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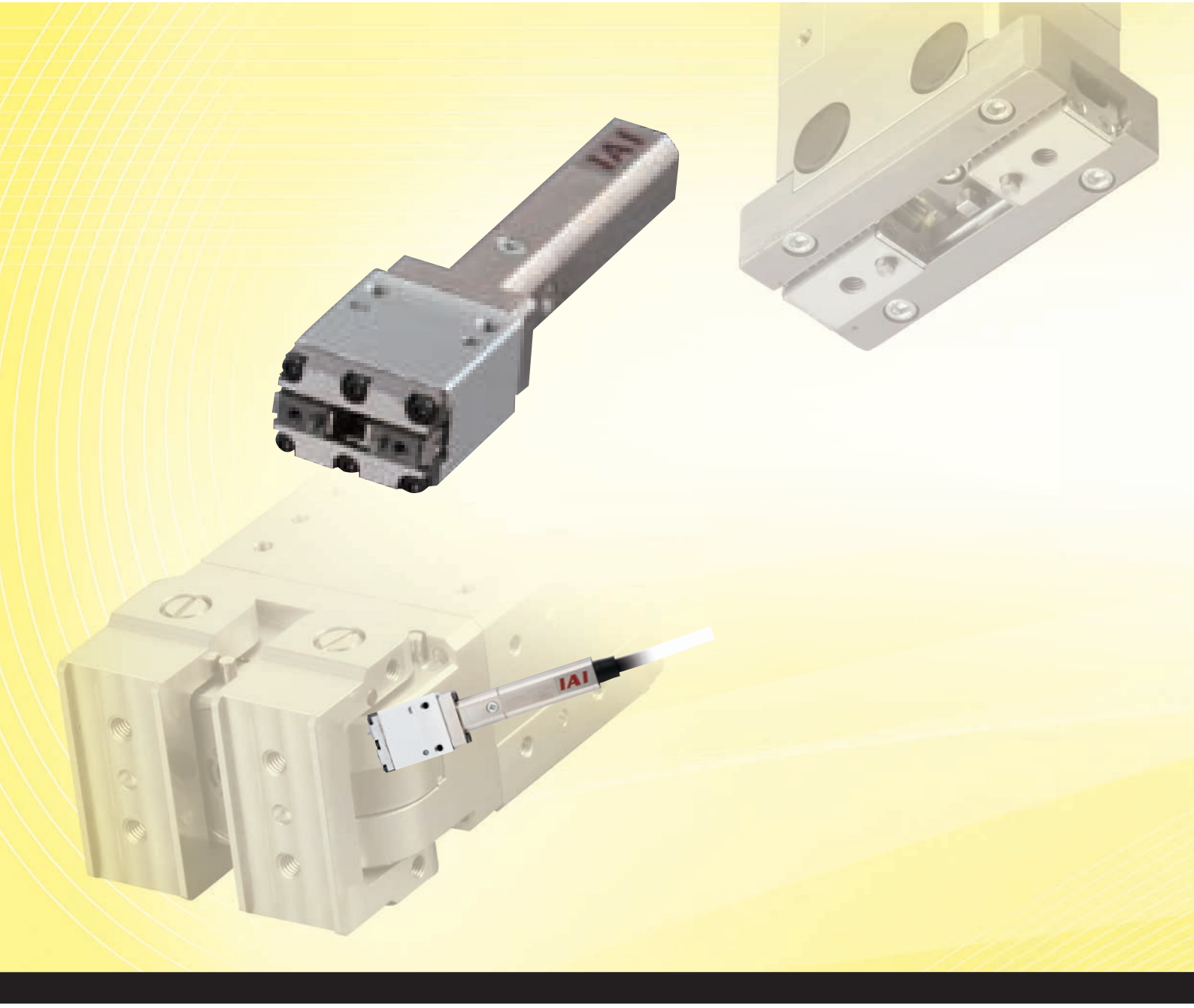
Vertical Gripper, Slider Type RCD-GRSN



www.robocylinder.de

Gripper Specification

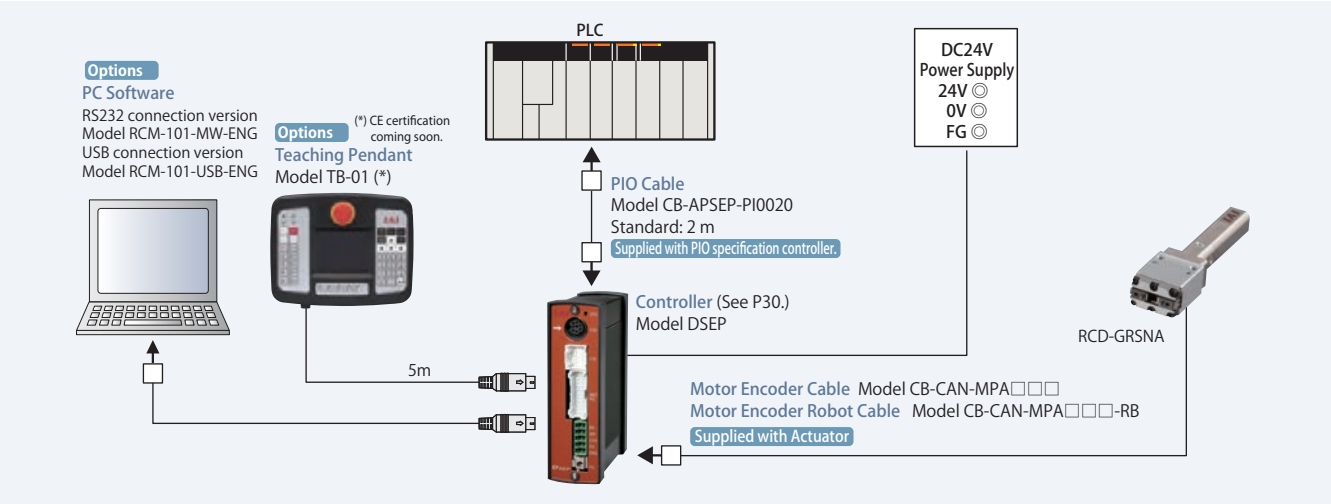
Slider Type

Type	Mini Slider Type
Model	RCD-GRSNA
External View	
Motor	DC brushless motor
Position Detection	Optical encoder
Drive System	Lead screw + grooved cam
Guide	
Opening/Closing Stroke (mm)	4
Gripping Force (N)	10
Opening/Closing Speed (mm/sec)	67
Positioning Repeatability (mm)	±0.05
Gripping Force Adjustment Range	40～70%
Actuator Cable (*1)	
Extension Cable (*2)	Standard cable (Model: CB-CAN-MPA□□□) Robot cable (Model: CB-CAN-MPA-□□□RB)
Exterior Dimensions of Actuator Frame (L x W x H)	22×15×84
Actuator Mass (kg)	0.085
See Page	P.7

(*1) This is the cable of approx. 0.2 m in length coming out from the gripper.
(*2) This cable is used to connect the controller to the connector at the end of the actuator cable.

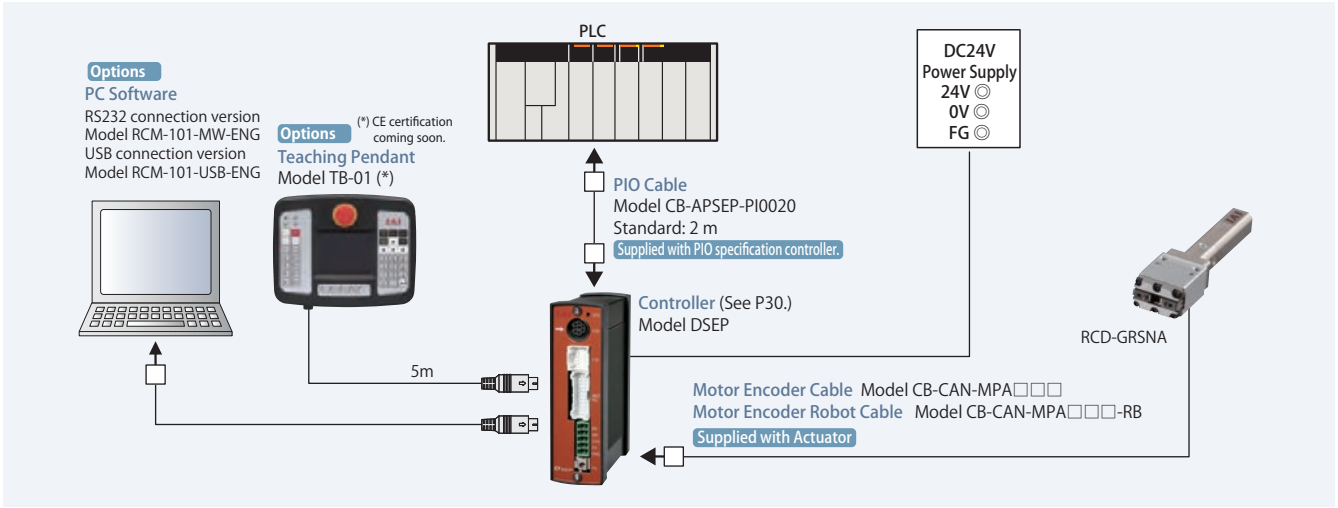
System Configuration

● Configuration of DSEP System

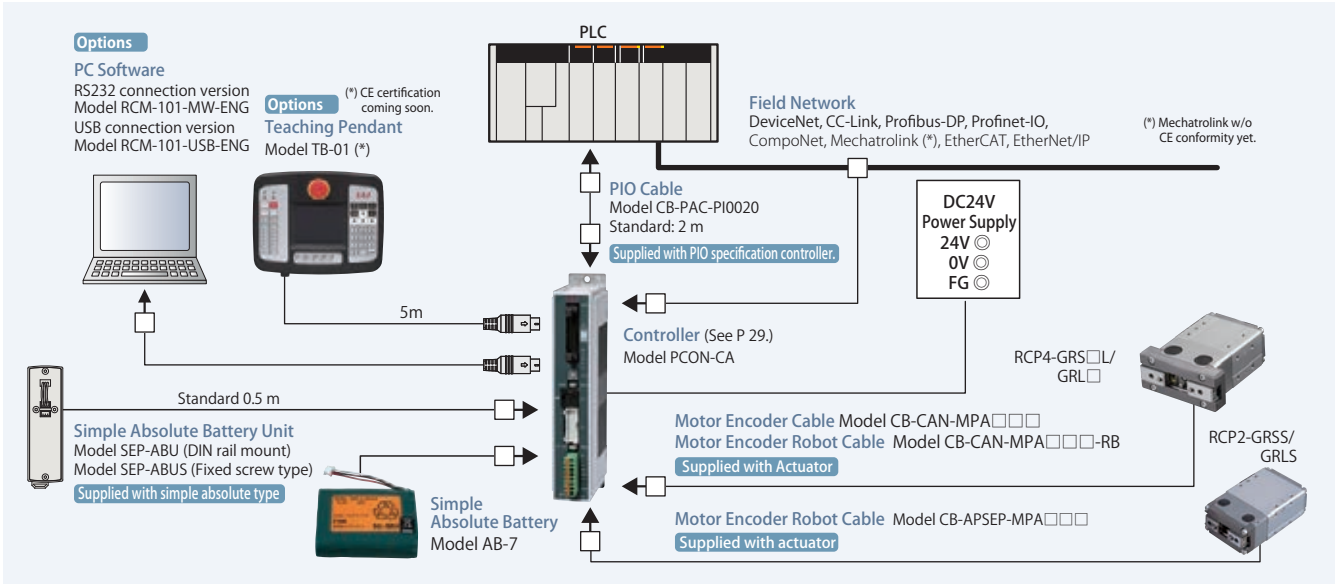


System Configuration

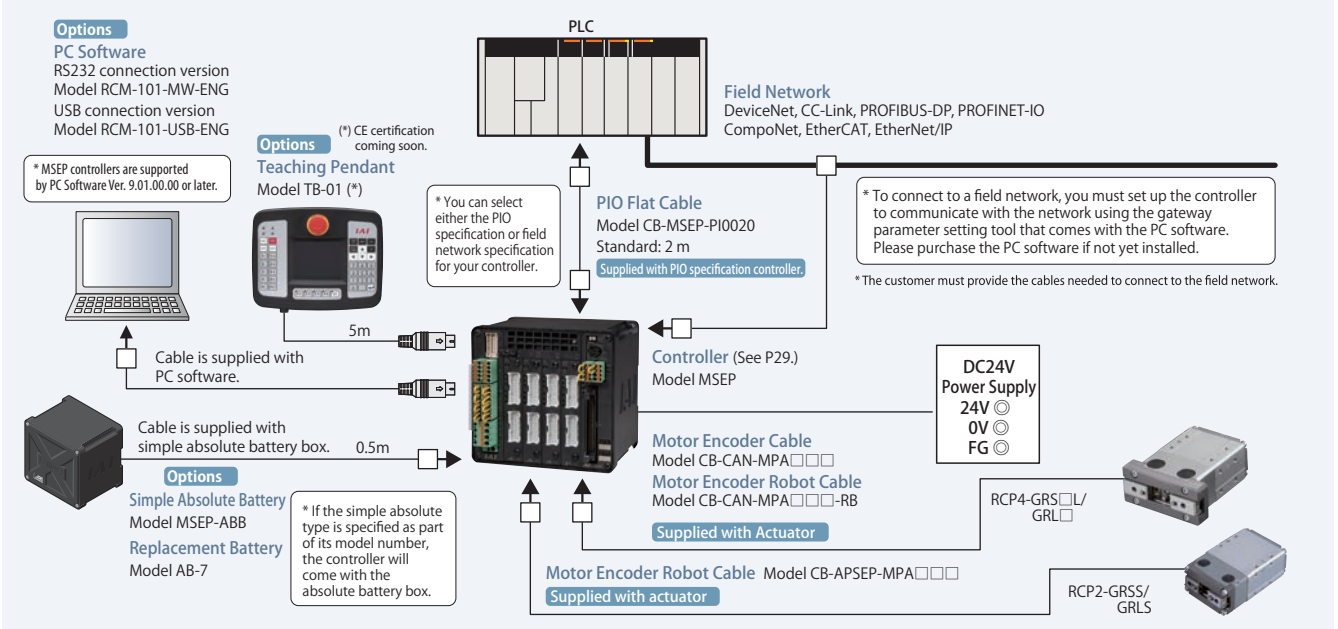
● Configuration of DSEP System



● Configuration of PCON-CA System

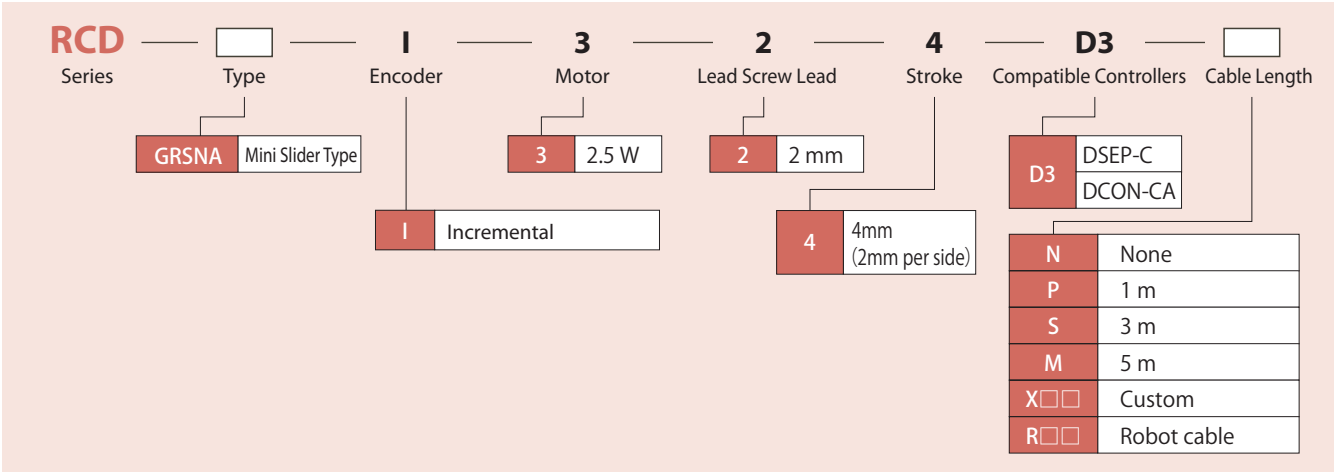


● Configuration of MSEP System



Model Number

<RCD Series>



RCD-GRSNA

RoboCylinder 2-Finger Gripper Vertical Mini Slider Type
22 mm Width BLDC Motor

■ Model Description

RCD – **GRSNA** – **I** – **3** – **2** — **4** — **D3** – ☐

Series	Type	Encoder	Motor	Lead	Stroke	Compatible Controllers	Cable Length
		I: Incremental	3: 2.5 W BLDC motor	2 : 2 mm	4 : 4 mm (2 mm per side)	D3: DSEP DCON-CA	N : None P : 1 m S : 3 m M : 5 m X☐☐ : Custom R☐☐ : Robot cable

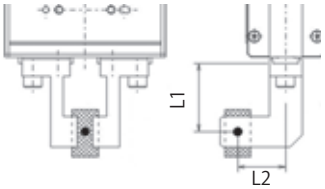
CE RoHS

POINT Notes on Selection

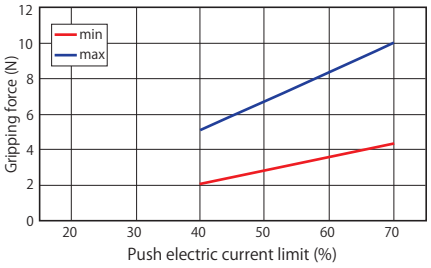
(1) The maximum opening/closing speed indicates the operating speed on one side. The relative operating speed is twice this value.
(2) The maximum gripping force is the sum of the gripping forces of both fingers, at a gripping point where there is no offset or overhang distance. The work part weight that can be actually moved depends on the friction coefficient between the gripper fingers and the work part, as well as on the shape of the work part. As a rough guide, a work part's weight should not exceed 1/10 to 1/20 of the gripping force. (See page 25 for details.)
(3) The maximum acceleration while moving is 1 G.

■ Gripping Force vs. Electric Current Limit

The gripping (pushing) force can be adjusted freely within the range of electric current limits of 40% to 70%.



* Operate with the L1 distance under 20 mm.
* The gripping force in the graph below assumes that L1 and L2 inthe figure above are zero. (Refer to p. 26 for the rough guide ongripping force at each distance of L1.) Also note that the grippingforce is a sum of gripping forces of both fingers.



* The gripping force graph above shows the number of references.

* Please note that, when gripping (pushing), the speed is fixed at 5 mm/s.

Actuator Specifications

■ Lead and Payload

Model Number	Deceleration Ratio	Max. Gripping Force (N)	Stroke (mm)
RCD-GRSNA-I-3-2-4-D3-①	3.7	10 (5 per side)	4 (2 per side)

Legend: ① Cable length

■ Stroke and Max. Opening/Closing Speed

Stroke (mm)	Max. Speed (mm/s)
4	7 6

Cable List

Type	Cable Symbol	
Standard Type	**P** (1m)	
	S (3m)	
	M (5m)	
Special Length	**X06** (6m) ~ **X10** (10m)	
	X11 (11m) ~ **X15** (15m)	
	X16 (16m) ~ **X20** (20m)	
Robot Cable	**R01** (1m) ~ **R03** (3m)	
	R04 (4m) ~ **R05** (5m)	
	R06 (6m) ~ **R10** (10m)	
	R11 (11m) ~ **R15** (15m)	
	R16 (16m) ~ **R20** (20m)	

Actuator Specifications

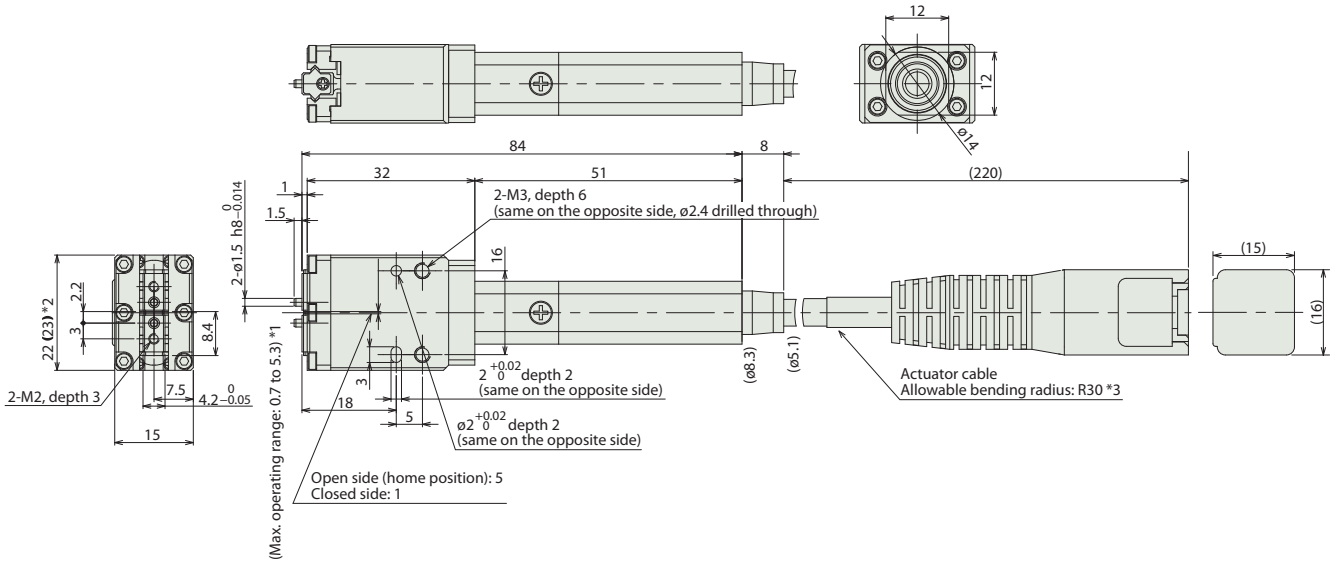
Item	Description
Drive System	Lead screw + grooved cam
Positioning Repeatability	±0.05 mm
Backlash per finger	0.4 mm or less
Lost Motion	0.25 mm or less per side
Guide	Linear guide
Static Allowable Moment	Ma: 0.04N•m Mb: 0.04N•m Mc: 0.07N•m
Weight	0.085 kg
Ambient Operating Temp./Humidity	0 to 40° C, 85% RH or less (non-condensing)

Dimensions

CAD drawings can be downloaded from IAI website. **www.robocylinder.de**

2D CAD

*1 The maximum range in which the finger operates for home return operation, etc. Be careful not to let the finger contacts other finger belonging to the customer or any work present nearby.
*2 The finger moves to the dimensions shown in [ ] during home return, so pay attention to contact.
*3 The actuator cable is not a robot cable, so it must be secured while in use.



Compatible Controllers

The RCD series actuators can operate with the controllers below. Select the controller according to your usage.

Name	External View	Model Number	Description	Max. Pos. Points	Input Voltage	Power Supply Capacity		See Page
Solenoid Valve Type		DSEP-C-3I-①-2-0	Simple controller capable of operating actuators with the same signals used to operate solenoid valves, supporting both the single-solenoid method and the double-solenoid method.	3 points	DC24V	(Standard specification) Rated: 0.7A Max: 1.5A		→ P30
Dustproof Solenoid Valve Type		DSEP-CW-3I-①-2-0						
Positioner Type		DCON-CA-3I-①-2-0	PIO control ready	512 points		Rated: 0.7A Max: 1.5A		→ P30
Pulse Train Type		DCON-CA-3I-PL□-2-0	Pulse-train input ready	–				
Network Type		DCON-CA-3I-④-0-0	Field network ready	768 points				

* ① indicates I/O type (NP/PN).
* □ indicates N (NPN specification) or P (PNP specification) symbol.
* ④ indicates field network specification symbol.

Note: Take note that the simple absolute type is not available.

Slider Type

Step 1
Check the required gripping force and maximum allowable work part mass.

Step 2
Check the gripping point disatnce.

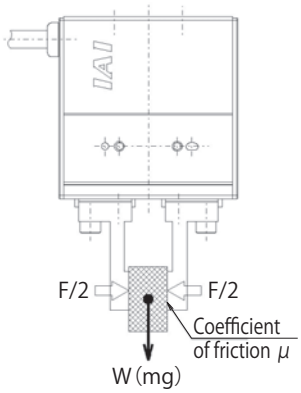
Step 3
Check the external forces the finger will receive.

Step 1 Check the required gripping force and maximum allowable work part mass.

If the work part is to be gripped using frictional force generated by gripping force, calculate the required gripping force as follows.

① Normal Transfer

F: Gripping force (N) – Total sum of push forces of both fingers
μ: Coefficient of static friction between the finger attachment and work part
m: Work part mass (kg)
g: Gravitational acceleration (= 9.8 m/s²)



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

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

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

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

- If the coefficient of friction μ is between 0.1 and 0.2, the following relationship holds water:

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

Normal transfer of work part

Required gripping force	▶ At least **10 to 20 times the work part mass**
Max. allowable work part mass	▶ Not more than **1/10th to 1/20th the gripp. force**

* The greater the coefficient of static friction, the greater than maximum allowable work part mass becomes. To ensure safety, however, select a model that can generate a gripping force of at least 10 to 20 times this work part mass.

② Work part receive large acceleration/deceleration and/or impact force during transfer.

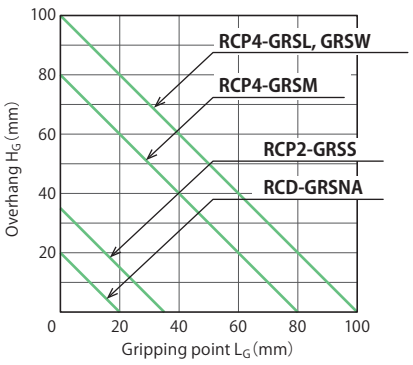
In addition to the gravity, a strong inertial force may act upon the work part.
In this case, select an appropriate model by increasing the safety factor further.

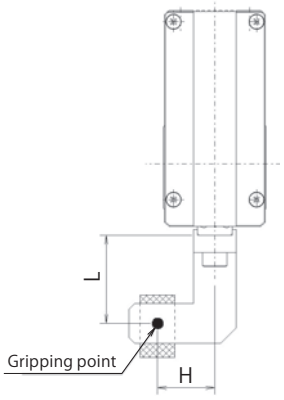
Receiving large acceleration/deceleration or impact

Required gripping force	▶ At least **30 to 50 times the work part mass**
Max. allowable work part mass	▶ Not more than **1/30th to 1/50th the gripp. force**

Step 2 Check the gripping point distance.

Use the actuator so that the distances (L, H) from the finger mounting surface to the gripping point 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, negatively affecting the service life of the actuator.



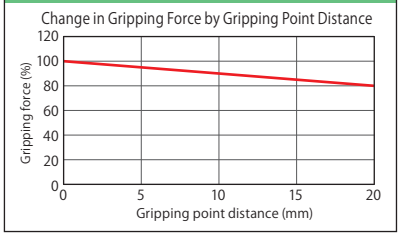


Even when the gripping point distance is within the limits, still design your actuator as compact and lightweight as possible. If the finger is long and large, or heavy, the inertial forces generating upon opening/closing as well as bending moments may cause the performance of the actuator to drop or negatively affect its guide.

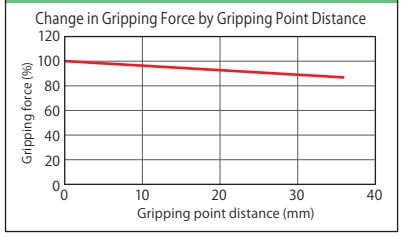
Rough Guide for Shape and Mass of Work Part

1. The graphs show the gripping force as a function of the gripping point distance when the maximum gripping force represents 100%.
2. The gripping point distance indicates the longitudinal distance from the finger attachment mounting surface to the gripping point.
3. The gripping force varies from one actuator to another. Use the values provided below for reference purpose only.

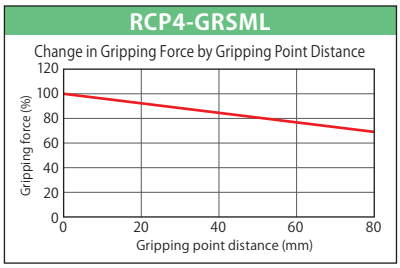
RCD-GRSNA



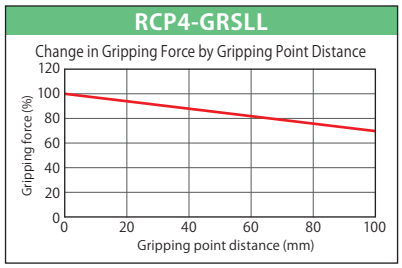
RCP2-GRSS



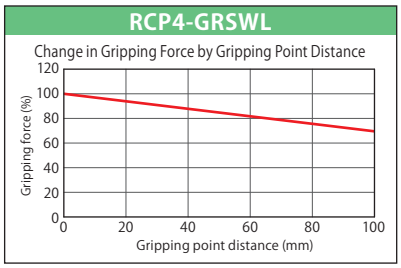
RCP4-GRSML



RCP4-GRSLL



RCP4-GRSWL



Step 3 Check the external forces the finger will receive.

① Allowable vertical load

Confirm that the vertical load each finger will receive is equal to or less than the allowable load.

② Allowable load moment

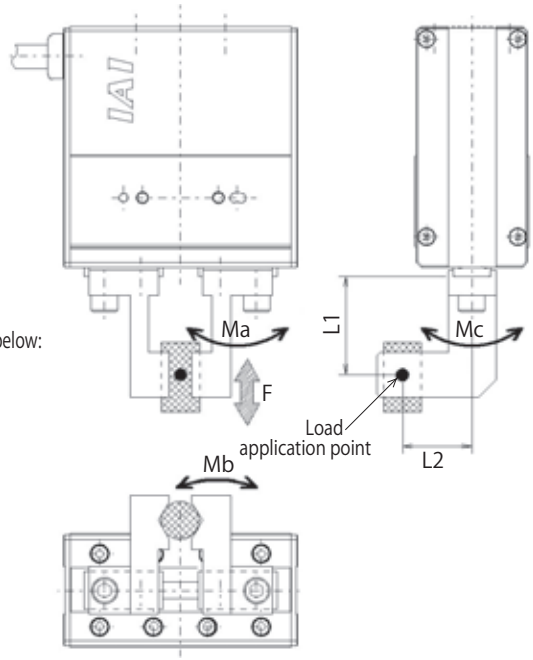
Calculate Ma and Mc using L1, and Mb using L2. Confirm that the moments each finger will receive are equal to or less than the maximum allowable load moment.

● When each finger receives a moment load, the allowable external force must satisfy the relationship below:

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

Calculate the allowable load F (N) based on both L1 and L2.

Confirm that the external force the finger will receive is equal to or less than the calculated allowable load F (N) (based on L1 or L2, whichever is smaller).



Model Number	Allowable vertical load F (N))	Maximum allowable load moment (N·m)		
		Ma	Mb	Mc
RCD-GRSNA	14	0.04	0.04	0.07
RCP2-GRSS	60	0.5	0.5	1.5
RCP4-GRSM	356	1.9	2.7	4.6
RCP4-GRSL	558	3.8	5.5	9.5
RCP4-GRSW	651	5.1	7.2	12.4

1. The allowable values listed above are static values. 2. The allowable values are per-finger values.

* The load application point shown above indicates the position of the load applied to the finger.
This position varies depending on the type of load.
- Load due to gripping force: Gripping point
- Load due to gravity: Gravity center position
- Inertial force while moving, centrifugal force while turning: Gravity center position

The load moment represents the total sum of loads of different types.

* The weight of the finger and that of the work part are also included in the external force.
The external force the finger will receive also includes the centrifugal force that generates when the gripper is turned while gripping the work part, or the inertial force that generates as the actuator accelerates/decelerates while moving.

Lever Type

Step 1
Check the required gripping force and maximum allowable work part mass.

Step 2
Check the inertial moment around the finger attachment.

Step 3
Check the external forces the finger will receive.

Step 1 Check the required gripping force and maximum allowable work part mass.

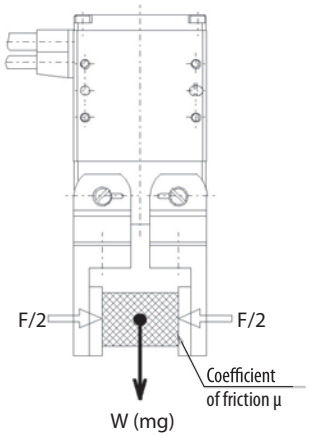
Follow the same instruction in step 1 for the slider type to calculate the required gripping force and confirm that the specified condition are met.

Normal transfer of work part

Required gripping force ▶ At least **10 to 20 times the work part mass**
Max. allowable work part mass ▶ Not more than **1/10th to 1/20th the gripp. force**

Receiving large acceleration/deceleration or impact

Required gripping force ▶ At least **30 to 50 times the work part mass**
Max. allowable work part mass ▶ Not more than **1/30th to 1/50th the gripp. force**



Step 2 Check the inertial moment around the finger attachment.

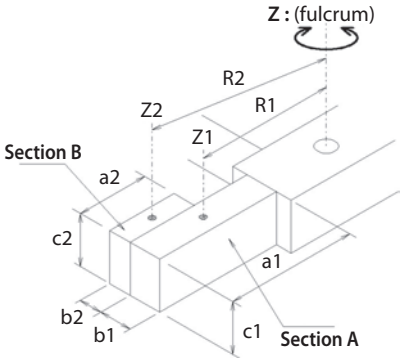
Confirm that the total inertial moment around the Z-axis (fulcrum) of the finger attachment is within the allowable range. Divide the total inertial moment into multiple components according to the configuration and shape of the finger and calculate each component separately. An example of calculating the total inertial moment by dividing it into two components is given below.

[1] Inertial moment J_{Z1} around the Z1-axis (center of gravity of A) (Section A)

m1 : Mass of A (kg)
a1, b1, c1 : Dimensions of A (mm)

$$m1\ (kg) = a1 \times b1 \times c1 \times \text{Specific gravity} \times 10^{-6}$$

$$J_{Z1}\ (kg{\cdot}m^2) = \frac{m1\ (a1^2 \times b1^2) \times 10^{-6}}{12}$$

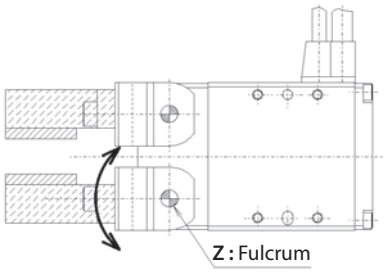


[2] Inertial moment J_{Z2} around the Z2-axis (center of gravity of B) (Section B)

m2 : Mass of B (kg)
a2, b2, c2 : Dimensions of B (mm)

$$m2\ (kg) = a2 \times b2 \times c2 \times \text{Specific gravity} \times 10^{-6}$$

$$J_{Z2}\ (kg{\cdot}m^2) = \frac{m2\ (a2^2 \times b2^2) \times 10^{-6}}{12}$$



[3] Total inertial moment J around the Z-axis (fulcrum)

R1 : Distance from the center of gravity of A to the fulcrum of opening/closing finger (mm)
R2 : Distance from the center of gravity of B to the fulcrum of opening/closing finger (mm)

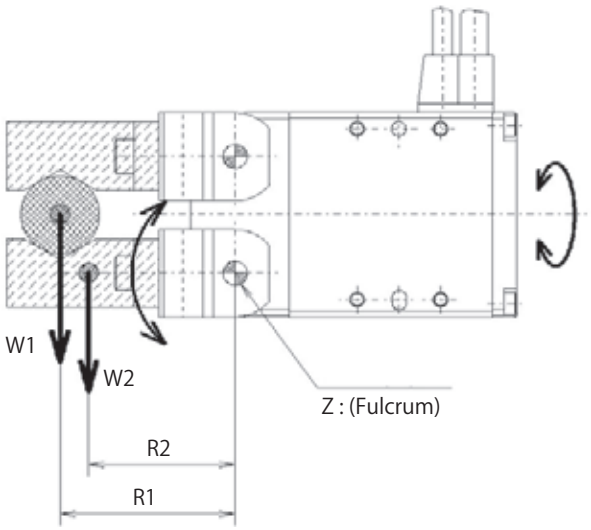
$$J\ (kg{\cdot}m^2) = (J_{Z1} + m1\ R1^2 \times 10^{-6}) + (J_{Z2} + m2\ R2^2 \times 10^{-6})$$

Model Number	Allowable inertial moment J (kg•m²)	Mass m (roughly) (kg)
RCP2-GRLS	1.5×10^{-4}	0.07
RCP4-GRLM	6.0×10^{-4}	0.15
RCP4-GRLL	1.3×10^{-3}	0.25
RCP4-GRLW	3.0×10^{-3}	0.4

Step 3 Check the external forces the finger will receive.

[1] Allowable load torque T

Confirm that the load torque the finger will receive is equal to or less than the maximum allowable load torque. The load torque is calculated from the weight of the finger and that of the work part as follows.



m1 : Work part mass (kg)
R1 : Distance from the center of gravity of the work part to the fulcrum of opening/closing finger (mm)
m2 : Finger mass (kg)
R2 : Distance from the center of gravity of the finger to the fulcrum of opening/closing finger (mm)
g : Gravitational acceleration (9.8 m/s^2)

$$T = (W1 \times R1 \times 10^{-3}) + (W2 \times R2 \times 10^{-3}) + (\text{Other load torque})$$
$$= (m1\ g \times R1 \times 10^{-3}) + (m2\ g \times R2 \times 10^{-3}) + (\text{Other load torque})$$

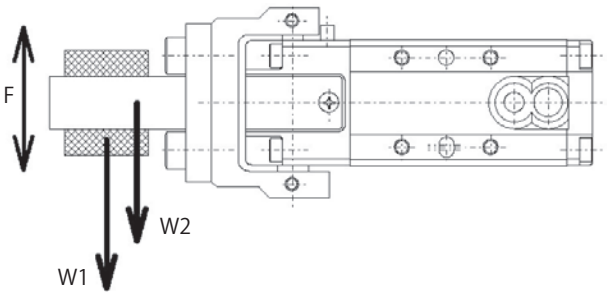
* The centrifugal force that generates when the gripper is turned while gripping the work part or the inertial force that generates as the actuator accelerates/decelerates while moving horizontally, is also a part of the load torque the finger will receive. Add each applicable force to the aforementioned torque to calculate the total torque, and confirm that the total torque is equal to or less than the maximum allowable load torque.

Model Number	Maximum allowable load torque T (N•m)
RCP2-GRLS	0.05
RCP4-GRLM	0.35
RCP4-GRLL	0.70
RCP4-GRLW	1.50

[2] Allowable thrust load F

Confirm that the thrust load generated by the finger opening/closing axis is equal to or less than the allowable load.

$$F = W1 + W2 + (\text{Other thrust load})$$
$$= m1\ g + m2\ g + (\text{Other thrust load})$$



Model Number	Maximum allowable thrust load F (N)
RCP2-GRLS	15
RCP4-GRLM	20
RCP4-GRLL	25
RCP4-GRLW	30

DSEP

Positioner Standard / Dustproof Type (Model C/CW)

3-Position controller SEP series for RCD Gripper

Controller Model Description

DSEP — [Type] — **3** — **I** — [I/O type] — [I/O cable length] — [Power supply voltage]

Type	
C	Standard
CW	Dustproof

Motor	
3	Brushless, DC, 2.5 W

Encoder	
I	Incremental

I/O type	
NP	NPN
PN	PNP

I/O cable length	
0	No cable
2	2 m (standard)
3	3m
5	5m

Power supply voltage	
0	24 V DC

DCON-CA

Positioner / Pulse-train / Field network Type

Position controller CON series for RCD Gripper

List of Models

RoboCylinder Position Controller <DCON-CA>

I/O type	PIO type	Pulse-train type	Field network type (*) Mechatrolink w/o CE conformity yet.							
			DeviceNet	CC-Link	PROFIBUS	CompoNet	MECHATROLINK	EtherCAT	EtherNet/IP	PROFINET
			DeviceNet connection specification	CC-Link connection specification	PROFIBUS-DP connection specification	CompoNet connection specification	Mechatrolink connection specification (*)	EtherCAT connection specification	EtherNet/IP connection specification	PROFINET-IO connection specification
I/O code	NP/PN	PLN/PLP	DV	CC	PR	CN	ML	EC	EP	PRT
Incremental specification	○	○	○	○	○	○	○	○	○	○

Controller Model Description

DCON — **CA** — [Motor type] **I** [Encoder type] — [I/O type] — [I/O cable length] — **0** — [Controller mounting specification]

Series	
DCON	

Type	
CA	Standard type

Motor type	
3	2.5W motor (brushless DC motor)

Encoder type	
I	Incremental

I/O type	
NP	PIO (NPN) specification
PN	PIO (PNP) specification
PLN	Pulse-train (NPN) specification
PLP	Pulse-train (PNP) specification
DV	DeviceNet specification
CC	CC-Link specification
PR	PROFIBUS-DP specification
CN	CompoNet specification
ML	MECHATROLINK specific. (*)
EC	EtherCAT specification
EP	EtherNet/IP specification
PRT	PROFINET-IO specification

* Mechatrolink w/o CE conformity yet.

I/O cable length	
0	No cable
2	2m
3	3m
5	5m

* If the field network specification is selected, the I/O cable length is "0."

Power supply voltage	
0	DC24V

Controller mounting specification	
(Blank)	Screw fastening specification
DN	DIN rail mounting specification

RCP2/RCP4/RCD Series
Gripper Type
Catalogue No. 0514-E

The information contained in this catalog is subject to change without notice for the purpose of product improvement

ISO 9001
BUREAU VERITAS
Certification

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