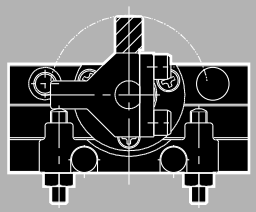

ALMOTION

Mini-Rotary Actuator

Rack-and-Pinion Type/Size: 05, 1

Series CRJ

In our pursuit of excellence in size and weight reduction, we proudly announce the release of the Series CRJ **Mini**-Rotary Actuator!

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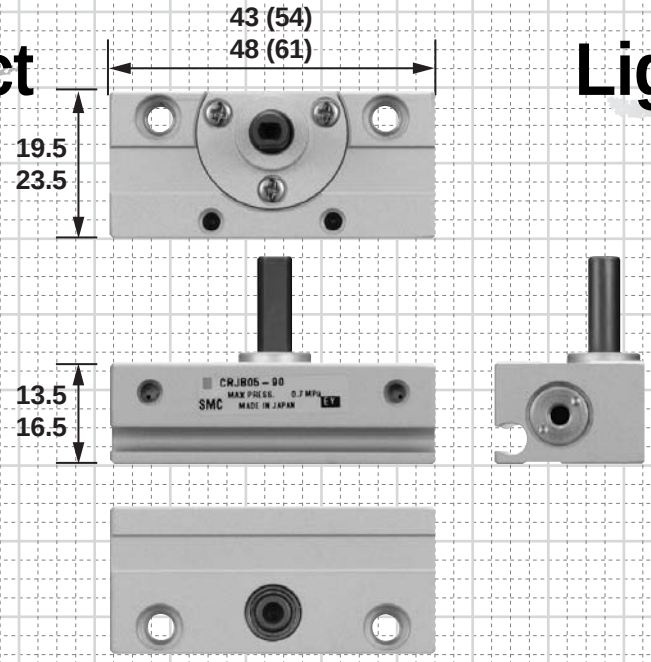
www.almotion.nl | www.linearmotion.nl | www.lineairegeleiding.nl

ALMOTION

Mini-Rotary Actuator Series CRJ

Rack-and-Pinion Type/Size: 05, 1

Compact



Actual size (CRJB05-90)

Light weight

CRJ05: 32g (39g)
CRJ 1: 54g (67g)

Dimensions
Weights

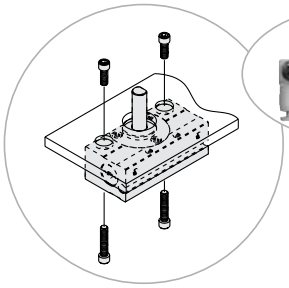
Top CRJ05
Bottom CRJ 1

Numbers in ( ) are for 180°.

Flexible mounting

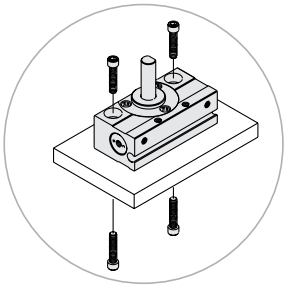
A new compact body design not only reduces overall space requirements, but also achieves space savings in wiring and piping.
Ease in mounting is maximized thanks to the merits of the new compact body.

Free mount

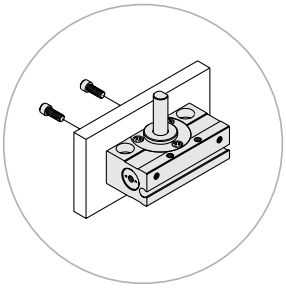


Speed controllers do not protrude from the top of the body.

Top mount



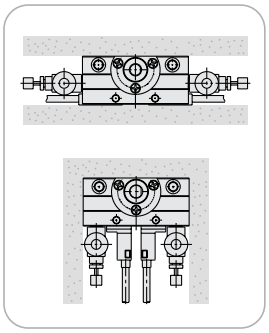
Bottom mount

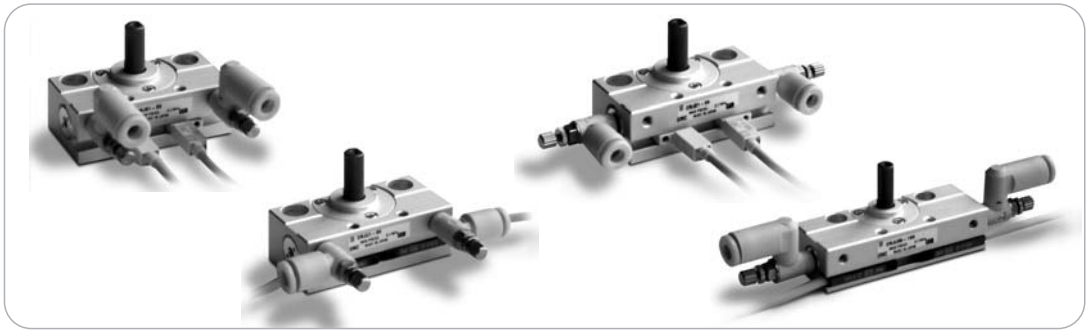


Side mount

Wiring and piping direction can be selected depending on mounting conditions.

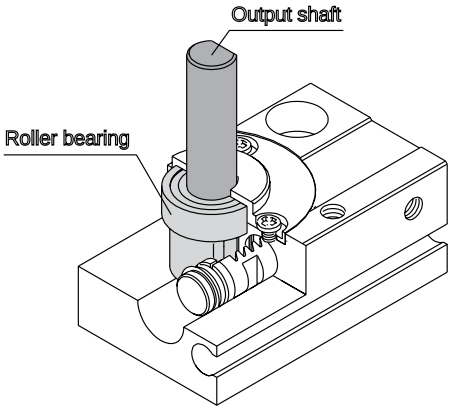
Mounting examples for auto switch and speed controller

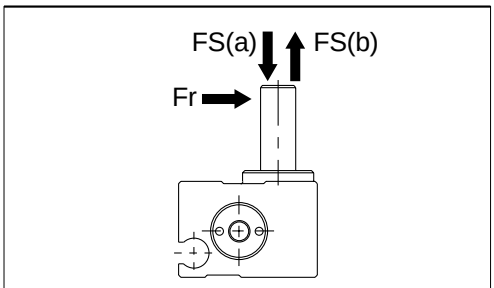




Improved allowable load

Large roller bearing and **large diameter output shaft** add to overall compactness while ensuring high rigidity.

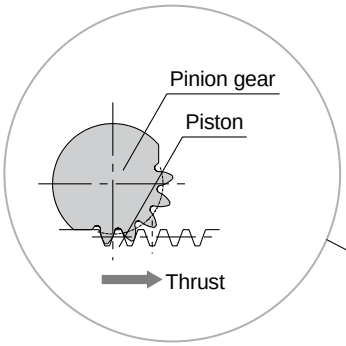




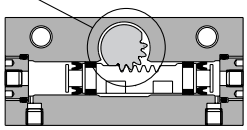
Model		CRJ05	CRJ1
Allowable load (N)	Fr	25	30
	FS(a)	20	25
	FS(b)	20	25
Output shaft size (mm)		ø5	ø6

Reduced backlash

Even with a single rack design, the use of a special construction minimizes backlash.

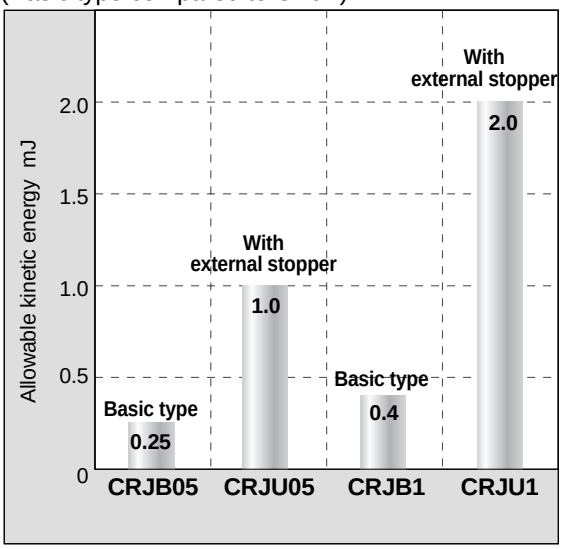


Stopping the pinion gear by having it strike against the flat surface of the piston eliminates backlash.

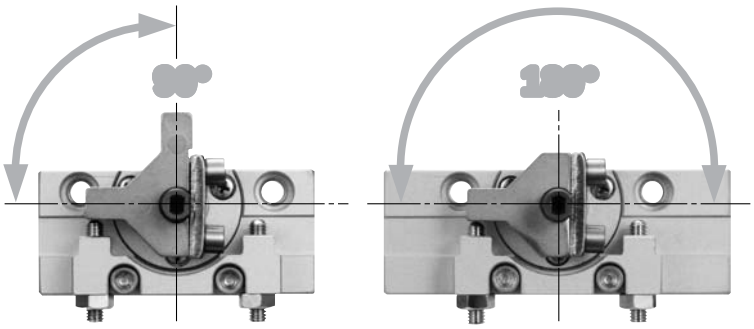


With external stopper/*Series CRJU*

4 to 5 times allowable kinetic energy
(Basic type compared to CRJB)



Angle is adjustable: ±5° at each rotation end



Variations

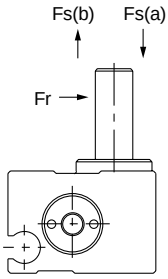
Series		Rotation angle				Port location	Auto switch
		90°	100°	180°	190°		
Basic type	CRJB05	●	●	●	●	Front port Side port	D-F8 D-F9
	CRJB 1	●	●	●	●		
With external stopper	CRJU05	●	—	●	—		
	CRJU 1	●	—	●	—		

Series CRJ
Model Selection

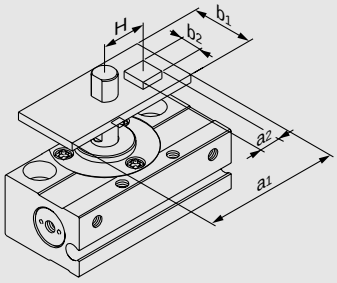
Procedure	Calculation	Example

1 Operating conditions

List all possible operating conditions according to the mounting position.



- Model used
- Operating pressure
- Mounting position
- Load type
  - Ts (N·m)
  - Tf (N·m)
  - Ta (N·m)
- Load configuration
- Rotation time t (s)
- Rotation angle
- Load mass m (kg)
- Distance between central axis and center of gravity H (mm)



Rotary actuator: CRJB05-90 **Pressure:** 0.4MPa
Mounting orientaion: Vertical **Type of load:** Inertial load Ta
Load 1 configuration: 20mm x 10mm (rectangular plate)
Load 2 configuration: 5mm x 5mm (square plate)
Rotation time t: 0.2s **Rotation angle:** 90°
Load 1 mass m1: 0.03kg **Load 2 mass m2:** 0.006kg
Distance between central axis and center of gravity H: 7mm

2 Required torque

Confirm the type of load as shown below, and select an actuator that satisfies the required torque.

- **Static load: Ts**
- **Resistance load: Tf** **Load types**
- **Inertial load: Ta**

Effective torque ≥ Ts
Effective torque ≥ (3 to 5) x Tf
Effective torque ≥ 10 x Ta
Effective torque

Inertial load
$10 \times Ta = 10 \times I \times \dot{\omega}$
$= 10 \times 1.57 \times 10^{-6} \times (2 \times (\pi / 2) / 0.2^2)$
$= 0.0012 N \cdot m <$ Effective torque OK
Note) I substitutes for ⑤, the value for inertial moment.

3 Rotation time

Confirm that it is within the rotation adjustment time range.

0.1 to 0.5s/90°

0.2s/90° OK

4 Allowable load

Confirm that the radial load, thrust load and moment are within the allowable ranges.

Thrust load: m x 9.8 ≤ Allowable load
Allowable load

(0.03 + 0.006) x 9.8 = 0.35N < Allowable load OK

5 Inertial moment

Find the load's inertial moment "I" for the energy calculation.

$I_1 = m \times (a^2 + b^2)/12$
$I_2 = m \times (a^2 + b^2)/12 + m \times H^2$
$I = I_1 + I_2$
Inertial moment

$I_1 = 0.03 \times (0.02^2 + 0.01^2)/12 = 1.25 \times 10^{-6} kg \cdot m^2$
$I_2 = 0.006 \times (0.005^2 + 0.005^2)/12 + 0.006 \times 0.007^2$
$= 0.32 \times 10^{-6} kg \cdot m^2$
$I = 1.25 \times 10^{-6} + 0.32 \times 10^{-6}$
$= 1.57 \times 10^{-6} kg \cdot m^2$

6 Kinetic energy

Confirm that the load's kinetic energy is within the allowable value.

$1/2 \times I \times \omega^2 \leq$ Allowable energy
$\omega = 2\theta / t$ (ω: Terminal angular velocity)
θ: Rotation angle (rad)
t: Rotation time (s)
Allowable kinetic energy/Rotation time

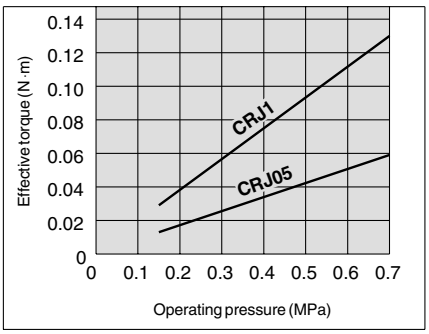
$1/2 \times 1.57 \times 10^{-6} \times (2 \times (\pi / 2)/0.2)^2$
$= 0.00019 J = 0.19 mJ <$ Allowable energy OK

Effective Torque

Unit: N·m

Size	Operating pressure (MPa)						
	0.15	0.2	0.3	0.4	0.5	0.6	0.7
05	0.013	0.017	0.026	0.034	0.042	0.050	0.059
1	0.029	0.038	0.057	0.076	0.095	0.11	0.13

Note) Effective torque values are representative values. They are not guaranteed values. Use them only as a guide.



CRB
CRBU
CRJ
CRA1
CRQ
MRQ
MSQ
MSU

Load Types

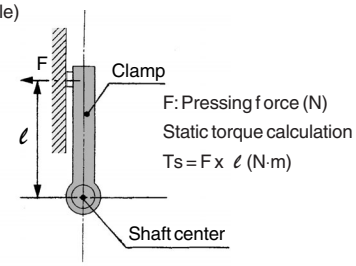
• Static load: Ts

Definition for our purposes:

A load that requires pressing force only, as represented by the clamp.

(If the mass of the clamp itself in the drawing below is considered in the calculations, it should be regarded as an inertial load.)

(Example)



• Resistance load: Tf

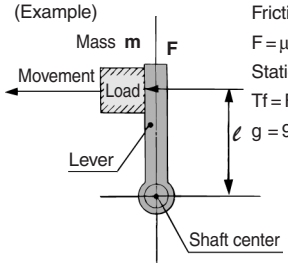
Definition for our purposes:

A load that is affected by external forces such as friction or gravity. Since the purpose is to move the load, and speed adjustment is necessary, allow an extra margin of 3 to 5 times in the effective torque.

∗ Actuator effective torque ≥ (3 to 5) x Tf

(If the mass of the lever itself in the drawing below is considered in the calculations, it should be regarded as an inertial load.)

(Example)



Friction coefficient μ
F = μ mg
Static torque calculation
Tf = F x ℓ (N·m)
g = 9.8m / s²

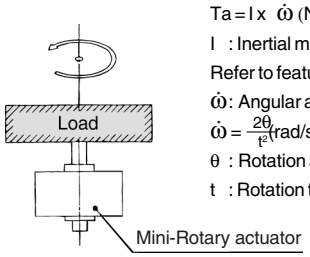
• Inertial load:

Definition for our purposes:

The load that is actually rotated by the actuator. Since the purpose is to rotate the load, and speed adjustment is necessary, allow an extra margin of 10 times or more in the effective torque.

∗ Actuator effective torque ≥ S x Ta
(S is 10 times or more)

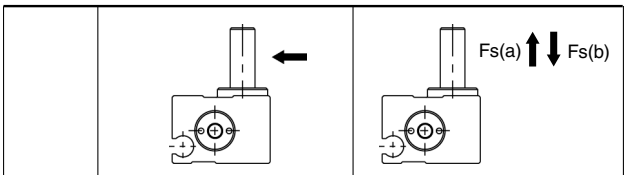
Accelerating torque calculation



Ta = I x $\dot{\omega}$ (N·m)
I : Inertial moment
Refer to features page 5.
$\dot{\omega}$: Angular acceleration
$\dot{\omega} = \frac{2\theta}{t^2}$ (rad/s²)
θ : Rotation angle (rad)
t : Rotation time (S)

Allowable Load

Set the load and moment applied to the shaft within the allowable values provided in the table below.
(Operation above the allowable values can cause adverse effects on service life, such as play in the shaft and loss of accuracy .)



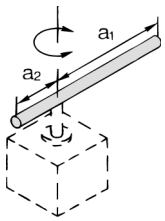
Size	Allowable radial load Fr (N)	Allowable thrust load (N)	
		Fs(a)	Fs(b)
05	25	20	20
1	30	25	25

Inertial Moment Formulas

I: Inertial moment kg·m², m: Load mass kg

1. Thin shaft

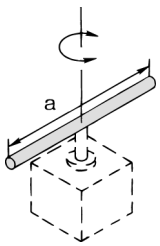
Position of rotational axis: Perpendicular to the shaft anywhere along its length



$$I = m_1 \times \frac{a_1^2}{3} + m_2 \times \frac{a_2^2}{3}$$

2. Thin shaft

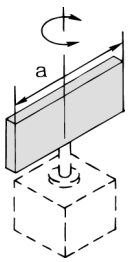
Position of rotational axis: Through the shaft's centre of gravity



$$I = m \times \frac{a^2}{12}$$

3. Thin rectangular plate (rectangular parallelopiped)

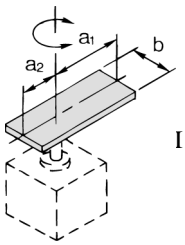
Position of rotational axis: Through the plate's centre of gravity



$$I = m \times \frac{a^2}{12}$$

4. Thin rectangular plate (rectangular parallelopiped)

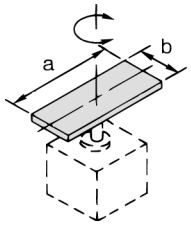
Position of rotational axis: Perpendicular to the plate through one end (also the same in the case of a thicker plate)



$$I = m_1 \times \frac{4a_1^2 + b^2}{12} + m_2 \times \frac{4a_2^2 + b^2}{12}$$

5. Thin rectangular plate (rectangular parallelopiped)

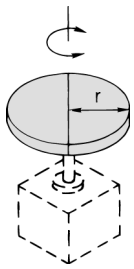
Position of rotational axis: Through the centre of gravity and perpendicular to the plate (also the same in the case of a thicker plate)



$$I = m \times \frac{a^2 + b^2}{12}$$

6. Cylinder (including thin round plate)

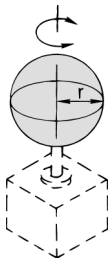
Position of rotational axis: Through the plate's central axis



$$I = m \times \frac{r^2}{2}$$

7. Solid sphere

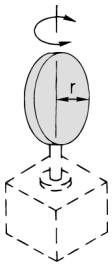
Position of rotational axis: Through the sphere's diameter



$$I = m \times \frac{2r^2}{5}$$

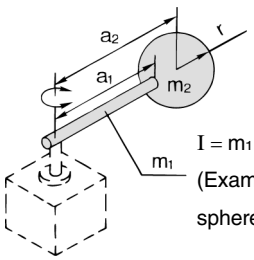
8. Thin round plate

Position of rotational axis: Through the plate's diameter



$$I = m \times \frac{r^2}{4}$$

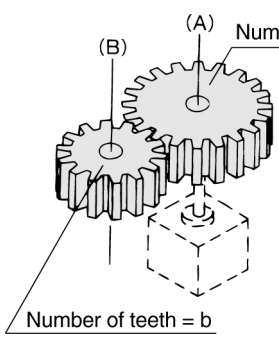
9. Load at the end of lever



$$I = m_1 \times \frac{a_1^2}{3} + m_2 \times a_2^2 + K$$

(Example) When the shape of m_2 is a sphere, refer to 7 above. $K = m_2 \times \frac{2r^2}{5}$

10. Gear transmission



1. Find the inertial moment I_B for the rotation of shaft (B).
2. Next, I_B is entered to find the inertial moment I_A for the rotation of shaft (A) as

$$I_A = \left(\frac{a}{b}\right)^2 \times I_B$$

Kinetic Energy/Rotation Time

Even in cases where the torque required for rotation of the load is small, damage to internal parts may result from the inertial force of the load.
Take into account the load's inertial moment and rotation time during operation when making your model selection.
(The inertial moment and rotation time charts can be used for your convenience in making model selections.)

1. Allowable kinetic energy and rotation time adjustment range

From the table below, set the rotation time within the proper adjustment range for stable operation. Note that slow speed operation exceeding the rotation time adjustment range, may lead to sticking or stopping of operation.

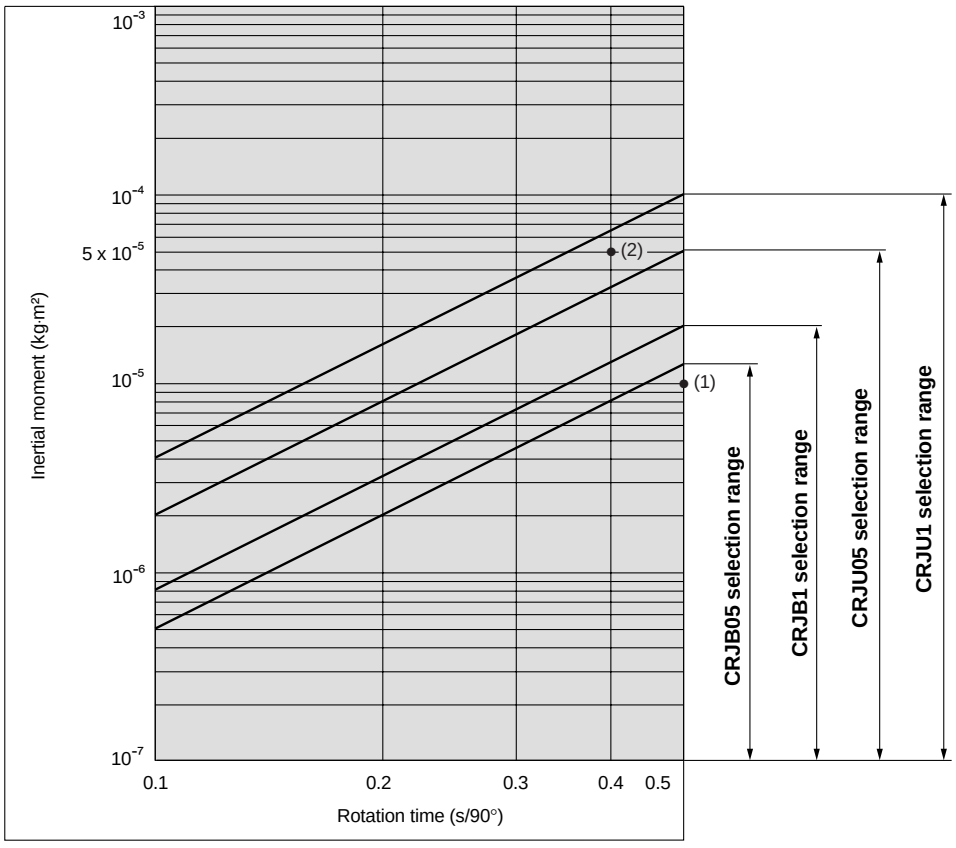
Size			Allowable kinetic energy mJ	Rotation time adjustment range for stable operation s/90°
05	Basic type	CRJB05	0.25	0.1 to 0.5
	With external stopper	CRJU05	1.0	
1	Basic type	CRJB 1	0.40	
	With external stopper	CRJU 1	2.0	

2. Inertial moment calculation

Since the formulas for inertial moment differ depending on the configuration of the load, refer to the inertial moment calculation formulas on the preceding page.

3. Model selection

Select models by applying the inertial moment and rotation time that you have calculated to the chart below.



1. <How to read the chart>

- Inertial moment …… 1 x 10^{-5}kg·m²
- Rotation time …..…… 0.5s/90°

CRJB05 is selected in this case.

2. <Calculation example>

Load configuration: A cylinder of radius 0.05m and mass 0.04kg

Rotation time: 0.4s/90°

I = 0.04 x 0.05²/2 = 5 x 10^{-5}kg·m²

In the inertial moment and rotation time chart, find the intersection of the lines extended from the points corresponding to 5 x 10^{-5} kg·m² on the vertical axis (inertial moment) and 0.4s/90° on the horizontal axis (rotation time). Since the resulting intersection point falls within the CRJU1 selection range, CRJU1 may be selected.

Mini-Rotary Actuator
Air Consumption

Air consumption is the volume of air that is expended by the Mini-Rrotary Actuator's reciprocal operation inside the actuator and in the piping between the actuator and the switching valve. It is required for selection of a compressor and for calculation of its running cost.

* The air consumption (Q_{CR}) required for one reciprocation of a single Mini-Rotary Actuator alone is shown in the table below, and can be used to simplify the calculation.

Formulas

$$Q_{CR} = 2V \times \left(\frac{P + 0.1}{0.1}\right) \times 10^{-3}$$

$$Q_{CP} = 2 \times a \times \ell \times \frac{P}{0.1} \times 10^{-6}$$

$$Q_C = Q_{CR} + Q_{CP}$$

Q_{CR} = Air consumption of Mini-Rotary Actuator [ℓ (ANR)]
Q_{CP} = Air consumption of tubing or piping [ℓ (ANR)]
V = Internal volume of Mini-Rotary Actuator [cm^3]
P = Operating pressure [MPa]
ℓ = Length of piping [mm]
a = Internal cross section of piping [mm^2]
Q_C = Air consumption required for one reciprocation of Mini-Rotary Actuator [ℓ (ANR)]

When selecting a compressor, it is necessary to choose one that has sufficient reserve for the total downstream air consumption of all pneumatic actuators. This is affected by factors such as leakage in piping, consumption by drain valves and pilot valves, and reduction of air volume due to temperature drops.

Formula

$$Q_{C2} = Q_C \times n \times \text{Number of actuators} \times \text{Reserve factor}$$

Q_{C2} = Compressor discharge flow rate
n = Actuator reciprocations per minute

Internal cross section of tubing and steel piping

Nominal size	O.D. (mm)	I.D. (mm)	Internal cross section a (mm^2)
T□ 0425	4	2.5	4.9
T□ 0604	6	4	12.6
TU 0805	8	5	19.6
T□ 0806	8	6	28.3
1/8B	—	6.5	33.2
T□ 1075	10	7.5	44.2
TU 1208	12	8	50.3
T□ 1209	12	9	63.6
1/4B	—	9.2	66.5
TS 1612	16	12	113
3/8B	—	12.7	127
T□ 1613	16	13	133
1/2B	—	16.1	204
3/4B	—	21.6	366
1B	—	27.6	598

Air Consumption

Air consumption of rotary actuator: Q_{CR} ℓ (ANR)

Size	Rotation	Internal volume (cm^3)	Operating pressure (MPa)						
			0.15	0.2	0.3	0.4	0.5	0.6	0.7
05	90°	0.15	0.00074	0.00089	0.0012	0.0015	0.0018	0.0021	0.0024
	180°	0.31	0.0015	0.0018	0.0025	0.0031	0.0037	0.0043	0.0049
1	90°	0.33	0.0016	0.0020	0.0026	0.0033	0.0039	0.0046	0.0052
	180°	0.66	0.0033	0.0039	0.0052	0.0065	0.0078	0.0091	0.010

Mini-Rotary Actuator

Series CRJ

How to Order

Basic type CRJ B 05 — 90 E — F9B S

With external stopper CRJ U 05 — 90 E — F9B S

Rotation angle

90	90°
100	100°
180	180°
190	190°

Size

05
1

Number of auto switches

Nil	2 pcs.
S	1 pc.

Auto switch type

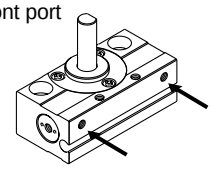
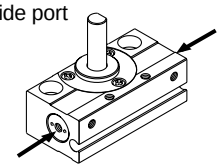
Nil	Without auto switch (built-in magnet)

∗ Select applicable auto switches from the table below.

Rotation angle

90	90°
180	180°

Connecting port position

Nil	Front port 
E	Side port 

These auto switches have been changed
Contact SMC or view www.smcworld.com

F9N➡**M9N**
F9P➡**M9P**
F9B➡**M9B**

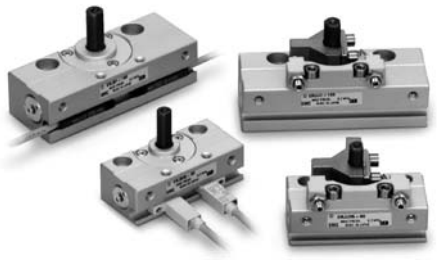
Applicable auto switches

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage DC	Load voltage DC	Load voltage AC	Auto switch part no. Perpendicular	Auto switch part no. In-line	Lead wire length (m)∗ 0.5 (Nil)	3 (L)	5 (Z)
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24V	12V	—	—	**F9N**	●	●	—
								F8N	—	●	●	○
				3-wire (PNP)				—	**F9P**	●	●	—
								F8P	—	●	●	○
				2-wire				—	**F9B**	●	●	—
								F8B	—	●	●	○
	Diagnostic indication (2-colour indication)			3-wire (NPN)				—	**F9NW**	●	●	○
				3-wire (PNP)				—	**F9PW**	●	●	○
				2-wire				—	**F9BW**	●	●	○

∗ Lead wire length symbols: 0.5m ..... Nil (Example) F9N
3m ..... L (Example) F9NL
5m ..... Z (Example) F9NWZ

∗ Auto switches marked "○" are produced upon receipt of order.

Series CRJ



Specifications

Size/Type	05		1	
	Basic type	With external stopper	Basic type	With external stopper
Fluid	Air (non-lube)			
Max. operating pressure	0.7MPa			
Min. operating pressure	0.15MPa			
Ambient and fluid temperature	0° to 60°C (with no freezing)			
Rotation angle Note)	$90^{+8°}_{0}$, $100^{+10°}_{0}$ $180^{+8°}_{0}$, $190^{+10°}_{0}$	90, 180	$90^{+8°}_{0}$, $100^{+10°}_{0}$ $180^{+8°}_{0}$, $190^{+10°}_{0}$	90, 180
Angle adjustment range	—	±5° at each rotation end	—	±5° at each rotation end
Cylinder bore size	ø6		ø8	
Port size	M3			

Note) If optimum accuracy of the rotation angle is required, select an actuator with external stopper.

Allowable Kinetic Energy and Rotation Time Adjustment Range

Size/Type			Allowable kinetic energy (mJ)	Rotation time adjustment range for stable operation (s/90°)
05	Basic type	**CRJB05**	0.25	0.1 to 0.5
	With external stopper	**CRJU05**	1.0	
1	Basic type	**CRJB 1**	0.40	
	With external stopper	**CRJU 1**	2.0	

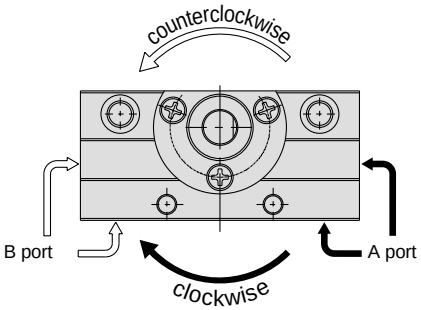
Weights

Type/Size		Model	Weight (g) Note)
Basic type	05	**CRJB05-90**	32
		CRJB05-100	
		CRJB05-180	39
		CRJB05-190	
	1	**CRJB 1-90**	54
		CRJB 1-100	
		CRJB 1-180	67
		CRJB 1-190	
With external stopper	05	**CRJU05-90**	47
		CRJU05-180	53
	1	**CRJU 1-90**	70
		CRJU 1-180	81

Note) Above values do not include auto switch weights.

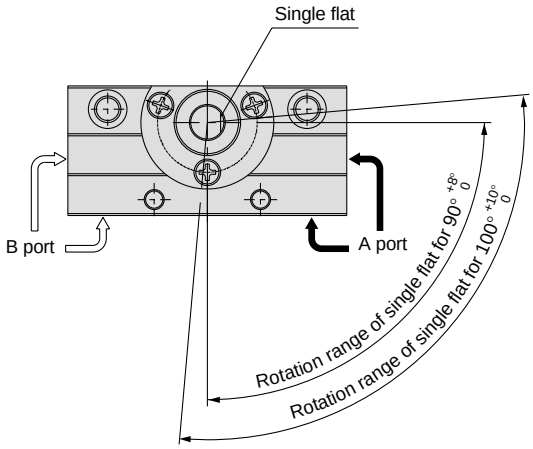
Rotating Direction and Rotation Angle

- The shaft turns clockwise when the A port is pressurized, and counterclockwise when the B port is pressurized.
- For actuators with external stopper, the rotation end can be set within the ranges shown in the drawing by adjusting the stopper bolt.

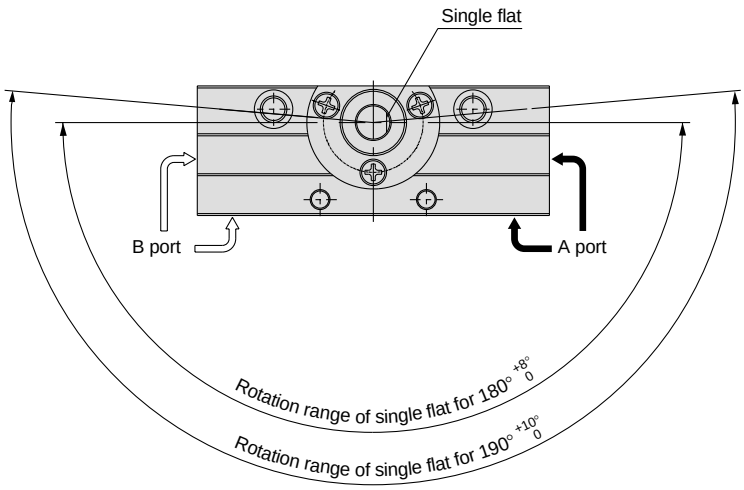


Basic type

For 90° and 100°

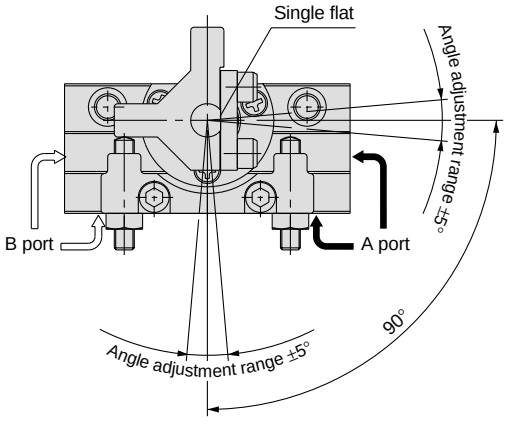


For 180° and 190°

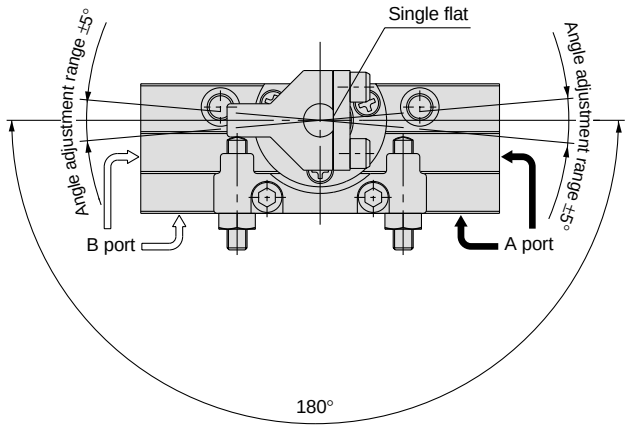


With external stopper

For 90°



For 180°

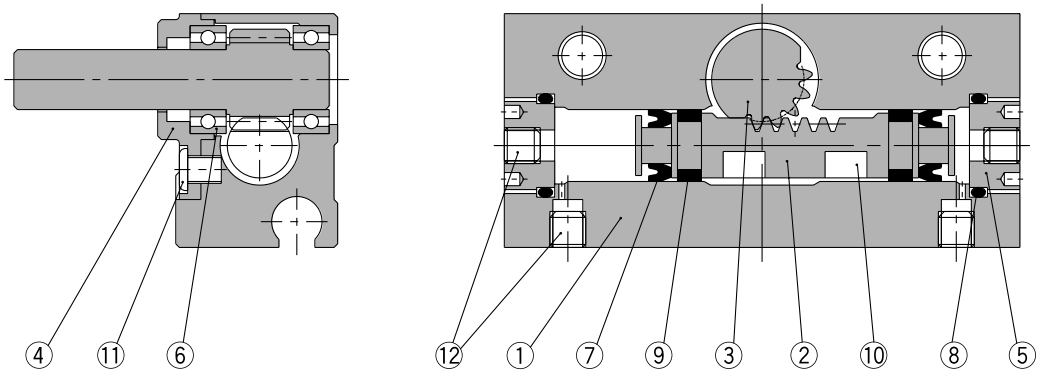


Note) • The drawings show the rotation range for the shaft's single flat.
• The single flat position in the drawings shows the counterclockwise rotation end when the rotation angle is adjusted to 90° and 180°.

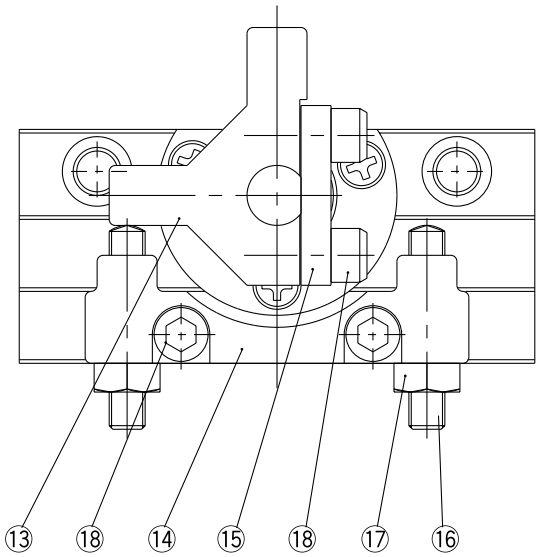
Series CRJ

Construction

Basic type/CRJB



With external stopper/CRJU



Parts list

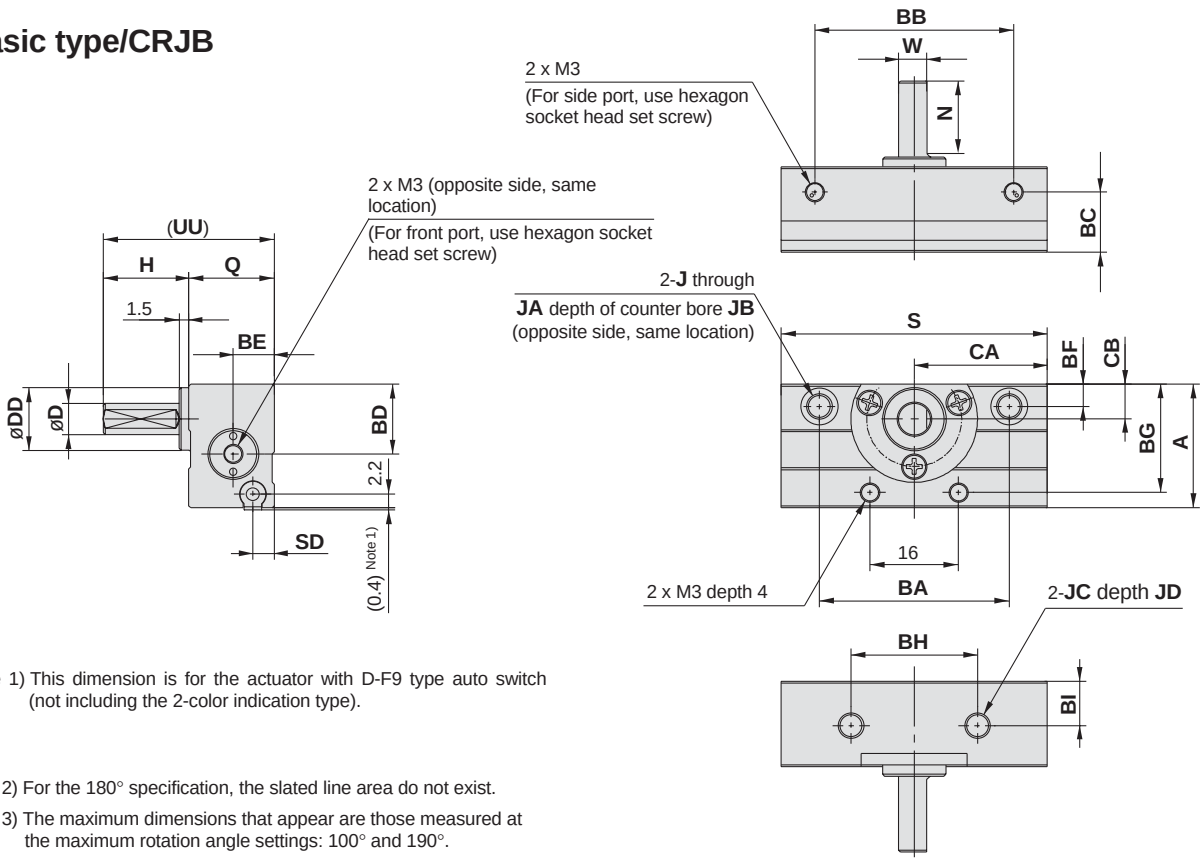
No.	Description	Material
1	**Body**	Aluminum alloy
2	**Piston**	Stainless steel
3	**Shaft**	Stainless steel
4	**Bearing retainer**	Aluminum alloy
5	**Cover**	Aluminum alloy
6	**Bearing**	Bearing steel
7	**Piston seal**	NBR
8	**O-ring**	NBR
9	**Wear ring**	Resin

No.	Description	Material
10	**Magnet**	Magnetic material
11	**Round head no. 0 Phillips screw**	Steel wire
12	**Hexagon socket head set screw**	Stainless steel
13	**Stopper**	Chrome molybdenum steel
14	**Holder**	Aluminum alloy
15	**Stopper retainer**	Steel
16	**Hexagon socket head set screw**	Steel wire
17	**Hexagon nut**	Steel wire
18	**Hexagon socket head cap screw**	Stainless steel

∗ The mounting position of hexagon socket head set screws (no. 12) varies depending on the connecting port position.

Dimensions/Size 0.5, 1

Basic type/CRJB

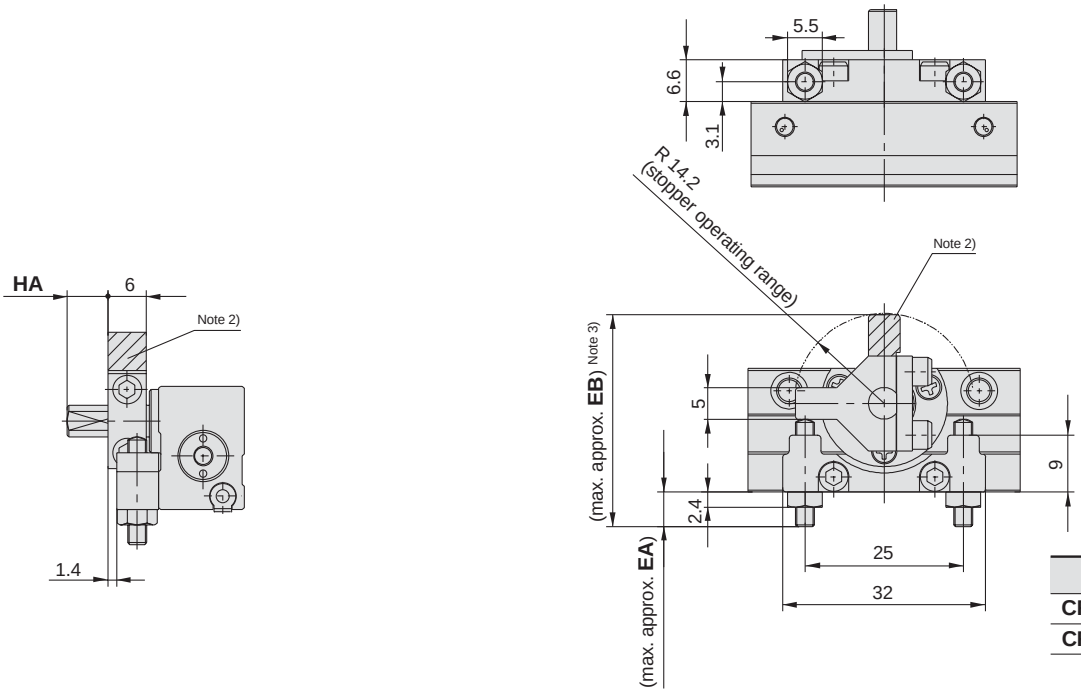


Note 1) This dimension is for the actuator with D-F9 type auto switch (not including the 2-color indication type).

Note 2) For the 180° specification, the slated line area do not exist.

Note 3) The maximum dimensions that appear are those measured at the maximum rotation angle settings: 100° and 190°.

With external stopper/CRJU



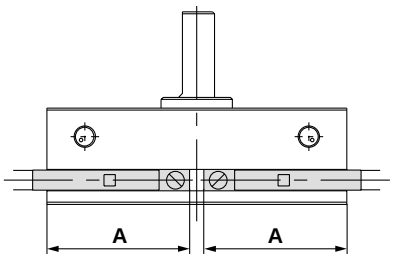
(mm)

Size	EA	EB	HA
CRJU05	5.6	33.8	6.5
CRJU 1	5.6	35.8	7.5

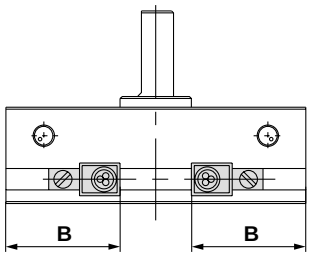
(mm)

Size	Rotation angle	A	BA	BB	BC	BD	BE	BF	BG	BH	BI	CA	CB	D	DD	J	JA	JB	JC	JD	H	N	Q	S	SD	UU	W
CRJB05	90°	19.5	30	32.4	9.5	11	6.5	3.5	17.1	20	7	21.5	5.5	5g6	10h9	M4	5.8	3.5	M4	5	14.5	12.5	13.5	43	3.4	28	4.5
	180°			43.4								27												54			
CRJB 1	90°	23.5	35	37.4	12.5	14	9	4.5	21.1	22	8.5	24	7.5	6g6	14h9	M5	7.5	4.5	M5	6	15.5	13.5	16.5	48	5.9	32	5.5
	180°			50.4								30.5												61			

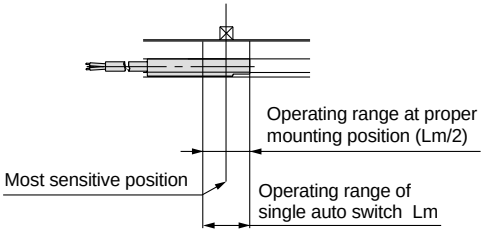
Auto Switch/Proper Mounting Position at Rotation End



For D-F9



For D-F8



Size	Rotation	D-F9 auto switch			D-F8 auto switch		
		A	Rotation range θm	Actuation range	B	Rotation range θm	Actuation range
05	90°	20.5	40°	10°	16.5	20°	10°
	180°	23.2			19.2		
1	90°	22.4	30°	10°	18.4	15°	10°
	180°	25.6			21.6		

Rotation range θm: Value of the operating range Lm of a single auto switch converted to an axial rotation range.

Actuation range: Value of auto switch hysteresis converted to an angle.

Series CRJ
Auto Switch Common Specifications

Auto Switch Common Specifications

Type	Solid state switch
Operating time	1ms or less
Impact resistance	1000m/s²
Insulation resistance	50MΩ or more at 500VDC (between lead wire and case)
Withstand voltage	1000VAC for 1min. (between lead wire and case)
Ambient temperature	–10° to 60°C
Enclosure	IEC529 standard IP67 JISC0920 watertight construction

Lead Wire Lengths

Indication of lead wire length

(Example)

D-F9P[L]

Lead wire length

Nil	0.5m
L	3m
Z	5m

Note 1) Lead wire length Z: Auto switch applicable to 5m length
Solid state switches: All models are produced upon receipt of order.

Note 2) The standard lead wire length is 3m for water resistant 2-color indication solid state switches. (0.5m is not available.)

Note 3) For solid state with flexible wire specification, enter "–61" after the lead wire length.

(Example)

D-F9PL-[61]

Flexible specification

Lead Wire Colour Changes

Lead wire colours of SMC auto switches have been changed in order to meet standard IEC947-5-2 for production beginning September, 1996 and thereafter, as shown in the tables below.
Take special care regarding wire polarity during the time that the old colours still coexist with the new colours.

2-wire

	Old	New
(+) Output	Red	Brown
(–) Output	Black	Blue

3-wire

	Old	New
(+) Power supply	Red	Brown
GND Power supply	Black	Blue
Output	White	Black

Solid state with diagnostic output

	Old	New
(+) Power supply	Red	Brown
GND Power supply	Black	Blue
Output	White	Black
Diagnostic output	Yellow	Orange

Solid state with latch type diagnostic output

	Old	New
(+) Power supply	Red	Brown
GND Power supply	Black	Blue
Output	White	Black
Latch type diagnostic output	Yellow	Orange

Series CRJ/Specific Product Precautions

Be sure to read before handling.

Rotation Angle Adjustment

⚠Caution

As a standard feature, the actuator with external stopper is equipped with a rotation angle adjustment screw that can be used to adjust the angle of rotation.

Size	Angle adjustment per single rotation of angle adjustment screw
05	2.3°
1	2.3°

The rotation adjustment range for the actuator with external stopper is ±5° at each rotation end. Please note that adjusting beyond this range, may cause product malfunction.

Mounting of Speed Controller and Fittings

⚠Caution

The M3 piping port is used. In case the speed controller or fittings are directly connected, use the series listed below.

- Speed controller
  AS12□1F/Elbow type
  AS13□1F/Universal type
- One-touch fitting
  One-touch mini Series KJ
- Reducer bushing Series M3

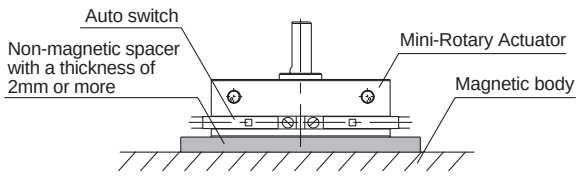
Auto Switch Mounting

⚠Caution

If a size 05 actuator with auto switch is being used, keep the magnetic body away at least 2mm or more from the bottom of the actuator.

If the magnetic body comes closer than 2mm, malfunction of the auto switch may occur due to the magnetic force drop.

* When using the bottom face for mounting, a non-magnetic spacer (such as aluminum) is required as shown below.



Maintenance

⚠Caution

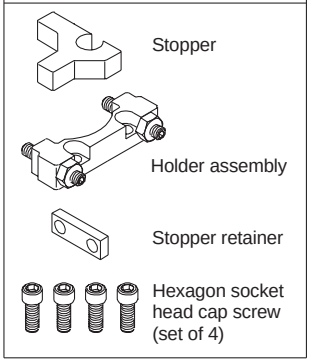
This product requires special tools; therefore, it cannot be disassembled for maintenance.

External Stopper Unit

⚠Caution

Order external stopper unit with the unit part numbers shown below.

Component parts



Model	Unit part no.
CRJU05- 90	P531010-1
CRJU05-180	P531010-2
CRJU 1- 90	P531020-1
CRJU 1- 180	P531020-2

Note 1) External stopper units for 180° cannot be applied to the 90° Mini-Rotary Actuators.
Note 2) When using external stoppers for 90°, use Mini-Rotary Actuators with a rotation range of 100°, and for 180°, use actuators with a rotation range of 190°.

External Stopper Assembly Procedure

* Actuators with external stopper (Model CRJU) come already assembled; therefore, the following procedure is not required.

⚠Caution

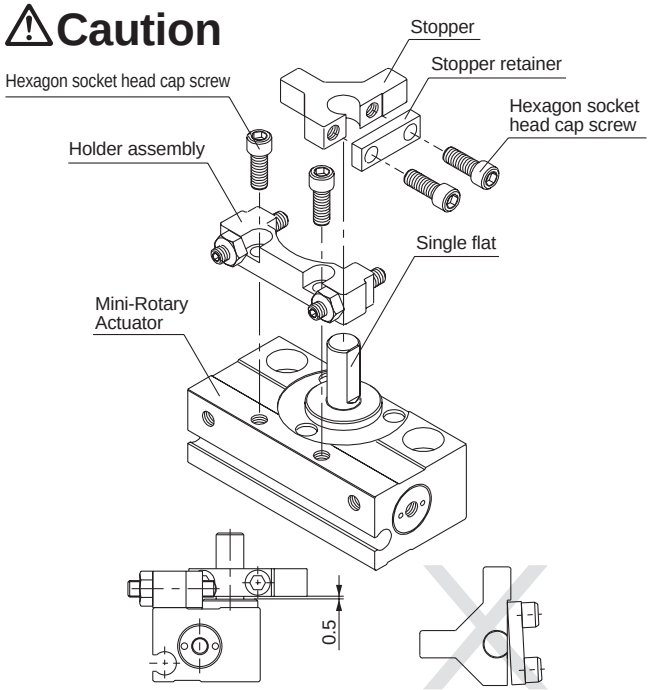


Figure 1 **Figure 2**

1 Assemble the stopper retainer to the stopper temporarily. Then place the stopper retainer in the single flat position and tighten with hexagon socket head cap screws.

Leave a space of approximately 0.5mm between the stopper and the Mini-Rotary Actuator, as shown in Figure 1.

Tighten the hexagon socket head cap screws evenly so that the stopper retainer is not unevenly tightened as in Figure 2.

Furthermore, take precautions to avoid applying excessive force to the shaft when tightening.

2 Tighten the holder assembly with hexagon socket head cap screws.

	Tightening torque N·m
Hexagon socket head cap screws	0.8 to 1.2