

# Microspeed Cylinder



Achieves Stable Low Speed Operation Low Friction Low Minimum Operating Pressures Low Breakaway Pressure

# Microspeed Cylinder

Low friction characteristics improved (CM2X, CQSX, CQ2X) Minimum operating pressure cut in half (compared to previous series) while achieving stable thrust.



# Achieves stable low speed operation even at 0.5mm/s (1mm/s for Ø16 or smaller)

### **Operates smoothly with minimal stick-slip**

CJ2XB10-60



Note 1) The average speed is obtained by dividing the stroke by the piston rod movement time.

Note 2) The out operating direction is considered to be positive with regard to speed.

CQSXB20-20D



# Allows low speed transfer of work pieces that cannot tolerate shock

Capable of smooth starts with minimal lurching even after long periods of no operation

# All models have the same dimensions as standard cylinders

	Start after non-operation
Speed→	Conventional cylinder
Stroke→	Conventional cylinder Microspeed cylinder
	→Time

### Clean room specifications introduced (10-/11-CQSX, CQ2X, CM2X) Particulate generation data for microspeed cylinder clean room specifications are measured using the following test method.

#### Example of test method]

lace the test sample in an acrylic chamber, operate the solenoid valve while supplying a volume of clean air equal to the intake volume f a laser dust monitor (28.3 /min) (0.99CFM), and measure the amount of particulate generation for a specified number of operating ycles. The chamber is set up on a Class 100 clean bench.

#### Measuring conditions

-				
Chamber volume	15 <b>/</b> (0.53ft <sup>3</sup> )			
Cleanliness of air supplied to chamber	Same quality as supply air			
	Hitachi Electronics			
	Engineering Corporation			
Laser dust monitor	TS-6200			
	Min. measurable particle dia. 0.1µm			
	Intake rate 28.3 Imin (0.99CFM)			
Laser dust monitor	Sampling time: 5min			
setting conditions	Interval time: 55min			
	Operation frequency: 30cpm			
	Average piston speed: 100mm/s (3.9inls)			
Cylinder operating conditions	Mounting: Horizontal no-load			
	Supply pressure: 0.5MPa (72psi)			



Particulate generation measuring circuit

### **Applicable Cylinders**

Air Cylinder	
Series CJ2X	



Bore size	Min. operating	Min. piston	
(mm)	pressure (MPa)	speed (mm/s)	
10, 16	0.06	1	

### Compact Cylinder



Bore size (mm)	Min. operating pressure (MPa)	Min. piston speed (mm/s)				
12, 16	0.03	1				
20, 25	0.025	0.5				

Bore size Min. operating Min. piston pressure (MPa) speed (mm/s)

Free Mount Cylinder

Series CUX

10, 16	0.06	1				
20, 25, 32	0.05	0.5				
Compact Cylinder						

### Series 10-/11-CQSX



 
 Bore size (mm)
 Min. operating pressure (MPa)
 Min. piston speed (mm/s)

 12, 16
 0.04 (0.03)
 1(1)

 20, 25
 0.035 (0.025)
 1(0.5)

 Figures in ( ) are for 11-CQSX.

# Series CQ2X

Compact Cylinder

Bore size	Min. operating	Min. piston
(mm)	pressure (MPa)	speed (mm/s)
32, 40	0.025	0.5

### Air Cylinder Series CM2X



Bore size	Min. operating	Min. piston		
(mm)	pressure (MPa)	speed (mm/s)		
20, 25, 32, 40	0.025			

### 10-CQSXB20-50D





#### Compact Cylinder Series 10-/11-CQ2X



 
 Bore size (mm)
 Min. operating pressure (MPa)
 Min. piston speed (mm/s)

 32, 40
 0.035 (0.025)
 1 (0.5)

 Figures in ( ) are for 11-CQ2X

#### Air Cylinder Series 10-/11-CM2X



Bore size (mm)	Min. operating pressure (MPa)	Min. piston speed (mm/s)				
20, 25, 32, 40	0.035 (0.025)	1 (0.5)				
Figures in () are for 11-CM2X.						





# Series CJ2X

The dimensions are the same as the standard double acting single rod cylinder; refer to the series CJ2 section in "Best Pneumatics No. 2"

### How to Order



### Auto switch specifications

		-	ght			Load vo	Itage	Auto	o switch m	odel	Lead w	/ire le	ength	(m)*			
Туре	Special function	Electrical entry	licator li	Wiring (output)		DC	AC	Band mount	Rail r	nount	0.5	3	5	None	Appl Ic	icable ad	
			12	Quint		1		(ø16)	Perpendicular	In-line	(111)	(L)	(2)	(14)			
				3 wire (NPN)	—	5V		C76	—	A76H	•	•	-	—	IC circuit	—	
<del>ہ</del>		Grommet	Yes		—	—	200V	—	A72	A72H	•	•	-	—			
wit						12V	100V	C73	A73	A73H	•	٠	٠	—			
d s			No			5V, 12V	100V or less	C80	A80	A80H	•	•	-	-	IC circuit	Relay,	
See			Yes	2 wire	24V	12V	—	C73C	A73C	—	•	٠	•	٠	—	PLC	
		Connector	No	1		5V, 12V	24V or less	C80C	A80C	_	•	•	•	•	IC circuit		
	Diagnostic indication (2 color indicator)	Grommet	Yes	1		—	—		A79W		•	•	-	—	—		
	switch	Gror			3 wire (NPN)				H7A1	F7NV	F79	•	•	0	—	10	
			Gromn	Gro		Grommet 3 wire (PNP)	50, 120		H7A2	F7PV	F7P	•	•	0	—		
<del>с</del>						1			H7B	F7BV	J79	•	•	0	_		
ž			Connector		2 wire		12V		H7C	J79C		•	•	•	•	—	
e e			1	3 wire (NPN)	1		1	H7NW	F7NWV	F79W	•	•	0	—			
stai	Diagnostic		V	3 wire (PNP)	1	50, 120		H7PW		F7PW	•	•	0	_	IC circuit	Relay.	
solid	indication (2 color indicator)	Crommet	Yes	2 wire	24V - wire (NPN)	12V		H7BW	F7BWV	J79W	•	•	0	_		PLC	
0,0	With timor	Giommet		3 wire (NPN)						EZNIT		•					
	Diagnostic output	1		5 WIE (NFN)		5V, 12V						•		-	IC circuit		
	(2 color indicator) Latch type	-		4 wire						г/уг	•	•		-			
	diagnostic output (2 color indicator)			(NPN)				H7LF		F7LF	•	٠	0	-			
* Lea	d wire length sy	mbols:	0.5	m Nil (	Exa	mple) C	73C	5m	Z (Ex	(ample)	C73C	Z					
			3m	L		С	73CL	None	N		C730	N					

\* Solid state auto switches with a "O" symbol are produced upon receipt of order.

### 

### Model number for cylinder with built-in magnet

Indicate -A (rail mount type) or -B (band mount type) at the end of the auto switch cylinder designation.

Example	Rail mount type	CDJ2XB10-45-A
схаттріе	Band mount type	CDJ2XB16-60-B

Double acting single rod

Air



JIS symbol





#### Fluid Proof pressure 1.05MPa (152psi) 0.7MPa (101psi) Maximum operating pressure 0.06MPa (8.7psi) Minimum operating pressure Without auto switch: -10 to 70°C (14 to 158°F) Ambient and fluid temperature With auto switch: -10 to 60°C (14 to 140°F) (with no freezing) Cushion Rubber bumper (standard) Lubrication Non-lube Thread tolerance JIS class 2 +1.0 Stroke length tolerance Piston speed 1 to 300mm/s (0.04 to 11.8in/s) ø10 0.035J (0.026ft-lb) Allowable kinetic energy 0.090J (0.066ft·lb) ø16

### Standard Strokes

1

Specifications

Action

Bore size (mm)	Standard strokes (mm)
10	15, 30, 45, 60, 75, 100, 125, 150
16	15, 30, 45, 60, 75, 100, 125, 150, 175, 200

### Mounting and Accessories

	Mounting	Basic type	Axial foot type	Front flange type	Double* clevis type
ard	Mounting nut	•	•	•	_
inda	Rod end nut	•	٠	•	•
Sta	Clevis pin	_	_	_	•
c	Single knuckle joint	•	•	•	•
ptio	Double knuckle joint *	•	•	•	•
0	T (bracket)				٠

\* For double clevis and double knuckle joint types, pins and snap rings are packed together.

### Head Cover Port Position

For the standard type, two head cover port positions are available: Perpendicular to axis and axial direction.



Perpendicular to axis Axial direction

### Auto Switch Mounting Bracket Part Nos. (Band Mount Type)

Mounting Bracket Part Nos.

Mounting	Bore siz	e (mm)
bracket	10	16
Foot bracket	CJ-L010B	CJ-L016B
Flange bracket	CJ-F010B	CJ-F016B
T (bracket)*	CJ-T010B	CJ-T016B

\* T (bracket) is applicable to double clevis type (D).

Bore size Auto switch mounting Note bracket part no.				
		Bore size (mm)	Auto switch mounting bracket part no.	Note

Bore size (mm)	Auto switch mounting bracket part no.	Note
10 BJ2-010		Common for models
16	BJ2-016	D-C7, C8 and D-H7

### **▲** Specific **Product Precautions**

L Be sure to read before handling. Refer to pages 15 through 24 for safety instructions and precautions. I. \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_

Mounting Precautions

### ▲Caution

1. When mounting, hold the rod cover and apply an appropriate tightening force to the mounting nut, or fasten by applying the appropriate tightening force to the rod cover body.

Holding the head cover or tightening the head cover body may cause the cover to rotate and slippage to occur.

2. The correct tightening torque for the mounting threads must be within the range shown in the table below. Apply Loctite (No. 242 Blue) or equivalent to the mounting threads.

Bore size (mm)	Proper mounting thread tightening torque (N·m) ft·lb (mounting nut tightening torque)
10	(3.0 to 3.2) 2.2 to 2.4
16	(5.4 to 5.9) 4.0 to 4.4

3. Use appropriate plyers (C type snap ring mounting tool) for the installation and removal of knuckle pin and clevis pin snap rings.

Especially with ø10, use ultra thin plyers.

4. Do not remove auto switch mounting rails if they have been mounted. Since the mounting screw penetrates into the cylinder, the removal of the rail will cause air leakage.

#### **Operating Precautions**

### ▲Warning

1. With the meter-out function, controlling the speed may not be possible during low speed operation.

### Caution

1. For series CJ2X, maximum internal leakage of 0.1Nr/min (ANR) occurs due to its construction.

**SMC** 2





The dimensions are the same as the standard double acting single rod cylinder; refer to the series CU/CDU section in "Best Pneumatics No. 2"





10, 16	5, 10, 15, 20, 25, 30
20, 25, 32	5, 10, 15, 20, 25, 30, 40, 50

### Auto switch specifications

			-	to		Load voltage		Auto swite	h model	Lead wi	re leng	th (m)*							
	Туре	Special	Electrical	ight	Wiring			, 		0.5 3 5		5	Applicable						
		Turiction	enuy	<u> </u>	(Output)	D	C	AC	Perpendicular	In-line	(Nil)	(L)	(Z)	lo	ad				
	itch			No	2 wire	241/	5V 12V	100V or less	A90V	A90	•	•	—	IC circuit					
	d sw		Grommet		ZWIE	240	12V	100V	A93V	A93	•	•	-	_					
	Ree		Yes 3 wire (NPN equ	3 wire (NPN equiv.)	—	5V	—	A96V	A96	•	•	-	IC circuit						
		Grommet	Grommet Yes			3 wire (NPN)		5V		F9NV	F9N	•	•	0	IC	Polov			
	/itch			3 wire (PNP)							12V		F9PV	F9P	•	•	0	circuit	PLC
	e sv			- Grommet	Yes -		2 wire	2 wire	24\/	12V		F9BV	F9B	•	•	0	—		
	stat	Diagnostic				3 wire (NPN)		5V		F9NWV	F9NW	•	•	0	IC				
Solid	indication (2 color indicator)	indication 3 wire (PNP)	12V		F9PWV	F9PW	•	•	0	circuit									
	.,	(			2 wire		12V		F9BWV	F9BW	•	•	0	_					
	* Lead wire length symbols: 0.5m Nil (Example) A93																		



3m ..... L (Example) A93L 5m ..... Z (Example) F9NWZ

\* Solid state auto switches with a "O" symbol are produced upon receipt of order.

D-9 type auto switches can also be mounted.



### Specifications

Fluid	Air
Proof pressure	1.05MPa (152psi)
Maximum operating pressure	0.7MPa (72psi)
Ambient and fluid temperature (with no freezing)	Without auto switch: -10 to 70°C (14 to 158°F) With auto switch: -10 to 60°C (14 to 140°F)
Lubrication	Non-lube
Piston speed	ø10, ø16: 1 to 300mm/s (0.04 to 11.8in/s) ø20 to ø32: 0.5 to 300mm/s (0.02 to 11.8in/s)
Cushion	Double side rubber bumper
Rod end threads	Male threads
Thread tolerance	JIS class 2
Stroke length tolerance	+1.0 0
Mounting	Basic type

### **Minimum Operating Pressure**

					MPa (psi)
Bore size (mm)	ø <b>10</b>	ø <b>16</b>	ø <b>20</b>	ø <b>25</b>	ø <b>32</b>
Min. operating pressure	0.06 (8.7)	0.06 (8.7)	0.05 (7.3)	0.05 (7.3)	0.05 (7.3)

### **Standard Strokes**

Bore size (mm)	Standard stroke (mm)
10, 16	5, 10, 15, 20, 25, 30
20, 25, 32	5, 10, 15, 20, 25, 30, 40, 50

### Specific Product Precautions

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I Be sure to read before handling.

Refer to pages 15 to 24 for safety instructions and precautions.

Maintenance

\_ \_ \_ \_ \_

### ▲Caution

1. Fastening the cylinder with a force exceeding the indicated torque (shown in the table below) may affect operation. Apply Loctite (No. 242 Blue) or equivalent to the mounting threads.

Mounting

Bore size (mm)	Hexagon socket head cap screw size (mm)	Proper tightening torque (N·m) (cylinder body)
10	M3	0.54±10%
16	M4	1.23±10%
20, 25	M5	2.55±10%
32	M6	4.02±10%

### Operation

2. Grease pack When grease only is required for maintenance, order using the following part numbers. Grease pack GR-L-005 (5g) GR-L-010 (10g) GR-L-150 (150g)

### JIS symbol

Double acting/Single rod





### 

1. With CUX10, maximum internal leakage of 0.1NI/min (ANR) occurs due to its construction.

**∆**Caution

\_ \_ \_ \_

25

32

size

1. Replacement parts/Seal kits To order the kits, use the order numbers for each bore size.

Bore size (mm)	Order no.	Kit contents
16	CUX16-PS	Piston seal 1 pc.
20	CUX20-PS	Rod seal 1 pc.

CUX25-PS Gasket 1 pc. CUX32-PS Grease pack (10g) 1 pc.

\* Seals cannot be replaced for 10mm bore





The dimensions are the same as the standard double acting single rod cylinder; refer to the series CQS/CDQS section in "Best Pneumatics No. 2"

How to Order



### Auto switch specifications

		-	Ħ							Loodwir	o longt	h (m)*		
	Special	Electrical Wiring Load voltage		Wiring	Load voltage		Auto switch model				II (III)	Applicable		
Туре	function	entry	Indicato	(output)	DC AC		Perpendicular	In-line	0.5 (Nil)	3 (L)	5 (Z)	lo lo	ad	
vitch			No	2 wire	24V		100V or less	A90V	A90	•	•	_	IC circuit	
l sv	—	Grommet				12V	100V	A93V	A93	•	•	—	—	]
Reec			Yes	3 wire (NPN equiv.)	_	5V	_	A96V	A96	•	•	_	IC circuit	
				3 wire (NPN)		5V		F9NV F9N	F9N	•	•	0	IC	
witch	_			3 wire (PNP)		12V		F9PV	F9P	•	•	0	circuit	PLC
esi		Grommet	Yes	2 wire	241/	12V	]	F9BV	F9B	•	٠	0	—	
lid stat	Diagnostic	Diagnostic	Gioniniet	3 wire (NPN)	241	5V		F9NWV	F9NW	•	•	0	IC	
Š	indication (2 color indicator)			3 wire (PNP)		12V		F9PWV	F9PW	•	•	0	circuit	
				2 wire		12V		F9BWV	F9BW	•	•	0	—	

\* Lead wire length symbols: 0.5m ...... Nil (Example) A93

3m .....L (Example) A93L

5m .....Z (Example) F9NWZ

\* Solid state auto switches with a "O" symbol are produced upon receipt of order.

tured in 1mm increments by installing spacers in a standard stroke cylinder. The cylinder length is the same as the longer standard cylinder. Example) For CQSXB25-47D, a 3mm

Manufacturing intermediate strokes

Intermediate strokes can be manufac-

5, 10, 15, 20, 25, 30, 35, 40, 45, 50

20

25

width spacer is installed in a standard stroke CQSXB25-50D cylinder.

#### Mounting bracket part numbers

Bore size (mm)	Foot type Note 1)	Flange type	Double clevis type			
12	CQS-L012	CQS-F012	CQS-D012			
16	CQS-L016	CQS-F016	CQS-D016			
20	CQS-L020	CQS-F020	CQS-D020			
25	CQS-L025	CQS-F025	CQS-D025			

Note 1) When ordering the foot bracket, order 2 pieces per cylinder. Note 2) Accessories for each bracket are as follows.

Foot/Flange types: Body mounting screws

Double clevis type: Clevis pins, C type snap ring for shaft, and body mounting screws





### Specifications

Туре	Pneumatic (non-lube) type				
Action	Double acting single rod				
Fluid	Air				
Proof pressure	1.5MPa (217psi)				
Maximum operating pressure	1.0MPa (145psi)				
Ambient and fluid temperature (with no freezing)	Without auto switch: -10 to 70°C (14 to 158°F) With auto switch: -10 to 60°C (14 to 140°F)				
Rubber bumper	None				
Rod end threads	Female threads				
Rod end thread tolerance	JIS class 2				
Stroke length tolerance	Standard stroke: <sup>+1.0</sup>				
Mounting	Through hole/Double end tapped common				
Piston speed	Ø12, Ø16: 1 to 300mm/s (0.04 to 11.8inls) Ø20, Ø25: 0.5 to 300mm/s (0.02 to 11.8inls)				

### Minimum Strokes for Auto Switch Mounting

					mm (in)			
Number of auto switches	D-A9□, D-F9□WV	D-A9⊡V	D-F9N	D-F9₿, D-F9⊡W	D-F9⊡V			
2 pcs.	10 (0.4)	10 (0.4)	15 (0.6) Note)	20 (0.80) Note)	5 (0.2)			
1 pc.	10 (0.4) Note)	5 (0.2)	15 (0.6) Note)	20 (0.80) Note)	5 (0.2)			

Note) Consult SMC when operating with a stroke below those shown above.

### **Minimum Operating Pressure**

				MPa (psi)
Bore size (mm)	12	16	20	25
Min. operating pressure	0.03 (4.3)	0.03 (4.3)	0.025 (3.6)	0.025 (3.6)

### **Body Options**

Description	Application			
Rod end male threads	Applicable to all standard			
Rubber bumper	double acting single rod types.			

### ▲ Specific Product Precautions

#### Be sure to read before handling.

Refer to pages 15 to 24 for safety instructions and precautions.

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### Snap Ring Installation and Removal

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- 1. Use the correct plyers (C type snap ring mounting tool) for installation and removal.
- 2. Be careful even when using the correct plyers (C type snap ring mounting tool). The snap ring may slip off the end of the plyers (C type snap ring mounting tool) and spring out, causing bodily injury or damage to nearby equipment. Furthermore, make sure the snap ring is securely seated in its mounting groove at the time of installation, before supplying air.

### Maintenance

### 

1. Replacement parts/Seal kits To order the kits, use the order numbers for each bore size.

Bore size (mm)	Order no.	Kit contents			
12	CQSX12-PS	Piston seal 1 pc.			
16	CQSX16-PS	Rod seal 1 pc.			
20		Tube dasket 1 nc			

 20
 CQSX20-PS
 Tube gasket 1 pc.

 25
 CQSX25-PS
 Grease pack (10g) 1 pc.

 2. Grease packs
 Grease pack (10g) 1 pc.

When grease only is required for maintenance, order using the following part numbers. Grease pack GR-L-005 (5g)

GR-L-005 (5g) GR-L-010 (10g) GR-L-150 (150g)



### JIS symbol

Double acting/Single rod







The dimensions are the same as the standard double acting single rod cylinder; refer to the series C02/CD02 section in "Best Pneumatics No. 2"





#### Auto switch specifications

			light		L	oad vol	tage	Rail n	nount	Direct	mount	Lead w	/ire le	ngth	(m)*													
Туре	Special	Electrical	ntry 8 (output)					ø <b>32</b> ,	ø <b>40</b>	ø <b>32</b> , ø <b>40</b>		0.5	3	5	None	Appl	icable											
	TUTICUOT	01111	Indi	(output)			AC	Perpendicular	In-line	Perpendicular	In-line	(Nil)	(L)	(Z)	(N)	IU	au											
				3 wire (NPN equiv.)	—	5V	—	-	A76H	A96V	A96	•	•	-	-	IC circuit	—											
		Grommet	Yes			—	200V	A72	A72H	—		•	•	—	-													
litcl		C.C.				101/	1001/	A73	A73H	—		•	•	٠	-	—												
SV						120	1000	—		A93V	A93	•	•	—	-		Polov											
ed			No	2 wire	241/	5V, 12V	100V or less	A80	A80H	A90V	A90	•	•	—	-	IC circuit	PLC											
۳ ۳		Connector	Yes		240	12V		A73C				•	•	٠	•	—												
	Dispessetia indication	No	No	-		5V, 12V	24V or less	A80C				•	•	٠	•	IC circuit												
	(2 color indicator)	Grommet	Yes					A79W				•	•	—	-	—												
				3 wire (NPN)		5V, 12V F7P F9NV F7PV F7P F9PV	F9NV	F9N	•	•	0	-	10															
		Grommet		3 wire (PNP)			F9PV	F9P	•	•	0	_	circuit															
tch				2 wire		12V		F7BV	J79	F9BV	F9B	•	•	0	-													
SVI		Connector	1					J79C		—		•	•	•	•													
state	Diagnostic		Yes	3 wire (NPN)	24V	EV. 40V		F7NWV	F79W	F9NWV	F9NW	•	•	0	-	2	Relay, PLC											
Solid	indication (2 color indicator)														3 wire (PNP)		5V, 12V			F7PW	F9PWV	F9PW	•	•	0	_	circuit	
		Grommet		2 wire		12V		F7BWV	J79W	F9BWV	F9BW	•	•	0	-													
	With timer			3 wire (NPN)		51/ 121/			F7NT	—		-	•	0	-	IC												
	Diagnostic indication (2 color indicator)			4 wire		50, 120			F79F			•	•	0	-	circuit												
	Latch type with diagnostic output (2 color indicator)			(NPN)		_		—	F7LF	—	_	•	•	0	_													

\* Lead wire length symbols: 0.5m ...... Nil (Example) A80C

5m ..... Z (Example) A80CZ

3m ......L (Example) A80CL None ... N (Example) A80CN

\* Solid state auto switches with a "O" symbol are produced upon receipt of order.

Mounting bracket part number

Bore size (mm)	Foot type	Flange type	Double clevis type		
32	CQ-L032	CQ-F032	CQ-D032		
40	CQ-L040	CQ-F040	CQ-D040		

Note 1) When ordering the foot bracket, order 2 pieces per cylinder.

Note 2) Accessories for each bracket are as follows. Foot/Flange types: Body mounting

screws Double clevis type: Clevis pins, C type snap ring for shaft, and body

mounting screws

Note 3) For the double clevis type, clevis pins and snap ring are packed together.





JIS symbol

Double acting: Single rod



### Specifications

Bore size (mr	m)	32	40			
Туре		Pneumatic (non-lube) type				
Fluid		A	Nir			
Proof pressu	ure	1.5MPa (217psi)				
Maximum op	erating pressure	1.0MPa (145psi)				
Ambient and fluid temperature (with no freezing)		Without auto switch: –10 to 70°C (14 to 158°F) With auto switch: –10 to 60°C (14 to 140°F)				
Piping	Threaded type	Ided type M5 x 0.8 <sup>Note 1)</sup> , Rc 1/8 Rc 1/8				
Rubber bum	iper	No				
Rod end thre	eads	Female thread				
Rod end three	ead tolerance	JIS class 2				
Stroke lengt	h tolerance	+1.0				
Mounting		Through hole				
Piston speed	d	0.5 to 300mm/s (0.02 to 11.8in/s)				

Note 1) In the case of a cylinder without auto switch, M5 x 0.8 applies to the 5mm stroke only.

### **Minimum Operating Pressure**

Bore size (mm)	32	40
Min. operating pressure (MPa) psi	(0.025) 3.6	(0.025) 3.6

### Standard Strokes

Bore size (mm)	Standard stroke (mm)				
32, 40	5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 75, 100				

Manufacturing intermediate strokes

Intermediate strokes can be manufactured in 1mm increments by installing spacers in a standard stroke cylinder. However, consult SMC regarding size ø40 equipped with bumper.

Example) For CQ2XB40-57D, a 18mm width spacer is installed in a standard stroke CQ2XB40-75D cylinder.

### ▲ Specific Product Precautions

Be sure to read before handling.

Refer to pages 15 to 24 for safety instructions and precautions.

Refer to pages 15 to 24 for safety instructions and precautions

Snap Ring Installation and Removal

### **∆**Caution

н

- 1. Use the correct plyers (C type snap ring mounting tool) for installation and removal.
- 2. Be careful even when using the correct plyers (C type snap ring mounting tool). The snap ring may slip off the end of the plyers (C type snap ring mounting tool) and spring out, causing bodily injury or damage to nearby equipment. Furthermore, make sure the snap ring is securely seated in its mounting groove at the time of installation, before supplying air.

#### Maintenance

### 

 Replacement parts/Seal kits To order the kits, use the order numbers for each bore size.

Bore size (mm)	Order no.	Kit contents		
32	CQ2X32-PS	Piston seal		pc. pc.
40	CQ2X40-PS	Gasket Grease pack (10g)		pc. pc.

2. Grease packs

When grease only is required for maintenance, order using the following part numbers. Grease pack GR-L-005 (5g)

GR-L-010 (10g) GR-L-150 (150g)







The dimensions are the same as the standard double acting single rod cylinder; refer to the series CM2 section in "Best Pneumatics No. 2"



 Nil
 Without auto switch (built-in magnet)

 \* Select an applicable auto switch model number from the table below.

#### Auto switch specifications

			light	10/1-1-1-1-1		Load v	oltage		Lead v	vire le	ength	(m)*			
Туре	Special function	Electrical entry	Indicator	(output)		DC	AC	Auto switch model	0.5 (Nil)	3 (L)	5 (Z)	None (N)	Appl Ic	Applicable load	
			Yes	3 wire (NPN equiv.)	—	5V	_	C76	•	•	-	—	IC circuit		
			103			12V	100V	C73	•	٠	٠	—	—	Relay,	
		Grommet	No			5V, 12V	100V or less	C80	•	٠	—	—	IC circuit	PLC	
ي ا			Yes			12V	—	B53	•	•	•	—		PLC	
j;			103	-		12V	100V, 200V	B54	•	•	•	—			
S	Connect Termina condui		No	2 wire	2411	12V	200V or less	B64	•	•	—	—		Relay,	
) Sec		Connector	Yes	2 wire	240	12V		C73C	•	•	•	•		PLC	
<b>~</b>			No	-		5V, 12V	24V or less	C80C	•	•	•	•	IC circuit		
		Terminal		Yes	12V 12V	12V	—	A33A	-	-	-	•		PLC	
		conduit	Yes			100V. 200V	A34A	_	-	-	•		Relay		
	Diagnostic indication	DIN terminal						,	A44A	-	-	_	•		PLC
	(2 color indicator)	Grommet		O uning (NIDNI)				B59W	•	•	-	-			
		Grommet	3 wire (NPN)	5V, 12V		H/A1	•	•	0	-	IC circuit				
				2 wire				•	•	0	-				
ج ا	—	<u> </u>	-		12V				•		-				
, tto		Connector		2 wire (NDNI)		51/ 401/			•	•	•	•	10		
S		Terminal		S WIE (INFIN)		50,120		G39A	-	-	-	•	IC CITCUIT		
ate		Conduit	Yes	2 wire (NPN)	241/	120			-			•		Relay,	
st	Diagnostic indication		103	3 wire (NI N)	240	5V, 12V						_	IC circuit	PLC	
ie	(2 color indicator)			2 wiro		12\/		H7BW				_			
Ň	With timer	Grommet		3 wire (NPN)		121		G5NT			$\left  \begin{array}{c} 0 \\ 0 \end{array} \right $				
	Diagnostic output					5V, 12V		H7NF		-	0		IC circuit		
	(∠ color indicator) Latch type with diagnostic output			4 wire											
	(2 color indicator)			(INFIN)				H/LF	•	•	0	—			

\* Lead wire length symbols: 0.5m ..... Nil

3m ..... L 5m ..... Z

None ..... N

(Example) C80CZ, C80CN \* Solid state auto switches with a "O" symbol are produced

upon receipt of order. \* Do not designate "None" (N) for lead wire length with auto

switch types D-A3□A, A44A, G39A and K39A.





JIS symbol Double acting: Single rod

### Standard Strokes

Bore size (mm)	Standard stroke (mm) Note 1)
20	
25	25, 50, 75, 100, 125, 150
32	200, 250, 300
40	

Note 1) Intermediate strokes other than the above are produced upon receipt of order.



- Be sure to read before handling.
- Refer to pages 15 to 24 for safety
- instructions and precautions.
- -----

#### **Operating Precautions**

#### **∆**Warning

 Do not rotate the cover.
 Rotating the cover when mounting the cylinder or screwing pipe fittings into the ports may cause

damage from the cover joint section.

### 

 Be careful of the snap ring springing out.
 When replacing the rod seal, be careful of the snap ring springing out while removing it.

Ma	inte	ena	nce
inia		-110	100

### **∆**Caution

1. Replacement parts/Seal kits

To order the kits, use the order numbers for each bore size.

Bore size (mm)	Order no.	Kit contents
20	CM2X20-PS	
25	CM2X25-PS	Rod seal 1 pc.
32	CM2X32-PS	Grease pack (10g) 1 pc
40	CM2X40-PS	ereace pack (reg) 1 pc.

2. Grease packs

When grease only is required for maintenance, order using the following part numbers. Grease pack GR-L-005 (5g)

- GR-L-010 (10g)
- GR-L-150 (150g)

### Specifications

Bore size (mm)		20, 25, 32, 40		
Туре		Pneumatic type		
Action		Double acting single rod		
Fluid		Air		
Proof pressure		1.5MPa (217psi)		
Maximum operating pressure		1.0MPa (145psi)		
Minimum operating pressure		0.025MPa (3.6psi)		
Ambient and fluid temper (with no freezing)	ature	Without auto switch: –10 to 70°C (14 to 158°F) With auto switch: –10 to 60°C (14 to 140°F)		
Cushion		Rubber bumper		
Piping	Threaded type	ø20 to ø32: Rc 1/8, ø40: Rc 1/4		
Lubrication		Non-lube		
Thread tolerance		JIS class 2		
Stroke length tolerance		+1.4		

### **Piston Speed**

Bore size (mm)	20	25	32	40		
Piston speed (mm/s)	0.5 to 300 (0.02 to 11.8in/s)					
Allowable kinetic energy J (ft·lb)	0.27 (0.20)	0.4 (0.30)	0.65 (0.48)	1.2 (0.89)		

### **Mounting Bracket Part Numbers**

Bore size (mm)	20	25	32	40	
Axial foot *	CM-L020B	CM-L	.032B	CM-L040B	• M/hon ordering fact
Flange	CM-F020B	CM-F	032B	CM-F040B	<ul> <li>when ordering root</li> <li>brackets, order 2 pieces</li> </ul>
Single clevis	CM-C020B	CM-C	032B	CM-C040B	cylinder.
Double clevis (with pins)**	CM-D020B	CM-D	0032B	CM-D040B	(cotter pins for ø40) are
Trunnion (with nuts)	CM-T020B	CM-T	7032B	CM-T040B	packed together.

### Auto Switch Mounting Bracket Part Numbers

		Bore size (mm)					
Auto switch model	20	25	32	40			
D-C7/C8, D-H7	BM2-020	BM2-025	BM2-032	BM2-040			
D-B5/B6, D-G5	BA2-020	BA2-025	BA2-032	BA2-040			
D-A3□A/A44A, D-G39A/K39A	BM3-020	BM3-025	BM3-032	BM3-040			

#### Mounting Type and Accessories

Accessory		Standard		Optional			
Mounting type	Mounting nut	Rod end nut	Clevis pin	Single knuckle joint	Double knuckle joint	Clevis bracket	
Basic type	• (1 pc.)	•	—	•	•	-	
Axial foot type	• (2)	•	_	•	•	_	
Front flange type	• (1)	•	_	•	•	_	
Rear flange type	• (1)	•	_	•	•	_	
Integral clevis type	Note 1)	•	_	•	•	•	
Single clevis type	Note 1)	•	_	•	•	_	
Double clevis type Note 3)	Note 1)	•	•	•	•	_	
Front trunnion type	• (1) Note 2)	•	_	•	•	_	
Rear trunnion type	• (1) Note 2)	•	_	•	•	_	
Boss-cut basic type	• (1)	•	_	•	•	_	
Boss-cut flange type	• (1)	•	_	•	•	_	
Boss-cut trunnion type	• (1)	•	_	•	•	_	
Note					With pins	With pins	

Note 1) Mounting nuts are not included with the integral clevis, single clevis and double clevis types. Note 2) Trunnion nuts are included with the front trunnion and rear trunnion types. Note 3) Pins and snap rings (cotter pins for ø40) are packed together with the double clevis and double

Note 3) Pins and snap rings (cotter pins for ø40) are packed together with the double clevis and double knuckle joint.



### Microspeed Cylinder for Clean Room Series 10-, 11-

The double seal construction of the actuator rod section and exhaust through relief ports directly to the outside of a clean room allow operation of this cylinder type in a class 100 clean room. The dimensions and applicable auto switches are identical to the standard clean room series.



Bore	size		TU- (Relieving type)					
(mi	m)	12	16	20	25			
Fluid			A	dr				
Proof pressure			1.5MPa	(217psi)				
Maximum oper	ating pressure		1.0MPa	(145psi)				
Minimum opera	ating pressure	0.04MPa	a (5.8psi)	0.035MP	a (5.1psi)			
Ameliant and flu		Without	t auto switch: -1	0 to 70°C (14 to	o 158°F)			
Amplent and flu	id temperature	With a	auto switch: -10	to 60°C (14 to	140°F)			
Piston speed			1 to 200mm/s	(0.04 to 7.9in/s)				
Piston rod dian	neter	ø6	ø8	ø10	ø12			
Red and threads	Female threads	M3 x 0.5	M4 x 0.7	M5 x 0.8	M6 x 1.0			
Rou enu tireaus	Male threads	M5 x 0.8	M6 x 1.0	M8 x 1.25	M10 x 1.25			
Rod end thread	l tolerance	JIS class 2						
Stroke tolerand	e	+1.0 mm						
Port size		M5 x 0.8 (10-32 nominal)						
Vacuum port, r	elief port	M5 x 0.8 (10-32 nominal)						
			44 0/					
Bore	SIZE		II- (vac	um type)				
(mr	n)	12	16	20	25			
Fluid		Air						
Proof pressure			1.5MPa	(217psi)				
Maximum oper	ating pressure		1.0MPa	(145psi)				
Minimum opera	ating pressure	0.03MP	a (43psi)	0.025MP	a (3.6psi)			
Ambient and flu	id temperature	Without auto switch: -10 to 70°C (14 to 158°F)						
Amplent and hu	ia temperature	With auto switch: -10 to 60°C (14 to 140°F)						
Piston speed		1 to 200mm/s (	0.04 to 7.9 in/s)	0.5 to 200mm/s	(0.02 to 7.9 in/s)			
Piston rod dian	neter	ø6	ø8	ø10	ø12			
Pod and throads	Female threads	M3 x 0.5	M4 x 0.7	M5 x 0.8	M6 x 1.0			
Rou enu tilleaus	Male threads	M5 x 0.8	M6 x 1.0	M8 x 1.25	M10 x 1.25			
Rod end thread	I tolerance	JIS class 2						

+1.0 mm M5 x 0.8 (10-32 nominal)

M5 x 0.8 (10-32 nominal)

Bore	size	10- (Relie	ving type)	11- (Vacuum type)			
(mr	n)	32	40	32	40		
Fluid			A	dr			
Proof pressure			1.5MPa	(217psi)			
Maximum opera	ating pressure		1.0MPa	(145psi)			
Minimum opera	ating pressure	0.035MP	a (5.1psi)	0.025MP	a (3.6psi)		
		Without auto switch: -10 to 70°C (14 to 158°F)					
Amplent and hu	iu temperature	With auto switch: -10 to 60°C (14 to 140°F)					
Piston speed		1 to 200mm/s (0.04 to 7.9in/s) 0.5 to 200mm/s (0.02 to 7.9in/s)					
Piston rod dian	neter	ø16					
Ded and threads	Female threads	M8 x 1.25					
Rod end threads	Male threads	M14 x 1.5					
Rod end thread	tolerance	JIS class 2					
Stroke tolerand	e	Standard stroke: <sup>+1.0</sup> mm					
Port size		M5 x 0.8 (10-32 nominal), Rc 1/8					
Vacuum port, r	elief port	M5 x 0.8 (10-32 nominal)					

Stroke tolerance

Port size Vacuum port, relief port



#### Specifications

Bore size	10- (Relieving type)				11- (Vacuum type)				
(mm)	20	25	32	40	20	25	32	40	
Fluid				A	dr				
Proof pressure				1.5MPa	(217psi)				
Maximum operating pressure				1.0MPa	(145psi)				
Minimum operating pressure		0.035MP	a (5.1psi)			0.025MP	a (3.6psi)		
Ambient and fluid temperature			Withou	t auto switch: -1	0 to 70°C (14 to	o 158°F)			
Ambient and huid temperature	With auto switch: $-10$ to $60^{\circ}$ C (14 to $140^{\circ}$ F)								
Cushion				Rubber	bumper				
Piston speed		1 to 200mm/s (	(0.04 to 7.9in/s)		(	).5 to 200mm/s	5 to 200mm/s (0.02 to 7.9in/s)		
Piston rod diameter	ø8	ø10	ø12	ø14	ø8	ø10	ø12	ø14	
Rod end threads	M8 x 1.25	M10 :	x 1.25	M14 x 1.5	M8 x 1.25	M10 >	(1.25	M14 x 1.5	
Rod end thread tolerance		JIS class 2							
Stroke tolerance		+1.4 0 mm							
Port size	Rc 1/8 Rc 1/4 Rc 1/8 R					Rc 1/4			
Vacuum port, relief port				M5 x 0.8 (10	-32 nominal)				

### ▲ Specific Product Precautions

Be sure to read before handling.

Refer to pages 15 to 24 for safety instructions and precautions. 

### Operation

#### **∆**Warning

1. Do not rotate the cover. • Rotating the cover when mounting the cylinder or screwing pipe fittings into the ports may cause damage from the cover joint section

#### **∆**Caution

 Be careful of the snap ring springing out.
 When replacing the rod seal, be careful of the snap ring springing out while removing it.

### Maintenance

### **∆**Caution

1. Grease packs Order grease for maintenance using the order numbers below. Grease pack GR-X-005 (5a)



### **Microspeed Cylinder**

Symbol

-XB13

Related Products/Order Made Specifications 5 to 500mm/s (CY1: 7 to 50mm/s)

### Order Made

### **Microspeed Cylinder**



**Specifications** 

Applicable cylinder	Air cyl	inder/S	Standar	d type	Free mount cylinder	Compact cylinder	Ultra compact cylinder	Magnetically coupled rodless cylinder	Compact guide cylinder	Guide cylinder <slide bearing=""></slide>	Sli ui	de nit	Dual rod cylinder	Compact slider	Platform cylinder
Series	CJ2	CM2	CG1	MB	CU	CQ2	CQS	CY1	$MGP^{M}_{L}$	MGGM MGCM	CX2	CXW <sup>M</sup> ∟	CXS <sup>M</sup> ∟	MXU	CXTL
Action	Double acting/single rod					Double acting									
Bore size (mm)	6, 10 16	20, 25 32, 45	20, 25 32, 40 50, 63	32, 40 50, 63 80, 100	6, 10 16, 20 25, 32	12, 16, 20 25, 32, 40 50, 63, 80 100	12, 16 20, 25	CY1B: 6 10, 15, 20 25, 32 40, 50, 63 CY1S, CY1L: 6 to 40	12, 16, 20 25, 32, 40 50, 63, 80 100	20, 25, 32 40, 50	10, 15 25	10, 16 20 25, 32	6, 10 15, 20 25, 32	6, 10 16	12, 16 20, 25 32, 40
Piston speed	5 to 50mm/s							7 to 50 mm/s	5 to 50 mm/s	5 to 50mm/s					
Cushion	Rubl	oer bun	nper	Double-side air cushion	Double-side rubber bumper	No rubber bumper	No rubber bumper	Doubl rubber	le-side bumper	Rubber bumper (basic cylinder section)	Sh abso (optional	ock orber for CX2)		Rubber bumper	
Auto switch								Cap	able						
Mounting	Basic type Foot type Flange type Double clevis type	Basic Foot Flange Trunnic Clevis	type type type on type s type	Basic type Foot type Flange type Clevis type Trunnion type	Basic type	Basic type Foot type Flange type Double clevis type	Basic type Foot type Flange type Double clevis type	Basic type Slider type	Basic type	Basic type Front mount flange type		В	asic typ	e	
Dimensions Other specifications	The dimensions and specifications are identical to the standard double acting type; refer to the general catalog ons "Best Pneumatics No. 2".														

\* Shock absorbers are not available with series MGGM.

### **Related Products**

The effective area of controlled flow is approximately 1/10 of the standard type. Suitable for controlling the speed of microspeed cylinders. The dual type speed controller is especially suitable for cylinders with a small bore size.

### Elbow/Universal Type



### Flow rate and effective area

Model		AS12□1FM-M5	AS22⊡1	AS22□1FM-□02			
		AS13□1FM-M5	AS23⊡1	AS23□1FM-□02			
Tubing	Metric sizes	ø3.2, ø4, ø6	ø3.2, ø4	ø6, ø8	ø4	ø6	ø8, ø10
O.D.	Inch sizes	ø1/8", ø5/32", ø3/16" ø1/4"	ø1/8", ø5/32"	ø3/16", ø1/4" ø5/16"	ø5/32"	ø3/16"	ø1/4", ø5/16" ø3/8"
Controlled	Flow rate (CFM)	7 (0.25)	12 (0.42)		38 (1.33)		
flow	Effective area mm <sup>2</sup> (cv)	0.1 (0.006)	0.2 (	0.01)	0.6 (0.0		03)
Free flow	Flow rate (CFM)	100 (3.5)	180 (6.7)	230 (8.1)	260 (9.1)	390 (13.7)	460 (16.1)
	Effective area mm <sup>2</sup> (cv)	1.5 (0.08)	2.7 (0.15)	3.5 (0.19)	4 (0.22)	6 (0.33)	7 (0.39)

Note) Flow rates are the values measured with pressure at 0.5MPa (72psi) and temperature at 20°C (68°F).

### **In-line Type**



### Elbow Type (Metal Body)



**Dual Type** 



### Flow rate and effective area

	Model	AS1001FM	AS20	01FM	AS20	51FM
Tubing	Metric sizes	ø3.2, ø4, ø6	ø4	ø6	ø6	ø8
O.D.	Inch sizes	ø1/8", ø5/32", ø3/16" ø1/4"	ø5/32"	ø3/16", ø1/4"	ø3/16"	ø1/4", ø5/16"
Controlled	ontrolled Flow rate (CFM) 7 (0.25)		12 (0.42)		38 (1.33)	
flow	Effective area mm <sup>2</sup> (cv)	0.1 (0.006)	0.2 (0.01)		0.6 (0.03)	
Free flow	Flow rate (CFM)	100 (3.5)	130 (4.6)	230 (8.1)	290 (10.2)	460 (16.1)
Tiee now	Effective area mm <sup>2</sup> (cv)	1.5 (0.08)	2 (0.11)	3.5 (0.19)	4.5 (0.25)	7 (0.39)

Note) Flow rates are the values measured with pressure at 0.5MPa (72psi) and temperature at 20°C (68°F).

### Flow rate and effective area

Model		AS12⊡0M		AS22□0M-□01		AS2200M-02		
Dort oine		Cylinder side	MEVOR	10-32UNF	R 1/8	NPT1/8	R 1/4	NPT1/4
Port size		Tubing side	1015 X 0.0		Rc 1/8		Rc 1/4	
Controlled	Flov	rate (CFM)	7 (0.25)		12 (0.42)		38 (1.33)	
flow	Effec	tive area mm <sup>2</sup> (cv)	0.1 (0.006)		0.2 (0.01)		0.6 (0.03)	
Erec flow	Flov	v rate (CFM)	105 (3.7)		280 (9.8)		420 (14.7)	
Free now	Effec	tive area mm <sup>2</sup> (cv)	1.6 (0.09)		4.3 (0.24)		6.5 (0.36)	

Note 1) Flow rates are the values measured with pressure at 0.5MPa (72psi) and temperature at 20°C (68°F).

### Flow rate and effective area

	Model	ASD230FM-M5 ASD330FM-D0		ASD430FM-D02			
	Metric sizes	ø4, ø6	ø6, ø8	ø6	ø8, ø10		
Tubing O.D.	Inch sizes	ø1/8", ø5/32" ø3/16", ø1/4"	ø3/16", ø1/4"	-	ø1/4", ø5/16" ø3/8"		
Controlled	Flow rate (CFM)	7 (0.25)	12 (0.42)		38 (1.33)		
now	Effective area mm <sup>2</sup> (cv)	0.1 (0.006)	0.2 (0.01)		0.6 (0.03)		
Free flow	Flow rate (CFM)	75 (2.6)	175 (6.1)	295 (10.3)	350 (12.3)		
	Effective area mm <sup>2</sup> (cv)	1.1 (0.06)	2.7 (0.15)	4.5 (0.25)	5.3 (5.3)		

Note 1) Flow rates are the values measured with pressure at 0.5MPa (72psi) and temperature at 20°C (68°F).



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.



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



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.

- 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.

### Actuator Precautions 1 Be sure to read before handling

### Precautions on Design

### A 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. Install a protective cover when there is a 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 mounting parts and connecting parts so that they will not become loose.

 $\rightarrow$ Refer to the "Specific Product Precautions" section for each model.

4. A deceleration circuit or shock absorber, etc., 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.

Consider a possible drop in operating 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/or 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 air pressure, 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, a power outage or a manual emergency stop.

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.

10. When transferring work pieces that may fall and be damaged due to vibration, install a guide to prevent this from happening.

### ▲ Caution

1. Design a construction which will not apply lateral load to the cylinder.

Malfunction may occur when a lateral load is applied to the cylinder.

2. Design a construction which will not apply vibration to the cylinder.

Malfunction may occur due to the vibration.

3. Avoid using a guide, etc., that exhibits variations in operating resistance.

Operation may become unstable when using a guide, etc., that exhibits variations in operating resistance, or when the external load varies.

4. Avoid a construction in which the mounting orientation changes.

Operation may become unstable if the mounting orientation changes.

 Avoid operating where the temperature fluctuates greatly.
 Furthermore, when using at low temperatures, make sure that frost does not form inside of the cylinder and on the piston rod.

Operation may become unstable. 6. Do not operate at a high frequency.

- As a rule, operate at a rate of 30 c.p.m. or less.
- 7. Adjust the speed in the operating environment.
  - Selection

### A Warning

### 1. Confirm the specifications.

The products advertised in this catalog are designed according to use in industrial compressed air systems. If the products are used in conditions where pressure, temperature, etc., 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 minute as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders, etc., 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.

Actuator Precautions 2 Be sure to read before handling

### Selection

### ▲ Caution

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

The piston rod will be damaged if operated beyond the maximum stroke. Refer to the air cylinder model selection procedure for the maximum useable stroke.

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

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 model selection procedure 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 intermediate supports for long stroke cylinders.

Provide intermediate supports for cylinders with long strokes to prevent rod damage due to sagging of the rod, deflection of the tube, vibration and external loads, etc.

### **Pneumatic Circuits**

### **▲** Caution

1. Make the piping connecting the speed controller and cylinder port as short as possible.

Speed adjustment may become unstable with a longer distance between the speed controller and cylinder.

2. Use a low speed type speed controller, which facilitates speed adjustment for low speed operation, or a dual speed controller (series ASD), which prevents cylinder lurching.

(When using a low speed type speed controller the maximum speed may be restricted.)

Refer to the recommended circuits on page 18.

#### Mounting

### ▲ Caution

- 1. Do not apply a lateral load to the piston rod. Malfunction may occur when a lateral load is applied to the piston rod.
- Be certain to align the rod shaft center with the load and direction of movement when connecting.

When not properly aligned the rod and tube may be twisted, and damage may be caused due to wear on areas such as the inner tube surface, bushing, rod surface and seals.

- 3. When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.
- 4. Do not scratch or gouge the sliding parts of the cylinder tube or piston rod, etc., 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, etc., in the piston rod may lead to damaged seals and cause air leakage.

### 5. Prevent the seizure of rotating parts.

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

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

Verify correct mounting by suitable function and leakage inspections after compressed air and power are connected following mounting, maintenance or conversions.

#### 7. 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 pipe 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 pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



### Microspeed Cylinder

Actuator Precautions 3 Be sure to read before handling

### **Recommended Pneumatic Circuits**

Π

### **A**Warning Horizontal actuation

Ι



### Meter-in speed controllers

Meter-in speed controllers are able to reduce lurching while controlling the speed. The two knobs facilitate adjustment.



### **Dual speed controllers**

The meter-out function controls the speed. When meter-in control is also used, lurching is reduced. Compared to a circuit with only meter-in control, more stable low speed actuation is possible.

### **Vertical actuation**



- (1) Basically adjusted with meter-out control. When meter-in control is also used, lurching is reduced.\*
- (2) Depending on the size of the load, installing a regulator with check valve at position (a) can decrease lurching during descent and actuation delay during ascent.

```
As a rule
when W + P₀a>P₀A
```

adjust  $P_1$  so that  $W + P_1a = P_0A$ .



- (1) Basically adjusted with meter-out control. When meter-in control is also used, lurching is reduced.\*
- (2) Installing a regulator with check valve at position (b) can decrease lurching during descent and actuation delay during ascent.
   As a rule

adjust  $P_2$  so that  $W + P_2A = P_0a$ .

W: Load (N) Po: Operating pressure (MPa) a: Rod side piston area (mm<sup>2</sup>) A: Head side piston area (mm<sup>2</sup>)

### **M**Warning

C J2X and C UX10 are subject to internal leakage due their construction, and this may disable the meter-out control (\*) during low speed operation.



Actuator Precautions 4 Be sure to read before handling

### Cushion

### ▲ Caution

### 1. Readjust using the cushion needle.

Cushions are adjusted at the time of shipment, however, the cushion needle on the cover should be readjusted when the product is put into service, based upon factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. Tighten the lock nut securely after adjustment is performed.

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

This will cause damage to the seals.

### Lubrication

### ▲ Caution

### 1. Operate without lubrication.

Malfunction may occur when lubricated.

### 2. Only use the grease recommended by SMC.

The Microspeed cylinder and the Microspeed cylinder with clean room specifications use different types of grease. Use of grease other than the specified type can cause malfunction and particulate generation.

### Air Supply

### ▲ Warning

1. Use clean air.

Do not use compressed air which 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  $5\mu m$  or finer.

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

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

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

Take measures to prevent freezing, since moisture in circuits can be frozen under 5°C, and this may cause damage to seals and lead to malfunction.

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

#### Take measures to prevent pressure fluctuation.

Malfunction may occur with the fluctuation of pressure.

### **Operating Environment**

### ▲ Warning

- 1. Do not use in environments or locations where there is a danger of corrosion.
- 2. Do not use in dusty locations or where water, oil, etc., splash on the equipment.

### Maintenance

### \land 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 equipment 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

Remove drainage from air filters regularly. (Refer to specifications.)



### **Microspeed Cylinder**

### Series CJ2X/CUX/CQSX/CQ2X/CM2X

Clean Room Series Precautions 1 Be sure to read before handling

### Air Supply

### **A**Caution

#### 1. System configuration

Refer to the "Compressed Air Cleaning System" below to configure a system for the quality of compressed air to be used.



### 2. Piping

- 1. Apply a downward incline of 1cm per 1m in the direction of air flow in the main piping.
- When branching from the main piping, provide the outlet for compressed air on the upper part of the piping using a tee to prevent the escape of drainage that accumulates inside the piping.
- 3. Set up drainage equipment at every low point and dead end to prevent the accumulation of drainage.
- For the future extension of piping, install a tee at the end of the piping and close it with a plug.
- 5. 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.

6. Wrapping of pipe 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 piping tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



#### 3. Maintenance

When the heatless air dryer series ID is not used for an extended time, the absorbent may become damp. In this case, close the valve on the downstream side of the dryer, performing regeneration to dry the absorbent before operating.

#### 4. Design Precautions

To prevent the unpredictable situations described on the right, design with consideration for safety.

### **M**Warning

### 1. Design to prevent compressed air at high temperatures from flowing downstream.

When the cooling water of a water-cooled after-cooler or the fan motor of an air-cooled after-cooler stops, high temperature compressed air flows downstream and can cause damage or malfunction of downstream equipment (AFF, AM, AD and IDF, etc.).

2. Use a design which considers interruption of the compressed air supply.

Freezing of a refrigerated air dryer or malfunction of a switching valve (heatless dryer) may cause the interruption of compressed air flow.

### A Caution

### 1. Design a layout which gives consideration to cooling water leakage and condensation.

With a water-cooled after-cooler, water leakage may occur due to freezing, etc., or a refrigerated air dryer and its downstream piping may produce dripping water due to condensation forming from over refrigeration.

#### 2. Design to prevent back pressure and back flow.

The generation of back pressure or back flow can cause damage to equipment and malfunction. Give consideration to safety measures, including handling methods.

### Series CJ2X/CUX/CQSX/CQ2X/CM2X

### **Microspeed Cylinder**

Clean Room Series Precautions 2 Be sure to read before handling

### Piping in a Clean Room

### **A**Caution

1. Do not use common piping for the relief port of the air cylinder and the breathing pipe of the regulator with the exhaust piping of the solenoid valves.

Common piping can cause malfunction of the air cylinder and pressure fluctuation in the regulator.

2. Set up the exhaust piping of the solenoid valves to release exhaust outside the clean room.

### 3. Air filter drain piping

Perform piping for drainage discharge from the drain guide section of the air filter to outside the clean room. 4. Be sure that piping connection threads and tubing connections are tightened securely and do not loosen.

When piping shakes due to vibration of equipment, etc., give this special attention.

5. Use a polyurethane tube without plasticizer for the tubing.



### Handling

### **A**Caution

- 1. Open the inner package of the double-packaged clean room series in the clean room or in a clean environment.
- 2. When bringing standard pneumatic equipment into a clean room, carefully remove dirt by blowing with very clean air, and then wiping the cylinder tube surface and the exterior surfaces of solenoid valves and auxiliary equipment with alcohol, etc.
- Before replacing parts or disassembling inside the clean room carefully release the compressed air inside the piping to the outside of the clean room.
- 4. Do not use rotating type mounting brackets such as a clevis and trunnion, etc., because the amount of particulate generation due to the sliding rotation of metal parts in their bearings is unacceptable.

### **Lubrication of Actuators**

### **A**Warning

Be sure to your wash hands after handling a fluorine type grease.

The grease itself is not dangerous, but at high temperatures of  $260^\circ\text{C}$  or more, toxic gas may be released.

### 

- 1. Do not use grease other than the SMC specified type. Using a grease other than the specified type can cause malfunction and particulate generation, etc.
- 2. Do not lubricate, as this actuator is a non-lube type.

Since clean room series actuators are lubricated with fluorine type grease at the factory, lubrication with turbine oil, etc., will result in failure to meet the product specifications.

- 3. The microspeed cylinder and the microspeed cylinder with clean room specifications use different types of grease. For the microspeed cylinder with clean room specifications, use GR-X-005 (5g pack) grease.
- 4. Refer to "Microspeed Cylinder Actuator Precautions" on pages 16 to 18 for other information.

### Piston Speed

### A Caution

To maintain the grade of particulate generation and low speed operation, limit the air cylinder's maximum drive speed to no more than 200mm/s.



Auto Switch Precautions 1 Be sure to read before handling

### **Design & Selection**

### \land 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 current load, 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. 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 if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

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

In case of high pison speed, the use of an auto switch (D-F7NT and G5NT) with a built-in OFF delay timer (approx. 200ms) makes it possible to extend the load operating time.

### 4. Keep wiring as short as possible.

#### <Reed switch>

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

- 1) For an auto switch without a contact protection circuit, use a contact protection box when the wire length is 5m or longer.
- 2) Even if an auto switch has a built-in contact protection circuit, when the wiring is more than 30m 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 contact SMC in this case.

#### <Solid state switch>

 Although wire length does not affect switch function, use wiring 100m or shorter.

### 5. Take precautions for the internal voltage drop of the switch.

#### <Reed switch>

- 1) Switches with an indicator light (Except D-A76H, A96, A96V, C76))
  - If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)

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

Even though an auto switch operates normally, the load may not operate.

 $\sim 0$ 

Load

\_\_\_\_\_

< 0----

### 🗥 Warning

 In the same way, when operating below 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.

Supply \_ Internal voltage > Minimum operating voltage drop of switch > voltage of load

 If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Model D-A80, A80H, A90, A90V, C80, 90).

#### <Solid state switch>

3) Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch. Take the same precautions as in 1).

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

#### 6. Pay attention to leakage current.

#### <Solid state switch>

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

Operating current of load (OFF condition) > Leakage current

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3 wire switch if this specification will not be satisfied.

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

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

#### <Reed switch>

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

#### <Solid state switch>

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

Auto Switch Precautions 2 Be sure to read before handling

#### Mounting & Adjustment

### \land Warning

### 1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s<sup>2</sup> or more for reed switches and 1000m/s<sup>2</sup> 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, mounting bracket 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 each series catalog regarding switch mounting, moving, and tightening torque, etc.)

### 4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting positions shown in the catalog indicate the optimum positions at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation may be unstable.

#### Wiring

### ▲ Warning

### 1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from repeatedly applying 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 wire with power lines or high voltage lines.

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

### \land Warning

### 5. Do not allow short circuit of loads.

#### <Reed switch>

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

#### <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, as in the case of reed switches.

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

### 6. Avoid incorrect wiring.

#### <Reed switch>

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

[For D-97, the side without indication is (+) and the blue wire is (-).]

1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.

Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.

Applicable models: D-A73, A73H, A73C, C73, C73C, D-97, 93A, A93, A93V, D-A33A, A34A, A44A, D-B53, B54

 However, in the case of a 2 color indicator type auto switch (D-A79W, B59W), note that the switch will be in a normally ON condition if connections are reversed.

#### <Solid state switch>

- 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 state. However, note that the switch will be damaged if reversed connections are made while the load is in a short circuited 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.

#### \* Lead wire color changes

Lead wire colors of SMC switches have been changed in order to meet NECA Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided. Special care should be taken regarding wire polarity during the time that the old colors still coexist with the new colors.

2 wire			3 wire				
	Old	New		Old	New		
Output (+)	Red	Brown	Power supply	Red	Brown		
Output (–)	Black	Blue GND		Black	Blue		
			Output	White	Black		

#### Solid state

with ulaying	type		
	Old	New	
Power supply	Red	Brown	Powe
GND	Black	Blue	GND
Output	White	Black	Outp
Diagnostic output	Yellow	Orange	Latch t diagno

type diagnostic output							
	Old	New					
Power supply	Red	Brown					
GND	Black	Blue					
Output	White	Black					
Latch type diagnostic output	Yellow	Orange					

Solid state with latch

23 🖉 SMC<sup>°</sup>

Auto Switch Precautions 3 Be sure to read before handling

#### **Operating Environment**

### ▲ Warning

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. (Consult SMC regarding the availability of a magnetic field resistant auto switch.)

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

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

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

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

#### <Reed switch>

When excessive impact (300m/s<sup>2</sup> or more) is applied to a reed switch during operation, the contact will malfunction and generate or cut off a signal momentarily (1ms or less). Consult SMC regarding the need to use a solid state switch depending upon the environment.

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

#### <Solid state switch>

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

### 8. Avoid accumulation of iron debris or close contact with magnetic substances.

When a large amount of ferrous debris such as machining chips or welding 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

### \land Warning

- 1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.
- 1) Securely tighten 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 switches or repair lead wires, etc., if damage is discovered.

3) Confirm the lighting of the green light on a 2 color indicator type switch.

Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

#### Other

### \land Warning

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

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