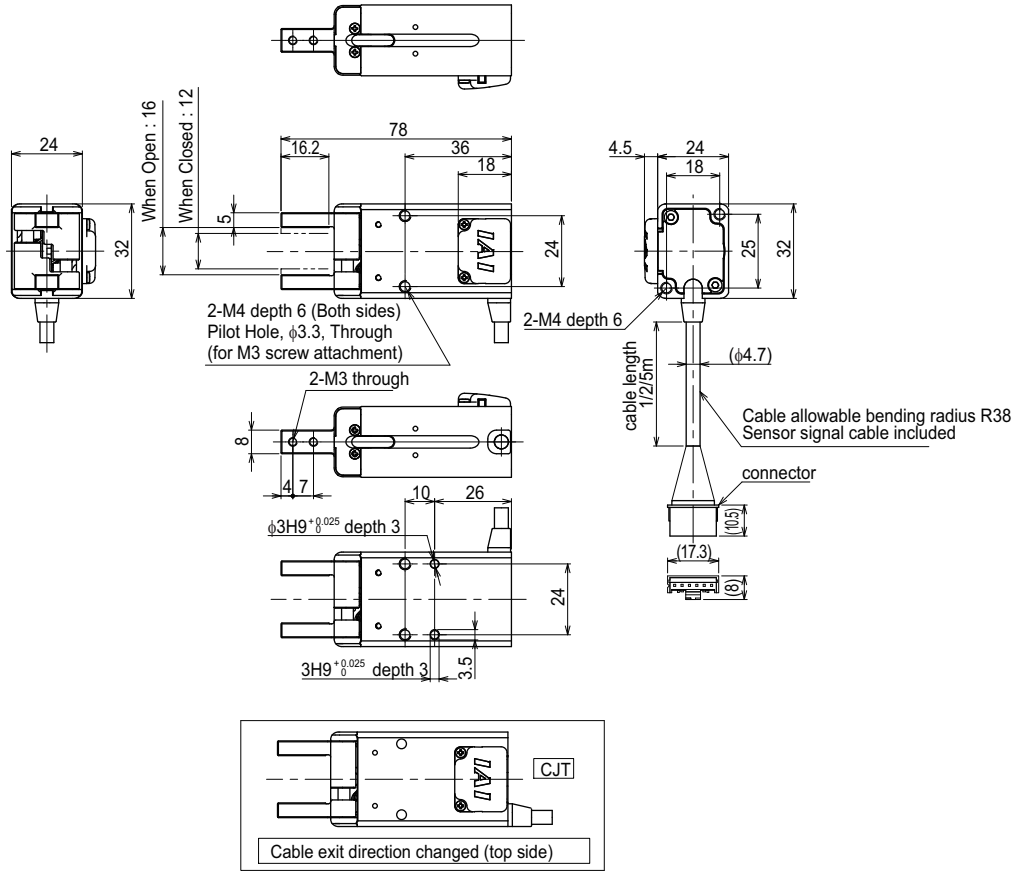
6.1.2 GRS-SEG/SIG (With Sensor)



6.1.3 GRS-SEG/SIG (With Rubber Cover)

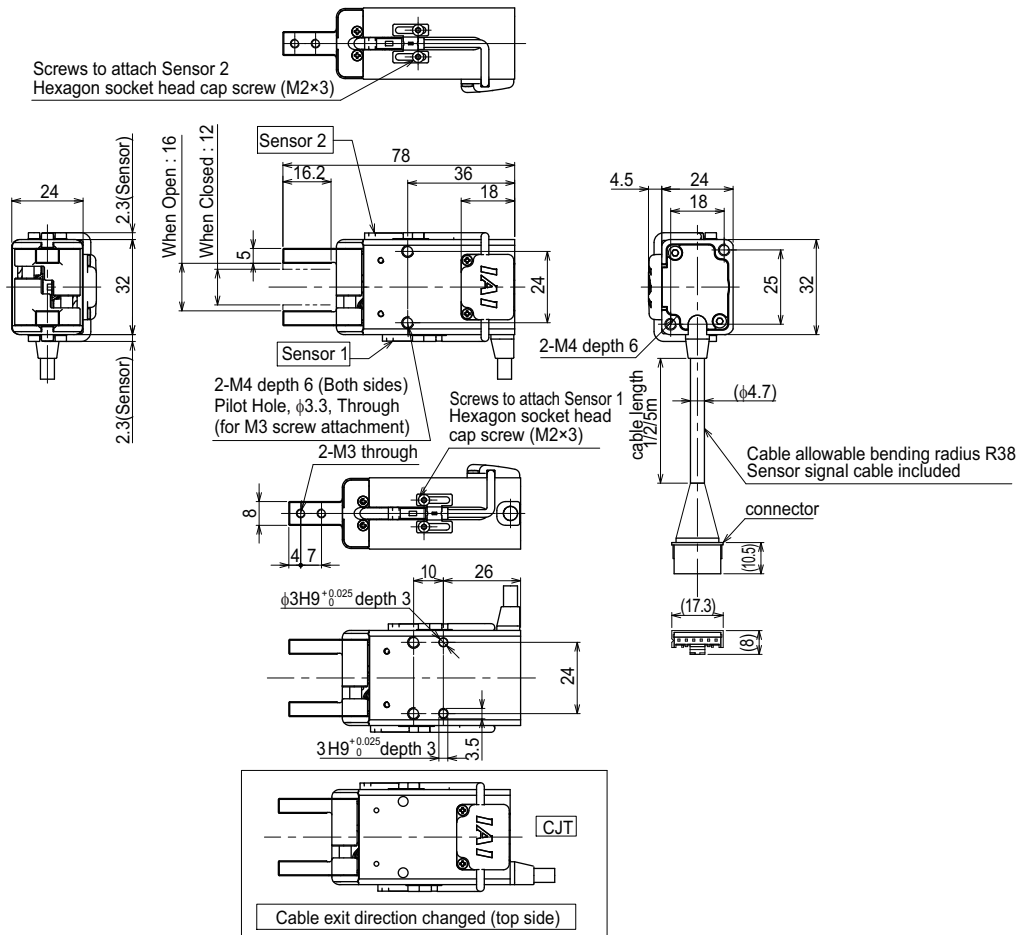


6.1.4 GRS-MEG/MIG

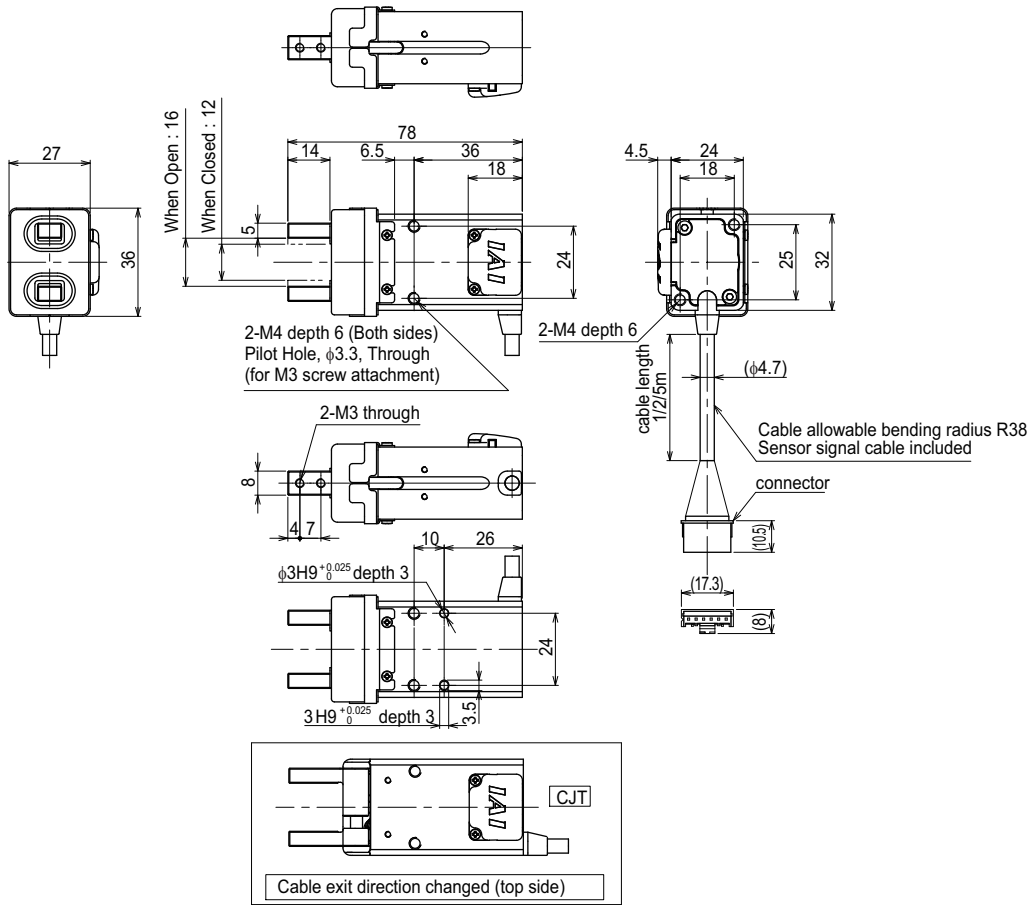


Mass
0.27kg

6.1.5 GRS-MEG/MIG (With Sensor)



6.1.6 GRS-MEG/MIG (With Rubber Cover)



Chapter 7

Warranty

- 7.1 External Dimensions.....7-1
- 7.2 Scope of the warranty7-1
- 7.3 Honoring the warranty.....7-1
- 7.4 Limited liability.....7-2
- 7.5 Conformance with applicable standards/regulations, etc., and application conditions.....7-2
- 7.6 Other Items excluded from warranty.....7-2

7.1 External Dimensions

Whichever of the following periods is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to a specified location
- 2,500 operational hours

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 malfunction in question pertains to our product as delivered by IAI or our authorized dealer.
- (2) The breakdown or malfunction in question occurred during the warranty period.
- (3) The breakdown or malfunction in question occurred while the product was in use for an appropriate purpose under the operating conditions and operating environment specified in the instruction manual and catalog.
- (4) The breakdown or malfunction in question was caused by a specification defect, malfunction, or poor product quality.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty

- Anything other than our product
- Modification or repair performed by a party other than IAI (unless approved by IAI)
- Anything that could not be easily predicted with the level of science and technology available at the time of shipment from IAI
- Natural disaster, unnatural disaster, incident or accident for which we are not liable
- Natural fading of paint or other symptoms of aging
- Wear, depletion or other expected results of use
- Operation noise, vibration or other subjective sensations 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 consigned to IAI for repair under warranty.

7.4 Limited liability

- (1) We 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 assume no liability for any program or control method created by the customer to operate our product or for the results of any such program or control method.

7.5 Conformance with applicable standards/regulations, etc., and application conditions

- (1) If our product is combined with another product or any system, equipment, 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 assume no liability 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 IAI if you must use our product for any of these applications:

- Medical equipment used to maintain, control or otherwise affect human life or physical health
 - Mechanisms and machinery designed for the purpose of moving or transporting people (vehicles, railway facilities, aviation facilities etc.)
 - Machinery components essential for safety (safety devices etc.)
 - Equipment used to handle cultural assets, art or other irreplaceable items
- (3) Contact IAI in advance if our product is to be used in any condition or environment that differs from that 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:

- Guidance for mounting/adjustment and witnessing of test operation
- Maintenance and inspection
- Technical guidance and education on operating/wiring methods, etc.
- Technical guidance and education on programming and other items related to programs

Chapter 8

Appendix

- 8.1 Temperature Increase Measurement Data (Reference)8-1
- 8.2 Leakage Flux Measurement Data (Reference)8-2

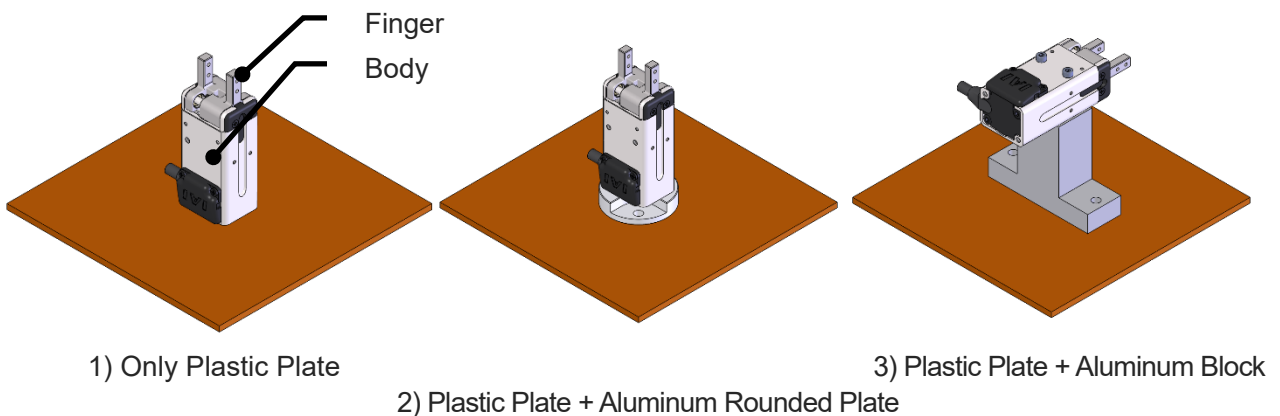
8.1 Temperature Increase Measurement Data (Reference)

Shown below is a table of data measuring the temperature rise (reference).

Temperature Increase Measurement Data (Reference) [$\Delta^{\circ}\text{C}$]

Type	Operational Conditions	Measured Point	Condition of Unit Installation		
			1) Only Plastic Plate	2) Plastic Plate + Aluminum Rounded Plate ($\phi 34$ t8)	3) Plastic Plate + Aluminum Block (25 × 20 × 47)
S	Released Condition Continued (1h)	Finger	14	10.6	7.1
		Body	17.2	12.3	9
	Open/Close Operation Continued (60CPM 1h)	Finger	19.5	14.3	10.4
		Body	24.1	16.9	13.3
	Open/Close Operation Continued (120CPM 1h)	Finger	35.9	21.3	15.5
		Body	42.3	25.8	20
M	Released Condition Continued (1h)	Finger	14	10.9	6.7
		Body	15.1	11.4	7.6
	Open/Close Operation Continued (60CPM 1h)	Finger	17.3	14.9	9.6
		Body	19.4	16.1	11.5
	Open/Close Operation Continued (120CPM 1h)	Finger	27	23.7	13.3
		Body	30	25.5	17.3

* Operational Conditions 60CPM: Open 0.5s / Close 0.5s 120CPM: Open 0.25s / Close 0.25s



8.2 Leakage Flux Measurement Data (Reference)

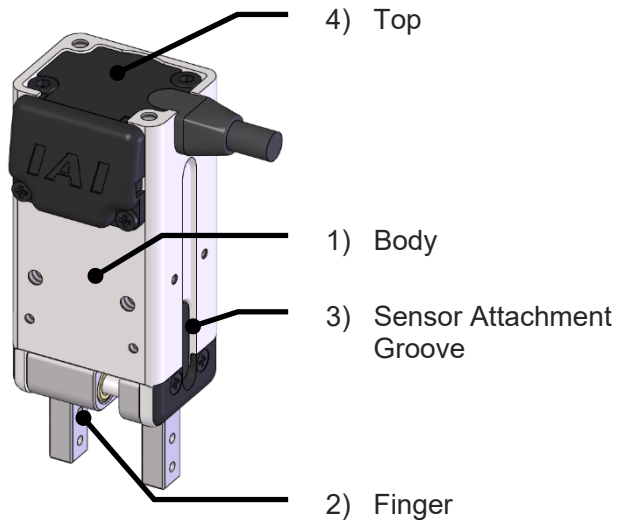
By conducting to the built-in solenoid, the solenoid gripper generates flux, however, the leakage flux externally stays small as it is covered with a body made of copper.

On the sensor attachment grooves located on the sides of the body, leakage flux should be generated from the built-in magnet.

Shown below is the measurement data (reference) of the leakage flux.

Leakage Flux Measurement Data (Reference) [mT]

Type	Operational Conditions	Condition of Unit Installation			
		1) Body	2) Finger	3) Side (Sensor Attachment Groove)	4) Top
S	Gripping (Power not conducted)	0.7	0	24	0.2
	Released (Power conducted)	0.2	0.1	22	10
M	Gripping (Power not conducted)	0.4	0	20	0.2
	Released (Power conducted)	0.1	0.1	20	8



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Revision history

Revision Date	Revision Description
April 2018	First Edition
June 2018	1B Edition Pg. 8-2 8.2 Leakage Flux Measurement Data (Reference) added
July 2018	1C Edition Pg. 1-11 Vertical lines on right for H _C and H _G moved to align with center line
August 2018	1D Edition Pg. 1-18 Note added for minimum bending radius for CB-CRS-PCS□□□
September 2018	1E Edition Intro-12, Pg. 1-11 Correction made
Mach 2026	1F Edition Intro-12 International Standard Compliance Complied with RoHS3 Directive Chapter 1 to 6 Changed "σ" into three-digit number Pg. 1-1 Removed the First Steps Guide and DVD Instruction Manual from the components Footer Manual No. added Overall Corrections made, terms integrated, layout changed



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