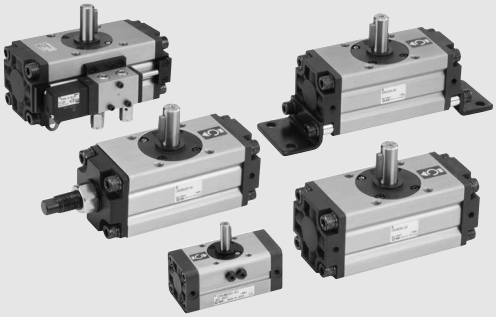
Models with cushion or with solenoid valve available.
(Only sizes 50 or larger are available.)

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

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



Series Variations

				Fluid	Air	Hydraulic oil	Page
				Size	30 50 63 80 100	50 63 80 100	
Standard	Rotating angle		90°		● ● ● ● ●	● ● ● ●	P.218 to P.246
			100°		● ● ● ● ●	● ● ● ●	
			180°		● ● ● ● ●	● ● ● ●	
			190°		● ● ● ● ●	● ● ● ●	
	Shaft type		Single shaft	S	● ● ● ● ●	● ● ● ●	
			Double shaft	W	● ● ● ● ●	● ● ● ●	
			Single shaft with four chamfers	X	● ● ● ● ●	● ● ● ●	
			Double shaft key	Y	● ● ● ● ●	● ● ● ●	
			Double shaft with four chamfers	Z	● ● ● ● ●	● ● ● ●	
	Cushion		None		● ● ● ● ●	● ● ● ●	
			Air cushion		● ● ● ● ●	● ● ● ●	
	Variations		With auto switch		● ● ● ● ●	● ● ● ●	
			Angle adjustable type		● ● ● ● ●		
			With solenoid valve		● ● ● ● ●		
			Clean series	11-	● ●		
			Copper-free and fluorine-free (Standard)	20-*	● ● ● ● ●		
			With One-touch fittings		● ● ● ● ●		
			Flange	F	● ● ● ● ●	● ● ● ●	
Option	Mounting bracket		Foot	L	● ● ● ● ●	● ● ● ●	
Made to Order	Shaft type		Single shaft	S	●		P.221 to P.223
			Single shaft with four chamfers	X	●		
			Double shaft key	Y	●		
			Double shaft with four chamfers	Z	●		
			Single round shaft	T	● ● ● ● ●	● ● ● ●	
			Double shaft (Round, With four chamfers)	J	● ● ● ● ●	● ● ● ●	
			Double round shaft	K	● ● ● ● ●	● ● ● ●	
	Pattern		Shaft end form		● ● ● ● ●	● ● ● ●	P.248 to P.268
			End of rotation		● ● ● ● ●	● ● ● ●	
			Port location		● ● ● ● ●	● ● ● ●	
	Shaft, Bolt, Parallel key stainless steel spec.			-X6	● ● ● ● ●	● ● ● ●	
	Operating temp.	Heat resistance 100°C		-X7	● ● ● ● ●	● ● ● ●	
	Both sides angle adjustable			-X10	● ● ● ● ●	● ● ● ●	
	One side angle adjustable, One side with cushion			-X11	● ● ● ● ●	● ● ● ●	
	Fluororubber seal			-X16	● ● ● ● ●	● ● ● ●	

∗ For details, refer to the SMC website.

Rotary Actuator

Series CRA1

Rack & Pinion Style/Size: 30, 50, 63, 80, 100

Series CRA1 rack & pinion style ø 50 to ø 100 products have been remodeled for a lightweight design. Please refer to **page 194** for details.

How to Order

Size 30

CRA1 **B** **W** □ **30** – **90** ——— □

Size 50 to 100

CRA1 **B** **S** □ □ **50** – **90** □ – □

Mounting style

B	Basic style
L	Foot style

Rod end shape
Double shaft
Refer to pages 221 and 223 for the rod-end shape variations.

Rotating angle

90	90°
180	180°

Mounting style

B	Basic style
L *	Foot style
F	Flange style

* For part numbers, refer to the tables below.

Shaft type

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

* Refer to page 222 for the rod-end shape variations.

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Nil	Standard
P	Combination of Simple specials/Made to Order

* Refer to pages 248 to 268 for details.

Size

50
63
80
100

Rotating angle

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

Air cushion

Nil	None
C *	With air cushion

* For pneumatic type only.

Made to Order or port type
Refer to page 220 for Made to Order.

Nil	Rc
XF *	G
XN *	NPT

* These cannot be combined with Made to Order.
* Except the air-hydro type.
* Except size 30.

Foot Bracket Part No.

Size	Foot bracket	Description	Mounting screws included in foot bracket
30	CRA1L30-Y-1		M5 x 0.8 x 25
50	CRA1L50-Y-1	Foot bracket : 2 pcs.	M8 x 1.25 x 35
63	CRA1L63-Y-1	Mounting thread: 4 pcs.	M10 x 1.5 x 40
80	CRA1L80-Y-1	Collar * : 4 pcs.	M12 x 1.75 x 50
100	CRA1L100-Y-1		M12 x 1.75 x 50

* Size 30 does not include collars.

Rotary Actuator with Auto Switch

Series CDRA1

Rack & Pinion Style/Size: 30, 50, 63, 80, 100

Series CDRA1 rack & pinion style ø 50 to ø100 products have been remodeled to support the compact auto switch D-M9□ model. Please refer to **page 194** for details.

How to Order

Mounting style

B	Basic style
L	Foot style

Shape type
Double shaft
Refer to pages 221 and 223 for the rod-end shape variations.

Rotating angle

90	90°
180	180°

Size 30

C D RA1 B W ☐ 30 – 90 —— J79W ☐ – ☐

Size 50 to 100

C D RA1 B S ☐ ☐ 50 – 90 ☐ – J59W ☐ – ☐

Built-in magnet

Mounting style

B	Basic style
L *	Foot style
F	Flange style

* For part numbers of foot bracket, refer to page 218.

Shaft type

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

* Refer to page 222 for the rod-end shape variations.

Type

Nil	Pneumatic
H	Air-hydro

Size

50
63
80
100

Rotating angle

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

Pattern

Nil	Standard
P	Combination of Simple specials/Made to Order

* Refer to pages 248 to 268 for details.

Number of auto switches

S	1 pc.
Nil	2 pcs.

Note) Maximum number of auto switches mountable is two.

Auto switch

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

Air cushion

Nil	None
C *	With air cushion

* For pneumatic type only.

Made to Order or port type

Refer to page 220 for Made to Order.

Nil	Rc
XF *	G
XN *	NPT

* These cannot be combined with Made to Order.
* Except the air-hydro type.
* Except size 30.

Applicable Auto Switches/Refer to pages 807 to 856 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC	Load voltage AC	Auto switch model Size 30 Perpendicular	Auto switch model Size 30 In-line	Auto switch model Size 50 to 100 In-line	Lead wire * length (m) 0.5 (Nil)	3 (L)	5 (Z)	None (N)	Pre-wired connector	Applicable load	
Solid state auto switch	——	Grommet	Yes	3-wire (NPN)	5V, 12V	——	F7NV	F79	F59	●	●	○	—	○	IC circuit	Relay, PLC
				3-wire (PNP)			F7PV	F7P	F5P	●	●	○	—	○		
				2-wire	12V		F7BV	J79	J59	●	●	○	—	○		
					——	100V, 200V	——	——	J51	●	●	○	—	—	——	
		Connector			12V		J79C	——	——	●	●	●	●	—		
	Diagnosis indication (2-color)	Grommet		3-wire (NPN)	5V, 12V	——	F7NWV	F79W	F59W	●	●	○	—	○	IC circuit	
				3-wire (PNP)			——	F7PW	F5PW	●	●	○	—	○		
				2-wire	12V		F7BWV	J79W	J59W	●	●	○	—	○	——	
	Water resistant (2-color)						F7BAV **	F7BA **	F5BA **	—	●	○	—	○		
	Diagnosis output (2-color)			4-wire (NPN)	5V, 12V		——	F79F	F59F	●	●	○	—	○	IC circuit	
Reed auto switch	——	Grommet	Yes	3-wire (NPN equiv.)	——	5V	——	A76H	A56	●	●	—	—	—	IC circuit	——
				2-wire	——	200V	A72	A72H	——	●	●	—	—	—	——	Relay, PLC
			No		12V	100V	A73	A73H	——	●	●	●	—	—		
						100 V or less	A80	A80H	——	●	●	—	—	—	IC circuit	
		Connector	Yes			——	A73C	——	——	●	●	●	●	—	——	
		Grommet					——	——	A53	●	●	●	—	—		
		Connector	No				A80C	——	——	●	●	●	●	—	IC circuit	
		Grommet	Yes		12V	100V, 200V	——	——	A54	●	●	●	—	—	——	
			No			200 V or less	——	——	A64	●	●	—	—	—		
						——	——	——	A67	●	●	—	—	—	IC circuit	PLC
	Diagnosis indication (2-color)		Yes		——	——	A79W	——	A59W	●	●	—	—	—	——	Relay, PLC

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

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

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

• Refer to page 225 for applicable switches other than those indicated above.
* Auto switches are shipped together, (but not assembled).

Made to Order — Refer to pages 843 and 844 for detailed solid state auto switches with pre-wired connectors.

Specifications

Type	Pneumatic					Air-hydro			
Size	30	50	63	80	100	50	63	80	100
Fluid	Air (Non-lube)					Hydraulic oil			
Max. operating pressure	1.0 MPa								
Min. operating pressure	0.1 MPa								
Ambient and fluid temperature	0 to 60°C (No freezing)								
Cushion	None	Not attached, Air cushion				None			
Output (N·m) (1)	1.9	9.3	17	32	74	9.3	17	32	74
Allowable surge pressure	—					1.5 MPa			
Backlash	(2)	Within 1°							
Tolerance in rotating angle	—	$^{+4°}_{0}$							

Note 1) Output under the operating pressure of 0.5 MPa. Refer to page 32 for further information.
Note 2) Since CRA1□30 has a stopper installed, there is no backlash produced under pressure.

Allowable Kinetic Energy/Safe Range of Rotation Time

Model	Allowable kinetic energy		Cushion angle	Adjustable range of rotation time safe in operation
	Allowable kinetic energy (J)			
	Without cushion	With cushion Note)		Rotation time (s/90°)
CRA1□W 30	0.01	—	—	0.2 to 1
CRA1□□ 50	0.05	0.98	35°	0.2 to 2
CRA1□□ 63	0.12	1.50	35°	0.2 to 3
CRA1□□ 80	0.16	2.00	35°	0.2 to 4
CRA1□□100	0.54	2.90	35°	0.2 to 5

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

Weight/Standard

(kg)

Model	Standard weight		Additional weight	
	90°	180°	Foot bracket	Flange bracket
CRA1BW 30	0.3	0.4	0.1	—
CRA1BW 50	1.5	1.7	0.3	0.5
CRA1BW 63	2.5	3	0.5	0.9
CRA1BW 80	4.3	5	0.9	1.5
CRA1BW100	8.5	9.5	1.2	2

Weight/With Auto Switches and Solenoid Valves

(kg)

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

* Weight of the solenoid valve is not included. Refer to page 235 concerning weight of the solenoid valve.

Made to Order

Made to Order

(Refer to pages 248 to 268 for details.)

Symbol	Specifications/Description	Applicable shaft type
—	Shaft type variations	S,X,Y,Z,T,J,K
XA1 to XA24	Shaft pattern sequencing I	S,W,Y
XA33 to XA59	Shaft pattern sequencing II	X,Z,T,J,K
XC7	Reversed shaft	S,W,X,T,J
XC8 to XC11	Change of rotation range	S,W,Y
XC30	Fluorine grease	S,W,X,Y,Z,T,J,K
XC31 to XC36	Change of rotation range and rotation direction of shaft	S,W,Y
XC37 to XC46	Change of rotation range and angle adjusting direction	S,W,Y
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	S,W,Y
XC59 to XC61	Change of port direction	S,W,X,Y,Z,T,J,K
XC63, XC64	One side air-hydro, One side air	S,W,X,Y,Z,T,J,K
X6	Stainless steel specifications for main parts	S,W,X,Y,Z,T,J,K
X7 *	Heat resistant type (100°C)	S,W,X,Y,Z,T,J,K
X10	Both sides angle adjustable type	S,W,X,Y,Z,T,J,K
X11	One side angle adjustable, One side cushion	S,W,X,Y,Z,T,J,K
X16	Fluororubber seal	S,W,X,Y,Z,T,J,K

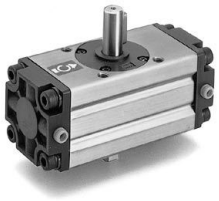
* X7: Not available for the built-in magnet type.

Symbol

With One-touch Fittings

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

With One-touch fittings



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

Specifications

Applicable size	30, 50, 63
Type	Pneumatic
Max. operating pressure	1.0 MPa
Min. operating pressure	0.1 MPa
Auto switch	Mountable

Refer to pages 228, 230 and 232 for the dimensions.

Applicable Tubing Specifications

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

Clean Series

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

Clean Series

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

Specifications

Applicable size	30, 50
Type	Pneumatic
Max. operating pressure	1.0 MPa
Min. operating pressure	0.1 MPa
Auto switch	Mountable

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

Shaft Type Variations/Without Key Grooves (Size 30)

Shaft Type: T, J, K

Refer to “How to Order” on pages 218 and 219.

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

Shaft type

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

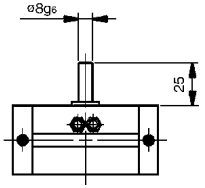
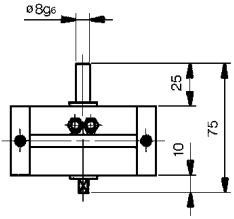
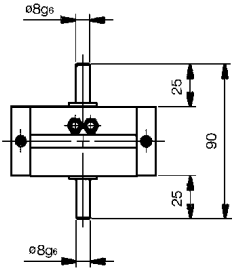
Specifications

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

∗ Refer to page 220 for other specifications.

Dimensions

(mm)

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

D-□

Shaft Variations/Without Keyway (Size 50 to 100)

Shaft Type: T, J, K

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

Air cushion

Nil	None
C	With air cushion

Refer to "How to Order" on pages 218, 219, 234 and 240.

Shaft type

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

Specifications

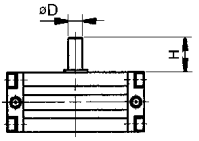
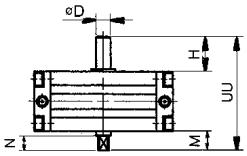
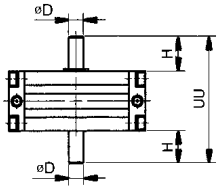
Size	50, 63, 80, 100	
Type	Pneumatic	Air-hydro
Fluid	Air (Non-lube)	Hydraulic oil
Shaft type	Single round shaft (T), Double round shaft (K), Double shaft/Long shaft without key and with four chamfers (J)	
Cushion	Not attached, Air cushion	None
Auto switch	Mountable	
Mounting	Basic style, Foot style	

Note) Except flange style.

∗ Refer to page 220 for other specifications.

Dimensions

(mm)

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

Size	**D** (g6)	**H**	**D** (g6)	**H**	**M**	**N**	**UU**	**D** (g6)	**H**	**UU**
50	15	36	15	36	20	15	118	15	36	134
63	17	41	17	41	22	17	139	17	41	158
80	20	50	20	50	25	20	167	20	50	192
100	25	60	25	60	30	25	202	25	60	232

∗ Refer to page 230 for other specifications.

Shaft Variations (Size 30)

Shaft Type: S, X, Y, Z

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

Refer to "How to Order" on pages 218 and 219.

Shaft type

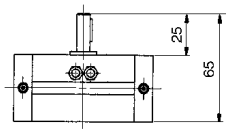
S	Single shaft key
X	Single shaft with four chamfers
Y	Double shaft key
Z	Double shaft with four chamfers

Specifications

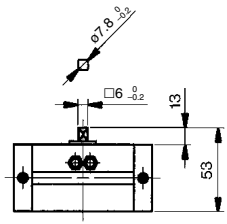
Size	30
Type	Pneumatic
Max. operating pressure (MPa)	1.0 MPa
Min. operating pressure (MPa)	0.1 MPa
Shaft type	Single shaft key (S), Single shaft with four chamfers (X), Double shaft key (Y), Double shaft with four chamfers (Z)
Mounting	Basic style, Foot style
Auto switch	Mountable

∗ Refer to page 220 for other specifications.

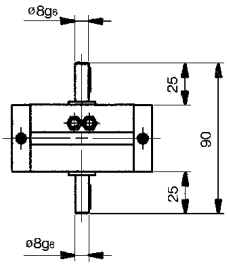
S (Single shaft key)



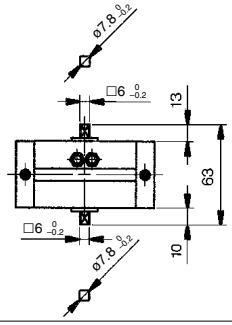
X (Single shaft with four chamfers)



Y (Double shaft key)



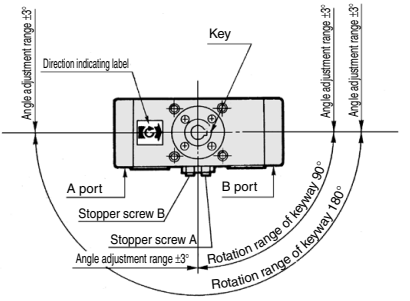
Z (Double shaft with four chamfers)



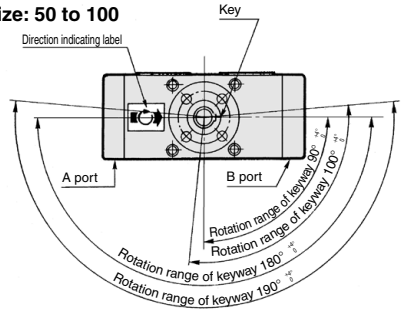
Rotation Range of Keyway

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

Size: 30



Size: 50 to 100



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

How to Set Rotation Time

Even if the torque that is generated by the rotary actuator is small, the parts could become damaged depending on the inertia of the load. Therefore, the rotation time should be determined by calculating the load's inertial moment and kinetic energy. Refer to pages 33 and 35 for details on how to set the rotation time.

Allowable load on the shaft

Refer to the model selecting order step for rotary actuators on page 39 concerning allowable loads on the shafts of Series CRA1.

How to Use the Air-hydro Type

Caution on Design

⚠Warning

1. **Do not use a rotary actuator of the air-hydro type near flames, or in equipment or machinery that exceeds an ambient temperatures of 60°C.**
   There is a danger of causing a fire because the rotary actuator of the air-hydro type uses a flammable hydraulic fluid.

⚠Caution

1. **Do not use in an environment, equipment, or machine that is not compatible with oil mist.**
   Rotary actuators of the air-hydro types generate an oil mist during operation which may affect the environment.
2. **Be sure to install an exhaust cleaner on the directional control valve for the rotary actuator of the air-hydro type.**
   A very small amount of hydraulic fluid is discharged from the exhaust port of the rotary actuator of the air-hydro type's directional control valve, which may contaminate the surrounding area.
3. **Install a rotary actuator of the air-hydro type in locations where it can be serviced easily.**
   Since the rotary actuator of the air-hydro type requires maintenance, such as refilling of hydraulic fluid and bleeding of air, ensure sufficient space for these activities.
4. **Do not use in cases where external leakage of hydraulic oil may adversely affect equipment or machinery.**
   Although it only occurs in minute amounts, a certain amount of sliding leakage from the piston seal is unavoidable with the rotary actuator of the air-hydro type. Because of the construction of the rotary actuator of the air-hydro type, hydraulic oil may leak into the outside due to sliding leakage.

Selection

⚠Caution

1. **Select the rotary actuator of the air-hydro type based on the combination with the air-hydro unit.**
   Select a proper air-hydro unit that is necessary for good operation of the rotary actuator of the air-hydro type.

Piping

⚠Caution

1. **Use self-align fittings in conjunction with the piping for the rotary actuator of the air-hydro type.**
   Do not use a One-touch fitting with the piping for the rotary actuator of the air-hydro type, as this may result in oil leakage.
2. **For rotary actuator of the air-hydro type piping, use hard nylon tubing or copper piping.**
   As in the case of hydraulic circuits, surge pressures greater than the operating pressure may occur in a rotary actuator of the air-hydro type's piping, making it necessary to use safer piping materials.

Lubrication

⚠Warning

1. **Make sure to completely discharge the compressed air in the system before filling the air-hydro unit with hydraulic oil.**
   When supplying hydraulic fluid to the air-hydro unit, first confirm that safety measures are implemented to prevent dropping of objects and the release of clamped objects, etc. Then, shut off the air supply and the equipment's electric power and exhaust the compressed air in the system.
   If the air-hydro unit's supply port is opened with compressed air still remaining in the system, there is a danger of hydraulic fluid being blown out.

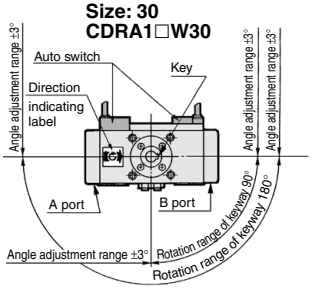
Maintenance

⚠Caution

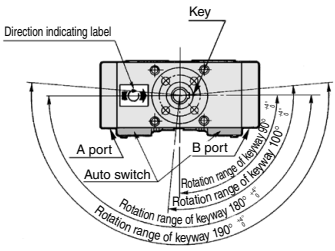
1. **Bleed air from the rotary actuator of the air-hydro type on a regular basis.**
   Since air may accumulate inside a rotary actuator of the air-hydro type, bleed air from it, for example before starting work. Bleed air from a bleeder valve provided on the rotary actuator of the air-hydro type or the piping.
2. **Verify the oil level of the air-hydro system on a regular basis.**
   Since a very small amount of hydraulic fluid is discharged from the rotary actuator of the air-hydro type and air-hydro unit circuit, the fluid will gradually decrease. Therefore, check the fluid regularly and refill as necessary.
   The oil level can be checked with a level gauge in the air-hydro converter.

Rotation Range of Keyway/Auto Switch Mounting Position

Size: 30
CDRA1□W30

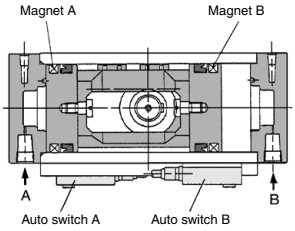


Size: 50 to 100
CDRA1□□50 to 100



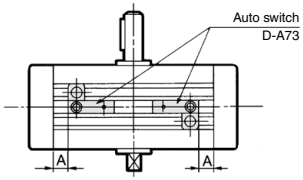
Working Principle

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

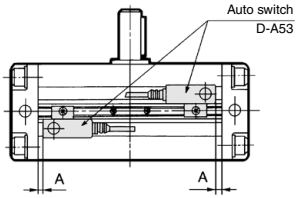


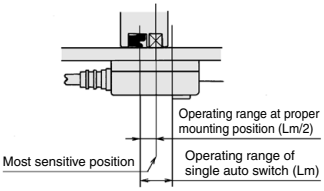
Proper Auto Switch Mounting Position at Rotation End

CDRA1□W30



CDRA1□□50 to 100





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

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

∗ The dimensions inside ( ) are for 180°. ∗∗ Up to 2 auto switches can be mounted per actuator.
Note) The values given in the table above are representative values.
In the actual setting, adjust the value after confirming the auto switch performance.
∗ Please consult with SMC concerning the angles for the auto switches other than the models D-A73 and D-A53.

Auto switches in addition to those listed above are also available.

Auto Switch Specifications/Refer to page 807 to 856 for further information on auto switch single body.

Type	Model	Electrical entry	Features	Applicable size
Solid state switch	D-F7NT	Grommet (In-line)	With timer	30
	D-F5NT	Grommet (In-line)		50 to 100

∗ With pre-wire connector is also available for D-F5NT, D-F7NT. For details about pre-wire connectors, refer to pages 843 and 844.

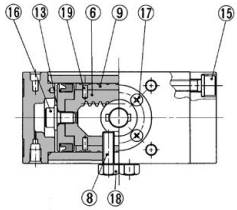
Sets of Mounting Screws for Auto Switch

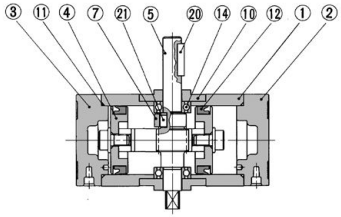
Model	Part no.	Description
CDRA1□W30	P294010-24	Round head Phillips screw: 2 pcs.
CDRA1□□50 to 100	P294020-24	Hexagon nut: 2 pcs.

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

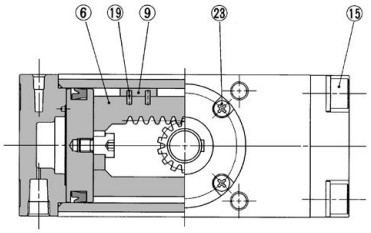
Construction

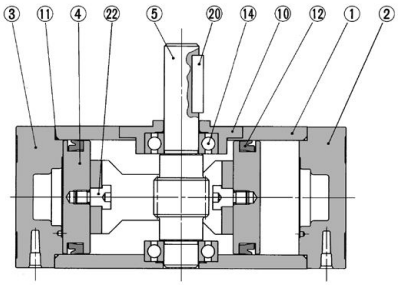
Without air cushion
Size: 30





Without air cushion
Size: 50 to 100





Component Parts

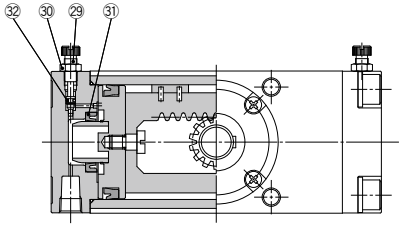
No.	Description	Material	Note
①	**Body**	Aluminum alloy	Anodized
②	**Right cover**	Aluminum alloy	Anodized
③	**Left cover**	Aluminum alloy	Anodized
④	**Piston**	Aluminum alloy	Chromated
⑤	**Shaft**	Chrome molybdenum steel	
⑥	**Rack**	Carbon steel	
⑦	**Stopper**	Chrome molybdenum steel	
⑧	**Stopper screw**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

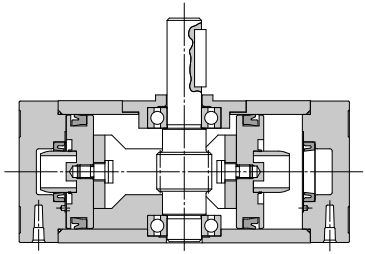
Note) Size 50 to 100: Aluminum alloy (Anodized)

Component Parts

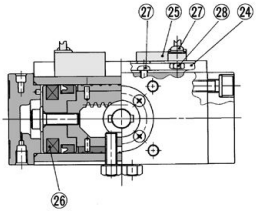
No.	Description	Material	Note
⑫	**Piston seal**	NBR	
⑬	**O-ring**	NBR	
⑭	**Bearing**	Bearing steel	
⑮	**Hexagon socket head cap screw with spring washer**	Chrome molybdenum steel	Black zinc chromated
⑯	**Hexagon socket head cap flange screw**	Chrome molybdenum steel	Zinc chromated
⑰	**Cross-recessed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

With air cushion

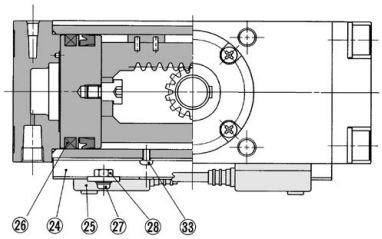




With auto switch
Size: 30



Size: 50 to 100



CRB2 -Z
CRBU2
CRB1
MSU
CRJ
CRA1 -Z
CRA1
CRQ2
MSQ
MSZ
CRQ2X MSQX
MRQ

Component Parts

No.	Description	Material	Note
㉔	**Auto switch mounting rail**	Aluminum alloy	
㉕	**Auto switch**	—	
㉖	**Plastic magnet**	Magnetic material	
㉗	**Round head Phillips screw**	Steel wire	
㉘	**Hexagon nut**	Steel wire	
㉙	**Needle valve**	Stainless steel Note2)	
㉚	**Lock nut**	Stainless steel	Nickel plated
㉛	**Cushion seal**	NBR	
㉜	**O-ring**	NBR	
㉝	**Round head Phillips screw**	Steel wire	

Note 2) Size 63 to 100: Brass (Electroless nickel plating)

Replacement Parts (Corresponding parts shown below are set.)

Size	Replacement parts			
	Standard	With air cushion	With auto switch	Air-hydro
CRA1□W 30-90	P294010-20	——	P294010-20	——
CRA1□W 30-180	P294010-21	——	P294010-21	——
CRA1□□50	P294020-20A	P294020-20A	P294020-20A	P294020-23A
CRA1□□63	P294030-20A	P294030-20A	P294030-20A	P294030-23A
CRA1□□80	P294040-20	P294040-20	P294040-20	P294040-23
CRA1□□100	P294050-20A	P294050-20A	P294050-20A	P294050-23A

	No.	Description	Quantity
Corresponding parts	**9**	**Slider**	2
	11	**Tube gasket**	2
	12	**Piston seal**	2
	19	**Spring pin**	4

Note) When ordering spare parts, write "1 piece" for 1 set of the parts for one actuator.
Note) The air-hydro types comes with 4 sliders and 8 spring pins.

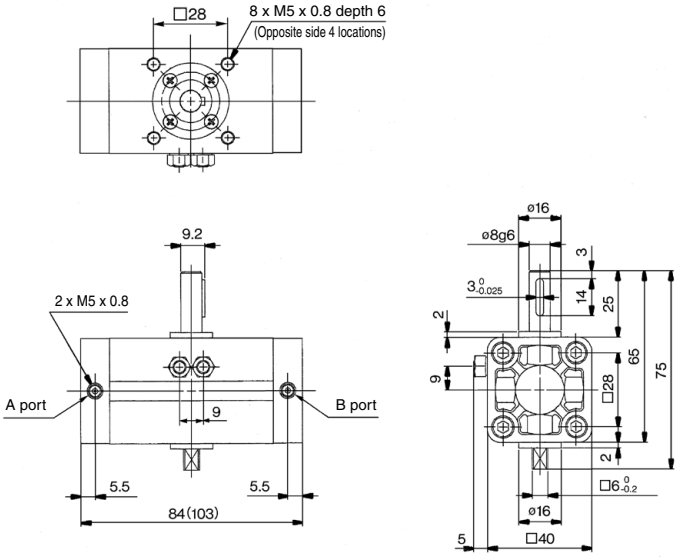
A grease pack (10 g) is included. If an additional grease pack is needed, order with the following part number.
Grease pack part no.: GR-S-010 (10 g)
∗ Individual part cannot be shipped.

D-□

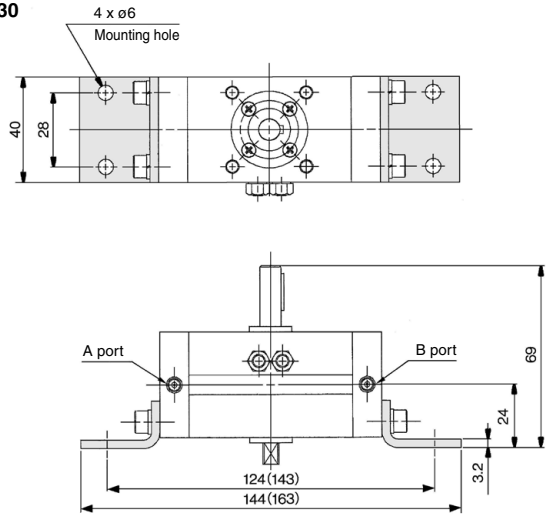
Size 30/Basic Style: CRA1BW, Foot Style: CRA1LW

This drawing is for 90° specifications.

Basic style: CRA1BW30



Foot style: CRA1LW30

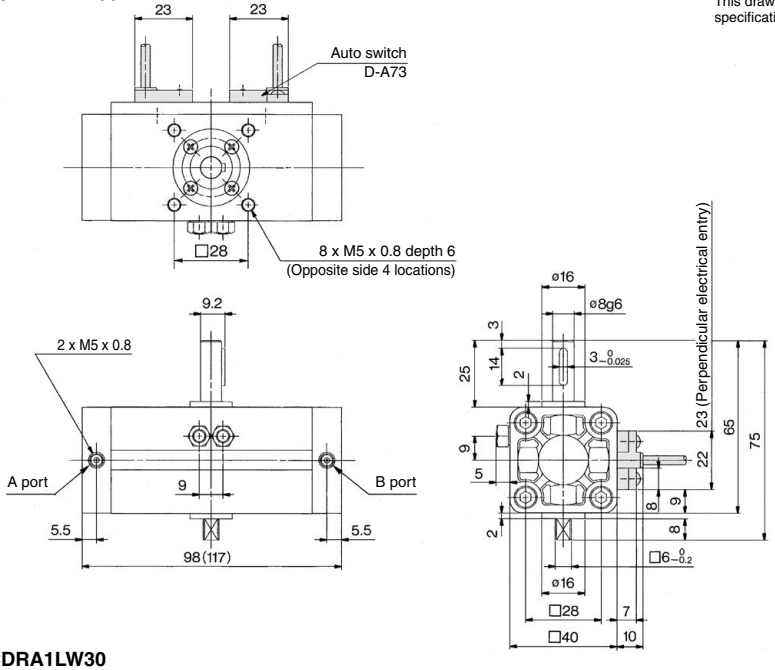


∗ ( ) are the dimensions for rotation of 180°.
The dimensions below show pressurization to B port.

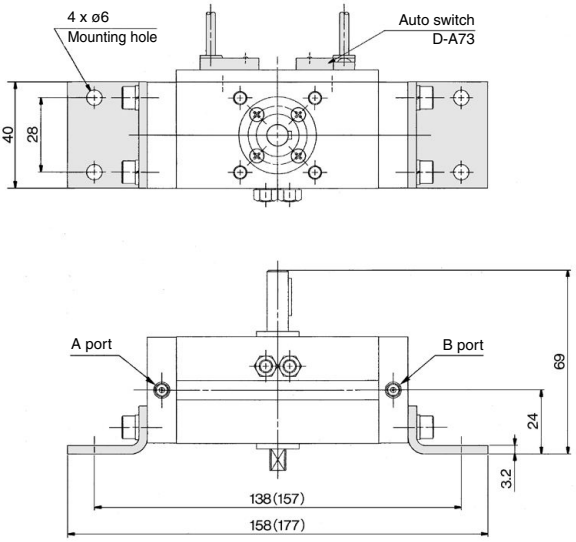
Size 30/Basic Style: CDRA1BW, Foot Style: CDRA1LW

This drawing is for 90° specifications.

With auto switch
Basic style: CDRA1BW30



Foot style: CDRA1LW30

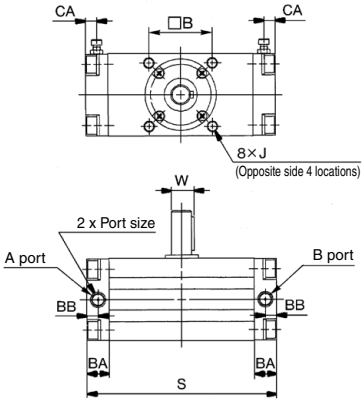


∗ ( ) are the dimensions for rotation of 180°.
⋆ The dimensions below show pressurization to B port.

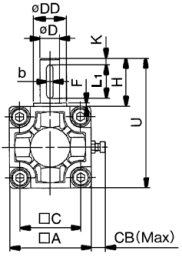
Size 50, 63, 80, 100/Basic Style: CRA1B□

Size: 50 to 100

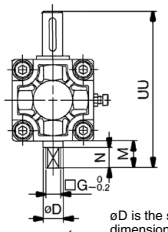
Single shaft type: CRA1BS



Single shaft



Double shaft type: CRA1BW
Double shaft



øD is the shaft dimension.

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

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

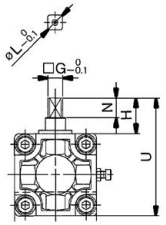
Model	Port size ∗	A	B	C	D (g6)	DD (h9)	F	H	J	K	S	U	W	BA	BB	★ CA	★ CB	Key dimensions b	Key dimensions L1
CRA1BS 50	Rc 1/8	62	48	46	15	25	2.5	36	M8 x 1.25 Depth 8	5	144 (177)	98	17	17	8.5	8.5	13	5 $^{0}_{-0.030}$	25
CRA1BS 63	Rc 1/8	76	60	57	17	30	2.5	41	M10 x 1.5 Depth 12	5	163 (201.5)	117	19.5	20	10	10	14	6 $^{0}_{-0.030}$	30
CRA1BS 80	Rc 1/4	92	72	70	20	35	3	50	M12 x 1.75 Depth 13	5	186 (230)	142	22.5	23.5	12	12	18	6 $^{0}_{-0.030}$	40
CRA1BS100	Rc 3/8	112	85	85	25	40	4	60	M12 x 1.75 Depth 14	5	245 (311)	172	28	25	12.5	12.5	18	8 $^{0}_{-0.036}$	45

∗ In addition to Rc, G and NPT are also available.

★ For model with air cushion

Model	D (g6)	G	M	N	UU	L
CRA1BW 50	15	11	20	15	118	14
CRA1BW 63	17	13	22	17	139	16
CRA1BW 80	20	15	25	20	167	19
CRA1BW100	25	19	30	25	202	24

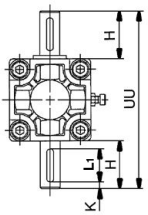
Single shaft with four chamfers: CRA1BX



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

Model	G	H	N	U	L
CRA1BX 50	11	27	15	89	14
CRA1BX 63	13	29	17	105	16
CRA1BX 80	15	38	20	130	19
CRA1BX100	19	44	25	156	24

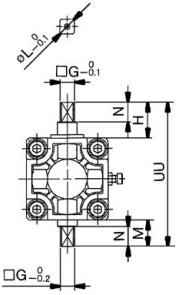
Double shaft key: CRA1BY



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

Model	H	K	UU	L1
CRA1BY 50	36	5	134	25
CRA1BY 63	41	5	158	30
CRA1BY 80	50	5	192	40
CRA1BY100	60	5	232	45

Double shaft with four chamfers: CRA1BZ

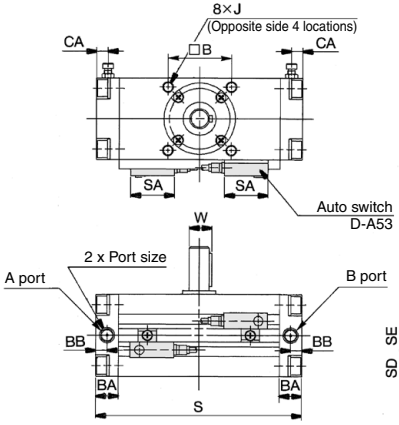


Note) Other dimensions are the same as the single shaft.

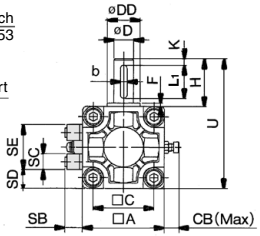
Model	G	H	M	N	UU	L
CRA1BZ 50	11	27	20	15	109	14
CRA1BZ 63	13	29	22	17	127	16
CRA1BZ 80	15	38	25	20	155	19
CRA1BZ100	19	44	30	25	186	24

Size 50, 63, 80, 100/Basic Style: CDRA1B□

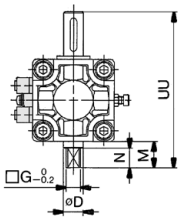
With auto switch
Single shaft type: CDRA1BS



Single shaft



Double shaft type: CDRA1BW
Double shaft



øD is the shaft dimension.

Double Shaft Type

Model	D (g6)	G	M	N	UU	L
CDRA1BW 50	15	11	20	15	118	14
CDRA1BW 63	17	13	22	17	139	16
CDRA1BW 80	20	15	25	20	167	19
CDRA1BW100	25	19	30	25	202	24

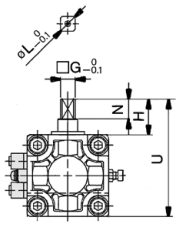
Single Shaft Type

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

Model	Port size∗	A	B	C	D (g6)	DD (h9)	F	H	J	K	S	U	W	BA	BB	CA	CB	SA	SB	SC	SD	SE	Key dimensions b	Key dimensions L1
CDRA1BS 50	Rc 1/8	62	48	46	15	25	2.5	36	M 8 x 1.25 depth 8	5	156 (189)	98	17	17	8.5	8.5	13	33	13.5	12	14	34	5 0 -0.030	25
CDRA1BS 63	Rc 1/4	76	60	57	17	30	2.5	41	M10 x 1.5 depth 12	5	175 (213.5)	117	19.5	20	10	10	14	33	14.5	12	21	34	6 0 -0.030	30
CDRA1BS 80	Rc 1/4	92	72	70	20	35	3	50	M12 x 1.75 depth 13	5	199 (243)	142	22.5	23.5	12	12	18	33	15.5	12	29	34	6 0 -0.030	40
CDRA1BS100	Rc 3/8	112	85	85	25	40	4	60	M12 x 1.75 depth 14	5	259 (325)	172	28	25	12.5	12.5	18	33	16	12	39	34	8 0 -0.036	45

∗ In addition to Rc, G and NPT are also available.

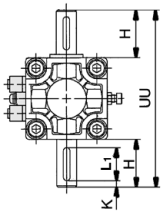
Single shaft with four chamfers: CDRA1BX□



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

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

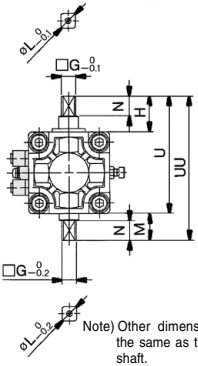
Double shaft key: CDRA1BY□



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

Model	H	K	UU	L1
CDRA1BY□50	36	5	134	25
CDRA1BY□63	41	5	158	30
CDRA1BY□80	50	5	192	40
CDRA1BY□100	60	5	232	45

Double shaft with four chamfers: CDRA1BZ□

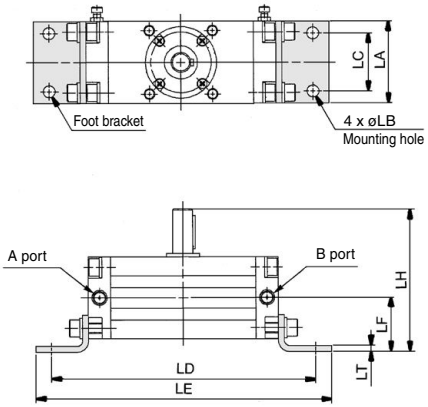


Note) Other dimensions are the same as the single shaft.

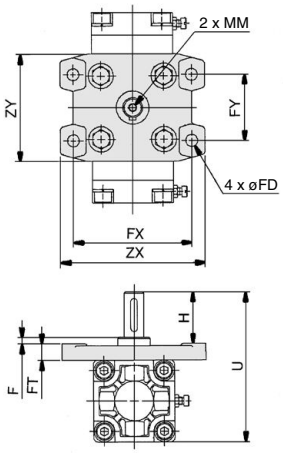
Model	G	H	M	N	U	UU	L
CDRA1BZ□50	11	27	20	15	89	109	14
CDRA1BZ□63	13	29	22	17	105	127	16
CDRA1BZ□80	15	38	25	20	130	155	19
CDRA1BZ□100	19	44	30	25	156	186	24

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

Foot style: CRA1L□



Flange style
Single shaft: CRA1FS



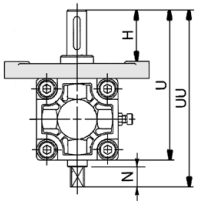
• Dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

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

Note) Other dimensions are the same as standard.

Model	F	H	MM	U	FD	FT	FX	FY	ZX	ZY
CRA1F□□50	4	39	M6 x 1.0 depth 12	114	9	13	90	50	110	81
CRA1F□□63	5	45	M6 x 1.0 depth 12	136	11.5	15	105	59	130	101
CRA1F□□80	5	55	M8 x 1.25 depth 16	165	13.5	18	130	76	160	119
CRA1F□□100	5	60	M10 x 1.5 depth 20	190	13.5	18	150	92	180	133

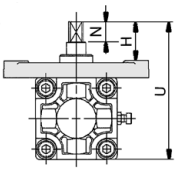
Flange style
Double shaft: CRA1FW



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

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

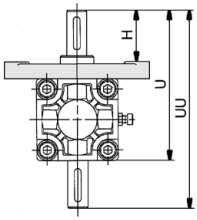
Flange style
Single shaft with four chamfers: CRA1FX



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

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

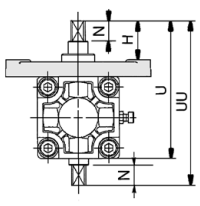
Flange style
Double shaft key: CRA1FY



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

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

Flange style
Double shaft with four chamfers: CRA1FZ



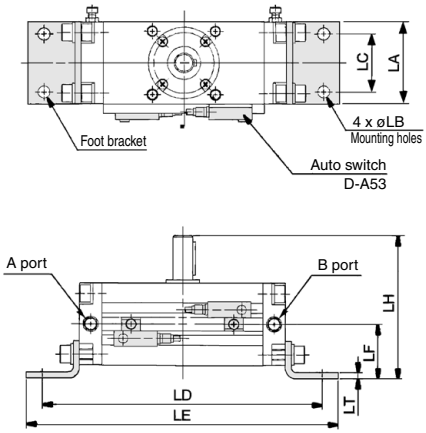
Note) Other dimensions are the same as the single shaft.

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

Note) The dimensions of shaft key and four chamfers are the same as standard.

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

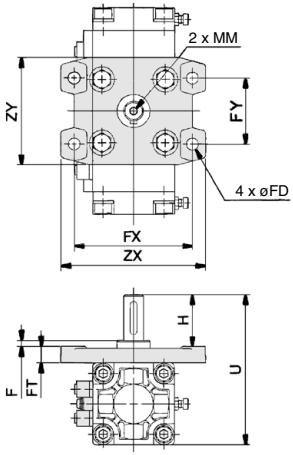
With auto switch
Foot style: CDRA1L□



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

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

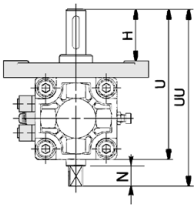
Flange style
Single shaft: CDRA1FS



Note) Other dimensions are the same as standard.

Model	F	H	MM	U	FD	FT	FX	FY	ZX	ZY
CDRA1F□□50	4	39	M6 x 1.0 depth 12	114	9	13	90	50	110	81
CDRA1F□□63	5	45	M6 x 1.0 depth 12	136	11.5	15	105	59	130	101
CDRA1F□□80	5	55	M8 x 1.25 depth 16	165	13.5	18	130	76	160	119
CDRA1F□□100	5	60	M10 x 1.5 depth 20	190	13.5	18	150	92	180	133

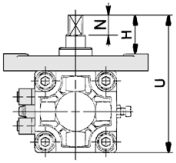
Flange style
Double shaft: CDRA1FW



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

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

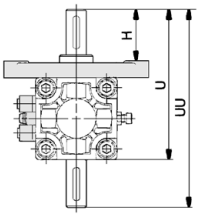
Flange style
Single shaft with four chamfers: CDRA1FX



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

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

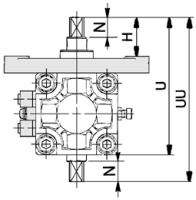
Flange style
Double shaft key: CDRA1FY



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

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

Flange style
Double shaft with four chamfers: CDRA1FZ



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

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

Note) The dimensions of shaft key and four chamfers are the same as standard.

Rotary Actuator with Solenoid Valve

Series CVRA1

Rack & Pinion Style/Size: 50, 63, 80, 100

How to Order

Electrical entry

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

Light/Surge voltage suppressor

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

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

Rated voltage

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

* For other rated voltages, please consult with SMC.

Manual override

Nil	None
B	Locking B type
C	Locking C type

Solenoid valve configuration

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

Made to Order
Refer to page 235 for details.

Without auto switch	CVRA1	B	W			50	–	90		–	1	1	G			–			
With auto switch	CDVRA1	B	S			50	–	90		–	1	1	G			–		J59W	–

Built-in magnet

With solenoid valve

Mounting style

B	Basic style
L *	Foot style

Note) No flange style "F" is available.

Shaft type

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

* Refer to page 222 for the rod-end shape variations.

Type

Nil	Standard
U	Angle adjustable

Size

50
63
80
100

Rotating angle

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

Pattern

Nil	Standard
P	Combination of Simple specials/Made to Order

* Refer to pages 248 to 268 for details.

Air cushion

Nil	None
C *	With air cushion

* Except angle adjustable type "U".

Number of auto switches

S	1 pc.
Nil	2 pcs.

Note) Maximum number of auto switches mountable is two.

Auto switch

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

Applicable Auto Switches
/Refer to pages 807 to 856 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model	Lead wire length * (m) 0.5 (Nil)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Solid state auto switch	—	Grommet	Yes	3-wire (NPN)	24V	5V, 12V	—	F59	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				F5P	●	●	○	○		
				2-wire		12V		J59	●	●	○	○	—	
					—	—	100V, 200V	J51	●	●	○	—		
	Diagnosis indication (2-color)			3-wire (NPN)	24V	5V, 12V	—	F59W	●	●	○	○	IC circuit	
				3-wire (PNP)				F5PW	●	●	○	○		
				2-wire		12V		J59W	●	●	○	○	—	
	Diagnosis output (2-color)			4-wire (NPN)		5V, 12V		F59F	●	●	○	○	IC circuit	
Reed auto switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5V	—	A56	●	●	—	—	IC circuit	—
				2-wire	24V	12V		A53	●	●	●	—	—	Relay, PLC
						12V	100V, 200V	A54	●	●	—	—		
			No				200 V or less	A64	●	●	—	—		
							—	A67	●	●	—	—	IC circuit	PLC
	Diagnosis indication (2-color)		Yes			—	—	A59W	●	●	—	—	—	Relay,PLC

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

* Refer to page 225 for applicable switches other than those indicated above.

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

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

Made to Order Refer to pages 843 and 844 for detailed solid state auto switches with pre-wired connectors.

Made to Order

(Refer to pages 248 to 268 for details.)

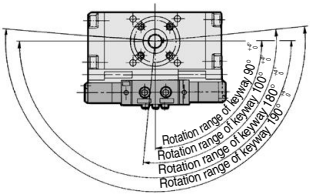
Symbol	Specifications/Description	Applicable shaft type
—	Shaft type variations	S,X,Y,Z,T,J,K
XA1 to XA24	Shaft pattern sequencing I	S,W,Y
XA33 to XA46	Shaft pattern sequencing II	X,Z,T,J,K
XC7	Reversed shaft	S,W,X,T,J
XC8 to XC11	Change of rotation range	S,W,Y
XC30	Fluorine grease	S,W,X,Y,Z,T,J,K
XC31 to XC36	Change of rotation range and rotation direction of shaft	S,W,Y
XC37 to XC46	Change of rotation range and angle adjusting direction	S,W,Y
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	S,W,Y
X6	Stainless steel specifications for main parts	S,W,X,Y,Z,T,J,K
X10	Both sides angle adjustable type	S,W,X,Y,Z,T,J,K
X11	One side angle adjustable, One side cushion	S,W,X,Y,Z,T,J,K

⚠Precautions

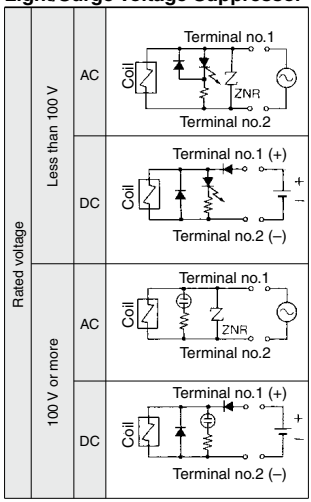
Be sure to read before handling. Refer to front matter 35 for Safety Instructions and pages 4 to 14 for Rotary Actuator and Auto Switch Precautions.

Rotation Range of Keyway

Solenoid Valve Mounting Positions



Light/Surge Voltage Suppressor



Note) Light is not available on grommet type.

Specifications

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

Weight

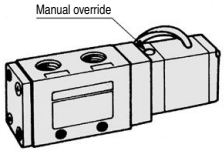
(kg)

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

How to calculate weight
Weight = Basic weight * + Add'l weight + No. of positions/solenoids
* Refer to page 220 for basic weight.

Manual Override

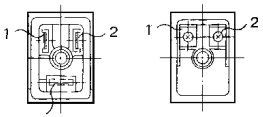
Non-locking push style is standard.



Electrical Wiring

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

DIN terminal **With terminal block**



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

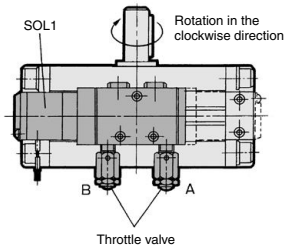
Instant Energizing Time

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

How to Adjust the Rotation Speed

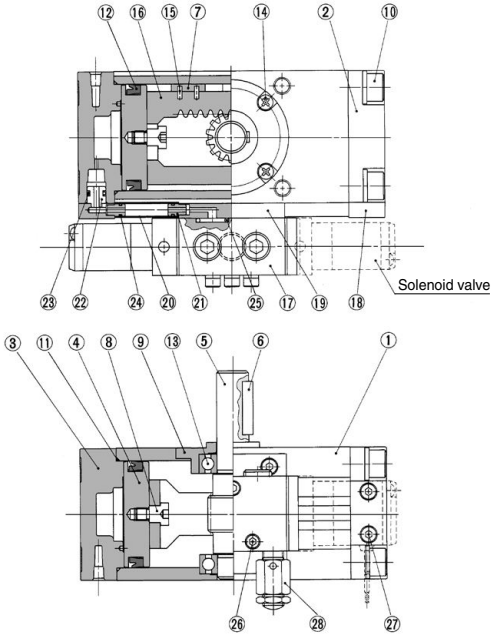
Rotation direction
When current is applied to SOL1, the shaft rotates clockwise.

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

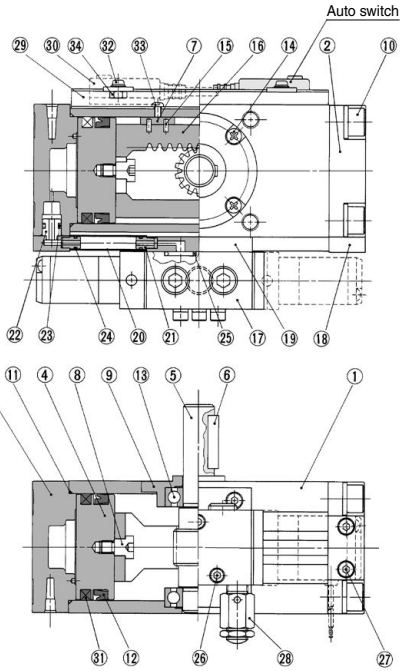


Construction

With solenoid valve



With solenoid valve and auto switch



Component Parts

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

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

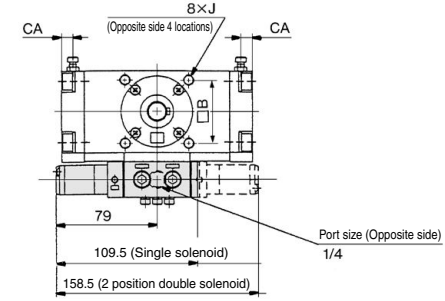
With Solenoid Valve, With Solenoid Valve and Auto Switch/Replacement Parts

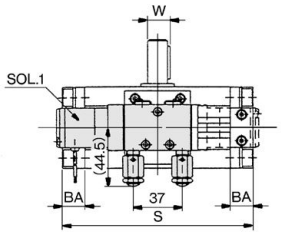
Type	Model	Description (The parts shown below are sets.)
C□VRA1□□50	P294020-49A	⑦, Slider : 2 pcs. ㉓, O-ring : 2 pcs. ⑪, Tube gasket : 2 pcs. ㉔, O-ring : 4 pcs. ⑫, Piston seal : 2 pcs. ㉕, O-ring : 2 pcs. ⑮, Spring pin : 4 pcs.
C□VRA1□□63	P294030-49A	
C□VRA1□□80	P294040-49	
C□VRA1□□100	P294050-49A	

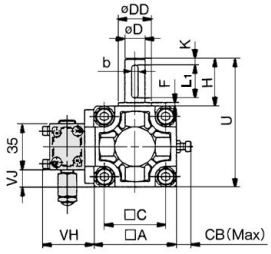
A grease pack (10 g) is included. If an additional grease pack is needed, order with the following part number.
Grease pack part no.: GR-S-010 (10 g)
∗ Individual part cannot be shipped.

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

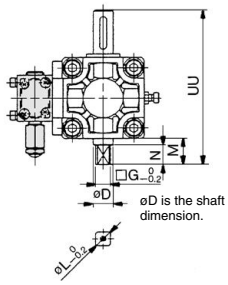
Single shaft type: CVRA1BS□50 to 100







Double shaft type: CVRA1BW□



Double Shaft Type (mm)

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

Single Shaft Type (mm)

Model	A	B	BA	C	CA	CB	D (g6)	DD (h9)	F	H	J	K	S *	U	W	Valve dimensions VH	Valve dimensions VJ	Key dimensions b	Key dimensions L1
CVRA1BS□50	62	48	17	46	8.5	13	15	25	2.5	36	M8 x 1.25 depth 8	5	144 (177)	98	17	39	13.5	5 $^{0}_{-0.030}$	25
CVRA1BS□63	76	60	20	57	10	14	17	30	2.5	41	M10 x 1.5 depth 12	5	163 (201.5)	117	19.5	39	20.5	6 $^{0}_{-0.030}$	30
CVRA1BS□80	92	72	23.5	70	12	18	20	35	3	50	M12 x 1.75 depth 13	5	186 (230)	142	22.5	43	28.5	6 $^{0}_{-0.030}$	40
CVRA1BS□100	112	85	25	85	12.5	18	25	40	4	60	M12 x 1.75 depth 14	5	245 (311)	172	28	43	38.5	8 $^{0}_{-0.036}$	45

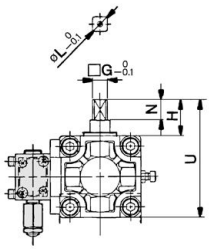
* ( ) are the dimensions for rotation of 180° and 190°.

Port Size

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

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

Single shaft with four chamfers: CVRA1BX□

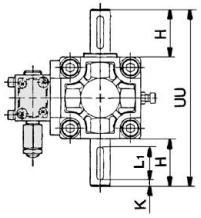


(mm)

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

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

Double shaft key: CVRA1BY□

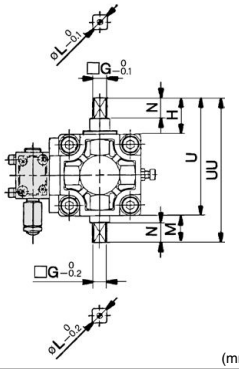


(mm)

Model	L_1	H	K	UU
CVRA1BY□50	25	36	5	134
CVRA1BY□63	30	41	5	158
CVRA1BY□80	40	50	5	192
CVRA1BY□100	45	60	5	232

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

Double shaft with four chamfers: CVRA1BZ□

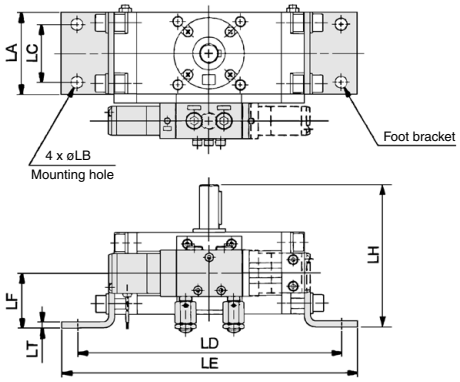


(mm)

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

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

Foot style: CVRA1L□□



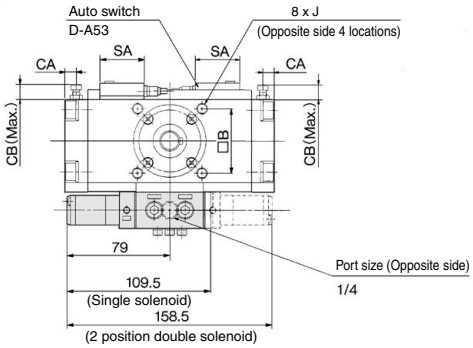
⋆ The dimensions below show pressurization to B port. (mm)

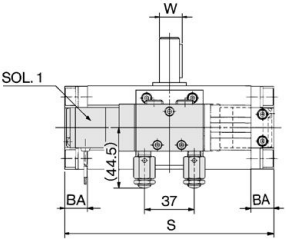
Model	LA	LB	LC	LD	LE	LF	LH	LT
CVRA1L□□50	62	9	44	200 (233)	224 (257)	41	108	4.5
CVRA1L□□63	76	11	55	235 (273.5)	263 (301.5)	48	127	5
CVRA1L□□80	92	13	67	274 (318)	316 (360)	58	154	6
CVRA1L□□100	112	13	87	333 (399)	375 (441)	73.5	189.5	6

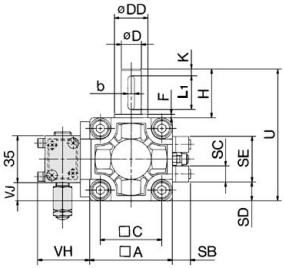
∗ ( ) are the dimensions for rotation of 180° and 190°.
Note) Other dimensions are the same as the single shaft.

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

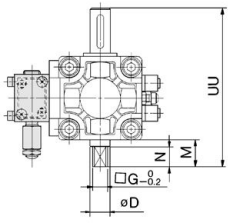
Single shaft type: CDVRA1BS□50 to 100







Double shaft type: CDVRA1BW□



øD is the shaft dimension.

Double Shaft Type (mm)

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

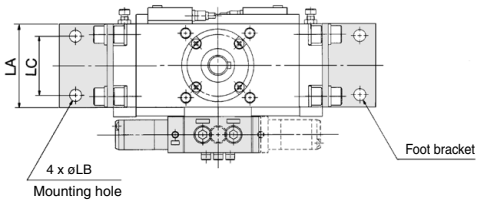
Single Shaft Type

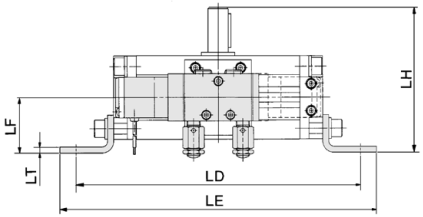
(mm)

Model	A	B	BA	C	CA	CB	øD (g6)	øDD (h9)	F	H	J	K	S	U	W	SA	SB	SC	SD	SE	Valve dimensions VH	Valve dimensions VJ	Key dimensions b	Key dimensions L1
CDVRA1BS□50	62	48	17	46	8.5	13	15	25	2.5	36	M 8 x 1.25 Depth 8	5	156 (189)	98	17	33	13.5	12	14	34	39	13.5	5 0 -0.030	25
CDVRA1BS□63	76	60	20	57	10	14	17	30	2.5	41	M10 x 1.5 Depth 12	5	175 (213.5)	117	19.5	33	14.5	12	21	34	39	20.5	6 0 -0.030	30
CDVRA1BS□80	92	72	23.5	70	12	18	20	35	3	50	M12 x 1.75 Depth 13	5	199 (243)	142	22.5	33	15.5	12	29	34	43	28.5	6 0 -0.030	40
CDVRA1BS□100	112	85	25	85	12.5	18	25	40	4	60	M12 x 1.75 Depth 14	5	259 (325)	172	28	33	16	12	39	34	43	38.5	8 0 -0.036	45

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

Foot style: CDVRA1L□□





(mm)

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

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

Rotary Actuator: Angle Adjustable Type

* Angle adjustment mechanism is provided as standard.

Series CRA1□□U

Rack & Pinion Style/Size: 50, 63, 80, 100

How to Order

Without auto switch CRA1 **B** **W** **U** [ ] **50** – **90** [ ] [ ]

With auto switch CDRA1 **B** **S** **U** [ ] **50** – **90** – **J59W** [ ] – [ ]

Built-in magnet

Mounting style

B	Basic style
L *	Foot style
F	Flange style

* Refer to the table below for the part numbers of foot bracket.

Shaft type

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

* Refer to page 222 for the rod-end shape variations.

Angle adjustable type

Pattern

Nil	Standard
P	Combination of Simple specials/Made to Order

* Refer to pages 248 to 268 for details.

Size

50
63
80
100

Rotating angle

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

Auto switch

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

Number of auto switches

S	1 pc.
Nil	2 pcs.

Note) Maximum number of auto switches mountable is two.

Made to Order or port type

Refer to page 241 for Made to Order.

Nil	Rc
XF *	G
XN *	NPT

* These cannot be combined with Made to Order.
* Except the air-hydro type.

Applicable Auto Switches/Refer to pages 807 to 856 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model	Lead wire * length (m) 0.5 (Nil)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Solid state auto switch	—	Grommet	Yes	3-wire (NPN)	24V	5V, 12V	—	**F59**	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				**F5P**	●	●	○	○		
				2-wire		12V		**J59**	●	●	○	○	—	
					—	—	100V, 200V	**J51**	●	●	○	—		
	Diagnosis indication (2-color)			3-wire (NPN)	24V	5V, 12V	—	**F59W**	●	●	○	○	IC circuit	
				3-wire (PNP)				**F5PW**	●	●	○	○		
				2-wire		12V		**J59W**	●	●	○	○	—	
	Water resistant (2-color)							**F5BA** **	—	●	○	○		
	Diagnosis output (2-color)			4-wire (NPN)		5V, 12V		**F59F**	●	●	○	○	IC circuit	
Reed auto switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5V	—	**A56**	●	●	—	—	IC circuit	—
			Yes	2-wire	24V	12V	—	**A53**	●	●	●	—	—	Relay, PLC
			No			12V	100V, 200V	**A54**	●	●	●	—		
							200 V or less	**A64**	●	●	—	—		
							—	**A67**	●	●	—	—	IC circuit	PLC
	Diagnosis indication (2-color)		Yes			—	—	**A59W**	●	●	—	—	—	Relay, PLC

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

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

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

Made to Order — Refer to pages 843 and 844 for detailed solid state auto switches with pre-wired connectors.

* Refer to page 225 for applicable switches other than those indicated above.
* Auto switches are shipped together, (but not assembled).

Specifications

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

Weight

(kg)

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

Made to Order

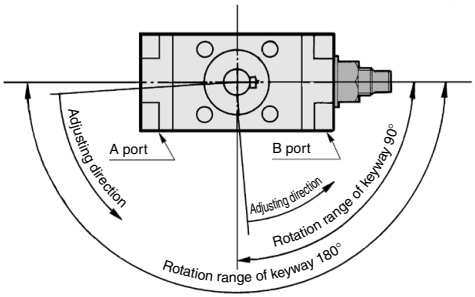
Made to Order
(Refer to pages 248 to 268 for details.)

Symbol	Specifications/Description	Applicable shaft type
—	Shaft type variations	S,X,Y,Z,T,J,K
XA1 to XA24	Shaft pattern sequencing I	S,W,Y
XA33 to XA46	Shaft pattern sequencing II	X,Z,T,J,K
XC7	Reversed shaft Change of rotation range	S,W,X,T,J
XC30	Fluorine grease	S,W,X,Y,Z,T,J,K
XC37 to XC46	Change of rotation range and angle adjusting direction	S,W,Y
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	S,W,Y
XC59 to XC61	Change of port direction	S,W,X,Y,Z,T,J,K
XC62	Reversed auto switch mounting	S,W,X,Y,Z,T,J,K
X7 *	Heat resistant type (100°C)	S,W,X,Y,Z,T,J,K
X10	Both sides angle adjustable type	S,W,X,Y,Z,T,J,K
X11	One side angle adjustable, One side cushion	S,W,X,Y,Z,T,J,K
X16	Fluororubber seal	S,W,X,Y,Z,T,J,K

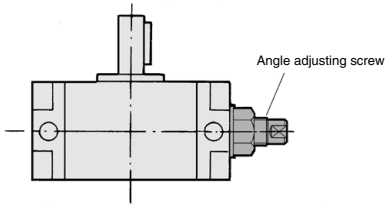
* X7: Not available for the built-in magnet type.

Rotation Range of Keyway

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



How to Adjust Angle



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

Adjusting Angle per One Rotation of Angle Adjusting Screw

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

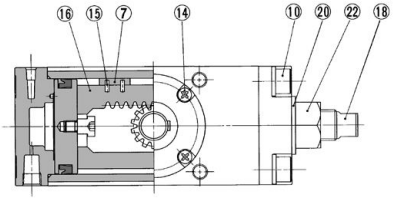
Foot Bracket Part No.

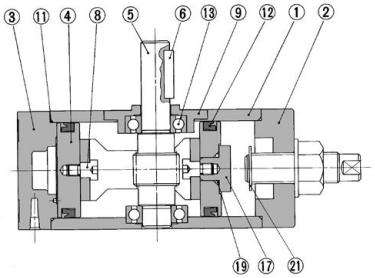
Size	Foot	Description	Mounting screws included in foot bracket
50	P294020-25	Foot bracket : 2 pcs. Mounting thread: 4 pcs. Collar * : 4 pcs.	M 8 x 1.25 x 35
63	P294030-25		M10 x 1.5 x 40
80	P294040-25		M12 x 1.75 x 50
100	P294050-25		M12 x 1.75 x 50

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

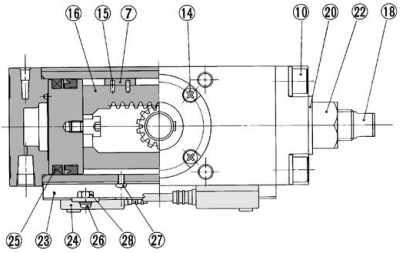
Construction

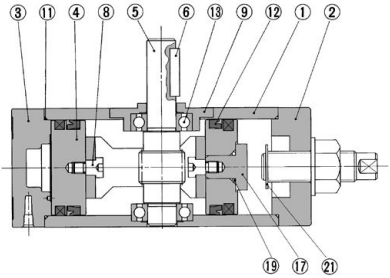
Standard: CRA1□□U





With auto switch: CDRA1□□U





Component Parts

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

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

Replacement Parts

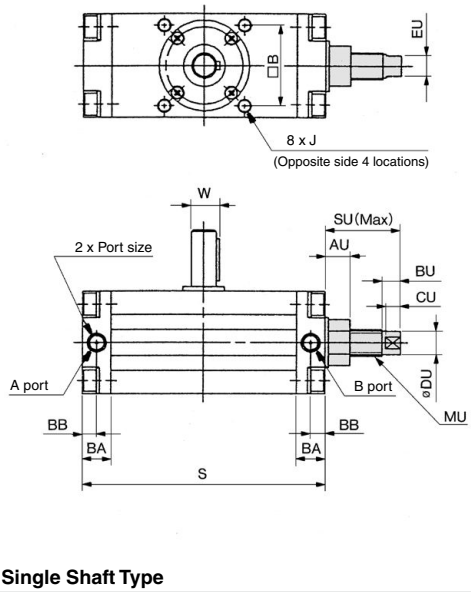
Model	Part no.	Description (The parts shown below are set.)	
C□RA1□□U50	P294020-22A	⑦ Slider	: 2 pcs.
C□RA1□□U63	P294030-22A	⑪ Tube gasket	: 2 pcs.
C□RA1□□U80	P294040-22	⑫ Piston seal	: 2 pcs.
C□RA1□□U100	P294050-22A	⑮ Spring pin	: 4 pcs.
		⑳ Seal washer	: 1 pc.

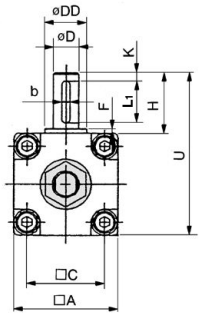
A grease pack (10 g) is included. If an additional grease pack is needed, order with the following part number.
Grease pack part no.: GR-S-010 (10 g)
∗ Individual part cannot be shipped.

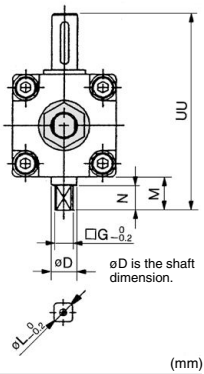
Size 50, 63, 80, 100/Standard: CRA1□□U

* The dimensions below show pressurization to B port.

Single shaft type: CRA1BSU







Double Shaft Type: CRA1BWU (mm)

Model	D (g6)	G	L	M	N	UU
CRA1BWU 50	15	11	14	20	15	118
CRA1BWU 63	17	13	16	22	17	139
CRA1BWU 80	20	15	19	25	20	167
CRA1BWU100	25	19	24	30	25	202

Single Shaft Type

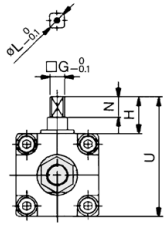
(mm)

Model	Port size *	A	AU	B	BA	BB	BU	C	CU	D (g6)	DD (h9)	DU	EU	F	H	J	K	MU	S	SU	U	W	Key dimensions b	Key dimensions L1
CRA1BSU 50	Rc1/8	62	15	48	17	8.5	11	46	9	15	25	14	12	2.5	36	M8 x 1.25 depth 8	5	M16 x 1.5	144 (177)	45	98	17	5 0 -0.030	25
CRA1BSU 63	Rc1/8	76	19	60	20	10	13	57	11	17	30	18	14	2.5	41	M10 x 1.5 depth 12	5	M20 x 1.5	163 (201.5)	54.5	117	19.5	6 0 -0.030	30
CRA1BSU 80	Rc1/4	92	22	72	23.5	12	16	70	13	20	35	22	19	3	50	M12 x 1.75 depth 13	5	M24 x 1.5	186 (230)	62.5	142	22.5	6 0 -0.030	40
CRA1BSU100	Rc3/8	112	22	85	25	12.5	16	85	13	25	40	22	19	4	60	M12 x 1.75 depth 14	5	M24 x 1.5	245 (311)	73.5	172	28	8 0 -0.036	45

* ( ) are the dimensions for rotation of 180° and 190°.
* In addition to Rc, G and NPT are also available.

Size 50, 63, 80, 100

Single shaft with four chamfers: CRA1BXU□

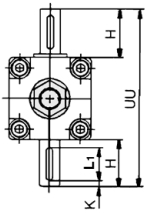


(mm)

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

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

Double shaft key: CRA1BYU□

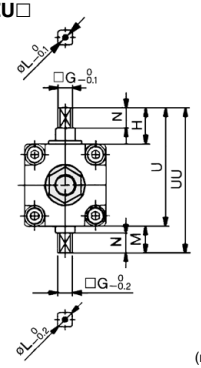


(mm)

Model	L_1	H	K	UU
CRA1BYU□50	25	36	5	134
CRA1BYU□63	30	41	5	158
CRA1BYU□80	40	50	5	192
CRA1BYU□100	45	60	5	232

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

Double shaft with four chamfers: CRA1BZU□

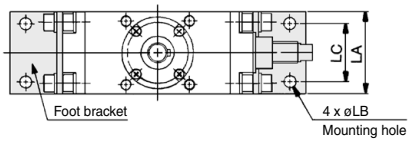


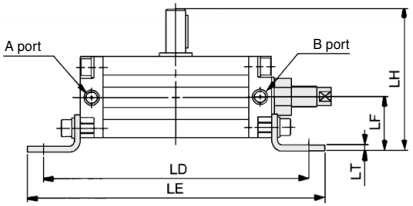
(mm)

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

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

Foot style: CRA1L□U





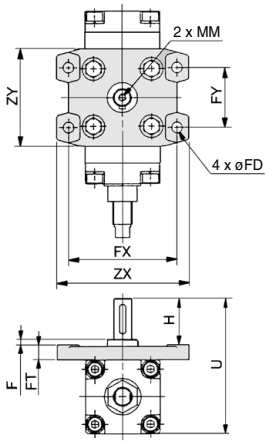
⋆ The dimensions below show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.

(mm)

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

Size 50, 63, 80, 100

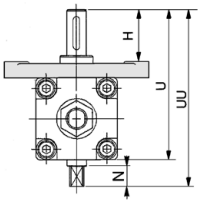
Single shaft flange style: CRA1FSU



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

Model	F	FD	FT	FX	FY	H	MM	U	ZX	ZY
CRA1F□U50	4	9	13	90	50	39	M6x 1.0 depth 12	114	110	81
CRA1F□U63	5	11.5	15	105	59	45	M6x 1.0 depth 12	136	130	101
CRA1F□U80	5	13.5	18	130	76	55	M8x 1.25 depth 16	165	160	119
CRA1F□U100	5	13.5	18	150	92	60	M10x 1.5 depth 20	190	180	133

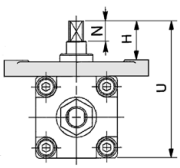
Flange style Double shaft: CRA1FWU



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

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

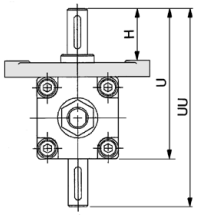
Flange style Single shaft with four chamfers: CRA1FXU



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

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

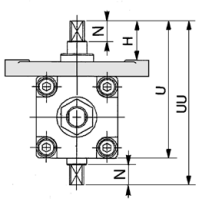
Flange style Double shaft key: CRA1FYU



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

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

Flange style Double shaft with four chamfers: CRA1FZU

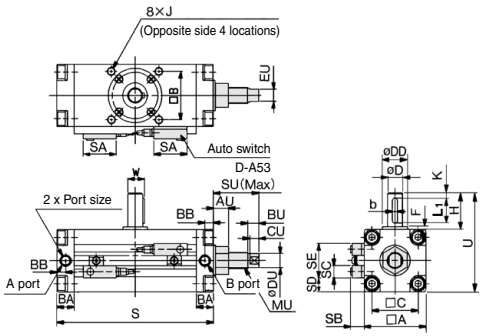


Note) Other dimensions are the same as the single shaft. (mm)

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

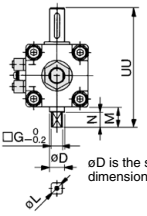
Size 50, 63, 80, 100

Single shaft type: CDRA1BSU



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

Double shaft type: CDRA1BWU



(mm)

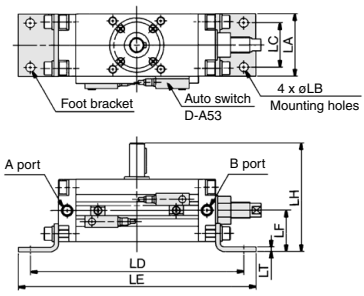
Model	øD (g6)	□G	M	N	UU	øL
CDRA1BWU50	15	11	20	15	118	14
CDRA1BWU63	17	13	22	17	139	16
CDRA1BWU80	20	15	25	20	167	19
CDRA1BWU100	25	19	30	25	202	24

(mm)

Model	Port size ∗	□A	□B	□C	øD (g6)	øDD (h9)	F	H	J	K	S	U	W	BA	BB	SA	SB	SC	SD	SE	Key dimensions b	Key dimensions L1	AU	BU	CU	DU	EU	SU	MU
CDRA1BSU50	Rc 1/8	62	48	46	15	25	2.5	36	M8 x 1.25 depth 8	5	156 (189)	98	17	17	8.5	33	13.5	12	14	34	5 0 -0.030	25	15	11	9	14	12	45	M16 x 1.5
CDRA1BSU63	Rc 1/8	76	60	57	17	30	2.5	41	M10 x 1.5 depth 12	5	175 (213.5)	117	19.5	20	10	33	14.5	12	21	34	6 0 -0.030	30	19	13	11	18	14	54.5	M20 x 1.5
CDRA1BSU80	Rc 1/4	92	72	70	20	35	3	50	M12 x 1.75 depth 13	5	199 (243)	142	22.5	23.5	12	33	15.5	12	29	34	6 0 -0.030	40	22	16	13	22	19	62.5	M24 x 1.5
CDRA1BSU100	Rc 3/8	112	85	85	25	40	4	60	M12 x 1.75 depth 14	5	259 (325)	172	28	25	12.5	33	16	12	39	34	8 0 -0.036	45	22	16	13	22	19	73.5	M24 x 1.5

∗ In addition to Rc, G and NPT are also available.

Foot style: CDRA1LSU

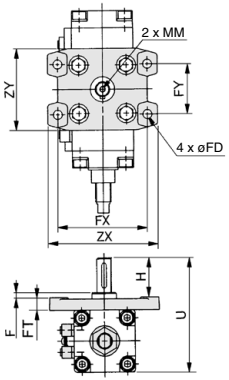


⋆ The dimensions above show pressurization to B port.
∗ ( ) are the dimensions for rotation of 180° and 190°.
Note) Other dimensions are the same as the single shaft.

(mm)

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

Flange style single shaft: CDRA1FSU



(mm)

Model	F	H	MM	U	øFD	FT	FX	FY	ZX	ZY
CDRA1FSU50	4	39	M6 x 1.0 depth 12	114	9	13	90	50	110	81
CDRA1FSU63	5	45	M6 x 1.0 depth 12	136	11.5	15	105	59	130	101
CDRA1FSU80	5	55	M8 x 1.25 depth 16	165	13.5	18	130	76	160	119
CDRA1FSU100	5	60	M10 x 1.5 depth 20	190	13.5	18	150	92	180	133

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

Made to Order

Shaft shape pattern is dealt with simple Made-to-Order system. (Refer to front matter 32.)
Please contact SMC for a specification sheet when placing an order.

Shaft Pattern Sequencing I

Applicable shaft type: S, W, Y

How to Order

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

Built-in magnet

Nil	None
D	Built-in magnet

Mounting style

B	Basic style
L	Foot style

Shaft type

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

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Size

30
50
63
80
100

Rotating angle

90°
100°
180°
190°

Auto switch

Refer to page 219 for the part no. of auto switches.

Air cushion

Nil	None
C *	With air cushion

* For pneumatic type only.

Simple Specials, Made-to-Order symbol

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

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

• Combination 3 Types

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

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

• Combination 4 Types

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

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

* Combination of simple special and Made-to-Order is available for up to 4 types.
* Above is the typical example of combination.

How to order model with auto switches

Refer to page 219 for "How to Order" products with auto switch.

How to order model with solenoid valve

Refer to page 234 for "How to order" products with solenoid valve.

Refer to page 218 for "How to Order".

How to order angle adjustable type

Refer to page 240 for "How to Order" angle adjustable type.

SMC

Symbol
-XA1 to XA24

Combination Chart of Simple Specials for Tip End Shape

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

Symbol	Description	Shaft direction		Shaft type			Combination			
		Upper	Lower	S	W	Y	XA1	XA2	XA13	XA24
XA 1	Female thread at the end	●	–	●	●	●	–	●	–	●
XA 2	Female thread at the end	–	●	●	●	●	●	–	–	●
XA13	Shaft through-hole	●	●	●	●	●	–	–	–	●
XA14	Shaft through-hole + Rod end female thread	●	–	●	●	●	–	–	–	●
XA15	Shaft through-hole + Rod end female thread	–	●	●	●	●	–	–	–	●
XA16	Shaft through-hole + Double shaft-end female threads	●	●	●	●	●	–	–	–	●
XA17	Shorted shaft (Long shaft with key)	●	–	●	●	●	–	●	●	–
XA18	Shorted shaft (Short shaft and with four sided chamfer)	–	●	–	●	●	W, Y *	–	W, Y *	–
XA19	Shorted shaft (Double shaft)	●	●	–	●	●	–	–	W, Y *	–
XA20	Reverse shaft, Shorted shaft	●	●	–	●	●	–	–	S, W *	–
XA24	Double key	●	–	●	●	●	–	–	–	–

* Corresponding shafts type available for combination.

Combination Chart of Made to Order

Chart 2. Combination between -XA□ and -XC□

Symbol	Description	Shaft type			Applicable size	Combination	
		S	W	Y		XA1,2,13 to 19	XA20,24
XC 7	Reversed shaft	●	●	–	50, 63, 80, 100	–	–
XC 8 to XC11	Change of rotating range	●	●	●		●	–
XC30	Fluorine grease	●	●	●	30 to 100	●	●
XC31 to XC36	Change of rotation range and shaft rotation direction	●	●	●	50, 63, 80, 100	●	–
XC37 to XC46	Change of rotation range and angle adjusting direction	●	●	●		●	–
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	●	●	●		●	–
XC59 to XC61	Change of port direction	●	●	●	30 to 100	●	●
XC62	Reverse mounting of auto switch	●	●	●	50, 63, 80, 100	●	●
XC63	One side hydro, One side air	●	●	●		●	●
XC64	One side hydro, One side air	●	●	●		●	●

Chart 3. Combination between -XA□ and -X□

Symbol	Description	Shaft type			Applicable size	Combination	
		S	W	Y		XA1,2,13 to 20	XA24
X 6	Shaft, bolt made of stainless steel	●	●	●	30 to 100	●	●
X 7	Heat resistance (100°C)	●	●	●		●	●
X10	Angle adjustment for both sides	●	●	●	50 to 100	●	●
X11	Angle adjustment for single side, Air cushion with single side	●	●	●		●	●
X16	Fluororubber seal	●	●	●	30 to 100	●	●

* **Chart 7. For combination between -XC□ and -XC□, refer to page 257.**
Chart 8. For combination between -X□ and -XC□, refer to page 257.
Chart 9. For combination between -X□ and -X□, refer to page 266.

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

Made to Order

Shaft shape pattern is dealt with simple Made-to-Order system. (Refer to front matter 32.)
Please contact SMC for a specification sheet when placing an order.

Symbol

Shaft Pattern Sequencing I — -XA1 to XA17

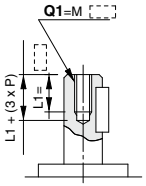
Applicable shaft type: S, W, Y

Additional Reminders

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

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

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

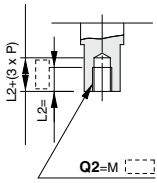


(mm)

Size	Q1
30	M3
50	M4, M5, M6
63	M4, M5, M6
80	M4, M5, M6, M 8
100	M5, M6, M8, M10

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

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

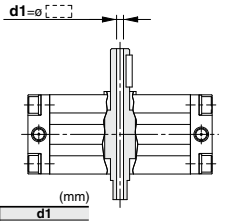


(mm)

Size	Q2
30	M3, M4
50	M4, M5, M6
63	M4, M5, M6
80	M4, M5, M6, M 8
100	M5, M6, M8, M10

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

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

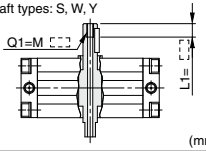


(mm)

Size	d1
30	ø2.5
50	ø4 to ø 7
63	ø4 to ø 8
80	ø6.8 to ø11
100	ø6.8 to ø13

Symbol: A14
Note) Except flange style

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

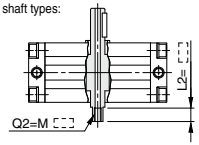


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	–	–	–	–
M5 x 0.8	–	ø4	ø4	–	–
M6 x 1	–	ø5	ø5	–	–
M8 x 1.25	–	–	ø6.8	ø 6.8	ø 6.8
M10 x 1.5	–	–	–	ø 8.5	ø 8.5
M12 x 1.75	–	–	–	ø10.3	ø10.3
Rc1/8	–	–	–	ø 8	ø 8
Rc1/4	–	–	–	–	ø11

Symbol: A15
Note) Except flange style

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

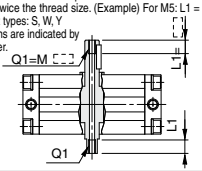


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	–	–	–	–
M5 x 0.8	–	ø4	ø4	–	–
M6 x 1	–	ø5	ø5	–	–
M8 x 1.25	–	–	ø6.8	ø 6.8	ø 6.8
M10 x 1.5	–	–	–	ø 8.5	ø 8.5
M12 x 1.75	–	–	–	ø10.3	ø10.3
Rc1/8	–	–	–	ø 8	ø 8
Rc1/4	–	–	–	–	ø11

Symbol: A16
Note) Except flange style

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

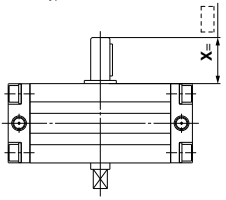


(mm)

Thread \ Size	30	50	63	80	100
M3 x 0.5	ø2.5	–	–	–	–
M5 x 0.8	–	ø4	ø4	–	–
M6 x 1	–	ø5	ø5	–	–
M8 x 1.25	–	–	ø6.8	ø 6.8	ø 6.8
M10 x 1.5	–	–	–	ø 8.5	ø 8.5
M12 x 1.75	–	–	–	ø10.3	ø10.3
Rc1/8	–	–	–	ø 8	ø 8
Rc1/4	–	–	–	–	ø11

Symbol: A17

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



(mm)

Size	X
30	15 to 25
50	18.5 to 36
63	21 to 41
80	25 to 50
100	32.5 to 60

Symbol

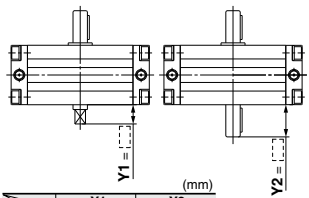
Shaft Pattern Sequencing I

-XA18 to XA24

Applicable shaft type: S, W, Y

Symbol: A18

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

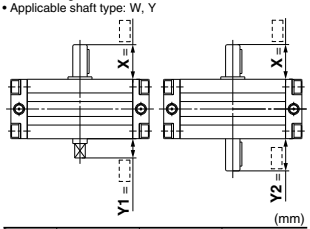


(mm)

Size \ Shaft type	Y1 W	Y2 Y
30	3 to 8	15 to 25
50	1 to 20	18.5 to 36
63	1 to 22	21 to 41
80	1 to 25	25 to 50
100	1 to 30	32.5 to 60

Symbol: A19

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

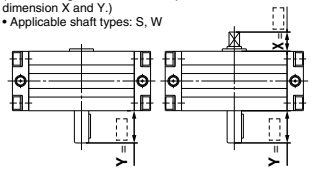


(mm)

Size \ Shaft type	X W	X Y	Y1 W	Y2 Y
30	15 to 25		3 to 8	15 to 25
50	18.5 to 36		1 to 20	18.5 to 36
63	21 to 41		1 to 22	21 to 41
80	25 to 50		1 to 25	25 to 50
100	32.5 to 60		1 to 30	32.5 to 60

Symbol: A20

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

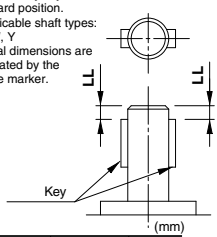


(mm)

Size \ Shaft type	X W	X S	Y W
50	2 to 11		18.5 to 36
63	2.5 to 16.5		21 to 41
80	3 to 20		25 to 50
100	3 to 22		32.5 to 60

Symbol: A24

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



(mm)

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

Series ***CRA1*** (Size 30, 50, 63, 80, 100)
Simple Specials:
-XA33 to -XA59: Shaft Pattern Sequencing II

Made to Order

Shaft shape pattern is dealt with simple Made-to-Order system. (Refer to front matter 32.)
Please contact SMC for a specification sheet when placing an order.

Shaft Pattern Sequencing II

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

How to Order

C D RA1 B J [ ] P 50 – 90 C – F59 – X A34 A37 C59 -X6

Built in magnet

Nil	None
D	Built-in magnet

Mounting style

B	Basic style
L	Foot style

Shaft type

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

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Size

30
50
63
80
100

Ratating angle

90°
100°
180°
190°

Auto switch

Refer to page 219 for the part no. of auto switches.

Suffix symbol

Nil	Without air cushion
C *	With air cushion

* For pneumatic type only.

Simple Specials, Made-to-Order symbol

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

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

• Combination 3 Types

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

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

• Combination 4 Types

				• Combination of Applicable Chart
A33	A34	C30	C59	Chart 4, 5, 7
A34	A37	C59	-X6	Chart 4, 5, 6, 8
A35	A36	-X6	-X16	Chart 4, 6, 9
A43	C59	C62	-X16	Chart 5, 6, 7, 8
A45	C60	-X10	-X16	Chart 5, 6, 8, 9
A46	C30	C61	C62	Chart 5, 7

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

* Combination of simple special and Made-to-Order, it is possible for up to 4 types.
* Above is the typical example of combination.

How to order model with auto switches

Refer to page 219 for "How to Order" products with auto switch.

How to order model with solenoid valve

Refer to page 234 for "How to order" products with solenoid valve,

Refer to page 218 for "How to Order".

How to order angle adjustable type

Refer to page 240 for "How to Order" angle adjustable type.

Symbol
-XA33 to XA59

Combination Chart of Simple Specials for Tip End Shape

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

Symbol	Description	Shaft direction		Shaft type					Combination								
		Upper	Lower	X	Z	T	J	K	∗ Corresponding shafts type available for combination								
XA33	Female thread at the end	●	–	–	–	●	●	●	**XA33**								
XA34	Female thread at the end	–	●	–	–	●	●	●	T, J, K ∗	**XA34**							
XA35	Female thread at the end	●	–	●	●	–	–	–	—	—	**XA35**						
XA36	Female thread at the end	–	●	●	●	–	–	–	—	—	X,Z ∗	**XA36**					
XA37	Stepped round shaft	●	–	–	–	●	●	●	—	T, J, K ∗	—	—	**XA37**				
XA38	Stepped round shaft	–	●	–	–	–	–	●	K ∗	—	—	—	K ∗				
XA40	Shaft through hole	●	●	–	–	●	–	●	—	—	—	—	—				
XA41	Shaft through hole	●	●	●	●	–	●	–	—	—	—	—	—				
XA43	Shaft through-hole + Double shaft-end-female threads	●	●	–	–	●	–	●	—	—	—	—	—				
XA44	Shaft through-hole + Double shaft-end-female threads	●	●	●	●	–	●	–	—	—	—	—	—	**XA38**			
XA45	Middle-cut chamfer	●	–	–	–	●	●	●	—	T, J, K ∗	—	—	—	K ∗	**XA40**	**XA41**	**XA45**
XA46	Middle-cut chamfer	–	●	–	–	–	–	●	K ∗	—	—	—	K ∗	—	—	—	K ∗
XA51	Change of long shaft length (Without keyway)	●	–	–	–	●	●	●	—	T, J, K ∗	—	—	—	K ∗	T, K ∗	J ∗	—
XA52	Change of short shaft length (Without keyway)	–	●	–	–	–	–	●	K ∗	—	—	—	—	—	K ∗	—	K ∗
XA53	Change of double shaft length (Both without keyway)	●	●	–	–	–	–	●	—	—	—	—	—	—	K ∗	—	—
XA54	Change of long shaft length (With four chamfers)	●	–	●	●	–	–	–	—	—	—	X, Z ∗	—	—	—	X, Z ∗	—
XA55	Change of short shaft length (With four chamfers)	–	●	–	●	–	●	–	J ∗	—	Z ∗	—	J ∗	—	—	J, Z ∗	J ∗
XA56	Change of double shaft length (Both with four chamfers)	●	●	–	●	–	–	–	—	—	—	—	—	—	—	Z ∗	—
XA57	Change of double shaft length (Without keyway, With four chamfers)	●	●	–	–	–	●	–	—	—	—	—	—	—	—	J ∗	—
XA58	Reversed shaft, Change of shaft length (With four chamfers, Without keyway)	●	●	–	–	●	●	–	—	—	—	—	—	—	T ∗	J ∗	—
XA59	Reversed shaft, Change of shaft length (With four chamfers)	–	●	●	–	–	–	–	—	—	—	—	—	—	—	X ∗	—

Combination Chart of Made to Order

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

Symbol	Description	Shaft type					Applicable size	Combination
		X	Z	T	J	K		XA33 to 38, 40 to 46, 51 to 59
XC7	Reversed shaft	●	–	●	●	–	50, 63,	–
XC8 to XC11	Change of rotating range	–	–	–	–	–	80, 100	–
XC30	Fluorine grease	●	●	●	●	●	30 to 100	●
XC31 to XC36	Change of rotation range and shaft rotation direction	–	–	–	–	–	50, 63, 80, 100	–
XC37 to XC46	Change of rotation range and angle adjusting direction	–	–	–	–	–		–
XC47 to XC58	Change of rotation range and angle adjusting direction (Angle adjusting screw is equipped on the left.)	–	–	–	–	–		–
XC59 to XC61	Change of port direction	●	●	●	●	●	30 to 100	●
XC62	Reverse mounting of auto switch	●	●	●	●	●	50, 63, 80, 100	●
XC63	One side hydro, One side air	●	●	●	●	●		●
XC64	One side hydro, One side air	●	●	●	●	●		●

Chart 6. Combination between -XA□ and -X□

Symbol	Description	Shaft type					Applicable size	Combination
		X	Z	T	J	K		XA33 to 38, 40 to 46, 51 to 59
X6	Shaft, bolt made of stainless steel	●	●	●	●	●	30 to 100	●
X7	Heat resistance (100°C)	●	●	●	●	●		●
X10	Angle adjustment for both sides	●	●	●	●	●	50 to 100	●
X11	Angle adjustment for single side, Air cushion with single side	●	●	●	●	●		●
X16	Fluororubber seal	●	●	●	●	●	30 to 100	●

∗ **Chart 7. For combination between -XC□ and -XC□, refer to page 257.**
Chart 8. For combination between -X□ and -XC□, refer to page 257.
Chart 9. For combination between -X□ and -X□, refer to page 266.

Series ***CRA1*** (Size 30, 50, 63, 80, 100)
Simple Specials:
-XA33 to -XA59: Shaft Pattern Sequencing II

Made to Order

Shaft shape pattern is dealt with simple Made-to-Order system. (Refer to front matter 32.)
Please contact SMC for a specification sheet when placing an order.

Symbol

Shaft Pattern Sequencing II — -XA33 to XA41

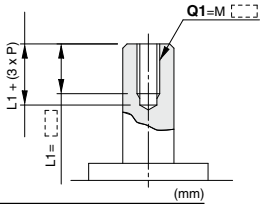
Applicable shaft type: X, Z, T, J, K

Additional Reminders

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

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

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

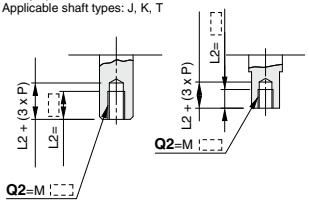


(mm)

Size	Q1
30	M3
50	M4, M5, M6, M 8
63	M4, M5, M6, M 8, M10
80	M4, M5, M6, M 8, M10, M12
100	M5, M6, M8, M10, M12

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

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

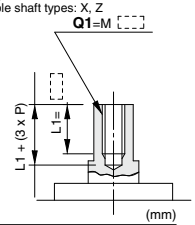


(mm)

Size	Q2
30	M3
50	M4, M5, M6, M 8
63	M4, M5, M6, M 8, M10
80	M4, M5, M6, M 8, M10, M12
100	M5, M6, M8, M10, M12

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

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

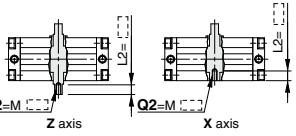


(mm)

Size	Q1
30	M3
50	M4, M5, M6, M 8
63	M4, M5, M6, M 8, M10
80	M4, M5, M6, M 8, M10, M12
100	M5, M6, M8, M10, M12

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

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

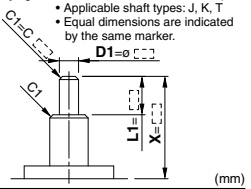


(mm)

Size	Q2
30	M3
50	M4, M5, M6, M 8
63	M4, M5, M6, M 8, M10
80	M4, M5, M6, M 8, M10, M12
100	M5, M6, M8, M10, M12

Symbol: A37
Note) Except flange style

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

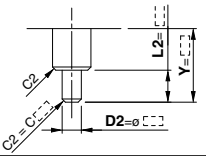


(mm)

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

Symbol: A38
Note) Except flange style

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

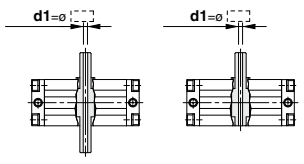


(mm)

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

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

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

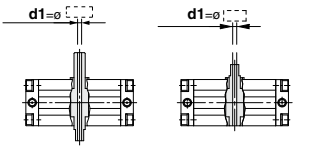


(mm)

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

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

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



(mm)

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

SMC

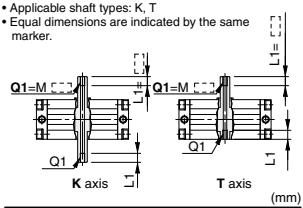
Symbol
-XA43 to XA55

Shaft Pattern Sequencing II

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

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

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

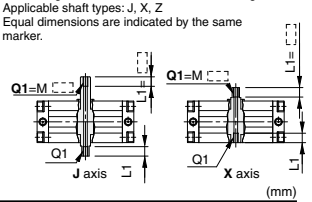


(mm)

Thread \ Size	30	50	63	80	100
M 3 x 0.5	ø2.5	–	–	–	–
M 5 x 0.8	–	ø4	ø4	–	–
M 6 x 1	–	ø5	ø5	–	–
M 8 x 1.25	–	–	ø6.8	ø 6.8	ø 6.8
M10 x 1.5	–	–	–	ø 8.5	ø 8.5
M12 x 1.75	–	–	–	ø10.3	ø10.3
Rc 1/8	–	–	–	ø 8	ø 8
Rc 1/4	–	–	–	–	ø11

Symbol: A44
Note) Except flange style

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

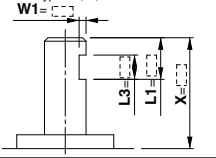


(mm)

Thread \ Size	30	50	63	80	100
M 3 x 0.5	ø2.5	–	–	–	–
M 5 x 0.8	–	ø4	ø4	–	–
M 6 x 1	–	ø5	ø5	–	–
M 8 x 1.25	–	–	ø6.8	ø 6.8	ø 6.8
M10 x 1.5	–	–	–	ø 8.5	ø 8.5
M12 x 1.75	–	–	–	ø10.3	ø10.3
Rc 1/8	–	–	–	ø 8	ø 8
Rc 1/4	–	–	–	–	ø11

Symbol: A45
Note) Except flange style

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

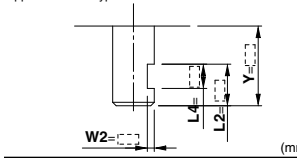


(mm)

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

Symbol: A46
Note) Except flange style

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

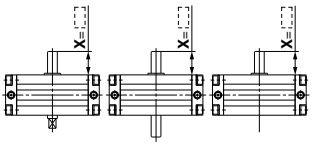


(mm)

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

Symbol: A51

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

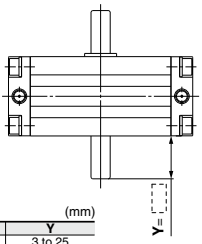


(mm)

Size	X
30	3 to 25
50	3.5 to 36
63	3.5 to 41
80	4 to 50
100	5 to 60

Symbol: A52

Shorten the short shaft.
- Applicable shaft type: K

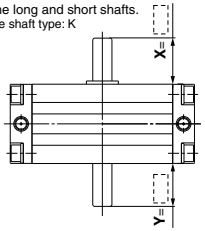


(mm)

Size	Y
30	3 to 25
50	1 to 36
63	1 to 41
80	1 to 50
100	1 to 60

Symbol: A53

Shorten the long and short shafts.
- Applicable shaft type: K

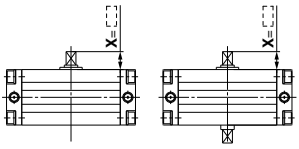


(mm)

Size	X	Y
30	3 to 25	3 to 25
50	3.5 to 36	1 to 36
63	3.5 to 41	1 to 41
80	4 to 50	1 to 50
100	5 to 60	1 to 60

Symbol: A54

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

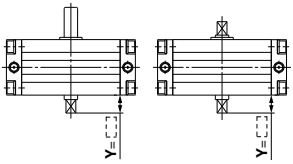


(mm)

Size	X
30	3 to 13
50	3.5 to 27
63	3.5 to 29
80	4 to 38
100	5 to 44

Symbol: A55

Shorten the short shaft.
- Apricable shaft types: J, Z



(mm)

Size	Y
30	3 to 10
50	1 to 20
63	1 to 22
80	1 to 25
100	1 to 30

Series ***CRA1*** (Size 30, 50, 63, 80, 100)
Simple Specials:
-XA33 to -XA59: Shaft Pattern Sequencing II

Made to Order

Shaft shape pattern is dealt with simple Made-to-Order system. (Refer to front matter 32.)
Please contact SMC for a specification sheet when placing an order.

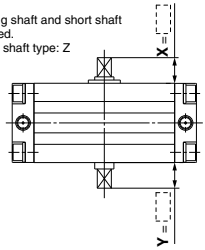
Symbol

Shaft Pattern Sequencing II — -XA56 to XA59

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

Symbol: A56

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

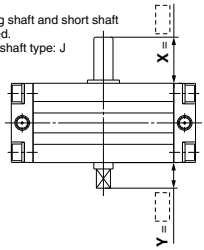


(mm)

Size	X	Y
30	3 to 13	3 to 10
50	3.5 to 27	1 to 20
63	3.5 to 29	1 to 22
80	4 to 38	1 to 25
100	5 to 44	1 to 30

Symbol: A57

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

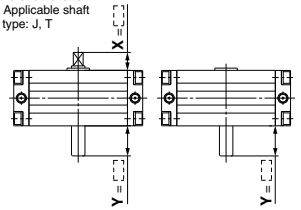


(mm)

Size	X	Y
30	3 to 25	3 to 10
50	3.5 to 36	1 to 20
63	3.5 to 41	1 to 22
80	4 to 50	1 to 25
100	5 to 60	1 to 30

Symbol: A58

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

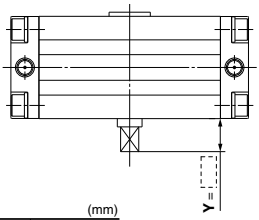


(mm)

Size	Y
50	1 to 36
63	1 to 41
80	1 to 50
100	1 to 60

Symbol: A59

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



(mm)

Size	Y1
50	1 to 27
63	1 to 29
80	1 to 38
100	1 to 44

Made to Order Specifications 1

Made to Order

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

How to Order

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

Magnet

Nil	None
D	Built-in magnet

Mounting style

B	Basic style
L	Foot style
F	Flange style

Shaft type

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

Type

Nil	Pneumatic
H	Air-hydro

Pattern

Size

30
50
63
80
100

Rotating angle

90°
100°
180°
190°

Air cushion

Nil	None
C *	With air cushion

* For pneumatic type only.

Auto switch

Refer to page 219 for the part no. of auto switches.

Simple Specials, Made-to-Order symbol

- When the number of combinations are one or two, please refer to chart 7 and 8.

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

• Combination 3 Types

C7	C30	C59
C31	C60	-X6
C59	-X10	-X16

• Combination of Applicable Chart

Chart 7
Chart 7, 8
Chart 8, 9

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

• Combination 4 Types

C7	C30	C59	C62
C31	C60	C30	-X6
C59	C62	-X10	-X16

• Combination of Applicable Chart

Chart 7
Chart 7, 8
Chart 7, 8, 9

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

* Combination of Made-to-Order is available up to 4 types.
* Above is the typical example of combination.
* Chart 9. For combination chart between -X□ and -X□, refer to page 266.

How to order model with auto switches

Refer to page 219 for "How to Order" products with auto switch.

How to order model with solenoid valve

Refer to page 234 for "How to order" products with solenoid valve,

How to order angle adjustable type

Refer to page 240 for "How to Order" angle adjustable type.

Refer to page 218 for "How to Order".

Combination Chart of Made to Order

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

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

Chart 8. Combination between -X□ and -XC□ (Refer to page 266 for Made-to-Order/details on -X□.)

Part no.	Description	Shaft type S	W	X	Y	Z	T	J	K	Applicable size	XC7	XC8 to 11	XC30	XC31 to 36	XC37 to 58	XC59 to 61	XC62	XC63	XC64
X 6	Shaft, Bolt, Parallel key stainless steel spec.	●	●	●	●	●	●	●	●	30 to 100	●	●	●	●	—	●	●	●	●
X 7	Heat resistance (100°C)	●	●	●	●	●	●	●	●		●	●	—	●	●	●	—	—	—
X10	Angle adjustment for both sides	●	●	●	●	●	●	●	●	50 to 100	●	—	●	—	—	●	●	—	—
X11	Angle adjustment for single side, Air cushion with single side	●	●	●	●	●	●	●	●		●	—	—	—	—	●	●	—	—
X16	Fluororubber seal	●	●	●	●	●	●	●	●	30 to 100	●	●	●	●	●	●	●	—	—

Made to Order Specifications 2

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

Made to Order

1 Reversed Shaft

Symbol: **-XC7**

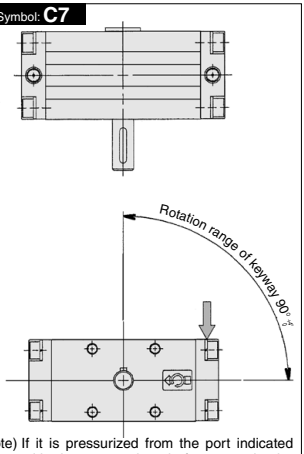
CRA1 Refer to "How to Order" on page 257. — **XC7**

Reverse mounting of rotation shaft (-XC7)

Specifications

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

Symbol: **C7**



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

2 Change of Rotating Range

Symbol: **-XC8 to -XC11**

CRA1 Refer to "How to Order" on page 257. — **XC8**

Symbol: XC8 to -XC11

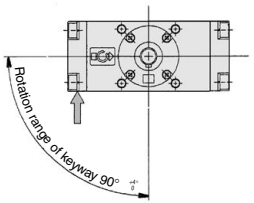
Specifications

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

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

Symbol: **C8**

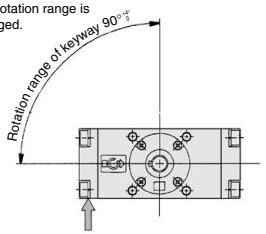
The rotation range is changed.



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

Symbol: **C9**

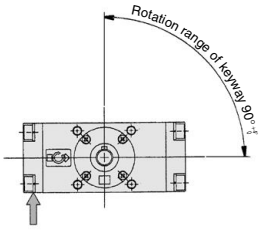
The rotation range is changed.



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

Symbol: **C10**

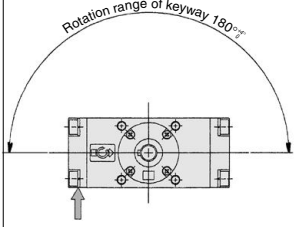
The rotation range is changed.



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

Symbol: **C11**

The rotation range is changed.



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

3 Fluorine Grease

Symbol: **-XC30**

CRA1 Refer to "How to Order" on page 257. — **XC30**

Fluorine grease

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

Specifications

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

∗ Refer to page 220 for other specifications.
∗∗ Except air-hydro type.

Symbol

4 Reversed Shaft -XC31 to XC36

CRA1 Refer to "How to Order" on page 257. -XC31

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

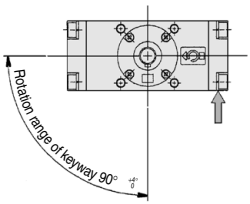
Specifications

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

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

Symbol: C31

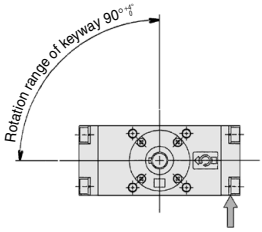
The rotation range is changed and the rotating direction is reversed.



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

Symbol: C32

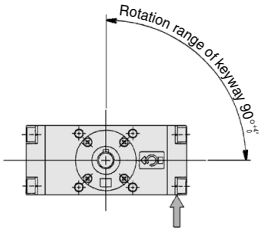
The rotation range is changed and the rotating direction is reversed.



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

Symbol: C33

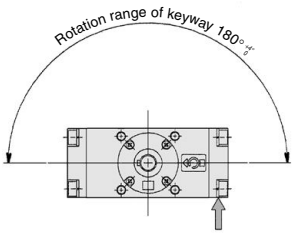
The rotation range is changed and the rotating direction is reversed.



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

Symbol: C34

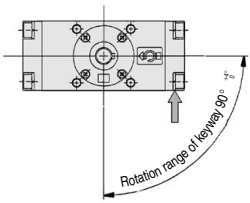
The rotation range is changed and the rotating direction is reversed.



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

Symbol: C35

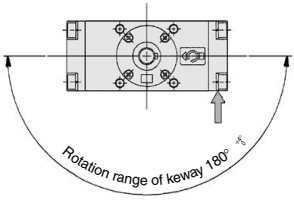
The rotation range is changed and the rotating direction is reversed.



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

Symbol: C36

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



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

Made to Order Specifications 3

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

Made to Order

5 Change of Rotation Range and Angle adjusting direction

Symbol: **-XC37 to XC42**

CRA1 | **Refer to "How to Order" on page 257.** — **XC37**

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

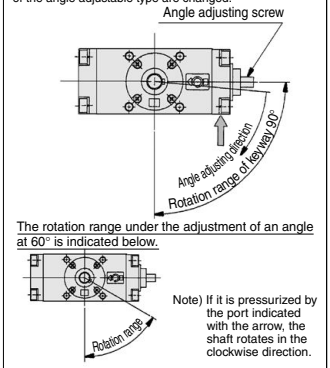
Specifications

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

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

Symbol: C37

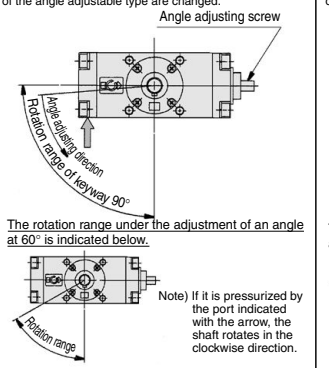
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C38

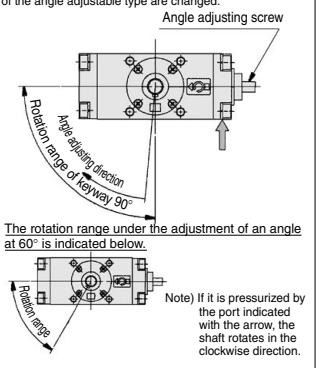
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C39

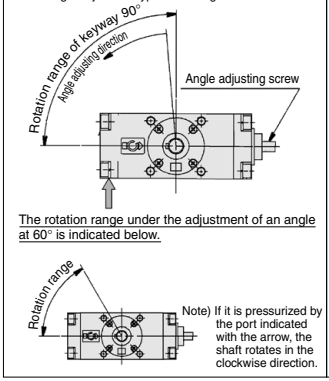
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C40

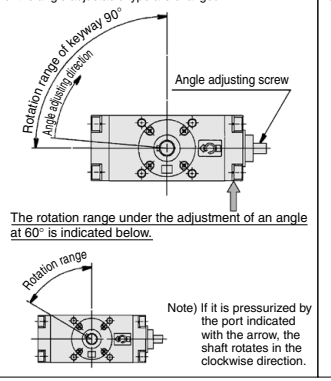
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C41

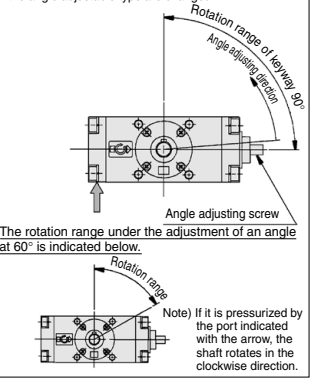
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C42

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



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

Symbol

Change of Rotation Range and Angle adjusting direction -XC43 to XC46

CRA1 | **Refer to "How to Order" on page 257.** — **XC43**

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

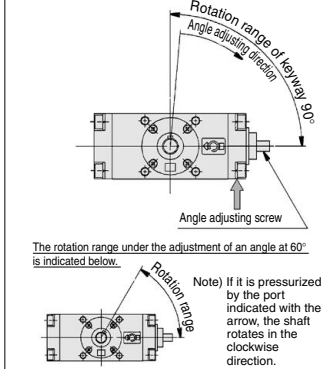
Specifications

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

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

Symbol: C43

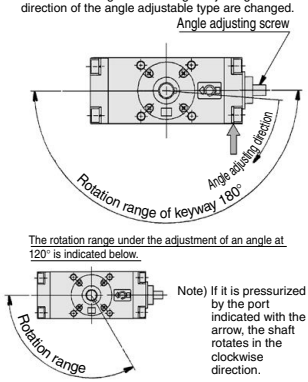
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C44

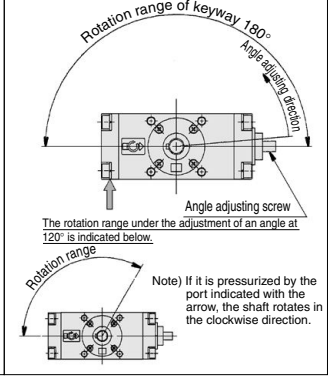
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C45

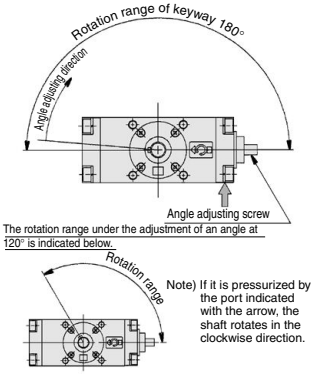
The rotation range and the angle adjusting direction of the angle adjustable type are changed.



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

Symbol: C46

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



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

Made to Order Specifications 4

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

Made to Order

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

Symbol: **-XC47 to XC52**

CRA1 | **Refer to "How to Order" on page 257.** | **-XC47**

Specifications

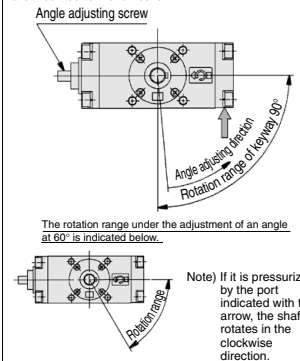
Applicable size	**50, 63, 80, 100**
Applicable shaft type	Shaft S, W, Y

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

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

Symbol: C47

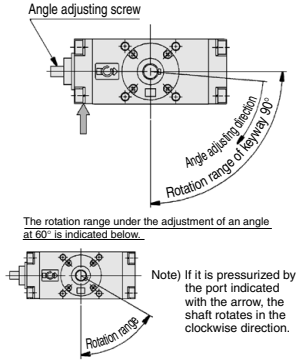
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



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

Symbol: C48

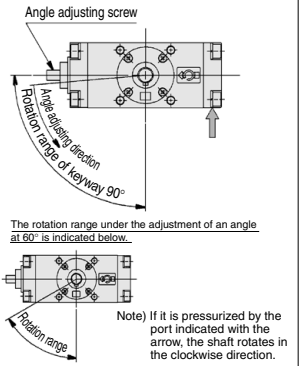
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



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

Symbol: C49

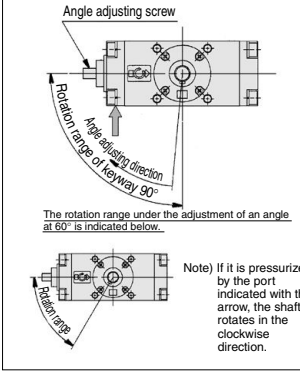
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



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

Symbol: C50

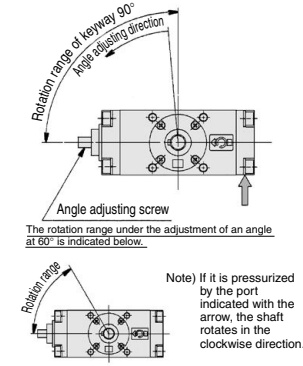
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



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

Symbol: C51

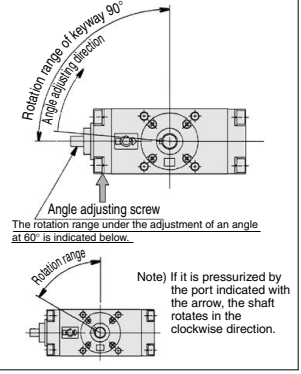
For the angle adjusting type, angle adjusting screws are mounted to the left cover.



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

Symbol: C52

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



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

Symbol

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

CRA1 | **Refer to "How to Order" on page 257.** — **XC53**

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

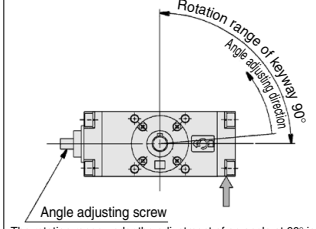
Specifications

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

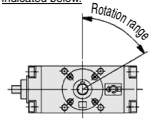
The patterns with the rotation angle of 90° and 180° are applicable to the respective patterns with the rotation angles of 100° and 190° of the Made-to-Order specifications.

Symbol: C53

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



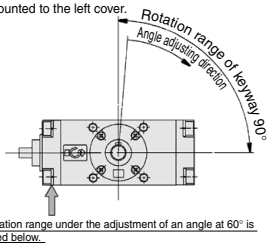
The rotation range under the adjustment of an angle at 60° is indicated below.



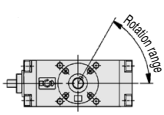
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C54

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



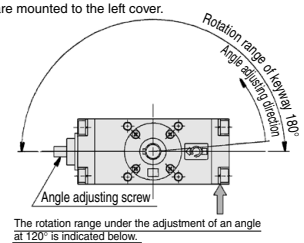
The rotation range under the adjustment of an angle at 60° is indicated below.



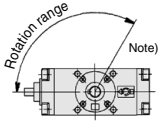
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C55

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



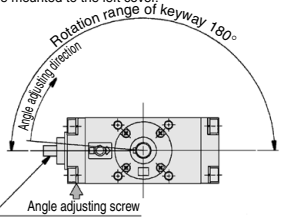
The rotation range under the adjustment of an angle at 120° is indicated below.



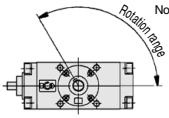
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C56

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



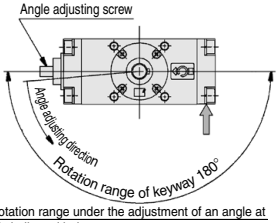
The rotation range under the adjustment of an angle at 120° is indicated below.



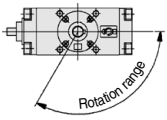
Note) If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C57

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



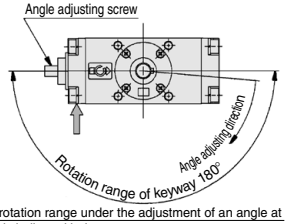
The rotation range under the adjustment of an angle at 120° is indicated below.



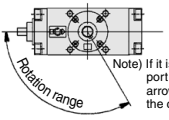
Note)If it is pressurized by the port indicated with the arrow, the shaft rotates in the clockwise direction.

Symbol: C58

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



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



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

Made to Order Specifications 5

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

Made to Order

7 Change of Port Location (Mounting location of the cover is changed.)

Symbol: **-XC59 to XC61**

CRA1 — **Refer to "How to Order" on page 257.** — **XC59**

Specifications

∗ Except for the solenoid valve equipped style.

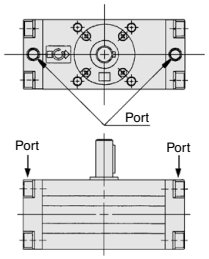
Applicable size	30, 50, 63, 80, 100
Applicable shaft type	Shaft S, W, X, Y Z, T, J, K

Port position is changed. (-XC59 to XC61)

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

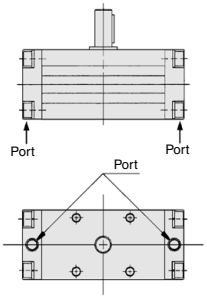
Symbol: C59

Direction of the port is changed. (Upwards)



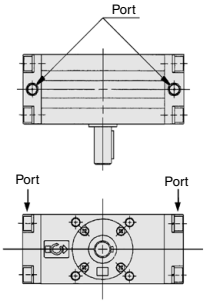
Symbol: C60

Direction of the port is changed. (Downwards)



Symbol: C61

Direction of the port is changed. (Backwards)



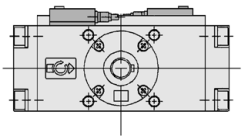
8 Reverse Mounting of the Auto Switch Against the Standard

Symbol: **-XC62**

CRA1 — **Refer to"How to Order" auto switch equipped type on page 219.** — **XC62**

Symbol: C62

The auto switch is reverse mounted to the standard.



Symbol

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

CRA1 **Refer to"How to Order" on page 257.** **—XC63**

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

Specifications

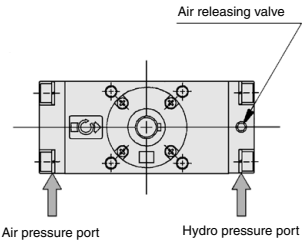
Applicable size	50, 63, 80, 100
Applicable shaft type	Shaft S, W, X, Y Z, T, J, K

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

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

Symbol: C63

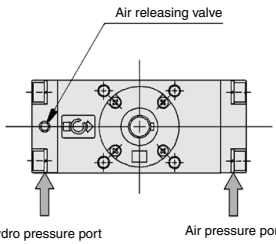
One side air, one side air-hydro specifications (Left side air, right side hydro)



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

Symbol: C64

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



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

Series CRA1
Made to Order Specifications: -X6 to -X16

Made to Order

How to Order

C **D** RA1 B S **□** **P** 50 — 90 **S** – **F59** – **X6** – **X16**

- **D**: Built-in magnet
- **□**: Type

Nil	Standard
U	Angle adjustable type

- **P**: Pattern
- **S**: Suffix symbol

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

∗ Refer to pages 267 and 268 for details.

- **F59**: Auto switch
- **X6** – **X16**: Made-to-Order symbol
  - Combination is available only when all the conditions are fulfilled in above combination chart 9.

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

Combination Chart of Made to Order

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

Part no.	Description	Shaft type								Applicable size	Combination		
		S	W	X	Y	Z	T	J	K				
X 6	Shaft, Bolt, Parallel key stainless steel spec.	●	●	●	●	●	●	●	●	30 to 100	X6		
X 7 *	Heat resistance (100°C)	●	●	●	●	●	●	●	●		●	X7	
X10	Angle adjustment for both sides	●	●	●	●	●	●	●	●	50 to 100	—	●	
X11	Angle adjustment for single side, Air cushion with single side	●	●	●	●	●	●	●	●		—	●	X10 to X11
X16	Fluororubber seal	●	●	●	●	●	●	●	●	30 to 100	●	—	●

*X7: Not available for the built-in magnet type.

1 Shaft, Bolt, Parallel Key Made of Stainless Steel Spec.

Symbol: **-X6**

C□RA1 | Refer to "How to Order" on pages 218, 219 and 234. | S — X6

Stainless steel for main part

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

Specifications

Type	Pneumatic
Size	**30, 50, 63, 80, 100**
Fluid	Air (Non-lube)
Max. operating pressure	1.0 MPa
Min. operating pressure	0.1 MPa
Stainless steel part	Shaft, Bolt, Parallel key
Cushion	30 — Without cushion 50 to 100 — With or without air cushion
Auto switch	Mountable

∗ Refer to page 220 for other specifications.
∗∗ Except for the angle adjustable type.

2 Heat Resistant Type

Symbol: **-X7**

CRA1 | Refer to "How to Order" on pages 218 and 240. | — X7

Heat resistant type

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

Specifications

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

∗ Refer to page 220 for other specifications.
∗∗ Except for models with solenoid valve.

3 Both Sides Angle Adjustable Type

Symbol: **-X10**

Refer to "How to Order" on page 214.

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

Both sides angle adjustable type

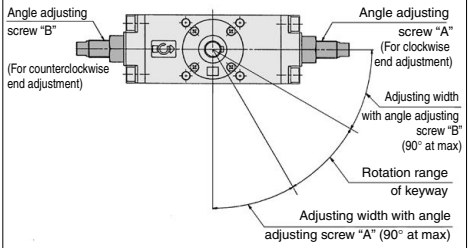
Specifications

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

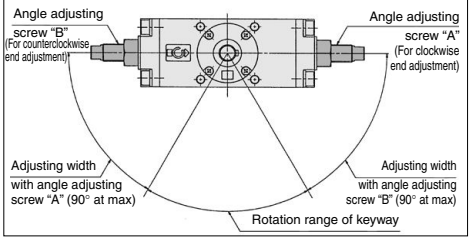
∗ Refer to page 220 for other specifications.

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

Rotation at 90°



Rotation at 180°



Made to Order Specifications 7

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

Made to Order

4 One Side Angle Adjustable, One Side Cushion

Symbol **-X11**

Refer to "How to Order" on page 214.

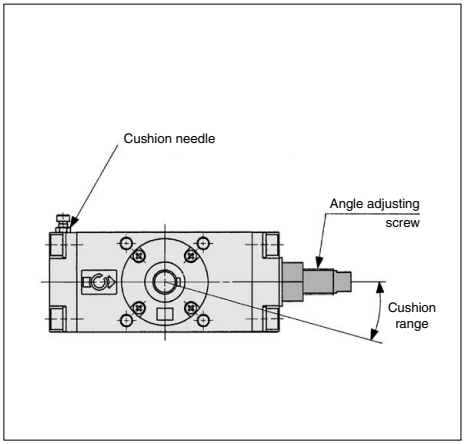
C□RA1 | Mounting | Shaft type | U | Size | Rotation | C-X11

One side angle adjustable, one side cushion

Specifications

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

∗ Refer to page 220 for other specifications.



∗ Refer to pages 230, 231 and 237 for dimensions.

5 Fluororubber Seal

Symbol **-X16**

CDRA1 | Refer to "How to Order" on pages 219 and 240. | — X16

Fluororubber seal

Seal is now changed to fluororubber.

Specifications

Type	Pneumatic
Size	**30, 50, 63, 80, 100**
Fluid	Air (Non-lube)
Max. operating pressure	1.0 MPa
Min. operating pressure	0.1 MPa
Ambient and fluid temperature	0°C to 60°C (No freezing)
Seal material	FKM
Cushion	30 — Without cushion 50 to 100 — With or without air cushion
Auto switch	Mountable

∗ Refer to page 220 for other specifications.
∗∗ Except for models with solenoid valve.

Rotary Actuators Precautions 1

Be sure to read this before handling.

Design/Selection

⚠ Warning

1. Confirm the specifications.

Products represented in this catalog are designed only for use in compressed air systems (including vacuum).
Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)
Please contact SMC when using a fluid other than compressed air (including vacuum).
We do not guarantee against any damage if the product is used outside of the specification range.

2. If the operation involves load fluctuations, ascending/descending movements, or changes in frictional resistance, make sure to provide safety measures.

Operating speed will increase, and bodily injury may occur, or damage to the machinery itself may occur.

3. If there is a chance that the product will pose a hazard to humans, install a protective cover.

If the moving portion of the product will pose a hazard to humans or will damage machinery or equipment, provide a construction that prevents direct contact with those areas.

4. Be certain that the secured portions will not loosen.

Be certain to adopt a reliable connecting method if the rotary actuator is used very frequently or if it is used in a location that is exposed to a large amount of vibration.

5. There may be cases in which a speed reduction circuit or a shock absorber is required.

If the driven object moves at high speeds or is heavy, it will be unfeasible for only the rotary actuator's cushion to absorb the shock. Therefore, provide a speed-reduction circuit to reduce the rotary actuator's speed before the thrust is applied to the cushion, or an external shock absorber to dampen the shock. If these countermeasures are taken, make sure to take the rigidity of the machinery and equipment into consideration.

6. Consider the possibility of a reduction in the circuit air pressure caused by a power failure.

When an actuator is used as clamping mechanism, there is a danger of workpiece dropping if there is a decrease in clamping force, due to a drop in circuit pressure caused by a power failure. Therefore, safety equipment should be installed to prevent damage to machinery/equipment and bodily injury.

7. Consider the possibility of power source related malfunctions that could occur.

For the machinery and equipment that rely on power sources such as compressed air, electricity, or hydraulic pressure, adopt a countermeasure to prevent the equipment from causing a hazard to humans or damage to the machinery and equipment in the event of malfunction.

8. If a speed controller is provided in the exhaust restrictor, implement a safety design taking the residual pressure into consideration.

If air pressure is applied to the air supply side without residual pressure in the exhaust side, the rotary actuator will operate at abnormally high speed, which could pose a hazard to humans and can damage the machinery and equipment.

9. Consider the behavior of the rotary actuator in the event of an emergency stop.

Devise a safe system so that if a person engages the emergency stop, or if a safety device is tripped during a system malfunction such as a power failure, the movement of the rotary actuator will not cause a hazard to humans or damage the equipment.

10. Consider the action of the rotary actuator when restarting after an emergency stop.

Devise a safe design so that the restarting of the rotary actuator will not pose a hazard to humans or damage the equipment. Install manually controlled equipment for safety when the actuator has to be reset to the starting position.

11. Do not use the product as a shock absorber.

If an abnormal pressure or air leakage occurs, the rotary actuator's speed reduction capability could become severely effected, which could pose a hazard to humans and damage the machinery and equipment.

12. Select a speed within the product's allowable energy value.

If the product's kinetic energy of the load exceeds the allowable value, it could damage the product, and cause a hazard to humans and damage the machinery and equipment.

13. Provide a shock absorber if the kinetic energy that is applied to the product exceeds the allowable value.

If the product's kinetic energy exceeds the allowable value, it could damage the product, and cause a hazard to humans and damage the machinery or equipment.

14. Do not stop or hold the product at midpoint by keeping air pressure in the product.

For a product lacking an external stopping mechanism, if the directional control valve is closed to keep the air pressure in the product, in an attempt to stop the product at midpoint, it might not be possible to maintain that stopped position due to an air leakage. As a result, it could pose a hazard to humans and cause damage to machinery and/or equipment.

15. Give consideration to the decline in strength caused by changes of the shaft type.

Some shaft types, such as simple specials, may have shapes and dimensions that result in decreased strength when compared with standard models. Consider this carefully when using.

16. Do not use two or more rotary actuators with the aim of synchronized movement.

One of the actuators may bear the load of operation, making synchronized movement impossible, and possibly leading to deformation of the equipment.

17. Do not use in a location where adverse effect could be occurred by the oozing of the lubricant to the exterior.

The lubricant coating the interior of the product may leak to the outside of the product from the portion of the connection of the rotary shaft, body cover, etc.

18. Do not disassemble the product or make any modifications, including additional machining.

It may cause human injury and/or an accident.

19. Refer to the Auto Switches Precautions (pages 13 to 16) for using with an auto switch.

Rotary Actuators Precautions 2

Be sure to read this before handling.

Design/Selection

⚠Caution

1. Do not use below the speed adjustment range specified for the product.

If the product is used below the specified speed adjustment range, it could cause the product to stick, slip, or the movement to stop.

2. Do not apply an external torque to the product that exceeds the rated output.

If an external force that exceeds the product's rated output is applied to the product, it could damage the product.

3. The holding torque of the rotating end of the double piston type.

If the internal piston of a double piston product comes in contact with the angle adjustment screen or the cover and stops, the holding torque at the rotating end is one half of the actual output.

4. If it is necessary to provide repeatability of the rotation angle, directly stop the load externally.

Even with a product that is equipped with an angle adjuster, there are times in which the initial rotation angle could change.

5. Do not use under hydraulic pressure.

The product will be damaged if it is used by applying hydraulic pressure.

6. There is a possibility of backlash being generated when stopping the double piston style in the middle with a valve of the closed center type.

7. For the vane type product, if it is necessary to ensure a rotation angle, make sure to use a minimum pressure of 0.3 MPa.

8. Do not use the made-to-order -XC30 at low speeds.

Although fluorine grease is used, it is not designed for low-speed applications.
For information on fluorine grease, refer to the Material Safety Data Sheet (MSDS).

9. Do not use in places where there are many temperature fluctuations. When using in lower temperature applications, use caution so that frost does not occur inside the cylinder or the piston rod.

Operation may be unstable.

10. Adjust the speed control in the environment in which it will be used in.

Speed adjustment may be changed if the environment is different.

Mounting

⚠Warning

1. Operation manual

Install the product and operate it only after reading the operation manual carefully and understanding its contents. Also, keep the manual in a location where it can be referred to as necessary.

Mounting

⚠Warning

2. Ensure sufficient space for maintenance activities.

When installing the products, allow access for maintenance.

3. Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

4. Before adjusting the angle by supplying air pressure, take appropriate measures to prevent the equipment from rotating unnecessarily.

When an adjustment is performed under air pressure, the equipment could rotate and fall during the adjustment, depending on the mounted placement of the equipment. As a result, it could pose a hazard to humans and damage the machinery and equipment.

5. Do not loosen the angle adjustment screw beyond the allowable adjustment range.

The angle adjustment screw could fall out if it is loosened beyond its allowable adjustment range and cause a hazard to humans and damage to machinery and equipment.

6. Do not place a magnetic object near the product.

The auto switch is a magnetic sensing type. If a magnetic object is placed close to it, the rotary actuator could operate suddenly, which could pose a hazard to humans and damage the machinery and equipment.

7. Do not perform additional machining to the product.

Additional machining to the product can result in insufficient strength and cause damage to the product. This can lead to possible human injury and damage to the surrounding equipment.

8. Do not enlarge the fixed throttle by modifying the pipe connectors.

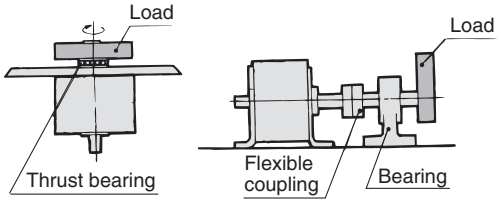
If the hole diameter is enlarged, the product's rotation speed will increase, causing the shock force to increase and damage to the product. As a result, it could pose a hazard to humans and damage the machinery and equipment.

9. If shaft couplings are used, use those with angular freedom.

If shaft couplings that lack angular freedom are used, they could scrape due to eccentricity, leading to equipment malfunction and product damage. As a result, it could pose a hazard to humans and damage the machinery and equipment.

10. Do not apply to the shaft a load that exceeds the values given in a catalog.

If a load that exceeds the allowable value is applied to the product, it could lead to equipment malfunction, a hazard to humans, and damage to the machinery and equipment. Provided that a dynamic load is not generated, a load that is within the allowable radial/thrust load can be applied. However, applications in which the load is applied directly to the shaft should be avoided wherever possible. The methods such as those described below are recommended to prevent the load from being applied directly to the shaft in order to ensure a proper operating condition.



Rotary Actuators Precautions 3

Be sure to read this before handling.

Mounting

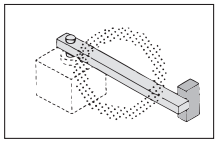
⚠Warning

11. Place an external stopper in a position that is away from the rotating shaft.

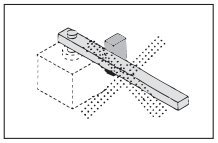
If the stopper is placed near the rotating shaft, the torque that is generated by the product itself will cause the reaction force which is directed to the stopper to be redirected and applied to the rotating shaft. This will lead to the breakage of the rotating shaft and bearing. As a result, it could pose a hazard to humans and damage the machinery and equipement.

Precautions when Using External Stoppers

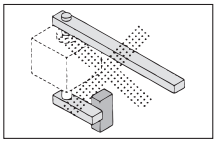
- Be sure to install external stoppers in the proper places. Installation in the wrong place can result in equipment breakage, which could damage other equipment or cause human injury.



Install the stopper at a sufficient distance from the rotating shaft.

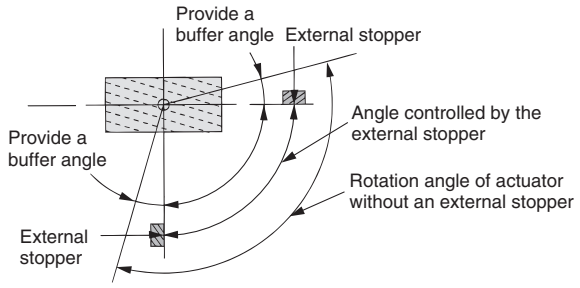


The external stopper becomes a fulcrum, resulting in the load's inertia force being applied to the shaft as a bending moment.



If an external stopper is installed on the shaft side which is opposite of the load, the inertia force generated by the load is applied directly to the shaft.

- Install external stoppers within the range of the rotating shaft angle.
  Installing an external stopper at the maximum rotation angle may result in inability to fully absorb the kinetic energy generated, and damage to equipment may occur.
  When using external stoppers at rotation angles of 90°, 180°, or 270°, use products with rotation angles of 100°, 190°, or 280° respectively.

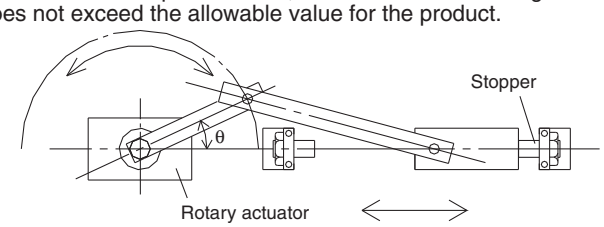


Backlash of the Single Rack Pinion Type CRA1 Series

There is a backlash of within 1° at the rotation end of the CRA1 series. It is necessary to decide the position of the external stopper when precise rotation is required.

Precautions when Converting Rotational Motion to Linear Motion

When using a link mechanism, etc., to convert rotational motion to linear motion, and determining the operation end using the stopper on the linear motion end (see below), a small value for θ at the operation end may result in the torque of the rotary actuator causing excessive radial load to act on the output axle, and equipment breakage may occur.
Install a stopper on the rotational motion side, or increase the value of θ at the operation end, to make sure the load generated does not exceed the allowable value for the product.



12. Do not use springs, etc., to add force in the rotational movement direction.

When rotational force from an external spring, etc., acts and generates negative pressure on the product's interior, breakage of the internal seal or acceleration of abrasion may occur.

⚠Caution

1.Observe the specified torque to secure the block of the angle adjustment unit.

If it is secured with a torque that is lower than the specified torque, the block could become loosened during use, causing the angle to exceed the set angle.

2. Do not use organic solvent to wipe the area of the name plate that shows the model.

It will erase what is indicated on the name plate.

3. Do not hit the rotating shaft by securing the body or hit the body by securing the rotating shaft.

These actions could cause the shaft to bend or damage the bearing. When a load must be coupled to the rotating shaft, secure the rotating shaft.

4. Do not place your foot directly on the shaft or on the equipment that is coupled to the shaft.

Placing one's weight directly onto the rotating shaft could cause the rotating shaft or the bearing to become damaged.

5. If a product is equipped with an angle adjustment function, use it within the specified adjustment range.

If the product is used outside the specified adjustment range, it could lead to equipment malfunction or product damage. Refer to the product specifications for details on the adjustment range of the products.

Piping

⚠Caution

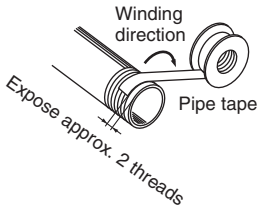
1. Refer to the Fittings and Tubing Precautions (pages 38 to 41) for handling one-touch fittings.

2. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

3. Wrapping of pipe tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping. Also, if pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



Rotary Actuators Precautions 4

Be sure to read this before handling.

Speed and Cushion Adjustment

⚠Warning

1. To make a speed adjustment, gradually adjust starting from the low speed end.

If the speed adjustment is performed from the high speed end, it could damage the product. As a result, it could pose a hazard to humans and damage the machinery and equipment.

2. The cushion needle is not adjusted at the time of shipment. Therefore, an adjustment must be made in accordance with the operating speed and the moment of inertia of the load.

The absorption of kinetic energy by the bumper is regulated by the adjustment of the needle. An improper adjustment could lead to damage of the equipment and the product. As a result, it could pose a hazard to humans and damage the machinery and equipment.

3. Do not operate with the cushion needle in a fully closed condition.

This could tear the seal, which could pose a hazard to humans and damage the machinery and equipment.

4. Do not apply an excessive force to loosen the cushion needle.

The needle itself is provided with a pull stop. However, the pullstop could be damaged if the needle is loosened through the application of excessive force. As a result, it could pose a hazard to humans and damage the machinery and equipment.

5. For products with shock absorbers, when the shock absorber stops motion before reaching the stroke end using a stopper mechanism with the objective of shortening takt time, be sure the shock absorber is stopped in a position where it has adequately absorbed the kinetic energy.

Failure to do so can result in damage to equipment.

Lubrication

⚠Warning

1. This product should be used without lubrication. If it is lubricated, it could lead to sticking or slipping.

Air Supply

⚠Warning

1. Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

2. When there is a large amount of drainage.

Compressed air containing a large amount of drainage can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment.

If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to SMC's Best Pneumatics catalog.

4. Use clean air.

Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

⚠Caution

1. When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.

2. Install an air filter.

Install an air filter upstream near the valve. Select an air filter with a filtration size of 5 μm or smaller.

3. Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.

Compressed air that contains a large amount of drainage can cause malfunction of pneumatic equipment such as rotary actuators. Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or water separator.

4. Ensure that the fluid and ambient temperature are within the specified range.

If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals and equipment malfunction. Therefore, take appropriate measures to prevent freezing.

For compressed air quality, refer to SMC's Best Pneumatics catalog.

Rotary Actuators Precautions 5

Be sure to read this before handling.

Operating Environment

⚠Warning

1. Do not use in an atmosphere having corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.

Refer to the construction for information on the rotary actuators material.

2. Do not expose the product to direct sunlight for an extended period of time.

3. Do not use in a place subject to heavy vibration and/or shock.

4. Do not mount the product in locations where it is exposed to radiant heat.

5. Do not use in dusty locations or where water or oil, etc., splash on the equipment.

Maintenance

⚠Warning

1. Perform maintenance inspection according to the procedures indicated in the operation manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Maintenance work

If handled improperly, compressed air can be dangerous. Assembly, handling, repair and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.

3. Drain flushing

Remove drainage from air filters regularly.

4. Removal of equipment, and supply/exhaust of compressed air

When components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent cylinders from sudden movement.

⚠Caution

1. For lubrication, use the designated grease for each specific product.

The use of a non-designated lubricant could damage the seals.

Rotary Actuators Precautions 6

Be sure to read this before handling.

For Air-hydro Type

Please read this page along with the Rotary Actuators Precautions.

Design

⚠Warning

1. Do not use the product near flames, or in equipment or machinery that exceeds an ambient temperatures of 60°C.

There is a danger of causing a fire because the air-hydro type uses a flammable hydraulic fluid.
Refer to the Material Safety Data Sheet (MSDS) of the hydraulic fluid when supplying the fluid.

2. Do not use the product in a clean room.

⚠Caution

1. Do not use in an environment, equipment, or machine that is not compatible with oil mist.

The air-hydro type generates an oil mist during operation which may affect the environment.

2. Be certain to install an exhaust cleaner on the directional control valve for the air-hydro type.

A very small amount of hydraulic fluid is discharged from the exhaust port of a directional control valve, which may contaminate the surrounding area.

3. Install the air-hydro type in locations where it can be serviced easily.

Since the air-hydro type requires maintenance, such as refilling of hydraulic fluid and bleeding of air, ensure sufficient space for these activities.

Selection

⚠Caution

1. Select an air-hydro type in combination with an air-hydro unit.

Since good operation of an air-hydro type depends on its combination with an air-hydro unit, carefully select an appropriate air-hydro unit.

Piping

⚠Warning

1. For air-hydro type piping, use self-aligning fittings.

Do not use one-touch fittings in the piping for an air-hydro type, because oil leakage may occur.

2. For air-hydro type piping, use hard nylon tubing or copper piping.

As in the case of hydraulic circuits, surge pressures greater than the operating pressure may occur in an air-hydro type piping, making it necessary to use safer piping materials.

Lubrication

⚠Warning

1. Completely discharge the compressed air in the system before filling the air-hydro unit with hydraulic oil.

When supplying hydraulic fluid to the air-hydro unit, first confirm that safety measures are implemented to prevent dropping of objects and the release of clamped objects, etc. Then, shut off the air supply and the equipment's electric power and exhaust the compressed air in the system.
If the air-hydro unit's supply port is opened with compressed air still remaining in the system, there is a danger of hydraulic fluid being blown out.
Refer to the Material Safety Data Sheet (MSDS) of the hydraulic fluid when supplying the fluid.

2. Use petroleum hydraulic fluid which can be used as turbine oil.

If non-flammable hydraulic fluid is used, it may cause problems.
Suitable viscosity is in the range of approximately 40 to 100 mm^2/s in operating temperature.
The suitable operating temperature for ISO VG32 is the range of 15 to 35°C. If the operating temperature range is beyond ISO VG32, select ISO VG46 (suitable for 25 to 45°C range).

Note) Refer to SMC's website for details about each manufacturer's brand name of class 1 turbine oil (no additive) ISO VG32. Additionally, please contact SMC for details about class 2 turbine oil (with additives) ISO VG32.

Maintenance

⚠Caution

1. Bleed air from the air-hydro type on a regular basis.

Since air may accumulate inside the air-hydro type, bleed air from it, for example before starting work. Bleed air from a bleeder valve provided on the air-hydro type or the piping.

2. Verify the oil level of the air-hydro system on a regular basis.

Since a very small amount of hydraulic fluid is discharged from the air-hydro type and the air-hydro unit circuit, the fluid will gradually decrease. Therefore, check the fluid regularly and refill as necessary.
The oil level can be checked with a level gauge in the air-hydro converter.

Auto Switches Precautions 1

Be sure to read this before handling.

Design/Selection

Cylinders or actuators include cylinders, air grippers, rotary actuators, and electrical actuators/cylinders.

⚠Warning

1. Confirm the specifications.

If the product is used with excess load applied or beyond the specification range, this may cause the product to break or malfunction. We do not guarantee against any damage if the product is used outside of the specification range.

2. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch.

Also, perform periodic maintenance and confirm proper operation.

3. Do not attempt to disassemble, modify (including exchanging the printed circuit boards), or repair the product.

An injury or failure can result.

⚠Caution

1. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but the operating time will be short if the speed is too fast. As a result, the load may not operate completely. The maximum detectable piston speed is:

$$V\ (mm/s) = \frac{\text{Auto switch operating range (mm)}}{\text{Time load applied (ms)}} \times 1000$$

In cases of high piston speed, the use of an auto switch (D-F5NT, F7NT, G5NT, M5NT, M5PT) with a built-in OFF delay timer (≈ 200 ms) makes it possible to extend the load operating time.

The wide-range detection type D-G5NB (operating range 35 to 50 mm) may also be useful, depending on the application. Please consult with SMC for other models.

2. Take precautions when multiple cylinders/ actuators are used close together.

When multiple auto switch cylinders/actuators are used in close proximity, magnetic field interference may cause the auto switches to malfunction. Maintain a minimum cylinder separation of 40 mm. (When the allowable interval is specified for each cylinder series, use the indicated value.)

The auto switches may malfunction due to the interference from the magnetic fields.

Use of a magnetic screen plate (MU-S025) or commercially available magnetic screen tape can reduce the interference of magnetic force.

3. Ensure sufficient clearance for maintenance activities.

When designing an application, be certain to allow sufficient clearance for maintenance.

⚠Caution

4. Do not mount the cylinder or actuator with the auto switch on a footing.

If work personnel gets on or puts the work personnel's foot on the footing accidentally, an excessive load is applied to the cylinder or actuator, causing the cylinder or actuator to break.

5. Design the circuit so that any back-flow current does not flow in if a short-circuit trouble occurs or forced operation is performed to check the operation.

If a back-flow current occurs, this may cause the switch to malfunction or break.

6. When multiple auto switches are required.

"n" indicates the number of auto switches which can be physically mounted on the cylinders/actuators. Detection intervals depends on the auto switch mounting structure and set position, therefore some required interval and set positions may not be available.

7. Limitations on detectable position

There are positions or surfaces (bottom surface of the foot bracket, etc.) where the auto switch cannot be mounted due to the physical interference depending on the cylinder or actuator mounting status or mounting bracket. Select an appropriate auto switch setting position where the auto switch does not interfere with the cylinder or actuator mounting bracket (trunnion or reinforcing ring) after checking it sufficiently.

Auto Switches Precautions 2

Be sure to read this before handling.

Mounting/Adjustment

⚠Caution

1. Do not drop or bump.

Do not drop, bump, or apply an excessive impact (300m/s^2 or more for reed auto switches, 1000m/s^2 or more for solid state auto switches) while handing the auto switch. It may cause the auto switch to break or malfunction.

2. Observe the proper tightening torque for mounting an auto switch.

When an auto switch is tightened beyond the range of tightening torque, auto switch mounting screws, auto switch mounting brackets or auto switch may be damaged.
On the other hand, tightening below the range of tightening torque may allow the auto switch to slip out of position.

3. Do not carry a cylinder by the auto switch lead wires.

This may cause disconnection of the lead wire or the internal element to break.

4. Do not use screws other than the set screws installed on the auto switch body to secure the auto switch.

If using other screws, auto switch may be damaged.

5. Mount an auto switch at the center of the operating range.

In the case of 2-color display auto switch, mount it at the center of the green LED illuminating range.
Adjust the mounting position of the auto switch so that the piston stops at the center of the operating range. (The mounting position shown in the catalog indicates the optimum position at stroke end.)
If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable depending on the operating environment. Also there are some cylinders or actuators with individual setting methods for auto switches. If so, mount it in accordance with the indicated method.

Even if 2-color indication solid state auto switches are fixed at a proper operating range (the green light lights up), the operation may become unstable depending on the installation environment or magnetic field disturbance.
(Magnetic body, external magnetic field, proximal installation of cylinders with built-in magnet and actuators, temperature change, other factors for magnetic force fluctuation during operation, etc.)

6. Check the actual actuation status and adjust the auto switch mounting position.

According to the installation environment, the cylinder or actuator may not operate even at its proper mounting position. Even when setting at a midpoint of the stroke, check the actuation status and make the adjustment in the same manner.

Wiring

⚠Caution

1. Confirm proper insulation of wiring.

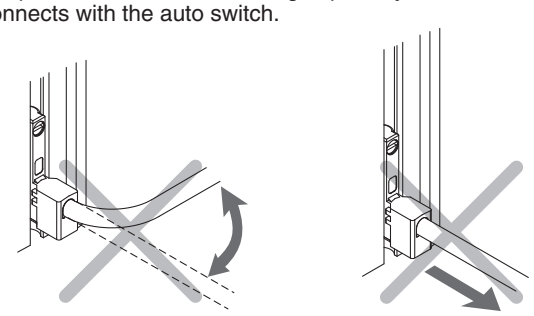
If there is any improper insulation (mixed contact with other circuit, grounding fault, or improper insulation between terminals, etc.) in the wiring, an over-current flows in, causing the auto switch to break.

2. Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines.

If an inrush current is generated, the noise may cause the auto switch to malfunction.

3. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from repeatedly applying bending stress or stretching force to the lead wires.
Stress and tensile force applied to the connection between the lead wire and auto switch increases the possibility of disconnection.
Keep the lead wire from moving especially in the area where it connects with the auto switch.



4. Be certain to connect the load before power is applied.

<2-wire type>
If the power is turned ON when an auto switch is not connected to a load, the auto switch will be instantly damaged because of excess current (short circuit).
It is the same as when the 2-wire brown lead wire (+, output) is directly connected to the (+) power supply terminal.

Auto Switches Precautions 4

Be sure to read this before handling.

Operating Environment

⚠Warning

1. Never use in an atmosphere of explosive gases.

The structure of auto switches is not intended to prevent explosion. This may lead to explosion hazard.
Please contact SMC concerning ATEX compliant products.

⚠Caution

1. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders/ actuators will become demagnetized. (Please consult with SMC if a magnetic field resistant auto switch can be used.)

2. Do not use in an environment where the auto switch will be continually exposed to water.

Although auto switches satisfy IEC standard IP67 construction except some models (D-A3□, A44□, G39□, K39□, RNK, RPK) do not use auto switches in applications where continually exposed to water splash or spray. This may cause improper insulation or malfunction.

3. Do not use in an environment with oil or chemicals.

If auto switches are used in an environment containing coolant, cleaning solvent, various oils, or chemicals even for a short period of time, this may adversely affect the auto switches, resulting in improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

4. Do not use in an environment with temperature cycles.

If temperature cycles other than normal temperature changes are applied, this may adversely affect the insides of the auto switches.

5. Avoid accumulation of iron waste or close contact with magnetic substances.

If many iron particles, such as cutting chips or spatters accumulate around a cylinder with the auto switches or an actuator or if a magnetic substance (attracted by a magnet) is put close to a cylinder with the auto switch or an actuator, the magnetic force inside the cylinder or actuator loses, causing the auto switch to malfunction.

6. Please contact SMC concerning water resistance, elasticity of lead wires, usage at welding sites, etc.

7. Do not use in direct sunlight.

8. Do not mount the product in locations where it is exposed to radiant heat.

9. Take appropriate measures against the lightning surge on the equipment side as the auto switches do not have any lightning surge resistance specified in the CE marking.

Maintenance

⚠Warning

1. Removal of equipment, and supply/exhaust of compressed air

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.
When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent actuators from moving suddenly.

2. Do not touch a terminal during energizing.

Touching a terminal during energizing may cause electric shock, malfunction, or auto switch breakage.

⚠Caution

1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Secure and tighten auto switch mounting screws.
If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

2) Confirm that there is no damage to lead wires.
To prevent faulty insulation, replace auto switches or repair lead wires, etc., if damage is discovered.

3) Confirm the detection setting position.
- Red light of 1-color display auto switch
  Confirm that the set position stops at the center of the operating range (red display area).
- Confirm the green light and position of the 2-color display auto switch.
  Confirm that the set position stops at the center of the appropriate operating range (green display area). If stopped with the red LED lit, the operation may become unstable due to effects of the equipment environment or external disturbance. So, set the mounting position at the center of the appropriate operating range again.

Some cylinders or actuators indicate the individual setting procedures for the auto switch. If so, set the mounting position using the individual setting procedures.

2. Do not use solvents such as benzene, thinner etc. to clean the product.

They could damage the surface of the body and erase the markings on the body. For heavy stains, use a cloth lightly dampened with diluted neutral detergent, then wipe up any residue with a dry cloth.

Solid State Auto Switches Precautions

Be sure to read this before handling.

Design/Selection

⚠Caution

1. Keep wiring as short as possible.

Be sure to use a wire length of 100 m or less.
When the wire length is long, we recommend the ferrite core is attached to the both ends of the cable to prevent excess noise. A contact protection box is not necessary for solid state switches due to the nature of this product construction.

2. Do not exceed the trimmer switch sensor cable length 3 m.

If the sensor cable length exceeds 3 m, the CE marking does not apply to the auto switch.

3. Do not use a load that generates surge voltage.

If driving a load such as a relay that generates a surge voltage, use a built-in surge absorbing element type device.

4. Pay attention to the internal voltage drop of the auto switch.

Generally, the internal voltage drop of the solid state auto switch is larger than that of the reed auto switch. When the auto switches ("n" pcs.) are connected in series, the voltage drop is multiplied by "n". In this case, the auto switches operate correctly, but the loads may not operate. Additionally, note that the 12 VDC relay does not apply to the auto switch.

5. Pay attention to leakage current.

<2-wire type>

Current (leakage current) flows to the load to operate the internal circuit when in the OFF state.

Operating current of load (OFF condition) > Leakage current

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3-wire auto switch if this specification will not be satisfied.
Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

6. Output operation of the solid state auto switch is not stable for 50 [ms] after powered ON.

In the output operation immediately after powered ON or AND connection operation, the input device (PLC or relay, etc.) may judge the ON position as OFF output or the OFF position as ON output. So, please make the setting on the equipment so that the input judgement signal is set disabled for 50 [ms] immediately after powered ON or AND connection. When using SMC's AHC system (Auto Hand Changing System) Series MA, please also make this setting.

Wiring

⚠Caution

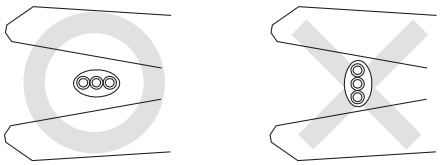
1. Do not allow short-circuit of loads.

All models of D-J51, G5NB and PNP output type auto switches do not have built-in short circuit protection circuits.
Carefully handle as the auto switch may be damaged.

2. Avoid incorrect wiring.

1) If connections are reversed on a 2-wire type auto switch, the auto switch will not be damaged if protected by a protection circuit, but the auto switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the auto switch could be damaged by a load short circuit in this condition.
2) If connections are reversed (power supply line + and power supply line –) on a 3-wire type auto switch, the auto switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue wire and the power supply line (–) is connected to the black wire, the auto switch will be damaged.

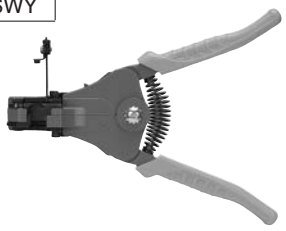
3. When the lead wire sheath is stripped, confirm the stripping direction. The insulator may be split or damaged depending on the direction. (D-M9□ only)



Recommended Tool

Description	Model
Wire stripper	D-M9N-SWY

∗ Stripper for a round cable (ø2.0) can be used for a 2-wire type cable.



4. Do not disconnect the cable between the sensor and amplifier of the heat resistant 2-color display solid state auto switch by the customer.

Even when the sensor and amplifier are connected again, a contact resistance is produced, causing the auto switch to malfunction. Additionally, the sensor and amplifier are paired and they do not operate correctly in different combinations.

Operating Environment

⚠Caution

1. Do not use in an area where surges are generated.

If there is an equipment unit (electromagnetic lifter, high-frequency induction furnace, motor, or radio, etc.) that generates large surges or electromagnetic waves around cylinders with solid state auto switches or actuators, this may cause the circuit element inside the auto switch to break.

Reed Auto Switches Precautions

Be sure to read this before handling.

Design/Selection

⚠Caution

1. Keep wiring as short as possible.

As the length of the wiring to a load gets longer, the rush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)

1) Use a contact protection box when the wire length is 5 m or longer.
2) Even if an auto switch has a built-in contact protection circuit, when the wiring is more than 30 m long, it is not able to adequately absorb the rush current and its life may be reduced. It is again necessary to connect a contact protection box in order to extend its life. Please consult with SMC in this case.

2. Do not use a load that generates surge voltage.

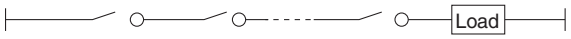
If a surge voltage is generated, the discharge occurs at the contact, possibly resulting in the shortening of product life.

If driving a load such as a relay that generates a surge voltage, use an auto switch with built-in contact protection circuit or use a contact protection box.

3. Pay attention to the internal voltage drop of the auto switch.

1) Auto switch with an indicator light (Except D-A56, A76H, A96, A96V, C76, E76A, Z76)

• If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to the internal voltage drop in the auto switch specifications.) [The voltage drop will be "n" times larger when "n" auto switches are connected.]
Even though an auto switch operates normally, the load may not operate.



• In the same way, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of auto switch} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of a light emitting diode causes a problem, select an auto switch without an indicator light (D-A6□, A80, A80H, A90, A90V, C80, R80, 90, E80A, Z80).

Wiring

⚠Caution

1. Do not allow short-circuit of loads.

If the power is turned ON with a load in a short circuited condition, the auto switch will be instantly damaged because of excess current flow into the switch.

2. Avoid incorrect wiring.

A 24 VDC auto switch with indicator light has polarity. The brown lead wire or terminal No. 1 is (+), and the blue lead wire or terminal No. 2 is (–).

[For D-97, (+) is on the no-displayed side, (–) is on the black line side.]

1) If connections are reversed, an auto switch will operate, however, the light emitting diode will not light up.
Also, take note that a current greater than that specified will damage a light emitting diode and it will no longer operate.
Applicable model:
D-A73, A73H, A73C, A93, A93V, A53, A54, B53, B54, C73, C73C, E73A, Z73, D-R73, R73C, 97, 93A, A33, A34, A33A, A34A, A44, A44A
2) When using a 2-color indicator type auto switch (D-A79W, A59W and B59W), the auto switch will constantly remain ON if the connections are reversed.

Operating Environment

⚠Caution

1. Do not use in an environment where there is excessive impact shock.

When excessive impact (300 m/s^2 or more) is applied to a reed auto switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1 ms or less). Please consult with SMC if a solid state auto switch can be used according to the environment.

Prior to Use
Auto Switches Common Specifications 1

Refer to the Auto Switch Precautions on pages 8 to 11 before using auto switches.

Auto Switches Common Specifications

Type	Reed auto switch	Solid state auto switch
Leakage current	None	3-wire: 100 μA or less, 2-wire: 0.8 mA or less
Operating time	1.2 ms	1ms or less*3)
Impact resistance	300 m/s²	1000 m/s² *4)
Insulation resistance	50 MΩ or more (500 VDC measured via megohmmeter) (Between lead wire and case)	
Withstand voltage	1500 VAC for 1 minute*1) (Between lead wire and case)	1000 VAC for 1 minute (Between lead wire and case)
Ambient temperature	−10 to 60°C	
Enclosure	IEC60529 Standard IP67*2)	

* 1) Electrical entry: Connector type (A73C/A80C/C73C/C80C): 1000 VAC/min. (Between lead wire and the case)
* 2) The terminal conduit type (D-A3/A3□A/A3□C/G39/G39A/G39C/K39/K39A/K39C), DIN terminal type (D-A44/A44A/A44C) and heat resistant auto switch (D-F7NJ) conform to IEC60529 Standard IP63.
The trimmer type amplifier section (D-R□K) conforms to IP40.
* 3) Excluding the solid state auto switches with a timer (D-M5□T/G5NT/F7NT/F5NT types) and magnetic field resistant 2-color indication solid state auto switch (D-P3DW□/P4DW).
The operating time for D-J51 is 2 ms or less and for D-P3DW□/P4DW are 40 ms or less.
* 4) 980 m/s² for the trimmer type sensor section, 98 m/s² for the amplifier section.

Lead Wire

Lead wire length indication

(Example)

D-M9BW L

Auto switch model

Lead wire length

Symbol	Length	Tolerance	Connector Specifications	Solid state	Reed
Nil	0.5 m	±15 mm		●	●
M	1 m	±30 mm		●*2)	–
L	3 m	±90 mm		●	●
Z	5 m	±150 mm		●	●*3)
N*1)	None	–		●	●
SAPC	0.5 m	±15 mm	M8-3 pin Plug connector	○	–
MAPC	1 m	±30 mm		○	–
SBPC	0.5 m	±15 mm	M8-4 pin Plug connector	○	–
MBPC	1 m	±30 mm		○	–
SDPC	0.5 m	±15 mm	M12-4 pin A code (Normal key) Plug connector	○	–
MDPC	1 m	±30 mm		○	–
LDPC	3 m	±90 mm		○	–

●:Standard ○:Produced upon receipt of order (Standard)

* 1) Applicable to the connector type (D-□□C) only.
* 2) Applicable to the D-M9□ (V), D-M9□W (V), and D-M9□A (V) only.
* 3) Applicable to the D-B53/B54, D-C73(C)/C80C, D-A93(V), D-A73(C)/A80C, D-A53/A54, D-Z73, and D-90/97/90A/93A only.
* 4) For reed auto switches M8 and M12 type with connector, please contact SMC.
* 5) The standard lead wire length of the trimmer auto switch is 3 m.
* 6) The standard lead wire length of the solid state auto switch with the timer except for the D-P3DW and D-M9□A (V)□, water-resistant 2-color display solid state auto switch, wide range detection auto switch, heat resistant 2-color display solid state auto switch, and strong magnetic field resistant 2-color display solid state auto switch is 3 m or 5 m. (Product with a lead wire length of 0.5 m is not available.)

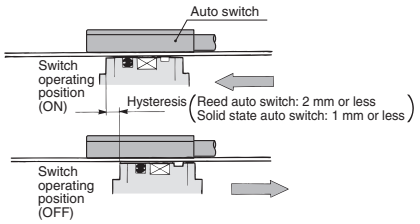
Lead wires with a connector indication

Part No. of Lead Wires with Connectors
(Applicable only for connector type)

Model	Lead wire length
D-LC05	0.5 m
D-LC30	3 m
D-LC50	5 m

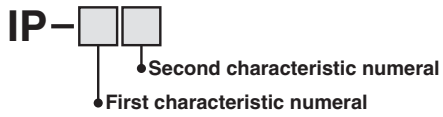
Prior to Use
Auto Switches Common Specifications 2

Refer to the Auto Switch Precautions on pages 8 to 11 before using auto switches.

Term	Meaning
Hysteresis	 A deviation amount between the ON position and OFF position caused by auto switch characteristics (difference in sensitivity between ON and OFF). When the switch is turned ON once and the switch (or piston) is moved in the opposite direction, a symptom occurs that the position where the switch turns OFF deviates to a position where it is further returned from the ON position. This deviation amount is called “hysteresis”. Note) Hysteresis may fluctuate due to the operating environment. Please contact SMC if hysteresis causes an operational problem.
Most sensitive position	A position (sensor layout position) where the sensitivity is highest on the detection surface of the auto switch enclosure. When the center of the magnet is aligned with this position, this becomes almost the center of the operating range and stable operation can be obtained.
Programmable Logic Controller (PLC)	One of elements making up the sequence control. The PLC is so designed that it receives signals, such as auto switch output and outputs them to other devices so as to perform the electrical control according to the preset program.
Operating temperature range	A temperature range, in which the auto switch can be used. If significant temperature change or freezing occurs even in this temperature range, this may cause the auto switch to malfunction.
Operating voltage	A voltage, at which the auto switch can be used. The operating voltage is indicated using generally used voltage (24 VDC or 100 VAC, etc.). For 2-wire type, the operating voltage has the same meaning as the power supply voltage or load voltage.
Operating current range	A range of the current value that can be flowed to the output of the auto switch. If the operating current is lower than this range, the auto switch does not operate correctly. Conversely, if the operating current is higher than this range, this may cause the auto switch to break.
Current consumption	This current value is necessary for the 3-wire type auto switch to operate the circuit through the power cable. For 2-wire type, as the current consumption is a part of the load current, it is not defined.
Insulation resistance	A resistance between the electric circuit and enclosure. Unless otherwise described particularly, 50MΩ (Min) is used for auto switch.
Magnetic field resistant auto switch	An auto switch, for which measures against effects arising from external (welding) magnetic field generated in the spot welding process, etc. are taken. The solid state auto switch functions as it detects the frequency of the applied magnetic field. If the external magnetic field (AC) is applied, the last signal is retained not to be affected by the external magnetic field. This system can be used by the cylinder with normal magnetic force. The reed auto switch built-in a magnetic field shielded sensor with a low sensitivity to make the effect of the external magnetic field (DC or AC magnetic field) insusceptible. Therefore, a dedicated cylinder built-in the strong magnet needs to be selected and there is also an operable range (conditions).
Impact resistance value	A minimum acceleration that may cause the auto switch to malfunction or break when the standard impact is applied.
Water-resistant type auto switch	A model, long-term water resistance of which is improved by taking structural measures for the general (general purpose) product.
Withstand voltage	A tolerance dose when the voltage is applied to the portion between the electrical circuit and enclosure. The withstand voltage shows a strength level of the product against the voltage. If a voltage exceeding the withstand voltage is applied, this may cause the product to break. (The voltage described here is different from the power supply voltage necessary to operate the product.)
Proper mounting position	A dimension that shows the mounting position when the position is detected at the stroke end of the cylinder. As this position is set, the maximum sensitivity position is aligned with the center of the magnet. However, make the adjustment with the actual machine by considering the characteristic difference during actual setting. When an adjustment allowance is needed for the detection before the stroke, set a value with an adjustment allowance added to the proper mounting position.
Applicable load	A device that is assumed as a target load of the auto switch.
Operating time	A period of time until the auto switch output becomes stable after the magnetic force to operate the auto switch has been received.
Operating range	An auto switch operating range in response to the cylinder piston movement (ON length in response to the stroke). The operating range is determined by the magnetic force of the magnet (range, in which the magnetic force acts) and switch sensitivity. So, the operating range may vary as these conditions are changed by the ambient environment, etc. The operating range in the standard status (normal temperature, single cylinder, magnetic force, and sensitivity, etc.) is described in the catalog.

Prior to Use
Auto Switches Common Specifications 3

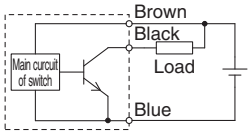
Refer to the Auto Switch Precautions on pages 8 to 11 before using auto switches.

Term	Meaning
Minimum Stroke for Auto Switch Mounting	A minimum stroke value of the auto switch that can be mounted on the cylinder. The minimum stroke is determined by the specification limit (auto switch operation or position setting ability, etc.) and physical limit (mechanical interference associated with the auto switch mounting). Note that the catalog shows the value assuming that the position detection is performed at the stroke end and this value does not consider the adjustment allowance. When an adjustment allowance is needed, such as detection before the stroke, a value is set that this adjustment allowance is added to the minimum stroke.
Internal voltage drop	A voltage that is applied to the portion between the COM and signal line when the auto switch is ON. As only a value that the internal voltage drop is subtracted from the power supply voltage is applied to the input side of the PLC, the detection fault (incorrect input) may occur if this value is lower than the minimum operating voltage. So, take great care when selecting a device.
2-Color Indication	As the end part of the auto switch operating range (boundary between ON and OFF) is an area where is susceptible to the external disturbance or stroke change during cylinder operation, this function is intended to quickly and properly make the setting at the center of the operating range where the stable operation can be obtained by changing the operation indication color of the auto switch.
Load	A device that is connected to the output of the auto switch so as to do any work is called “load”. For example, the load is a relay or PLC, etc. To check the operation of the auto switch, a device equivalent to the load (such as resistor, etc.) is connected.
Load current	A current that flows to the load when the ON-OFF output is ON.
Enclosure	A class of protection against solid or water entry of the electrical machinery and apparatus specified in IEC60529.  **●First Characteristics:** **Degrees of protection against solid foreign objects** **0** Non-protected **1** Protected against solid foreign objects of 50 mm ø and greater **2** Protected against solid foreign objects of 12 mm ø and greater **3** Protected against solid foreign objects of 2.5 mm ø and greater **4** Protected against solid foreign objects of 1.0 mm ø and greater **5** Dust-protected **6** Dusttight **●Second Characteristics:** **Degrees of protection against water** **0** Non-protected **1** Protected against vertically falling water drops **2** Protected against vertically falling water drops when enclosure tilted up to 15° **3** Protected against rainfall when enclosure tilted up to 60° **4** Protected against splashing water **5** Protected against water jets **6** Protected against powerful water jets **7** Protected against the effects of temporary immersion in water **8** Protected against the effects of continuous immersion in water Example) In the case of stipulated as IP65, we can know the degrees of protection is dusttight and water jet-proof on the grounds that the first characteristic numeral is 6 and the second characteristic numeral is 5 respectively, that gives it will not be adversely affected by direct water jets from any direction.
Solid state auto switch	A switch that detects the magnetic field by the MR element and incorporates the judgement circuit to turn ON or OFF the output regardless of the contact or non-contact of the mechanical contact like transistor (non-contact part).
Leak current	A current that flows to operate the internal circuit when the ON-OFF output is OFF. In particular, if this leak current exceeds the detection current in the 2-wire type auto switch or PLC, this may cause reset fault. So, take great care when selecting a device.
Reed auto switch	A switch that uses the reed switch to detect the magnetic field and turn ON or OFF the output by the contact or non-contact of the mechanical contact (contact part is provided like relay or limit switch).
Induction load	A load that has the coil. The connection target of the auto switch is a relay.
Recommended lead wire bending radius	A minimum bending radius (reference value) of the lead wire when the lead wire is secured and constructed (oscillation or rotation is not considered). (As the temperature or current value conforms to the auto switch specifications, this lead wire bending radius differs from the value disclosed by the electric wire manufacturer.)
Electrical entry	A structure, in which the lead wire of the auto switch is taken out in the horizontal direction when the cylinder is laid out horizontally (cylinder rod is horizontal), is called “in-line entry”. A structure, in which the lead wire is taken out in a direction perpendicular to the cylinder axis center, is called “perpendicular entry”.

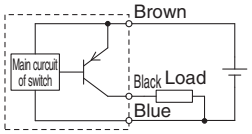
Prior to Use
Auto Switches/Internal Circuit

Solid State Auto Switches

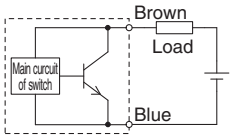
Solid state 3-wire, NPN



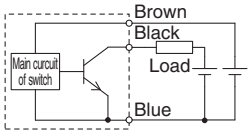
Solid state 3-wire, PNP

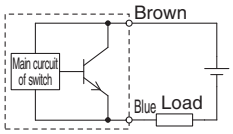


2-wire (Solid state)

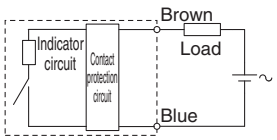
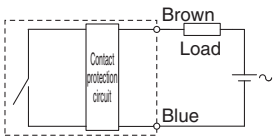
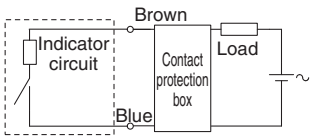
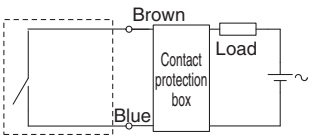


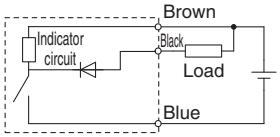
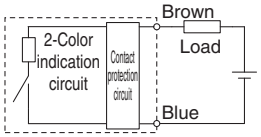
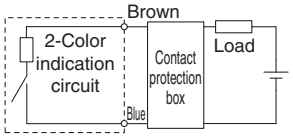
(Power supply for switch and load are separate)





Reed Auto Switches

No.	①	②	③	④
Circuit diagram	**2-wire (Reed switch)**	**2-wire (Reed switch)**	**2-wire (Reed switch)**	**2-wire (Reed switch)**
				

No.	⑤	⑥	⑦
Circuit diagram	**3-wire (Reed switch, NPN)**	**2-wire (Reed switch)**	**2-wire (Reed switch)**
			

Contact Protection Box/CD-P11, CD-P12

<Applicable switch models>

D-A7/A8, D-A7□H/A80H, D-A73C, A80C, D-C7/C8, D-C73C/C80C, D-E7□A, E80A, D-Z7/Z8, D-9/9□A, D-A9/A9□V, D-A79W

The auto switches above do not have a built-in contact protection circuit. A contact protection box is not required for solid state auto switches due to their construction.

1. **Where the operation load is an inductive load.**
2. **Where the wiring length to load is greater than 5 m.**
3. **Where the load voltage is 100/200 VAC.**

   Therefore, use a contact protection box with the switch for any of the above cases:

   The contact life may be shortened (due to permanent energizing conditions.)

   D-A72(H) must be used with the contact protection box regardless of load types and lead wire length since it is greatly affected by loads. (Where the load voltage is 110 VAC)

   When the load voltage is increased by more than 10% to the rating of applicable auto switches (except D-A73C/A80C/C73C/C80C/90/97/A79W) above, use a contact protection box (CD-P11) to reduce the upper limit of the load current by 10% so that it can be set within the range of the load current range, 110 VAC.

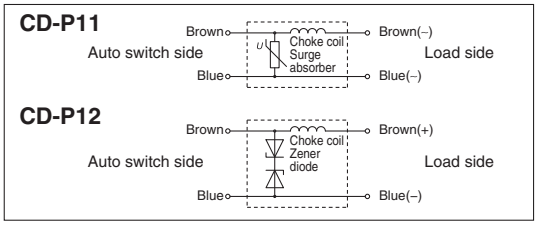
Even for the built-in contact protection circuit type (D-A34[A][C], DA44[A][C], D-A54/A64, D-A59W, D-B59W), **use the contact protection box when the wiring length to load is very long (over 30 m) and PLC (Programmable Logic Controller) with a large inrush current is used.**

Contact Protection Box Specifications

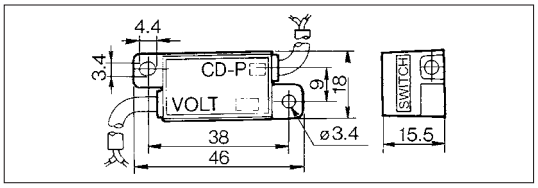
Part no.	CD-P11		CD-P12
Load voltage	100 VAC or less	200 VAC	24 VDC
Max. load current	25 mA	12.5 mA	50 mA

∗Lead wire length — Auto switch connection side 0.5 m
Load connection side 0.5 m

Contact Protection Box Internal Circuit



Contact Protection Box/Dimensions



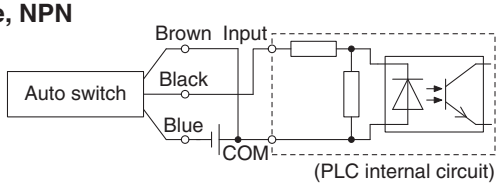
Contact Protection Box Connection

To connect a switch unit to a contact protection box, connect the lead wire from the side of the contact protection box marked SWITCH to the lead wire coming out of the switch unit. Keep the switch as close as possible to the contact protection box, with a lead wire length of no more than 1 meter.

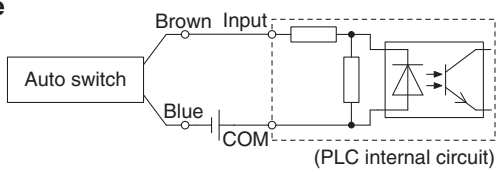
Prior to Use
Auto Switch Connection and Example

Sink Input Specifications

3-wire, NPN

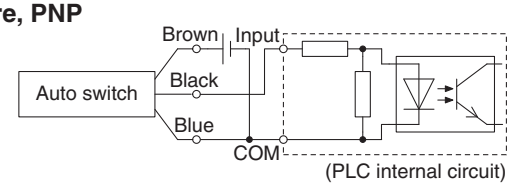


2-wire

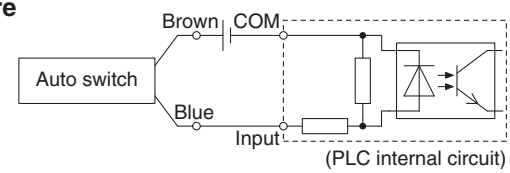


Source Input Specifications

3-wire, PNP



2-wire



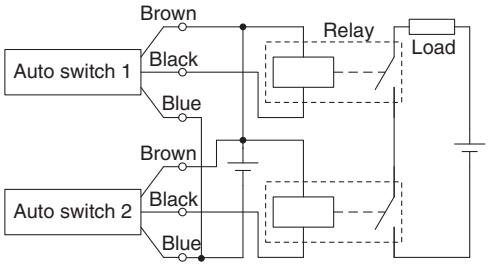
Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

Example of AND (Series) and OR (Parallel) Connection

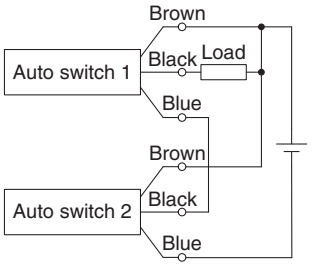
∗ When using solid state auto switches, ensure the application is setup so the signals for the first 50 ms are invalid.

3-wire AND connection for NPN output

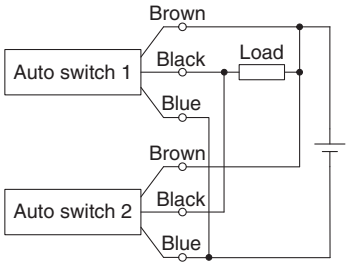
(Using relays)



(Performed with auto switches only)

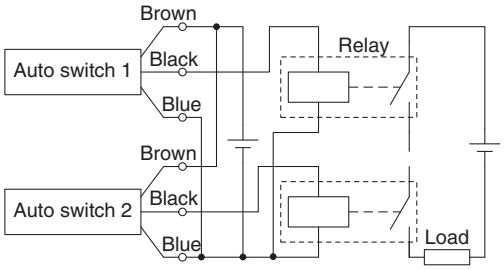


3-wire OR connection for NPN output

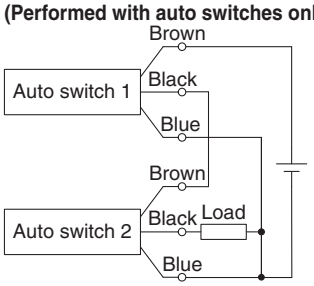


3-wire AND connection for PNP output

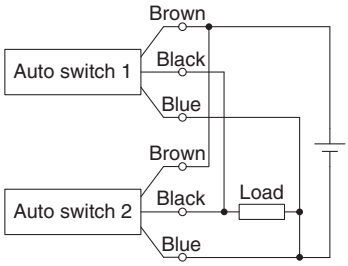
(Using relays)



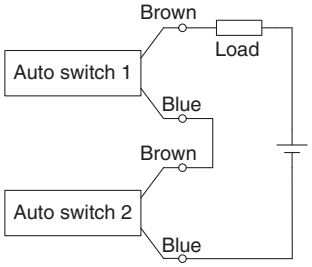
(Performed with auto switches only)



3-wire OR connection for PNP output



2-wire AND connection

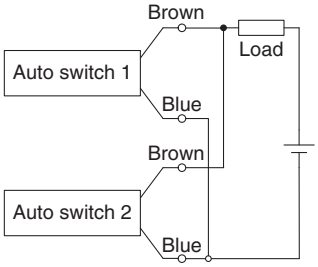


When two auto switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state. The indicator lights will light up when both of the auto switches are in the ON state. Auto switches with load voltage less than 20V cannot be used.

Load voltage at ON = Power supply voltage – Residual voltage x 2 pcs.
= 24 V – 4 V x 2 pcs.
= 16 V

Example: Power supply is 24 VDC
Internal voltage drop in auto switch is 4 V.

2-wire OR connection



(Solid state)
When two auto switches are connected in parallel, malfunction may occur because the load voltage will increase when in the OFF state.

(Reed auto switch)
Because there is no current leakage, the load voltage will not increase when turned OFF. However, depending on the number of auto switches in the ON state, the indicator lights may sometimes grow dim or not light up, due to the dispersion and reduction of the current flowing to the auto switches.

Load voltage at OFF = Leakage current x 2 pcs. x Load impedance
= 1 mA x 2 pcs. x 3 kΩ
= 6 V

Example: Load impedance is 3 kΩ.
Leakage current from auto switch is 1 mA.