

Electric Gripper Instruction Manual

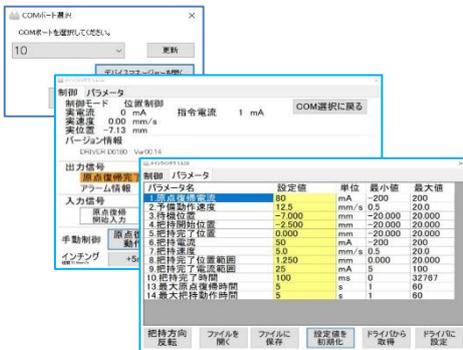
CGS0402 Series



Servo Driver (D6180)



Electric Gripper



Dedicated Software

Revision History

Date	Rev.	Details
September 16 th , 2020	0.0	First Edition
January 26 th , 2021	0.1	Added Pin No. 3 of Communication Cable on page 17

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1. Handling Precautions

- ◆ When selecting and handling equipment, someone with sufficient knowledge and experience such as system designers or other responsible workers must ensure that they handle the product after reading "Safety Precautions", "Catalog", and "Instruction Manual". Mishandling the product is dangerous.
- ◆ Customers are asked to independently verify the compatibility between this product and the customer's own system.
- ◆ The dangers, warnings, and cautions listed in "Safety Precautions" do not take into account all situations. Read the Catalog and Instruction Manual carefully and always put safety first.

This Instruction Manual divides handling-based precautions into "Warnings" and "Cautions".

WARNING

This is shown for potential dangers that may lead to death or serious injury if the product is mishandled.

CAUTION

This is shown for potential dangers that may lead to slight-to-moderate injury or cause physical damage to property if the product is mishandled.

The  Caution described in this section may lead to serious results depending on the situation. The content detailed for each definition is important, so be sure to follow the instructions within.

WARNING

- Do not use the product for any purpose outside its scope of specifications. Using the product outside the scope of specifications may cause its malfunction, break down or damage. It may also significantly reduce its lifespan.
- Do not use the product in an explosive atmosphere, inflammable gas atmosphere, corrosive atmosphere, somewhere exposed to water, oil or any other liquid, or next to combustibles. Doing so may cause you to receive an electric shock or cause an injury or fire.
- Do not move, install, connect or inspect while the power is turned on. Be sure to perform such work after turning off the power. Doing it while the power is on may cause you to receive an electric shock or damage the Driver.
- Installation, connection, and inspection work must be performed by a worker with knowledge of the equipment and who is well-acquainted with the safety information and precautions.
- Design a safety circuit or device to ensure that the equipment is not damaged and that injury accidents do not occur when the machine stops due to a system abnormality, such as emergency stop or power failure.
- When using the product at one of the below places, ensure that shielding measures are taken. Not taking measures may cause a malfunction, leading to the damage of equipment or causing an injury.
 - Places exposed to large current and strong magnetic fields
 - Places exposed to noise due to factors such as static electricity
 - Places exposed to radiation
- Before installing the product in equipment, confirm the correct installation and wiring methods, and that the movement commands are correct. Not confirming this before use may cause an injury or damage the mechanical equipment when in contact with movable parts.

- Before supplying electricity to or operating the product, ensure that the equipment's operating area is kept safe. Carelessly supplying electricity may cause an electric shock or an injury when in contact with movable parts.
- Do not touch the terminal or any switches while the power is turned on as this may cause an electric shock or malfunction.
- Do not scratch cords such as Cables as this may cause a fire, electric shock or a malfunction due to a short circuit or conduction failure.
- Stop operation immediately if there is an abnormal noise or if it starts vibrating excessively.
Using the product in that state may cause it to be damaged or to malfunction or crash due to damage.
- Do not throw the product into a fire as this may cause the product to explode or emit poisonous gas.
- Work relating to the product such as maintenance, improvement or replacement must only be performed after completely cutting off the power supply.

CAUTION

Precautions for use

- Only use the product after fully reading the Instruction Manual and understanding the contents, and be sure to strictly observe the precautions for safety reasons.
- Do not use the product in places exposed to direct sunlight (ultraviolet rays), places with lots of dust and high salinity and iron powder, humid places, or in an atmosphere containing organic solvent, phosphate ester type hydraulic oil, sulfur dioxide, chlorine gas, or acids. This may cause performance to drop rapidly over a short period or shorten its lifespan.
- Do not use the product in a corrosive gas atmosphere, inflammable gas or inflammable liquid atmosphere as there is a danger it may become less robust due to rusting or that it may ignite or explode due to the Motor.
- If you hit, drop or apply a thrust or moment load that exceeds the permissible value, there is a danger that it may damage the product, so handle it with care.
- When opening the product, check whether there are any abnormalities and that it is the same product that you ordered.
- Disassembling parts of the product may allow the intrusion of dust or worsen the assembly accuracy of parts, so do not disassemble the product.
- Prevent the intrusion of foreign substances such as dust or machining dust. If foreign substances do enter the product, this may cause Ball Screws or the Slide Guide Rail to break, reduce the product's lifespan, or cause loss of function.
- This product does not have a waterproof and oilproof structure, so it cannot be used in places exposed to water or in an oil bath condition.
- Lubricant is essential for using Ball Screws and Slide Guide Rails. When using the product in the standard way, inspect the Grease once every two or three months and replenish it. If the Grease becomes dirty during use, refill it with the recommended Grease after removing the old Grease.
We can provide support for greasing and Motor replacement maintenance (fee required). Please contact KSS for more details.
- Do not use the product at a gripping force range, maximum speed, or allowable moment that exceeds the company's specifications. This may cause abnormal noise, vibration, accuracy deterioration and shortened lifespan of the Ball Screw and Slide Guide Rail.
- Keep the product away from magnetic storage. Data in the magnetic media may be destroyed by the magnetism from the magnet.

Precautions for safety

- Stop operations immediately and turn off the power if the equipment generates an abnormal odor or sound, or if it is heating abnormally or vibrating.
- Do not apply an electrical current above the rated current to the Motor.
- Check the polarity of the servo driver power before running the Motor.
- As there is a possibility that the Motor may heat abnormally due to the load condition or used driver. Ensure that the surface temperature of the Electric Gripper is within 50°C when using it.
- Check the wiring system, drive system, and the phase sequence. Erroneous wiring may cause the Motor to malfunction.
- Be sure to ground the product (grounding resistance: 100Ω or less).
- Do not forcibly bend, pull or pinch the Motor Lead Wire.
- Do not touch the movable parts when in motion.
- Motor withstand voltage test and megger test must be conducted after detaching control and connection.
- Turn off the input power of the Driver before maintenance and inspection.

Operating Environment

- Do not use the product outside an ambient temperature of 0 to 40°C, outside the ambient humidity of 20 to 80% RH or in places exposed to condensation, corrosive gas or inflammable gas.
- Do not use the product at places where there is an intense electric field or a ferromagnetic field.
- Do not use the product in places where fine particles such as iron powder, dust, oil mist, cutting fluid, moisture, high salinity, or organic solvent is generated or scattered.
- Do not use the product in places that are constantly vibrating or under special environments such as impact load or vacuum.

2. Profile of Product

This product is a lightweight and compact Electric Gripper that uses the world's smallest class Bi-directional Ball Screw from KSS.

Combining Ball Screw, DC motor, and a Linear Scale, it enables multipoint positioning and gripping force control.

Its usability-orientated exclusive design allows 4-direction mounting, regular maintenance (motor replacement and greasing), opening and closing movements during non-conduction, centering, and dimension measurement. In addition, combining the KSS Electric Gripper with its dedicated Servo Driver enables zero return (homing), gripping and standby movements to be performed easily.

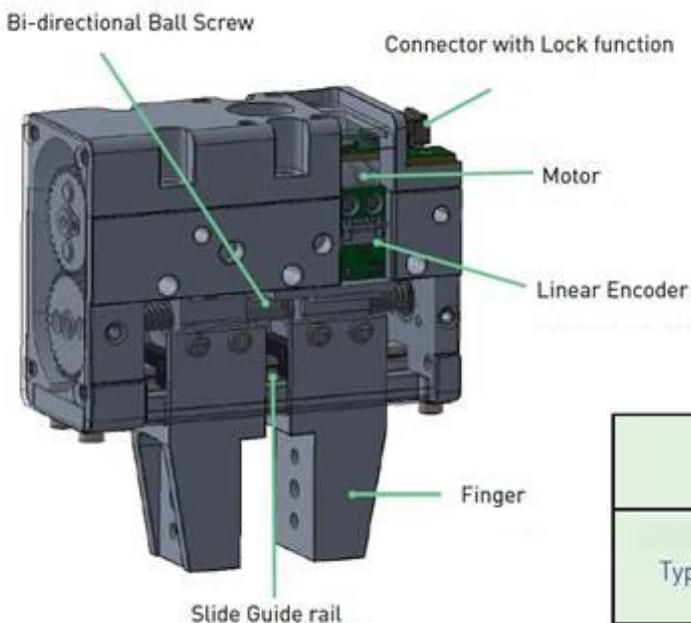


**Electric Gripper
(CGS0402 Series)**



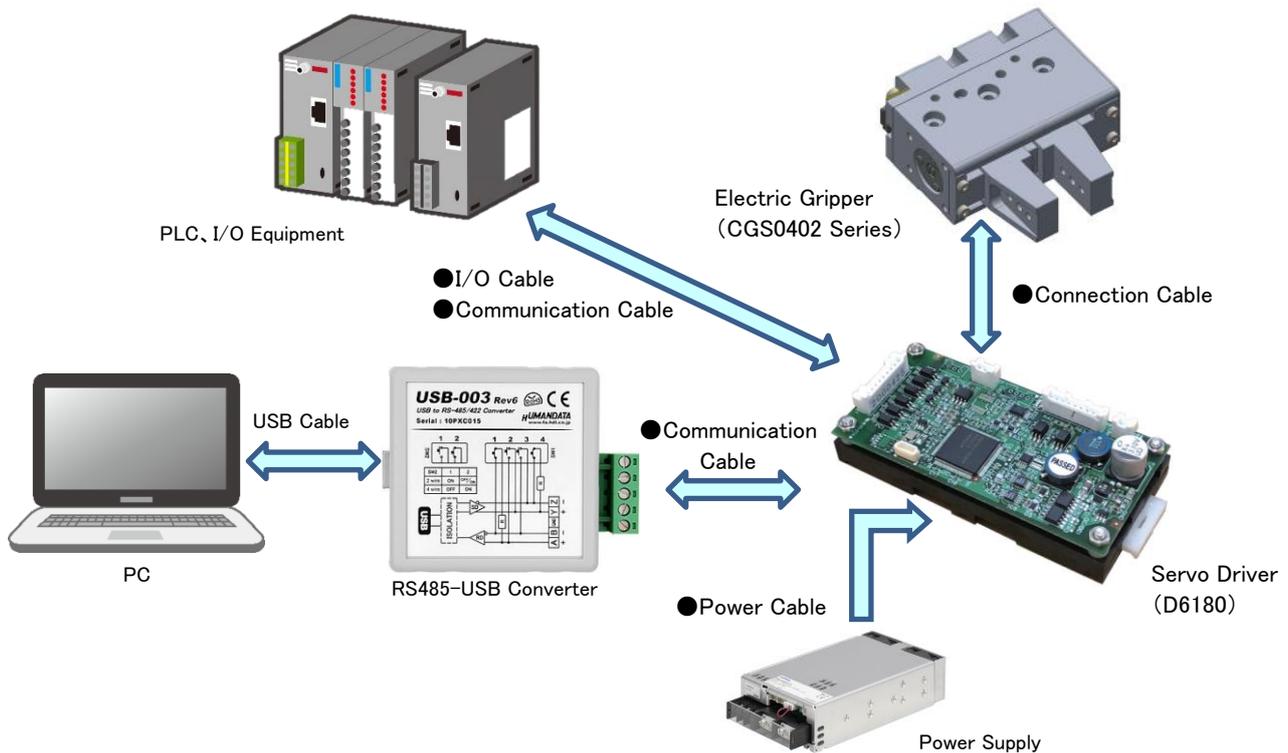
**Dedicated Servo Driver
(D6180)**

—Main Components—



Main Components	
Types of Screw	Bi-directional Ball Screw (Φ4mm、Lead 2mm)
Sliding Guide	Slide Guide rail
Motor	Coreless DC geared Motor
Linear Encoder	Incremental A, B phase(5V)

3. System Configuration



“●” are optional cables handled by KSS.

Note) Connector on the device side that connects to the Driver is not included.

4. Required Equipment

Required Equipment	Host Device		Remarks
	PC	PLC (RS485, I/O)	
KSS Electric Gripper CGS0402 Series	○	○	Finger-type, Fingerless-type
Dedicated Servo Driver D6180	○	○	
Dedicated Software D6180 Controller	○	—	Provided free-of-charge OS: Windows7 and newer version
RS485-USB Converter	○	—	Recommendation) USB-003 HuMANDATA LTD.
Connection Cable ASE-CC Series	○	○	1m, 3m, 5m, 10m are available
Power Cable ASE-PW01 (1m)	○	○	
I/O Cable ASE-IO01 (1m)	△	△	Not required when I/O is not used
Communication Cable ASE-CM01	○	○	
Power Supply DC24V, 1A	○	○	To be provided by customer

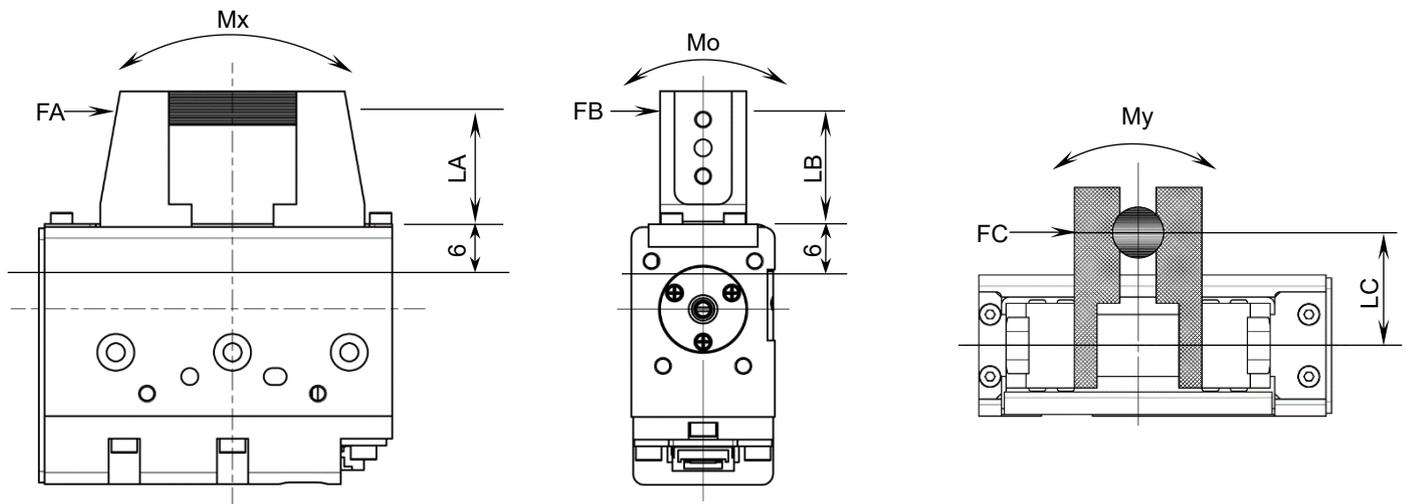
○ : Required △ : Required if necessary — : Not Required

Note) Host Device (PC, PLC etc.) should be provided by customer.

6. Basic Specifications

Item		Value	Remarks
Gripping force range		2~20N	One side
Gripping speed range		0.5~10mm/sec	One side
Positioning speed range		0.5~20mm/sec	One side
Travel (stroke)		14mm	One side 7mm
Repeatability		±0.01mm	
Mass		180g (Vertical finger) 166g (Fingerless)	Excluding cable
Lubrication	Ball Screw	Multemp PS No. 2	
	Slide Guide Rail	Multemp PS No. 2	
Allowable moment (static)	Mo	0.98Nm	One side
	Mx	0.56Nm	One side
	My	0.47Nm	One side

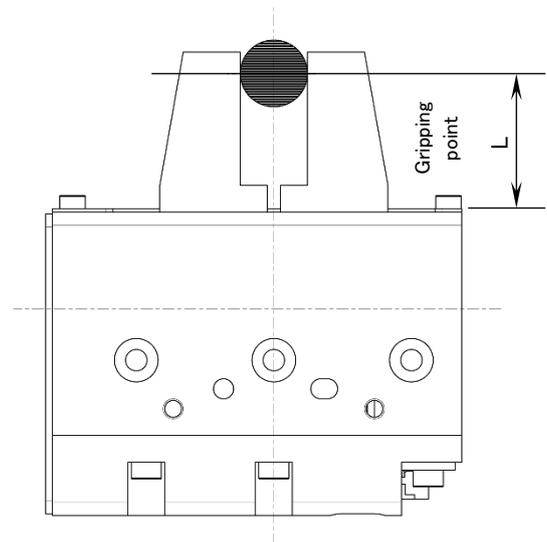
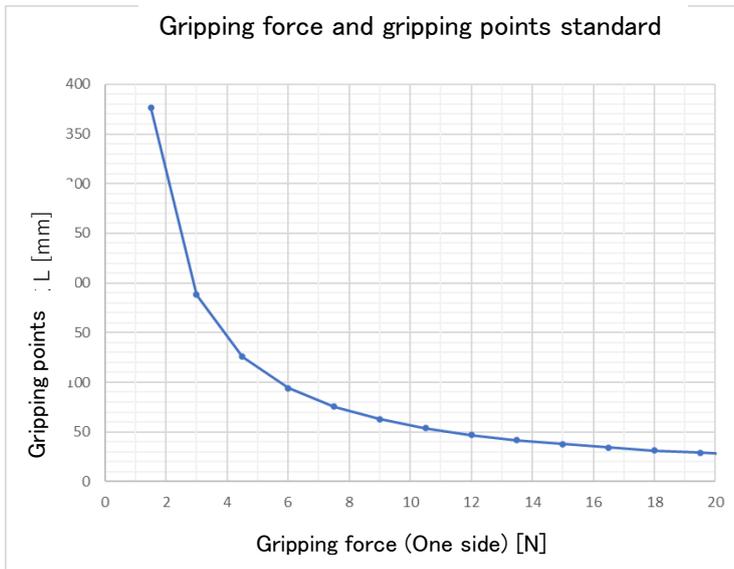
● Allowable moment



- $M_x = F_A \times (L_A + 6) \text{ Nm}$
- $M_o = F_B \times (L_B + 6) \text{ Nm}$
- $M_y = F_C \times L_C \text{ Nm}$

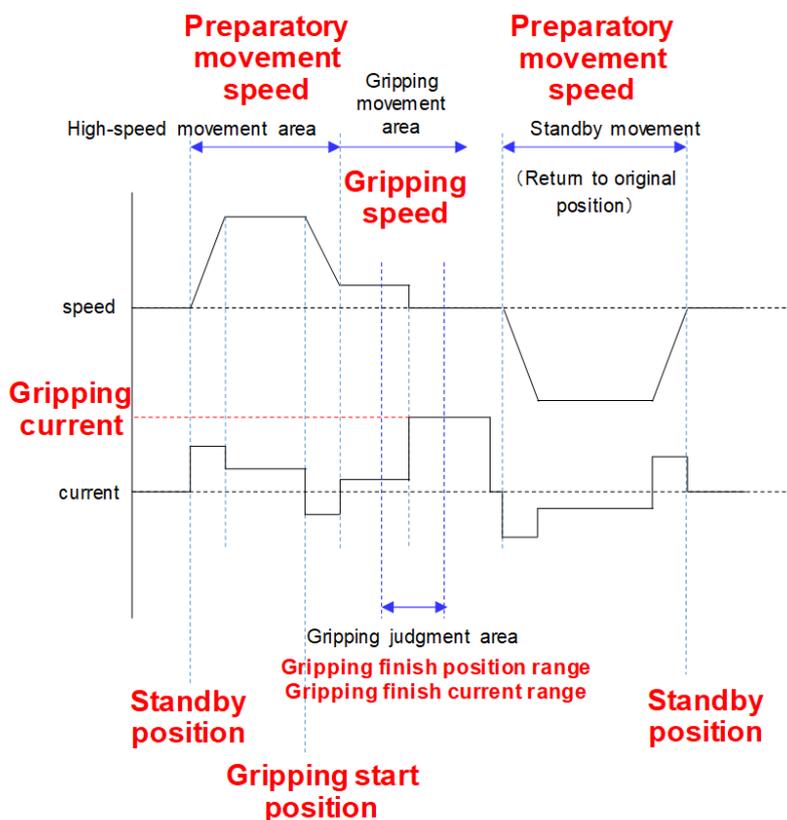
● Gripping force and Gripping points

To use the product within the allowable moment of the Slide Guide Rail, determine the gripping force and gripping points as shown by the below diagram.



● Gripping movements and Standby movements

The sequence of gripping and standby movements is shown in the below diagram. The zero return movement (homing) is set by the Servo Driver parameter (zero return (homing) current, preparatory movement speed, standby position), and it is a pressing method in either an opening or closing direction.



Servo Driver parameter name

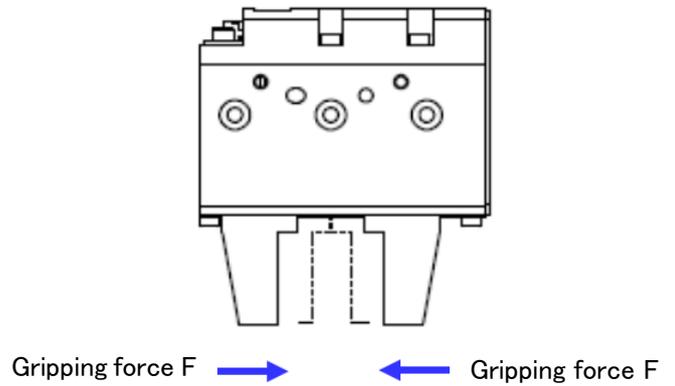
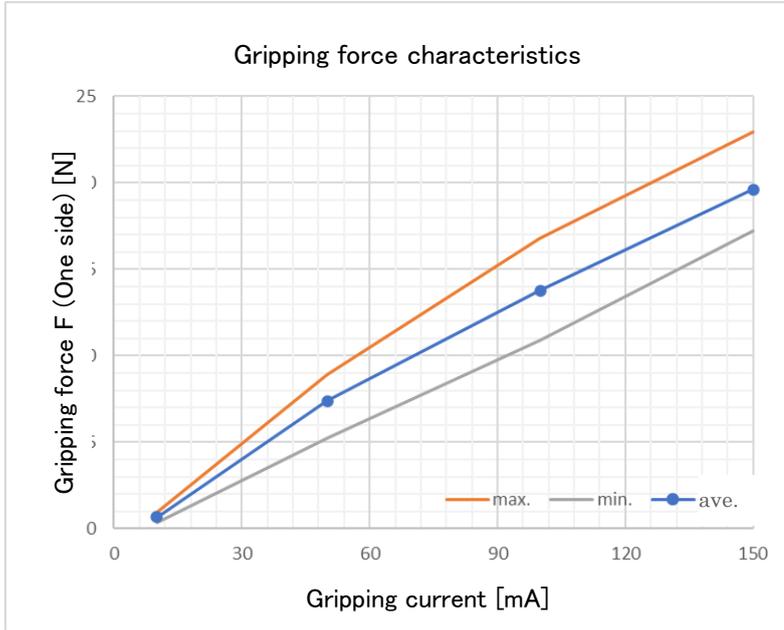
Parameter names
1. Zero return (homing) current
2. Preparatory movement speed
3. Standby position
4. Gripping start position
5. Gripping finish position
6. Gripping current
7. Gripping speed
8. Gripping finish position range
9. Gripping finish current range
10. Gripping finish time
13. Maximum zero return (homing) time
14. Maximum gripping movement time

Zero return: Speed-limited current control
 High-speed movement area: Positioning control
 Gripping movement area: Speed-limited current control
 Standby movement: Positioning control

Note) Acceleration is a fixed value of 125 [mm/s²].

● **Gripping characteristics**

The relationship between gripping current and gripping force is shown in the below diagram. This is for your reference.

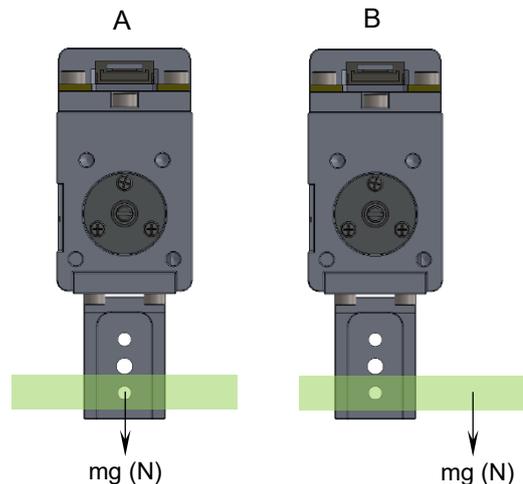
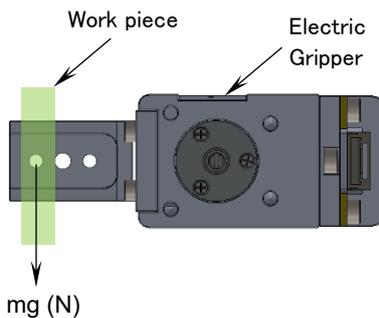
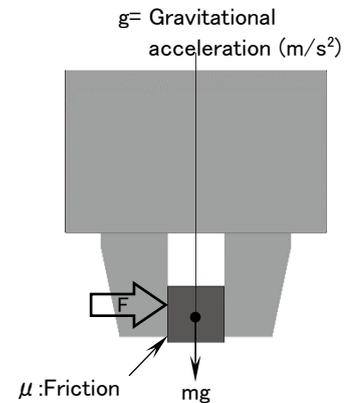


*Note)
The default value for the gripping current of the recommended D6180 Driver is 50mA.
Limit the upper gripping current setting to 150mA.

● **Gripping force and work mass**

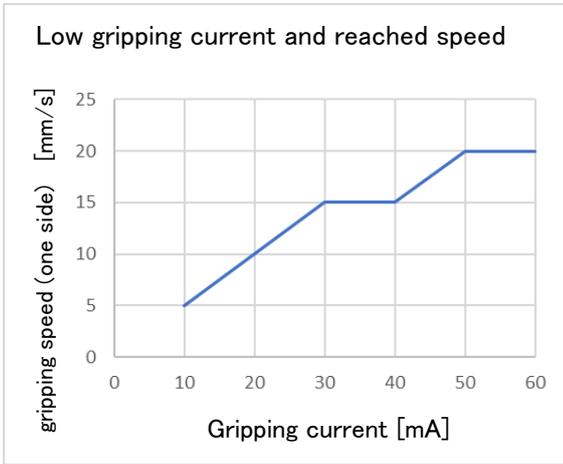
The mass of a work piece that can be gripped with the Electric Gripper varies greatly due to the below factors.

1. **Frictional coefficient (μ) of work piece and finger (claw)**
When the gripping force is $F(N)$ and the mass of work piece is $m(kg)$, it should be $F \times \mu > mg$.
2. **Gravity center of work piece and gripping position**
B requires larger gripping force than A.
3. **Inertial force when transferring the work piece**
4. **Presence or absence of oil in clamp part**
5. **Touching condition of finger (claw) and work piece**



● **Low gripping current and gripping speed, preparatory movement speed**

When using the product at a low gripping current setting of 50mA or less, the gripping speed and preparatory movement speed will not reach the set value. Set the gripping current, gripping speed, and preparatory movement speed in accordance with the below diagram.



Gripping Speed	Gripping Current				
	10mA	20mA	30mA	40mA	50mA
5mm/s	○	○	○	○	○
10mm/s	×	○	○	○	○
15mm/s	×	×	○	○	○
20mm/s	×	×	×	×	○

○ : Reaches the set speed, × : Not reaches the set speed

● **Soft touch function**

If it is necessary to avoid an impact load on the gripped work piece, limit the gripping speed in accordance with the below table.

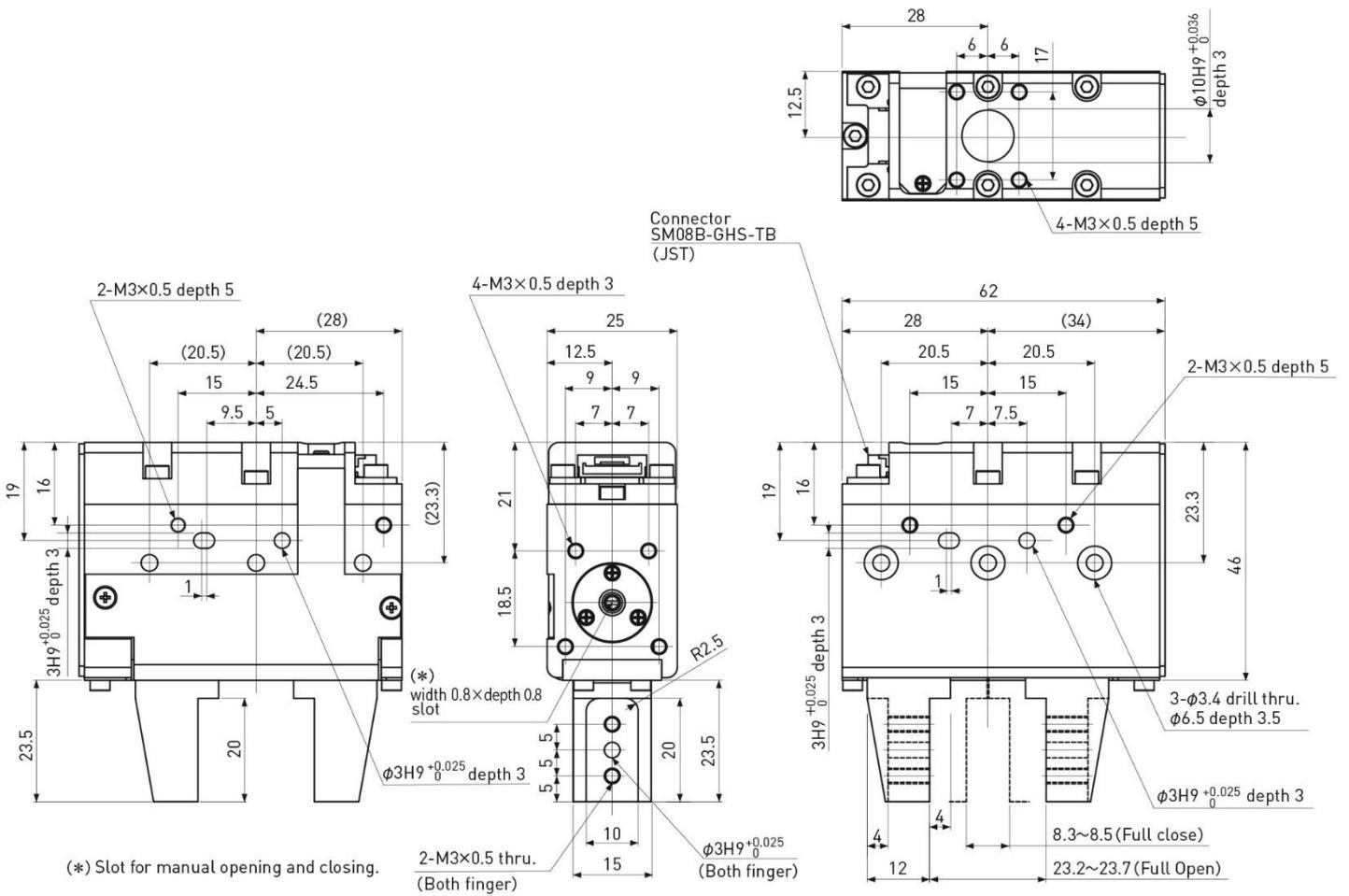
If an impact load on the work piece can be tolerated, a gripping speed can be used up to 20mm/s.

Gripping Speed	Gripping Current		
	50mA	100mA	150mA
0.5mm/s	○	○	○
1mm/s	○	○	○
5mm/s	○	○	○
10mm/s	×	×	○
15mm/s	×	×	×
20mm/s	×	×	×

○ : Soft touch function enabled
× : Soft touch function disabled

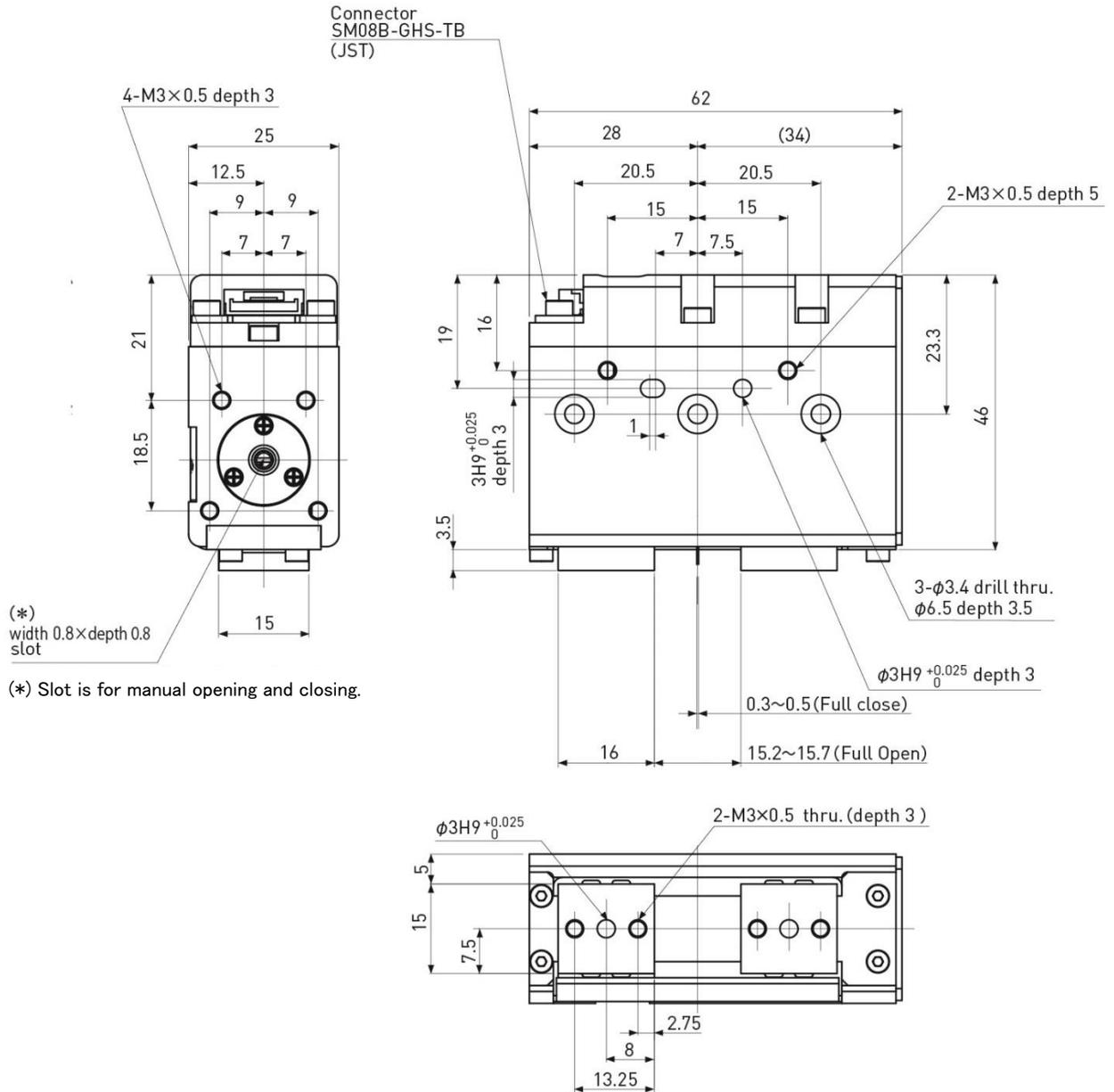
7. External Dimensions

● Electric Gripper – Vertical Finger-type

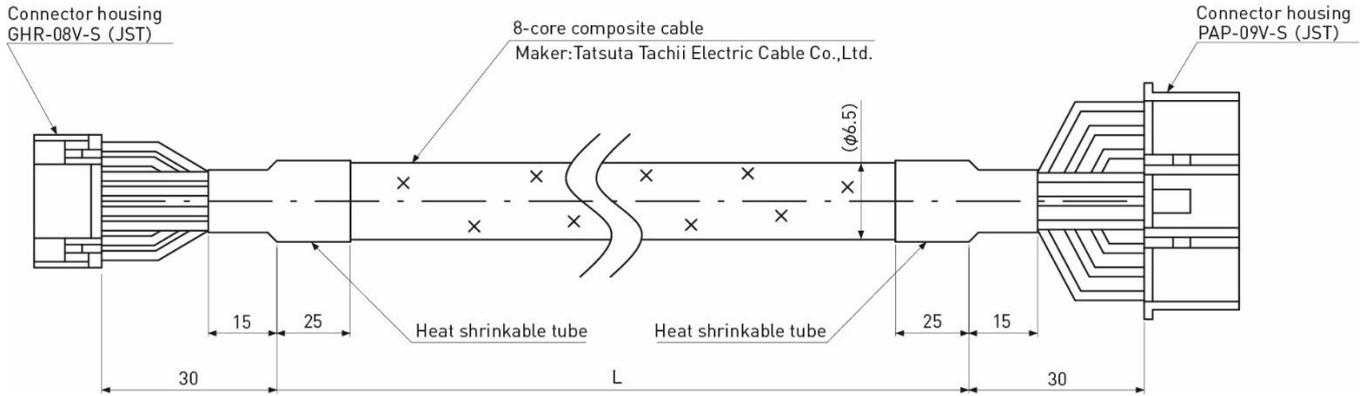


●Electric Gripper Fingerless-type

Dimensions besides those shown in the below diagram are the same as the vertical finger type.



● Connection Cable (ASE-CC□□)



Pin assignment

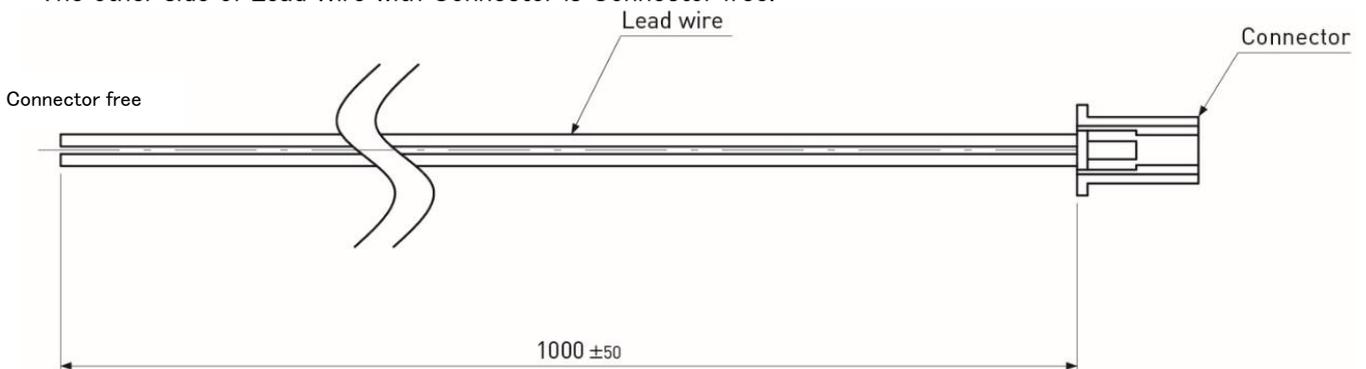
Model	Cable length L (tolerance)
ASE-CC01	1000(+50/0)
ASE-CC03	3000(+100/0)
ASE-CC05	5000(+150/0)
ASE-CC10	10000(+200/0)

GHR-08V-S		
Pin No.	Wiring Colors	Function
1	White	/B
2	Yellow	B
3	Blue	/A
4	Green	A
5	Red/White	+5V
6	Black/White	0V
7	Black	M-
8	Red	M+

PAP-09V-S		
Pin No.	Wiring Colors	Function
1	Green	A
2	Blue	/A
3	Yellow	B
4	White	/B
5	Red/White	+5V
6	Black/White	0V
7	Gray	shield
8	Red	M+
9	Black	M-

● Power Cable (ASE-PW01)

The other side of Lead Wire with Connector is Connector free.



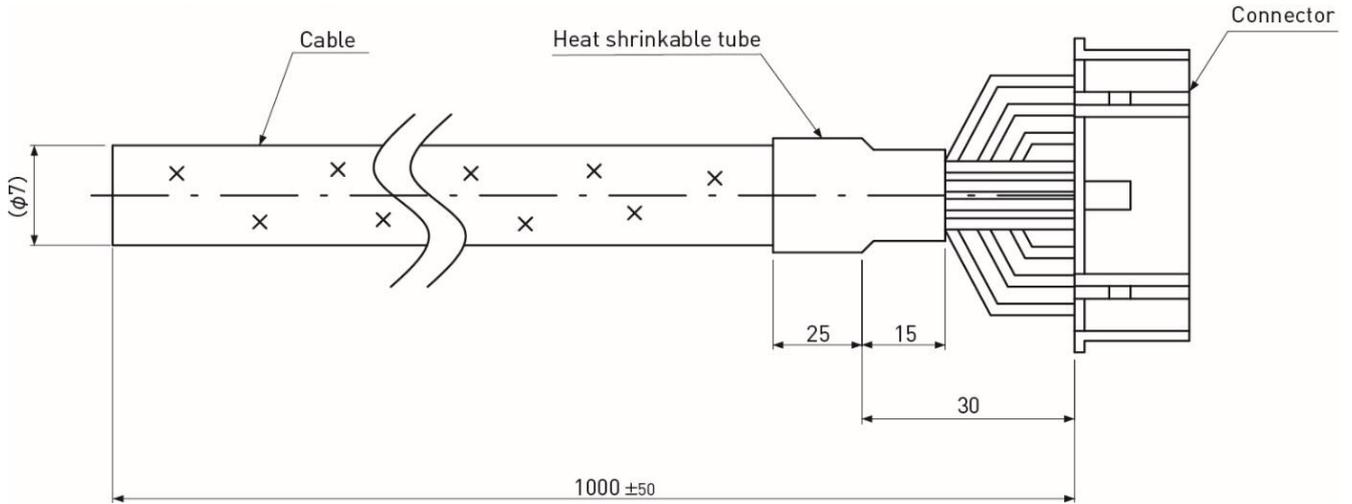
Pin assignment

PAP-02V-S		
Pin No.	Wiring Colors	Function
1	Red	+
2	Black	-

Component List

Product name	Model name	Manufacturer
Lead wire	UL1571(IR) AWG24	Hitachi Metals
Connector	PAP-02V-S	J.S.T. Mfg.
Connector Contact	SPHD-002T-P0.5	J.S.T. Mfg.

● I/O Cable (ASE-IO01)



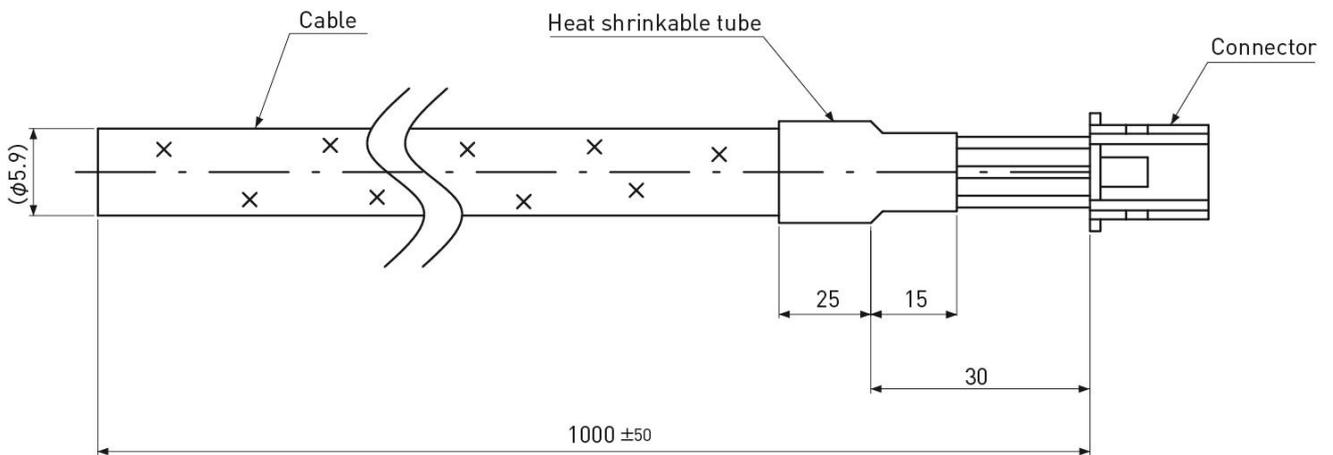
Pin assignment

PAP-10V-S		
Pin No.	Wiring Colors	Function
1	Red	ORG+
2	Red/White	ORG-
3	Green	STR+
4	Green/White	STR-
5	Yellow	END+
6	Yellow/White	END-
7	Brown	ORG OUT
8	Brown/White	HOLD OUT
9	Black	ALM OUT
10	Black/White	COM

Component List

Product name	Model name	Manufacturer
Cable	TKVVBS(UL2576) AWG24 5P (twisted pair)	Tatsuta Tachii Electric Cable
Connector	PAP-10V-S	J.S.T. Mfg.
Connector Contact	SPHD-002T-P0.5	J.S.T. Mfg.

●Communication Cable (ASE-CM01)



Pin assignment

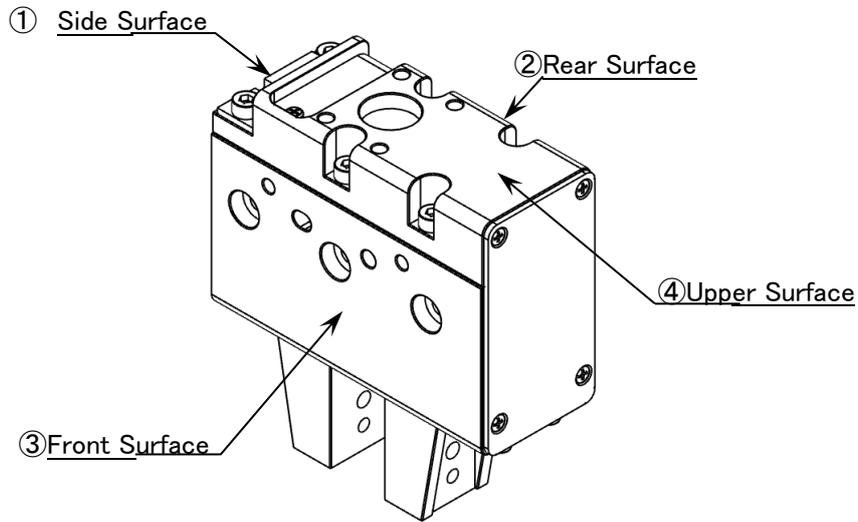
PAP-03V-S		
Pin No.	Wiring Colors	Function
1	Red	COM A
2	Red/White	COM B
3	Black	SG

Component List

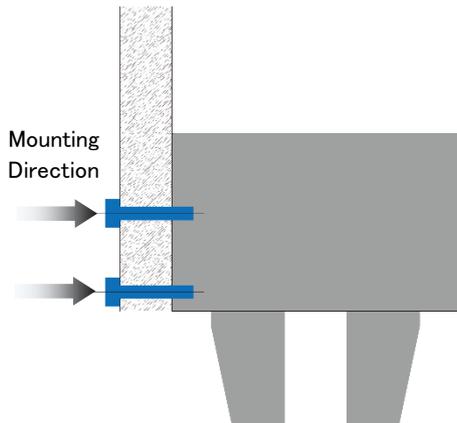
Product name	Model name	Manufacturer
Cable	TKVVBS(UL2576) AWG24 2P	Tatsuta Tachii Electric Cable
Connector	PAP-03V-S	J.S.T. Mfg.
Connector Contact	SPHD-002T-P0.5	J.S.T. Mfg.

8. Installation

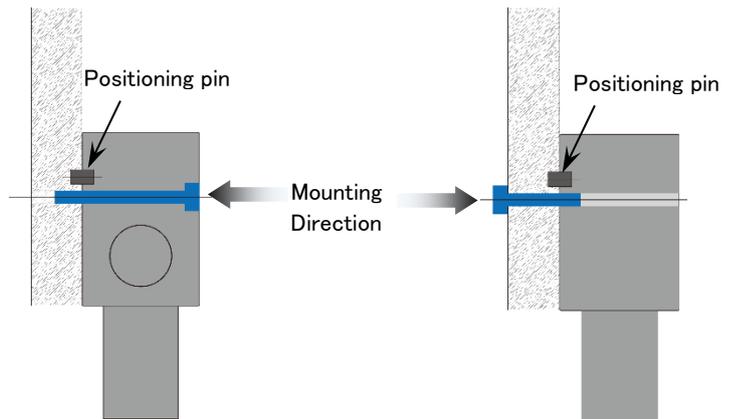
KSS Electric Grippers can be mounted on 4 sides. Please install it on your equipment based on the below diagram.



i When using the side surface①

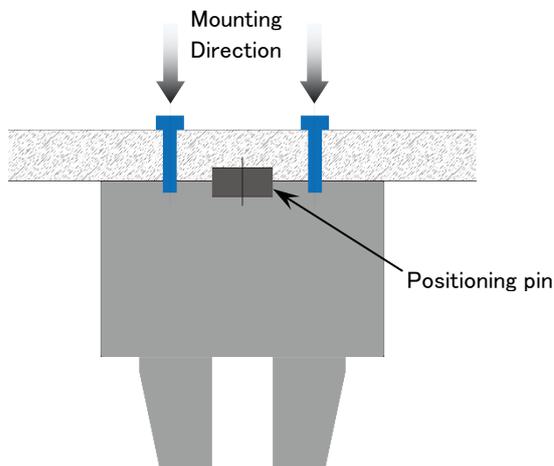


ii When using the rear surface②



iii When using the front surface③

iv When using the upper surface ④



•See pages 13 and 14 and the specification drawing for detailed dimensions of each mounting surface.

9. Maintenance

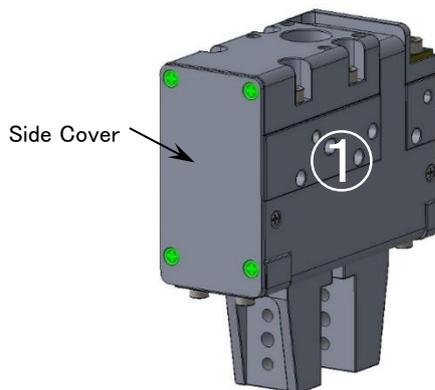
The following are guidelines for when customers perform their own greasing and Motor replacement maintenance. KSS can provide support for this maintenance work (fee required), so please contact us for more details.

● Greasing

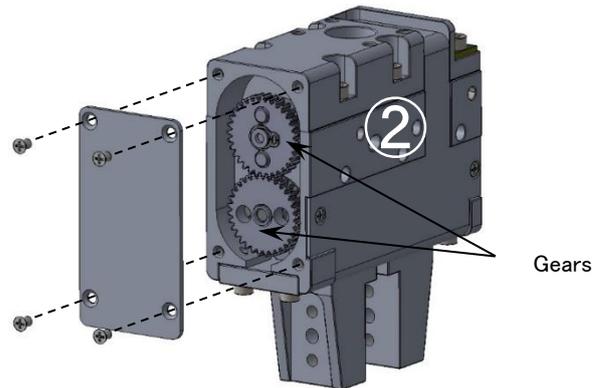
To maintain the performance of the Electric Gripper, the Gears, Ball Screw, and Slide Guide Rail must be greased regularly.

Replenish Grease on these parts in accordance with the following procedures.

i Greasing the Gear

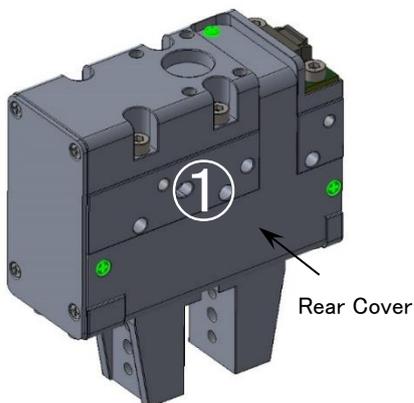


① Loosen the screws that are shown in green.

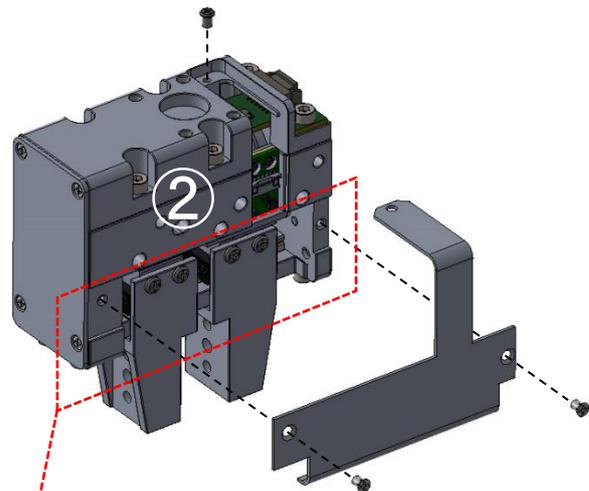


② Remove the side cover and apply Grease on the Gears.
* Recommended Grease: Multemp PS No.2

ii Greasing the Ball Screw and Slide Guide



① Loosen the screws that are shown in green.

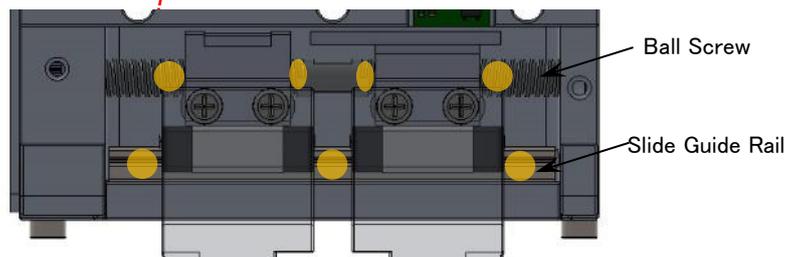


② Remove the rear cover to expose the Ball Screw and Slide Guide Rail.

③ Apply new Grease.

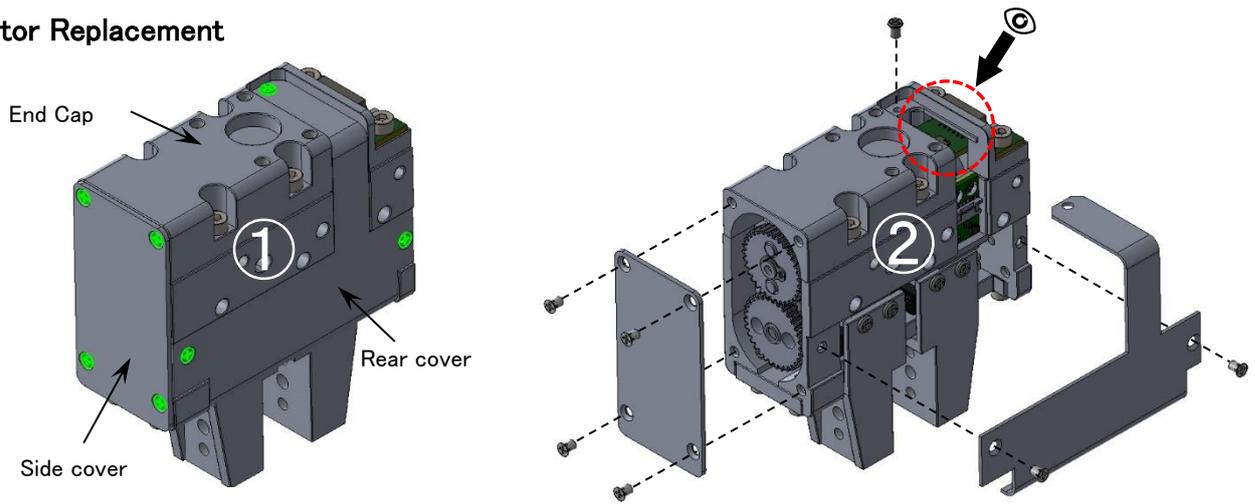
Apply the Grease to the positions shown in yellow.

If the old Grease is dirty, remove it before applying the new Grease. Apply the Grease by stroking it back-and-forth motion.

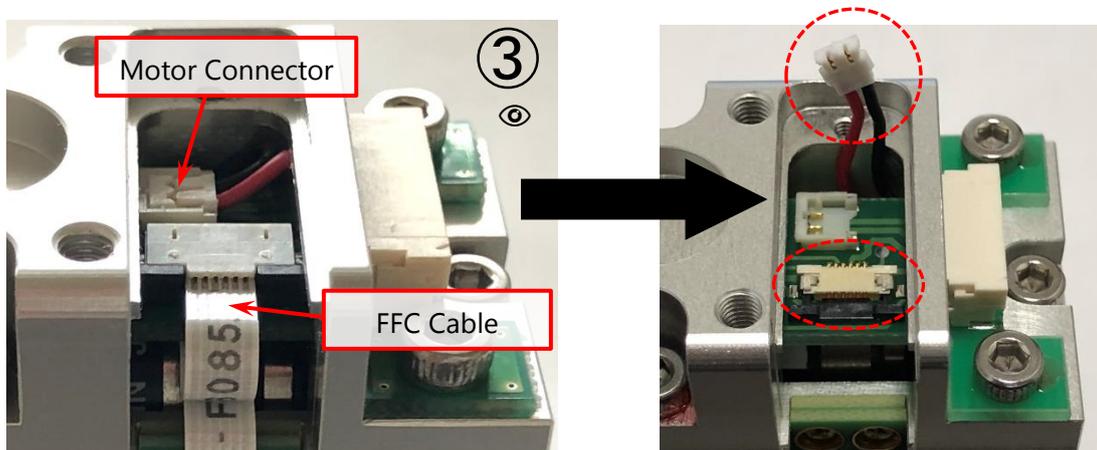


* Recommended Grease: Multemp PS No.2 (Ball Screw and Slide Guide Rail)

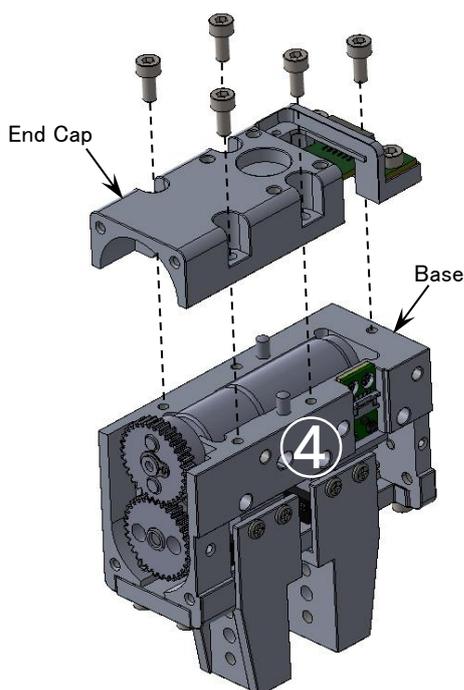
● Motor Replacement



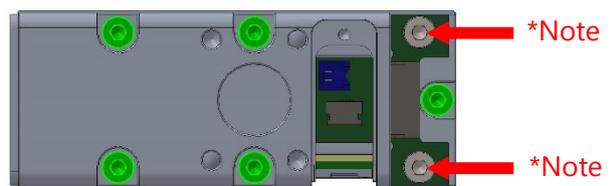
①、② Loosen the screws shown in green to remove the side and rear covers.

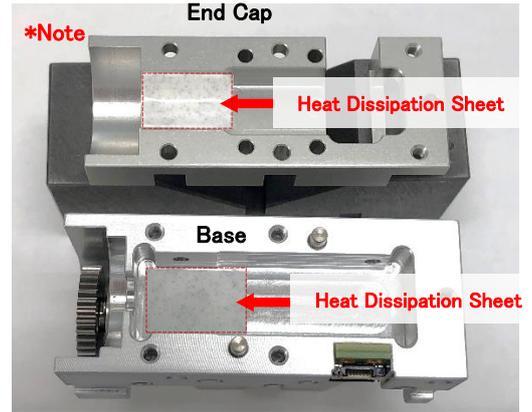
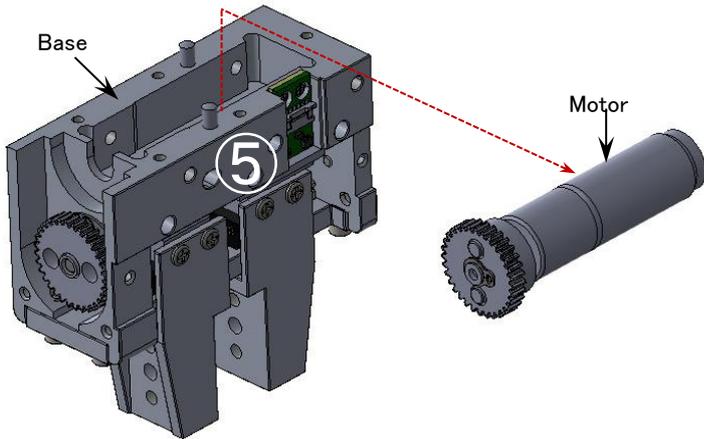


③ Remove the Motor Connector and FFC Cable.

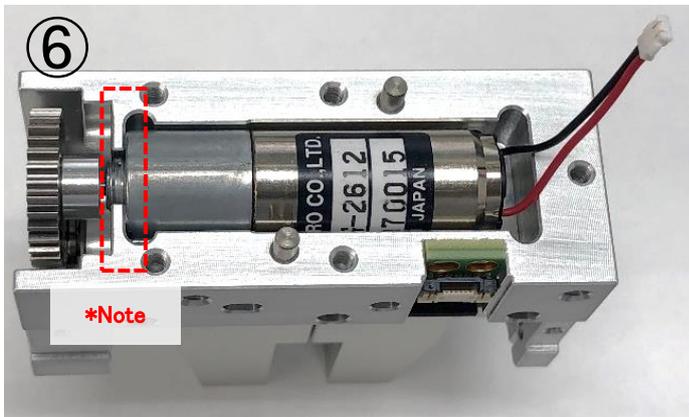


④ Next, loosen the bolts shown in green, and separate the End Cap and Base to expose the Motor.
*Note: Do not loosen the bolts denoted by the red arrows.





⑤ Remove the Motor from the Base.
*Note: When removing the Motor, you will find Heat Dissipation Sheets inside the End Cap and Base.



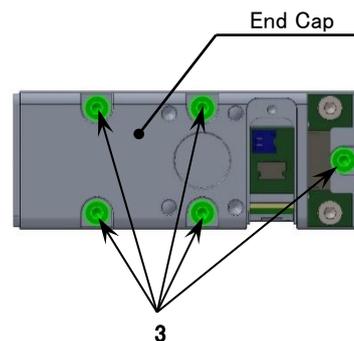
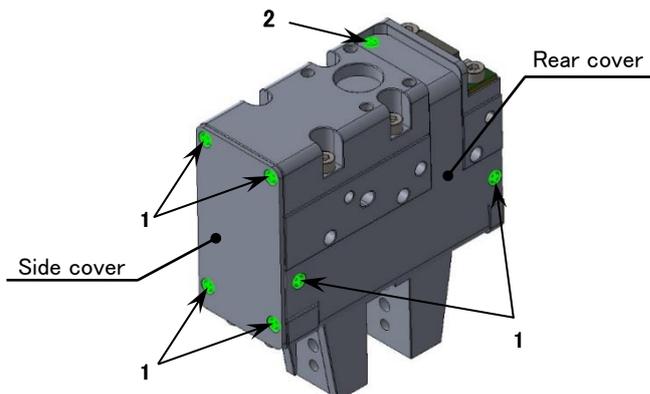
⑥ Install the new Motor.
*Note: Ensure that the end face of the Motor is firmly pressed up against the abutting surface of the Base.

When reinstalling the End Cap and Cover, follow disassembly procedures ① to ④ but in reverse order.

Refer to the following table for Bolts and tightening torque when reassembling.

*Note: After reassembling the Side and Rear Covers, be sure to retighten the M2.5 × 8L bolts that secure the End Cap.

No.	Bolt type	Size	qty	Tightening torque	Apply to
1	No. 0 class 1 flat head screw	M2 × 3L	6	0.009Nm	Side cover, Rear cover
2	No. 0 class 1 pan head screw	M2 × 3L	1	0.009Nm	Rear cover
3	Hexagon socket head cap bolt	M2.5 × 8L	5	0.36Nm	End Cap



【Supplementary information】

Centering accuracy

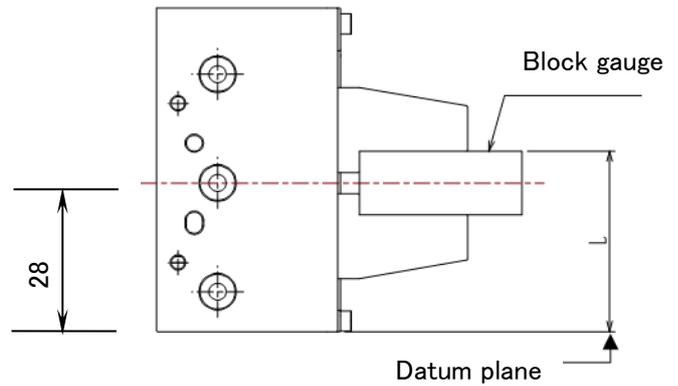
Centering accuracy is specified as follows. If centering accuracy is required, use the datum plane shown in the below diagram as the abutting surface.

— Example of centering accuracy calculation —

When using a 10mm-thick block gauge

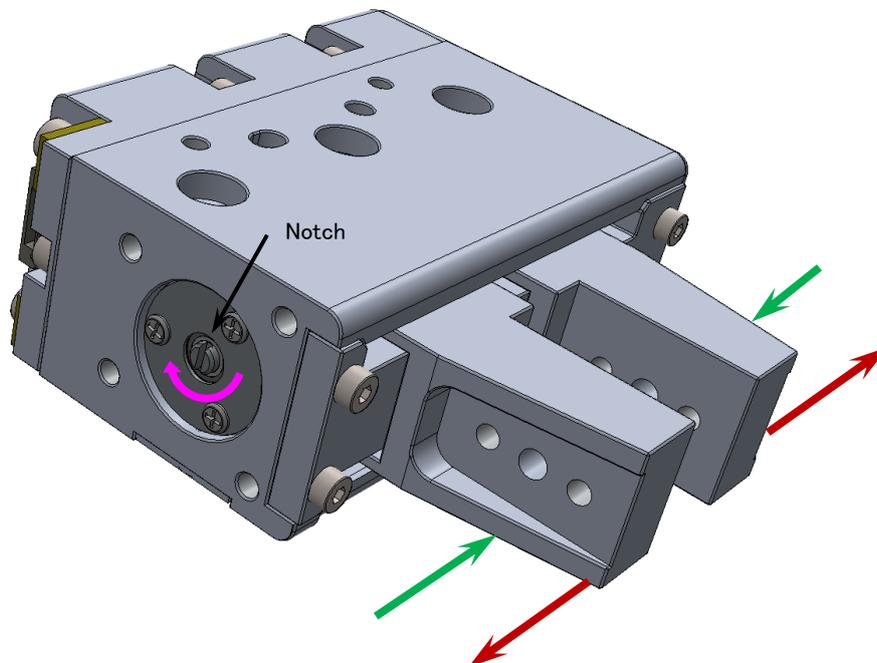
Grip the gauge with both fingers and measure the L dimension (mm).

Centering accuracy = $28\text{mm} - (L - 10\text{mm}/2)$



Opening/closing movement by manual

After installing the product in your own equipment, if the Electric Gripper becomes stuck while using it or adjusting the stroke in a de-energized state, perform the opening/closing movement manually as shown below.



Rotating the notch CW/CCW with a flathead screwdriver will enable the open/close movement to be performed manually.