



# Compact Cylinder/Guide Rod Type

# Series CQM

ø12, ø16, ø20, ø25, ø32, ø40, ø50

## How to Order

Without auto switch

CQM B 20 10

With auto switch

CDQM B 20 10 M9B S

With auto switch  
Mounting

<b>B</b>	Through-hole (standard)
<b>A</b>	Both end tapped (ø32 to ø50)

Note 1) Cylinder bodies of ø12 to ø25 are common for both B (through hole) and A (both end tapped) types. Symbol to order is unified to "B" for those sizes.

Note 2) Contact SMC for the other mounting types.

Bore size

12	12 mm
16	16 mm
20	20 mm
25	25 mm
32	32 mm
40	40 mm
50	50 mm

Port thread/Mounting thread type

Symbol	Port thread	Mounting thread	Bore size
Nil	M thread	M thread	ø12 to ø25
	Rc		
	NPT		
TN	NPT	M thread	ø32 to ø50
TF	G		
NN	M thread	Inch thread	ø12 to ø25
	NPT		

Note 3) M thread to be used for without auto switch type of ø32, 5 stroke exceptionally.

Number of auto switches

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

Auto switch type

Nil	Without auto switch (Built-in magnet cylinder)
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\* Refer to the table below for auto switch model numbers.

\* Auto switches are packed together when shipped (unassembled). (Except for D-P5DWL)

Cylinder stroke (mm)

Refer to the next page for standard and intermediate strokes.

Applicable auto switches/Refer to page 5.3-2 to 5.3-75 of Best Pneumatics vol. 2 for detailed auto switch specifications.

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage			Rail mounting		Direct mounting		Lead wire length (m)*				Applicable load				
					DC	AC	ø32 to ø50		ø12 to ø50		0.5 (Nil)	3 (L)	5 (Z)	None (N)						
							Perpendicular	In-line	Perpendicular	In-line										
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	—	5 V	—	—	A76H	A96V	A96	●	●	—	—	IC circuit	—			
				2-wire	24 V	100 V	—	—	200 V	A72	A72H	—	—	●	●	—	—	—	—	
							12 V	—	—	A73	A73H	—	—	●	●	●	—	—	—	
							5 V, 12 V	—	—	A80	A80H	A90V	A90	●	●	—	—	—	IC circuit	Relay, PLC
							12 V	—	—	—	—	A93V	A93	●	●	—	—	—	—	
							12 V	—	—	A73C	—	—	—	●	●	●	●	—	—	
							5 V, 12 V	—	—	A80C	—	—	—	—	—	—	—	—	—	—
—	—	—	A79W	—	—	—	—	—	—	●	●	—	—	—	—					
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	F7NV	F79	M9NV	M9N	●	●	○	—	IC circuit	Relay, PLC			
				3-wire (PNP)				F7PV	F7P	M9PV	M9P	●	●	○	—	—				
				2-wire				F7BV	J79	M9BV	M9B	●	●	○	—	—				
								J79C	—	—	—	●	●	●	●	—		—		
				Connector				3-wire (NPN)	F7NWW	F79W	F9NWW	F9NW	●	●	○	—		—	—	—
		3-wire (PNP)	—		F7PW	F9PWW	F9PW	●	●	○	—	—	—	—	—					
		2-wire	F7BWW		J79W	F9BWW	F9BW	●	●	○	—	—	—	—	—	—				
			—		F7BA	—	F9BA	—	●	○	—	—	—	—	—	—				
			—		F7BAV	—	—	—	—	●	○	—	—	—	—	—				
		Water resistant (2-colour display)	—	—	—	—	—	—	—	—	—	●	●	—	—	—		—		
Magnetic field resistant (2-colour display)	—	—	—	—	—	—	—	—	—	—	●	●	—	—	—					
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				

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

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

- In addition to the models in the above table, there are some other auto switches that are applicable. For more information, please refer to page 10.
- D-P5DWL type: ø40 and ø50 only available.

Order made specifications → Contact SMC.

- -50 Without indicator light
- -61 Flexible lead wire
- Pre-wire connector

# Compact Cylinder/Guide Rod Type **Series CQM**



## ⚠ Caution

This product should not be used as a stopper.

## Specifications

<b>Model</b>	Pneumatic (non-lube) type	
<b>Action</b>	Double acting single rod	
<b>Fluid</b>	Air	
<b>Proof pressure</b>	1.5 MPa	
<b>Maximum operating pressure</b>	1.0 MPa	
<b>Minimum operating pressure</b>	ø12, 16	0.12 MPa
	ø20 to 50	0.1 MPa
<b>Ambient and fluid temperature</b>	Without auto switch: -10°C to 70°C (with no freezing) With auto switch: -10°C to 60°C (with no freezing)	
<b>Cushion</b>	Rubber bumper at both ends	
<b>Stroke length tolerance</b>	+1.0 mm 0	
<b>Mounting</b>	Through-holes	
<b>Piston speed</b>	ø12 to 40	50 to 500 mm/s
	ø50	50 to 300 mm/s

## Standard Stroke

Bore size (mm)	Standard stroke (mm)
<b>12, 16</b>	5, 10, 15, 20, 25, 30
<b>20, 25</b>	5, 10, 15, 20, 25, 30, 35, 40, 45, 50
<b>32, 40</b>	5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 75, 100
<b>50</b>	10, 15, 20, 25, 30, 35, 40, 45, 50, 75, 100

## Manufacture of Intermediate Stroke

Description		Intermediate stroke range	
Spacers are installed in a standard stroke cylinder.		Bore size (mm)	Intermediate stroke range (mm)
		<b>12, 16</b>	1 to 29
		<b>20, 25</b>	1 to 49
Bore size (mm)	Description	<b>32</b>	1 to 99
<b>12 to 32</b>	Available in 1 mm stroke increments	<b>40, 50</b>	5 to 95
<b>40, 50</b>	Available in 5 mm stroke increments		

Example) Part number: CQMB32-57

It is produced by installing a 18 mm spacer in a standard stroke cylinder CQMB32-75. B dimension: 108 mm.

## Theoretical Output

Unit: N

Bore size (mm)	Operating direction	Operating pressure (MPa)		
		0.3	0.5	0.7
<b>12</b>	IN	25	42	59
	OUT	34	57	79
<b>16</b>	IN	45	75	106
	OUT	60	101	141
<b>20</b>	IN	71	118	165
	OUT	94	157	220
<b>25</b>	IN	113	189	264
	OUT	147	245	344
<b>32</b>	IN	181	302	422
	OUT	241	402	563
<b>40</b>	IN	317	528	739
	OUT	377	628	880
<b>50</b>	IN	495	825	1150
	OUT	589	982	1370

## Auto Switch Mounting Bracket Weight

Mounting bracket part no.	Applicable cylinder bore size	Weights (g)
BQ-2	ø32 to ø50	1.5
BQP1-050	ø40, ø50	16

## Weight

### Without auto switch

Unit: g

Bore size (mm)	Cylinder stroke (mm)											
	5	10	15	20	25	30	35	40	45	50	75	100
<b>12</b>	44	52	60	69	77	86	—	—	—	—	—	—
<b>16</b>	56	67	77	87	97	108	—	—	—	—	—	—
<b>20</b>	92	107	122	137	152	167	183	198	213	227	—	—
<b>25</b>	125	143	162	180	198	216	234	252	270	288	—	—
<b>32</b>	182	205	228	250	274	297	320	343	366	389	553	669
<b>40</b>	269	295	320	345	370	396	421	446	471	497	692	823
<b>50</b>	—	500	540	580	620	661	701	740	780	821	1133	1341

### With auto switch (built-in magnet)

Unit: g

Bore size (mm)	Cylinder stroke (mm)											
	5	10	15	20	25	30	35	40	45	50	75	100
<b>12</b>	52	59	68	77	84	93	—	—	—	—	—	—
<b>16</b>	66	77	87	97	107	118	—	—	—	—	—	—
<b>20</b>	122	138	153	168	182	197	213	227	242	257	—	—
<b>25</b>	168	186	205	223	240	258	277	295	313	331	—	—
<b>32</b>	241	264	287	309	333	356	379	401	425	448	564	680
<b>40</b>	345	371	396	421	447	473	498	523	548	574	705	836
<b>50</b>	—	618	658	698	738	779	819	858	898	939	1147	1355

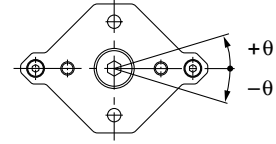
Add each weight of auto switches and mounting brackets.

Refer to pages 14 to 18 for auto switch weight.

## Plate Non-rotating Accuracy

Non-rotating accuracy without load is designed to be same or less than the figures shown in the table below at the retracted cylinder end (plate).

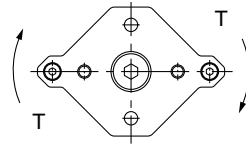
Bore size (mm)	Non-rotating accuracy
12, 16	±0.2°
20 to 50	±0.1°



## Plate Allowable Rotational Torque

**Make sure to operate strictly within the allowable rotation torque range to the plate.**

Operation outside of this range may result in shorter service life or damage to the devise.



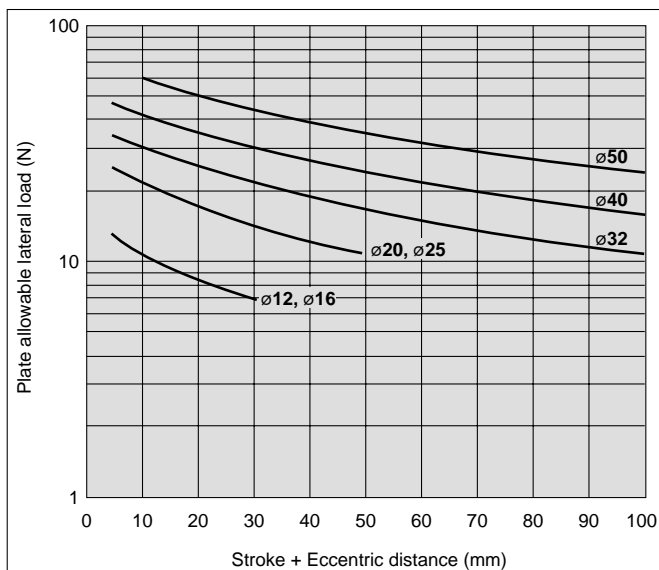
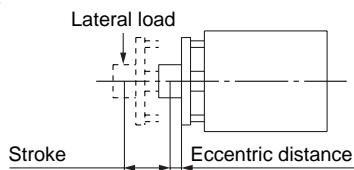
Unit: N·m

Bore size (mm)	Cylinder stroke (mm)											
	5	10	15	20	25	30	35	40	45	50	75	100
12	0.11	0.10	0.08	0.07	0.07	0.06	—	—	—	—	—	—
16	0.15	0.12	0.11	0.10	0.09	0.08	—	—	—	—	—	—
20	0.37	0.32	0.28	0.25	0.23	0.21	0.19	0.18	0.17	0.16	—	—
25	0.40	0.35	0.31	0.28	0.25	0.23	0.21	0.20	0.18	0.17	—	—
32	0.66	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.25	0.20
40	1.06	0.96	0.88	0.81	0.75	0.70	0.65	0.61	0.58	0.55	0.43	0.36
50	—	1.70	1.56	1.45	1.35	1.26	1.19	1.12	1.06	1.01	0.80	0.67

## Plate Allowable Lateral Load

**Make sure to operate strictly within the allowable lateral load range to the plate.**

Operation outside of this range may result in shorter service life or damage to the devise.

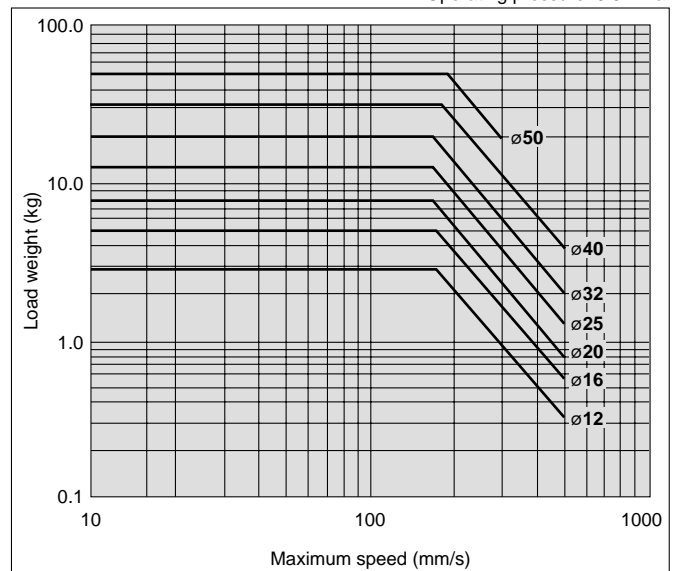


## Allowable Kinetic Energy

**Make sure to operate strictly within the allowable range of the load weight and maximum speed.**

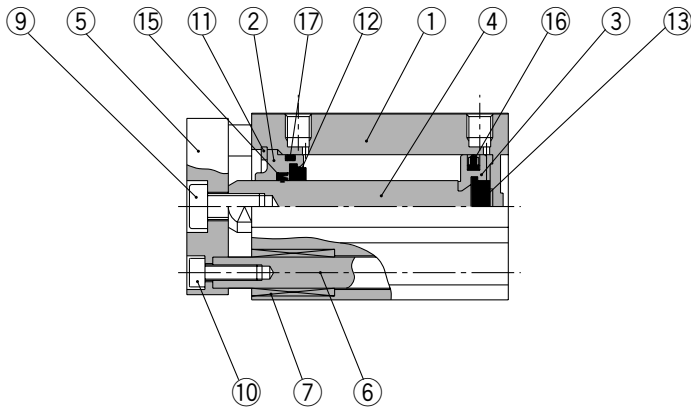
Operation outside of this range may cause excessive impact, which may result in the damage to the devise.

Operating pressure: 0.5 MPa

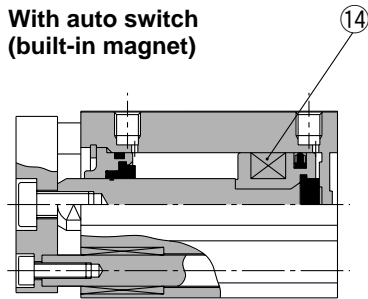


## Construction

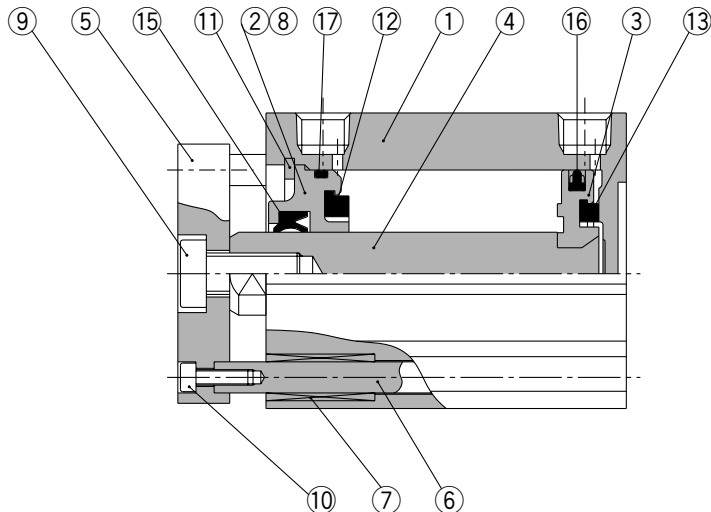
ø12 to 25



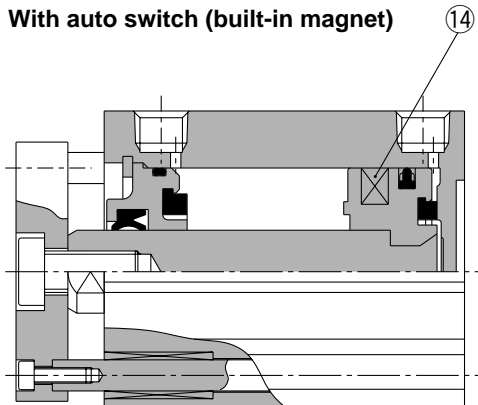
With auto switch  
(built-in magnet)



ø32 to 50



With auto switch (built-in magnet)



### Parts list

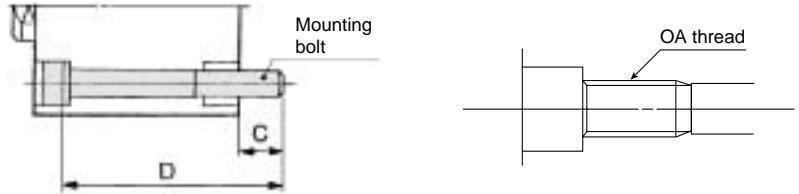
No.	Description	Material	Note
1	<b>Cylinder tube</b>	Aluminum alloy	Hard anodized
2	<b>Collar</b>	Aluminum alloy	ø12 to ø40 Anodized
		Aluminum alloy casted	ø50 Chromated, Coated
3	<b>Piston</b>	Aluminum alloy	Chromated
4	<b>Piston rod</b>	Stainless steel	ø12 to ø25
		Carbon steel	ø32 to ø50 Hard chrome plated
5	<b>Plate</b>	Aluminum alloy	Anodized
6	<b>Guide rod</b>	Stainless steel	Hard chrome plated
7	<b>Bushing</b>	Oil-impregnated sintered alloy	
8	<b>Bushing</b>	Bronze casting	ø50 only
9	<b>Hexagon socket head cap screw</b>	Carbon steel	Nickel plated
10	<b>Hexagon socket head cap screw</b>	Carbon steel	Nickel plated
11	<b>Snap ring</b>	Carbon tool steel	Phosphate coated
12	<b>Bumper A</b>	Urethan	
13	<b>Bumper B</b>	Urethan	
14	<b>Magnet</b>	—	
15	<b>Rod seal</b>	NBR	
16	<b>Piston seal</b>	NBR	
17	<b>Gasket</b>	NBR	

# Series CQM

## Mounting bolt

Mounting method: Mounting bolt for through-hole style of CQMB is available as an option.

Ordering: Add the word "Bolt" in front of the bolts to be used.  
Example) Bolt M3 x 25 ℓ 2 pcs.



Note) To install a through-hole type mounting bolt, bore size 12 to 25 mm, make sure to use the flat washer that is provided.

## Mounting Bolt for CQM/Without Auto Switch

Model	C	D	Mounting bolt
<b>CQMB12-5</b>	6.5	25	M3 x 25 ℓ
<b>-10</b>		30	x 30 ℓ
<b>-15</b>		35	x 35 ℓ
<b>-20</b>		40	x 40 ℓ
<b>-25</b>		45	x 45 ℓ
<b>-30</b>		50	x 50 ℓ
<b>CQMB16-5</b>	6.5	25	M3 x 25 ℓ
<b>-10</b>		30	x 30 ℓ
<b>-15</b>		35	x 35 ℓ
<b>-20</b>		40	x 40 ℓ
<b>-25</b>		45	x 45 ℓ
<b>-30</b>		50	x 50 ℓ
<b>CQMB20-5</b>	6.5	25	M5 x 25 ℓ
<b>-10</b>		30	x 30 ℓ
<b>-15</b>		35	x 35 ℓ
<b>-20</b>		40	x 40 ℓ
<b>-25</b>		45	x 45 ℓ
<b>-30</b>		50	x 50 ℓ
<b>-35</b>		55	x 55 ℓ
<b>-40</b>		60	x 60 ℓ
<b>-45</b>		65	x 65 ℓ
<b>-50</b>		70	x 70 ℓ

Model	C	D	Mounting bolt
<b>CQMB25-5</b>	8.5	30	M5 x 30 ℓ
<b>-10</b>		35	x 35 ℓ
<b>-15</b>		40	x 40 ℓ
<b>-20</b>		45	x 45 ℓ
<b>-25</b>		50	x 50 ℓ
<b>-30</b>		55	x 55 ℓ
<b>-35</b>	60	x 60 ℓ	
<b>-40</b>	65	x 65 ℓ	
<b>-45</b>	70	x 70 ℓ	
<b>-50</b>	75	x 75 ℓ	
<b>CQMB32-5</b>	9	30	M5 x 30 ℓ
<b>-10</b>		35	x 35 ℓ
<b>-15</b>		40	x 40 ℓ
<b>-20</b>		45	x 45 ℓ
<b>-25</b>		50	x 50 ℓ
<b>-30</b>		55	x 55 ℓ
<b>-35</b>		60	x 60 ℓ
<b>-40</b>		65	x 65 ℓ
<b>-45</b>		70	x 70 ℓ
<b>-50</b>		75	x 75 ℓ
<b>-75</b>	110	x 110 ℓ	
<b>-100</b>	135	x 135 ℓ	

Model	C	D	Mounting bolt
<b>CQMB40-5</b>	7.5	35	M5 x 35 ℓ
<b>-10</b>		40	x 40 ℓ
<b>-15</b>		45	x 45 ℓ
<b>-20</b>		50	x 50 ℓ
<b>-25</b>		55	x 55 ℓ
<b>-30</b>		60	x 60 ℓ
<b>-35</b>		65	x 65 ℓ
<b>-40</b>		70	x 70 ℓ
<b>-45</b>		75	x 75 ℓ
<b>-50</b>		80	x 80 ℓ
<b>-75</b>	115	x 115 ℓ	
<b>-100</b>	140	x 140 ℓ	
<b>CQMB50-10</b>	12.5	45	M6 x 45 ℓ
<b>-15</b>		50	x 50 ℓ
<b>-20</b>		55	x 55 ℓ
<b>-25</b>		60	x 60 ℓ
<b>-30</b>		65	x 65 ℓ
<b>-35</b>		70	x 70 ℓ
<b>-40</b>		75	x 75 ℓ
<b>-45</b>		80	x 80 ℓ
<b>-50</b>		85	x 85 ℓ
<b>-75</b>		120	x 120 ℓ
<b>-100</b>	145	x 145 ℓ	

## Mounting Bolt for CDQM/With Auto Switch (Built-in magnet)

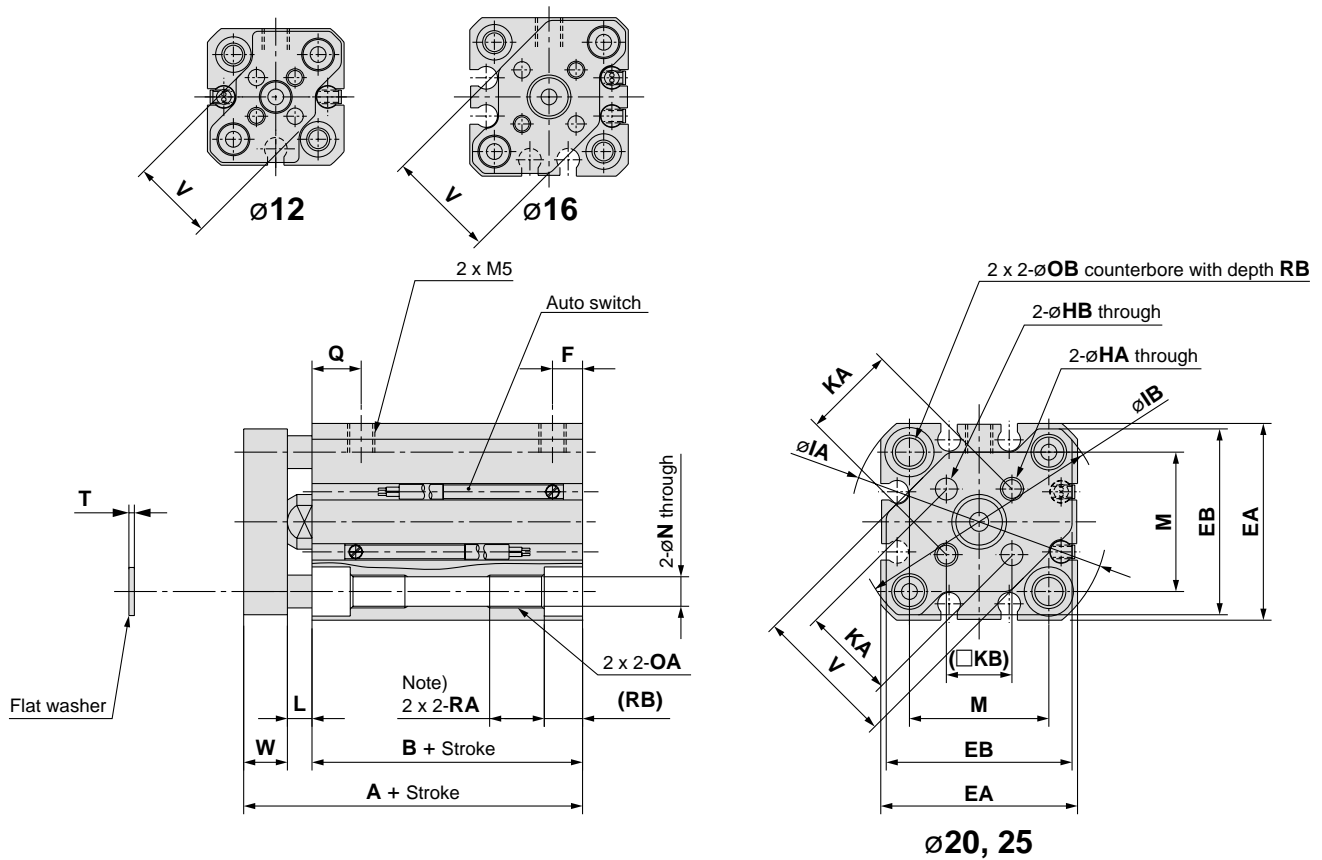
Model	C	D	Mounting bolt
<b>CDQMB12-5</b>	6.5	30	M3 x 30 ℓ
<b>-10</b>		35	x 35 ℓ
<b>-15</b>		40	x 40 ℓ
<b>-20</b>		45	x 45 ℓ
<b>-25</b>		50	x 50 ℓ
<b>-30</b>		55	x 55 ℓ
<b>CDQMB16-5</b>	6.5	30	M3 x 30 ℓ
<b>-10</b>		35	x 35 ℓ
<b>-15</b>		40	x 40 ℓ
<b>-20</b>		45	x 45 ℓ
<b>-25</b>		50	x 50 ℓ
<b>-30</b>		55	x 55 ℓ
<b>CDQMB20-5</b>	6.5	35	M5 x 35 ℓ
<b>-10</b>		40	x 40 ℓ
<b>-15</b>		45	x 45 ℓ
<b>-20</b>		50	x 50 ℓ
<b>-25</b>		55	x 55 ℓ
<b>-30</b>		60	x 60 ℓ
<b>-35</b>		65	x 65 ℓ
<b>-40</b>		70	x 70 ℓ
<b>-45</b>		75	x 75 ℓ
<b>-50</b>		80	x 80 ℓ

Model	C	D	Mounting bolt
<b>CDQMB25-5</b>	8.5	40	M5 x 40 ℓ
<b>-10</b>		45	x 45 ℓ
<b>-15</b>		50	x 50 ℓ
<b>-20</b>		55	x 55 ℓ
<b>-25</b>		60	x 60 ℓ
<b>-30</b>		65	x 65 ℓ
<b>-35</b>	70	x 70 ℓ	
<b>-40</b>	75	x 75 ℓ	
<b>-45</b>	80	x 80 ℓ	
<b>-50</b>	85	x 85 ℓ	
<b>CDQMB32-5</b>	9	40	M5 x 40 ℓ
<b>-10</b>		45	x 45 ℓ
<b>-15</b>		50	x 50 ℓ
<b>-20</b>		55	x 55 ℓ
<b>-25</b>		60	x 60 ℓ
<b>-30</b>		65	x 65 ℓ
<b>-35</b>		70	x 70 ℓ
<b>-40</b>		75	x 75 ℓ
<b>-45</b>		80	x 80 ℓ
<b>-50</b>		85	x 85 ℓ
<b>-75</b>	110	x 110 ℓ	
<b>-100</b>	135	x 135 ℓ	

Model	C	D	Mounting bolt
<b>CDQMB40-5</b>	7.5	45	M5 x 45 ℓ
<b>-10</b>		50	x 50 ℓ
<b>-15</b>		55	x 55 ℓ
<b>-20</b>		60	x 60 ℓ
<b>-25</b>		65	x 65 ℓ
<b>-30</b>		70	x 70 ℓ
<b>-35</b>		75	x 75 ℓ
<b>-40</b>		80	x 80 ℓ
<b>-45</b>		85	x 85 ℓ
<b>-50</b>		90	x 90 ℓ
<b>-75</b>	115	x 115 ℓ	
<b>-100</b>	140	x 140 ℓ	
<b>CDQMB50-10</b>	12.5	55	M6 x 55 ℓ
<b>-15</b>		60	x 60 ℓ
<b>-20</b>		65	x 65 ℓ
<b>-25</b>		70	x 70 ℓ
<b>-30</b>		75	x 75 ℓ
<b>-35</b>		80	x 80 ℓ
<b>-40</b>		85	x 85 ℓ
<b>-45</b>		90	x 90 ℓ
<b>-50</b>		95	x 95 ℓ
<b>-75</b>		120	x 120 ℓ
<b>-100</b>	145	x 145 ℓ	

## Dimensions

ø12 to ø25



Bore size (mm)	Stroke range (mm)	Without auto switch		With auto switch		EA	EB	F	HA		OA		HB	IA	IB
		A	B	A	B				—	NN	—	NN			
12	5 to 30	26.5	17	31.5	22	25	24	5	M3	4-40UNC	M4	8-32UNC	3	32	31.5
16	5 to 30	26.5	17	31.5	22	29	28	5	M3	4-40UNC	M4	8-32UNC	3	38	37
20	5 to 50	32	19.5	42	29.5	36	34	5.5	M4	6-32UNC	M6	1/4-20UNC	4	47	45.5
25	5 to 50	35.5	22.5	45.5	32.5	40	38	5.5	M5	10-32UNF	M6	1/4-20UNC	5	52	50.5

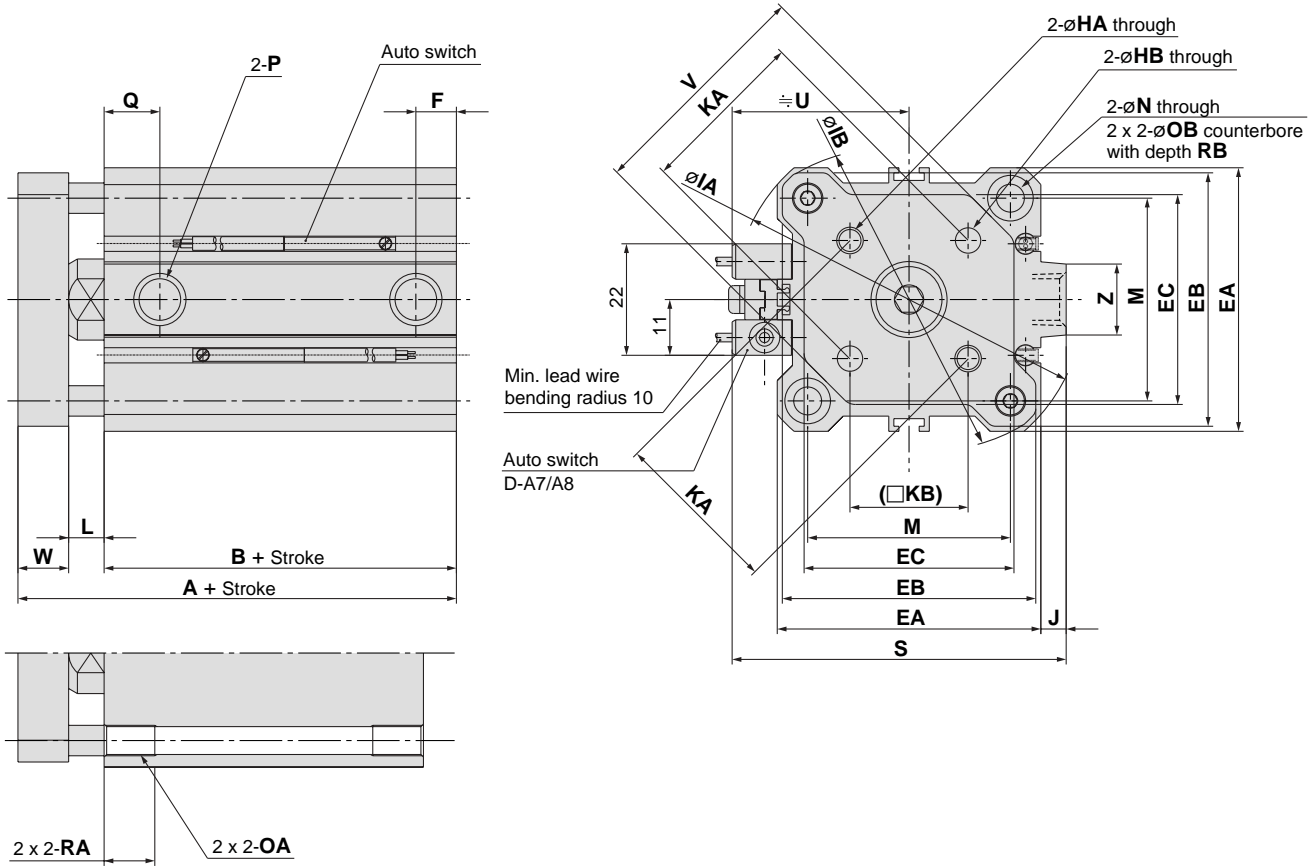
Bore size (mm)	KA	KB	L	M	N	OB	Q	RA	RB	T	V	W
12	10	7.1	3.5	15.5	3.5	6.5	7.5	7	4	0.5	14.9	6
16	14	9.9	3.5	20	3.5	6.5	7.5	7	4	0.5	20	6
20	17	12	4.5	25.5	5.4	9	9	10	7	1	26	8
25	22	15.6	5	28	5.4	9	11	10	7	1	30	8

Note) For the following bore/stroke sizes, the through-hole is threaded.  
 Standard without auto switch: ø12 and ø16; 5 stroke, ø25; 5 to 10 stroke  
 Built-in magnet with auto switch: ø20; 5 stroke

# Series CQM

## Dimensions

∅32 to ∅50



Both ends tapped (CQMA)

(mm)

Bore size (mm)	Stroke range (mm)	Without auto switch								With auto switch								EA	EB	EC	
		A	B	F	Q	P				A	B	F	Q	P							
						—	TN	TF	NN					—	TN	TF	NN				
32	5	40	23	5.5	11.5	M5	—	—	M5	50	33	7.5	10.5	Rc1/8	NPT1/8	G1/8	NPT1/8	52	50	41.4	
	10 to 50			7.5	10.5	Rc1/8	NPT1/8	G1/8	NPT1/8												45
	75, 100	50	33	8	11	Rc1/8	NPT1/8	G1/8	NPT1/8												56.5
40	5 to 50	46.5	29.5	8	11	Rc1/8	NPT1/8	G1/8	NPT1/8	56.5	39.5	8	11	Rc1/8	NPT1/8	G1/8	NPT1/8	52	50	41.4	
	75, 100	56.5	39.5																		64
50	10 to 50	50.5	30.5	10.5	10.5	Rc1/4	NPT1/4	G1/4	NPT1/4	60.5	40.5	10.5	10.5	Rc1/4	NPT1/4	G1/4	NPT1/4	64	62	53.4	
	75, 100	60.5	40.5																		

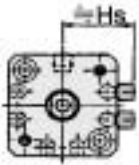
Bore size (mm)	HA			OA		HB	IA	IB	J	KA	KB	L	M	N	OB	RA	RB	S	U	V	W	Z
	—, TN, TF	NN	—, TN, TF	NN																		
32	M5	10-32UNF	M6	1/4-20UNC	5	60	58.5	4.5	28	19.8	7	34	5.5	9	10	7	58.5	31.5	38	10	14	
40	M5	10-32UNF	M6	1/4-20UNC	5	69	67.5	5	33	23.3	7	40	5.5	9	10	7	66	35	46	10	14	
50	M6	1/4-20UNC	M8	5/16-18UNC	6	86	84.5	7	42	29.7	8	50	6.6	11	14	8	80	41	58	12	19	



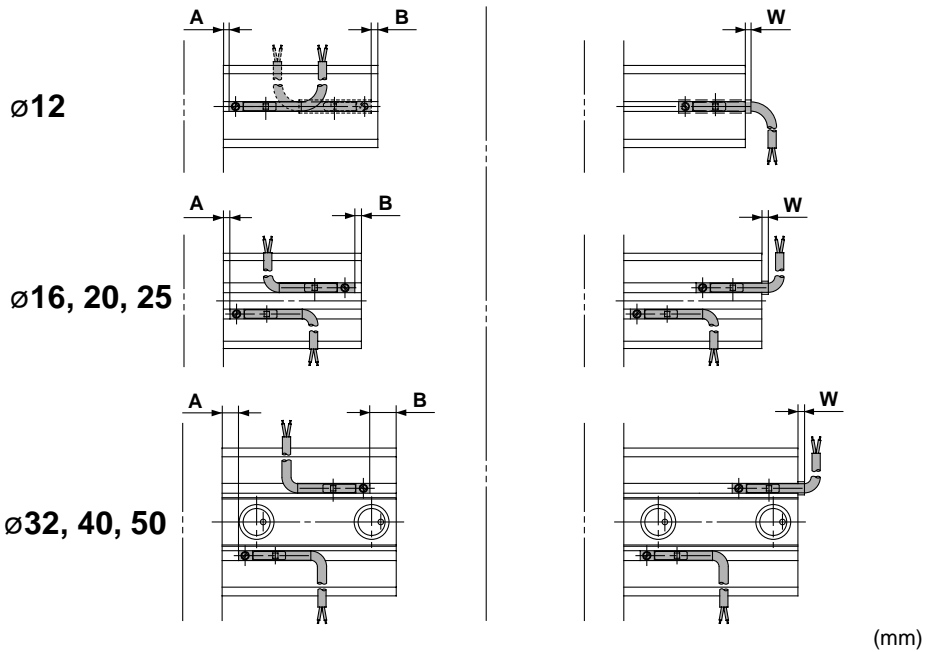
## Auto Switches/Proper Mounting Positions and Height for Stroke End Detection

Reed switch  
D-A9□

Solid state switch  
D-M9□  
D-F9BAL  
D-F9□W



\* Mounting height "Hs" exists only for the D-F9BAL type.

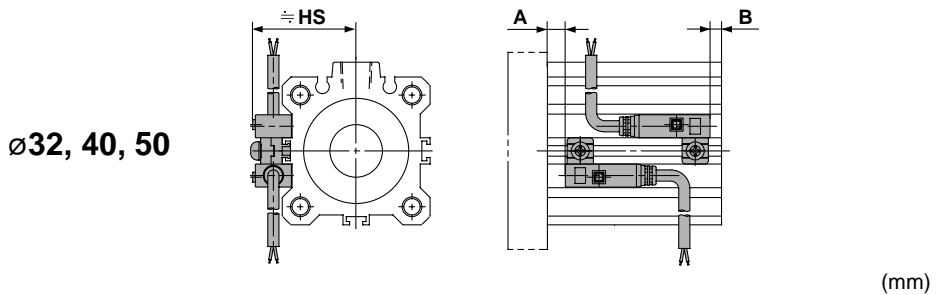


Auto switch model		D-A9□			D-M9□ D-F9□W			D-F9BAL			
Symbol		A	B	W	A	B	W	A	B	W	HS
Bore size (mm)	12	1.5	0	1.5 (4)	5.5	4.5	5.5	4.5	3.5	14.5	16.5
	16	2	0	2 (4.5)	6	4	6	5	3	15	18.5
	20	6	3.5	-1.5 (1)	10	7.5	2.5	9	6.5	11.5	22
	25	7	5.5	-3.5 (-1)	11	9.5	0.5	10	8.5	9.5	24
	32	8	5	-3 (-0.5)	12	9	1	11	8	10	26.5
	40	12	7.5	-5.5 (-3)	16	11.5	-1.5	15	10.5	7.5	30
	50	10	10.5	-8.5 (-6.5)	14	14.5	-4.5	13	13.5	4.5	36

The dimension inside ( ) is for D-A93.

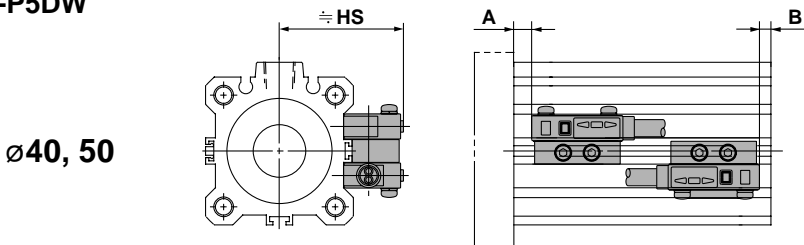
Reed switch  
D-A7□H  
D-A80H

Solid state switch  
D-F7□  
D-J79  
D-F7□W  
D-J79W  
D-F7BAL  
D-F7□F  
D-F7NTL



Auto switch model		D-A7□H D-A80H			D-F7□ D-J79 D-F7□W D-F79F			D-F7LF			D-F7NTL		
Symbol		A	B	Hs	A	B	Hs	A	B	Hs	A	B	Hs
Bore size (mm)	32	9.5	6.5	32.5	9.5	6.5	32.5	13.5	10.5	32.5	14.5	11.5	32.5
	40	13.5	9	36	13.5	9	36	17.5	13	36	18.5	14	36
	50	11.5	12	42	11.5	12	42	15.5	16	42	16.5	17	42

Solid state switch  
D-P5DW



Auto switch model		D-P5DW		
Symbol		A	B	Hs
Bore size (mm)	40	9	4.5	44
	50	7	7.5	50

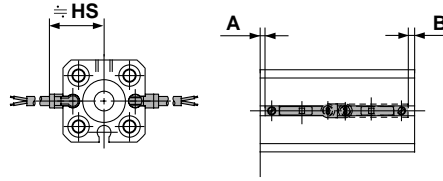
# Series CQM

## Auto Switches/Proper Mounting Positions and Height for Stroke End Detection

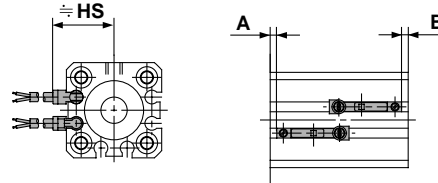
Reed switch  
D-A9□V

Solid state switch  
D-M9□V  
D-F9□WV

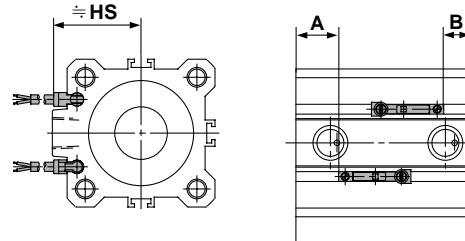
∅12



∅16, 20, 25



∅32, 40, 50



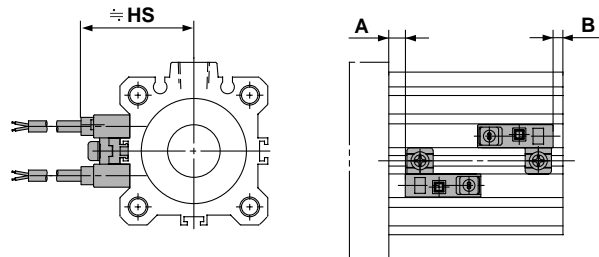
(mm)

Auto switch model		D-A9□V			D-M9□V, D-F9□WV		
Symbol		A	B	Hs	A	B	Hs
Bore size (mm)	12	1.5	0	17	5.5	4.5	19
	16	2	0	19	6	4	21
	20	6	3.5	22.5	10	7.5	24
	25	7	5.5	24.5	11	9.5	26
	32	8	5	27	12	9	29
	40	12	7.5	30.5	16	11.5	32.5
	50	10	10.5	36.5	14	14.5	42

Reed switch  
D-A7□  
D-A80  
D-A73C  
D-A80C  
D-A79W

Solid state switch  
D-F7□V  
D-J79C  
D-F7□WV  
D-F7BAVL

∅32, 40, 50



(mm)

Auto switch model		D-A7□ D-A80			D-A73C D-A80C			D-A79W			D-F7□V D-F7BAVL D-F7□WV			D-J79C		
Symbol		A	B	Hs	A	B	Hs	A	B	Hs	A	B	Hs	A	B	Hs
Bore size (mm)	32	9 (9.5)	6 (6.5)	31.5	9.5	6.5	38.5	6.5	3.5	34	9.5	6.5	35	9.5	6.5	38
	40	13 (13.5)	8.5 (9)	35	13.5	9	42	10.5	6	37.5	13.5	9	38.5	13.5	9	41.5
	50	11 (11.5)	11.5 (12)	41	11.5	12	48	12	8.5	43.5	11.5	12	44.5	11.5	12	47.5

The dimension inside ( ) is for D-A72.

## The number of surfaces and grooves where an auto switch can be mounted (as direct mounting).

The number of the surfaces and grooves where the auto switch can be mounted, by switch type, are shown in the table below.

View from piston rod end

Switch type	D-A9□, M9□, F9□				D-A7□, A8□, F7□, J7□			
	Bore size (mm)	A (Mounting groove no.)	B (Mounting groove no.)	C (Mounting groove no.)	D (Mounting groove no.)	A (Mounting groove no.)	B (Mounting groove no.)	C (Mounting groove no.)
12	—	○ (1)	○ (1)	○ (1)	—	—	—	—
16	—	○ (2)	○ (2)	○ (2)	—	—	—	—
20	—	○ (2)	○ (2)	○ (2)	—	—	—	—
25	—	○ (2)	○ (2)	○ (2)	—	—	—	—
32	○ (2)	—	—	—	—	○	○	○
40	○ (2)	—	—	—	—	○	○	○
50	○ (2)	—	—	—	—	○	○	○

## Operating Range

Auto switch model	Bore size (mm)						
	12	16	20	25	32	40	50
D-F7□, D-F7□V D-J79, D-J79C D-F7□W, D-F7□WV D-J79W D-F7BAL, D-F7BAVL D-F7NTL, D-F79F	—	—	—	—	6	6	6
D-F7LF	—	—	—	—	8	7	8
D-M9□V D-F9□W, D-F9□WV D-F9BAL	3	4	5	5.5	5.5	5.5	5.5
D-A7□, D-A80	—	—	—	—	12	11	10
D-A9□(V)	6	7.5	10	10	9.5	9.5	9.5
D-M9□	2	2.5	3.5	3.5	4	4	4

\* The operating ranges are provided as guidelines including hystereses and are not guaranteed values (assuming approximately ±30% variations). They may vary significantly with ambient environments.

## Auto Switch Mounting Bracket/Part No.

Bore size (mm)	Mounting bracket part no.	Note	Applicable switch	
			Reed switch	Solid state switch
32, 40 50	BQ-2	<ul style="list-style-type: none"> <li>Switch mounting screw (M3 x 0.5 x 10 ℓ)</li> <li>Switch spacer</li> <li>Switch mounting nut</li> </ul>	D-A7□, A80 D-A73C, A80C D-A7□H, A80H D-A79W	D-F7□, J79 D-F7□V D-J79C D-F7□W, J79W D-F7□WV D-F7BAL, F7BAVL D-F7□F D-F7NTL
40, 50	BQP1-050	<ul style="list-style-type: none"> <li>Switch mounting bracket</li> <li>Switch mounting nut</li> <li>Hexagon socket head cap bolt (M3 x 0.5 x 14 ℓ spring washer 2 pcs.)</li> <li>Round head Phillips screw (M3 x 0.5 x 16 ℓ spring washer 2 pcs.)</li> </ul>	—	D-P5DWL

[Mounting screws set made of stainless steel]

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

For BBA2: D-A7/A8/F7/J7

"D-F7BAL/F7BAVL" switch is set on the cylinder with the stainless steel screws above when shipped. When a switch is shipped independently, "BBA2" screws are attached.

## Minimum Auto Switch Mounting Stroke

Bore size (mm)	Auto switch model Number of auto switch	Bore size (mm)						
		D-A9□	D-A9□V	D-M9□	D-F9□W	D-M9□V	D-F9□WV	D-F9BAL
12 to 25	2 pcs.	10	10	15	15	5	10	25
	1 ps.	10	5	15	15	5	10	25
32, 40, 50	2 pcs.	10	10	10	15	5	15	20
	1 pc.	10	5	10	15	5	10	20

Bore size (mm)	Auto switch model Number of auto switch	Bore size (mm)								
		D-F7□V D-J79C	D-A7□ D-A8□ D-A73C D-A80C	D-F7□WV D-F7BAVL	D-A7□H D-F7□ D-J79	D-A79W	D-F7□W D-J79W D-F7BAL D-F7NT D-F79F	D-F7LF	D-P5DW	
32, 40, 50	2 pcs.	5	10	15	15	20	20	25	15	
	1 pc.	5	5	10	15	15	20	25	15	

Besides the models listed in "How to Order," the following auto switches are applicable. Refer to page 5.3-2 of Best Pneumatics vol. 2 for detailed specifications.

Auto switch type	Part no.	Electrical entry	Features	Applicable bore size
Solid state switch	D-F7NTL	Grommet (In-line)	With timer	ø32 to ø50

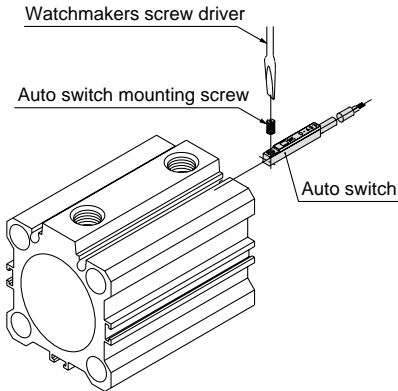
\* With pre-wire connector is available for D-F7NTL type, too. Contact SMC for details.

\* Contact SMC for detailed normally closed solid (N.C. = b contact) state auto switches such as D-F9G and D-F9H.

## Auto Switch Mounting

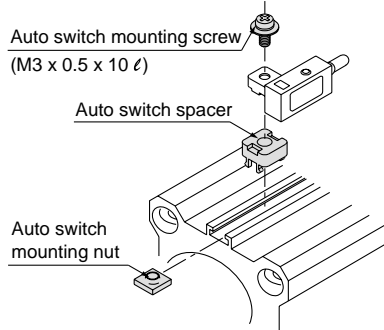
To mount auto switches, follow the instruction illustrated below.

### ø12 to ø50/Direct mounting



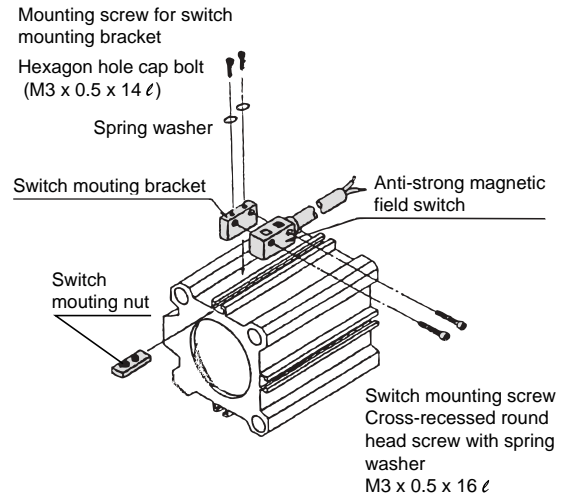
- Use a watchmakers screwdriver with a handle 5 to 6 mm in diameter when tightening the auto switch mounting screw.  
Tightening torque should be set 0.10 to 0.20 N·m.

### ø32 to ø50/Rail mounting



- Tightening torque of auto switch mounting screw should be set 0.5 to 0.7 N·m.
- \* In the case of cylinders with built-in magnets, unassembled auto switch mounting brackets are packed together when shipped.

### ø40, ø50/D-P5DWL



1. Mount the switch mounting bracket onto the switch mounting nut by tightening mounting screw for bracket fixing lightly through the mounting hole on the top of bracket.
2. Insert the switch mounting bracket assembly (bracket + nut) into the mounting groove and set it at the auto switch mounting position.
3. Push the auto switch mounting screw lightly into the auto switch through the mounting hole to fix switch mounting bracket tentatively.
4. After reconfirming the detecting position, tighten the mounting screw for switch mounting bracket and switch mounting screw, and fix the auto switch. (Tightening torque should be 0.5 to 0.7 N·m.)

# Auto Switch Specifications

## Auto Switch Common Specifications

Type	Reed switch	Solid state switch
Leakage current	None	3-wire: 100 $\mu$ A or less, 2-wire: 0.8 mA or less
Operating time	1.2 ms	1 ms or less <sup>Note 2)</sup>
Impact resistance	300 m/s <sup>2</sup>	1000 m/s <sup>2</sup>
Insulation resistance	50 M $\Omega$ or more at 500 VDC (between lead wire and case)	
Withstand voltage	1500 VAC for 1 min. <sup>Note 1)</sup> (between lead wire and case)	1000 VAC for 1 min. (between lead wire and case)
Ambient temperature	-10 to 60°C	
Enclosure	IEC529 standard IP67, watertight (JISC0920)	

Note 1) Connector style (D-A73C/A80C) and A9/A9  $\square$ V style: 1000 V AC/min. (between lead wire and the case)

Note 2) Except solid state switch with timer (F7NLT) and solid state switch for strong magnetic field resistant 2-colour display (D-P5DWL).

## Lead Wire Length

### Lead wire length indication

(Example) **D-M9P****L**

#### Lead wire length

Nil	0.5 m
L	3 m
Z	5 m
N *	None

\* Applicable for the connector style (D- $\square\square$ C) only.

Note 1) Lead wire length Z: 5 m applicable auto switches

Reed switch: D-A73 (C) (H), A80C

Solid state switch: All types are produced upon receipt of order.

Note 2) The standard lead wire length of solid state switch with timer or with water tight 2-colour display is 3 meters. (Not available 0.5 m)

Note 3) The standard lead wire length of solid state switch for strong magnetic fields resistant 2-colour display is 3 m and 5 m.

Note 4) For solid state switches with flexible wire specification, add "61" at the end of the lead wire length.

(Example) **D-F9PVL-61**

#### Flexible specification

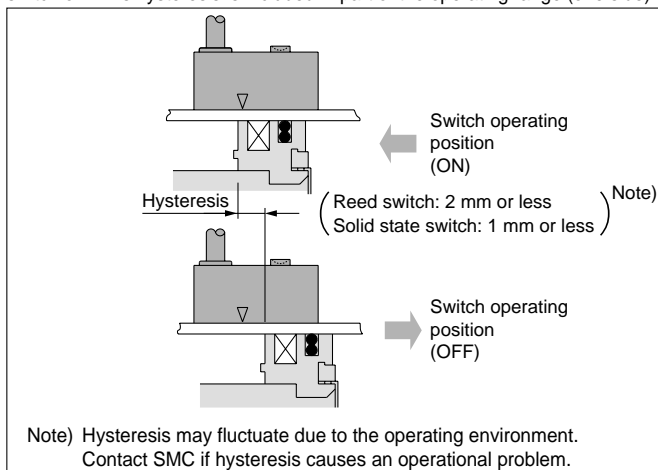
### Part Nos. of lead wires with connectors

(applicable only for connector type)

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

## Auto Switch Hysteresis

Hysteresis is the distance between the position at which piston movement operates an auto switch to the position at which reverse movement turns the switch off. This hysteresis is included in part of the operating range (one side).



## Contact Protection Box/CD-P11, CD-P12

### <Applicable switch type>

D-A9 and D-A9 $\square$ V, D-A7 $\square$ (H), (C) and D-A80 $\square$ (H), (C) type switches do not have internal contact protection circuits.

- ① The operated load is an induction load.
- ② The length of wiring to the load is 5 m or more.
- ③ The load voltage is 100 VAC and 200 VAC.

A contact protection box should be used in any of the above situations. The lifetime of the contact may be shortened.

D-A72 (H) must be used with the contact protection box regardless of load styles and lead wire length.

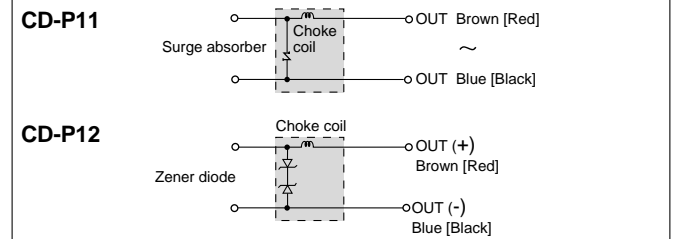
## Specifications

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

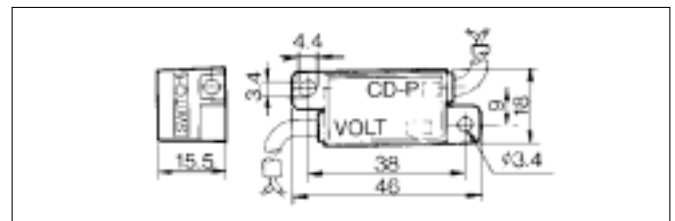
\* Lead wire length — Switch connection side: 0.5 m  
Load connection side: 0.5 m



## Internal circuits



## Dimensions



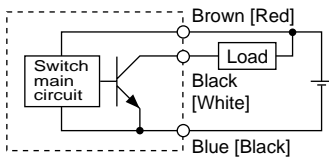
## Contact Protection Box/Connection

To connect a switch unit to a contact protection box, connect the lead wire from the side of the contact protection box marked SWITCH to the lead wire coming out of the switch unit. The switch unit should be kept as close as possible to the contact protection box with a lead wire that is no more than 1 meter in length.

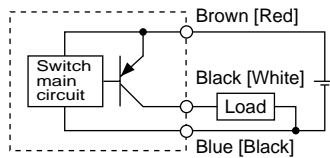
# Auto Switch Connections and Examples

## Basic Wiring

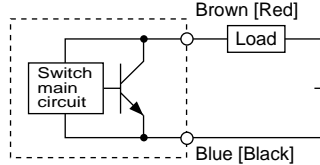
### Solid state 3-wire, NPN



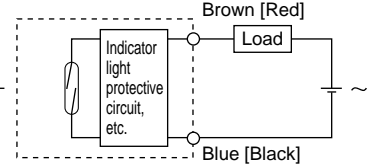
### Solid state 3-wire, PNP



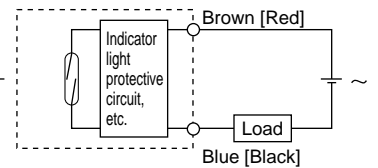
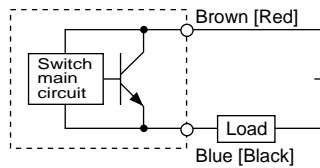
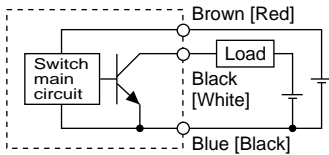
### 2-wire (Solid state switch)



### 2-wire (Reed switch)



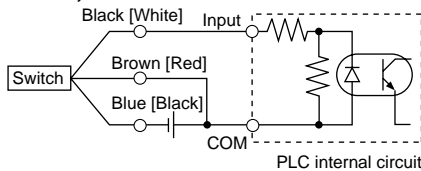
(Power supplies for switch and load are separate)



## Examples of Connection to PLC (Programable Logic Controller)

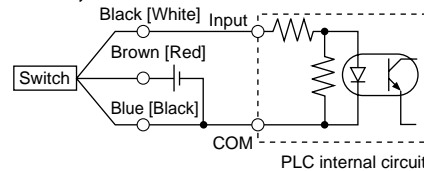
### • Sink input specifications

#### 3-wire, NPN



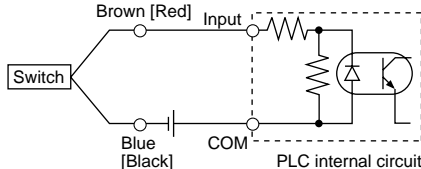
### • Source input specifications

#### 3-wire, PNP

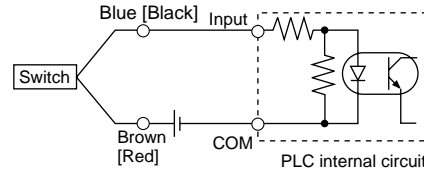


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

#### 2-wire



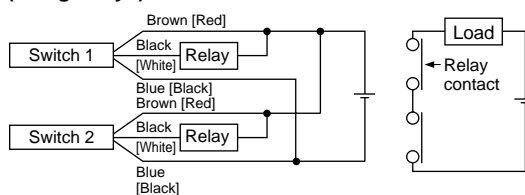
#### 2-wire



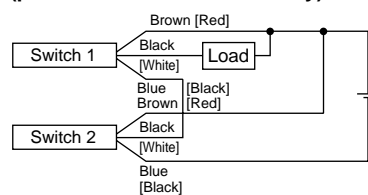
## Connection Examples for AND (Series) and OR (Parallel)

### • 3-wire (using relays)

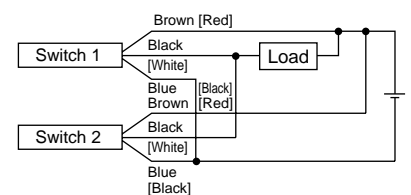
#### AND connection for NPN output (using relays)



#### AND connection for NPN output (performed with switches only)

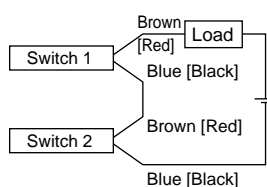


#### OR connection for NPN output



The indicator light illuminates when the two switches are in the ON state.

#### 2-wire with 2-switch AND connection

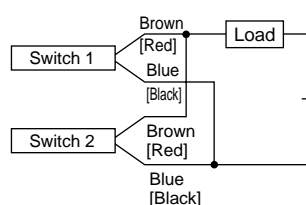


When two switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state. The indicator lights will light when both switches are in the ON state.

Load voltage at ON = Power supply voltage – Internal voltage drop x 2 pcs.  
= 24 V – 4 V x 2 pcs.  
= 16 V

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, malfunction may occur because the load voltage will increase when in the OFF state.


Load voltage at OFF = Leakage current x 2 pcs. x Load impedance  
= 1 mA x 2 pcs. x 3 kΩ  
= 6 V

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

#### < Reed Switch >

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 grow dim or not light up because of the dispersion and reduction of the current flowing to the switches.

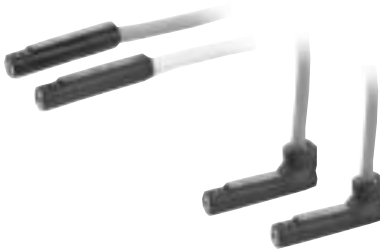
# Reed Switches: Direct Mounting Type D-A90(V), D-A93(V), D-A96(V)

 Refer to [www.smcworld.com](http://www.smcworld.com) for details of products compatible with overseas standards.

## Auto Switch Specification

PLC: Programmable Logic Controller

**Grommet  
Electrical entry: In-line**



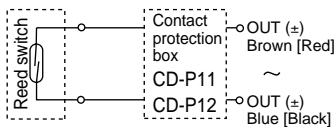
### ⚠ Caution

#### Operating Precautions

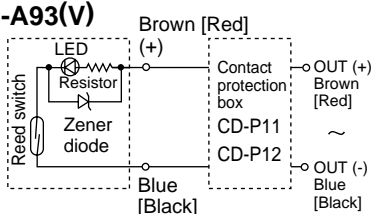
- Do not use anything other than the mounting screws attached to the auto switch body to secure the switch. If screws other than those specified are used, it may cause the switch to be damaged.

## Auto switch internal circuits

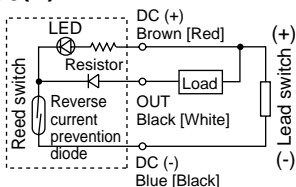
### D-A90(V)



### D-A93(V)



### D-A96(V)



- Note) 1. In the case operation load is an inductive load.  
2. In the case the wiring length to load is more than 5 m.  
3. In the case the load voltage is 100 VAC.

A contact protection box should be used if any of the above conditions is applicable. The lifetime of the contact may be shortened. (For detailed information about the contact protection box, please refer to page 12.)

### D-A90, D-A90V (Without indicator light)

Auto switch part no.	D-A90, D-A90V		
Applicable load	IC circuit, Relay, PLC		
Load voltage	24 V <sub>AC</sub> or less	48 V <sub>AC</sub> or less	100 V <sub>AC</sub> or less
Maximum load current	50 mA	40 mA	20 mA
Contact protection circuit	None		
Internal resistance	1 Ω or less (including lead wire length of 3 m)		

### D-A93, D-A93V, D-A96, D-A96V (With indicator light)

Auto switch part no.	D-A93, D-A93V	D-A96, D-A96V
Applicable load	Relay, PLC	IC
Load voltage	24 VDC	100 VAC
Load current range and max. load current	5 to 40 mA	5 to 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) D-A93V — 2.7 V or less	0.8 V or less
Indicator light	Red LED lights up when ON	

#### ● Lead wires

- Oilproof vinyl heavy insulation cable,  $\phi 2.7$ , 0.5 m
- D-A90(V), D-A93(V) 0.18 mm<sup>2</sup> x 2 cores (Brown, Blue [Red, Black])
- D-A96(V) 0.15 mm<sup>2</sup> x 3 cores (Brown, Black, Blue [Red, White, Black])

Note 1) Refer to page 12 for auto switch common specifications.

Note 2) Refer to page 12 for lead wire lengths.

Note 3) Visibility of indicator light decreases under 5 mA, and may be hard to recognize under 2.5 mA. For over 1mA, there should be no problem for contact outputs.

## Auto Switch Weight

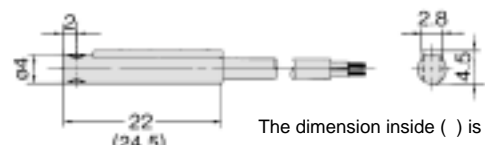
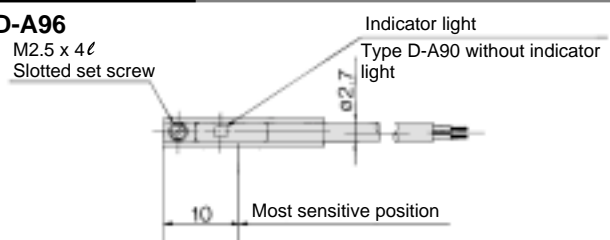
Unit: g

Model	D-A90	D-A90V	D-A93	D-A93V	D-A96	D-A96V
Lead wire length 0.5 m	6	6	6	6	8	8
Lead wire length 3 m	30	30	30	30	41	41

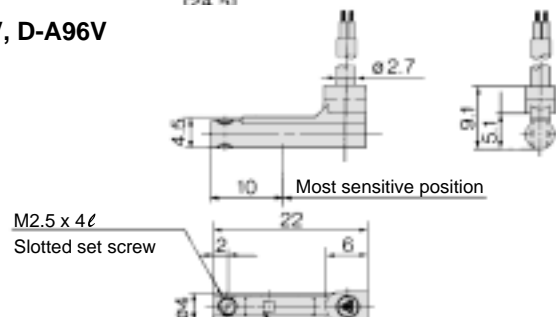
## Auto Switch Dimensions

Unit: mm

### D-A90, D-A93, D-A96



### D-A90V, D-A93V, D-A96V



Indicator light  
Type D-A90V without indicator light

# Solid State Switches: Direct Mounting Type D-M9N, D-M9P, D-M9B



Refer to [www.smcworld.com](http://www.smcworld.com) for details of products compatible with overseas standards.

## Grommet

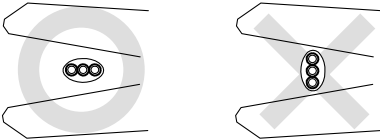
- 2-wire load current is reduced (2.5 to 40 mA).
- Lead-free
- Use of lead wire compliant with UL standards (style 2844)



## Caution

### Operating Precautions

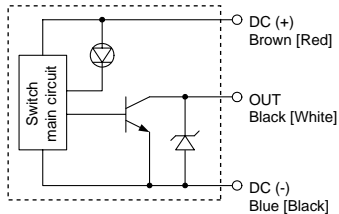
- ① When the cable sheath is stripped, confirm the stripping direction. The insulator may be split or damaged depending on the direction.



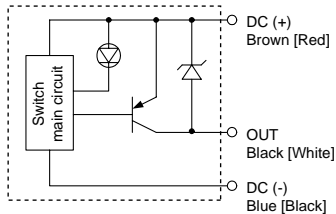
- ② Do not use anything other than the mounting screws attached to the auto switch body to secure the switch. If screws other than those specified are used, it may cause the switch to be damaged.

## Auto switch internal circuits

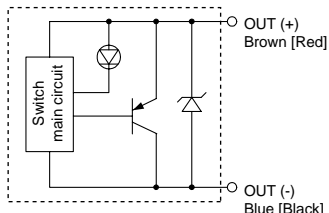
### D-M9N



### D-M9P



### D-M9B



## Auto Switch Specifications

PLC: Programmable Logic Controller

D-M9□ (With indicator light)			
Auto switch part no.	D-M9N	D-M9P	D-M9B
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 VDC)		—
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 μA or less at 24 VDC		0.8 mA or less
Indicator light	Red LED lights up when ON		

### Lead wires

Oilproof vinyl heavy insulation cable,  $\phi 2.7 \times 3.2$  ellipse

D-M9B 0.15 mm<sup>2</sup> x 2 cores

D-M9N, D-M9P 0.15 mm<sup>2</sup> x 3 cores

Note 1) Refer to page 12 for auto switch common specifications.

Note 2) Refer to page 12 for lead wire lengths.

## Auto Switch Weight

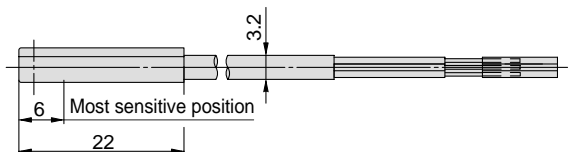
Unit: g

Model	D-M9N	D-M9P	D-M9B
Lead wire length (m)	0.5	8	7
	3	41	38
	5	68	63

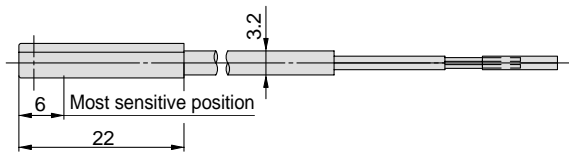
## Auto Switch Dimensions

Unit: mm

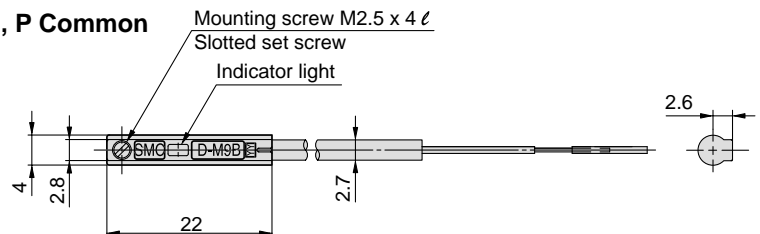
### D-M9N, P (3-wire)



### D-M9B (2-wire)



### D-M9□ D-M9B, N, P Common







# Solid State Switches with 2-Color Display: Direct Mount Type D-F9NW(V), D-F9PW(V), D-F9BW(V)



Refer to [www.smcworld.com](http://www.smcworld.com) for details of products compatible with overseas standards.

## Auto Switch Specifications

PLC: Programmable Logic Controller

D-F9□W, D-F9□WV (With indicator light)						
Auto switch part no.	D-F9NW	D-F9NWV	D-F9PW	D-F9PWV	D-F9BW	D-F9BWV
Electrical entry direction	In-line	Perpendicular	In-line	Perpendicular	In-line	Perpendicular
Wiring type	3-wire			2-wire		
Output type	NPN		PNP		—	
Applicable load	IC circuit, Relay IC, PLC				24 VDC 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		—		24 VDC (10 to 28 VDC)	
Load current	40 mA or less		80 mA or less		5 to 40 mA	
Internal voltage drop	1.5 V or less (0.8 V or less at 10 mA load current)		0.8 V or less		4 V or less	
Leakage current	100 μA or less at 24 VDC				0.8 mA or less	
Indicator light	Actuated position ..... Red LED lights up Optimum operating position ..... Green LED lights up					

### ● Lead wires

- Oilproof vinyl heavy insulation cable,  $\phi 2.7$ , 0.5 m
- 0.15 mm<sup>2</sup> x 3 cores (Brown, Black, Blue [Red, White, Black])
- 0.18 mm<sup>2</sup> x 2 cores (Brown, Blue [Red, Black])

Note 1) Refer to page 12 for auto switch common specifications.

Note 2) Refer to page 12 for lead wire lengths.

## Auto Switch Weight

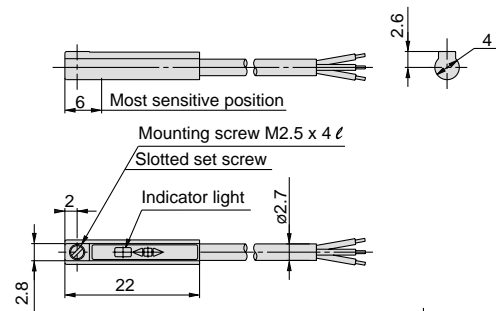
Unit: g

Model		D-F9NW(V)	D-F9PW(V)	D-F9BW(V)
Lead wire length (m)	0.5	7	7	7
	3	34	34	32
	5	56	56	52

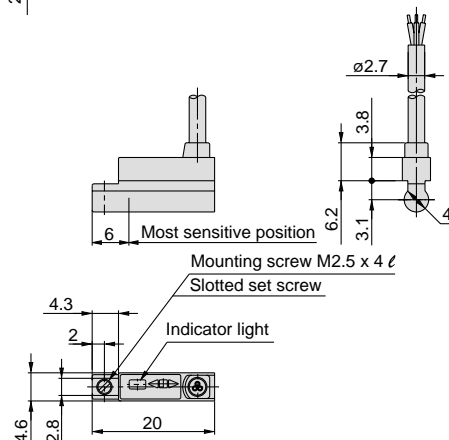
## Auto Switch Dimensions

Unit: mm

### D-F9□W



### D-F9□WV



## Grommet



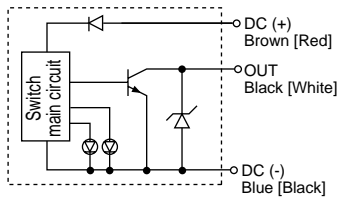
## ⚠ Caution

### Operating Precautions

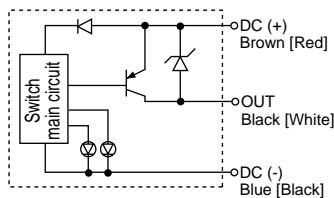
Do not use anything other than the mounting screws attached to the auto switch body to secure the switch. If screws other than those specified are used, it may cause the switch to be damaged.

## Auto switch internal circuits

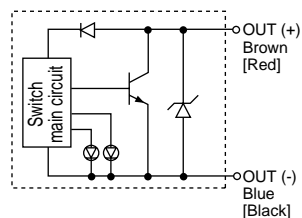
### D-F9NW, F9NWV



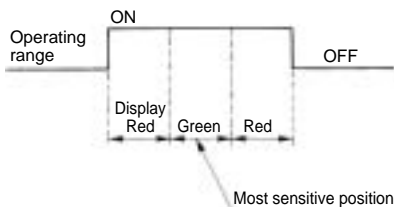
### D-F9PW, F9PWV



### D-F9BW, F9BWV



## Indicator light



# Water-resistant Solid State Switches with 2-Color Display: Direct Mount Type

## D-F9BAL



Refer to [www.smcworld.com](http://www.smcworld.com) for details of products compatible with overseas standards.

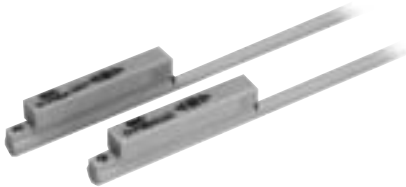
### Auto Switch Specifications

PLC: Programmable Logic Controller

D-F9BAL (With indicator light)	
Auto switch part no.	D-F9BAL
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 30 mA
Internal voltage drop	5 V or less
Leakage current	1 mA or less at 24 VDC
Indicator light	Actuated position ..... Red LED lights up Optimum operating position ..... Green LED lights up

### Grommet

#### Water (coolant) resistant type



### Caution

#### Operating Precautions

- Please consult with SMC if using coolant liquid other than water based solution.
- Do not use anything other than the mounting screws attached to the auto switch body to secure the switch. If screws other than those specified are used, it may cause the switch to be damaged.

#### Lead wires

- Oilproof vinyl heavy insulation cable,  $\phi 2.7$ , 0.5 m
- 0.18 mm<sup>2</sup> x 2 cores (Brown, Blue [Red, Black])

Note 1) Refer to page 12 for auto switch common specifications.

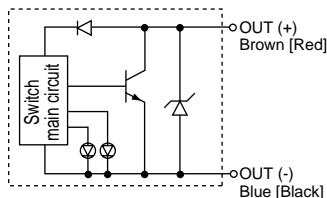
Note 2) Refer to page 12 for lead wire lengths.

### Auto Switch Weight

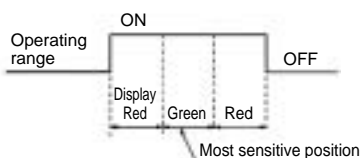
Unit: g

Model		D-F9BA
Lead wire length (m)	0.5	—
	3	37
	5	57

### Auto switch internal circuits

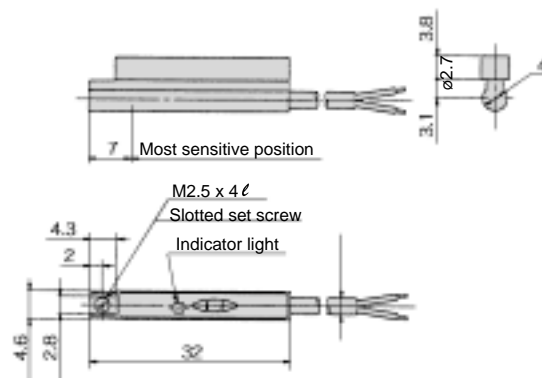


### Indicator light



### Auto Switch Dimensions

Unit: mm





**Series CQM**

# Safety Instructions

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

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

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

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

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

Note 2) JIS B 8370: Pneumatic system axiom

## **⚠ Warning**

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

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be 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 catalogue 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 maintenance of pneumatic systems should be performed by trained and experienced operators.

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

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven object have been confirmed.
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.

### **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, clutch and brake circuit in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



# Series CQM Actuator Precautions 1

Be sure to read before handling.

## Design

### ⚠ Warning

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

In such cases, bodily injury may occur, e.g., by having hands or get in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed to prevent such dangers.

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

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

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

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

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

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

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

When a cylinder is used as part of 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 human injury or damage to machinery. Suspension mechanisms and lifting devices also require for drop prevention measures.

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

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

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

Take special care 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 particularly to limbs, and/or damage to equipment when this occurs.

- 8. Consider emergency stops.**

Design the system so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device responding to abnormal conditions such as 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.

## Selection

### ⚠ Warning

- 1. Confirm the specifications.**

The products featured in this catalog are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are out of the range of specifications, damage and/or malfunction may occur. Do not use in these conditions. (Refer to specifications.) Consult SMC if fluid other than compressed air is required.

- 2. Intermediate stops**

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

In addition, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Consult SMC in cases where you need to hold a stopped position for long periods.

### ⚠ Caution

- 1. Operate within the limit of the maximum usable stroke.**

Operation with a stroke exceeding the maximum stroke range will damage the piston rod. Operate within the standard stroke range.

- 2. Operate the piston in such a way that collision damage will not occur at the stroke end.**

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

## Mounting

### ⚠ Caution

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

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

- 2. When using an external guide, connect the rod end and the load in such a way that there is no interference at any positions within the stroke.**

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

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause malfunction. Also, scratches or gouges in the piston rod may lead to damaged seals and cause air leakage.

- 4. Prevent sticking (through friction) of the rotating parts.**

Prevent sticking (through friction) of the rotating parts, for example pins, by applying grease.



# Series CQM Actuator Precautions 2

Be sure to read before handling.

## Mounting

### ⚠ Caution

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

Following mounting repairs, or conversions, verify correct mounting by conducting suitable function and leakage tests after piping and power connections have been made.

#### 6. Instruction manual

The product should be mounted and operated after thoroughly reading the manual and understanding its contents. Keep the instruction manual where it can be referred to as needed.

## Piping

### ⚠ Caution

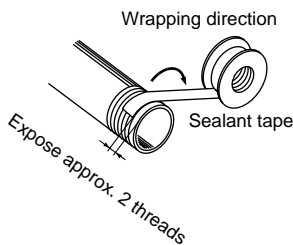
#### 1. Preparation before piping

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

#### 2. Wrapping of sealant tape

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

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



## Lubrication

### ⚠ Caution

#### 1. Lubrication of non-lube type cylinder

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

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

Stopping lubrication later may lead to malfunctions because the new lubricant will cancel out the original lubricant. Therefore, lubrication must be continued once it has been started.

## Air Supply

### ⚠ Warning

#### 1. Use clean air.

Do not use compressed air containing chemicals, synthetic oils containing organic solvents, salt or corrosive gases, as this 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 μm or finer.

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

Air that includes excessive drainage or condensate 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 when 5°C or less, since moisture in circuits can freeze and cause damage to seals and lead to malfunctions.

Refer to SMC's Best Pneumatics catalogue Vol. 4 for further details on compressed air quality.

## Operating Environment

### ⚠ Warning

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

#### 2. In dusty locations, or where water or oil may splash on the equipment, install something like a cover to protect the rod.

#### 3. When using auto switches, do not operate in an atmosphere with strong magnetic fields.

## Maintenance

### ⚠ Warning

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

Improper handling and maintenance may cause malfunctioning and damage of machinery or equipment to occur.

#### 2. Removal of components, 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. Filter drainage

Drain out condensate from air filters regularly.



# Series CQM Auto Switch Precautions 1

Be sure to read before handling.

## Design and Selection

### Warning

#### 1. Confirm the specifications.

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

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

When two or more auto switch cylinders 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.)

#### 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:

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

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

##### <Solid state switch>

- 2) Although wire length should not affect switch function, use a wire that is 100 m or shorter.

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

##### <Reed switch>

- 1) Switches with an indicator light (Except D-A96, A96V, D-A76H)

- 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.



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

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

- 2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Model A90, A90V, A80 (H), (C)).

##### <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) above. Also, note that a 12 VDC 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.

$$\text{Current to operate load (OFF condition)} > \text{Leakage current}$$

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

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

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

##### <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 a surge is applied repeatedly. When directly driving a load which generates surge, such as a relay or solenoid valve, 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 safeguard against malfunctions by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch. Also perform periodic inspection 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.



# Series CQM Auto Switch Precautions 2

Be sure to read before handling.

## Mounting and Adjustment

### 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, or switch may be damaged. On the other hand, tightening below torque range may allow the switch to slip out of position.

#### 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 position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will 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 (such as 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 in conjunction 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

#### 5. 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>

D-M9□ and 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 24 VDC switch with indicator light has polarity. The brown [red] lead wire is (+), and the blue [black] lead wire is (-).

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

Also note that a current greater than the maximum specified one will damage a light emitting diode and make it inoperable.

Applicable models: D-A93, A93V, D-A73, D-A73H, D-A73C

<Solid state switch>

1) Even if connections are reversed on a 2-wire type switch, the switch will not be damaged because it is protected by a protection circuit, but it will remain in a normally ON state. But reverse wiring in a load short circuit condition should be avoided to protect the switch from being damaged.

2) Even if power supply line (+) and power supply line (-) power supply line connections are reversed 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, the switch will be damaged.

#### \* Lead wire colour 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 colours still coexist with the new colours.

#### 2-wire

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

#### 3-wire

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black

#### Solid state with diagnostic output

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

#### Solid state with latch type diagnostic output

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





# Series CQM Auto Switch Precautions 3

Be sure to read before handling.

## Operating Environment

### ⚠ Warning

#### 1. Never use in an atmosphere of explosive gases.

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

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

Auto switches will malfunction or magnets inside cylinders will become demagnetized if used in such an environment.

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

Switches satisfy IEC standard IP67 construction (JIS C 0920: watertight construction). Nevertheless, they should not be used in applications where they are continually exposed to water splash or spray. This may cause deterioration of the insulation or swelling of the potting resin inside switches may cause malfunction.

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

Consult with SMC if auto switches will be used in an environment laden 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 a deterioration of the insulation, a malfunction due to swelling of the potting resin, or hardening of the lead wires.

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

Consult with SMC if switches are to be 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/s<sup>2</sup> or more) is applied to a reed switch during operation, the contact point may malfunction and generate or cut off a signal momentarily (1 ms or less). Consult with 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 (such as solenoid type lifters, high frequency induction furnaces, motors, etc.) that generate a large amount of surge in the area around cylinders with solid state auto switches, their proximity or pressure may cause deterioration or damage to the 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 accumulated amount of ferrous waste such as machining chips or welding spatter, or a magnetic substance (something attracted by a magnet) is brought into close proximity to an cylinder with auto switches, this may cause the auto switches to malfunction due to a loss of the magnetic force inside the cylinder.

## Maintenance

### ⚠ Warning

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

##### 1) 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 that the green light on the 2-colour display type switch lights up.

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

## Other

### ⚠ Warning

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



# Series CQM Specific Product Precautions

Be sure to read before handling.

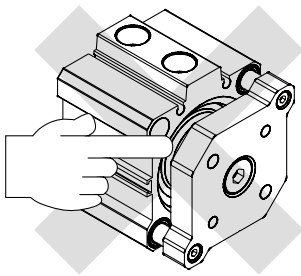
## Mounting

## Others

### Warning

1. Do not put hands or fingers between the plate and cylinder tubing.

Never put hands or fingers in the gap between the plate and cylinder tubing when the piston rods are retracted. Due to the heavy power output of the cylinder, failure to comply with this directive may result in trapping and subsequent injury to the human body.



### Caution

1. Do not scratch or dent the sliding parts of the piston rod and guide rods.

Damage to seals may cause air leakage or faulty operation.

2. Mounting of work piece

When screwing a bolt onto the threaded portion of the plate surface, be certain that the guide rods are fully extended - to the end.

Also, be careful that the tightening torque is not applied to the guide rods.

### Caution

1. This product should not be used as a stopper.





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