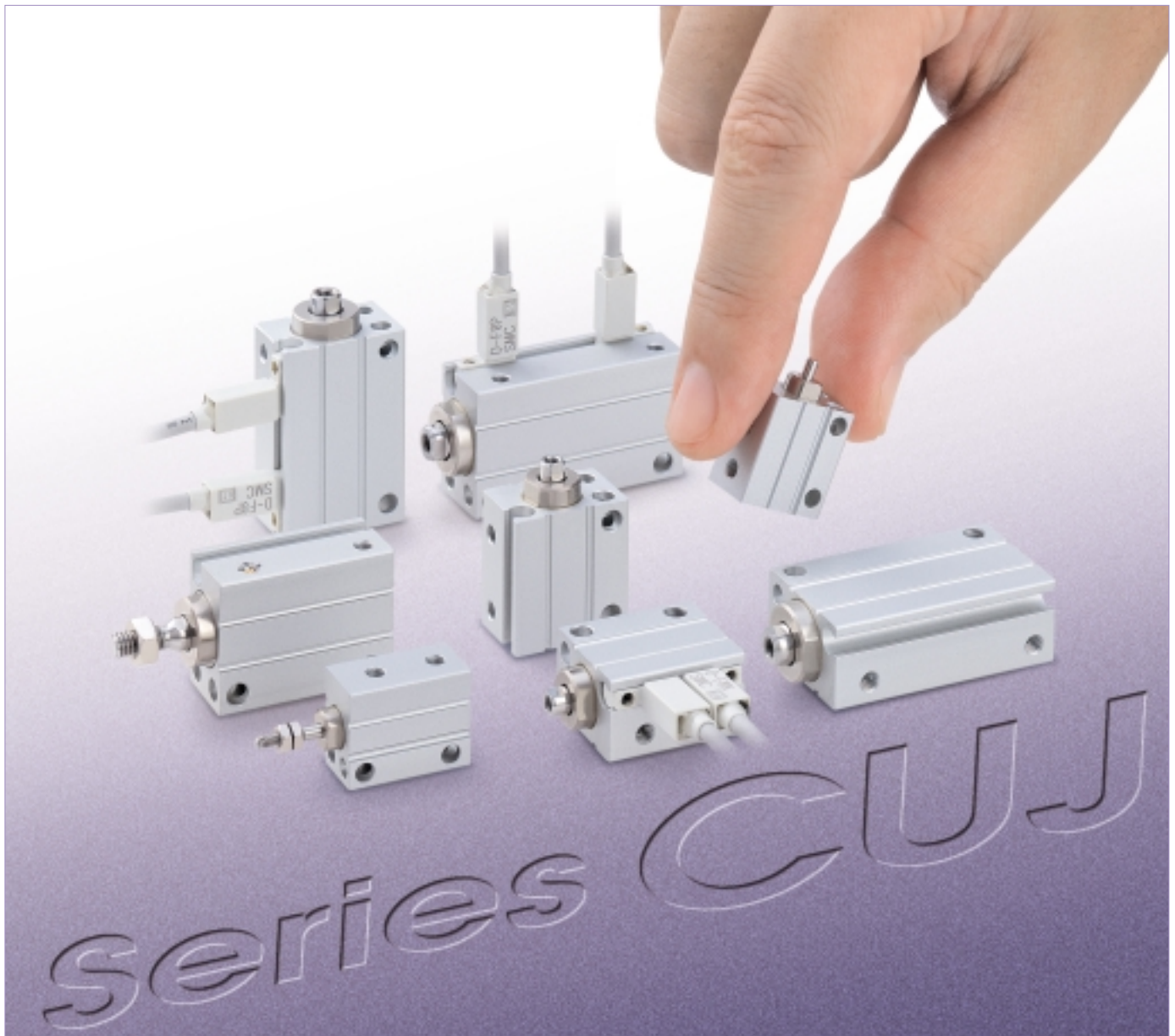
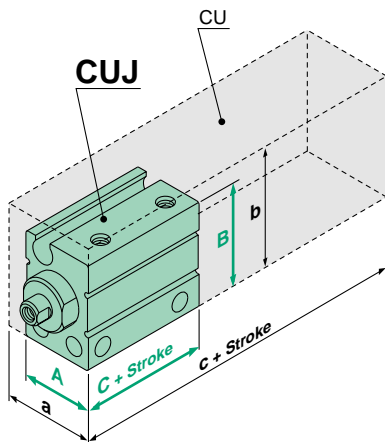
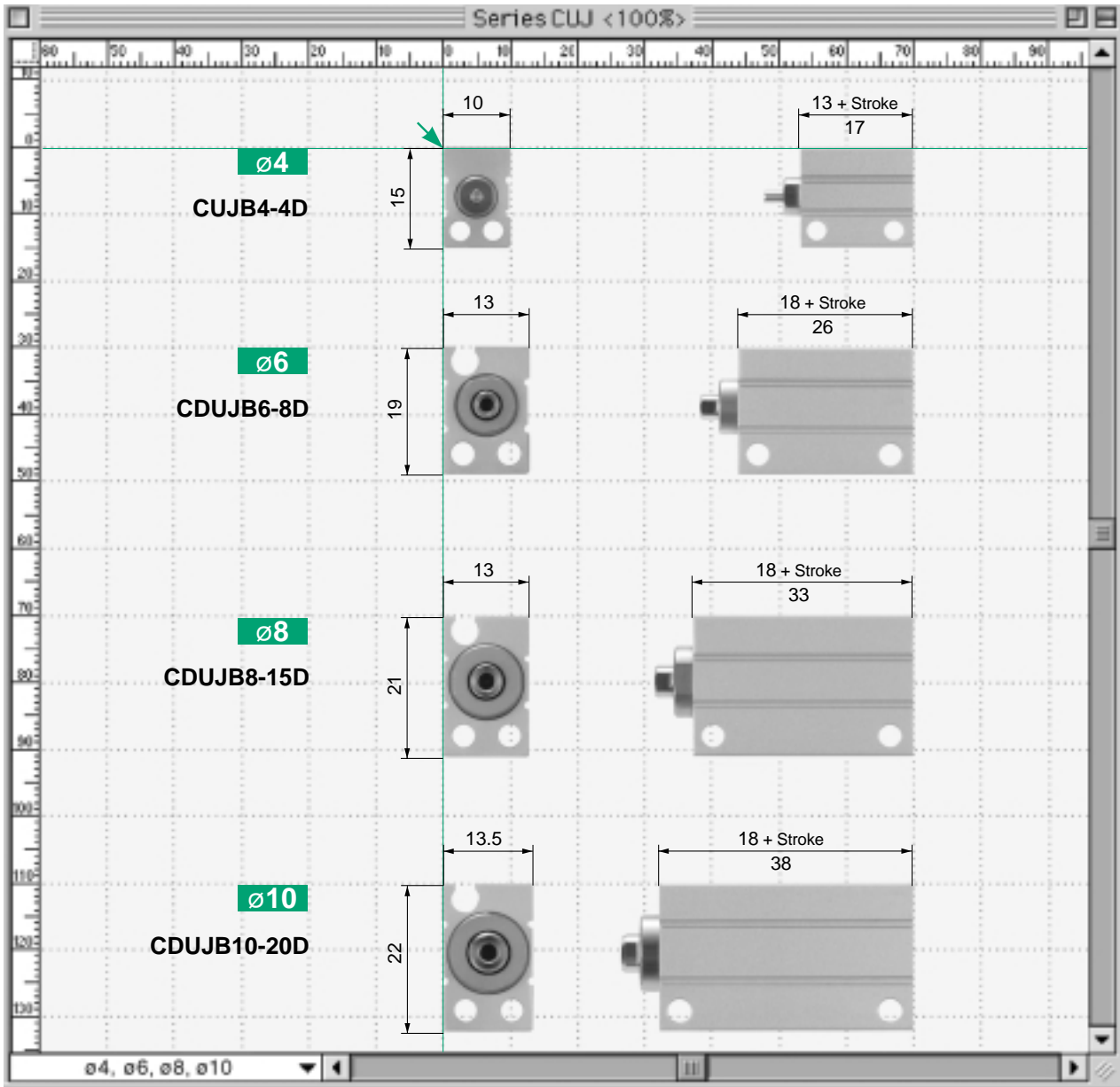




Mini Free-mount Cylinder
Series CUJ
ø4, ø6, ø8, ø10



Miniature body



- Length is shortened by approx. **64% max.**
- Volume is reduced by approx. **70% max.**

(As compared with SMC Series CU cylinders without magnet)

Dimensions (without magnet) (mm)

Bore Size	A (a)	B (b)	C (c)
4	10 (—)	15 (—)	13 (—)
6	13 (13)	19 (22)	13 (33)
8	13 (—)	21 (—)	13 (—)
10	13.5 (15)	22 (24)	13 (36)

Numbers in parentheses are the dimensions of SMC Series CU cylinders.

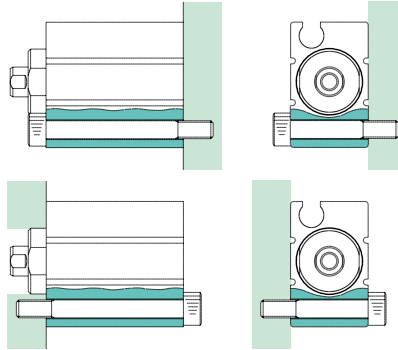
Series CUJ $\varnothing 4, \varnothing 6, \varnothing 8, \varnothing 10$

Concentrates wiring and piping on one surface

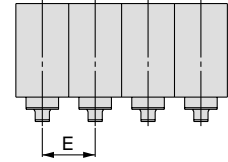
Allows more efficient installation, since four directions can be used freely.



Free-mount design allows installation from four directions.



Fine pitch mounting is possible.

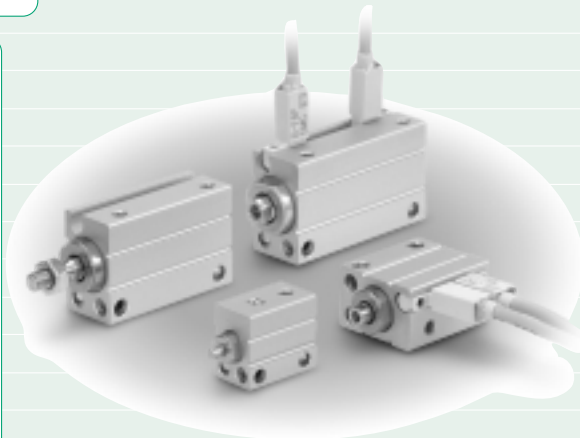
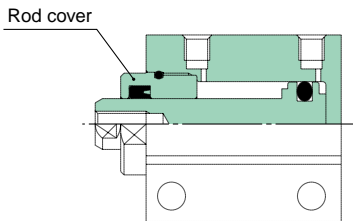


Pitch dimensions (without magnet) (mm)

Bore Size	E
4	10
6	13
8	13
10	13.5

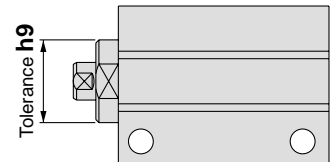
Easy seal replacement

Seals can be replaced easily just by removing the rod cover.

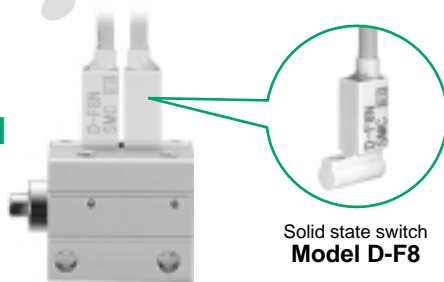


With front boss (h9)

Centering can be done easily.



Two auto switches can be installed even for 4mm strokes.



Clean room series Series 10-, 11-CUJ



Series Variations

Series	Bore size (mm)	Action	Stroke (mm)						Clean room series	Auto switch	Rod end configuration	
			4	6	8	10	15	20				
CUJ	4	Double acting	●	●	●	●				Nil	Male thread Without thread	
		Single acting (spring return)	●	●	●	●						
	6	Double acting	●	●	●	●	●		●	Solid state switch D-F8□ D-F9□	Female thread Male thread	
		Single acting (spring return)	●	●	●	●	●		●			
	8	Double acting	●	●	●	●	●	●	●			
		Single acting (spring return)	●	●	●	●	●	●	●			
	10	Double acting	●	●	●	●	●	●	●			
		Single acting (spring return)	●	●	●	●	●	●	●			

Mini Free-mount Cylinder

Series CUJ

∅4, ∅6, ∅8, ∅10

How to Order

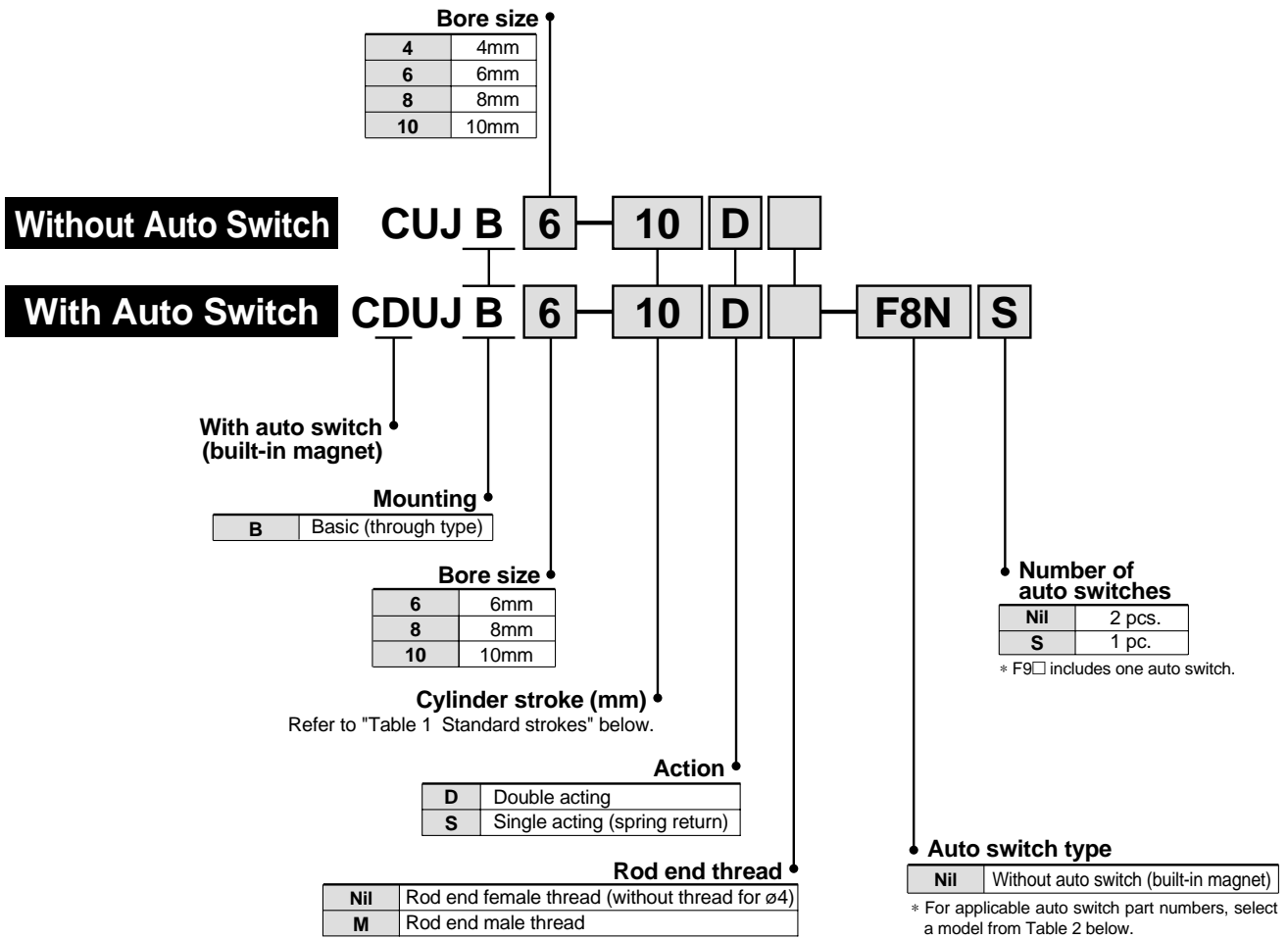


Table 1 Standard strokes

Action	Bore size (mm)	Standard stroke (mm)
Double acting	4	4, 6, 8, 10
	6	4, 6, 8, 10, 15
	8, 10	4, 6, 8, 10, 15, 20
Single acting (spring return)	4	4, 6
	6	4, 6, 8
	8, 10	4, 6, 8, 10

Table 2 Applicable auto switch models Refer to pages 11 to 14 for detailed specifications.

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage		Auto switch part number		Lead wire length (m)			Applicable load			
					DC	AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)				
							Perpendicular	In-line							
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	12V	—	—	F9N	●	●	○	—	Relay, PLC	
								—	F8N	—	●	●			○
								—	F9P	—	●	●			○
								—	F8P	—	●	●			○
								—	F9B	—	●	●			○
—	F8B	—	●	●	○										

* Lead wire length symbols: 0.5m Nil (Example) F8N
3.0m L (Example) F8NL

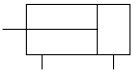
* Auto switches marked with a "○" symbol are produced upon receipt of order.

Specifications

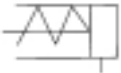


Symbol

Double acting/Single rod

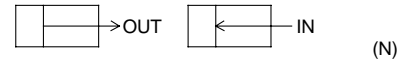


Single acting/Spring return



Bore size (mm)	4	6	8	10
Action	Double acting/Single acting (spring return)			
Fluid	Air			
Proof pressure	1.05MPa			
Min. operating pressure MPa	Double acting	0.15MPa		0.1MPa
	Single acting (spring return)	0.35MPa	0.3MPa	0.2MPa
Max. operating pressure	0.7MPa			
Ambient and fluid temperature	Without auto switch: -10°C to 70°C (with no freezing) With auto switch: -10°C to 60°C (with no freezing)			
Cushion	None			
Lubrication	Non-lube			
Piston speed	50 to 500mm/s			
Thread tolerance	JIS class 2			
Stroke length tolerance	$\begin{matrix} +0.5 \\ 0 \end{matrix}$			
Mounting	Through hole			

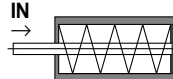
Theoretical Output/Double Acting



Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm ²)	Operating pressure (MPa)		
				0.3	0.5	0.7
4	2	OUT	12.6	3.76	6.28	8.79
		IN	9.4	2.82	4.71	6.59
6	4	OUT	28.3	8.48	14.13	19.79
		IN	15.7	4.71	7.85	10.99
8	5	OUT	50.3	15.07	25.13	35.18
		IN	30.6	9.18	15.31	21.44
10	6	OUT	78.5	23.56	39.26	54.97
		IN	50.3	15.07	25.13	35.18

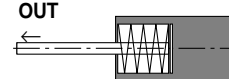
Spring Reaction Force/Single Acting

Spring in pre-loaded condition



When the spring is set in the cylinder

Spring in loaded condition



When the spring is contracted by applying air

Bore size (mm)	Spring condition	Stroke (mm)			
		4	6	8	10
4	Pre-loaded	1.70	1.27	—	—
	Loaded	2.55	2.55	—	—
6	Pre-loaded	2.45	2.01	1.57	—
	Loaded	3.33	3.33	3.33	—
8	Pre-loaded	4.67	3.76	2.86	1.96
	Loaded	6.47	6.47	6.47	6.47
10	Pre-loaded	5.04	4.18	3.31	2.45
	Loaded	6.77	6.77	6.77	6.77

Weights/Double Acting

Bore size (mm)	Standard stroke (mm)						Additional weight	
	4	6	8	10	15	20	With magnet	Rod end male thread
CUJB4	7.2	7.9	8.6	9.3	—	—	—	0.4
CUJB6	12.4	13.6	14.8	16.0	18.9	—	2.7	0.8
CUJB8	15.6	17.0	18.4	19.7	23.0	26.4	3.0	1.5
CUJB10	17.9	19.4	20.8	22.3	25.9	29.5	3.2	2.6

Single Acting

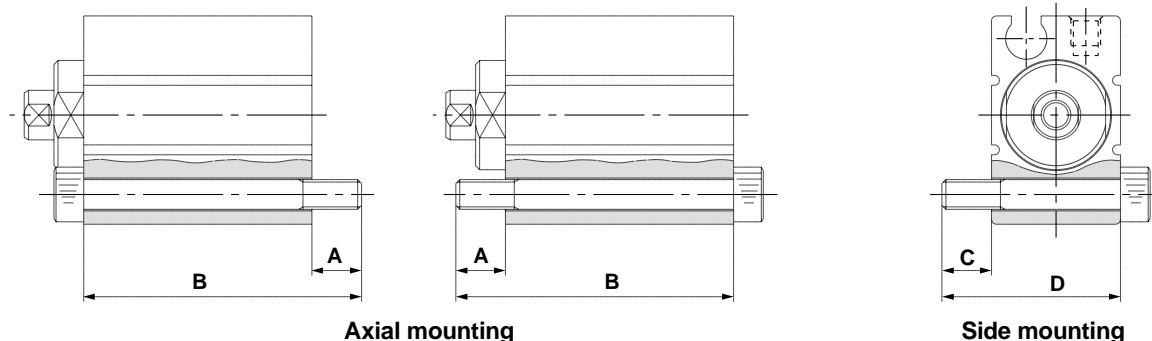
Bore size (mm)	Standard stroke (mm)				Additional weight	
	4	6	8	10	With magnet	Rod end male thread
CUJB4	7.2	7.9	—	—	—	0.4
CUJB6	12.8	14.0	15.2	—	2.4	0.8
CUJB8	15.8	17.2	18.6	19.9	2.5	1.5
CUJB10	17.9	19.4	20.8	22.3	2.4	2.6

Series CUJ

Mounting

Through hole mounting bolts are available for mounting a cylinder.
To order bolts, add "CUJ-" at the beginning of the bolt description.

(Example) CUJ-M3 x 27L



Without Auto Switch

For axial mounting

Model	A	B	Mounting bolt
CUJB4-4	4	21	M2.5 x 21L
-6		23	M2.5 x 23L
-8		25	M2.5 x 25L
-10		27	M2.5 x 27L
CUJB6-4	5	22	M3 x 22L
-6		24	M3 x 24L
-8		26	M3 x 26L
-10		28	M3 x 28L
-15	33	M3 x 33L	
CUJB8-4	5	22	M3 x 22L
-6		24	M3 x 24L
-8		26	M3 x 26L
-10		28	M3 x 28L
-15		33	M3 x 33L
-20	38	M3 x 38L	
CUJB10-4	5	22	M3 x 22L
-6		24	M3 x 24L
-8		26	M3 x 26L
-10		28	M3 x 28L
-15		33	M3 x 33L
-20		38	M3 x 38L

For side mounting

Model	C	D	Mounting bolt
CUJB4-4	4	14	M2.5 x 14L
-6			
-8			
CUJB6-4	5	18	M3 x 18L
-6			
-8			
-10			
-15	33	M3 x 33L	
CUJB8-4	5	18	M3 x 18L
-6			
-8			
-10			
-15			
-20	38	M3 x 38L	
CUJB10-4	5	18	M3 x 18L
-6			
-8			
-10			
-15			
-20			

With Auto Switch

For axial mounting

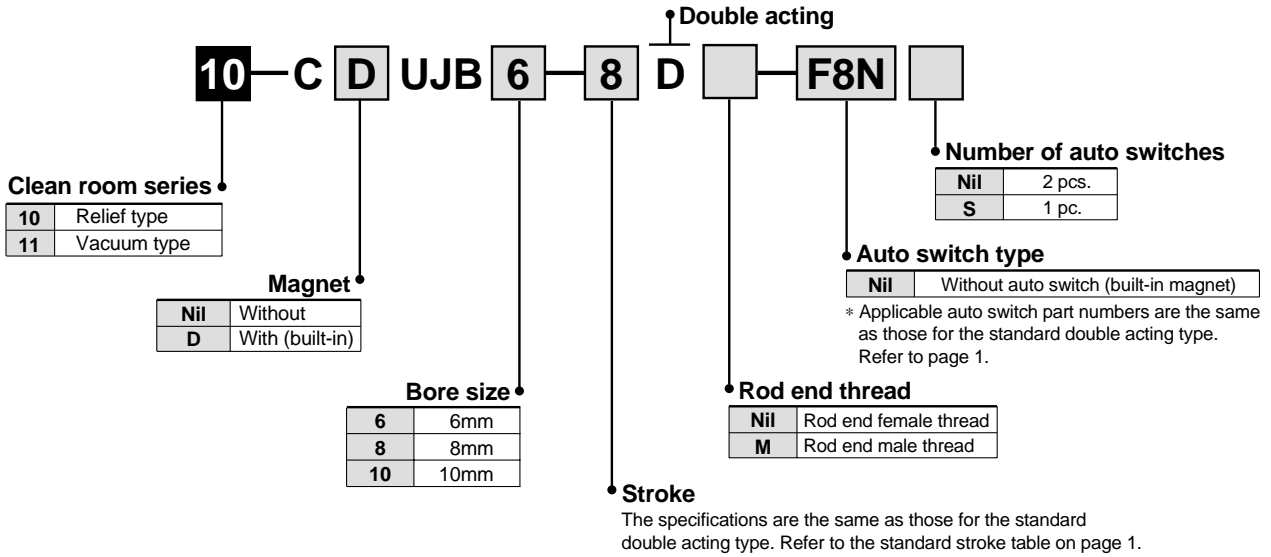
Model	A	B	Mounting bolt
CDUJB6-4	5	27	M3 x 27L
-6		29	M3 x 29L
-8		31	M3 x 31L
-10		33	M3 x 33L
-15		38	M3 x 38L
CDUJB8-4	5	27	M3 x 27L
-6		29	M3 x 29L
-8		31	M3 x 31L
-10		33	M3 x 33L
-15		38	M3 x 38L
-20		43	M3 x 43L
CDUJB10-4	5	27	M3 x 27L
-6		29	M3 x 29L
-8		31	M3 x 31L
-10		33	M3 x 33L
-15		38	M3 x 38L
-20		43	M3 x 43L

For side mounting

Model	C	D	Mounting bolt
CDUJB6-4	5	18	M3 x 18L
-6			
-8			
-10			
CDUJB8-4	5	18	M3 x 18L
-6			
-8			
-10			
-15			
-20	43	M3 x 43L	
CDUJB10-4	5	18	M3 x 18L
-6			
-8			
-10			
-15			
-20			

■ Clean Room Series

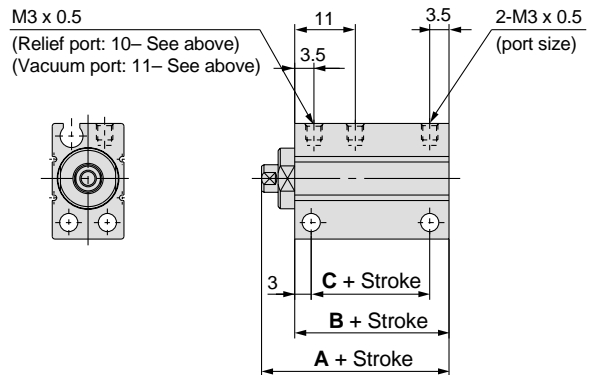
How to Order



Specifications

The specifications are the same as those for the standard double acting type. Refer to page 2.

Dimensions



(mm)

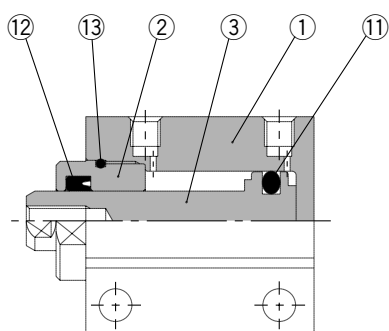
Bore size (mm)	Without auto switch			With auto switch		
	A	B	C	A	B	C
6, 8, 10	24	18	11.5	29	23	16.5



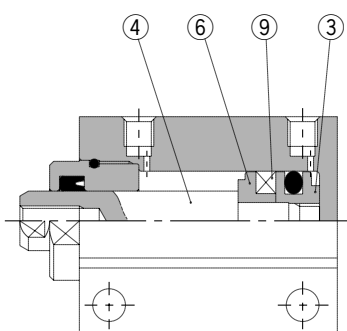
Series CUJ

Construction

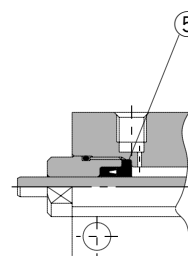
Double acting



Without magnet

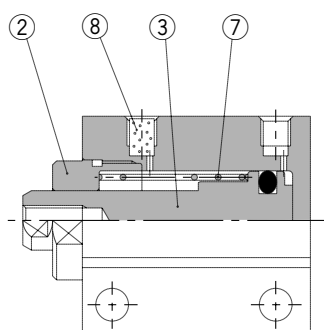


Built-in magnet

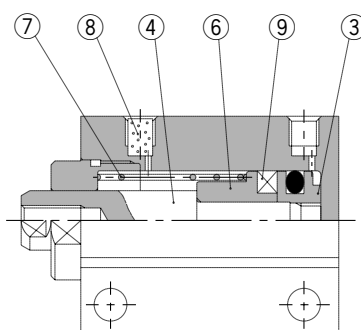


For $\phi 4$

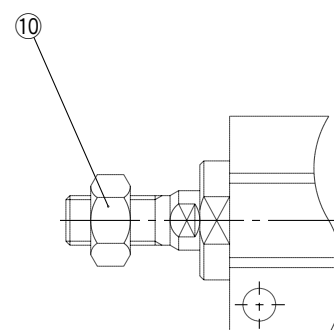
Single acting



Without magnet



Built-in magnet



Rod end male thread

Parts list

No.	Description	Material	Note
1	Cylinder tube	Aluminum alloy	Hard anodized
2	Rod cover	Bronze alloy	Electroless nickel plated
3	Piston	Without switch Stainless steel	
		With switch Aluminum alloy	Chromated
4	Piston rod	Stainless steel	
5	Seal retainer	Stainless steel	CUJB4 only
6	Magnet retainer	Aluminum alloy	Chromated
7	Return spring	Piano wire	
8	Bronze element	Sintered metal BC	
9	Magnet	—	
10	Rod end nut	Steel	Nickel plated
11	Piston seal	NBR	
12	Rod seal	NBR	
13	Tube gasket	NBR	

Replacement parts: Seal kits (double acting)

Bore size	Kit no.	Contents
4	CUJB4-PS	Above numbers 11, 12, 13 and an exclusive grease pack.
6	CUJB6-PS	
8	CUJB8-PS	
10	CUJB10-PS	

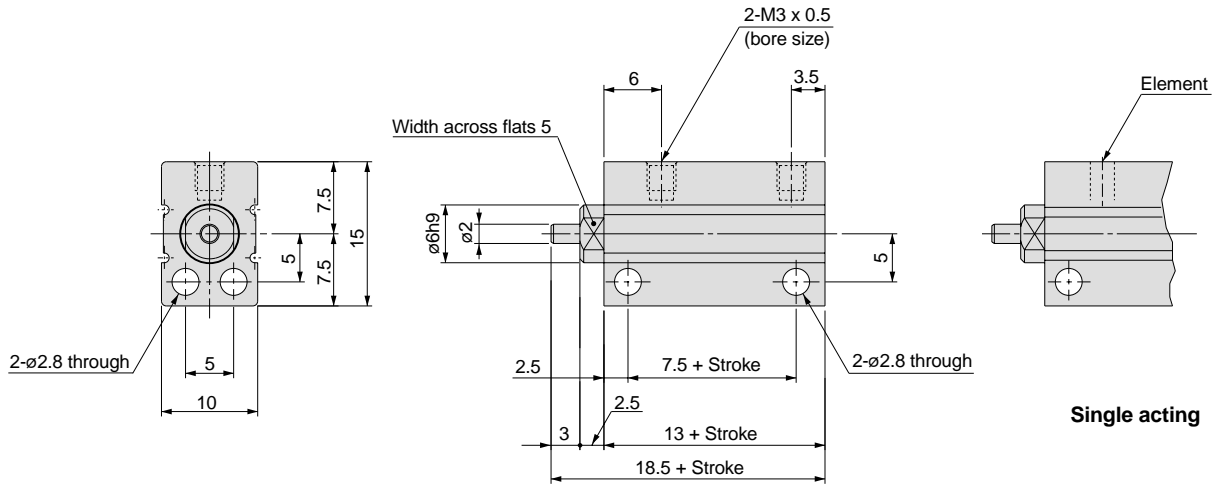
Replacement parts: Seal kits (single acting)

Bore size	Kit no.	Contents
4	CUJB4-S-PS	Above number 11 and an exclusive grease pack.
6	CUJB6-S-PS	
8	CUJB8-S-PS	
10	CUJB10-S-PS	

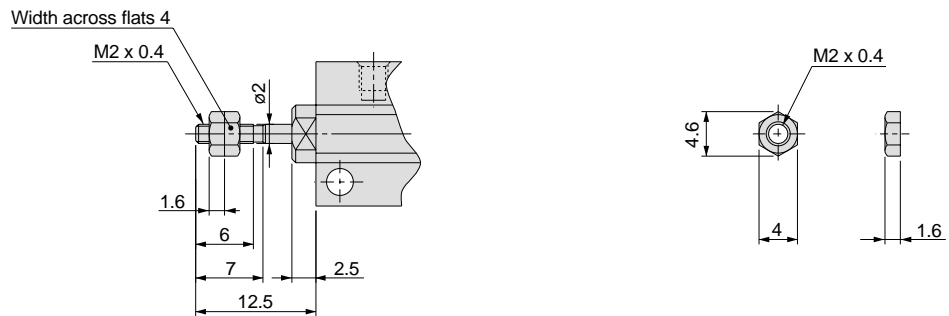
Dimensions for $\phi 4$ Double Acting/Single Acting

Without magnet/CUJB4

Note) The angular position of the width across flats is is not fixed with respect to the tube.



Rod end male thread



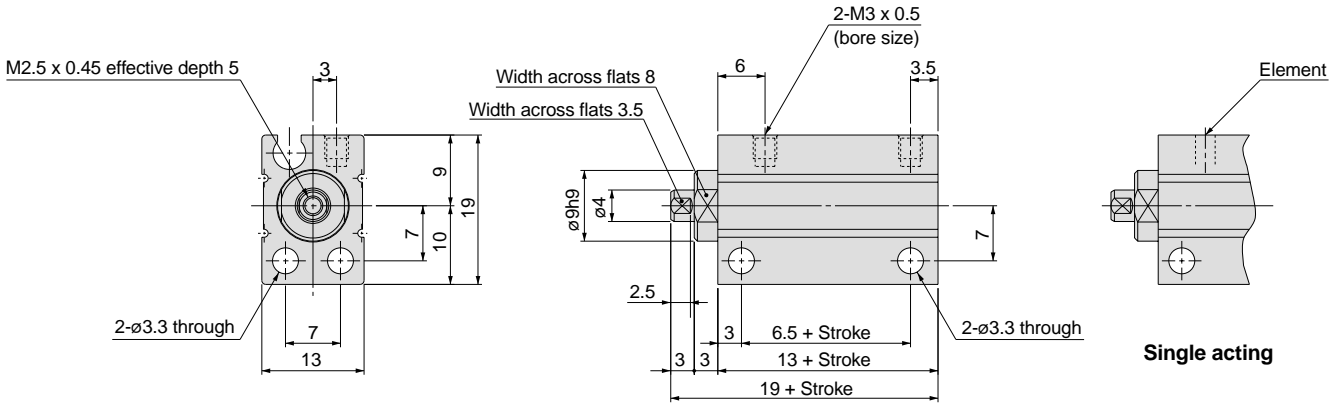
Rod end nut part no.: NTJ-004

Series CUJ

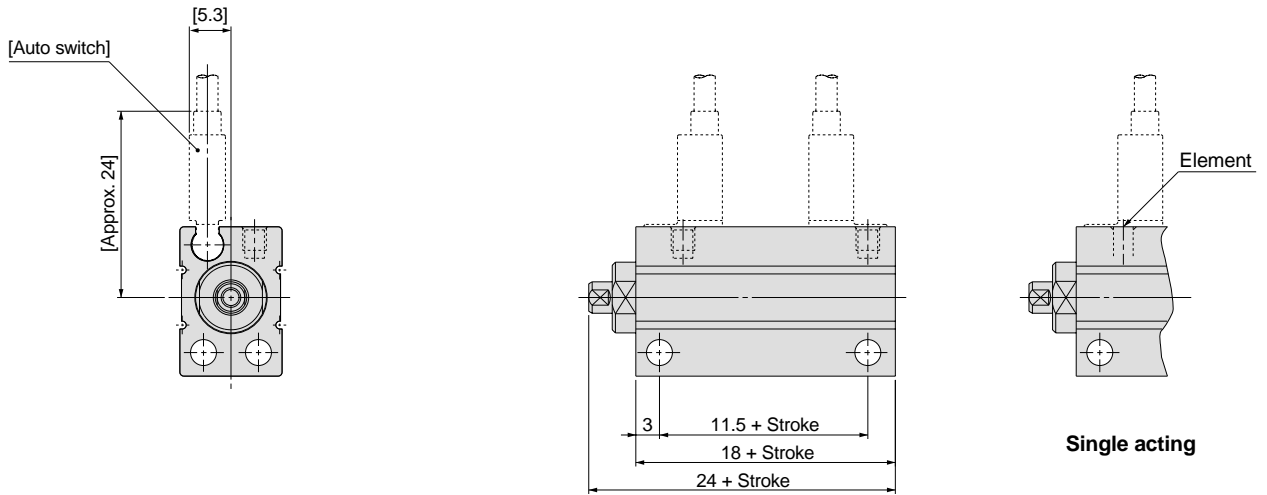
Dimensions for $\phi 6$ Double Acting/Single Acting

Without magnet/ CUJB6

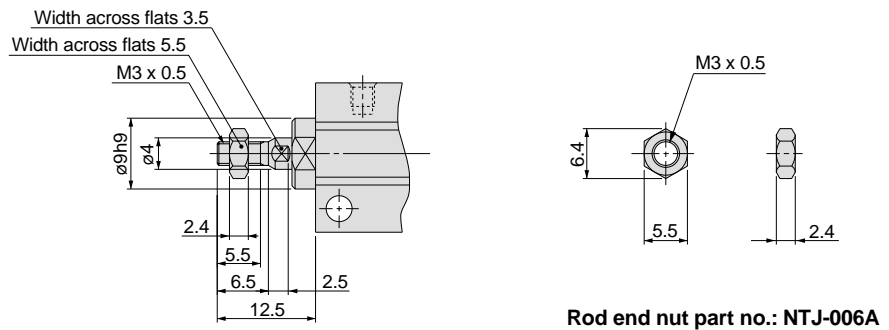
Note) The angular position of the width across flats is not fixed with respect to the tube.



Built-in magnet/ CDUJB6



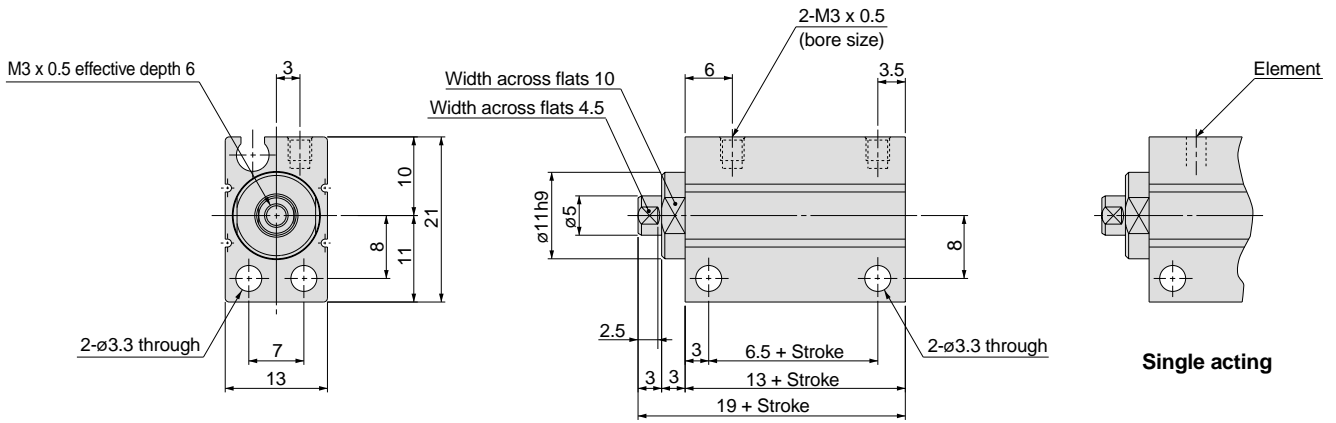
Rod end male thread



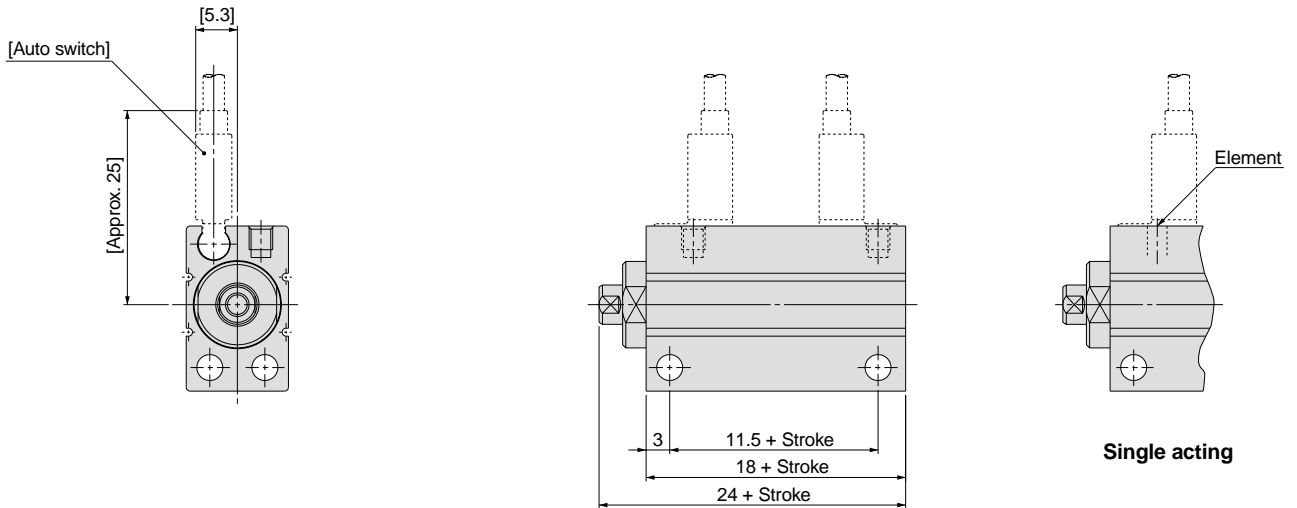
Dimensions for $\varnothing 8$ Double Acting/Single Acting

Without magnet/CUJB8

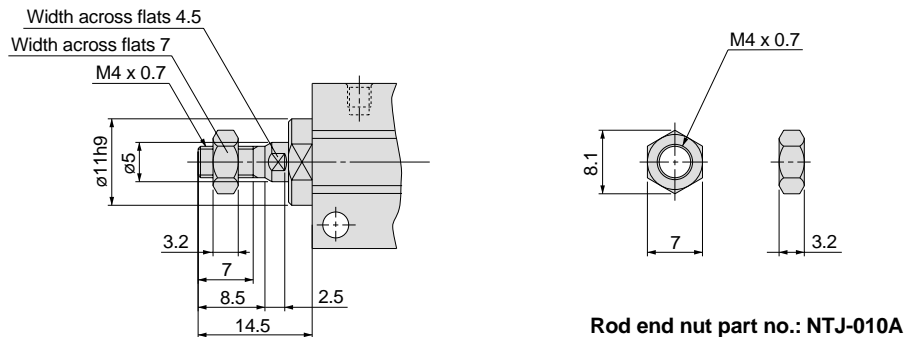
Note) The angular position of the width across flats is not fixed with respect to the tube.



Built in magnet/CDUJB8



Rod end male thread

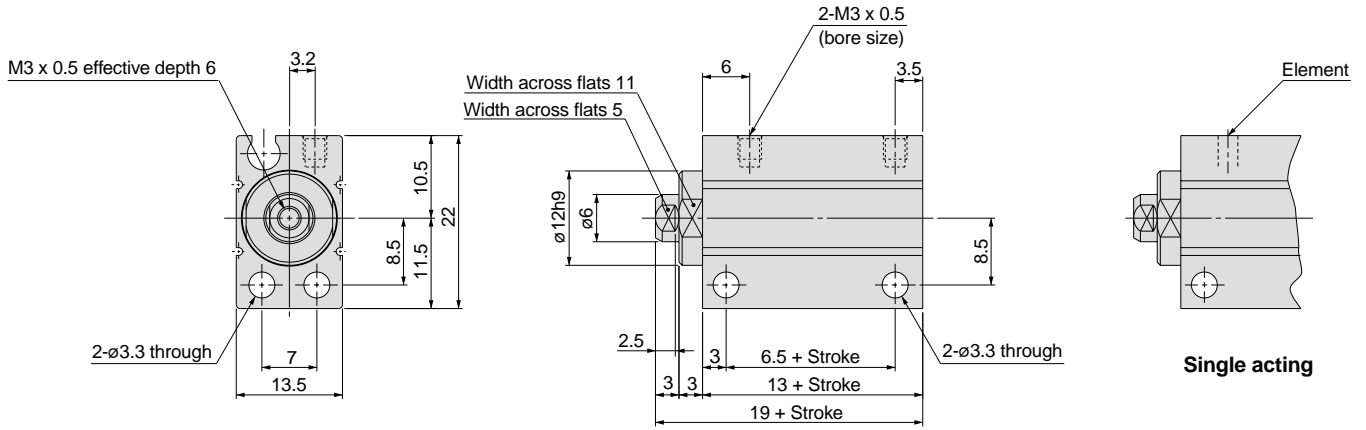


Series CUJ

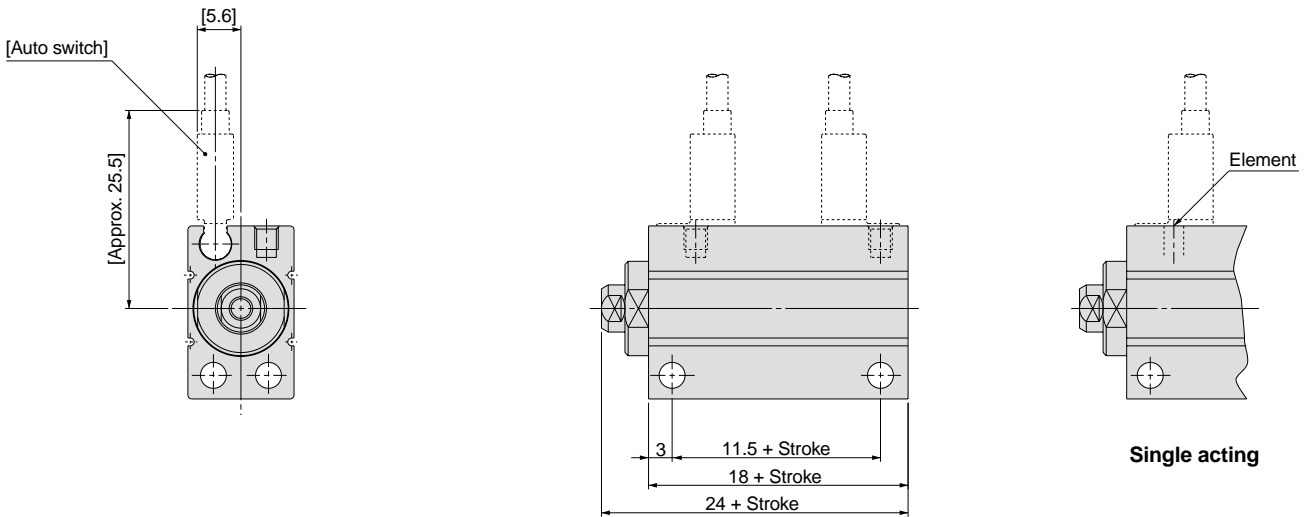
Dimensions for $\phi 10$ Double Acting/Single Acting

Without magnet/CUJB10

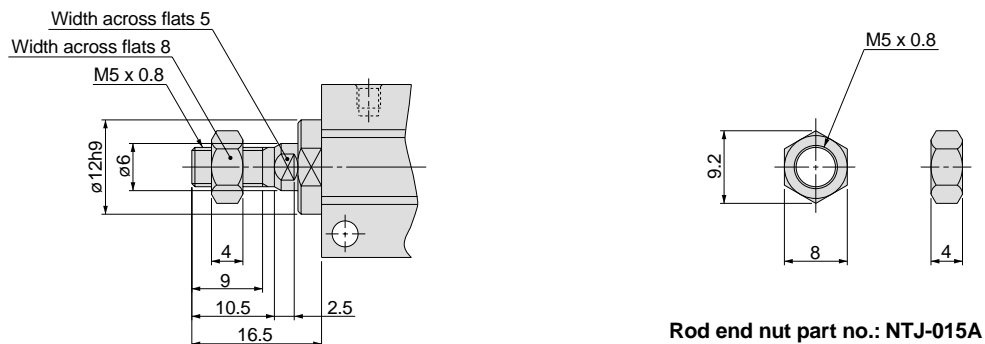
Note) The angular position of the width across flats is is not fixed with respect to the tube.



Built-in magnet/CDUJB10

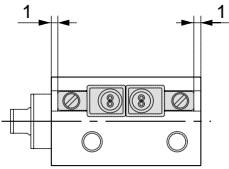


Rod end male thread



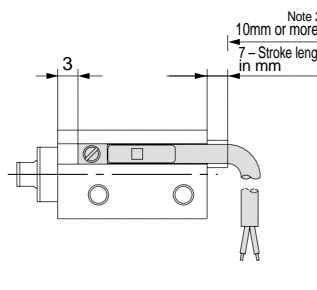
Proper Auto Switch Mounting Position for Stroke End Detection (ø6, ø8, ø10 common)

D-F8N, F8P, F8B

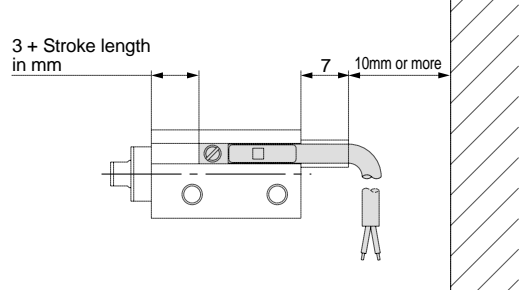


D-F9N, F9P, F9B

• When detecting extended stroke end



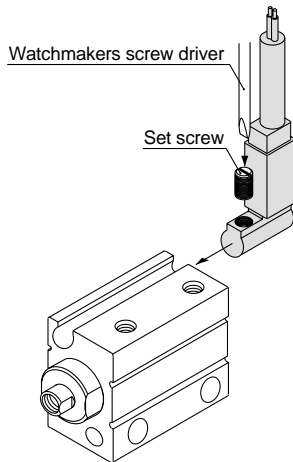
• When detecting retracted stroke end



Note 1) Solid state switch: D-F9□ includes one auto switch.

Note 2) To prevent interference caused by the lead wire, provide a clearance of 10mm or more in addition to the dimensions stated above. Negative numbers indicate recess, positive numbers indicate protrusion.

Auto Switch Mounting

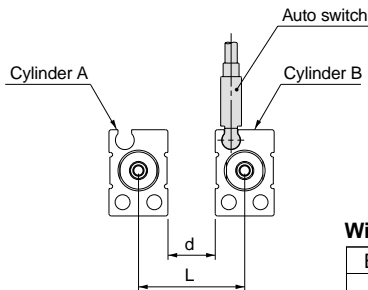


- When tightening an auto switch mounting screw, use a watchmakers screw driver with a handle of approximately 5 to 6mm in diameter.
- Use a tightening torque of approximately 0.10 to 0.20N·m.

When Using Cylinders Adjacently

1. When cylinders with auto switches are adjacent to one another as shown in the figure below, provide at least the amount of space shown in the tables below between them.

If the space is not sufficient, the magnets in adjacent cylinders may cause auto switches to malfunction.



Without shielding plate

Bore	ø6	ø8	ø10
L	19	19	19.5
d	6	6	6

With shielding plate

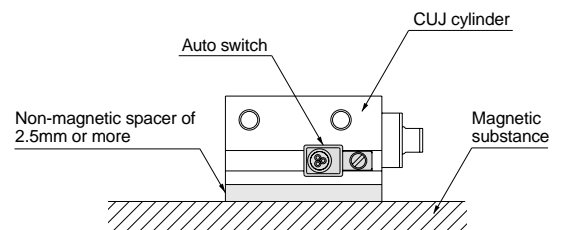
Bore	ø6	ø8	ø10
L	16	13.5	14
d	3	0.5	0.5

* The space can be reduced by attaching shielding plates (steel plates 0.2 to 0.3mm thick) to the sides of the cylinders facing each other. In the case of bore size ø6, be sure to attach a plate on Cylinder A (on the surface opposite to the switch groove).

2. In the case of bore size ø6 cylinders with auto switches, keep the switch groove side surface at least 2.5mm away from a magnetic substance.

If a magnetic substance is closer than 2.5mm, auto switches may malfunction due to a drop in magnetic force.

* If this surface is to be used for mounting, a spacer composed of a non-magnetic substance (aluminum, etc.) is required as shown in the figure below.



Auto Switch Common Specifications

Auto Switch Common Specifications

Type	Solid state switch
Operating time	1ms or less
Impact resistance	1000m/s ²
Insulation resistance	50MΩ or more at 500VDC (between lead wire and case)
Withstand voltage	1000VAC for 1min. (between lead wire and case)
Ambient temperature	-10 to 60°C
Enclosure	IEC529 standard IP67, JISC0920 watertight construction

Lead Wire Lengths

How to specify lead wire length

(Example)

D-F9P **L**

● Lead wire length

Nil	0.5m
L	3m
Z	5m

- Note 1) Lead wire length Z: Auto switch applicable to 5m length
Solid state switches: All models produced upon receipt of order (standard procedure).
Note 2) For solid state with flexible wire specification, add "-61" after the lead wire length.

(Example) D-F9PL-**61**

● Flexible specification

Lead Wire Color Changes

Lead wire colors of SMC auto switches have been changed as shown in the tables below starting from production in September 1996, in order to meet the IEC947-5-2 standard.

Take special care regarding wire polarity during the time when the old colors still coexist with the new colors.

2 wire

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

3 wire

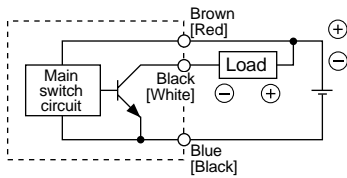
	Old	New
Power supply (+)	Red	Brown
Power supply GND	Black	Blue
Output	White	Black

Series CUJ Auto Switch Wiring Connections and Examples

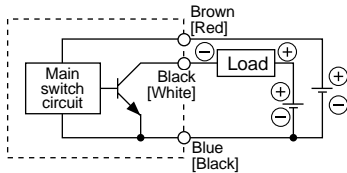
Basic Wiring

Note) Lead wire colors inside [] are those prior to conformity with IEC standards.

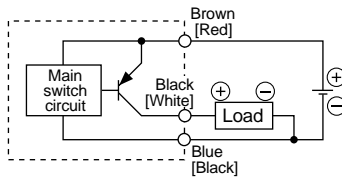
Solid state 3-wire, NPN



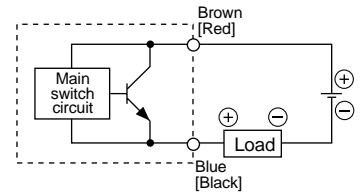
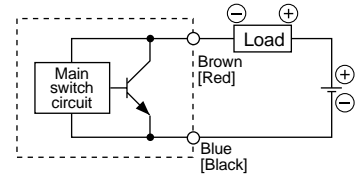
(Power supplies for switch and load are separate.)



Solid state 3-wire, PNP



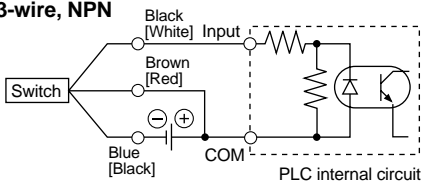
2-wire <Solid state>



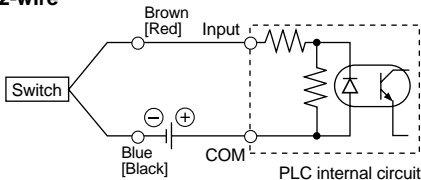
Examples of Connection to PLC

Sink input specifications

3-wire, NPN

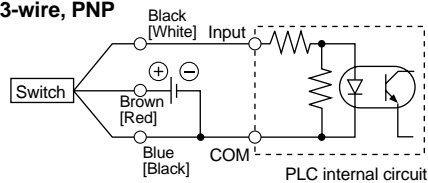


2-wire

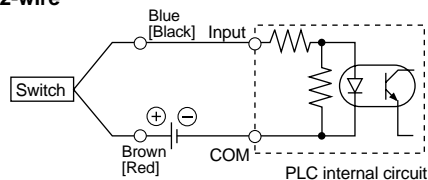


Source input specifications

3-wire, PNP



2-wire

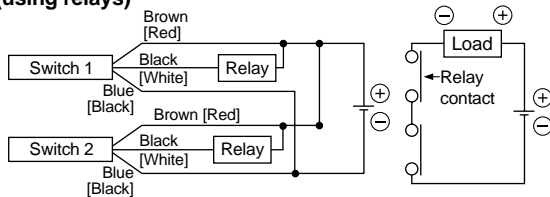


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

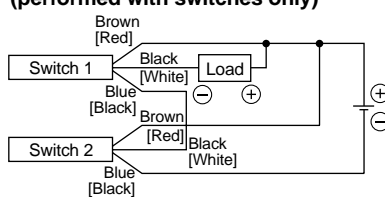
Connection Examples for AND (Series) and OR (Parallel)

3-wire

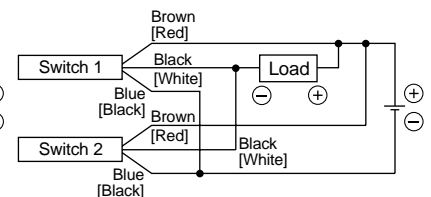
AND connection for NPN output (using relays)



AND connection for NPN output (performed with switches only)

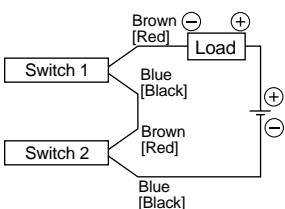


OR connection for NPN output



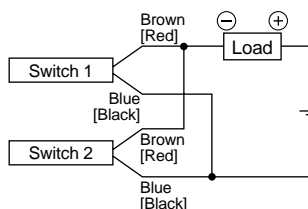
The indicator lights will light up when both switches are turned ON.

2-wire with 2-switch AND connection



When two switches are connected in series, a load may malfunction because the load voltage will drop when in the ON state. The indicator lights will light up if both of the switches are in the ON state.

2-wire with 2-switch OR connection



<Solid state>
When two switches are connected in parallel, malfunction may occur because the load voltage will increase when in the OFF state.

$$\begin{aligned} \text{Load voltage at ON} &= \text{Power supply voltage} - \text{Internal voltage drop} \times 2 \text{ pcs.} \\ &= 24\text{V} - 4\text{V} \times 2 \text{ pcs.} \\ &= 16\text{V} \end{aligned}$$

Example: Power supply is 24VDC
Internal voltage drop in switch is 4V

$$\begin{aligned} \text{Load voltage at OFF} &= \text{Leakage current} \times 2 \text{ pcs.} \times \text{Load impedance} \\ &= 1\text{mA} \times 2 \text{ pcs.} \times 3\text{k}\Omega \\ &= 6\text{V} \end{aligned}$$

Example: Load impedance is 3kΩ
Leakage current from switch is 1mA

Solid State Auto Switches/Direct Mount Type D-F9N, D-F9P, D-F9B

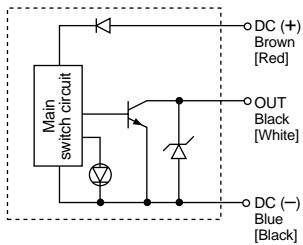
Grommet



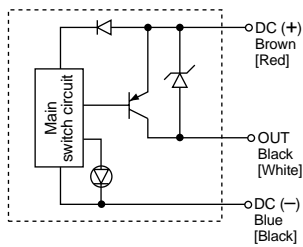
Auto Switch Internal Circuits

Lead wire colors inside [] are those prior to conforming with IEC standards.

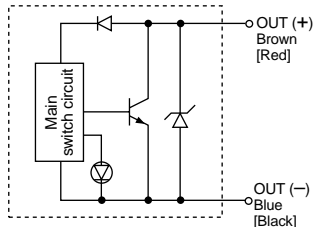
D-F9N



D-F9P



D-F9B



Auto Switch Specifications

D-F9□ (with indicator light)			
Auto switch part no.	D-F9N	D-F9P	D-F9B
Electrical entry direction	In-line	In-line	In-line
Wiring type	3 wire		2 wire
Output type	NPN	PNP	—
Applicable load	IC circuit, Relay, PLC		24VDC relay, PLC
Power supply voltage	5, 12, 24VDC (4.5 to 28VDC)		—
Current consumption	10mA or less		—
Load voltage	28VDC or less	—	24VDC (10 to 28VDC)
Load current	40mA or less	80mA or less	5 to 40mA
Internal voltage drop	1.5V or less (0.8V or less at a load current of 10mA)	0.8V or less	4V or less
Leakage current	100μA or less at 24VDC		0.8mA or less
Indicator light	Red LED lights when ON		

- Lead wires — Heavy duty oil resistant vinyl cord, $\phi 2.7$, 0.5m
D-F9N, D-F9P 0.15mm² x 3 wire (Brown, Black, Blue [Red, White, Black])
D-F9B 0.18mm² x 2 wire (Brown, Blue [Red, Black])

Note 1) Refer to page 11 for solid state switch common specifications.

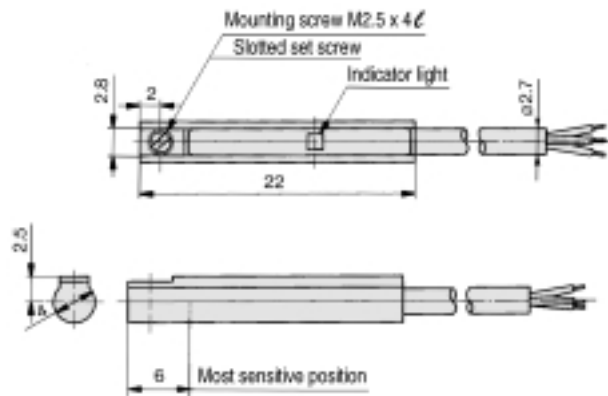
Note 2) Refer to page 11 for lead wire lengths.

Auto Switch Weights

Model	D-F9N	D-F9P	D-F9B
Lead wire length 0.5m	7	7	6
Lead wire length 3m	37	37	31

Auto Switch Dimensions

D-F9N, D-F9P, D-F9B



Solid State Auto Switches/Direct Mount Type D-F8N, D-F8P, D-F8B

Grommet



Auto Switch Specifications

D-F8□ (with indicator light)			
Auto switch part no.	D-F8N	D-F8P	D-F8B
Electrical entry direction	Perpendicular	Perpendicular	Perpendicular
Wiring type	3 wire		2 wire
Output type	NPN	PNP	—
Applicable load	IC circuit, 24VDC relay, PLC		24VDC relay, PLC
Power supply voltage	5, 12, 24VDC (4.5 to 28VDC)		—
Current consumption	10mA or less		—
Load voltage	28VDC or less	—	24VDC (10 to 28VDC)
Load current	40mA or less	80mA or less	2.5 to 40mA
Internal voltage drop	1.5V or less (0.8V or less at a load current of 10mA)	0.8V or less	4V or less
Leakage current	100μA or less at 24VDC		0.8mA or less at 24VDC
Indicator light	Red LED lights when ON		

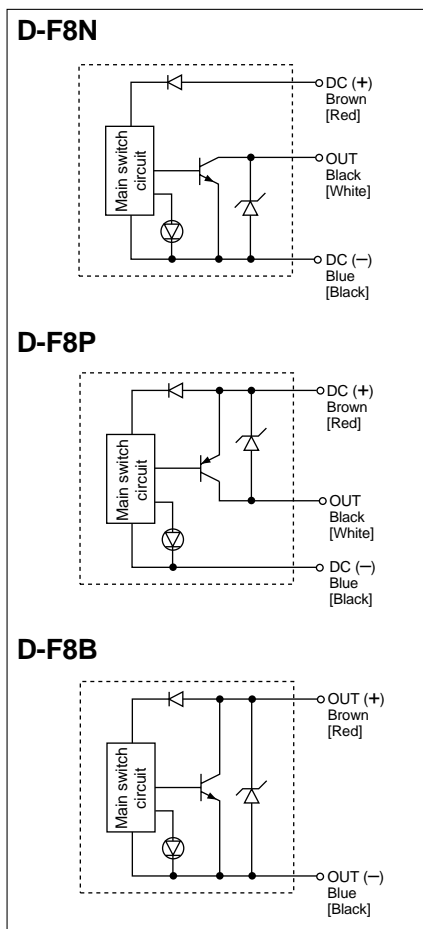
• Lead wires — Heavy duty oil resistant vinyl cord, $\phi 2.7$, 0.5m
 D-F8N, D-F8P 0.15mm² x 3 wire (Brown, Black, Blue [Red, White, Black])
 D-F8B 0.18mm² x 2 wire (Brown, Blue [Red, Black])

Note 1) Refer to page 11 for auto switch common specifications.

Note 2) Refer to page 11 for lead wire lengths.

Auto Switch Internal Circuits

Lead wire colors inside [] are those prior to conformity with IEC standards.



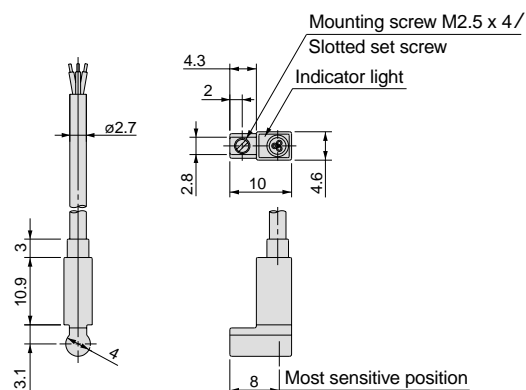
Auto Switch Weights

(g)

Model	D-F8N	D-F8P	D-F8B
Lead wire length 0.5m		7	
Lead wire length 3m		32	

Auto Switch Dimensions

D-F8N, D-F8P, D-F8B








Series CUJ

Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

 **Caution** : Operator error could result in injury or equipment damage.

 **Warning** : Operator error could result in serious injury or loss of life.

 **Danger** : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power — Recommendations for the application of equipment to transmission and control systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

Warning

1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



Series CUJ Actuator Precautions 1

Be sure to read before handling.

Design

⚠ Warning

1. **There is a danger of sudden action by air cylinders if sliding parts of machinery are twisted, etc., and changes in forces occur.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed to avoid such dangers.

2. **A protective cover is recommended to minimize the risk of human injury.**

If a driven object and moving parts of a cylinder pose a danger of human injury, design the structure to avoid contact with the human body.

3. **Securely tighten all stationary parts and connected parts so that they will not become loose.**

Especially when a cylinder operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

4. **A deceleration circuit or shock absorber may be required.**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact. In this case, the rigidity of the machinery should also be examined.

5. **Consider a possible drop in circuit pressure due to a power outage, etc.**

When a cylinder is used in a clamping mechanism, there is a danger of work pieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

6. **Consider a possible loss of power source.**

Measures should be taken to protect against human injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity or hydraulics, etc.

7. **Design circuitry to prevent sudden lurching of driven objects.**

When a cylinder is driven by an exhaust center type directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. Therefore, equipment should be selected and circuits designed to prevent sudden lurching, because there is a danger of human injury and/or damage to equipment when this occurs.

8. **Consider emergency stops.**

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, such as a power outage or a manual emergency stop.

Design

⚠ Warning

9. **Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that human injury or equipment damage will not occur upon restart of operation.

When the cylinder has to be reset at the starting position, install safe manual control equipment.

Selection

⚠ Warning

1. **Confirm the specifications.**

The products included in this catalog are designed according to use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are out of specification, damage and/or malfunction may be caused. Do not use in these conditions. (Refer to specifications.)

Consult SMC if you use a fluid other than compressed air.

2. **Intermediate stops**

When intermediate stopping of a cylinder piston is performed with a 3 position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and precise as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

⚠ Caution

1. **Operate within the limits of the maximum usable stroke.**

The piston rod will be damaged when operated with a stroke exceeding the maximum stroke range. Refer to the air cylinder selection procedures regarding the maximum usable stroke.

2. **Operate the piston within a range such that collision damage will not occur at the end of the stroke.**

Operate within a range such that damage will not occur when the piston having inertial force stops by striking the cover at the stroke end. Refer to the cylinder selection procedures for the range within which damage will not occur.

3. **Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.**

4. **Provide an intermediate support for a cylinder with a long stroke.**

If the cylinder has a long stroke, provide an intermediate support to prevent the rod from sagging and the tube from bending, as well as to prevent damage to the rod due to vibrations or external loads.



Series CUJ Actuator Precautions 2

Be sure to read before handling.

Mounting

⚠ Caution

1. Be sure to connect so that the rod axis is aligned with the load and movement direction.

If they are not aligned, stress could be applied to the rod and the tube, causing the inner surface of the tube, the bushing, the rod surface, and the seals to wear and to become damaged.

2. Do not scratch or gouge the sliding parts of the cylinder tube or piston rod by striking or grasping them with other objects.

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause malfunction.

Also, scratches or gouges in the piston rod may lead to damaged seals and cause air leakage.

3. Do not use until you verify that equipment can operate properly.

Following mounting, repair or conversions, verify correct mounting by suitable function and leakage tests after compressed air and power are connected.

4. Instruction manual

The product should be mounted and operated after thoroughly reading the manual and understanding its contents.

Keep the instruction manual where it can be referred to as needed.

Piping

⚠ Caution

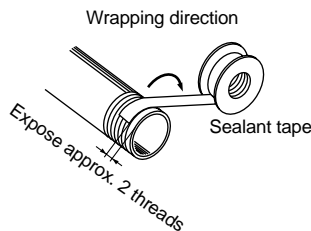
1. Preparation before piping

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.

2. Wrapping of sealant tape

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the piping.

Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



Lubrication

⚠ Caution

1. Lubrication of non-lube type cylinder

The cylinder is lubricated at the factory and can be used without any further lubrication.

However, in the event that it will be lubricated, use class 1 turbine oil (with no additives) ISO VG32.

Stopping lubrication later may lead to malfunction due to the loss of the original lubricant. Therefore, lubrication must be continued once it has been started.

Air Supply

⚠ Warning

1. Use clean air.

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

⚠ Caution

1. Install air filters.

Install air filters at the upstream side of valves. The filtration degree should be 5µm or finer.

2. Install an air dryer, after-cooler or water separator, etc.

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, after-cooler or water separator, etc.

3. Use the product within the specified range of fluid and ambient temperature.

At temperatures of 5°C or lower, take measures to prevent freezing, since moisture in circuits may be frozen and this can cause damage to seals and lead to malfunction.

Refer to SMC's "Air Cleaning Equipment" catalog for further details on compressed air quality.



Series CUJ Actuator Precautions 3

Be sure to read before handling.

Operating Environment

Warning

1. Do not use in environments where there is a danger of corrosion.

Refer to the construction drawings regarding cylinder materials.

2. In dusty locations or where water or oil splash on the equipment, install a protective cover over the rod.
3. When using auto switches, do not operate in an environment with strong magnetic fields.

Maintenance

Warning

1. Perform maintenance according to the procedure indicated in the instruction manual.

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

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

When machinery is removed, first check measures to prevent dropping of driven objects and run-away of equipment, etc. Then cut off the supply pressure and electric power, and exhaust all compressed air from the system.

When machinery is restarted, proceed with caution after confirming measures to prevent cylinder lurching.

Caution

1. Drain flushing

Drain air filters regularly.



Series CUJ Auto Switch Precautions 1

Be sure to read before handling.

Design and Selection

⚠ Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for load current, voltage, temperature or impact.

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

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

3. Monitor 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 if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

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

4. Keep wiring as short as possible.

<Solid state switch>

Although wire length should not affect switch function, use a wire 100m or shorter.

5. Be careful of the internal voltage drop of the switch.

<Solid state switch>

Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch.

- Note that there will be a large voltage drop if auto switches are connected in series as shown below. (Refer to internal voltage drop in the auto switch specifications.)

[The voltage drop will be "n" times larger when "n" auto switches are connected.]

Even though auto switches operate normally, the load may not operate.



⚠ Warning

- Similarly, when operating below a specified voltage, it is possible that the load may be ineffective even though the auto switch function is normal. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

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

Also, note that a 12VDC relay is not applicable.

6. Be careful of leakage current.

<Solid state switch>

With a 2 wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the above requirement is not satisfied, it will not reset correctly (stays ON). Use a 3 wire switch if this specification cannot be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

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

<Solid state switch>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid, which generates surge is directly driven, use a type of switch having a built-in surge absorbing element.

8. 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.

9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

Mounting and Adjustment

⚠ Warning

1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (1000m/s² or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

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

Never carry a cylinder by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper tightening torque.

When a switch is tightened beyond the range of tightening torque, the mounting screws or switch may be damaged.

On the other hand, tightening below the range of tightening torque may allow the switch to slip out of position. (Refer to page 10 regarding switch mounting, movement and tightening torque, etc.)



Series CUJ Auto Switch Precautions 2

Be sure to read before handling.

Wiring

⚠ Warning

1. Avoid repeatedly bending or stretching lead wires.

Broken wires will result from applying repeated bending stress or stretching force to the lead wires.

2. Be sure to connect the load before power is applied.

<2 wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

4. Do not run wiring near power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing auto switches may malfunction due to noise from these other lines.

⚠ Warning

* Lead wire color changes

Lead wire colors of SMC switches have been changed in order to meet NECA Standard 0402 for production beginning in September 1996. Please refer to the tables provided.

Take special care regarding wire polarity during the time that the old colors still coexist with the new colors.

2 wire

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

Solid state with diagnostic output

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

3 wire

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

⚠ Warning

5. Do not allow short circuit of loads.

<Solid state switch>

All models of PNP output type switches do not have built-in short circuit protection circuits. If loads are short circuited, the switches will be instantly damaged.

Take special care to avoid reverse wiring with the power supply line (brown [red]) and the output line (black [white]) on 3 wire type switches.

6. Avoid incorrect wiring.

<Solid state switch>

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

Note) Lead wire colors inside [] are those prior to conformity with IEC standards.



Series CUJ Auto Switch Precautions 3

Be sure to read before handling.

Operating Environment

Warning

1. Never use in an atmosphere of explosive gases.

The construction of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

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

Auto switches will malfunction or magnets inside cylinders will become demagnetized.

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

Although switches, except for a few models, conform to IEC standard IP67 construction (JIS C 0920: watertight construction), they should not be used in applications where they are continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

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

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

Warning

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

Consult SMC if switches are used where there are temperature cycles other than normal air temperature changes, as they may be adversely affected internally.

6. Do not use in locations where surge is generated.

<Solid state switch>

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) that generate a large amount of surge in the area around cylinders with solid state auto switches, this may cause deterioration or damage to the switch's internal circuitry. Avoid sources of surge generation and crossed lines.

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

When a large amount of ferrous waste such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch cylinder, it may cause auto switches to malfunction due to a loss of the magnetic force inside the cylinder.

Maintenance

Warning

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

1) Keep switch mounting screws securely tightened.

If screws should become loose or switches should slip from their original mounting position, retighten the screws after readjusting the mounting position.

2) Confirm that there is no damage to lead wires.

To prevent faulty insulation, replace switches or repair lead wires if damage is discovered.

Other

Warning

1. Consult SMC concerning water resistance, flexibility of lead wires, and usage at welding sites, etc.



Series CUJ Specific Product Precautions 1

Be sure to read before handling.

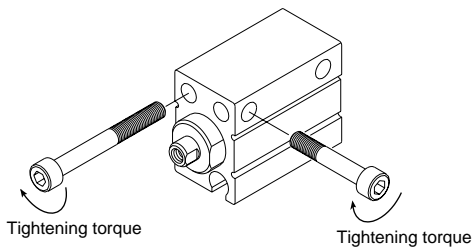
Refer to pages 15 through 21 for safety instructions, actuator precautions and auto switch precautions.

Mounting

⚠ Caution

When mounting a mini free-mount cylinder, tighten the bolts with the proper tightening torque.

	Bolt	Proper tightening torque N·m
CUJB4	M2.5 x 0.45	0.54
C(D)UJB6	M3 x 0.5	1.06
C(D)UJB8		
C(D)UJB10		

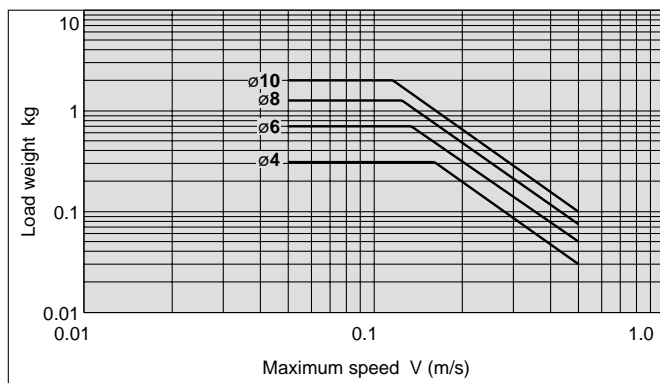


Allowable Kinetic Energy

⚠ Caution

When driving an inertial load, operate a cylinder with kinetic energy within the allowable value. The range in the chart below that is delineated by bold solid lines indicates the relation between load weights and maximum driving speeds.

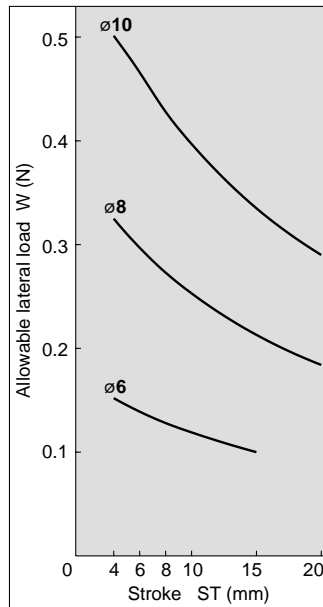
Bore size (mm)	4	6	8	10
Operating piston speed (m/s)	0.05 to 0.5			
Allowable kinetic energy (J)	3.8×10^{-3}	6.25×10^{-3}	9.35×10^{-3}	12.5×10^{-3}



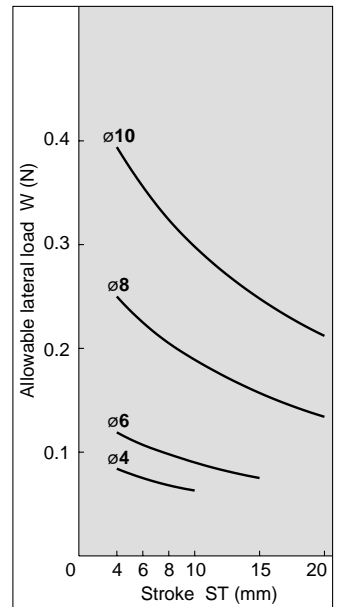
Selection

Strictly observe the limiting range of lateral load on a piston rod. (See the graphs below.) If this product is used beyond the limits, it may shorten the machine life or cause damage.

With auto switch



Without auto switch





Series CUJ Specific Product Precautions 2

Be sure to read before handling.

Refer to pages 15 through 21 for safety instructions, actuator precautions and auto switch precautions.

Mounting of Speed Controllers and Fittings

Caution

Since the cylinder port size of M3 x 0.5 is used, use the cylinder series models listed below when connecting speed controllers and fittings directly to cylinders.

- After manually tightening speed controllers and fittings, tighten approximately a quarter turn more using a tightening tool. In cases where there are gaskets in two places such as universal elbows, universal tees, etc., double the additional tightening to a half turn. If screws are tightened excessively, air leakage may result due to broken threads or a deformed gasket. If screws are tightened insufficiently, looseness and accompanying air leakage are likely to occur.

<Speed controllers>

With auto switch

Bore size (mm)	6, 8, 10
Port size	M3 x 0.5
Stroke (mm)	4 or more
AS12□1F-M3-23	●
AS12□1F-M3-04	●
AS13□1F-M3-23	●
AS13□1F-M3-04	●

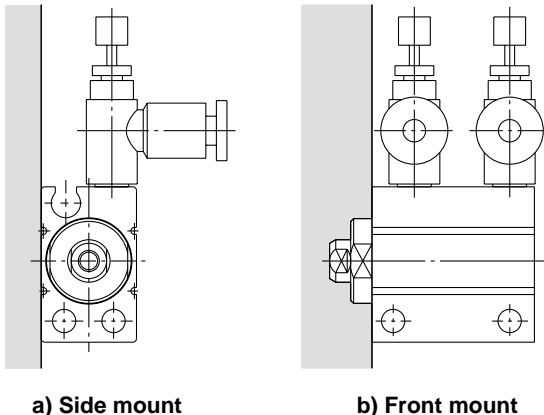
Note) Only applicable to the mounting position shown in Figure 1 below.

Without auto switch

Bore size (mm)	4, 6, 8, 10	
Port size	M3 x 0.5	
Stroke (mm)	6	8 or more
AS12□1F-M3-23	●	●
AS12□1F-M3-04	—	●
AS13□1F-M3-23	●	●
AS13□1F-M3-04	—	●

Note) Only applicable to the mounting position shown in Figure 1 below.

Figure 1



a) Side mount

b) Front mount

<One-touch fittings and hose nipples>

With auto switch

Bore size (mm)		6, 8, 10	
Port size		M3 x 0.5	
Stroke (mm)		4	6 or more
One-touch fitting	KJS23-M3	●	●
Hose nipple	M-3AU	●	●
	M-3ALU	●	●

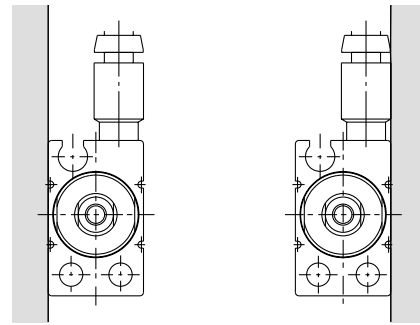
Without auto switch

Bore size (mm)		4		6, 8, 10	
Port size		M3 x 0.5			
Stroke (mm)		4	6 or more	4	6 or more
One-touch fitting	KJS23-M3	●	●	●	●
	KJS04-M3	—	○	—	△
	KJH23-M3	—	○	—	△
	KJH04-M3	—	○	—	△
	KJL23-M3	—	○	—	△
	KJL04-M3	—	○	—	△
	KJW23-M3	—	○	—	△
Hose nipple	M-3AU	●	●	●	●
	M-3ALU	●	●	●	●

●: Applicable to mounting positions 1, 2, 3 and 4.

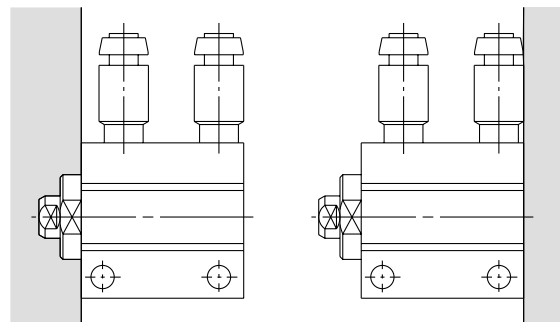
○: Applicable to mounting positions 1, 2 and 3.

△: Applicable to mounting positions 1 and 3.



Mounting position 1

Mounting position 2



Mounting position 3

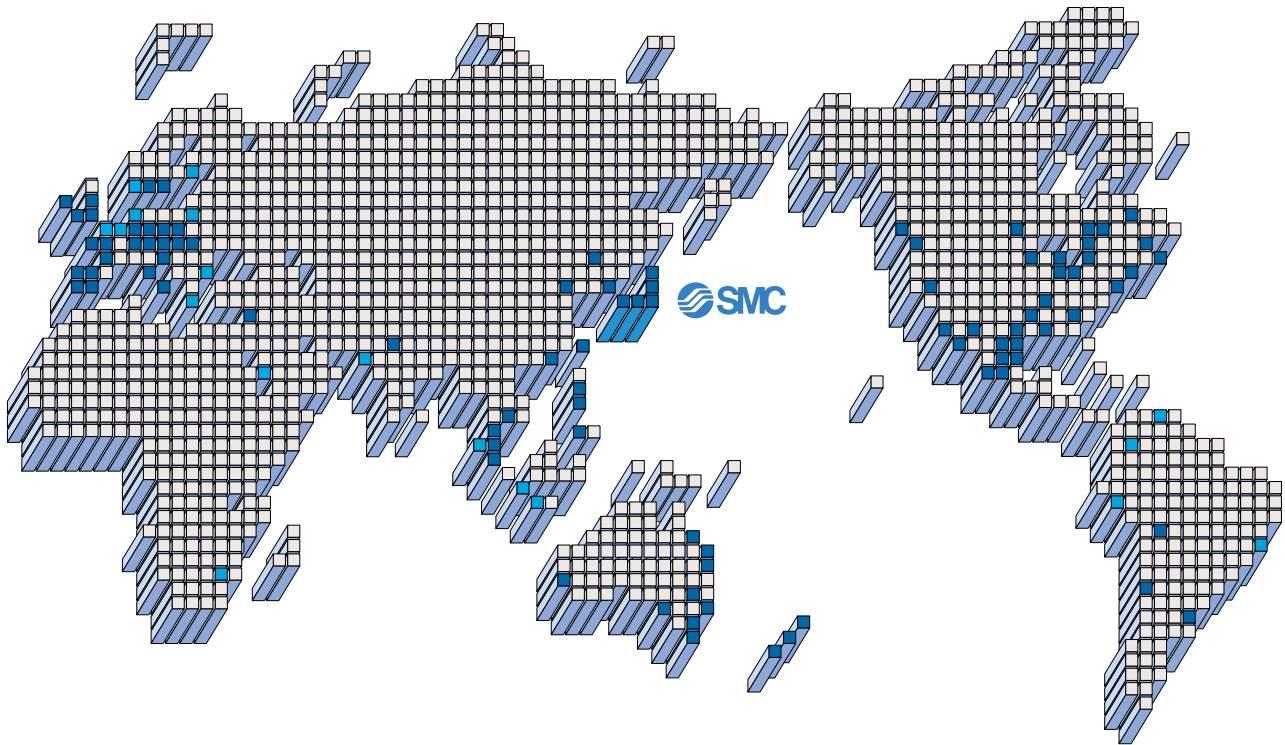
Mounting position 4

Notes) 1. The above figures show the mounting positions with series KJS One-touch fittings installed.

2. Refer to sections starting on pages 2-1-1 and 2-1-47 of "Best Pneumatics No. 4" for the details of One-touch fittings and hose nipples.



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SMC CORPORATION

1-16-4 Shimbashi, Minato-ku, Tokyo 105-0004, JAPAN

Tel: 03-3502-2740 Fax: 03-3508-2480

URL <http://www.smcworld.com>

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1st printing April, 2001 D-SMC.L.A. P-80 (D)

This catalog is printed on recycled paper with concern for the global environment.

All specifications in this catalog are subject to change without notice.

Printed in Japan.