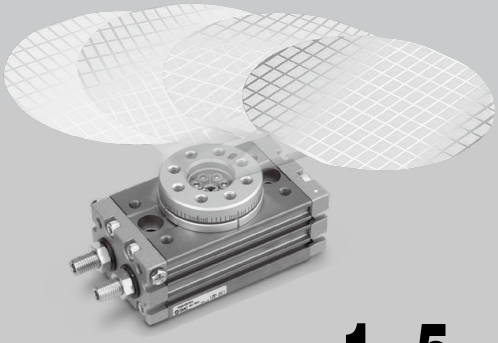
Low-Speed Rotary Actuator

CRQ2X/MSQX Series

CRQ2 Size: 10, 15, 20, 30, 40 MSQX Size: 10, 20, 30, 50

Possible to transfer a workpiece at low-speed.

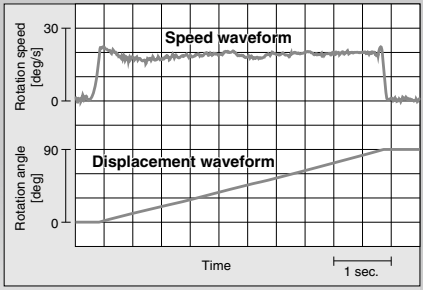


● **Rotation time adjustment range: 1 to 5 (s/90°)**

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	
Standard	CRQ2	10, 15, 20, 30, 40	0.2 to 1 (0.2 to 0.7 for CRQ2□10,15)
	MSQ	10, 20, 30, 50	

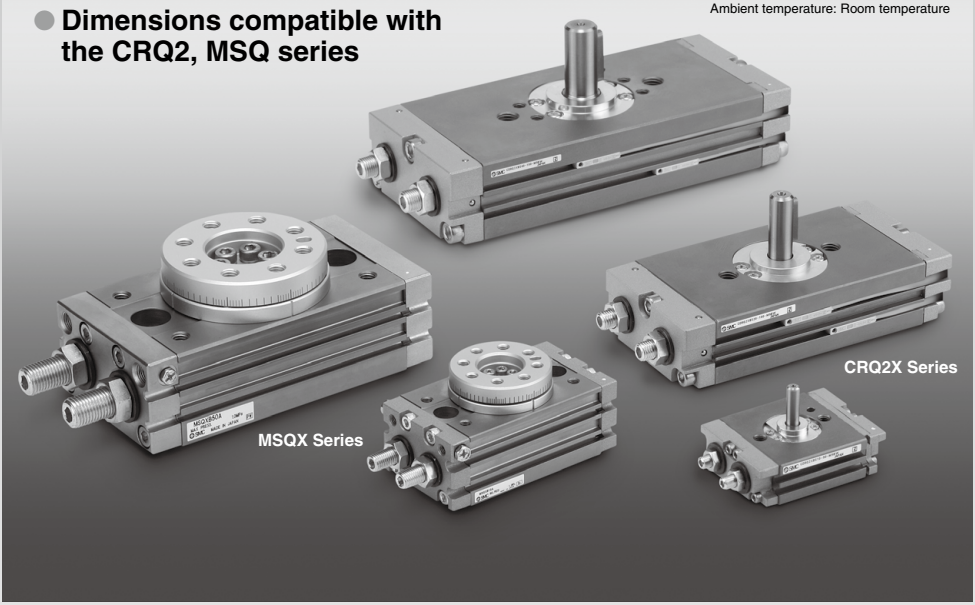
● **Realized a stable motion at 5 s/90°.**

Smooth motion without stick-slip phenomemon



Measurement conditions / Fluid: Air
Mounting orientation: Vertical without load
Operating pressure: 0.5 MPa
Pneumatic circuit: Meter-out circuit
Ambient temperature: Room temperature

● **Dimensions compatible with the CRQ2, MSQ series**



CRQ2X/MSQX Series
Model Selection

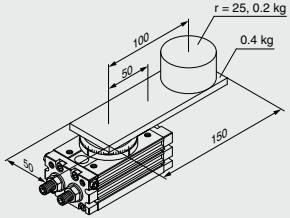
* **The selection procedure of the rotary for low-speed is the same as for an ordinary rotary. If the rotation time exceeds 2s per 90°, however, the necessary torque and the kinetic energy are calculated with rotation time of 2s per 90°.**

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. 380 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: t = 6s Rotation angle: θ = πrad (180°)

1 Calculation of moment of inertia

Calculate the moment of inertia of the load.

⇒ P. 379

- **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. 380

- **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 x 10

$$= 0.003896 \times \frac{2 \times \pi}{4^2} \times 10 = 0.015\ [N \cdot m]$$

(t is calculated with 2s per 90°.)

0.015 N·m < Effective torque OK

3 Checking rotation time

Confirm that it is within the adjustable range of rotation time.

⇒ P. 381

- **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. 381

- **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. 382

- **If the allowable value is exceeded, an external bearing needs to be installed.**

M = 0.4 x 9.8 x 0.05 + 0.2 x 9.8 x 0.1
= 0.392 [N·m]

0.392 [N·m] < Allowable moment load OK

6 Calculation of air consumption and necessary air quantity

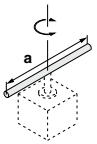
Calculate air consumption and necessary air quantity as required. **⇒ P. 383**

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

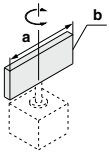
Position of rotational axis:
Perpendicular to the shaft through the center of gravity



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

2. Thin rectangular plate

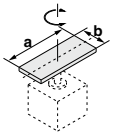
Position of rotational axis:
Parallel to side b through the center of gravity



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

3. Thin rectangular plate (Including rectangular parallelepiped)

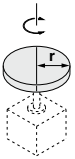
Position of rotational axis:
Perpendicular to the plate through the center of gravity



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

4. Round plate (Including column)

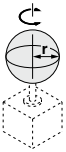
Position of rotational axis:
Passing through the center axis



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

5. Solid sphere

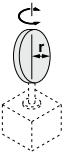
Position of rotational axis:
Passing through the diameter



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

6. Thin round plate

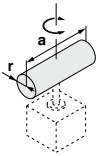
Position of rotational axis:
Passing through the diameter



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

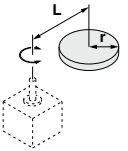
7. Cylindrical

Position of rotational axis:
Passing through the diameter and the center of gravity



$$I = m \cdot \frac{3r^2 + a^2}{12}$$

8. When rotational axis and the center of the load are not concentric.

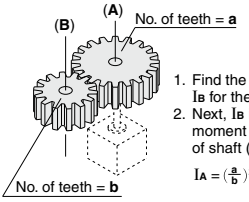


$$I = K + m \cdot L^2$$

K: The moment of inertia around the center of gravity of the load

In case of 4. Round plate $K = m \cdot \frac{r^2}{2}$

9. Gear transmission

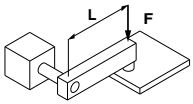
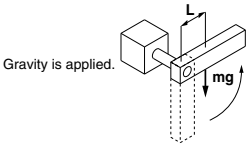
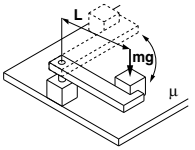
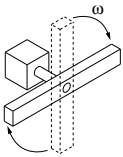
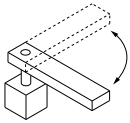


1. Find the moment of inertia I_B for the rotation of shaft (**B**).
2. Next, I_B is entered to find I_A the moment of inertia for the rotation of shaft (**A**) as

$$I_A = (\frac{a}{b})^2 \cdot I_B$$

Load Type

Calculation method of necessary torque depends on the load type. Refer to the table below.

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	$\mathbf{Ta} = I \cdot \omega = I \cdot \frac{2\theta}{t^2}$ **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

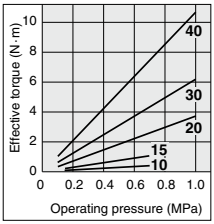
Note) To adjust the speed, margin is necessary for Tf and Ta.

Effective Torque

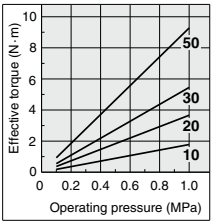
Unit: N·m

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

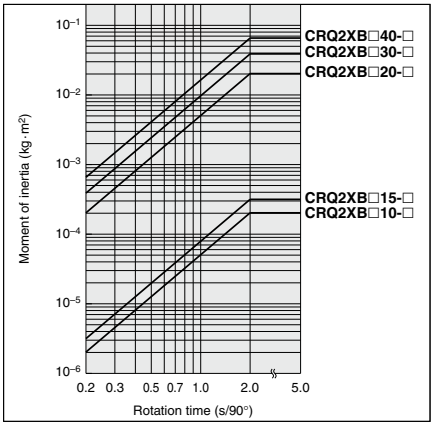
Set the rotation time, within stable operational guidelines, using the adjustment range specification table as detailed below. When operating at low-speeds which exceed the rotation time adjustment range, use caution as it may result in sticking or malfunction.

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	

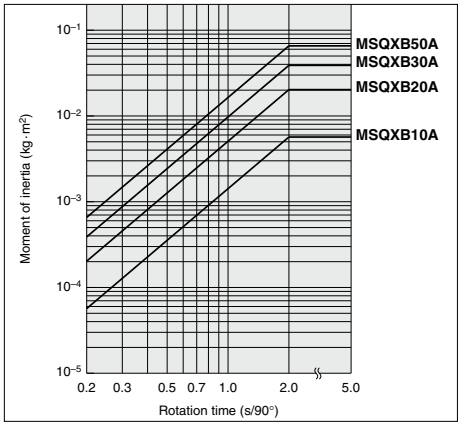
Model Selection

Select a model based on the moment of inertia and rotation time as shown graph below.

CRQ2X



MSQX

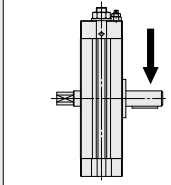


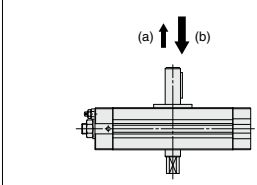
∗ If the rotation time exceeds 2 s per 90°, kinetic energy is calculated with rotation time of 2 s per 90°.

Allowable Load

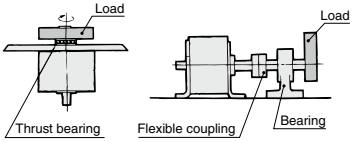
CRQ2X

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.



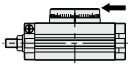


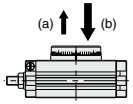
Size	Allowable radial load (N)	Allowable thrust load (N)	
		(a)	(b)
10	14.7	7.8	15.7
15	19.6	9.8	19.6
20	49	29.4	49
30	78	49	98
40	98	59	108

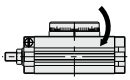


MSQX

Do not allow the load and moment applied to the table to exceed the allowable values shown in the 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)	
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 table below, and can be used to simplify the calculation.

Formulas

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

$$Q_{CP} = 2 \times a \times L \times \left(\frac{P}{0.1}\right) \times 10^{-6}$$

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

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

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

Q_{C2} = 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
CRQ2X Series
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

∗ Refer to pages 392 and 393 for the shaft type variations.

Pattern

Nil	Standard
P	Combination of Simple specials/ Made to Order

∗ Refer to pages 394 to 408 for details.

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 table below.

Made to Order specifications

∗ Refer to page 385 for details.

Applicable Auto Switches/Refer to pages 929 to 983 for detailed auto switch specification.

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)	1 (M)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Solid state auto switch	—	Grommet	Yes	3-wire (NPN)	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 indicator)			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 indicator)			3-wire (NPN)	5 V, 12 V		M9NAV∗1	M9NA∗1	○	○	●	○	○	IC circuit	
				3-wire (PNP)			M9PAV∗1	M9PA∗1	○	○	●	○	○		
				2-wire	12 V		M9BAV∗1	M9BA∗1	○	○	●	○	○	—	
Reed auto switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5 V	—	A96V	A96	●	●	●	●	○	IC circuit	—
			No	2-wire	24 V	12 V	100 V	A93V	A93	●	●	●	●	○∗2	—	Relay, PLC
							100 V or less	A90V	A90	●	●	●	●	○∗2	IC circuit	

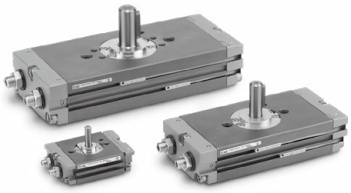
∗1 Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.
∗2 The load voltage used is 24 VDC.

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9NW
1 m ····· M (Example) M9NWM
3 m ····· L (Example) M9NWL
5 m ····· Z (Example) M9NWZ

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

∗ Auto switches marked with a "○" are produced upon receipt of orders.

∗ Refer to the **Web Catalog** for the details of auto switch with pre-wired connector.



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 381 for further information.

Symbol

Made to Order

Made to Order
(Refer to pages 394 to 408 for details.)

Symbol	Specifications/Content	Applicable shaft type
—	Shaft type variation	X,Y,Z,T,J,K
XA1 to XA24	Shaft pattern sequencing I	S,W
XA31 to XA59	Shaft pattern sequencing II	X,Y,Z,T,J,K
XC7	Reversed shaft	S,W,X,T,J
XC8 to XC11	Change of rotating range	S,W,Y X∗,Z∗,T∗, J∗,K∗
XC12 to XC15	Change of angle adjustable range (0° to 100°)"	
XC16, XC17	Change of angle adjustable range (90° to 190°)"	
XC18, XC19	Change of rotating range	
XC20, XC21	Change of angle adjustable range (90° to 190°)"	
X6	Shaft and parallel key made of stainless steel	S,W,X,Y,Z, T,J,K

∗ Among the symbols XC8 to XC21, only XC12 and XC16 are compatible with shaft types X, Z, T, J and K.

Allowable Kinetic Energy and Rotation Time Adjustment Range

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.

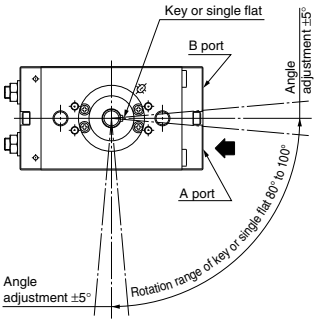
Moisture Control Tube IDK Series

When operating an actuator with a small diameter and a short stroke at a high frequency, the dew condensation (water droplet) may occur inside the piping depending on the conditions.
Simply connecting the moisture control tube to the actuator will prevent dew condensation from occurring. For details, refer to **the Web Catalog**.

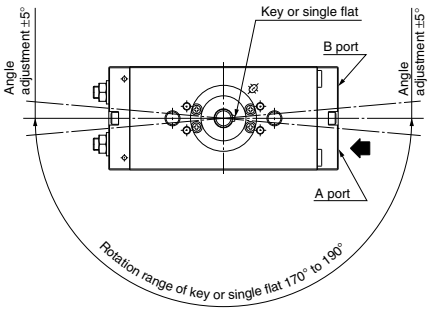
Rotation Range

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

Rotation angle: 90°

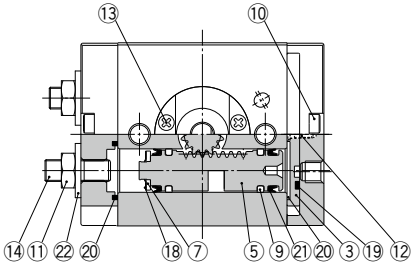


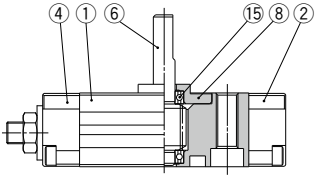
Rotation angle: 180°



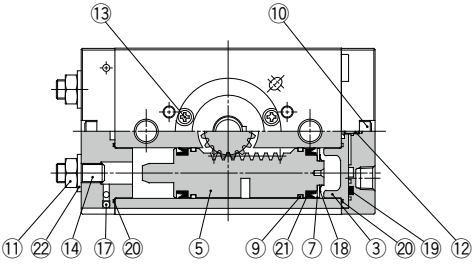
Construction

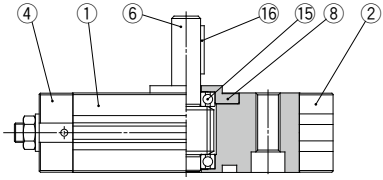
Standard
Size 10/15





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	**Size: 10, 15**	**Hexagon nut**	Steel wire
	Size: 20, 30, 40	**Small hexagon nut**	

Component Parts

No.	Description		Material
12	**Cross recessed screw No. 0**		Steel wire
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	**Type CS 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

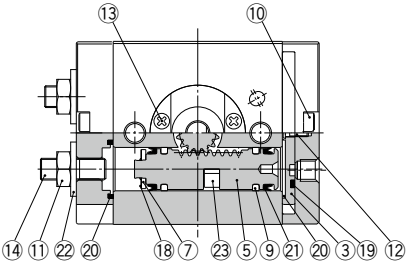
Parts included in Seal Kit

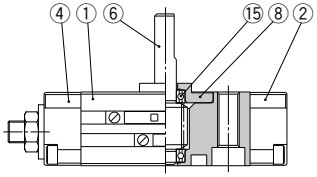
No.	Description	Qty.	Note
9	**Wear ring**	4	
19	**Seal**	1	
20	**Gasket for cover**	2	Size: 10, 15
	Gasket for end cover	1	
	Gasket	4	Size: 20, 30, 40
21	**Piston seal**	4	
22	**Seal washer**	2	

∗ A set includes all parts above.
A grease pack (10 g) is included. When only a grease pack is needed, order with the following part number.
Replacement parts/Grease pack part no: P523010-21 (10 g)

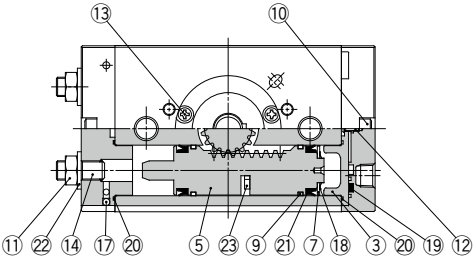
Construction

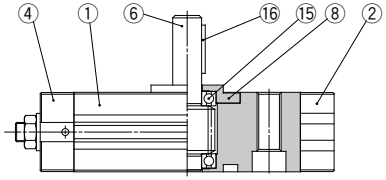
With auto switch
Size 10/15





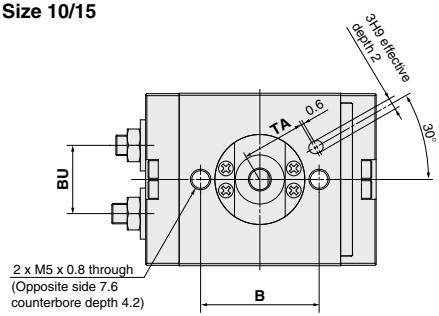
With auto switch
Size 20/30/40

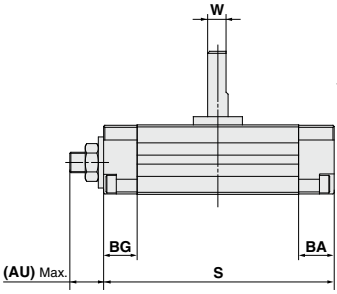


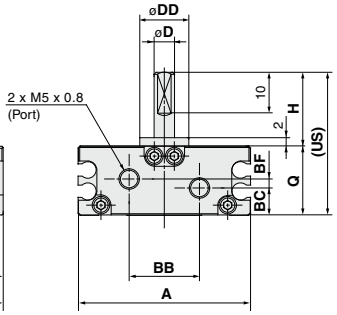


Dimensions

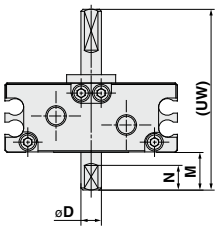
Size 10/15

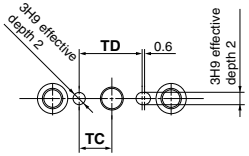






With double shaft





(mm)

Size	Rotation angle	A	AU*	B	BA	BB	BC	BF	BG	BU	D (g6)	DD (h9)	H
10	90°, 180°	42.4	(8.5)	29	8.7	17.2	6.7	2.2	8.2	16.7	5	12	18
15	90°, 180°	53.6	(9.5)	31	9.2	26.4	10.6	—	9	23.1	6	14	20

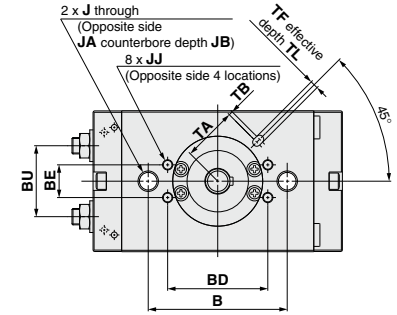
Size	Rotation angle	W	Q	S	US	UW	N	M	TA	TC	TD
10	90°	4.5	17	56.4	35	44	6	9	15.5	8	15.4
	180°			68.9							
15	90°	5.5	20	65.2	40	50	7	10	16	9	17.6
	180°			82.2							

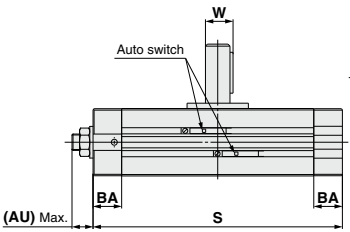
∗ The AU dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.

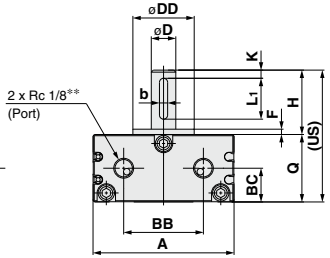
S: Upper 90°, Lower 180°

Dimensions

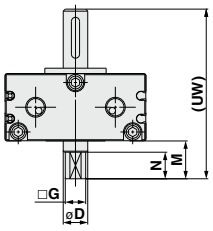
Size 20/30/40

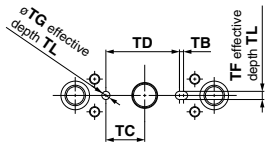






With double shaft





(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

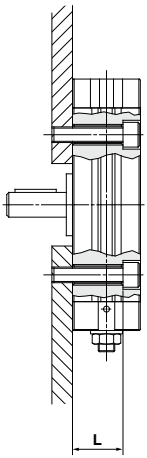
Size	Rotation angle	Q	S	W	Key dimensions b	Key dimensions L_1	US	TA	TB	TC	TD	TF (H9)	TG (H9)	TL	UW	G	M	N	L
20	90°	29	104.4	11.5	$4^{0}_{-0.03}$	20	59	24.5	1	13.5	27	4	4	2.5	74	$8^{0}_{-0.1}$	15	11	$9.6^{0}_{-0.1}$
	180°		129.5																
30	90°	33	122	13.5	$4^{0}_{-0.03}$	20	65	27	2	19	36	4	4	2.5	83	$10^{0}_{-0.1}$	18	13	$11.4^{0}_{-0.1}$
	180°		153																
40	90°	37	139.3	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 and NPTF 1/ 8 are also available.

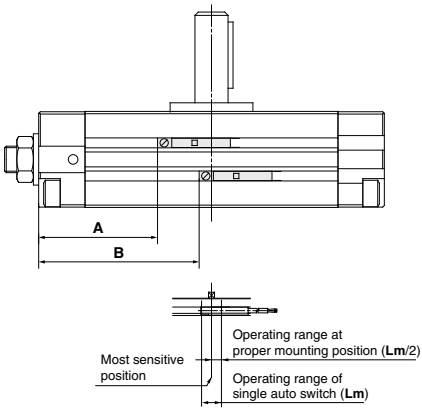
Unit Used as Flange Mount

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	Solid state switch				Reed switch			
		A	B	Operating angle (θ m)	Hysteresis angle	A	B	Operating angle (θ m)	Hysteresis angle
10	90°	19	25.5	61°	5°	15	21.5	63°	12°
	180°	22	35			18	31		
15	90°	22.5	31	47°	4°	18.5	27	52°	9°
	180°	26.5	43.5			22.5	39.5		
20	90°	40	52.5	40°	4°	36	48.5	41°	9°
	180°	46	71.5			42	67.5		
30	90°	47	63	29°	2°	43	59	32°	7°
	180°	55	86			51	82		
40	90°	54	73	24°	2°	50	69	24°	5°
	180°	63.5	101.5			59.5	97.5		

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) Since the above values are only provided as a guideline, they are not guaranteed.
In the actual setting, adjust them after confirming the auto switch operating condition.

1 Shaft Type Variation, Four Chamfers (Size 20/30/40) (Dimension parts different from the standard conform to the general tolerance.) Shaft Type: X, Z

CRQ2XB / CDRQ2XB **Shaft type** | **Size** — **Rotating angle**

Refer to "How to Order" on page 384 for further information.

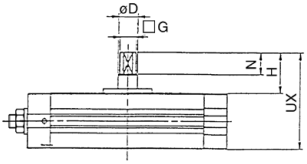
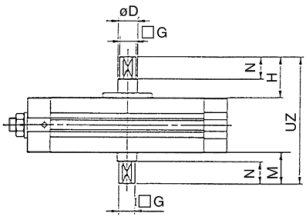
Shaft type

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	1.0 MPa
Min. operating pressure	0.1 MPa
Cushion	Not attached
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	$8^{0}_{-0.1}$	21	11	50	65	15
30	12	$10^{0}_{-0.1}$	24	13	57	75	18
40	15	$11^{0}_{-0.1}$	27	15	64	84	20

2 Shaft Type Variation, Double Shaft With Key (Size 20/30/40) (Dimension parts different from the standard conform to the general tolerance.) Shaft Type: Y

CRQ2XB / CDRQ2XB **Y** | **Size** — **Rotating angle**

Refer to "How to Order" on page 384 for further information.

Shaft type

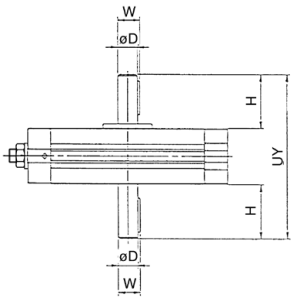
Y	Double shaft with key

Specifications

Fluid	Air (Non-lube)
Applicable shaft type	Double shaft with key (**Y**)
Applicable size	20, 30, 40
Max. operating pressure	1.0 MPa
Min. operating pressure	0.1 MPa
Cushion	Not attached
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 Keyway (Dimension parts different from the standard conform to the general tolerance.) Shaft Type: T, J, K

CRQ2XB / CDRQ2XB [Shaft type] [Size] — [Rotating angle]

● Refer to "How to Order" on page 384 for further information.

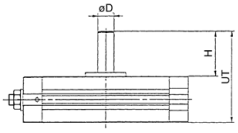
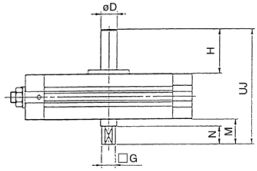
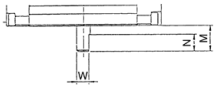
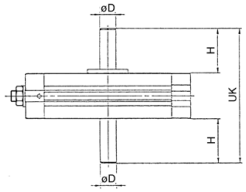
● Shaft type

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	1.0 MPa
Min. operating pressure	0.15 MPa	0.1 MPa
Cushion	Not attached	
Rotating 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
Auto switch	Mountable	

Dimensions

Shaft type	T	J	K
Form		**Size 20, 30, 40**  **Size 10, 15** 	

Size	D (g6)	G	W	H	M	N	UT	UJ	UK
10	5	—	4.5	18	9	6	35	44	53
15	6	—	5.5	20	10	7	40	50	60
20	10	$8^{0}_{-0.1}$	—	30	15	11	59	74	89
30	12	$10^{0}_{-0.1}$	—	32	18	13	65	83	97
40	15	$11^{0}_{-0.1}$	—	36	20	15	73	93	109

CRQ2X Series (Size: 10, 15, 20, 30, 40)
Simple Specials:
-XA1 to -XA24: Shaft Pattern Sequencing I

Shaft shape pattern is dealt with through the Simple Specials System.
Please contact your local sales representative for more details.

Symbol
-XA1 to XA24

Shaft Pattern Sequencing I

Applicable shaft type: S, W

How to Order

C D RQ2XB S P 20 [ ] – 90 – M9BW – X A2 A24 C12 -X6

Built-in magnet

Nil	None
D	Built-in magnet

Shaft type

S	Single shaft
W	Double shaft

Pattern

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

Auto switch

Refer to page 384 for the part no. of auto switches.

Rotating angle

90	80° to 100°
180	170° to 190°

How to order model with auto switches

Refer to page 384 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 steel spec) is available with all the types.

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

A 1	A24	C12	Chart 1, 2
A 2	A24	-X 6	Chart 1
A13	C 7	C 8	Chart 2, 5
A14	C12	-X 6	Chart 2

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

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

A 1	A 2	C 7	C 8	Chart 1, 2, 5
A 2	A24	C10	-X 6	Chart 1, 2
A14	C 7	C11	-X 6	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
XA 1	Female thread at the end	●	—	●	●	10, 15	XA 1
XA 2	Female thread at the end	—	●	●	●	20, 30, 40	● XA 2
XA 3	Tip end of male thread	●	—	●	●		— ● XA 3
XA 4	Tip end of male thread	—	●	—	●		W ∗ — W ∗ XA 4
XA 5	Stepped round shaft	●	—	●	●		— ● — ● XA 5
XA 6	Stepped round shaft	—	●	—	●		W ∗ — W ∗ — W ∗ XA 6
XA 7	Round shaft with steps and male thread	●	—	●	●	10, 15	— ● — ● — ● XA 7
XA 8	Round shaft with steps and male thread	—	●	—	●		W ∗ — W ∗ — W ∗ — W ∗ XA 8
XA 9	Change of the length of standard chamfered face	●	—	●	●		— ● — ● — ● — ● XA 9
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	●	●	●	●		— — — — — — — — ● ● — — XA13
XA14	Shaft through-hole and female thread	●	—	●	●	10, 15	— — — — — — — — ● ● — — — — XA14
XA15	Shaft through-hole and female thread	—	●	●	●	20, 30, 40	— — — — — — — — ● ● — — — — — — 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 ∗ XA18
XA19	Shortened shaft	●	●	—	●	10, 15	— — — — — — — — — — — W ∗ — — — — —
XA20	Reversed shaft	●	●	●	●	10, 15, 20, 30, 40	— — — — — — — — — — — ● — — — — — XA20
XA21	Stepped round shaft with double-sided chamfer	●	—	●	●		— ● — ● — ● — ● — ● — ● — — — — — ● ● XA21
XA22	Stepped round shaft with double-sided chamfer	—	●	—	●	10, 15	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 404.)

Symbol	Description	Applicable size	Combination XA1 to XA24
XC 7	Reversed shaft	10, 15 20, 30, 40	—
XC 8	Change of rotating range		●
XC 9			●
XC10			●
XC11	Change in angle adjustable range 0° to 100°		●
XC12			●
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			●

∗ Chart 5. Refer to page 404 for combination available between -XC□ and -XC□.

Shaft Pattern Sequencing I

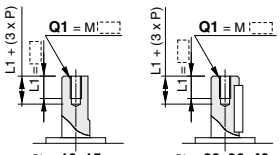
Symbol
-XA1 to XA8

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. Unless indicated otherwise, the dimensional tolerance conforms to the general tolerance. SMC will make appropriate arrangements.
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.
   M3 x 0.5, M4 x 0.7, M5 x 0.8
   M6 x 1
5. 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
• Applicable shaft types: S, W

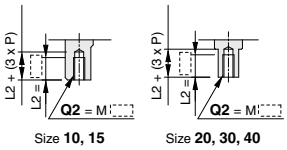


(mm)

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
• Applicable shaft types: S, W

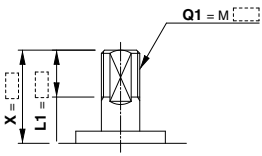


(mm)

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

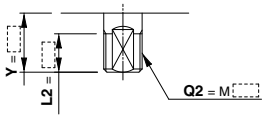


(mm)

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

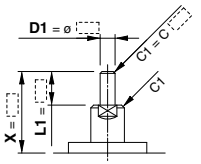


(mm)

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.

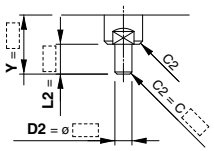


(mm)

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.

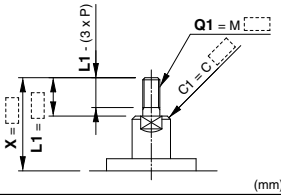


(mm)

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

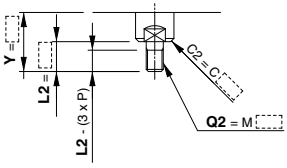


(mm)

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

Symbol
-XA9 to XA16

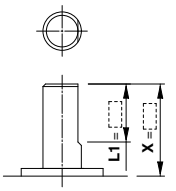
Shaft Pattern Sequencing I

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. Unless indicated otherwise, the dimensional tolerance conforms to the general tolerance. SMC will make appropriate arrangements.
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.
   M3 x 0.5, M4 x 0.7, M5 x 0.8
   M6 x 1
5. 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

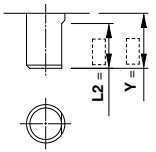


(mm)

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

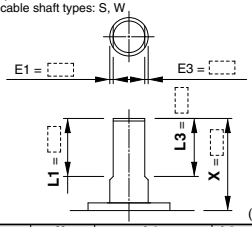


(mm)

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 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

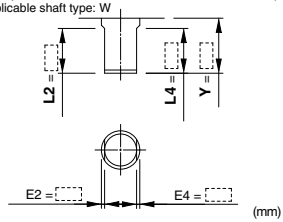


(mm)

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 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

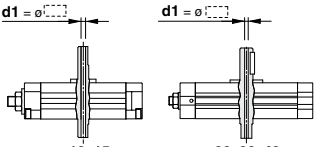


(mm)

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.
• Applicable shaft types: S, W



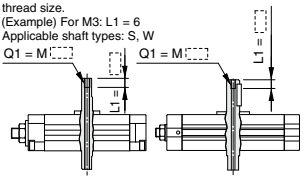
Size **10, 15** Size **20, 30, 40**

(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
• Applicable shaft types: S, W

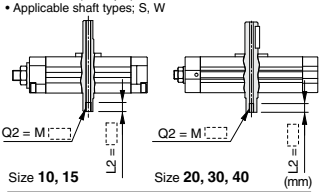


Size **10, 15** Size **20, 30, 40** (mm)

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
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
• Applicable shaft types; S, W

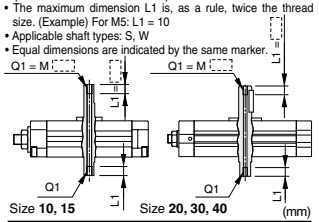


Size **10, 15** Size **20, 30, 40** (mm)

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
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
• Applicable shaft types: S, W
• Equal dimensions are indicated by the same marker.



Size **10, 15** Size **20, 30, 40** (mm)

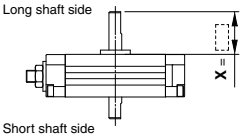
Thread \ Size	10	15	20	30	40
M3 x 0.5	ø2.5	ø2.5	ø2.5	—	—
M4 x 0.7	—	ø3.3	ø3.3	ø3.3	—
M5 x 0.8	—	—	—	ø4.2	ø4.2
M6 x 1	—	—	—	—	ø5

Shaft Pattern Sequencing I

Symbol
-XA17 to XA24

Symbol: A17

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

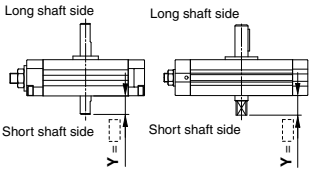


(mm)

Size	X
10	2 to 18
15	2 to 20
20	17 to 30
30	18 to 32
40	18.5 to 36

Symbol: A18

Shorten the short shaft.
• Applicable shaft type: W



Size **10, 15**

(mm)

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

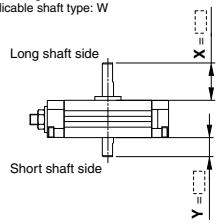
Size **20, 30, 40**

(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

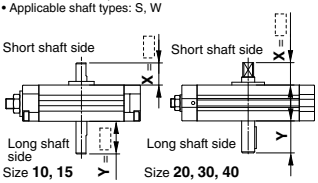


(mm)

Size	X	Y
10	2 to 18	1 to 9
15	2 to 20	1 to 10
20	17 to 30	1 to 15
30	18 to 32	1 to 18
40	18.5 to 36	1 to 20

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



Size **10, 15**

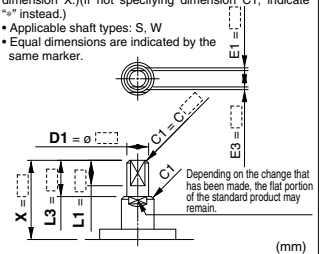
Size **20, 30, 40**

(mm)

Size	X	Y
10	2 to 10	1 to 17
15	2 to 11	1 to 19
20	2.5 to 16.5	16 to 28.5
30	3 to 20	16 to 30
40	3 to 22	16.5 to 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.

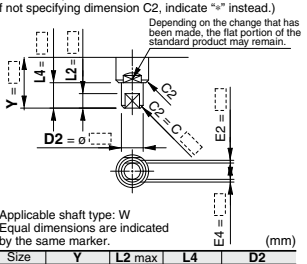


(mm)

Size	X	L1 max	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.)



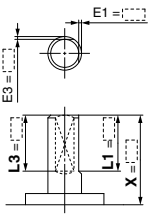
• Applicable shaft type: W
• Equal dimensions are indicated by the same marker.

(mm)

Size	Y	L2 max	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 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

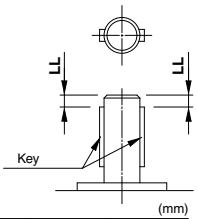


(mm)

Size	X	L1	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: 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

CRQ2X Series (Size: 10, 15, 20, 30, 40)
Simple Specials: -XA31 to -XA59: Shaft Pattern Sequencing II

Shaft shape pattern is dealt with through the Simple Specials System.
Please contact your local sales representative for more details.

Symbol

Shaft Pattern Sequencing II — -XA31 to XA59

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

How to Order

C | D | RQ2XB | T | P | 20 | | – 90 – | M9BW | – X | A34 | A37 | C12 | -X6

Built-in magnet

Nil	None
D	Built-in magnet

Shaft type

X	Single shaft with four chamfers
Y	Double shaft key
Z	Double shaft with four chamfers
T	Single round shaft
J	Double shaft
K	Double round shaft

∗ Refer to pages 392 and 393 for the shaft type variations.

Size

10
15
20
30
40

Pattern

How to order model with auto switches

Refer to page 384 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

Auto switch

Refer to page 384 for "How to Order" products with auto switches.

Rotating angle

90	80° to 100°
180	170° to 190°

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 steel spec) is available for all the types.

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

A33	A34	C12	Chart 3, 4
A34	A37	-X 6	Chart 3
A35	C 7	C12	Chart 4, 5
A40	C 8	-X 6	Chart 4, 5

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

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

A33	A34	C 7	C12	Chart 3, 4, 5
A34	A37	C12	-X 6	Chart 3, 4
A43	C 7	C11	-X 6	Chart 4, 5

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.

Symbol

Shaft Pattern Sequencing II

-XA31 to XA59

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**												
XA32	Female thread at the end	—	●	—	—	—	—	●	—		Y *	**XA32**											
XA33	Female thread at the end	●	—	●	●	●	—	—	—	10, 15,	—	—	**XA33**										
XA34	Female thread at the end	—	●	—	●	●	●	—	—	20, 30, 40	—	—	K, T *	**XA34**									
XA35	Female thread at the end	●	—	—	—	—	●	—	●	20, 30, 40	—	—	—	X *	**XA35**								
XA36	Female thread at the end	—	●	●	—	—	—	—	●		—	—	J *	—	Z *	**XA36**							
XA37	Stepped round shaft	●	—	●	●	●	—	—	—	10, 15,	—	—	—	KT *	—	J *	**XA37**						
XA38	Stepped round shaft	—	●	—	●	—	—	—	—	20, 30, 40	—	—	K *	—	—	—	K *						
XA39	Shaft through hole	●	●	—	—	—	—	●	—	20, 30, 40	—	—	—	—	—	—	—						
XA40	Shaft through hole	●	●	—	●	●	—	—	—	10, 15,	—	—	—	—	—	—	—						
XA41	Shaft through hole	●	●	●	—	—	●	—	●	20, 30, 40	—	—	—	—	—	—	—						
XA42	Shaft through hole and female thread	●	●	—	—	—	—	●	—	20, 30, 40	—	—	—	—	—	—	—						
XA43	Shaft through hole and female thread	●	●	—	●	●	—	—	—		—	—	—	—	—	—	—						
XA44	Shaft through hole and female thread	●	●	●	—	—	●	—	●	10, 15,	—	—	—	—	—	—	—	**XA38**					
XA45	Middle-cut chamfer	●	—	●	●	●	—	—	—	20, 30, 40	—	—	—	K *	—	J *	—	K *	**XA39**	**XA40**	**XA41**	**XA45**	
XA46	Middle-cut chamfer	—	●	—	●	—	—	—	—		—	—	K *	—	—	—	K *	—	—	—	—	K *	**XA46**
XA48	Change of long shaft length	●	—	—	—	—	—	●	—		—	Y *	Y *	—	—	—	—	—	Y *	—	—	—	—
XA49	Change of short shaft length	—	●	—	—	—	—	●	—	20, 30, 40	Y *	—	—	—	—	—	—	—	Y *	—	—	—	—
XA50	Change of double shaft length	●	●	—	—	—	—	●	—		—	—	—	—	—	—	—	—	Y *	—	—	—	—
XA51	Change of long shaft length	●	—	●	●	●	—	—	—		—	—	—	K, T *	—	J *	—	K *	—	K, T *	—	—	K *
XA52	Change of short shaft length	—	●	—	●	—	—	—	—	10, 15, 20, 30, 40	—	—	K *	—	—	—	K *	—	—	K *	—	K, T *	—
XA53	Change of double shaft length	●	●	—	●	—	—	—	—		—	—	—	—	—	—	—	—	—	K *	—	—	—
XA54	Change of long shaft length	●	—	—	—	—	●	—	●		—	—	—	X *	—	Z *	—	—	—	—	X, Z *	—	—
XA55	Change of short shaft length	—	●	●	—	—	—	—	●	20, 30, 40	—	—	J *	—	Z *	—	J *	—	—	—	J, Z *	—	J *
XA56	Change of double shaft length	●	●	—	—	—	—	—	●		—	—	—	—	—	—	—	—	—	—	Z *	—	—
XA57	Change of double shaft length	●	●	●	—	—	—	—	—	10, 15,	—	—	—	—	—	—	—	—	—	—	J *	—	—
XA58	Reversed shaft, Change of double shaft length	●	●	●	—	●	—	—	—	20, 30, 40	—	—	—	—	—	—	—	—	—	T *	J *	—	—
XA59	Reversed shaft, Change of double shaft length	●	●	—	—	—	●	—	—	20, 30, 40	—	—	—	—	—	—	—	—	—	—	X *	—	—

＊ Corresponding shafts type available for combination

Combination Chart of Made to Order

Chart 4. Combination between -XA□ and -XC□ (Made to Order/Details of -XC□, refer to page 404.)

Symbol	Description	Applicable size	Combination
			XA31 to XA59
XC 7	Reversed shaft	10, 15, 20, 30, 40	—
XC 8	Change of rotating range		●
XC 9			●
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			●

＊ Chart 5. Refer to page 404 for combination available between -XC□ and -XC□.

Symbol

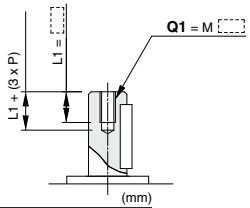
Shaft Pattern Sequencing II — -XA31 to XA38

Additional Reminders

1. Enter the dimensions within a range that allows for additional machining.
2. Unless indicated otherwise, the dimensional tolerance conforms to the general tolerance. SMC will make appropriate arrangements.
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.
   M3 x 0.5, M4 x 0.7, M5 x 0.8
   M6 x 1
5. Enter the desired figures in the ☐☐☐ portion of the diagram.
6. XA31 to XA59 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
- Applicable shaft type: Y

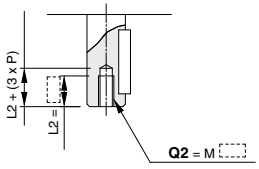


(mm)

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
- Applicable shaft type: Y

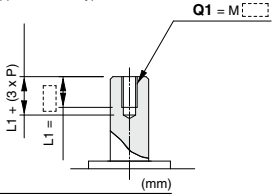


(mm)

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
- Applicable shaft types: J, K, T

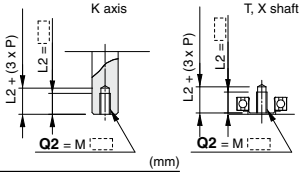


(mm)

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
- Applicable shaft types: K, T, X

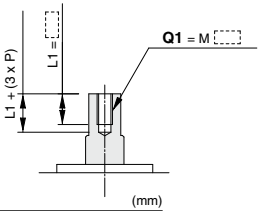


(mm)

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
- Applicable shaft types: X, Z

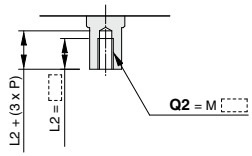


(mm)

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
- Applicable shaft types: J, Z

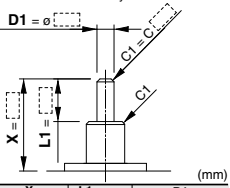


(mm)

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.

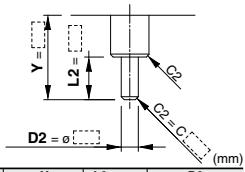


(mm)

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)

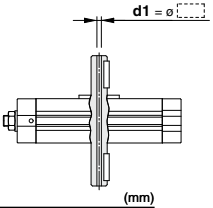
Size	Y	L2 max	D2
10	1 to 18	Y	ø3.5 to ø4.9
15	1 to 20	Y	ø3.5 to ø5.9
20	1 to 30	Y	ø5 to ø9.9
30	1 to 32	Y	ø5 to ø11.9
40	1 to 36	Y	ø5 to ø14.9

Shaft Pattern Sequencing II

Symbol
-XA39 to XA48

Symbol: A39

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

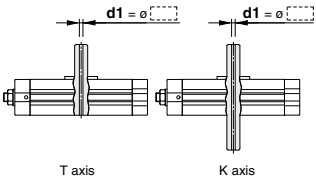


(mm)

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.
• Applicable shaft types: K, T

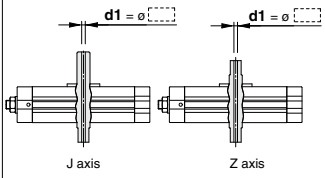


(mm)

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.
• Applicable shaft types: J, X, Z

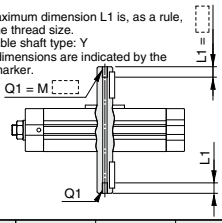


(mm)

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.

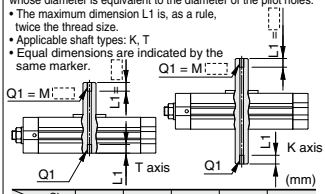


(mm)

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.

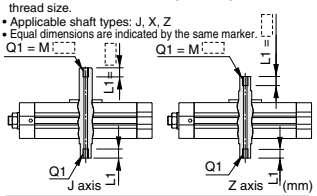


(mm)

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 x 1.25	—	—	—	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.

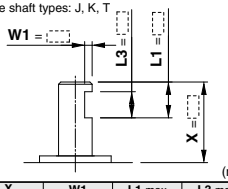


(mm)

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 keyway portion.)
• Applicable shaft types: J, K, T

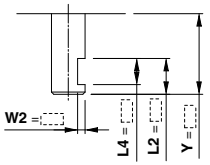


(mm)

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 keyway portion.)
• Applicable shaft type: K

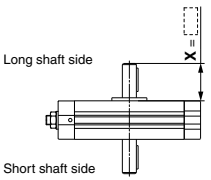


(mm)

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

Symbol: A48

Shorten the long shaft.
• Applicable shaft type: Y



Size **20, 30, 40**

(mm)

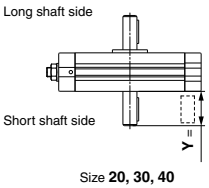
Size	X
20	17 to 30
30	18 to 32
40	18.5 to 36

Shaft Pattern Sequencing II

Symbol
-XA49 to XA57

Symbol: A49

Shorten the short shaft.
• Applicable shaft type: Y



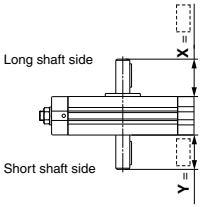
Size **20, 30, 40**

(mm)

Size	Y
20	17 to 30
30	18 to 32
40	18.5 to 36

Symbol: A50

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



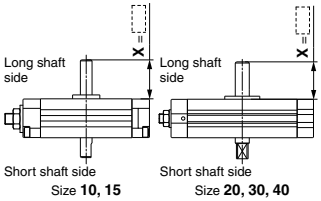
Size **20, 30, 40**

(mm)

Size	X	Y
20	17 to 30	17 to 30
30	18 to 32	18 to 32
40	18.5 to 36	18.5 to 36

Symbol: A51

Shorten the long shaft.
• Applicable shaft types: J, K, T



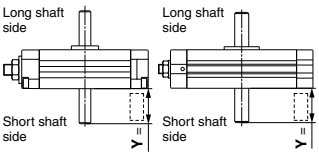
Size **10, 15** Size **20, 30, 40**

(mm)

Size	X
10	3 to 18
15	3 to 20
20	3.5 to 30
30	4 to 32
40	4 to 36

Symbol: A52

Shorten the short shaft.
• Applicable shaft type: K



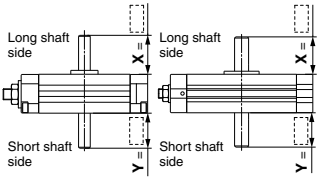
Size **10, 15** Size **20, 30, 40**

(mm)

Size	Y
10	1 to 18
15	1 to 20
20	1 to 30
30	1 to 32
40	1 to 36

Symbol: A53

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



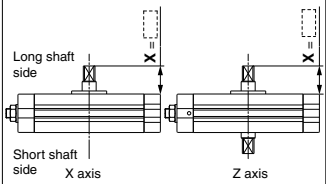
Size **10, 15** Size **20, 30, 40**

(mm)

Size	X	Y
10	3 to 18	1 to 18
15	3 to 20	1 to 20
20	3.5 to 30	1 to 30
30	4 to 32	1 to 32
40	4 to 36	1 to 36

Symbol: A54

Shorten the long shaft.
• Applicable shaft types: X, Z

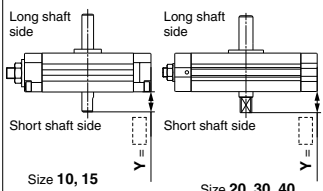


(mm)

Size	X
20	3.5 to 21
30	4 to 24
40	4 to 27

Symbol: A55

Shorten the short shaft.
• Applicable shaft type: J, Z



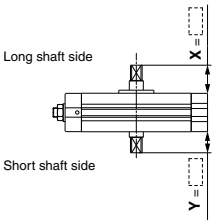
Size **10, 15** Size **20, 30, 40**

(mm)

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

Symbol: A56

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



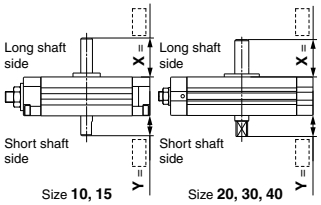
Size **20, 30, 40**

(mm)

Size	X	Y
20	3.5 to 21	1 to 15
30	4 to 24	1 to 18
40	4 to 27	1 to 20

Symbol: A57

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



Size **10, 15** Size **20, 30, 40**

(mm)

Size	X	Y
10	3 to 18	1 to 9
15	3 to 20	1 to 10
20	3.5 to 30	1 to 15
30	4 to 32	1 to 18
40	4 to 36	1 to 20

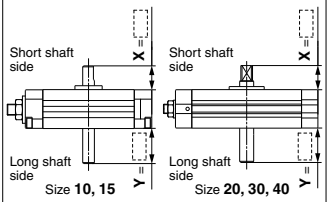
Symbol

Shaft Pattern Sequencing II

-XA58 to XA59

Symbol: **A58**

The rotation axis is reversed, and then shorten the long and short shafts.
• Applicable shaft type: J, T

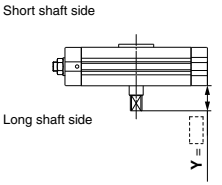


(mm)

Size	X	Y
10	3 to 10	1 to 17
15	3 to 11	1 to 19
20	3.5 to 16.5	1 to 28.5
30	4 to 20	1 to 30
40	4 to 22	1 to 34

Symbol: **A59**

The rotation axis is reversed, and then shorten the long shaft.
• Applicable shaft type: X



(mm)

Size	Y
20	1 to 19.5
30	1 to 22
40	1 to 25

CRQ2X Series
Made to Order Specifications 1

Please contact SMC for detailed dimensions, specifications and lead times.

Made to Order

How to Order

C | D | RQ2XB | S | P | 20 | | – | 90 | – | M9BW | – X | A1 | C7 | C12 | -X6

Built-in magnet

Nil	None
D	Built-in magnet

Shaft type

Standard	S	Single shaft
	W	Double shaft
Shaft type variation	X	Single shaft with four chamfers
	Y	Double shaft key
	Z	Double shaft with four chamfers
	T	Single round shaft
	J	Double shaft
	K	Double round shaft

Size

10
15
20
30
40

Pattern

Auto switch

Refer to page 384 for the part no. of auto switches.

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 384 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 2, 4 and 5.
- ∗ Combination of XA is possible for up to 2 types.
- ∗ Combination of -X6 (shaft, parallel key stainless steel spec.) is available for all the types.

• Combination 3 Types

C7 | C12 | -X6 → Chart 5

• Combination of Applicable Chart

Chart 5

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

• Combination 4 Types

A1 | C7 | C12 | -X6 → Chart 2, 5

• Combination of Applicable Chart

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 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	XC 7
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	●
XC19			
XC20	Change in angle adjustable range 90° to 190°		●
XC21			

1 Reversed Shaft

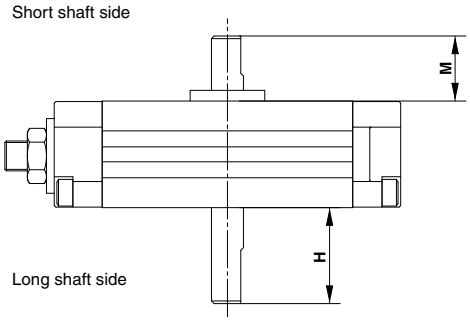
Symbol **-XC7**

CRQ2XB
CDRQ2XB **Refer to "How to Order" on page 384.** — **XC7**

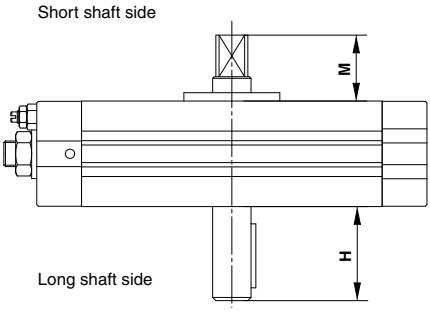
Reversed shaft

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	28.5 (19.5)*
30	20	30 (22)*
40	22	34 (25)*

∗ For X shaft

CRQ2X Series
Made to Order Specifications 2

Please contact SMC for detailed dimensions, specifications and lead times.

Made to Order

2 Change of Rotating Range

Symbol
-XC8 to XC11, XC18/XC19

CRQ2XB
CDRQ2XB **Refer to "How to Order" on page 384.** **—X C8**

Symbol
-XC8 to XC11, XC18/XC19

Specifications

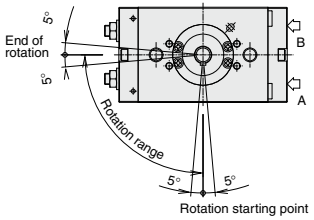
Applicable shaft type	S, W, Y

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

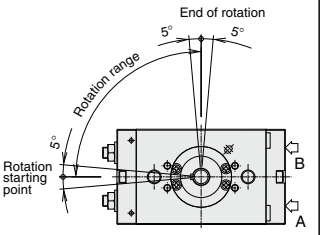
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 90° ±10°.
The rotation starting point is on the perpendicular line (down).



The figure shows the view from the long shaft end.

Symbol: C9

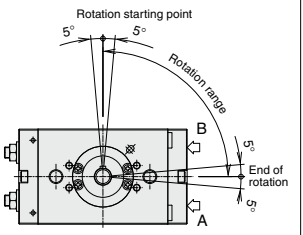
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 90° ±10°.
The rotation starting point is on the horizontal line (left).



The figure shows the view from the long shaft end.

Symbol: C10

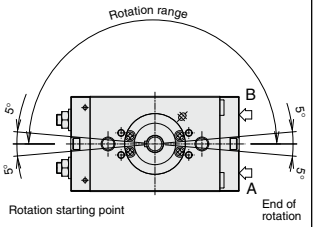
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 90° ±10°.
The rotation starting point is on the perpendicular line (up).



The figure shows the view from the long shaft end.

Symbol: C11

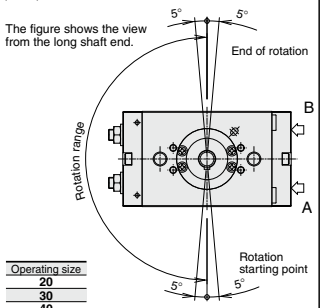
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 180° ±10°.
The rotation starting point is on the horizontal line (left).



The figure shows the view from the long shaft end.

Symbol: C18

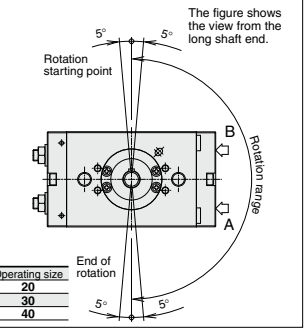
Angle adjustment at the rotation starting point and the end point are at ±5°.
Rotating range is changed. Rotation angle is at 180° ±10°.
The rotation starting point is on the perpendicular line (down).



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

SMC

3 Change of Angle Adjustable Range (0° to 100°, 90° to 190°)

Symbol
-XC12 to XC17, XC20/XC21

CRQ2XB / CDRQ2XB — Refer to "How to Order" on page 384. — X **C12**

Symbol
-XC12 to XC17, XC20/XC21

Specifications

Applicable shaft type	S, W, Y, X*, Z*, T*, J*, K*

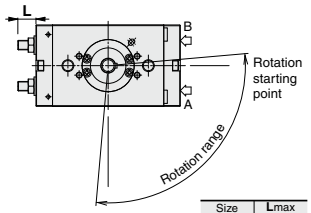
Additional Reminders

The rotation starting point is the position of the flat and the key groove when the actuator is pressurized through connection port B.

* Only XC12 and XC16 are compatible with shaft types X, Z, T, J and K.

Symbol: C12

The rotation angle can be adjusted between 0° and 100°.

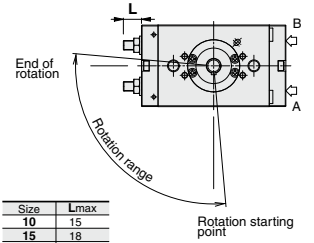


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C13

The rotation angle can be adjusted between 0° and 100°.

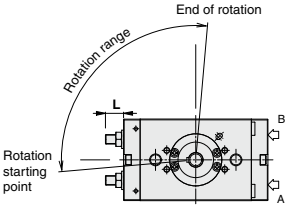


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C14

The rotation angle can be adjusted between 0° and 100°.

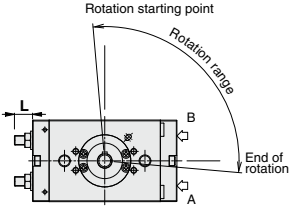


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C15

The rotation angle can be adjusted between 0° and 100°.

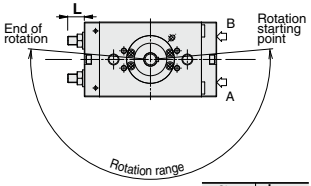


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C16

The rotation angle can be adjusted between 90° and 190°.

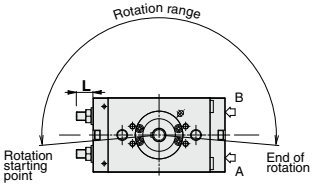


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C17

The rotation angle can be adjusted between 90° and 190°.

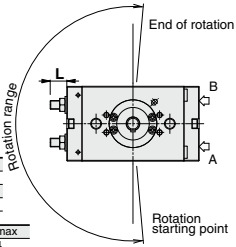


Size	Lmax
10	15
15	18
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Symbol: C20

The rotation angle can be adjusted between 90° and 190°.



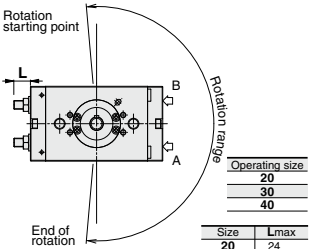
Operating size
20
30
40

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° and 190°.



Operating size
20
30
40

Size	Lmax
20	24
30	27
40	31.5

The figure shows the view from the long shaft end.

Made to Order

Symbol
-X6

4 Shaft, Parallel Key Made of Stainless Steel Spec.

C RQ2XB
CDRQ2XB [Shaft type] [Size] – [Rotation] S-X6

- Shaft type: Refer to "How to Order" on page 384 for further information.
- Size
- Rotation
- S-X6: 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	S, W, X, Y, Z, T, J, K
Applicable size	20, 30, 40
Max. operating pressure	1.0 MPa
Min. operating pressure	0.1 MPa
Cushion	Not attached
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

Low-Speed Rotary Table
Rack & Pinion Type
MSQX Series
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

Nil	Standard
X	Made to Order

Auto switch

Nil	Without auto switch (Built-in magnet)

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

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	n pcs.

Made to Order
Refer to page 410 for details.

Applicable Auto Switches/Refer to pages 929 to 983 for detailed auto switch specification.

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)	1 (M)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Solid state auto 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 indicator)			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 indicator)			3-wire (NPN)		5 V, 12 V		M9NAV∗1	M9NA∗1	○	○	●	○	○	IC circuit	
				3-wire (PNP)				M9PAV∗1	M9PA∗1	○	○	●	○	○		
				2-wire		12 V		M9BAV∗1	M9BA∗1	○	○	●	○	○	—	
Reed auto switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5 V	—	A96V	A96	●	●	●	●	○	IC circuit	—
			No	2-wire	24 V	12 V	100 V	A93V	A93	●	●	●	●	○∗2	—	Relay, PLC
							100 V or less	A90V	A90	●	●	●	●	○∗2	IC circuit	

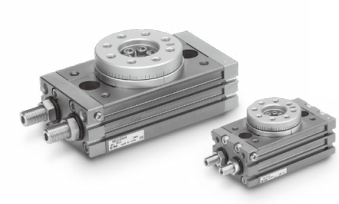
∗1 Although it is possible to mount water resistant type auto switches, note that the rotary actuator itself is not of water resistant construction.
∗2 The load voltage used is 24 VDC.

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9NW
1 m ····· M (Example) M9NWM
3 m ····· L (Example) M9NWL
5 m ····· Z (Example) M9NWZ

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

∗ Auto switches marked with a "○" are produced upon receipt of orders.

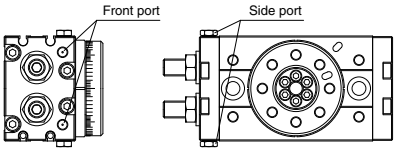
∗ Refer to the **Web Catalog** for the details of auto switch with pre-wired connector.



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 381 for further information.



Symbol

Made to Order

Made to Order
Refer to page 416 for details.

Symbol	Specifications/Content
-X15□	With external stopper

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

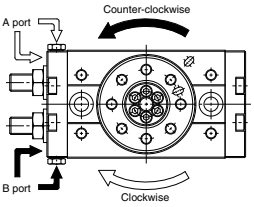
(g)

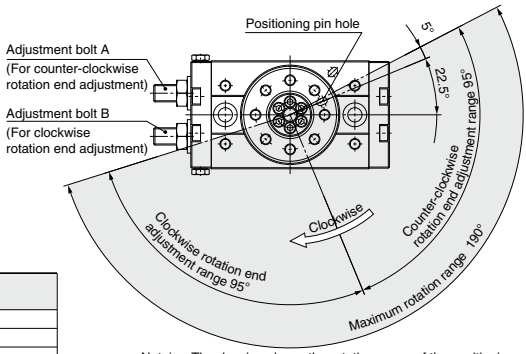
Size	10	20	30	50
Basic	500	940	1230	1990

∗ 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.





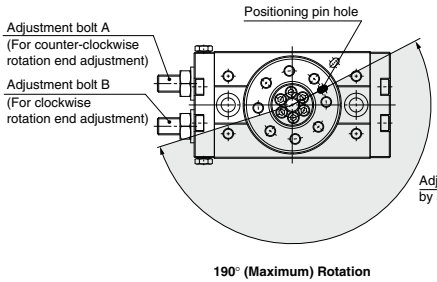
With Adjustment Bolt

Size	Adjustment angle per rotation of angle adjustment screw
10	10.2°
20	7.2°
30	6.5°
50	8.2°

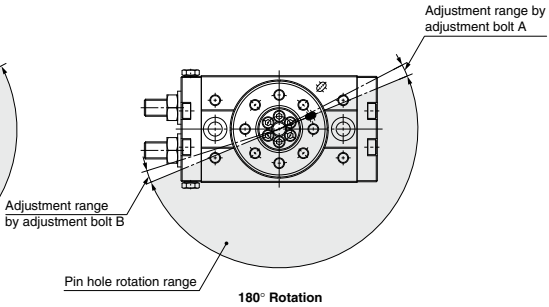
Note) • The drawing shows the rotation range of the positioning pin hole.
• The pin hole position in the drawing shows the counter-clockwise rotation end when the adjustment bolts A and B are tightened equally and the rotation is adjusted 180°.

Rotation Angle Range Example

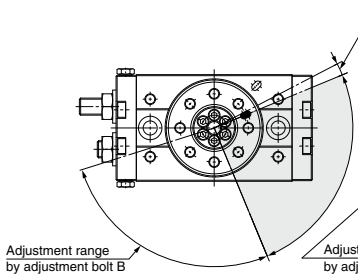
• Various rotation ranges are possible as shown in the drawings below using adjustment bolts A and B.
(The drawings also show the rotation ranges of the positioning pin hole.)



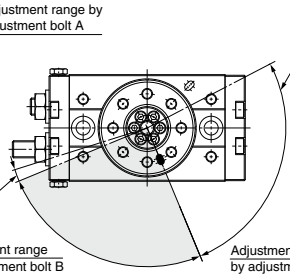
190° (Maximum) Rotation



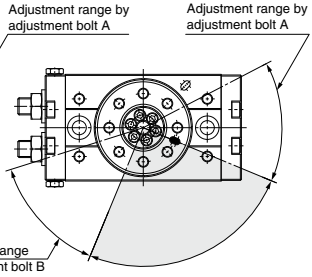
180° Rotation



90° Rotation



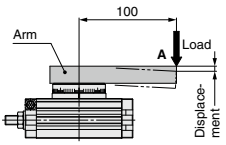
90° Rotation



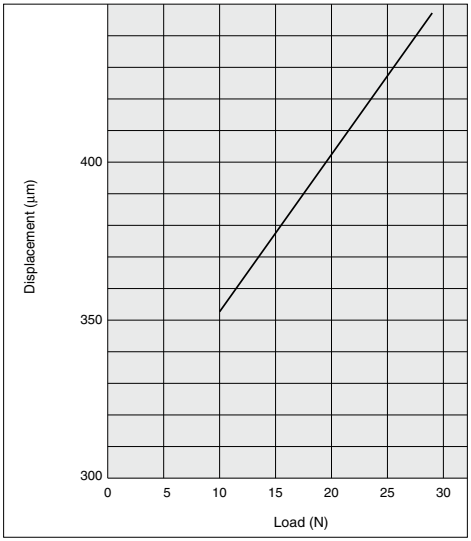
90° Rotation

Table Displacement (Reference values)

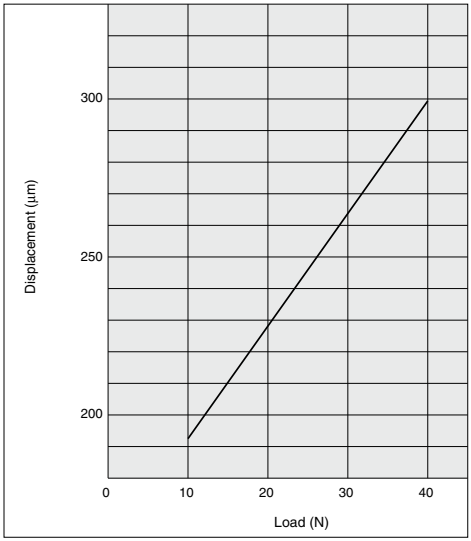
• The following graphs show the displacement at point A, which is 100 mm apart from the center of rotation, where the load is applied.



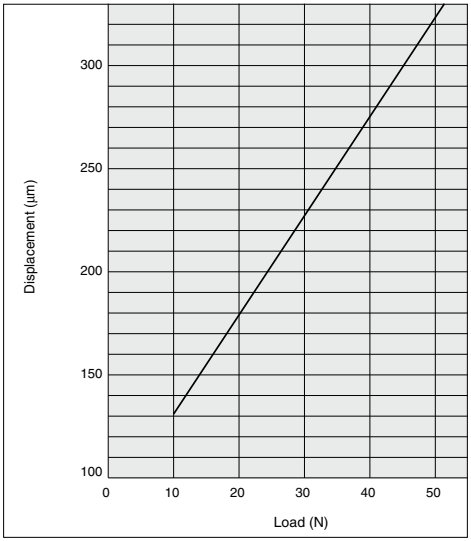
MSQXB10A



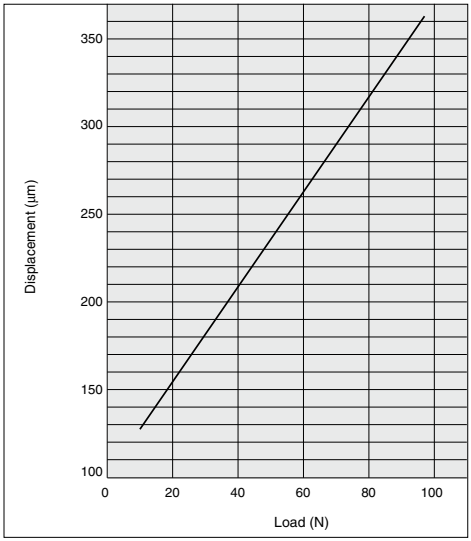
MSQXB20A



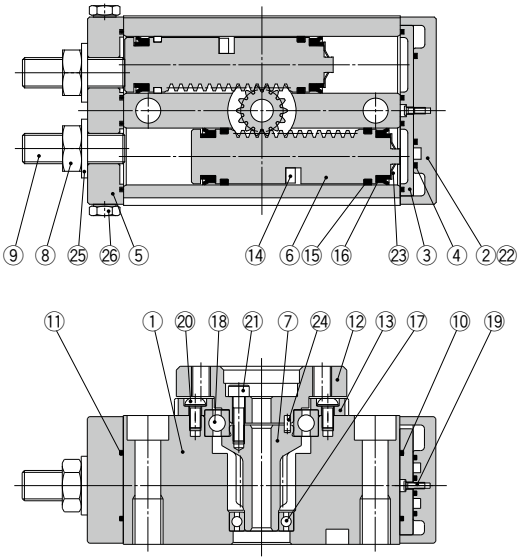
MSQXB30A



MSQXB50A



Construction



Component Parts

No.	Description	Material
1	**Body**	Aluminum alloy
2	**Cover**	Aluminum alloy
3	**Plate**	Aluminum alloy
4	**Seal**	NBR
5	**End cover**	Aluminum alloy
6	**Piston**	Stainless steel
7	**Pinion**	Chrome molybdenum steel
8	**Hexagon small nut**	Steel wire
9	**Adjustment bolt**	Chrome molybdenum steel
10	**Gasket**	NBR
11	**Gasket**	NBR
12	**Table**	Aluminum alloy
13	**Bearing retainer**	Aluminum alloy
14	**Magnet**	—

∗ Individual part cannot be shipped.

Component Parts

No.	Description		Material
15	**Wear ring**		Resin
16	**Piston seal**		NBR
17	**Bearing**		Bearing steel
18	**Bearing**		Bearing steel
19	**Cross recessed screw No. 0**		Steel wire
20	**Cross recessed screw**	**Size: 10**	Stainless steel
	Hexagon this socket head bolt	**Size: 20 to 50**	Chrome molybdenum steel
21	**Hexagon socket head cap screw**		Stainless steel
22	**Hexagon socket head cap screw**		Stainless steel
23	**Push nut**		Stainless steel
24	**Parallel pin**		Carbon steel
25	**Seal washer**		NBR
26	**Plug**		Steel wire

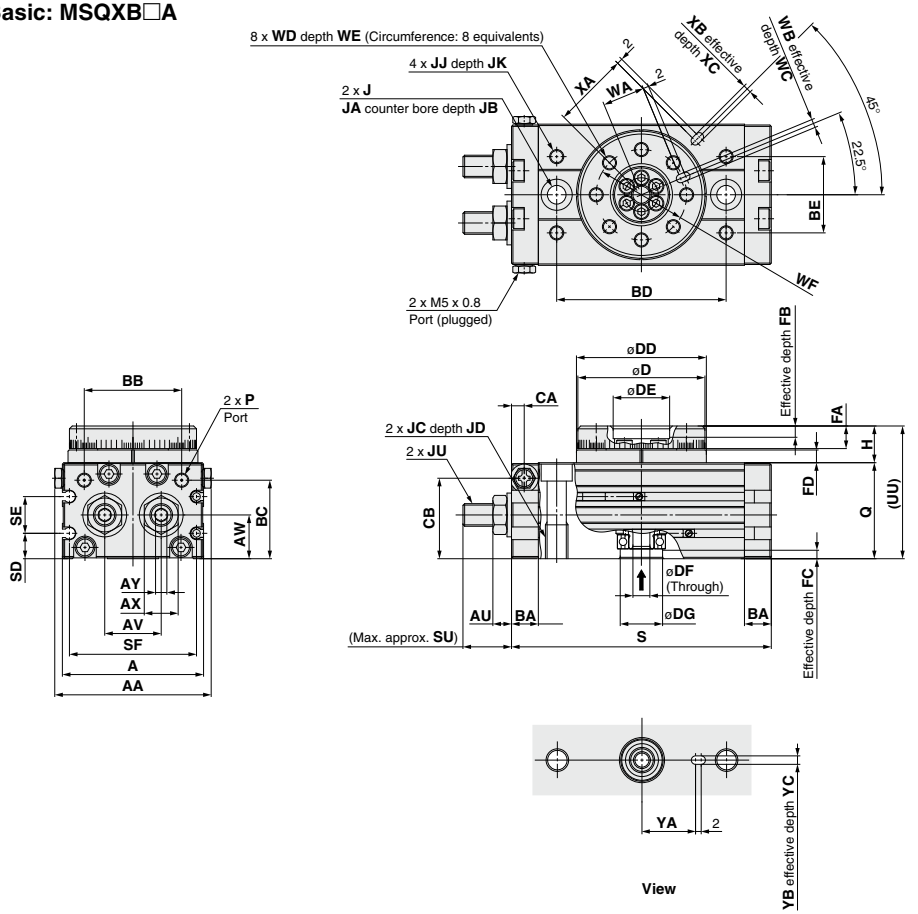
Replacement Parts

Description	Part no.											
	10			**20**			**30**			**50**		
Seal kit	P523010-20			P523020-20			P523030-20			P523040-20		
	No.	Description	Qty.	No.	Description	Qty.	No.	Description	Qty.	No.	Description	Qty.
Parts included in seal kit	**4**	**Seal**	1	**4**	**Seal**	1	**4**	**Seal**	1	**4**	**Seal**	1
	10	**Gasket**	1	**10**	**Gasket**	1	**10**	**Gasket**	1	**10**	**Gasket**	1
	11	**Gasket**	1	**11**	**Gasket**	1	**11**	**Gasket**	1	**11**	**Gasket**	1
	15	**Wear ring**	4	**15**	**Wear ring**	4	**15**	**Wear ring**	4	**15**	**Wear ring**	4
	16	**Piston seal**	4	**16**	**Piston seal**	4	**16**	**Piston seal**	4	**16**	**Piston seal**	4
	25	**Seal washer**	2	**25**	**Seal washer**	2	**25**	**Seal washer**	2	**25**	**Seal washer**	2

∗ A set includes all parts above.
A grease pack (10 g) is included. When only a grease pack is needed, order with the following part number.
Replacement parts/Grease pack part no: P523010-21 (10 g)

Dimensions

Basic: MSQXB□A



(mm)

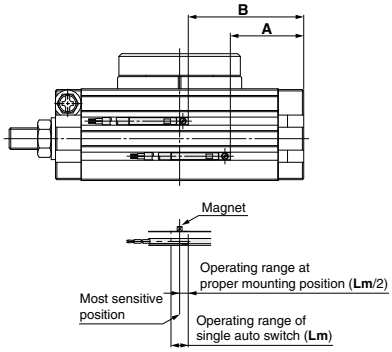
Size	AA	A	AU	AV	AW	AX	AY	BA	BB	BC	BD	BE	CA	CB	D	DD	DE	DF	DG	FA	FB	FC	FD	H	J	JA	JB
10	55.4	50	6.6	20	15.5	12	4	9.5	34.5	27.8	60	27	4.5	28.5	45h9	46h9	20H9	6	15H9	8	4	3	4.5	13	6.8	11	6.5
20	70.8	65	7.6	27.5	16	14	5	12	46	30	76	34	6	30.5	60h9	61h9	28H9	9	17H9	10	6	2.5	6.5	17	8.6	14	8.5
30	75.4	70	7.6	29	18.5	14	5	12	50	32	84	37	6.5	33.5	65h9	67h9	32H9	12	22H9	10	4.5	3	6.5	17	8.6	14	8.5
50	85.4	80	10	38	22	19	6	15.5	63	37.5	100	50	10	37.5	75h9	77h9	35H9	13	26H9	12	5	3	7.5	20	10.5	18	10.5

(mm)

Size	JC	JD	JJ	JK	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	7	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	8	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	8	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	8	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 and 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°	27	45	90°	10°	31	49	42°	10°
20	190°	35	62	80°	10°	39	66	35°	10°
30	190°	39	68	65°	10°	43	72	30°	10°
50	190°	49	83	50°	10°	53	87	24°	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) Since the above values are only provided as a guideline, they are not guaranteed.
In the actual setting, adjust them after confirming the auto switch operating condition.

MSQX Series
Made to Order Specifications:

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 – M9BW – 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	

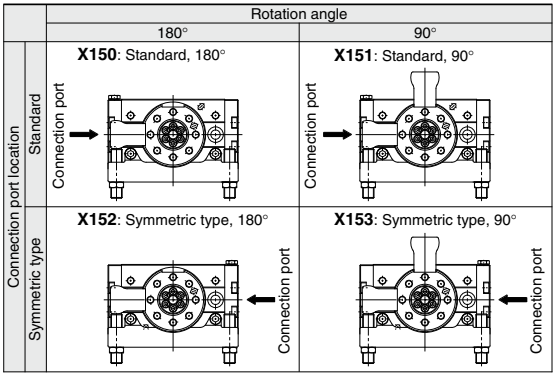
Auto switch

Nil	Without auto switch (Built-in magnet)

∗ Refer to page 409 for the part no. of auto switches.

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 $^{+5°}_{-5°}$			

∗ Specifications other than the above are the same as standard.

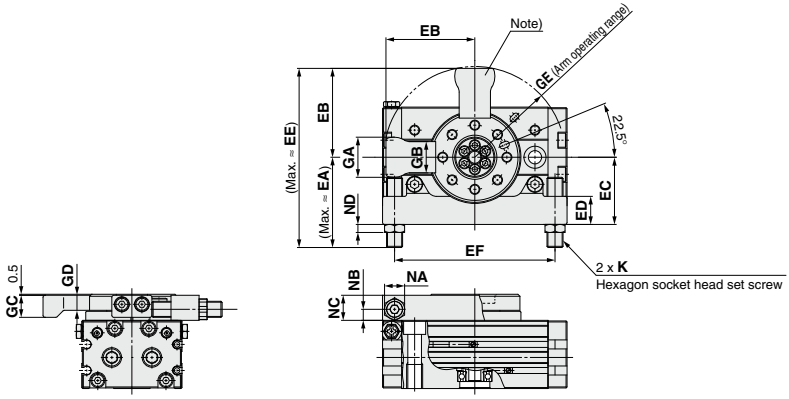
Weight

(g)

Size	10	20	30	50
90° spec.	600	1150	1460	2390
180° spec.	570	1090	1390	2280

∗ 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.

SMC

CRQ2X/MSQX Series
Specific Product Precautions

Be sure to read this before handling the products.
For safety instructions as well as rotary actuator and auto switch precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" of each product on the SMC website: https://www.smcworld.com

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.)**