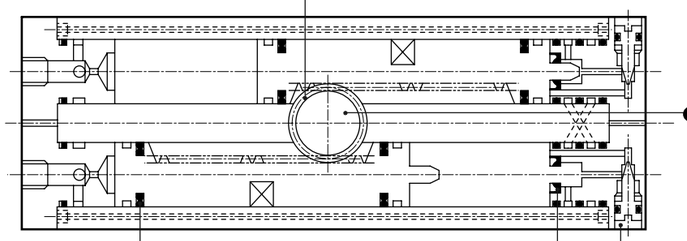
●: Standard, ◎: Option, ○: Custom order, : Not available

Variation	Model no. JIS symbol	Size	Effective torque (0.5MPa) (N·m)	Maximum oscillating angle (°) 90		Maximum oscillating angle (°) 180	270	Option: Adjustable angle A	Option: Copper and PTFE free P6	Switch	Page
Rack and pinion mechanism	RRC	8	0.7	●		●	●	◎	◎	◎	8
		32	3.1								
		63	5.6								

Product introduction

● Maximum oscillating angle 270°
Torques: 0.7, 3.1, 5.6N·m (applicable pressure 0.5 MPa), oscillation angle 90°, 180°, 270°, are in the series.
Appropriate model matching to applications is available.

● Space saving
Compact and thin design permits installation in a narrow space.



● Stable torque and long service life
Due to 2 linear cylinders and rack & pinion combined unique mechanism, stable torque even in low pressure, and internal/external leakage as same as linear cylinder, furthermore long service life are achieved.

● Cushion needle direction can be changed.
Only RRC-32, 63, 3 direction possible.

● Oil-free
Possible using with oil-free.
Total operation cost will be reduced.

● Cushion provided as standard
Rubber cushion or air cushion is provided as standard.

Safety precautions

Always read this section before starting use.
Refer to Ending 69 for cylinders and to Ending 78 for cylinder switches.

Rotary actuator rack & pinion RRC Series

Design & Selection

⚠ WARNNG

■ Do not brake or hold by sealing pneumatics into the product.

If no stopping device is provided outside the product and braking is applied by sealing air in with valves, the stop position may not be held because of air leakage, possibly resulting in injury or damage to operator, component, or device.

⚠ CAUTION

■ Do not apply torque exceeding rated output to the product.

If force exceeding rated output is applied, the product could be damaged.

■ If oscillation angle repeatability is required, directly stop external load.

The initial oscillation angle could change even with products provided with adjustable angles.

■ If axial load (thrust) on the shaft exceeds the tolerable value, operation faults could occur. If such a load is unavoidable, use a structure with thrust bearing as shown in Fig. 1.

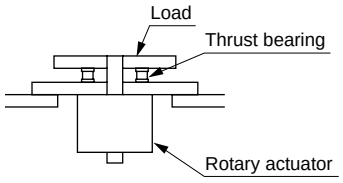


Fig.1

■ Avoid applying bending (radial) load exceeding the allowable value onto the shaft end, or operation faults could occur.

If such a load is unavoidable, use a structure conveying only rotation as shown in Fig. 2.
When connecting the shaft end and load at any position in the oscillation range, use flexible coupling, etc., that will not twist off to prevent the shaft from breaking and bearings from wearing or seizure.

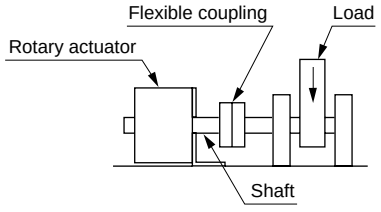


Fig.2 Radial load

■ Install the external stopper away from the rotary shaft.

If the stopper is installed near the rotary shaft, a torque generated by the product could be applied on the rotary shaft. This reaction on the stopper may cause damaging the rotary shaft or bearings, and possibly resulting in injury or damage to operator, equipment, or device.

■ If the load weight is large and oscillation is fast, large inertia could be generated and allowable absorption exceeded, possibly damaging the rotary actuator.

Install a shock absorber to absorb inertia.

■ When installing a load or jig, etc., on the rotary actuator shaft, check that load is not applied as shown in Fig. 3.

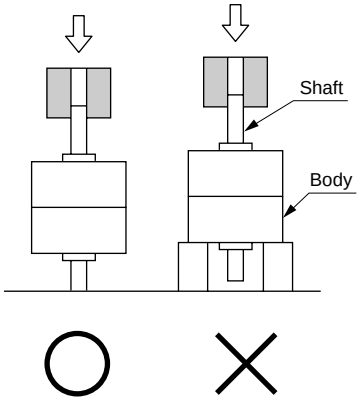


Fig.3

■ Avoid seizure at rotating sections.

Apply grease to rotating sections (pins, etc.) to prevent seizing.

■ Holding torque at the oscillation end is half the effective torque, so use with a load factor of 50% or less.

Installation & Adjustment

⚠ CAUTION

■ When adjusting the angle by supplying pressure, do not rotate the device more than necessary beforehand.

When adjusting while supplying pressure, the device could rotate and drop during adjustment, depending on how it is installed, possibly resulting in operator, component, or device injury or damage.

■ Do not loosen the angle adjustment hexagon bolt beyond the adjustment range.

If the bolt is loosened beyond the adjustment range, the angle adjustment hexagon bolt could be dislocated, possibly resulting in injury or damage to operator, component or device.
The cylinder's oscillation angle will decrease when the angle adjustment hexagon bolt is rotated clockwise.

■ Observe steps (1) to (5) when adjusting the angle. If the angle is not adjusted this way, the seal washer may break after one or two adjustments.

Angle adjustment procedures:

(1) First loosen the hexagon nut as shown in Fig. 1.

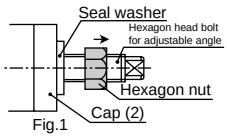


Fig.1

(2) Separate the seal washer from the cap (2) as shown in Fig. 2.

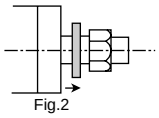


Fig.2

(3) Turn the angle adjustment hexagon bolt, hexagon nut, and seal washer together as shown in Fig. 3, and adjust the angle. Check that the rubber section of the seal washer does not bite into the screw.

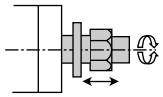


Fig.3

(4) After adjusting the angle, move the seal washer near the cap (2) by hand as shown in Fig. 4.

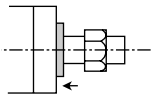


Fig.4

(5) Tighten as shown in Fig. 5 with the hexagon nut. Check that the rubber section of the seal washer does not bite into the screw section.

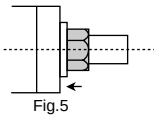
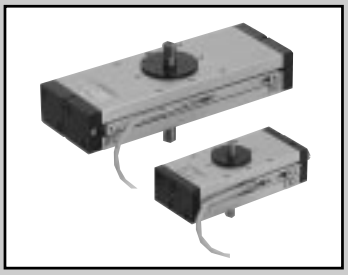


Fig.5

■ Securely tighten the hexagon nut after adjusting the angle. The hexagon nut may loosen and cause external leakage in prolonged use.



Rotary actuator Rack & pinion type

RRC Series

- Size: 8, 32, 63
- Oscillating angle: 90°, 180°, 270°

JIS symbol 

RoHS CAD

Specifications

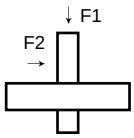
Descriptions		RRC		
Size		8	32	63
Effective torque Note 1	N·m	0.7	3.1	5.6
Actuation		Rack & pinion type		
Working fluid		Compressed air		
Max. working pressure	MPa	1.0		
Min. working pressure Note 2	MPa	0.1		
Withstanding pressure	MPa	1.6		
Ambient temperature	℃	-10 to 60 (no freezing)		
Port size		Rc1/8		
Oscillating angle tolerance	Degree	90^{+8}_{+1}, 180^{+8}_{+1}, 270^{+8}_{+1}		
Cushion		Rubber cushion	Air cushion	
Effective cushion length	mm	-	4.8	5.8
Allowable energy absorption	J	0.05	0.21	0.41
Volumetric capacity	cm^3 90°	3	12	22
	cm^3 180°	6	24	44
	cm^3 270°	9	36	66
Lubrication		Not required (when lubricating, use turbine oil ISOVG32.)		

Note 1: An effective torque value is a product at working pressure 0.5MPa.
Note 2: When using RRC-8 with maximum oscillating angle, working pressure to be 0.3MPa and over.
Note 3: Adjustable angle is available as an option. Refer to page 13.

Maximum load Load which applies to shaft to be following number or less.

Unit: N

Model no. / Load direction	RRC-8	RRC-32	RRC-63
Thrust load F1	9.8	39.2	58.8
Radial load F2	19.6	78.4	117.6



Switch specifications

- 1 color/2 color indicator

Descriptions	Proximity 2 wire			Proximity 3 wire		Reed 2 wire						
	T1H/T1V	T2H/T2V	T2YH/T2YV	T3H/T3V	T3YH/T3YV	T0H/T0V	T5H/T5V		T8H/T8V			
Applications	Programmable controller, relay, small solenoid valve	Programmable controller		Programmable controller, relay		Programmable controller, relay	Programmable controller, relay, IC circuit (without indicator light), serial connection		Programmable controller, relay			
Output method	-	-		NPN output		-						
Power voltage	-	-		10 to 28 VDC		-						
Load voltage	85 to 265 VAC	10 to 30 VDC		30 VDC or less		12/24 VDC	110 VAC	5/12/24 VDC	110 VAC	12/24 VDC	110 VAC	220 VAC
Load current	5 to 100mA	5 to 20mA (Note 1)		100mA or less	50mA or less	5 to 50mA	7 to 20mA	50mA or less	20mA or less	5 to 50mA	7 to 20mA	7 to 10mA
Current consumption	-	-		10mA or less with 24 VDC		-						
Internal voltage drop	7V or less	4V or less		0.5V or less		2.4V or less	0V		3V or less			
Light	LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Without indicator light		LED (ON lighting)			
Leakage current	1mA or less with 100 VAC 2mA or less with 200 VAC	1mA or less		10μA or less		0mA						

Note 1: The maximum load current 20mA above is applied at 25℃. The current will be lower than 20mA if ambient temperature around switch is higher than 25℃. (5 to 10mA when 60℃)
Note 2: Refer to Ending 1 for other switch specifications.

Cylinder weight

Unit: kg

Oscillating angle / Model no.	90°	180°	270°	Switch weight (per switch)	Switch bracket 90°	180°	270°
RRC-8	0.39	0.43	0.49	0.018	0.005		
RRC-32	1.02	1.23	1.45		0.011	0.013	0.015
RRC-63	1.68	2.03	2.37		0.012	0.014	0.016

(E.g.) Product weight of RRC-8-90-T2H-D

Product weight: 0.39kg
Switch weight: 0.018×2 pcs. = 0.036 kg
Switch bracket weight: 0.005×2 pcs. = 0.010 kg
Product weight: 0.39 kg + 0.036 kg + 0.010 kg = 0.436 kg

How to order

Without switch

RRC - 8 - 90 ——— A

With switch

RRC - 8 - 90 - T2H - R - A

Ⓐ Size

Ⓑ Maximum oscillating angle

Ⓒ Switch model no.
* indicates lead wire length.

Ⓓ Switch quantity

Ⓔ Option

Symbol	Descriptions
Ⓐ Size	
Model no.	**Effective torque**
8	0.7 (N·m)
32	3.1 (N·m)
63	5.6 (N·m)
Ⓑ Maximum oscillating angle	
90	90°
180	180°
270	270°

Ⓒ Switch model no.

Axial lead wire	Radial lead wire	Contact	Indicator	Lead wire
T0H*	**T0V***	Reed	1 color indicator type	2-wire
T5H*	**T5V***		w/o light	
T8H*	**T8V***		1 color indicator type	
T1H*	**T1V ***	Proximity	1 color indicator type	2-wire
T2H*	**T2V***			3-wire
T3H*	**T3V***		2 color indicator type	2-wire
T2YH*	**T2YV***			3-wire
T3YH*	**T3YV***		1 color indicator type (custom order)	3-wire
T3PH*	**T3PV***			

*Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

Ⓓ Switch quantity	
R	Clockwise rotation detection
L	Counterclockwise rotation detection
D	Two

Ⓔ Option	
A	Adjustable angle
P6	Copper and PTFE free

<Example of model number>

RRC-8-90-T2H-R-A

Model: Rotary actuator rack & pinion type
Ⓐ Size: 8
Ⓑ Maximum oscillating angle: 90°
Ⓒ Switch model no.: proximity T2H switch, lead wire 1m
Ⓓ Switch quantity: clockwise rotation detection
Ⓔ Option: adjustable angle

How to order switch

● Switch body + mounting bracket (including rail)

RRC - T2H* - 8 - 90
(C) (A) (B)

Switch model no. (Item Ⓒ above)
Size (Item Ⓐ above)
Maximum oscillating angle (Item Ⓑ above)

● Only switch body

SW - T2H*

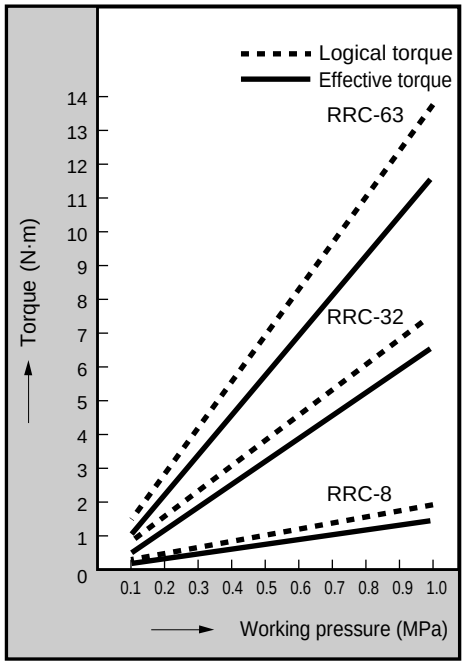
Switch model no. (Item Ⓒ above)

● Mounting bracket (including rail)

RRC - T - 8 - 90
Bracket

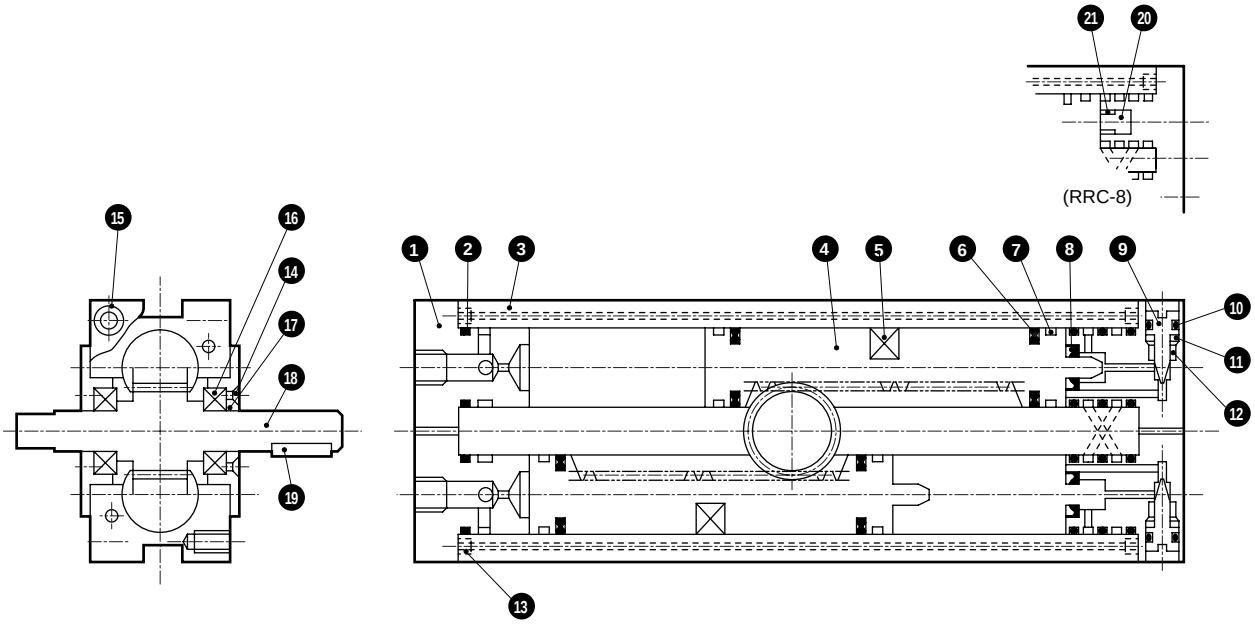
Size (Item Ⓐ above)
Maximum oscillating angle (Item Ⓑ above)

Torque

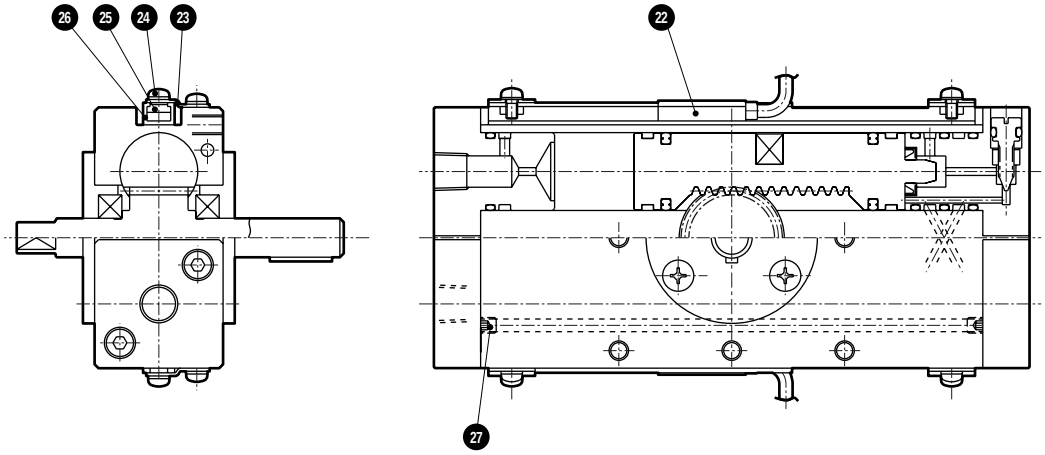


Internal structure and parts list

● Standard type



● With switch



No.	Parts name	Material	Remarks	No.	Parts name	Material	Remarks
1	Cap (2)	Aluminum alloy		16	Bearing	--	
2	Cap gasket	Nitrile rubber		17	Cover	Aluminum alloy	
3	Body	Aluminum alloy		18	Shaft	Steel	
4	Piston	Stainless steel		19	Key	Steel	
5	Magnet	Plastic		20	Cushion rubber	Urethane rubber	Only RRC-8
6	Piston packing seal	Nitrile rubber		21	DU bush	--	Only RRC-8
7	Wear ring	Acetar resin		22	Switch	--	
8	Cushion packing seal	Nitrile rubber	RRC-8 is excluded.	23	Stop plate	Stainless steel	
9	Needle	Copper alloy	RRC-8 is excluded.	24	Washer assembly cross headed pan	Steel	
10	Needle gasket	Nitrile rubber	RRC-8 is excluded.	25	Lock nut	Stainless steel	
11	Cap (1)	Aluminum alloy		26	Switch rail	Aluminum alloy	
12	U nut	Steel	RRC-8 is excluded.	27	Hexagon socket head set screw	Steel	
13	Hexagon socket head set screw	Alloy steel					
14	Cross headed flat head screw	Steel					
15	Hexagon socket bolt	Alloy steel					

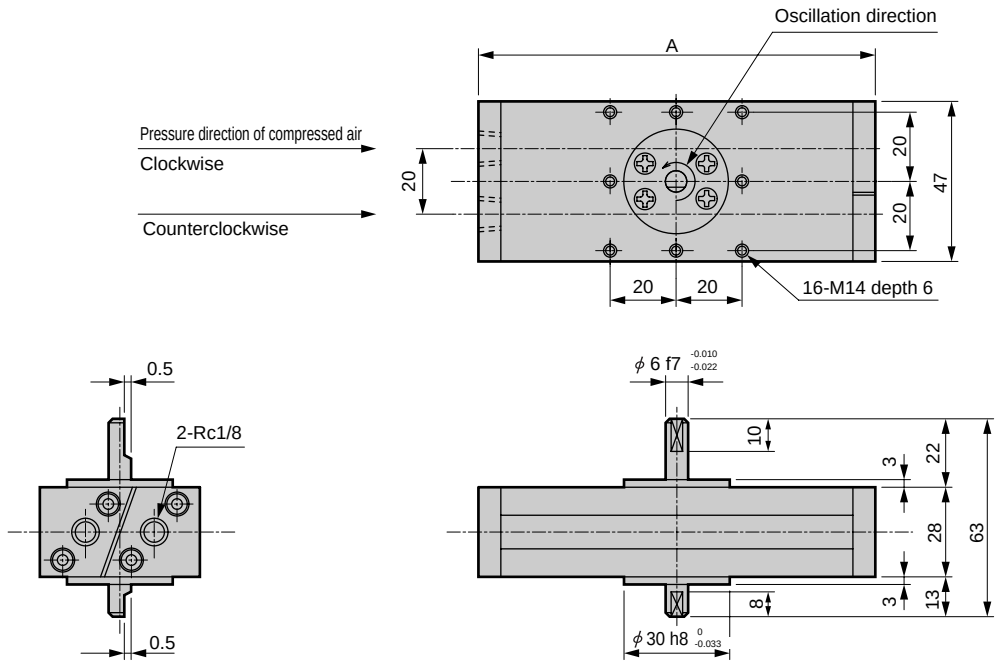
Repair parts list

Model no.	Kit No.	Repair parts number
RRC-8	RRC-8K	❷ ❻ ❼ ❽ ❿
RRC-32	RRC-32K	
RRC-63	RRC-63K	

Note: Specify the kit no. when placing an order.

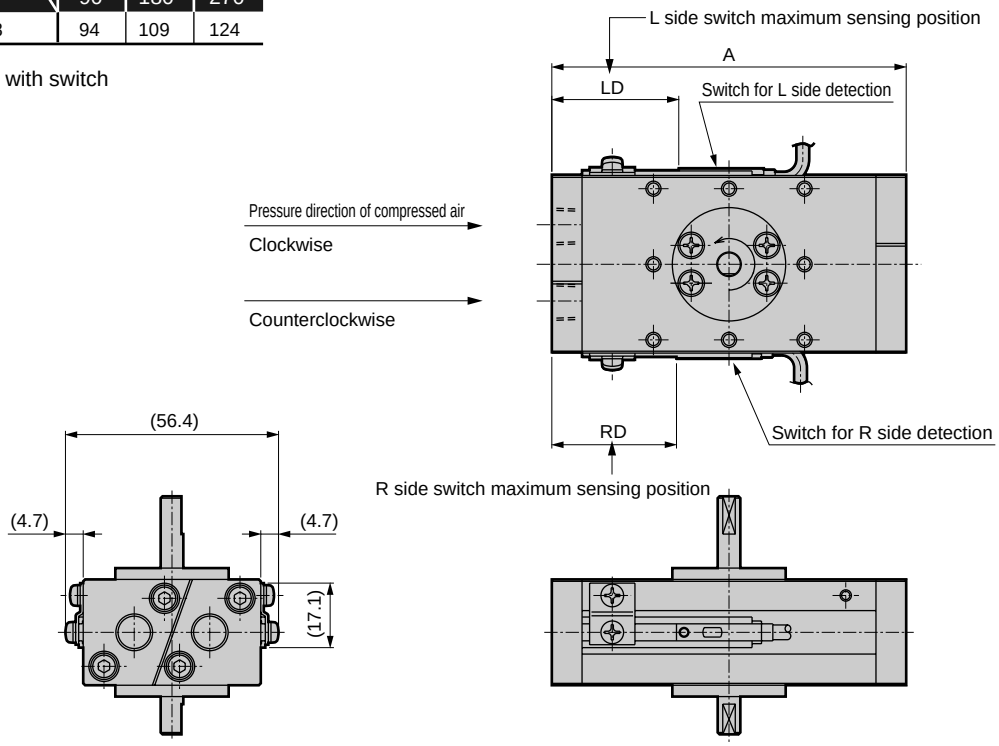
Dimensions

● RRC-8



Symbol / Model no.	A		
	Oscillating angle		
	90°	180°	270°
RRC-8	94	109	124

● RRC-8 with switch



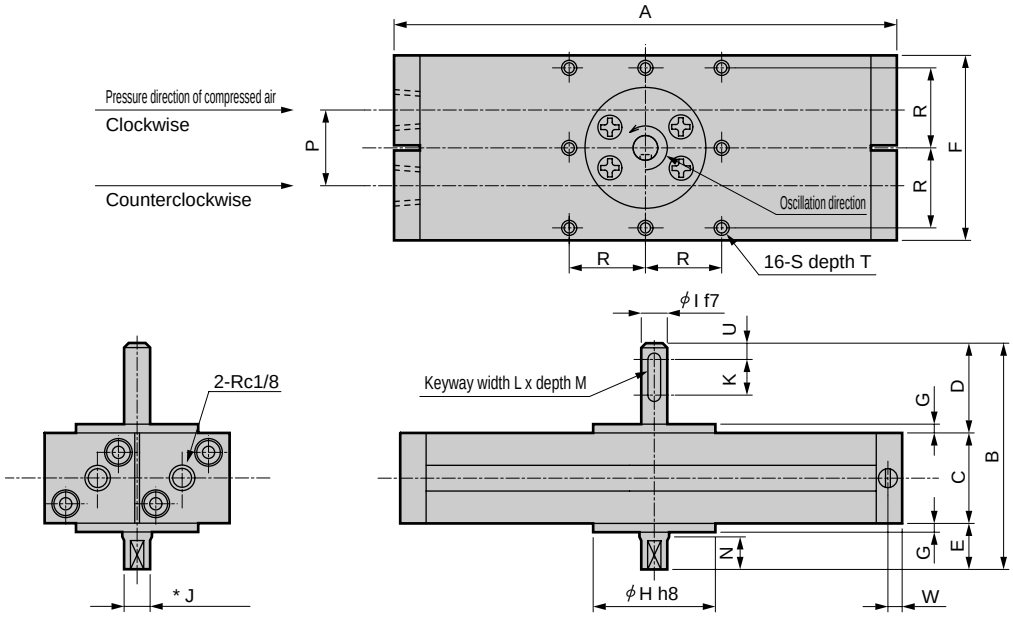
Symbol / Model no.	A			RD														
	Oscillating angle			T1*			T2*/T3*			T0*/T5*			T8*			T2Y*/T3Y*		
				Oscillating angle			Oscillating angle			Oscillating angle			Oscillating angle			Oscillating angle		
	90°	180°	270°	90°	180°	270°	90°	180°	270°	90°	180°	270°	90°	180°	270°	90°	180°	270°
RRC-8	94	109	124	30.8	35.5	40.2	32.2	37	41.6	30	34.3	41	24	28.3	35	30.8	35.5	40.2

Symbol / Model no.	LD														
	T1*			T2*/T3*			T0*/T5*			T8*			T2Y*/T3Y*		
	Oscillating angle			Oscillating angle			Oscillating angle			Oscillating angle			Oscillating angle		
	90°	180°	270°	90°	180°	270°	90°	180°	270°	90°	180°	270°	90°	180°	270°
RRC-8	30.8	35.5	40.2	32.2	37	41.6	30	34.3	41	24	28.3	35	30.8	35.5	40.2

Note: Dimensions other than above are same as the type without switch.

Dimensions

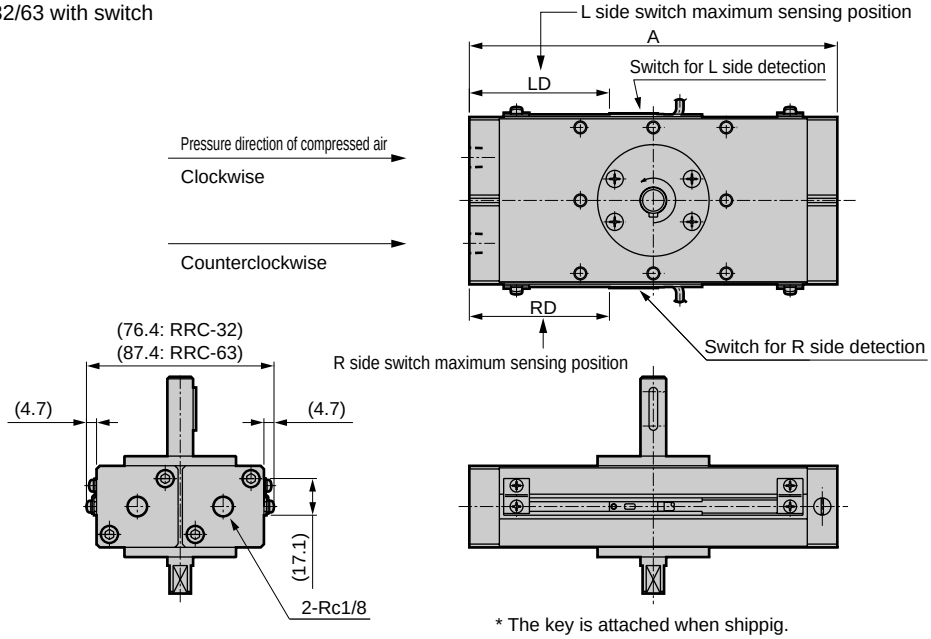
● RRC-32/63



* The key is attached when shippig.

Symbol / Model no.	A Oscillating angle 90°	A Oscillating angle 180°	A Oscillating angle 270°	B	C	D	E	F	G	H	I	J	K	L	M	N	P	R	S	T	U	W
RRC-32	153	191	229	84	33	31	20	67	3	44	10	8	13	3	1.8	10	34	29	M5	8	4.5	6
RRC-63	172	216	260	101	38	41.5	21.5	78	4.5	52	12	10	16	4	2.5	13	40	34	M6	9	7	7

● RRC-32/63 with switch



* The key is attached when shippig.

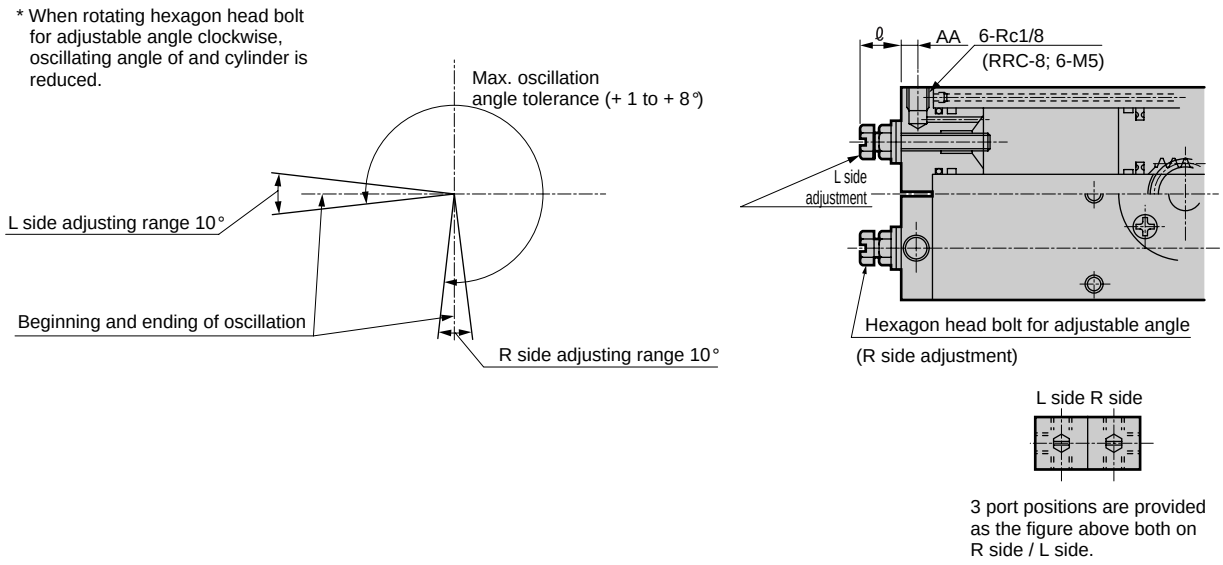
Symbol / Model no.	A Oscillating angle 90°	A Oscillating angle 180°	A Oscillating angle 270°	RD T1* Oscillating angle 90°	RD T1* Oscillating angle 180°	RD T1* Oscillating angle 270°	RD T2*/T3* Oscillating angle 90°	RD T2*/T3* Oscillating angle 180°	RD T2*/T3* Oscillating angle 270°	RD T0*/T5* Oscillating angle 90°	RD T0*/T5* Oscillating angle 180°	RD T0*/T5* Oscillating angle 270°	RD T8* Oscillating angle 90°	RD T8* Oscillating angle 180°	RD T8* Oscillating angle 270°	RD T2Y*/T3Y* Oscillating angle 90°	RD T2Y*/T3Y* Oscillating angle 180°	RD T2Y*/T3Y* Oscillating angle 270°
RRC-32	153	191	229	56.8	66.3	75.5	58.2	67.7	77.1	57.6	67.1	76.5	51.6	61.1	70.5	56.8	66.3	75.5
RRC-63	172	216	260	64.5	75.5	86.5	65.9	76.9	87.9	65.3	76.3	87.3	59.3	70.3	81.3	64.5	75.5	86.5

Symbol / Model no.	LD T1* Oscillating angle 90°	LD T1* Oscillating angle 180°	LD T1* Oscillating angle 270°	LD T2*/T3* Oscillating angle 90°	LD T2*/T3* Oscillating angle 180°	LD T2*/T3* Oscillating angle 270°	LD T0*/T5* Oscillating angle 90°	LD T0*/T5* Oscillating angle 180°	LD T0*/T5* Oscillating angle 270°	LD T8* Oscillating angle 90°	LD T8* Oscillating angle 180°	LD T8* Oscillating angle 270°	LD T2Y*/T3Y* Oscillating angle 90°	LD T2Y*/T3Y* Oscillating angle 180°	LD T2Y*/T3Y* Oscillating angle 270°
RRC-32	56.8	66.3	75.5	58.2	67.7	77.1	57.6	67.1	76.5	51.6	61.1	70.5	56.8	66.3	75.5
RRC-63	64.5	75.5	86.5	65.9	76.9	87.9	65.3	76.3	87.3	59.3	70.3	81.3	64.5	75.5	86.5

Note: Dimensions other than above are same as the type without switch.

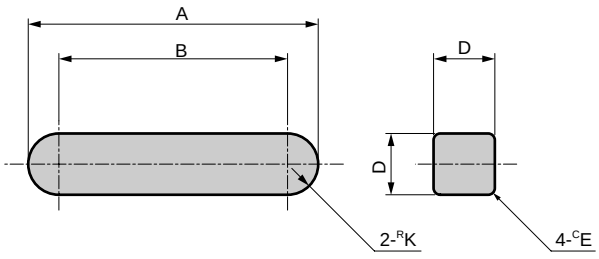
Dimensions: Option

● Adjustable angle



Symbol / Model no.	ℓ MIN	ℓ MAX	AA	Allowable energy absorption J (For adjustable angle single 10°)	Hexagon head bolt dimension for adjustable angle (Common for R and L)
RRC-8	10.7	11.5	4	0.02	M5×0.5
RRC-32	13.4	15.5	6	0.06	M6×0.75
RRC-63	13.5	16.0	7	0.13	M6×0.75

● Key dimensional drawing



Model no. \ Symbol	A	B	K	D	E
RRC-32	16 $^{-0.4}_{-0.5}$	13	1.5	3 $^{0}_{-0.025}$	0.2
RRC-63	20 $^{-0.5}_{-0.6}$	16	2	4 $^{0}_{-0.030}$	0.2

* The key is attached when shippig.

Selection guide of rotary actuator

Step1 Oscillating time check

Use oscillating time withing specified range of the below table. Unit: S

Oscillating angle (°) / Model no.	90	180	270
RRC-8	0.015 to 0.151	0.030 to 0.302	0.045 to 0.452
RRC-32	0.038 to 0.377	0.075 to 0.754	0.113 to 1.131
RRC-63	0.073 to 0.440	0.147 to 0.880	0.220 to 1.320

* Oscillating time on table is time to achieve the end of oscillating after starting movement.

Step2 Size selection

● If clamp, or simple static forces, etc., are necessary.

Static load

(1) Working pressure is determined. P (MPa)
(2) A required force is determined. F (N)
(3) Length of an arm from a rotary actuator is determined. ℓ (m)

➡ Calculation of required torque

$T = F\ell$ (N·m)

➡ Determine size of rotary actuator according to output torque graph.

● To move load

Resistance load

When force (resistance load) caused by fictional force, gravity or other external force is applied.
(1) Working pressure is determined. P (MPa)
(2) A required force is determined. F_R (N)
(3) Length of an arm from a rotary actuator is determined. ℓ (m)

➡ Calculation of resistance torque

$T_R = K \times F_R \times \ell$ (N·m)
K: slack coefficient
If load fluctuation free K = 2
If load fluctuates K = 5
(When resistance torque caused by gravity functions)
if load fluctuates, when K < 5, change of angular speed increases.

Inertia load

To rotate body.
(1) Oscillating angle /oscillating time and working pressure are determined.
Oscillating angle θ (rad)
Oscillating time t (s)
Working pressure P (MPa)
90° = 1.5708 (rad)
180° = 3.1416 (rad)
270° = 4.7124 (rad)
(2) Calculate load moment of inertia according to load shape and weight. Refer to moment of inertia table for the calculation formula.
I (kg/m^2)
(3) Angular acceleration is calculated.
$\alpha = \frac{2\theta}{t^2}$ (rad/s^2)
θ : Oscillating angle (rad)
t : Oscillating time (s)

➡ Calculation of acceleration torque

$T_A = 5 \times I \times \alpha$ (N·m)
T_A is the required torque to accelete inertia load till set speed.

⬇

Required torque $T = T_R + T_A$ ➡ Determine size of rotary actuator according to output torque graph.

⬆

Step3 Check of allowable energy

When using an inertial load, keep the load energy to lower than the rotary actuator's allowable energy.
(1) Calculate angular speed $\omega = \frac{2\theta}{t}$ (rad/s)

θ : Oscillating angle (rad) t: Oscillating time (s)

(2) Calculation of load inertia energy

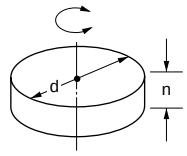
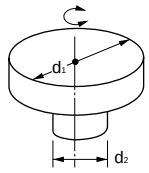
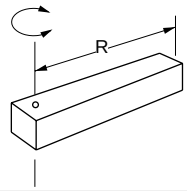
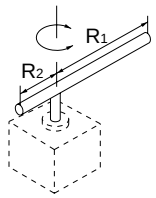
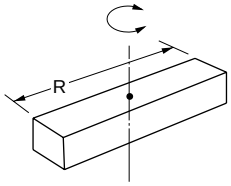
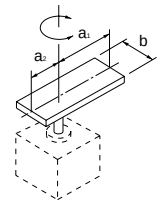
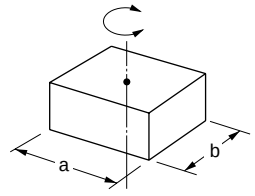
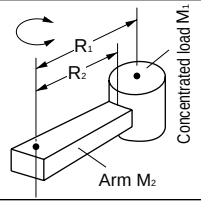
$E = 1/2 I\omega^2$ (J)

I: Load moment of inertia (kg/m^2)

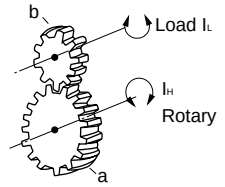
Check if load inertia energy E to be allowable energy of rotary actuator or less.
When exceeding allowable energy, external shock absorber, etc. is required.

2. Figure for moment of inertia calculation

● When rotary shaft goes through workpiece

Shape	Sketch	Requirements	Moment of inertia I kg/m²	Radius of gyration K_1^2	Remarks
Dial plate		● Diameter d (m) ● Weight M (kg)	$I = \frac{Md^2}{8}$	$\frac{d^2}{8}$	● No installation direction ● When using with sliding, please consult with CKD
Dial plate with step		● Diameter d_1 (m) d_2 (m) ● Weight d_1 section M_1 (kg) d_2 section M_2 (kg)	$I = \frac{1}{8}(M_1d_1^2 + M_2d_2^2)$	$\frac{d_1^2 + d_2^2}{8}$	● Ignore, when d_2 section is extremely small comparing to d_1 section
Bar (center of rotation is an end)		● Bar length R(m) ● Weight M (kg)	$I = \frac{MR^2}{3}$	$\frac{R^2}{3}$	● The installation direction is horizontal ● If vertical installation attitude, oscillating time varies
Thin rod		● Bar length R_1 R_2 ● Weight M_1 M_2	$I = \frac{M_1 \cdot R_1^2}{3} + \frac{M_2 \cdot R_2^2}{3}$	$\frac{R_1^2 + R_2^2}{3}$	● The installation direction is horizontal ● If vertical installation attitude, oscillating time varies
Bar (center of rotation is center of gravity)		● Bar length R(m) ● Weight M (kg)	$I = \frac{MR^2}{12}$	$\frac{R^2}{12}$	● No installation direction
Thin rectangle plate (rectangular parallelepiped)		● Plate length a_1 a_2 ● Length of side b ● Weight M_1 M_2	$I = \frac{M_1}{12}(4a_1^2 + b^2) + \frac{M_2}{12}(4a_2^2 + b^2)$	$\frac{(4a_1^2 + b^2) + (4a_2^2 + b^2)}{12}$	● The installation direction is horizontal ● If vertical installation attitude, oscillating time varies
Lectangular parallelepiped		● Length of side a (m) b (m) ● Weight M (kg)	$I = \frac{M}{12}(a^2 + b^2)$	$\frac{a^2 + b^2}{12}$	● No installation direction ● When using with sliding, please consult with CKD
Concentrated load		● Shape of concentrated load ● Length to center of gravity of concentrated load R_1 (m) ● Arm length R_2 (m) ● Concentrated load weight M_1 (kg) ● Arm weight M_2 (kg)	$I = M_1(R_1^2 + k_1^2) + \frac{M_2R_2^2}{3}$	Calculate k_1^2 according to shape of concentrated load	● The installation direction is horizontal ● When M_2 is extremely small comparing to M_1, may be calculated as $M_2 = 0$

How to convert load J_L to rotary actuator shaft rotation when using with gear

Gear		● Gear Rotary side (the tooth number) a Load side (the tooth number) b ● Load inertia Moment N·m	Moment of inertia of load rotary shaft rotation $I_H = \left(\frac{a}{b}\right)^2 I_L$		● When shape of gear is increasing, gear moment of inertia should be considered.