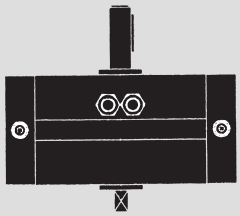
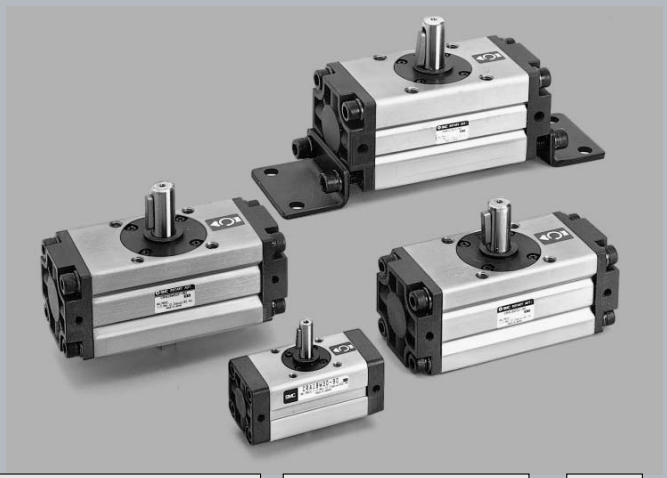


Rotary Actuator
Rack & Pinion Style
Series CRA1
Size: 30, 50, 63, 80, 100

Models with cushion or with solenoid valve available.
(Only sizes 50 or larger are available.)

Angle adjustment is possible.
Size 30·····Fine angle adjuster is standard equipment.
Size 50 or larger···Angle adjustable type

Auto switch is mountable.
Adjustment of switch location is easy with rail mounting.



CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

Series Variations

				Fluid		Air		Hydraulic oil		Page
				Size		30	50 63 80 100		50 63 80 100	
Standard	Rotating angle			90°		●	●	●	●	11-7-2 to 11-7-31
				100°		●	●	●	●	
				180°		●	●	●	●	
				190°		●	●	●	●	
	Shaft type			Single shaft	S	●	●	●	●	
				Double shaft	W	●	●	●	●	
				Single shaft with four chamfers	X	●	●	●	●	
				Double shaft key	Y	●	●	●	●	
				Double shaft with four chamfers	Z	●	●	●	●	
	Cushion			None		●	●	●	●	
				Air cushion		●	●	●	●	
	Variations			With auto switch		●	●	●	●	
				Angle adjustable type		●	●	●	●	
				With solenoid valve		●	●	●	●	
				Clean series	11-	●	●	●	●	
				Copper-free (Standard)	20-	●	●	●	●	
				With One-touch fittings		●	●	●	●	
				Flange	F	●	●	●	●	
Option	Mounting bracket			Foot	L	●	●	●	●	
Made to Order	Shaft type			Single shaft	S	●	●	●	●	11-7-4 to 11-7-6
				Single shaft with four chamfers	X	●	●	●	●	
				Double shaft key	Y	●	●	●	●	
				Double shaft with four chamfers	Z	●	●	●	●	
				Single round shaft	T	●	●	●	●	
				Double shaft (Round, With four chamfers)	J	●	●	●	●	
				Double round shaft	K	●	●	●	●	
	Pattern			Shaft end form		●	●	●	●	11-7-32 to 11-7-51
				End of rotation		●	●	●	●	
				Port location		●	●	●	●	
	Shaft, Bolt, Parallel key stainless spec.				-X6	●	●	●	●	
	Operating temp.	Heat resistance 100°C			-X7	●	●	●	●	
	Both sides angle adjustable				-X10	●	●	●	●	
	One side angle adjustable, One side with cushion				-X11	●	●	●	●	
	Fluoro rubber for seals				-X16	●	●	●	●	

Rotary Actuator
Rack & Pinion Style
Series CRA1
Size: 30, 50, 63, 80, 100

How to Order

Size 30

CRA1 B W 30 — 90

Mounting style

B	Basic style
L	Foot style

Rod end shape
Double shaft

Rotating angle

90	90°
180	180°

Size 50 to 100

CRA1 B S □ 50 — 90 □

Mounting style

B	Basic style
L *	Foot style
F	Flange style

* For part numbers, refer to the tables below.

Shaft type

Standard	**S**	Single shaft
	W	Double shaft
Option	**X**	Single shaft with four chamfers
	Y	Double shaft key
	Z	Double shaft with four chamfers

Type

Nil	Pneumatic
H	Air-hydro

Size

50
63
80
100

Rotating angle

Standard	**90**	90°
	180	180°
Option	**100**	100°
	190	190°

Air cushion

Nil	None
C	With air cushion

Foot Bracket Part No.

Size	Foot bracket	Mounting screws included in foot bracket
30	CRA1L30-Y-1	M5 x 0.8 x 25
50	CRA1L50-Y-1	M8 x 1.25 x 35
63	CRA1L63-Y-1	M10 x 1.5 x 40
80	CRA1L80-Y-1	M12 x 1.75 x 50
100	CRA1L100-Y-1	M12 x 1.75 x 50

Note 1) The part numbers shown above include mounting screw.
Note 2) As ordering foot bracket, write “1 piece” for the bracket for one rotary actuator.

Specifications

Type	Pneumatic					Air-hydro			
Size	30	50	63	80	100	50	63	80	100
Fluid	Air (Non-lube)					Hydraulic oil			
Max. operating pressure	1 MPa								
Min. operating pressure	0.1 MPa								
Ambient and fluid temperature	0 to 60°C (No freezing)								
Cushion	None	Not attached, Air cushion				None			
Output (N·m) (1)	1.9	9.3	17	32	74	9.3	17	32	74
Allowable surge pressure	—					1.5 MPa			
Backlash	(2)	Within 1°							
Tolerance in rotating angle	—	+ 4° 0							

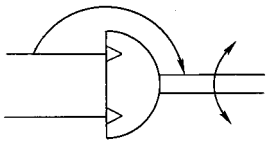
Note 1) Output under the operating pressure of 0.5 MPa. Refer to page 11-1-29 for further information.
Note 2) Since CRA1□30 has a stopper installed, there is no backlash produced under pressure.

Allowable Kinetic Energy/Safe Range of Rotation Time

Model	Allowable kinetic energy			Adjustable range of rotation time safe in operation
	Allowable kinetic energy (mJ)		Cushion angle	
	Without cushion	With cushion Note)		Rotation time (s/90°)
CRA1□W30	10	—	—	0.2 to 1
CRA1□□50	50	980	35°	0.2 to 2
CRA1□□63	120	1500	35°	0.2 to 3
CRA1□□80	160	2000	35°	0.2 to 4
CRA1□□100	540	2900	35°	0.2 to 5

Note) Allowable kinetic energy of the bumpers equipped model
The maximum absorbed energy under proper adjustment of the cushion needle.

JIS Symbol



Made to Order P. 11-7-32 to 11-7-51

Weight/Standard

(kg)

Model	Standard weight		Additional weight	
	90°	180°	Foot bracket	Flange bracket
CRA1BW30	0.3	0.4	0.1	—
CRA1BW50	1.5	1.7	0.3	0.5
CRA1BW63	2.5	3	0.5	0.9
CRA1BW80	4.3	5	0.9	1.5
CRA1BW100	8.5	9.5	1.2	2

⚠ Caution

Be sure to read before handling. Refer to pages 11-13-3 to 11-13-4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to pages 11-1-4 to 11-1-6 for Precautions on every series.

Weight/With Auto Switches and Solenoid Valves

(kg)

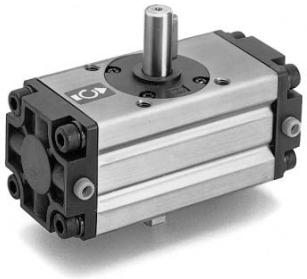
Size	Additional weight	
	With 2 auto switches	With solenoid valve *
30	0.1	—
50	0.2	0.2
63	0.4	0.2
80	0.6	0.2
100	0.9	0.2

* Weight of the solenoid valve is not included. Refer to page 11-7-19 concerning weight of the solenoid valve.

With One-touch Fittings

CRA1 | Mounting | Shaft type | Size | F | Rotating angle | Suffix symbol

F: With One-touch fittings



Piping steps and installation space are saved by One-touch fittings built in the connection ports.

Specifications

Applicable size	**30, 50, 63**
Type	Pneumatic
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Auto switch	Mountable

Refer to pages 11-7-10 to 11-7-12 for dimensions.

Applicable Tubing Specifications

Size	30	50	63
Applicable tubing O.D.	ø4	ø6	
Applicable tubing material	Nylon, Soft nylon, Polyurethane		

Clean Series

11–CRA1 | Mounting | Shaft type | Size | Rotating angle | Suffix symbol

11: Clean Series

Vacuum ports are equipped to prevent dust from being produced from the rod part of the rotary actuators.

Specifications

Type	Pneumatic
Applicable size	**30, 50**
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Auto switch	Mountable

For further specifications, refer to “Pneumatic Clean Series” catalog.

Copper-free

No influence on cathode ray tubes by copper ion and fluorine resin. As standard models are already made applicable to copper free styles, they can be applied as they are.

Specifications

Type	Pneumatic
Applicable size	**30, 50, 63, 80, 100**
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Auto switch	Mountable

Shaft Type Variations/Without Key Grooves (Size 30)

Shaft Type: T, J, K

Refer to “How to Order” on pages 11-7-2 to 11-7-13.

C□RA1 | Mounting | Shaft type | 30 | Rotating angle

Shaft type

T	Single round shaft
J	Double shaft (Long shaft without key and with four chamfers)
K	Double round shaft

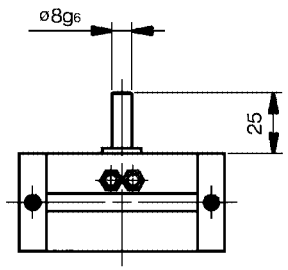
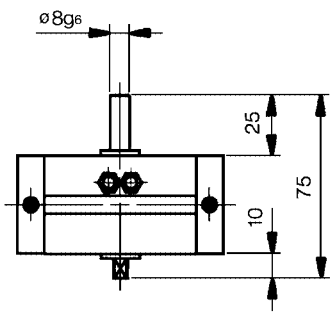
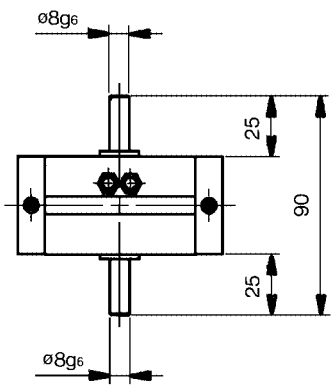
Specifications

Type	Pneumatic
Size	**30**
Shaft type	Single round shaft (T), Double round shaft (K), Double shaft/(Long shaft without key and with four chamfers) (J)
Cushion	None
Auto switch	Mountable
Mounting	Basic style, Foot style

∗ Refer to page 11-7-3 for other specifications.

Dimensions

(mm)

Shaft type	T (Single round shaft)	J (Double shaft/Long shaft without key and with four chamfers)	K (Double round shaft)
Configuration			

Shaft Variations/Without Key Groove (Size 50 to 100)

Shaft Type: T, J, K

C□RA1 | Mounting | Shaft type | Size | Rotating angle | |

Air cushion

Nil	None
C	With air cushion

Refer to "How to Order" on pages 11-7-2, 13, 18 and 24.

Shaft type

T	Single round shaft
J	Double shaft (Long shaft without key and with our chamfers)
K	Double round shaft

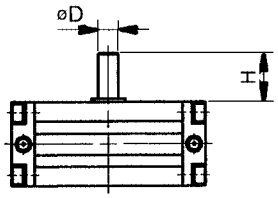
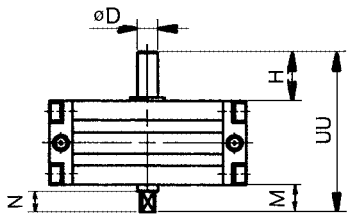
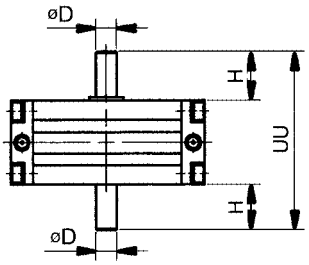
Specifications

Type	Pneumatic	Air-hydro
Size	**50, 63, 80, 100**	
Fluid	Air (Non-lube)	Hydraulic oil
Shaft type	Single round shaft (T), Double round shaft (K), Double shaft/Long shaft without key and with four chamfers (J)	
Cushion	Not attached, Air cushion	None
Auto switch	Mountable	
Mounting	Basic style, Foot style	

Note) Except flange style.
∗ Refer to page 11-7-3 for other specifications.

Dimensions

(mm)

Shaft type	**T (Single round shaft)**		**J (Double shaft/Long shaft without key & with four chamfers)**					**K (Double round shaft)**		
Configuration										
Size	**D (g6)**	**H**	**D (g6)**	**H**	**M**	**N**	**UU**	**D (g6)**	**H**	**UU**
50	15	36	15	36	20	15	118	15	36	134
63	17	41	17	41	22	17	139	17	41	158
80	20	50	20	50	25	20	167	20	50	192
100	25	60	25	60	30	25	202	25	60	232

∗ Refer to pages 11-7-11 to 11-7-12 for other specifications.

Shaft Variations (Size 30)

Shaft Type: S, X, Y, Z

C□RA1 **Mounting** **Shaft type** 30 **Rotating angle**

Refer to "How to Order" on pages 11-7-2 to 11-7-13.

Shaft type

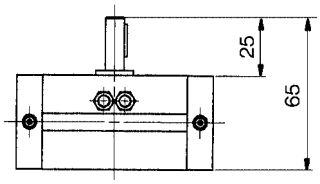
S	Single shaft key
X	Single shaft with four chamfers
Y	Double shaft key
Z	Double shaft with four chamfers

Specifications

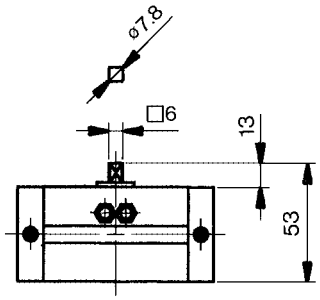
Type	Pneumatic
Size	**30**
Max. operating pressure (MPa)	1 MPa
Min. operating pressure (MPa)	0.1 MPa
Shaft type	Single shaft key (S), Double shaft with four chamfers (X), Double shaft key (Y), Double shaft with four chamfers (Z)
Mounting	Basic style, Foot style
Auto switch	Mountable

∗ Refer to page 11-7-3 for other specifications.

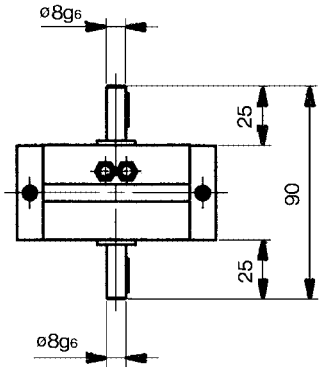
S (Single shaft key)



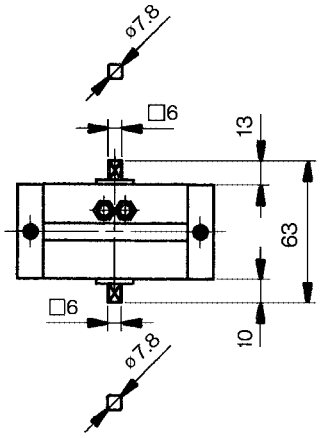
X (Single shaft with four chamfers)



Y (Double shaft key)



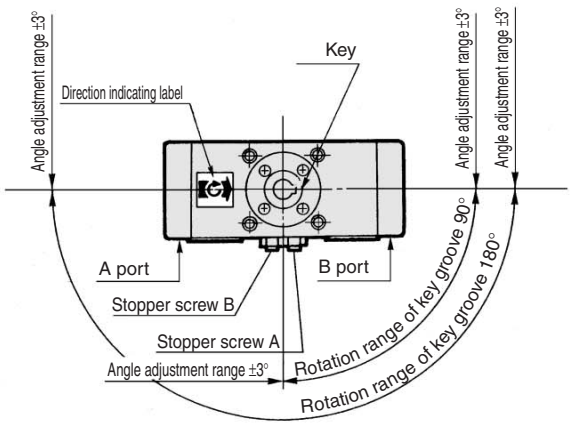
Z (Double shaft with four chamfers)



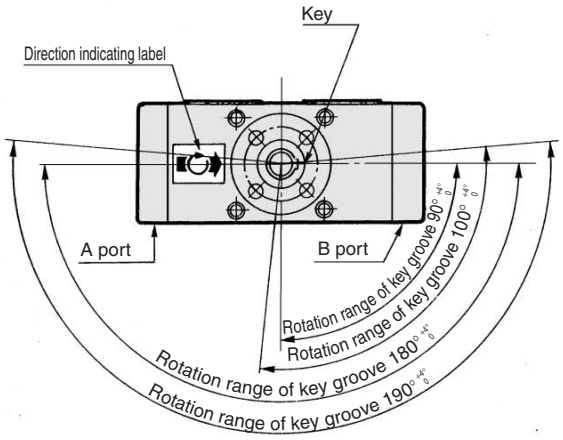
Rotation Range of Key Groove

If air pressure is applied from the A side of the direction indication label, the shaft rotates clockwise. If air pressure is applied from the B side, the shaft rotates counterclockwise.

Size: 30



Size: 50 to 100



· Stopper screw A: For end adjustment in clockwise direction
· Stopper screw B: For end adjustment in counter clockwise direction

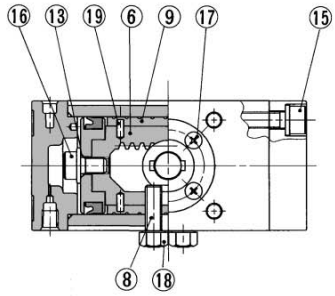
How to Set Rotation Time

Even if the torque that is generated by the rotary actuator is small, the parts could become damaged depending on the inertia of the load. Therefore, the rotation time should be determined by calculating the load's inertial moment and kinetic energy. Refer to pages 11-1-34 to 35 for details on how to set the rotation time.

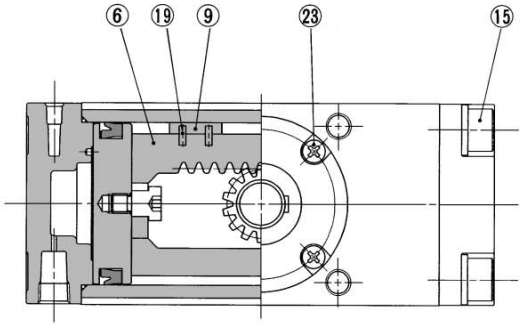
Allowable load on the shaft
Refer to the model selecting order step 3 for rotary actuators on page 11-1-20 concerning allowable loads on the shafts of Series CRA1.

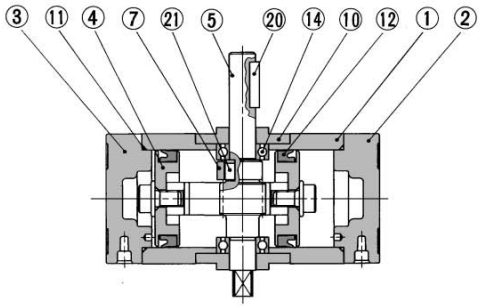
Construction

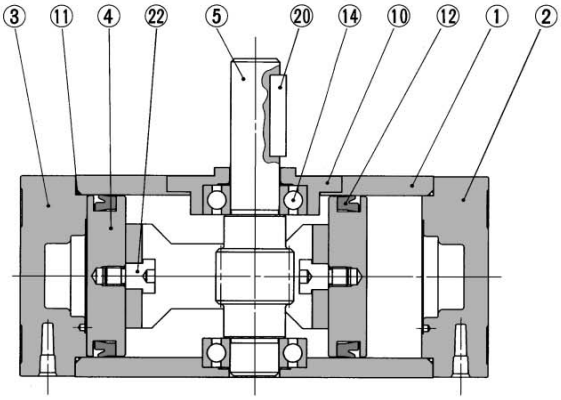
Without air cushion
Size: 30



Without air cushion
Size: 50 to 100







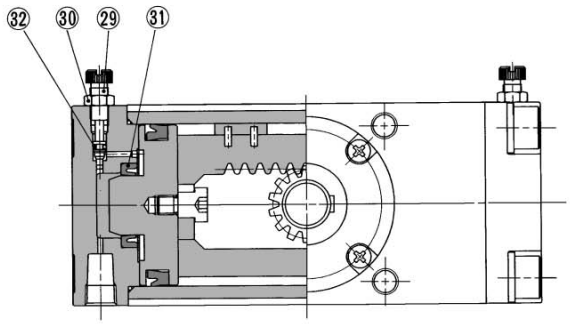
Component Parts

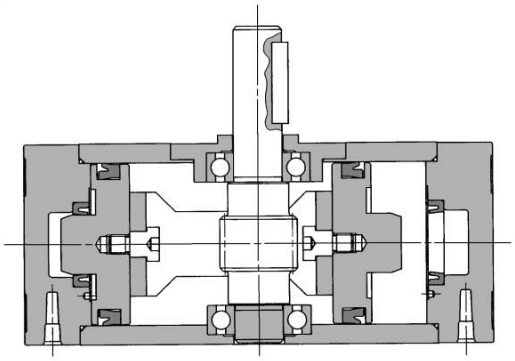
No.	Description	Material	Note
①	Body	Aluminum alloy	Hard anodized
②	Right cover	Aluminum alloy	Black anodized
③	Left cover	Aluminum alloy	Black anodized
④	Piston	Aluminum alloy	Chromated
⑤	Shaft	Chrome molybdenum steel	
⑥	Rack	Carbon steel	Nitrided
⑦	Stopper	Chrome molybdenum steel	
⑧	Stopper screw	Chrome molybdenum steel	Black dyed
⑨	Slider	Resin	
⑩	Bearing retainer	Zinc alloy Note)	Black painted
⑪	Tube gasket	NBR	

Note) Size 50 to 100: Aluminum alloy (Black anodized)

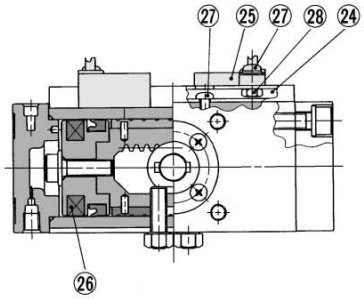
No.	Description	Material	Note
⑫	Piston seal	NBR	
⑬	O-ring	NBR	
⑭	Bearing	Bearing steel	
⑮	Hexagon socket head cap screw with spring washer	Chrome molybdenum steel	Black zinc chromated
⑯	Hexagon socket head cap flange screw	Chrome molybdenum steel	Zinc chromated
⑰	Cross-recessed countersunk head screw	Steel wire	Black dyed
⑱	Hexagon nut	Steel wire	Black dyed
⑲	Spring pin	Steel wire	
⑳	Parallel keyway	Carbon steel	
㉑	Parallel keyway	Carbon steel	
㉒	Connecting screw	Carbon steel	Zinc chromated
㉓	Round head Phillips screw	Steel wire	Black zinc chromated

With air cushion

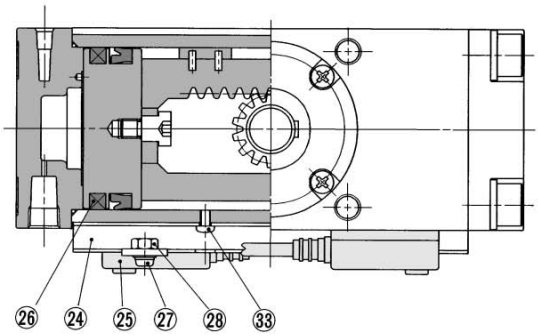




With auto switch
Size: 30



Size: 50 to 100



Component Parts

No.	Description	Material	Note
㉔	Auto switch mounting rail	Aluminum alloy	
㉕	Auto switch	—	
㉖	Plastic magnet	Magnetic material	
㉗	Round head Phillips screw	Steel wire	Nickel plated
㉘	Hexagon nut	Steel wire	Nickel plated
㉙	Needle valve	Steel wire	Nickel plated
㉚	Lock nut	Steel wire	Nickel plated
㉛	Cushion seal	NBR	
㉜	O-ring	NBR	
㉝	Round head Phillips screw	Steel wire	Nickel plated

Replacement Parts (Corresponding parts shown below are set.)

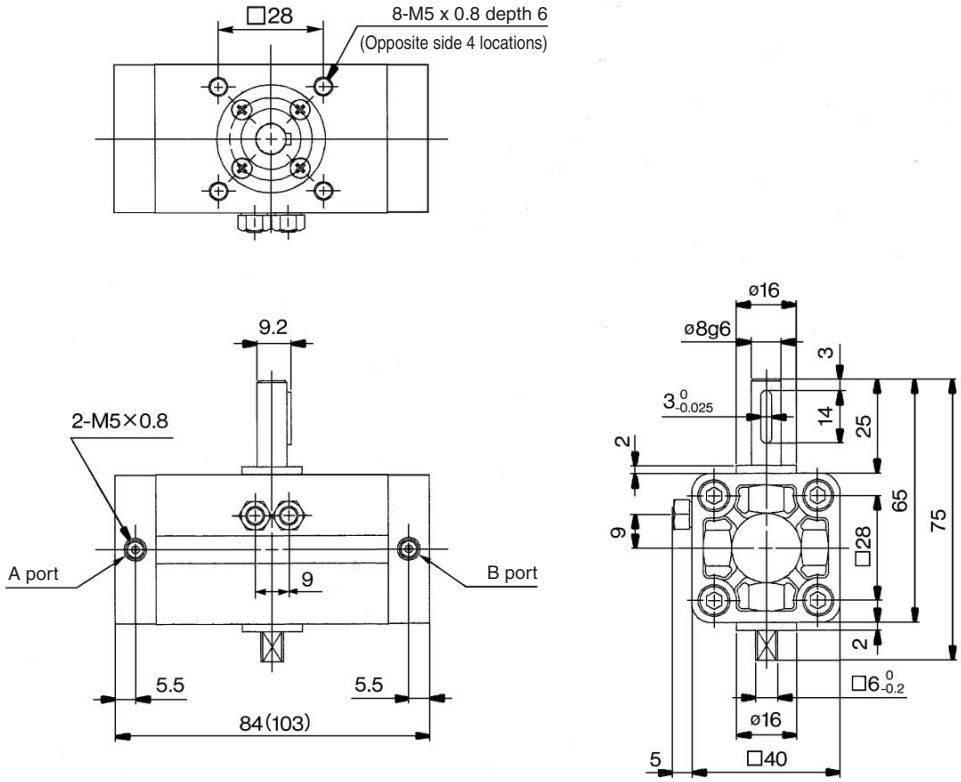
Size	Replacement parts			
	Standard	With air cushion	With auto switch	Air-hydro
CRA1□W30-90	P294010-20	—	P294010-20	—
CRA1□W30-180	P294010-21	—	P294010-21	—
CRA1□□50	P294020-20A	P294020-20A	P294020-20A	P294020-23A
CRA1□□63	P294030-20A	P294030-20A	P294030-20A	P294030-23A
CRA1□□80	P294040-20	P294040-20	P294040-20	P294040-23
CRA1□□100	P294050-20A	P294050-20A	P294050-20A	P294050-23A
Corresponding parts	⑨, ⑪, ⑫, and ⑲ are set.			

Note) When ordering spare parts, write “1 piece” for 1 set of the parts for one actuator.

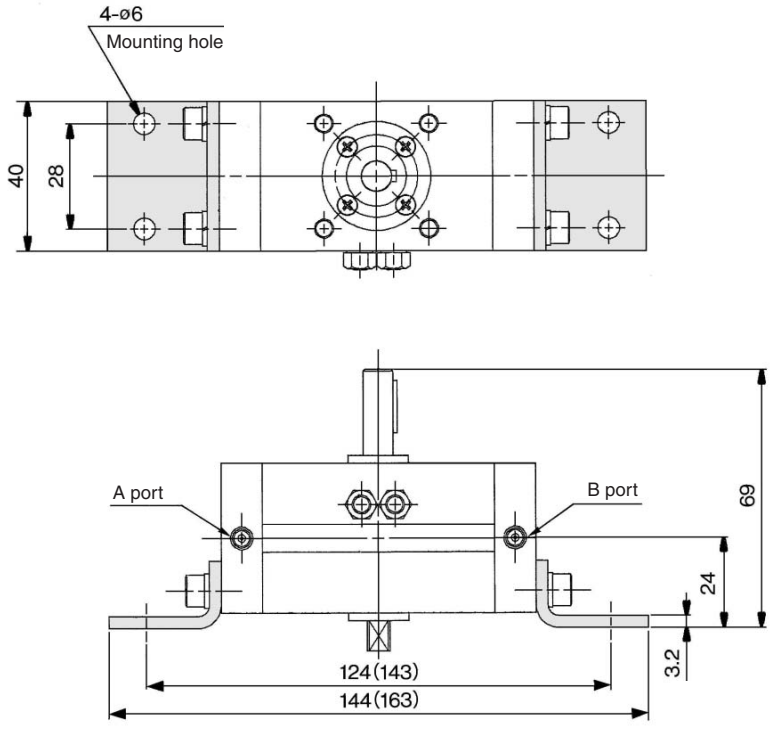
Size 30/Basic Style: CRA1BW, Foot Style: CRA1LW

This drawing is for 90° specifications.

Basic style: CRA1BW30



Foot style: CRA1LW30

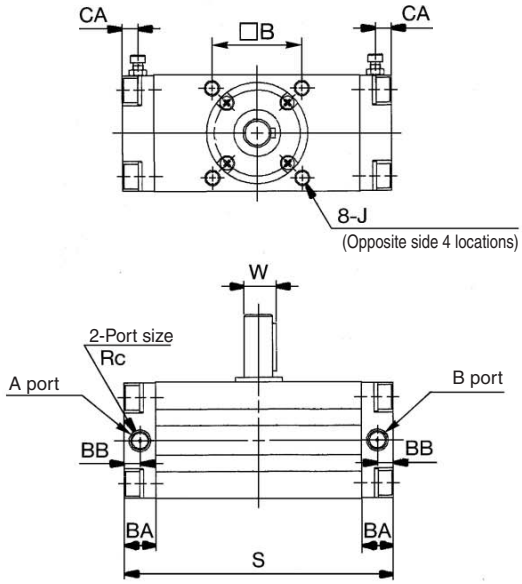


∗ ( ) are the dimensions for rotation of 180°.
★The dimensions below show pressurization to B port.

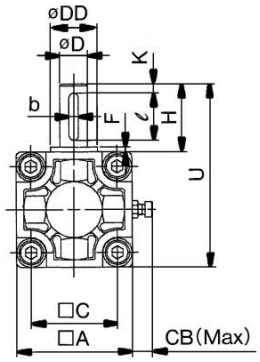
Size 50, 63, 80, 100/Basic Style: CRA1B□

Size: 50 to 100

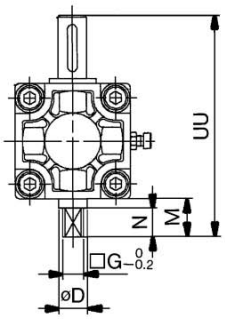
Single shaft type: CRA1BS



Single shaft



Double shaft type: CRA1BW
Double shaft



Note) Other dimensions are the same as the single shaft.

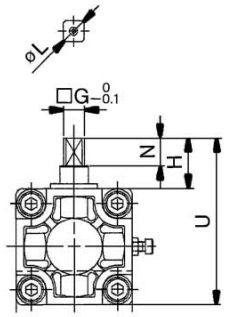
∗ The dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

Model	Port size Rc	A	B	C	D (g6)	DD (h9)	F	H	J	K	S	U	W	BA	BB	⋆ CA	⋆ CB	Keyway dimensions b	Keyway dimensions ℓ
CRA1BS50	1/8	62	48	46	15	25	2.5	36	M8 x 1.25 Depth 8	5	144 (177)	98	17	17	8.5	8.5	13	$5^{0}_{-0.030}$	25
CRA1BS63	1/8	76	60	57	17	30	2.5	41	M10 x 1.5 Depth 12	5	163 (201.5)	117	19.5	20	10	10	14	$6^{0}_{-0.030}$	30
CRA1BS80	1/4	92	72	70	20	35	3	50	M12 x 1.75 Depth 13	5	186 (230)	142	22.5	23.5	12	12	18	$6^{0}_{-0.030}$	40
CRA1BS100	3/8	112	85	85	25	40	4	60	M12 x 1.75 Depth 14	5	245 (311)	172	28	25	12.5	12.5	18	$8^{0}_{-0.036}$	45

⋆ For model with air cushion

Model	D (g6)	G	M	N	UU	L
CRA1BW50	15	11	20	15	118	14
CRA1BW63	17	13	22	17	139	16
CRA1BW80	20	15	25	20	167	19
CRA1BW100	25	19	30	25	202	24

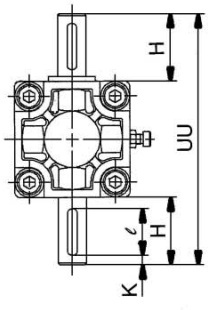
Single shaft with four chamfers: CRA1BX



Note) Other dimensions are the same as the single shaft.

Model	G	H	N	U	L
CRA1BX50	11	27	15	89	14
CRA1BX63	13	29	17	105	16
CRA1BX80	15	38	20	130	19
CRA1BX100	19	44	25	156	24

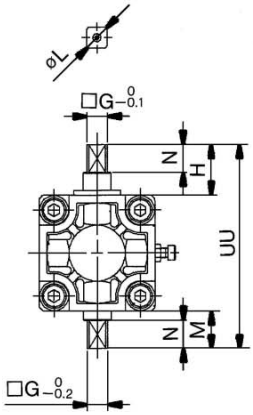
Double shaft key: CRA1BY



Note) Other dimensions are the same as the single shaft.

Model	H	K	UU	ℓ
CRA1BY50	36	5	134	25
CRA1BY63	41	5	158	30
CRA1BY80	50	5	192	40
CRA1BY100	60	5	232	45

Double shaft with four chamfers: CRA1BZ

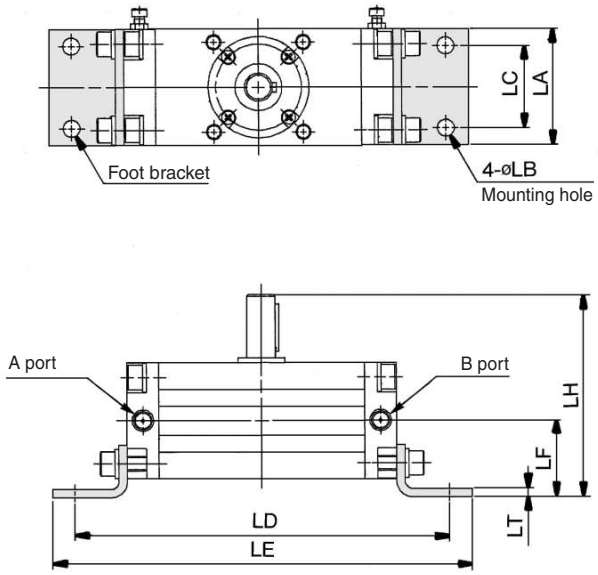


Note) Other dimensions are the same as the single shaft.

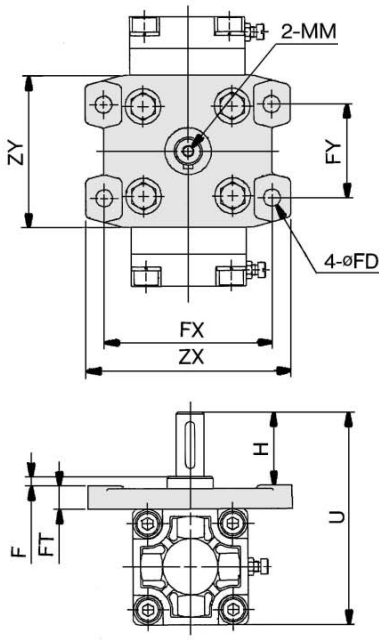
Model	G	H	M	N	UU	L
CRA1BZ50	11	27	20	15	109	14
CRA1BZ63	13	29	22	17	127	16
CRA1BZ80	15	38	25	20	155	19
CRA1BZ100	19	44	30	25	186	24

Size 50, 63, 80, 100/Foot Style: CRA1L□, Flange Style: CRA1F□

Foot style: CRA1L□



Flange style
Single shaft: CRA1FS



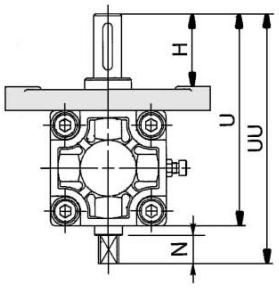
● Dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

Model	LA	LB	LC	LD	LE	LF	LH	LT
CRA1L□□50	62	9	44	200 (233)	224 (257)	41	108	4.5
CRA1L□□63	76	11	55	235 (273.5)	263 (301.5)	48	127	5
CRA1L□□80	92	13	67	274 (318)	316 (360)	58	154	6
CRA1L□□100	112	13	87	333 (399)	375 (441)	73.5	189.5	6

Note) Other dimensions are the same as standard.

Model	F	H	MM	U	FD	FT	FX	FY	ZX	ZY
CRA1F□□50	4	39	M 6 x 1.0 depth 12	114	9	13	90	50	110	81
CRA1F□□63	5	45	M 6 x 1.0 depth 12	136	11.5	15	105	59	130	101
CRA1F□□80	5	55	M8 x 1.25 depth 16	165	13.5	18	130	76	160	119
CRA1F□□100	5	60	M10 x 1.5 depth 20	190	13.5	18	150	92	180	133

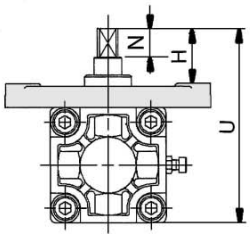
Flange style
Double shaft: CRA1FW



Note) Other dimensions are the same as the single shaft.

Model	H	N	U	UU
CRA1FW□50	39	15	114	134
CRA1FW□63	45	17	136	158
CRA1FW□80	55	20	165	190
CRA1FW□100	60	25	190	220

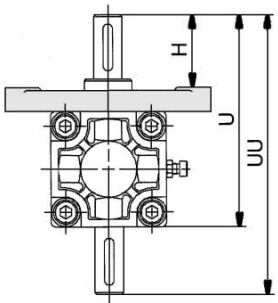
Flange style
Single shaft with four chamfers: CRA1FX



Note) Other dimensions are the same as the single shaft.

Model	H	N	U
CRA1FX□50	30	15	105
CRA1FX□63	33	17	124
CRA1FX□80	43	20	153
CRA1FX□100	44	25	174

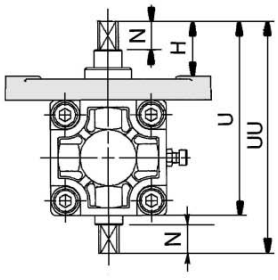
Flange style
Double shaft key: CRA1FY



Note) Other dimensions are the same as the single shaft.

Model	H	U	UU
CRA1FY□50	39	114	150
CRA1FY□63	45	136	177
CRA1FY□80	55	165	215
CRA1FY□100	60	190	250

Flange style
Double shaft with four chamfers: CRA1FZ



Note) Other dimensions are the same as the single shaft.

Model	H	N	U	UU
CRA1FZ□50	30	15	105	125
CRA1FZ□63	33	17	124	146
CRA1FZ□80	43	20	153	178
CRA1FZ□100	44	25	174	204

Rotary Actuator with Auto Switch
Rack & Pinion Style
Series CDRA1
Size: 30, 50, 63, 80, 100

How to Order

Mounting style

B	Basic style
L	Foot style

Rotating angle

90	90°
180	180°

Size 30: C D RA1 B W30 — 90 — J79W S

Size 50 to 100: C D RA1 B W ☐ 50 — 90 ☐ — J59W S

Built-in magnet

Number of auto switches

S	1 pc.
Nil	2 pcs.

Note) Maximum number of auto switches mountable is two.

Mounting style

B	Basic style
L *	Foot style
F	Flange style

* For part numbers of foot bracket, refer to page 11-7-2.

Size

50
63
80
100

Auto switch
* For the applicable auto switch model, refer to the table below.
* Auto switches are shipped together, (but not assembled).

Cushion

Nil	None
C	With cushion

Shaft type

Standard	S	Single shaft
	W	Double shaft
Option	X	Single shaft with four chamfers
	Y	Double shaft key
	Z	Double shaft with four chamfers

Type

Nil	Pneumatic
H	Air-hydro

Rotating angle

Standard	90	90°
	180	180°
Option	100	100°
	190	190°

Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC	Load voltage DC	Load voltage AC	Auto switch model: Size 30 Perpendicular	Auto switch model: Size 30 In-line	Auto switch model: Size 50 to 100 In-line	Lead wire * length (m): 0.5 (Nil)	3 (L)	5 (Z)	None (N)	Pre-wire connector	Applicable load	
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5 V	—	—	A76H	A56	●	●	—	—	—	IC circuit	—
				2-wire	—	—	200 V	A72	A72H	—	●	●	—	—	—	—	Relay, PLC
					24 V	12 V	100 V	A73	A73H	—	●	●	●	—	—		
							—	—	—	A53	●	●	●	—	—		
		Connector						A73C	—	—	●	●	●	●	—		
		Grommet				—	100 V, 200 V	—	—	A54	●	●	●	—	—		
	Diagnosis indication (2-color)						—	A79W	—	A59W	●	●	—	—	—		
Solid state switch	—	Grommet	Yes	3-wire (NPN)		5 V, 12 V	—	F7NV	F79	F59	●	●	○	—	○	IC circuit	PLC
				3-wire (PNP)				F7PV	F7P	F5P	●	●	○	—	○		
				2-wire		12 V		F7BV	J79	J59	●	●	○	—	○		
					—	—	100 V, 200 V	—	—	J51	●	●	○	—	—	—	
		Connector			24 V	12 V	—	J79C	—	—	●	●	●	●	—		
	Diagnosis indication (2-color)	Grommet		3-wire (NPN)		5 V, 12 V		F7NWV	F79W	F59W	●	●	○	—	○	IC circuit	
				3-wire (PNP)				—	F7PW	F5PW	●	●	○	—	○		
				2-wire		—	—	F7BWV	J79W	J59W	●	●	○	—	○	—	
	Water resistant (2-color)							—	F7BA **	F5BA **	—	●	○	—	○		
								F7BAV **	—	—	—	●	○	—	—		
	Diagnosis output (2-color)			4-wire (NPN)		5 V, 12 V		—	F79F	F59F	●	●	○	—	○	IC circuit	

** Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.

* Lead wire length symbols: 0.5 m ····· Nil (Example) A73C
3 m ····· L (Example) A73CL
5 m ····· Z (Example) A73CZ
None ····· N (Example) A73CN

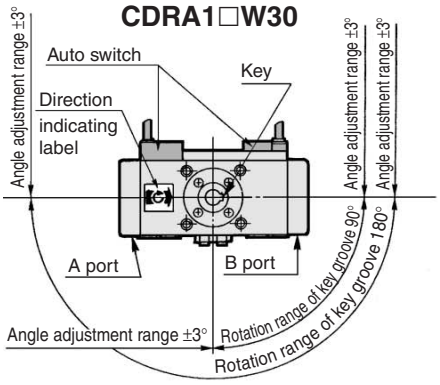
* Auto switches marked with "○" are made to order specifications.

Made to Order Refer to page 11-11-36 for detailed solid state switches with pre-wire connectors.

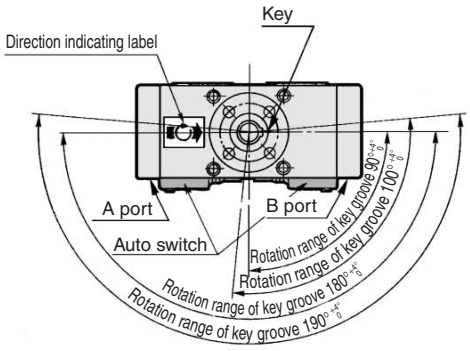
• Refer to page 11-7-14 for applicable switches other than those indicated above.
• For F7NWV, F7BWV switch types, refer to Best Pneumatics Vol. 8.

Rotation Range of Key Groove/Switch Mounting Position

Size: 30
CDRA1□W30

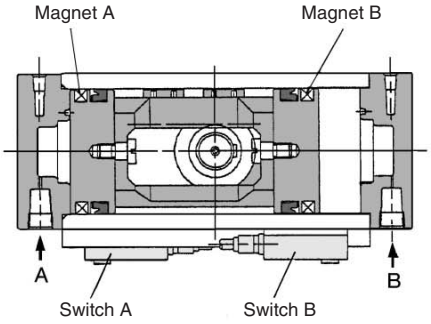


Size: 50 to 100
CDRA1□□50 to 100



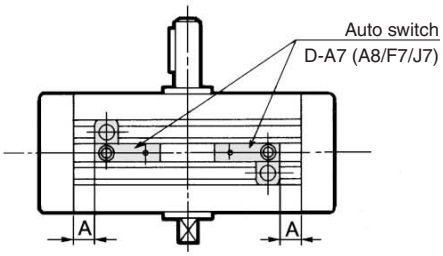
Working Principle

In the diagram below, switch B is ON. When pressure is applied from A, the piston moves to B, causing the shaft to rotate clockwise. At this time, magnet B goes out of the movement range of switch B, causing switch B to turn OFF. Furthermore, the piston moves to the right, causing magnet A to enter the movement range of switch A. As a result, switch A turns ON.

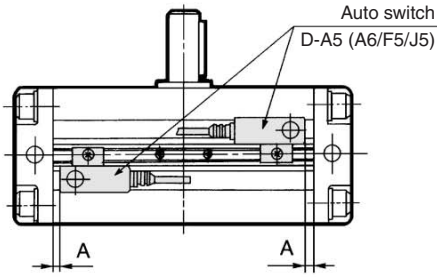


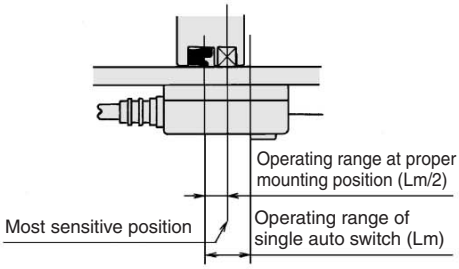
Proper Auto Switch Mounting Position at Rotation End

CDRA1□W30



CDRA1□□50 to 100





Operating angle θ m: Converts the operating range (Lm) of the auto switch into the rotation angle.
Angle of hysteresis: The hysteresis of the auto switch is converted to degrees.

Model	A (mm)	Operating angle θ m	Hysteresis angle (1)
CDRA1□W30-90	9 (19)	95°	20°
CDRA1□□50-90	9 (26)	65°	20°
CDRA1□□63-90	11 (30)	60°	10°
CDRA1□□80-90	15 (37)	45°	7°
CDRA1□□100-90	27 (60)	35°	5°

∗ The dimensions inside ( ) are for 180°.
∗∗ Up to 2 auto switches can be mounted per actuator. The dimensions in the table are the values that represent the most sensitive positions of the auto switches. Thus, they are not the dimensions that represent the mounting position at the time of shipment.
★ Please consult with SMC concerning the angles for the auto switches other than the models D-A73 and D-A53.

Auto Switch Specifications/Refer to page 11-11-1 for further information on auto switch single body.

Type	Model	Electrical entry	Features	Applicable size
Reed switch	D-A80	Grommet (Perpendicular)	Without indicator light	30
	D-A80H	Grommet (In-line)		
	D-A80C	Connector (In-line)		
	D-A64	Grommet (In-line)	Without indicator light, built-in contact protection circuit	50 to 100
	D-A67	Grommet (In-line)	Without indicator light	
Solid state switch	D-F7NTL	Grommet (In-line)	With timer	30
	D-F5NTL	Grommet (In-line)		50 to 100

∗ With pre-wire connector is also available for D-F5NTL, D-F7NTL. For details, refer to pages 11-11-34 to 35.

Sets of Mounting Screws for Auto Switch (Round head Phillips screw, Hexagon nut)

Model	Part no.
CDRA1□W30	P294010-24
CDRA1□□50 to 100	P294020-24

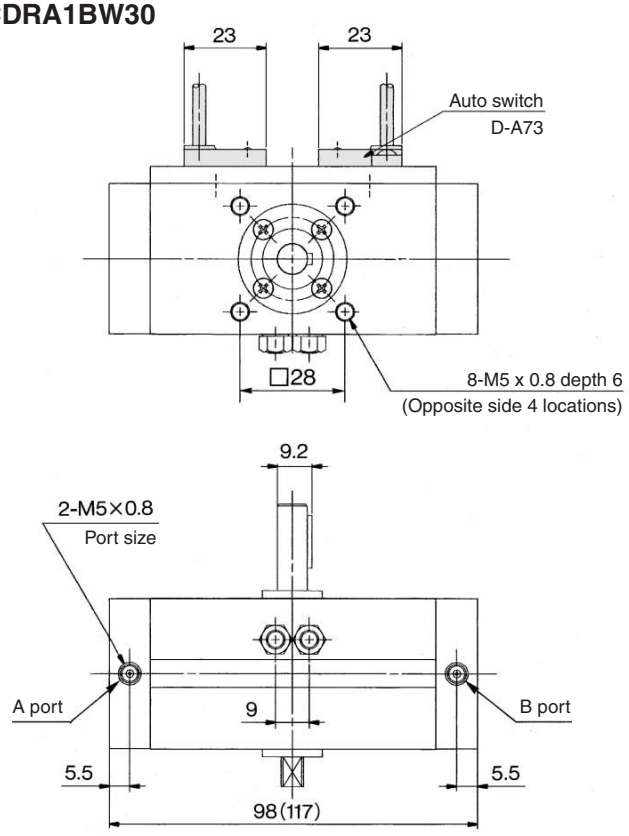
Note 1) The above part numbers include 2 pieces of mounting screws and 2 pieces of nuts.
Note 2) To order a set for 1 unit, the ordering quantity should be "1".

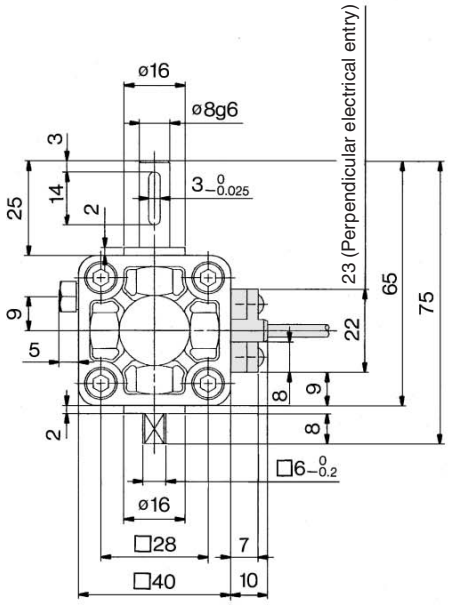
Size 30/Basic Style: CDRA1BW, Foot Style: CDRA1LW

This drawing is for 90° specifications.

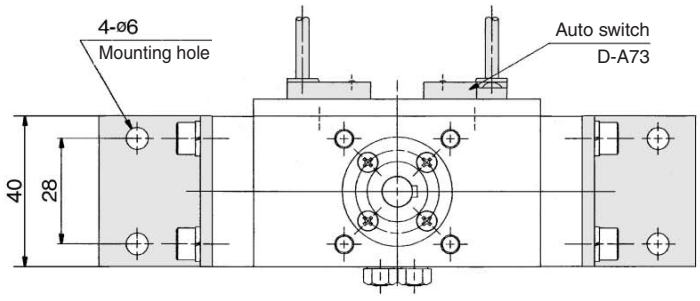
CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

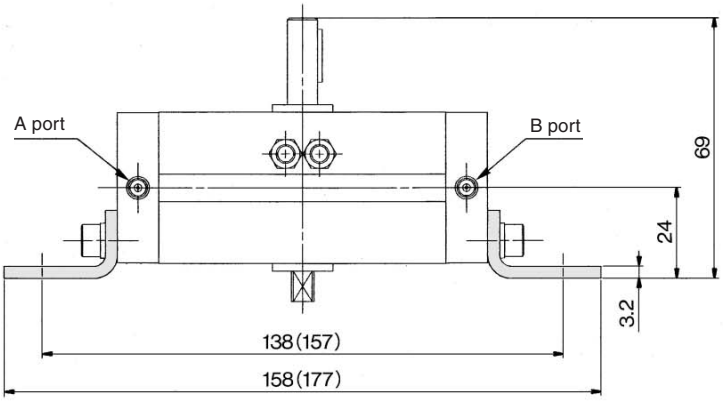
With auto switch
Basic style: CDRA1BW30





Foot style: CDRA1LW30

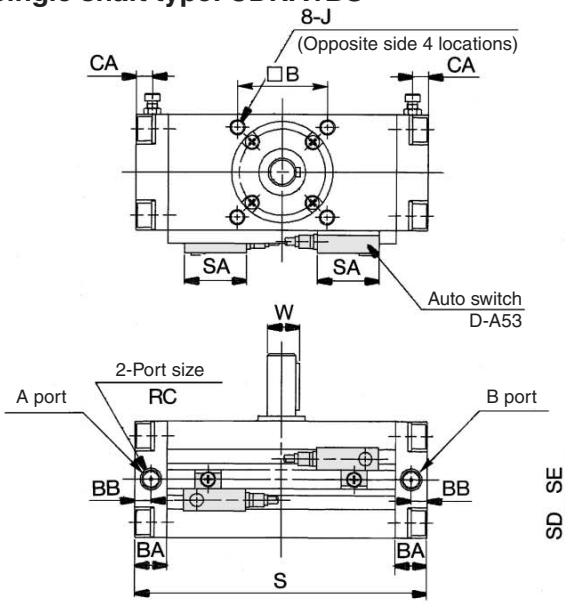




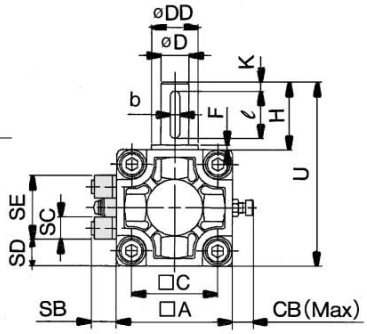
∗ ( ) are the dimensions for rotation of 180°.
⋆ The dimensions below show pressurization to B port.

Size 50, 63, 80, 100/Basic Style: CRA1B□

With auto switch
Single shaft type: CDRA1BS

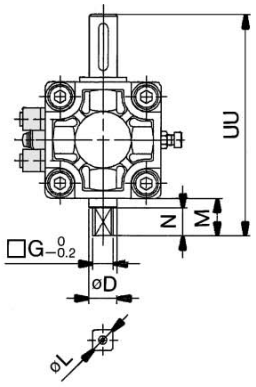


Single shaft



Double shaft type: CDRA1BW

Double shaft



Double Shaft Type

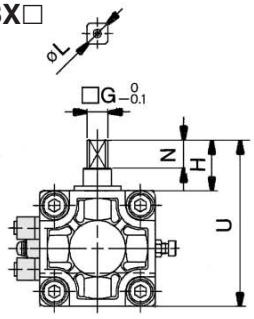
Model	D(g6)	G	M	N	UU	L
CDRA1BW50	15	11	20	15	118	14
CDRA1BW63	17	13	22	17	139	16
CDRA1BW80	20	15	25	20	167	19
CDRA1BW100	25	19	30	25	202	24

Single Shaft Type

⋆ The dimensions below show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

Model	Port size Rc	A	B	C	D (g6)	DD (h9)	F	H	J	K	S	U	W	BA	BB	CA	CB	SA	SB	SC	SD	SE	Keyway dimensions b	Keyway dimensions ℓ
CDRA1BS50	1/8	62	48	46	15	25	2.5	36	M8 x 1.25 depth 8	5	156 (189)	98	17	17	8.5	8.5	13	33	13.5	12	14	34	5 $^{0}_{-0.030}$	25
CDRA1BS63	1/8	76	60	57	17	30	2.5	41	M10 x 1.5 depth 12	5	175 (213.5)	117	19.5	20	10	10	14	33	14.5	12	21	34	6 $^{0}_{-0.030}$	30
CDRA1BS80	1/4	92	72	70	20	35	3	50	M12 x 1.75 depth 13	5	199 (243)	142	22.5	23.5	12	12	18	33	15.5	12	29	34	6 $^{0}_{-0.030}$	40
CDRA1BS100	3/8	112	85	85	25	40	4	60	M12 x 1.75 depth 14	5	259 (325)	172	28	25	12.5	12.5	18	33	16	12	39	34	8 $^{0}_{-0.036}$	45

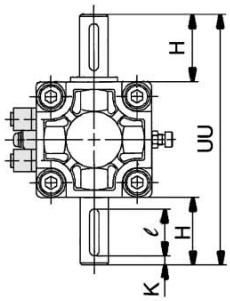
Single shaft with four chamfers: CDRA1BX□



Note) Other dimensions are the same as the single shaft.

Model	G	H	N	U	L
CDRA1BX□50	11	27	15	89	14
CDRA1BX□63	13	29	17	105	16
CDRA1BX□80	15	38	20	130	19
CDRA1BX□100	19	44	25	156	24

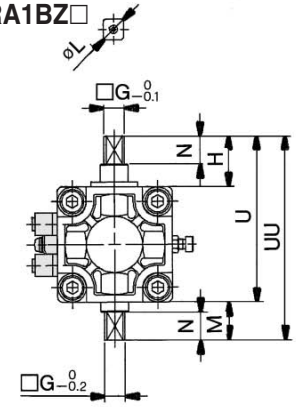
Double shaft key: CDRA1BY□



Note) Other dimensions are the same as the single shaft.

Model	H	K	UU	ℓ
CDRA1BY□50	36	5	134	25
CDRA1BY□63	41	5	158	30
CDRA1BY□80	50	5	192	40
CDRA1BY□100	60	5	232	45

Double shaft with four chamfers: CDRA1BZ□

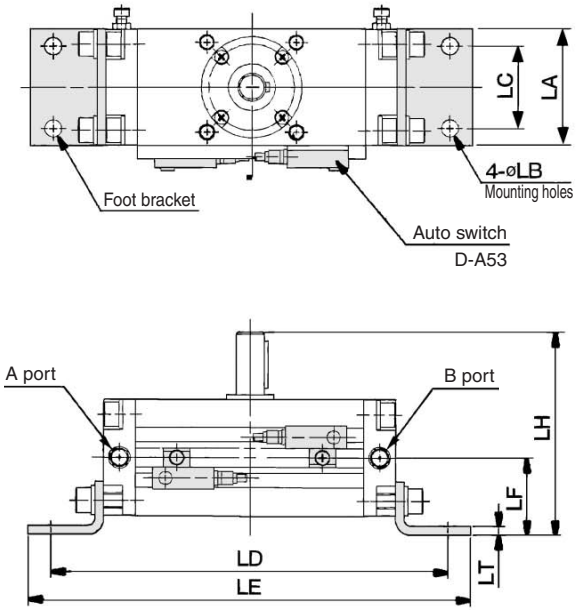


Note) Other dimensions are the same as the single shaft.

Model	G	H	M	N	U	UU	L
CDRA1BZ□50	11	27	20	15	89	109	14
CDRA1BZ□63	13	29	22	17	105	127	16
CDRA1BZ□80	15	38	25	20	130	155	19
CDRA1BZ□100	19	44	30	25	156	186	24

Size 50, 63, 80, 100/Foot Style: CDRA1L, Flange Style: CDRA1F

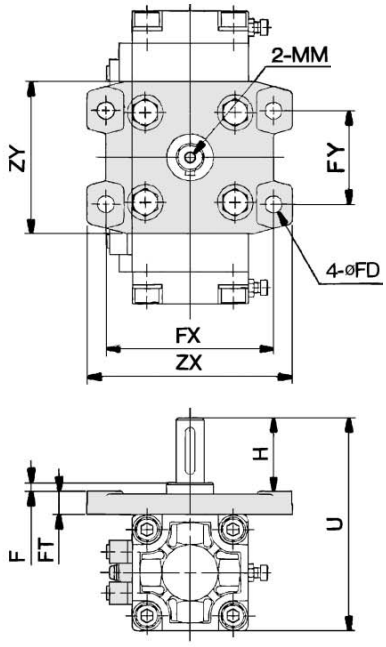
Foot style: CDRA1L□



★Dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

Model	LA	LB	LC	LD	LE	LF	LH	LT
CDRA1L□□50	62	9	44	212 (245)	236 (269)	41	108	4.5
CDRA1L□□63	76	11	55	247 (285.5)	275 (313.5)	48	127	5
CDRA1L□□80	92	13	67	287 (331)	329 (373)	58	154	6
CDRA1L□□100	112	13	87	347 (413)	389 (455)	73.5	189.5	6

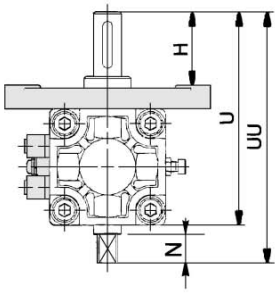
Flange style
Single shaft: CRA1FS



Note) Other dimensions are the same as standard.

Model	F	H	MM	U	FD	FT	FX	FY	ZX	ZY
CDRA1F□□50	4	39	M 6 x 1.0 depth 12	114	9	13	90	50	110	81
CDRA1F□□63	5	45	M 6 x 1.0 depth 12	136	11.5	15	105	59	130	101
CDRA1F□□80	5	55	M8 x 1.25 depth 16	165	13.5	18	130	76	160	119
CDRA1F□□100	5	60	M10 x 1.5 depth 20	190	13.5	18	150	92	180	133

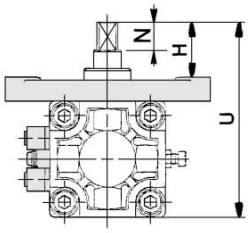
Flange style
Double shaft: CDRA1FW



Note) Other dimensions are the same as the single shaft.

Model	H	N	U	UU
CDRA1FW□50	39	15	114	134
CDRA1FW□63	45	17	136	158
CDRA1FW□80	55	20	165	190
CDRA1FW□100	60	25	190	220

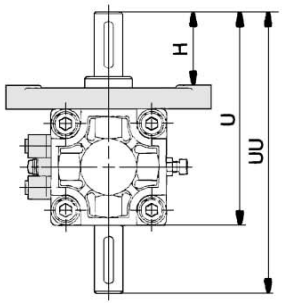
Flange style
Single shaft with four chamfers: CDRA1FX



Note) Other dimensions are the same as the single shaft.

Model	H	N	U
CDRA1FX□50	30	15	105
CDRA1FX□63	33	17	124
CDRA1FX□80	43	20	153
CDRA1FX□100	44	25	174

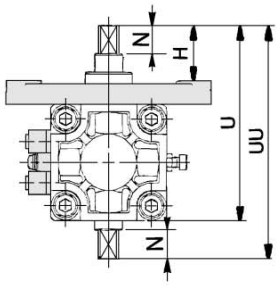
Flange style
Double shaft key: CDRA1FY



Note) Other dimensions are the same as the single shaft.

Model	H	U	UU
CDRA1FY□50	39	114	150
CDRA1FY□63	45	136	177
CDRA1FY□80	55	165	215
CDRA1FY□100	60	190	250

Flange style
Double shaft with four chamfers: CDRA1FZ



Note) Other dimensions are the same as the single shaft.

Model	H	N	U	UU
CDRA1FZ□50	30	15	105	125
CDRA1FZ□63	33	17	124	146
CDRA1FZ□80	43	20	153	178
CDRA1FZ□100	44	25	174	204

Rotary Actuator with Solenoid Valve
Rack & Pinion Style
Series CVRA1
Size: 50, 63, 80, 100

How to Order

Electrical entry

G	Grommet (Lead wire: 300 mm)	
H	Grommet (Lead wire: 600 mm)	
E	Grommet terminal	
T	Conduit terminal	
D	DIN terminal	
L	L plug connector	With lead wire
LN		Without lead wire
LO		Without connector
M	M plug connector	With lead wire
MN		Without lead wire
MO		Without connector

Light/Surge voltage suppressor

Nil	None
Z *	With light/surge voltage suppressor
S *	With surge voltage suppressor

* Light attached type (Z) is not available for grommet type. Surge voltage suppressor attached type is available only for grommet type.

Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	110 to 120 VAC, 50/60 Hz
4	220 VAC, 50/60 Hz
5	24 VDC
6	12 VDC
7	240 VAC, 50/60 Hz
9	Other

Solenoid valve configuration

1	Single solenoid
2	Double solenoid
3	Closed center
4	Exhaust center
5	Pressure center

Manual override

Nil	None
B	Locking B type
C	Locking C type

Without auto switch CVRA1 | B | S | | 50 | 90 | | 1 | 1 | G | | |

With auto switch CDVRA1 | B | S | | 50 | 90 | | 1 | 1 | G | | | J59W | S

Built-in magnet

With solenoid valve

Mounting style

B	Basic style
L	Foot style

Note) No flange style "F" is available.

Shaft type

S	Single shaft
W	Double shaft
X	Single shaft with four chamfers
Y	Double shaft key
Z	Double shaft with four chamfers

Type

Nil	Standard
U	Angle adjustable

Size

50
63
80
100

Cushion

Nil	None
C *	With cushion

* Except angle adjustable type "U".

Rotating angle

Standard	90	90°
	180	180°
Option	100	100°
	190	190°

Auto switch

* For the applicable auto switch model, refer to the table below.
* Auto switches are shipped together, (but not assembled).

Number of auto switches

S	1 pc.
Nil	2 pcs.

Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC	Load voltage AC	Auto switch model	Lead wire length * (m) 0.5 (Nil)	3 (L)	5 (Z)	Pre-wire connector	Applicable load	
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	5 V	—	A56	●	●	—	—	IC circuit	—
				2-wire	12 V	—	A53	●	●	●	—	—	Relay, PLC
					24 V	100 V, 200 V	A54	●	●	●	—		
	Diagnosis indication (2-color)				—	—	A59 W	●	●	—	—		
Solid state switch	—	Grommet	Yes	3-wire (NPN)	5 V, 12 V	—	F59	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)			F5P	●	●	○	○		
				2-wire	12 V		J59	●	●	○	○	—	
					—	100 V, 200 V	J51	●	●	○	—		
	Diagnosis indication (2-color)			3-wire (NPN)	5 V, 12 V	—	F59 W	●	●	○	○	IC circuit	
				3-wire (PNP)			F5PW	●	●	○	○		
				2-wire	24 V		J59 W	●	●	○	○	—	
	Water resistant (2-color)						F5BA **	—	●	○	○		
	Diagnosis output (2-color)			4-wire (NPN)	5 V, 12 V		F59F	●	●	○	○	IC circuit	

** Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.

* Lead wire length symbols: 0.5 m·····Nil (Example) A53
3 m····· L (Example) A53L
5 m····· Z (Example) A53Z

* Auto switches marked with "○" are made-to-order specifications.

Made to Order Refer to page 11-11-36 for detailed solid state switches with pre-wire connectors.

⚠ Caution

Be sure to read before handling. Refer to pages 11-13-3 to 4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to pages 11-1-4 to 6 for Precautions on every series.

Specifications

Fluid		Air	
Proof pressure		1.35 MPa	
Max. operating pressure		0.9 MPa	
Min. operating pressure		0.15 MPa	
Ambient and fluid temperature		0°C to 50°C (No freezing)	
Lubrication		Non-lube	
Mounting		Basic style, Foot style	
Solenoid valve part no.		VF3□ 20-□□□□-02-X14	
Electrical entry		Grommet, Grommet terminal, Conduit terminal, DIN terminal, L plug connector, M plug connector	
Coil rated voltage	AC	100, 200 V (50/60 Hz)	
	DC	24 V	
Allowable voltage change		–15 to +10% of the rated voltage	
Coil insulation		Equivalent to B class (130°C)	
Power consumption	AC	Inrush	5.6 VA (50 Hz), 5.0 VA (60 Hz)
		Holding	3.4 VA (50 Hz), 2.3 VA (60 Hz)
Apparent current	DC	1.8 W	

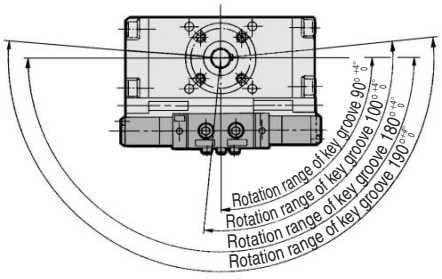
Weight

(kg)

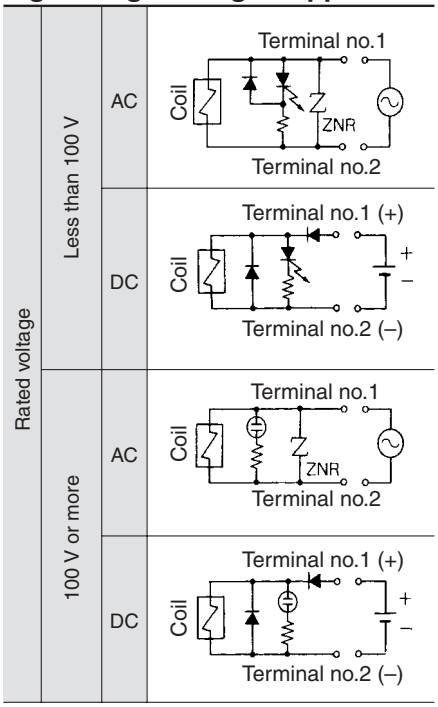
Model	Additional weight	No. of positions/solenoids				
		2 position single	2 position double	3 position closed center	3 position exhaust center	3 position pressure center
CVRA1□□50 to 100	0.2	0.2	0.3	0.4	0.4	0.4

How to calculate weight
Weight = Basic weight * + Add'l weight + No. of positions/solenoids
* Refer to page 11-7-3 for basic weight.

Rotation Range of Keygrooves Solenoid Valve Mounting Positions



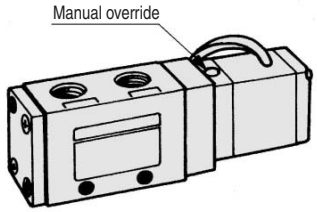
Light/Surge Voltage Suppressor



Note) Light is not available on grommet type.

Manual Override

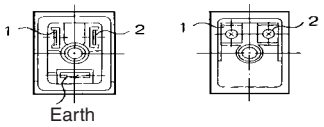
Non-locking push style is standard.



Electrical Wiring

The DIN terminal and the terminal pin (with light/surge voltage suppressor) are connected internally as shown below. Therefore, connect them the respective power supply terminals.

DIN terminal **With terminal block**



Terminal no.	1	2
DIN connector	+	–
Terminal connector	+	–

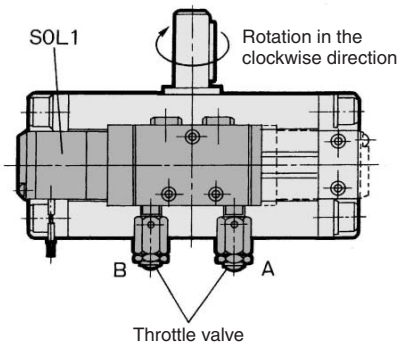
Instant Energizing Time

To operate the double solenoid type by applying an instantaneous current, ensure that the current is applied for at least 0.1 second.

How to Adjust the Rotation Speed

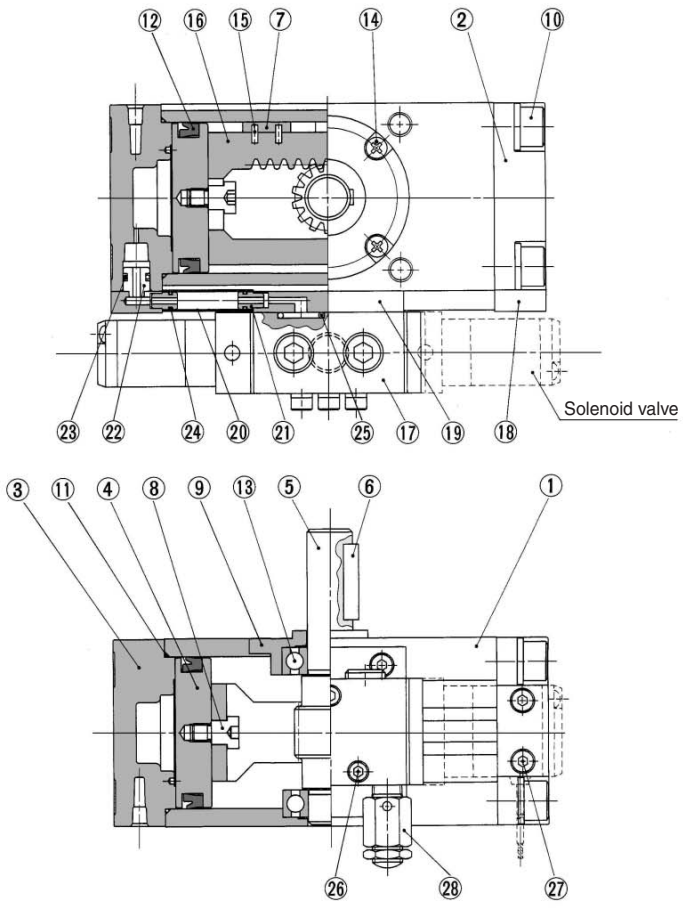
Rotation direction
When current is applied to SOL1, the shaft rotates clockwise.

How to adjust the rotation speed:
Turn the needle valve of the throttle valve clockwise to reduce the exhaust flow volume, thus slowing the rotation speed.
Throttle valve A regulates the clockwise rotation speed of the shaft and throttle valve B regulates the counterclockwise speed to the shaft.

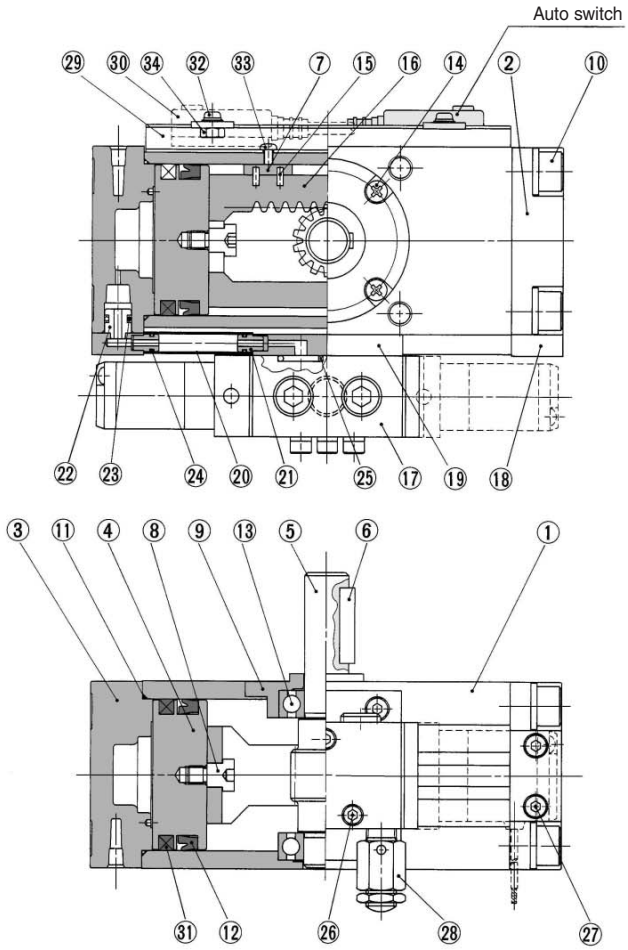


Construction

With solenoid valve



With solenoid valve and auto switch



Component Parts

No.	Description	Material	Note
①	Body	Aluminum alloy	Hard anodized
②	Right cover	Aluminum alloy	Black anodized
③	Left cover	Aluminum alloy	Black anodized
④	Piston	Aluminum alloy	Chromated
⑤	Shaft	Chrome molybdenum steel	
⑥	Parallel keyway	Carbon steel	
⑦	Slider	Resin	
⑧	Connecting screw	Carbon steel	Zinc chromated
⑨	Bearing retainer	Aluminum alloy	Black anodized
⑩	Hexagon socket head cap screw with spring washer	Chromium molybdenum steel	Black zinc chromated
⑪	Tube gasket	NBR	
⑫	Piston seal	NBR	
⑬	Bearing	Bearing steel	
⑭	Round head Phillips screw	Steel wire	Black zinc chromated
⑮	Spring pin	Steel wire	
⑯	Rack	Carbon steel	Nitrided
⑰	Solenoid valve		

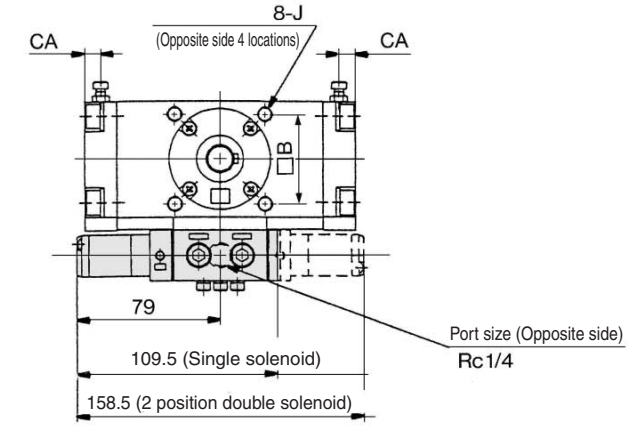
No.	Description	Material	Note
⑱	Sub-plate	Aluminum alloy	Black anodized
⑲	Sub-plate	Aluminum alloy	Black anodized
⑳	Pipe	Stainless steel	
㉑	Fitting	Aluminum alloy	Chromated
㉒	Fitting	Aluminum alloy	Chromated
㉓	O-ring	NBR	
㉔	O-ring	NBR	
㉕	O-ring	NBR	
㉖	Hexagon socket head cap screw	Steel wire	Black dyed
㉗	Hexagon socket head cap screw	Steel wire	Black dyed
㉘	Metal valve	Stainless steel	
㉙	Switch mounting rail	Aluminum alloy	
㉚	Auto switch		
㉛	Plastic magnet	Magnetic material	
㉜	Round head Phillips screw	Steel wire	Nickel plated
㉝	Round head Phillips screw	Steel wire	Nickel plated
㉞	Hexagon nut	Steel wire	Nickel plated

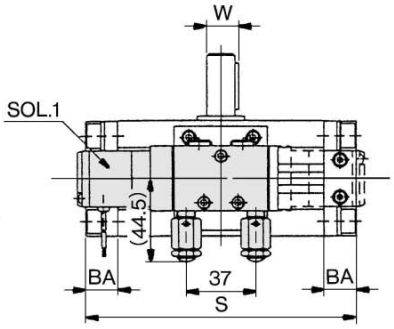
Replacement Parts (The corresponding parts shown below are sets.)

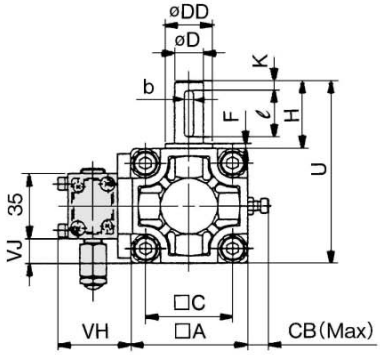
Size (Type)	With solenoid valve, With solenoid valve auto switch
C□VRA1□□50	P294020-49A
C□VRA1□□63	P294030-49A
C□VRA1□□80	P294040-49
C□VRA1□□100	P294050-49A
Corresponding parts no.	⑦, ⑪, ⑫, ⑮, ㉓, ㉔, ㉕ are set.

Size 50, 63, 80, 100/Basic Style: CVRA1BS50 to 100

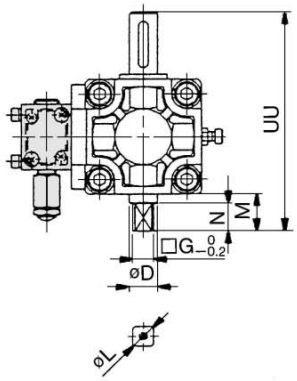
Single shaft type: CVRA1BS□50 to 100







Double shaft type: CVRA1BW□



CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

Double Shaft Type

(mm)

Model	D (g6)	G	M	N	UU	L
CVRA1BW□50	15	11	20	15	118	14
CVRA1BW□63	17	13	22	17	139	16
CVRA1BW□80	20	15	25	20	167	19
CVRA1BW□100	25	19	30	25	202	24

Single Shaft Type

(mm)

Model	A	B	BA	C	CA	CB	D (g6)	DD (h9)	F	H	J	K	S *	U	W	Valve dimensions		Keyway dimensions	
																VH	VJ	b	ℓ
CVRA1BS□50	62	48	17	46	8.5	13	15	25	2.5	36	M8 x 1.25 depth 8	5	144 (177)	98	17	39	13.5	$5^{0}_{-0.030}$	25
CVRA1BS□63	76	60	20	57	10	14	17	30	2.5	41	M10 x 1.5 depth 12	5	163 (201.5)	117	19.5	39	20.5	$6^{0}_{-0.030}$	30
CVRA1BS□80	92	72	23.5	70	12	18	20	35	3	50	M12 x 1.75 depth 13	5	186 (230)	142	22.5	43	28.5	$6^{0}_{-0.030}$	40
CVRA1BS□100	112	85	25	85	12.5	18	25	40	4	60	M12 x 1.75 depth 14	5	245 (311)	172	28	43	38.5	$8^{0}_{-0.036}$	45

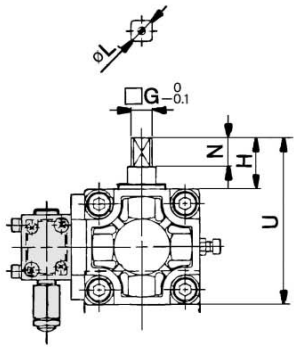
* ( ) are the dimensions for rotation of 180° and 190°.

Port Size

Model	Port size
CVRA1BS□50	Rc 1/4
CVRA1BS□63	Rc 1/4
CVRA1BS□80	Rc 1/4
CVRA1BS□100	Rc 1/4

Size 50, 63, 80, 100/Basic Style: CVRA1B, Foot Style: CVRA1L

Single shaft with four chamfers: CVRA1BX□

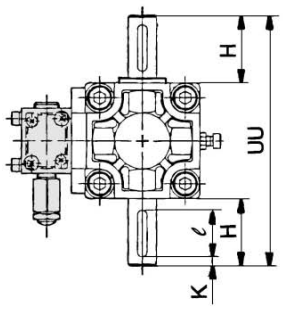


(mm)

Model	G	H	L	N	U
CVRA1BX□50	11	27	14	15	89
CVRA1BX□63	13	29	16	17	105
CVRA1BX□80	15	38	19	20	130
CVRA1BX□100	19	44	24	25	156

Note) Other dimensions are the same as the single shaft.

Double shaft key: CVRA1BY□

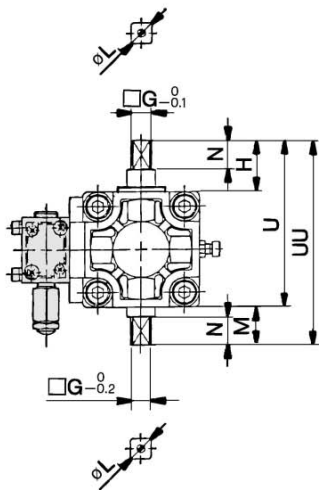


(mm)

Model	ℓ	H	K	UU
CVRA1BY□50	25	36	5	134
CVRA1BY□63	30	41	5	158
CVRA1BY□80	40	50	5	192
CVRA1BY□100	45	60	5	232

Note) Other dimensions are the same as the single shaft.

Double shaft with four chamfers: CVRA1BZ□

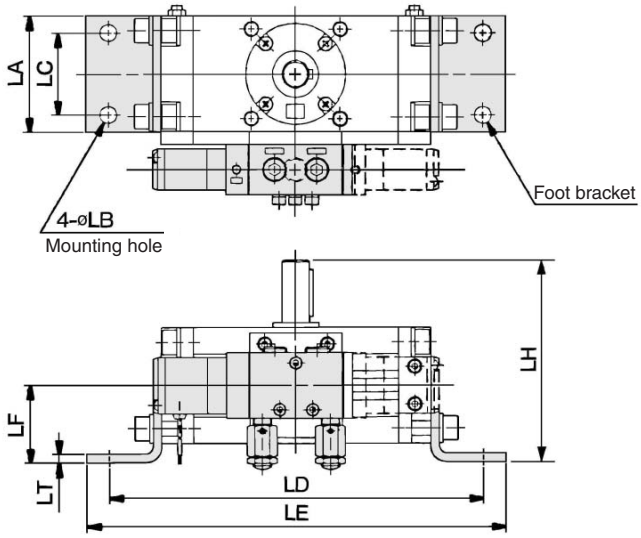


(mm)

Model	G	H	L	M	N	U	UU
CVRA1BZ□50	11	27	14	20	15	89	109
CVRA1BZ□63	13	29	16	22	17	105	127
CVRA1BZ□80	15	38	19	25	20	130	155
CVRA1BZ□100	19	44	24	30	25	156	186

Note) Other dimensions are the same as the single shaft.

Foot style: CVRA1L□□



★The dimensions below show pressurization to B port.

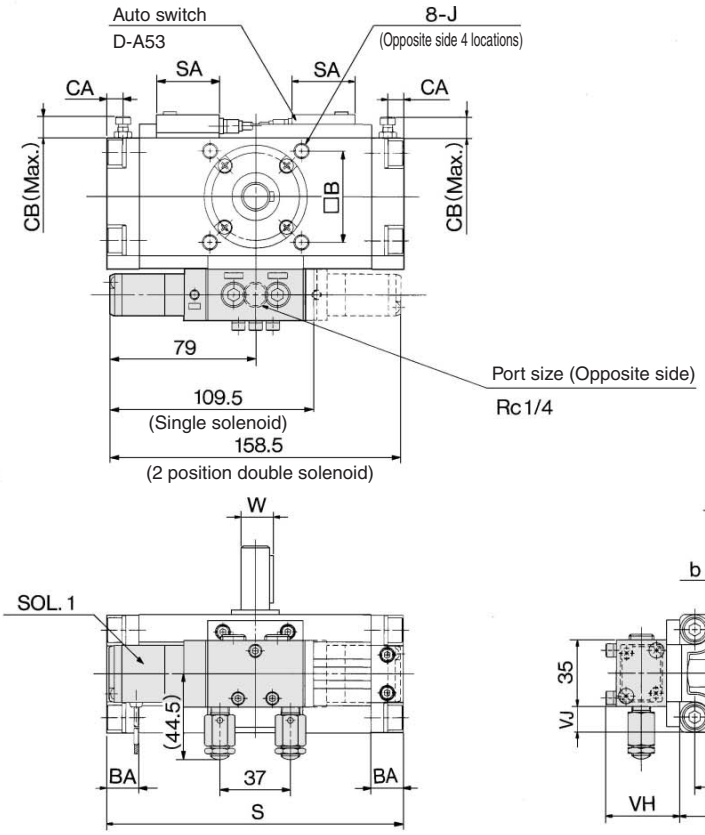
(mm)

Model	LA	LB	LC	LD	LE	LF	LH	LT
CVRA1L□□50	62	9	44	200 (233)	224 (257)	41	108	4.5
CVRA1L□□63	76	11	55	235 (273.5)	263 (301.5)	48	127	5
CVRA1L□□80	92	13	67	274 (318)	316 (360)	58	154	6
CVRA1L□□100	112	13	87	333 (399)	375 (441)	73.5	189.5	6

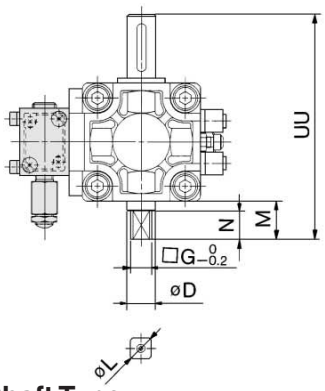
∗ ( ) are the dimensions for rotation of 180° and 190°.
Note) Other dimensions are the same as the single shaft.

Size 50, 63, 80, 100/Basic Style: CDVRA1BS50 to 100

Single shaft type: CDVRA1BS□50 to 100



Double shaft type: CDVRA1BW□



Double Shaft Type

(mm)

Model	D (g6)	G	M	N	UU	øL
CDVRA1BW□50	15	11	20	15	118	14
CDVRA1BW□63	17	13	22	17	139	16
CDVRA1BW□80	20	15	25	20	167	19
CDVRA1BW□100	25	19	30	25	202	24

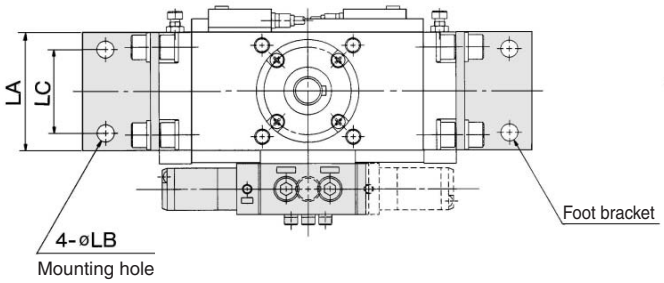
Single Shaft Type

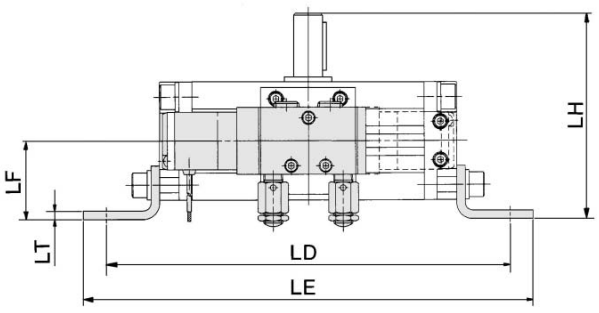
(mm)

Model	A	B	BA	C	CA	CB	øD (g6)	øDD (h9)	F	H	J	K	S	U	W	SA	SB	SC	SD	SE	Valve dimensions VH	Valve dimensions VJ	Keyway dimensions b	Keyway dimensions ℓ
CDVRA1BS□50	62	48	17	46	8.5	13	15	25	2.5	36	M8 x 1.25 depth 8	5	156 (189)	98	17	33	13.5	12	14	34	39	13.5	5 0 −0.030	25
CDVRA1BS□63	76	60	20	57	10	14	17	30	2.5	41	M10 x 1.5 depth 12	5	175 (213.5)	117	19.5	33	14.5	12	21	34	39	20.5	6 0 −0.030	30
CDVRA1BS□80	92	72	23.5	70	12	18	20	35	3	50	M12 x 1.75 depth 13	5	199 (243)	142	22.5	33	15.5	12	29	34	43	28.5	6 0 −0.030	40
CDVRA1BS□100	112	85	25	85	12.5	18	25	40	4	60	M12 x 1.75 depth 14	5	259 (325)	172	28	33	16	12	39	34	43	38.5	8 0 −0.036	45

∗ ( ) are the dimensions for rotation of 180° and 190°.

Foot style: CDVRA1L□□





(mm)

Model	LA	LB	LC	LD	LE	LF	LH	LT
CDVRA1L□□50	62	9	44	212 (245)	236 (269)	41	108	4.5
CDVRA1L□□63	76	11	55	247 (285.5)	275 (313.5)	48	127	5
CDVRA1L□□80	92	13	67	287 (331)	329 (373)	58	154	6
CDVRA1L□□100	112	13	87	347 (413)	389 (455)	73.5	189.5	6

∗ ( ) are the dimensions for rotation of 180° and 190°.

Rotary Actuator: Angle Adjustable Type
Rack & Pinion Style

Series CRA1□□U

Size: 50, 63, 80, 100

∗ Angle adjusting mechanism is provided as standard.

How to Order

Without auto switch

CRA1 **B** **S** **U** **50** — **90**

With auto switch

CDRA1 **B** **S** **U** **50** — **90** — **J59 W** **S**

Built-in magnet

Mounting style

B	Basic style
L∗	Foot style
F	Flange style

∗ For part numbers, refer to the tables below.

Shaft type

Standard	**S**	Single shaft
	W	Double shaft
Option	**X**	Single shaft with four chamfers
	Y	Double shaft key
	Z	Double shaft with four chamfers

Size

50
63
80
100

Angle adjustable type

Rotating angle

Standard	**90**	90°
	180	180°
Option	**100**	100°
	190	190°

Auto switch

∗ For the applicable auto switch model, refer to the table below.

∗ Auto switches are shipped together (but not assembled).

Number of auto switches

Nil	2 pcs.
S	1 pc.

Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model	Lead wire ∗ length (m) 0.5 (Nil)	3 (L)	5 (Z)	Pre-wire connector	Applicable load	
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5 V	—	**A56**	●	●	—	—	IC circuit	
				2-wire	24 V	12 V	—	**A53**	●	●	●	—	—	Relay, PLC
						—	100 V, 200 V	**A54**	●	●	●	—		
	Diagnosis indication (2-color)						—	**A59 W**	●	●	—	—		
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**F59**	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				**F5P**	●	●	○	○		
				2-wire		12 V		**J59**	●	●	○	○	—	
					—	—	100 V, 200 V	**J51**	●	●	○	—		
	Diagnosis indication (2-color)			3-wire (NPN)	24 V	5 V, 12 V	—	**F59 W**	●	●	○	○	IC circuit	
				3-wire (PNP)				**F5PW**	●	●	○	○		
				2-wire		—		**J59 W**	●	●	○	○	—	
	Water resistant (2-color)							**F5BA** ∗∗	—	●	○	○		
	Diagnosis output (2-color)			4-wire (NPN)		5 V, 12 V		**F59F**	●	●	○	○	IC circuit	

∗∗ Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) A53
3 m ····· L (Example) A53L
5 m ····· Z (Example) A53Z

∗ Auto switches marked with "O" are made to order specifications.

Made to Order

Refer to page 11-11-36 for detailed solid state switches with pre-wire connectors.

Specifications

Fluid	Air (Non-lube)
Cushion	None
Mounting	Basic style, Foot style, Flange style
Angle adjustable range	0° to 90°
Backlash	Within 1°

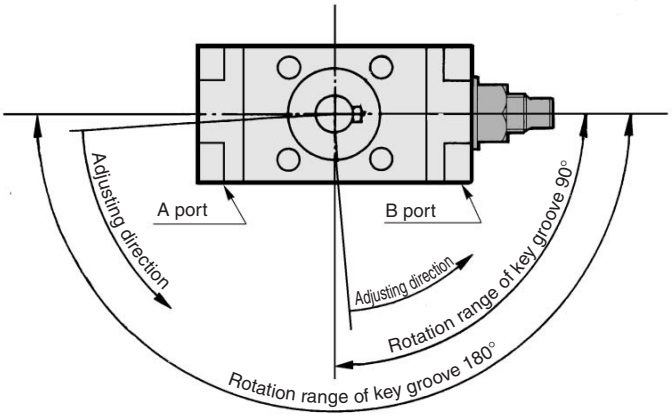
Weight

(kg)

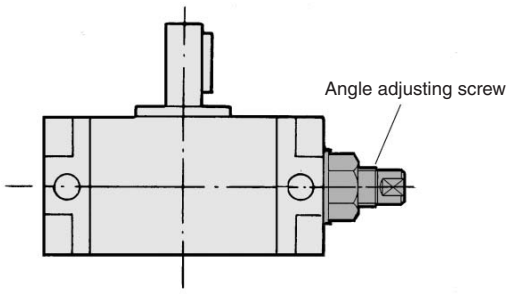
Model	Standard weight		Additional weight
	90°	180°	
CRA1□□U50	1.5	1.7	0.5
CRA1□□U63	2.5	3.0	0.8
CRA1□□U80	4.3	5.0	1.5
CRA1□□U100	8.5	9.5	2.0

Rotation Range of Key Groove

Adjusting direction is in the direction the arrows show.
Adjusting angle at 90° at maximum.
90° type: 90° to 0°, 180° type: 180° to 90°



How to Adjust Angle



Rotation angle becomes smaller by tightening the angle adjusting screw to the right.

Adjusting Angle per One Rotation of Angle Adjusting Screw

Size	**50**	**63**	**80**	**100**
Adjusting angle	8.2°	7.0°	6.1°	4.1°

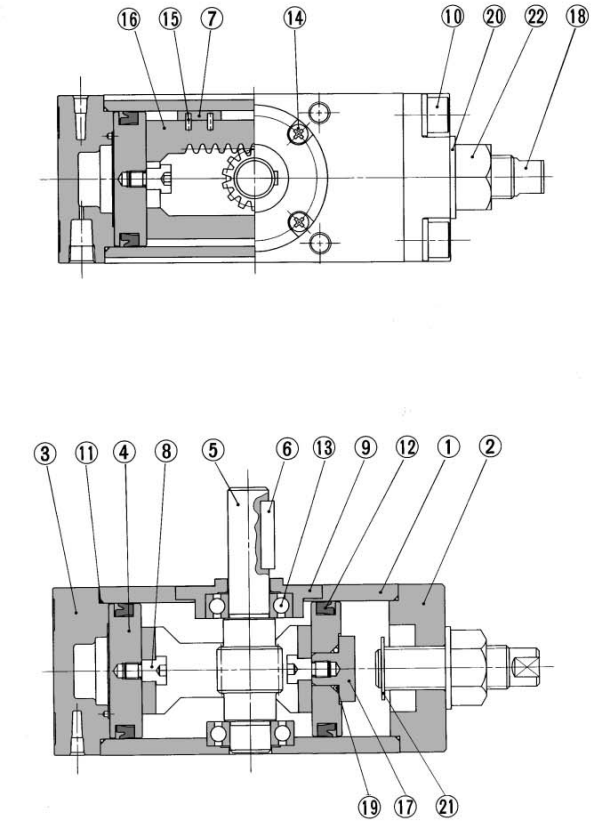
Foot Bracket Part No.

Size	Foot
50	P294020-25
63	P294030-25
80	P294040-25
100	P294050-25

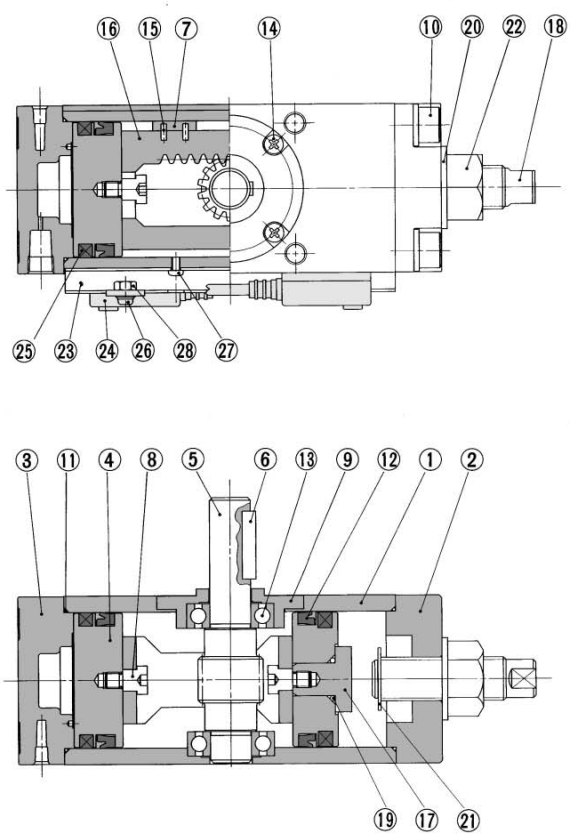
Note) Part no. in the table includes mounting screw.

Construction

Standard: CRA1□□U



With auto switch: CDRA1□□U



Component Parts

No.	Description	Material	Note
①	Body	Aluminum alloy	Hard anodized
②	Right cover	Carbon steel	Black zinc chromated
③	Left cover	Aluminum alloy	Black anodized
④	Piston	Aluminum alloy	Chromated
⑤	Shaft	Chrome molybdenum steel	
⑥	Parallel keyway	Carbon steel	
⑦	Slider	Resin	
⑧	Connecting screw	Carbon steel	Zinc chromated
⑨	Bearing retainer	Aluminum alloy	Black anodized
⑩	Hexagon socket head cap screw with spring washer	Chrome molybdenum steel	Black zinc chromated
⑪	Tube gasket	NBR	
⑫	Piston seal	NBR	
⑬	Bearing	Bearing steel	
⑭	Round head Phillips screw	Steel wire	Black zinc chromated

No.	Description	Material	Note
⑮	Spring pin	Steel wire	
⑯	Rack	Carbon steel	Nitrided
⑰	Stopper	Carbon steel	Zinc chromated
⑱	Stopper screw	Carbon steel	Black zinc chromated
⑲	O-ring	NBR	
⑳	Seal washer	NBR	
㉑	E type stopper ring	Steel wire	Chromated
㉒	Hexagon nut	Steel wire	Nickel plated
㉓	Switch mounting rail	Aluminum alloy	
㉔	Auto switch		
㉕	Plastic magnet	Magnetic material	
㉖	Round head Phillips screw	Steel wire	Nickel plated
㉗	Round head Phillips screw	Steel wire	Nickel plated
㉘	Hexagon nut	Steel wire	Nickel plated

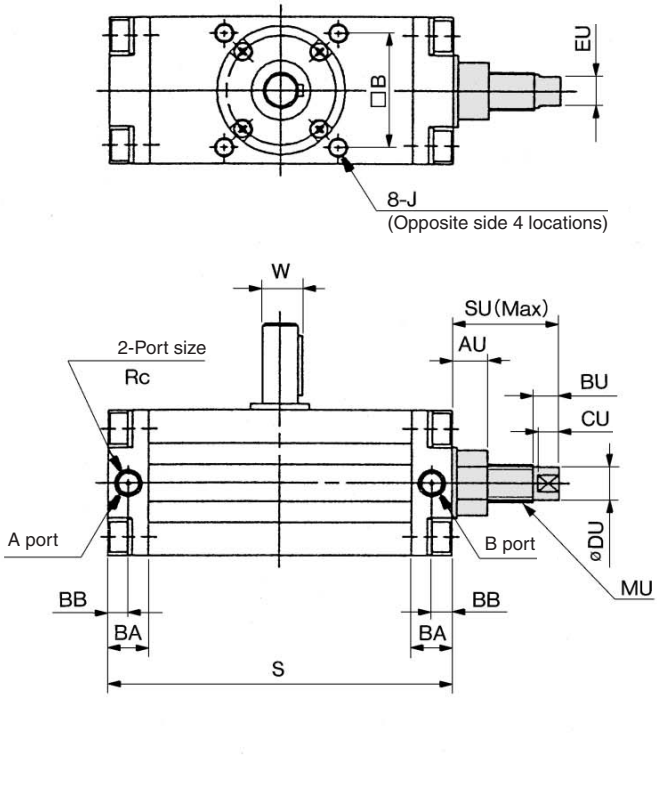
Replacement Parts (The corresponding parts shown below are set.)

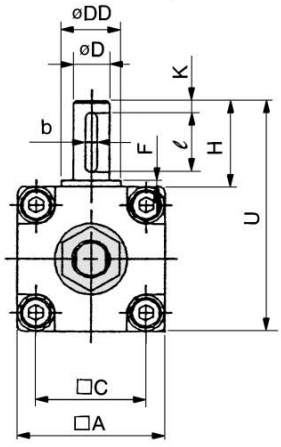
Size (Type)	With angle adjuster, With angle adjuster and auto switch
CRA1□□U50	P294020-22A
CRA1□□U63	P294030-22A
CRA1□□U80	P294040-22
CRA1□□U100	P294050-22A
Corresponding parts no.	⑦, ⑪, ⑫, ⑮, and ⑳ are set.

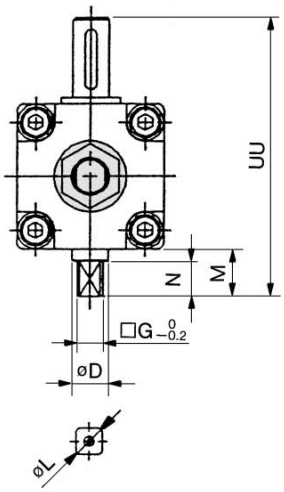
Size 50, 63, 80, 100/Standard: CRA1□□U

★The dimensions below show pressurization to B port.

Single shaft type: CRA1BSU







Double Shaft Type: CRA1BWU (mm)

Model	D (g6)	G	L	M	N	UU
CRA1BWU50	15	11	14	20	15	118
CRA1BWU63	17	13	16	22	17	139
CRA1BWU80	20	15	19	25	20	167
CRA1BWU100	25	19	24	30	25	202

Single Shaft Type

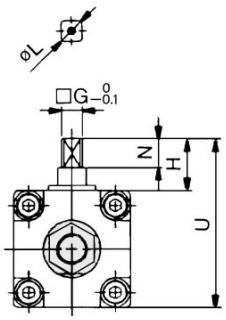
(mm)

Model	Port size Rc	A	AU	B	BA	BB	BU	C	CU	D (g6)	DD (h9)	DU	EU	F	H	J	K	MU	S	SU	U	W	Keyway dimensions b	Keyway dimensions ℓ
CRA1BSU50	1/8	62	15	48	17	8.5	11	46	9	15	25	14	12	2.5	36	M8 x 1.25 depth 8	5	M16 x 1.5	144 (177)	45	98	17	5 0 −0.030	25
CRA1BSU63	1/8	76	19	60	20	10	13	57	11	17	30	18	14	2.5	41	M10 x 1.5 depth 12	5	M20 x 1.5	163 (201.5)	54.5	117	19.5	6 0 −0.030	30
CRA1BSU80	1/4	92	22	72	23.5	12	16	70	13	20	35	22	19	3	50	M12 x 1.75 depth 13	5	M24 x 1.5	186 (230)	62.5	142	22.5	6 0 −0.030	40
CRA1BSU100	3/8	112	22	85	25	12.5	16	85	13	25	40	22	19	4	60	M12 x 1.75 depth 14	5	M24 x 1.5	245 (311)	73.5	172	28	8 0 −0.036	45

∗ ( ) are the dimensions for rotation of 180° and 190°.

Size 50, 63, 80, 100

Single shaft with four chamfers: CRA1BXU□

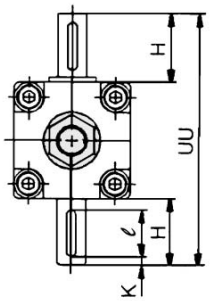


(mm)

Model	G	H	L	N	U
CRA1BXU□50	11	27	14	15	89
CRA1BXU□63	13	29	16	17	105
CRA1BXU□80	15	38	19	20	130
CRA1BXU□100	19	44	24	25	156

Note) Other dimensions are the same as the single shaft.

Double shaft key: CRA1BYU□

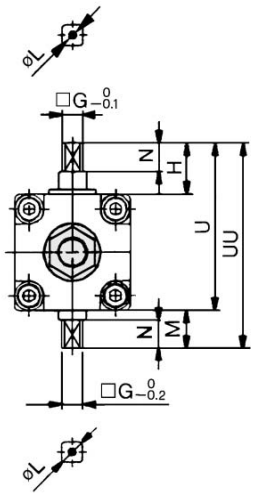


(mm)

Model	ℓ	H	K	UU
CRA1BYU□50	25	36	5	134
CRA1BYU□63	30	41	5	158
CRA1BYU□80	40	50	5	192
CRA1BYU□100	45	60	5	232

Note) Other dimensions are the same as the single shaft.

Double shaft with four chamfers: CRA1BZU□

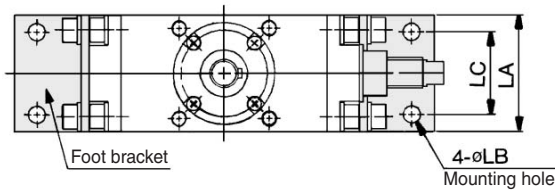


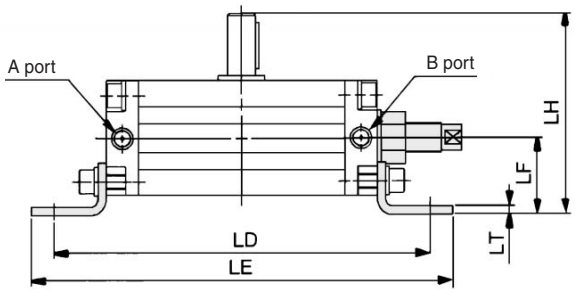
(mm)

Model	G	H	L	M	N	U	UU
CRA1BZU□50	11	27	14	20	15	89	109
CRA1BZU□63	13	29	16	22	17	105	127
CRA1BZU□80	15	38	19	25	20	130	155
CRA1BZU□100	19	44	24	30	25	156	186

Note) Other dimensions are the same as the single shaft.

Foot style: CRA1L□U





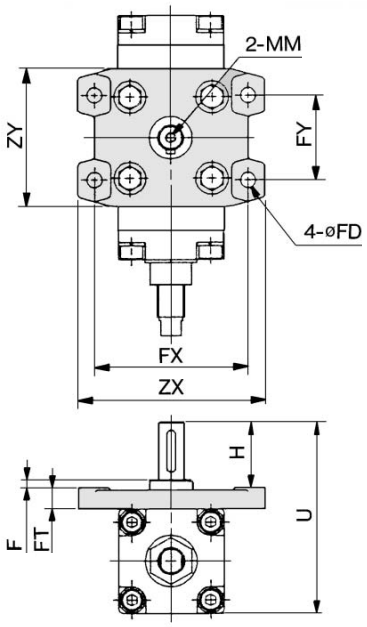
★ The dimensions below show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°. (mm)

Model	LA	LB	LC	LD	LE	LF	LH	LT
CRA1L□U50	62	9	44	200 (233)	224 (257)	41	108	4.5
CRA1L□U63	76	11	55	235 (273.5)	263 (301.5)	48	127	5
CRA1L□U80	92	13	67	274 (318)	316 (360)	58	154	6
CRA1L□U100	112	13	87	333 (399)	375 (441)	73.5	189.5	6

Note) Other dimensions are the same as the single shaft.

Size 50, 63, 80, 100

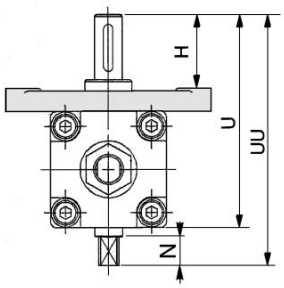
Single shaft flange style: CRA1FSU



Note) Other dimensions are the same as standard. (mm)

Model	F	FD	FT	FX	FY	H	MM	U	ZX	ZY
CRA1F□U50	4	9	13	90	50	39	M6 x 1.0 depth 12	114	110	81
CRA1F□U63	5	11.5	15	105	59	45	M6 x 1.0 depth 12	136	130	101
CRA1F□U80	5	13.5	18	130	76	55	M8 x 1.25 depth 16	165	160	119
CRA1F□U100	5	13.5	18	150	92	60	M 10 x 1.5 depth 20	190	180	133

Flange style Double shaft: CRA1FWU

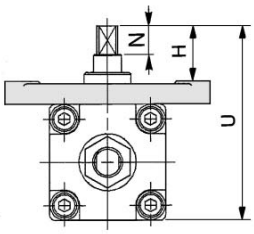


(mm)

Model	H	N	U	UU
CRA1FWU50	39	15	114	134
CRA1FWU63	45	17	136	158
CRA1FWU80	55	20	165	190
CRA1FWU100	60	25	190	220

Note) Other dimensions are the same as the single shaft.

Flange style Single shaft with four chamfers: CRA1FXU

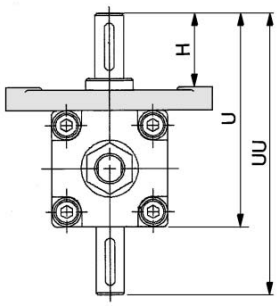


(mm)

Model	H	N	U
CRA1FXU50	30	15	105
CRA1FXU63	33	17	124
CRA1FXU80	43	20	153
CRA1FXU100	44	25	174

Note) Other dimensions are the same as the single shaft.

Flange style Double shaft key: CRA1FYU

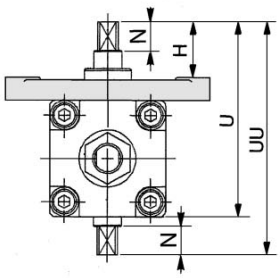


(mm)

Model	H	U	UU
CRA1FYU50	39	114	150
CRA1FYU63	45	136	177
CRA1FYU80	55	165	215
CRA1FYU100	60	190	250

Note) Other dimensions are the same as the single shaft.

Flange style Double shaft with four chamfers: CRA1FZU



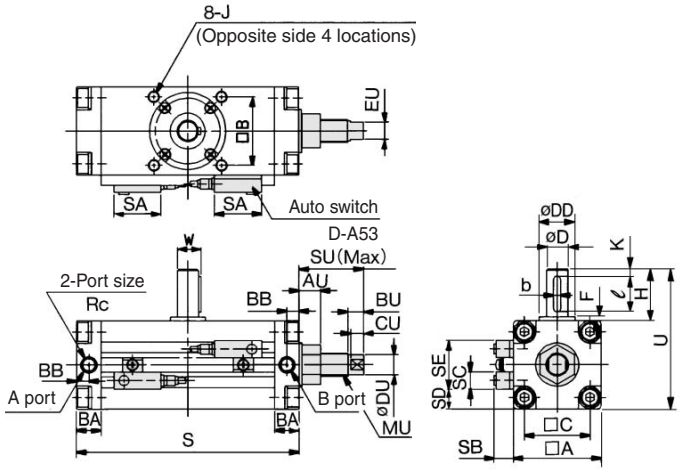
(mm)

Model	H	N	U	UU
CRA1FZU50	30	15	105	125
CRA1FZU63	33	17	124	146
CRA1FZU80	43	20	153	178
CRA1FZU100	44	25	174	204

Note) Other dimensions are the same as the single shaft.

Size 50, 63, 80, 100

Single shaft type: CDRA1BSU

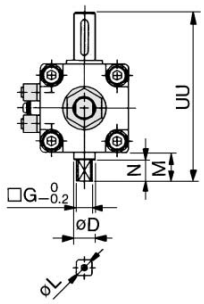


★ The dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

(mm)

Model	Port size Rc	□A	□B	□C	øD (g6)	øDD (h9)	F	H	J	K	S	U	W	BA	BB	SA	SB	SC	SD	SE	Keyway dimensions b	Keyway dimensions ℓ	AU	BU	CU	DU	EU	SU	MU
CDRA1BSU50	1/8	62	48	46	15	25	2.5	36	M8 x 1.25 depth 8	5	156 (189)	98	17	17	8.5	33	13.5	12	14	34	$5^{0}_{-0.030}$	25	15	11	9	14	12	45	M16 x 1.5
CDRA1BSU63	1/8	76	60	57	17	30	2.5	41	M10 x 1.5 depth 12	5	175 (213.5)	117	19.5	20	10	33	14.5	12	21	34	$6^{0}_{-0.030}$	30	19	13	11	18	14	54.5	M20 x 1.5
CDRA1BSU80	1/4	92	72	70	20	35	3	50	M12 x 1.75 depth 13	5	199 (243)	142	22.5	23.5	12	33	15.5	12	29	34	$6^{0}_{-0.030}$	40	22	16	13	22	19	62.5	M24 x 1.5
CDRA1BSU100	3/8	112	85	85	25	40	4	60	M12 x 1.75 depth 14	5	259 (325)	172	28	25	12.5	33	16	12	39	34	$8^{0}_{-0.036}$	45	22	16	13	22	19	73.5	M24 x 1.5

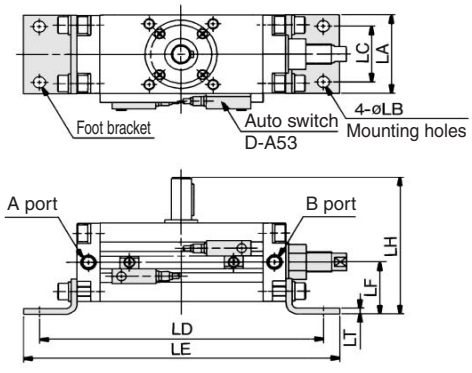
Double shaft type: CDRA1BWU



(mm)

Model	øD (g6)	□G	M	N	UU	øL
CDRA1BWU50	15	11	20	15	118	14
CDRA1BWU63	17	13	22	17	139	16
CDRA1BWU80	20	15	25	20	167	19
CDRA1BWU100	25	19	30	25	202	24

Foot style: CDRA1LSU

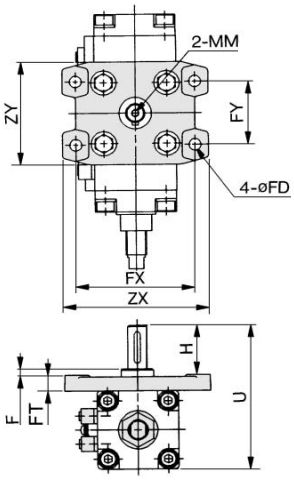


★ The dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.
Note) Other dimensions are the same as the single shaft.

(mm)

Model	LA	øLB	LC	LD	LE	LF	LH	LT
CDRA1LSU50	62	9	44	212 (245)	236 (269)	41	108	4.5
CDRA1LSU63	76	11	55	247 (285.5)	275 (313.5)	48	127	5
CDRA1LSU80	92	13	67	287 (331)	329 (373)	58	154	6
CDRA1LSU100	112	13	87	347 (413)	389 (455)	73.5	189.5	6

Single shaft flange style: CDRA1FSU



(mm)

Model	F	H	MM	U	øFD	FT	FX	FY	ZX	ZY
CDRA1FSU50	4	39	M 6 x 1.0 depth 12	114	9	13	90	50	110	81
CDRA1FSU63	5	45	M 6 x 1.0 depth 12	136	11.5	15	105	59	130	101
CDRA1FSU80	5	55	M8 x 1.25 depth 16	165	13.5	18	130	76	160	119
CDRA1FSU100	5	60	M10 x 1.5 depth 20	190	13.5	18	150	92	180	133

Series CRA1 (Size 30, 50, 63, 80, 100)
Simple Specials:
-XA1 to -XA24: Shaft Pattern Sequencing I

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Shaft Pattern Sequencing I

Applicable shaft type: S, W, Y

How to Order

C | D | RA1 | B | S | | P | 50 | 90 | C | F59 | X | A2 | A24 | C10 | -X6

Built-in magnet

Nil	None
D	Built-in magnet

Mounting style

B	Basic style
L	Foot style

Shaft type

S	Single shaft key
W	Double shaft (Long shaft and with four chamfers)
Y	Double shaft key

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Size

30
50
63
80
100

Rotating angle

90°
100°
180°
190°

Auto switch

Refer to page 11-7-13 for the part no. of auto switches.

Air cushion

Nil	None
C	With air cushion

Simple specials, Made-to-order symbol

- **Refer to chart 1, 2 and 3 when the number of combinations is one or two.**

∗ **Combination of XA is possible for up to 2 types.**

- **Combination 3 Types**

			• Combination of Applicable Chart
A1	A24	C30	Chart 1, 2
A2	A24	-X6	Chart 1, 3
A13	C8	C59	Chart 2, 7
A14	C60	-X6	Chart 2, 3, 8
A15	-X10	-X16	Chart 3, 9

Combination is available only when all the conditions are fulfilled in above combination chart.

- **Combination 4 Types**

				• Combination of Applicable Chart
A1	A2	C8	C59	Chart 1, 2, 7
A2	A24	C10	-X6	Chart 1, 2, 3, 8
A13	A24	-X6	-X16	Chart 1, 3, 9
A14	C11	C30	-X16	Chart 2, 3, 7, 8
A15	C60	-X10	-X16	Chart 2, 3, 8, 9
A14	C32	C61	C62	Chart 2, 7

Combination is available only when all the conditions are fulfilled in above combination chart.

∗ **Combination of simple special and made-to-order is available for up to 4 types.**

∗ **Above is the typical example of combination.**

How to order model with auto switches

Refer to page 11-7-13 for "How to Order" products with auto switch.

How to order model with solenoid valve

Refer to page 11-7-18 for "How to order" products with solenoid valve.

How to order angle adjustable type

Refer to page 11-7-24 for "How to Order" angle adjustable type.

Series CRA1 (Size 30, 50, 63, 80, 100)
Simple Specials:
-XA1 to -XA24: Shaft Pattern Sequencing I

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Combination Chart of Simple Specials for Tip End Shape

Chart 1. Combination between -XA□ and -XA□ (S, W, Y shaft)

Symbol	Description	Shaft direction		Combination	
		Upper	Lower	XA1	XA24
XA1	Female thread at the end	●	—	—	●
XA2	Female thread at the end	—	●	●	●
XA13	Shaft through-hole	●	●	—	●
XA14	Shaft through-hole + Rod end female thread	●	—	—	●
XA15	Shaft through-hole + Rod end female thread	—	●	—	●
XA16	Shaft through-hole + Double shaft-end female threads	●	●	—	●
XA24	Double key	●	—	—	—

Combination Chart of Made to Order

Chart 2. Combination between -XA□ and -XC□ (Refer to page 11-7-40 for made-to-order/details on -XC□.)

Symbol	Description	Shaft type			Applicable size	Combination	
		S	W	Y		XA1/2/13 to 16	XA24
XC7	Reversed shaft	●	●	—	50, 63, 80, 100	—	—
XC8 to XC11	Change of rotating range	●	●	●		●	—
XC30	Fluoro grease	●	●	●	30 to 100	●	●
XC31 to XC36	Change of rotation range and shaft rotation direction	●	●	●	50, 63, 80, 100	●	—
XC37 to XC46	Change of rotation range and angle adjusting direction	●	●	●		●	—
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	●	●	●		●	—
XC59 to XC61	Change of port direction	●	●	●	30 to 100	●	●
XC62	Reverse mounting of auto switch	●	●	●	50, 63, 80, 100	●	●
XC63	One side hydro, One side air	●	●	●		●	●
XC64	One side hydro, One side air	●	●	●		●	●

Chart 3. Combination between -XA□ and -X□ (Refer to page 11-7-49 for made-to-order/details on -X□.)

Symbol	Description	Shaft type			Applicable size	Combination	
		S	W	Y		XA1/2/13 to 16	XA24
X6	Shaft, Bolt, Parallel key stainless specification.	●	●	●	30 to 100	●	●
X7	Heat resistance (100°C)	●	●	●		●	●
X10	Angle adjustment for both sides	●	●	●	50 to 100	●	●
X11	Angle adjustment for single side, Air cushion with single side	●	●	●		●	●
X16	Fluoro rubber for seals	●	●	●	30 to 100	●	●

∗ **Chart 7. For combination between -XC□ and -XC□, refer to page 11-7-40.**
Chart 8. For combination between -X□ and -XC□, refer to page 11-7-40.
Chart 9. For combination between -X□ and -X□, refer to page 11-7-49.

Made to Order

Series ***CRA1*** (Size: 30, 50, 63, 80, 100)
Simple Specials:
-XA1 to -XA24: Shaft Pattern Sequencing I

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

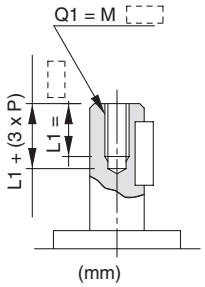
Shaft Pattern Sequencing I — -XA1 to XA24

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. SMC will make appropriate arrangements if no dimensional, tolerance, or finish instructions are given in the diagram.
3. The length of the unthreaded portion is 2 to 3 pitches.
4. Unless specified otherwise, the thread pitch is based on coarse metric threads.
P = Thread pitch
M3 x 0.5, M4 x 0.7, M 5 x 0.8
M6 x 1, M8 x 1.25, M10 x 1.5
5. Enter the desired figures in the portion of the diagram.
6. Chamfer face of the parts machining additionally is C0.5.

Symbol: A1
Machine female threads into the long shaft.
Note) Except flange style

The maximum dimension L1 is, as a rule, twice the thread size.
(Example) For M3: L1 = 6 mm
• Applicable shaft types: S, W, Y

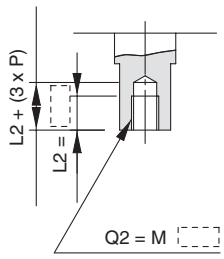


(mm)

Size	Q1
30	M3
50	M4, M5, M6
63	M4, M5, M6
80	M4, M5, M6, M8
100	M5, M6, M8, M10

Symbol: A2
Machine female threads into the short shaft.
Note) Except flange style

The maximum dimension L2 is, as a rule, twice the thread size.
(Example) For M4: L2 = 8 mm
• Applicable shaft types: S, W, Y

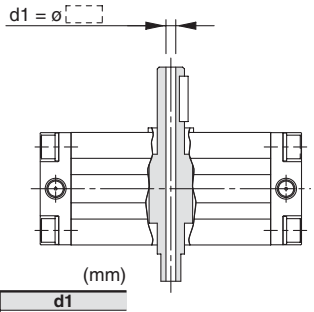


(mm)

Size	Q2
30	M3, M4
50	M4, M5, M6
63	M4, M5, M6
80	M4, M5, M6, M8
100	M5, M6, M8, M10

Symbol: A13
Shaft with through-hole
Note) Except flange style

Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft types: S, W, Y

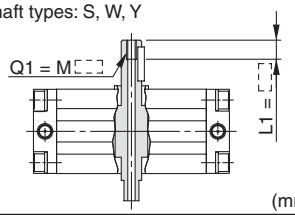


(mm)

Size	d1
30	ø2.5
50	ø4 to ø7
63	ø4.5 to ø18
80	ø6.8 to ø11
100	ø6.8 to ø13

Symbol: A14
Note) Except flange style

A special end is machined onto the long shaft, and a through-hole is drilled into it. Female threads are machined into the through-hole, whose diameter is equivalent to the pilot hole diameter.
The maximum dimension L1 is, as a rule, twice the thread size.
(Example) For M3: L1 = 6 mm
• Applicable shaft types: S, W, Y

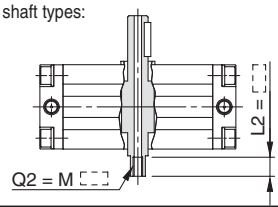


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	—	—	—	—
M5 x 0.8	—	ø4	ø4	—	—
M6 x 1	—	ø5	ø5	—	—
M8 x 1.25	—	—	ø6.8	ø6.8	ø6.8
M10 x 1.5	—	—	—	ø8.5	ø8.5
M12 x 1.75	—	—	—	ø10.3	ø10.3
Rc 1/8	—	—	—	ø8	ø8
Rc 1/4	—	—	—	—	ø11

Symbol: A15
Note) Except flange style

A special end is machined onto the short shaft, and a through-hole is drilled into it. Female threads are machined into the through-hole, whose diameter is equivalent to the pilot hole diameter. The maximum dimension L2 is, as a rule, twice the thread size.
(Example) For M4: L2 = 8 mm
• Applicable shaft types: S, W, Y

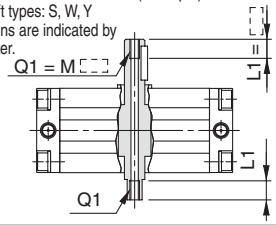


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	—	—	—	—
M5 x 0.8	—	ø4	ø4	—	—
M6 x 1	—	ø5	ø5	—	—
M8 x 1.25	—	—	ø6.8	ø6.8	ø6.8
M10 x 1.5	—	—	—	ø8.5	ø8.5
M12 x 1.75	—	—	—	ø10.3	ø10.3
Rc 1/8	—	—	—	ø8	ø8
Rc 1/4	—	—	—	—	ø11

Symbol: A16
Note) Except flange style

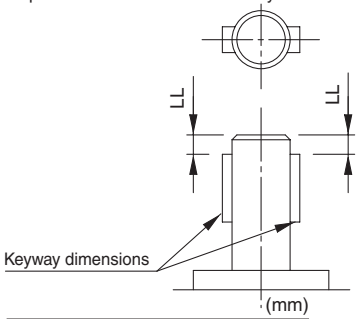
A special end is machined onto both the long and short shafts, and a through-hole is drilled into both shafts. Female threads are machined into the through-holes, whose diameter is equivalent to the diameter of the pilot holes. The maximum dimension L1 is, as a rule, twice the thread size. (Example) For M5: L1 = 10 mm
• Applicable shaft types: S, W, Y
• Equal dimensions are indicated by the same marker.



(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	—	—	—	—
M5 x 0.8	—	ø4	ø4	—	—
M6 x 1	—	ø5	ø5	—	—
M8 x 1.25	—	—	ø6.8	ø6.8	ø6.8
M10 x 1.5	—	—	—	ø8.5	ø8.5
M12 x 1.75	—	—	—	ø10.3	ø10.3
Rc 1/8	—	—	—	ø8	ø8
Rc 1/4	—	—	—	—	ø11

Symbol: A24
Double key
Keys and keyways are machined at 180° from the standard position.
• Applicable shaft types: S, W, Y
• Equal dimensions are indicated by the same marker.



(mm)

Size	Key groove dimension	LL
30	3 x 3 x 14	3
50	5 x 5 x 25	5
63	6 x 6 x 30	5
80	6 x 6 x 40	5
100	8 x 7 x 45	5

Made to Order

Series CRA1 (Size: 30, 50, 63, 80, 100)

Simple Specials:
-XA33 to -XA46: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Shaft Pattern Sequencing II

Applicable shaft type: X, Z, T, J, K

How to Order

C | D | RA1 | B | S | | P | 50 | 90 | C | F59 | X | A34 | A37 | C59 | -X6

Built in magnet

Nil	None
D	Built-in magnet

Mounting style

B	Basic style
L	Foot style

Shaft type

X	Single shaft with four chamfers
Z	Double shaft with four chamfers
T	Single round shaft
J	Double shaft (Long shaft without key & with four chamfers)
K	Double round shaft

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Size

30
50
63
80
100

Ratating angle

90°
100°
180°
190°

Auto switch

Refer to page 11-7-13 for the part no. of auto switches.

Suffix symbol

Nil	Without air cushion
C	With air cushion

Simple specials, Made-to-order symbol

- **Refer to chart 4, 5 and 6 when the number of combinations is one or two.**

* **Combination of XA is possible for up to 2 types.**

- **Combination 3 Types**

			• Combination of Applicable Chart
A33	A34	C30	Chart 4, 5
A34	A37	-X6	Chart 4, 6
A35	C30	C59	Chart 5, 7
A40	C60	-X6	Chart 5, 6, 8
A43	-X10	-X16	Chart 6, 9

Combination is available only when all the conditions are fulfilled in above combination chart.

- **Combination 4 Types**

				• Combination of Applicable Chart
A33	A34	C30	C59	Chart 4, 5, 7
A34	A37	C59	-X6	Chart 4, 5, 6, 8
A36	A37	-X6	-X16	Chart 4, 6, 9
A43	C59	C62	-X16	Chart 5, 6, 7, 8
A45	C60	-X10	-X16	Chart 5, 6, 8, 9
A46	C30	C61	C62	Chart 5, 7

Combination is available only when all the conditions are fulfilled in above combination chart.

* **Combination of simple special and made-to-order, it is possible for up to 4 types.**

* **Above is the typical example of combination.**

How to order model with auto switches

Refer to page 11-7-13 for "How to Order" products with auto switch.

How to order model with solenoid valve

Refer to page 11-7-18 for "How to order" products with solenoid valve,

How to order angle adjustable type

Refer to page 11-7-24 for "How to Order" angle adjustable type.

Series CRA1 (Size 30, 50, 63, 80, 100)
Simple Specials:
-XA33 to -XA46: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Combination Chart of Simple Specials for Tip End Shape

Chart 4. Combination between -XA□ and -XA□

Symbol	Description	Shaft direction		Shaft type					Combination				
		Upper	Lower	X	Z	T	J	K	∗ Corresponding shafts type available for combination				
XA33	Female thread at the end	●	—	—	—	●	●	●	**XA33**				
XA34	Female thread at the end	—	●	—	—	●	●	●	T, J, K ∗	**XA34**			
XA35	Female thread at the end	●	—	●	●	—	—	—	—	—	**XA35**		
XA36	Female thread at the end	—	●	●	●	—	—	—	—	—	X, Z ∗		
XA37	Stepped round shaft	●	—	—	—	●	●	●	—	T, J, K ∗	—	**XA37**	
XA38	Stepped round shaft	—	●	—	—	—	—	●	K ∗	—	—	K ∗	
XA40	Shaft through hole	●	●	—	—	●	—	●	—	—	—	—	
XA41	Shaft through hole	●	●	●	●	—	●	—	—	—	—	—	
XA43	Shaft through-hole + Double shaft-end-female threads	●	●	—	—	●	—	●	—	—	—	—	
XA44	Shaft through-hole + Double shaft-end-female threads	●	●	●	●	—	●	—	—	—	—	—	
XA45	Middle-cut chamfer	●	—	—	—	●	●	●	—	T, J, K ∗	—	T, J, K ∗	**XA45**
XA46	Middle-cut chamfer	—	●	—	—	—	—	●	K ∗	—	—	—	K ∗

Combination Chart of Made to Order

Chart 5. Combination between -XA□ and -XC□ (Refer to page 11-7-40 for made-to-order/details on -XC□.)

Symbol	Description	Shaft type					Applicable size	Combination
		X	Z	T	J	K		**XA33 to 38, 40 to 46**
XC7	Reversed shaft	●	—	●	●	—	50, 63, 80, 100	—
XC8 to XC11	Change of rotating range	—	—	—	—	—		—
XC30	Fluoro grease	●	●	●	●	●	30 to 100	●
XC31 to XC36	Change of rotation range and shaft rotation direction	—	—	—	—	—	50, 63, 80, 100	—
XC37 to XC46	Change of rotation range and angle adjusting direction	—	—	—	—	—		—
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	—	—	—	—	—		—
XC59 to XC61	Change of port direction	●	●	●	●	●	30 to 100	●
XC62	Reverse mounting of auto switch	●	●	●	●	●	50, 63, 80, 100	●
XC63	One side hydro, One side air	●	●	●	●	●		●
XC64	One side hydro, One side air	●	●	●	●	●		●

Chart 6. Combination between -XA□ and -X□ (Refer to page 11-7-49 for made-to-order/details on -X□.)

Symbol	Description	Shaft type					Applicable size	Combination
		X	Z	T	J	K		**XA33 to 38, 40 to 46**
X6	Shaft, Bolt, Parallel key stainless specifications	●	●	●	●	●	30 to 100	●
X7	Heat resistance (100°C)	●	●	●	●	●		●
X10	Angle adjustment for both sides	●	●	●	●	●	50 to 100	●
X11	Angle adjustment for single side, Air cushion with single side	●	●	●	●	●		●
X16	Fluoro rubber for seals	●	●	●	●	●	30 to 100	●

∗ **Chart 7. For combination between -XC□ and -XC□, refer to page 11-7-40.**
Chart 8. For combination between -X□ and -XC□, refer to page 11-7-40.
Chart 9. For combination between -X□ and -X□, refer to page 11-7-49.

Series CRA1 (Size 30, 50, 63, 80, 100)

Simple Specials:
-XA33 to -XA46: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

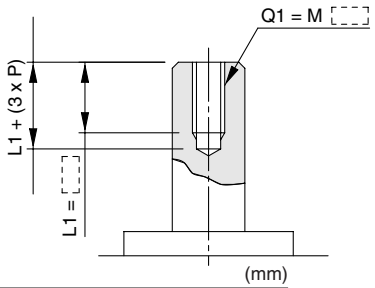
Shaft Pattern Sequencing II

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. SMC will make appropriate arrangements if no dimensional, tolerance, or finish instructions are given in the diagram.
3. The length of the unthreaded portion is 2 to 3 pitches.
4. Unless specified otherwise, the thread pitch is based on coarse metric threads.
   P = Thread pitch
   M3 x 0.5, M4 x 0.7, M 5 x 0.8
   M6 x 1, M8 x 1.25, M10 x 1.5
5. Enter the desired figures in the portion of the diagram.
6. Chamfer face of the parts machining additionally is C0.5.

Symbol: A33
Machine female threads into the long shaft.
Note) Except flange style

The maximum dimension L1 is, as a rule, twice the thread size.
(Example) For M3: L1 = 6 mm
• Applicable shaft types: J, K, T

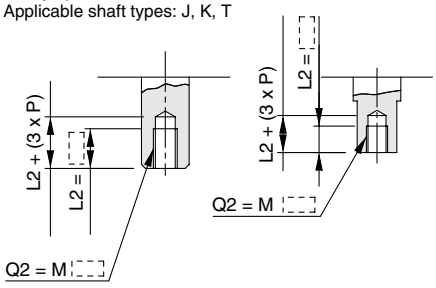


(mm)

Size	Q1
30	M3
50	M4, M5, M6, M8
63	M4, M5, M6, M8, M10
80	M4, M5, M6, M8, M10, M12
100	M5, M6, M8, M10, M12

Symbol: A34
Machine female threads into the short shaft.
Note) Except flange style

The maximum dimension L2 is, as a rule, twice the thread size.
(Example) For M3: L2 = 6 mm
• Applicable shaft types: J, K, T

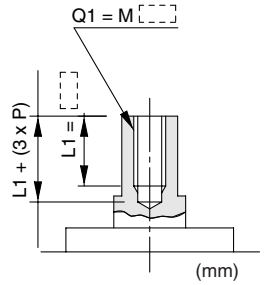


(mm)

Size	Q2
30	M3
50	M4, M5, M6, M8
63	M4, M5, M6, M8, M10
80	M4, M5, M6, M8, M10, M12
100	M5, M6, M8, M10, M12

Symbol: A35
Machine female threads into the shaft.
Note) Except flange style

The maximum dimension L1 is, as a rule, twice the thread size.
(Example) For M3: L1 = 6 mm
• Applicable shaft types: X, Z

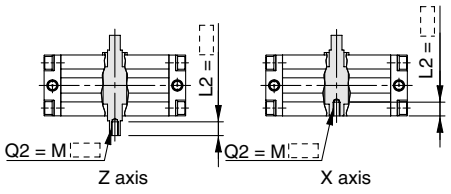


(mm)

Size	Q1
30	M3
50	M4, M5, M6, M8
63	M4, M5, M6, M8, M10
80	M4, M5, M6, M8, M10, M12
100	M5, M6, M8, M10, M12

Symbol: A36
Machine female threads into the short shaft.
Note) Except flange style

The maximum dimension L2 is, as a rule, twice the thread size.
(Example) For M4: L2 = 8 mm
• Applicable shaft types: X, Z

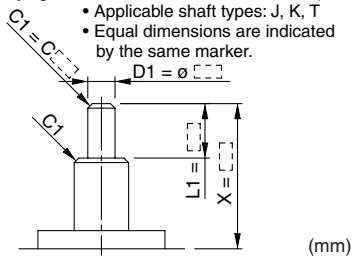


(mm)

Size	Q2
30	M3
50	M4, M5, M6, M8
63	M4, M5, M6, M8, M10
80	M4, M5, M6, M8, M10, M12
100	M5, M6, M8, M10, M12

Symbol: A37
Note) Except flange style

The long shaft can be further shortened by machining it into a stepped round shaft.
• Minimum machining diameter is 0.1 mm.
(If shortening the shaft is not required, indicate "∗" for dimension X.)
(If not specifying dimension C1, indicate "∗" instead.)
• Applicable shaft types: J, K, T
• Equal dimensions are indicated by the same marker.

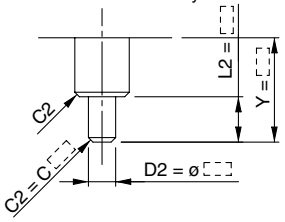


(mm)

Size	X	L1 max	D1
30	3 to 25	X – 2	ø5 to ø7.9
50	3.5 to 36	X – 2.5	ø5 to ø14.9
63	3.5 to 41	X – 2.5	ø5 to ø16.9
80	4 to 50	X – 3	ø8 to ø19.9
100	5 to 60	X – 4	ø8 to ø24.9

Symbol: A38
Note) Except flange style

The short shaft can be further shortened by machining it into a stepped round shaft.
• Minimum machining diameter is 0.1 mm.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
(If not specifying dimension C2, indicate "∗" instead.)
• Applicable shaft type: K
• Equal dimensions are indicated by the same marker.

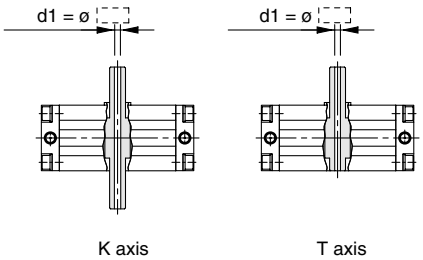


(mm)

Size	Y	L2 max	D2
30	3 to 25	Y – 2	ø5 to ø7.9
50	1 to 36	Y	ø5 to ø14.9
63	1 to 41	Y	ø5 to ø16.9
80	1 to 50	Y	ø8 to ø19.9
100	1 to 60	Y	ø8 to ø24.9

Symbol: A40
Shaft with through-hole
Note) Except flange style

• Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft types: K, T

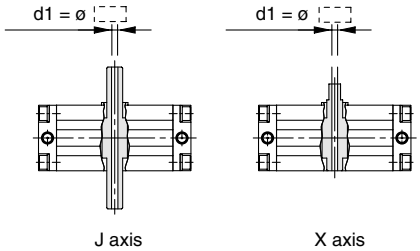


(mm)

Size	d1
30	ø2.5
50	ø4 to ø7.5
63	ø4 to ø8
80	ø6.8 to ø11
100	ø6.8 to ø13

Symbol: A41
Shaft with through-hole
Note) Except flange style

• Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft types: J, X, Z



(mm)

Size	d1
30	ø2.5
50	ø4 to ø7.5
63	ø4 to ø8
80	ø6.8 to ø11
100	ø6.8 to ø13

Made to Order

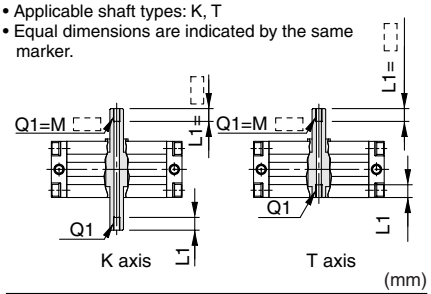
Series CRA1 (Size 30, 50, 63, 80, 100)

Simple Specials:
-XA33 to -XA46: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Symbol: A43
Shaft through-hole and female thread
Note) Except flange style

- Applicable shaft types: K, T
- Equal dimensions are indicated by the same marker.

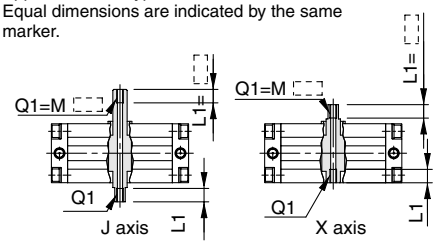


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	—	—	—	—
M5 x 0.8	—	ø4	ø4	—	—
M6 x 1	—	ø5	ø5	—	—
M8 x 1.25	—	—	ø6.8	ø6.8	ø6.8
M10 x 1.5	—	—	—	ø8.5	ø8.5
M12 x 1.75	—	—	—	ø10.3	ø10.3
Rc 1/8	—	—	—	ø8	ø8
Rc 1/4	—	—	—	—	ø 11

Symbol: A44
Note) Except flange style

Shaft through-hole and female thread machining
- Applicable shaft types: J, X, Z
- Equal dimensions are indicated by the same marker.

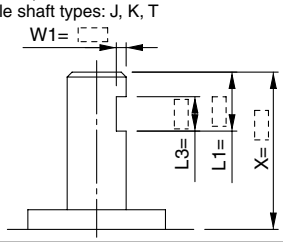


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	—	—	—	—
M5 x 0.8	—	ø4	ø4	—	—
M6 x 1	—	ø5	ø5	—	—
M8 x 1.25	—	—	ø6.8	ø6.8	ø6.8
M10 x 1.5	—	—	—	ø8.5	ø8.5
M12 x 1.75	—	—	—	ø10.3	ø10.3
Rc 1/8	—	—	—	ø8	ø8
Rc 1/4	—	—	—	—	ø 11

Symbol: A45
Note) Except flange style

The long shaft can be further shortened by machining a middle-cut chamfer into it.
- Minimum machining diameter is 0.1 mm.
  (The position is that of the standard flat at the key groove portion.)
  (If shortening the shaft is not required, indicate "∗" for dimension X.)
- Applicable shaft types: J, K, T

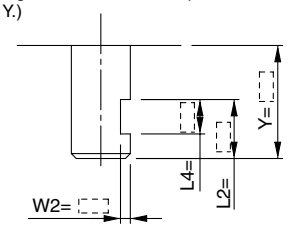


(mm)

Size	X	W1	L1 max	L3 max
30	8.5 to 25	1 to 2	X – 2	L1 – 2
50	12.5 to 36	1 to 5.5	X – 2.5	L1 – 2
63	13.5 to 41	1 to 6.5	X – 2.5	L1 – 2
80	16.5 to 50	1 to 8	X – 3	L1 – 3
100	21 to 60	1.5 to 10.5	X – 4	L1 – 4

Symbol: A46
Note) Except flange style

The short shaft can be further shortened by machining a middle-cut chamfer into it.
- Minimum machining diameter is 0.1 mm.
  (The position is that of the standard flat at the key groove portion.)
- Applicable shaft type: K
  (If shortening the shaft is not required, indicate "∗" for dimension Y.)



(mm)

Size	Y	W2	L2 max	L4 max
30	8.5 to 25	1 to 2	Y – 2	L2 – 2
50	10 to 36	1 to 5.5	Y	L2 – 2
63	11 to 41	1 to 6.5	Y	L2 – 2
80	13.5 to 50	1 to 8	Y	L2 – 3
100	17 to 60	1.5 to 10.5	Y	L2 – 4

Made to Order

Series CRA1
Made to Order Specifications: -XC7 to -XC64

How to Order

C D RA1 B S P 50 90 C F59 X C59 C62 -X10 -X16

Built in magnet

Nil	None
D	Built-in magnet

Mounting style

B	Basic style
L	Foot style
F	Flange style

Shaft type

S	Single shaft key
W	Double shaft (Long shaft and with four chamfers)
Y	Double shaft key
Z	Double shaft with four chamfers
T	Single round shaft
J	Double shaft (Long shaft without key & with four chamfers)
K	Double round shaft

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Size

30
50
63
80
100

Rotating angle

90°
100°
180°
190°

Air cushion

Nil	None
C	With air cushion

Auto switch

Refer to page 11-7-13 for the part no. of auto switches.

Simple specials, Made-to-order symbol

- **When the number of combinations are one or two, please refer to chart 7 and 8.**
- ∗ **Combination of XA is possible for up to 2 types.**

- **Combination 3 Types**

C7	C30	C59	Chart 7
C31	C60	-X6	Chart 7, 8
C59	-X10	-X16	Chart 8, 9

- **Combination of Applicable Chart**

Combination is available only when all the conditions are fulfilled in above combination chart.

- **Combination 4 Types**

C7	C30	C59	C62	Chart 7
C31	C60	C62	-X6	Chart 7, 8
C59	C62	-X10	-X16	Chart 7, 8, 9

- **Combination of Applicable Chart**

Combination is available only when all the conditions are fulfilled in above combination chart.

∗ **Combination of made-to-order is available up to 4 types.**
∗ **Above is the typical example of combination.**
∗ **Chart 9. For combination chart between -X□ and -X□, refer to page 11-7-49.**

How to order model with auto switches

Refer to page 11-7-13 for "How to Order" products with auto switch.

How to order model with solenoid valve

Refer to page 11-7-18 for "How to order" products with solenoid valve,

How to order angle adjustable type

Refer to page 11-7-24 for "How to Order" angle adjustable type.

Combination Chart of Made to Order

Chart 7. Combination between -XC□ and -XC□

Part no.	Description	Shaft type S	W	X	Y	Z	T	J	K	Applicable size	Combination
XC 7	Reversed shaft	●	●	●	—	—	●	●	—	50, 63 80, 100	XC7 — ∗ Corresponding shafts type available for combination
XC 8 to XC11	Change of rotating range	●	●	—	●	—	—	—	—		— XC 8 to XC11
XC30	Fluoro grease	●	●	●	●	●	●	●	●	30 to 100	S, W, X, T, J ∗ S, W, Y ∗ XC30
XC31 to XC36	Changes of rotation range and the revolving direction of shaft	●	●	—	●	—	—	—	—	50, 63 80, 100	— — S, W, Y ∗ XC31 to XC36
XC37 to XC46	Changes of rotation range and the angle adjustment direction	●	●	—	●	—	—	—	—		— — S, W, Y ∗ — XC37 to XC46
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjustment screw is set on the left side.)	●	●	—	●	—	—	—	—		— — — — — XC47 to XC58
XC59 to XC61	Change of port direction	●	●	●	●	●	●	●	●	30 to 100	S, W, Y ∗ ● S, W, Y ∗ S, W, Y ∗ S, W, Y ∗ S, W, Y ∗ XC59 to XC61
XC62	Reverse mounting of auto switch	●	●	●	●	●	●	●	●	50, 63 80, 100	● ● ● ● ● ● ● XC62
XC63	One side hydro, One side air	●	●	●	●	●	●	●	●		● ● — ● — — ● ●
XC64	One side hydro, One side air	●	●	●	●	●	●	●	●		● ● — ● — — ● ●

Chart 8. Combination between -X□ and -XC□ (Refer to page 11-7-49 for made-to-order/details on -X□.)

Part no.	Description	Shaft type S	W	X	Y	Z	T	J	K	Applicable size	XC7	XC8 to 11	XC30	XC31 to 36	XC37 to 58	XC59 to 61	XC62
X6	Shaft, Bolt, Parallel key stainless spec.	●	●	●	●	●	●	●	●	30 to 100	●	●	●	●	—	●	●
X7	Heat resistance (100°C)	●	●	●	●	●	●	●	●		●	●	—	●	●	●	—
X10	Angle adjustment for both sides	●	●	●	●	●	●	●	●	50 to 100	●	—	●	—	—	●	●
X11	Angle adjustment for single side, Air cushion with single side	●	●	●	●	●	●	●	●		●	—	—	—	—	●	●
X16	Fluoro rubber for seals	●	●	●	●	●	●	●	●	30 to 100	●	●	●	●	●	●	●

Series CRA1
Made to Order Specifications:
-XC7: Reverse Mounting of Rotation Shaft (Size: 50 to 100)
-XC8 to -XC11: Change of Rotation Range (Size: 50 to 100)
-XC30 Fluoro Grease (Size: 30 to 100)

Please consult with SMC for further information on specifications, dimensions and delivery.

1 Reversed Shaft -XC7

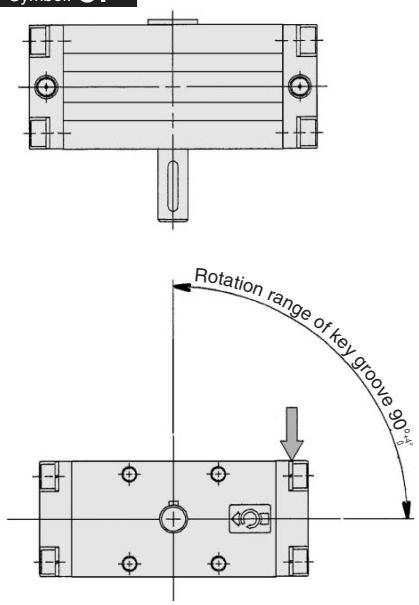
CRA1 → Refer to "How to Order" on page 11-7-40. — XC7

Reverse mounting of rotation shaft (-XC7)

Specifications

Applicable size	50, 63, 80, 100
Applicable shaft type	Shaft S, W, X, T, J

Symbol: **C7**



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

2 Change of Rotating Range -XC8 to XC11

CRA1 → Refer to "How to Order" on page 11-7-40. — XC8

Symbol -XC8 to XC11

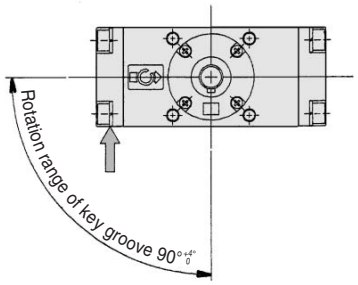
Specifications

Applicable size	50, 63, 80, 100
Applicable shaft type	Shaft S, W, Y

The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications.

Symbol: **C8**

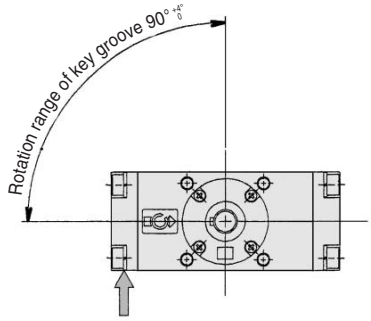
The rotation range is changed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: **C9**

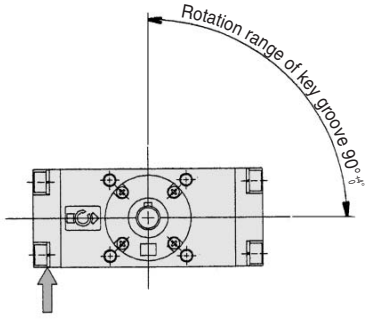
The rotation range is changed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: **C10**

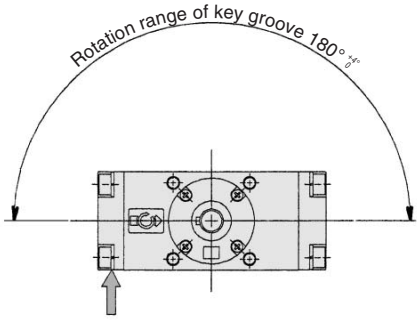
The rotation range is changed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: **C11**

The rotation range is changed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

3 Fluoro Grease -XC30

CRA1 Refer to "How to Order" on page 11-7-40. — XC30

Fluoro grease

Lubricant oil in the seal part of packing and inner wall of the cylinder is changed to fluoro type.
(Not the low speed specifications.)

Specifications

Applicable size	30, 50, 63, 80, 100
Applicable shaft type	S, W, X, Y, Z, T, J, K

∗ Refer to page 11-7-3 for other specifications.
∗∗ Except air-hydro type.

Series CRA1
Made to Order Specifications:
-XC31 to -XC36: Change of Rotation Range and Rotation Direction of Shaft

Please consult with SMC for further information on specifications, dimensions and delivery.

4 Reversed Shaft -XC31 to XC36

CRA1 **→ Refer to "How to Order" on page 11-7-40.** **—XC31**

• Change of the rotation range and the rotation direction of shaft (-XC31 to XC36)

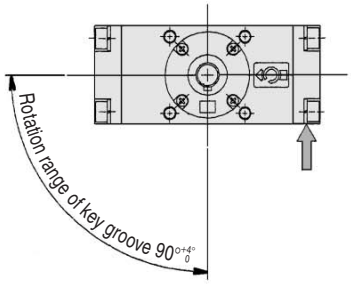
Specifications

Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, Y

The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications.

Symbol: C31

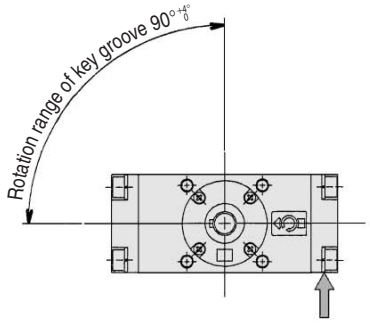
The rotation range is changed and the rotating direction is reversed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C32

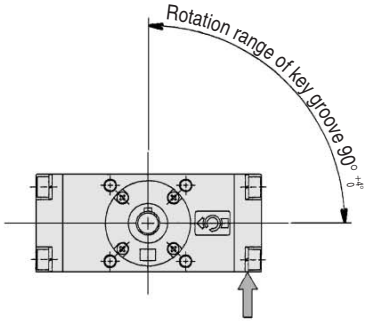
The rotation range is changed and the rotating direction is reversed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C33

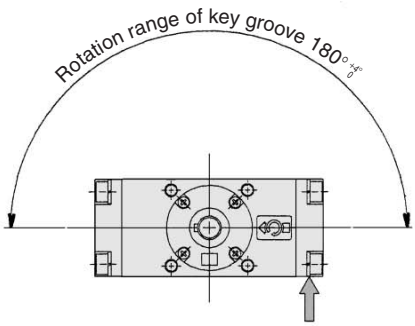
The rotation range is changed and the rotating direction is reversed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C34

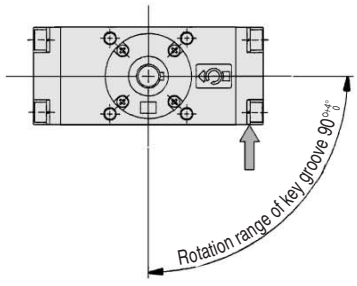
The rotation range is changed and the rotating direction is reversed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C35

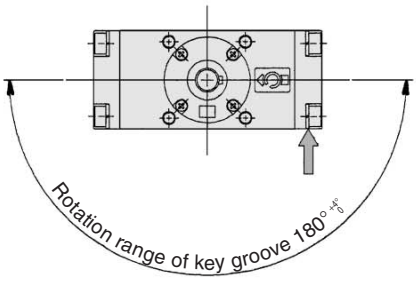
The rotation range is changed and the rotating direction is reversed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C36

The rotation range is changed and the rotating direction is reversed.



Note) If it is pressurized from the port indicated with the arrow, the shaft rotates in the clockwise direction.

Series CRA1
Made to Order Specifications:
-XC37 to -XC42: Change of Rotation Range and Angle Adjusting Direction

Please consult with SMC for further information on specifications, dimensions and delivery.

5 Change of Rotation Range and Angle adjusting -XC37 to XC42

CRA1 → Refer to "How to Order" on page 11-7-40. **—XC37**

• Change of rotation range and angle adjusting direction (-XC37 to XC42)

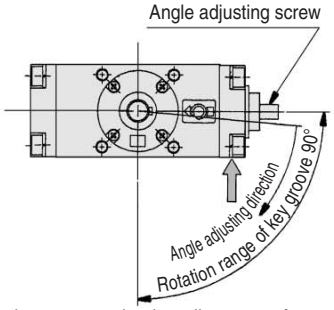
Specifications

Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, Y

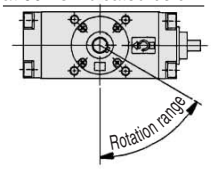
The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications.

Symbol: C37

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



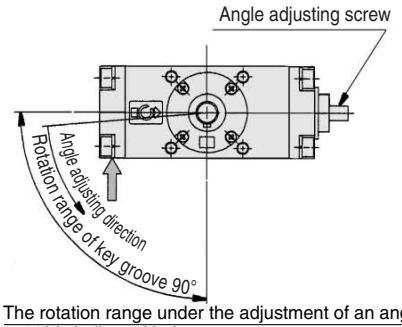
The rotation range under the adjustment of an angle at 60° is indicated below.



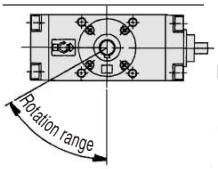
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C38

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



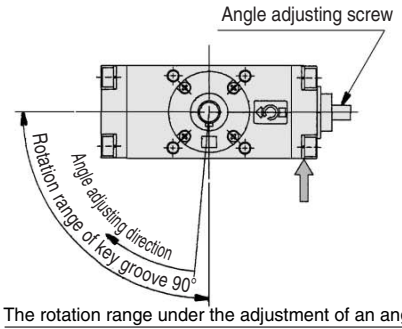
The rotation range under the adjustment of an angle at 60° is indicated below.



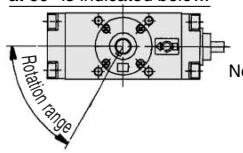
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C39

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



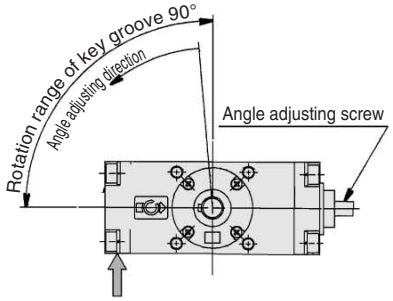
The rotation range under the adjustment of an angle at 60° is indicated below.



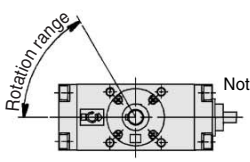
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C40

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



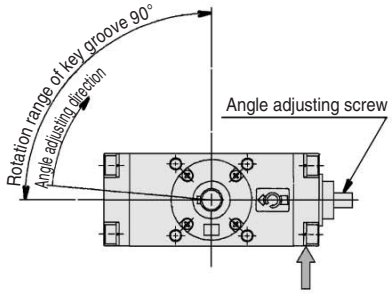
The rotation range under the adjustment of an angle at 60° is indicated below.



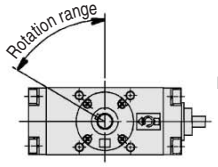
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C41

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



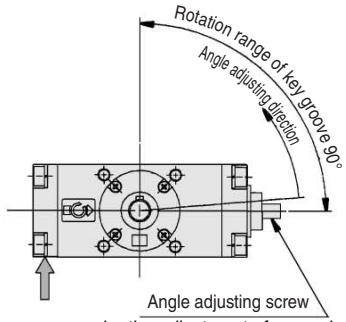
The rotation range under the adjustment of an angle at 60° is indicated below.



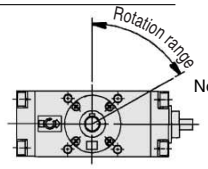
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C42

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



The rotation range under the adjustment of an angle at 60° is indicated below.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Series CRA1
Made to Order Specifications:
-XC43 to -XC46: Change of Rotation Range and Angle Adjusting Direction

Please consult with SMC for further information on specifications, dimensions and delivery.

5 Change of Rotation Range and Angle Adjusting -XC43 to XC46

CRA1 → Refer to "How to Order" on page 11-7-40. **—XC43**

• Change of rotation range and angle adjusting direction (-XC43 to XC46)

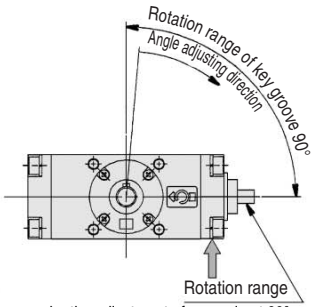
Specifications

Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, Y

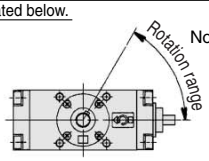
The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the Made to order specifications.

Symbol: C43

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



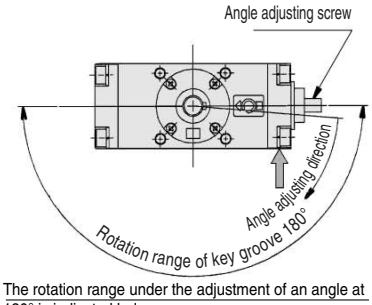
The rotation range under the adjustment of an angle at 60° is indicated below.



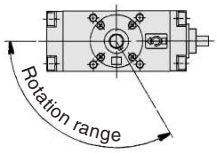
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C44

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



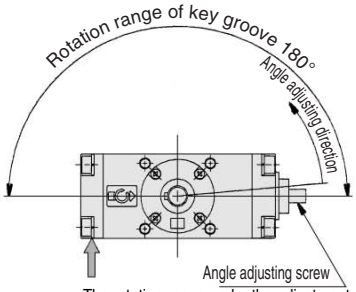
The rotation range under the adjustment of an angle at 120° is indicated below.



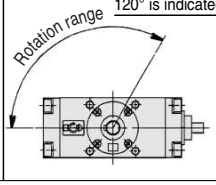
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C45

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



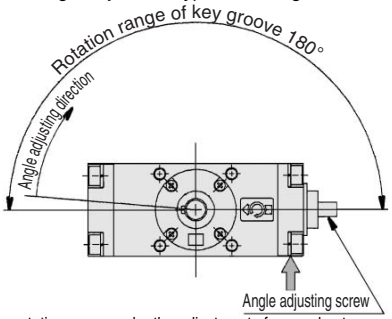
The rotation range under the adjustment of an angle at 120° is indicated below.



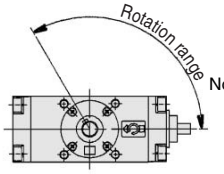
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C46

The rotation range and the angle adjusting direction of the angle adjustable type are changed.



The rotation range under the adjustment of an angle at 120° is indicated below.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Made to Order Specifications:

-XC47 to XC52: Change of Rotation Range and Angle Adjusting Direction (Angle adjusting screw moved to the left)

Please consult with SMC for further information on specifications, dimensions and delivery.

6 Change of Rotation Range and Angle Adjusting Direction (Angle adjusting screw moved to the left) -XC47 to XC52

CRA1 → Refer to "How to Order" on page 11-7-40. **—XC47**

• Change of rotation range and angle adjusting direction (Angle adjusting screw moved to the left) (-XC47 to XC52)

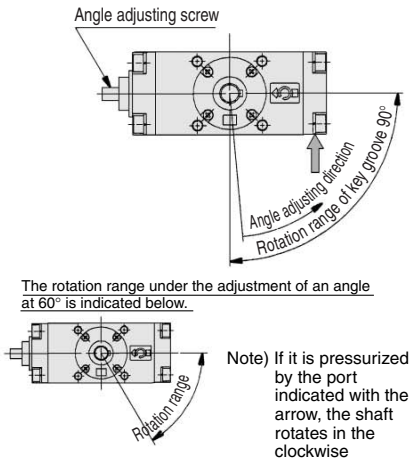
Specifications

Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, Y

The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications.

Symbol: C47

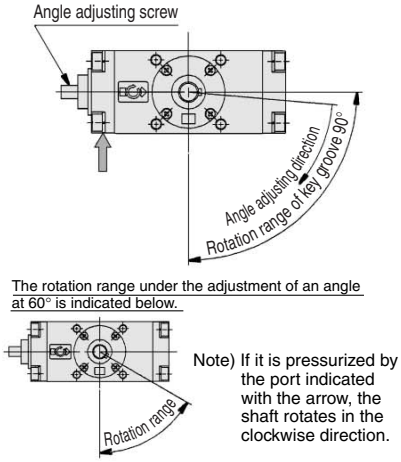
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C48

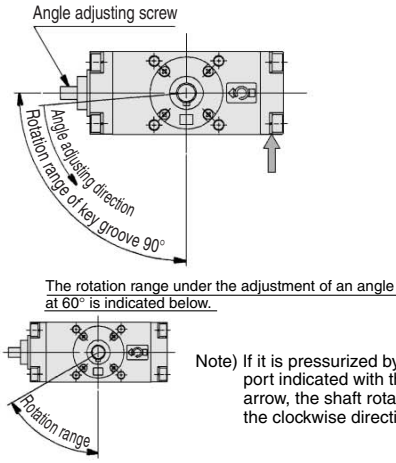
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C49

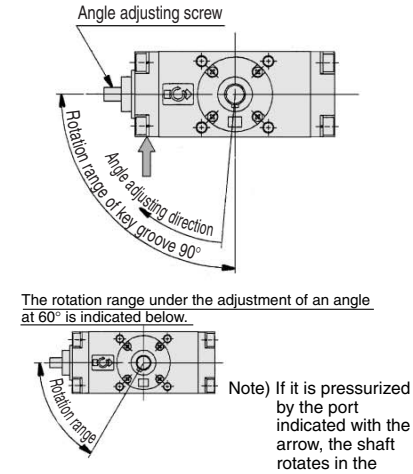
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C50

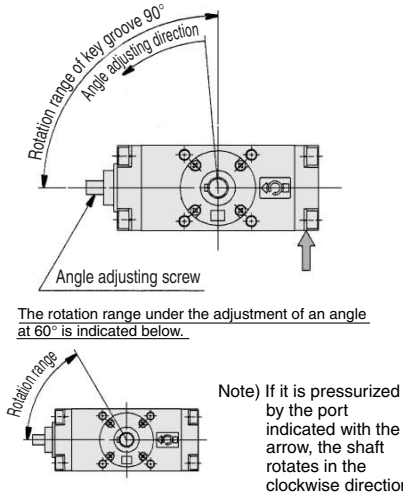
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C51

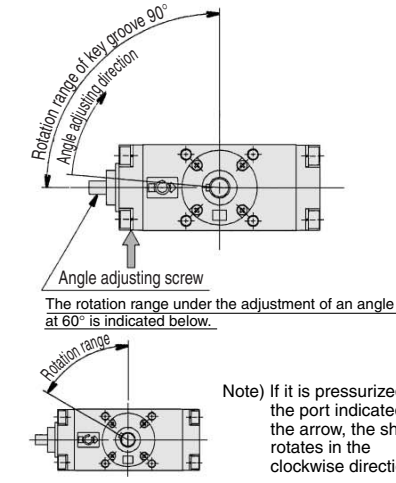
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C52

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Series CRA1
Made to Order Specifications:
-XC53 to XC58: Change of Rotation Range and Angle Adjusting Direction (Angle adjusting screw moved to the left)

Please consult with SMC for further information on specifications, dimensions and delivery.

6 Change of Rotation Range and Angle Adjusting Direction (Angle adjusting screw moved to the left) -XC53 to XC58

CRA1 → Refer to "How to Order" on page 11-7-40. **—XC53**

Specifications

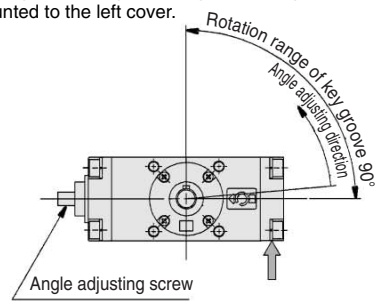
Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, Y

• Change of rotation range and angle adjusting direction (Angle adjusting screw moved to the left) (-XC53 to XC58)

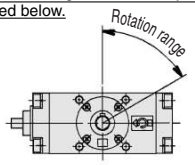
The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications.

Symbol: C53

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



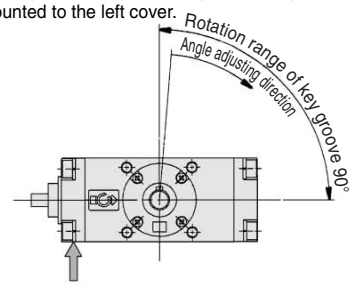
The rotation range under the adjustment of an angle at 60° is indicated below.



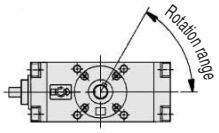
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clock-wise direction.

Symbol: C54

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



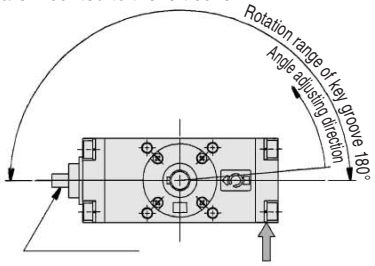
The rotation range under the adjustment of an angle at 60° is indicated below.



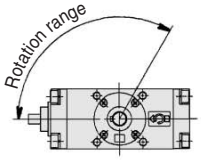
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direc-

Symbol: C55

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



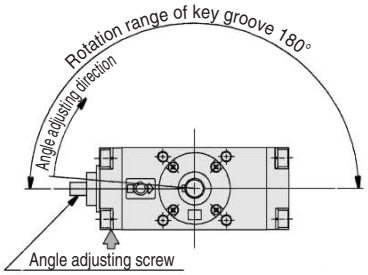
The rotation range under the adjustment of an angle at 120° is indicated below.



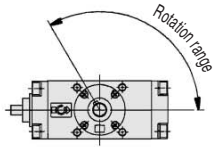
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C56

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



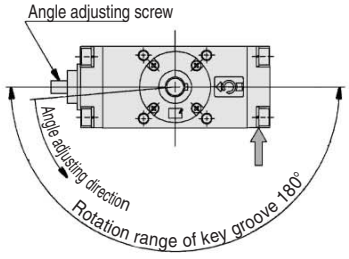
The rotation range under the adjustment of an angle at 120° is indicated below.



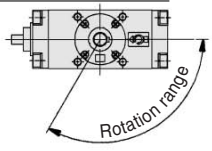
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clock-wise direction.

Symbol: C57

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



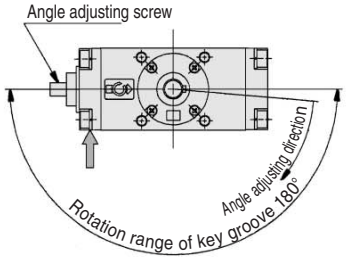
The rotation range under the adjustment of an angle at 120° is indicated below.



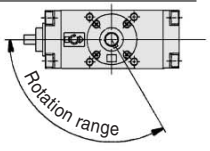
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clock-wise direction.

Symbol: C58

For the angle adjusting type, angle adjusting screws are mounted to the left cover.



The rotation range under the adjustment of an angle at 120° is indicated below.



Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Series CRA1
Made to Order Specifications:
-XC59 to -XC61: Change of Port Location (Size 30 to 100)
-XC62: Reverse Auto Switch Mounting (Size 50 to 100)

Please consult with SMC for further information on specifications, dimensions and delivery.

7 Change of Port Location (Mounting location of the cover is changed.) -XC59 to XC61

CRA1 → Refer to "How to Order" on page 11-7-40. **—XC59**

- **Port position is changed. (-XC59 to XC61)**

Specifications

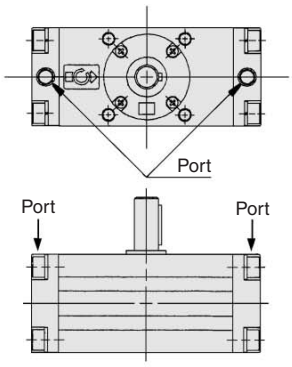
∗ Except for the solenoid valve equipped style.

Applicable size	**30, 50, 63, 80, 100**
Applicable shaft type	Shaft S, W, X, Y Z, T, J, K

The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications. For the bumper equipped type, the needle position is on the opposite side of the port.

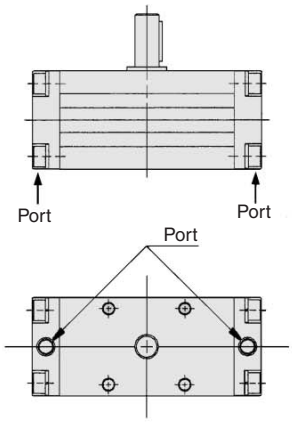
Symbol: C59

Direction of the port is changed. (Upwards)



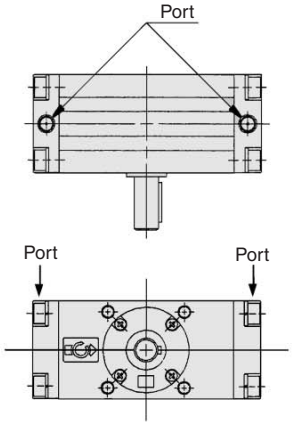
Symbol: C60

Direction of the port is changed. (Downwards)



Symbol: C61

Direction of the port is changed. (Backwards)

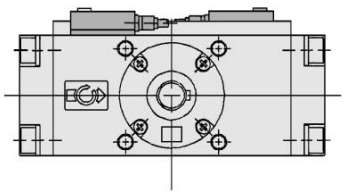


8 Reverse Mounting of the Auto Switch Against the Standard -XC62

CRA1 →Refer to"How to Order" auto switch equipped type on page 11-7-13. **— XC62**

Symbol: C62

The auto switch is reverse mounted to the standard.



Series CRA1
Made to Order Specifications:
-XC63, -XC64: One Side Air-hydro, One Side Air Type

Please consult with SMC for further information on specifications, dimensions and delivery.

9 One Side Air-hydro, One Side Air Type -XC63, -XC64

CRA1 **→ Refer to"How to Order" on page 11-7-40.** **—XC63**

- **One side air-hydro, One side air**
  -XC63: Left side air
  Right side air-hydro
  -XC64: Left side air-hydro
  Right side air

Specifications

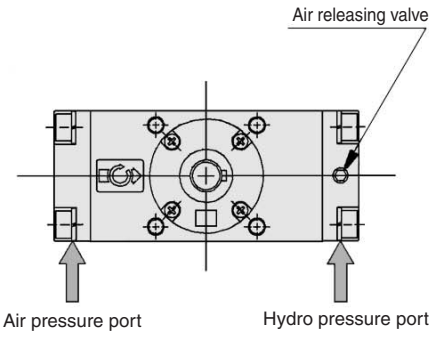
Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, X, Y Z, T, J, K

∗ Except for the solenoid valve equipped type, angle adjustable type and air cushion equipped type.

The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the made-to-order specifications.

Symbol: C63

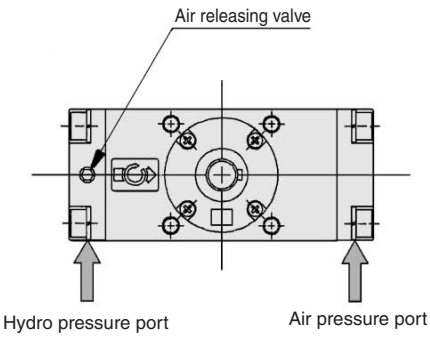
One side air, one side air-hydro specifications (Left side air, Right side hydro)



The figure shows the pressurized situation to the hydro pressure port.

Symbol: C64

One side air, one side air-hydro specifications (Left side hydro, Right side air)



The figure shows the pressurized situation to the air pressure port.

Series CRA1
Made to Order Specifications: -X6 to -X11

Please consult with SMC for further information on specifications, dimensions and delivery.

How to Order

C D RA1 B S P 50 — 90 S — A53 — X6 — X16

- D: Built-in magnet
- P: Pattern
- S: Suffix symbol
- A53: Auto switch
- X6 — X16: Made-to-order symbol
  - Combination is available only when all the conditions are fulfilled in above combination chart 9.

Pattern	
Nil	Made-to-order for 1 kind
P	Made-to-order for 2 kinds

Suffix symbol	
Nil	-X7, -X16
S	-X6
U	-X10
C	-X11

∗ Refer to pages 11-7-50 to 51 for details.

∗ Combination of made-to-order for -X is available up to 2 kinds.
∗ Above is the typical example of combination.

CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

Combination Chart of Made to Order

Chart 9. Combination between -X□ and -X□ (S, W, X, Y, Z, T, J, K shaft)

Part no.	Description	Shaft type								Applicable size	Combination		
		S	W	X	Y	Z	T	J	K				
X6	Shaft, Bolt, Parallel key stainless spec.	●	●	●	●	●	●	●	●	30 to 100	X6		
X7	Heat resistance (100°C)	●	●	●	●	●	●	●	●		●	X7	
X10	Angle adjustment for both sides	●	●	●	●	●	●	●	●	50 to 100	—	●	
X11	Angle adjustment for single side, Air cushion with single side	●	●	●	●	●	●	●	●		—	●	X10 to X11
X16	Fluoro rubber for seals	●	●	●	●	●	●	●	●	30 to 100	●	—	●

Series CRA1
Made to Order Specifications:
-X6: Shaft, Bolt, Parallel Key Stainless Spec.
-X7: Heat Resistant Type

Please consult with SMC for further information on specifications, dimensions and delivery.

1 Shaft, Bolt, Parallel key Made of Stainless Steel Spec. -X6

C□RA1 → Refer to "How to Order" on pages 11-7-2, 13 and 18. S — X6

Stainless steel for main part

For applications in areas that pose a risk of rust or corrosion, a portion of the materials used in the standard parts has been changed to stain-less steel.

Specifications

Type	Pneumatic
Size	**30, 50, 63, 80, 100**
Fluid	Air (Non-lube)
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Stainless steel part	Shaft, Bolt, Parallel key
Cushion	30 — Without cushion 50 to 100 — With or without air cushion
Auto switch	Mountable

∗ Refer to page 11-7-3 for other specifications.
∗∗ Except for the angle adjustable type.

2 Heat Resistant Type -X7

CRA1 → Refer to "How to Order" on pages 11-7-2 and 24. — X7

Heat resistant type

In this rotary actuator, the material of the seals has been changed to the heat resistant type (to withstand up to 100°C), for applications in environments that exceed the standard specification temperatures of 0 to 60°C.

Specifications

Type	Pneumatic
Size	**30, 50, 63, 80, 100**
Rotation	90°, 180° (Size 30 to 100) 100°, 190° (Size 50 to 100)
Ambient and fluid temperature	0 to 100°C
Lubrication	ISO VG32
Seal material	FPM
Shaft type	Single shaft, Double shaft, Single shaft with four chamfers, Double shaft key, Double shaft with four chamfers, Double round shaft, Double shaft (Round shaft, with four chamfers), Double round shaft
Cushion	30 — Without cushion 50 to 100 — With or without air cushion
Auto switch	Not mountable

∗ Refer to page 11-7-3 for other specifications.
∗∗ Except for models with solenoid valve.

3 Fluoro Rubber for Seals -X16

CDRA1 → Refer to "How to Order" on pages 11-7-13 and 24. — X16

Fluoro rubber for seals

Seal is now changed to fluoro rubber.

Specifications

Type	Pneumatic
Size	**30, 50, 63, 80, 100**
Fluid	Air (Non-lube)
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Ambient and fluid temperature	0°C to 60°C (No freezing)
Seal material	FPM
Cushion	30 — Without cushion 50 to 100 — With or without air cushion
Auto switch	Mountable

∗ Refer to page 11-7-3 for other specifications.
∗∗ Except for models with solenoid valve.

Series CRA1
Made to Order Specifications:
-X10: Both Sides Angle Adjustable Type
-X11: One Side Angle Adjustable, One Side Cushion Type

Please consult with SMC for further information on specifications, dimensions and delivery.

4 Both Sides Angle Adjustable Type -X10

Refer to "How to Order" on page 11-7-24.

C□RA1 | Mounting | Shaft type | U | Size | Rotation | U-X10

Both sides angle adjustable type

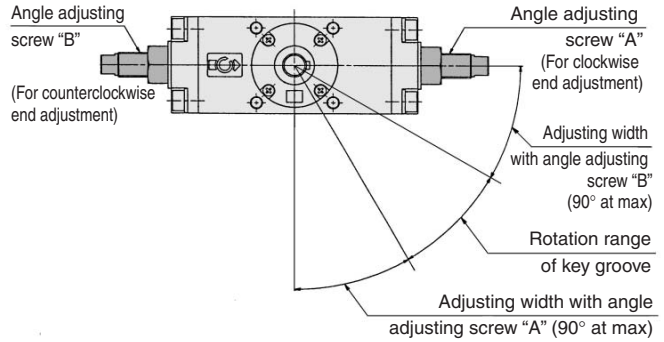
Specifications

Type	Pneumatic
Size	**50, 63, 80, 100**
Rotation	90°, 180°, 100°, 190°
Shaft type	Single shaft (S), Double shaft (W), Single shaft with four chamfers (X), Double shaft key (Y), Double shaft with four chamfers (Z), Single round shaft (T), Double shaft/Round shaft, with four chamfers (J), Double round shaft (K)
Cushion	None
Variation	With auto switch, With solenoid valve

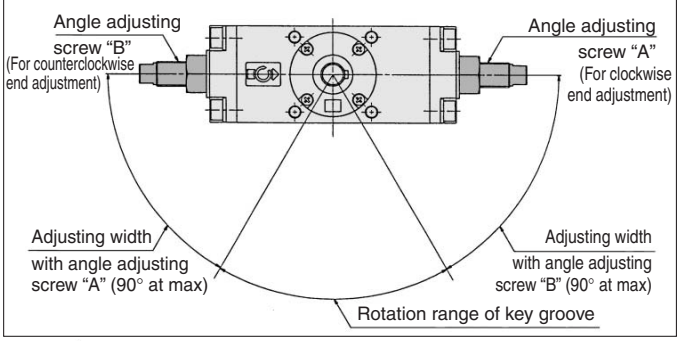
∗ Refer to page 11-7-3 for other specifications.

Adjusting direction: Adjusting direction "A": When angle adjusting screw on "A" side is screwed into the right direction.
Adjusting direction "B": When angle adjusting screw on "B" side is screwed into the right direction.

Rotation at 90°



Rotation at 180°



5 One Side Angle Adjustable, One Side Cushion -X11

Refer to "How to Order" on page 11-7-24.

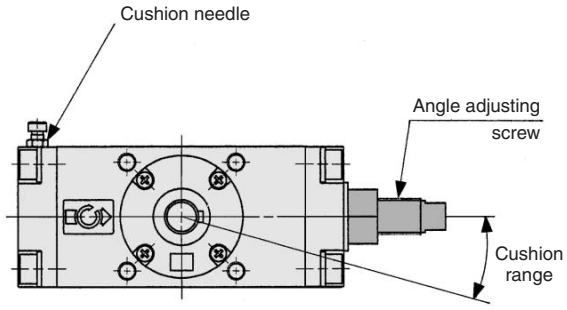
C□RA1 | Mounting | Shaft type | U | Size | Rotation | C-X11

One side angle adjustable, one side cushion

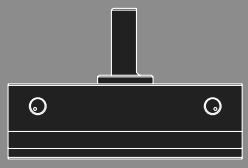
Specifications

Type	Pneumatic
Size	**50, 63, 80, 100**
Rotation	90°, 180°, 100°, 190°
Shaft type	Single shaft (S), Double shaft (W), Single shaft with four chamfers (X), Double shaft key (Y), Double shaft with four chamfers (Z), Single round shaft (T), Double shaft/Round shaft, with four chamfers (J), Double round shaft (K)
Cushion	With cushion on one side
Suffix symbol for auto switch	Mountable
Variation	With auto switch, With solenoid valve

∗ Refer to page 11-7-3 for other specifications.



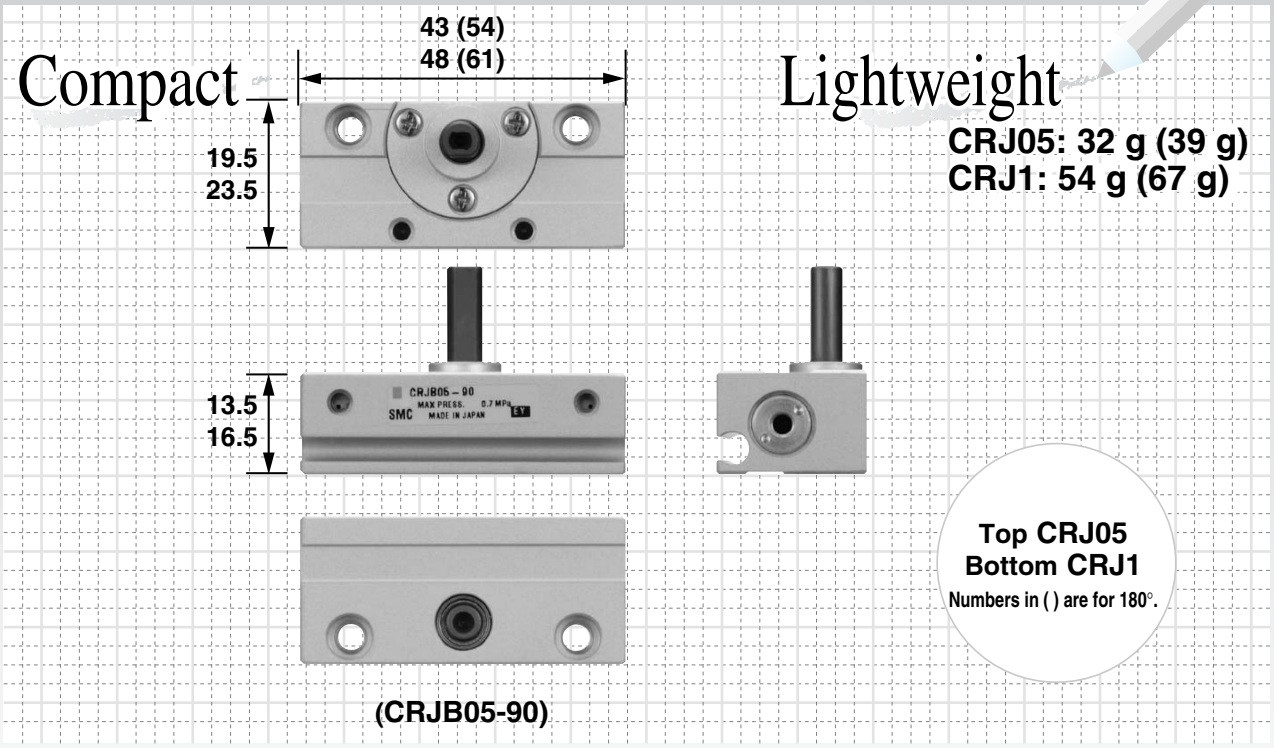
∗ Refer to pages 11-7-11 to 11-7-12 for dimensions.



Mini-rotary Actuator
Rack & Pinion Style
Series CRJ
Size: 05, 1

Mini-rotary Actuator *Series CRJ*

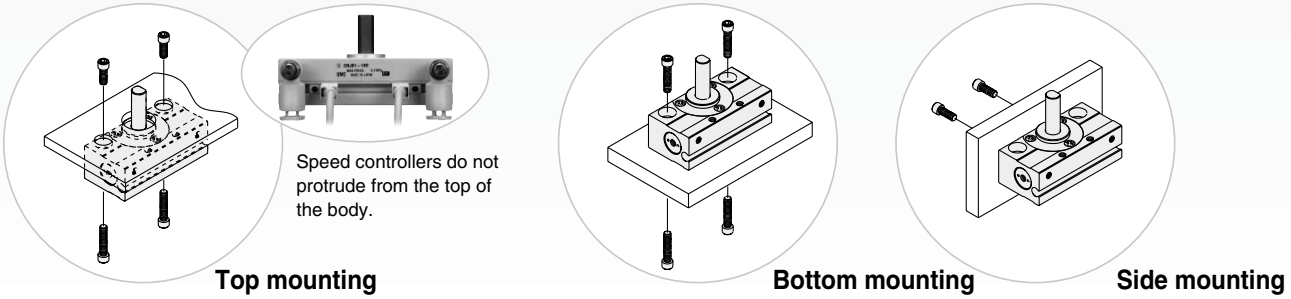
Rack & Pinion Style/Size: 05, 1



Flexible mounting

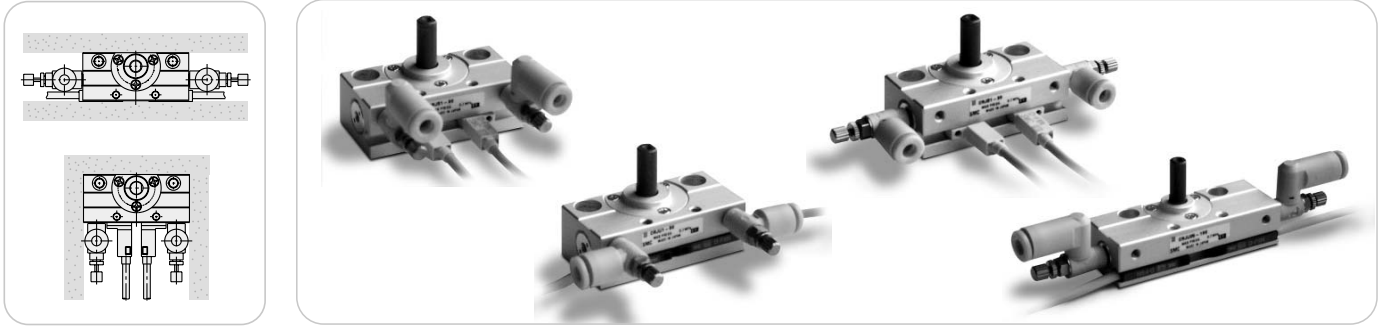
A new compact body design not only reduces overall space requirements, but also achieves space-savings in wiring and piping. Ease in mounting is maximized thanks to the merits of the new compact body.

■ Free mounting



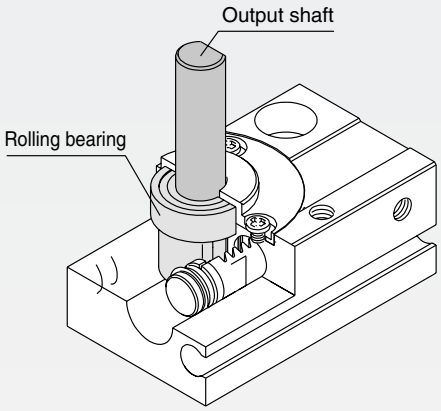
■ Wiring and piping direction can be selected depending on mounting conditions.

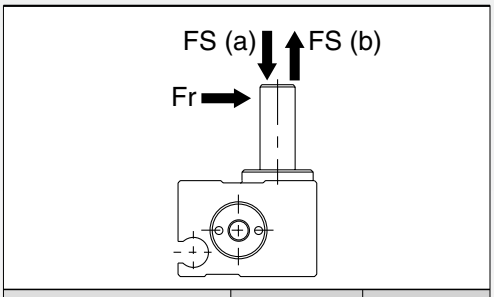
Mounting examples for auto switch and speed controller



Allowable load improved

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

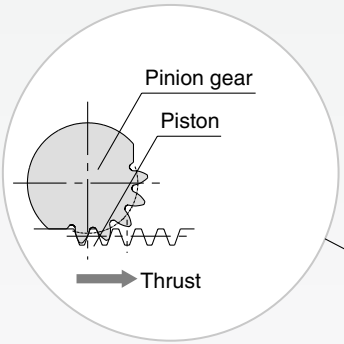




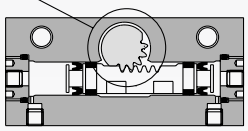
Model		CRJ05	CRJ1
Allowable load (N)	Fr	25	30
	FS (a)	20	25
	FS (b)	20	25
Output shaft size (mm)		ø5	ø6

Backlash reduced

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

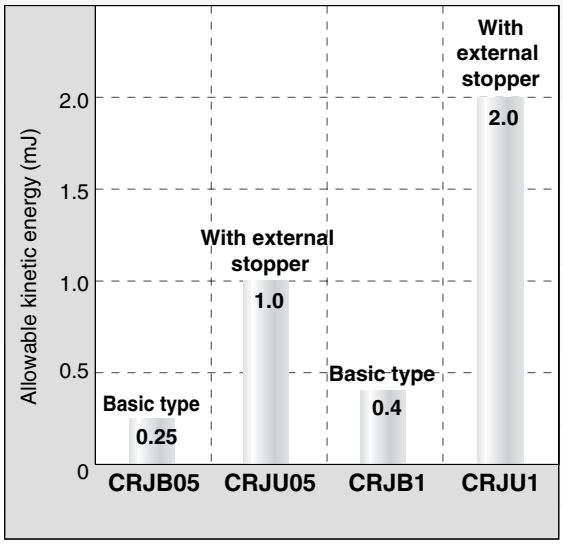


Stopping the pinion gear by having it strike against the flat surface of the piston eliminates backlash.

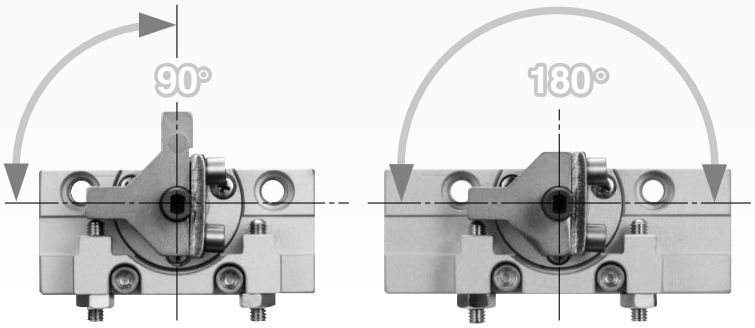


■ With external stopper/*Series CRJU*

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



Angle is adjustable: ±5° at each rotation end



Series Variations

Series		Rotating angle				Connection port location	Auto switch
		90°	100°	180°	190°		
Basic type	CRJB05	●	●	●	●	Front ported Side ported	D-F8 D-F9 D-M9
	CRJB1	●	●	●	●		
With external stopper	CRJU05	●	—	●	—		
	CRJU1	●	—	●	—		

⚠Precautions

Be sure to read before handling. Refer to pages 11-13-3 to 4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to pages 11-1-4 to 6 for Precautions on every series.

Rotation 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 x 0.5 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

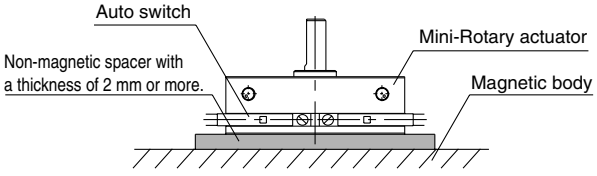
Mounting of Auto Switch

⚠Caution

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

If the magnetic body comes closer than 2 mm, 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

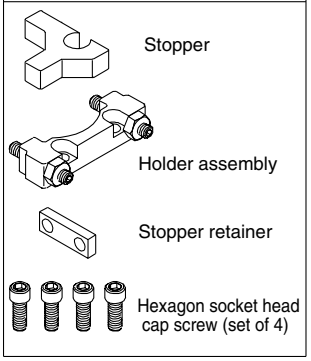
This product requires special tools; therefore, it cannot be disassembled for maintenance.

External Stopper Unit

⚠Caution

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

Parts List



Model	Unit part no.
CRJU05-90	P531010-1
CRJU05-180	P531010-2
CRJU1-90	P531020-1
CRJU1-180	P531020-2

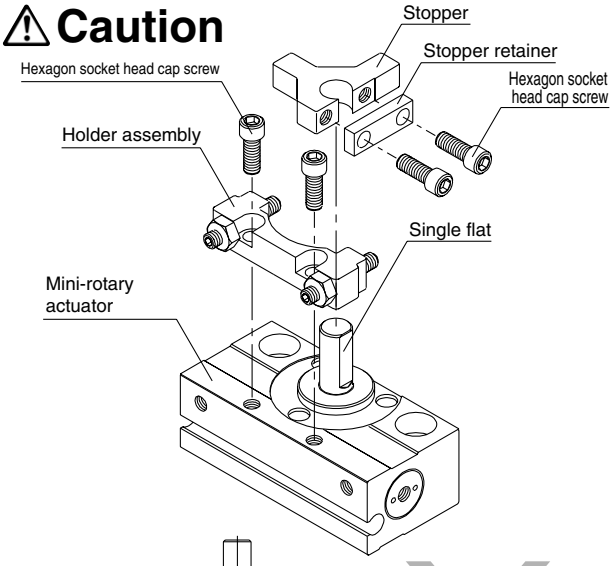
Note 1) External stopper units for 180° cannot be applied to the 90° Mini-rotary Actuators.

Note 2) When using external stoppers for 90°, use Mini-rotary Actu- ators 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



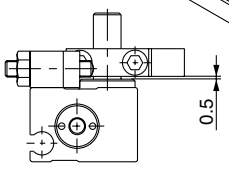


Fig. (1)

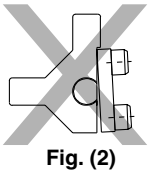


Fig. (2)

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 0.5 mm between the stopper and the Mini-rotary actuator, as shown in Fig. (1).
Tighten the hexagon socket head cap screws evenly so that the stopper retainer is not unevenly tightened as in Fig. (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 screw	0.8 to 1.2

Mini-rotary Actuator
Rack & Pinion Style
Series CRJ

How to Order

Rotating angle

90	90°
100	100°
180	180°
190	190°

Basic type CRJ B **05** – **90** **E** – **M9B** **S**

With external stopper CRJ U **05** – **90** **E** – **M9B** **S**

Number of auto switches

Nil	2 pcs.
S	1 pc.

Size

05
1

Auto switch

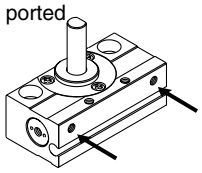
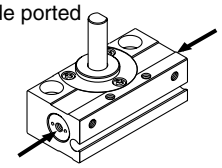
Nil	Without auto switch (Built-in magnet)

∗ For the applicable auto switch model, refer to the table below.

Rotating angle

90	90°
180	180°

Connection port location

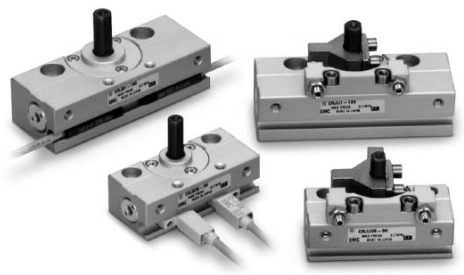
Nil	Front ported 
E	Side ported 

Applicable Auto Switch/Refer to pages 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch model		Lead wire length∗ (m)		
					DC		AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)
								Perpendicular	In-line			
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	12 V	—	—	**M9N**	●	●	—
								F8N	—	●	●	○
				3-wire (PNP)				—	**M9P**	●	●	—
								F8P	—	●	●	○
				2-wire				—	**M9B**	●	●	—
								F8B	—	●	●	○
	Diagnosis indication (2-color)			3-wire (NPN)				—	**F9NW**	●	●	○
				3-wire (PNP)				—	**F9PW**	●	●	○
				2-wire				—	**F9BW**	●	●	○

∗ Lead wire length symbols: 0.5 m ·····Nil (Example) M9N
3 m ·····L (Example) M9NL
5 m ·····Z (Example) F9NWZ

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



Specifications

Size	05		1	
	Basic type	With external stopper	Basic type	With external stopper
Fluid	Air (Non-lube)			
Max. operating pressure	0.7 MPa			
Min. operating pressure	0.15 MPa			
Ambient and fluid temperature	0 to 60°C (No freezing)			
Rotating 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 x 0.5			

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

Allowable Kinetic Energy and Rotation Time Adjustment Range

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	**CRJB1**	0.40	
	With external stopper	**CRJU1**	2.0	

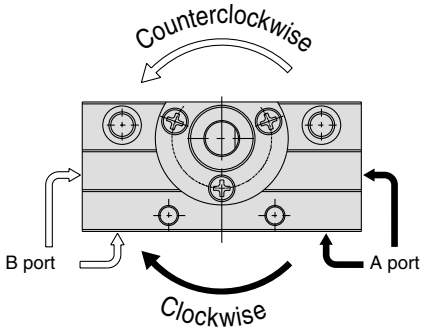
Weight

Type		Model	Weight (g) Note)
Basic type	05	**CRJB05-90**	32
		CRJB05-100	
		CRJB05-180	39
		CRJB05-190	
	1	**CRJB1-90**	54
		CRJB1-100	
		CRJB1-180	67
		CRJB1-190	
With external stopper	05	**CRJU05-90**	47
		CRJU05-180	53
	1	**CRJU1-90**	70
		CRJU1-180	81

Note) Values above do not include auto switch weights.

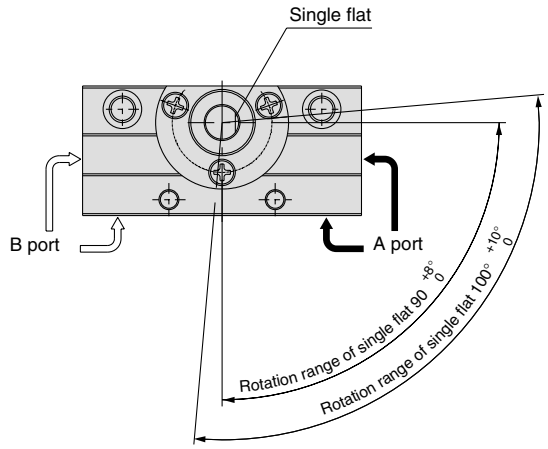
Rotating Direction and Rotating Angle

• 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.

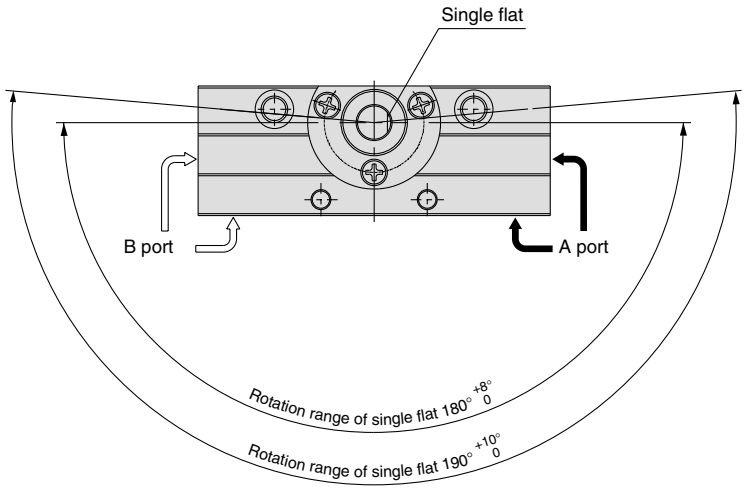


Basic type

For 90° and 100°

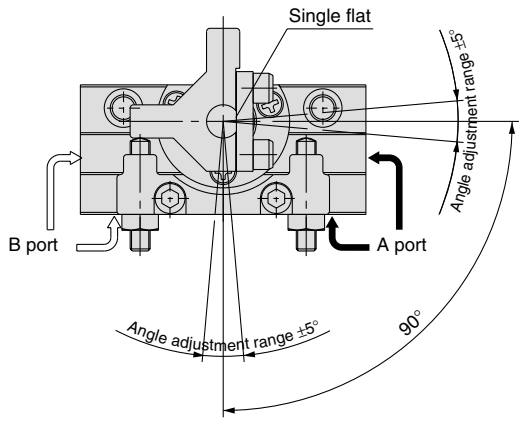


For 180° and 190°

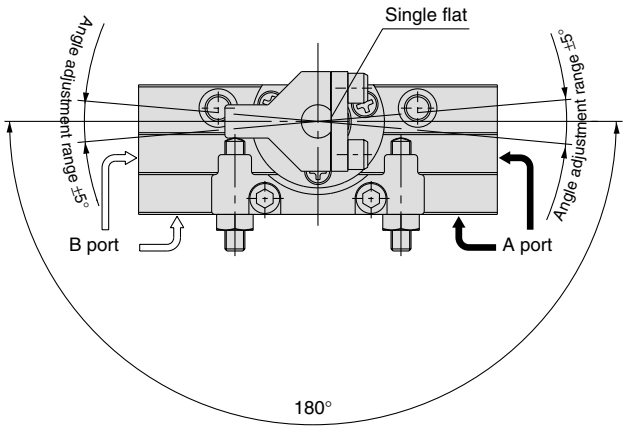


With external stopper

For 90°



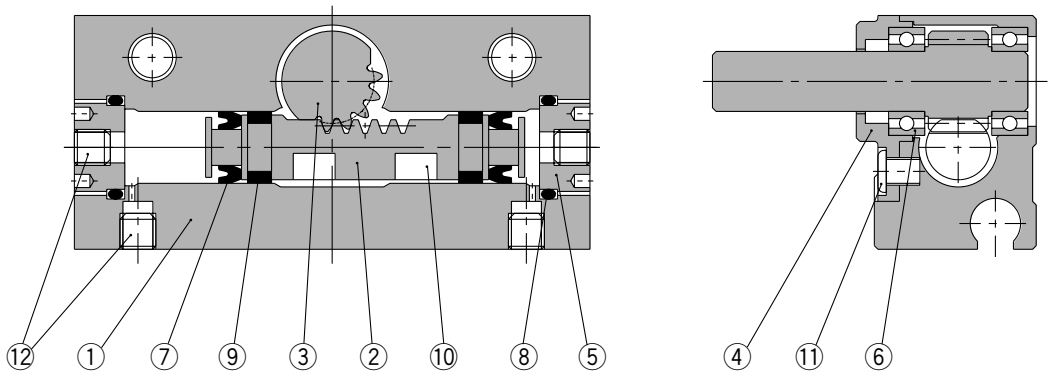
For 180°



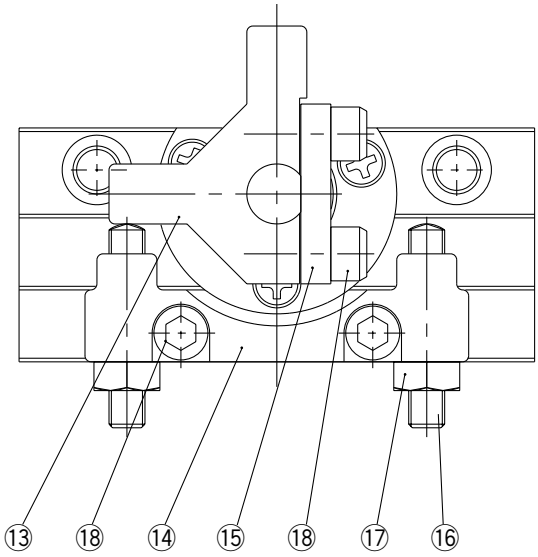
Note) • The drawings show the rotation range for the shaft's single flat.
• The single flat position in the drawings shows the counterclockwise rotation end when the rotation angle is adjusted to 90° and 180°.

Construction

Basic type: CRJB



With external stopper: CRJU



Component Parts

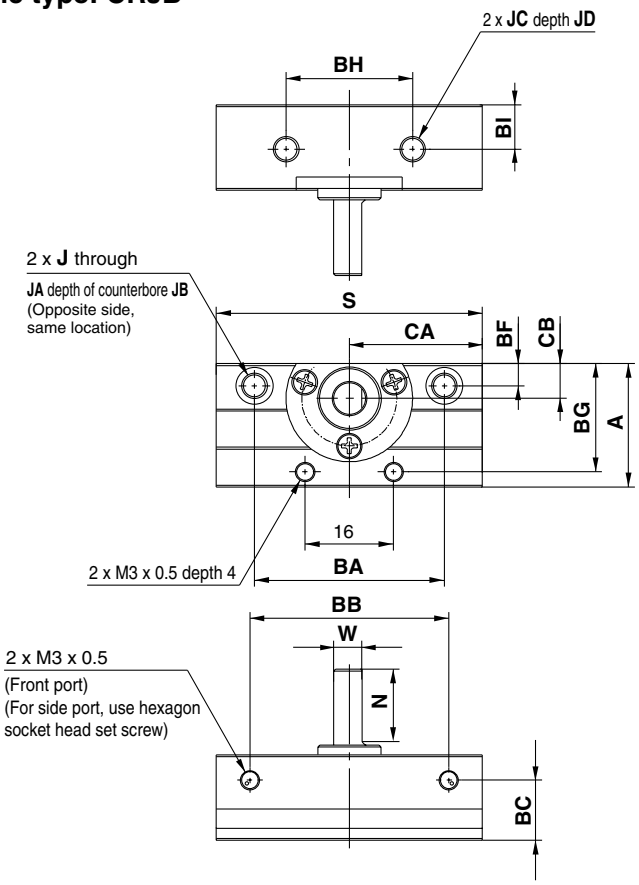
No.	Description	Material
①	Body	Aluminum alloy
②	Piston	Stainless steel
③	Shaft	Stainless steel
④	Bearing retainer	Aluminum alloy
⑤	Cover	Aluminum alloy
⑥	Bearing	Bearing steel
⑦	Piston seal	NBR
⑧	O-ring	NBR
⑨	Wear ring	Resin

No.	Description	Material
⑩	Magnet	Magnetic material
⑪	Round head no. 0 Philips 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

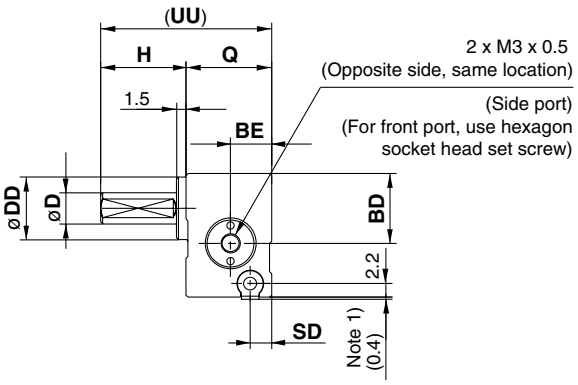
∗ The mounting position of hexagon socket head set screws (No. 12) varies depending on the connecting port location.

Dimensions/Size 05, 1

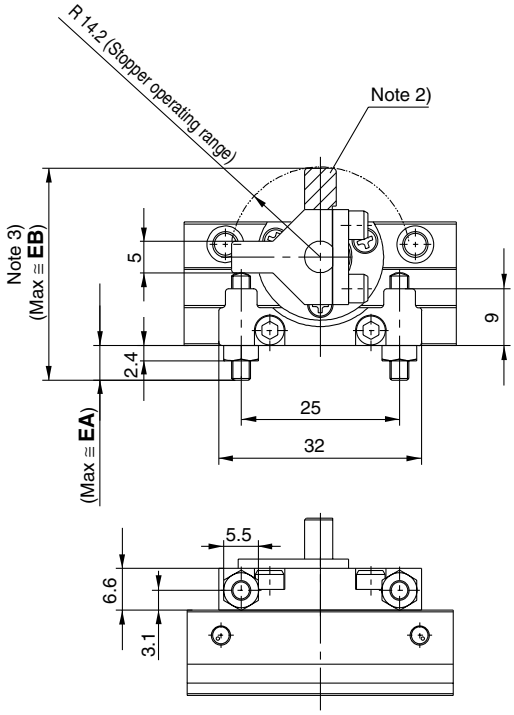
Basic type: CRJB



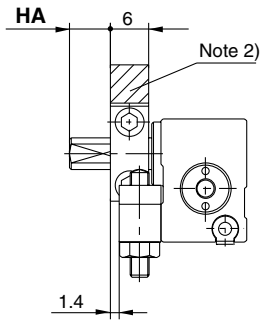
Note 1) This dimension is for the actuator with D-F9 type auto switch (not including the 2-color indication type).



With external stopper: CRJU



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 rotating angle. settings: 100° and 190°.



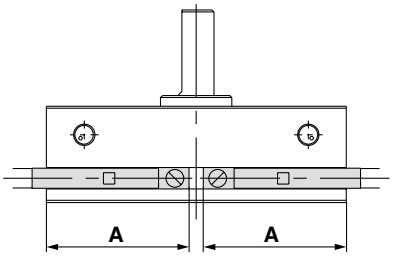
(mm)

Size	EA	EB	HA
CRJU05	5.6	33.8	6.5
CRJU1	5.6	35.8	7.5

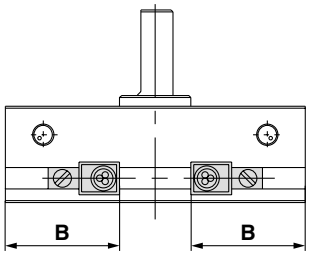
(mm)

Size	Rotating 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 x 0.7	5.8	3.5	M4 x 0.7	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 x 0.8	7.5	4.5	M5 x 0.8	6	15.5	13.5	16.5	48	5.9	32	5.5
	180°			50.4								30.5												61			

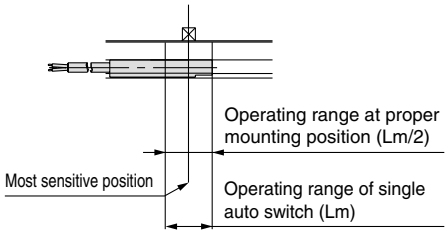
Proper Auto Switch Mounting Position (Detection at rotation end)



For D-F9, D-M9



For D-F8



Size	Rotating angle	D-F9, D-M9 auto switch			D-F8 auto switch		
		A	Operating angle θ m	Hysteresis angle	B	Operating angle θ m	Hysteresis angle
05	90°	20.5	40° (35°)	10° (10°)	16.5	20°	10°
	180°	23.2			19.2		
1	90°	22.4	30° (25°)	10° (10°)	18.4	15°	10°
	180°	25.6			21.6		

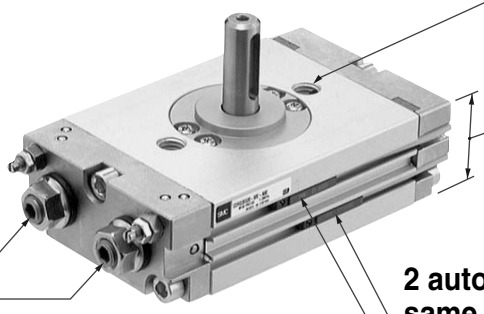
Operating angle θ m: Value of the operating range Lm of a single auto switch converted to an axial rotating angle.
Hysteresis angle : Value of auto switch hysteresis converted to an angle.
Note) Figures in parentheses are the cases for D-M9 switch types.

Compact Rotary Actuator
Rack & Pinion Style
Series CRQ2
Size: 10, 15, 20, 30, 40

Unidirectional pipe connection possible

Rotary actuator body serves as a flange.

Built-in cushion
10, 15: Rubber bumper
20, 30, 40: Air cushion



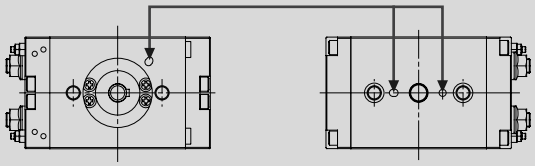
Thin, space-saving design
10: 17 mm
15: 20 mm
20: 29 mm
30: 33 mm
40: 37 mm

Equipped with an angle adjusting mechanism

2 auto switches are mountable on the same side. (Mountable on the both sides.)
Mounting smaller auto switches prevents the auto switch from protruding from the body edge and realizes space-savings.

Double piston style
Compact, with no backlash.

Centering is easy when mounting the main body.
Pin hole for positioning the main body



Whole size
Shaft type: Both single shaft and double shaft is possible.

Series Variations

			Size 10	15	20	30	40	Page
Standard	Rotating angle	80° to 100° 170° to 190°	●	●	●	●	●	11-8-2 to 11-8-9
	Shaft type	Single shaft S	●	●	●	●	●	
		Double shaft W	●	●	●	●	●	
	Cushion	None	●		●	●	●	
		Rubber bumper	●	●				
		Air cushion			●	●	●	
	Variations	With auto switch	●	●	●	●	●	
		Copper-free 20-	●	●	●	●	●	
Made to Order	Shaft type	Single shaft with four chamfers X			●	●	●	11-8-10 11-8-11
		Double shaft key Y			●	●	●	
		Double shaft with four chamfers Z			●	●	●	
		Single round shaft T	●	●	●	●	●	
		Double shaft (without keys on the long shaft) J	●	●	●	●	●	
		Double round shaft K	●	●	●	●	●	
	Pattern	Shaft end form	●	●	●	●	●	11-8-12 to 11-8-24
		Rotation range	●	●	●	●	●	
	Shaft, parallel key stainless spec. -X6		●	●	●	●	●	

Compact Rotary Actuator
Rack & Pinion Style
Series CRQ2
Size: 10, 15, 20, 30, 40

How to Order

Without auto switch

CRQ2B [S] [20] [ ] – [90] [ ]

Shaft type

Single shaft	S
Double shaft	W

Size

10
15
20
30
40

Rotating angle

90	80° to 100°
180	170° to 190°

Air cyshion

Size	Air cushion	
	None	Attached
10, 15	Nil	—
20, 30, 40		C

Thread type

Size	Port type	
10, 15	Nil	M5
20, 30, 40	Nil	Rc 1/8
	TF	G 1/8
	TN	NPT 1/8
	TT	NPTF 1/8

With auto switch

CDRQ2B [S] [20] [ ] – [90] [ ] – [F9BW] [S]

Built-in magnet

Shaft type

Single shaft	S
Double shaft	W

Size

10
15
20
30
40

Rotating angle

90	80° to 100°
180	170° to 190°

Suffix symbol

Size	Air cushion	
	None	Attached
10, 15	Nil	—
20, 30, 40		C

Auto switch

Nil	Without auto switch (Built-in magnet)

∗ For the applicable auto switch model, refer to the table below.
∗ Auto switches are shipped together, (but not assembled).

Port type

Size	Port type	
10, 15	Nil	M5
20, 30, 40	Nil	Rc 1/8
	TF	G 1/8
	TN	NPT 1/8
	TT	NPTF 1/8

Number of auto switches

Nil	2 pcs.
S	1 pc.

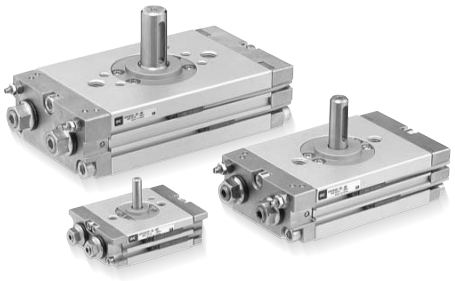
Applicable Auto Switch
/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model: Perpendicular	Auto switch model: In-line	Lead wire length (m) ∗ 0.5 (Nil)	3 (L)	5 (Z)	Pre-wire connector	Applicable load	
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5 V	—	**A96V**	**A96**	●	●	—	—	IC circuit	—
				2-wire	24 V	12 V	100 V	**A93V**	**A93**	●	●	—	—	—	Relay, PLC
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**M9NV**	**M9N**	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9PV**	**M9P**	●	●	○	○		
				2-wire		12 V		**M9BV**	**M9B**	●	●	○	○	—	
	Diagnostic indication (2-color)			3-wire (NPN)		5 V, 12 V		**F9NWV**	**F9NW**	●	●	○	○	IC circuit	
				3-wire (PNP)				**F9PWV**	**F9PW**	●	●	○	○		
				2-wire		12 V		**F9BWV**	**F9BW**	●	●	○	○	—	
	Water resistant (2-color)							—	**F9BA**∗∗	—	●	○	○		

∗ Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.
∗∗ Lead wire length symbols: 0.5 m ····· Nil (Example) A93
3 m ····· L (Example) A93L
5 m ····· Z (Example) F9NWZ
∗ Auto switches marked with "○" are made-to-order specification.
• Auto switches other than those listed above are also available. Refer to page 11-8-9 for details.

Made to Order

Refer to page 11-11-36 for detailed solid state switches with pre-wire connectors.



Specifications

Size	10	15	20	30	40
Fluid	Air (Non-lube)				
Max. operating pressure	0.7 MPa		1 MPa		
Min. operating pressure	0.15 MPa		0.1 MPa		
Ambient and fluid temperature	0° to 60°C (No freezing)				
Cushion	Rubber bumper		Not attached, Air cushion		
Angle adjustment	±5°				
Rotation	80° to 100°, 170° to 190°				
Port size	M5 x 0.8		Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8		
Mounting	Basic style				
Output (N·m) *	0.3	0.75	1.8	3.1	5.3

∗ Output under the operating pressure at 0.5 MPa. Refer to page 11-1-29 for further information.

CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

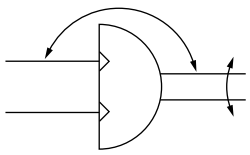
Made to Order P. 11-8-12 to 11-8-24

Allowable Kinetic Energy and Rotation Time Adjustment Range

Size	Allowable kinetic energy				Stable operational rotation time adjustment range
	Allowable kinetic energy (mJ)			Cushion angle	
	Without cushion	Rubber bumper	With air cushion*		Rotation time s/90°
10	—	0.25	—	—	0.2 to 0.7
15	—	0.39	—	—	0.2 to 0.7
20	25	—	120	40°	0.2 to 1
30	48	—	250	40°	0.2 to 1
40	81	—	400	40°	0.2 to 1

∗ Allowable kinetic energy for the bumper equipped type.
Maximum absorbed energy under proper adjustment of the cushion needles.

JIS Symbol



Weight

(g)

Size	Standard weight*	
	90°	180°
10	120	150
15	220	270
20	600	700
30	900	1100
40	1400	1600

∗ Values less the weight of auto switch.

⚠ Precautions

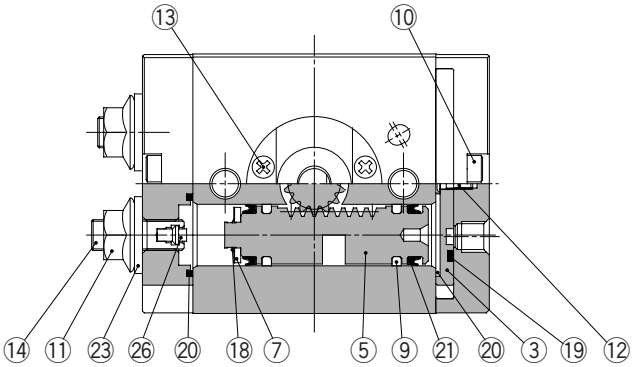
Be sure to read before handling. Refer to pages 11-13-3 to 11-13-4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to pages 11-1-4 to 11-1-6 for Precautions on every series.

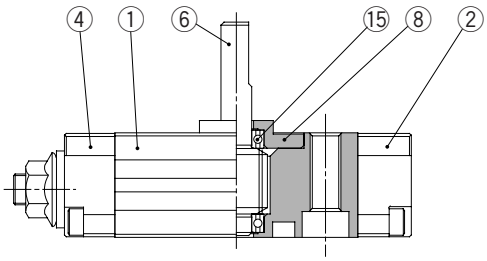
⚠ Caution

The angle adjustment bolt is set at random within the adjustable rotating range.
Therefore, it must be readjusted to obtain the angle that suits your application.

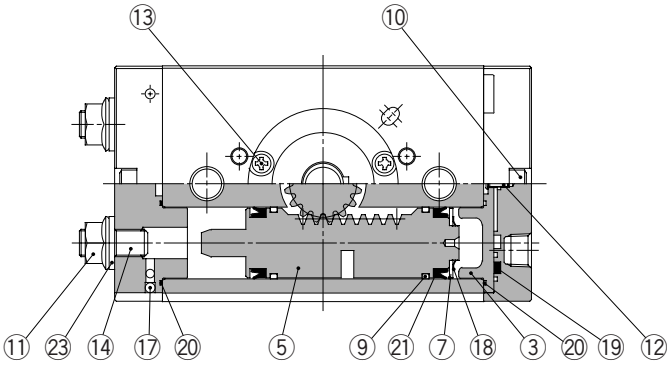
Construction

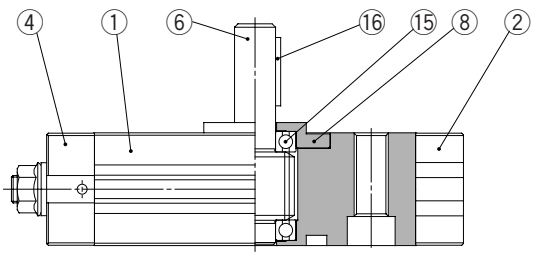
Basic type
Size 10/15





Basic type
Size 20/30/40





Component Parts

No.	Description	Material	Note
①	Body	Aluminum alloy	White hard anodized
②	Cover	Aluminum alloy	Electroless nickel plated
③	Plate	Aluminum alloy	
④	End cover	Aluminum alloy	Electroless nickel plated
⑤	Piston	Stainless steel	
⑥	Shaft	Stainless steel	For 10, 15
		Chrome molybdenum steel	For 20, 30, 40
⑦	Seal retainer	Aluminum alloy	Chromated
⑧	Bearing retainer	Aluminum alloy	White hard anodized
⑨	Wearing	Resin	
⑩	Hexagon socket head cap screw	Stainless steel	
⑪	Hexagon nut with flange	Steel wire	Electroless nickel plated
⑫	Cross recessed No. 0 screw	Steel wire	Zinc chromated
⑬	Cross recessed No. 0 screw	Steel wire	Nickel plated 10, 15
	Round head Phillips screw		Nickel plated 20, 30, 40

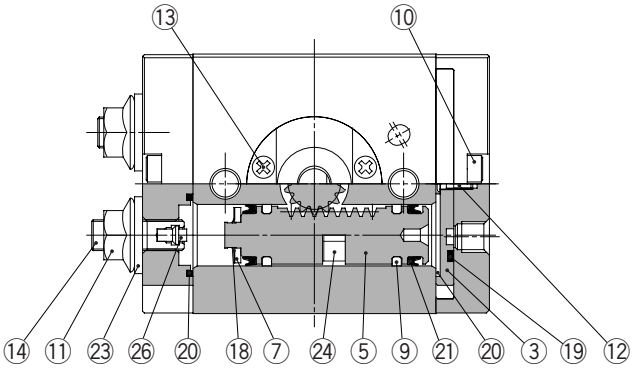
No.	Description	Material	Note
⑭	Hexagon socket head set screw	Chrome molybdenum steel	Electroless nickel plated
⑮	Bearing	Bearing steel	
⑯	Parallel key	Carbon steel	20, 30, 40
⑰	Steel ball	Stainless steel	20, 30, 40
⑱	Type CS retaining ring	Stainless steel	
⑲	Seal	NBR	
⑳	Gasket		
㉑	Piston seal		
㉒	Cushion seal		20, 30, 40 with cushion
㉓	Seal washer		
㉔	Magnet	Magnetic material	With auto switch
㉕	Cushion valve ass'y		20, 30, 40 with cushion
㉖	Cushion pad	Rubber material	10, 15

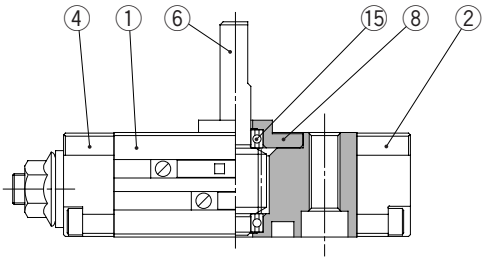
Replacement Parts

Description	Part no.					Description
	10	**15**	**20**	**30**	**40**	
Seal kit	P473010-1	P473020-1	P473030-1	P473040-1	P473050-1	19, 20, 21, 23

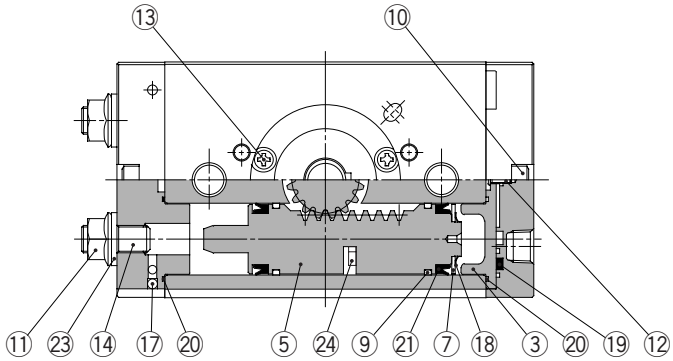
Construction

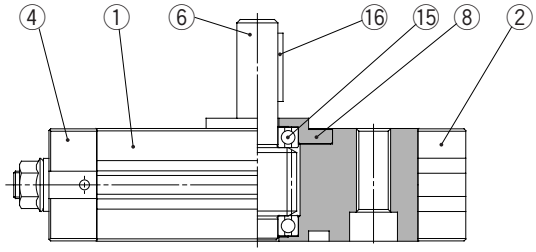
With auto switch
Size 10/15



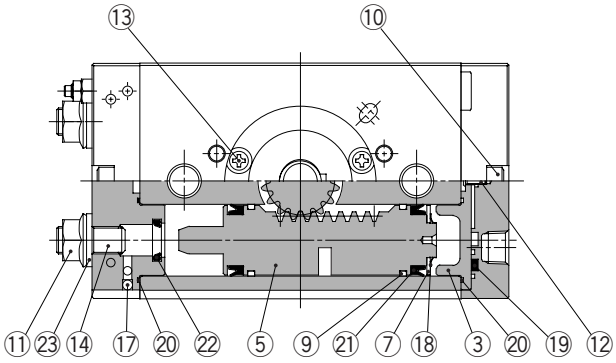


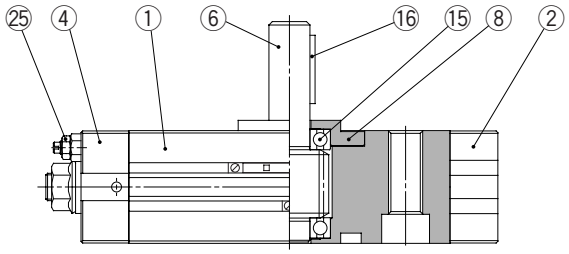
With auto switch
Size 20/30/40



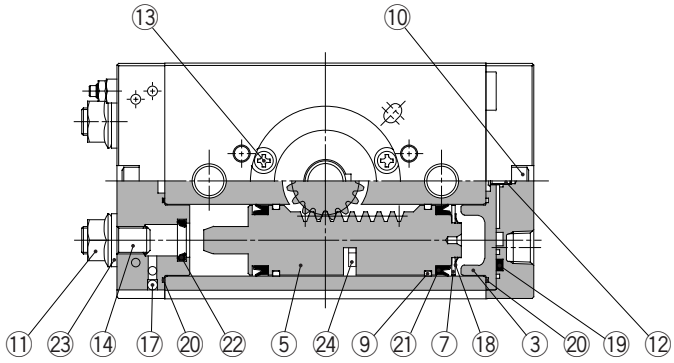


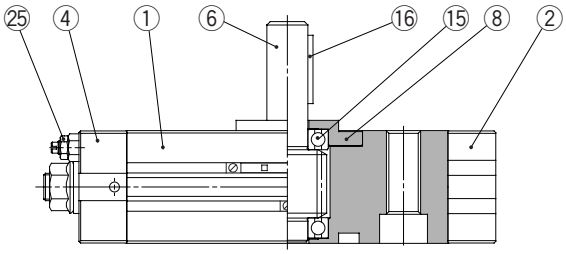
With cushion
Size 20/30/40





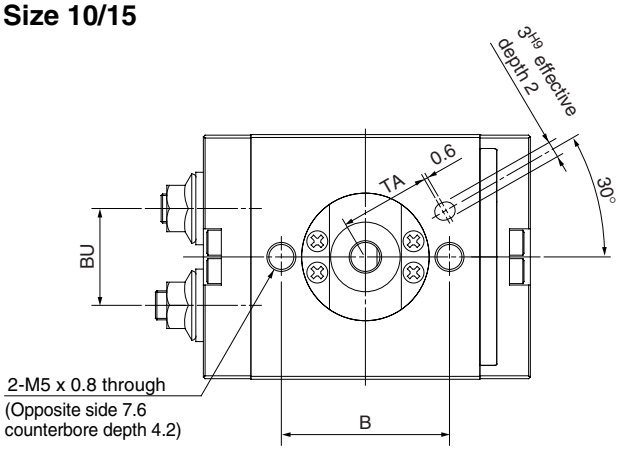
With auto switch and cushion
Size 20/30/40

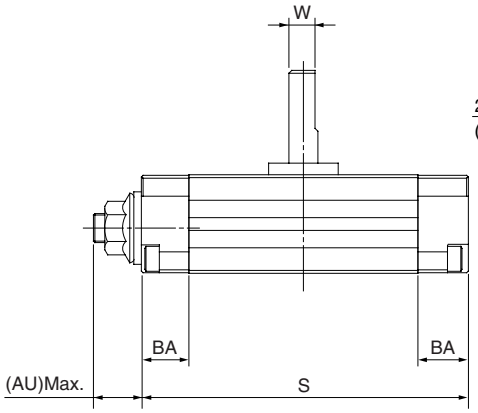


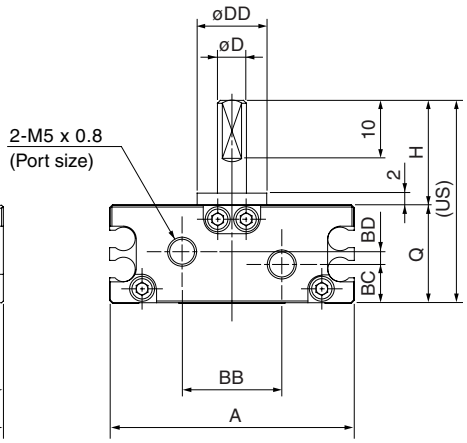


Dimensions

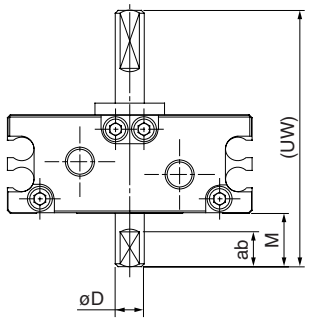
Size 10/15

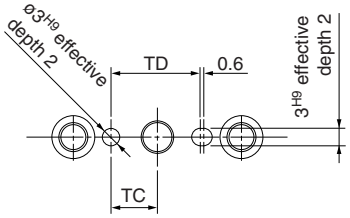






With double shaft





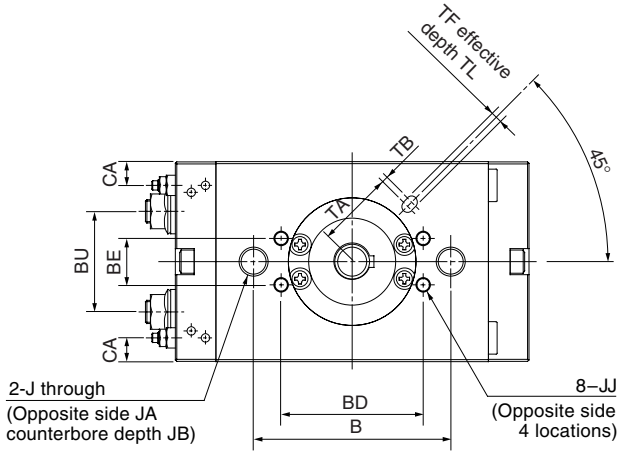
(mm)

Size	Rotating angle	A	AU*	B	BA	BB	BC	BD	BU	D (g6)	DD (h9)	H
10	90°, 180°	42	(8.5)	29	8.5	17	6.7	2.2	16.7	5	12	18
15	90°, 180°	53	(9.5)	31	9	26.4	10.6	—	23.1	6	14	20

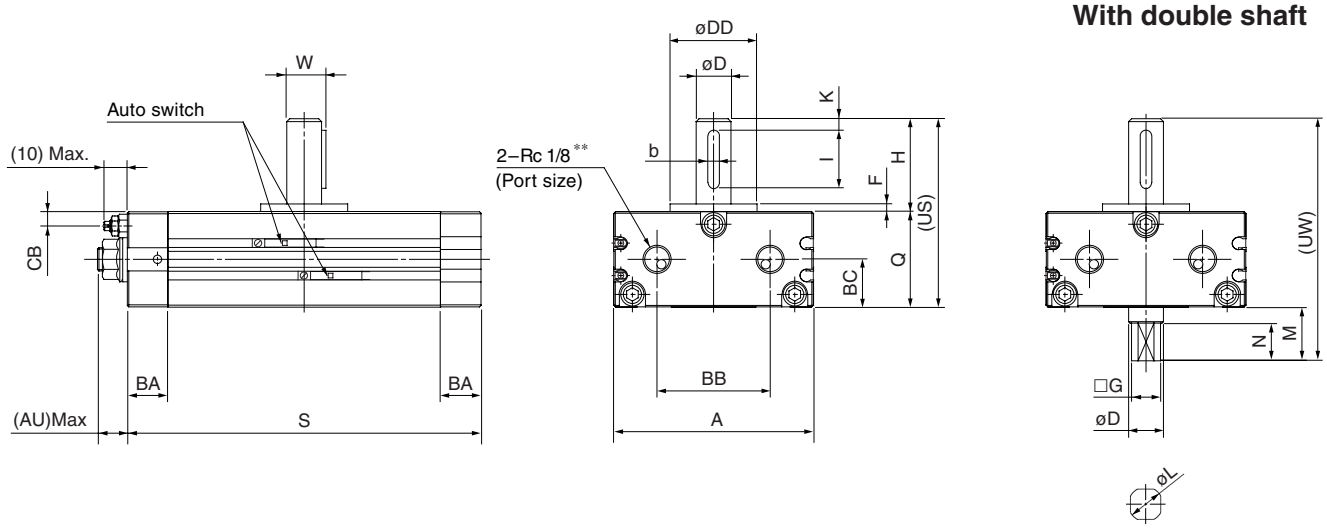
Size	Rotating angle	W	Q	S	US	UW	ab	M	TA	TC	TD
10	90°	4.5	17	56	35	44	6	9	15.5	8	15.4
	180°			69							
15	90°	5.5	20	65	40	50	7	10	16	9	17.6
	180°			82							

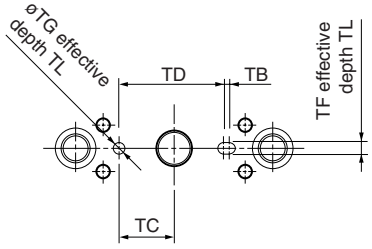
* AU dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.
S: Upper 90° Lower 180°

Size 20/30/40



With double shaft





(mm)

Size	Rotating angle	A	AU*	B	BA	BB	BC	BD	BE	BU	CA	CB	D (g6)	DD (h9)	F	H	J	JA	JB
20	90°, 180°	63	(11)	50	14	34	14.5	—	—	30.4	7	4.7	10	25	2.5	30	M8 x 1.25	11	6.5
30	90°, 180°	69	(11)	68	14	39	16.5	49	16	34.7	8.1	4.9	12	30	3	32	M10 x 1.5	14	8.5
40	90°, 180°	78	(13)	76	16	47	18.5	55	16	40.4	8.3	5.2	15	32	3	36	M10 x 1.5	14	8.6

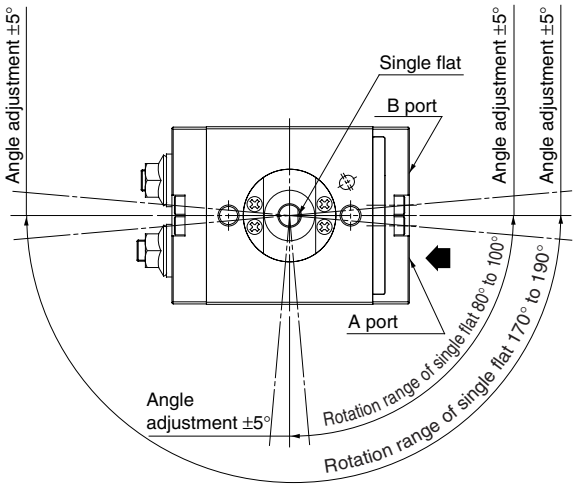
Size	Rotating angle	JJ	K	Q	S	W	Keyway dimensions b	Keyway dimensions l	US	TA	TB	TC	TD	TF (H9)	TG (H9)	TL	UW	G	M	N	L
20	90°	—	3	29	104	11.5	$4^{0}_{-0.03}$	20	59	24.5	1	13.5	27	4	4	2.5	74	8	15	11	9.6
	180°				130																
30	90°	M5 x 0.8 depth 6	4	33	122	13.5	$4^{0}_{-0.03}$	20	65	27	2	19	36	4	4	2.5	83	10	18	13	11.4
	180°				153																
40	90°	M6 x 1 depth 7	5	37	139	17	$5^{0}_{-0.03}$	25	73	32.5	2	20	39.5	5	5	3.5	93	11	20	15	14
	180°				177																

∗ AU dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.
S: Upper space 90°, Lower space 180°
∗∗ In addition to Rc 1/ 8, G 1/ 8, NPT 1/ 8, NPTF 1/ 8 are also available.

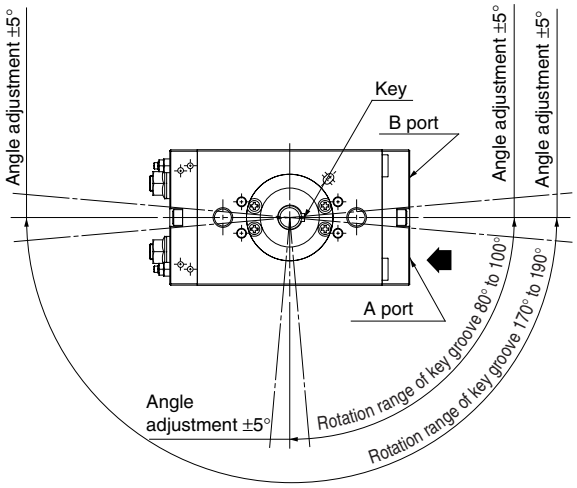
Rotation Range

When pressurized from the port indicated by the arrow, the shaft will rotate in a clockwise direction.

Size 10/15

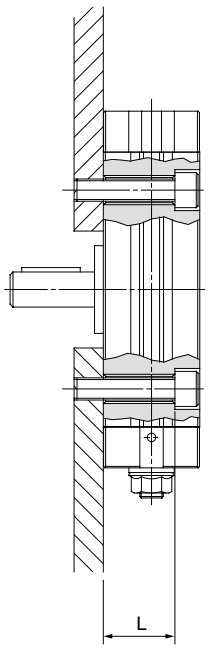


Size 20/30/40



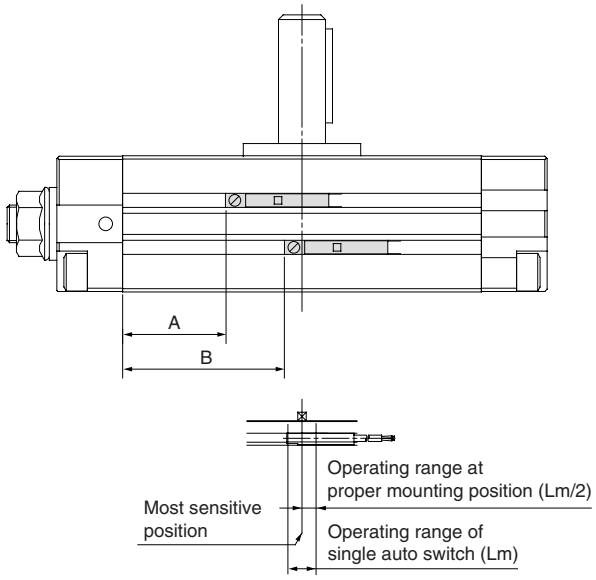
Unit Used as Flange Mount

The L dimensions of this unit are shown in the table below.
When hexagon socket head cap bolt of the JIS standard is used, the head of the bolt will recess into the groove of actuator.



Size	L	Screw
10	13	M4
15	16	M4
20	22.5	M6
30	24.5	M8
40	28.5	M8

Proper Auto Switch Mounting Position at Rotation End



Size	Rotating angle	Reed switch				Solid state switch			
		A	B	Operating angle (θ m)	Hysteresis angle	A	B	Operating angle (θ m)	Hysteresis angle
10	90°	6.5	13	63°	12°	10.5	17	75° (41°) ∗	3°
	180°	9.5	22.5			13.5	26.5		
15	90°	9.5	18	52°	9°	13.5	22	69° (32°) ∗	3°
	180°	13.5	30.5			17.5	34.5		
20	90°	22	34.5	41°	9°	26	38.5	56° (25°) ∗	4°
	180°	28	53.5			32	57.5		
30	90°	29	45	32°	7°	33	49	43° (20°) ∗	3°
	180°	37	68			41	72		
40	90°	34	53	24°	5°	38	57	36° (17°) ∗	4°
	180°	43.5	81.5			47.5	85.5		

Operating angle θ m: The value of the individual switch's movement range Lm as represented by an angle.
Hysteresis angle: Value of the switch's hysteresis as represented by an angle.
∗ Figures in parentheses are the cases for D-M9□, D-M9□V switch types.

Auto switches in addition to those listed above are also available. For detail specifications, refer to page 11-11-1.

Type	Model	Electrical entry	Feature
Reed switch	D-A90	Grommet (In-line)	Without indicator light
	D-A90V	Grommet (Perpendicular)	

• For details, refer to "Best Pneumatics Vol. 6/7/8/9/10". It is also available as normally closed (NC = b contact), and also with solid state switches (D-F9G, F9H type).

1. Shaft Type Variation, Four Chamfers (Size 20/30/40)

Shaft Type: X, Z

CRQ2B / CDRQ2B — Shaft type | Size | Rotating angle

Refer to "How to Order" on page 11-8-2 for further information.

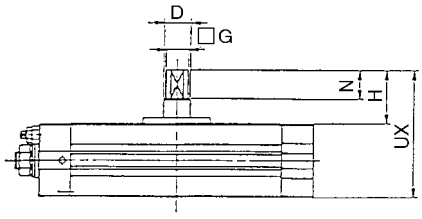
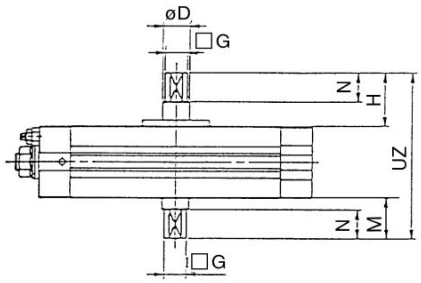
Shaft type

X	Single shaft with four chamfers
Z	Double shaft with four chamfers

Specifications

Fluid	Air (Non-lube)
Applicable shaft type	Single w/ four chamfers (**X**), Double w/ four chamfers (**Z**)
Applicable size	20, 30, 40
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Cushion	Not attached, Air cushion
Rotation	80° to 100°, 170° to 190°
Port size	Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8
Auto switch	Mountable

Dimensions

Shaft type	X	Z
Form		

(mm)

Size	D (g6)	G	H	N	UX	UZ	M
20	10	8	21	11	50	65	15
30	12	10	24	13	57	75	18
40	15	11	27	15	64	84	20

2. Shaft Type Variation, Double Shaft With Key (Size 20/30/40)

Shaft Type: Y

CRQ2B / CDRQ2B — Y | Size | Rotating angle

Refer to "How to Order" on page 11-8-2 for further information.

Shaft type

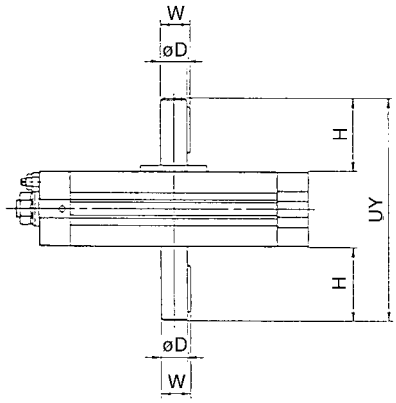
Y	Double shaft with key

Specifications

Fluid	Air (Non-lube)
Applicable shaft type	Double shaft with key (**Y**)
Applicable size	20, 30, 40
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Cushion	Not attached, Air cushion
Rotating angle	80° to 100°, 170° to 190°
Port size	Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8
Auto switch	Mountable

Dimensions

Y



(mm)

Size	D (g6)	W	H	UY
20	10	11.5	30	89
30	12	13.5	32	97
40	15	17	36	109

3. Shaft Type Variation/Without Key Groove

Shaft Type: T, J, K

CRQ2B
CDRQ2B **Shaft type** | **Size** | **Rotating angle**

Refer to "How to Order" on page 11-8-2 for further information.

Shaft type

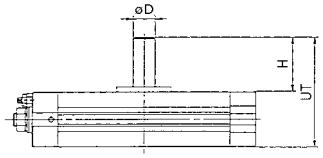
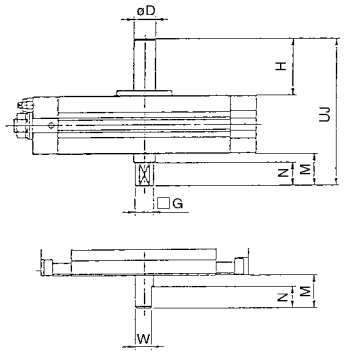
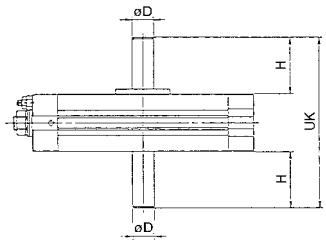
T	Single round shaft	
J	Double shaft	Without long shaft key, with four chamfers on short shaft, one chamfer on short shaft for 10 and 15.
K	Double round shaft	

Specifications

Fluid	Air (Non-lube)	
Applicable shaft type	Single round shaft (**T**), Double shaft (**J**), Double round shaft (**K**)	
Applicable size	10, 15	20, 30, 40
Max. operating pressure	0.7 MPa	1 MPa
Min. operating pressure	0.15 MPa	0.1 MPa
Cushion	Rubber bumper	Not attached, Air cushion
Rotating angle	80° to 100°, 170° to 190°	
Port size	Rc 1/8 G 1/8, NPT 1/8, NPTF 1/8	
Auto switch	Mountable	

Dimensions

(mm)

Shaft type	T	J	K
Form			

Size	D (g6)	H	M	N	UT	UJ	UK
10	5	18	9	6	35	44	53
15	6	20	10	7	40	50	60
20	10	30	15	11	59	74	89
30	12	32	18	13	65	83	97
40	15	36	20	15	73	93	109

Series ***CRQ2*** (Size: 10, 15, 20, 30, 40)

Simple Specials:
-XA1 to -XA24: Shaft Pattern Sequencing I

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Shaft Pattern Sequencing I — -XA1 to XA24

Applicable shaft type: S, W

How to Order

C D RQ2B S P 20 [ ] 90 C A90 X A2 A24 C30 -X6

Built-in magnet

Nil	None
D	Built-in magnet

Shaft type

Single shaft	S
Double shaft	W

Pattern

Size

10
15
20
30
40

Auto switch

Refer to page 11-8-2 for the part no. of auto switches.

Air cushion

Size	Air cushion	
	None	Attached
10, 15	Nil	—
20, 30, 40		C

Rotating angle

90	80° to 100°
180	170° to 190°

Thread type

Size	Port type	
10, 15	Nil	M5
20, 30, 40	Nil	Rc 1/8
	TF	G 1/8
	TN	NPT 1/8
	TT	NPTF 1/8

How to order model with auto switches

Refer to page 11-8-2 for "How to Order"products with auto switch.

Symbol for simple special, made to order products

- When the number of combinations is 1 or 2, refer to chart 1 and 2.
- ∗ Combination of XA is possible for up to 2 types.
- ∗ Combination of -X6 (Shaft, parallel stainless spec) is available with all the types.

• Combination 3 Types / **• Combination of Applicable Chart**

A1	A24	C30	Chart 1, 2
A2	A24	-X6	Chart 1
A13	C8	C30	Chart 2, 5
A14	C30	-X6	Chart 2

Combination is available only when all the conditions are fulfilled among the combination chart above.

• Combination 4 Types / **• Combination of Applicable Chart**

A1	A2	C8	C30	Chart 1, 2, 5
A2	A24	C10	-X6	Chart 1, 2
A14	C11	C30	-X6	Chart 2, 5
A14	C8	C12	C30	Chart 2, 5

Combination is available only when all the conditions are fulfilled among the combination chart above.

∗ **Combination of simple specials and made-to-order, it is possible for up to 4 types.**

Combination Chart of Simple Specials for Tip End Shape

Chart 1. Combination between -XA□ and -XA□ (S, W shaft)

Symbol	Description	Top port: Upper	Top port: Lower	Shaft type: S	Shaft type: W	Applicable size	Combination
XA1	Female thread at the end	●	—	●	●	10, 15	XA1
XA2	Female thread at the end	—	●	●	●	20, 30, 40	● XA2
XA3	Tip end of male thread	●	—	●	●	10, 15	— ● XA3
XA4	Tip end of male thread	—	●	—	●		W∗ — W∗ XA4
XA5	Stepped round shaft	●	—	●	●		— ● — ● XA5
XA6	Stepped round shaft	—	●	—	●		W∗ — W∗ — W∗ XA6
XA7	Round shaft with steps and male thread	●	—	●	●		— ● — ● — ● XA7
XA8	Round shaft with steps and male thread	—	●	—	●		W∗ — W∗ — W∗ — W∗ XA8
XA9	Change of the length of standard chamfered face	●	—	●	●		— ● — ● — ● — ● XA9
XA10	Change of the length of standard chamfered face	—	●	—	●		W∗ — W∗ — W∗ — W∗ — W∗ XA10
XA11	Two-sided chamfer	●	—	●	●		— ● — ● — ● — ● — ● XA11
XA12	Two-sided chamfer	—	●	—	●		W∗ — W∗ — W∗ — W∗ — W∗ — W∗ XA12
XA13	Shaft through-hole	●	●	●	●	10, 15 20, 30, 40	— — — — — — — — ● ● — — XA13
XA14	Shaft through-hole and female thread	●	—	●	●		— — — — — — — — ● ● — — — XA14
XA15	Shaft through-hole and female thread	—	●	●	●		— — — — — — — — ● ● — — — — XA15
XA16	Shaft through-hole and female thread	●	●	●	●		— — — — — — — — — — — — — — XA16
XA17	Shortened shaft	●	—	●	●	10, 15	— ● — ● — ● — ● — ● — ● — ● ● — ● — XA17
XA18	Shortened shaft	—	●	—	●	10, 15, 20, 30, 40	W∗ — W∗ — W∗ — W∗ — W∗ — W∗ — W∗ — W∗ W∗ — — W∗ XA18
XA19	Shortened shaft	●	●	—	●	10, 15	— — — — — — — — — — — — W∗ — — — —
XA20	Reversed shaft	●	●	●	●	10, 15, 20, 30, 40	— — — — — — — — — — — — — ● — — — — — XA20
XA21	Stepped round shaft with double-sided chamfer	●	—	●	●	10, 15	— ● — ● — ● — ● — ● — ● — ● — — — — — ● ● XA21
XA22	Stepped round shaft with double-sided chamfer	—	●	—	●		W∗ — W∗ — W∗ — W∗ — W∗ — W∗ — W∗ — — — — W∗ — — W∗ XA22
XA23	Right-angle chamfer	●	—	●	●		● ● — ● — ● — ● — ● — ● ● ● ● ● — ● ● — ●
XA24	Double key	●	—	●	●	20, 30, 40	● ● — — — — — — — — — — ● ● ● ● — ● ● — —

∗ Describes the combination available for corresponding shaft shapes.

Combination Chart of Made to Order

Chart 2. Combination between -XA□ and -XC□ (Made to Order/ Details of -XC□, refer to page 11-8-20.)

Symbol	Description	Applicable size	Combination XA1 to XA24
XC7	Reversed shaft	10, 15 20, 30, 40	—
XC8	Change of rotating range		●
XC9			●
XC10			●
XC11			●
XC12	Change in angle adjustable range 0° to 100°		●
XC13			●
XC14			●
XC15			●
XC16	Change in angle adjustable range 90° to 190°		●
XC17			●

Symbol	Description	Applicable size	Combination XA1 to XA24
XC18	Change of rotating range	20, 30, 40	●
XC19			●
XC20	Change in angle adjustable range 90° to 190°		●
XC21			●
XC22	Without inner rubber bumper	10, 15	●
XC30	Fluoro grease	10, 15, 20, 30, 40	●

∗ Chart 5. Refer to page 11-8-20 for combination available between -XC□ and -XC□.

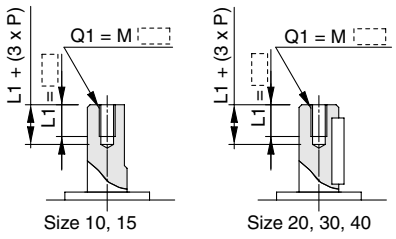
Shaft Pattern Sequencing I — -XA1 to XA8

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. SMC will make appropriate arrangements if no dimensional, tolerance, or finishin structions are given in the diagram.
3. The length of the unthreaded portion is 2 to 3 pitches.
4. Unless specified otherwise, the thread pitch is based on coarse metric threads.
   P = Thread pitch
5. M3 x 0.5; M4 x 0.7; M5 x 0.8; M6 x 1
   Enter the desired figures in the [ ] portion of the diagram.
6. XA1 to XA24 are the standard products that have been additionally machined.
7. Chamfer face of the parts machining additionally is C0.5.

Symbol: A1

Machine female threads into the long shaft.
The maximum dimension L1 is, as a rule, twice the thread size (Example) For M3: L1 = 6 mm
• Applicable shaft types: S, W

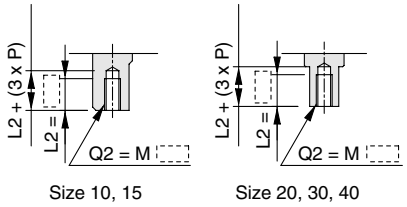


(mm)

Size	Q1
10	M3
15	M3, M4
20	M3, M4
30	M3, M4, M5
40	M4, M5, M6

Symbol: A2

Machine female threads into the short shaft.
The maximum dimension L2 is, as a rule, twice the thread size. (Example) For M4: L2 = 8 mm
• Applicable shaft types: S, W

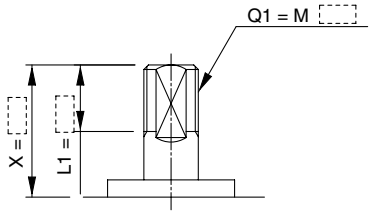


(mm)

Size	Q2
10	M3
15	M3, M4
20	M3, M4
30	M3, M4, M5
40	M4, M5, M6

Symbol: A3

The long shaft can be further shortened by machining male threads into it.
(If shortening the shaft is not required, indicate "∗" for dimension X.)
• Applicable shaft types: S, W

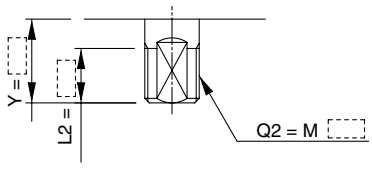


(mm)

Size	X	L1 max	Q1
10	9 to 18	X – 4	M5
15	10 to 20	X – 4	M6

Symbol: A4

The short shaft can be further shortened by machining male threads into it.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
• Applicable shaft type: W

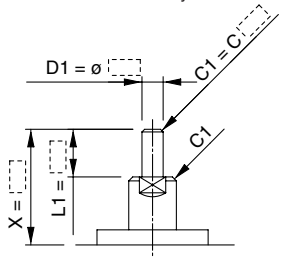


(mm)

Size	Y	L2 max	Q2
10	7 to 9	Y – 2	M5
15	8 to 10	Y – 3	M6

Symbol: A5

The long shaft can be further shortened by machining it into a stepped round shaft.
(If shortening the shaft is not required, indicate "∗" for dimension X.)
(If not specifying dimension C1, indicate "∗" instead.)
• Applicable shaft types: S, W
• Equal dimensions are indicated by the same marker.

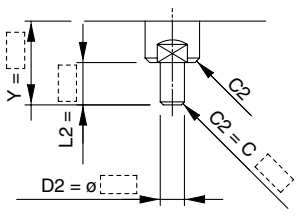


(mm)

Size	X	L1 max	D1
10	3 to 18	X – 2	ø3.5 to ø4.9
15	3 to 20	X – 2	ø3.5 to ø5.9

Symbol: A6

The short shaft can be further shortened by machining it into a stepped round shaft.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
(If not specifying dimension C2, indicate "∗" instead.)
• Applicable shaft type: W
• Equal dimensions are indicated by the same marker.

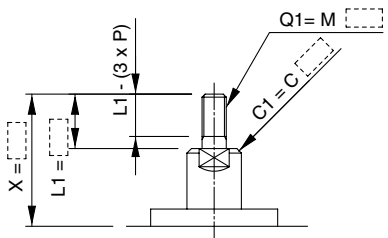


(mm)

Size	Y	L2 max	D2
10	1 to 9	Y	ø3.5 to ø4.9
15	1 to 10	Y	ø3.5 to ø5.9

Symbol: A7

The long shaft can be further shortened by machining it into a stepped round shaft with male threads.
(If shortening the shaft is not required, indicate "∗" for dimension X.)
(If not specifying dimension C1, indicate "∗" instead.)
• Applicable shaft types: S, W

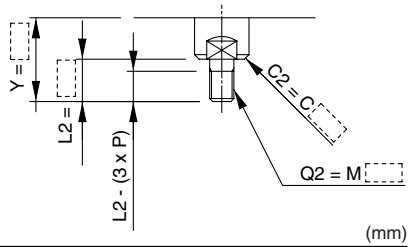


(mm)

Size	X	L1 max	Q1
10	8 to 18	X – 2	M3, M4
15	9.5 to 20	X – 2	M3, M4, M5

Symbol: A8

The short shaft can be further shortened by machining it into a stepped round shaft with male threads.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
(If not specifying dimension C2, indicate "∗" instead.)
• Applicable shaft type: W



(mm)

Size	Y	L2 max	Q2
10	6 to 9	Y	M3, M4
15	7.5 to 10	Y	M3, M4, M5

Series ***CRQ2*** **(Size: 10, 15, 20, 30, 40)**

Simple Specials:
-XA1 to -XA24: Shaft Pattern Sequencing I

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

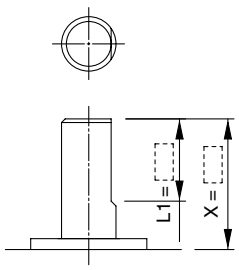
Shaft Pattern Sequencing I

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. SMC will make appropriate arrangements if no dimensional, tolerance, or finish instructions are given in the diagram.
3. The length of the unthreaded portion is 2 to 3 pitches.
4. Unless specified otherwise, the thread pitch is based on coarse metric threads.
   P = Thread pitch
5. M3 x 0.5; M4 x 0.7; M5 x 0.8; M6 x 1
   Enter the desired figures in the ☐ portion of the diagram.
6. XA9 to XA24 are the standard products that have been additionally machined.
7. Chamfer face of the parts machining additionally is C0.5.

Symbol: A9

The long shaft can be further shortened by changing the length of the standard chamfer on the long shaft side.
(If shortening the shaft is not required, indicate "∗" for dimension X.)
• Applicable shaft types: S, W

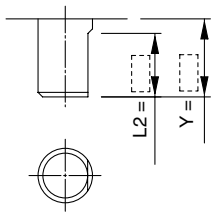


(mm)

Size	X	L1
10	8 to18	{10 – (18 – X) } to (X – 2)
15	10 to 20	{10 – (20 – X) } to (X – 2)

Symbol: A10

The short shaft can be further shortened by changing the length of the standard chamfer.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
• Applicable shaft type: W

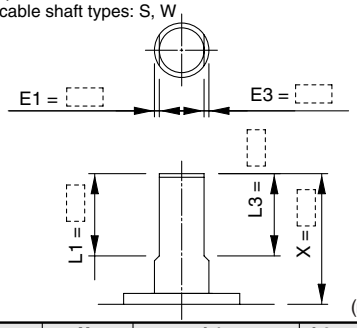


(mm)

Size	Y	L2
10	3 to 9	6 – (9 – Y) to Y
15	3 to 10	7 – (10 – Y) to Y

Symbol: A11

The long shaft can be further shortened by machining a double-sided chamfer on to it.
• Since L1 is a standard chamfer, dimension E1 is 0.5 mm or more.
(If altering the standard chamfer and shortening the shaft are not required, indicate "∗" for both the L1 and X dimensions.)
• Applicable shaft types: S, W

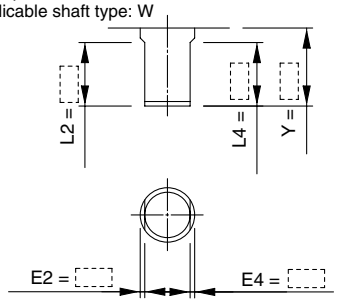


(mm)

Size	X	L1	L3 max
10	8 to 18	{10 – (18 – X)} to (X – 2)	X – 2
15	10 to 20	{10 – (20 – X)} to (X – 2)	X – 2

Symbol: A12

The short shaft can be further shortened by machining a double-sided chamfer on to it.
• Since L2 is a standard chamfer, dimension E2 is 0.5 mm or more.
(If altering the standard chamfer and shortening the shaft are not required, indicate "∗" for both the L2 and Y dimensions.)
• Applicable shaft type: W

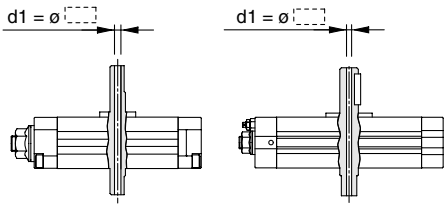


(mm)

Size	Y	L2	L4 max
10	3 to 9	6 – (9 – Y) to Y	Y
15	3 to10	7 – (10 – Y) to Y	Y

Symbol: A13

Shaft with through-hole
Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft types: S, W



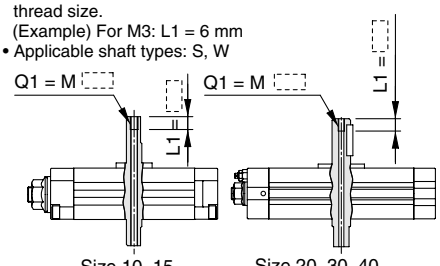
Size 10, 15 Size 20, 30, 40

(mm)

Size	d1
10	ø2 to ø3
15	ø2 to ø4
20	ø2.5 to ø3.5
30	ø3 to ø5.5
40	ø4 to ø7

Symbol: A14

A special end is machined onto the long shaft, and a through-hole is drilled into it. Female threads are machined into the through-hole, whose diameter is equivalent to the pilot hole diameter.
• The maximum dimension L1 is, as a rule, twice the thread size.
(Example) For M3: L1 = 6 mm
• Applicable shaft types: S, W



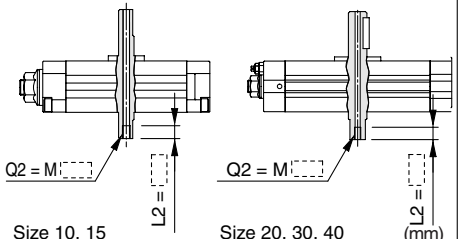
Size 10, 15 Size 20, 30, 40

(mm)

Size / Thread	10	15	20	30	40
M3 x 0.5	ø2.5	ø2.5	ø2.5	—	—
M4 x 0.7	—	ø3.3	ø3.3	ø3.3	—
M5 x 0.8	—	—	—	ø4.2	ø4.2
M6 x 1	—	—	—	—	ø5

Symbol: A15

A special end is machined onto the short shaft, and a through-hole is drilled into it. Female threads are machined into the through-hole, whose diameter is equivalent to the pilot hole diameter.
• The maximum dimension L2 is, as a rule, twice the thread size. (Example) For M4: L2 = 8 mm
• Applicable shaft types; S, W



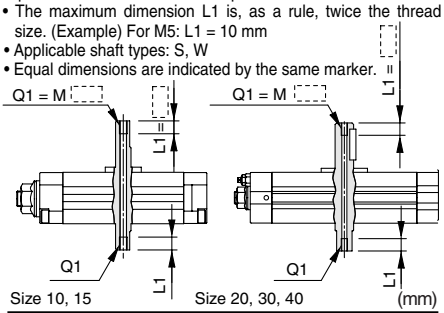
Size 10, 15 Size 20, 30, 40

(mm)

Size / Thread	10	15	20	30	40
M3 x 0.5	ø2.5	ø2.5	ø2.5	—	—
M4 x 0.7	—	ø3.3	ø3.3	ø3.3	—
M5 x 0.8	—	—	—	ø4.2	ø4.2
M6 x 1	—	—	—	—	ø5

Symbol: A16

A special end is machined onto both the long and short shafts, and a through-hole is drilled into both shafts. Female threads are machined into the through-holes, whose diameter is equivalent to the diameter of the pilot holes.
• The maximum dimension L1 is, as a rule, twice the thread size. (Example) For M5: L1 = 10 mm
• Applicable shaft types: S, W
• Equal dimensions are indicated by the same marker.



Size 10, 15 Size 20, 30, 40

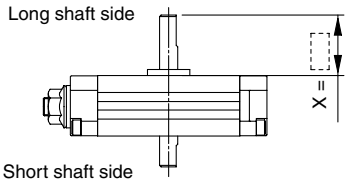
(mm)

Size / Thread	10	15	20	30	40
M3 x 0.5	ø2.5	ø2.5	ø2.5	—	—
M4 x 0.7	—	ø3.3	ø3.3	ø3.3	—
M5 x 0.8	—	—	—	ø4.2	ø4.2
M6 x 1	—	—	—	—	ø5

-XA9 to XA24

Symbol: A17

Shorten the long shaft.
• Applicable shaft types: S, W

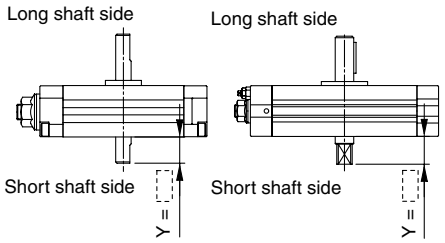


(mm)

Size	X
10	2 to 18
15	2 to 20

Symbol: A18

Shorten the short shaft.
• Applicable shaft type: W shaft



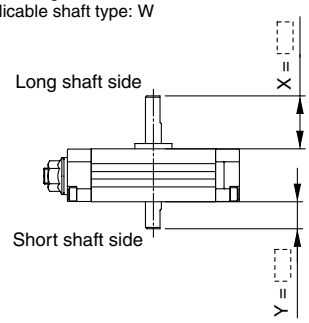
Size 10, 15 Size 20, 30, 40

(mm)

Size	Y
10	1 to 9
15	1 to 10
20	1 to 15
30	1 to 18
40	1 to 20

Symbol: A19

Both the long shaft and short shaft are shortened.
• Applicable shaft type: W

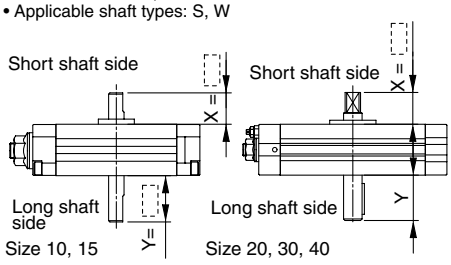


(mm)

Size	X	Y
10	2 to 18	1 to 9
15	2 to 20	1 to 10

Symbol: A20

Reverse the assembly of the shaft. (Thus shortening the long end and the short end of the shaft.)
(If shortening the shaft is not required, indicate "∗" for dimension X and Y.)
• Applicable shaft types: S, W

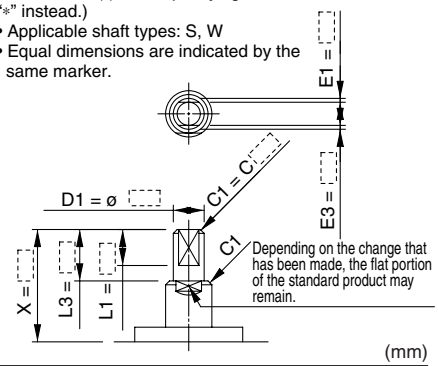


(mm)

Size	X	Y
10	2 to 10	1 to 17
15	2 to 11	1 to 19
20	2.5 to 16.5	29
30	3 to 20	30
40	3 to 22	34

Symbol: A21

The long shaft can be further shortened by machining it into a stepped round shaft with a double-sided chamfer.
(If shortening the shaft is not required, indicate "∗" for dimension X.)(If not specifying dimension C1, indicate "∗" instead.)
• Applicable shaft types: S, W
• Equal dimensions are indicated by the same marker.

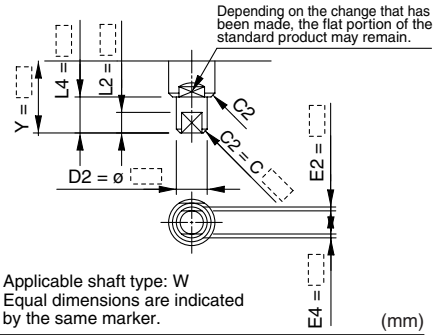


(mm)

Size	X	L1max	L3	D1
10	5 to 18	X – 3.5	L1 + 1.5	ø3.5 to ø4.9
15	5.5 to 20	X – 4	L1 + 2	ø3.5 to ø5.9

Symbol: A22

The short shaft can be further shortened by machining it into a stepped round shaft with a double-sided chamfer.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
(If not specifying dimension C2, indicate "∗" instead.)



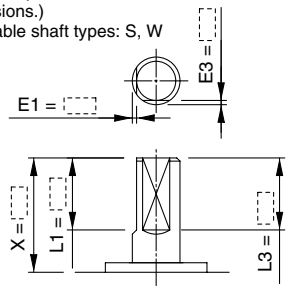
• Applicable shaft type: W
• Equal dimensions are indicated by the same marker.

(mm)

Size	Y	L2max	L4	D2
10	3 to 9	Y – 1.5	L2 + 1.5	ø3.5 to ø4.9
15	3.5 to 10	Y – 2	L2 + 2	ø3.5 to ø5.9

Symbol: A23

The long shaft can be further shortened by machining right-angle double-sided chamfer onto it.
• Since L1 is a standard chamfer, dimension E1 is 0.5 mm or more.
(If altering the standard chamfer and shortening th shaft are not required, indicate "∗" for both the L1 and X dimensions.)
• Applicable shaft types: S, W

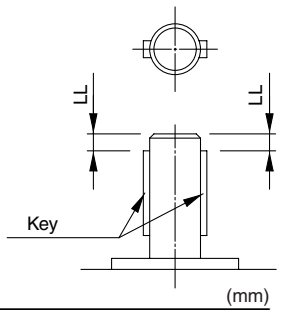


(mm)

Size	X	L1	L3max
10	8 to 18	{10 – (18 – X)} to (X – 2)	X-2
15	10 to 20	{10 – (20 – X)} to (X – 2)	X-2

Symbol: A24

Double key
Keys and keyways are machined at 180° from the standard position.
• Applicable shaft types: S, W
• Equal dimensions are indicated by the same marker.



(mm)

Size	Key dimensions	LL
20	4 x 4 x 20	3
30	4 x 4 x 20	4
40	5 x 5 x 25	5

Series CRQ2 (Size: 10, 15, 20, 30, 40)

Simple Specials:
-XA31 to -XA46: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

Shaft Pattern Sequencing II

Applicable shaft type: X, Y, Z, T, J and K

How to Order

C D RQ2B X P 20 [ ] — 90 C — A90 — X A34 A37 C30 -X6

Built-in magnet

Nil	None
D	Built-in magnet

Shaft type

X *	Single shaft with four chamfers
Y *	Double shaft with key
Z *	Double shaft with four chamfers
T	Single round shaft
J	Double shaft (Long shaft without key & with four chamfers)
K	Double round shaft

* Applicable size: 20, 30, 40

Size

10
15
20
30
40

Pattern

How to order model with auto switches

Refer to page 11-8-2 for "How to Order" products with auto switches.

Thread type

Size	Port type	
10, 15	Nil	M5
20, 30, 40	Nil	Rc 1/8
	TF	G 1/8
	TN	NPT 1/8
	TT	NPTF 1/8

Air cushion

Size	Air cushion	
	None	Attached
10, 15	Nil	—
20, 30, 40		C

Rotating angle

90	80° to 100°
180	170° to 190°

Auto switch

Refer to page 11-8-2 for "How to Order" products with auto switches.

Symbol for simple specials, Made-to-order products

- **When number of combinations is 1 or 2, refer to chart 3 and 4.**

* **Combination of XA is possible for up to 2 types.**
* **Combination of -X6 (shaft, parallel key stainless spec) is available for all the types.**

• Combination 3 Types

A33	A34	C30	Chart 3, 4
A34	A37	-X6	Chart 3
A35	C30	C12	Chart 4, 5
A40	C8	-X6	Chart 4, 5

• Combination of Applicable Chart

Combination is available only when all the conditions are fulfilled among the nation chart above.

• Combination 4 Types

A33	A34	C30	C12	Chart 3, 4, 5
A34	A37	C12	-X6	Chart 3, 4
A43	C12	C30	-X6	Chart 4, 5

• Combination of Applicable Chart

Combination is available only when all the conditions are fulfilled among the nation chart above.

* **Combination of simple specials and made-to-order, it is possible for up to 4 types.**

Combination Chart of Simple Specials for Tip End Shape

Chart 3. Combination between -XA□ and -XA□ (X, Y, Z, T, J, K shafts)

Symbol	Description	Top port		Shaft type						Applicable size	Combination							
		Upper	Lower	J	K	T	X	Y	Z									
XA31	Female thread at the end	●	—	—	—	—	—	●	—	20, 30, 40	**XA31** Y *	∗ Corresponding shafts type available for combination						
XA32	Female thread at the end	—	●	—	—	—	—	●	—									
XA33	Female thread at the end	●	—	●	●	●	—	—	—	10, 15, 20, 30, 40	—	**XA33**						
XA34	Female thread at the end	—	●	—	●	●	●	—	—		—	K, T *	**XA34**					
XA35	Female thread at the end	●	—	—	—	—	●	—	●	20, 30, 40	—	—	—	**XA35**				
XA36	Female thread at the end	—	●	●	—	—	—	—	●		—	J *	—	X, Z *	**XA36**			
XA37	Stepped round shaft	●	—	●	●	●	—	—	—	10, 15, 20, 30, 40	—	—	K *	—	J *	**XA37**		
XA38	Stepped round shaft	—	●	—	●	—	—	—	—		—	K *	—	—	—	K *		
XA39	Shaft through hole	●	●	—	—	—	—	●	—	20, 30, 40	—	—	—	—	—	—		
XA40	Shaft through hole	●	●	—	●	●	—	—	—	10, 15, 20, 30, 40	—	—	—	—	—	—		
XA41	Shaft through hole	●	●	●	—	—	●	—	●		—	—	—	—	—	—		
XA42	Shaft through hole and female thread	●	●	—	—	—	—	●	—	20, 30, 40	—	—	—	—	—	—		
XA43	Shaft through hole and female thread	●	●	—	●	●	—	—	—	10, 15, 20, 30, 40	—	—	—	—	—	—		
XA44	Shaft through hole and female thread	●	●	●	—	—	●	—	●		—	—	—	—	—	—	**XA38**	
XA45	Middle-cut chamfer	●	—	●	●	●	—	—	—		—	—	K *	—	J *	—	K *	**XA45**
XA46	Middle-cut chamfer	—	●	—	●	—	—	—	—		—	—	—	—	—	K *	—	K *

Combination Chart of Made to Order

Chart 4. Combination between -XA□ and -XC□ (Made to Order/Details of -XC□, refer to page 11-8-20.)

Symbol	Description	Applicable size	Combination
			XA31 to XA46
XC7	Reversed shaft	10, 15, 20, 30, 40	—
XC8	Change of rotating range		●
XC9			●
XC10			●
XC11			●
XC12	Change in angle adjustable range 0° to 100°		●
XC13			●
XC14			●
XC15			●
XC16	Change in angle adjustable range 90° to 190°		●
XC17			●
XC18	Change of rotating range	20, 30, 40	●
XC19			●
XC20	Change in angle adjustable range 90° to 190°		●
XC21			●
XC22	Without inner rubber bumper	10, 15	●
XC30	Fluoro grease	10, 15, 20, 30, 40	●

∗ Chart 5. Refer to page 11-8-20 for combination available between -XC□ and -XC□.

Series ***CRQ2*** **(Size: 10, 15, 20, 30, 40)**
Simple Specials:
-XA31 to -XA46: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with simple made-to-order system.
Please contact SMC for a specification sheet when placing an order.

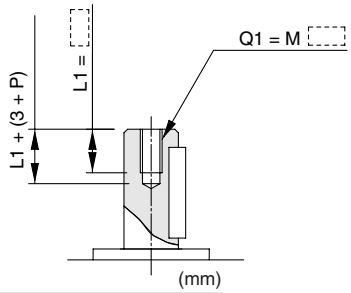
Shaft Pattern Sequencing II

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. SMC will make appropriate arrangements if no dimensional, tolerance, or finishin structions are given in the diagram.
3. The length of the unthreaded portion is 2 to 3 pitches.
4. Unless specified otherwise, the thread pitch is based on coarse metric threads.
   P = Thread pitch
5. M3 x 0.5; M4 x 0.7; M5 x 0.8; M6 x 1
   Enter the desired figures in the [ ] portion of the diagram.
6. XA31 to XA46 are the standard products that have been additionally machined.
7. Chamfer face of the parts machining additionally is C0.5.

Symbol: A31

Machine female threads into the long shaft.
- The maximum dimension L1 is, as a rule, twice the thread size.
  (Example) For M3: L1 = 6 mm
- Applicable shaft type: Y

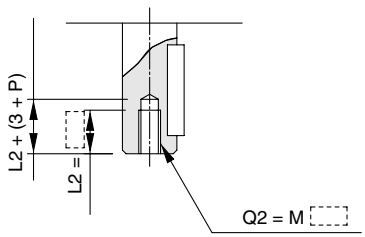


(mm)

Size	Q1
20	M3, M4
30	M3, M4, M5
40	M4, M5, M6

Symbol: A32

Machine female threads into the short shaft.
- The maximum dimension L2 is, as a rule, twice the thread size.
  (Example) For M4: L2 = 8 mm
- Applicable shaft type: Y

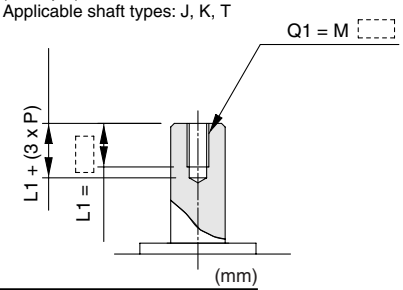


(mm)

Size	Q2
20	M3, M4
30	M3, M4, M5
40	M4, M5, M6

Symbol: A33

Machine female threads into the long shaft.
- The maximum dimension L1 is, as a rule, twice the thread size.
  (Example) For M3: L1 = 6 mm
- Applicable shaft types: J, K, T

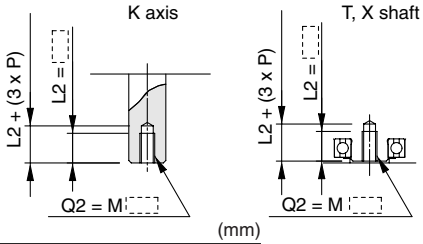


(mm)

Size	Q1
10	M3
15	M3, M4
20	M3, M4, M5, M6
30	M4, M5, M6, M8
40	M4, M5, M6, M8, M10

Symbol: A34

Machine female threads into the short shaft.
- The maximum dimension L2 is, as a rule, twice the thread size.
  (Example) For M5: L2 = 10 mm
- Applicable shaft types: K, T, X

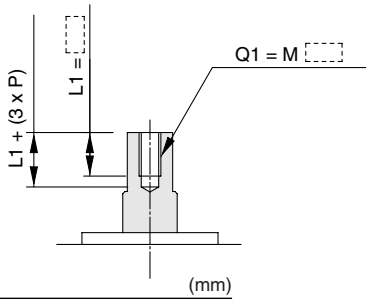


(mm)

Size	Q2
10	M3
15	M3, M4
20	M3, M4, M5, M6
30	M4, M5, M6, M8
40	M4, M5, M6, M8, M10

Symbol: A35

Machine female threads into the long shaft.
- The maximum dimension L1 is, as a rule, twice the thread size.
  (Example) For M3: L1 = 6 mm
- Applicable shaft types: X, Z

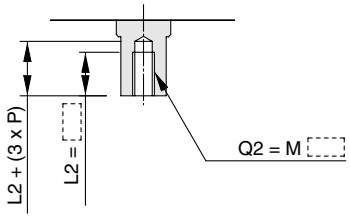


(mm)

Size	Q1
20	M3, M4
30	M3, M4, M5, M6
40	M4, M5, M6, M8

Symbol: A36

Machine female threads into the short shaft.
- The maximum dimension L2 is, as a rule, twice the thread size.
  (Example) For M4: L2 = 8 mm
- Applicable shaft types: J, Z

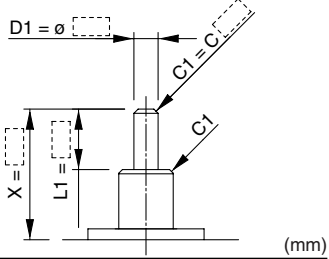


(mm)

Size	Q2
20	M3, M4
30	M3, M4, M5, M6
40	M4, M5, M6, M8

Symbol: A37

The long shaft can be further shortened by machining it into a stepped round shaft. (If shortening the shaft is not required, indicate "∗" for dimension X.) (If not specifying dimension C1, indicate "∗" instead.)
- Applicable shaft types: J, K, T
- Equal dimensions are indicated by the same marker.

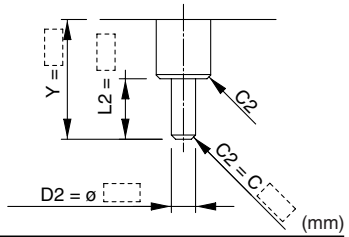


(mm)

Size	X	L1 max	D1
10	3 to 18	X – 2	ø3.5 to ø4.9
15	3 to 20	X – 2	ø3.5 to ø5.9
20	3.5 to 30	X – 2.5	ø5 to ø9.9
30	4 to 32	X–3	ø5 to ø11.9
40	4 to 36	X – 3	ø5 to ø14.9

Symbol: A38

The short shaft can be further shortened by machining it into a stepped round shaft.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
(If not specifying dimension C2, indicate "∗" instead.)
- Applicable shaft type: K
- Equal dimensions are indicated by the same marker.



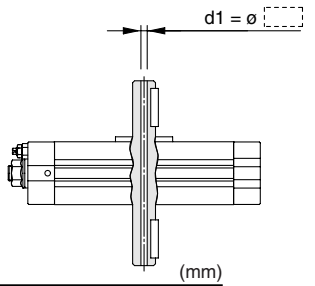
(mm)

Size	Y	L2 max	D2
10	1 to 18	Y	ø3.5 to ø4.9
15	1 to 20	Y	ø3.5 to ø5.9
20	1 to 30	Y	ø5 to ø9.9
30	1 to 32	Y	ø5 to ø11.9
40	1 to 36	Y	ø5 to ø14.9

-XA31 to XA46

Symbol: A39

Shaft with through-hole
Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft type: Y

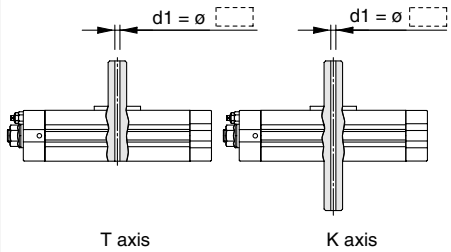


(mm)

Size	d1
20	ø2.5 to ø3.5
30	ø3 to ø5.5
40	ø4 to ø7

Symbol: A40

Shaft with through-hole
Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft types: K, T

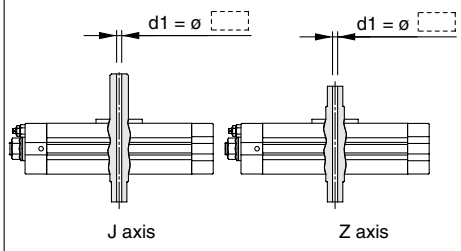


(mm)

Size	d1
10	ø2 to ø3
15	ø2 to ø4
20	ø2.5 to ø6
30	ø3 to ø8
40	ø4 to ø10

Symbol: A41

Shaft with through-hole
Minimum machining diameter for d1 is 0.1 mm.
• Applicable shaft types: J, X, Z

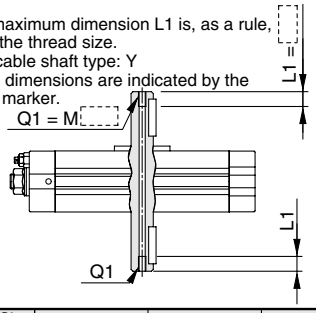


(mm)

Size	d1
10	ø2 to ø3
15	ø2 to ø4
20	ø2.5 to ø5
30	ø3 to ø7
40	ø4 to ø8

Symbol: A42

A special end is machined onto both the long and short shafts, and a through-hole is drilled into both shafts. Female threads are machined into the through-holes, whose diameter is equivalent to the diameter of the pilot holes.
• The maximum dimension L1 is, as a rule, twice the thread size.
• Applicable shaft type: Y
• Equal dimensions are indicated by the same marker.

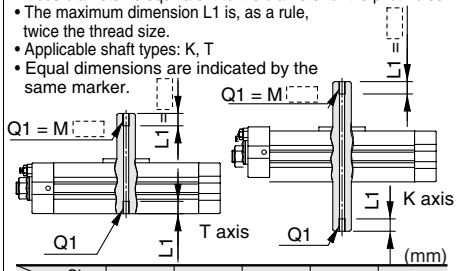


(mm)

Thread \ Size	20	30	40
M3 x 0.5	ø2.5	—	—
M4 x 0.7	ø3.3	ø3.3	—
M5 x 0.8	—	ø4.2	ø4.2
M6 x 1	—	—	ø5

Symbol: A43

A special end is machined onto both the long and short shafts, and a through-hole is drilled into both shafts. Female threads are machined into the through-holes, whose diameter is equivalent to the diameter of the pilot holes.
• The maximum dimension L1 is, as a rule, twice the thread size.
• Applicable shaft types: K, T
• Equal dimensions are indicated by the same marker.

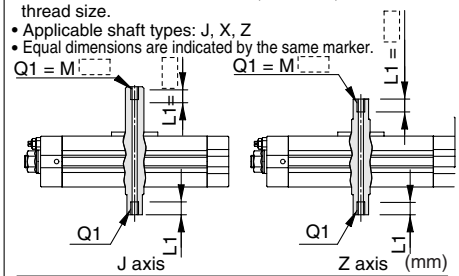


(mm)

Thread \ Size	10	15	20	30	40
M 3 x 0.5	ø2.5	ø2.5	ø2.5	—	—
M 4 x 0.7	—	ø3.3	ø3.3	ø3.3	—
M 5 x 0.8	—	—	ø4.2	ø4.2	ø4.2
M 6 x 1	—	—	ø5	ø5	ø5
M 8 x1.25	—	—	—	ø6.8	ø6.8
M10 x 1.5	—	—	—	—	ø8.5
Rc 1/8	—	—	—	—	ø8.2

Symbol: A44

A special end is machined onto both the long and short shafts, and a through-hole is drilled into both shafts. Female threads are machined into the through-holes, whose diameter is equivalent to the diameter of the pilot holes.
• The maximum dimension L1 is, as a rule, twice the thread size.
• Applicable shaft types: J, X, Z
• Equal dimensions are indicated by the same marker.

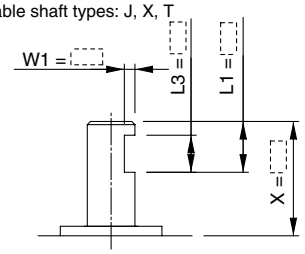


(mm)

Thread \ Size	10	15	20	30	40
M3 x 0.5	ø2.5	ø2.5	ø2.5	—	—
M4 x 0.7	—	ø3.3	ø3.3	ø3.3	—
M5 x 0.8	—	—	ø4.2	ø4.2	ø4.2
M6 x 1	—	—	—	ø5	ø5
M8 x 1.25	—	—	—	—	ø6.8

Symbol: A45

The long shaft can be further shortened by machining a middle-cut chamfer into it.
(If shortening the shaft is not required, indicate "∗" for dimension X.)
(The position is that of the standard flat at the key groove portion.)
• Applicable shaft types: J, X, T

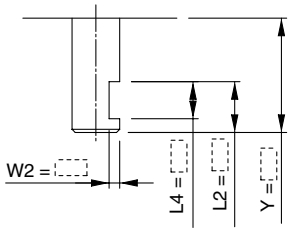


(mm)

Size	X	W1	L1 max	L3 max
10	6 to 18	0.5 to 1.5	X – 2	L1 – 1
15	6.5 to 20	0.5 to 1.5	X – 2	L1 – 1
20	9.5 to 30	1 to 2	X – 2.5	L1 – 2
30	11.5 to 32	1 to 2	X – 3	L1 – 2
40	12.5 to 36	1 to 2	X – 3	L1 – 2

Symbol: A46

The short shaft can be further shortened by machining a middle-cut chamfer into it.
(If shortening the shaft is not required, indicate "∗" for dimension Y.)
(The position is that of the standard flat at the key groove portion.)
• Applicable shaft type: K



(mm)

Size	Y	W2	L2 max	L4 max
10	4 to 18	0.5 to 1.5	Y	L2 – 1
15	4.5 to 20	0.5 to 1.5	Y	L2 – 1
20	6.5 to 30	1 to 2	Y	L2 – 2
30	8.5 to 32	1 to 2	Y	L2 – 2
40	9.5 to 36	1 to 2	Y	L2 – 2

Series ***CRQ2*** (Size: 10, 15, 20, 30, 40)
Made to Order Specifications: -XC7 to -XC22/XC30

Please consult with SMC for further information on specifications, dimensions and delivery.

-XC7 to XC22, XC30

How to Order

C D RQ2B S P 20 — 90 — A90 X C7 C12 C30 -X6

Built-in magnet

Nil	None
D	Built-in magnet

Shaft type

S	Single shaft
W	Double shaft
X *	Single shaft with four chamfers
Y *	Double shaft with key
Z *	Double shaft with four chamfers
T	Single round shaft
J	Double shaft (Long shaft without key & with four chamfers)
K	Double round shaft

* Applicable size: 20, 30, 40

Pattern

How to order model with auto switches

Refer to page 11-8-2 for "How to Order" products with auto switches.

Size

10
15
20
30
40

Thread type

Size	Port type	
10, 15	Nil	M5
20, 30, 40	Nil	Rc 1/8
	TF	G 1/8
	TN	NPT 1/8
	TT	NPTF 1/8

Air cushion

Size	Air cushion	
	None	Attached
10, 15	Nil	—
20, 30, 40		C

Rotating angle

90	80° to 100°
180	170° to 190°

Auto switch

Refer to page 11-8-2 for the part no. of auto switches.

Symbol for simple specials, Made-to-order products

- **When number of combinations is 1 or 2, refer to chart 3 and 4.**
- **Combination of XA is possible for up to 2 types.**
- **Combination of -X6 (shaft, parallel key stainless spec.) is available for all the types.**

• Combination 3 Types

C7	C30	C22	Chart 5
C22	C22	-X6	Chart 5

• Combination of Applicable Chart

Combination is available only when all the conditions are fulfilled among the combination chart above.

• Combination 4 Types

C7	C12	C30	-X6	Chart 5

• Combination of Applicable Chart

Combination is available only when all the conditions are fulfilled among the combination chart above.

* **Combination of made-to-order is available up to 4 types.**

Combination Chart of Made to Order

Chart 5. Combination between -XC□ and -XC□

Symbol	Description	Applicable size	Combination		
XC7	Reversed shaft	10, 15, 20, 30, 40			
XC8 to XC11	Change of rotating range				
XC12 to XC15	Change in angle adjustable range 0° to 100°				
XC16	Change in angle adjustable range 90° to 190°				
XC17					
XC18	Change of rotating range	20, 30, 40	XC7 to XC17	XC18 to XC21	
XC19					
XC20	Change in angle adjustable range 90° to 190°				
XC21					
XC22	Without inner rubber bumper	10, 15	●	●	XC22
XC30	Fluoro grease	10, 15, 20, 30, 40	●	●	●

Series CRQ2 (Size: 10, 15, 20, 30, 40)
Made to Order Specifications: -XC7

Please consult with SMC for further information on specifications, dimensions and delivery.

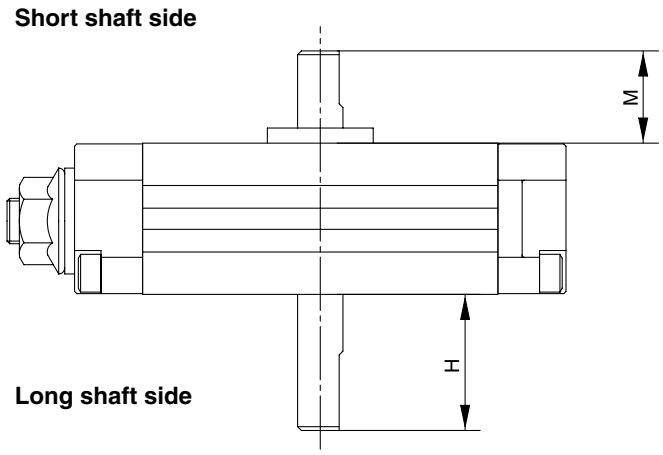
1 Reversed Shaft -XC7

CRQ2B
CDRQ2B → Refer to "How to Order" on page 11-8-12. — XC7

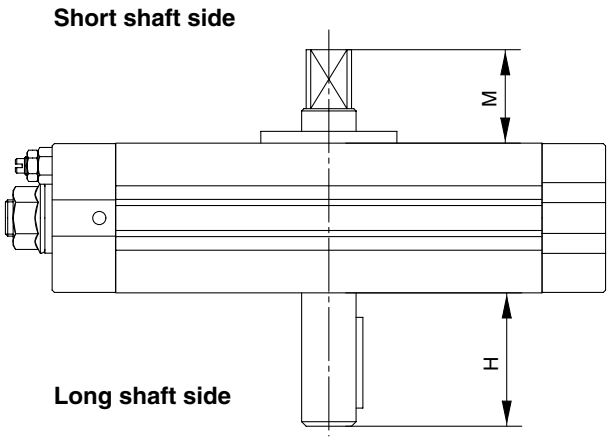
Reversed shaft

Specifications

Applicable size	**10, 15, 20, 30, 40**
Applicable shaft type	S, W, X, T, J shaft



Size 10, 15



Size 20, 30, 40

(mm)

Size	M	H
10	10	17
15	11	19
20	16.5	29
30	20	30
40	22	34

Series ***CRQ2*** **(Size: 10, 15, 20, 30, 40)**

Made to Order Specifications: -XC8 to -XC19: Change of Rotating Range

Please consult with SMC for further information on specifications, dimensions and delivery.

2 Change of Rotating Range -XC8 to XC19

CRQ2B
CDRQ2B → **Refer to "How to Order" on page 11-8-12.** **−X** **C8**

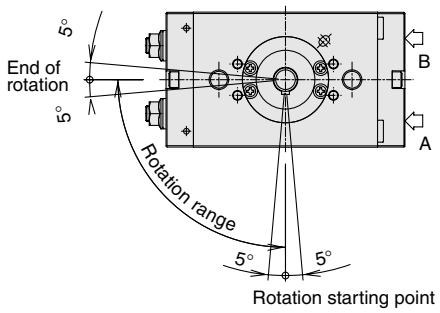
Symbol
-XC8 to XC19

Additional Reminders

The rotation starting point shows the positions of one flat chamfering and the key groove when pressurized to the connecting port (B).

Symbol: C8

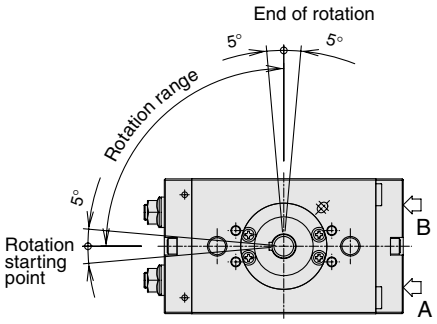
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 90° ±10°.
The rotation starting point is on the perpendicular line (down).



The figure shows the view from the long shaft end.

Symbol: C9

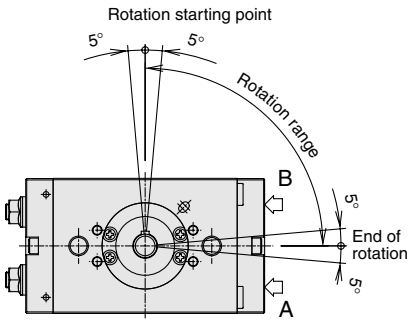
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 90° ±10°.
The rotation starting point is on the horizontal line (left).



The figure shows the view from the long shaft end.

Symbol: C10

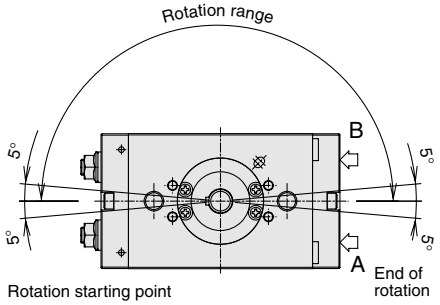
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 90° ±10°.
The rotation starting point is on the perpendicular line (up).



The figure shows the view from the long shaft end.

Symbol: C11

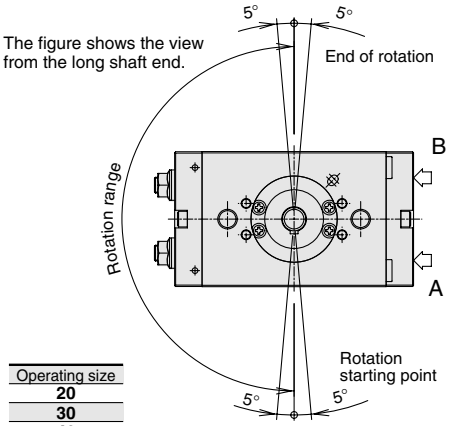
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 180° ±10°.
The rotation starting point is on the horizontal line (left).



The figure shows the view from the long shaft end.

Symbol: C18

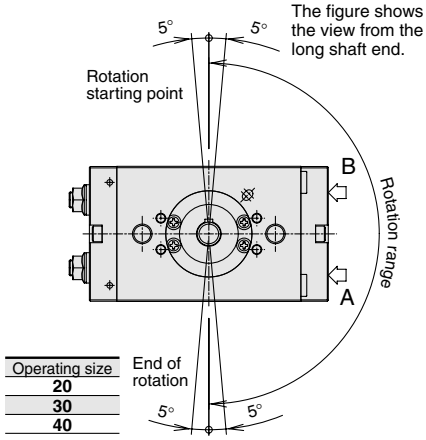
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 180° ±10°.
The rotation starting point is on the perpendicular line (down).



Operating size
20
30
40

Symbol: C19

Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 180° ±10°.
The rotation starting point is on the perpendicular line (up).



Operating size
20
30
40

Series CRQ2 (Size: 10, 15, 20, 30, 40)

Made to Order Specifications:

-XC12 to -XC21: Change of Angle Adjusting Range (0° to 100°, 90° to 190°)

Please consult with SMC for further information on specifications, dimensions and delivery.

3 Change of Angle Adjustable Range (0° to 100°, 90° to 190°) -XC12 to XC21

CRQ2B / CDRQ2B → Refer to "How to Order" on page 11-8-12. **–X C12**

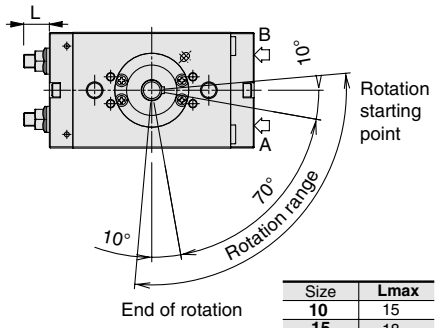
Symbol
-XC12 to XC21

Additional Reminders

The rotation starting point is the position of the flat and the key groove when the actuator is pressurized through connection port B.
There are no air cushion effects in the rotating ranges of 70° shown in the diagram.

Symbol: C12

The rotation angle can be adjusted between 0° to 100°.

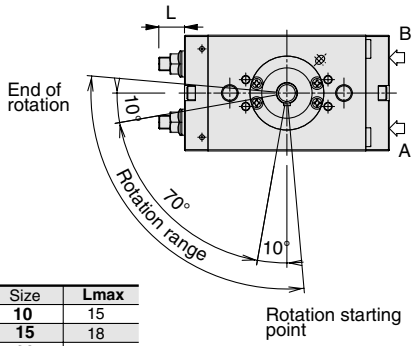


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C13

The rotation angle can be adjusted between 0° to 100°.

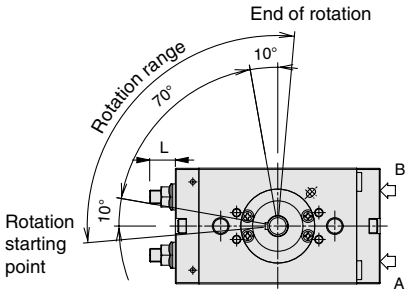


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C14

The rotation angle can be adjusted between 0° to 100°.

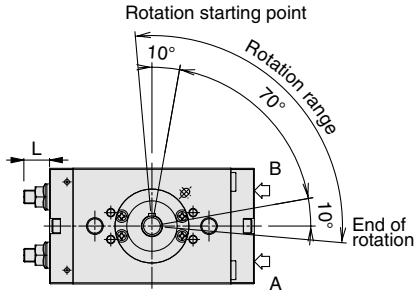


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C15

The rotation angle can be adjusted between 0° to 100°.

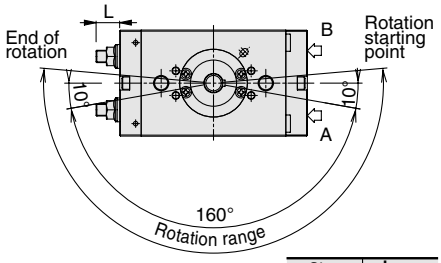


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C16

The rotation angle can be adjusted between 90° to 190°.

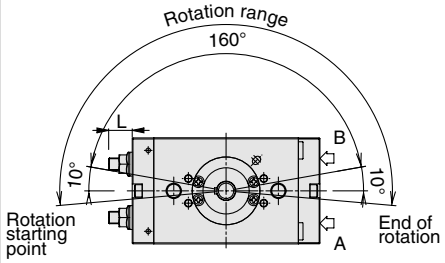


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C17

The rotation angle can be adjusted between 90° to 190°.

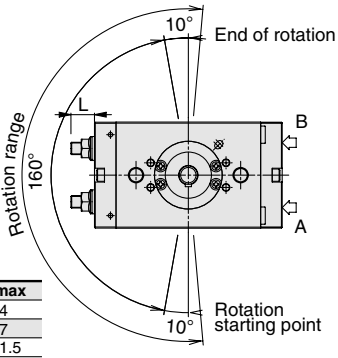


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C20

The rotation angle can be adjusted between 90° to 190°.

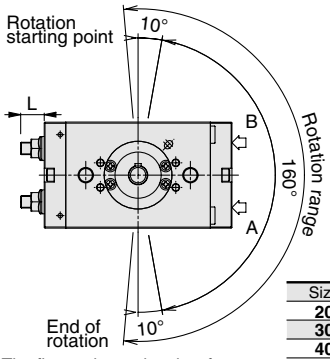


Size	Lmax
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C21

The rotation angle can be adjusted between 90° to 190°.



Size	Lmax
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Series CRQ2 (Size: 10, 15, 20, 30, 40)

Made to Order Specifications:

-XC22: Without Inner Rubber Bumper, -XC30: Fluoro Grease -X6: Shaft, Parallel Key Made of Stainless Steel Spec.

Please consult with SMC for further information on specifications, dimensions and delivery.

4 Without Inner Rubber Bumper -XC22

CRQ2B
CDRQ2B
→ Refer to "How to Order" on page 11-8-12. — XC22

Without inner rubber bumper

5 Fluoro Grease -XC30

CRQ2B
CDRQ2B
→ Refer to "How to Order" on page 11-8-12. — XC30

Fluoro grease

Fluoro grease is used as lubricant oil in seal part of packing and inner wall of cylinder.

Specifications

Fluid	Air (Non-lube)
Applicable size	10, 15
Max. operating pressure	0.7 MPa
Min. operating pressure	0.15 MPa
Port size	M5 x 0.8
Rotation	80° to 100°, 170° to 190°
Applicable shaft type	Single shaft, Double shaft
Auto switch	Mountable

∗Refer to page 11-8-3 for other specifications.

Refer to page 11-8-6 for other specifications.

6 Shaft, Parallel Key Made of Stainless Steel Spec. -X6

CRQ2B
CDRQ2B
Shaft type — Size — Rotation — S-X6

Refer to "How to Order" on page 11-8-2 for further information.

Shaft, parallel key made of stainless steel

Stainless steel is used as a substitute material for standard parts when used under conditions with a possibility of oxidization or decay.

Fluid	Air (Non-lube)
Applicable shaft type	Single shaft (S), Double shaft (W)
Applicable size	20, 30, 40
Max. operating pressure	1 MPa
Min. operating pressure	0.1 MPa
Cushion	Not attached, Air cushion
Rotation range	80° to 100°, 170° to 190°
Stainless steel part	Shaft, Parallel key
Port size	Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8
Auto switch	Mountable

Rotary Actuator with Solenoid Valve
Rack & Pinion Style
Series CVRA1
Size: 50, 63, 80, 100

How to Order

Electrical entry

G	Grommet (Lead wire: 300 mm)	
H	Grommet (Lead wire: 600 mm)	
E	Grommet terminal	
T	Conduit terminal	
D	DIN terminal	
L	L plug connector	With lead wire
LN		Without lead wire
LO		Without connector
M	M plug connector	With lead wire
MN		Without lead wire
MO		Without connector

Light/Surge voltage suppressor

Nil	None
Z *	With light/surge voltage suppressor
S *	With surge voltage suppressor

* Light attached type (Z) is not available for grommet type. Surge voltage suppressor attached type is available only for grommet type.

Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	110 to 120 VAC, 50/60 Hz
4	220 VAC, 50/60 Hz
5	24 VDC
6	12 VDC
7	240 VAC, 50/60 Hz
9	Other

Solenoid valve configuration

1	Single solenoid
2	Double solenoid
3	Closed center
4	Exhaust center
5	Pressure center

Manual override

Nil	None
B	Locking B type
C	Locking C type

Without auto switch CVRA1 | B | S | | 50 | 90 | | 1 | 1 | G | | |

With auto switch CDVRA1 | B | S | | 50 | 90 | | 1 | 1 | G | | | J59W | S

Built-in magnet

With solenoid valve

Mounting style

B	Basic style
L	Foot style

Note) No flange style "F" is available.

Shaft type

S	Single shaft
W	Double shaft
X	Single shaft with four chamfers
Y	Double shaft key
Z	Double shaft with four chamfers

Type

Nil	Standard
U	Angle adjustable

Size

50
63
80
100

Cushion

Nil	None
C *	With cushion

* Except angle adjustable type "U".

Rotating angle

Standard	90	90°
	180	180°
Option	100	100°
	190	190°

Auto switch

* For the applicable auto switch model, refer to the table below.
* Auto switches are shipped together, (but not assembled).

Number of auto switches

S	1 pc.
Nil	2 pcs.

Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC	Load voltage AC	Auto switch model	Lead wire length * (m) 0.5 (Nil)	3 (L)	5 (Z)	Pre-wire connector	Applicable load	
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	5 V	—	A56	●	●	—	—	IC circuit	—
				2-wire	12 V	—	A53	●	●	●	—	—	Relay, PLC
					24 V	100 V, 200 V	A54	●	●	●	—		
	Diagnosis indication (2-color)				—	—	A59 W	●	●	—	—		
Solid state switch	—	Grommet	Yes	3-wire (NPN)	5 V, 12 V	—	F59	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)			F5P	●	●	○	○		
				2-wire	12 V		J59	●	●	○	○	—	
					—	100 V, 200 V	J51	●	●	○	—		
	Diagnosis indication (2-color)			3-wire (NPN)	5 V, 12 V	—	F59 W	●	●	○	○	IC circuit	
				3-wire (PNP)			F5PW	●	●	○	○		
				2-wire	24 V		J59 W	●	●	○	○	—	
	Water resistant (2-color)						F5BA **	—	●	○	○		
	Diagnosis output (2-color)			4-wire (NPN)	5 V, 12 V		F59F	●	●	○	○	IC circuit	

** Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.

* Lead wire length symbols: 0.5 m·····Nil (Example) A53
3 m····· L (Example) A53L
5 m····· Z (Example) A53Z

* Auto switches marked with "○" are made-to-order specifications.

Made to Order Refer to page 11-11-36 for detailed solid state switches with pre-wire connectors.

⚠ Caution

Be sure to read before handling. Refer to pages 11-13-3 to 4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, and refer to pages 11-1-4 to 6 for Precautions on every series.

Specifications

Fluid		Air	
Proof pressure		1.35 MPa	
Max. operating pressure		0.9 MPa	
Min. operating pressure		0.15 MPa	
Ambient and fluid temperature		0°C to 50°C (No freezing)	
Lubrication		Non-lube	
Mounting		Basic style, Foot style	
Solenoid valve part no.		VF3□ 20-□□□□-02-X14	
Electrical entry		Grommet, Grommet terminal, Conduit terminal, DIN terminal, L plug connector, M plug connector	
Coil rated voltage	AC	100, 200 V (50/60 Hz)	
	DC	24 V	
Allowable voltage change		–15 to +10% of the rated voltage	
Coil insulation		Equivalent to B class (130°C)	
Power consumption	AC	Inrush	5.6 VA (50 Hz), 5.0 VA (60 Hz)
		Holding	3.4 VA (50 Hz), 2.3 VA (60 Hz)
Apparent current	DC	1.8 W	

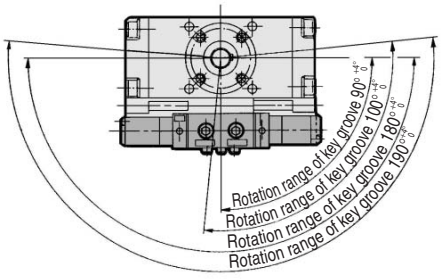
Weight

(kg)

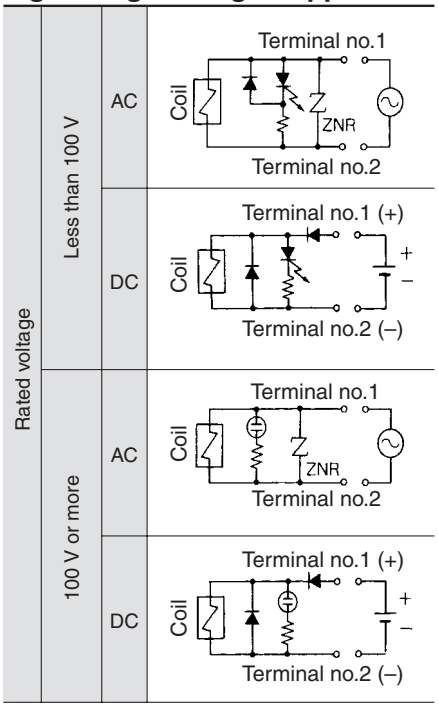
Model	Additional weight	No. of positions/solenoids				
		2 position single	2 position double	3 position closed center	3 position exhaust center	3 position pressure center
CVRA1□□50 to 100	0.2	0.2	0.3	0.4	0.4	0.4

How to calculate weight
Weight = Basic weight * + Add'l weight + No. of positions/solenoids
* Refer to page 11-7-3 for basic weight.

Rotation Range of Keygrooves Solenoid Valve Mounting Positions



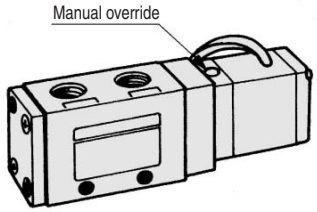
Light/Surge Voltage Suppressor



Note) Light is not available on grommet type.

Manual Override

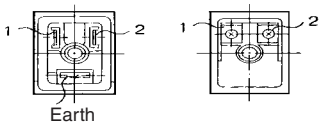
Non-locking push style is standard.



Electrical Wiring

The DIN terminal and the terminal pin (with light/surge voltage suppressor) are connected internally as shown below. Therefore, connect them the respective power supply terminals.

DIN terminal **With terminal block**



Terminal no.	1	2
DIN connector	+	–
Terminal connector	+	–

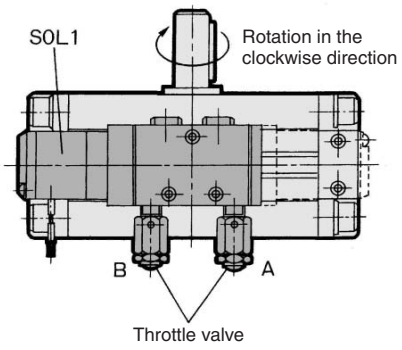
Instant Energizing Time

To operate the double solenoid type by applying an instantaneous current, ensure that the current is applied for at least 0.1 second.

How to Adjust the Rotation Speed

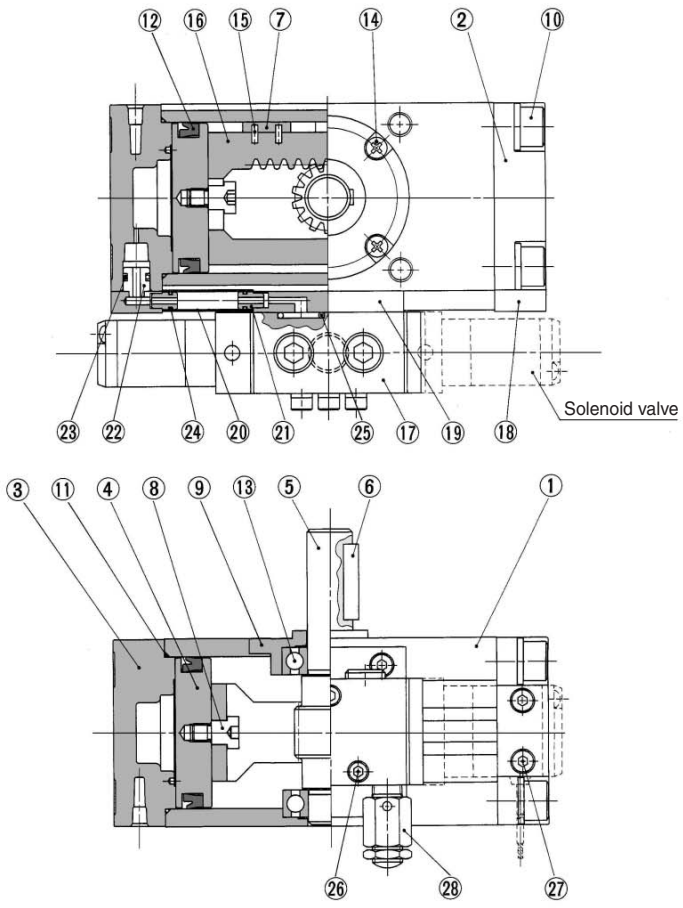
Rotation direction
When current is applied to SOL1, the shaft rotates clockwise.

How to adjust the rotation speed:
Turn the needle valve of the throttle valve clockwise to reduce the exhaust flow volume, thus slowing the rotation speed.
Throttle valve A regulates the clockwise rotation speed of the shaft and throttle valve B regulates the counterclockwise speed to the shaft.

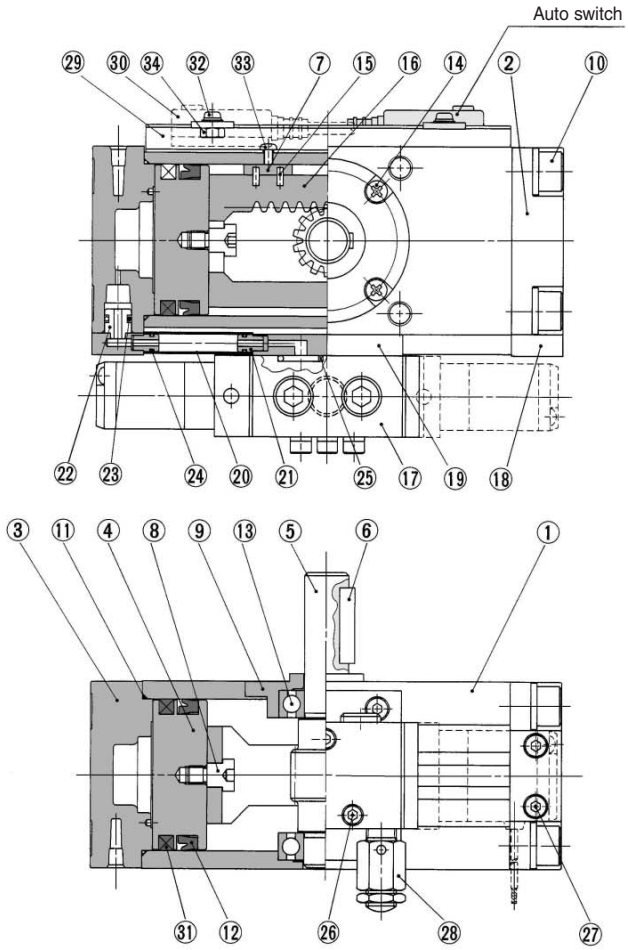


Construction

With solenoid valve



With solenoid valve and auto switch



Component Parts

No.	Description	Material	Note
①	Body	Aluminum alloy	Hard anodized
②	Right cover	Aluminum alloy	Black anodized
③	Left cover	Aluminum alloy	Black anodized
④	Piston	Aluminum alloy	Chromated
⑤	Shaft	Chrome molybdenum steel	
⑥	Parallel keyway	Carbon steel	
⑦	Slider	Resin	
⑧	Connecting screw	Carbon steel	Zinc chromated
⑨	Bearing retainer	Aluminum alloy	Black anodized
⑩	Hexagon socket head cap screw with spring washer	Chromium molybdenum steel	Black zinc chromated
⑪	Tube gasket	NBR	
⑫	Piston seal	NBR	
⑬	Bearing	Bearing steel	
⑭	Round head Phillips screw	Steel wire	Black zinc chromated
⑮	Spring pin	Steel wire	
⑯	Rack	Carbon steel	Nitrided
⑰	Solenoid valve		

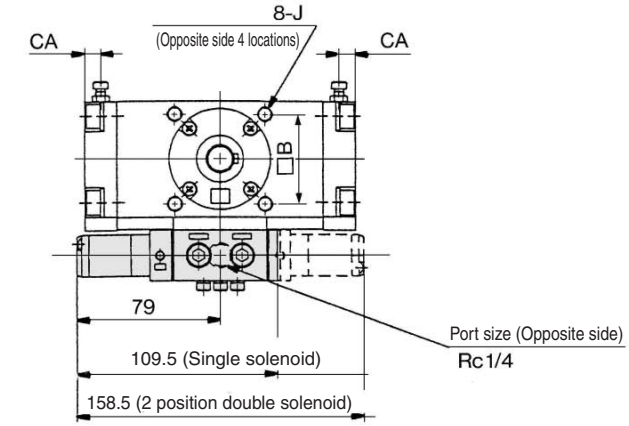
No.	Description	Material	Note
⑱	Sub-plate	Aluminum alloy	Black anodized
⑲	Sub-plate	Aluminum alloy	Black anodized
⑳	Pipe	Stainless steel	
㉑	Fitting	Aluminum alloy	Chromated
㉒	Fitting	Aluminum alloy	Chromated
㉓	O-ring	NBR	
㉔	O-ring	NBR	
㉕	O-ring	NBR	
㉖	Hexagon socket head cap screw	Steel wire	Black dyed
㉗	Hexagon socket head cap screw	Steel wire	Black dyed
㉘	Metal valve	Stainless steel	
㉙	Switch mounting rail	Aluminum alloy	
㉚	Auto switch		
㉛	Plastic magnet	Magnetic material	
㉜	Round head Phillips screw	Steel wire	Nickel plated
㉝	Round head Phillips screw	Steel wire	Nickel plated
㉞	Hexagon nut	Steel wire	Nickel plated

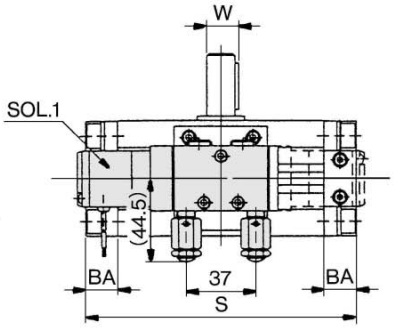
Replacement Parts (The corresponding parts shown below are sets.)

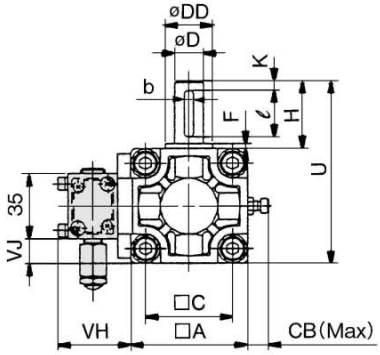
Size (Type)	With solenoid valve, With solenoid valve auto switch
C□VRA1□□50	P294020-49A
C□VRA1□□63	P294030-49A
C□VRA1□□80	P294040-49
C□VRA1□□100	P294050-49A
Corresponding parts no.	⑦, ⑪, ⑫, ⑮, ㉓, ㉔, ㉕ are set.

Size 50, 63, 80, 100/Basic Style: CVRA1BS50 to 100

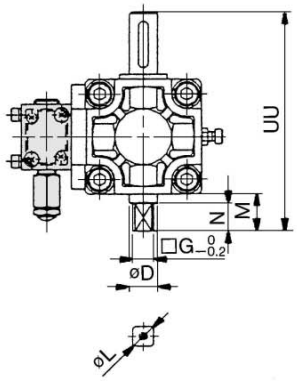
Single shaft type: CVRA1BS□50 to 100







Double shaft type: CVRA1BW□



CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

Double Shaft Type

(mm)

Model	D (g6)	G	M	N	UU	L
CVRA1BW□50	15	11	20	15	118	14
CVRA1BW□63	17	13	22	17	139	16
CVRA1BW□80	20	15	25	20	167	19
CVRA1BW□100	25	19	30	25	202	24

Single Shaft Type

(mm)

Model	A	B	BA	C	CA	CB	D (g6)	DD (h9)	F	H	J	K	S *	U	W	Valve dimensions		Keyway dimensions	
																VH	VJ	b	ℓ
CVRA1BS□50	62	48	17	46	8.5	13	15	25	2.5	36	M8 x 1.25 depth 8	5	144 (177)	98	17	39	13.5	$5^{0}_{-0.030}$	25
CVRA1BS□63	76	60	20	57	10	14	17	30	2.5	41	M10 x 1.5 depth 12	5	163 (201.5)	117	19.5	39	20.5	$6^{0}_{-0.030}$	30
CVRA1BS□80	92	72	23.5	70	12	18	20	35	3	50	M12 x 1.75 depth 13	5	186 (230)	142	22.5	43	28.5	$6^{0}_{-0.030}$	40
CVRA1BS□100	112	85	25	85	12.5	18	25	40	4	60	M12 x 1.75 depth 14	5	245 (311)	172	28	43	38.5	$8^{0}_{-0.036}$	45

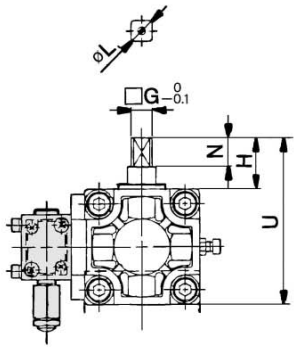
* ( ) are the dimensions for rotation of 180° and 190°.

Port Size

Model	Port size
CVRA1BS□50	Rc 1/4
CVRA1BS□63	Rc 1/4
CVRA1BS□80	Rc 1/4
CVRA1BS□100	Rc 1/4

Size 50, 63, 80, 100/Basic Style: CVRA1B, Foot Style: CVRA1L

Single shaft with four chamfers: CVRA1BX□

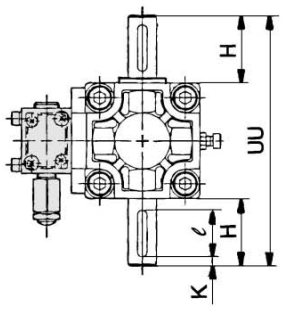


(mm)

Model	G	H	L	N	U
CVRA1BX□50	11	27	14	15	89
CVRA1BX□63	13	29	16	17	105
CVRA1BX□80	15	38	19	20	130
CVRA1BX□100	19	44	24	25	156

Note) Other dimensions are the same as the single shaft.

Double shaft key: CVRA1BY□

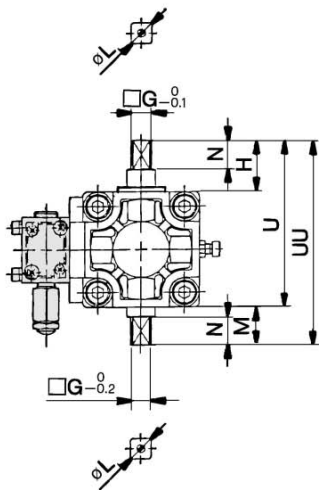


(mm)

Model	ℓ	H	K	UU
CVRA1BY□50	25	36	5	134
CVRA1BY□63	30	41	5	158
CVRA1BY□80	40	50	5	192
CVRA1BY□100	45	60	5	232

Note) Other dimensions are the same as the single shaft.

Double shaft with four chamfers: CVRA1BZ□

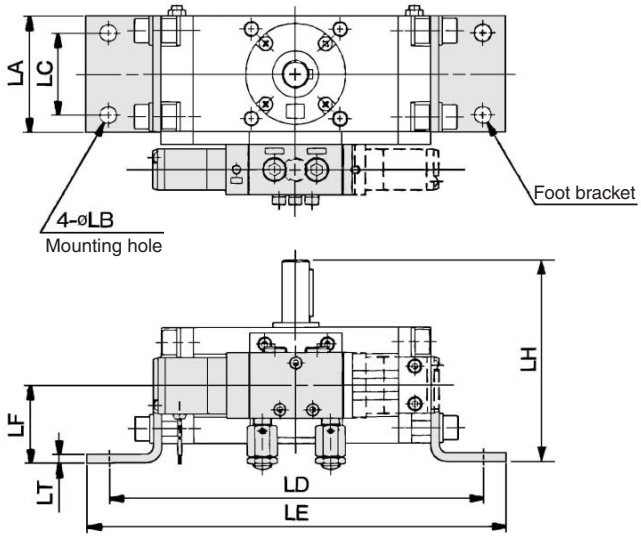


(mm)

Model	G	H	L	M	N	U	UU
CVRA1BZ□50	11	27	14	20	15	89	109
CVRA1BZ□63	13	29	16	22	17	105	127
CVRA1BZ□80	15	38	19	25	20	130	155
CVRA1BZ□100	19	44	24	30	25	156	186

Note) Other dimensions are the same as the single shaft.

Foot style: CVRA1L□□



★The dimensions below show pressurization to B port.

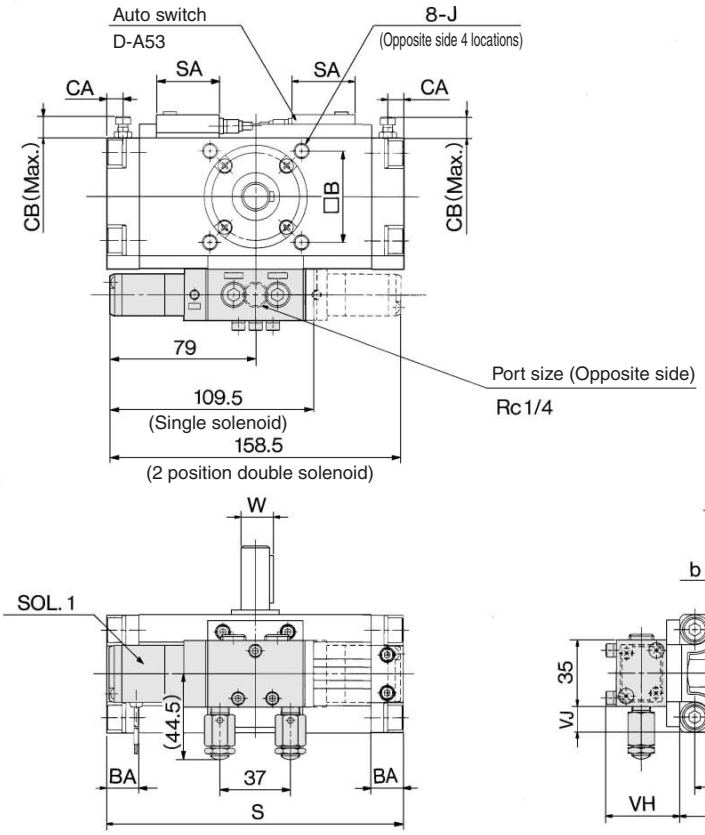
(mm)

Model	LA	LB	LC	LD	LE	LF	LH	LT
CVRA1L□□50	62	9	44	200 (233)	224 (257)	41	108	4.5
CVRA1L□□63	76	11	55	235 (273.5)	263 (301.5)	48	127	5
CVRA1L□□80	92	13	67	274 (318)	316 (360)	58	154	6
CVRA1L□□100	112	13	87	333 (399)	375 (441)	73.5	189.5	6

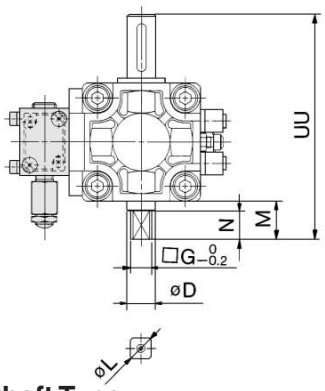
∗ ( ) are the dimensions for rotation of 180° and 190°.
Note) Other dimensions are the same as the single shaft.

Size 50, 63, 80, 100/Basic Style: CDVRA1BS50 to 100

Single shaft type: CDVRA1BS□50 to 100



Double shaft type: CDVRA1BW□



Double Shaft Type

(mm)

Model	D (g6)	G	M	N	UU	øL
CDVRA1BW□50	15	11	20	15	118	14
CDVRA1BW□63	17	13	22	17	139	16
CDVRA1BW□80	20	15	25	20	167	19
CDVRA1BW□100	25	19	30	25	202	24

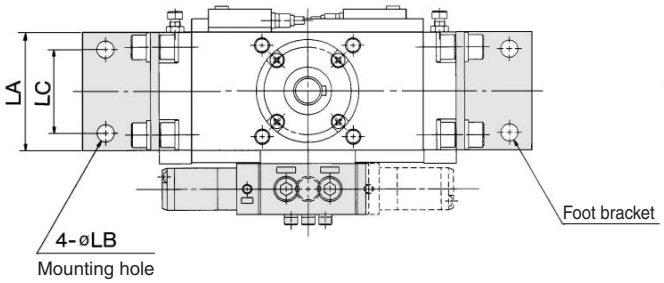
Single Shaft Type

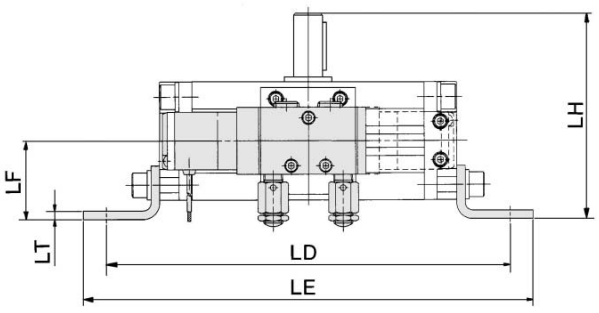
(mm)

Model	A	B	BA	C	CA	CB	øD (g6)	øDD (h9)	F	H	J	K	S	U	W	SA	SB	SC	SD	SE	Valve dimensions VH	Valve dimensions VJ	Keyway dimensions b	Keyway dimensions ℓ
CDVRA1BS□50	62	48	17	46	8.5	13	15	25	2.5	36	M8 x 1.25 depth 8	5	156 (189)	98	17	33	13.5	12	14	34	39	13.5	5 0 −0.030	25
CDVRA1BS□63	76	60	20	57	10	14	17	30	2.5	41	M10 x 1.5 depth 12	5	175 (213.5)	117	19.5	33	14.5	12	21	34	39	20.5	6 0 −0.030	30
CDVRA1BS□80	92	72	23.5	70	12	18	20	35	3	50	M12 x 1.75 depth 13	5	199 (243)	142	22.5	33	15.5	12	29	34	43	28.5	6 0 −0.030	40
CDVRA1BS□100	112	85	25	85	12.5	18	25	40	4	60	M12 x 1.75 depth 14	5	259 (325)	172	28	33	16	12	39	34	43	38.5	8 0 −0.036	45

∗ ( ) are the dimensions for rotation of 180° and 190°.

Foot style: CDVRA1L□□



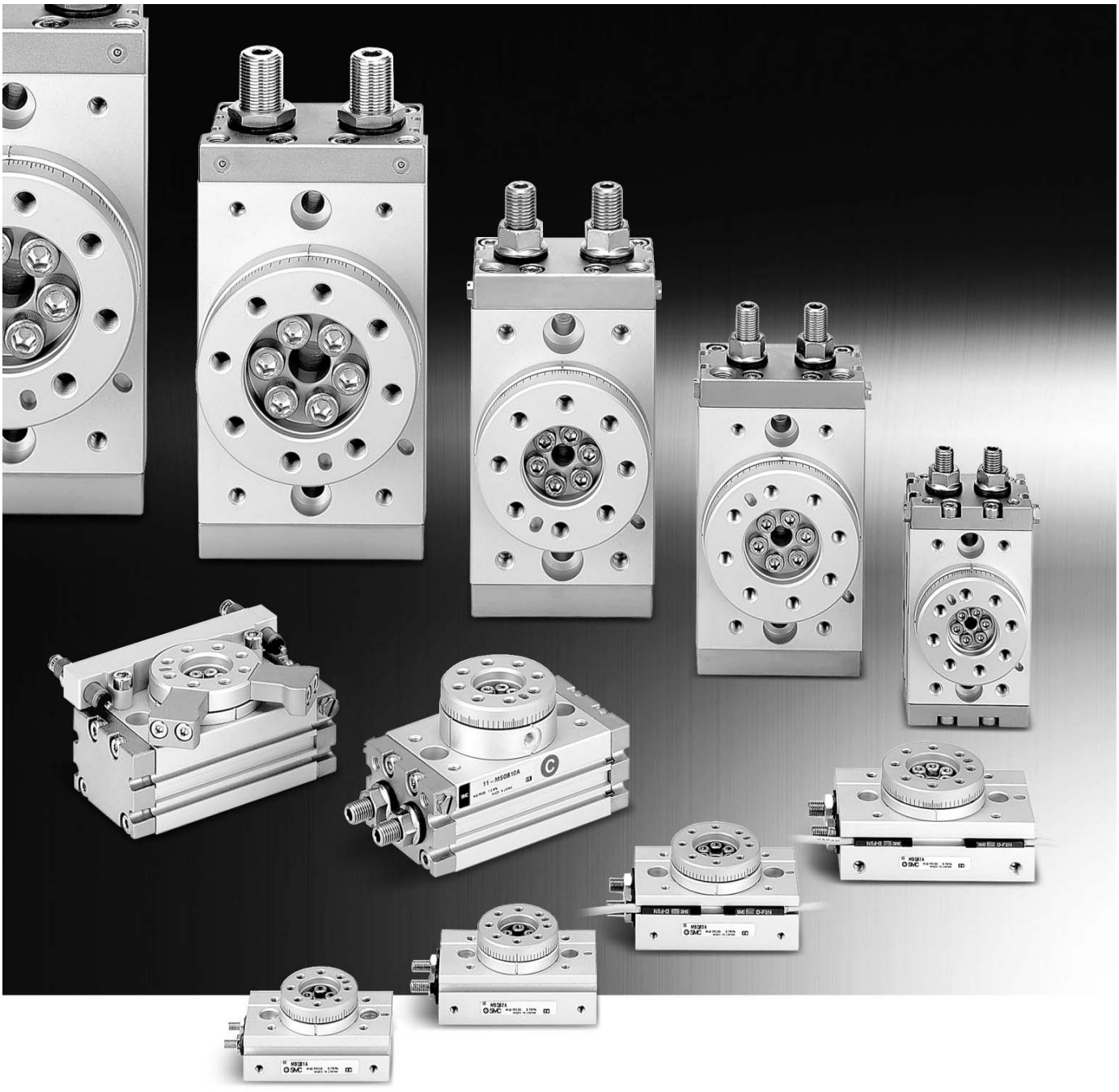


(mm)

Model	LA	LB	LC	LD	LE	LF	LH	LT
CDVRA1L□□50	62	9	44	212 (245)	236 (269)	41	108	4.5
CDVRA1L□□63	76	11	55	247 (285.5)	275 (313.5)	48	127	5
CDVRA1L□□80	92	13	67	287 (331)	329 (373)	58	154	6
CDVRA1L□□100	112	13	87	347 (413)	389 (455)	73.5	189.5	6

∗ ( ) are the dimensions for rotation of 180° and 190°.

Rotary Table
Rack & Pinion Style
Series MSQ
Size: 1, 2, 3, 7, 10, 20, 30, 50, 70, 100, 200

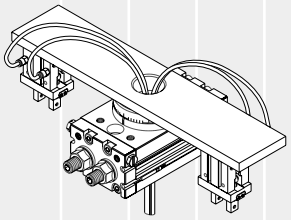


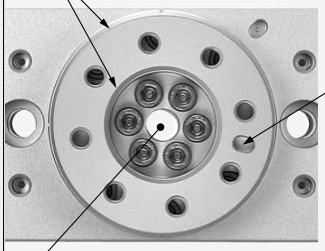
Series MSQ now includes smaller sizes 1, 2, 3 and 7

Compact rotary table with Low Table Height

Easy mounting of workpiece

- **Table I.D/O.D tolerances**
  Basic type: **MSQB** H9/h9
  High precision type: **MSQA** H8/h8
- **Positioning pin hole**
- **Hollow axis**
  Accommodates wiring and piping for equipment mounted on the table





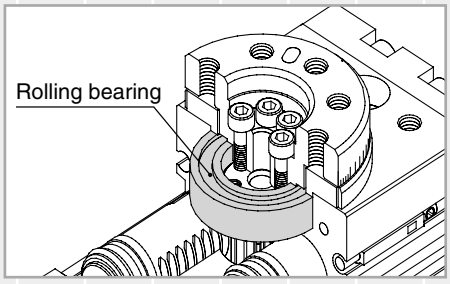
Hollow axis

Size	1	2	3	7
Hollow axis	ø3.5	ø3.8	ø5	ø6

Size	10	20	30	50	70	100	200
Hollow axis	ø5	ø9	ø9	ø10	ø16	ø19	ø24

Large rolling element bearing

3 to 4 times higher axial load
(compared with series CRQ)



Basic type
MSQB

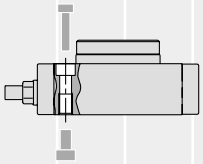
Pivoting angle adjustment range: 0 to 190°

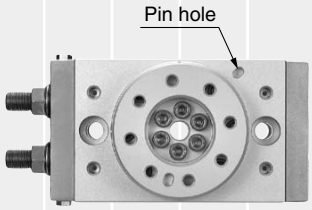
With internal shock absorber

2 to 5 times more kinetic energy
(compared with an adjustment bolt)

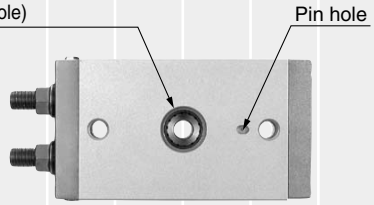
Easy mounting of body

- **Reference dia: Boss, Hole**
- **Mounting from 2 directions**
- **Positioning pin hole**



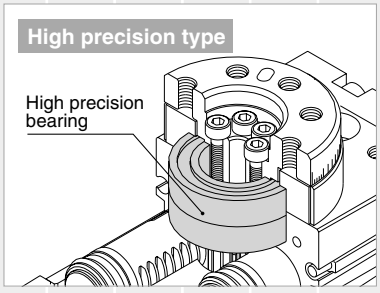


High precision type
MSQA



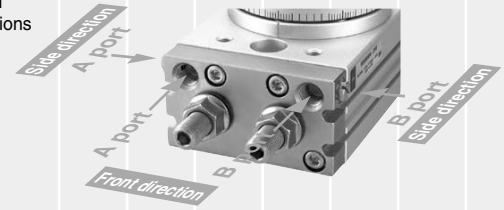
Movement in direction of table's radial thrust: 0.01 mm or less

By using high precision bearing, the movement in the direction of table's radial thrust is reduced.



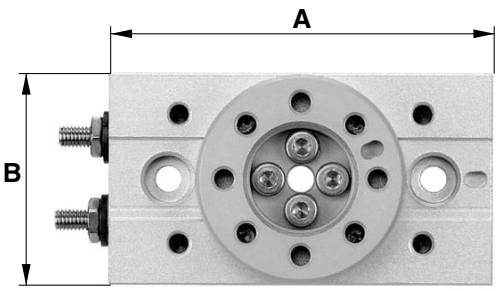
Piping from 2 directions (front and side) is possible.

Piping position can be selected
accommodate mounting conditions

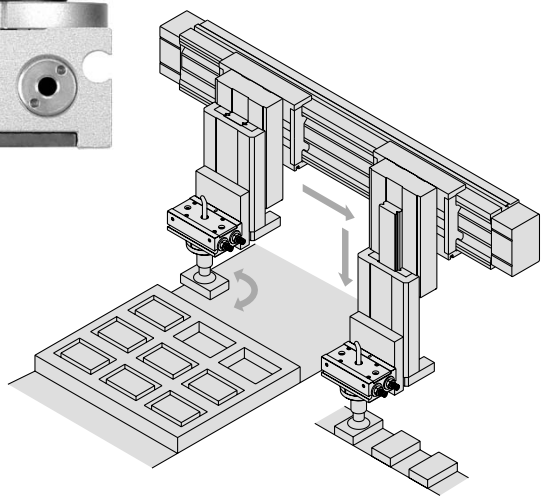


Small sizes 1, 2, 3, and 7

Small size and lightweight



(Picture of MSQB1A)



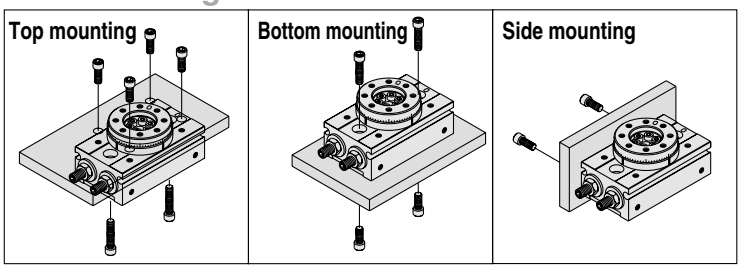
Measurements mm

Size	Model	A	B	C	D	Mass (g)
1	MSQB1A	50.5	28	25	16	70
2	MSQB2A	56	30	28	18	105
3	MSQB3A	60	34.5	30.5	20.5	150
7	MSQB7A	73.5	41	34.5	23	250

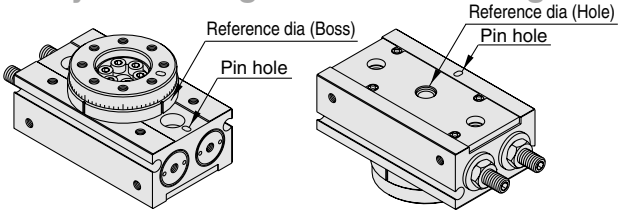
Variety of installation options for space-saving

Offers maximum space-saving installation by taking advantage of the compact body, space-saving wiring and piping.

Free mounting

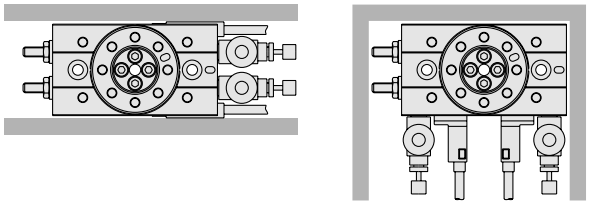


Easy center alignment at mounting



Wiring and piping can be selected according to mounting conditions

Example of auto switch and speed controller mounting

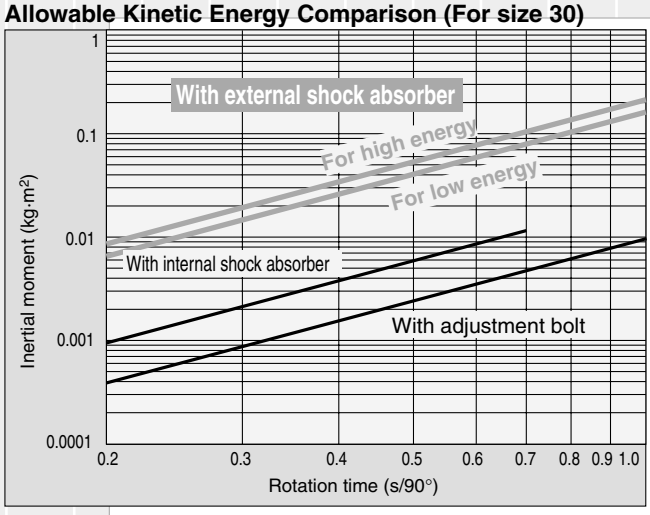


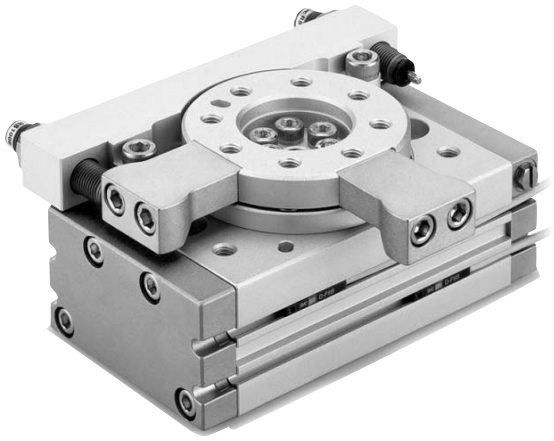
External shock absorber types

4 to 10 times more allowable kinetic energy

(Compared with internal shock absorber)
2 types of shock absorbers are available, for low energy and high energy.

Allowable Kinetic Energy Comparison (For size 30)





Total length shortened

Longitudinal mounting spare is reduced because there is no protrusion from adjustment bolts or internal shock absorbers.

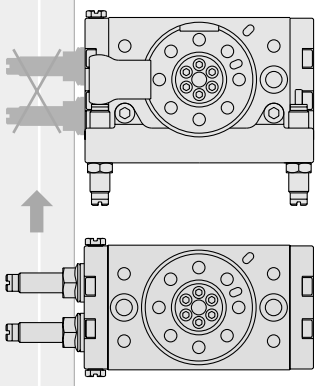
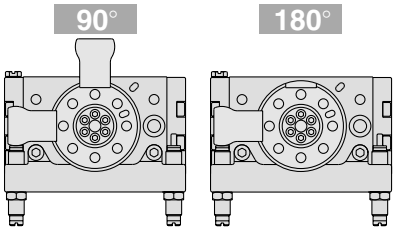
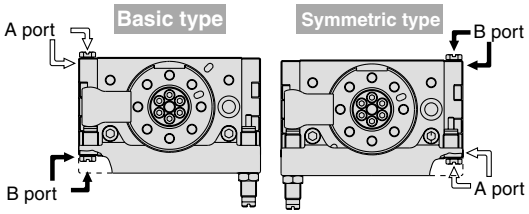


Table height is the same for both types with adjustment bolts or internal shock absorbers.

Rotating angle: 90°, 180°



Symmetric type



Basic: MSQB

: Additional series

Size	With adjustment bolt		With internal shock absorber		With external shock absorber
		Clean		Clean	
1	●	●	–	–	–
2	●	●	–	–	–
3	●	●	–	–	–
7	●	●	–	–	–
10	●	●	●	●	●
20	●	●	●	●	●
30	●	●	●	●	●
50	●	●	●	●	●
70	●	–	●	–	–
100	●	–	●	–	–
200	●	–	●	–	–

High precision: MSQA

: Additional series

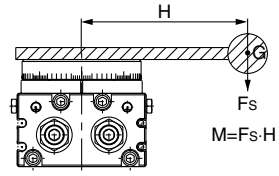
Size	With adjustment bolt		With internal shock absorber		With external shock absorber
		Clean		Clean	
1	●	●	–	–	–
2	●	●	–	–	–
3	●	●	–	–	–
7	●	●	–	–	–
10	●	●	●	●	●
20	●	●	●	●	●
30	●	●	●	●	●
50	●	●	●	●	●

Model Selection

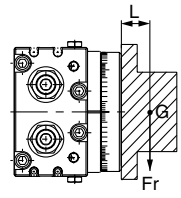
Model Selection Procedure	Formula	Selection Example

1 Operating conditions

Enumerate the operating conditions according to the mounting position.



Vertical Mounting

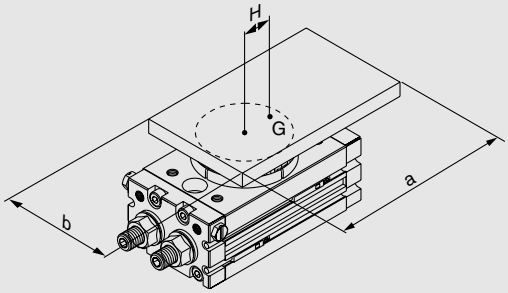


Horizontal Mounting

Formula

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

Selection Example



Rotary table: MSQB50A, Pressure: 0.5 MPa
Mounting orientation: Vertical
Load type: Inertial load Ta
Load configuration: 100 mm x 60 mm (Rectangular plate)
Rotation time t: 0.3s, Rotation angle: 90°
Load mass m: 0.4 kg
Distance between central axis and center of gravity H: 40 mm

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
- Inertial load: Ta

Load types

Formula

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

Effective torque

Selection Example

Inertial load
$10 \times Ta = 10 \times I \times \dot{\omega}$
$= 10 \times 0.00109 \times (2 \times (\pi / 2) / 0.3^2)$
$= 0.380$ N·m < Effective torque OK

Note) I substitutes for ⑤ the value for inertial moment.

3 Rotation time

Confirm that it is within the adjustable range of rotation time.

Formula

0.2 to 1.0 s / 90°

Selection Example

0.3 s / 90° OK

4 Allowable load

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

Formula

Thrust load: m x 9.8 ≤ Allowable load
Moment: m x 9.8 x H ≤ Allowable moment

Allowable load

Selection Example

0.4 x 9.8 = 3.92 N < Allowable load OK
0.4 x 9.8 x 0.04 = 0.157 N·m
0.157 N·m < Allowable moment OK

5 Inertial moment

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

Formula

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

Inertial moment

Selection Example

$I = 0.4 \times (0.10^2 + 0.06^2) / 12 + 0.4 \times 0.04^2$
$= 0.00109$ kg·m²

6 Kinetic energy

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

Formula

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

Allowable kinetic energy/Rotation time

Selection Example

$1/ 2 \times 0.00109 \times (2 \times (\pi / 2) / 0.3)^2$
$= 60$ mJ < Allowable energy OK

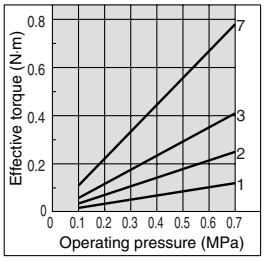
Effective Torque

Unit: N·m

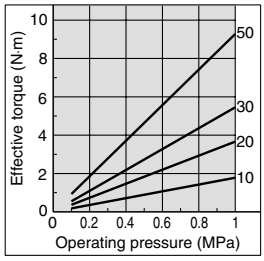
Size	Operating pressure (MPa)									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
1	0.017	0.035	0.052	0.070	0.087	0.10	0.12	—	—	—
2	0.035	0.071	0.11	0.14	0.18	0.21	0.25	—	—	—
3	0.058	0.12	0.17	0.23	0.29	0.35	0.41	—	—	—
7	0.11	0.22	0.33	0.45	0.56	0.67	0.78	—	—	—
10	0.18	0.36	0.53	0.71	0.89	1.07	1.25	1.42	1.60	1.78
20	0.37	0.73	1.10	1.47	1.84	2.20	2.57	2.93	3.29	3.66
30	0.55	1.09	1.64	2.18	2.73	3.19	3.82	4.37	4.91	5.45
50	0.9	1.85	2.78	3.71	4.64	5.57	6.50	7.43	8.35	9.28
70	1.36	2.72	4.07	5.43	6.79	8.15	9.50	10.9	12.2	13.6
100	2.03	4.05	6.08	8.11	10.1	12.2	14.2	16.2	18.2	20.3
200	3.96	7.92	11.9	15.8	19.8	23.8	27.7	31.7	35.6	39.6

Note) Effective torque values are representative values and not to be considered as guaranteed values. Use them as a guide.

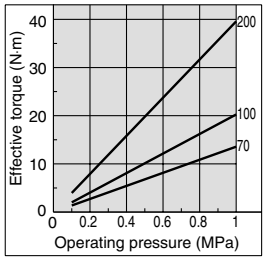
Size: 1 to 7



Size: 10 to 50

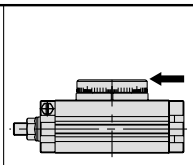


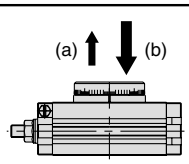
Size: 70 to 200

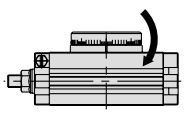


Allowable Load

Do not allow the load and moment applied to the table to exceed the allowable values shown in the table below.
(Operation beyond the allowable values can cause adverse effects on service life, such as play in the table and loss of accuracy.)







Size	Allowable radial load (N)		Allowable thrust load (N)				Allowable moment (N·m)	
			(a)		(b)			
	Basic type	High precision type	Basic type	High precision type	Basic type	High precision type	Basic type	High precision type
1	31	31	41	41	41	41	0.56	0.84
2	32	32	45	45	45	45	0.82	1.2
3	33	33	48	48	48	48	1.1	1.6
7	54	54	71	71	71	71	1.5	2.2
10	78	86	74	74	78	107	2.4	2.9
20	147	166	137	137	137	197	4.0	4.8
30	196	233	197	197	363	398	5.3	6.4
50	314	378	296	296	451	517	9.7	12.0
70	333	—	296	—	476	—	12.0	—
100	390		493		708		18.0	
200	543		740		1009		25.0	

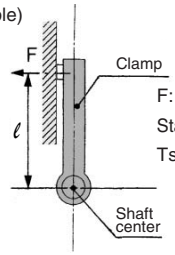
Load Type

●Static load: Ts

A load as represented by the clamp which requires pressing force only

(During examination if it is decided to consider the mass of the clamp itself in the drawing below, it should be regarded as an inertial load.)

(Example)



F: Pressing force (N)

Static torque calculation

$Ts = F \times \ell$ (N·m)

●Resistance load: Tf

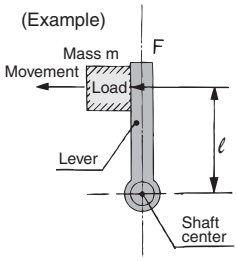
A load that is affected by external forces such as friction or gravity

Since the object 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) Tf

(During examination if it is decided to consider the mass of the lever itself in the drawing below, it should be regarded as an inertial load.)

(Example)



Friction coefficient μ

$F = \mu mg$

Static torque calculation

$Tf = F \times \ell$ (N·m)

$g = 9.8$ m/s²

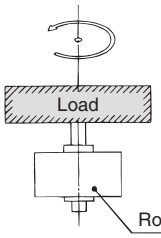
●Inertial load: Ta

A load that must be rotated by the actuator

Since the object is to rotate the inertial load, and speed adjustment is necessary, allow an extra margin of 10 times or more in the effective torque.

∗Actuator effective torque ≥ S · Ta

(S is 10 times or more)



$Ta = I \cdot \dot{\omega}$ (N·m)

I: Inertial moment

Refer to page 11-9-7.

$\dot{\omega}$: Angular acceleration

$\dot{\omega} = \frac{2\theta}{t^2}$ (rad/s²)

θ: Rotation angle (rad)

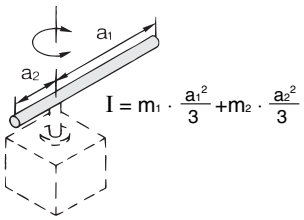
t: Rotation time (s)

Inertial Moment Formula (Calculation of Inertial Moment I)

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

1. Thin shaft

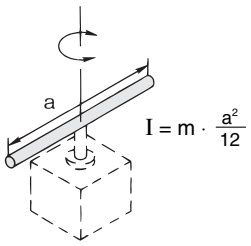
Position of rotational axis: Perpendicular to the shaft through one end



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

2. Thin shaft

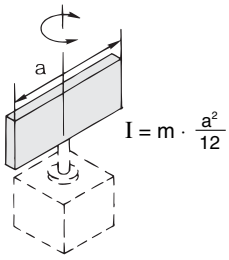
Position of rotational axis: Through the shaft's center of gravity



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

3. Thin rectangular plate (Rectangular parallelepiped)

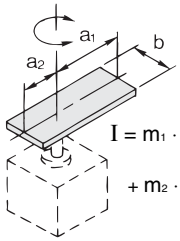
Position of rotational axis: Through the plate's center of gravity



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

4. Thin rectangular plate (Rectangular parallelepiped)

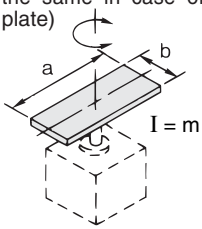
Position of rotational axis: Perpendicular to the plate through one of its points (also the same in case of a thicker plate)



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

5. Thin rectangular plate (Rectangular parallelepiped)

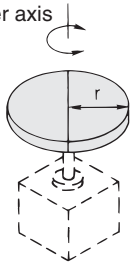
Position of rotational axis: Through the center of gravity and perpendicular to the plate (also the same in case of a thicker plate)



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

6. Cylinder (Including thin round plate)

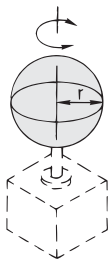
Position of rotational axis: Center axis



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

7. Solid sphere

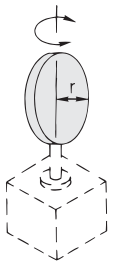
Position of rotational axis: Diameter



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

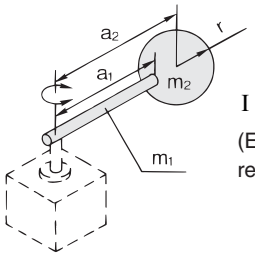
8. Thin round plate

Position of rotational axis: Diameter



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

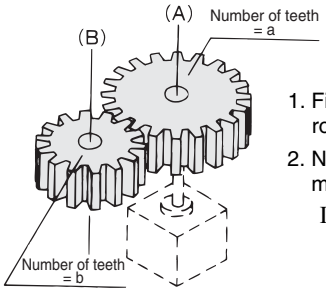
9. Load at lever end



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

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

10. Gear transmission



1. Find the inertial moment I_B for the rotation of shaft (B).
2. Next, I_B is entered to find I_A the inertial moment for the rotation of shaft (A) as $I_A = (\frac{a}{b})^2 \cdot I_B$

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.
Select models giving consideration to the load's inertial moment and rotation time during operation.
(The inertial moment and rotation time charts can be used for your convenience in making model selections on page 8.)

①Allowable kinetic energy and rotation time adjustment range

From the table below, set the rotation time within the adjustment range for stable operation. Note that 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°		
	With adjustment bolt	With internal shock absorber	With external shock absorber		With adjustment bolt	With internal shock absorber	With external shock absorber
			For low energy	For high energy			
1	1	–	–	–	0.2 to 0.7	–	–
2	1.5						
3	2						
7	6				0.2 to 1.0	0.2 to 0.7	0.2 to 1.0 Note)
10	7	39	161	231			
20	25	116	574	1060			
30	48	116	805	1210			
50	81	294	1310	1820			
70	240	1100	–	–	0.2 to 1.5	0.2 to 1.0	–
100	320	1600			0.2 to 2.0		
200	560	2900			0.2 to 2.5		

Note) Refer to the note regarding the rotation time adjustment range on page 11-9-24.

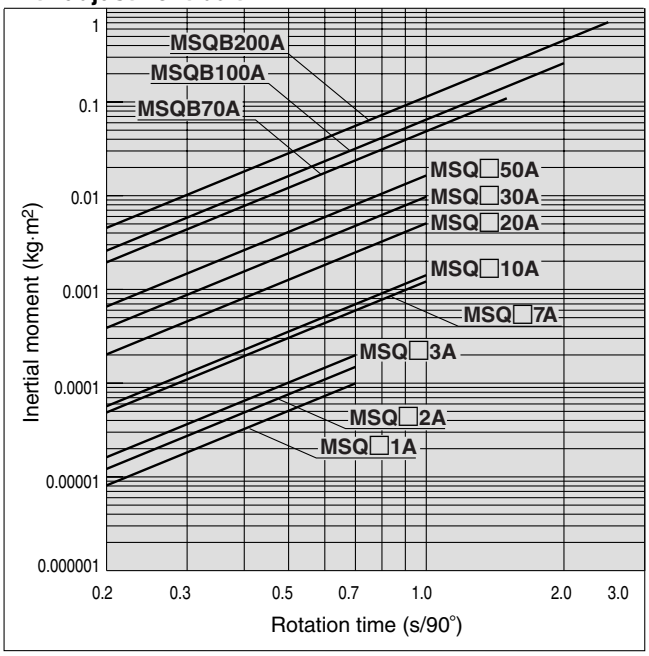
②Inertial moment calculation

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

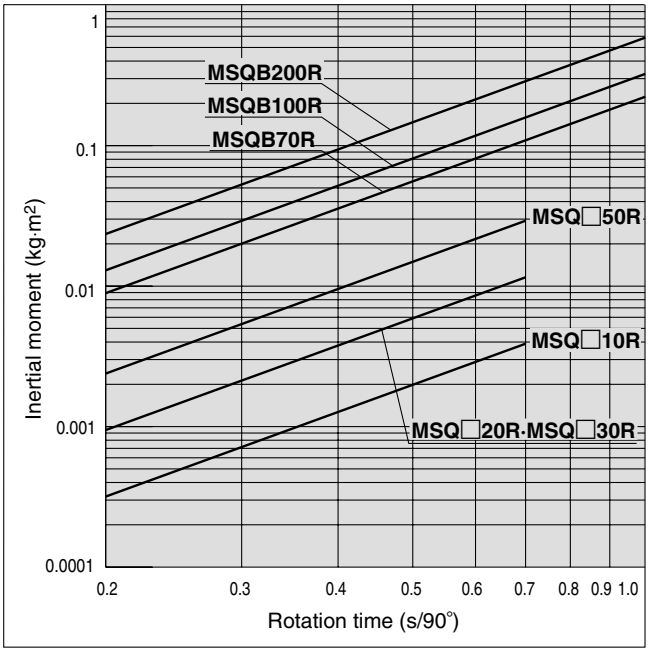
Kinetic Energy/Rotation Time

③**Model selection** Select models by applying the inertial moment and rotation time which have been found to the charts below.

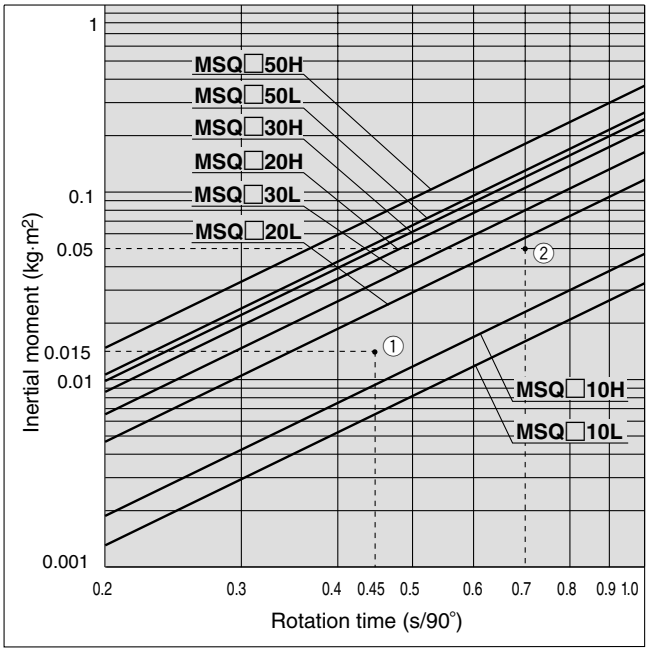
With adjustment bolt



With internal shock absorber



With external shock absorber



①**<Viewing the charts>**

- **Inertial moment** ····· 0.015 kg·m²
- **Rotation time** ·····0.45 s/90°

MSQ□20L is selected for the above.

②**<Example>**

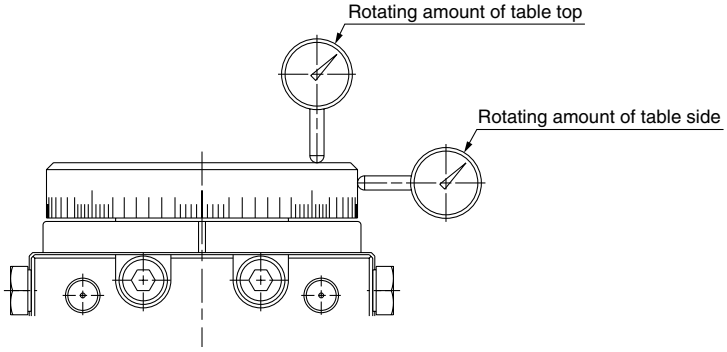
Load configuration: A cylinder of radius 0.5 m and mass 0.4 kg

Rotation time: 0.7 s/90°

$$I = 0.4 \times \frac{0.5^2}{2} = 0.05 \text{ kg·m}^2$$

In the inertial moment and rotation time chart, find the intersection of the lines extended from the points corresponding to 0.05 kg·m² on the vertical axis (inertial moment) and 0.7 s/90° on the horizontal axis (rotation time). Since the resulting intersection point lines within the MSQ□20L selection range, MSQ□20L can be selected.

Rotation Accuracy: Displacement Values at 180° (Reference values)



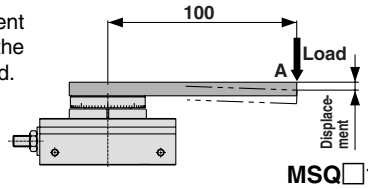
mm

Measuring plate	MSQA	MSQB
Rotating amount of table top	0.03	0.1
Rotating amount of table side	0.03	0.1

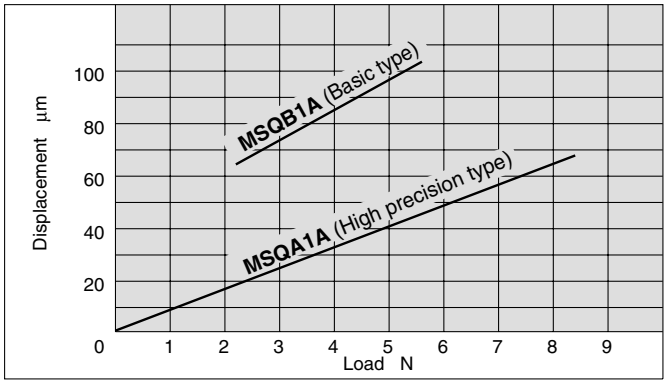
Values in the table are actual values and not guaranteed values.

Table Displacement (Reference values)

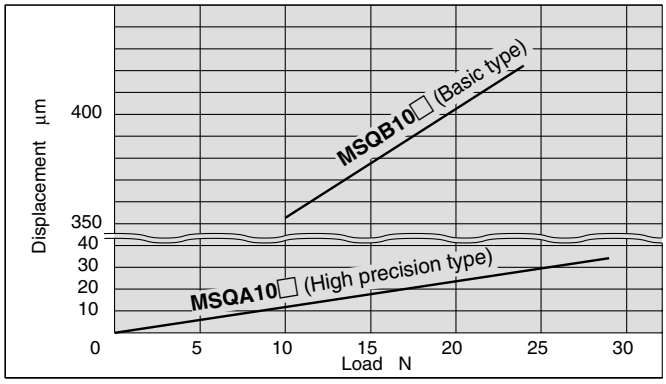
• The following graphs show the displacement at point A, which is 100 mm apart from the center of rotation, where the load is applied.



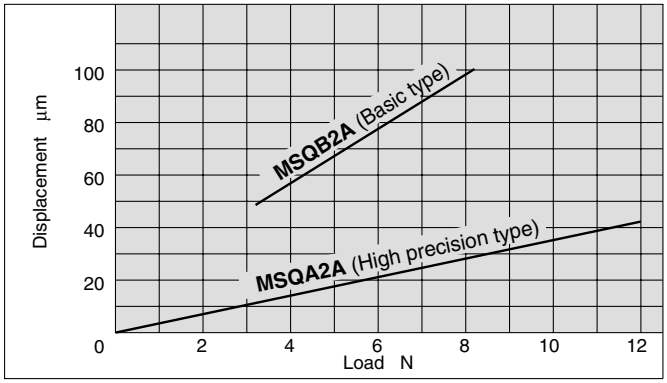
MSQ□1A



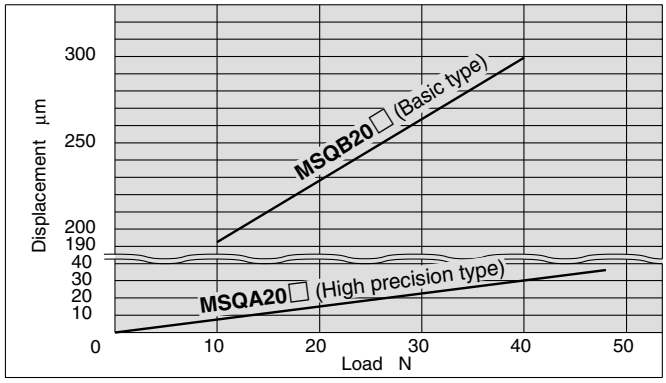
MSQ□10□



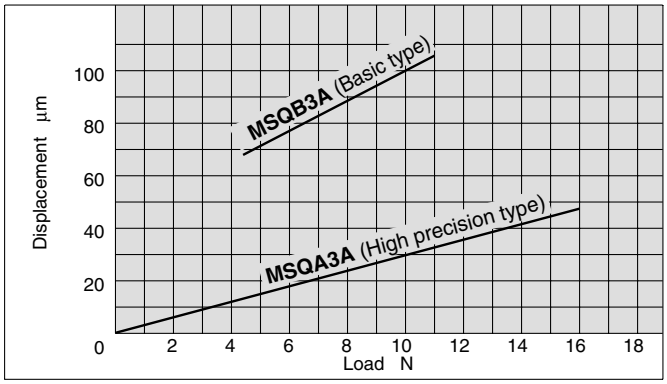
MSQ□2A



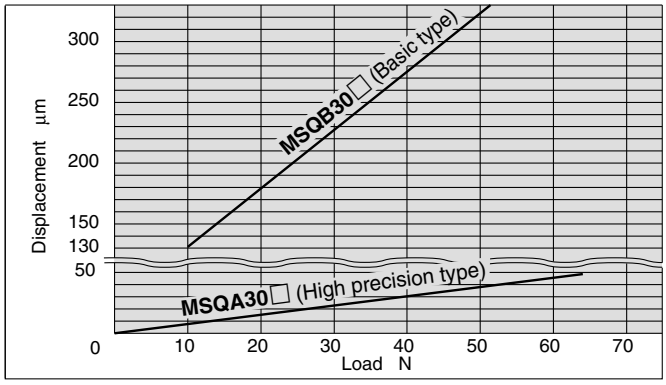
MSQ□20□



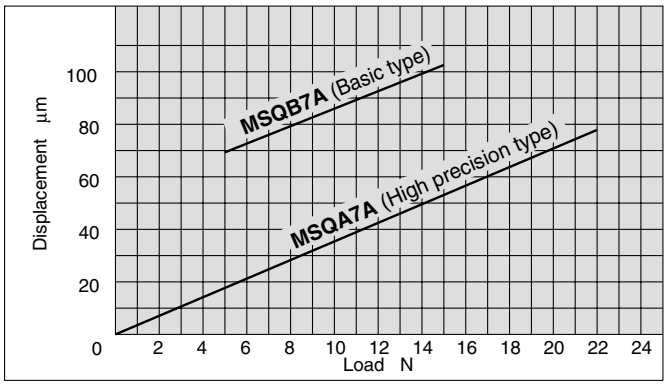
MSQ□3A



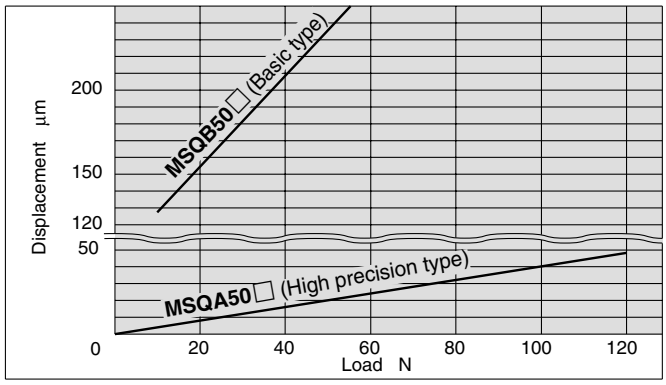
MSQ□30□



MSQ□7A



MSQ□50□



Rotary Table: Basic Type/High Precision Type
Rack & Pinion Style
Series MSQ
Size: 1, 2, 3, 7

How to Order

High precision type: **MSQA 1 A □ — M9B □**

Basic type: **MSQB 1 A □ — M9B □**

Size

1
2
3
7

A	With adjustment bolt

Number of auto switches

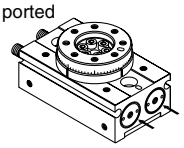
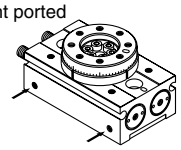
Nil	2 pcs.
S	1 pc.
n	n pcs.

Auto switch

Nil	Without auto switch (Built-in magnet)

∗ For the applicable auto switch model, refer to the table below.
∗ Auto switches are shipped together, (but not assembled).

Port location

Nil	Side ported 
E	Front ported 

Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch type		Lead wire length (m)∗			Applicable load	
					DC		AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)		
								Perpendicular	In-line					
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	12 V	—	**F8N**	**M9N**	●	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				**F8P**	**M9P**	●	●	○		
				2-wire				**F8B**	**M9B**	●	●	○	—	
	Diagnostic indication (2-color display)			3-wire (NPN)				—	**F9NW**	●	●	○	IC circuit	
				3-wire (PNP)				—	**F9PW**	●	●	○		
				2-wire				—	**F9BW**	●	●	○	—	

∗ Lead wire length symbols: 0.5 m ·····Nil (Example) M9N
3 m ····· L (Example) M9NL
5 m ····· Z (Example) M9NZ

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

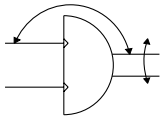
Made to Order → Please contact SMC.

- –50 Without indicator light
- –61 Flexible lead wire
- Pre-wire connector

Basic type/MSQB

High precision type/MSQA

JIS Symbol



Specifications

Size	1	2	3	7
Fluid	Air (non-lube)			
Maximum operating pressure	0.7 MPa			
Minimum operating pressure	0.1 MPa			
Ambient and fluid temperature	0 to 60°C (with no freezing)			
Cushion	None		Rubber bumper	
Angle adjustment range	0 to 190°			
Maximum rotation	190°			
Cylinder bore size	ø6	ø8	ø10	ø12
Port size	M3 x 0.5			M5 x 0.8

Allowable Kinetic Energy and Rotation Time Adjustment Range

Size	Allowable kinetic energy (mJ)	Rotation time adjustment range for suitable operation (s/90°)
1	1	0.2 to 0.7
2	1.5	
3	2	
7	6	0.2 to 1.0

Weight

(g)

Size	1	2	3	7
Basic type	75	105	150	250
High precision type	80	115	165	265

Note) Excluding the weight of auto switches

Clean Series

Prevents dispersion of the particles generated inside of the product into the clean room by sucking them out of the vacuum port on the body side.

How to Order

11 – MSQ B 1 A E – M9B S

- **11**: Clean Series Vacuum type
- **B**: Basic type / **A**: High precision type
- **1**: Size (1, 2, 3, 7)
- **A**: With adjustment bolt
- **E**: Front ported / **Nil**: Side ported (Port location)
- **M9B**: Auto switch
- **S**: Number of auto switches

Specifications and Allowable Load

Particle generation grade	Grade 1 Note)
Suction flow rate (example)	1 ℓ/min (ANR)

11-MSQA is identical to the high precision type and 11-MSQB is identical to the basic type.

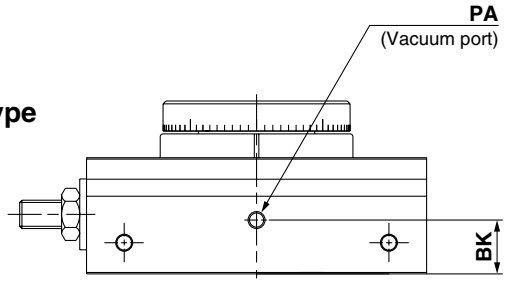
Note) Please refer to "Pneumatic Clean Series" catalog for further details.

Dimensions

Clean series products do not have a hollow axis.

Basic type
11-MSQB□A

High precision type
11-MSQA□A

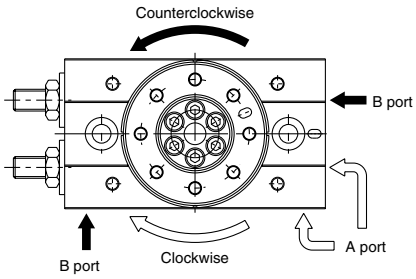


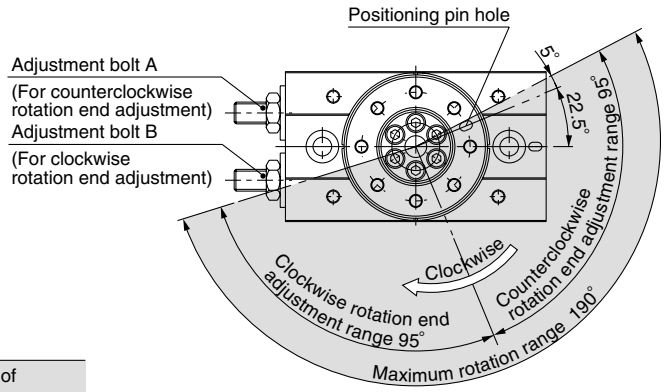
Size	BK	PA
1	5.3	M3 x 0.5
2	7.5	M3 x 0.5
3	9.5	M3 x 0.5
7	7	M5 x 0.8

Dimensions other than above are identical to the basic type and the high precision type.

Rotation Direction and Rotation Angle

- The rotary table turns in the clockwise direction when the A port is pressurized, and in the counterclockwise direction when the B port is pressurized.
- By adjusting the adjustment bolt, the rotation end can be set within the range shown in the drawing for the desired rotation angle.





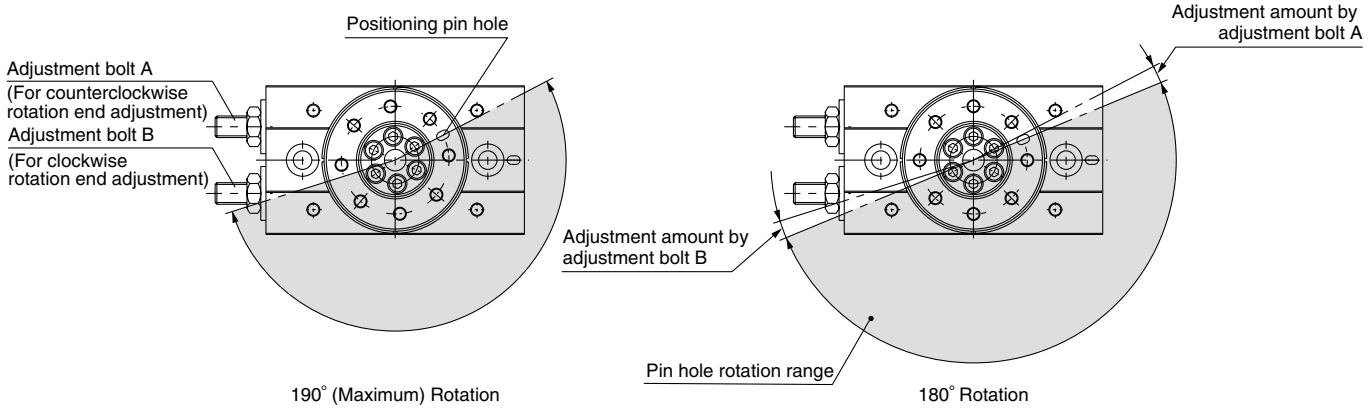
With adjust bolt, internal shock absorber

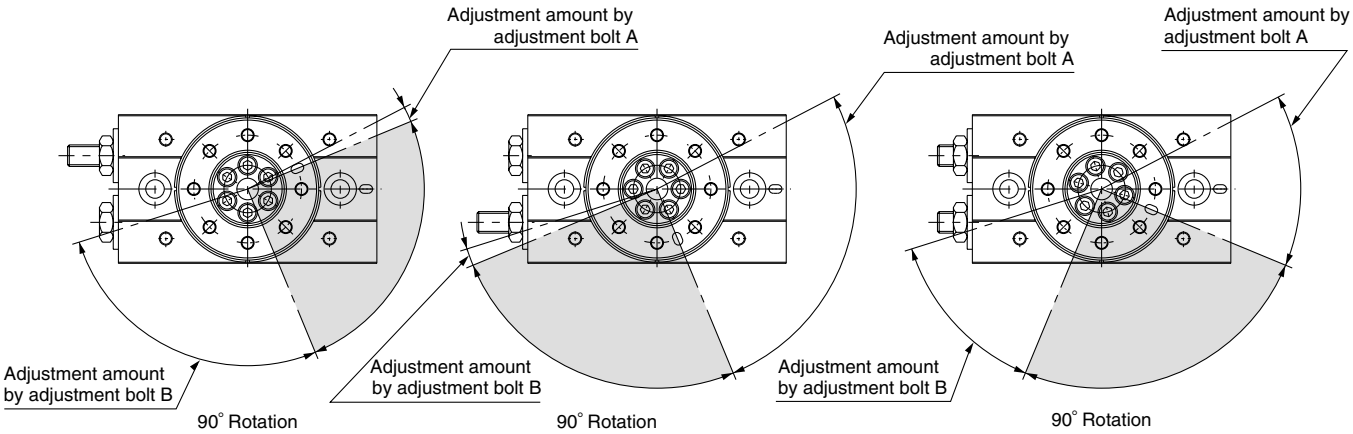
Size	Adjustment angle per rotation of angle adjustment screw
1	8.2°
2	10.0°
3	10.9°
7	10.2°

Note) • The drawing shows the rotation range of the positioning pin hole.
• The pin hole position in the drawing shows the counterclockwise rotation end when the adjustment bolts A and B are tightened equally and the rotation is adjusted 180°.

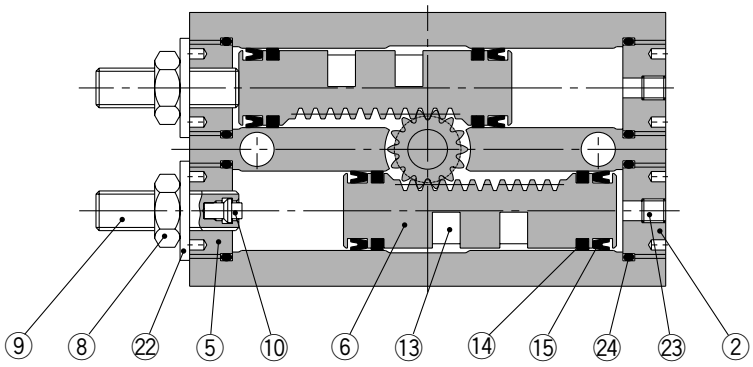
Rotation Range Example

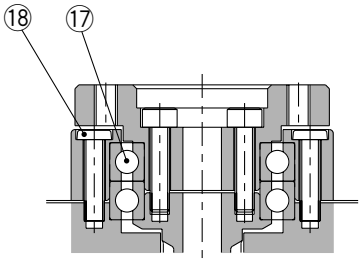
- Various rotation ranges are possible as shown in the drawings below using adjustment bolts A and B. (The drawings also show the rotation ranges of the positioning pin hole.)



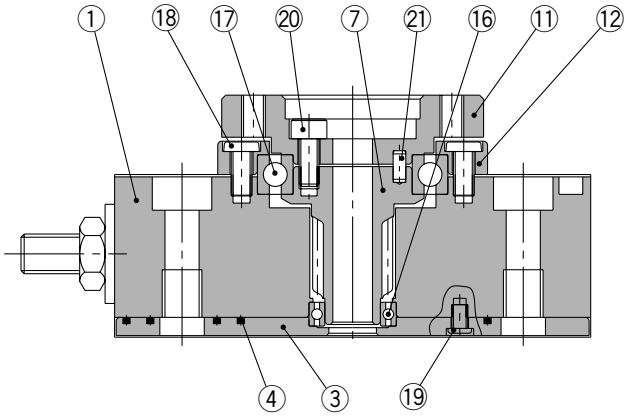


Construction





MSQA□A
(High precision type)



Component Parts

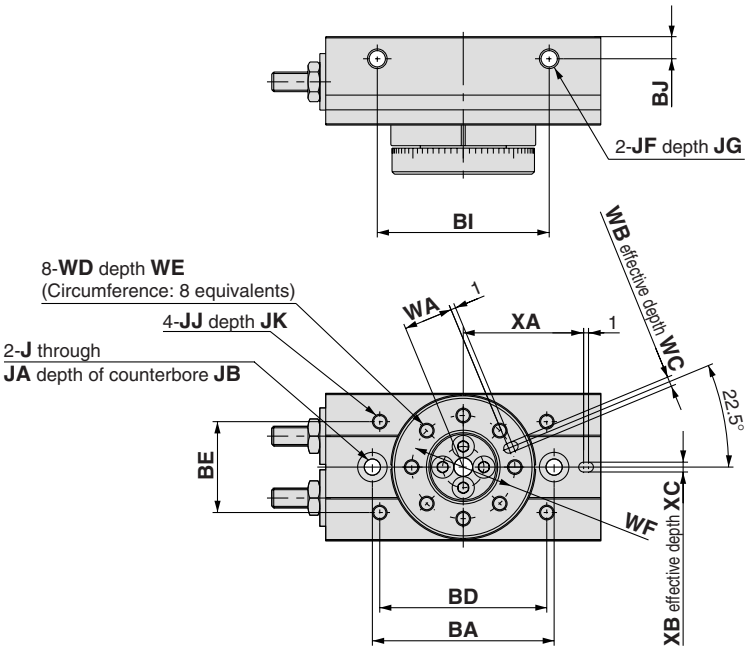
No.	Description		Material
①	**Body**		Aluminium alloy
②	**Cover**		Aluminium alloy
③	**Plate**		Aluminium alloy
④	**Seal**		NBR
⑤	**End cover**		Aluminium alloy
⑥	**Piston**		Stainless steel
⑦	**Pinion**		Chrome molybdenum steel
⑧	**Hexagon nut**		Steel wire
⑨	**Adjustment bolt**		Steel wire
⑩	**Cushion pad**	**Size: 3, 7**	Rubber material
⑪	**Table**		Aluminium alloy
⑫	**Bearing retainer**		Aluminium alloy
⑬	**Magnet**		Magnetic material
⑭	**Wear ring**		Resin

No.	Description			Material
⑮	**Piston seal**			NBR
⑯	**Deep groove ball bearing**			Bearing steel
⑰	**Basic type**	**Deep groove ball bearing**		Bearing steel
	High precision type	**Special bearing**		
⑱	**Round head Philips screw No.0**	**Basic type**	**Size: 1 to 3**	Steel wire
	Round head Philips screw		**Size: 7**	
	Round head Philips screw	**High precision type**		
⑲	**Round head Philips screw No.0**			Steel wire
⑳	**Hexagon socket head set bolt**			Stainless steel
㉑	**Parallel pin**			Carbon steel
㉒	**Seal washer**			NBR
㉓	**Hexagon socket head set screw**			Stainless steel
㉔	**O-ring**			NBR

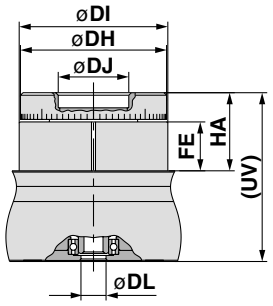
∗ ㉓ The hexagon socket head set screws are tightened at different positions depending on the position of the connecting port.

Dimensions: Size 1, 2, 3, 7

Basic type: MSQB□A

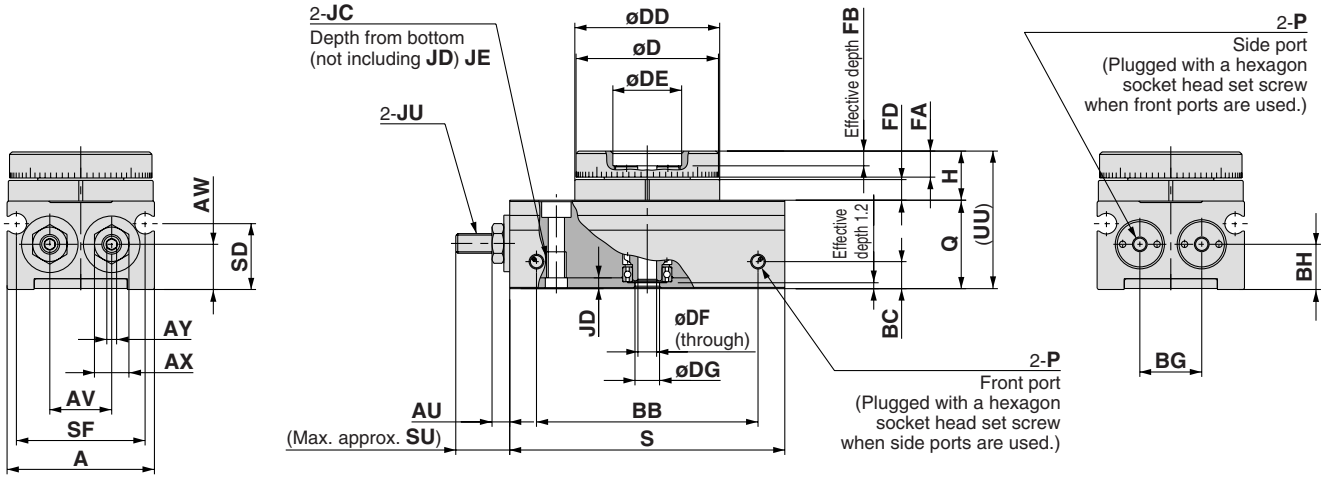


High precision type: MSQA□A



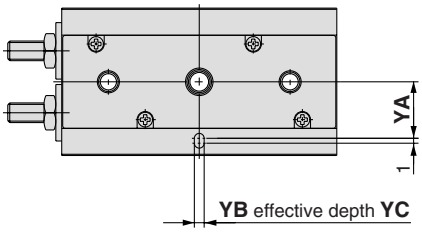
(mm)

Size	DH	DI	DJ	DL	FE	HA	UV
1	27h8	27.5h8	14H8	4.5H8	8.2	13.5	29.5
2	29h8	29.5h8	14H8	5 H8	9.7	15.5	33.5
3	33h8	34h8	17H8	6 H8	9.7	15.5	36
7	39h8	40h8	20H8	7 H8	9.5	16.5	39.5



(mm)

Size	A	AU	AV	AW	AX	AY	BA	BB
1	28	2.8	11	8.2	5.5	1.5	35	39.6
2	30	3.6	12.6	9.2	7	2	37	45.1
3	34.5	4.4	15.5	10.5	8	2.5	43	46.7
7	41	4.8	18.4	12.2	10	3	50	59.2



(mm)

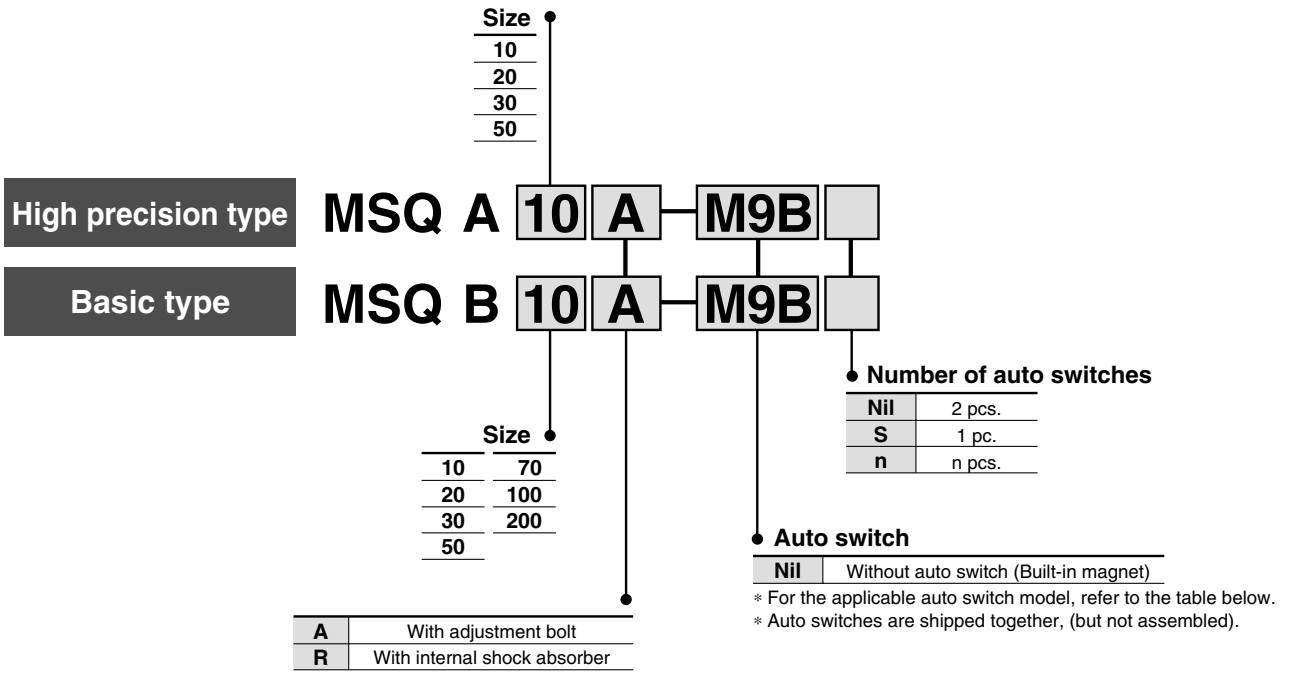
Size	BC	BD	BE	BG	BH	BI	BJ	D	DD	DE	DF	DG	FA	FB	FD	H	J	JA	JB	JC	JD	JE	JF	JG
1	4.5	32	17	11	8.2	30	4.5	27h9	27.5h9	14H9	3.5	4.5H9	4.8	2	3.7	9	3.3	6	3.5	M4 x 0.7	2.2	5.3	M4 x 0.7	4
2	5.5	34	18.5	12.6	9.2	35	4.5	29h9	29.5h9	14H9	3.8	5 H9	5.3	2.5	4.2	10	3.3	6	3.5	M4 x 0.7	2.2	5.3	M4 x 0.7	4
3	5.5	38	23	15.5	10.5	40	4.5	33h9	34 h9	17H9	5	6 H9	5.3	2.5	4.2	10	4.2	7.5	4.5	M5 x 0.8	2.5	6	M4 x 0.7	4
7	5.5	45	30	18.4	12.2	50	5	39h9	40 h9	20H9	6	7 H9	6.5	2.5	4.5	11.5	4.2	7.5	4.5	M5 x 0.8	2.5	6	M5 x 0.8	5

(mm)

Size	JJ	JK	JU	P	Q	S	SD	SF	SU	UU	WA	WB	WC	WD	WE	WF	XA	XB	XC	YA	YB	YC
1	M3 x 0.5	3.5	M3 x 0.5	M3 x 0.5	16	50.5	10.8	24.4	9.4	25	9.5	2H9	2	M3 x 0.5	4.8	20	22.5	2H9	2	11	2H9	2
2	M3 x 0.5	3.5	M4 x 0.7	M3 x 0.5	18	56	13.4	26.2	11.3	28	10	2H9	2	M3 x 0.5	5.3	21	24.5	2H9	2	11.5	2H9	2
3	M3 x 0.5	3.5	M5 x 0.8	M3 x 0.5	20.5	60	15.2	31	11.8	30.5	12	2H9	2	M3 x 0.5	5.3	25	27	2H9	2	13.5	2H9	2
7	M4 x 0.7	4.5	M6 x 1	M5 x 0.8	23	73.5	15.4	37.4	14.9	34.5	14	3H9	3	M4 x 0.7	6.5	29	32.5	3H9	3	15.5	3H9	3

Rotary Table: Basic Type/High Precision Type
Rack & Pinion Style
Series MSQ
Size: 10, 20, 30, 50, 70, 100, 200

How to Order



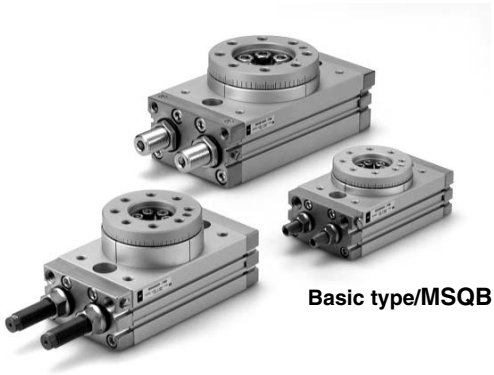
Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC	Load voltage DC	Load voltage AC	Auto switch model: Perpendicular	Auto switch model: In-line	Lead wire length (m)∗ 0.5 (Nil)	3 (L)	5 (Z)	Applicable load	
Reed switch	—	Grommet	No	2-wire	24 V	5 V, 12 V	100 V or less	**A90V**	**A90**	●	●	—	IC circuit	Relay, PLC
			Yes	3-wire (NPN equiv.)	—	5 V	—	**A96V**	**A96**	●	●	—		—
				2-wire	24 V	12 V	100 V	**A93V**	**A93**	●	●	—	—	Relay, PLC
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**M9NV**	**M9N**	●	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9PV**	**M9P**	●	●	○		
				2-wire		12 V		**M9BV**	**M9B**	●	●	○	—	
	Diagnostic indication (2-color display)			3-wire (NPN)		5 V, 12 V		**F9NWV**	**F9NW**	●	●	○	IC circuit	
				3-wire (PNP)				**F9PWV**	**F9PW**	●	●	○		
				2-wire		12 V		**F9BWV**	**F9BW**	●	●	○	—	
	Improved water resistance (2-color display)							—	**F9BA**∗∗	—	●	○		

∗∗ Though it is possible to mount water resistant auto switch, the rotary table itself is not water resistance type.
∗ Lead wire length symbols: 0.5 m ·····Nil (Example) M9N
3 m ····· L (Example) M9NL
5 m ····· Z (Example) M9NZ
∗ Solid state switches marked "○" are produced upon receipt of order.

Made to Order → Please contact SMC.

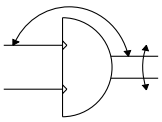
- –50 Without indicator light
- –61 Flexible lead wire
- Pre-wire connector



Basic type/MSQB

High precision type/MSQA

JIS Symbol



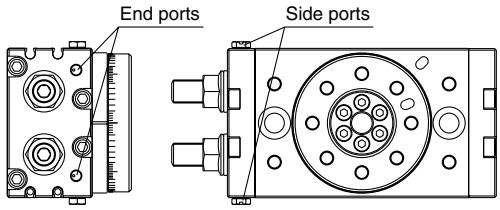
Specifications

Size			10	20	30	50	70	100	200
Fluid			Air (non-lube)						
Maximum operating pressure	With adjustment bolt		1 MPa						
	With internal shock absorber		0.6 MPa Note 1)						
Minimum operating pressure	Basic type		0.1 MPa						
	High precision type		0.2 MPa	0.1 MPa			—		
Ambient and fluid temperature			0 to 60°C (with no freezing)						
Cushion	With adjustment bolt		Rubber bumper						
	With internal shock absorber		Shock absorber						
		Shock absorber model	RBA0805 -X692	RBA1006-X692		RBA1411 -X692	RBA2015-X821		RBA2725 -X821
Angle adjustment range			0 to 190° Note 2)						
Maximum rotation			190°						
Cylinder bore size			ø15	ø18	ø21	ø25	ø28	ø32	ø40
Port size	End ports		M5 x 0.8		Rc 1/8				
	Side ports		M5 x 0.8						

Note 1) The maximum operating pressure of the actuator is restricted by the maximum allowable thrust of the shock absorber.

Note 2) Be careful if the rotation angle of a type with internal shock absorber is set below the value in the table below, the piston stroke will be smaller than the shock absorber's effective stroke, resulting in decreased energy absorption ability.

Size	10	20	30	50	70	100	200
Minimum rotation angle that will not allow decrease of energy absorption ability	52°	43°	40°	60°	71°	62°	82°



Allowable Kinetic Energy and Rotation Time Adjustment Range

Size	Allowable kinetic energy (mJ)		Rotation time adjustment range for stable operation (s/90°)	
	With adjustment bolt	With internal shock absorber	With adjustment bolt	With Note1) internal shock absorber
10	7	39	0.2 to 1.0	0.2 to 0.7
20	25	116		
30	48	116		
50	81	294		
70	240	1100	0.2 to 1.5	0.2 to 1.0
100	320	1600	0.2 to 2.0	
200	560	2900	0.2 to 2.5	

Note 1) Be careful if a type with internal absorber is used below the minimum speed, the energy absorption ability will decrease drastically.

Weight

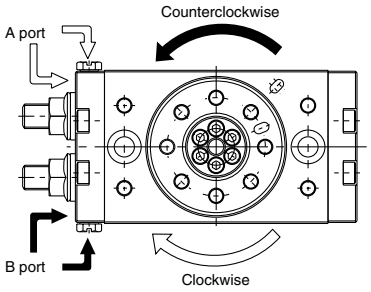
(g)

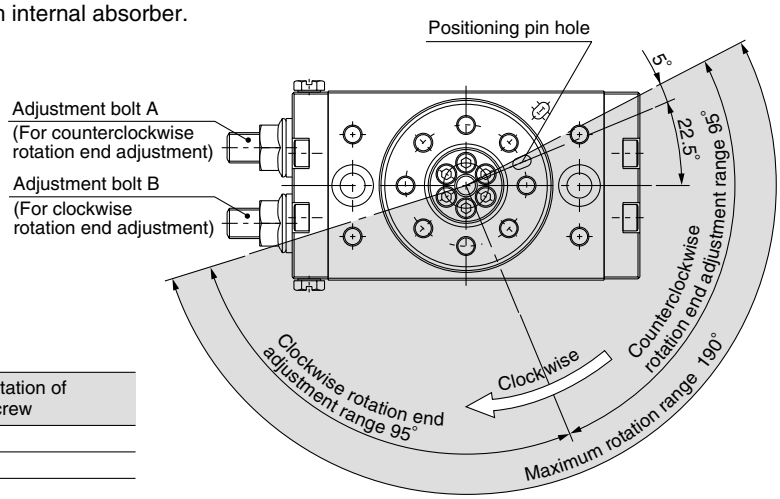
Size		10	20	30	50	70	100	200
Basic type	With adjustment bolt	530	990	1290	2080	2880	4090	7580
	With internal shock absorber	540	990	1290	2100	2890	4100	7650
High precision type	With adjustment bolt	560	1090	1410	2240	–		
	With internal shock absorber	570	1090	1410	2260			

Note) Values above do not include auto switch weights.

Rotation Direction and Rotation Angle

- The rotary table turns in the clockwise direction where the A port is pressurized, and in the counterclockwise direction when the B port is pressurized.
- By adjusting the adjustment bolt, the rotation end can be set within the ranges shown in the drawing for the desired rotation angle.
- The rotation angle can also be set on a type with internal absorber.





With adjust bolt, internal shock absorber

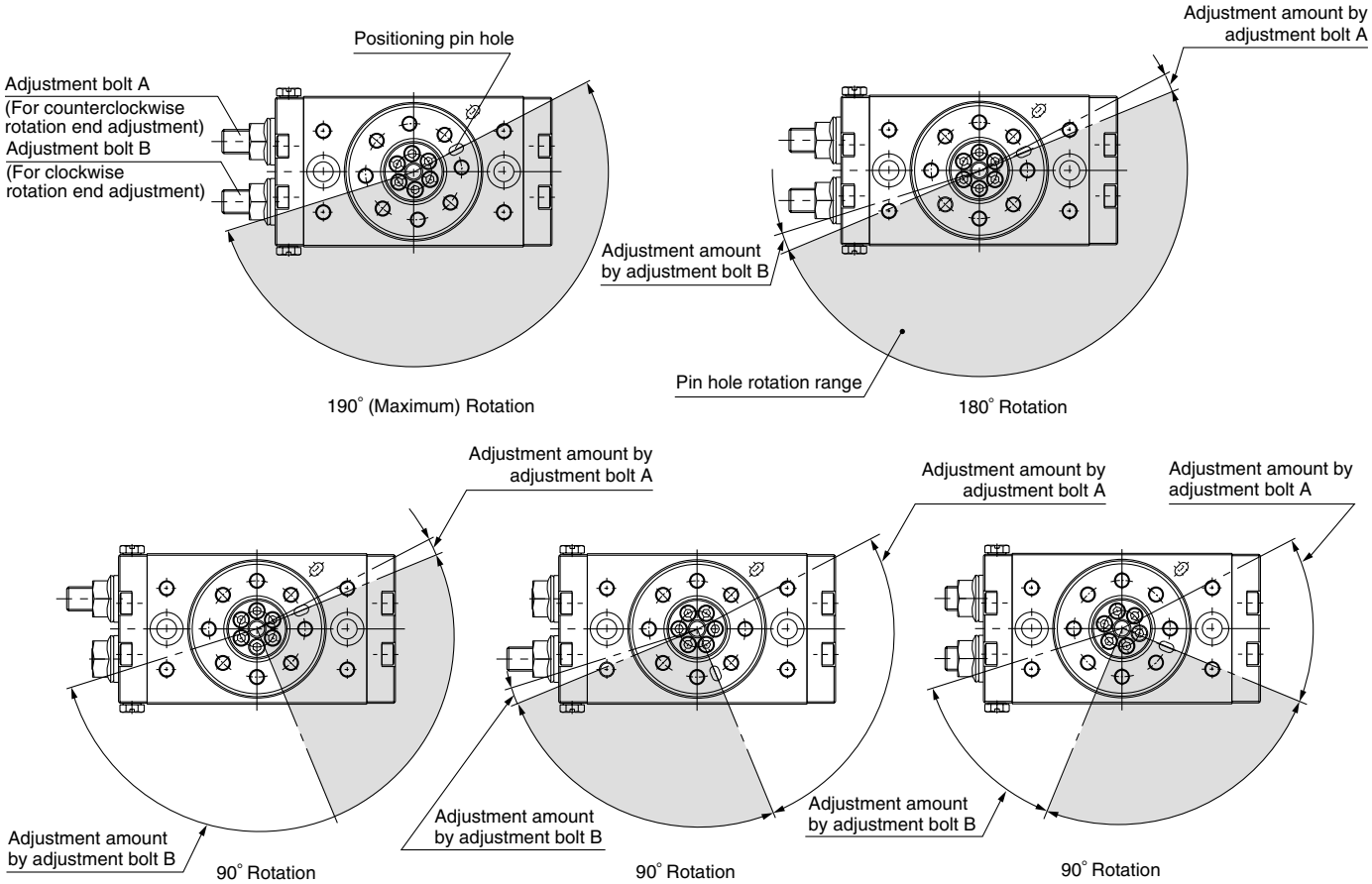
Size	Adjustment angle per rotation of angle adjustment screw
10	10.2°
20	7.2°
30	6.5°
50	8.2°
70	7.0°
100	6.1°
200	4.9°

Note) • The drawing shows the rotation range of the positioning pin hole.
• The pin hole position in the drawing shows the counterclockwise rotation end when the adjustment bolts A and B are tightened equally and the rotation is adjusted 180°.

Rotation Range Example

- Various rotation ranges are possible as shown in the drawings below using adjustment bolts A and B. (The drawings also show the rotation ranges of the positioning pin hole.)

- The rotation angle can also be set on a type with inertial absorber.



Clean Series

Prevents dispersion of the particles generated inside of the product into the clean room by sucking them out of the vacuum port on the body side.

How to Order

11 – MSQ B 10 A – A90 S

- **11**: Clean Series Vacuum type
- **MSQ**: Rotary Table Series MSQ
- **B**: Type
  - **A** High precision type
  - **B** Basic type
- **10**: Size
  - **10**
  - **20**
  - **30**
  - **50**
- **A**: Auto switch
  - **A** With adjustment bolt
  - **R** Shock absorber
- **A90**: Auto switch
- **S**: Number of auto switches

Specifications and Allowable Load

Particle generation grade	Grade 1 Note)
Suction flow rate (example)	1 ℓ/min (ANR)

11-MSQA is identical to the high precision type and 11-MSQB is identical to the basic type.

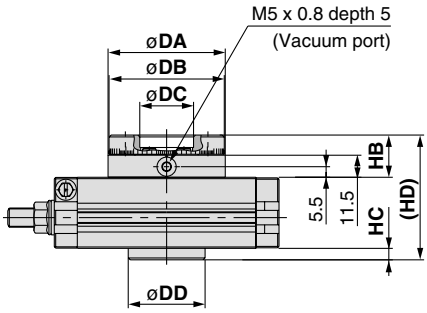
Note) Please refer to "Pneumatic Clean Series" catalog for further details.

CRB2
CRBU2
CRB1
MSU
CRJ
CRA1
CRQ2
MSQ
MRQ
D-
20-

Dimensions

Clean series products do not have a hollow axis.

Basic type
11-MSQB□A
11-MSQB□R

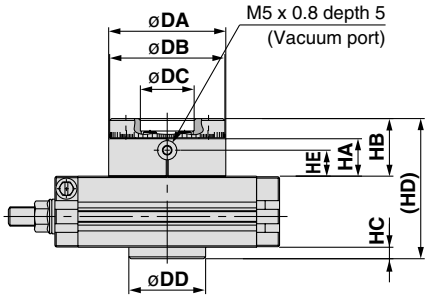


(mm)

Size	**DA**(h9)	**DB**(h9)	**DC**(H9)	**DD**(h9)	**HB**	**HC**	**HD**
10	46	45	20	35	20	5	59
20	61	60	28	40	22	6	65
30	67	65	32	48	22	6	68
50	77	75	35	54	24	7	77

Dimensions other than above are identical to the basic type.

High precision type
11-MSQA□A
11-MSQA□R

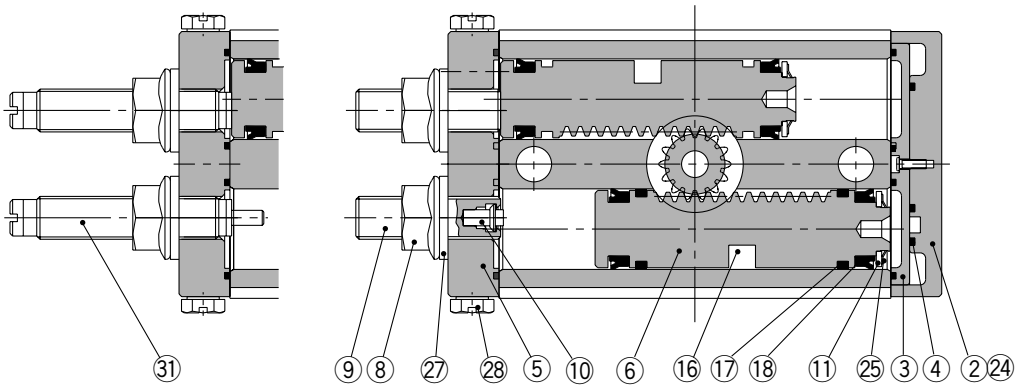


(mm)

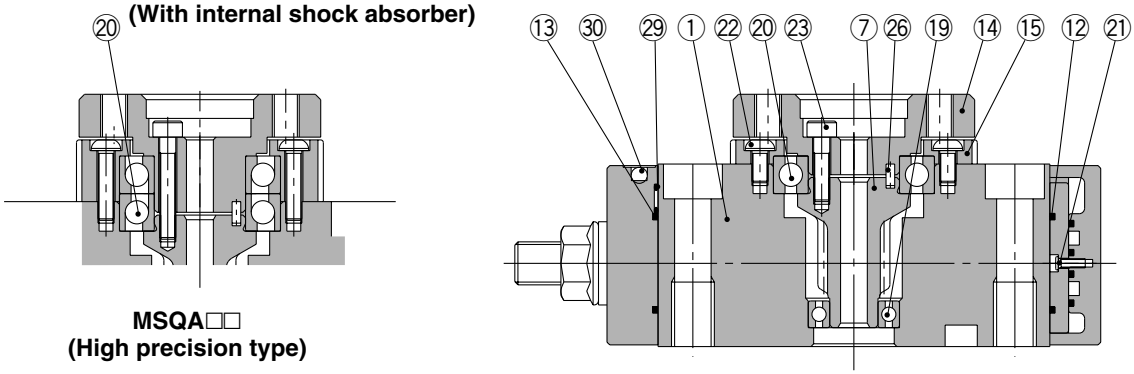
Size	**DA**(h8)	**DB**(h8)	**DC**(H8)	**DD**(h8)	**HA**	**HB**	**HC**	**HD**	**HE**
10	46	45	20	35	15.5	24	5	63	9.5
20	61	60	28	40	19.5	30	6	73	13.5
30	67	65	32	48	19.5	30	6	76	13.5
50	77	75	35	54	21.5	34	7	87	15.5

Dimensions other than above are identical to the high precision type.

Construction



MSQ□□R
(With internal shock absorber)



MSQA□□
(High precision type)

Component Parts

No.	Description		Material
①	**Body**		Aluminium alloy
②	**Cover**		Aluminium alloy
③	**Plate**		Aluminium alloy
④	**Seal**		NBR
⑤	**End cover**		Aluminium alloy
⑥	**Piston**		Stainless steel
⑦	**Pinion**		Chrome molybdenum steel
⑧	**Hexagon nut with flange**	**Size: 10 to 50**	Steel wire
	Hexagon nut	**Size: 70 to 200**	
⑨	**Adjustment bolt**		Chrome molybdenum steel
⑩	**Cushion pad**		Rubber material
⑪	**Seal retainer**		Aluminium alloy
⑫	**Gasket**		NBR
⑬	**Gasket**		NBR
⑭	**Table**		Aluminium alloy
⑮	**Bearing retainer**		Aluminium alloy
⑯	**Magnet**		Magnetic material
⑰	**Wear ring**		Resin
⑱	**Piston seal**		NBR

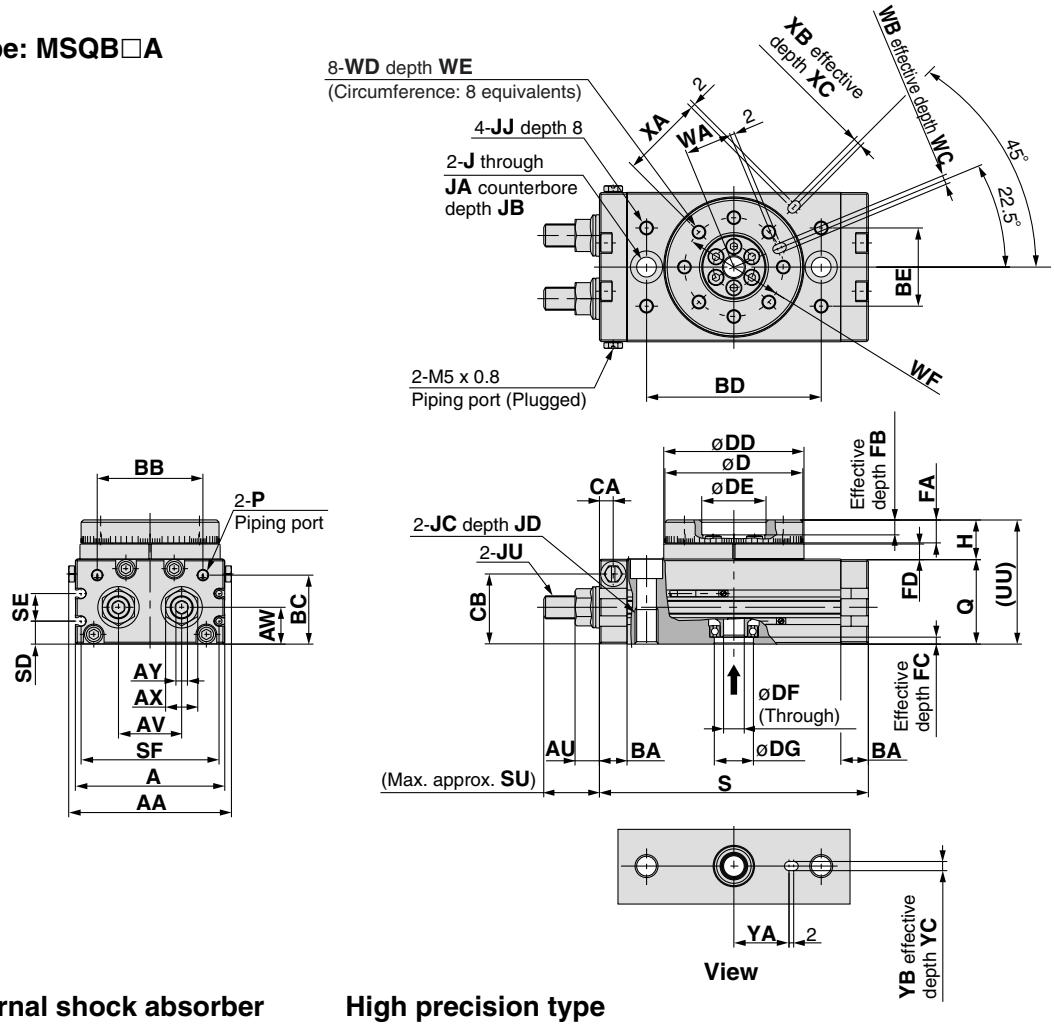
No.	Description		Material
⑲	**Deep groove ball bearing**	**Size: 10 to 50**	Bearing steel
	Needle bearing	**Size: 70 to 200**	
⑳	**Deep groove ball bearing**	**Basic type**	Bearing steel
	Angular contact ball bearing	**High precision type**	
㉑	**Round head philips screw No.0**		Steel wire
㉒	**Round head philips screw**	**Size: 10**	Stainless steel
	Low head cap screw	**Size: 20 to 50**	Chrome molybdenum steel
	Hexagon socket head set bolt	**Size: 70 to 200**	
㉓	**Hexagon socket head set bolt**		Stainless steel
㉔	**Hexagon socket head set bolt**	**Size: 10 to 50**	Stainless steel
		Size: 70 to 200	Carbon steel
㉕	**CS type snap ring**		Spring steel
㉖	**Parallel pin**	**Size: 10 to 50**	Carbon steel
	Parallel key	**Size: 70 to 200**	
㉗	**Seal washer**		NBR
㉘	**Plug**		Brass
㉙	**O-ring**	**Size: 70 to 200 only**	NBR
㉚	**Steel balls**	**Size: 70 to 200 only**	Stainless steel
㉛	**Shock absorber**		—

Replacement Parts

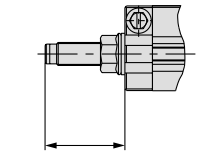
Description	Kit no.							Note
	10	**20**	**30**	**50**	**70**	**100**	**200**	
Seal kit	P523010-5	P523020-5	P523030-5	P523040-5	P391050-5	P391060-5	P391070-5	A set of above numbers ④, ⑫, ⑬, ⑰, ⑱ and ㉗

Dimensions: Size 10, 20, 30, 50

Basic type: MSQB□A



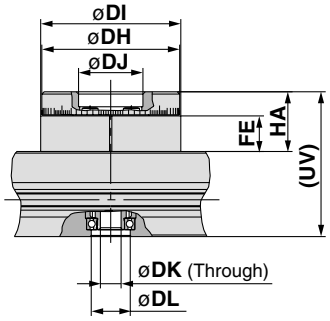
With internal shock absorber
MSQA□R
MSQB□R



(mm)

Size	FU
10	31.5
20	34.7
30	34.7
50	51.7

High precision type
MSQA□A: With adjustment bolt
MSQA□R: With internal shock absorber



(mm)

Size	DH	DI	DJ	DK	DL	FE	HA	UV
10	45h8	46h8	20H8	5	15H8	10	18.5	52.5
20	60h8	61h8	28H8	9	17H8	15.5	26	63
30	65h8	67h8	32H8	9	22H8	16.5	27	67
50	75h8	77h8	35H8	10	26H8	17.5	30	76

(mm)

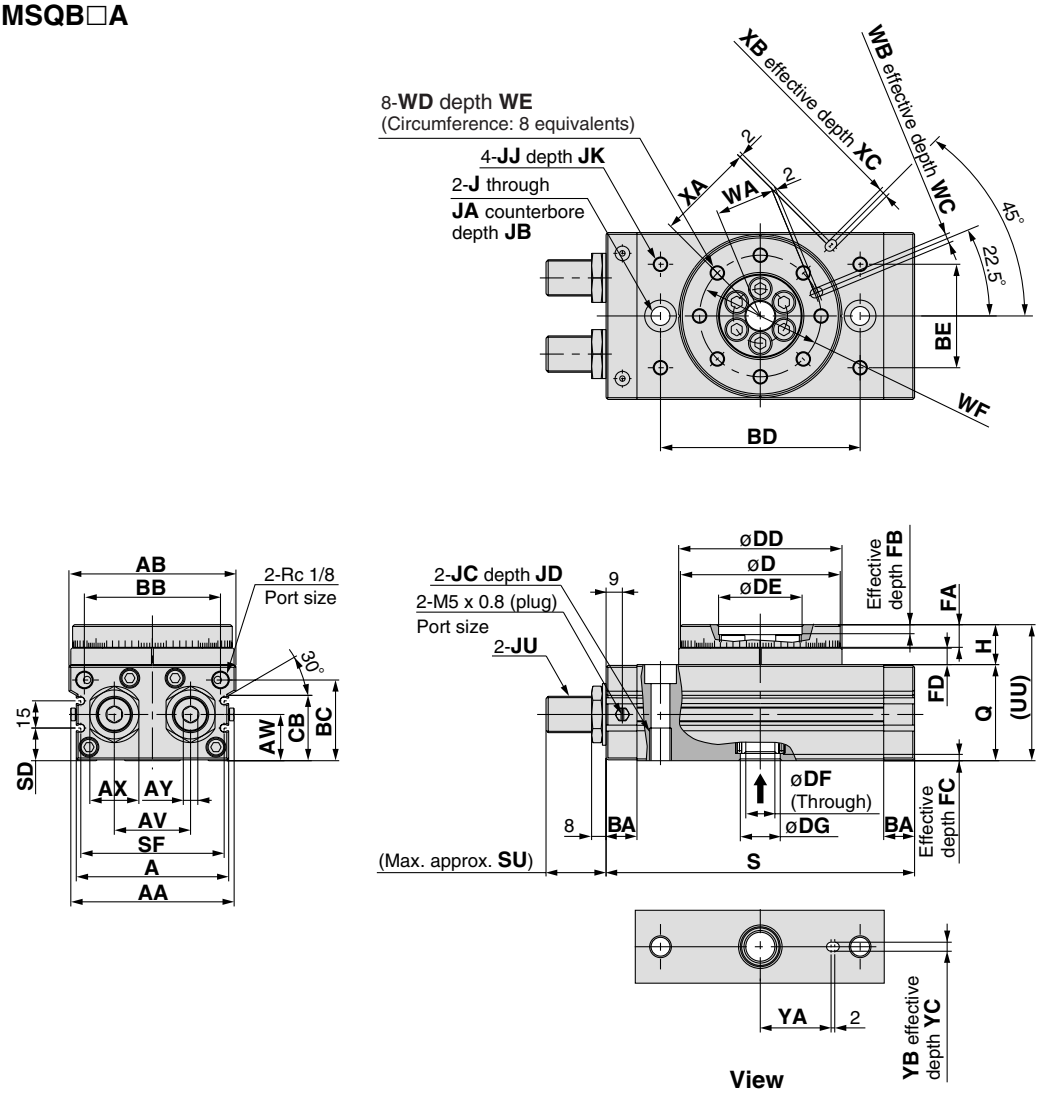
Size	AA	A	AU	AV	AW	AX	AY	BA	BB	BC	BD	BE	CA	CB	D	DD	DE	DF	DG	FA	FB	FC	FD	H	J	JA	JB
10	55.4	50	8.6	20	15.5	12	4	9.5	34.5	27.8	60	27	4.5	28.5	45h9	46h9	20H9	5	15H9	8	4	3	4.5	13	6.8	11	6.5
20	70.8	65	10.6	27.5	16	14	5	12	46	30	76	34	6	30.5	60h9	61h9	28H9	9	17H9	10	6	2.5	6.5	17	8.6	14	8.5
30	75.4	70	10.6	29	18.5	14	5	12	50	32	84	37	6.5	33.5	65h9	67h9	32H9	9	22H9	10	4.5	3	6.5	17	8.6	14	8.5
50	85.4	80	14	38	22	19	6	15.5	63	37.5	100	50	10	37.5	75h9	77h9	35H9	10	26H9	12	5	3	7.5	20	10.5	18	10.5

(mm)

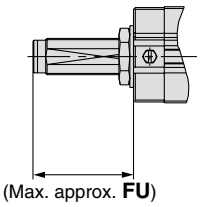
Size	JC	JD	JJ	JU	P	Q	S	SD	SE	SF	SU	UU	WA	WB	WC	WD	WE	WF	XA	XB	XC	YA	YB	YC
10	M8 x 1.25	12	M5 x 0.8	M8 x 1	M5 x 0.8	34	92	9	13	45	17.7	47	15	3H9	3.5	M5 x 0.8	8	32	27	3H9	3.5	19	3H9	3.5
20	M10 x 1.5	15	M6 x 1	M10 x 1	M5 x 0.8	37	117	10	12	60	25	54	20.5	4H9	4.5	M6 x 1	10	43	36	4H9	4.5	24	4H9	4.5
30	M10 x 1.5	15	M6 x 1	M10 x 1	Rc 1/8	40	127	11.5	14	65	25	57	23	4H9	4.5	M6 x 1	10	48	39	4H9	4.5	28	4H9	4.5
50	M12 x 1.75	18	M8 x 1.25	M14 x 1.5	Rc 1/8	46	152	14.5	15	75	31.4	66	26.5	5H9	5.5	M8 x 1.25	12	55	45	5H9	5.5	33	5H9	5.5

Dimensions: Size 70, 100, 200

Basic type: MSQB□A



With shock absorber
MSQB□R



(mm)

Size	FU
70	55.4
100	55.5
200	74.7

(mm)

Size	AA	AB	A	AV	AW	AX	AY	BA	BB	BC	BD	BE	CB	D	DD	DE	DF	DG	FA	FB	FC	FD	H	J	JA	JB
70	90	92	84	42	25.5	27	8	17	75	44.5	110	57	36	88h9	90h9	46H9	16	22H9	12.5	5	3.5	9	22	10.4	17.5	10.5
100	101	102	95	50	29.5	27	8	17	85	50.5	130	66	42	98h9	100h9	56H9	19	24H9	14.5	6	3.5	12	27	10.4	17.5	10.5
200	119	120	113	60	36.5	36	10	24	103	65.5	150	80	57	116h9	118h9	64H9	24	32H9	16.5	9	5.5	15	32	14.2	20	12.5

(mm)

Size	JC	JD	JJ	JK	JU	Q	S	SD	SF	SU	UU	WA	WB	WC	WD	WE	WF	XA	XB	XC	YA	YB	YC
70	M12 x 1.75	18	M8 x 1.25	10	M20 x 1.5	53	170	18	79	34.2	75	32.5	5H9	5.5	M8 x 1.25	12.5	67	54	5H9	3.5	39	5H9	3.5
100	M12 x 1.75	18	M8 x 1.25	10	M20 x 1.5	59	189	22	90	34.3	86	37.5	6H9	6.5	M10 x 1.5	14.5	77	59	6H9	4.5	49	6H9	4.5
200	M16 x 2	25	M12 x 1.75	13	M27 x 1.5	74	240	29	108	40.2	106	44	8H9	8.5	M12 x 1.75	16.5	90	69	8H9	4.5	54	8H9	6.5

Rotary Table: Basic Type/High Precision Type
W/ External Shock Absorber, Rack/Pinion Style

Series MSQ

Size: 10, 20, 30, 50

How to Order

MSQ B 10 L 2 — M9B S

A	High precision type
B	Basic type

Size

10
20
30
50

Shock absorber type

L	Shock absorber for low energy
H	Shock absorber for high energy

2	Standard type	180°
3		90°
4	Symmetric type	180°
5		90°

Refer to the table to the right.

Number of auto switch

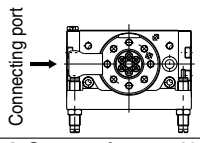
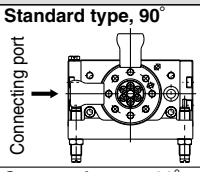
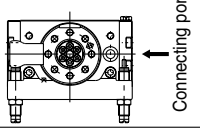
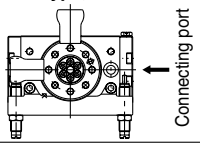
Nil	2 pcs.
S	1 pc.
n	n pcs.

Auto switch

Nil	Without auto switch (Built-in magnet)

∗ For the applicable auto switch model, refer to the table below.
∗ Auto switches are shipped together, (but not assembled).

Port location/Rotation

Connecting port position	Rotation: 180°	Rotation: 90°
Standard type	**2: Standard type, 180°** 	**3: Standard type, 90°** 
Symmetric type	**4: Symmetric type, 180°** 	**5: Symmetric type, 90°** 

Applicable Auto Switch/Refer to page 11-11-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage: DC		Load voltage: AC	Auto switch model: Perpendicular	Auto switch model: In-line	Lead wire length (m)∗: 0.5 (Nil)	3 (L)	5 (Z)	Applicable load	
Reed switch	–	Grommet	No	2-wire	24 V	5 V, 12 V	100 V or less	**A90V**	**A90**	●	●	–	IC circuit	Relay, PLC
			Yes	3-wire (NPN equiv.)	–	5 V	–	**A96V**	**A96**	●	●	–		–
				2-wire	24 V	12 V	100 V	**A93V**	**A93**	●	●	–	–	Relay, PLC
Solid state switch	–	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	–	**M9NV**	**M9N**	●	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9PV**	**M9P**	●	●	○		
				2-wire		12 V		**M9BV**	**M9B**	●	●	○	–	
	Diagnostic indication (2-color display)			3-wire (NPN)		5 V, 12 V		**F9NWV**	**F9NW**	●	●	○	IC circuit	
				3-wire (PNP)				**F9PWV**	**F9PW**	●	●	○		
				2-wire		12 V		**F9BWV**	**F9BW**	●	●	○	–	
	Improved water resistance (2-color display)							–	**F9BA**∗∗	–	●	○		

∗∗ Though it is possible to mount water resistant auto switch, the rotary table itself is not water resistance type.
∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9N
3 m ····· L (Example) M9NL
5 m ····· Z (Example) M9NZ

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

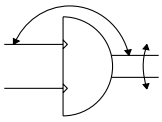
Made to Order → Please contact SMC.

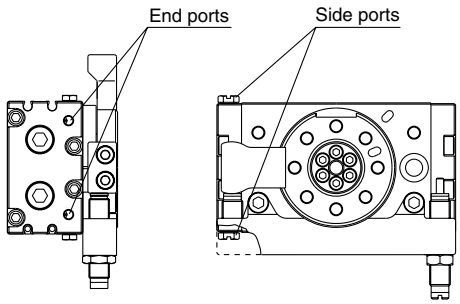
- –50 Without indicator light
- –61 Flexible lead wire
- Pre-wire connector

Specifications

Size		10	20	30	50
Fluid		Air (non-lube)			
Maximum operating pressure		1 MPa			
Minimum operating pressure		0.2 MPa			
Ambient and fluid temperature		0 to 60°C (with no freezing)			
Cushion		Shock absorber			
Shock absorber type	For low energy	RB0805	RB1006		RB1411
	For high energy	RB0806	RB1007		RB1412
Rotation		90°, 180°			
Angle adjusting range		Each rotation end ±3°			
Cylinder bore size		ø15	ø18	ø21	ø25
Port size	End ports	M5 x 0.8		Rc 1/8	
	Side ports	M5 x 0.8			

JIS Symbol





Allowable Kinetic Energy and Rotation Time Adjustment Range

Size	Allowable kinetic energy (mJ)		Rotation time adjustment range for stable operation (s/90°)
	Shock absorber for low energy	Shock absorber for high energy	
10	161	231	0.2 to 1.0 Note)
20	574	1060	
30	805	1210	
50	1310	1820	

Note) Values above indicate the time between the start of rotation and the deceleration caused by the shock absorber. Although the time required by the rotary table to reach the rotation end after deceleration differs depending on the operating conditions (inertial moment of the load, rotation speed and operating pressure), approximately 0.2 to 2 seconds are required. The range of angles within which the shock absorber operates is between the rotation end and the values shown below.

Size	10	20	30	50
For low energy	7.1°	6.9°	6.2°	9.6°
For high energy	8.6°	8.0°	7.3°	10.5°

Weight

(g)

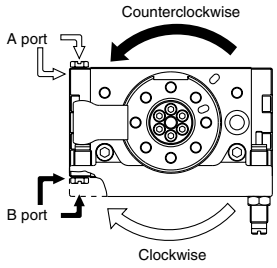
Size		10	20	30	50
Basic type	90° specifications	630	1200	1520	2480
	180° specifications	600	1140	1450	2370
High precision type	90° specifications	700	1390	1750	2810
	180° specifications	670	1340	1680	2690

Note) Values above do not include auto switch weights.

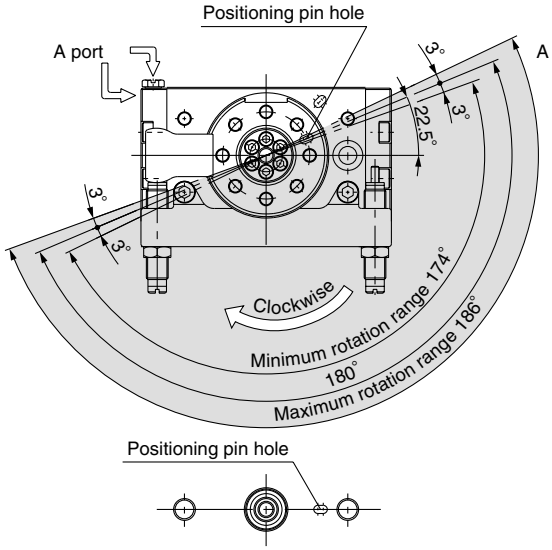
Rotation Direction and Rotation Angle

- The rotary table turns in the clockwise direction where the A port is pressurized, and in the counterclockwise direction when the B port is pressurized.
- By adjusting the shock absorber, the rotation end can be set within the ranges shown in the drawing.

Standard type

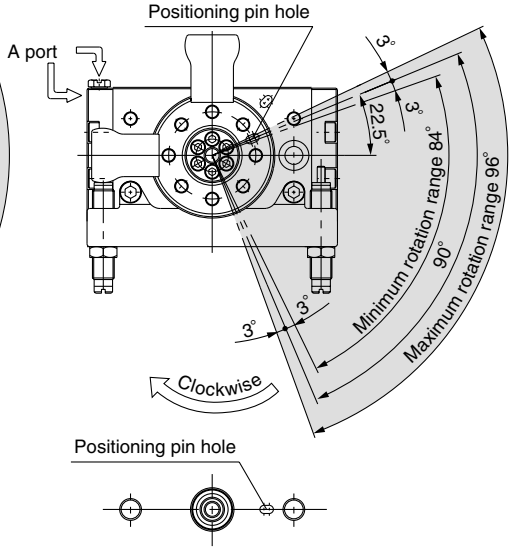


For 180°



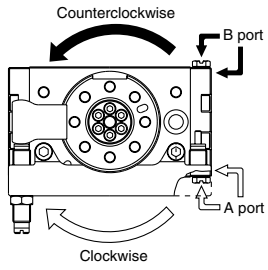
Position of bottom positioning pin hole

For 90°

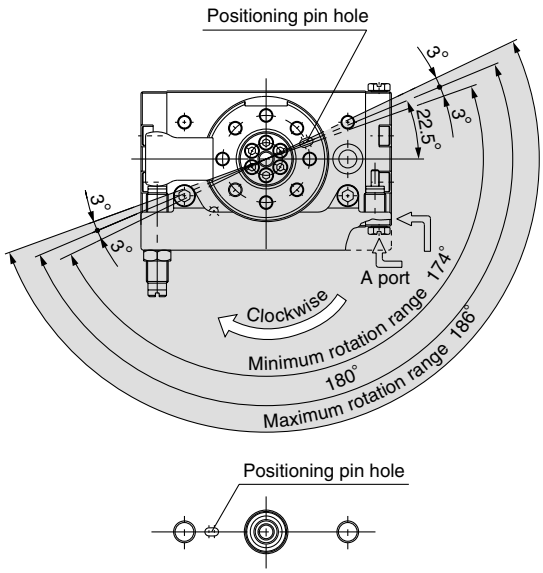


Position of bottom positioning pin hole

Symmetric type

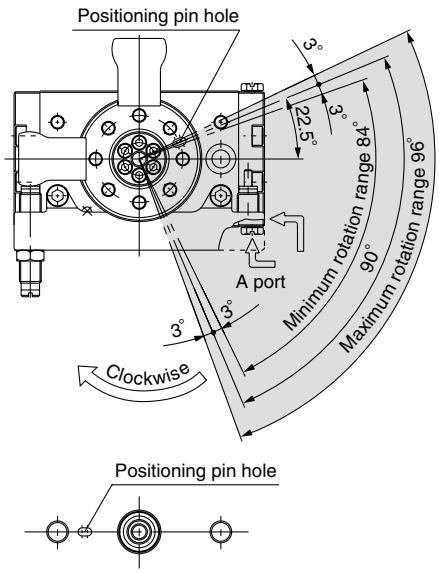


For 180°



Position of bottom positioning pin hole

For 90°



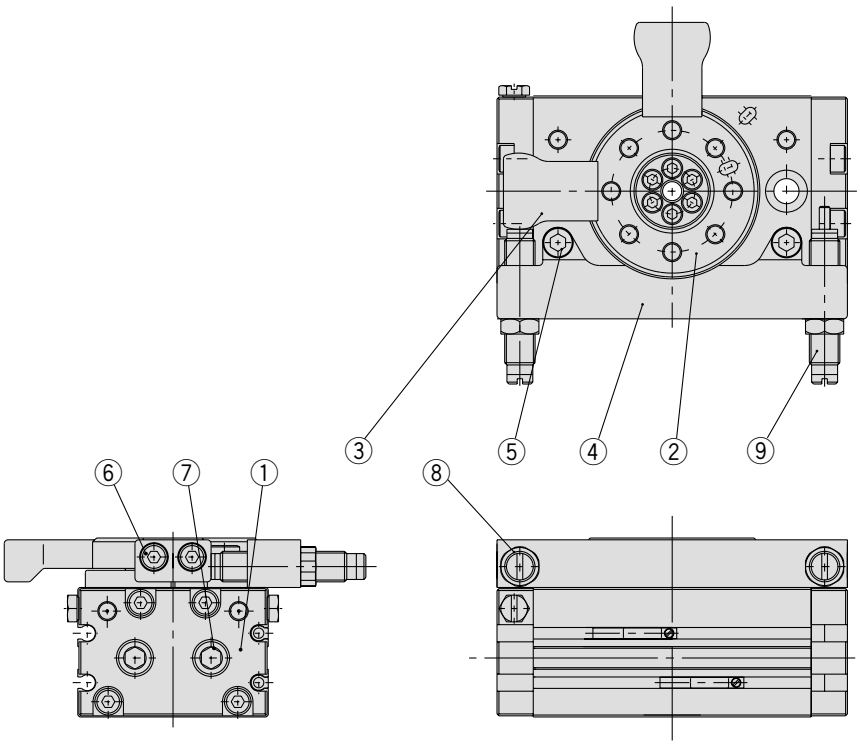
Position of bottom positioning pin hole

With external shock absorber

Size	Adjustment angle per rotation of angle adjustment screw
10	1.4°
20	1.2°
30	1.1°
50	1.3°

Note) · The drawings show the rotation range for the top positioning pin hole of the table.
· The pin hole position in the drawing shows the counterclockwise rotation end when the shock absorbers are tightened equally and the rotation is adjusted to 180° and 90°.

Construction



Component Parts

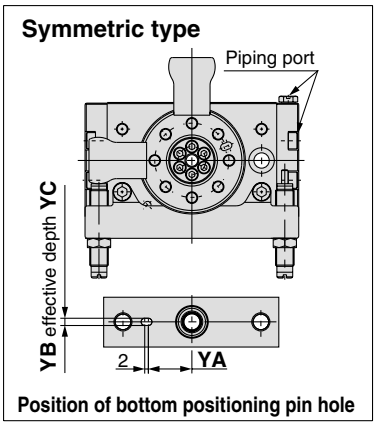
No.	Description	Material
①	End cover	Aluminium alloy
②	Table	Aluminium alloy
③	Arm	Chrome molybdenum steel
④	Shock absorber holder	Aluminium alloy
⑤	Hexagon socket head set bolt	Stainless steel
⑥	Hexagon socket head set bolt	Stainless steel
⑦	Taper plug	Steel wire
⑧	Hexagon nut	Steel wire
⑨	Shock absorber	—

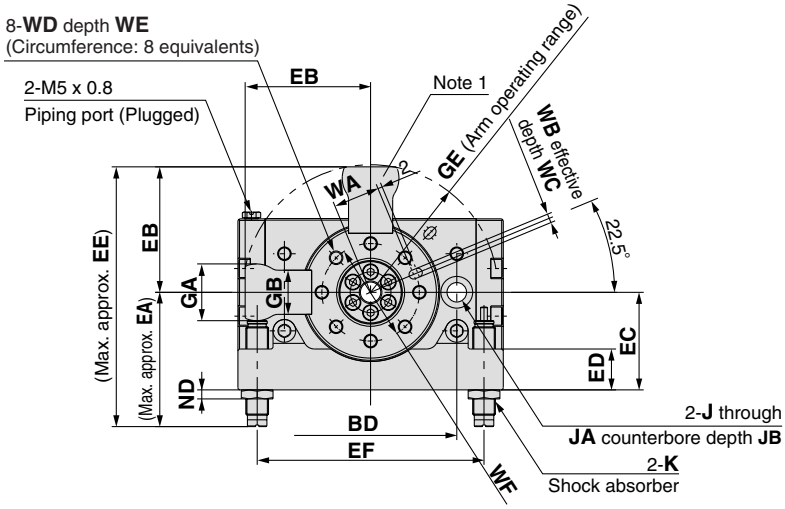
Replacement Parts

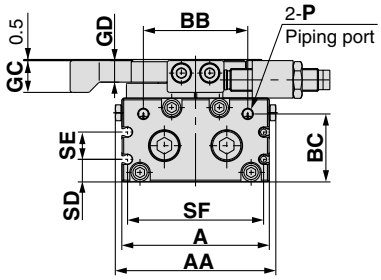
Description	Kit no.				Note
	10	20	30	50	
Seal kit	P523010-6	P523020-6	P523030-6	P523040-6	Seal washer ㉗ is excluded from the kit contents described on page 11-9-20.

Dimensions: With External Shock Absorber Size: 10, 20, 30, 50

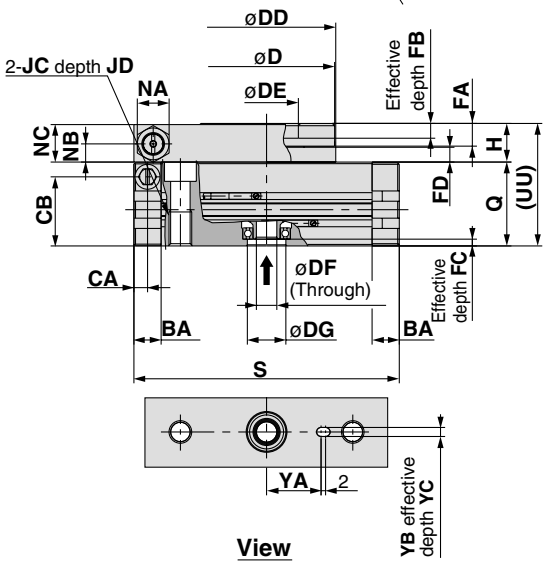
Basic type: MSQB□$^{L}_{H}$□



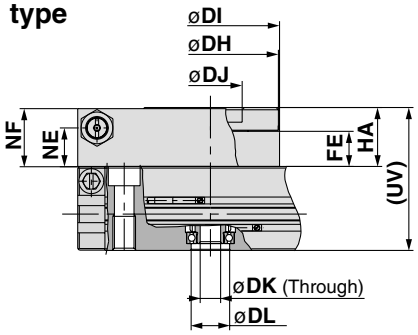




Note 1) This part is not available with 180° specification.



High precision type MSQA□$^{L}_{H}$□



(mm)

Size	DH	DI	DJ	DK	DL	FE	HA	NE	NF	UV
10	45	46	20H8	5	15H8	10	18.5	11	18	52.5
20	60	61	28H8	9	17H8	15.5	26	17	25.5	63
30	65	67	32H8	9	22H8	16.5	27	18	26.5	67
50	75	77	35H8	10	26H8	17.5	30	18.5	29.5	76

(mm)

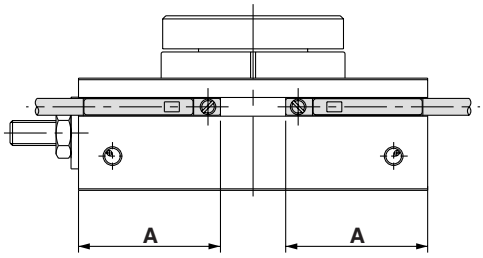
Size	AA	A	BA	BB	BC	BD	CA	CB	D	DD	DE	DF	DG	EA	EB	EC	ED	EE	EF	FA	FB	FC	FD	GA	GB	GC	GD	GE	H
10	55.4	50	9.5	34.5	27.8	60	4.5	28.5	45	46	20H9	5	15H9	52.9	44.3	33.5	14	97.2	80	8	4	3	4.5	20	15.6	11	7.5	45.2	13
20	70.8	65	12	46	30	76	6	30.5	60	61	28H9	9	17H9	61.8	55.3	43	18	117.1	100	10	6	2.5	6.5	25	19.5	14	9.5	56.4	17
30	75.4	70	12	50	32	84	6.5	33.5	65	67	32H9	9	22H9	63.1	60.3	46	19.5	123.4	110	10	4.5	3	6.5	27	21.5	14	9.5	61.5	17
50	85.4	80	15.5	63	37.5	100	10	37.5	75	77	35H9	10	26H9	86.7	71.4	56	22	158.1	130	12	5	3	7.5	32	28	18	11.5	72.9	20

(mm)

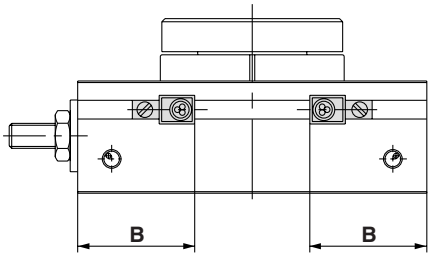
Size	J	JA	JB	JC	JD	K	NA	NB	NC	ND	P	Q	S	SD	SE	SF	UU	WA	WB	WC	WD	WE	WF	YA	YB	YC
10	6.8	11	6.5	M8 x 1.25	12	M8 x 1	10	5.5	12.5	4	M5 x 0.8	34	92	9	13	45	47	15	3H9	3.5	M5 x 0.8	8	32	19	3H9	3.5
20	8.6	14	8.5	M10 x 1.5	15	M10 x 1	14	8	16.5	4	M5 x 0.8	37	117	10	12	60	54	20.5	4H9	4.5	M6 x 1	10	43	24	4H9	4.5
30	8.6	14	8.5	M10 x 1.5	15	M10 x 1	14	8	16.5	4	Rc 1/8	40	127	11.5	14	65	57	23	4H9	4.5	M6 x 1	10	48	28	4H9	4.5
50	10.5	18	10.5	M12 x 1.75	18	M14 x 1.5	19	8.5	19.5	6	Rc 1/8	46	152	14.5	15	75	66	26.5	5H9	5.5	M8 x 1.25	12	55	33	5H9	5.5

Proper Auto Switch Mounting Position at Rotation End

• Size: 1 to 7



When D-F9 and M9 are used

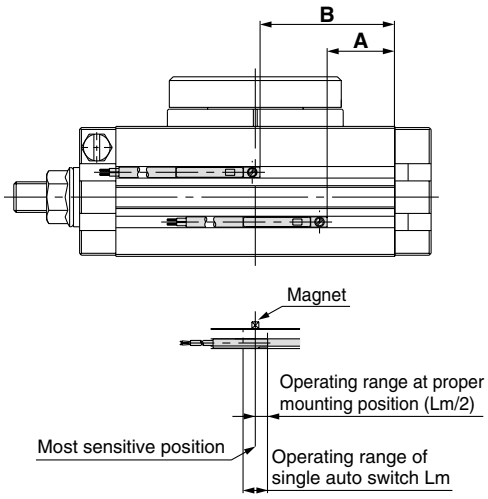


When D-F8 is used

Size	Rotation	Solid state switch								
		D-F9□W			D-M9□			D-F8□		
		A	Operating angle θ m	Hysteresis angle	A	Operating angle θ m	Hysteresis angle	B	Operating angle θ m	Hysteresis angle
1	190°	20.9	40°	10°	20.9	55°	10°	16.9	20°	10°
2	190°	22.8	35°	10°	22.8	45°	10°	18.8	20°	10°
3	190°	24.4	30°	10°	24.4	40°	10°	20.4	15°	10°
7	190°	28.7	25°	10°	28.7	40°	10°	24.7	15°	10°

Operating angle θ m: Value of the operating range Lm of a single auto switch converted to an axial rotation angle.
Hysteresis angle : Value of auto switch hysteresis converted to an angle.

• Size: 10 to 200



Size	Rotation	Reed switch				Solid state switch							
		D-A9□, D-A9□V				D-M9□V, D-F9□W, D-F9□WV, D-F9BAL				D-M9□			
		A	B	Operating angle θ m	Hysteresis angle	A	B	Operating angle θ m	Hysteresis angle	A	B	Operating angle θ m	Hysteresis angle
10	190°	17	36	90°	10°	21	40	90°	10°	21	40	60°	10°
20	190°	23	50	80°	10°	27	54	80°	10°	27	54	50°	10°
30	190°	27	66	65°	10°	31	60	65°	10°	31	60	50°	10°
50	190°	33	68	50°	10°	37	72	50°	10°	37	72	40°	10°
70	190°	37	78	45°	10°	41	82	45°	10°	41	82	40°	10°
100	190°	44	91	40°	10°	48	95	40°	10°	48	95	30°	10°
200	190°	57	115	35°	10°	61	19	35°	10°	61	19	20°	10°

Operating angle θ m: Value of the operating range Lm of a single auto switch converted to an axial rotation angle.
Hysteresis angle: Value of auto switch hysteresis converted to an angle.

Specific Product Precautions 1

Be sure to read before handling.

Speed Adjustment

⚠ Warning

1. Perform speed adjustment gradually from the low speed side.

Speed adjustment from the high speed side can cause product damage leading to human injury and damage to equipment an machinery.

⚠ Caution

1. When operating at high speed with a large load weight, a large amount of energy is applied to the actuator and can cause damage.

Refer to the model selection on page 11-9-5 to find the proper operating time.

2. Do not machine the fixed orifice of the port to enlarge its size. If the fixed orifice size is enlarged, the actuator operating speed and impact force will increase and cause damage.

Lubrication

⚠ Caution

1. Use the product without lubrication.

This product is lubricated with grease at the factory, and further lubrication will result in a failure to meet the product's specifications.

Rotation Adjustment

⚠ Caution

1. As a standard feature, the rotary table is equipped with a rotation adjustment screw (adjustment bolt or shock absorber) that can be used to adjust the rotation. The table below shows the rotation adjustment per single rotation of the rotation adjustment screw. Please refer to following pages for the rotation direction, rotation angle and rotation angle range.

MSQ size1 to 7 → page 11-9-13
MSQ size10 to 200 → page 11-9-18
MSQ with external shock absorber → page 11-9-25

With adjustment bolt, With external shock absorber

Size	Rotation adjustment per single rotation of rotation adjustment screw
1	8.2°
2	10.0°
3	10.9°
7	10.2°
10	10.2°
20	7.2°
30	6.5°
50	8.2°
70	7.0°
100	6.1°
200	4.9°

With external shock absorber

Size	Rotation adjustment per single rotation of rotation adjustment screw
10	1.4°
20	1.2°
30	1.1°
50	1.3°

The rotation adjustment range for the external shock absorber is ±3° at each rotation end. When adjusted beyond this range, note that the shock absorber's durability may decrease.

2. Series MSQ is equipped with a rubber bumper or shock absorber. Therefore, perform rotation adjustment in the pressurized condition (minimum operation pressure: 0.1 MPa or more for adjustment bolt and internal shock absorber types, and 0.2 MPa or more for external shock absorber type.)

Specific Product Precautions 2

Be sure to read before handling.

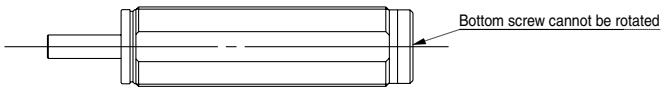
Shock Absorber

⚠ Caution

1. Refer to the table below for tightening torques of the shock absorber setting nut.

Size	10	20	30	50	70	100	200
Tightening torque N · m	1.67	3.14		10.8	23.5		62.8

2. Never rotate the bottom screw of the shock absorber. (It is not an adjustment screw.) This may cause oil leakage.



3. When rotation of the rotary table with internal shock absorber is set at a value smaller than the table below, the piston stroke becomes smaller than the shock absorber's effective stroke and energy absorption capacity decreases.

Size	10	20	30	50	70	100	200
Minimum rotation without energy absorption capacity decrease	52°	43°	40°	60°	71°	62°	82°

4. Products with shock absorber are not designed to smooth stop but to absorb the kinetic energy of the load. If the load has to be stopped smoothly, a shock absorber of the optimum size meeting the operating conditions must be installed external to the equipment.

5. Shock absorbers are consumable parts. When a decrease in energy absorption capacity is noticed, it must be replaced.

With internal shock absorber

Size	Shock absorber model
10	RBA0805-X692
20	RBA1006-X692
30	
50	RBA1411-X692
70	RBA2015-X821
100	
200	RBA2725-X821

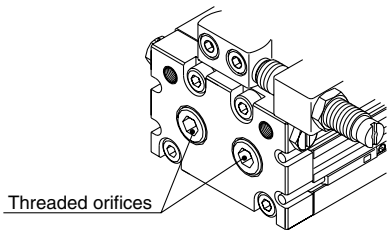
With external shock absorber

Size	Type	Shock absorber model
10	For low energy	RB0805
	For high energy	RB0806
20	For low energy	RB1006
	For high energy	RB1007
30	For low energy	RB1006
	For high energy	RB1007
50	For low energy	RB1411
	For high energy	RB1412

External Shock Absorber

⚠ Caution

The threaded orifices shown below are not connecting ports. Never remove the plugs as this will cause malfunction.



Speed Controller and Fittings

⚠ Caution

Size 1, 2, and 3 use M3 x 0.5 piping ports. When connecting a speed controller or fittings directly, use the following series.

- Speed controller
  AS12□1F/Elbow type
  AS13□1F/Universal type
- One-touch fittings
  One-touch miniature fittings Series KJ
- Miniature fittings Series M3

Auto Switch

⚠ Caution

In the case of sizes 1, 2, 3 and 7, when 2 pieces of auto switches are installed in one switch groove, the minimum detectable rotation angles are as follows.

Size	Minimum detectable rotation
1	25°
2	25°
3	20°
7	20°

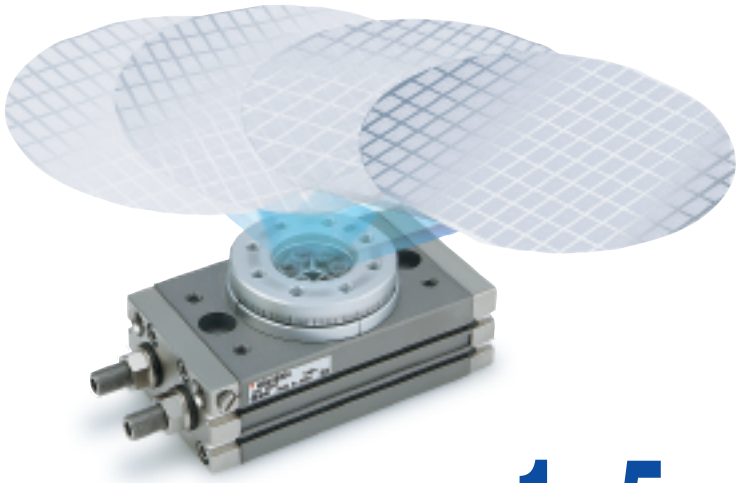
Maintenance

⚠ Caution

Because sizes 1, 2, 3 and 7 require special tools, they cannot be disassembled.
Because sizes 10, 20, 30 and 50 have the table press fit into an angular type bearing, they cannot be disassembled.

Low-Speed Rotary Actuator

Possible to transfer a workpiece at low-speed.

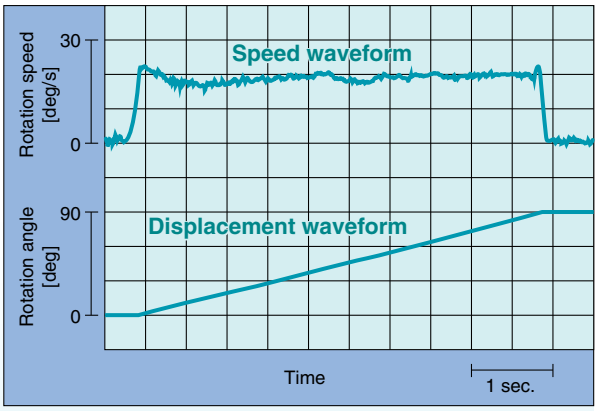


● Rotation time adjustment range: 1 to 5 (s/90°)

Model		Size	Rotation time adjustment range (s/90°) 1 2 3 4 5
Low-speed	**CRQ2X**	10, 15, 20, 30, 40	**1 to 5** (0.7 to 5 for CRQ2X□10,15)
	MSQX	10, 20, 30, 50	
Stand-ard	CRQ2	10, 15, 20, 30, 40	0.2 to 1 (0.2 to 0.7 for CRQ2□10,15)
	MSQ	10, 20, 30, 50	

● Realized a stable motion at 5s/90°.

Smooth motion without stick-slip phenomemon



Measurement conditions / Fluid: Air
Mounting orientation: Horizonal without load
Operating pressure: 0.5 MPa
Pneumatic circuit: Meter-out circuit
Ambient temperature: Room temperature

● Dimensions compatible with the CRQ2, MSQ series

Series CRQ2X/MSQX

SMC

CAT.ES20-197A

Series CRQ2X/MSQX
Model Selection

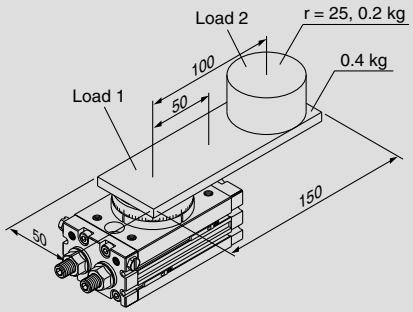
* **The selection procedure of the rotary for low-speed is the same as for an ordinary rotary. If the rotation time exceeds 2s per 90°, however, the necessary torque and the kinetic energy are calculated with rotation time of 2s per 90°.**

Selection Procedure	Remarks	Selection Example

0 Operating conditions

Operating conditions are as follows:
- **Provisionally selected model**
- **Operating pressure: MPa**
- **Mounting position**
- **Load type**
  - **Static load: N·m**
  - **Resistance load: N·m**
  - **Inertial load: N·m**
- **Load dimension: m**
- **Load mass: kg**
- **Rotation time: s**
- **Rotation angle: rad**

- **See P.3 for load type.**
- **The unit of the rotation angle is Radians.**
  180° = πrad
  90° = π/2rad



Provisionally selected model: MSQXB10A
Operating pressure: 0.3 MPa
Mounting position: Vertical, Type of load: Inertial load
Rotation time: 6s Rotation angle: πrad (180°)

1 Calculation of moment of inertia

Calculate the moment of inertia of the load.

⇒ P.2

- **If the moment of inertia of the load is made up of multiple components, calculate the moment of inertia of each component and add them together.**

Load 1 moment of inertia: I_1

$$I_1 = 0.4 \times \frac{0.15^2 + 0.05^2}{12} + 0.4 \times 0.05^2 = 0.001833$$

Load 2 moment of inertia: I_2

$$I_2 = 0.2 \times \frac{0.025^2}{2} + 0.2 \times 0.1^2 = 0.002063$$

Total moment of inertia: I

$$I = I_1 + I_2 = 0.003896\ [kg \cdot m^2]$$

2 Calculation of necessary torque

Calculate necessary torque corresponding to the load type, and ensure it is within effective torque range.

- **Static load (Ts)**
  Necessary torque T = Ts
- **Resistance load (Tf)**
  Necessary torque T = Tf x (3 to 5)
- **Inertial load (Ta)**
  Necessary torque T = Ta x 10

⇒ P.3

- **When calculating the inertial load, if the rotation time exceeds 2s per 90°, inertial load is calculated with rotation time of 2s per 90°.**
- **Even for resistance load, when the load is rotated, necessary torque calculated from inertial load shall be added.**

  Necessary torque T = Tf x (3 to 5) + Ta x 10

Inertial load: Ta

$$Ta = I \cdot \dot{\omega}$$

$$\dot{\omega} = \frac{2\theta}{t^2}\ [rad/s^2]$$

Necessary torque: T

$$T = Ta \times 10$$

$$= 0.003896 \times \frac{2 \times \pi}{4^2} \times 10 = 0.015\ [N \cdot m]$$

(t is calculated with 2s per 90°.)

0.109 N·m < Effective torque OK

3 Checking rotation time

Confirm that it is within the adjustable range of rotation time.

⇒ P.4

- **Converted to the time per 90° for comparison. (For comparison, 6s/180° is converted to 3s/90°.)**

$$1.0 \leq t \leq 5$$

t = 3s/90° OK

4 Calculation of kinetic energy

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

Can be confirmed by the graph of the moment of inertia and the rotation time.

⇒ P.4

- **If the rotation time exceeds 2s per 90°, kinetic energy is calculated with rotation time of 2s per 90°.**
- **If the allowable value is exceeded, an external cushioning mechanism such as an absorber needs to be installed.**

$$E = \frac{1}{2} \cdot I \cdot \omega^2$$

$$\omega = \frac{2 \cdot \theta}{t}$$

Kinetic energy

$$\frac{1}{2} \times 0.003896 \times \left(\frac{2 \times \pi}{4}\right)^2 = 0.0048\ [J]$$

(t is calculated with 2s per 90°.)

0.0048 [J] < Allowable energy OK

5 Checking allowable load

Check if the load applied to the product is within the allowable range.

⇒ P.5

- **If the allowable value is exceeded, an external bearing needs to be installed.**

$$M = 0.4 \times 9.8 \times 0.05 + 0.2 \times 9.8 \times 0.1$$
$$= 0.392\ [N \cdot m]$$

0.392 [N·m] < Allowable moment load OK

6 Calculation of air consumption and necessary air quantity

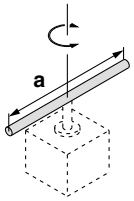
Calculate air consumption and necessary air quantity as required. **⇒ P.6**

Equation Table of Moment of Inertia (Calculation of moment of inertia I)

I: Moment of inertia (kg·m²) **m**: Load mass (kg)

1. Thin shaft

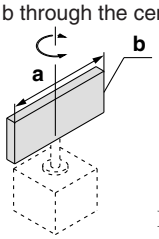
Position of rotational axis:
Perpendicular to the shaft through the center of gravity



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

2. Thin rectangular plate

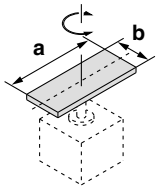
Position of rotational axis:
Parallel to side b through the center of gravity



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

3. Thin rectangular plate (Including rectangular parallelepiped)

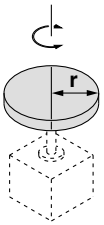
Position of rotational axis:
Perpendicular to the plate through the center of gravity



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

4. Round plate (Including column)

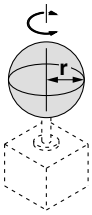
Position of rotational axis:
Passing through the center axis



$$I = \mathbf{m} \cdot \frac{\mathbf{r}^2}{2}$$

5. Solid sphere

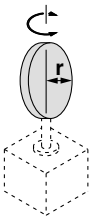
Position of rotational axis:
Passing through the diameter



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

6. Thin round plate

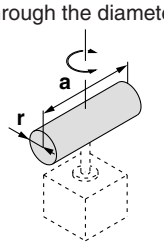
Position of rotational axis:
Passing through the diameter



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

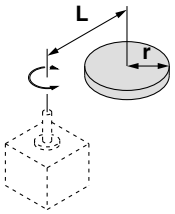
7. Cylindrical

Position of rotational axis:
Passing through the diameter and the center of gravity



$$I = \mathbf{m} \cdot \frac{3\mathbf{r}^2 + \mathbf{a}^2}{12}$$

8. When rotational axis and the center of the load are not concentric.

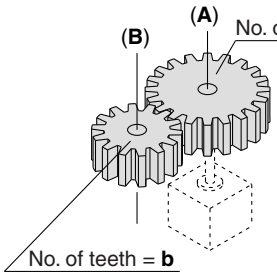


$$I = \mathbf{K} + \mathbf{m} \cdot \mathbf{L}^2$$

K: The moment of inertia around the center of gravity of the load

In case of 4. Round plate $\mathbf{K} = \mathbf{m} \cdot \frac{\mathbf{r}^2}{2}$

9. Gear transmission



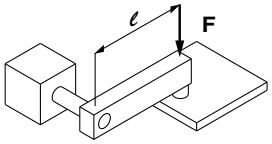
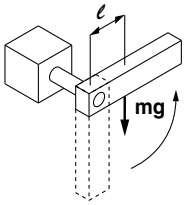
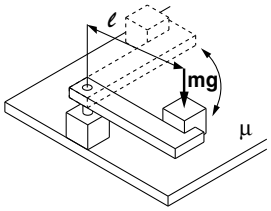
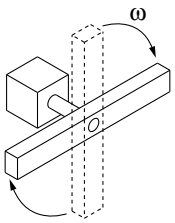
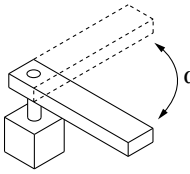
1. Find the moment of inertia I_B for the rotation of shaft (**B**).
2. Next, I_B is entered to find I_A the moment of inertia for the rotation of shaft (**A**) as

$$I_A = (\frac{a}{b})^2 \cdot I_B$$

Model Selection

Load Type

Calculation method of necessary torque depends on the load type. Refer the below table.

Load type		
Static load: Ts	**Resistance load: Tf**	**Inertial load: Ta**
Only pressing force is necessary. (e.g. for clamping)	Weight or friction force is applied to rotating direction.	Rotate the load with inertia.
	Gravity is applied.   Friction force is applied.	Center of rotation and center of gravity of the load are concentric.   Rotation shaft is vertical (up and down).
Ts = **F**·ℓ **Ts**: Static load (N·m) **F** : Clamping force (N) ℓ : Distance from the rotation center to the clamping position (m)	Gravity is applied in rotating direction. **Tf** = **m**·**g**·ℓ Friction force is applied in rotating direction. **Tf** = μ·**m**·**g**·ℓ **Tf** : Resistance load (N·m) **m** : Load mass (kg) **g** : Gravitational acceleration 9.8 (m/s^2) ℓ : Distance from the rotation center to the point of application of the weight or friction force (m) μ : Friction coefficient	$\mathbf{Ta} = I \cdot \omega = I \cdot \frac{2\theta}{\mathbf{t}^2}$ **Ta**: Inertial load (N·m) I : Moment of inertia (kg·m^2) ω : Angular acceleration (rad/s^2) θ : Rotation angle (rad) **t** : Rotation time (s) For low speed rotary, if the rotation time exceeds 2s per 90°, inertial load is calculated with rotation time of 2s per 90°.
Necessary torque: **T** = **Ts**	Necessary torque: **T** = **Tf** x (3 to 5) Note)	Necessary torque: **T** = **Ta** x 10 Note)

• Resistance load: Gravity or friction force is applied to rotating direction.
  Ex. 1) Rotation shaft is horizontal (lateral), and the rotation center and the center of gravity of the load are not concentric.
  Ex. 2) Load moves by sliding on the floor

  ∗ The total of resistance load and inertial load is the necessary torque. **T** = **Tf** x (3 to 5) + **Ta** x 10

• Not resistance load: Neither weight or friction force is applied in rotating direction.
  Ex. 1) Rotation shaft is vertical (up and down).
  Ex. 2) Rotation shaft is horizontal (lateral), and rotation center and the center of gravity of the load are not concentric.

  ∗ Necessary torque is inertial load only. **T** = **Ta** x 10

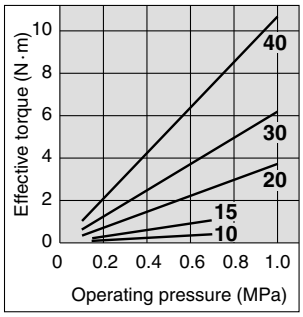
Note) To adjust the speed, margin is necessary for Tf and Ta.

Effective Torque

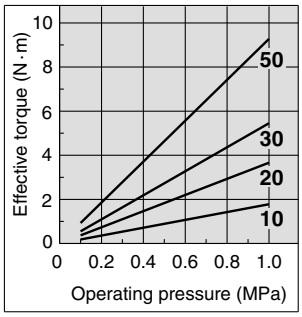
Unit: N·m

Model	Size	Operating pressure (MPa)										
		0.1	0.15	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
CRQ2X	10	—	0.09	0.12	0.18	0.24	0.30	0.36	0.42	—	—	—
	15	—	0.22	0.30	0.45	0.60	0.75	0.90	1.04	—	—	—
	20	0.37	0.55	0.73	1.10	1.47	1.84	2.20	2.57	2.93	3.29	3.66
	30	0.62	0.94	1.25	1.87	2.49	3.11	3.74	4.37	4.99	5.60	6.24
	40	1.06	1.59	2.11	3.18	4.24	5.30	6.36	7.43	8.48	9.54	10.6
MSQX	10	0.18	—	0.36	0.53	0.71	0.89	1.07	1.25	1.42	1.60	1.78
	20	0.37	—	0.73	1.10	1.47	1.84	2.20	2.57	2.93	3.29	3.66
	30	0.55	—	1.09	1.64	2.18	2.73	3.19	3.82	4.37	4.91	5.45
	50	0.93	—	1.85	2.78	3.71	4.64	5.57	6.50	7.43	8.35	9.28

CRQ2X



MSQX



Note 1) Values of operating torque in the above table are representative values, and not guaranteed. Make use of the values as a reference when ordering.
Note 2) Except for cases when an external stopper is used, the holding torque at the operation end is half of the table value.

Kinetic Energy/Rotating Time

In a rotational movement, the kinetic energy of a load may damage the internal parts, even if the required torque for a load is small. Consider the moment of inertia and rotation time before selecting a model.
(For model selection, refer to the moment of inertia and rotation time graph as shown on the below table.)

Allowable kinetic energy and rotation time adjustment range

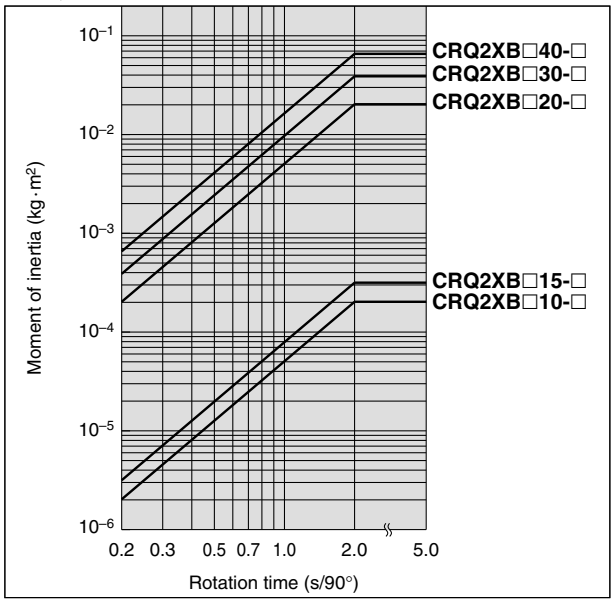
Set the rotation time, within stable operational guidelines, using the adjustment range specification table as detailed below. When operating at low-speeds which exceed the rotation time adjustment range, use caution as it may result in sticking or malfunction.

Model	Size	Allowable kinetic energy (J)	Stable operational rotation time adjustment range (s/90°)
CRQ2X	10	0.00025	0.7 to 5
	15	0.00039	
	20	0.025	1 to 5
	30	0.048	
	40	0.081	
MSQX	10	0.007	
	20	0.025	
	30	0.048	
	50	0.081	

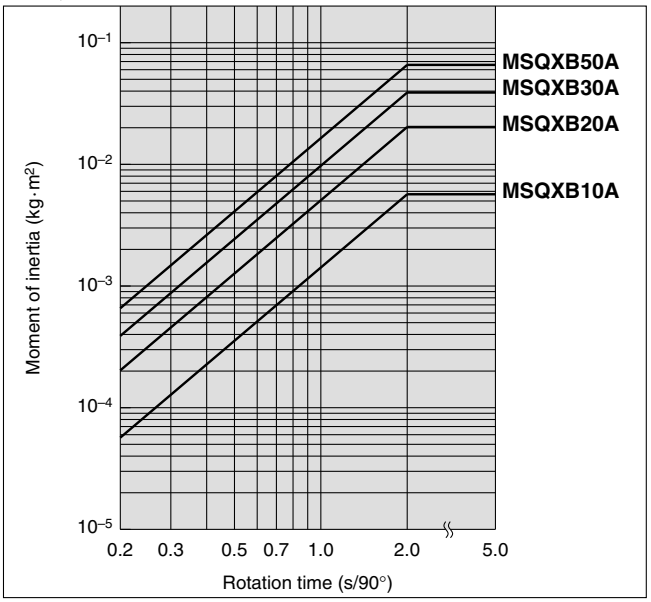
Model Selection

Select a model based on the moment of inertia and rotation time as shown graph below.

CRQ2X



MSQX



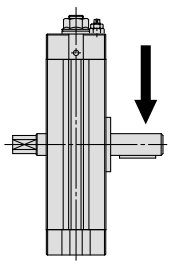
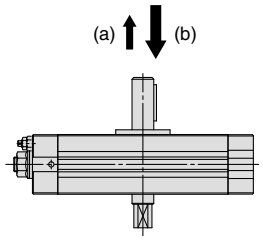
∗ If the rotation time exceeds 2s per 90°, kinetic energy is calculated with rotation time of 2s per 90°.

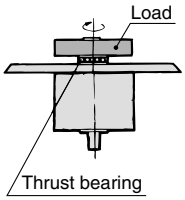
Model Selection

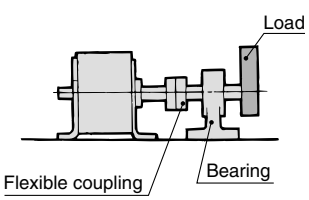
Allowable Load

CRQ2X

A load up to the allowable radial/thrust load can be applied provided that a dynamic load is not generated. However, applications which apply a load directly to the shaft should be avoided whenever possible. In order to further improve the operating conditions, a method such as that shown in the drawing on the right side is recommended so that a direct load is not applied to the shaft.

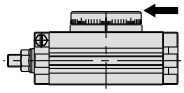
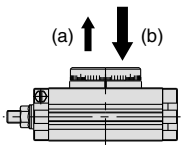
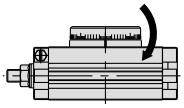
Size		
	Allowable radial load (N)	Allowable thrust load (N)
		(a) / (b)
10	14.7	7.8 / 15.7
15	19.6	9.8 / 19.6
20	49	29.4 / 49
30	78	49 / 98
40	98	59 / 108





MSQX

Do not allow the load and moment applied to the table to exceed the allowable values shown in the below table.
(Operation beyond the allowable values can cause adverse effects on service life, such as play in the table and loss of accuracy.)

Size			
	Allowable radial load (N)	Allowable thrust load (N)	Allowable moment (N·m)
		(a) / (b)	
10	78	74 / 78	2.4
20	147	137 / 137	4.0
30	196	197 / 363	5.3
50	314	296 / 451	9.7

Rotary Actuator Technical Data
Air Consumption

Air consumption is the volume of air which is expended by the rotary actuator's reciprocal operation inside the actuator and in the piping between the actuator and the switching valve, etc. This is necessary for selection of a compressor and for calculation of its running cost.

* The air consumption (Q_{CR}) required for one reciprocation of the rotary actuator alone is shown in the below table, and can be used to simplify the calculation.

Formulas

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

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

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

Q_{CR} = Air consumption of rotary actuator [ℓ (ANR)]
Q_{CP} = Air consumption of tubing or piping [ℓ (ANR)]
V = Internal volume of 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 rotary actuator [ℓ (ANR)]

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

Formulas

$$Qc_2 = Qc \times n \times \text{Number of actuators} \times \text{Reserve factor}$$

Qc_2 = Compressor discharge flow rate [ℓ/min (ANR)]
n = Actuator reciprocations per minute
Reserve factor: 1.5 or greater

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
TU0805	8	5	19.6
T□0806	8	6	28.3
1/8B	—	6.5	33.2
T□1075	10	7.5	44.2
TU1208	12	8	50.3
T□1209	12	9	63.6
1/4B	—	9.2	66.5
TS1612	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: Q_{CR} ℓ (ANR)

Model	Size	Rotation angle (°)	Internal volume **V** (cm^3)	Operating pressure (MPa)										
				0.1	0.15	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
CRQ2X	**10**	90	1.2	—	0.006	0.007	0.009	0.012	0.014	0.016	0.018	—	—	—
		180	2.2	—	0.011	0.013	0.018	0.022	0.026	0.031	0.035	—	—	—
	15	90	2.9	—	0.015	0.017	0.023	0.029	0.035	0.041	0.046	—	—	—
		180	5.5	—	0.028	0.033	0.044	0.055	0.066	0.077	0.088	—	—	—
	20	90	7.1	0.028	0.036	0.043	0.057	0.071	0.085	0.099	0.114	0.128	0.142	0.156
		180	13.5	0.054	0.068	0.081	0.108	0.135	0.162	0.189	0.216	0.243	0.270	0.297
	30	90	12.1	0.048	0.060	0.073	0.097	0.121	0.145	0.169	0.193	0.218	0.242	0.266
		180	23.0	0.092	0.115	0.138	0.184	0.230	0.276	0.322	0.368	0.413	0.459	0.505
	40	90	20.6	0.082	0.103	0.123	0.164	0.206	0.247	0.288	0.329	0.370	0.411	0.452
		180	39.1	0.156	0.195	0.234	0.313	0.391	0.469	0.547	0.625	0.703	0.781	0.859
MSQX	**10**	190	6.6	0.026	0.033	0.040	0.053	0.066	0.079	0.092	0.106	0.119	0.132	0.145
	20		13.5	0.054	0.068	0.081	0.108	0.135	0.162	0.189	0.216	0.243	0.270	0.297
	30		20.1	0.080	0.101	0.121	0.161	0.201	0.241	0.281	0.322	0.362	0.402	0.442
	50		34.1	0.136	0.171	0.205	0.273	0.341	0.409	0.477	0.546	0.614	0.682	0.750

Low-Speed Compact Rotary Actuator
Rack & Pinion Type
Series CRQ2X
Size: 10, 15, 20, 30, 40

How to Order

Standard CRQ2 X B S 20 ☐ – 90

With auto switch CDRQ2 X B S 20 ☐ – 90 – M9BW ☐

- Built-in magnet
- Low-speed specification

Shaft type

S	Single shaft
W	Double shaft

Size

10
15
20
30
40

Thread type

Port type		Size
Nil	M5	10, 15
	Rc 1/8	20, 30, 40
TF	G 1/8	
TN	NPT 1/8	
TT	NPTF 1/8	

Rotation angle

90	80° to 100°
180	170° to 190°

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	n pcs.

Auto switch

Nil	Without auto switch (Built-in magnet)

∗ For applicable auto switch models, refer to the below table.

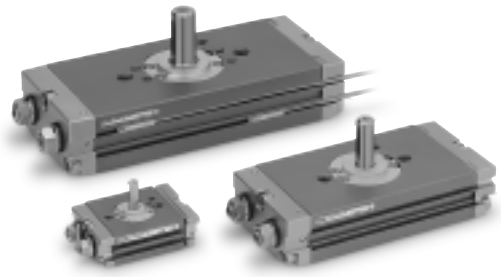
Applicable Auto Switches/Refer to pages 24 through to 27 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch model		Lead wire length (m)∗				Applicable load	
					DC		AC	Perpendicular	In-line	0.5 (Nil)	1 (M)	3 (L)	5 (Z)		
Solid state switch	——	Grommet	Yes	3-wire (NPN)	24 V	5 V,12 V	—	M9NV	M9N	●	—	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				M9PV	M9P	●	—	●	○		
				2-wire		12 V		M9BV	M9B	●	—	●	○	—	
	Diagnostic indication (2-color)			3-wire (NPN)		5 V,12 V		M9NWV	M9NW	●	●	●	○	IC circuit	
				3-wire (PNP)				M9PWV	M9PW	●	●	●	○		
				2-wire		12 V		M9BWV	M9BW	●	●	●	○	—	
	Water resistant (2-color) ∗∗			3-wire (NPN)		5 V,12 V		M9NAV	M9NA	○	○	●	○	IC circuit	
				3-wire (PNP)				M9PAV	M9PA	○	○	●	○		
				2-wire		12 V		M9BAV	M9BA	○	○	●	○	—	
Reed switch	——	Grommet	No	2-wire	24 V	12 V	100 V or less	A90V	A90	●	—	●	—	IC circuit	Relay, PLC
			Yes	3-wire (NPN equiv.)	—	5 V	—	A96V	A96	●	—	●	—		—
				2-wire	24 V	12 V	100 V	A93V	A93	●	—	●	—	—	Relay, PLC

∗∗ Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9NW
1 m ····· M M9NWM
3 m ····· L M9NWL
5 m ····· Z M9NWZ

- Auto switches marked with "○" are manufactured upon a receipt of order.
- For details about auto switches with pre-wired connector, refer to "SMC Best Pneumatics 2004" Vol. 11 catalog.
- Auto switches are shipped together, (but not assembled).



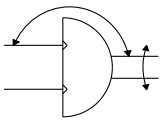
Specifications

Size	10	15	20	30	40
Fluid	Air (Non-lube)				
Max. operating pressure	0.7 MPa		1 MPa		
Min. operating pressure	0.15 MPa		0.1 MPa		
Ambient and fluid temperature	0° to 60°C (No freezing)				
Cushion	Not attached				
Angle adjustment range	Rotation end ±5°				
Rotation angle	80° to 100°, 170° to 190°				
Port size	M5 x 0.8		Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8		
Output (N·m)∗	0.30	0.75	1.8	3.1	5.3

∗ Output under the operating pressure at 0.5 MPa. Refer to page 4 for further information.

Allowable Kinetic Energy and Rotation Time Adjustment Range

JIS Symbol



Size	Allowable kinetic energy (J)	Stable operational rotation time adjustment range (s/90°)
10	0.00025	0.7 to 5
15	0.00039	
20	0.025	1 to 5
30	0.048	
40	0.081	

Note) If operated where the kinetic energy exceeds the allowable value, this may cause damage to the internal parts and result in product failure. Please pay special attention to the kinetic energy levels when designing, adjusting and during operation to avoid exceeding the allowable limit.

Weight

(g)

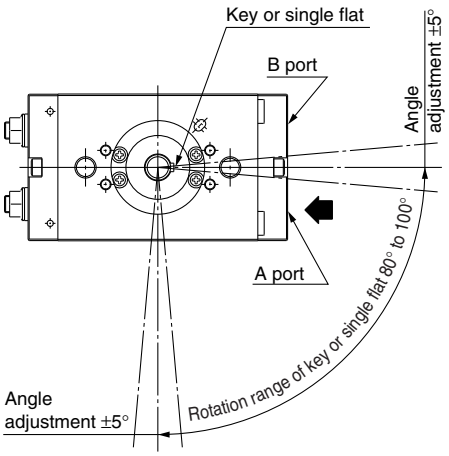
Size	Standard weight∗	
	90°	180°
10	120	150
15	220	270
20	600	700
30	900	1100
40	1400	1600

∗ Not including the weight of auto switch.

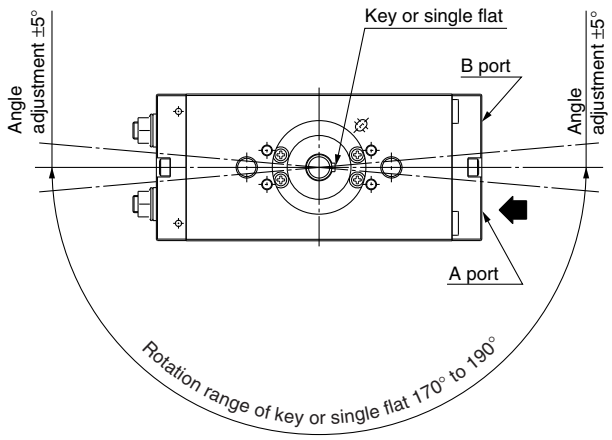
Rotation Range

When pressurized from the port indicated by the arrow, the shaft will rotate in a clockwise direction.

Rotation angle: 90°

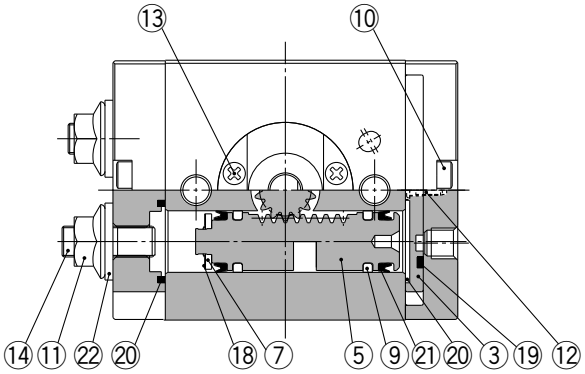


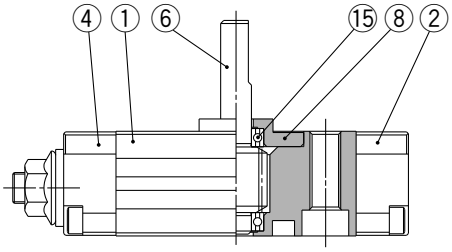
Rotation angle: 180°



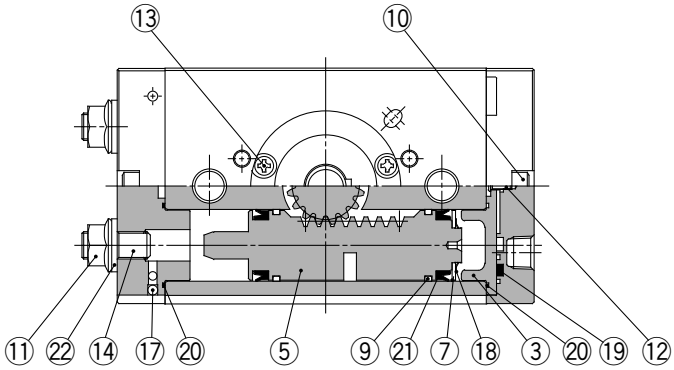
Construction

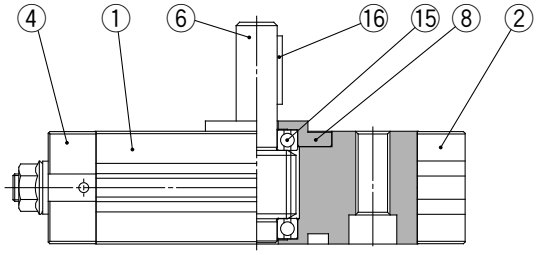
Standard
Size 10/15





Standard
Size 20/30/40





Component Parts

No.	Description		Material
1	**Body**		Aluminum alloy
2	**Cover**		Aluminum alloy
3	**Plate**		Aluminum alloy
4	**End cover**		Aluminum alloy
5	**Piston**		Stainless steel
6	**Size: 10, 15**	**Shaft**	Stainless steel
	Size: 20, 30, 40		Chrome molybdenum steel
7	**Seal retainer**		Aluminum alloy
8	**Bearing retainer**		Aluminum alloy
9	**Wear ring**		Resin
10	**Hexagon socket head cap screw**		Stainless steel
11	**Hexagon nut with flange**		Steel wire
12	**Cross recessed screw No. 0**		Steel wire

Component Parts

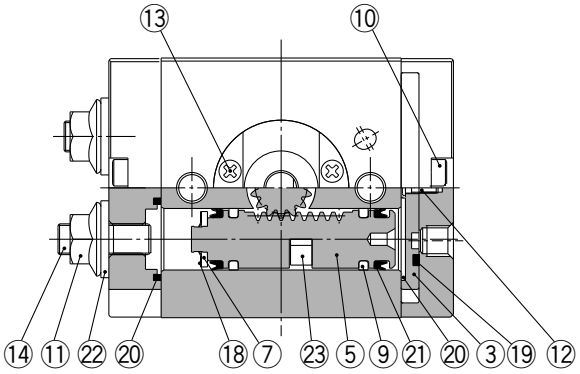
No.	Description		Material
13	**Size: 10, 15**	**Cross recessed screw No. 0**	Steel wire
	Size: 20, 30, 40	**Cross recessed screw**	
14	**Hexagon socket head set screw**		Chrome molybdenum steel
15	**Bearing**		Bearing steel
16	**Size: 20, 30, 40 only**	**Parallel key**	Carbon steel
17	**Size: 20, 30, 40 only**	**Steel ball**	Stainless steel
18	**CS-type retaining ring**		Stainless steel
19	**Seal**		NBR
20	**Gasket**		NBR
21	**Piston seal**		NBR
22	**Seal washer**		NBR
23	**With auto switch only**	**Magnet**	—

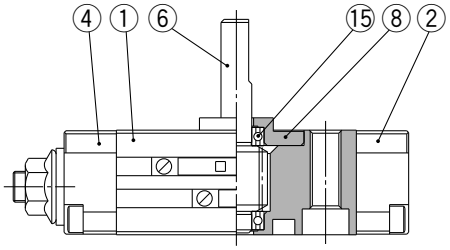
Replacement Parts

Description	Part no.					Note
	10	**15**	**20**	**30**	**40**	
Seal kit	P473010-23	P473020-23	P473030-23	P473040-23	P473050-23	A set of above numbers ⑨, ⑲, ⑳, ㉑ and ㉒

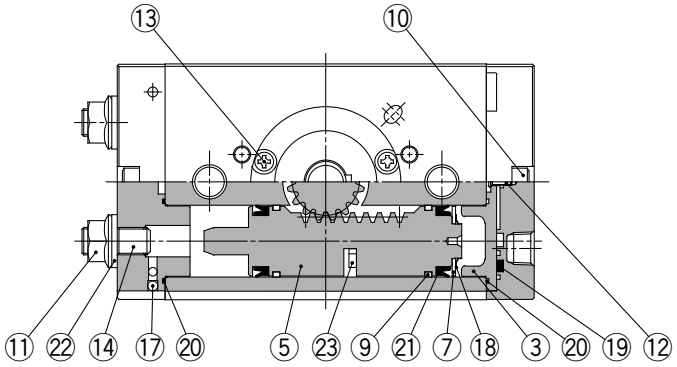
Construction

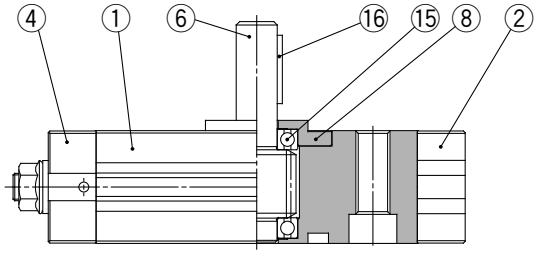
With auto switch
Size 10/15





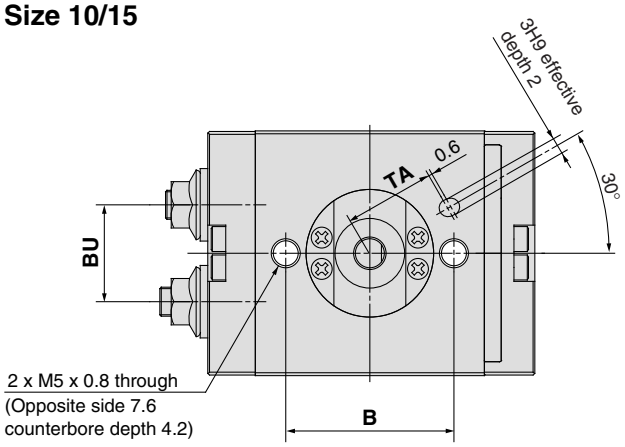
With auto switch
Size 20/30/40

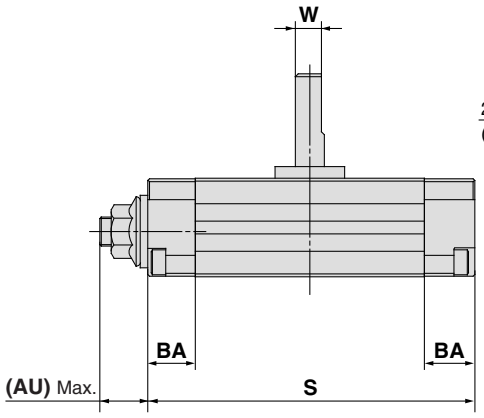


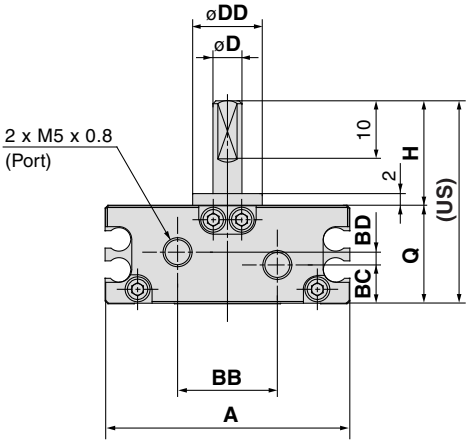


Dimensions

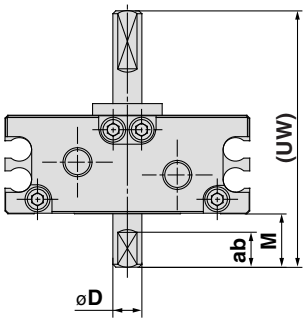
Size 10/15

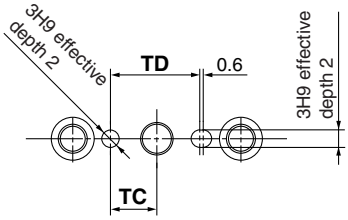






With double shaft





(mm)

Size	Rotation angle	A	AU*	B	BA	BB	BC	BD	BU	D (g6)	DD (h9)	H
10	90°, 180°	42	(8.5)	29	8.5	17	6.7	2.2	16.7	5	12	18
15	90°, 180°	53	(9.5)	31	9	26.4	10.6	—	23.1	6	14	20

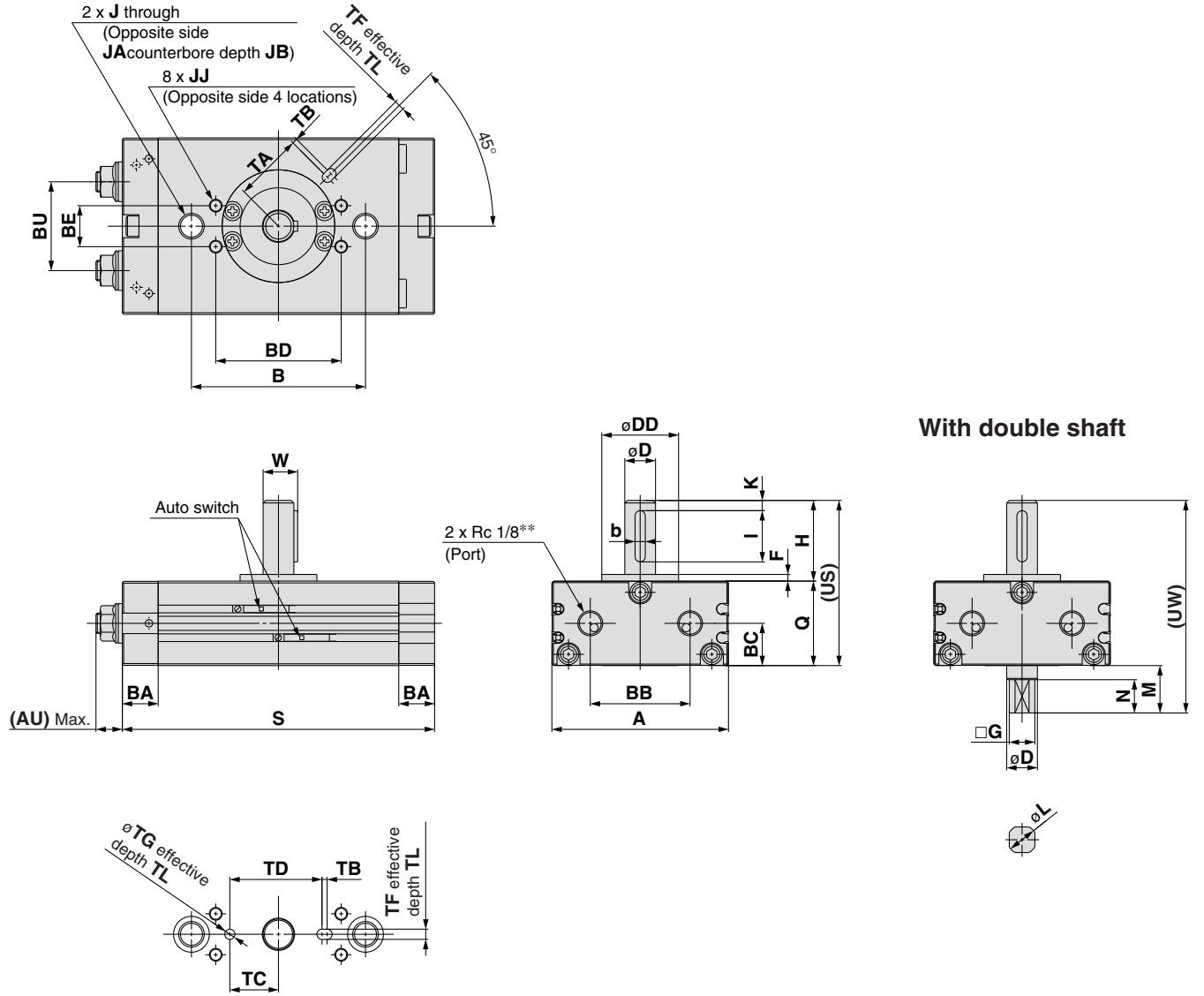
Size	Rotation angle	W	Q	S	US	UW	ab	M	TA	TC	TD
10	90°	4.5	17	56	35	44	6	9	15.5	8	15.4
	180°			69							
15	90°	5.5	20	65	40	50	7	10	16	9	17.6
	180°			82							

∗ The AU dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.

S: Upper 90°, Lower 180°

Dimensions

Size 20/30/40



(mm)

Size	Rotation angle	A	AU*	B	BA	BB	BC	BD	BE	BU	D (g6)	DD (h9)	F	H	J	JA	JB	JJ	K
20	90°, 180°	63	(11)	50	14	34	14.5	—	—	30.4	10	25	2.5	30	M8 x 1.25	11	6.5	—	3
30	90°, 180°	69	(11)	68	14	39	16.5	49	16	34.7	12	30	3	32	M10 x 1.5	14	8.5	M5 x 0.8 depth 6	4
40	90°, 180°	78	(13)	76	16	47	18.5	55	16	40.4	15	32	3	36	M10 x 1.5	14	8.6	M6 x 1 depth 7	5

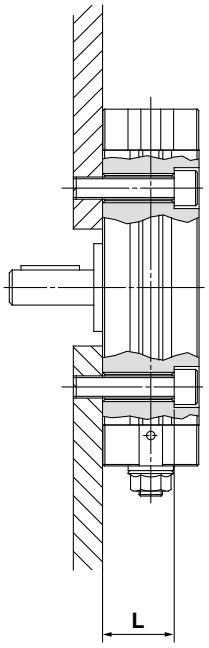
Size	Rotation angle	Q	S	W	Keyway dimensions b	Keyway dimensions l	US	TA	TB	TC	TD	TF (H9)	TG (H9)	TL	UW	G	M	N	L
20	90°	29	104	11.5	$4^{0}_{-0.03}$	20	59	24.5	1	13.5	27	4	4	2.5	74	$8^{0}_{-0.1}$	15	11	$9.6^{0}_{-0.1}$
	180°		130																
30	90°	33	122	13.5	$4^{0}_{-0.03}$	20	65	27	2	19	36	4	4	2.5	83	$10^{0}_{-0.1}$	18	13	$11.4^{0}_{-0.1}$
	180°		153																
40	90°	37	139	17	$5^{0}_{-0.03}$	25	73	32.5	2	20	39.5	5	5	3.5	93	$11^{0}_{-0.1}$	20	15	$14^{0}_{-0.1}$
	180°		177																

∗ The AU dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.
S: Upper 90°, Lower 180°

∗∗ In addition to Rc 1/ 8, G 1/ 8, NPT 1/ 8, NPTF 1/ 8 are also available.

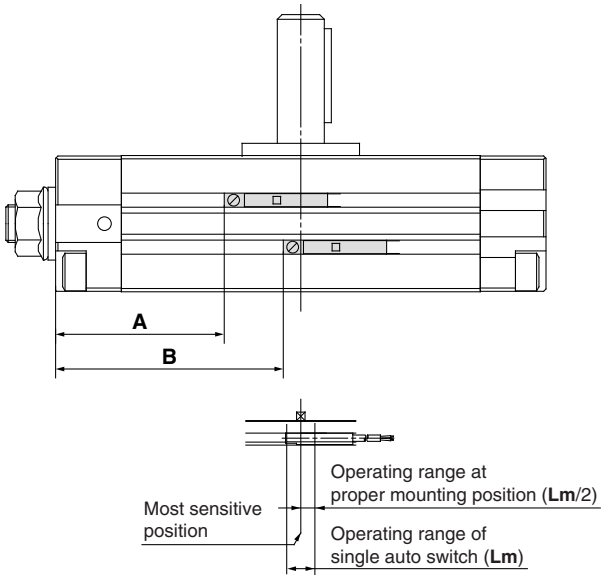
Unit Used as Flange Mount

The L dimensions of this unit are shown in the below table. When hexagon socket head cap bolt of the JIS standard is used, the head of the bolt will recess into the groove of actuator.



Size	L	Screw
10	13	M4
15	16	M4
20	22.5	M6
30	24.5	M8
40	28.5	M8

Auto Switch Proper Mounting Position (at Rotation End Detection)



Size	Rotation angle	Reed switch				Solid state switch			
		A	B	Operating angle (θ m)	Hysteresis angle	A	B	Operating angle (θ m)	Hysteresis angle
10	90°	15	21.5	63°	12°	19	25.5	75°	3°
	180°	18	31			22	35		
15	90°	18.5	27	52°	9°	22.5	31	69°	3°
	180°	22.5	39.5			26.5	43.5		
20	90°	36	48.5	41°	9°	40	52.5	56°	4°
	180°	42	67.5			46	71.5		
30	90°	43	59	32°	7°	47	63	43°	3°
	180°	51	82			55	86		
40	90°	50	69	24°	5°	54	73	36°	4°
	180°	59.5	97.5			63.5	101.5		

Operating angle θ**m**: Value of the operating range of single auto switch (Lm) as represented by rotation angle for shaft
Hysteresis angle: Value of the auto switch hysteresis as represented by angle

Note) For actual setting, adjustment shall be made after checking the auto switch operating condition.

Low-Speed Rotary Table
Rack & Pinion Type
Series MSQX
Size: 10, 20, 30, 50

How to Order

Basic **MSQ X B 10 ☐ A – M9BW ☐**

Low-speed specification

Size

10
20
30
50

Thread type

Port type		Size
Nil	M5	10, 20
	Rc 1/8	30, 50
TF	G 1/8	
TN	NPT 1/8	
TT	NPTF 1/8	

With adjustment bolt

Auto switch

Nil	Without auto switch (Built-in magnet)

∗ For applicable auto switch models, refer to the below table.

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	n pcs.

Applicable Auto Switches/Refer to pages 24 through to 27 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch model		Lead wire length (m)∗				Applicable load	
					DC		AC	Perpendicular	In-line	0.5 (Nil)	1 (M)	3 (L)	5 (Z)		
Solid state switch	——	Grommet	Yes	3-wire (NPN)	24 V	5 V,12 V	—	**M9NV**	**M9N**	●	—	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9PV**	**M9P**	●	—	●	○		
				2-wire		12 V		**M9BV**	**M9B**	●	—	●	○	—	
	Diagnostic indication (2-color)			3-wire (NPN)		5 V,12 V		**M9NWV**	**M9NW**	●	●	●	○	IC circuit	
				3-wire (PNP)				**M9PWV**	**M9PW**	●	●	●	○		
				2-wire		12 V		**M9BWV**	**M9BW**	●	●	●	○	—	
	Water resistant ∗∗ (2-color)			3-wire (NPN)		5 V,12 V		**M9NAV**	**M9NA**	○	○	●	○	IC circuit	
				3-wire (PNP)				**M9PAV**	**M9PA**	○	○	●	○		
				2-wire		12 V		**M9BAV**	**M9BA**	○	○	●	○	—	
Reed switch	——	Grommet	No	2-wire	24 V	12 V	100 V or less	**A90V**	**A90**	●	—	●	—	IC circuit	Relay, PLC
			Yes	3-wire (NPN equiv.)	—	5 V	—	**A96V**	**A96**	●	—	●	—		—
				2-wire	24 V	12 V	100 V	**A93V**	**A93**	●	—	●	—	—	Relay, PLC

∗∗ Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9NW
1 m ····· M M9NWM
3 m ····· L M9NWL
5 m ····· Z M9NWZ

- Auto switches marked with "○" are manufactured upon a receipt of order.
- For details about auto switches with pre-wired connector, refer to "SMC Best Pneumatics 2004" Vol. 11 catalog.
- Auto switches are shipped together, (but not assembled).

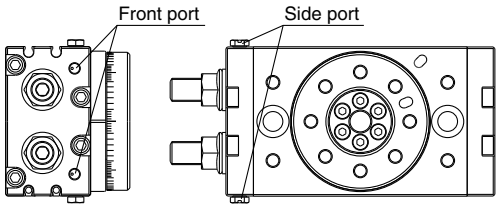
Made to Order → Refer to "SMC Best Pneumatics 2004" Vol. 11 catalog.

- –50 Without indicator light
- –61 Flexible lead wire
- Pre-wired connector

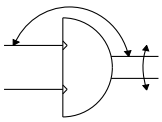
Specifications

Size		10	20	30	50
Fluid		Air (Non-lube)			
Max. operating pressure		1 MPa			
Min. operating pressure		0.1 MPa			
Ambient and fluid temperature		0° to 60°C (No freezing)			
Cushion		Not attached			
Angle adjustment range		0 to 190°			
Maximum rotation angle		190°			
Port size	**End port**	M5 x 0.8		Rc 1/8, G 1/8, NPT 1/8, NPTF 1/8	
	Side port	M5 x 0.8			
Output (N·m)∗		0.89	1.8	2.7	4.6

∗ Output under the operating pressure at 0.5 MPa. Refer to page 4 for further information.



JIS Symbol



Allowable Kinetic Energy and Rotation Time Adjustment Range

Size	Allowable kinetic energy (J)	Stable operational rotation time adjustment range (s/90°)
10	0.007	1 to 5
20	0.025	
30	0.048	
50	0.081	

Note) If operated where the kinetic energy exceeds the allowable value, this may cause damage to the internal parts and result in product failure. Please pay special attention to the kinetic energy levels when designing, adjusting and during operation to avoid exceeding the allowable limit.

Weight

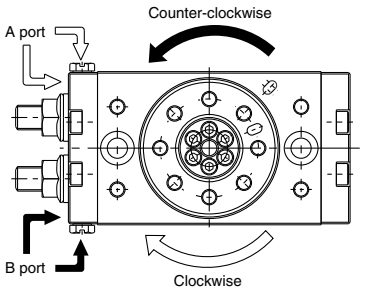
(g)

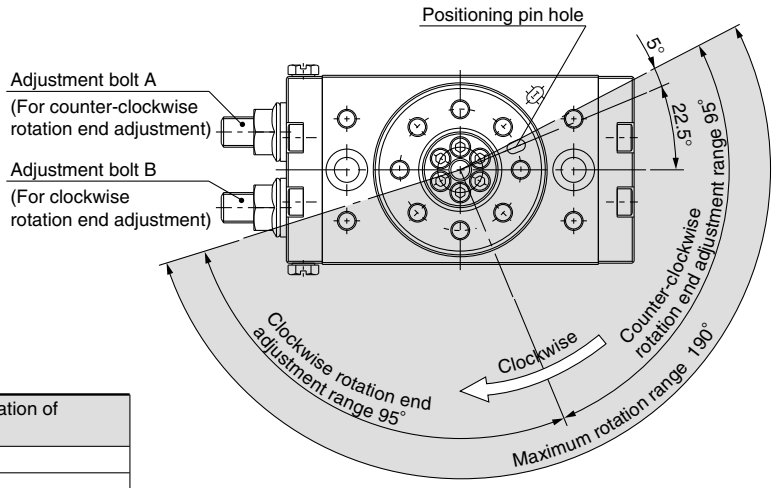
Size	10	20	30	50
Basic	530	990	1290	2080

∗ Not including the weight of auto switch.

Rotation Direction and Rotation Angle

• The rotary table turns in the clockwise direction when the A port is pressurized, and in the counter-clockwise direction when the B port is pressurized.
• By adjusting the adjustment bolt, the rotation end can be set within the range shown in the drawing for the desired rotation angle.





With Adjustment Bolt

Size	Adjustment angle per rotation of angle adjustment screw
10	10.2°
20	7.2°
30	6.5°
50	8.2°

Note) • The drawing shows the rotation range of the positioning pin hole.
• The pin hole position in the drawing shows the counter-clockwise rotation end when the adjustment bolts A and B are tightened equally and the rotation is adjusted 180°.

Rotation Angle Range Example

• Various rotation ranges are possible as shown in the drawings below using adjustment bolts A and B.
(The drawings also show the rotation ranges of the positioning pin hole.)

• The rotation angle can also be set on a type with inertial absorber.

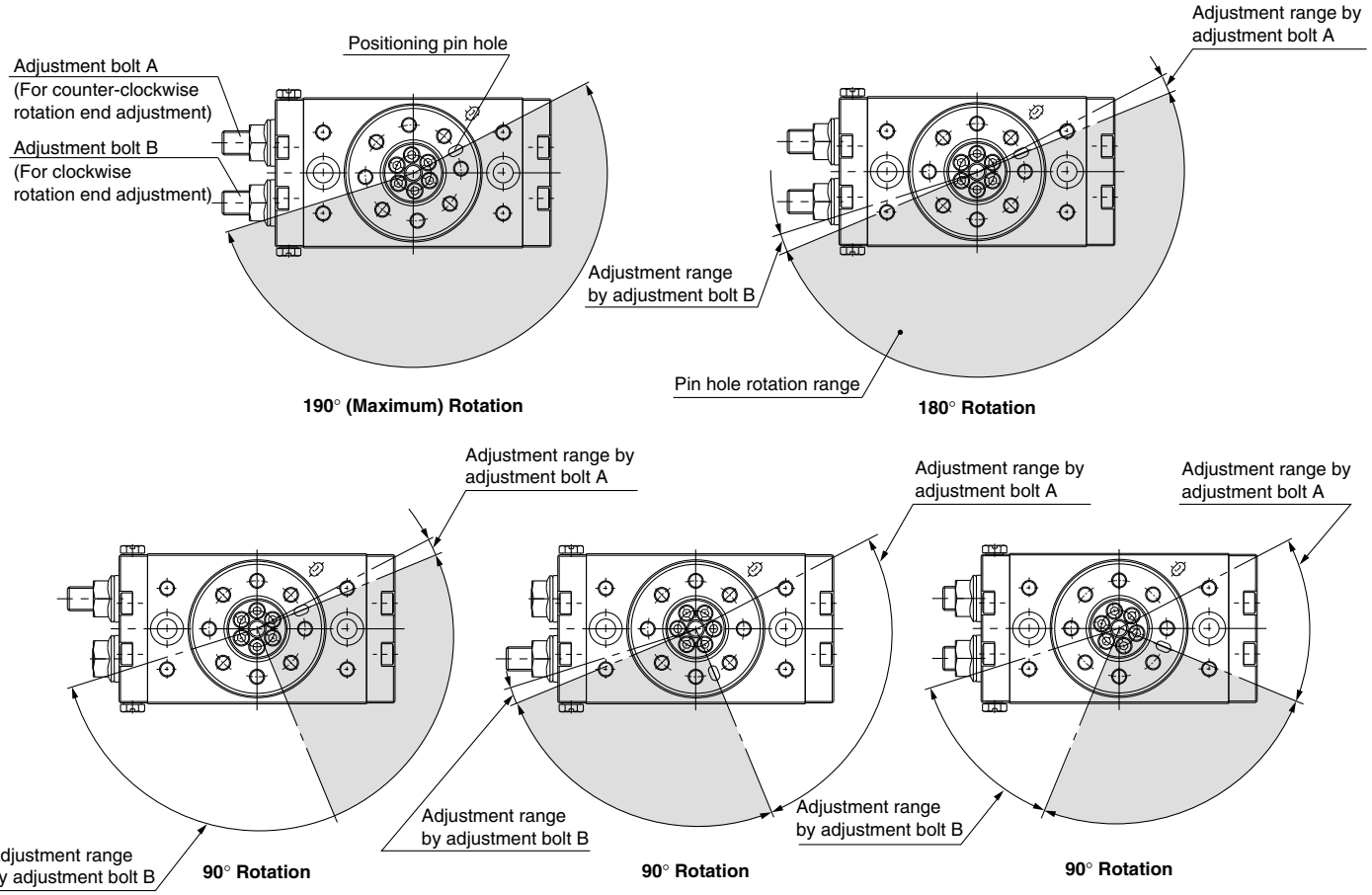
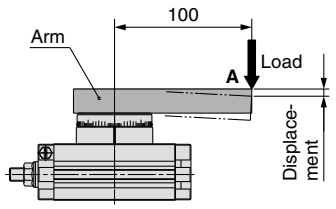
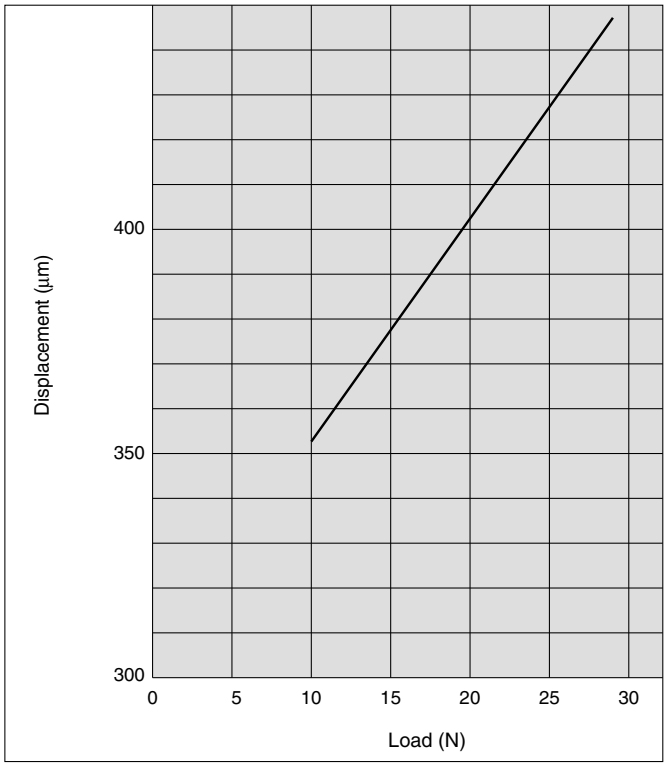


Table Displacement (Reference values)

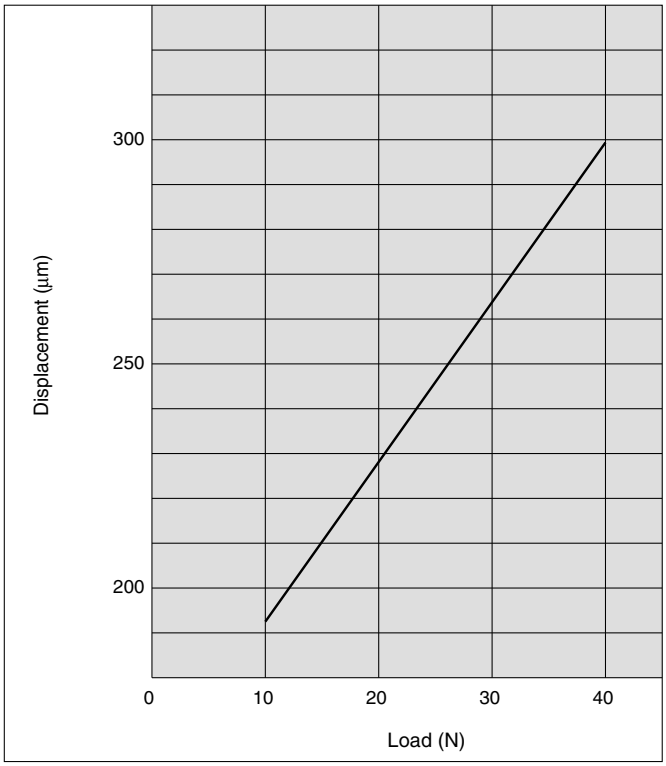
• The following graphs show the displacement at point A, which is 100 mm apart from the center of rotation, where the load is applied.



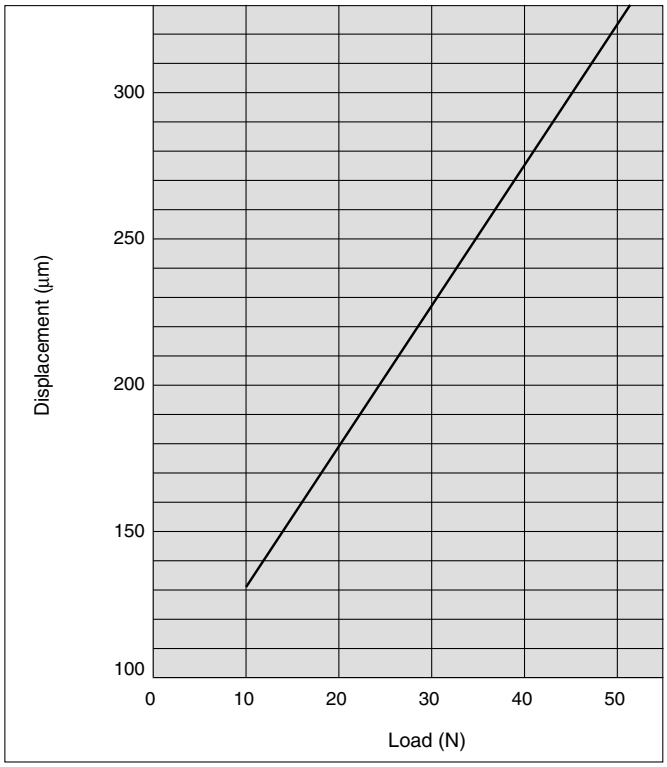
MSQXB10A



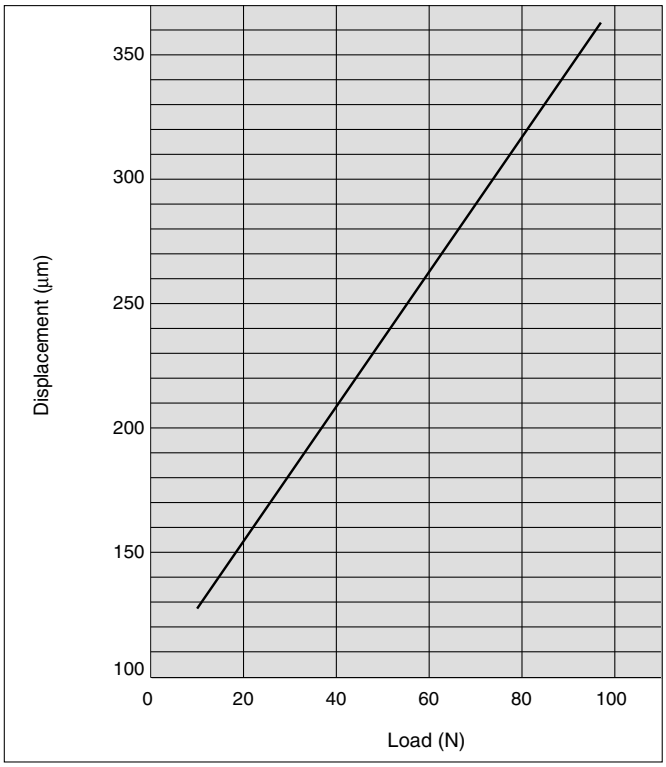
MSQXB20A



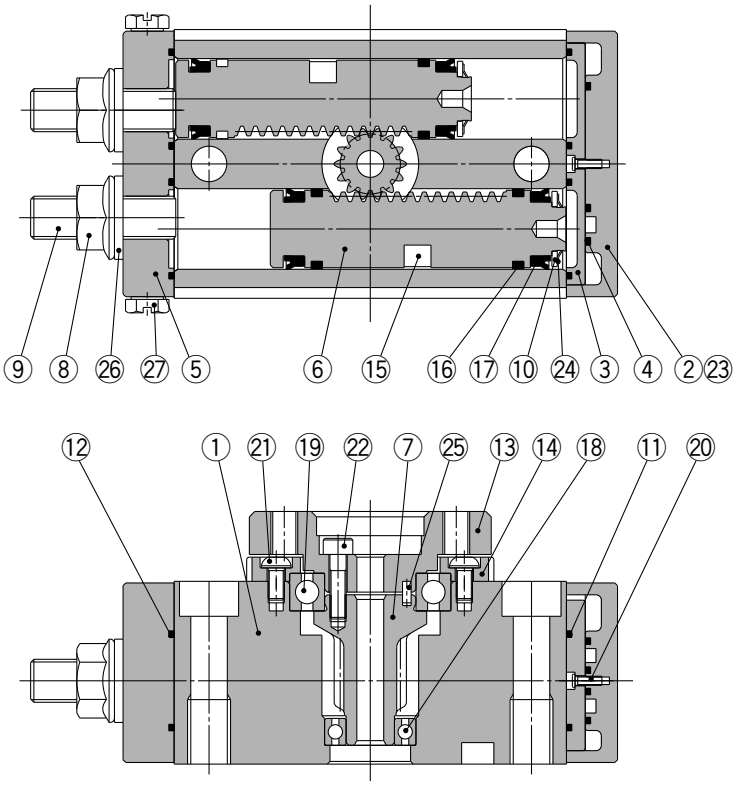
MSQXB30A



MSQXB50A



Construction



Component Parts

No.	Description	Material
1	**Body**	Aluminium alloy
2	**Cover**	Aluminium alloy
3	**Plate**	Resin
4	**Seal**	NBR
5	**End cover**	Aluminium alloy
6	**Piston**	Stainless steel
7	**Pinion**	Chrome molybdenum steel
8	**Hexagon nut with flange**	Steel wire
9	**Adjustment bolt**	Chrome molybdenum steel
10	**Seal retainer**	Aluminium alloy
11	**Gasket**	NBR
12	**Gasket**	NBR
13	**Table**	Aluminium alloy
14	**Bearing retainer**	Aluminium alloy

Component Parts

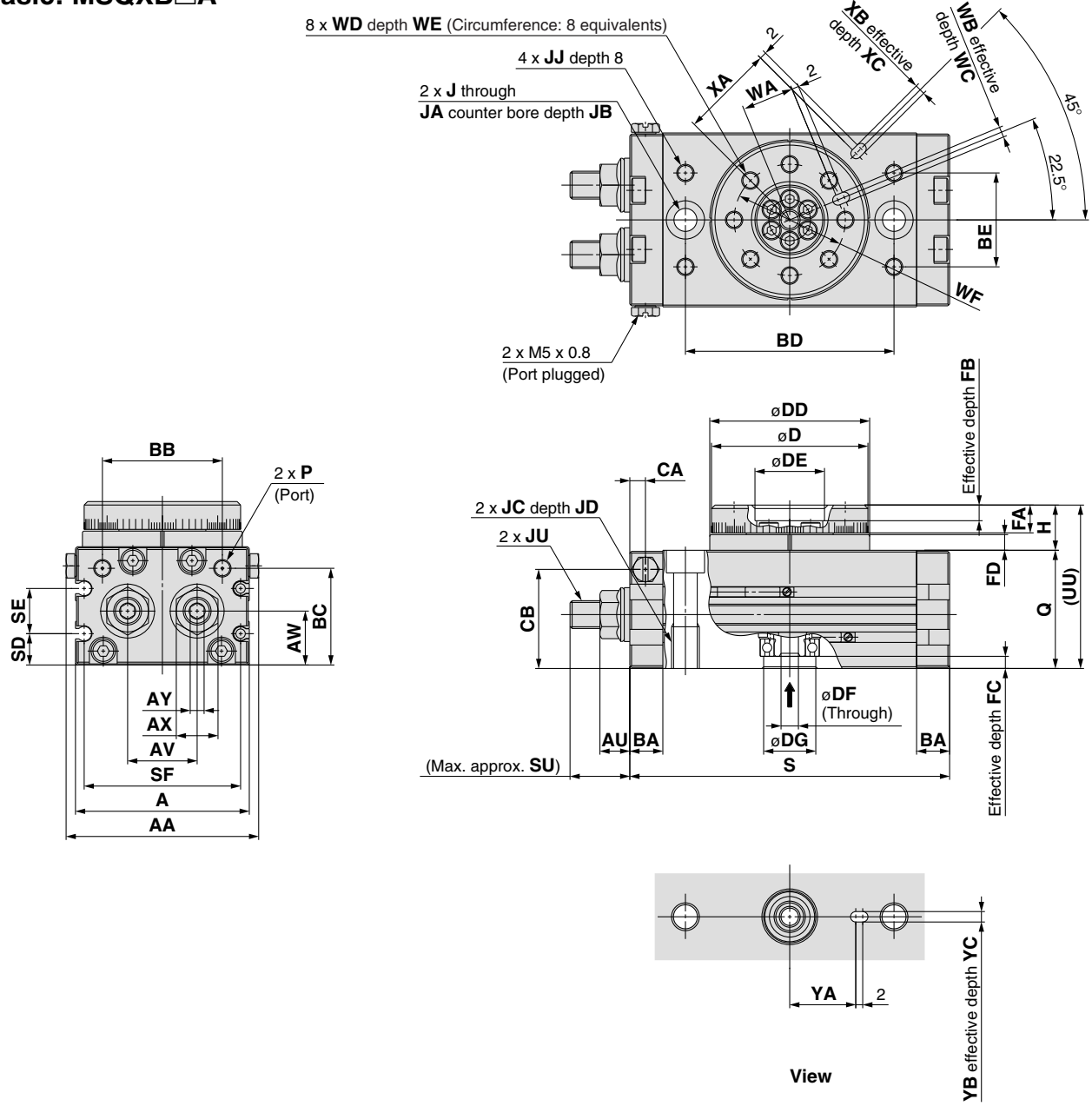
No.	Description		Material
15	**Magnet**		—
16	**Wear ring**		Resin
17	**Piston seal**		NBR
18	**Deep groove ball bearing**		Bearing steel
19	**Deep groove ball bearing**		Bearing steel
20	**Cross recessed screw No. 0**		Steel wire
21	**Cross recessed screw**	**Size: 10**	Stainless steel
	Low head cap screw	**Size: 20 to 50**	Chrome molybdenum steel
22	**Hexagon socket head cap screw**		Stainless steel
23	**Hexagon socket head cap screw**		Stainless steel
24	**CS-type retaining ring**		Spring steel
25	**Parallel pin**	**Size: 10 to 50**	Carbon steel
26	**Seal washer**		NBR
27	**Plug**		Brass

Replacement Parts

Description	Part no.				Note
	10	**20**	**30**	**50**	
Seal kit	P523010-20	P523020-20	P523030-20	P523040-20	A set of above numbers ④, ⑪, ⑫, ⑯, ⑰ and ㉖

Dimensions

Basic: MSQXB□A



(mm)

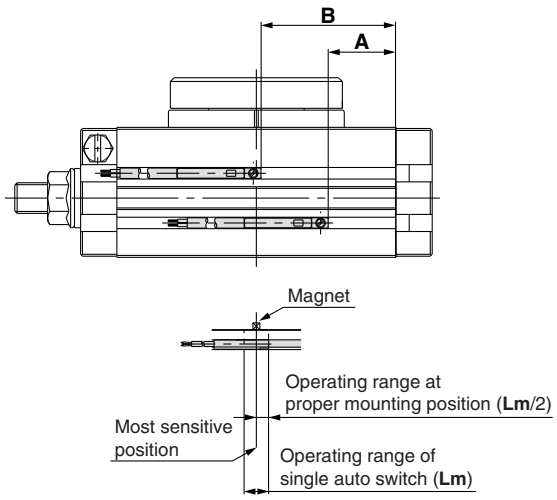
Size	AA	A	AU	AV	AW	AX	AY	BA	BB	BC	BD	BE	CA	CB	D	DD	DE	DF	DG	FA	FB	FC	FD	H	J	JA	JB
10	55.4	50	8.6	20	15.5	12	4	9.5	34.5	27.8	60	27	4.5	28.5	45h9	46h9	20H9	5	15H9	8	4	3	4.5	13	6.8	11	6.5
20	70.8	65	10.6	27.5	16	14	5	12	46	30	76	34	6	30.5	60h9	61h9	28H9	9	17H9	10	6	2.5	6.5	17	8.6	14	8.5
30	75.4	70	10.6	29	18.5	14	5	12	50	32	84	37	6.5	33.5	65h9	67h9	32H9	9	22H9	10	4.5	3	6.5	17	8.6	14	8.5
50	85.4	80	14	38	22	19	6	15.5	63	37.5	100	50	10	37.5	75h9	77h9	35H9	10	26H9	12	5	3	7.5	20	10.5	18	10.5

(mm)

Size	JC	JD	JJ	JU	P	Q	S	SD	SE	SF	SU	UU	WA	WB	WC	WD	WE	WF	XA	XB	XC	YA	YB	YC
10	M 8 x 1.25	12	M5 x 0.8	M 8 x 1	M5 x 0.8	34	92	9	13	45	17.7	47	15	3H9	3.5	M5 x 0.8	8	32	27	3H9	3.5	19	3H9	3.5
20	M10 x 1.5	15	M6 x 1	M10 x 1	M5 x 0.8	37	117	10	12	60	25	54	20.5	4H9	4.5	M6 x 1	10	43	36	4H9	4.5	24	4H9	4.5
30	M10 x 1.5	15	M6 x 1	M10 x 1	Rc 1/8**	40	127	11.5	14	65	25	57	23	4H9	4.5	M6 x 1	10	48	39	4H9	4.5	28	4H9	4.5
50	M12 x 1.75	18	M8 x 1.25	M14 x 1.5	Rc 1/8**	46	152	14.5	15	75	31.4	66	26.5	5H9	5.5	M8 x 1.25	12	55	45	5H9	5.5	33	5H9	5.5

** In addition to Rc 1/ 8, G 1/ 8, NPT 1/ 8, NPTF 1/ 8 are also available.

Auto Switch Proper Mounting Position (at Rotation End Detection)



Size	Rotation angle	Reed switch				Solid state switch			
		A	B	Operating angle (θ m)	Hysteresis angle	A	B	Operating angle (θ m)	Hysteresis angle
10	190°	17	36	90°	10°	21	40	60°	10°
20	190°	23	50	80°	10°	27	54	50°	10°
30	190°	27	56	65°	10°	31	60	50°	10°
50	190°	33	68	50°	10°	37	72	40°	10°

Operating angle θ**m**: Value of the operating range of single auto switch (Lm) as represented by rotation angle for shaft
Hysteresis angle: Value of the auto switch hysteresis as represented by angle

Note) For actual setting, adjustment shall be made after checking the auto switch operating condition.

Series CRQ2X/MSQX
Auto Switch Specifications

Auto Switch Common Specifications

Type	Reed switch	Solid state switch
Leakage current	None	3-wire: 100 μA or less 2-wire: 0.8 mA or less
Operating time	1.2 ms	1 ms or less
Impact resistance	300 m/s^2	1000 m/s^2
Insulation resistance	50 MΩ or more at 500 VDC Mega (between lead wire and case)	
Withstand voltage	1500 VAC for 1 minute (between lead wire and case)	1000 VAC for 1 minute (between lead wire and case)
Ambient temperature	–10 to 60°C	
Enclosure	IEC60529 standard IP67, JIS C 0920 waterproof construction	
Standard	Conforming to CE Standards	

Lead Wire Length

Lead wire length indication

(Example) **D-M9BW L**

Lead wire length

Nil	0.5 m
M	1 m
L	3 m
Z	5 m

Note 1) Applicable auto switch with 5 m lead wire "Z"
Solid state switch: Manufactured upon receipt of order as standard.
Note 2) To designate solid state switches with flexible specifications, add "-61" after the lead wire length. Flexible cable is used for D-M9□(V), D-M9□W(V), D-M9□A(V) as standard. There is no need to place the suffix -61 to the end of part number.
Note 3) 1 m (M): D-M9□W, D-M9□A(V).
Note 4) Lead wire length tolerance

Lead wire length	Tolerance
0.5 m	±15 mm
1 m	±30 mm
3 m	±90 mm
5 m	±150 mm

Contact Protection Box: CD-P11, CD-P12

<Applicable switch model>

D-A9□(V) type

The above auto switch type does not have a built-in contact protection circuit.

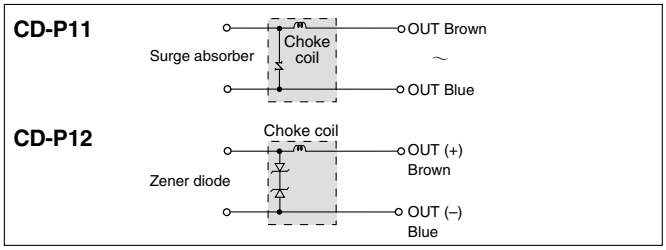
① **Where the operation load is an inductive load.**
② **Where the wiring length to load is greater than 5 m.**
③ **Where the load voltage is 100 VAC.**
Therefore, use a contact protection box with the switch for any of the above cases:
The contact life may be shortened (due to permanent energizing conditions). Since the solid state auto switch is a semiconductor switch which has no contacts, no contact protection box is needed.
④ **Where the load voltage is 110 VAC.**
When the load voltage is increased by more than 10% to the rating of applicable auto switches above, use a contact protection box (CD-P11) to reduce the upper limit of the load current by 10% so that it can be set within the range of the load current range.

Specifications

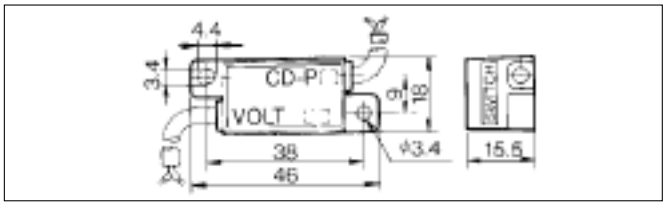
Part no.	CD-P11		CD-P12
Load voltage	100 VAC	200 VAC	24 VDC
Max. load current	25 mA	12.5 mA	50 mA

∗ Lead wire length —— Switch connection side 0.5 m
Load connection side 0.5 m

Internal Circuit



Dimensions



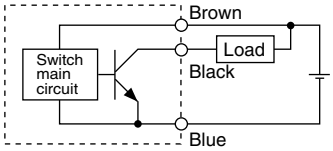
Connection

To connect a switch unit to a contact protection box, connect the lead wire from the side of the contact protection box marked SWITCH to the lead wire coming out of the switch unit. Keep the switch as close as possible to the contact protection box, with a lead wire length of no more than 1 meter.

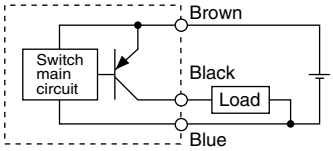
Auto Switch Connections and Examples

Basic Wiring

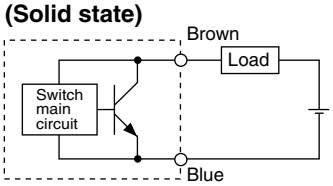
Solid state 3-wire, NPN



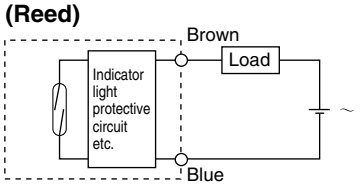
Solid state 3-wire, PNP



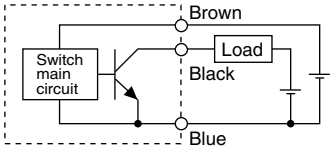
2-wire (Solid state)

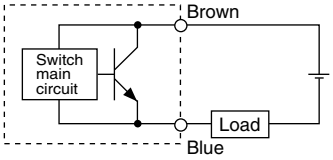


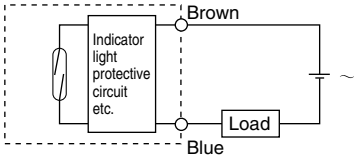
2-wire (Reed)



(Power supplies for switch and load are separate.)



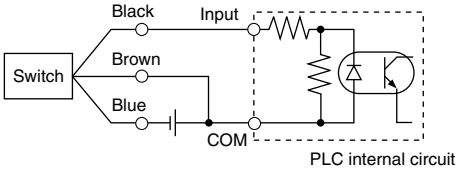




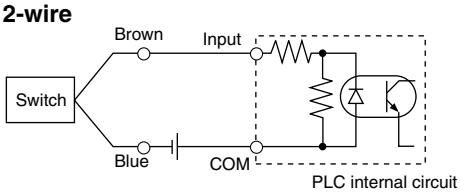
Example of Connection to PLC (Programmable Logic Controller)

• Sink input specification

3-wire, NPN

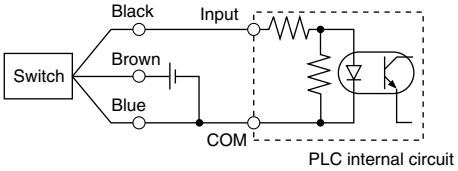


2-wire

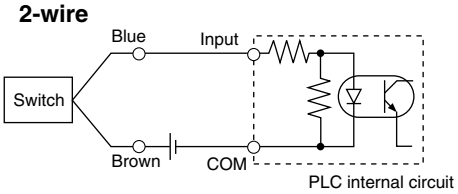


• Source input specification

3-wire, PNP



2-wire

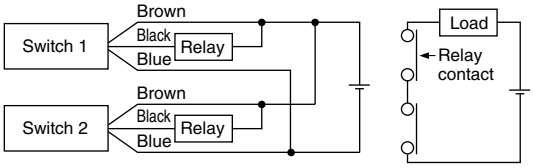


Connect according to the applicable PLC input specifications, since the connection method will vary depending on the PLC input specifications.

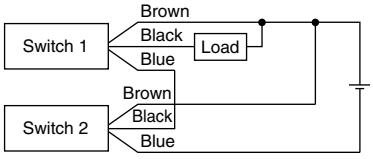
Example of AND (Serial) and OR (Parallel) Connection

• 3-wire

AND connection for NPN output (using relays)

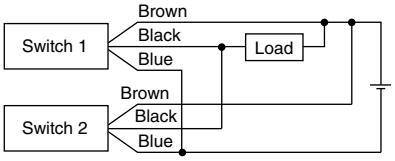


AND connection for NPN output (performed with switches only)

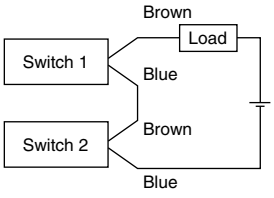


The indicator lights will illuminate when both switches are turned ON.

OR connection for NPN output



2-wire with 2-switch AND connection



When two switches are connected in series, a load may malfunction because the load voltage will decrease when in the ON state.
The indicator lights will illuminate if both of the switches are in the ON state.

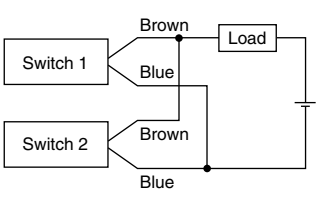
$$\text{Load voltage at ON} = \left(\frac{\text{Power supply voltage}}{} - \frac{\text{Residual voltage}}{}\right) \times 2 \text{ pcs.}$$

$$= 24 \text{ V} - 4 \text{ V} \times 2 \text{ pcs.}$$

$$= 16 \text{ V}$$

Example: Power supply is 24 VDC.
Internal voltage drop in switch is 4 V.

2-wire with 2-switch OR connection



(Solid state)
When two switches are connected in parallel, a malfunction may occur because the load voltage will increase when in the OFF state.

$$\text{Load voltage at OFF} = \text{Leakage current} \times 2 \text{ pcs.} \times \text{Load impedance}$$

$$= 1 \text{ mA} \times 2 \text{ pcs.} \times 3 \text{ k}\Omega$$

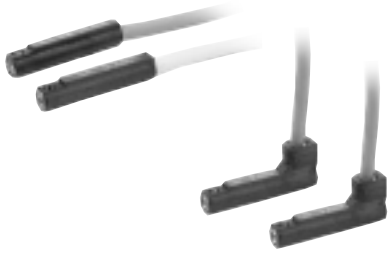
$$= 6 \text{ V}$$

Example: Load impedance is 3 kΩ.
Leakage current from switch is 1 mA.

(Reed)
Because there is no current leakage, the load voltage will not increase when turned OFF. However, depending on the number of switches in the ON state, the indicator lights may sometimes dim or not light because of the dispersion and reduction of the current flowing to the switches.

Reed Switch: Direct Mounting Style
D-A90(V)/D-A93(V)/D-A96(V)

Grommet



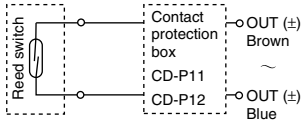
⚠Caution

Precautions

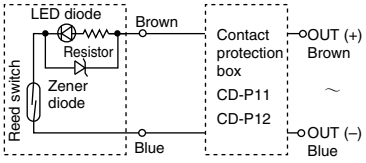
Fix the switch with the existing screw installed on the switch body. The switch may be damaged if a screw other than the one supplied is used.

Auto Switch Internal Circuit

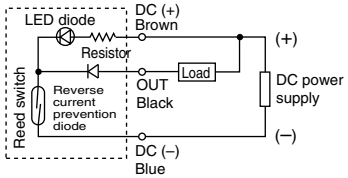
D-A90(V)



D-A93(V)



D-A96(V)



Note) ① In a case where the operation load is an inductive load.
② In a case where the wiring load is greater than 5 m.
③ In a case where the load voltage is 100 VAC.

Use the auto switch with a contact protection box in any of the above mentioned cases. (For details about the contact protection box, refer to page 22.)

Auto Switch Specifications

PLC: Programmable Logic Controller

D-A90/D-A90V (Without indicator light)						
Auto switch part no.	**D-A90**	**D-A90V**	**D-A90**	**D-A90V**	**D-A90**	**D-A90V**
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Applicable load	IC circuit, Relay, PLC					
Load voltage	24 VAC/DC or less		48 VAC/DC or less		100 VAC/DC or less	
Maximum load current	50 mA		40 mA		20 mA	
Contact protection circuit	None					
Internal resistance	1 Ω or less (including lead wire length of 3 m)					
Standard	Conforming to CE Standards					
D-A93/D-A93V/D-A96/D-A96V (With indicator light)						
Auto switch part no.	**D-A93**	**D-A93V**	**D-A93**	**D-A93V**	**D-A96**	**D-A96V**
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Applicable load	Relay, PLC				IC circuit	
Load voltage	24 VDC		100 VAC		4 to 8 VDC	
Load current range and max. load current	5 to 40 mA		5 to 20 mA		20 mA	
Contact protection circuit	None					
Internal voltage drop	D-A93 — 2.4 V or less (to 20 mA)/3 V or less (to 40 mA) D-A93V — 2.7 V or less				0.8 V or less	
Indicator light	Red LED illuminates when turned ON.					
Standard	Conforming to CE Standards					

- Lead wires
  D-A90(V)/D-A93(V) — Oilproof heavy-duty vinyl cable: ø2.7, 0.18 mm² x 2 cores (Brown, Blue), 0.5 m
  D-A96(V) — Oilproof heavy-duty vinyl cable: ø2.7, 0.15 mm² x 3 cores (Brown, Black, Blue), 0.5 m

Note 1) Refer to page 22 for reed switch common specifications.
Note 2) Refer to page 22 for lead wire lengths.
Note 3) If load current is less than 5 mA, the visibility of the indicator light is decreased. If less than 2.5 mA, the light may become invisible. From the point of view of contact output, however, it is not a problem as long as the load current is more than 1 mA.

Weight

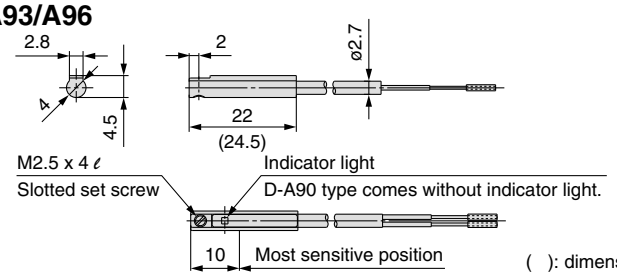
Unit: g

Auto switch part no.		D-A90(V)	D-A93(V)	D-A96(V)
Lead wire length (m)	0.5	6	6	8
	3	30	30	41

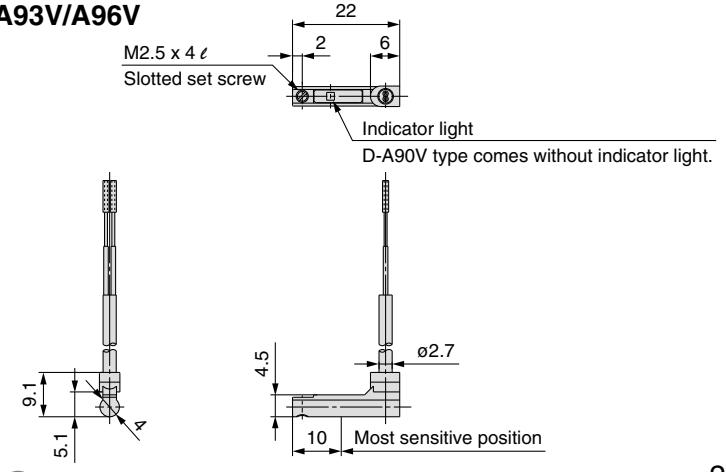
Dimensions

Unit: mm

D-A90/A93/A96



D-A90V/A93V/A96V



Solid State Switch: Direct Mounting Style
D-M9N(V)/D-M9P(V)/D-M9B(V) CE

Grommet

- **2-wire load current is reduced (2.5 to 40 mA).**
- **UL certified (style 2844) lead cable is used.**
- **Flexibility is 1.5 times greater than the conventional model (SMC comparison).**
- **Using flexible cable as standard spec.**
- **Brightness of indicator light is 2 times greater than the conventional model (SMC comparison).**

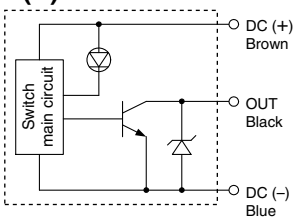
⚠Caution

Precautions

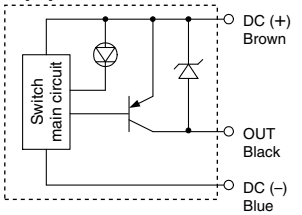
Fix the switch with the existing screw installed on the switch body. The switch may be damaged if a screw other than the one supplied is used.

Auto Switch Internal Circuit

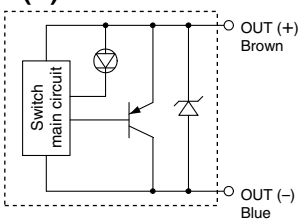
D-M9N(V)



D-M9P(V)



D-M9B(V)



Auto Switch Specifications

PLC: Programmable Logic Controller

D-M9□/D-M9□V (With indicator light)						
Auto switch part no.	D-M9N	D-M9NV	D-M9P	D-M9PV	D-M9B	D-M9BV
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Wiring type	3-wire				2-wire	
Output type	NPN		PNP		—	
Applicable load	IC circuit, Relay, PLC				24 VDC relay, PLC	
Power supply voltage	5, 12, 24 VDC (4.5 to 28 V)				—	
Current consumption	10 mA or less				—	
Load voltage	28 VDC or less		—		24 VDC (10 to 28 VDC)	
Load current	40 mA or less				2.5 to 40 mA	
Internal voltage drop	0.8 V or less				4 V or less	
Leakage current	100 μA or less at 24 VDC				0.8 mA or less	
Indicator light	Red LED illuminates when turned ON.					
Standard	Conforming to CE Standards					

- Lead wires — Oilproof heavy-duty vinyl cable: ø2.7 x 3.2 ellipse
  D-M9B(V) 0.15 mm² x 2 cores
  D-M9N(V), D-M9P(V) 0.15 mm² x 3 cores

Note 1) Refer to page 22 for solid state switch common specifications.
Note 2) Refer to page 22 for lead wire lengths.

Weight

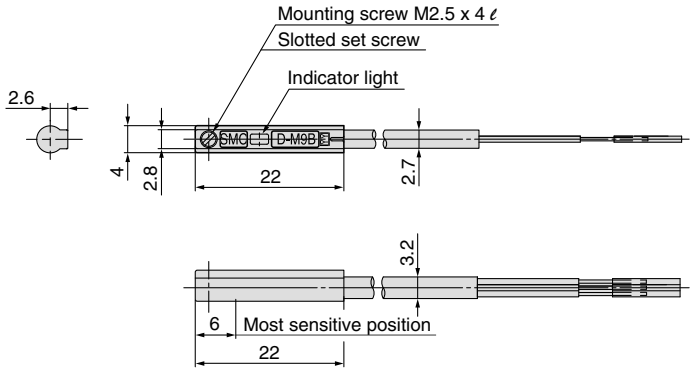
Unit: g

Auto switch part no.		D-M9N(V)	D-M9P(V)	D-M9B(V)
Lead wire length (m)	0.5	8	8	7
	3	41	41	38
	5	68	68	63

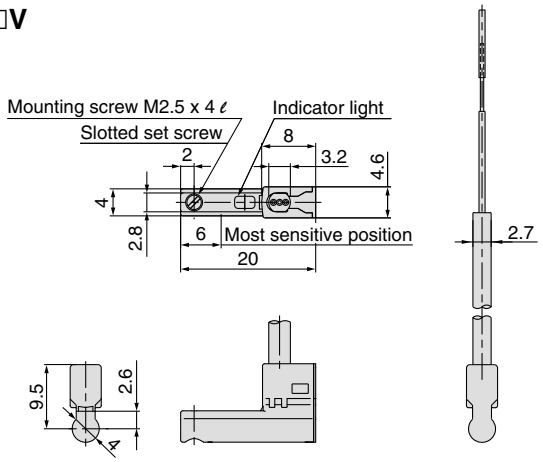
Dimensions

Unit: mm

D-M9□



D-M9□V



SMC

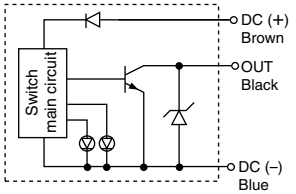
2-Color Indication Solid State Switch: Direct Mounting Style
D-M9NW(V)/D-M9PW(V)/D-M9BW(V)

Grommet

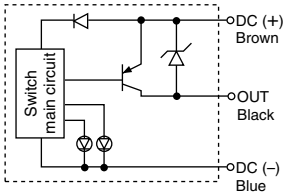
- 2-wire load current is reduced (2.5 to 40 mA).
- UL certified (style 2844) lead cable is used.
- Flexibility is 1.5 times greater than the conventional model (SMC comparison).
- Using flexible cable as standard spec.
- The optimum operating position can be determined by the color of the light. (Red → Green ← Red)
- Brightness of indicator light is 2 times greater than the conventional model (SMC comparison).

Auto Switch Internal Circuit

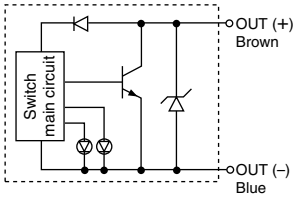
D-M9NW(V)



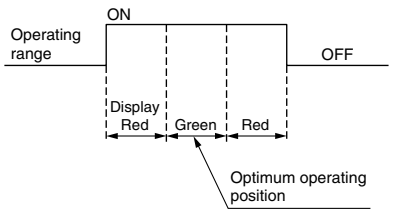
D-M9PW(V)



D-M9BW(V)



Indicator light / Display method



Auto Switch Specifications

PLC: Programmable Logic Controller

D-M9□W/D-M9□WV (With indicator light)						
Auto switch part no.	D-M9NW	D-M9NWV	D-M9PW	D-M9PWV	D-M9BW	D-M9BWV
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Wiring type	3-wire				2-wire	
Output type	NPN		PNP		—	
Applicable load	IC circuit, Relay, PLC				24 VDC relay, PLC	
Power supply voltage	5, 12, 24 VDC (4.5 to 28 V)				—	
Current consumption	10 mA or less				—	
Load voltage	28 VDC or less		—		24 VDC (10 to 28 VDC)	
Load current	40 mA or less				2.5 to 40 mA	
Internal voltage drop	0.8 V or less at 10 mA (2 V or less at 40 mA)				4 V or less	
Leakage current	100 μA or less at 24 VDC				0.8 mA or less	
Indicator light	Operating position ····· Red LED illuminates. Optimum operating position ····· Green LED illuminates.					
Standard	Conforming to CE Standards					

- Lead wires — Oilproof heavy-duty vinyl cable: ø2.7 x 3.2 ellipse
  D-M9BW(V) 0.15 mm² x 2 cores
  D-M9NW(V), D-M9PW(V) 0.15 mm² x 3 cores

Note 1) Refer to page 22 for solid state switch common specifications.
Note 2) Refer to page 22 for lead wire lengths.

Weight

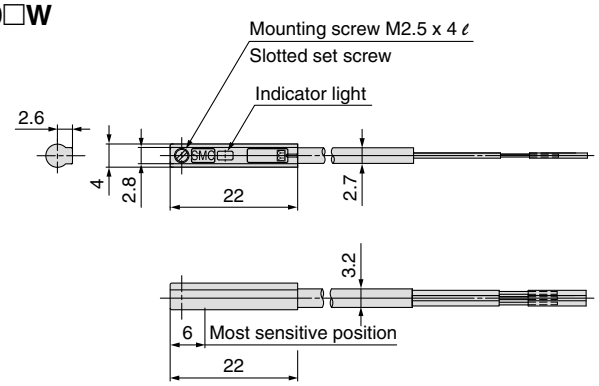
Unit: g

Auto switch part no.		D-M9NW(V)	D-M9PW(V)	D-M9BW(V)
Lead wire length (m)	0.5	8	8	7
	1	14	14	13
	3	41	41	38
	5	68	68	63

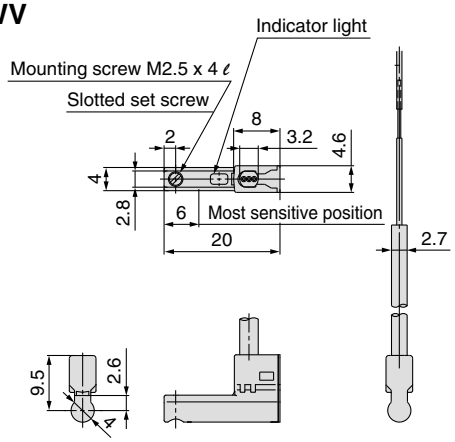
Dimensions

Unit: mm

D-M9□W



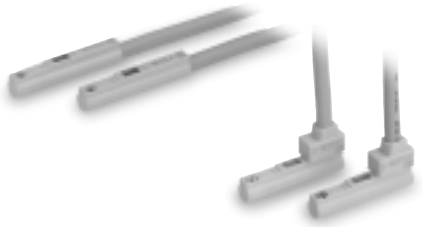
D-M9□WV



Water Resistant 2-Color Indication Solid State Switch: Direct Mounting Style
D-M9NA(V)/D-M9PA(V)/D-M9BA(V) CE

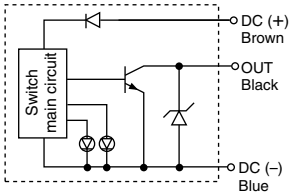
Grommet

- Water (coolant) resistant type
- 2-wire load current is reduced (2.5 to 40 mA).
- UL certified (style 2844) lead cable is used.
- The optimum operating position can be determined by the color of the light. (Red Green Red)

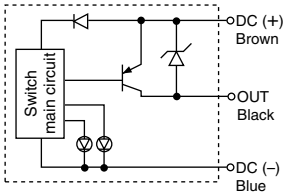


Auto Switch Internal Circuit

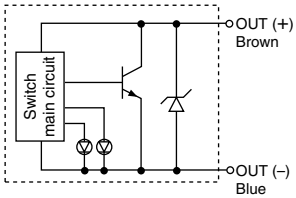
D-M9NA(V)



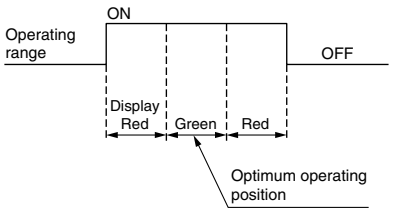
D-M9PA(V)



D-M9BA(V)



Indicator light / Display method



Auto Switch Specifications

PLC: Programmable Logic Controller

D-M9□A/D-M9□AV (With indicator light)						
Auto switch part no.	D-M9NA	D-M9NAV	D-M9PA	D-M9PAV	D-M9BA	D-M9BAV
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Wiring type	3-wire				2-wire	
Output type	NPN		PNP		—	
Applicable load	IC circuit, Relay, PLC				24 VDC relay, PLC	
Power supply voltage	5, 12, 24 VDC (4.5 to 28 V)				—	
Current consumption	10 mA or less				—	
Load voltage	28 VDC or less		—		24 VDC (10 to 28 VDC)	
Load current	40 mA or less				2.5 to 40 mA	
Internal voltage drop	0.8 V or less at 10 mA (2 V or less at 40 mA)				4 V or less	
Leakage current	100 μA or less at 24 VDC				0.8 mA or less	
Indicator light	Operating position ····· Red LED illuminates. Optimum operating position ····· Green LED illuminates.					
Standard	Conforming to CE Standards					

- Lead wires — Oilproof heavy-duty vinyl cable: ø2.7 x 3.2 ellipse
  D-M9BA(V) 0.15 mm² x 2 cores
  D-M9NA(V), D-M9PA(V) 0.15 mm² x 3 cores

Note 1) Refer to page 22 for solid state switch common specifications.
Note 2) Refer to page 22 for lead wire lengths.

Weight

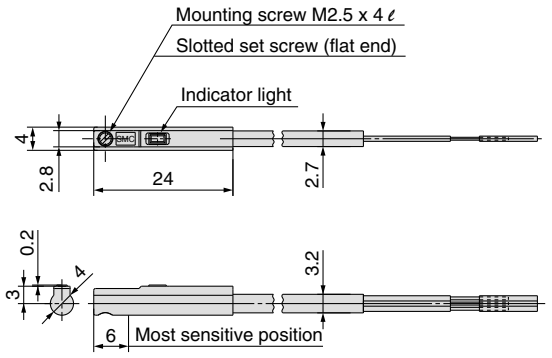
Unit: g

Auto switch part no.		D-M9NA(V)	D-M9PA(V)	D-M9BA(V)
Lead wire length (m)	0.5	8	8	7
	1	14	14	13
	3	41	41	38
	5	68	68	63

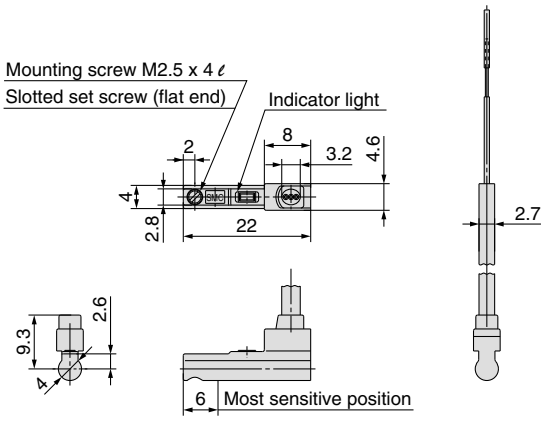
Dimensions

Unit: mm

D-M9□A



D-M9□AV



SMC

Made to Order

Please contact SMC for detailed specifications, lead times and prices.

Made to Order

Symbol

With External Stopper — X150/X151/X152/X153

Prevent holding torque from being halved at the rotation end.

How to Order

MSQXB 10 □ AX – M9NW – X150

Size

10
20
30
50

Port type

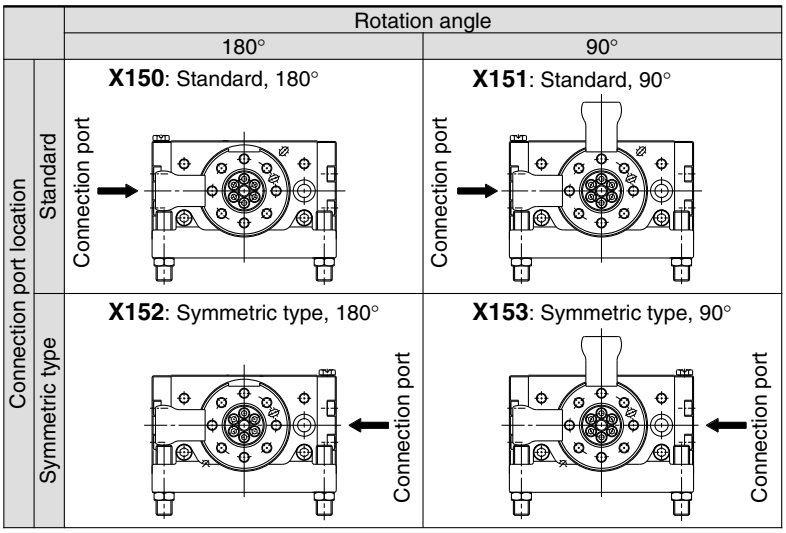
Port type		Size
Nil	M5	10, 20
	Rc 1/8	30, 50
TF	G 1/8	
TN	NPT 1/8	
TT	NPTF 1/8	

Auto switch

Nil	Without auto switch (Built-in magnet)

Connection port location and rotation angle

X150	Standard, 180°
X151	Standard, 90°
X152	Symmetric type, 180°
X153	Symmetric type, 90°



Specifications

Size	10	20	30	50
Rotation angle	90°, 180°			
Angle adjustment range	Each rotation end $^{+3°}_{-5°}$			

∗ Specifications other than the above are the same as standard.

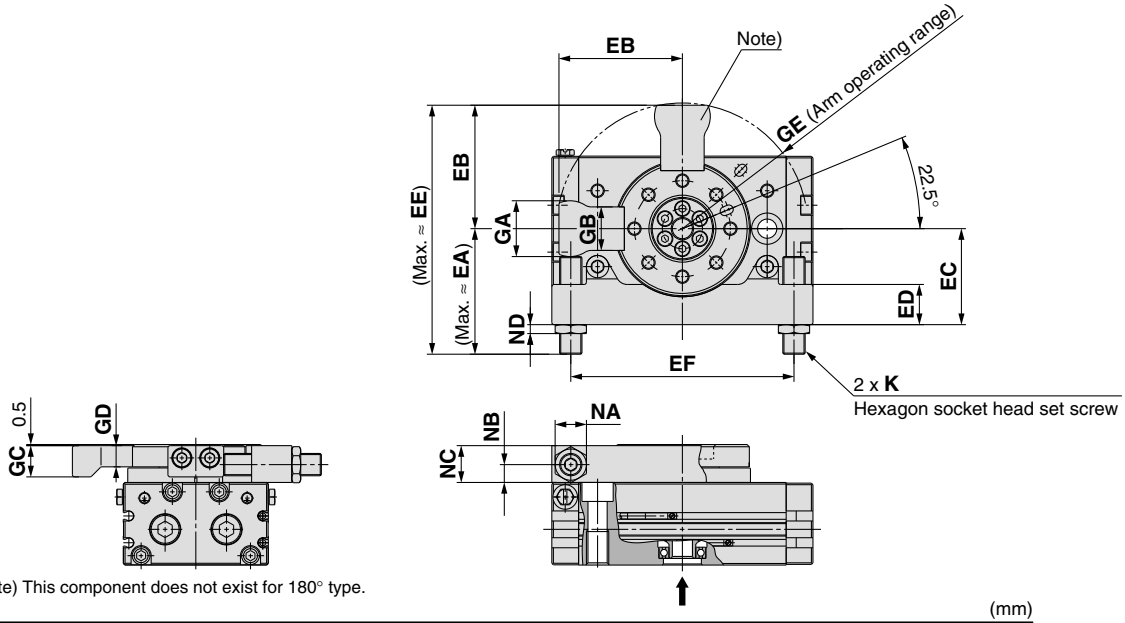
Weight

(g)

Size	10	20	30	50
90° spec.	630	1200	1520	2480
180° spec.	600	1140	1450	2370

∗ Values not including the auto switch weight.

Dimensions



Note) This component does not exist for 180° type.

(mm)

Size	EA	EB	EC	ED	EE	EF	GA	GB	GC	GD	GE	K	NA	NB	NC	ND
10	47.1	44.3	33.5	14	91.4	80	20	15.6	11	7.5	45.2	M8 x 1	10	5.5	12.5	4
20	57.1	55.3	43	18	112.4	100	25	19.5	14	9.5	56.4	M10 x 1	14	8	16.5	4
30	58.4	60.3	46	19.5	118.7	110	27	21.5	14	9.5	61.5	M10 x 1	14	8	16.5	4
50	74.4	71.4	56	22	145.8	130	32	28	18	11.5	72.9	M14 x 1.5	19	8.5	19.5	6

∗ Dimensions other than the above are the same as standard.

Series CRQ2X/MSQX
Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of **"Caution", "Warning"** or **"Danger"**. To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

■ Explanation of the Labels

Labels	Explanation of the labels
⚠ **Danger**	In extreme conditions, there is a possible result of serious injury or loss of life.
⚠ **Warning**	Operator error could result in serious injury or loss of life.
⚠ **Caution**	Operator error could result in injury Note 3) or equipment damage. Note 4)

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems
Note 2) JIS B 8370: General Rules for Pneumatic Equipment
Note 3) Injury indicates light wounds, burns and electrical shocks that do not require hospitalization or hospital visits for long-term medical treatment.
Note 4) Equipment damage refers to extensive damage to the equipment and surrounding devices.

■ Selection/Handling/Applications

1. The compatibility of the pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or post analysis and/or tests to meet the specific requirements. The expected performance and safety assurance are the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. Only trained personnel should operate pneumatically operated machinery and equipment.
Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators. (Understanding JIS B 8370 General Rules for Pneumatic Equipment, and other safety rules are included.)

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.
1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven objects have been confirmed.
2. When equipment is removed, confirm that safety process as mentioned above. Turn off the supply pressure for this equipment and exhaust all residual compressed air in the system, and release all the energy (liquid pressure, spring, condenser, gravity).
3. Before machinery/equipment is restarted, take measures to prevent quick extension of a cylinder piston rod, etc.

4. If the equipment will be used in the following conditions or environment, please contact SMC first and be sure to take all necessary safety precautions.
1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, requiring special safety analysis.
4. If the products are used in an interlock circuit, prepare a double interlock style circuit with a mechanical protection function for the prevention of a breakdown. And, examine the devices periodically if they function normally or not.

■ Exemption from Liability

1. SMC, its officers and employees shall be exempted from liability for any loss or damage arising out of earthquakes or fire, action by a third person, accidents, customer error with or without intention, product misuse, and any other damages caused by abnormal operating conditions.

2. SMC, its officers and employees shall be exempted from liability for any direct or indirect loss or damage, including consequential loss or damage, loss of profits, or loss of chance, claims, demands, proceedings, costs, expenses, awards, judgments and any other liability whatsoever including legal costs and expenses, which may be suffered or incurred, whether in tort (including negligence), contract, breach of statutory duty, equity or otherwise.

3. SMC is exempted from liability for any damages caused by operations not contained in the catalogs and/or instruction manuals, and operations outside of the specification range.

4. SMC is exempted from liability for any loss or damage whatsoever caused by malfunctions of its products when combined with other devices or software.

Series CRQ2X/MSQX
Auto Switches Precautions 1

Be sure to read this before handling.

Design and Selection

⚠Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately.
The product may be damaged or malfunction if it is used outside the range of specifications of current load, voltage, temperature or impact. We do not guarantee any damage in any case the product is used outside of the specification range.

2. Pay attention to the length of time that a switch is on at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate. However if the speed is too great, the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V\ (mm/s) = \frac{\text{Auto switch operating range (mm)}}{\text{Load operating time (ms)}} \times 1000$$

3. Keep wiring as short as possible.

<Reed switch>
As the length of the wiring to a load gets longer, the rush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)
Use a contact protection box when the wire length is 5 m or longer.

<Solid state switch>
Although wire length should not affect switch function, use a wire 100 m or shorter.

If the wiring is longer it will likely increase noise although the length is less than 100 m.
When the wire length is long, we recommend attaching the ferrite core to the both ends of the cable to prevent excess noise.
Since the solid state auto switch is a semiconductor switch which has no contacts, no contact protection box is needed.

4. Do not use a load that generates surge voltage. If a surge voltage is generated, the discharge occurs at the contact, possibly resulting in the shortening of product life.

<Reed switch>
If driving a load such as a relay that generates a surge voltage, use a switch with a built-in contact protection circuit or use a contact protection box.

<Solid state switch>
Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid, which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

5. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch. Also perform periodic maintenance and confirm proper operation.

6. Do not make any modifications (including exchanging the printed circuit boards) to the product.

It may cause human injuries and accidents.

⚠Caution

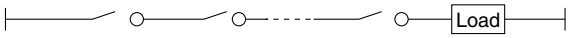
1. Use caution when multiple actuators are used and close to each other.

When two or more auto switch actuators are lined up in close proximity to each other, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40 mm. (When the allowable interval is specified for each cylinder series, use the indicated value.)
Use of a magnetic screen plate (MU-S025) or magnetic screen tape can reduce the interference of magnetic force.

2. Take note of the internal voltage drop of the auto switch.

<Reed switch>

1) Auto switches with an indicator light (Model D-A96(V))
   - If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)
     [The voltage drop will be "n" times larger when "n" auto switches are connected.]
     Even though an auto switch operates normally, the load may not operate.



   - In the same way, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Model D-A90).

<Solid state switch>

3) Generally, the internal voltage drop will be greater with a 2-wire solid state auto switch than with a reed switch. Take the same precautions as in 1).
   Also, note that a 12 VDC relay is not applicable.

Series CRQ2X/MSQX
Auto Switches Precautions 2

Be sure to read this before handling.

Design and Selection

⚠Caution

3. Pay attention to leakage current.

<Solid state switch>

With a 2-wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

Operating current of load (OFF condition) > Leakage current

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3-wire switch if this specification will not be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

4. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

5. Minimum stroke for auto switch mounting

The minimum stroke value for mounting one or two auto switches is obtained when the switch can detect at the cylinder stroke ends.

However, even if the switch is mounted at the proper position within the minimum stroke range, it may not be able to detect when the piston stops in the middle of the stroke due to a stopper, etc. It may also turn on in the middle of a stroke.

6. When multiple auto switches are required.

"n" indicates the number of switch which can be physically mounted. Detection intervals depends on the switch mounting structure and set position therefore some required interval and set positions may not be available.

7. Limitations of detectable positioning

When using certain mounting brackets, the surface and position where an auto switch can be mounted maybe restricted due to physical interference (bottom side of foot bracket etc.).

Please select the set position of the auto switch so that it does not interfere with the mounting bracket of the cylinder (trunnion or support ring etc.).

8. Use the cylinder and switch in proper combination.

The auto switch is pre-adjusted to activate properly for an auto-switch-capable SMC cylinder.

If the auto switch is mounted improperly, used for another brand of cylinder or used after the alternation of the machine installation, the switch may not activate properly.

Mounting and Adjustment

⚠Warning

1. Operating manual

Install the products and operate them only after reading the operating manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

2. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300 m/s² or more for reed switches and 1000 m/s² or more for solid state switches) while handling. Although the body of the auto switch may not be damaged, the inside of the auto switch could be damaged and cause a malfunction.

3. Mount auto switches using the proper fastening torque.

When a switch is tightened beyond the range of fastening torque, the mounting screws, auto switches, auto switch mounting bracket, etc. may be damaged. On the other hand, tightening below the range of fastening torque may allow the switch to slip out of position. (Refer to auto switch mounting for each series regarding auto switch mounting, moving, and fastening torque, etc.)

4. Mount an auto switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting position shown in a catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable or the service life will be shortened.

<D-M9□>

When the auto switch is used to replace old series auto switch, it may not activate depending on operating condition because of its shorter operating range.

Such as

- **Application where the stop position of actuator may vary and exceed the operating range of the auto switch, for example, pushing, pressing, clamping operation, etc.**
- **Application where the auto switch is used for detecting an intermediate stop position of the actuator. (In this case the detecting time will be reduced.)**

In these applications, set the auto switch to the center of the required detecting range.

5. Secure the space for maintenance.

When installing the products, please allow access for maintenance.

⚠Caution

1. Do not carry an actuator by the auto switch lead wires.

Never carry a cylinder (actuator) by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the auto switch to be damaged by the stress.

2. Fix the auto switch with appropriate screw installed on the auto switch body. If using other screws, auto switch may be damaged.

Series CRQ2X/MSQX
Auto Switches Precautions 3

Be sure to read this before handling.

Wiring

⚠Warning

1. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

2. Do not wire with power lines or high-voltage lines.

Wire separately from power lines or high-voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits, including auto switches, may malfunction due to noise from these other lines.

⚠Caution

1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from applying bending stress or stretching force to the lead wires.
Stress and tensile force applied to the connection between the cable and switch increases the possibility of disconnection.
Fix the cable in the middle so that it is not movable in the area where it connects with the switch.

2. Be sure to connect the load before power is applied.

<2-wire type>
If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.
It is the same as when the 2-wire brown cord (+, output) is directly connected to the (+) power supply terminal.

3. Do not allow short circuit of loads.

<Reed switch>
If the power is turned ON with a load in a short circuited condition, the switch will be instantly damaged because of excess current flow into the switch.

<Solid state switch>
Model D-M9□(V) except D-M9□W(V) and all models of PNP output type switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged, as in the case of reed switches.
Take special care to avoid reverse wiring with the power supply line (brown) and the output line (black) on 3-wire type switches.

⚠Caution

4. Avoid incorrect wiring.

<Reed switch>
A 24 VDC switch with indicator light has polarity. The brown lead wire is (+) and the blue lead wire or the second terminal are (–).

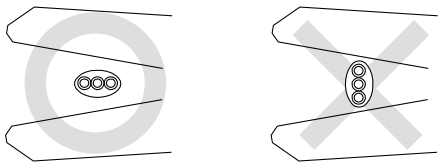
1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.
Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.
Applicable models:
D-A93, D-A54

<Solid state switch>

1) If connections are reversed on a 2-wire type switch, the auto switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state.
However, it is still necessary to avoid reversed connections, since the auto switch could be damaged by a load short circuit in this condition.
2) If connections are reversed (power supply line + and power supply line –) on a 3-wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue wire and the power supply line (–) is connected to the black wire, the auto switch will be damaged.

<D-M9□>
The D-M9□ does not have built-in short circuit protection circuit. Be aware that if the power supply connection is reversed (e.g. (+) power supply wire and (–) power supply wire connection is reversed), the auto switch will be damaged.

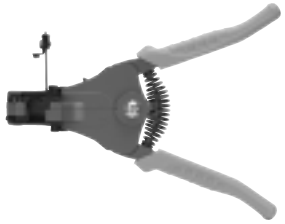
5. When the cable sheath is stripped, confirm the stripping direction. The insulator may be split or damaged depending on the direction. (D-M9□ only)



Recommended Tool

Model name	Model no.
Wire stripper	D-M9N-SWY

∗ Stripper for a round cable (ø2.0) can be used for a 2-wire type cable.



Series CRQ2X/MSQX
Auto Switches Precautions 4

Be sure to read this before handling.

Operating Environment

⚠Warning

1. Never use in an atmosphere of explosive gases.

The construction of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside actuators will become demagnetized.

3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches, satisfy IEC standard IP67 construction (JIS C 0920: waterproof construction), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside auto switches may cause malfunction.

4. Do not use in an environment with oil or chemicals.

Consult with SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

5. Do not use in an environment with temperature cycles.

Consult with SMC if switches are used where there are temperature cycles other than normal temperature changes, as they may be adversely affected internally.

6. Do not use in an environment where there is excessive impact shock.

<Reed switch>

When excessive impact (300 m/s^2 or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1 ms or less). Consult with SMC regarding the need to use a solid state switch depending upon the environment.

7. Do not use in an area where surges are generated.

<Solid state switch>

When there are units (solenoid type lifter, high-frequency induction furnace, motor, radio equipment etc.) which generate large surges or electromagnetic waves in the area around actuators with solid state auto switches, this may cause deterioration or damage to the auto switches. Avoid sources of surge generation and crossed lines.

⚠Caution

1. Avoid accumulation of iron debris or close contact with magnetic substances.

When a large amount of ferrous debris such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch actuator, it may cause the auto switch (actuator) to malfunction due to a loss of the magnetic force inside the actuator.

2. Consult with SMC concerning water resistance, elasticity of lead wires, usage at welding sites, etc.

3. Do not use in direct sunlight.

4. Do not mount the product in locations where it is exposed to radiant heat.

Maintenance

⚠Warning

1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Securely tighten auto switch mounting screws.
If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

2) Confirm that there is no damage to lead wires.
To prevent faulty insulation, replace auto switches or repair lead wires, etc., if damage is discovered.

3) Confirm the lighting of the green light on the 2-color indicator type auto switch.
Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

2. Maintenance procedures are outlined in the operation manual.

Not following proper procedures could cause the product to malfunction and could lead to damage to the equipment or machine.

3. Removal of equipment, and supply/exhaust of compressed air

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.
When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent actuators from sudden movement.

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Series CRQ2X/MSQX
Specific Product Precautions

Be sure to read this before handling.

Selection

⚠Caution

1. Changes in speed occur in applications in which there are changes to the load during operation, such as the load being lifted (lowered) against gravity.

2. The purpose of this product is stable rotation at low-speed.

It does not provide any function to cushion the impact at the operation start or end.

3. Speed may vary at the rotation end depending on operating conditions. (This phenomenon can be avoided by using the external stopper.)

Air Supply

⚠Caution

1. Do not use at dew point of -60°C or lower.

Operation at dew point of -60°C or lower may adversely affect the lubricant used inside and can lead to operation failure.

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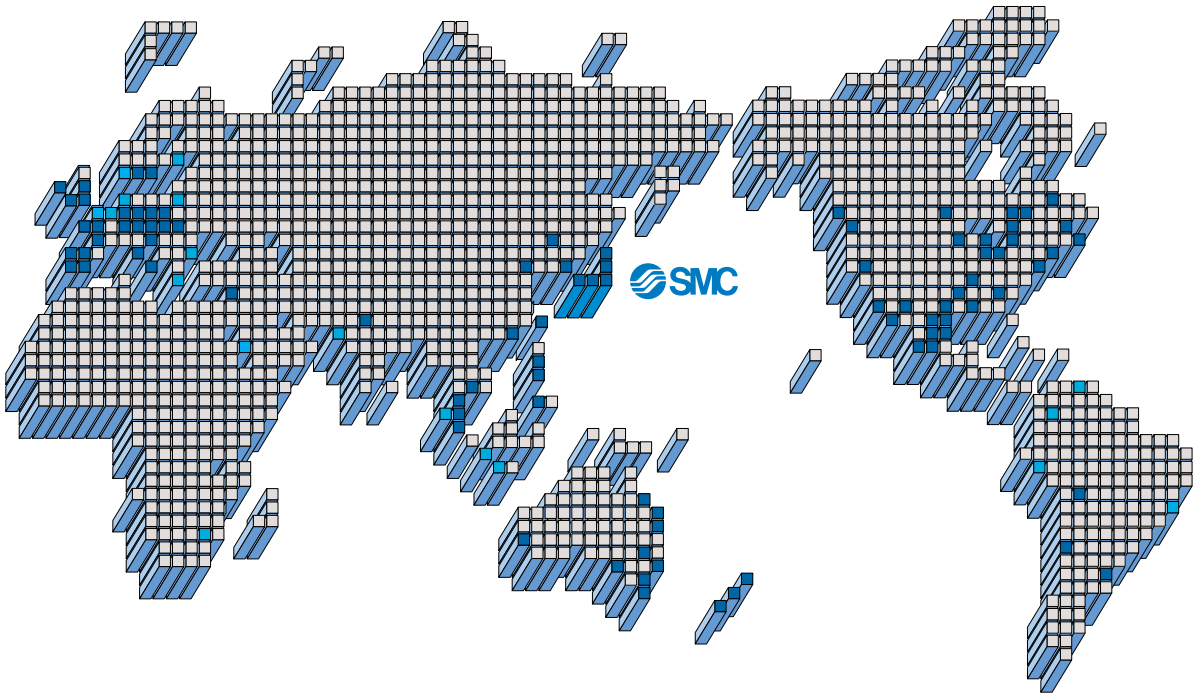

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⚠ Safety Instructions	Be sure to read “Precautions for Handling Pneumatic Devices” (M-03-E3A) before using.

SMC Corporation

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