

Guide Cylinder

Built-in Fine Lock Cylinder Compact Type

- **Locking in both directions is possible.**

Locking in either side of cylinder stroke is possible, too.

- **Maximum piston speed: 500 mm/s**

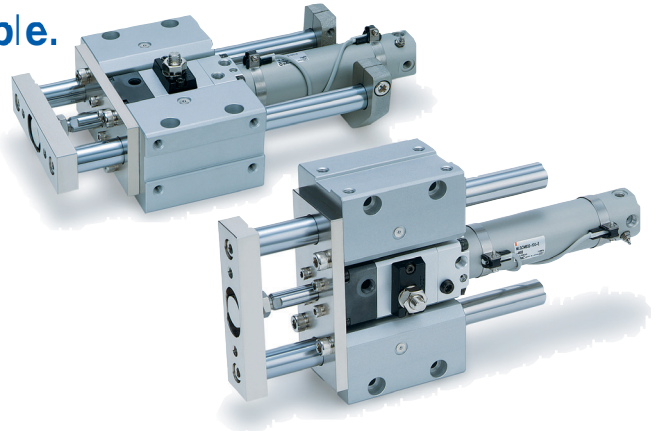
It can be used at 50 to 500 mm/s provided that it is within the allowable kinetic energy range.

- **Air cushion is standard.**

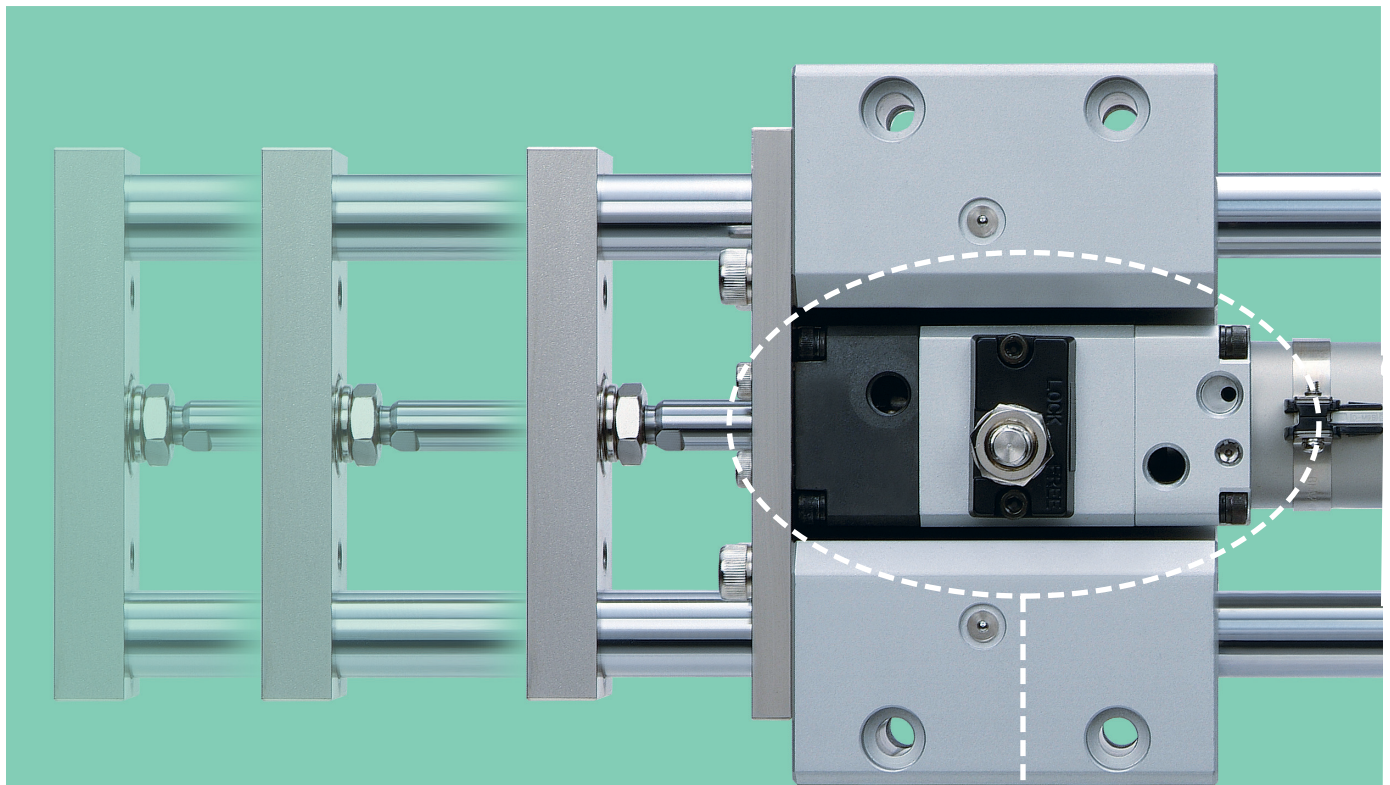
Enables the impact to be absorbed at the stroke end when the cylinder is operated at high speeds.

- **Cylinder position can be detected**

Built-in magnet for auto switches is provided in all models.



A linear transfer cylinder unit with a built-in locking mechanism and a guide rod integrated in a compact design.



**High level of stopping accuracy,
Three-types of locking mechanism**

Locking method	Spring locking	Pneumatic locking	Spring and pneumatic locking
Stopping accuracy*	±1.0 mm	±0.5 mm	
Features	<ul style="list-style-type: none"> ● Works on the safety side. (Exhaust locking) 	<ul style="list-style-type: none"> ● High precision ● Holding power can be adjusted freely. 	<ul style="list-style-type: none"> ● High precision ● Holding power can be adjusted freely. ● Works on the safety side.

* Piston speed at 300 mm/s

Series MLGC

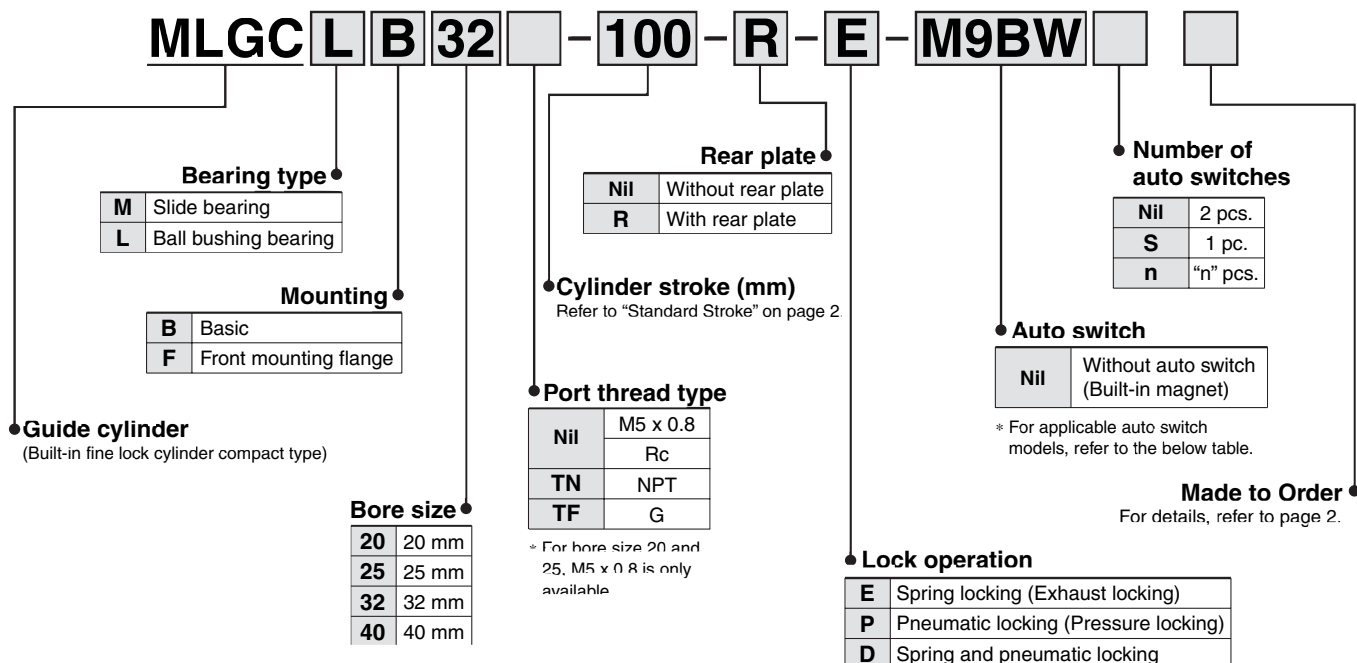
SMC
CAT FS20-192A

Guide Cylinder: Built-in Fine Lock Cylinder Compact Type

Series **MLGC**

∅20, ∅25, ∅32, ∅40

How to Order



Applicable Auto Switches / For detailed auto switch specifications, refer to page 10 through to 20

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage		Auto switch model			Lead wire length (m)					Pre-wired connector	Applicable load							
					DC	AC	Applicable tubing I.D.			0.5 (Nil)	1 (M)	3 (L)	5 (Z)	None (N)		IC circuit	Relay, PLC						
							∅20, ∅25	∅32	∅40														
Reed switch	—	Grommet	Yes	3-wire (NPN equivalent)	—	5 V	—	A96			●	—	●	—	—	—	IC circuit	Relay, PLC					
								A93			●	—	●	—	—	—	—		IC circuit				
								A90			●	—	●	—	—	—	—		IC circuit				
		Connector	None	Yes	2-wire	24 V	12 V	—	(B54)	B54	●	—	●	●	—	—	—						
									(B64)	B64	●	—	●	—	—	—							
									C73C			●	—	●	●	—			—				
Grommet	None	Yes	2-wire	24 V	—	—	C80C			●	—	●	●	—	—								
							(B59W) B59W			●	—	●	—	—									
							—			—	—	—	—	—									
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	—	—	M9N			●	—	●	○	—	○	IC circuit						
				3-wire (PNP)				M9P			●	—	●	○	—	○							
		Connector		None				Yes	2-wire	12 V	M9B			●	—	●	○	—	○	—			
									H7C			●	—	●	●	●	—						
		Grommet		None				Yes	3-wire (NPN)	5 V, 12 V	M9NW			●	●	●	○	—	○	IC circuit			
									3-wire (PNP)	5 V, 12 V	M9PW			●	●	●	○	—	○				
									2-wire	12 V	M9BW			●	●	●	○	—	○	—			
										H7BA			—	—	●	○	—	○					
									With diagnostic output (2-color indication)	None	Yes	4-wire (NPN)	5 V, 12 V	H7NF			●	—	●	○	—	○	IC circuit
												—			—	—	—	—	—				

* Lead wire length symbols: 0.5 m Nil (Example) M9NW
 1 m M (Example) M9NWM
 3 m I (Example) M9NWI
 5 m Z (Example) M9NWZ
 None N (Example) H7CN

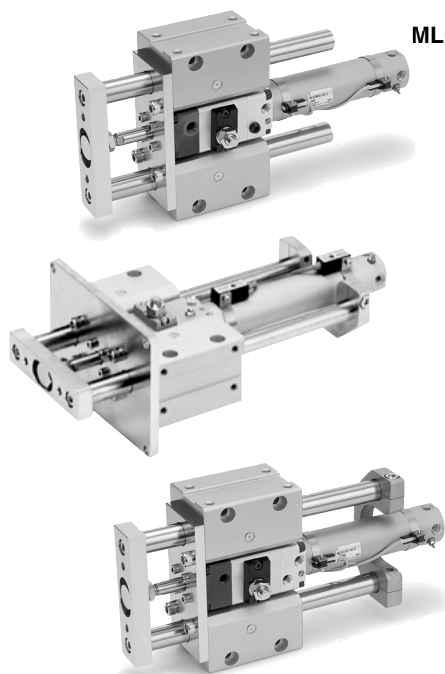
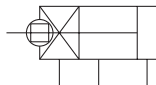
* Solid state switches marked with "○" are produced upon receipt of order
 * D A90V, M90V, M90WV, and D F9BA cannot be mounted

* Since there are other applicable auto switches than listed, refer to page 9 for details.
 * For details about auto switches with pre-wired connector, refer to "Best Pneumatics 2004" Vol 9 catalog.
 * D-A90, M90, M90W are shipped together (but not assembled).
 (Only switch mounting bracket is assembled at the time of shipment.)

Caution
 When using auto switches shown inside (), stroke end detection may not be possible depending on the one-touch fitting or speed controller model. Please contact SMC in this case.

Guide Cylinder Built-in Fine Lock Cylinder Compact Type **Series MLGC**

JIS Symbol



MLGCL (Ball bushing bearing)

Mode / Specifications

Standard Stroke

Model (Bearing type)	Bore size (mm)	Standard stroke (mm)	Long stroke (mm)
MLGCM (Slide bearing)	20	75, 100, 125, 150, 200	250, 300, 350, 400
	25		350, 400, 450, 500
MLGCL (Ball bushing bearing)	32	75, 100, 125, 150, 200, 250, 300	350, 400, 450, 500, 600
	40		350, 400, 450, 500, 600, 700, 800

* Intermediate strokes and short strokes other than the above are produced upon receipt of order

Specifications

Model	MLGC□□20	MLGC□□25	MLGC□□32	MLG□□40
Basic cylinder	CDLG1BA	Bore size	Thread type	Stroke
Bore size (mm)	20	25	32	40
Action	Double acting			
Fluid	Air			
Proof pressure	1.5 MPa			
Maximum operating pressure	1.0 MPa			
Minimum operating pressure	0.2 MPa (Horizontal with no load)			
Ambient and fluid temperature	-10 to 60°C			
Piston speed*1	50 to 500 mm/s			
Cushion	Air cushion			
Base cylinder lubrication	Non-lube			
Thread tolerance	JIS Class 2			
Stroke length tolerance	+1.9 +0.2 mm			
Non-rotating accuracy*2	Slide bearing	±0.06°	±0.05°	±0.05°
	Ball bushing bearing	±0.04°	±0.04°	±0.04°
Piping port size*3 (Rc, NPT, G)	Cylinder port	M5 x 0.8		1/8
	Lock port	1/8		
Lock operation	<input type="checkbox"/> Spring locking (Exhaust locking) <input type="checkbox"/> Pneumatic locking (Pressure locking) <input type="checkbox"/> Spring and pneumatic locking			

*1 Constraints associated with the allowable kinetic energy are imposed on the speeds at which the piston can be locked. The maximum speed of 750 mm/s can be accommodated if the piston is to be locked in the stationary state for the purpose of drop prevention.

*2 When the cylinder is retracted (initial value), with no load or without deflection of the guide rod, the non-rotating accuracy shall be the value in the table or less.

*3 For bore size 20 and 25, M5 x 0.8 is only available.



Made to Order
(For details, refer to page 21.)

Symbol	Specifications
XC79	Machining tapped hole, drilled hole and pin hole additionally

Fine Lock Specifications

Lock operation	Spring locking (Exhaust locking)	Spring and pneumatic locking	Pneumatic locking (Pressure locking)
Fluid	Air		
Maximum operating pressure	0.5 MPa		
Unlocking pressure	0.3 MPa or more		0.1 MPa or more
Lock starting pressure	0.25 MPa or less		0.05 MPa or less
Locking direction	Both directions		

Theoretical Output



Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm ²)	Operating pressure (MPa)										
				0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
20	8	OUT	314	62.8	94.2	126	157	188	220	251	283	314		
		IN	264	52.8	79.2	106	132	158	185	211	238	264		
25	10	OUT	491	98.2	147	196	246	295	344	393	442	491		
		IN	412	82.4	124	165	206	247	288	330	371	412		
32	12	OUT	804	161	241	322	402	482	563	643	724	804		
		IN	691	138	207	276	346	415	484	553	622	691		
40	16	OUT	1260	252	378	504	630	756	882	1010	1130	1260		
		IN	1060	212	318	424	530	636	742	848	954	1060		

Note) Theoretical output (N) = Pressure (MPa) x Piston area (mm²)

Series MLGC

Weights

Bore size (mm)		20	25	32	40
Basic weight	LB type (Ball bushing bearing / Basic)	2.8	4.45	4.54	8.12
	LF type (Ball bushing bearing / Front mounting flange)	3.52	5.42	5.52	9.61
	MB type (Slide bearing / Basic)	2.74	4.35	4.44	7.84
	MF type (Slide bearing / Front mounting flange)	3.45	5.31	5.42	9.33
	Additional weight with rear plate	0.29	0.47	0.47	0.8
Additional weight per each 50 mm of stroke		0.21	0.32	0.34	0.54
Additional weight for long stroke		0.01	0.01	0.02	0.03

Calculation: (Example)

MLGCLB32-500-R-D

(Ball bushing bearing / Basic, $\phi 32/500$ st., with rear plate)

- Basic weight..... 4.54 (LB type)
 - Additional weight with rear plate..... 0.47
 - Additional stroke weight..... 0.34/50 st
 - Stroke..... 500 st
 - Additional weight for long stroke..... 0.02
- 4.54 + 0.47 + 0.34 x 500/50 + 0.02 = 8.43 kg

Allowable Kinetic Energy when Locking

Bore size (mm)	20	25	32	40
Allowable kinetic energy (J)	0.26	0.42	0.67	1.19

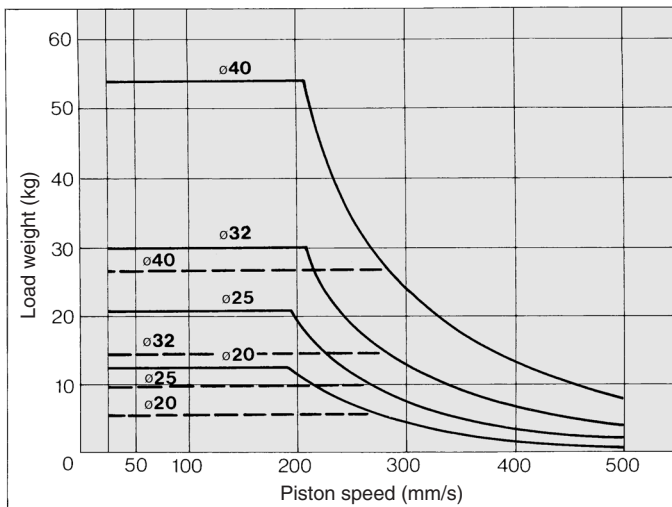
In terms of specific load conditions, the allowable kinetic energy indicated in the table above is equivalent to a 50% load ratio at 0.5 MPa, and a piston speed of 300 mm/sec. Therefore, if the operating conditions are below these values, calculations are unnecessary.

1. Apply the following formula to obtain the kinetic energy of the load.

$$E_k = \frac{1}{2} m v^2$$

E_k : Kinetic energy of load (J)
 m : Load weight (kg)
 (Load weight + Moving parts weight)
 v : Piston speed (m/s) (Average speed x 1.2)

- The piston speed will exceed the average speed immediately before locking. To determine the piston speed for the purpose of obtaining the kinetic energy of load, use 1.2 times the average speed as a guide.
- The relation between the speed and the load of the respective tube bores is indicated in the diagram below. Use the cylinder in the range below the line.
- During locking, the lock mechanism must absorb the thrust of the cylinder, in addition to the kinetic energy of the load. Therefore, in order to insure the proper braking force, even within a given allowable kinetic energy level, there is an upper limit to the size of the load. Thus, a horizontally mounted cylinder must be operated below the solid line, and a vertically mounted cylinder must be operated below the dotted line.



Holding Force of Spring Locking (Max. static load)

Bore size (mm)	20	25	32	40
Holding force (N)	196	313	443	784

Note) Holding force at piston rod extended side decreases approximately 15%.

Moving Parts Weights

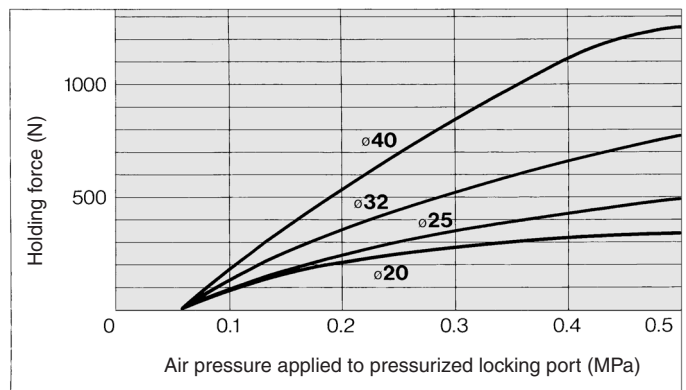
Bore size (mm)	20	25	32	40
Moving parts basic weight	0.59	1.17	1.17	2.21
Additional weight with rear plate	0.29	0.47	0.47	0.8
Additional weight per each 50 mm of stroke	0.18	0.28	0.29	0.46

Calculation: (Example)

MLGCLB32-500-R-D

- Moving parts basic weight..... 1.17
 - Additional weight with rear plate..... 0.47
 - Additional stroke weight..... 0.29/50 st
 - Stroke..... 500 st
- 1.17 + 0.47 + 0.29 x 500/50 = 4.54 kg

Holding Force of Pneumatic Locking (Max. static load)



1. The holding force is the lock's ability to hold a static load that does not involve vibrations or shocks, after it is locked without a load. Therefore, to use the cylinder near the upper limit of the constant holding force, be aware of the following:

- If the piston rod slips because the lock's holding force has been exceeded, the brake shoe could become damaged, resulting in a reduced holding force or shortened life.
- To use the lock for drop prevention purposes, the load to be attached to the cylinder must be within 35% of the cylinder's holding force.
- Do not use the cylinder in the locked state to sustain a load that involves impact.

Stopping Accuracy (Not including tolerance of control system.)

Locking method	Piston speed (mm/s)			
	50	100	300	500
Spring locking (Exhaust locking)	±0.4	±0.5	±1.0	±2.0
Pneumatic locking (Pressure locking) Spring and pneumatic locking	±0.2	±0.3	±0.5	±1.5

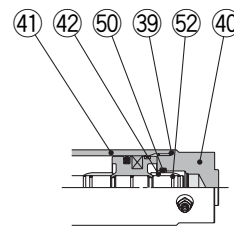
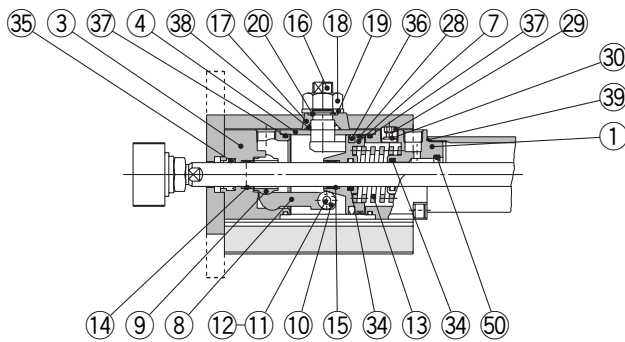
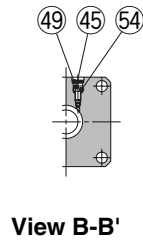
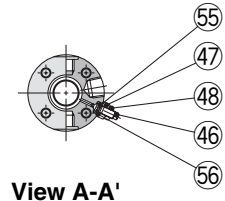
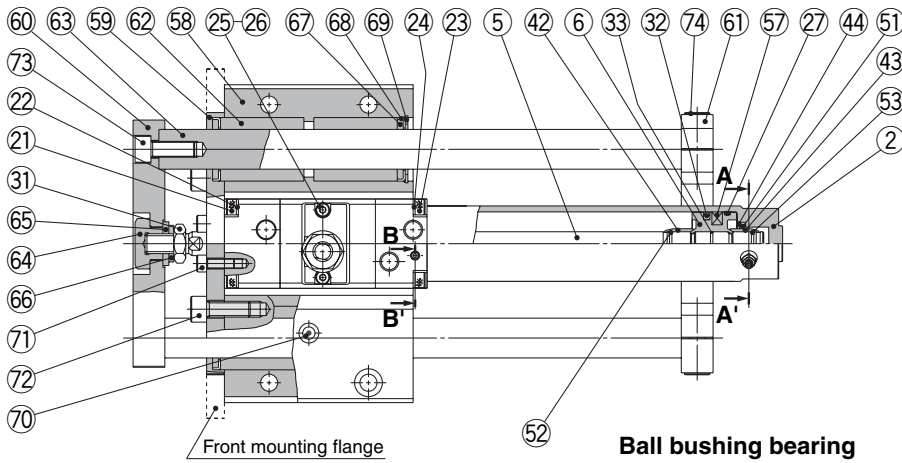
Condition/ Load: 25% of thrust force at 0.5 MPa
Solenoid valve: mounted to the lock port

Caution

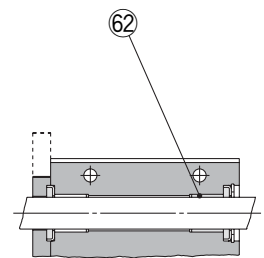
Recommended Pneumatic Circuit / Caution on Handling

For detailed specifications about the fine lock cylinder CLG1 series, refer to "Best Pneumatics 2004" Vol. 9 catalog.

Construction: With Rear Plate



Long stroke



Slide bearing

Component Parts

No.	Description	Material	Description
1	Rod cover	Aluminum alloy	Clear hard anodized
2	Tube cover	Aluminum alloy	Hard anodized
3	Cover	Carbon steel	Nitrided
4	Intermediate cover	Aluminum alloy	Clear hard anodized
5	Piston rod	Carbon steel	Hard chrome plated $\phi 20, \phi 25$ are stainless steel.
6	Piston	Aluminum alloy	Chromated
7	Brake piston	Carbon steel	Nitrided
8	Brake arm	Carbon steel	Nitrided
9	Brake shoe	Special friction material	
10	Roller	Carbon steel	Nitrided
11	Pin	Carbon steel	Heat treated
12	Snap ring	Stainless steel	
13	Brake spring	Spring steel wire	Dacrodized For spring locking, spring/pneumatic locking
14	Bushing	Oil-impregnated sintered alloy	
15	Bushing	Oil-impregnated sintered alloy	
16	Manual lock release cam	Chromium molybdenum steel	Nitrided, Nickel plated
17	Cam guide	Carbon steel	Nitrided, painted
18	Lock nut	Rolled steel	Nickel plated
19	Flat washer	Rolled steel	Nickel plated
20	Snap ring	Stainless steel	
21	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated
22	Spring washer	Steel wire	Nickel plated
23	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated
24	Spring washer	Steel wire	Nickel plated
25	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated
26	Spring washer	Steel wire	Nickel plated
27	Wear ring	Resin	
28	Wear ring	Resin	
29	Hexagon socket head plug	Carbon steel	Nickel plated For spring locking
30	Element	Bronze	
31	Rod end nut	Rolled steel	Nickel plated
32	Piston seal	NBR	
33	Piston gasket	NBR	
34	Rod seal A	NBR	
35	Rod seal B	NBR	
36	Brake piston seal	NBR	
37	Intermediate cover gasket	NBR	
38	Cam gasket	NBR	

Note) ①, ⑦, ⑩ will not be required for without rear plate.

Component Parts

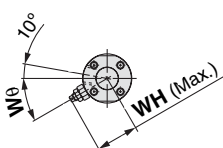
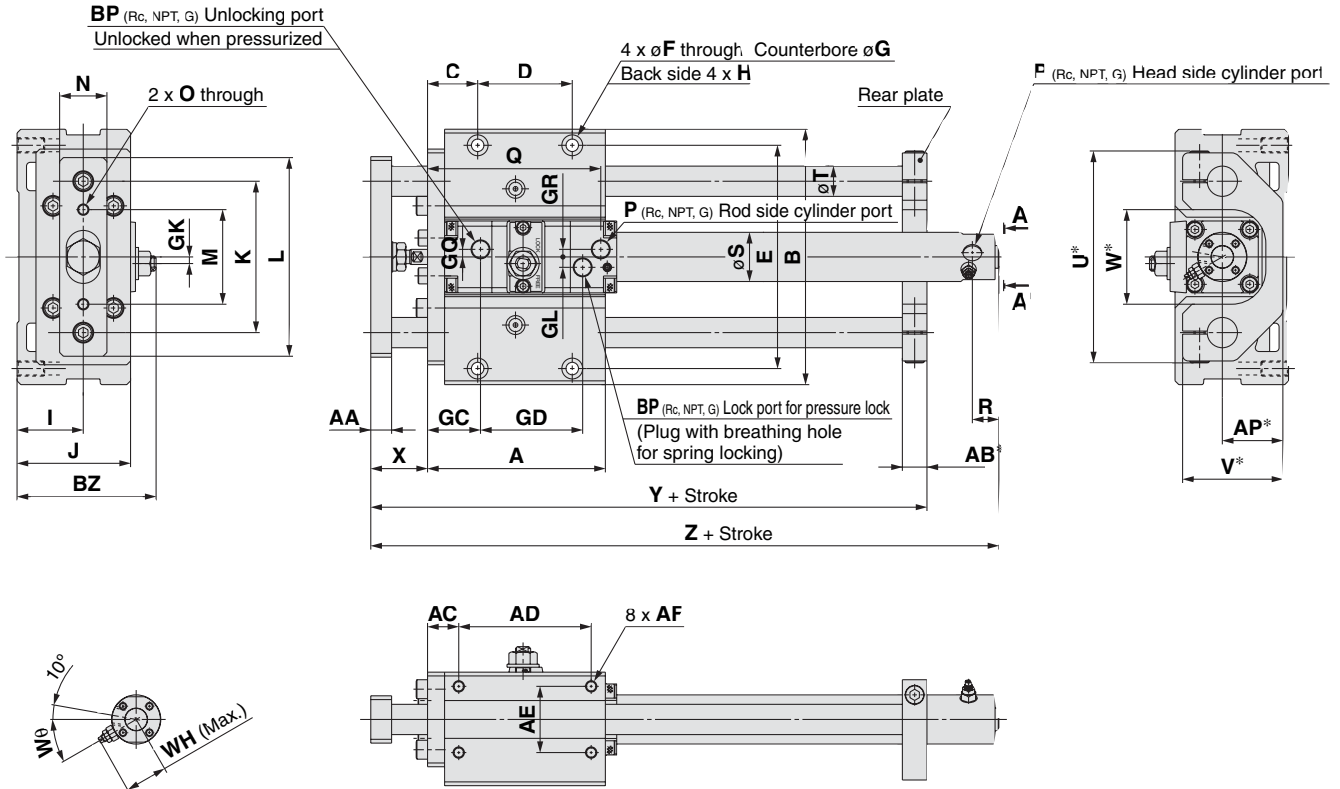
No.	Description	Material	Description
39	Cylinder tube gasket	NBR	
40	Had cover	Aluminum alloy	White hard anodized
41	Cylinder tube	Aluminum alloy	Hard anodized
42	Cushion valve A	Brass	
43	Cushion valve B	Brass	
44	Seal retainer	Rolled steel	Zinc chromated
45	Cushion valve A	Chromium molybdenum steel	Electroless nickel plated
46	Cushion valve B	Rolled steel	Electroless nickel plated
47	Valve retainer	Rolled steel	Electroless nickel plated
48	Lock nut	Rolled steel	Electroless nickel plated
49	Snap ring	Stainless steel	
50	Cushion seal A	Urethane	
51	Cushion seal B	Urethane	
52	Cushion ring gasket A	NBR	
53	Cushion ring gasket B	NBR	
54	Valve seal A	NBR	
55	Valve seal B	NBR	
56	Valve retainer gasket	NBR	
57	Magnet	—	
58	Guide body	Aluminum alloy	Clear anodized
59	Small flange	Rolled steel	Flat nickel plated Basic
59	Large flange	Rolled steel	Flat nickel plated Front mounting flange
60	Front plate	Rolled steel	Flat nickel plated
61	Rear plate	Cast iron	Platinum silver
62	Slide bearing	Bearing alloy	For slide bearing
62	Ball bushing bearing	—	For ball bushing bearing
63	Guide rod	Carbon steel	Hard chrome plated For slide bearing
63	Guide rod	High carbon chrome bearing steel	Quenched, Hard chrome plated For ball bushing bearing
64	End bracket	Carbon steel	Flat nickel plated
65	Washer	Rolled steel	Nickel plated
66	Spring washer	Steel wire	Nickel plated
67	Felt	Felt	
68	Holder	Stainless steel	
69	C-type snap ring for hole	Carbon tool steel	Nickel plated
70	Grease nipple	—	Nickel plated
71	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated For cylinder mounting
72	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated For large/small flange mounting
73	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated For front plate mounting
74	Hexagon socket head cap screw	Chromium molybdenum steel	Nickel plated For rear plate mounting

Series MLGC

Dimensions

Basic: With rear plate

MLGC□B□□-□-R-□



View A-A'

Standard Stroke

Bore size (mm)	Stroke range (mm)	A	AA	AB	AC	AD	AE	AF	AP	B	BP ^{Note 3)}	BZ	C	D	E	F	G	GC
20	75, 100, 125, 150, 200	94	12	13	16.5	70	35	M6 x 1 depth 12	32	135	1/8	73.5	26.5	50	118	6.8	11 depth 8	28
25	75, 100, 125	104	16	16	19	75	40	M8 x 1.25 depth 16	37	160	1/8	86.5	31.5	50	140	8.6	14 depth 10	29
32	150, 200, 250	104	16	16	19	75	40	M8 x 1.25 depth 16	37	160	1/8	86.5	31.5	50	140	8.6	14 depth 10	30
40	300	142	19	19	22	110	45	M10 x 1.5 depth 20	42	194	1/8	95	37	80	170	10.5	17 depth 12	35

Bore size (mm)	GD	GK	GL	GQ	GR	H	I	J	K	L	M	N	O	P ^{Note 2)}	Q	R	S
20	54	3.5	5.5	4	4	M8 x 1.25 depth 14	35	60	80	105	50	25	M6 x 1	M5 x 0.8	94	12	26
25	62	4	9	7	7	M10 x 1.5 depth 18	40	70	95	125	60	32	M8 x 1.25	M5 x 0.8	104	12	31
32	62	4	9	7	7	M10 x 1.5 depth 18	40	70	95	125	60	32	M8 x 1.25	1/8	104	12	38
40	67	4	11	8	7	M12 x 1.75 depth 21	45	82.5	115	150	75	38	M8 x 1.25	1/8	115	12	47

Bore size (mm)	T	U	V	W	WH	Wθ	X	Y	Z
20	16	112	53	50	23	30	30	146	82
25	20	132	63	60	25	30	37	167	199
32	20	132	63	60	28.5	25	37	167	202
40	25	162	73	70	33	20	44	210	227

Without Rear Plate

Bore size (mm)	Y
20	129
25	146
32	146
40	191

Long Stroke

Bore size (mm)	Stroke range (mm)	R	Z
20	250 to 400	14	190
25	350 to 500	14	207
32	350 to 600	14	210
40	350 to 800	15	236

Note 1) Dimensions marked with "*" are not required for without rear plate.

Note 2) For bore size 20 and 25, M5 x 0.8 is only available.

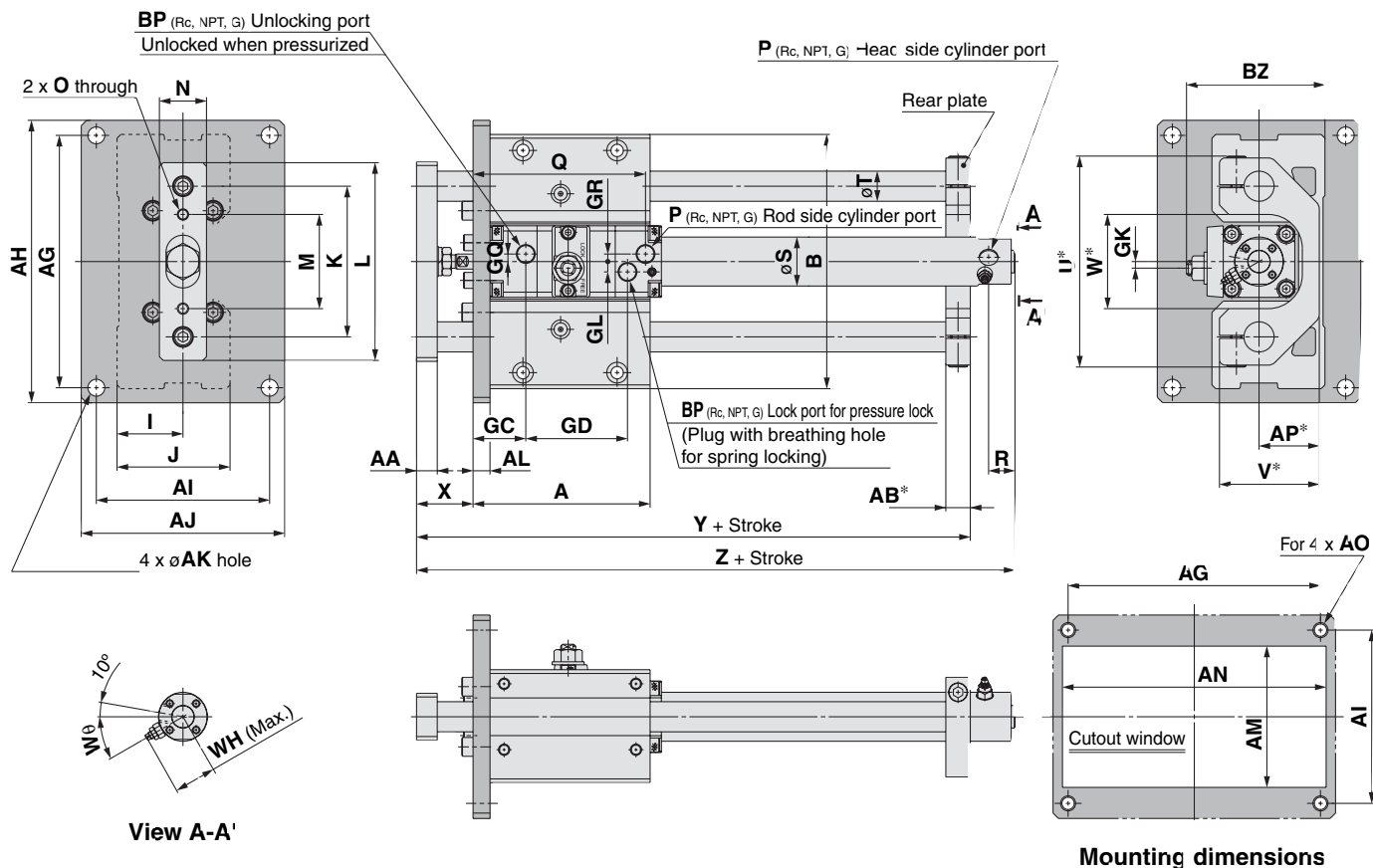
Rc, NPT, G port are available for bore size with 32 or greater.

Note 3) Rc, NPT, G port are available.

Dimensions

Front mounting flange: With rear plate

MLGC□F□□-□-R-□



Mounting dimensions

Standard Stroke

Bore size (mm)	Stroke range (mm)	A	AA	AB	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	B	BP ^{Note 3)}	BZ	GC	GD	GK
20	75, 100, 125, 150, 200	94	12	13	134	150	92	108	9	9	75	140	M8	32	135	1/8	73.5	28	54	3.5
25	75, 100, 125	104	16	16	160	176	110	125	9	9	88	165	M8	37	160	1/8	86.5	29	62	4
32	150, 200, 250	104	16	16	160	176	110	125	9	9	88	165	M8	37	160	1/8	86.5	30	62	4
40	300	142	19	19	190	210	115	135	11	12	96	200	M10	42	194	1/8	95	35	67	4

Bore size (mm)	GL	GQ	GR	I	J	K	L	M	N	O	P ^{Note 2)}	Q	R	S	T	U	V	W
20	5.5	4	4	35	60	80	105	50	25	M6 x 1	M5 x 0.8	94	12	26	16	112	53	50
25	9	7	7	40	70	95	125	60	32	M8 x 1.25	M5 x 0.8	104	12	31	20	132	63	60
32	9	7	7	40	70	95	125	60	32	M8 x 1.25	1/8	104	12	38	20	132	63	60
40	11	8	7	45	82.5	115	150	75	38	M8 x 1.25	1/8	115	12	47	25	162	73	70

Bore size (mm)	WH	Wθ	X	Y	Z
20	23	30	30	146	182
25	25	30	37	167	199
32	28.5	25	37	167	202
40	33	20	44	210	227

Without Rear Plate

Bore size (mm)	Y
20	129
25	146
32	146
40	191

Long Stroke

Bore size (mm)	Stroke range (mm)	R	Z
20	250 to 400	14	190
25	350 to 500	14	207
32	350 to 600	14	210
40	350 to 800	15	236

Note 1) Dimensions marked with "*" are not required for without rear plate.

Note 2) For bore size 20 and 25, M5 x 0.8 is only available.

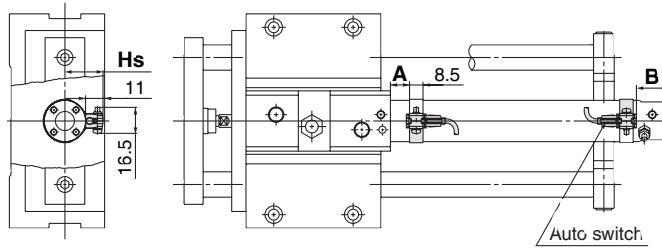
Rc, NPT, G port are available for bore size 32 or greater.

Note 3) Rc, NPT, G port are available.

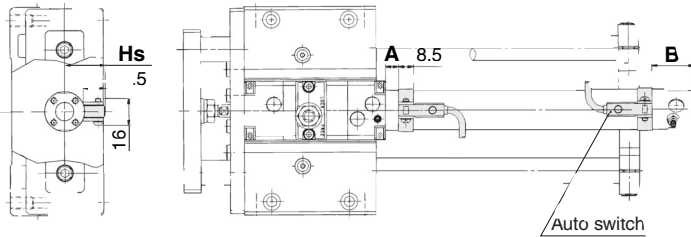
Series MLGC

Auto Switch Proper Mounting Position (Detection at stroke end) and Its Mounting Height

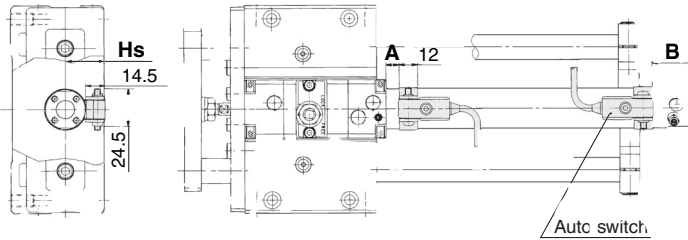
D-A9 type,
D-M9, M9□W type



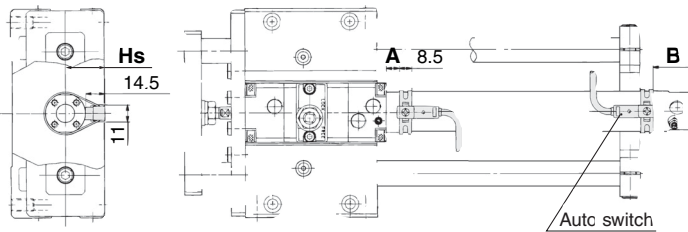
D-C7 C8 type,
D-H7 type



D-B5, B6 type,
D-G5, K5 type



D-B7 B8 type,
D-G7 K7 type



Auto Switch Proper Mounting Position

(mm)

Auto Switch Mounting Height

(mm)

Auto switch model	D-A9□				D-M9□ D-M9□W				D-B7□ D-B80 D-B73C D-B80C D-G79 D-K79 D-K79C				D-C7□ D-C80 D-C73C D-C80C				D-H7□ D-H7C D-H7□W D-H7BAL D-H7NF				D-B5□ D-B64				D-B59W				D-G5□ D-K59 D-G5NTL D-G5□W D-K59W D-G59F D-G5BAL			
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B				
20	6.5	23 (31)	10.5	27 (35)	8	24.5 (32.5)	7	23.5 (31.5)	6	22.5 (30.5)	1	17.5 (25.5)	4	20.5 (28.5)	2.5	19 (27)																
25	6.5	23 (31)	10.5	27 (35)	8	24.5 (32.5)	7	23.5 (31.5)	6	22.5 (30.5)	1	17.5 (25.5)	4	20.5 (28.5)	2.5	19 (27)																
32	6.5	25 (33)	10.5	29 (37)	8	26.5 (34.5)	7	25.5 (33.5)	6	24.5 (32.5)	1	19.5 (27.5)	4	22.5 (30.5)	2.5	21 (29)																
40	9.5	28 (37)	13.5	32 (41)	11	29.5 (38.5)	10	28.5 (37.5)	9	27.5 (36.5)	4	22.5 (31.5)	7	25.5 (34.5)	5.5	24 (33)																

* (): Values for long strokes.

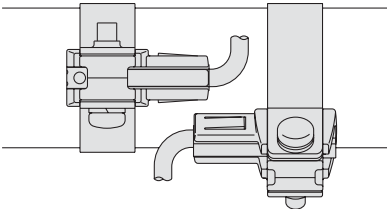
Note) When setting an auto switch, confirm the operation and adjust its mounting position.

Minimum Stroke for Auto Switch Mounting

n: Number of auto switches (mm)

Auto switch model	Number of auto switches mounted		
	With 1 pc.	With 2 pcs.	With n pcs.
		Same side	Same side
D-A9□ D-M9□ D-M9□W	10	45 <small>Note)</small>	45 + 45 (n-2)
D-C7□ D-C80	10	50	50 + 45 (n-2)
D-H7□ D-H7□W D-H7BAL D-H7NF	10	60	60 + 45 (n-2)
D-C73C/C80C D-H7C D-B73C/B80C D-K79C	10	65	65 + 50 (n-2)
D-B5□ D-B64 D-G5□ D-K59□	10	75	75 + 55 (n-2)
D-B59W	10	75	75 + 55 (n-2)
D-B7□ D-B80 D-G79 D-K79	10	45	50 + 45 (n-2)

Note) Caution when two D-A93, M9□, M9□W auto switches are used.

Auto switch model	With two auto switches	
	Same side	
	<p>The auto switches are offset (one auto switch is displaced more around the outside of the cylinder tube) so that the auto switches and lead wires do not interfere with each other.</p>	
D-A93	Less than 50 stroke	
D-M9□ D-M9□W	Less than 55 stroke	

Operating Range

Auto switch model	Bore size (mm)			
	20	25	32	40
D-A9□	7	6	8	8
D-M9□	3	3	4	3.5
D-M9□W	5	5.5	5	5.5
D-B7□/B80 D-B73C/B80C	8	10	9	10
D-C7□/C80 D-C73C/C80C	8	10	9	10
D-B5□/B64	8	10	9	10
D-B59W	13	13	14	14
D-G79/K79/K79C	8	10	9	10
D-H7BAL D-H7□/H7□W/H7NF	4	4	4.5	5
D-H7C	7	8.5	9	10
D-G5□/K59 D-G5□W/K59W D-G5NTL/G5BAL	4	4	4.5	5
D-G59F	5	5	5.5	6
D-G5NBL	35	40	40	45

* Since this is a guideline including hysteresis, not meant to be guaranteed.
(Assuming approximately ±30% dispersion.)
There may be the case it will vary substantially depending on an ambient environment.

Auto Switch Mounting Bracket Part No.

Auto switch model	Bore size (mm)			
	ø20	ø25	ø32	ø40
D-A9□ D-M9□ D-M9□W	Note) ①BMA2-020 ②BJ3-1	Note) ①BMA2-025 ②BJ3-1	Note) ①BMA2-032 ②BJ3-1	Note) ①BMA2-040 ②BJ3-1
D-C7□/C80 D-C73C/C80C D-H7□/H7C D-H7□W D-H7BAL D-H7NF	BMA2-020	BMA2-025	BMA2-032	BMA2-040
D-B5□/B64 D-B59W D-G5□/K59 D-G5□W/K59W D-G5BAL D-G59F D-G5NTL D-G5NBL	BA-01	BA-02	BA-32	BA-04
D-B7□/B80 D-B73C/B80C D-G79/K79 D-K79C	BM1-01	BM1-02	BM1-32	BM1-04

Note) Two types of brackets are used as a set

[Mounting screws set made of stainless steel]

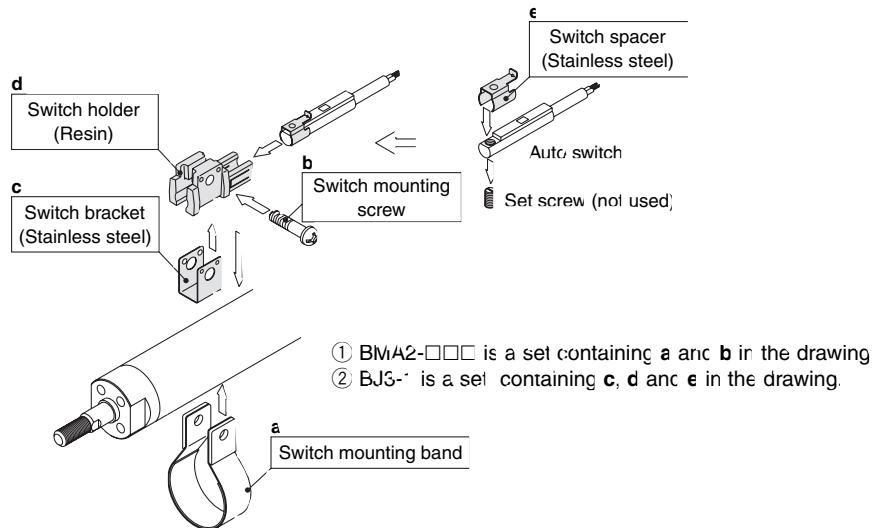
The following set of mounting screws made of stainless steel is also available. Use it in accordance with the operating environment. (Please order the switch mounting bracket separately since it is not included.)

BBA3: For D-B5, B6, G5, K5 type

BBA4: For D-C7, C8, H7 type

"D-H7BAL/G5BAL" switch is set on the cylinder with the stainless steel screws above when shipped.

When only a switch is shipped independently "BBA3" or "BBA4" screws are attached



Other than the applicable auto switches listed in "How to Order" the following auto switches can be mounted.
For detailed specifications, refer to "Best Pneumatics 2004" Vol. 9 catalog, etc.

Type	Model	Electrical entry (Direction)	Features	Applicable bore size
Reed switch	D-C73, C76, B73, B73C, B76	Grommet (in-line)	—	ø20 to ø40
	D-C80, B80C		Without indicator light	
	D-B53		—	
Solid state switch	D-H7A1, H7A2, H7B, G79, K79, K79C		—	
	D-H7NW, H7PW, H7BW		Diagnostic indication (2-color indication)	
	D-G5NTL		With timer	

* With pre-wired connector is available for solid state auto switches. For details, refer to "Best Pneumatics 2004" Vol. 9 catalog

* Normally closed (NC = b contact), solid state switches (D-F9G, F9H type) are also available. For details, refer to "Best Pneumatics 2004" Vol. 9 catalog

* Wide range detection type, solid state auto switch (D-G5NBL type) is also available. For details, refer to "Best Pneumatics 2004" Vol. 9 catalog

Series MLGC

Auto Switch Specifications

Auto Switch Common Specifications

Type	Reed switch	Solid state switch
Leakage current	None	3-wire: 100 A or less 2-wire: 0.8 mA or less
Operating time	1.2 ms	1 ms or less
Impact resistance	300 m/s ²	1000 m/s ²
Insulation resistance	50 M or more at 500 VDC Mega (between lead wire and case)	
Withstand voltage	1500 VAC for 1 minute (between lead wire and case) ^{Note}	1000 VAC for 1 minute (between lead wire and case)
Ambient temperature	-10 to 60°C	
Enclosure	IEC529 standard IP67, JIS C 0920 waterproof construction	
Standard	Conforming to CE Standards	

Note) D-C73C, C80C type: 1000 VAC/min (Between lead wire and case)

Lead Wire Length

Lead wire length indication

(Example) **D-M9BW L**

Lead wire length

Nil	0.5 m
M	1 m
L	3 m
Z	5 m

Note 1) Applicable auto switch with 5 m lead wire "Z"

Reed switch: D-B53, B54, C73(C), C80C type

Solid state switch: Manufactured upon receipt of order as standard

Note 2) To designate solid state switches with flexible specifications, add "61" after the lead wire length. Flexible cable is used for D-M9□, D-M9□W as standard. There is no need to place the suffix "61" to the end of part number.

(Example) **D-H7BAL-61**

Flexible specification

Note 3) For m (M), D-M9□W only

Note 4) Lead wire tolerance

Lead wire length	Tolerance
0.5 m	±15 mm
1 m	±30 mm
3 m	±90 mm
5 m	±150 mm

Part No. of Lead Wires with Connectors (Applicable for Connector Type Only)

Model	Lead wire length
D-LC05	0.5 m
D-LC30	3 m
D-LC50	5 m

Contact Protection Boxes: CD-P11, CD-P12

<Applicable switch model>

D-A9/C73C/C80C type

The auto switches below do not have a built-in contact protection circuit. Therefore, please use a contact protection box with the switch for any of the following cases:

- ① Where the operation load is an inductive load
- ② Where the wiring length to load is greater than 5 m.
- ③ Where the load voltage is 100 VAC

The contact life may be shortened (due to permanent energizing conditions)

Specifications

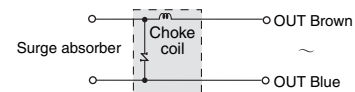
Part no.	CD-P11		CD-P12
Load voltage	100 VAC	200 VAC	24 VDC
Max. load current	25 mA	12.5 mA	50 mA

* Lead wire length: Switch connection side 0.5 m
Load connection side 0.5 m

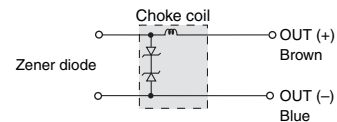


Internal Circuit

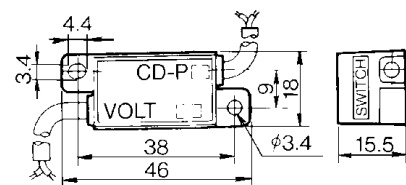
CD-P11



CD-P12



Dimensions



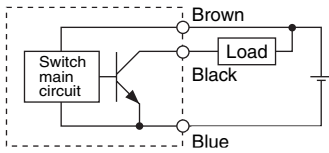
Connection

To connect a switch unit to a contact protection box, connect the lead wire from the side of the contact protection box marked SW TC-1 to the lead wire coming out of the switch unit. Keep the switch as close as possible to the contact protection box with a lead wire length of no more than 1 meter.

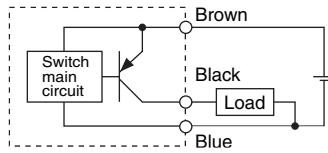
Auto Switch Connections and Examples

Basic Wiring

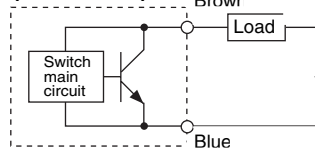
Solid state 3-wire, NPN



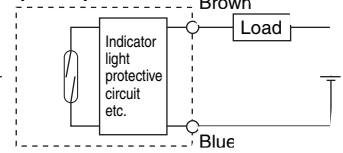
Solid state 3-wire, PNP



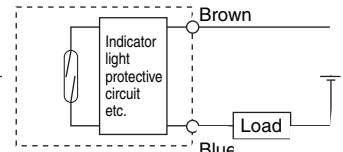
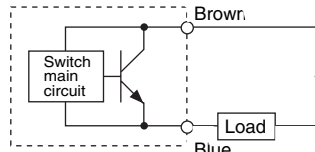
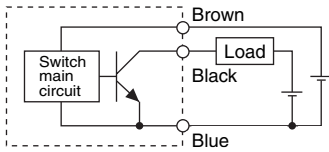
2-wire (Solid state)



2-wire (Reed)

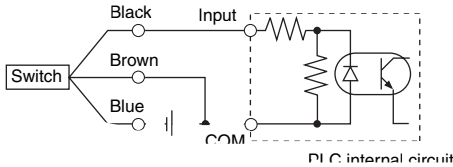


(Power supplies for switch and load are separate.)

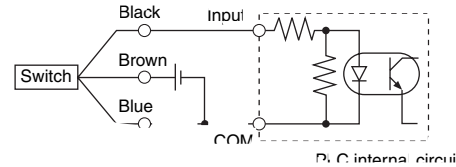


Example of Connection to PLC (Programmable Logic Controller)

• Sink input specification 3-wire, NPN

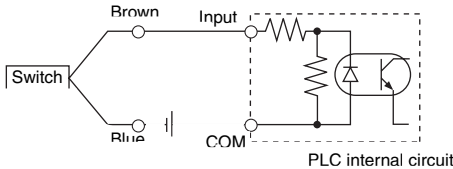


• Source input specification 3-wire, PNP

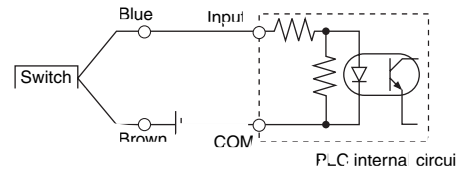


Connect according to the applicable PLC input specifications, since the connection method will vary depending on the PLC input specifications.

2-wire



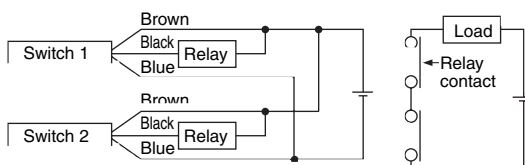
2-wire



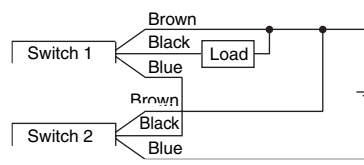
Example of AND (Serial) and OR (Parallel) Connection

• 3-wire

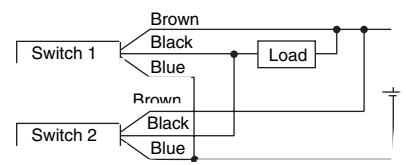
AND connection for NPN output (using relays)



AND connection for NPN output (performed with switches only)

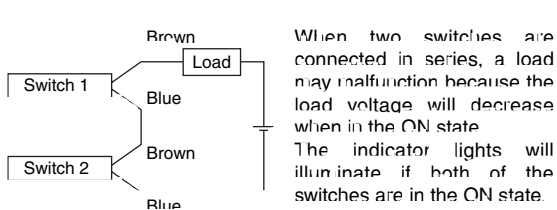


OR connection for NPN output



The indicator lights will illuminate when both switches are turned ON

2-wire with 2-switch AND connection

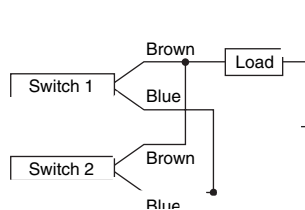


When two switches are connected in series, a load may malfunction because the load voltage will decrease when in the ON state. The indicator lights will illuminate if both of the switches are in the ON state.

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

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

2-wire with 2-switch OR connection



(Solid state)

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

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

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

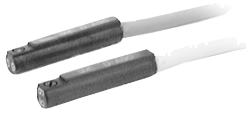
(Reed)

Because there is no current leakage, the load voltage will not increase when turned OFF. However, depending on the number of switches in the ON state, the indicator lights may sometimes dim or not light because of the dispersion and reduction of the current flowing to the switches.

Reed Switch: Direct Mounting Style D-A90/D-A93/D-A96



Grommet



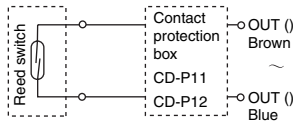
Caution

Operating Precautions

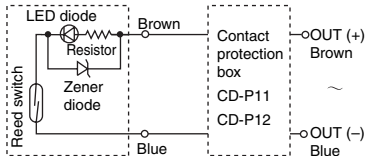
Fix the switch with the existing screw installed on the switch body. The switch may be damaged if a screw other than the one supplied, is used.

Auto Switch Internal Circuit

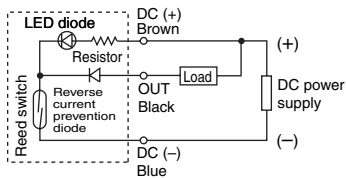
D-A90



D-A93



D-A96



- Note) ① In a case where the operation load is an inductive load
 ② In a case where the wiring load is greater than 5 m
 ③ In a case where the load voltage is 100 VAC

Use the auto switch with a contact protection box in any of the above mentioned cases. (For details about the contact protection box, refer to page 10.)

Auto Switch Specifications

PLC: Programmable Logic Controller

D-A90 (Without indicator light)			
Auto switch part no.	D-A90		
Electrical entry direction	In-line		
Applicable load	IC circuit, Relay, PLC		
Load voltage	24 VAC/DC or less	48 VAC/DC or less	100 VAC/DC or less
Maximum load current	50 mA	40 mA	20 mA
Contact protection circuit	None		
Internal resistance	1 or less (including lead wire length of 3 m)		
D-A93/D-A96 (With indicator light)			
Auto switch part no.	D-A93	D-A96	
Electrical entry direction	In-line		
Applicable load	Relay, PLC		IC circuit
Load voltage	24 VDC	100 VAC	4 to 8 VDC
Load current range and max. load current	5 to 40 mA	5 to 20 mA	20 mA
Contact protection circuit	None		
Internal voltage drop	D-A93 — 2.4 V or less (to 20 mA)/ 3 V or less (to 40 mA)		0.8 V or less
Indicator light	Red LED illuminates when ON.		
Standard	Conforming to CE Standards		

Lead wires

- D-A90/D-A93 Oilproof heavy-duty vinyl cable: $\phi 2.7$ 0.18 mm² x 2 cores (Brown, Blue) 0.5 m
 - D-A96 — Oilproof heavy-duty vinyl cable $\phi 2.7$ 0.15 mm² x 3 cores (Brown, Black, Blue) 0.5 m
- Note 1) Refer to page 10 for reed switch common specifications.
 Note 2) Refer to page 10 for lead wire lengths.

Weight

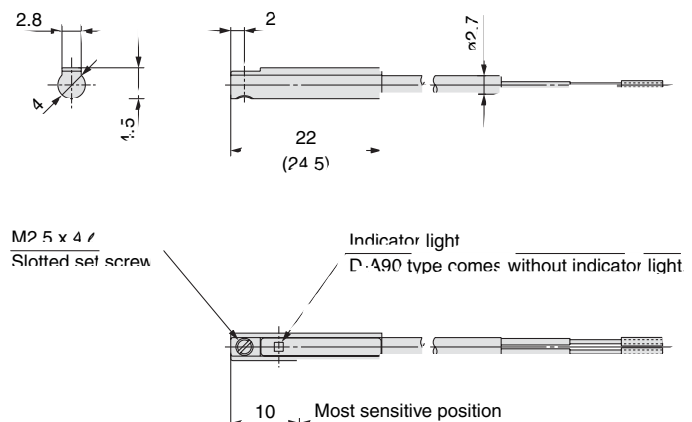
Unit: g

Auto switch part no.	D-A90	D-A93	D-A96
Lead wire length (m)	0.5	6	6
	3	30	41

Dimensions

Unit: mm

D-A90/D-A93/D-A96



() dimensions for D-A93.

Reed Switch: Band Mounting Style D-B54/D-B64



Grommet



Auto Switch Specifications

PLC: Programmable Logic Controller

D-B5 (With indicator light)			
Auto switch part no.	D-B54		
Applicable load	Relay, PLC		
Load voltage	24 VDC	100 VAC	200 VAC
Load current range ^{Note 3)}	5 to 50 mA	5 to 25 mA	5 to 12.5 mA
Contact protection circuit	Built-in		
Internal voltage drop	2.4 V or less (to 20 mA)/3.5 V or less (to 50 mA)		
Indicator light	Red LED illuminates when ON.		
D-B6 (Without indicator light)			
Auto switch part no.	D-B64		
Applicable load	Relay, PLC		
Load voltage	24 VAC/DC or less	100 VAC	200 VAC
Maximum load current	Max. 50 mA	Max. 25 mA	Max. 12.5 mA
Contact protection circuit	Built-in		
Internal resistance	25 or less		
Standard	Conforming to CE Standards		

● Lead wires — Oilproof heavy-duty vinyl cable: $\phi 4$ 0.3 mm² x 2 cores (Brown, Blue) 0.5 m

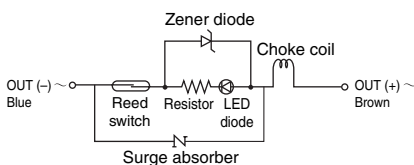
Note 1) Refer to page 10 for reed switch common specifications.

Note 2) Refer to page 10 for lead wire lengths.

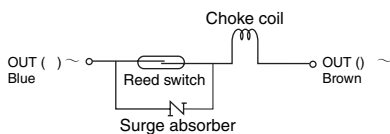
Note 3) Under 5 mA, the strength of the indicator light is poor. In some cases, visibility of the indicator light will not be possible where the output signal is less than 2.5 mA. However, there is no problem in terms of contact output, when an output signal exceeds 5 mA or more.

Auto Switch Internal Circuit

D-B54



D-B64



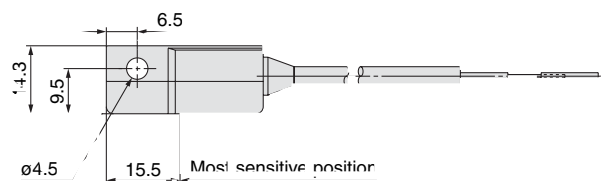
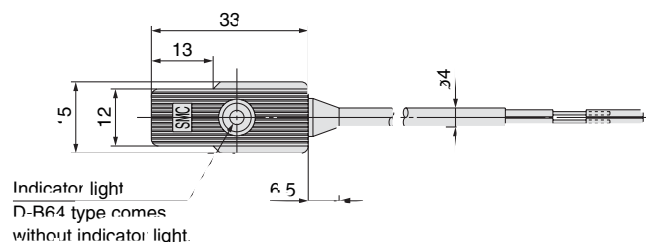
Weight

Unit: g

Auto switch part no.	D-B54	D-B64
Lead wire length (m)		
0.5	22	22
3	78	78
5	126	—

Dimensions

Unit: mm



Reed Switch: Band Mounting Style D-C73C/D-C80C



Connector



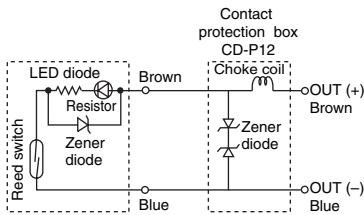
Caution

Operating Precautions

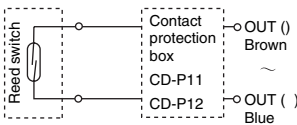
1. Confirm that the connector is appropriately tightened. If tightened insufficiently, the waterproof performance will deteriorate.
2. For how to handle a connector, refer to "Best Pneumatics 2004" Vol. 9 catalog.

Auto Switch Internal Circuit

D-C73C



D-C80C



- Note) ① In a case where the operation load is an inductive load
 ② In a case where the wiring load is greater than 5 m

Use the contact protection box in any of the above listed situations. The contact point life may decrease. (Refer to page 10 for contact protection box.)

Auto Switch Specifications

PLC: Programmable Logic Controller

D-C73C (With indicator light)	
Auto switch part no.	D-C73C
Applicable load	Relay, PLC
Load voltage	24 VDC
Load current range <small>Note 4)</small>	5 to 40 mA
Contact protection circuit	None
Internal voltage drop	2.4 V or less
Indicator light	Red LED illuminates when ON.
D-C80C (Without indicator light)	
Auto switch part no.	D-C80C
Applicable load	Relay, PLC
Load voltage	24 VAC/DC or less
Maximum load current	50 mA
Contact protection circuit	None
Internal resistance	1 Ω or less (including lead wire length of 3 m)
Standard	Conforming to CE Standards

● Lead wires — Oilproof heavy-duty vinyl cable ϕ 3.4, 0.2 mm² x 2 cores (Brown, Blue), 0.5 m

Note 1) Refer to page 10 for reed switch common specifications.

Note 2) Refer to page 10 for lead wire lengths

Note 3) Lead wire with connector may be shipped with switch.

Note 4) Under 5 mA, the strength of the indicator light is poor. In some cases, visibility of the indicator light will not be possible where the output signal is less than 2.5 mA. However, there is no problem in terms of contact output, when an output signal exceeds 5 mA or more.

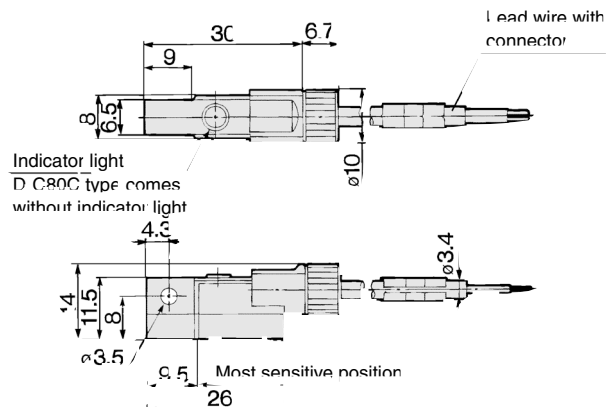
Weight

Unit: g

Auto switch part no.	D-C73C	D-C80C
Lead wire length (m)	0.5	14
	3	53
	5	83

Dimensions

Unit: mm

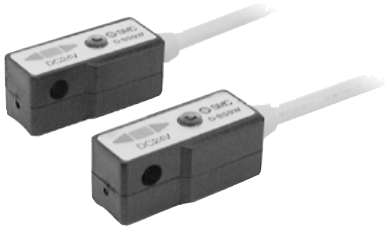


2-Color Indication Solid State Switch: Band Mounting Style D-B59W

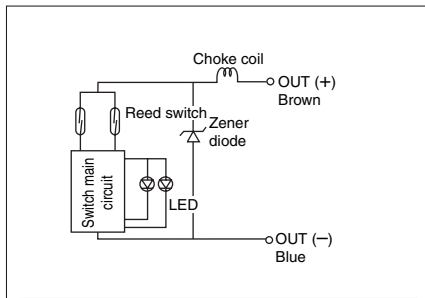


Grommet

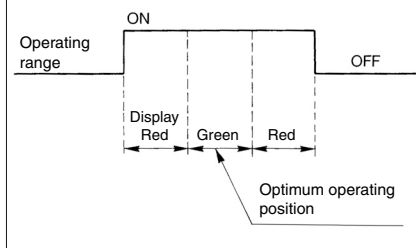
- The optimum operating position can be determined by the color of the light. (Red → Green → Red)



Auto Switch Internal Circuit



Indicator light / Display method



Auto Switch Specifications

PLC: Programmable Logic Controller

D-B59W (With indicator light)	
Auto switch part no.	D-B59W
Applicable load	Relay, PLC
Load voltage	24 VDC
Load current range ^{Note 3)}	5 to 40 mA
Contact protection circuit	Built-in
Internal voltage drop	4 V or less
Indicator light	Operating position Red LED illuminates. Optimum operating position Green LED illuminates.
Standard	Conforming to CE Standards

- Lead wires — Oilproof heavy-duty vinyl cable $\phi 4$, 0.3 mm² x 2 cores (Brown, Blue), 0.5 m

Note 1) Refer to page 10 for reed switch common specifications.

Note 2) Refer to page 10 for lead wire lengths

Note 3) Under 5 mA, the strength of the indicator light is poor. In some cases, visibility of the indicator light will not be possible where the output signal is less than 2.5 mA. However, there is no problem in terms of contact output, when an output signal exceeds 5 mA or more.

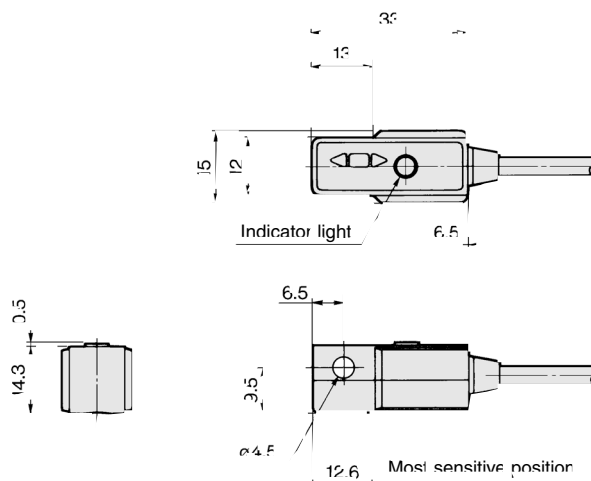
Weight

Unit: g

Auto switch part no.		D-B59W
Lead wire length (m)	0.5	20
	3	76
	5	—

Dimensions

Unit: mm



Solid State Switch: Direct Mounting Style D-M9N/D-M9P/D-M9B



Grommet

- 2-wire load current is reduced (2.5 to 40 mA).
- Lead free
- UL certified (style 2844) lead cable is used.
- Flexibility is 1.5 times greater than the conventional model (SMC comparison).
- Using flexible cable as standard spec.

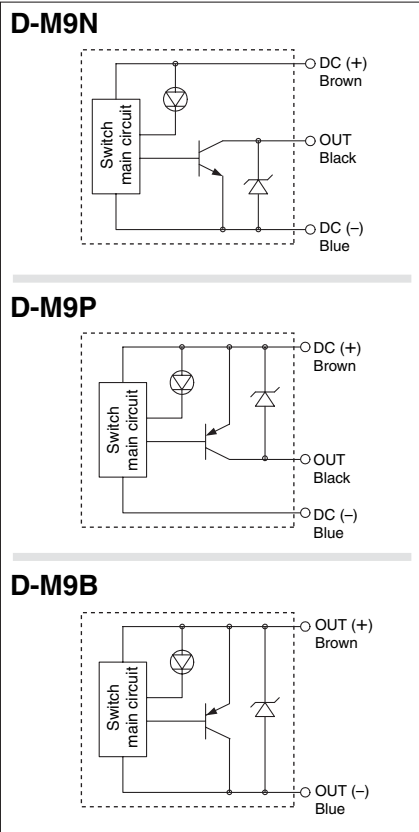


Caution

Operating Precautions

Fix the switch with the existing screw installed on the switch body. The switch may be damaged if a screw other than the one supplied, is used.

Auto Switch Internal Circuit



Auto Switch Specifications

PLC: Programmable Logic Controller

D-M9□ (With indicator light)			
Auto switch part no.	D-M9N	D-M9P	D-M9B
Electrical entry direction	In-line		
Wiring type	3-wire		2-wire
Output type	NPN	PNP	—
Applicable load	IC circuit, Relay, PLC		24 VDC relay, PLC
Power supply voltage	5, 12, 24 VDC (4.5 to 28 V)		
Current consumption	10 mA or less		
Load voltage	28 VDC or less	—	24 VDC (10 to 28 VDC)
Load current	40 mA or less		2.5 to 40 mA
Internal voltage drop	0.8 V or less		4 V or less
Leakage current	100 A or less at 24 VDC		0.8 mA or less
Indicator light	Red LED illuminates when ON.		
Standard	Conforming to CE Standards		

Lead wires

Oilproof heavy-duty vinyl cable: $\varnothing 2.7 \times 3.2$ ellipse

D-M9B 0.15 mm² x 2 cores

D-M9N, D-M9P 0.15 mm² x 3 cores

Note 1) Refer to page 10 for solid state switch common specifications.

Note 2) Refer to page 10 for lead wire lengths.

Weight

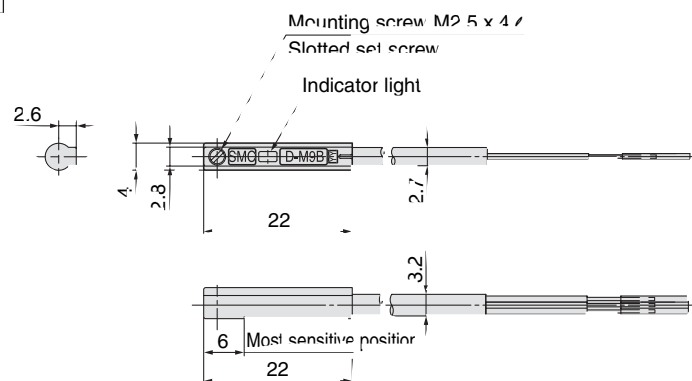
Unit: g

Auto switch part no.	D-M9N	D-M9P	D-M9B	
Lead wire length (m)	0.5	8	8	7
	3	41	41	38
	5	68	68	63

Dimensions

Unit: mm

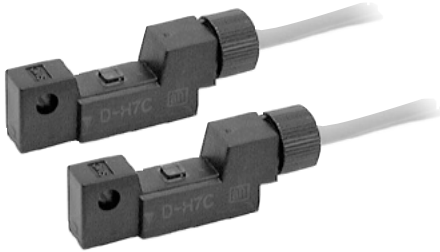
D-M9□



Solid State Switch: Band Mounting Style D-H7C



Connector

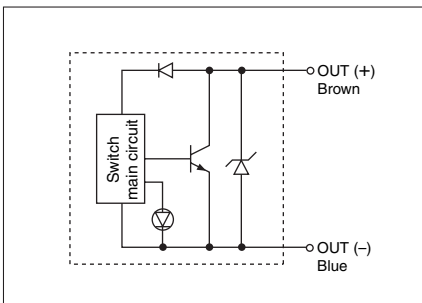


Caution

Operating Precautions

1. Confirm that the connector is appropriately tightened. If tightened insufficiently, the waterproof performance will deteriorate.
2. For how to handle a connector, refer to "Best Pneumatics 2004" Vol. 9 catalog.

Auto Switch Internal Circuit



Auto Switch Specifications

PLC: Programmable Logic Controller

D-H7C (With indicator light)	
Auto switch part no.	D-H7C
Wiring type	2-wire
Output type	—
Applicable load	24 VDC Relay, PLC
Power supply voltage	—
Current consumption	—
Load voltage	24 VDC (10 to 28 VDC)
Load current	5 to 40 mA
Internal voltage drop	4 V or less
Leakage current	0.8 mA or less at 24 VDC
Indicator light	Red LED illuminates when ON.
Standard	Conforming to CE Standards

- Lead wires — Oilproof heavy-duty vinyl cable: $\phi 3.4$ 0.2 mm² x 2 cores (Brown, Blue), 0.5 m
- Note 1) Refer to page 1C for solid state switch common specifications.
- Note 2) Refer to page 1C for lead wire lengths and lead wire with connector.

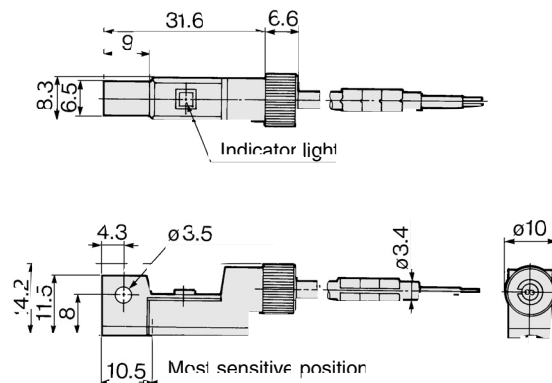
Weight

Unit: g

Auto switch part no.	D-H7C	
Lead wire length (m)	0.5	15
	3	54
	5	85

Dimensions

Unit: mm



2-Color Indication Solid State Switch: Direct Mounting Style

D-M9NW/D-M9PW/D-M9BW



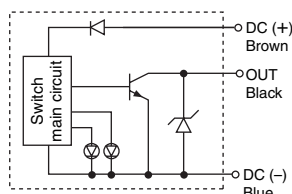
Grommet

- 2-wire load current is reduced (2.5 to 40 mA).
- RoHS compliant
- UL certified (style 2844) lead cable is used.
- The optimum operating position can be determined by the color of the light. (Red → Green → Red)

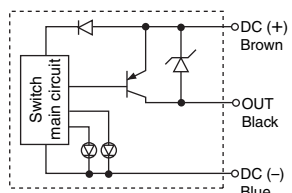


Auto Switch Internal Circuit

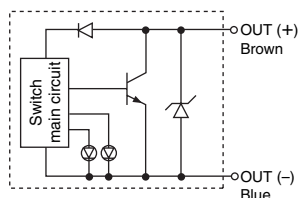
D-M9NW



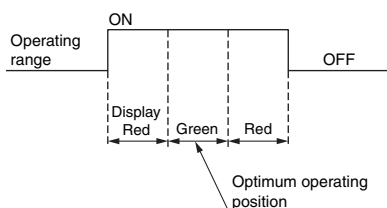
D-M9PW



D-M9BW



Indicator light / Display method



Auto Switch Specifications

PLC Programmable Logic Controller

D-M9□W (With indicator light)			
Auto switch part no.	D-M9NW	D-M9PW	D-M9BW
Electrical entry direction	In-line		
Wiring type	3-wire		2-wire
Output type	NPN	PNP	—
Applicable load	IC circuit, Relay, PLC		24 VDC relay, PLC
Power supply voltage	5, 12, 24 VDC (4.5 to 28 V)		
Current consumption	10 mA or less		
Load voltage	28 VDC or less	—	24 VDC (10 to 28 VDC)
Load current	40 mA or less		2.5 to 40 mA
Internal voltage drop	0.8 V or less at 10 mA (2 V or less at 40 mA)		
Leakage current	100 A or less at 24 VDC		0.8 mA or less
Indicator light	Operating position Red LED illuminates. Optimum operating position Green LED illuminates.		
Standard	Conforming to CE Standards		

● Lead wires

Oilproof heavy-duty vinyl cable: $\phi 2.7 \times 3.2$ ellipse

D-M9BW 0.15 mm² x 2 cores

D-M9NW, D-M9PW 0.15 mm² x 3 cores

Note 1) Refer to page 10 for solid state switch common specifications.

Note 2) Refer to page 10 for lead wire lengths.

Weight

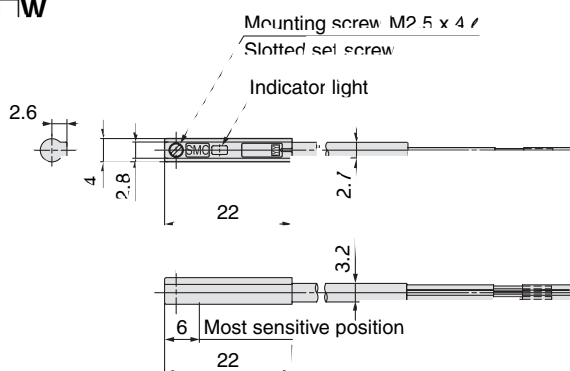
Unit: g

Auto switch part no.		D-M9NW	D-M9PW	D-M9BW
Lead wire length (m)	0.5	8	8	7
	1	14	14	13
	3	41	41	38
	5	68	68	63

Dimensions

Unit: mm

D-M9□W



Water Resistant 2-Color Indication Solid State Switch: Band Mounting Style D-H7BAL



Grommet

Water (coolant) resistant type

- The optimum operating position can be determined by the color of the light. (Red → Green → Red)



Caution

Operating Precautions

Please consult SMC if using coolant liquid other than water based solution.

Auto Switch Specifications

PLC: Programmable Logic Controller

D-H7BAL (With indicator light)	
Auto switch part no.	D-H7BAL
Wiring type	2-wire
Output type	—
Applicable load	24 VDC Relay, PLC
Power supply voltage	—
Current consumption	—
Load voltage	24 VDC (10 to 28 VDC)
Load current	5 to 40 mA
Internal voltage drop	4 V or less
Leakage current	0.8 mA or less at 24 VDC
Indicator light	Operating position Red LED illuminates. Optimum operating position Green LED illuminates.
Standard	Conforming to CE Standards

- Lead wires — Oilproof heavy-duty vinyl cable: $\phi 3, \phi 4, C.2 \text{ mm}^2 \times 2$ cores (Brown, Blue), 3 m (Standard)

Note 1) Refer to page 10 for solid state switch common specifications.

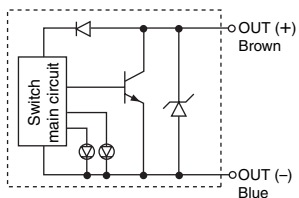
Note 2) Refer to page 10 for lead wire lengths

Weight

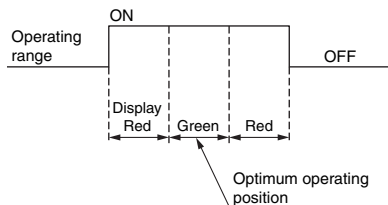
Unit: g

Auto switch part no.	D-H7BA	
Lead wire length (m)	0.5	—
	3	50
	5	81

Auto Switch Internal Circuit

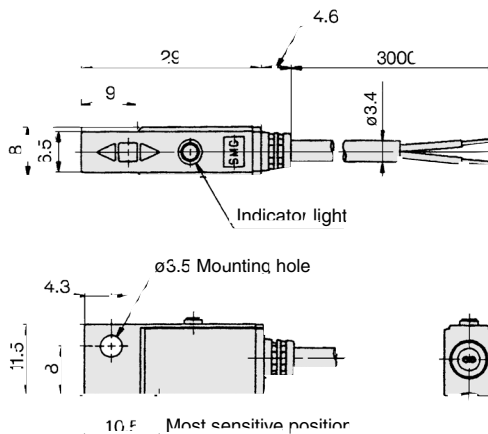


Indicator light / Display method



Dimensions

Unit: mm



2-Color Indication with Diagnostic Output Solid State Switch: Band Mounting Style D-H7NF



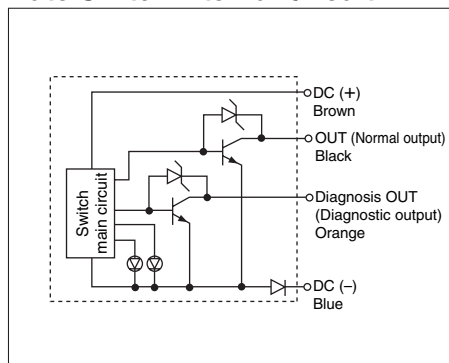
Grommet

Since the output signal can be detected in an unsteady detecting area, the difference of detecting position can be confirmed by the side of PLC (Programmable Logic Controller).

- The optimum operating position can be determined by the color of the light.
(Red → Green → Red)



Auto Switch Internal Circuit



Auto Switch Specifications

PLC: Programmable Logic Controller

D-H7NF (With indicator light)	
Auto switch part no.	D-H7NF
Wiring type	4-wire
Output type	NPN
Diagnostic output type	Normal operation
Applicable load	IC circuit, Relay, PLC
Power supply voltage	5, 12, 24 VDC (4.5 to 28 VDC)
Current consumption	10 mA or less
Load voltage	28 VDC or less
Load current	50 mA or less at the total amount of normal output and diagnostic output
Internal voltage drop	1.5 V or less (0.8 V or less at 5 mA)
Leakage current	100 A or less at 24 VDC
Indicator light	Operating position Red LED illuminates. Optimum operating position Green LED illuminates.
Standard	Conforming to CE Standards

- Lead wires Oilproof heavy-duty vinyl cable $\phi 3.4$ (0.2 mm² × 4 cores (Brown Black Orange Blue) 0.5 m
- Note 1) Refer to page 10 for solid state switch common specifications.
- Note 2) Refer to page 10 for lead wire lengths.

Weight

Unit: g

Auto switch part no.		D-H7NF
Lead wire length (m)	0.5	13
	3	56
	5	90

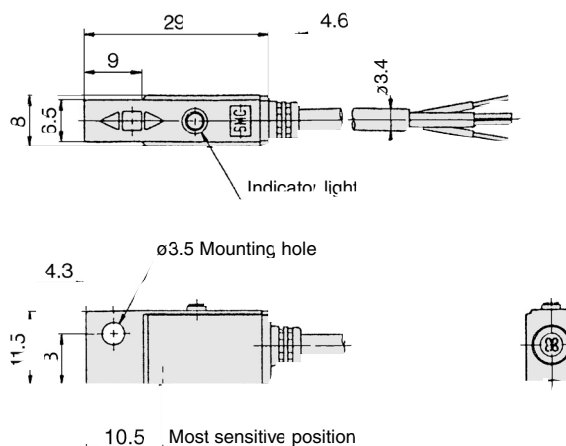
Diagnostic Output Operation

The diagnostic signal is output within unsteady detecting area (where indicator light is Red), and the diagnostic output becomes OFF when the detecting position remains within the optimum operating position (where indicator is Green). When the detecting position is not adjusted, the diagnostic output becomes ON.

Indicator light	OFF	ON		OFF	Red
		Bar	Green		
OUT (Normal output)	OFF	ON	ON	ON	ON
Diagnosis OUT (Diagnostic output)	OFF	ON	OFF	ON	ON

Dimensions

Unit: mm



Series MLGC Simple Specials

These changes are dealt with Simple Specials System.

Symbol

1 Tapped Hole, Drilled Hole, Pinned Hole Machined Additionally

XC79

This simple special is meant for machining additionally tapped hole, drilled hole and pinned hole, as requested from customer, on parts designed largely for mounting a workpiece, etc. in the combined air cylinders

But, for each model, since they have the portions which are impossible to machine additionally, refer to the additional machining limitation

Precautions

- We cannot take any responsibility as for the intensity of hole machined additionally and the effects of decreased intensity or the product itself.
- It will not be plated again for the machined part additionally.
- Be sure to fill in "through" for through-hole, and "effective depth" for blind hole.
- When using by machining through-hole additionally, ensure that the tip of the bolt, etc. for mounting workpiece should not stick into the cylinder side. It may result in an unexpected problem.
- Use caution not to interfere the existing mounting hole on the standard products with the hole to be machined additionally. But it is possible to drill additionally the larger size of hole at the same position as the existing hole.

Common Complementary Explanation / Holes which can be additionally machined are the following 3 types.

Tapped hole	Drilled hole	Pinned hole												
<p>Designated nominal diameter and tapped hole of a pitch are machined additionally. (Maximum nominal thread diameter M20)</p> <p>Blind hole is deep into the bottom of prepared hole which sums up A to C in Fig. 1 in contrast to the effective depth of tapped hole. When there is a condition which does not allow through-hole, etc., leave sufficient thickness in the inner part of hole.</p> <p>Note) P stands for thread pitch.</p>	<p>Drilled hole of a designated internal diameter is machined. (Maximum hole diameter 20 mm)</p> <p>If you wish for blind hole, instruct us with effective depth. (Refer to Fig. 2.) Besides, dimensional accuracy for internal diameter will be ± 0.2 mm.</p> <p>$C = 0.3D$</p>	<p>Pinned hole of a designated diameter (reamer hole) is machined. (Maximum hole diameter 20 mm)</p> <p>Internal dimension tolerates H7 tolerance to the designated hole diameter. (Refer to the table below.)</p> <table border="1"> <thead> <tr> <th>Hole dia.</th> <th>3 or less</th> <th>Over 3, 6 or less</th> <th>Over 6, 10 or less</th> <th>Over 10, 18 or less</th> <th>Over 18, 20 or less</th> </tr> </thead> <tbody> <tr> <td>Tolerance</td> <td>+0.01 0</td> <td>+0.012 0</td> <td>+0.015 0</td> <td>+0.018 0</td> <td>+0.021 0</td> </tr> </tbody> </table>	Hole dia.	3 or less	Over 3, 6 or less	Over 6, 10 or less	Over 10, 18 or less	Over 18, 20 or less	Tolerance	+0.01 0	+0.012 0	+0.015 0	+0.018 0	+0.021 0
Hole dia.	3 or less	Over 3, 6 or less	Over 6, 10 or less	Over 10, 18 or less	Over 18, 20 or less									
Tolerance	+0.01 0	+0.012 0	+0.015 0	+0.018 0	+0.021 0									

Limitation for Machining Additionally / Since the slanted lines denote the restricted range for machining additionally design the dimensions, referring to below

Series MLGC		Front plate material: Iron																										
Connecting port side	Mounting side																											
		<p>Dimensional Range Not Possible to Machine Additionally (mm)</p> <table border="1"> <thead> <tr> <th>Bore size</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>19</td> <td>10</td> <td>28</td> <td>16</td> </tr> <tr> <td>25</td> <td>24</td> <td>13</td> <td>36</td> <td>20</td> </tr> <tr> <td>32</td> <td>24</td> <td>13</td> <td>36</td> <td>20</td> </tr> <tr> <td>40</td> <td>30</td> <td>15</td> <td>42</td> <td>25</td> </tr> </tbody> </table>				Bore size	A	B	C	D	20	19	10	28	16	25	24	13	36	20	32	24	13	36	20	40	30	15
Bore size	A	B	C	D																								
20	19	10	28	16																								
25	24	13	36	20																								
32	24	13	36	20																								
40	30	15	42	25																								






Series MLGC

Safety Instructions

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

■Explanation of the Labels

Labels	Explanation of the labels
 Danger	In extreme conditions, there is a possible result of serious injury or loss of life.
 Warning	Operator error could result in serious injury or loss of life.
 Caution	Operator error could result in injury ^{Note 3)} or equipment damage. ^{Note 4)}

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems

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

Note 3) Injury indicates light wounds, burns and electrical shocks that do not require hospitalization or hospital visits for long-term medical treatment.

Note 4) Equipment damage refers to extensive damage to the equipment and surrounding devices.

■Selection/Handling/Applications

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

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or post analysis and/or tests to meet the specific requirements. The expected performance and safety assurance are the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

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

Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators. (Understanding JIS B 8370 General Rules for Pneumatic Equipment, and other safety rules are included.)

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

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven objects have been confirmed.
2. When equipment is removed, confirm that safety process as mentioned above. Turn off the supply pressure for this equipment and exhaust all residual compressed air in the system, and release all the energy (liquid pressure, spring, condenser, gravity).
3. Before machinery/equipment is restarted, take measures to prevent quick extension of a cylinder piston rod, etc.

4. Contact SMC if the product will 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, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, requiring special safety analysis.
4. If the products are used in an interlock circuit, prepare a double interlock style circuit with a mechanical protection function for the prevention of a breakdown. And, examine the devices periodically if they function normally or not.

■Exemption from Liability

1. SMC, its officers and employees shall be exempted from liability for any loss or damage arising out of earthquakes or fire, action by a third person, accidents, customer error with or without intention, product misuse, and any other damages caused by abnormal operating conditions.

2. SMC, its officers and employees shall be exempted from liability for any direct or indirect loss or damage, including consequential loss or damage, loss of profits, or loss of chance, claims, demands, proceedings, costs, expenses, awards, judgments and any other liability whatsoever including legal costs and expenses, which may be suffered or incurred, whether in tort (including negligence), contract, breach of statutory duty, equity or otherwise.

3. SMC is exempted from liability for any damages caused by operations not contained in the catalogs and/or instruction manuals, and operations outside of the specification range.

4. SMC is exempted from liability for any loss or damage whatsoever caused by malfunctions of its products when combined with other devices or software.



Series *MLGC* Auto Switches Precautions 1

Be sure to read this before handling.

Design and Selection

Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications of current load, voltage, temperature or impact. We do not guarantee any damage in any case the product is used outside of the specification range.

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

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate. However if the speed is too great, the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

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

In cases of high piston speed, the use of an auto switch (D-G5NTL) with a built-in OFF delay timer (200 ms) makes it possible to extend the load operating time.

Wide range detection type, D-G5NBL (operating range 35 to 45 mm) is also available.

3. Keep wiring as short as possible.

<Reed switch>

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

Use a contact protection box when the wire length is 5 m or longer.

<Solid state switch>

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

If the wiring is longer it will likely increase noise although the length is less than 100 m.

When the wire length is long, we recommend attaching the ferrite core to the both ends of the cable to prevent excess noise.

4. Do not use a load that generates surge voltage. If a surge voltage is generated, the discharge occurs at the contact, possibly resulting in the shortening of product life.

<Reed switch>

If driving a load such as a relay that generates a surge voltage, use a contact protection box.

<Solid state switch>

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

5. Cautions for use in an interlock circuit

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

6. Do not make any modifications to the product.

Do not take the product apart. It may cause human injuries and accidents.

Caution

1. Take precautions when multiple actuators are used close together.

When two or more actuators are lined up in close proximity to each other, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40 mm.

(When the allowable interval is specified for each cylinder series, use the indicated value.) The auto switches may malfunction due to the interference from the magnetic fields.

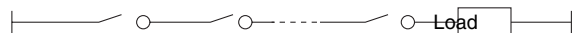
2. Take note of the internal voltage drop of the switch.

<Reed switch>

1) Switches with an indicator light (Except D-A96)

- If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.) [The voltage drop will be "n" times larger when "n" auto switches are connected.]

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



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

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

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

<Solid state switch>

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

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



Series *MLGC* Auto Switches Precautions 2

Be sure to read this before handling.

Design and Selection

Caution

3. Pay attention to leakage current.

<Solid state switch>

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

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

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. Refer to “Best Pneumatics 2004” Vol. 9.

4. Ensure sufficient clearance for maintenance activities.

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

5. Minimum stroke for auto switch mounting

The minimum stroke value for mounting one or two auto switches is obtained when the switch can detect at the cylinder stroke ends.

However, even if the switch is mounted at the proper position within the minimum stroke range, it may not be able to detect when the piston stops in the middle of the stroke due to a stopper, etc. It may also turn on in the middle of a stroke.

6. When multiple auto switches are required

“n” indicates the number of switch which can be physically mounted. Detection intervals depends on the switch mounting structure and set position therefore some required interval and set positions may not be available.

7. Limitations of detectable positioning

When using certain mounting brackets, the surface and position where an auto switch can be mounted maybe restricted due to physical interference. For example, when using some bracket types the switch cannot be surface mounted at an angle of 180 degrees.

Please select the set position of the auto switch so that it does not interfere with the rear plate of the cylinder.

8. Use the cylinder and switch in proper combination.

The auto switch is pre-adjusted to activate properly for an auto-switch-capable SMC cylinder.

If the auto switch is mounted improperly, used for another brand of cylinder or used after the alternation of the machine installation, the switch may not activate properly.

Mounting and Adjustment

Warning

1. Instruction manual

Install the products and operate them only after reading the instruction manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

2. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300 m/s² or more for reed switches and 1000 m/s² or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

3. Mount switches using the proper fastening torque.

When a switch is tightened beyond the range of fastening torque, the mounting screws, mounting bracket or switch may be damaged. On the other hand, tightening below the range of fastening torque may allow the switch to slip out of position. (For mounting and moving auto switches, tightening torque, etc., refer to each series.)

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 position shown in a catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable or the service life will be shortened.

<D-M9□>

When the D-M9□ auto switch is used to replace old series auto switch, it may not activate depending on operating condition because of its shorter operating range.

Such as

- Application where the stop position of actuator may vary and exceed the operating range of the auto switch, for example, pushing, pressing, clamping operation, etc.
- Application where the auto switch is used for detecting an intermediate stop position of the actuator. (In this case the detecting time will be reduced.)

In these applications, set the auto switch to the center of the required detecting range.

Caution

1. Do not carry an actuator by the auto switch lead wires.

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

2. Fix the switch with appropriate screw installed on the switch body. If using other screws, switch may be damaged.



Series *MLGC* Auto Switches Precautions 3

Be sure to read this before handling.

Wiring

Warning

1. Confirm proper insulation of wiring.

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

2. Do not wire with power lines or high voltage lines.

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

Caution

1. Avoid repeatedly bending or stretching lead wires.

Repeated bending or tensile force applied to the lead wire may cause the sheath to fall off or disconnection of the wire.

If bending or tensile force are not avoidable, fix the lead wire close to the switch and allow a bend radius of R40 to 80 mm or larger. Please consult SMC for details. Stress and tensile force applied to the connection between the cable and switch increases the possibility of disconnection.

Fix the cable in the middle so that it is not movable in the area where it connects with the switch.

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

<2-wire type>

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

It is the same as when the 2-wire brown cord (+, output) is directly connected to the (+) power supply terminal.

3. Do not allow short circuit of loads.

<Reed switch>

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

<Solid state switch>

Model D-M9□ and all models of PNP output type switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged, as in the case of reed switches.

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

Caution

4. Avoid incorrect wiring.

<Reed switch>

A 24 VDC switch with indicator light has polarity. The brown lead wire is (+) and the blue lead wire 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-A93, C73C, B54

2) When using D-B59W, the switch will constantly remain ON if the connections are reversed.

<Solid state switch>

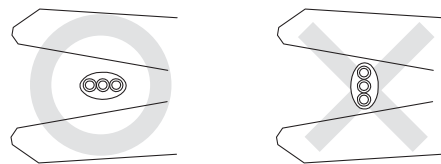
1) If connections are reversed on a 2-wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this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

<D-M9□>

D-M9□ does not have built-in short circuit protection circuit. Be aware that if the power supply connection is reversed (e.g. (+) power supply wire and (–) power supply wire connection is reversed), the switch will be damaged.

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



Recommended Tool

Model name	Model no.
Wire stripper	D-M9N-SWY

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



Series *MLGC* Auto Switches Precautions 4

Be sure to read this before handling.

Operating Environment

Warning

- 1. Never use in an atmosphere of explosive gases.**
The construction of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.
- 2. Do not use in an area where a magnetic field is generated.**
Auto switches will malfunction or magnets inside actuators will become demagnetized.
- 3. Do not use in an environment where the auto switch will be in water or continually exposed to water.**
Although switches, satisfy IEC standard IP67 construction (JIS C 0920: waterproof construction), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.
- 4. Do not use in an environment with oil or chemicals.**
Please 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.
- 5. Do not use in an environment with temperature cycles.**
Please 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 (300 m/s² or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1 ms or less). Please consult SMC regarding the need to use a solid state switch depending upon the environment.
- 7. Do not use in an area where surges are generated.**
<Solid state switch>
When there are units (solenoid type lifter, high frequency induction furnace, motor, radio equipment etc.) which generate large surges or electromagnetic waves in the area around actuators with solid state auto switches, this may cause deterioration or damage to the switches. Avoid sources of surge generation and crossed lines.

Caution

- 1. Avoid accumulation of iron debris or close contact with magnetic substances.**
When a large amount of ferrous debris such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch actuator, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the actuator.
- 2. Please consult SMC concerning water resistance, elasticity of lead wires, usage at welding sites, etc.**
- 3. Do not use in direct sunlight.**
- 4. Do not mount the product in locations where it is exposed to radiant heat.**

Maintenance

Warning

- 1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.**
 - 1) Securely tighten 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 the 2-color indicator type switch.
Confirm that the green LED is turned on when stopped at the established position. If the red LED is turned on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.
- 2. Maintenance procedures are outlined in the operation manual.**
Not following proper procedures could cause the product to malfunction and could lead to damage to the equipment or machine.
- 3. Removal of equipment, and supply/exhaust of compressed air**
Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.
When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent actuators from sudden movement.



Series MLGC Specific Product Precautions

Be sure to read this before handling. For Safety Instructions, Actuators Precaution, refer to “Precautions for Handling Pneumatic Devices” (M-03-E3A).

Mounting and Adjustment

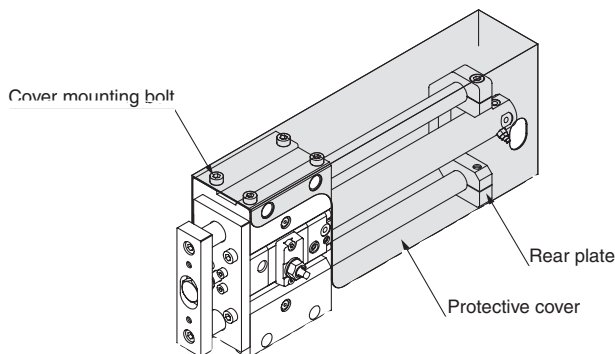
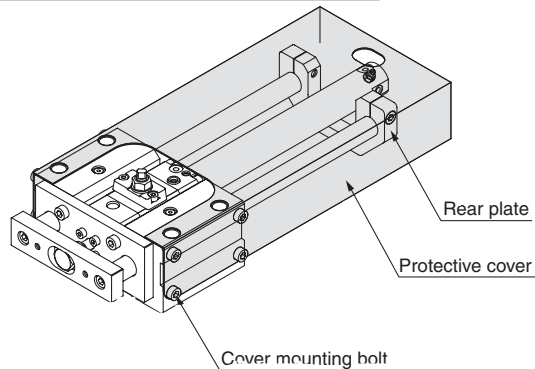
Warning

1. Installing a protective cover (In the case of rear plate)

During mounting, handling and operation the rear plate makes reciprocating movements. Therefore, pay careful attention not to insert your hand, etc. between the cylinder and the rear plate.

When you are going to fit this product to the outside of your equipment, take preventative measures such as installing a protective cover

Protective cover installation example



Caution on Handling the Fine Lock Cylinder

Caution

- 1 For details, make sure to refer to “Fine Lock Cylinder (CLG1 series)” in “Best Pneumatics 2004” Vol. 9 catalog.

Caution

1. Use caution that no scratch or dent will be given to the slide part of the guide rod.

Because the outer circumference of the guide rod is manufactured with precise tolerances even a slight deformation, scratch or gouge can lead to faulty operation or reduced durability.

2. When fitting the guide body, use the guide body which has high flatness of the fitting surface.

If the guide rod has twisted operation resistance will become abnormally higher and the bearing will wear at an early stage, thereby resulting in poor performance.

3. Allow an ample space around the cylinder

Ensure enough clearance around the cylinder to allow for unobstructed maintenance and inspection work.

4. Do not adjust the rod stroke by moving the rear plates.

The resulting impact cannot be absorbed easily the stroke position cannot be maintained, and faulty operation may ensue.

5. Lubrication

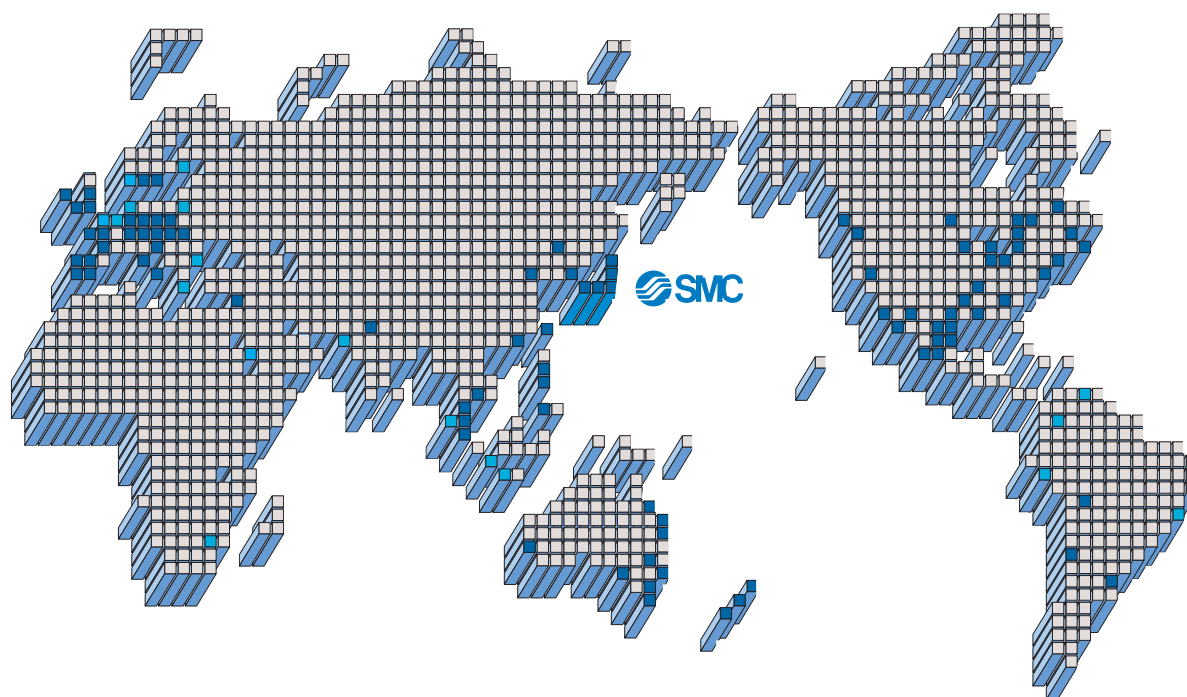
To prevent foreign particles from mixing with the grease, use a grease applicator that has a check valve. Use a high-quality lithium soap-based no. 2 grease.

6. Mounting orientation

For ceiling mount (opening of the rear plate face downwards), the base cylinder head end and the rear plate may interfere due to the deflection of the guide rod.



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Safety Instructions

Be sure to read "Precautions for Handling Pneumatic Devices" (M-03-E3A) before using.

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