

Solenoid Gripper **GRS**



# Small, affordable, easy to operate! The new Solenoid Gripper

## 1 Small size

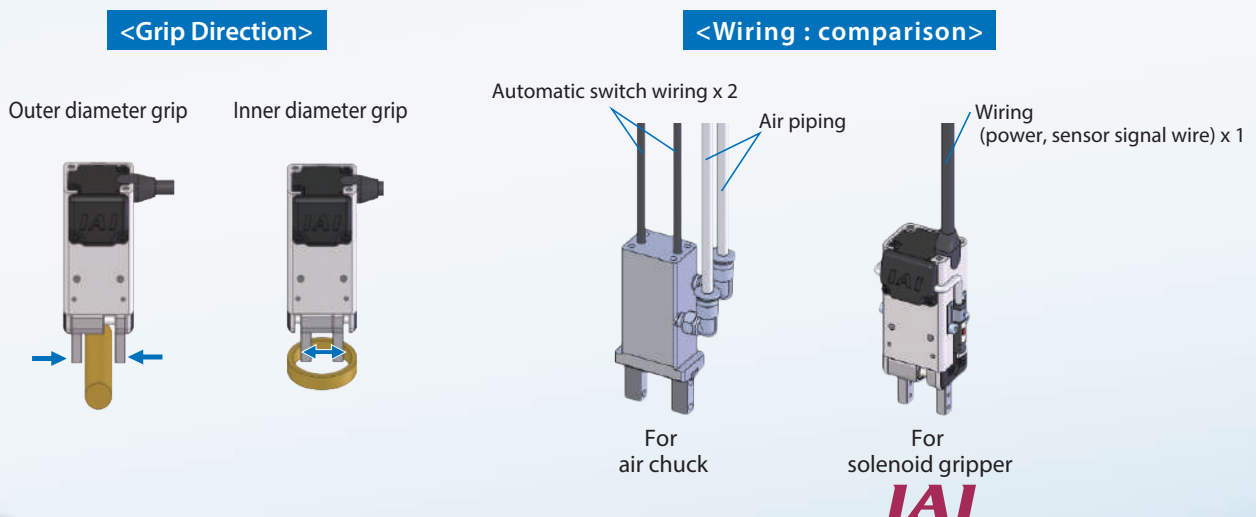
Compact and lightweight electric gripper that fits in the palm of the hand.

## 2 Low price

The price is as low as an air chuck.  
The motorization also contributes to energy saving.

## 3 ON/OFF control with a single wire

Opening and closing of the fingers are operated simply by ON/OFF signals. Continuous retention is possible while still in the gripping or release state. With just a single wire, wiring is easy too.



## 4 Long life

Excellent durability, enabling operation of **30 million times** or more.\*

\* Results of durability testing at IAI.  
Life under the user's operating conditions is not guaranteed.



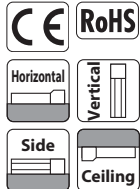


## GRS-SEG/SIG

Body width  
**26mm**O.D. grip  
I.D. gripSolenoid  
Gripper

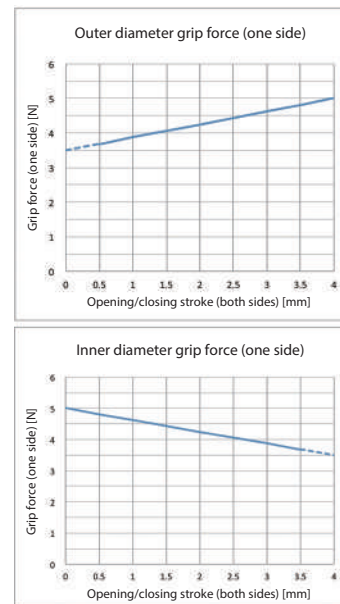
## Model Specification Items

<b>GRS</b>	-		-	<b>4</b>	-		-		-	
Series	-	Type	-	Stroke	-	Driver box	-	Solenoid gripper cable length	-	Options
SEG	-	Outer diameter grip	-	4: 4mm (2mm per side)	-	DBN	-	N	-	Refer to Options table below.
SIG	-	Inner diameter grip	-		-	DBP	-	P	-	
								S		
								M		
						N		X□□		
										Specified length



- (1) For outer diameter grip, it opens when conductive and closes when not conducting (normally closed). For inner diameter grip, it closes when conductive and opens when not conducting (normally open).
- (2) Since a spring is used for the grip mechanism, the grip force changes depending on the open/closing stroke of the fingers.
- (3) To operate the solenoid gripper, a driver box is essential. Please refer to P.8 for specification details.
- (4) Please refer to P.9 for gripper selection.

## Correlation Diagram of Grip Force and Opening/Closing Stroke



(Note) The grip force changes depending on the open/closing stroke of the fingers.

## Actuator Specifications

Model	Grip direction	Max grip force (N)	Stroke (mm)
GRS-SEG-4-①-②-③	Outer diameter	10 (5 per side)	4 (2 per side)
GRS-SIG-4-①-②-③	Inner diameter		

Legend ① Driver box ② Cable length ③ Option

## Stroke and Operation Time

Stroke (mm)	Operating time [Open/close] (s)
4	0.03 or less

## Solenoid gripper cable length

Type	Solenoid gripper cable code
Standard type	P(1m) S(3m) M(5m)
Specified length	X06(6m) ~ X10(10m) X11(11m) ~ X15(15m)

\* Robot cable specification option is not available.

## Option

Name	Option code	Reference page
Actuator cable (pigtail cable) length: 2 m	AC2	See P.7
Actuator cable (pigtail cable) length: 5 m	AC5	
Cable exit direction (Top)	CJT	
Sensor attached x 1 (NPN specification) (*1)	S1N	
Sensor attached x 2 (NPN specification) (*1)	S2N	
Sensor attached x 1 (PNP specification) (*1)	S1P	
Sensor attached x 2 (PNP specification) (*1)	S2P	
Rubber cover attached (chloroprene rubber)	RCH	
Rubber cover attached (silicone rubber)	RSL	

(\*1) Driver box: for DBN, only S1N and S2N can be selected.  
Driver box: for DBP, only S1P and S2P can be selected.

## Actuator Specifications

Item	Description
Max grip force	10N, one side 5N
Operating time	0.03s or less
Operation frequency	120CPM
Mass	0.16kg

CPM: Cycle per minute

Item	Description
Drive system	Grip mechanism (chuck): Compression spring + cam mechanism Release mechanism (unchuck): Solenoid electromagnetism + cam mechanism
Repeatability	±0.1mm
Backlash	One side 0.5mm or less
Finger guide	Slide guide
Ambient operating temp. & humidity	0 to 40°C, 85% RH or less (Non-condensing)
Degree of protection	IP20
Vibration resistance / shock resistance	4.9m/s <sup>2</sup> 100Hz or less
Compliant international standards	CE marking, RoHS Directive
Delivery date	Indicated in "Check Delivery Date" on the website

Dimensions

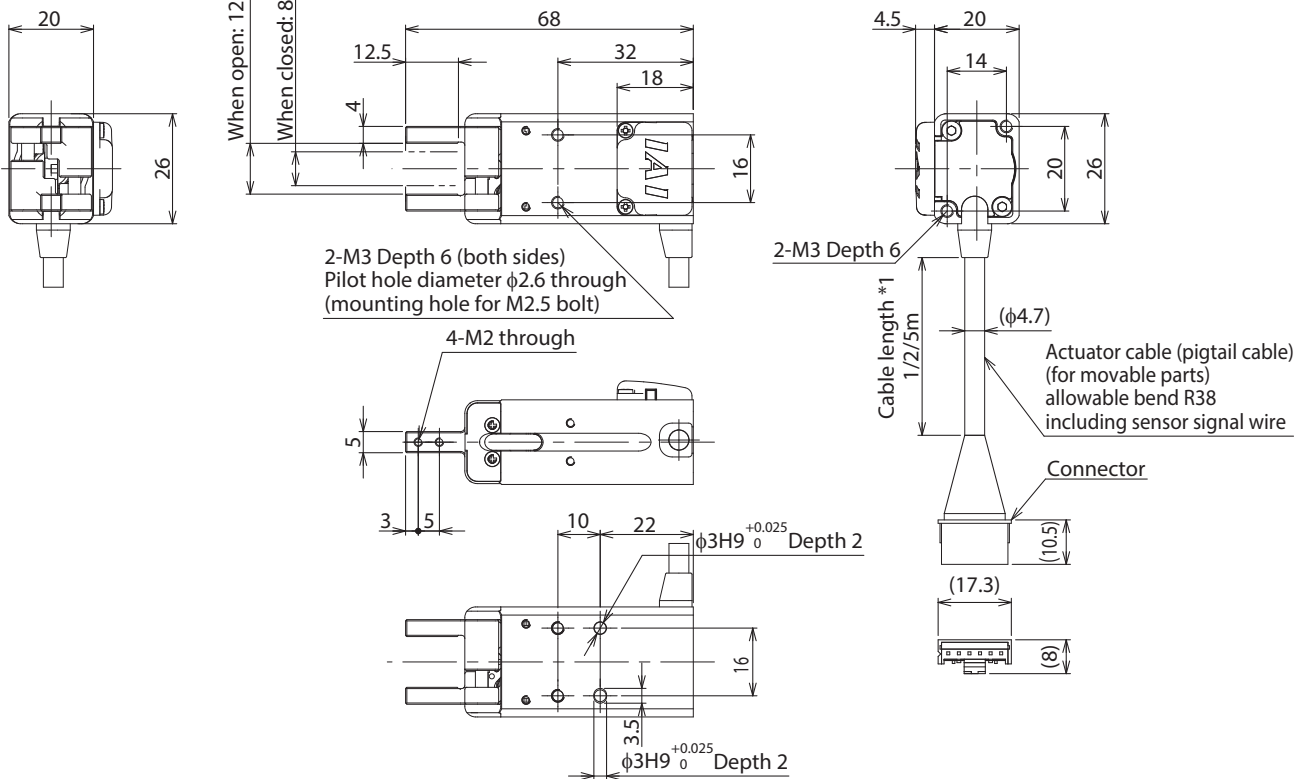
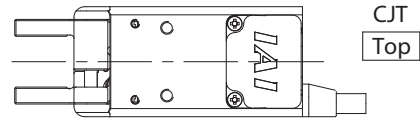
CAD drawings can be downloaded from our website.  
www.intelligentactuator.com

2D  
CAD

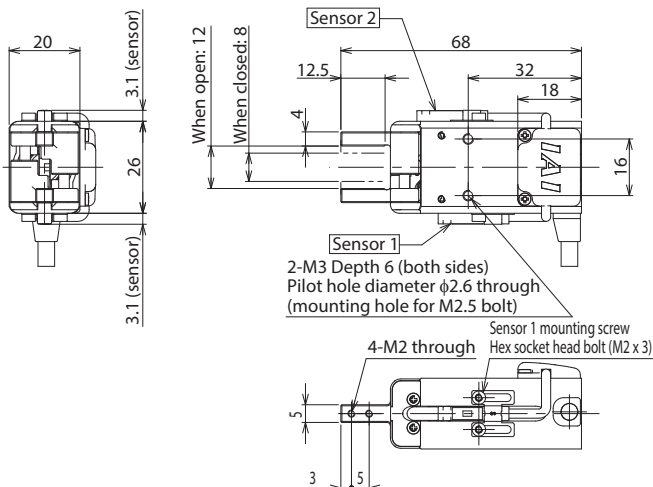
3D  
CAD

\*1 The actuator cable (pigtail cable) is a robot cable.  
The actuator cable (pigtail cable) standard length is 1m.  
Can be changed to 2m or 5m as an option (model: AC2/AC5).

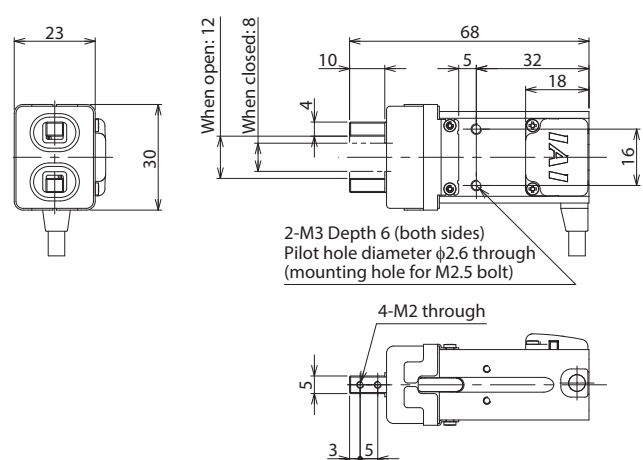
Actuator cable exit direction (Option)



Sensor attached (option)



Rubber cover attached (option)

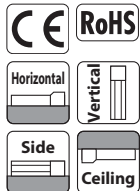


## GRS-MEG/MIG

Body width  
**32mm**O.D. grip  
I.D. gripSolenoid  
Gripper

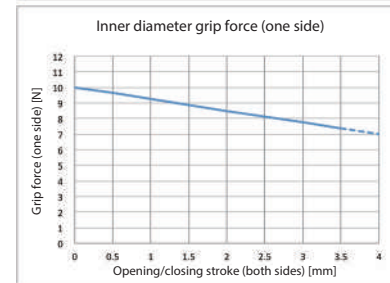
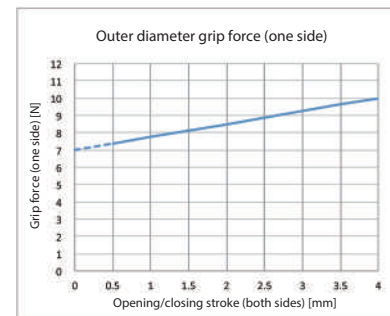
## ■ Model Specification Items

<b>GRS</b>	-		-	<b>4</b>	-		-		-	
Series	-	Type	-	Stroke	-	Driver box	-	Solenoid gripper cable length	-	Options
MEG	-	Outer diameter grip	-	4: 4mm (2mm per side)	-	DBN Driver box (NPN specification)	-	N None	-	Refer to Options table below.
MIG	-	Inner diameter grip	-		-	DBP Driver box (PNP specification)	-	P 1m	-	
	-		-		-	N No driver box	-	S 3m	-	
	-		-		-		-	M 5m	-	
	-		-		-		-	X□□ Specified length	-	



- (1) For outer diameter grip, it opens when conductive and closes when not conducting (normally closed).  
For inner diameter grip, it closes when conductive and opens when not conducting (normally open).
- (2) Since a spring is used for the grip mechanism, the grip force changes depending on the open/closing stroke of the fingers.
- (3) To operate the solenoid gripper, a driver box is essential.  
Please refer to P.8 for specification details.
- (4) Please refer to P.9 for gripper selection.

## ■ Correlation Diagram of Grip Force and Opening/Closing Stroke



(Note) The grip force changes depending on the open/closing stroke of the fingers.

## ■ Actuator Specifications

Model	Grip direction	Max grip force (N)	Stroke (mm)
GRS-MEG-4-①-②-③	Outer diameter	20 (10 per side)	4 (2 per side)
GRS-MIG-4-①-②-③	Inner diameter		

Legend ① Driver box ② Cable length ③ Option

## ■ Stroke and Operation Time

Stroke (mm)	Operating time [Open/close] (s)
4	0.03 or less

## ■ Solenoid gripper cable length

Type	Solenoid gripper cable code
Standard type	P(1m) S(3m) M(5m)
Specified length	X06(6m) ~ X10(10m) X11(11m) ~ X15(15m)

\* Robot cable specification option is not available.

## ■ Option

Name	Option code	Reference page
Actuator cable (pigtail cable) length: 2 m	AC2	See P.7
Actuator cable (pigtail cable) length: 5 m	AC5	
Cable exit direction (Top)	CJT	
Sensor attached x 1 (NPN specification) (*1)	S1N	
Sensor attached x 2 (NPN specification) (*1)	S2N	
Sensor attached x 1 (PNP specification) (*1)	S1P	
Sensor attached x 2 (PNP specification) (*1)	S2P	
Rubber cover attached (chloroprene rubber)	RCH	
Rubber cover attached (silicone rubber)	RSL	

(\*1) Driver box: for DBN, only S1N and S2N can be selected.  
Driver box: for DBP, only S1P and S2P can be selected.

## ■ Actuator Specifications

Item	Description
Max grip force	20N, one side 10N
Operating time	0.03s or less
Operation frequency	120CPM
Mass	0.27kg

CPM: Cycle per minute

Item	Description
Drive system	Grip mechanism (chuck): Compression spring + cam mechanism Release mechanism (unchuck): Solenoid electromagnetism + cam mechanism
Repeatability	±0.1mm
Backlash	One side 0.5mm or less
Finger guide	Slide guide
Ambient operating temp. & humidity	0 to 40°C, 85% RH or less (Non-condensing)
Degree of protection	IP20
Vibration resistance / shock resistance	4.9m/s <sup>2</sup> 100Hz or less
Compliant international standards	CE marking, RoHS Directive
Delivery date	Indicated in "Check Delivery Date" on the website

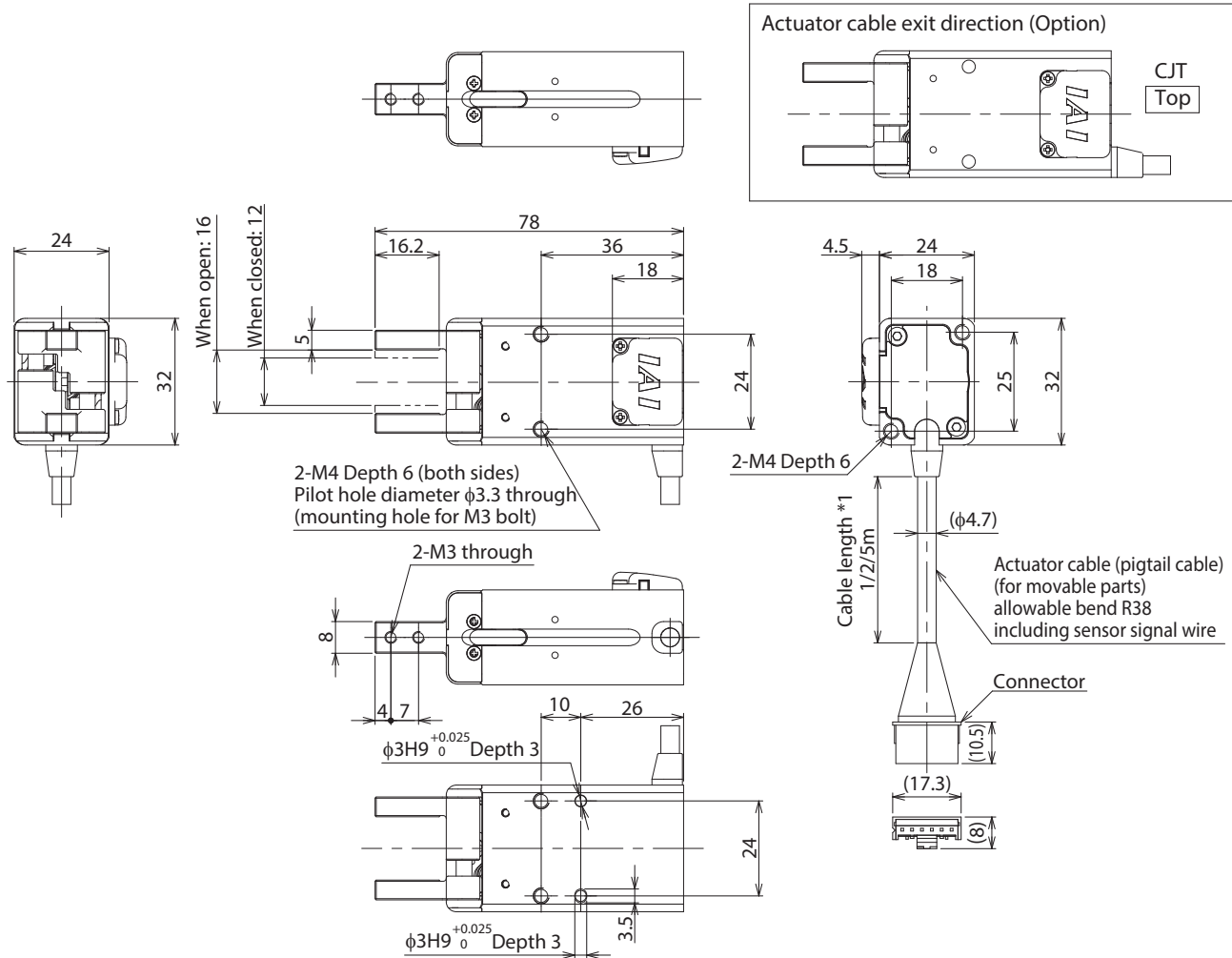
Dimensions

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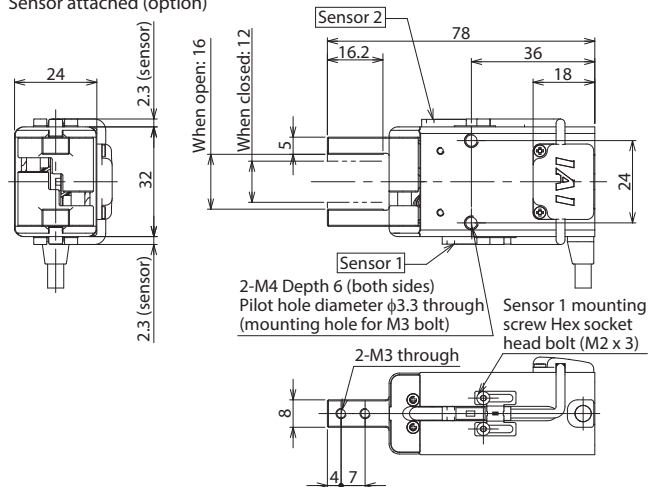
2D  
CAD

3D  
CAD

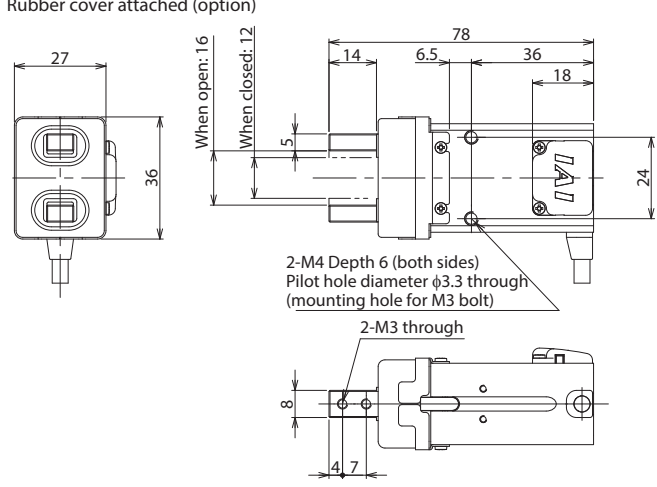
\*1 The actuator cable (pigtail cable) is a robot cable.  
The actuator cable (pigtail cable) standard length is 1m.  
Can be changed to 2m or 5m as an option (model: AC2/AC5).



Sensor attached (option)



Rubber cover attached (option)



## Options

### Actuator's pigtail cable Specification

**Model** **AC2/AC5**

**Description** Although the standard length of the actuator's pigtail cable is 1m, it can be changed to 2m/5m as an option.

### Cable exit direction (Top)

**Model** **CJT**

**Description** Although the standard outlet direction of the actuator's pigtail cable is on the side, it can be changed to the top outlet direction as an option.

### Sensor

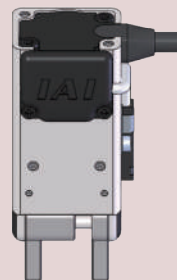
**Model** **S1N/S2N/S1P/S2P**

**Description** One or two sensors can be attached.

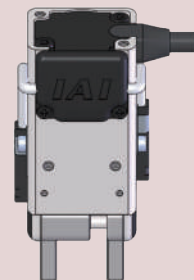
Applicable models	Sensor specification	Number of sensors	Single product model number
GRS-SEG/SIG	NPN	1	GRS-S1N-S
		2	GRS-S2N-S
	PNP	1	GRS-S1P-S
		2	GRS-S2P-S
GRS-MEG/MIG	NPN	1	GRS-S1N-M
		2	GRS-S2N-M
	PNP	1	GRS-S1P-M
		2	GRS-S2P-M

(When ordering by single product model number, a mounting bracket and bolts will also be included)

Sensor 1 pc.



Sensor 2 pcs.



### Rubber cover attached

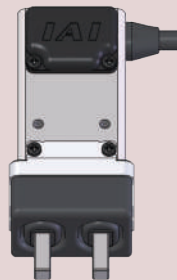
**Model** **RCH/RSL**

**Description** Rubber cover can be added to opening/closing part of the chuck.

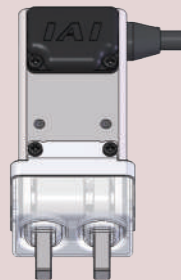
Applicable models	Rubber cover material	Single product model number
GRS-SEG/SIG	RCH (Chloroprene rubber)	GRS-RCH-S
GRS-MEG/MIG		GRS-RCH-M
GRS-SEG/SIG	RSL (Silicone rubber)	GRS-RSL-S
GRS-MEG/MIG		GRS-RSL-M

(When ordering by single product model number, a mounting bracket and screws will also be included)

RCH (chloroprene rubber)



RSL (silicone rubber)

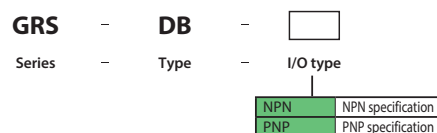




## Driver Box

The driver box allows the solenoid gripper to operate by following ON/OFF signals from an external control device, and controlling the current to suppress solenoid gripper heat generation.

### Model Configuration



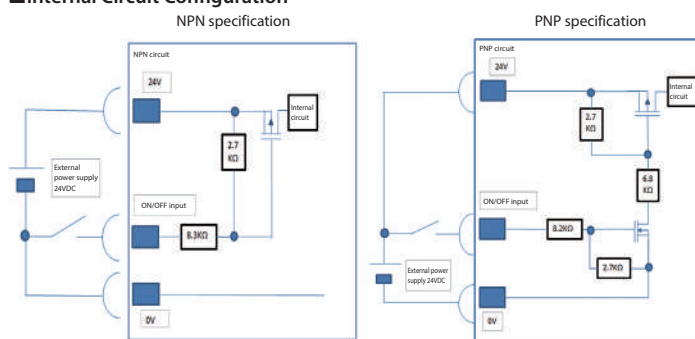
### Specifications

Item	Description	
Control target	GRS-S	GRS-M
Control method	PWM current control	
Power supply voltage	24VDC $\pm 10\%$	
Maximum output current (Release initial instantaneous 40ms)	2.8A	3.7A
Maximum power consumption (Release initial instantaneous 40ms)	74W	97W
Power consumption for release retention (Release status retained)	2.0W	2.1W
Power consumption for grip status	0W	0W
Open/close signal input	Signal input dedicated for 24VDC (NPN/PNP selection)	
Position sensor signal output	Signal output dedicated for 24VDC (NPN/PNP selection)	
Indicator light	LED during release operation: Light ON (green) LED during gripping operation: Light OFF	
Manual switch	OFF during normal operation Manual switch ON is enabled only when open/close signal input is OFF	
Ambient operating temperature	0 to 40°C	
Ambient operating humidity	85% RH or less (non-condensing)	
Operating ambience	No corrosive gas	
Ambient storage humidity	-10 to 65°C	
Ambient storage temperature	90% RH or less (non-condensing)	
Degree of protection	IP20	
Mass	22g	
External dimensions	58mm (W) * 58.1mm (H) * 16mm (T)	

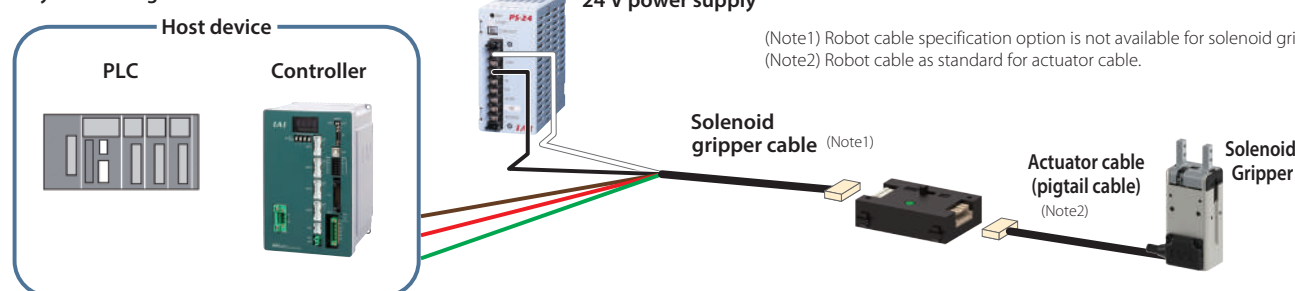
### Open/close Signal Input Specification

Item	NPN specification	PNP specification
Input voltage	24V $\pm 10\%$	24V $\pm 10\%$
Input current	2mA	2mA
Leakage current	0.25mA Max	0.25mA Max
Operating voltage	ON voltage: 6.0V or less OFF voltage: Input voltage - 3.0V or more	ON voltage: 18.0V or more OFF voltage: Input voltage 3.0V or less
Isolation method	Non-isolated	Non-isolated

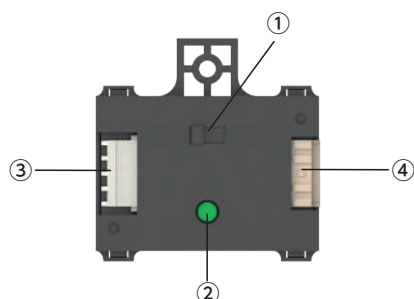
### Internal Circuit Configuration



### System Configuration

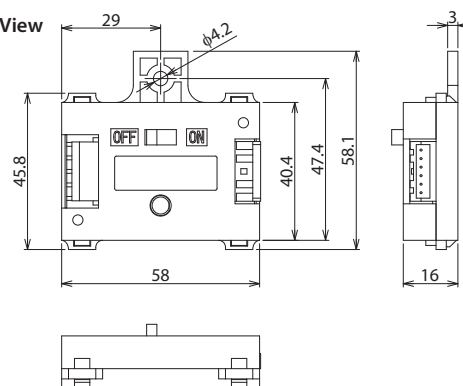


### Names of Each Part



- Slide switch  
For manual grip/release.  
(Enabled only when open/close signal from external device is OFF)
- LED display  
Light turns ON via signals from the external control device.  
Light is also ON during forced ON via slide switch.
- Power/control device side connector  
Cables from power supply and host devices to be connected.
- Gripper side connector  
For solenoid gripper connection.

### External View



### Signal Names (power/control device side)

Wire color	Signal name	Description
White	24V	24VDC $\pm 10\%$ power input for driver box, solenoid gripper sensor
Black	0V	0V(GND)
Brown	ON/OFF	Open/close signal input of solenoid gripper
Red	Sensor 1	Output of solenoid gripper sensor 1
Green	Sensor 2	Output of solenoid gripper sensor 2

# Reference Data

## Gripper Selection Method

### Slide type

#### Step 1

Check the required grip force and allowable workpiece mass



#### Step 2

Check the gripping point distance



#### Step 3

Check external force applied to fingers

### Step 1 Check the required grip force and allowable workpiece mass

When gripping the workpiece with frictional grip force, calculate the required grip force as follows.

#### (1) For normal transfer

**F** : Grip force (N) ... Total sum of push forces of both fingers  
**μ** : Static friction coefficient between the finger attachment and the workpiece  
**m** : Workpiece mass (kg)  
**g** : Gravitational acceleration (= 9.8m/s<sup>2</sup>)

- The conditions under which the workpiece remains statically gripped without dropping are as follows:

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

- Assuming a recommended safety factor of 2 for normal transfer, the required gripping force is calculated as follows:

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

- When the friction coefficient is  $\mu 0.1 \sim 0.2$

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

#### For ordinary workpiece transferring

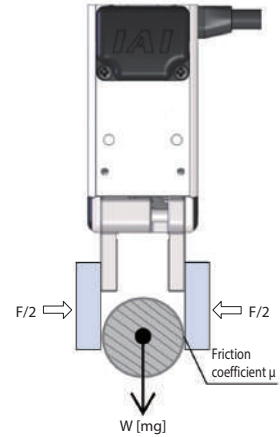
Required grip force: ▶ **10~20 times or more the workpiece mass**  
 Max. allowable mass: ▶ **Not more than 1/10th to 1/20th the gripping force**

#### (2) When considerable acceleration, deceleration, or impact force is applied during transfer of the workpiece

In addition to gravity, a greater inertial force is applied to the workpiece. In this case, select a model with an even higher safety factor.

#### When large acceleration, deceleration, or shock is applied

Required grip force: ▶ **30~50 times or more the workpiece mass**  
 Max. allowable mass: ▶ **Not more than 1/30th to 1/50th the gripping force**

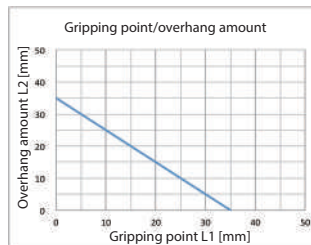


\* The greater the coefficient of static friction, the greater the maximum allowable workpiece mass. However, select a model that can generate a gripping force of at least 10 to 20 times this workpiece mass to ensure safety.

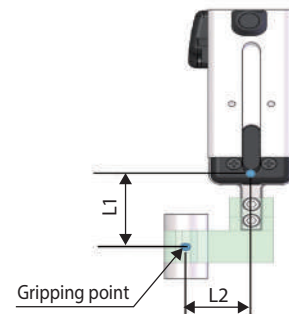
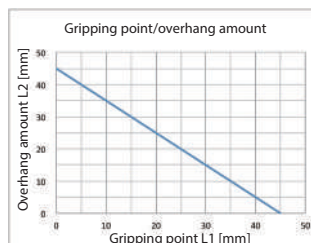
### Step 2 Check the distance to the gripping point

The distances (L1, L2) from the finger mounting surface to the gripping point have to fall in the ranges specified below. If the limits are exceeded, excessive moments may act upon the sliding part of the finger and internal mechanism and it could shorten the service life.

GRS-SEG/SIG



GRS-MEG/MIG



Even if the gripping point distance is within the limit range, keep the finger attachment as small and lightweight as possible. If the fingers are long and large, or if the mass is large, inertial force and bending moment during opening and closing may worsen the performance and adversely affect the guide section.

# Gripper Selection Method

## Step 3 Check external force applied to fingers

### (1) Allowable vertical load

Make sure that the vertical load applied to each finger is less than the allowable load.

### (2) Allowable load moment

Calculate  $M_a$  and  $M_c$  using value of  $L_1$  and  $L_2$ . Make sure the moment applied to each finger is less than the maximum allowable load moment.

● The allowable external force when applying moment load to each claw is

$$\text{Allowable load } F(N) > \frac{M \text{ (Maximum allowable moment (N-m))}}{L(\text{mm}) \times 10^{-3}}$$

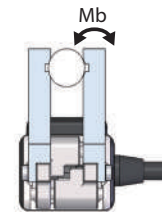
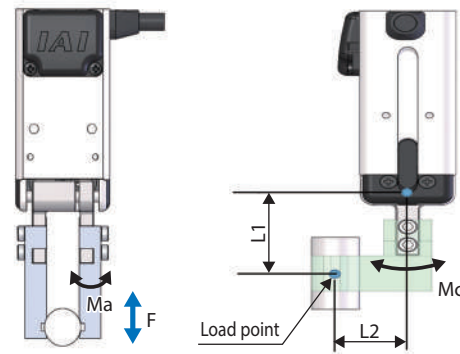
Calculate  $F(N)$  using  $L_1$  and  $L_2$ .

Check that the external force applied to the finger is less than the calculated allowable load  $F(N)$  (the smaller value of  $L_1$  and  $L_2$ ).

Model	Allowable vertical load $F(N)$	Maximum allowable load moment (N-m)		
		$M_a$	$M_b$	$M_c$
GRS-SEG/SIG	150	0.62	0.62	0.99
GRS-MEG/MIG	240	1.08	1.08	2.64

1. The allowable value above indicates a static value. 2. Indicates the allowable value per finger.

\* The mass of the finger and the workpiece mass are also part of the external force. Other external forces applied to the fingers are the centrifugal force when swiveling the gripper with the workpiece attachment gripped and the inertia force due to acceleration/deceleration during travel.



\* The load point above indicates the load position on the fingers. The position varies depending on the type of load.

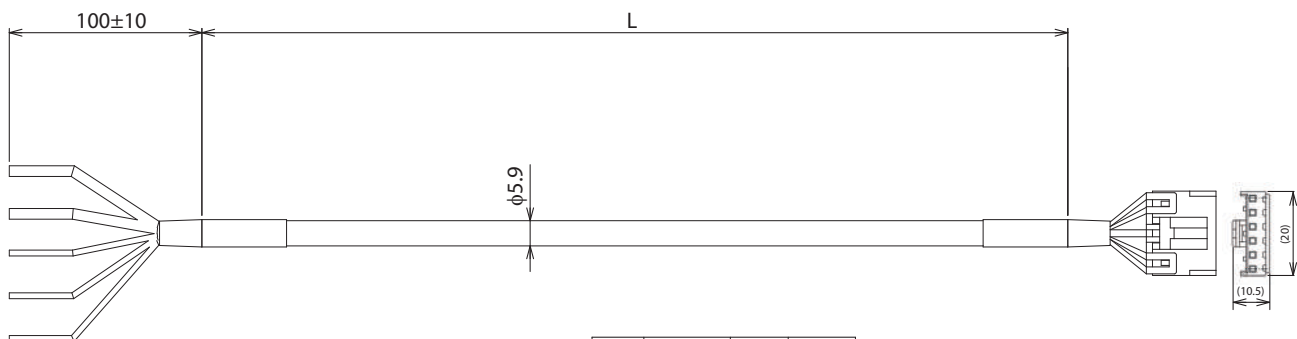
- Load due to grip force: Gripping point
- Load due to gravity: Center mass location
- Inertial force during travel, centrifugal force during swivel: Center mass location

The load moment is the total value calculated for each type of load.

## Maintenance Parts

Model **CB-GRS-PCS** Solenoid gripper cable

\* Please indicate the cable length (L) in , (e.g. 050 = 5m), maximum 15m



No.	Signal	Color	Wiring
1	+24V	White	AWG18
2	GND	Black	
3	ON/OFF	Brown	AWG22
4	Sensor 1	Red	
5	Sensor 2	Green	

Wiring layout

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**IAI America, Inc.**

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**Atlanta Office:** 1220 Kennestone Circle, Suite 108, Marietta, GA 30066 (888) 354-9470

**[www.intelligentactuator.com](http://www.intelligentactuator.com)**

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