

Stroke Reading Rodless Cylinder with Brake

Series **ML2B**

ø25, ø32, ø40



Transfer

Position feedback

**Rodless cylinder
With brake**

CEP1

CE1

CE2

ML2B



D-☐

-X☐

Individual
-X☐

Stroke Reading Rodless Cylinder with Brake

Incorporating a brake mechanism and stroke sensor allows positioning with high repeatability. (Stopping accuracy ± 0.5 mm)

Brake mechanism

Employs a combination spring and pneumatic lock type.

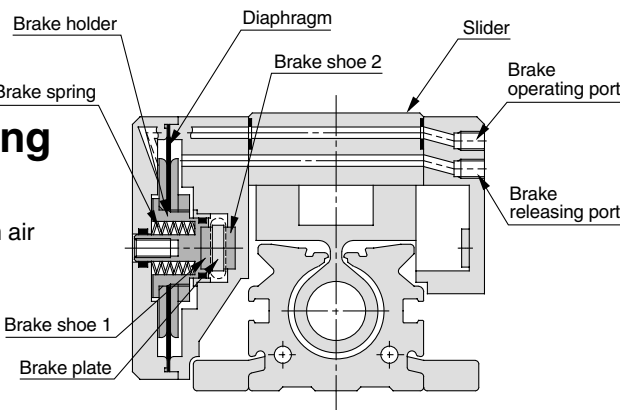
The cylinder position will be held by spring force when air pressure is absent.

The brake mechanism gives no direct load on the cylinder.

Spring force acts directly on the brake shoes to hold the brake disk; therefore, the table can be stopped without affecting the cylinder performance.

Locking in both directions is possible.

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



Maintenance and inspection

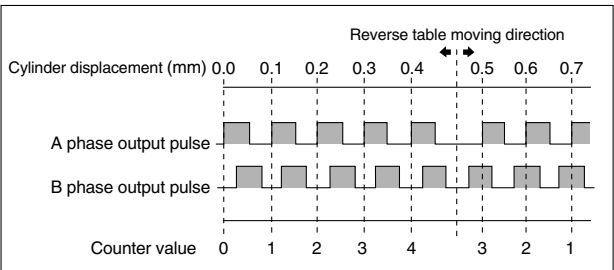
Brake unit is replaceable and has a manual override. Besides that, manual release is also possible manually.

Measuring

Smallest measuring unit 0.1 mm/Pulse

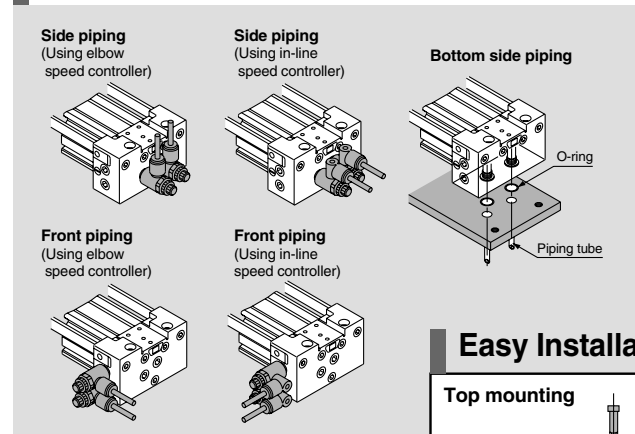
Measured with the scale plate with a sensing head built into the body.

Relation between Displacement and Output Pulse on Stroke Reading Cylinder



Rodless cylinder

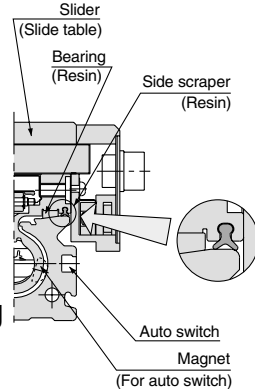
A variety of piping port locations gives high-freedom on machine design. (Operation air)



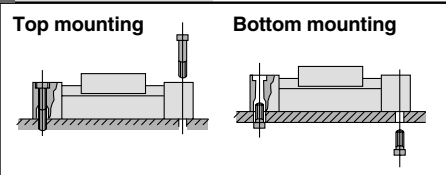
Dust protection

A special lip shaped side scraper installed on the bottom side of slide table prevents dust from entering.

Auto switches can be recessed in the body.

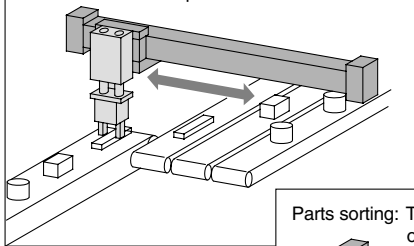


Easy Installation and Space-saving

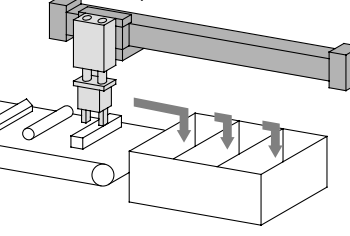


Application Example

Parts transferring: To distribute the different types of parts to each line.



Parts sorting: To classify the different types of parts.



Stroke adjusting unit, integrated shock absorber and stopper bolt.

Stroke adjustment is possible. Shock absorber is self adjusting for changing load demands.

Series ML2B

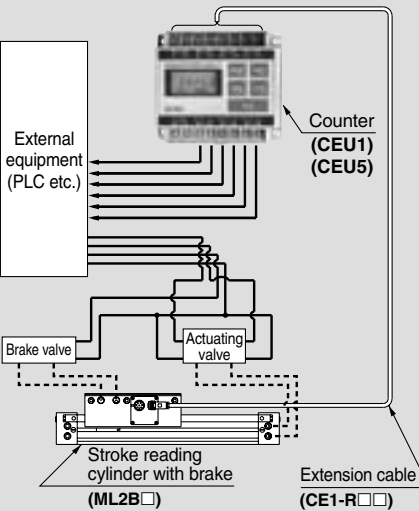
Ø25, Ø32, Ø40

For measuring intermediate stops

Stroke Reading Cylinder with Brake + Counter

Suitable for measurement on systems when table is stopped at intermediate strokes.

[3 point preset counter: **Series CEU1**]
[Multi-counter: **Series CEU5**]



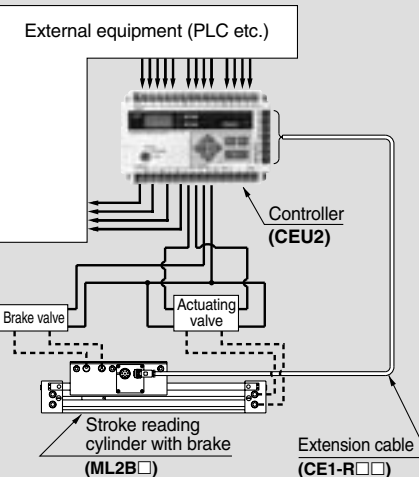
For precision positioning

(Stop accuracy ± 0.5 mm)

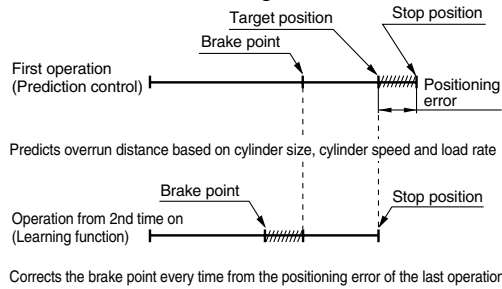
Stroke Reading Cylinder with Brake + Controller

Positioning with high reproducibility has been achieved by prediction control and learning function. The stop position will be automatically redressed by re-try function.

[Controller: **Series CEU2**]



Prediction control and learning function

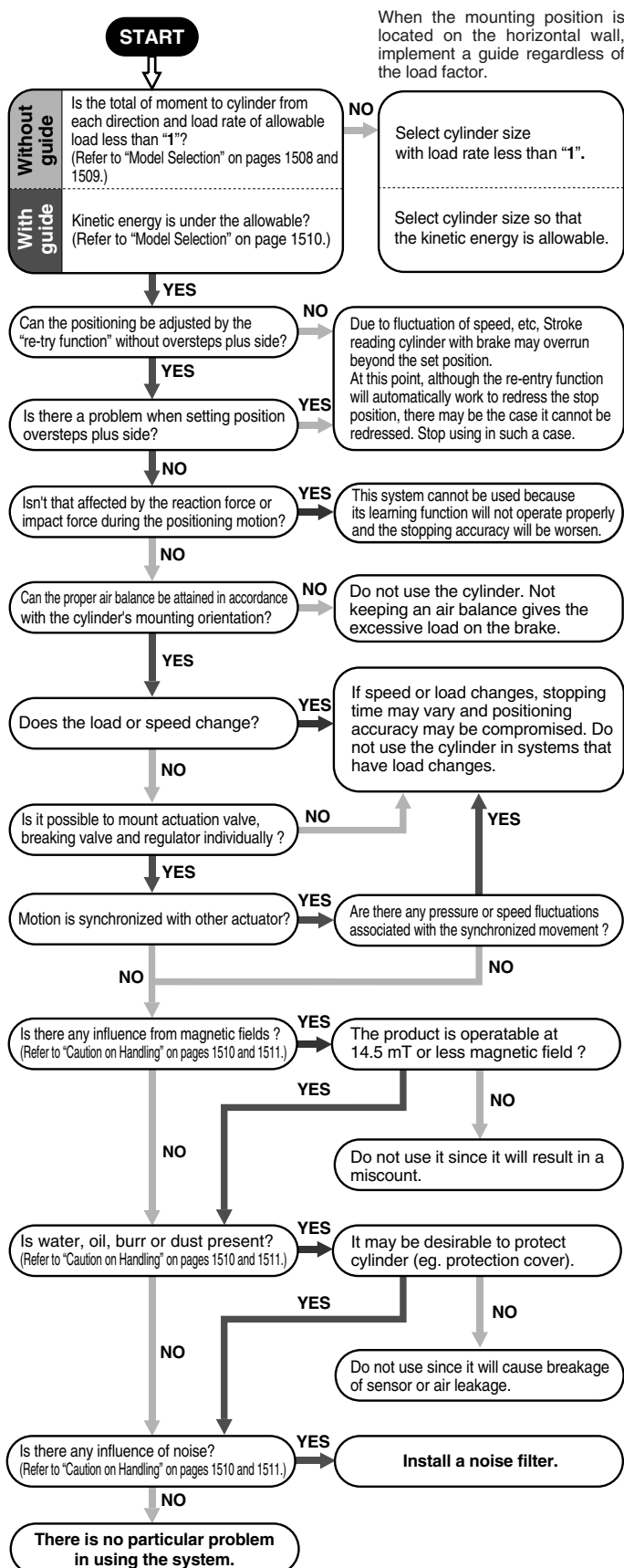


Series ML2B Prior to Use

* This series cannot be used in an environment where it is exposed to fluids (water, oil, coolant, etc.)

System Checking Flow Chart

Stroke reading cylinder with brake permits precise positioning at any designated point on its travel with combination of CEU2, directional control valve, brake valve. Check the operation flow chart below before starting the operation or stopping positioning repeatability may be compromised.



Model Selection

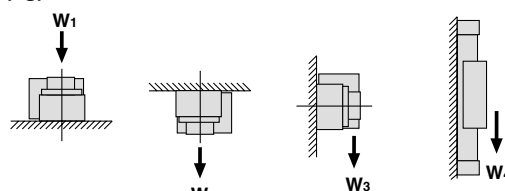
Maximum allowable load mass and allowable moment will vary depending on workpiece mounting methods, mounting orientation and piston speed.

A determination of usability is performed based on the operating limit values in the graphs with respect to operating conditions, but the total ($\sum \alpha_n$) of the load factors (α_n) for each mass and moment should not exceed 1. Besides, if it is used for positioning, maximum speed that can be achieved shall be 500 mm/s or less.

For details, refer to either "Instruction manual for positioning system with brake (rodless type)" or "Instruction manual for Stroke Reading Rodless Cylinder with Brake".

Load Mass

Load mass (kg)



Maximum Load Mass (kg)

Model	W1	W2	W3	W4
ML2B25	20.4	4.8	4.4	10.2
ML2B32	30.6	6.5	7.3	15.3
ML2B40	51.0	8.1	11.5	25.5

Moment

Allowable Moment (N·m)

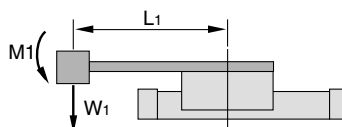
Model	Pitch moment	Roll moment	Yaw moment
	M1/M1e	M2	M3/M3e
ML2B25	10	1.2	3.0
ML2B32	20	2.4	6.0
ML2B40	40	4.8	12

Static Moment

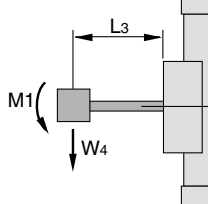
Moment generated by the workpiece mass even when the cylinder is stopped

Pitch moment

$$M_1 = W_1 \times L_1$$

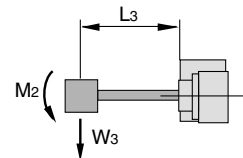


$$M_1 = W_4 \times L_3$$

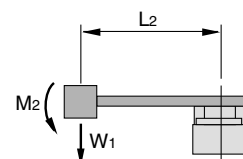


Roll moment

$$M_2 = W_3 \times L_3$$

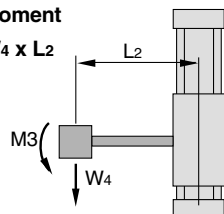


$$M_2 = W_1 \times L_2$$



Yaw moment

$$M_3 = W_4 \times L_2$$

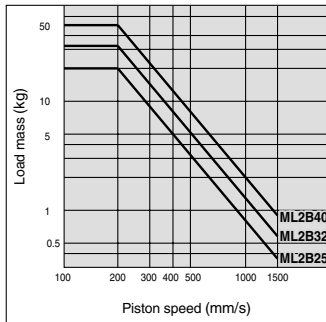


Maximum Load Mass/Allowable Moment (Not using external guide)

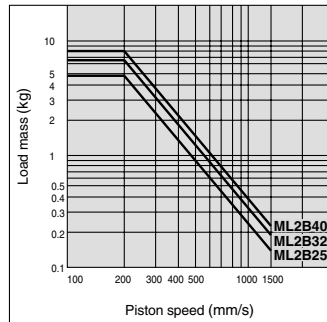
$$\text{The sum of the load rate } \sum \alpha_n = \frac{\text{Load mass [kg]}}{\text{Maximum load mass [Wmax]}} + \frac{\text{Static moment [M]}}{\text{Allowable static moment [Mmax]}} + \frac{\text{Dynamic moment [Me]}}{\text{Allowable dynamic moment [Memax]}} \leq 1$$

Wmax, Mmax, Memax from below graphs.

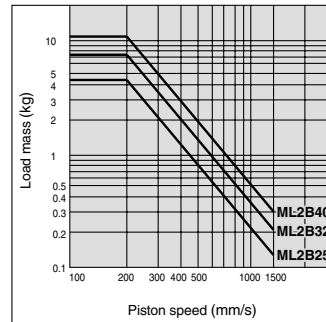
ML2B/W₁



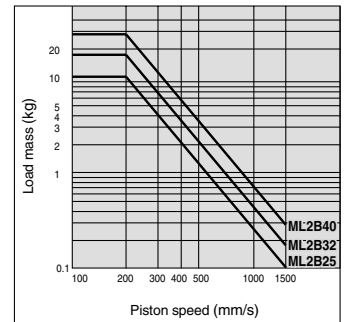
ML2B/W₂



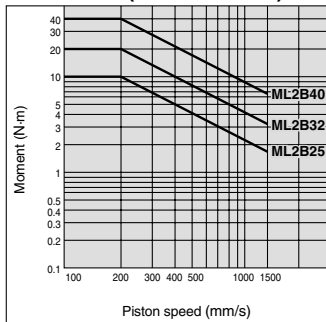
ML2B/W₃



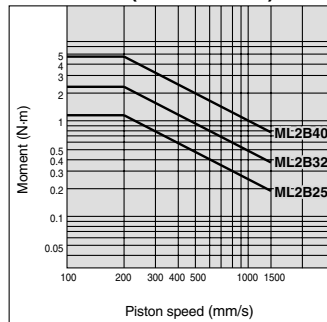
ML2B/W₄



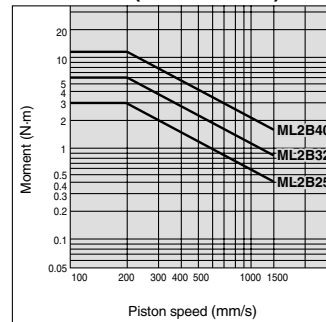
ML2B/M₁ (Pitch moment)



ML2B/M₂ (Roll moment)



ML2B/M₃ (Yaw moment)



CEP1

CE1

CE2

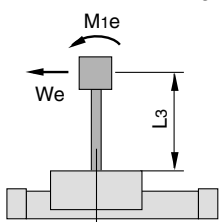
ML2B

Dynamic Moment

Moment generated by impact load at stroke end

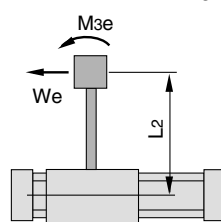
■ Pitch moment

$$M_{1e} = W_e \times L_3 \times \frac{1}{3}$$



■ Yaw moment

$$M_{3e} = W_e \times L_2 \times \frac{1}{3}$$



■ Reference formula [Dynamic moment at impact]

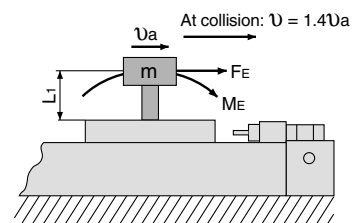
Use the following formula to calculate dynamic moment when shock for stopper collision impact is taken into consideration.

m : Load mass (kg)	U : Collision speed (mm/s)
F : Load (N)	L1 : Distance to the center of load gravity (m)
FE : Load equivalent to impact (at impact with stopper) (N)	ME : Dynamic moment (N·m)
Ua : Average speed (mm/s)	g : Gravitational acceleration (9.8 m/s ²)
M : Static moment (N·m)	

$$U = 1.4U_a \text{ (mm/s)} \quad F_E = \frac{1.4}{100} U_a \cdot g \cdot m$$

$$\therefore M_E = \frac{1}{3} \cdot F_E \cdot L_1 = 0.05 U_a \cdot m \cdot L_1 \text{ (N·m)}$$

Note) Average load coefficient (This coefficient is meant to average the maximum load moment at the time of impact with stopper in the light of calculating the service life.)



D-□

-X□

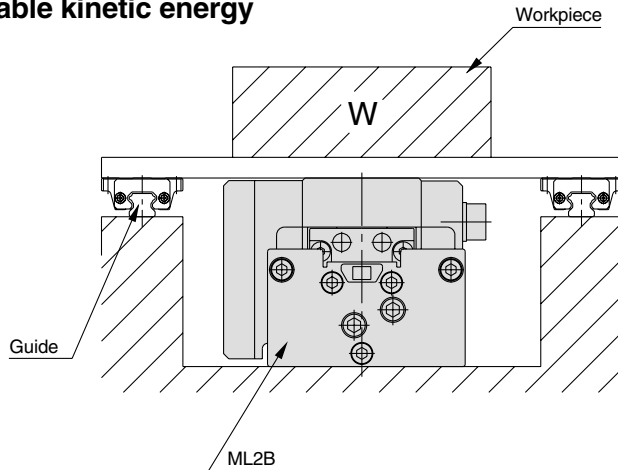
Individual
-X□

Series ML2B

Prior to Use

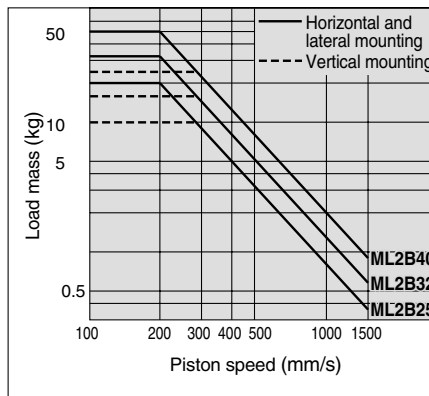
Model Selection Allowable Kinetic Energy (With external guide)

Allowable kinetic energy



Type	ML2B25	ML2B32	ML2B40
Allowable kinetic energy (J)	0.43	0.68	1.21

- 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 1.4 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 on the right. Use the cylinder in the range below the line.
- Locking mechanism has to absorb not only kinetic energy of pay load but also thrust energy of cylinder when locking. Accordingly, to secure braking force there is a certain limit for pay load despite being within allowable kinetic energy. In the case of horizontal orientation, the solid line is the load limit. In the case of vertical orientation, the dotted line is the load limit.



Handling of Technical Material

- For further positioning system, refer to "Instruction manual for positioning system with brake (rodless type)".
- For further cylinder information, refer to "Instruction manual for Stroke Reading Rodless Cylinder with Brake".

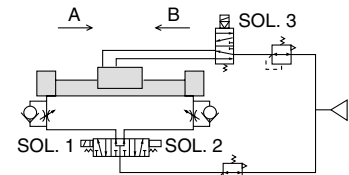


Caution on Handling

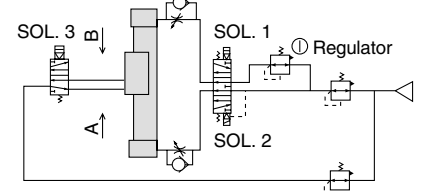
Pneumatic Circuit Design

1. Operating pneumatic circuit

[Horizontal and lateral mounting]



[Vertical mounting]



	SOL. 1	SOL. 2	SOL. 3
A	ON	OFF	ON
B	OFF	ON	ON
Stop	OFF	OFF	OFF

2. Solenoid valve for driving and braking

	Horizontal and lateral mounting	Vertical mounting
Solenoid valve for driving	VFS25□0	VFS24□0R
Solenoid valve for braking	VFS21□0	
Regulator	AR425	
Piping size	ML2B25, 32	Bore size ø4 or more
	ML2B40	Bore size ø5 or more

3. Piping

Piping length between cylinder ports and solenoid valve for driving should be less than 50 cm. When using system with brake, piping length between solenoid valve for braking and brake supply port should be less than 1 m. If longer, the brake function may be delayed when the cylinder position is held, for emergency stops or cylinder may eject at brake release.

4. Air balance

Air balance on both pneumatic circuits mentioned above is made by supplying air pressure, to both sides of the piston when at intermediate stop.

When mounting vertically the balance of load is kept by a regulator (1) decreases up-stream pressure. Use caution the piston rod may be lurch when the next motion gets started after the intermediate stops or commence the operation after the reverse motion gets done, unless the air balance is taken. It may result in degrading its accuracy.

5. Supply pressure

Set supply pressure 0.3 to 0.5 MPa to brake release port.

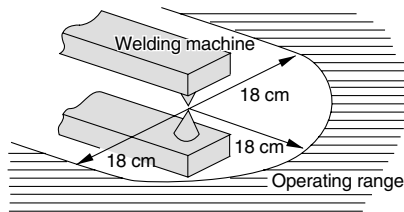
When supply pressure is below 0.3 MPa brake may not be released, when it is over 0.5 MPa brake life may be shortened. If line pressure is used directly as supply pressure, any fluctuation in pressure will appear in the form of changes in cylinder characteristics. Therefore, make sure to use a pressure regulator to convert line pressure into supply pressure for the solenoid valve for driving and the solenoid valve for braking. In order to actuate multiple cylinders at once, use a pressure regulator that can handle a large air flow volume and also consider installing an air tank.

Mounting

1. Position detecting sensor

Stroke reading rodless cylinder with brake is a magnetic type sensor. Strong magnetic fields around the sensor will cause a malfunction. External magnetic fields should be less than 14.5 mT or less.

A magnetic field of 14.5 mT is equivalent to a position that has about 18 cm radius from a welded part using about 15,000 amperes of welding amperage. When using it in a stronger magnetic field, cover the sensor with magnetic and shield it.



Avoid applications where the cylinder is in direct contact with water and oil, etc.

2. Noise

When stroke reading hy-rodless cylinder with brake is used in an atmosphere with electrical noise from a motor, welding machine, miscount is created by this noise. To prevent this, the noise source and wiring should be separated from power wire.

Maximum transmitted distance for stroke reading rodless cylinder with brake is 20 m. Be sure not to exceed this wire length.

3. Mounting

Flush piping thoroughly before connection in order to prevent dust or chips from entering the cylinder.

Take care not to score slide surface of the cylinder tube. This may damage the bearing and scraper, resulting in malfunctioning of the cylinder.

Take care not to apply a strong impact or excessive moment to the table when loading a workpiece as slide table is supported by bearing made of resin.

4. Piping

Piping connection to head covers can be selected according to application.

Bottom piping is effective for high density designed equipment and machines since piping does not come out from the mounting surface. (Below fig.: Refer to piping port variation.)

Using

1. When a stroke reading hy-rodless cylinder with brake is connected to load with an external support mechanism, accurate alignment is required even if the ML2B can be used with direct load within the allowable range. If stroke is longer, axis alignment deflection will be greater: therefore, install floating mechanism to absorb deflection. This actuator can be used without lubrication. However, if it is lubricated, use turbine oil Class 1 (ISO VG32). (Do not use machine oil or spindle oil.)

2. Cover the cylinder when it is used in an environment where cutting dust, powder (paper powder, thread yarn, etc.) and cutting oil (gas oil, water, warm water, etc.) present.

3. We recommend that grease be regularly applied to bearing (slide part) and dust seal band as it may extend the service life.

4. Brake and scale plates should be protected from load and external force which may cause malfunction. Do not apply load and external force on brake and scale plate. Readjustment for brake and scale plates in normal operating condition is not necessary due to preadjustment prior to delivery. Therefore, do not change the setting on adjustment parts carelessly.

CEP1

CE1

CE2

ML2B

Operating

1. Positioning at cylinder stroke end

Stable stop accuracy at end of stroke positioning is not obtained due to large speed change from cushion influence. Therefore, positioning position must not be within cushion stroke. (Refer to cushion stroke table.)

2. System with counter

Counter response speed is generally called "counting speed". If cylinder with brake is faster than "counting speed" in counter, the counter will make a reading error and miss-counting occurs.

Use CEU1, CEU2, or CEU5.

Cylinder speed < "Counting speed" in counter

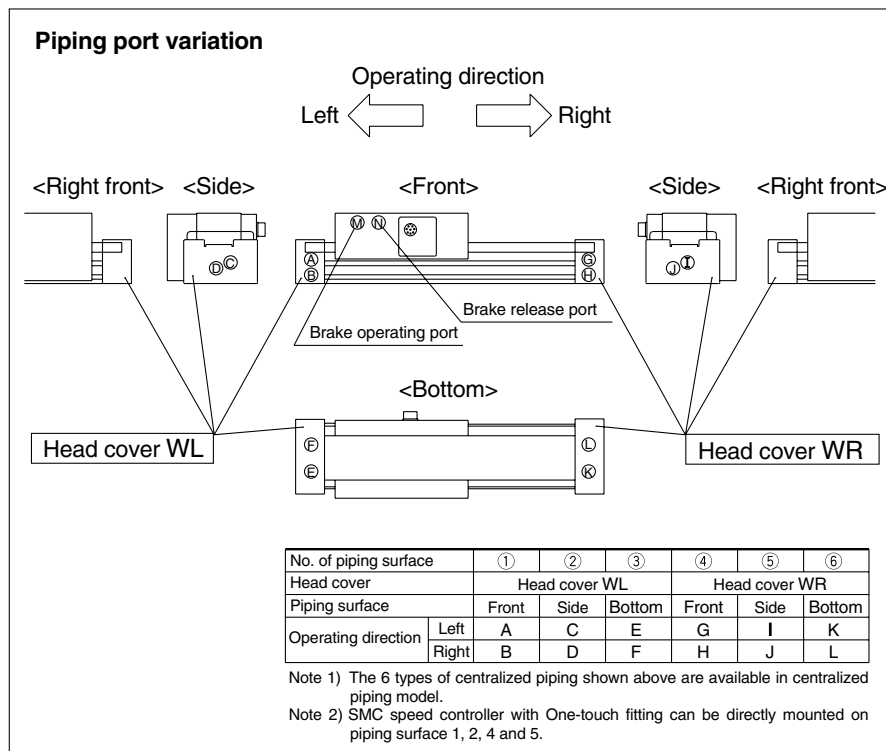
(Cylinder speed 500 mm/s is equivalent to 5 kcps of "counting speed" in counter.)

3. Ejection from jumping at beginning of extend or retract stroke may cause temporarily high speeds exceeding the response speed "counting speed" in the counter or position detection sensor. This can be a cause of malfunction.

D-□

-X□

Individual
-X□



Handling

1. Do not generate negative pressure in the cylinder tube.

Take precautions under operating conditions in which negative pressure is generated

inside the cylinder by external forces or inertial forces. Air leakage may occur due to separation of the seal belt.

Stroke Reading Rodless Cylinder with Brake

Series *ML2B*

ø25, ø32, ø40

How to Order

ML2B **25** **—** **500** **L** **—** **Y7BW** **—**

Basic type •

Bore size •

25	25 mm
32	32 mm
40	40 mm

Control method •

Nil	With brake and stroke sensor
S	With stroke sensor (Without brake)
B	With brake (Without stroke sensor)

Cylinder stroke •

Bore size (mm)	Standard stroke (mm)
25	1 to 2000
32	(Manufacturable in 1 mm increments)
40	

* The maximum manufacturable stroke of this product is 2000 (mm).

Stroke adjustment unit symbol •

Refer to page 1513 for stroke adjustment unit.

Number of auto switch

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

Applicable counter/Controller

Series CEU1
Series CEU5
Series CEU2

Auto switch

Nil	Without auto switch (Built-in magnet)
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* For the applicable auto switch model, refer to the table below.

Applicable Auto Switch/Refer to pages 1719 to 1827 for further information on auto switches.

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	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)				
								Perpendicular	In-line							
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	Y69A	Y59A	●	●	○	○	IC circuit	Relay, PLC	
	3-wire (PNP)			Y7PV				Y7P	●	●	○	○				
	2-wire			Y69B				Y59B	●	●	○					○
	3-wire (NPN)			5 V, 12 V	Y7NWV	Y7NW		●	●	○	○		IC circuit			
	3-wire (PNP)				Y7PWV	Y7PW		●	●	○		○				
	2-wire				Y7BWV	Y7BW		●	●	○				○		
Reed switch	—	Grommet	Yes	3-wire (NPN equivalent)	—	5 V	—	Z76	●	●	—		—		IC circuit	—
				2-wire	24 V	12 V	100 V	—	Z73	●	●	●	—		—	IC circuit
							100 V or less	—	Z80	●	●	—	—			

* Lead wire length symbols: 0.5 m Nil (Example) Y7BW
 3 m L (Example) Y7BWL
 5 m Z (Example) Y7BWZ

* Solid state auto switches marked with "○" are produced upon receipt of order.

* For details about auto switches with pre-wired connector, refer to pages 1784 and 1785.

* Normally closed (NC = b contact) solid state auto switches (D-Y7G/Y7H types) are also available. Refer to page 1748 for details.

* Auto switches are shipped together (not assembled).

Stroke Reading Rodless Cylinder with Brake **Series ML2B**



Cylinder Specifications

Bore size (mm)		25	32	40
Fluid		Air		
Action	Cylinder	Double acting		
	Brake	Spring and pneumatic		
Operating pressure range	Cylinder	0.1 to 0.8 MPa		
	Brake	0.3 to 0.5 MPa		
Proof pressure	Cylinder	1.2 MPa		
	Brake	0.75 MPa		
Ambient and fluid temperature		5 to 60°C (No freezing)		
Piston speed		100 to 1500 mm/s (During the positioning 100 to 500 mm/s)		
Cushion		Air cushion on both sides		
Lubrication		Non-lube		
Stroke tolerance (mm)		0 to 1.8		
Piping port size	Front/Side ported	Rc 1/8		Rc 1/4
	Bottom ported	ø5	ø6	ø8

As for 3 point preset counter and multi counter, it will be common to CEP1 and CE1 series. For details, refer to 3 point preset counter/CEU1 on page 1470, and Multi counter/CEU5 on page 1467 respectively. Regarding controller, since it will be common to CE2 series, refer to Controller/CEU2 on page 1502 for details.

Sensor Specifications

Maximum transmission distance	20 m (In the case of using our cable as well as our controller or counter.)
Position detection method	Incremental type
Magnetic field resistance	14.5 mT
Power supply	10.8 to 13.2 VDC (Ripple 1% or less)
Current consumption	40 mA
Resolution	0.1 mm/pulse
Accuracy	±0.2 mm ^{Note)} (at 20°C)
Output type	NPN open collector (35 VDC, 80 mA)
Output signal	A/B phase difference output
Insulation resistance	500 VDC, 50 MΩ or more (between case and 12E)
Vibration resistance	33.3 Hz, 2 hours at X, Y and 4 hours at Z JIS D 1601 as standard
Impact resistance	30 G, 3 times at X, Y, Z
Enclosure	IP50 (IEC standard)
Extension cable (Option)	5 m, 10 m, 15 m, 20 m Cable: ø7; 6 core twisted pair shielded wire; oil, heat and frame resistant cable

Note) Digital error under Controller (CEU2), Counter (CEU1 or CEU5) is included. Besides, the whole accuracy after mounting on an equipment may be varied depending on the mounting condition and surroundings. As an equipment, calibration should be done by customer.

CEP1

CE1

CE2

ML2B

Stroke Adjustment Unit Specifications

Applicable bore size (mm)		25	32	40
Unit symbol		L	L	L
Configuration Shock absorber model		RB1007 + with adjustment bolt	RB1412 + with adjustment bolt	RB1412 + with adjustment bolt
Stroke adjustment range by intermediate fixing spacer (mm)	Without spacer	0 to -11.5	0 to -12	0 to -16
	With short spacer	-11.5 to -23	-12 to -24	-16 to -32
	With long spacer	-23 to -34.5	-24 to -36	-32 to -48

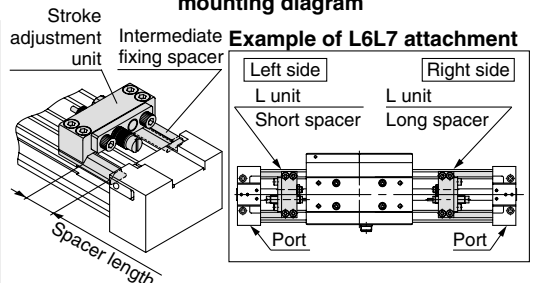
* Stroke adjustment range is applicable for one side when mounted on a cylinder.

* The shock absorber service life is different from that of the ML2B cylinder depending on operating conditions. Refer to the RB Series Specific Product Precautions for the replacement period.

Stroke Adjustment Unit Symbol

		Right side stroke adjustment unit			
		Without unit	L: With low load shock absorber + Adjustment bolt		
Left side stroke adjustment unit	Without unit	Nil	SL	SL6	SL7
	L: With low load shock absorber + Adjustment bolt	LS	L	LL6	LL7
	With short spacer	L6S	L6L	L6	L6L7
	With long spacer	L7S	L7L	L7L6	L7

Stroke adjustment unit mounting diagram



Shock Absorber Model

Model	ø25	ø32	ø40
	RB1007	RB1412	RB1412

Shock Absorber Specifications

Applicable bore size (mm)		25	32	40
Shock absorber model		RB1007	RB1412	RB1412
Maximum energy absorption (J)		5.9	19.6	19.6
Stroke absorption (mm)		7	12	12
Maximum collision speed (mm/s)		1500	1500	1500
Maximum operating frequency (cycle/min)		70	45	45
Spring force (N)	Extended	4.22	6.86	6.86
	Retracted	6.86	15.98	15.98
Operating temperature range (°C)		5 to 60		

D-□

-X□

Individual

-X□

Brake Capacity

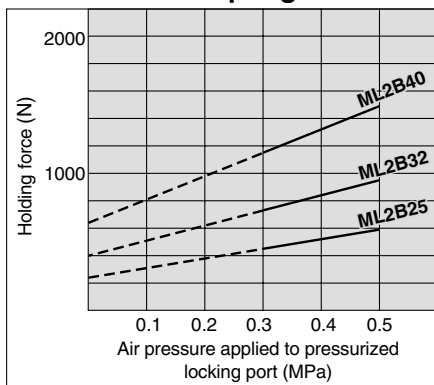
Holding Force of Spring Locking (Maximum static load)

Bore size (mm)	25	32	40
Holding force	245 N	400 N	628 N

Note) The holding force is the lock's ability to hold a static load that does not involve vibrations or impacts, when it is locked without a load. Therefore, when normally using the cylinder near the upper limit of the holding force, be aware of the points described below.

- Select the cylinder bore size so that the load is less than 80% of the holding force.
- If the piston rod slips because the lock's holding force has been exceeded, the brake shoe could be damaged, resulting in a reduced holding force or shortened life.

Holding Force of Locking for Pneumatic and Spring



Stopping Accuracy

When the cylinder is stopped at intermediate strokes by PLC and erratic stopping positions appear. Check piston speed, load, piping conditions, control method, etc. Use values on the table below as reference.

1. ML2B + CEU2

Piston speed	100 to 500 mm/s
Stopping accuracy	±0.5 mm

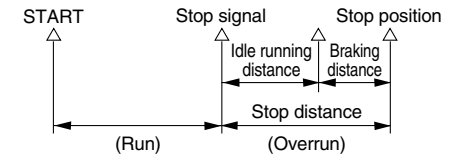
2. ML2B + PLC

Piston speed (mm/s)	100	300	500	800	1000
Stopping accuracy (mm)	±0.5	±1.0	±2.0	±3.0	±4.0

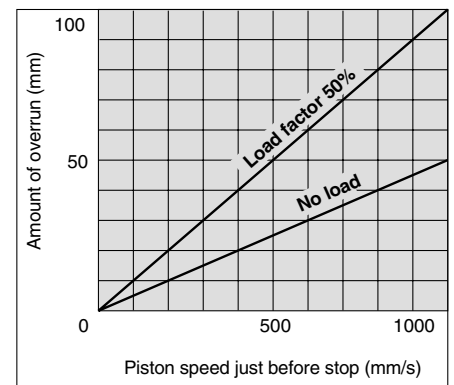
Condition/Driving pressure: 0.5 MPa
 Brake releasing pressure: 0.3 MPa
 Load factor: 25%
 (Solenoid valve for brake releasing is connected to the cylinder directly and the dispersion of control system is not included.)

Overrun (ML2B + PLC)

When cylinder is stopped at intermediate strokes, "idle running distance" is from the detection of stop signal to beginning of brake operation and "braking distance" is from beginning of brake operation to stop of slider.

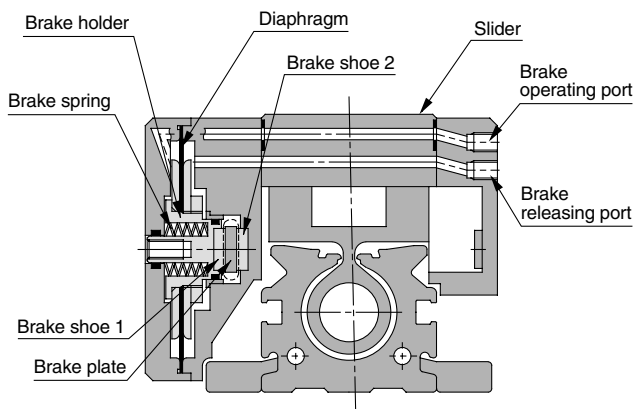


The graph below shows the relation between piston speed and overrun. (The length of overrun is changed dependent on piston speed, load, piping condition and control method. Be sure to adjust the stop signal position, etc. by trial operation with the actual machine.)



Condition/Driving pressure: 0.5 MPa
 Brake releasing pressure: 0.3 MPa
 Mounting orientation: Horizontal

Working Principle of Brake Mechanism



Anatomy of brake operation

Spring force generated by the brake spring and the air pressure supplied to brake operating port work on brake shoe 1 fixed to the brake holder, bend brake plate fixed on head cover on both sides, and stop slider by putting brake plate between brake shoe 1 and brake shoe 2 fixed on the slider side.

Brake release

The air pressure supplied to the brake releasing port acts on a diaphragm, extending the brake spring, and canceling the brake.

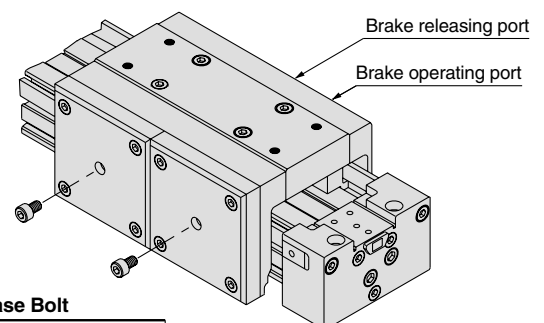
Manual Operation

[Brake releasing]

1. Supply brake releasing pressure of 0.3 to 0.5 MPa to brake releasing port on slider side.
2. Screw on appropriate hexagon socket head bolt into manual port on slide side.
3. Exhaust brake releasing air.

[Brake operation]

1. Supply brake releasing pressure of 0.3 to 0.5 MPa to brake releasing port on slider side.
2. Remove the bolt threaded into manual port.
3. Exhaust brake releasing air.



Manual Release Bolt

Model	Size	Length (L)
ML2B25	M5 x 0.8	L = 8
ML2B32	M6 x 1	L = 10
ML2B40	M8 x 1.25	L = 12

Note) Screw in after attaching a washer in the hexagon socket head cap bolt.

Cushion Capacity

Cushion Selection

<Air cushion>

Stroke reading hy-rodless cylinder with brake is equipped with a standard air cushion.

The air cushion mechanism is incorporated to prevent excessive impact of the piston at the stroke end during high speed operation. The purpose of air cushion, thus, is not to decelerate the piston near the stroke end.

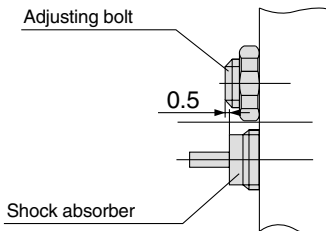
The weight and speed ranges that the air cushion can absorb are shown within the limit lines on the graph.

<Stroke adjusting unit with shock absorber>

Use this unit to decelerate the cylinder when weight and speed are beyond the air cushion limit lines or when the stroke adjustment causes limited or no cushion engagement.

⚠ Caution

- The absorption capacity of each unit shown here is given for the mounted shock absorber when used at full stroke. When the effective stroke of the absorber decreases as a result of stroke adjustment, the absorption capacity becomes extremely small. Fix the adjusting bolt to around 0.5 mm projection from the shock absorber as shown below.



- When the shock absorber is used within the air cushion stroke range, almost open the air cushion needle (about 1 turn from the fully closed position).

Air Cushion Stroke (mm)

Bore size (mm)	Cushion stroke
25	15
32	19
40	24

Service Life and Replacement Period of Shock Absorber

⚠ Caution

- Allowable operating cycle under the specifications set in this catalog is shown below.

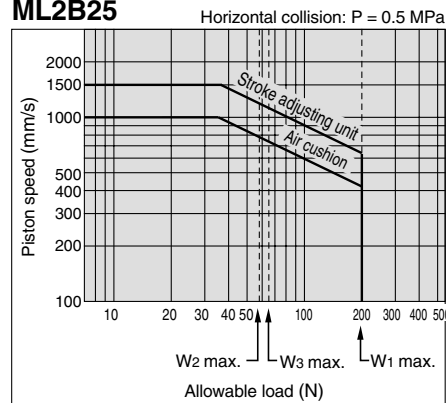
2 million cycles: RB1007, RB1412

Note) Specified service life (suitable replacement period) is the value at room temperature (20 to 25°C). The period may vary depending on the temperature and other conditions. In some cases the absorber may need to be replaced before the allowable operating cycle above.

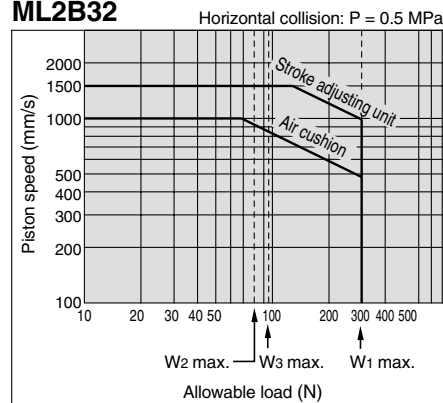
Bore size (mm)	Shock absorber model
25	RB1007
32	RB1412
40	RB1412

Absorption Capacity of the Air Cushion and Stroke Adjusting Unit

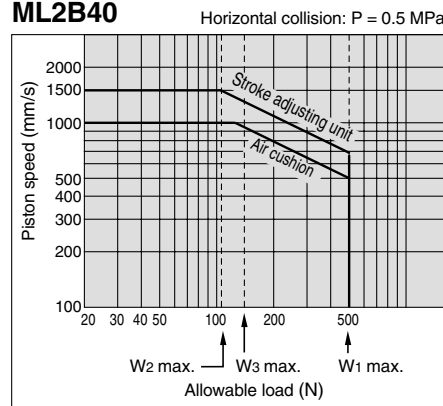
ML2B25



ML2B32



ML2B40



Tightening Torque for Stroke Adjusting Unit Holding Bolts (N·m)

Bore size (mm)	Tightening torque
25	3
32	5
40	10

Tightening Torque for Stroke Adjusting Unit Lock Plate Holding Bolts (N·m)

Bore size (mm)	Tightening torque
25	1.2
32	3.3
40	3.3

Calculation of Absorbed Energy for Stroke Adjusting Unit with Shock Absorber (N·m)

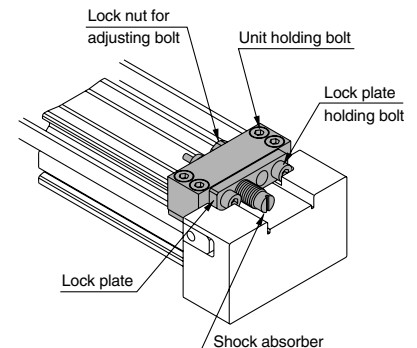
Type of impact	Horizontal collision	Vertical collision (Downward)	Vertical collision (Upward)
Kinetic energy E_1	$\frac{1}{2} m \cdot v^2$	$\frac{1}{2} m \cdot v^2$	$\frac{1}{2} m \cdot v^2$
Thrust energy E_2	$F \cdot s$	$F \cdot s + m \cdot g \cdot s$	$F \cdot s - m \cdot g \cdot s$
Absorbed energy E	$E_1 + E_2$		

Symbol

v : Speed of impact object (m/s) m : Mass of impact object (kg)
 F : Cylinder thrust (N) g : Gravitational acceleration (9.8 m/s²)
 s : Shock absorber stroke (m)

Note) The speed of the impact object is measured at the time of impact with the shock absorber.

Adjusting Procedure



<Movement and location of stroke adjustment>

The unit body can be moved after the four unit holding bolts are loosened and can be fixed at any position by uniformly tightening the four unit holding bolts. However, there is a possibility that the adjustment mechanism will be tilted due to high impact energy.

Since the holder mounting bracket for adjustment is available as an option for -X416, -X417, we recommend that you use it. If any other length is desired, please consult with SMC. (Refer to "Tightening Torque for Stroke Adjusting Unit Holding Bolts".)

<Stroke adjustment of the adjusting bolt>

Loosen the lock nut of the adjusting bolt, adjust the stroke from the lock plate side using a wrench, then re-tighten it.

<Adjustment of shock absorber>

Loosen the two lock plate holding bolts, turn the shock absorber and adjust the stroke. Then, uniformly tighten the lock plate holding bolts and secure the shock absorber. Take care not to over-tighten the holding bolts. (Refer to "Tightening Torque for Stroke Adjusting Unit Lock Plate Holding Bolts".)

Note)

Although the lock plate may slightly bend due to tightening of the lock plate holding bolt, this does not affect the shock absorber and locking function.

CEP1

CE1

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ML2B

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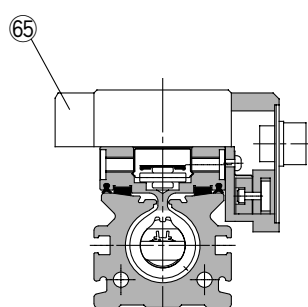
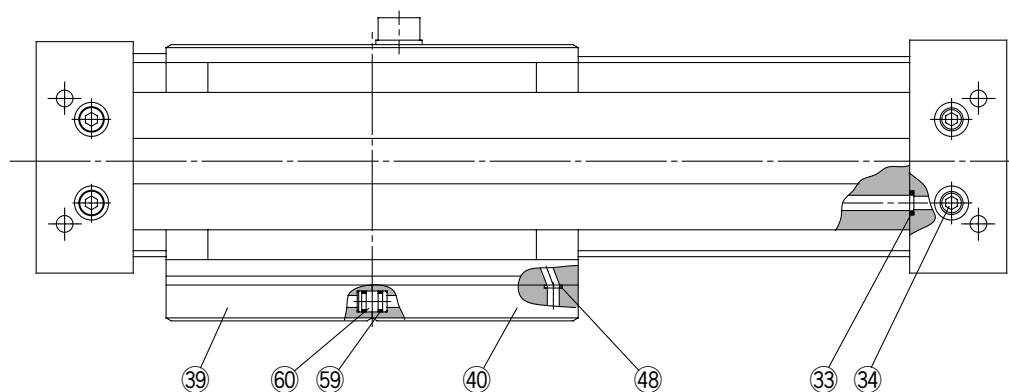
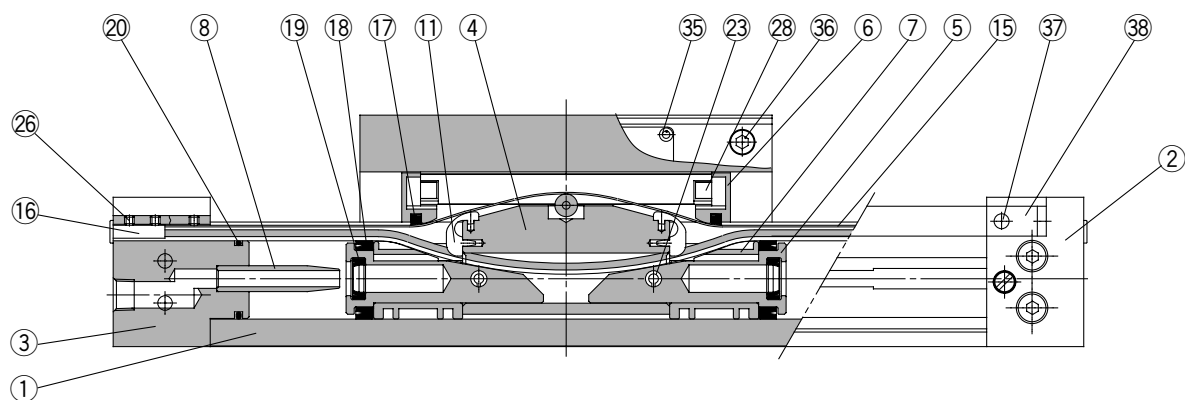
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Individual

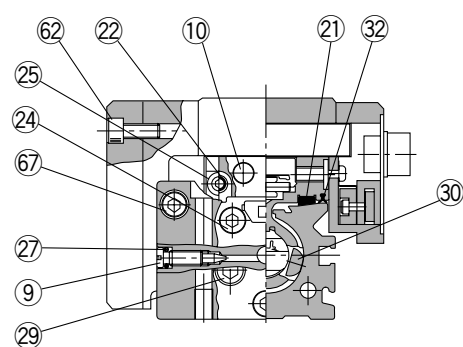
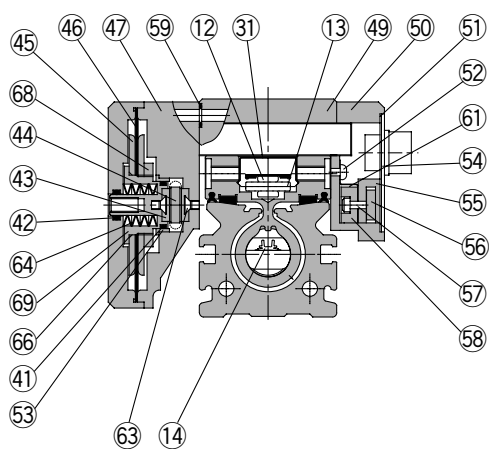
-X□

Series **ML2B**

Construction



ML2B□S



Component Parts

No.	Description	Material	Qty.	Note
1	Cylinder tube	Aluminum alloy	1	Hard anodized
2	Head cover WR	Aluminum alloy	1	Glossy, self-coloring
3	Head cover WL	Aluminum alloy	1	Glossy, self-coloring
4	Piston yoke	Aluminum alloy	1	Hard anodized
5	Piston	Aluminum alloy	2	Hard anodized
6	End cover	Special resin	2	
7	Wear ring	Special resin	2	
8	Cushion ring	Aluminum alloy	2	Anodized
9	Cushion needle	Steel wire	2	Nickel plated
10	Stopper	Carbon steel	4	
11	Belt separator	Special resin	2	
12	Guide roller	Special resin	1	
13	Guide roller shaft	Stainless steel	1	
14	Seal belt	Special resin	1	
15	Dust seal band	Stainless steel	1	
16	Belt clamp	Special resin	2	
17	Scraper	NBR	2	
18	Piston seal	NBR	2	
19	Cushion seal	NBR	2	
20	Tube gasket	NBR	2	
21	Bearing	Special resin	2	
22	Spacer	Stainless steel	4	
23	Spring pin	Carbon tool steel	2	Black zinc chromated
24	Hexagon socket head cap screw	Chromium molybdenum steel	6	Chromated
25	Hexagon socket button head screw	Chromium molybdenum steel	4	Chromated
26	Hexagon socket head set screw	Chromium molybdenum steel	8	Chromated
27	O-ring	NBR	2	
28	Double round parallel key	Carbon steel	2	
29	Hexagon socket head taper plug	Steel wire	6	Nickel plated
30	Magnet	—	2	
31	Top cover	Stainless steel	1	
32	Side scraper	Special resin	2	
33	O-ring	NBR	4	
34	Hexagon socket head taper plug	Steel wire	4	Chromated
35	Phillips truss head screw	Chromium molybdenum steel	4	Chromated
36	Hexagon socket head cap screw	Chromium molybdenum steel	3	Chromated
37	Parallel pin	Carbon steel	4	
38	Tension plate	Carbon steel	4	Nickel plated
39	Side cover L	Aluminum alloy	1	Hard anodized, Urban white
40	Side cover R	Aluminum alloy	1	Hard anodized, Urban white
41	O-ring	NBR	2	
42	O-ring	NBR	2	
43	Brake shoe	Special abrasion material	4	
44	Brake plate	Stainless steel	1	
45	Diaphragm shell	Stainless steel	4	
46	Diaphragm	NBR	2	
47	Brake body	Aluminum alloy	1	Hard anodized, Urban white
48	O-ring	NBR	1	
49	Slide table	Aluminum alloy	1	Hard anodized
50	Sensor body	Aluminum alloy	1	Hard anodized, Urban white
51	Connector gasket	NBR	1	
52	Round head Phillips screw	Chromium molybdenum steel	2	Chromated
53	Brake guide	Carbon steel	2	Gas soft treated
54	Connector cover 	Carbon steel	1	Chromated
55	Sensor guide	Special abrasion material	1	

No.	Description	Material	Qty.	Note
56	Scale plate	Carbon steel	1	Nickel plated
57	Hexagon socket head cap screw	Chromium molybdenum steel	2	Chromated
58	Sensor unit	—	1	
59	O-ring	NBR	6	
60	Joint valve	Stainless steel	1	
61	Sensor holder	Carbon steel	1	
62	Hexagon socket head cap screw	Carbon steel	8	
63	Cross recessed countersunk head screw	Carbon steel	4	
64	Brake spring	—	2	
65	Side plate	Aluminum alloy	1	Hard anodized, Urban white
66	O-ring	NBR	2	
67	Hexagon socket head cap screw	Chromium molybdenum steel	8	Chromated
68	Diaphragm nut	Carbon steel	2	Zinc chromated
69	Brake holder	Carbon steel	2	Gas soft treated

CEP1

CE1

CE2

ML2B

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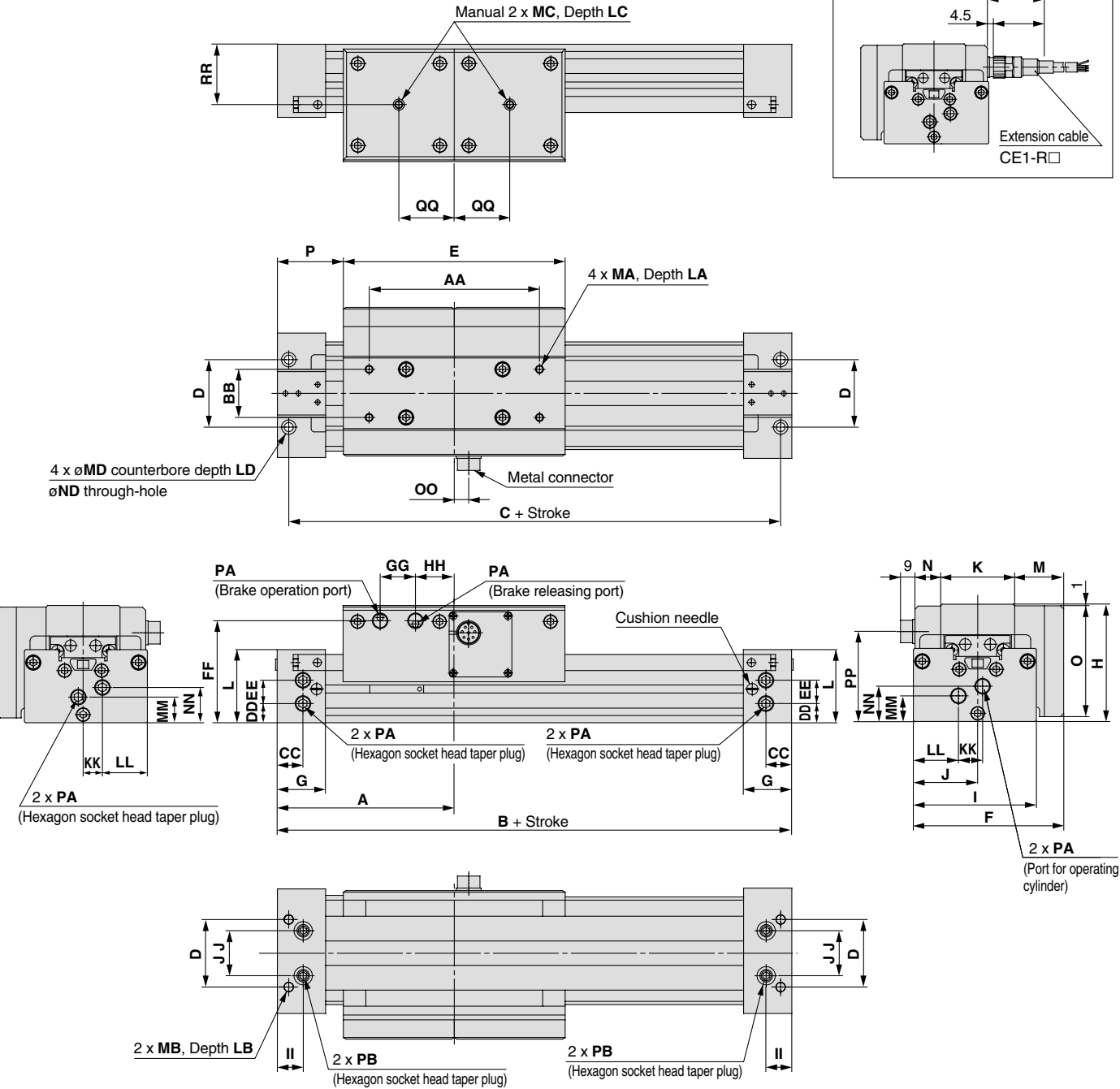
Individual
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Series ML2B

Dimensions

Basic style

ML2B Bore size — Stroke

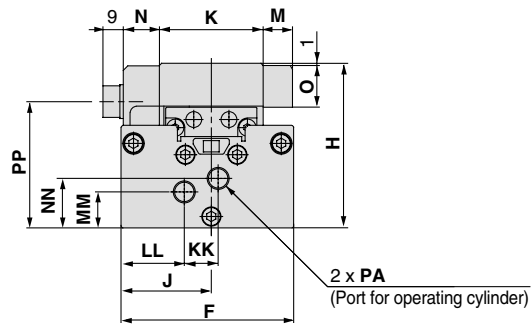


Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
ML2B25	110	220	206	42	138	93.5	30	73	76.5	40	46	45.5	30.9	16	69	41	106	30	16	11	14.5	63.5	22	24	16	28
ML2B32	140	280	264	51	168	107.5	37	88	91	46.5	58	54	32.4	15	84	56	133	35	19	15	16	77.5	27	32	19	32
ML2B40	170	340	322	59	204	130.5	45	106	110	55	68	64	41.4	19	102	68	164	40	23	16.5	22	95	35	37	23	36

Model	KK	LL	MM	NN	OO	PP	QQ	RR	MA	LA	MB	LB	MC	LC	MD	LD	ND	PA	PB
ML2B25	15	28	16	22	9	56	34.5	37.5	M5 x 0.8	11	M6 x 1	9.5	M5 x 0.8	9.5	9	5.5	5.6	Rc 1/8	Rc 1/16
ML2B32	16	30.5	21.5	26	10	62.5	42	45	M6 x 1	12	M8 x 1.25	16	M6 x 1	12	11	6.5	6.8	Rc 1/8	Rc 1/16
ML2B40	17.5	37.5	24.5	37.5	23	77	51	54	M8 x 1.25	14	M10 x 1.5	15	M8 x 1.25	12	14	8.5	8.6	Rc 1/4	Rc 1/8

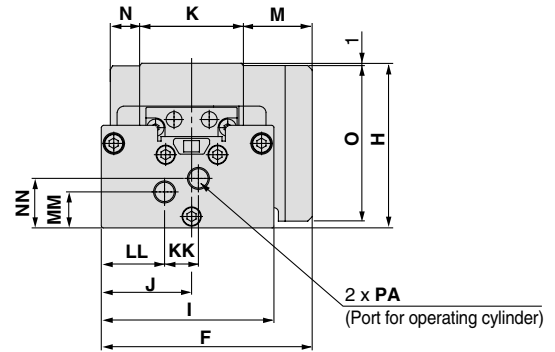
With stroke sensor:

ML2B Bore size S — Stroke



With brake:

ML2B Bore size B — Stroke



Applicable cylinder	F	H	J	K	M	N	O
ML2B25	76.5	73	40	46	13	16	18.5
ML2B32	91	88	46.5	58	15	15	19.5
ML2B40	110	106	55	68	19	19	21.5

Applicable cylinder	KK	LL	MM	NN	PA	PP
ML2B25	15	28	16	22	Rc 1/8	56
ML2B32	16	30.5	21.5	26	Rc 1/8	62.5
ML2B40	17.5	37.5	24.5	37.5	Rc 1/4	77

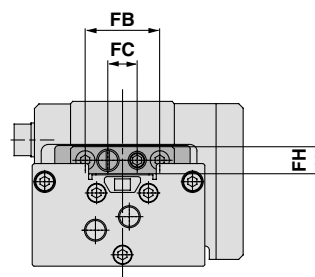
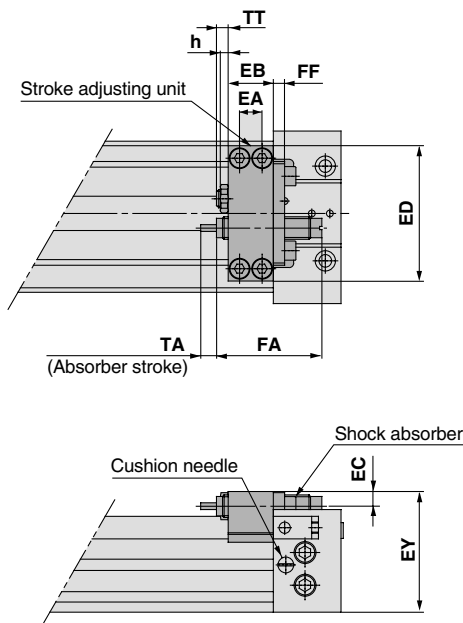
Applicable cylinder	F	H	I	J	K	M	N
ML2B25	93.5	73	76.5	40	46	30.5	16
ML2B32	107.5	88	91	46.5	58	32	15
ML2B40	130.5	106	110	55	68	41.5	19

Applicable cylinder	O	KK	LL	MM	NN	PA
ML2B25	69	15	28	16	22	Rc 1/8
ML2B32	84	16	30.5	21.5	26	Rc 1/8
ML2B40	102	17.5	37.5	24.5	37.5	Rc 1/4

Stroke Adjusting Unit

With shock absorber:

ML2B Bore size — Stroke L



Applicable cylinder	h	EA	EB	EC	ED	EY	FA	FB	FC	FF	FH	TA	TT
ML2B25	3.5	10	20	6.5	60	53.5	46.7	33	13	6	12	7	Max. 16.5
ML2B32	4.5	12	25	8.5	74	67	67.3	43	17	6	16	12	Max. 20
ML2B40	4.5	15	31	9.5	94	81.5	67.3	43	17	6	16	12	Max. 25

CEP1

CE1

CE2

ML2B

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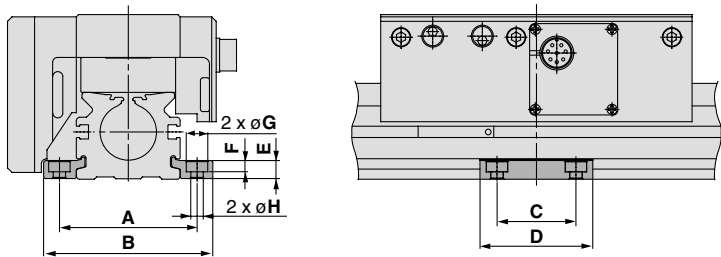
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Individual
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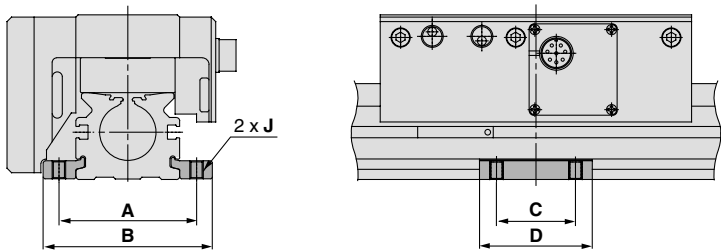
Series ML2B

Dimensions

Side support A MY-S□A



Side support B MY-S□B



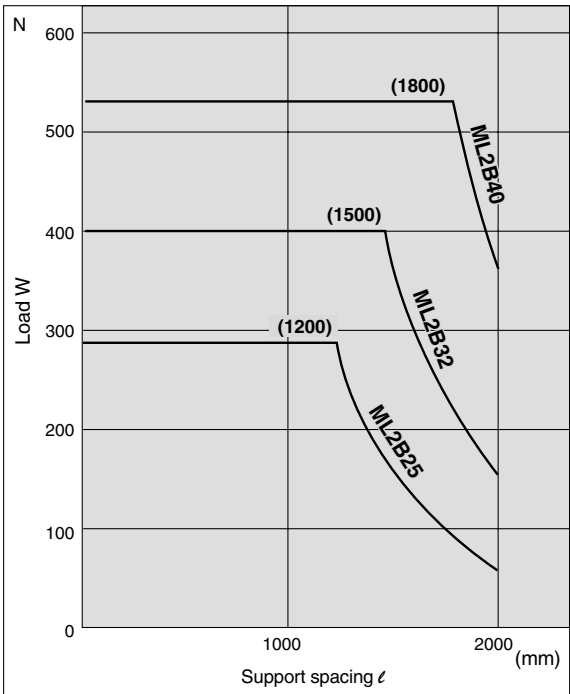
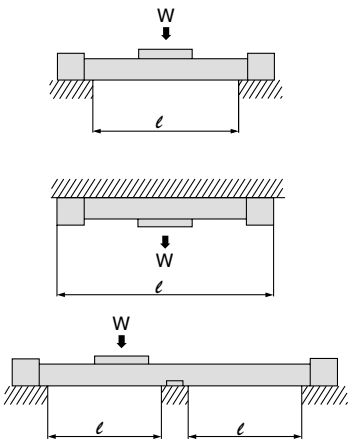
Part no.	Applicable cylinder	A	B	C	D	E	F	G	H	J
MY-S25 _B	ML2B25	61	75	35	50	8	5	9.5	5.5	M6 x 1
	ML2B32	70	84							
MY-S32 _B	ML2B40	87	105	45	64	11.7	6	11	6.6	M8 x 1.25

Guide for Side Support Application

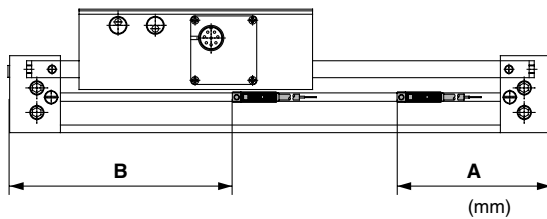
For long stroke operation, the cylinder tube may be deflected depending on its own weight and the load. In such a case, use a side support in the middle section. The spacing (ℓ) of the support must be no more than the values shown in the graph on the right.

Caution

If the cylinder mounting surfaces are not measured accurately, using a side support may cause poor operation. Therefore, be sure to level the cylinder tube when mounting. If there is vibration, impact, etc. at long stroke, we recommend adoption of side support even if it is within the allowable value shown in the graph.



Auto Switch Proper Mounting Position (Detection at Stroke End)



Auto switch model	Bore size (mm)	
	A	B
D-Z7□/Z80	91	131.5
D-Y59□/Y69□	102.5	180
D-Y7P/Y7PV	126.5	206
D-Y7□W		
D-Y7□WV		

Note) Adjust the auto switch after confirming the operating conditions in the actual setting.

Operating Range

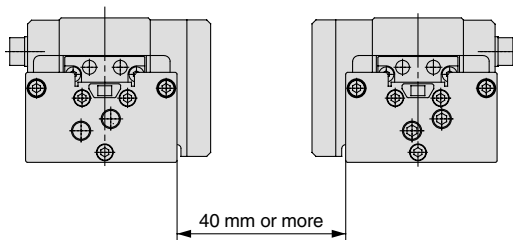
Auto switch model	Bore size (mm)		
	25	32	40
D-Z7□/Z80	12	12	12
D-Y59□/Y69□ D-Y7P/Y7PV D-Y7□W/Y7□WV	6	6	6

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



Caution on Handling Auto Switch

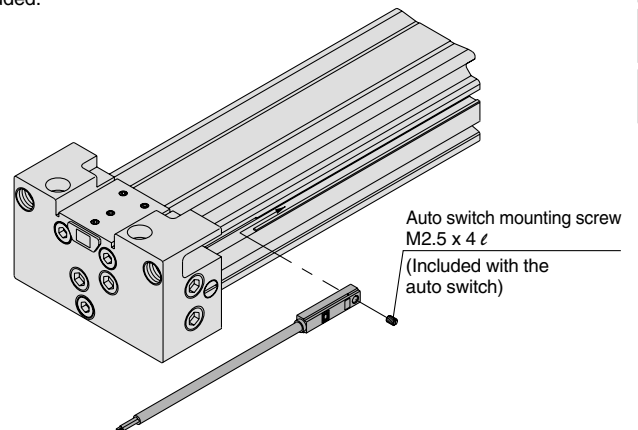
1. Always connect the auto switch to the power supply after the load has been connected.
2. Use caution not to apply excessive impact forces by dropping and bumping when handling.
3. When more than 2 cylinders with auto switches are juxtaposed, leave the distance of 40 mm or more between the cylinder tubes as shown in the below.



4. Avoid wiring patterns in which bending stress and pulling force are repeatedly applied to the lead wires.
5. Please consult with SMC when using in locations where water or coolant liquid, etc is splashing constantly.
6. Avoid the use in locations where the large amount of magnetism is occurring.

Auto Switch Mounting

When mounting and securing auto switches, they should be inserted into the cylinder's auto switch mounting rail from the direction shown in the drawing below. After setting in the mounting position, use a flat head watchmaker's screwdriver to tighten the auto switch mounting screw that is included.



Note) When tightening an auto switch mounting screw, use a watchmaker's screwdriver with a handle of approximately 5 to 6 mm in diameter. Also, tighten with a torque of about 0.05 to 0.1 N·m. As a guide, turn about 90° past the point at which tightening can first be felt.

CEP1

CE1

CE2

ML2B

D-□

-X□

Individual
-X□