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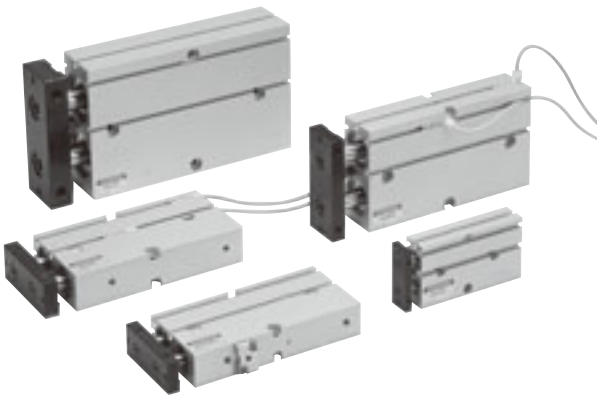
# KOGANEI

## ACTUATORS GENERAL CATALOG

### TWIN ROD CYLINDERS $\phi 6$



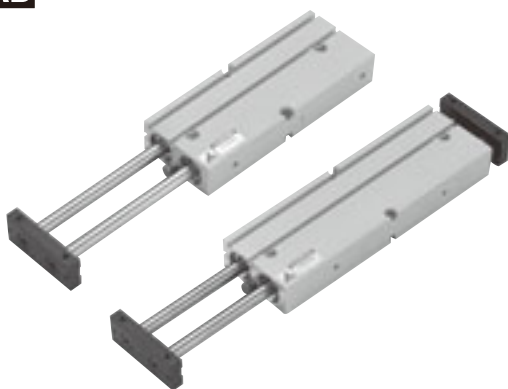
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### TWIN ROD CYLINDERS B SERIES



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alpha series

### TWIN ROD CYLINDERS B SERIES



**Caution**

Before use, be sure to read the "Safety Precautions" on p. 57.



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# KOGANEI

## ACTUATORS GENERAL CATALOG

# TWIN ROD CYLINDERS $\phi 6$ CONTENTS

TWIN ROD CYLINDERS  $\phi 6$

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**Caution**

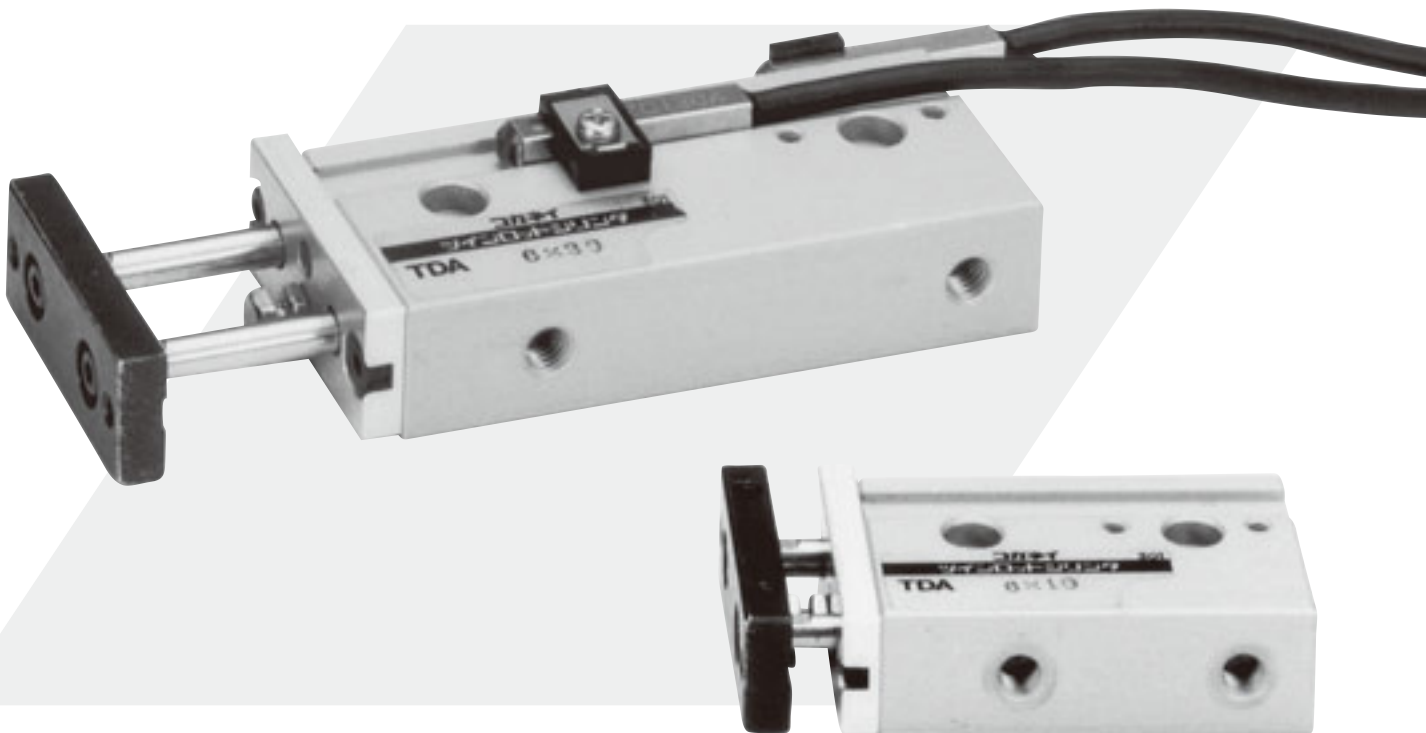
Before use, be sure to read the "Safety Precautions" on p. 57.

## TWIN ROD CYLINDERS $\phi$ 6

*A square style, a compact design that needs no guides, and direct mounting makes the mechanical devices more compact!*

*Non-rotating accuracy is  $\pm 0.45^\circ$ .*

*Moreover, cylinder thrust is twice that of conventional cylinders.*



## Selection Chart

Item / Operation type	Bore size mm	Strokes mm	Sensor switches		Non-ion specification
			Solid state type	Reed switch type	
Double acting type	6	10, 20, 30, 40, 50	ZC130 ZC153	CS5T CS11T	None

## Cylinder Thrust

Select a suitable cylinder bore size considering the load and air pressure to obtain the required thrust.

Since the figures in the table are calculated values, select a bore size that results in a load ratio (load ratio =  $\frac{\text{Load}}{\text{Calculated value}}$ ) of 70% or less (50% or less for high speed application).

Bore size mm [in.]	Rod size mm [in.]	Operation	Pressure area mm <sup>2</sup> [in. <sup>2</sup> ]	Air pressure MPa [psi.]							
				0.1 [15]	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]	
6 [0.236]	4 [0.157]	Double acting type	Push side	56 [0.087]	—	11.2 [2.52]	16.8 [3.78]	22.4 [5.04]	28 [6.29]	33.6 [7.55]	39.2 [8.81]
			Pull side	31 [0.048]	—	6.2 [1.39]	9.3 [2.09]	12.4 [2.79]	15.5 [3.48]	18.6 [4.18]	21.7 [4.88]

Note: Minimum operating pressure is 0.2MPa.

## Air Flow Rate and Air Consumption

While the twin rod cylinder's air flow rate and air consumption can be found through the following calculations, the quick reference chart below provides the answers more conveniently.

Air flow rate  $Q_1 = \frac{\pi D^2}{4} \times L \times \frac{60}{t} \times \frac{P+0.1013}{0.1013} \times 10^{-6} \times 2$

Air consumption  $Q_2 = \frac{\pi D^2}{4} \times L \times 2 \times n \times \frac{P+0.1013}{0.1013} \times 10^{-6} \times 2$

Q<sub>1</sub>: Required air flow rate for cylinder ℓ /min (ANR)  
 Q<sub>2</sub>: Air consumption of cylinder ℓ /min (ANR)  
 D: Cylinder bore diameter mm  
 L: Cylinder stroke mm  
 t: Time required for cylinder to travel one stroke s  
 n: Number of cylinder reciprocations per minute times/min  
 P: Air pressure MPa

Air flow rate  $Q_1' = \frac{\pi D'^2}{4} \times L' \times \frac{60}{t} \times \frac{P'+14.696}{14.696} \times \frac{1}{1728} \times 2$

Air consumption  $Q_2' = \frac{\pi D'^2}{4} \times L' \times 2 \times n \times \frac{P'+14.696}{14.696} \times \frac{1}{1728} \times 2$

Q<sub>1</sub>': Required air flow rate for cylinder ft.<sup>3</sup>/min. (ANR)\*  
 Q<sub>2</sub>': Air consumption of cylinder ft.<sup>3</sup>/min. (ANR)\*  
 D': Cylinder bore diameter in.  
 L': Cylinder stroke in.  
 t: Time required for cylinder to travel one stroke sec.  
 n: Number of cylinder reciprocations per minute times/min.  
 P': Air pressure psi.

\* Refer to p.54 for an explanation of ANR.

## Air consumption for each 1mm [0.0394in.] stroke

cm<sup>3</sup> [in.<sup>3</sup>]/Reciprocation (ANR)

Bore size mm [in.]	Air pressure MPa [psi.]						
	0.1 [15]	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]
6 [0.236]	(0.22 [0.0134])	0.34 [0.0207]	0.45 [0.0275]	0.56 [0.0342]	0.67 [0.0409]	0.78 [0.0476]	0.89 [0.0543]

The figures in the table show the air flow rate and air consumption when a Twin Rod cylinder makes 1 reciprocation with stroke of 1mm [0.0394in.].

The air flow rate and air consumption actually required is found by the following calculations.

- Finding the air flow rate (for selecting F.R.L., valves, etc.)

Example 1. When operating a Twin Rod cylinder with bore size of 6mm [0.236in.] at speed of 300mm/s [11.8in./sec.], under air pressure of 0.5MPa [73psi.]

$$0.67 \times \frac{1}{2} \times 300 \times 10^{-3} = 0.1 \text{ ℓ /s [0.00353ft.<sup>3</sup>/sec.]} \text{ (ANR)*}$$

(At this time, the flow rate per minute is  $0.67 \times \frac{1}{2} \times 300 \times 60 \times 10^{-3} = 6.03 \text{ ℓ /min [0.213ft.<sup>3</sup>/sec.]} \text{ (ANR)}$ )

- Finding the air consumption

Example 1. When operating a Twin Rod cylinder with bore size of 6mm [0.236in.] and stroke of 50mm [1.97in.], under air pressure of 0.5MPa [73psi.], for 1 reciprocation

$$0.67 \times 50 \times 10^{-3} = 0.0335 \text{ ℓ [0.00118ft.<sup>3</sup>]/Reciprocation (ANR)}$$

Example 2. When operating a twin rod cylinder with bore size of 6mm [0.236in.] and stroke of 50mm [1.97in.], under air pressure of 0.5MPa [73psi.], for 10 reciprocations per minute

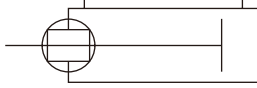
$$0.67 \times 50 \times 10 \times 10^{-3} = 0.335 \text{ ℓ /min [0.0118ft.<sup>3</sup>/min.]} \text{ (ANR)}$$

\* Refer to p.54 for an explanation of ANR.

# TWIN ROD CYLINDERS $\phi$ 6

## $\phi$ 6 Double Acting Type

### Symbol



### Specifications

Item	Bore size mm [in.]	6 [0.236]
Operation type		Double acting type
Media		Air
Mounting type		Side mount
Operating pressure range MPa [psi.]		0.2~0.7 [29~102]
Proof pressure MPa [psi.]		1.03 [149]
Operating temperature range °C [°F]		0~60 [32~140]
Operating speed range mm/s [in./sec.]		100~500 [3.9~19.7]
Cushion		None
Lubrication		Not required
Non-rotating accuracy		$\pm 0.45^\circ$
Stroke adjusting range mm [in.]		-5~0 [-0.197~0] (To the specification stroke)
Port size		M5×0.8

### Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke	mm
			Pull side stroke adjusting range
6	10, 20, 30, 40, 50	70	-5~0

Note: Consult us for delivery of strokes that exceed the standard strokes.

### Order Codes

**TDA 6× 10** — [ ] [ ] [ ]

**Twin rod cylinder double acting type** Note

**Bore size**  
6 —  $\phi$  6

**Stroke**

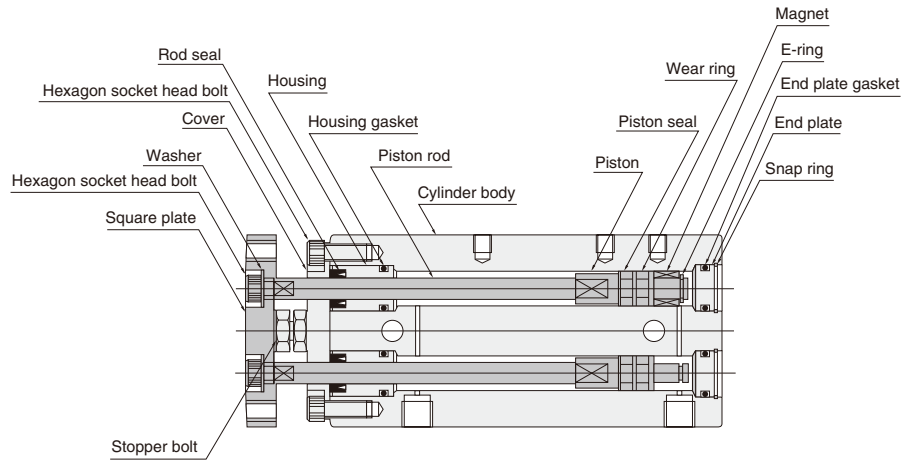
**Lead wire length**  
A : 1000mm [39in.]  
B : 3000mm [118in.]

**Number of sensor switches**  
1 — With 1 sensor switch  
2 — With 2 sensor switches

**Sensor switch**  
**Blank** — No sensor switch  
**ZC130** — 2-lead wire Solid state type with indicator lamp DC10~28V  
**ZC153** — 3-lead wire Solid state type with indicator lamp DC4.5~28V  
**CS5T** — 2-lead wire Reed switch type without indicator lamp DC5~28V AC85~115V  
**CS11T** — 2-lead wire Reed switch type with indicator lamp DC10~28V  
 ● For details of sensor switches, see p.1544.

Note: In the standard cylinder, a magnet for sensor switch is built-in.

# Inner Construction and Major Parts



TWIN ROD CYLINDERS φ6

## Major Parts and Materials

Parts	Materials
Cylinder body	Aluminum alloy (anodized)
Piston	Aluminum alloy (anodized)
Cover	Steel (nickel plated)
Wear ring	Plastic
Piston rod	Stainless steel
Gasket	Synthetic rubber (NBR)
Housing	Aluminum alloy (special wear-resistant treatment)
End plate	Plastic
Seal	Synthetic rubber (NBR)
Snap ring	Steel (nickel plated)
Magnet	Sintered alloy magnet
E-ring	Stainless steel
Washer	Steel (nickel plated)
Square plate	Mild steel (special surface treatment)
Stopper bolt	Mild steel (zinc plated)

Remark: Non-ion specification is not available.

## Seals

Parts	Rod seal	Piston seal	End plate gasket	Housing gasket
Quantity	2	2	2	2
Bore	6	MYR-4	COP-6L	1×6

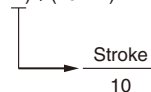
## Mass

Bore size		Zero stroke mass <sup>Note1</sup>	Additional mass	
mm [in.]			Additional mass of each 10mm [0.394in.] stroke	Mass of 1 sensor switch <sup>Note2</sup>
				CS5T□, CS11T□, ZC130□, ZC153□
6 [0.236]	Standard specification	55 [1.94]	12 [0.42]	20 [0.71]

- Notes: 1. The above table is for the standard strokes.  
 2. There are 2 types of sensor switch lead wire lengths.  
 A: 1000mm [39in.], B: 3000mm [118in.]  
 The sensor switch mass in the table above is for Type A.

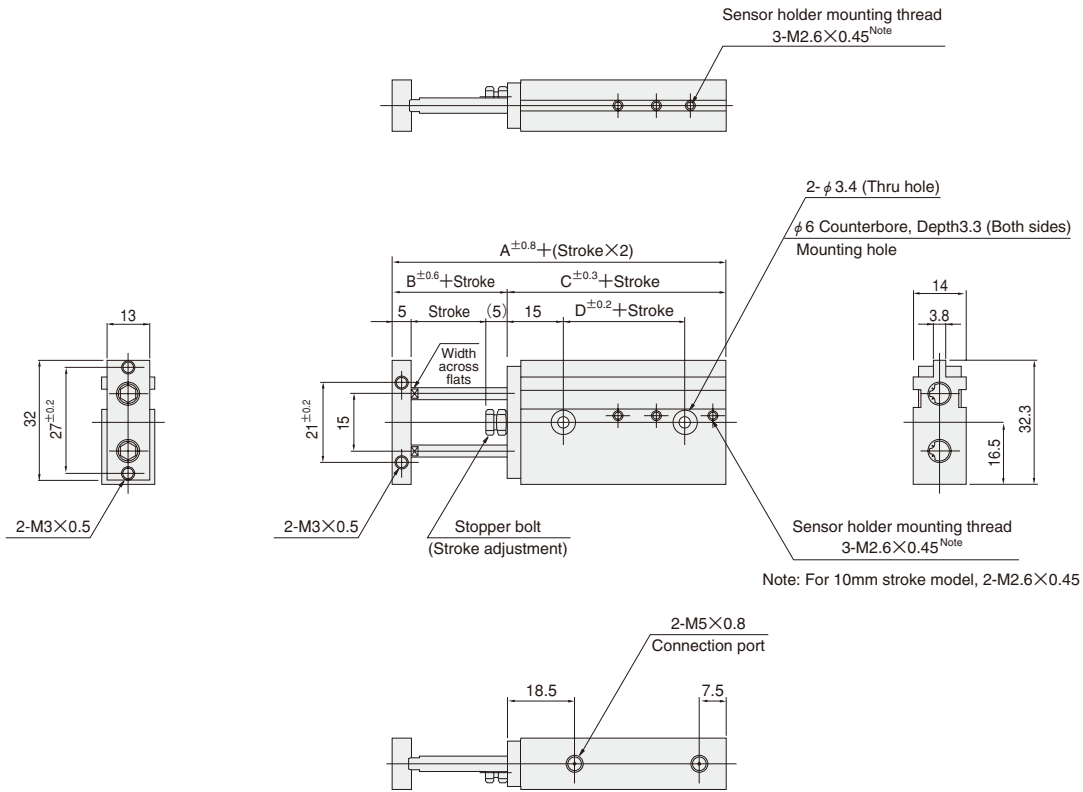
Calculation example: The mass for bore size of 6mm and stroke of 40mm with 2 sensor switches (CS5TA),

$$55 + (12 \times 4) + (20 \times 2) = 143\text{g [5.04oz.]}$$



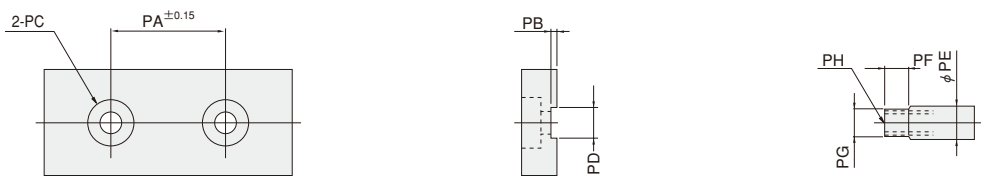
# Dimensions of Double Acting Type (mm)

TDA 6 × Stroke



Bore mm [in.]	Code	A	B	C	D
6 [0.236]		49	10	39	13

# Dimensions of Rod End Portion (mm)

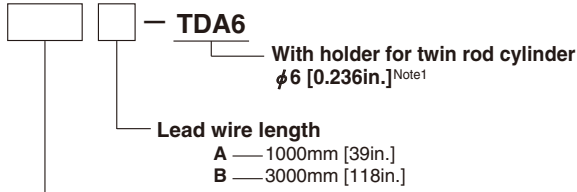


Bore mm [in.]	Code	PA	PB	PC	PD	PE	PF	PG	PH
6 [0.236]		15	0.5	φ 3 Counterbore φ 5 Depth 3.2	3.5 <sup>+0.15</sup> / <sub>+0.03</sub>	4	3	3.5 <sup>0</sup> / <sub>-0.15</sub>	M2.6 × 0.45 Depth 5

# SENSOR SWITCHES

## Solid State Type, Reed Switch Type

### Order Codes



#### Sensor switch

ZC130	— Solid state type	with indicator lamp	DC10~28V
ZC153	— Solid state type	with indicator lamp	DC4.5~28V
CS5T	— Reed switch type	without indicator lamp	DC5~28V
CS11T	— Reed switch type	with indicator lamp	AC85~115V
			DC10~28V

#### ● Order code of sensor holder only

#### C1-TDA6 Note2

- Notes: 1. Two sensor holders (one for the A, C surface and one for the B surface) come with 1 sensor switch.  
 2. One set consists of 2 sensor holders (1 each for the A, C surface and for the B surface).

Remark : For the mounting surfaces, see p.751.

● For details of sensor switches, see p.1544.

### Sensor Switch Operating Range, Response Differential, and Maximum Sensing Location

#### ● Operating range: $\ell$

The distance the piston travels in one direction, while the switch is in the ON position.

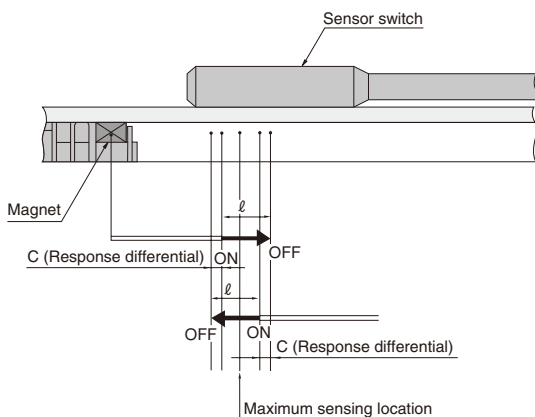
#### ● Response differential: C

The distance between the point where the piston turns the switch ON and the point where the switch is turned OFF as the piston travels in the opposite direction.

CS5T□			CS11T□			ZC130□, ZC153□		
Operating range	Response differential	Maximum sensing location	Operating range	Response differential	Maximum sensing location	Operating range	Response differential	Maximum sensing location
5~7 [0.197~0.276]	1.3 [0.051] or less	7 [0.276]	5~7 [0.197~0.276]	1.3 [0.051] or less	10.5 [0.413]	2~3 [0.079~0.118]	0.3 [0.012] or less	8.5 [0.335]

Note: The maximum sensing location is the length measured from the switch's opposite end side to the lead wire.

Remark: The above table shows reference values.



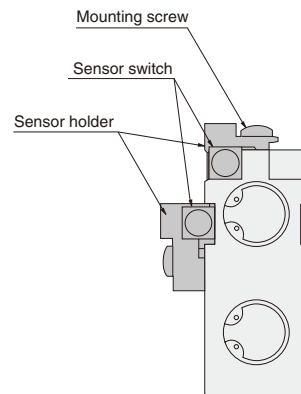
### Minimum Cylinder Strokes When Using Sensor Switches

Type of sensor switch	2 pcs. mounting			1 pc. mounting
	1-surface mounting		2-surface mounting	
	One groove on each A surface and B surface	Two grooves on B surface		
CS□T□	40	10	10	10
ZC□□	40	10	10	10

Remark : For the mounting surfaces, see p.751.

TWIN ROD CYLINDERS φ6

### Moving Sensor Switch

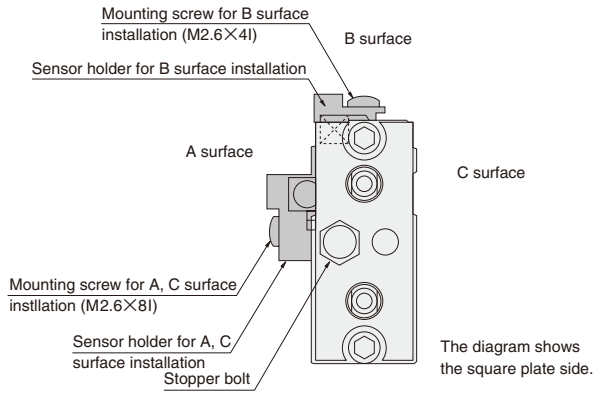


The diagram shows a view of the end plate side.

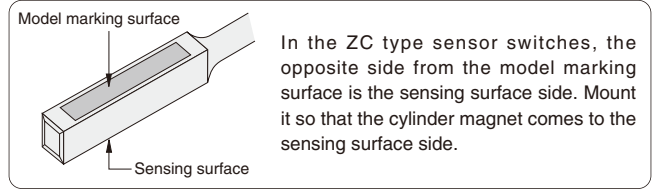
- Loosening mounting screw allows the sensor switch to be moved freely in the cylinder's axial direction.
- Tighten the mounting screw with a tightening torque of 0.3N·m [2.7in·lbf] or less.



## Sensor Switch Mounting Surface



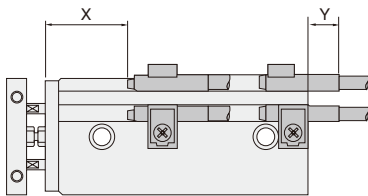
### Caution at mounting



- Mounting on either 1 or 2 surfaces of the A, B, or C surfaces allows detection of the rod side and head side stroke end.
- Since 2 sensor holders and 2 mounting screws (one for the A, C surface and one for the B surface) are provided for each sensor switch, use in accordance with the required mounting surface.

## Mounting Location of End of Stroke Detection Sensor Switch

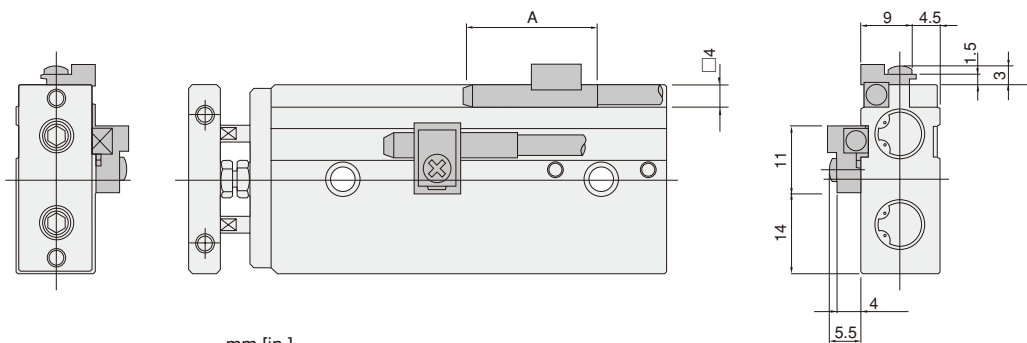
- When the sensor switch is mounted in the locations shown below (the figures in the tables are reference values), the magnet comes to the maximum sensing location of the sensor switch at the end of the stroke.



Mounting location	Sensor switch type		
	CS5T□	CS11T□	ZC130□, ZC153□
X	23 [0.906]	19.5 [0.768]	22 [0.866]
Y	6 [0.236]	6.5 [0.256]	8 [0.315]

Remark: Mount the sensor switch so that the surface showing the model faces up.

## Dimensions of Sensor Switch



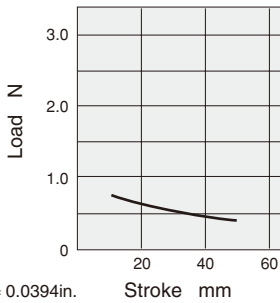
		mm [in.]			
Sensor switch Code	CS5T□	CS11T□	ZC130□	ZC153□	
A	22 [0.866]	26 [1.024]	25 [0.984]		



## Mounting and adjustment

### Allowable lateral load

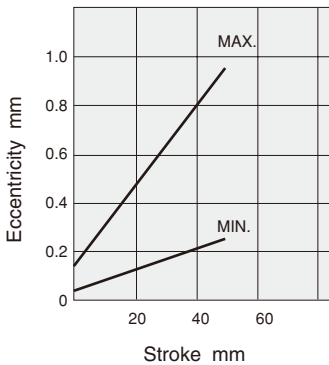
The lateral (side) load on the rod bearing should be at or below the graph values shown below.



1mm = 0.0394in.  
1N = 0.2248lbf.

### Plate eccentricity

For the eccentricity of the plate without load, use the graph values shown below as guides.



1mm = 0.0394in.



## Sensor switch

### Mounting

1. While any mounting direction is allowed, the mounting surface should always be flat. Twisting or bending during mounting may disturb the accuracy and may also result in air leaks or improper operation.
2. Care should be taken that scratches or dents on the cylinder's mounting surface may damage its flatness.
3. The hexagon socket head bolt on the rod end square plate has been mounted with a conical washer. Always confirm that the rod end square plate and hexagon socket head bolts are secured before using the cylinder.

### Stroke adjustment

On the Twin Rod cylinder, stroke adjusting is easy within a range of -5~0mm [-0.197~0 in.]. Turn the stopper to the left (counter-clockwise) to shorten the stroke.

Use a lock nut to tighten and secure the stopper in place after adjustment. Do not tighten the bolt to the right (clockwise) beyond the standard position. The stroke at shipping is set to the standard stroke. Do not adjust it to larger than the standard stroke.

### Cylinder speed

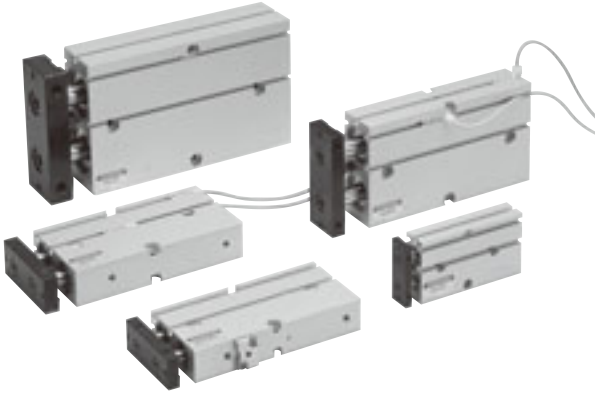
Use the cylinder at or below a speed of 500mm/s [19.7in./sec.] (use a speed controller for adjustment). For high speeds (500mm/s [19.7in./sec.]), install an external stopper, etc., to prevent direct shocks to the cylinder. Consult us if the situation will not permit installation of an external stopper, etc.

1. In the standard cylinder, the magnet for sensor switch is built-in. Mounting a sensor switch will enable use in sensor switch applications
2. When placing cylinders with 2 or more sensors in close for installation, the proximity of the magnetic fields may interfere with each other resulting in erratic operation.  
For this type of mounting configuration, consult us.





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is available.



# KOGANEI

## ACTUATORS GENERAL CATALOG

# TWIN ROD CYLINDERS B SERIES CONTENTS

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**Caution**

Before use, be sure to read the "Safety Precautions" on p. 57.

# KOGANEI

# TWIN ROD CYLINDERS

# B SERIES



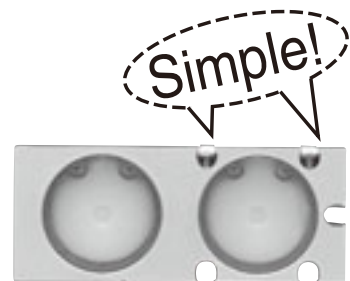
## SQUARE

*A slender, square form offering direct mounting, a compact design that eliminates the need for guides, and a sensor switch magnet as standard!*



## FLAT

*This horizontal lead wire type compact sensor switch does not protrude from the body, promoting further space-saving of the mechanical device. In addition, 5 mounting locations on 3 different surfaces facilitate detection of various applications.*

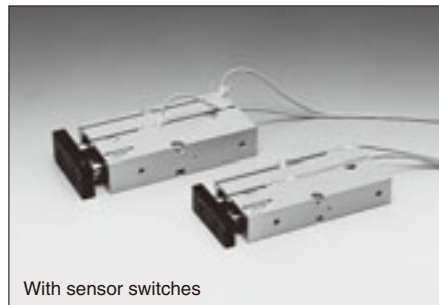
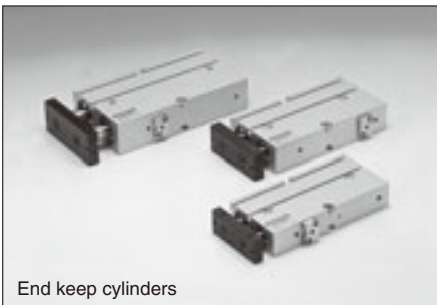
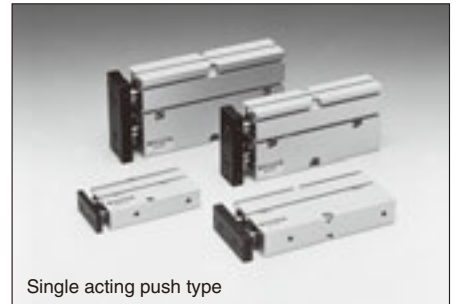
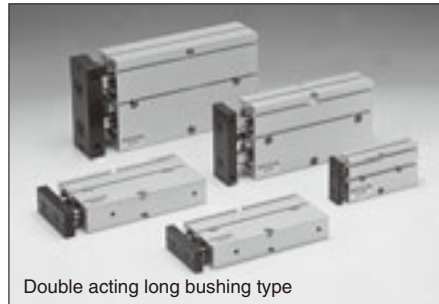
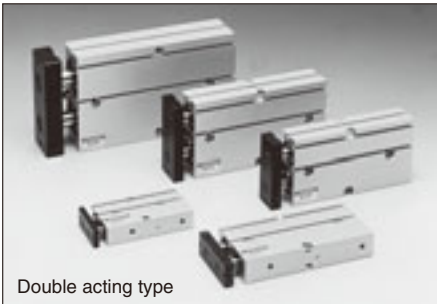
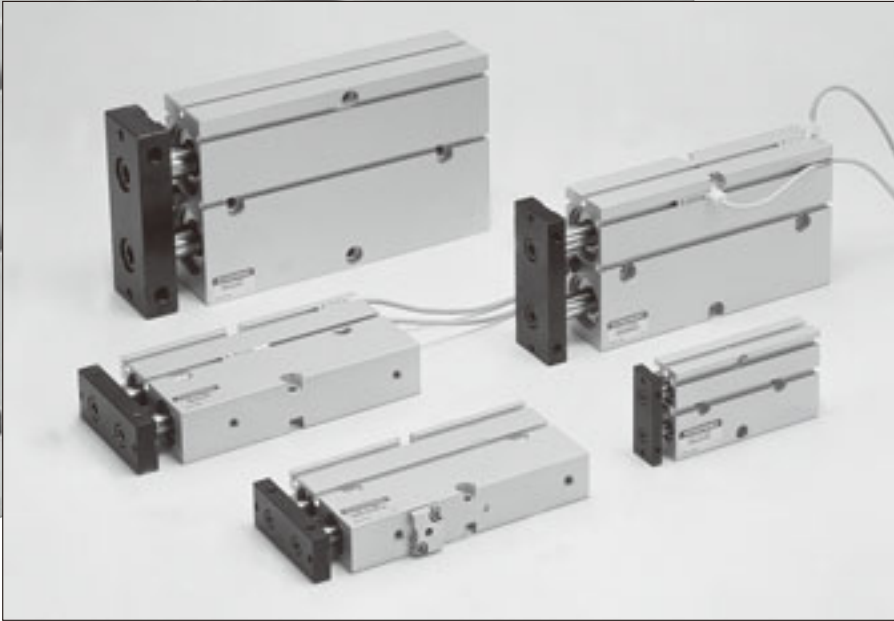


## POWERFUL

*Excellent non-rotating accuracy, while a double piston structure doubles the cylinder's thrust.*

*In addition, the Twin Rod cylinder B series helps save space and man-hours, plus it lowers costs.*





**Selection chart**

	Cylinder bore size mm	Strokes mm	Sensor switch		Non-ion Specification
			Solid state type	Reed switch type	
Double acting type	<div style="display: flex; justify-content: space-around;"> <span>10</span> <span>16</span> <span>20</span> <span>25</span> <span>32</span> </div>	<div style="display: flex; justify-content: space-between;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>10</span><span>20</span><span>30</span><span>40</span><span>50</span><span>60</span><span>70</span><span>80</span><span>90</span><span>100</span> </div> <div style="text-align: right; margin-right: 20px;"> <math>\phi 10</math> — <math>\phi 16, \phi 20, \phi 25, \phi 32</math> </div> </div>	ZE135 ZE235 ZE155 ZE255	ZE101 ZE102 ZE201 ZE202	Available
Double acting long bushing type	<div style="display: flex; justify-content: space-around;"> <span>10</span> <span>16</span> <span>20</span> <span>25</span> <span>32</span> </div>	<div style="display: flex; justify-content: space-between;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>10</span><span>20</span><span>30</span><span>40</span><span>50</span><span>60</span><span>70</span><span>80</span><span>90</span><span>100</span> </div> <div style="text-align: right; margin-right: 20px;"> <math>\phi 10</math> — <math>\phi 16, \phi 20, \phi 25, \phi 32</math> </div> </div>	ZE135 ZE235 ZE155 ZE255	ZE101 ZE102 ZE201 ZE202	None
Single acting push type	<div style="display: flex; justify-content: space-around;"> <span>10</span> <span>16</span> <span>20</span> <span>25</span> </div>	<div style="display: flex; justify-content: space-between;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>10</span><span>20</span><span>30</span><span>40</span><span>50</span><span>60</span> </div> <div style="text-align: right; margin-right: 20px;"> <math>\phi 10, \phi 16, \phi 20, \phi 25</math> </div> </div>	ZE135 ZE235 ZE155 ZE255	ZE101 ZE102 ZE201 ZE202	None
End keep cylinders	<div style="display: flex; justify-content: space-around;"> <span>16</span> <span>20</span> <span>25</span> </div>	<div style="display: flex; justify-content: space-between;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>10</span><span>20</span><span>30</span><span>40</span><span>50</span><span>60</span><span>70</span><span>80</span> </div> <div style="text-align: right; margin-right: 20px;"> <math>\phi 16, \phi 20, \phi 25</math> </div> </div>	ZE135 ZE235 ZE155 ZE255	ZE101 ZE102 ZE201 ZE202	None

# Cylinder Thrust

Select a suitable cylinder bore size considering the load and air pressure to obtain the required thrust.

Since the figures in the table are calculated values, select a bore size that results in a load ratio (load ratio =  $\frac{\text{Load}}{\text{Calculated value}}$ ) of 70% or less (50% or less for high speed application).

Bore size mm [in.]	Rod dia. mm [in.]	Operation		Pressure area mm <sup>2</sup> [in. <sup>2</sup> ]	Air pressure MPa [psi.]						N [lbf.]
					0.1 [15]	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	
10 [0.394]	6 [0.236]	Double acting type	Push side	157 [0.243]	—	31.4 [7.06]	47.1 [10.59]	62.8 [14.12]	78.5 [17.65]	94.2 [21.18]	109.9 [24.71]
			Pull side	100 [0.155]	—	20 [4.5]	30 [6.7]	40 [9.0]	50 [11.2]	60 [13.5]	70 [15.7]
		Single Acting Push Type	157 [0.243]	—	—	5.5 [1.24]	21.2 [4.77]	36.9 [8.30]	52.6 [11.82]	68.3 [15.35]	
16 [0.630]	8 [0.315]	Double acting type	Push side	402 [0.623]	40.2 [9.04]	80.4 [18.07]	120.6 [27.11]	160.8 [36.15]	201 [45.18]	241.2 [54.22]	281.4 [63.26]
			Pull side	301 [0.467]	30.1 [6.77]	60.2 [13.53]	90.3 [20.30]	120.4 [27.07]	150.5 [33.83]	180.6 [40.60]	210.7 [47.37]
		Single Acting Push Type	402 [0.623]	—	39.3 [8.83]	79.5 [17.87]	119.7 [26.91]	159.9 [35.95]	200.1 [44.98]	240.3 [54.02]	
20 [0.787]	10 [0.394]	Double acting type	Push side	628 [0.973]	62.8 [14.12]	125.6 [28.23]	188.4 [42.35]	251.2 [56.47]	314 [70.59]	376.8 [84.70]	439.6 [98.82]
			Pull side	471 [0.730]	47.1 [10.59]	94.2 [21.18]	141.3 [31.76]	188.4 [42.35]	235.5 [52.94]	282.6 [63.53]	329.7 [74.12]
		Single Acting Push Type	628 [0.973]	—	78.2 [17.58]	141 [31.70]	203.8 [45.81]	266.6 [59.93]	329.4 [74.05]	392.2 [88.17]	
25 [0.984]	12 [0.472]	Double acting type	Push side	981 [1.521]	98.1 [22.05]	196.2 [44.11]	294.3 [66.16]	392.4 [88.21]	490.5 [110.26]	588.6 [132.32]	686.7 [154.37]
			Pull side	755 [1.170]	75.5 [16.97]	151 [33.94]	226.5 [50.92]	302 [67.89]	377.5 [84.86]	453 [101.83]	528.5 [118.81]
		Single Acting Push Type	981 [1.521]	—	115.8 [26.03]	213.9 [48.08]	312 [70.14]	410.1 [92.19]	508.2 [114.24]	606.3 [136.30]	
32 [1.260]	16 [0.630]	Double acting type	Push side	1607 [2.491]	160.7 [36.13]	321.4 [72.25]	482.1 [108.38]	642.8 [144.50]	803.5 [180.63]	964.2 [216.75]	1124.9 [252.88]
			Pull side	1205 [1.868]	120.5 [27.09]	241 [54.18]	361.5 [81.27]	482 [108.35]	602.5 [135.44]	723 [162.53]	843.5 [189.62]
		Single Acting Push Type	1607 [2.491]	—	—	—	—	—	—	—	

Note: The values of the single acting push type show the thrust at the end of the 60mm stroke.

## The Spring Return Force (Only for the Single Acting Type)

Bore size mm [in.]	Stroke mm	N [lbf.]	
		At zero stroke	At the end of stroke
10 [0.394]	10	16.5 [3.71]	20.6 [4.63]
	20	12.4 [2.79]	
	30	8.2 [1.84]	
	40	25.1 [5.64]	41.6 [9.35]
	50	21.0 [4.72]	
	60	16.9 [3.80]	
16 [0.630]	10	15.9 [3.57]	20.4 [4.59]
	20	11.1 [2.50]	
	30	6.3 [1.42]	
	40	22.3 [5.01]	41.1 [9.24]
	50	17.6 [3.96]	
	60	12.8 [2.88]	
20 [0.787]	10	19.6 [4.41]	23.5 [5.28]
	20	15.7 [3.53]	
	30	11.8 [2.65]	
	40	31.7 [7.13]	47.4 [10.66]
	50	27.8 [6.25]	
	60	23.8 [5.35]	
25 [0.984]	10	32.9 [7.40]	39.5 [8.88]
	20	26.2 [5.89]	
	30	19.5 [4.38]	
	40	53.7 [12.07]	80.4 [18.07]
	50	47.1 [10.59]	
	60	40.4 [9.08]	

- Notes: 1. The values are for 2 springs.  
2. Avoid application that applies a load on the spring return side.

# Air Flow Rate and Air Consumption

While the Twin Rod cylinder's air flow rate and air consumption can be found through the following calculations, the quick reference chart to the right provides the answers more conveniently.

$$\text{Air flow rate } Q_1 = \frac{\pi D^2}{4} \times L \times \frac{60}{t} \times \frac{P+0.101}{0.101} \times 10^{-6} \times 2$$

$$\text{Air consumption } Q_2 = \frac{\pi D^2}{4} \times L \times 2 \times n \times \frac{P+0.101}{0.101} \times 10^{-6} \times 2$$

- Q<sub>1</sub>: Required air flow rate for cylinder      ℓ /min (ANR)
- Q<sub>2</sub>: Air consumption of cylinder              ℓ /min (ANR)
- D: Cylinder bore diameter                      mm
- L: Cylinder stroke                                mm
- t: Time required for cylinder to travel 1 stroke      s
- n: Number of cylinder reciprocations per minute      times/min
- P: Air pressure                                      MPa

$$\text{Air flow rate } Q_1' = \frac{\pi D'^2}{4} \times L' \times \frac{60}{t} \times \frac{P'+14.7}{14.7} \times \frac{1}{1728} \times 2$$

$$\text{Air consumption } Q_2' = \frac{\pi D'^2}{4} \times L' \times 2 \times n \times \frac{P'+14.7}{14.7} \times \frac{1}{1728} \times 2$$

- Q<sub>1</sub>': Required air flow rate for cylinder      ft<sup>3</sup>/min. (ANR)\*
- Q<sub>2</sub>': Air consumption of cylinder              ft<sup>3</sup>/min. (ANR)\*
- D': Cylinder bore diameter                      in.
- L': Cylinder stroke                                in.
- t: Time required for cylinder to travel 1 stroke      sec.
- n: Number of cylinder reciprocations per minute      times/min.
- P': Air pressure                                      psi.

\* Refer to p.54 for an explanation of ANR.

## Air consumption for each 1mm [0.0394in.] stroke      cm<sup>3</sup> [in.<sup>3</sup>]/Reciprocation (ANR)

Bore size mm	Air pressure MPa [psi.]						
	0.1 [15]	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]
10	(0.620 [0.03783])	0.924 [0.05639]	1.228 [0.07494]	1.534 [0.09361]	1.838 [0.11216]	2.146 [0.13096]	2.450 [0.14951]
16	1.584 [0.09666]	2.364 [0.14426]	3.146 [0.19198]	3.926 [0.23958]	4.704 [0.28706]	5.486 [0.33478]	6.266 [0.38238]
20	2.48 [0.1513]	3.72 [0.2270]	4.90 [0.2990]	6.14 [0.3747]	7.36 [0.4491]	8.58 [0.5236]	9.80 [0.5980]
25	3.88 [0.2368]	5.78 [0.3527]	7.66 [0.4674]	9.58 [0.5846]	11.50 [0.7018]	13.42 [0.8189]	15.34 [0.9361]
32	6.36 [0.3881]	9.46 [0.5773]	12.56 [0.7665]	15.70 [0.9581]	18.82 [1.1485]	21.96 [1.3401]	25.10 [1.5317]

The figures in the table show the air flow rate and air consumption when an air cylinder makes 1 reciprocation with stroke of 1mm [0.0394in.].

The air flow rate and air consumption actually required is found by the following calculations.

- Finding the air flow rate (for selecting F.R.L., valves, etc.)

Example 1. When operating a Twin Rod cylinder with bore size of 20mm [0.787in.] at speed of 300mm/s [11.8in./sec.] and under air pressure of 0.5MPa [73psi.]

$$7.36 \times \frac{1}{2} \times 300 \times 10^{-3} = 1.10 \text{ ℓ /s [0.0388ft}^3\text{/sec.]} \text{ (ANR)}$$

(At this time, the flow rate per minute is  $7.36 \times \frac{1}{2} \times 300 \times 60 \times 10^{-3} = 66.24 \text{ ℓ /min [2.338ft}^3\text{/min.]} \text{ (ANR)}$ )

- Finding the air consumption

Example 1. When operating a Twin Rod cylinder with bore size of 20mm [0.787in.], stroke of 50mm [1.97in.], and under air pressure of 0.5MPa [73psi.], for 1 reciprocation.

$$7.36 \times 50 \times 10^{-3} = 0.368 \text{ ℓ /Reciprocation [0.0130ft}^3\text{/Reciprocation]} \text{ (ANR)}$$

Example 2. When operating a Twin Rod cylinder with a bore size of 20mm [0.787in.], a stroke of 50mm [1.97in.], and under air pressure of 0.5MPa [73psi.], for 10 reciprocations per minute.

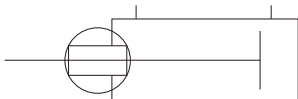
$$7.36 \times 50 \times 10 \times 10^{-3} = 3.68 \text{ ℓ /min [0.130ft}^3\text{/min.]} \text{ (ANR)}$$



# TWIN ROD CYLINDERS B SERIES

Double Acting Type

## Symbol



## Specifications

Item	Bore size mm [in.]				
	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operation type	Double acting type				
Media	Air				
Mounting type	Side mount				
Operating pressure range MPa [psi.]	0.15~0.7 [22~102]	0.1~0.7 [15~102]			
Proof pressure MPa [psi.]	1.05 [152]				
Operating temperature range °C [°F]	0~60 [32~140]				
Operating speed range mm/s [in./sec.]	100~500 [3.9~19.7]				
Cushion	Rubber bumper				
Lubrication	Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)				
Non-rotating accuracy	±0.4°	±0.3°			
Stroke adjusting range mm [in.]	-5~0 [-0.197~0] (To the specification stroke)				
Port size	M5×0.8			Rc1/8	

## Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke	mm
			Pull side stroke adjusting range
10	10, 20, 30, 40, 50, 60, 70	140	-5~0
16	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	
20	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	
25	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	
32	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	

Note: Consult us for delivery of strokes that exceed the standard strokes.  
Remark: Use the above table for non-ion specification, as well.

## Order Codes

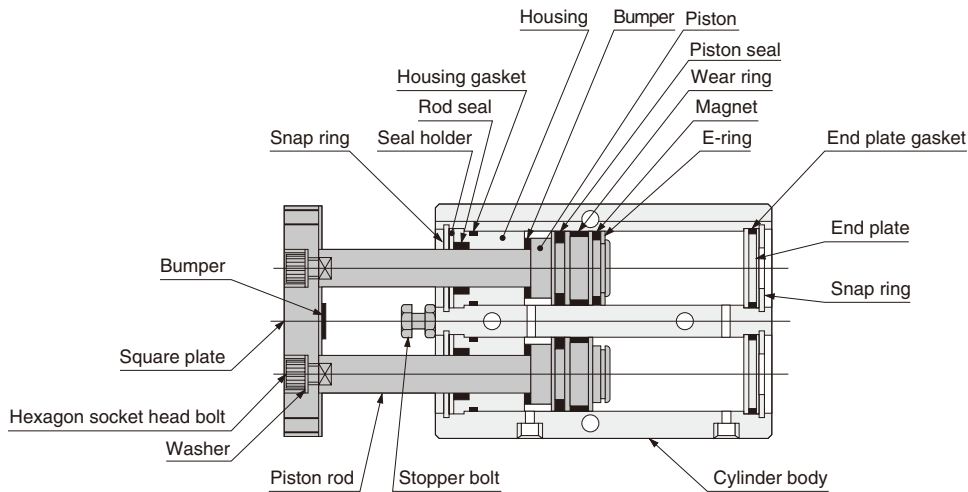
<b>TBDA</b> Twin rod cylinder B series double acting type <sup>Note1</sup>	<b>16×30</b> Bore size × Stroke	- [ ] - [ ] [ ] [ ]	<b>Number of sensor switches</b> 1 — With 1 sensor switch 2 — With 2 sensor switches	<b>Lead wire length</b> A : 1000mm [39in.] B : 3000mm [118in.]	<b>Sensor switch</b> <b>Blank</b> — No sensor switch	<b>Non-ion specification</b> <sup>Note2</sup> <b>Blank</b> — Standard specification The standard specification of φ10, φ16, and φ20 can also be used as non-ion specification. <b>NCU</b> — Non-ion specification for φ25, φ32 (Made to order)	<b>ZE135</b> — 2-lead wire, Solid state type with indicator lamp DC10~28V Horizontal lead wire <b>ZE235</b> — 2-lead wire, Solid state type with indicator lamp DC10~28V Vertical lead wire <b>ZE155</b> — 3-lead wire, Solid state type with indicator lamp DC4.5~28V Horizontal lead wire <b>ZE255</b> — 3-lead wire, Solid state type with indicator lamp DC4.5~28V Vertical lead wire <b>ZE101</b> — 2-lead wire, Reed switch type without indicator lamp DC5~28V AC85~115V Horizontal lead wire <b>ZE201</b> — 2-lead wire, Reed switch type without indicator lamp DC5~28V AC85~115V Vertical lead wire <b>ZE102</b> — 2-lead wire, Reed switch type with indicator lamp DC10~28V AC85~115V Horizontal lead wire <b>ZE202</b> — 2-lead wire, Reed switch type with indicator lamp DC10~28V AC85~115V Vertical lead wire
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Notes: 1. In the standard cylinder, the magnet for sensor switch is built-in.

2. Non-ion specifications of φ25, φ32 are made to order. The standard specification of φ10, φ16, and φ20 can also be used as non-ion specification. Consult us for specifications and delivery.

● For details of sensor switches, see p.1544.

# Inner Construction and Major Parts



TWIN ROD CYLINDERS B SERIES

## Major Parts and Materials

Parts	Materials
	For standard specification
Cylinder body	Aluminum alloy (anodized)
Piston	Aluminum alloy (chromic acid anodic oxide coating)
Wear ring	Plastic (non-teflon type <sup>Note</sup> )
Piston rod	Steel (chrome plated)
Gasket	Synthetic rubber (NBR)
Seal holder	Mild steel (nickel plated)
Housing	Aluminum alloy (special wear-resistant treatment)
End plate	Plastic (aluminum (anodized) for only $\phi$ 32 [1.260in.])
Seal	Synthetic rubber (NBR)
Snap ring	Steel (nickel plated)
Magnet	Plastic magnet
E-ring	Stainless steel
Washer	Steel (nickel plated)
Square plate	Mild steel (nickel plated)
Bumper	Synthetic rubber (NBR)
Stopper bolt	Mild steel (zinc plated)

Note: For  $\phi$  25 [0.984in.] and  $\phi$  32 [1.260in.] non-ion specification.  
 Remark: The standard specification for  $\phi$  10 [0.394in.],  $\phi$  16 [0.630in.], and  $\phi$  20 [0.787in.] can also be used as non-ion specification.  
 Non-ion specification of  $\phi$  25 [0.984in.] and  $\phi$  32 [1.260in.] are made to order.

## Seals

Item	Rod seal	Piston seal	End plate gasket	Housing gasket
Quantity	2	2	2	2
Bore mm				
10	PIU-6	COP-10L	1.5×9	1.5×9
16	PIU-8	COP-16L	1.5×14.5	1.5×13
20	PIU-10	COP-20	1.5×18	1.5×17
25	PIU-12	COP-25	1.5×23	1.5×22
32	PIU-16	COP-32	2×31.5	2×28.5

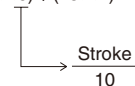
## Mass

Bore size mm [in.]	Standard specification	Zero stroke mass <sup>Note1</sup>	Additional mass		
			Additional mass for each 10mm [0.394in.] stroke	Mass of 1 sensor switch <sup>Note2</sup>	
				ZE□□□A	ZE□□□B
10 [0.394]	Standard specification	100 [3.53]	18 [0.63]	15 [0.53]	35 [1.23]
16 [0.630]	Standard specification	204 [7.20]	27 [0.95]		
20 [0.787]	Standard specification	335 [11.82]	36 [1.27]		
25 [0.984]	Standard specification	495 [17.46]	51 [1.80]		
32 [1.260]	Standard specification	1230 [43.39]	93 [3.28]		

Notes: 1. The above table is for the standard strokes.

2. There are 2 types of sensor switch lead wire lengths.  
 A : 1000mm [39in.], B : 3000mm [118in.]

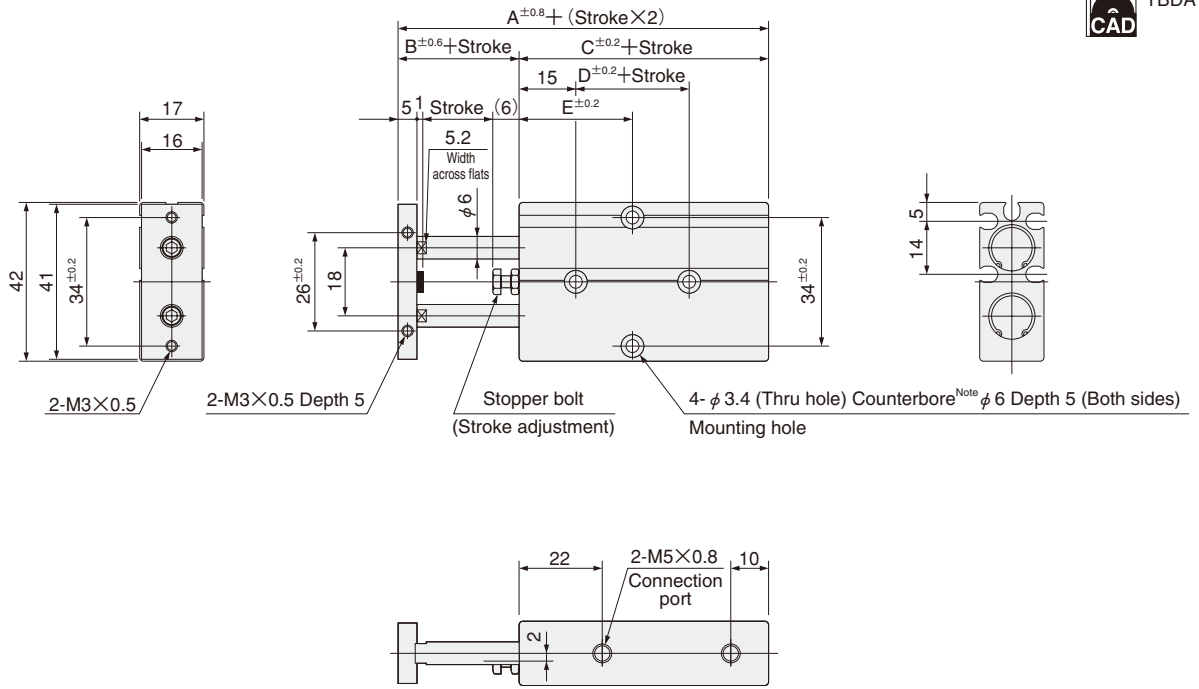
Calculation example: The mass for standard cylinder, bore size of 20mm, and stroke of 60mm, with 2 sensor switches (ZE135A),  
 $335 + (36 \times 6) + (15 \times 2) = 581\text{g}$  [20.49oz.]



# Dimensions of Double Acting Type (mm)



●  $\phi 10$



Stroke Bore mm [in.]	Code	A	B	C	D	E						
						10	20	30	40	50	60	70
10 [0.394]		58	12	46	10	30	30	35	40	45	50	55

Note: The counterbore depth is measured from the upper surface of the body.

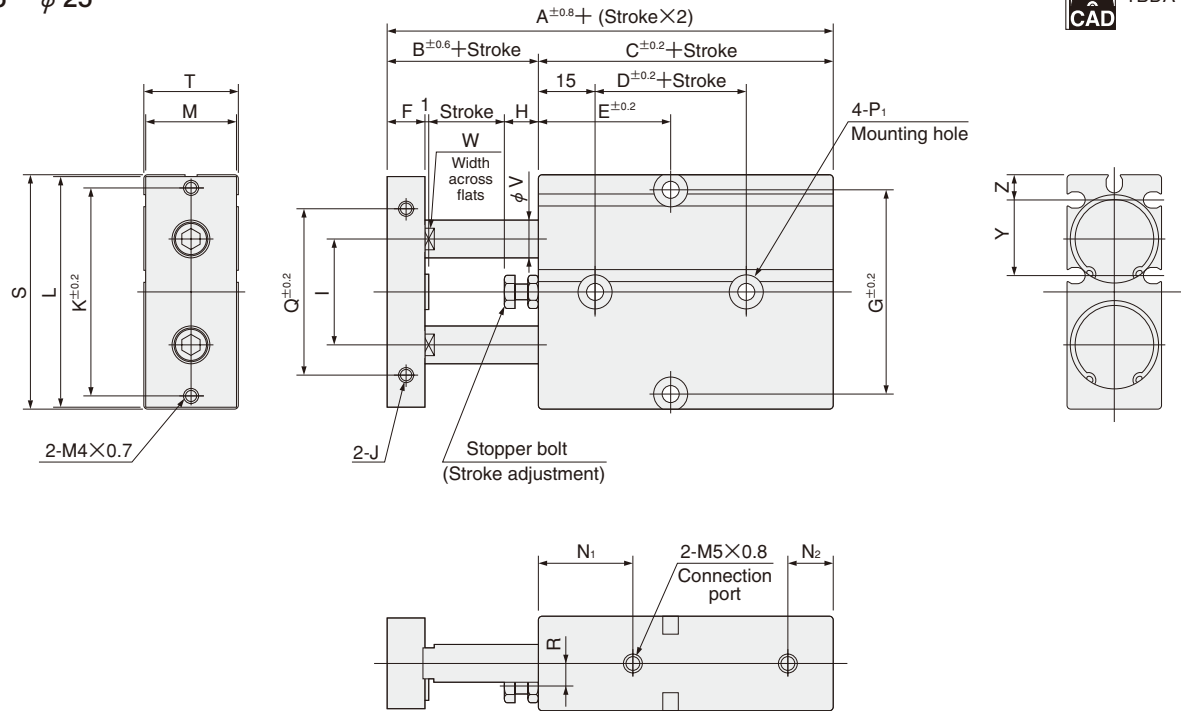
# Dimensions of Rod End (mm)



## Dimensions of Double Acting Type (mm)

●  $\phi 16 \sim \phi 25$

CAD TBDA Bore size



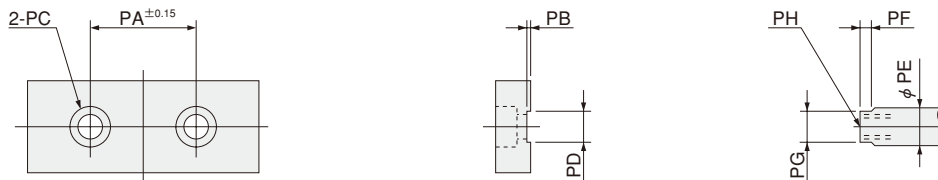
TWIN ROD CYLINDERS B SERIES

Code Stroke Bore mm [in.]	A	B	C	D	E										F	G	H	I	J	K	L	M
	10	20	30	40	50	60	70	80	90	100												
16 [0.630]	68	15	53	20	30	35	40	45	50	55	60	65	70	75	8	47	6	24	M4×0.7 Depth 5	47	53	20
20 [0.787]	78	20	58	20	35	35	40	45	50	55	60	65	70	75	10	55	9	28	M4×0.7 Depth 5	55	61	24
25 [0.984]	81	19	62	30	40	40	45	50	55	60	65	70	75	80	10	66	8	34	M5×0.8 Depth 6	66	72	29

Code Bore mm [in.]	N <sub>1</sub>	N <sub>2</sub>	P <sub>1</sub> Note				Q	R	S	T	V	W	Y	Z
	16 [0.630]	22	10	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth 5.5 (Both sides)				34	4	54	21	8	6.2	18.5
20 [0.787]	25	12	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth 5.5 (Both sides)				44	6	62	25	10	8.2	20	6.8
25 [0.984]	30	12	$\phi 4.5$ (Thru hole) Counterbore $\phi 9$ Depth 6 (Both sides)				56	7	73	30	12	10.2	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

## Dimensions of Rod End (mm)

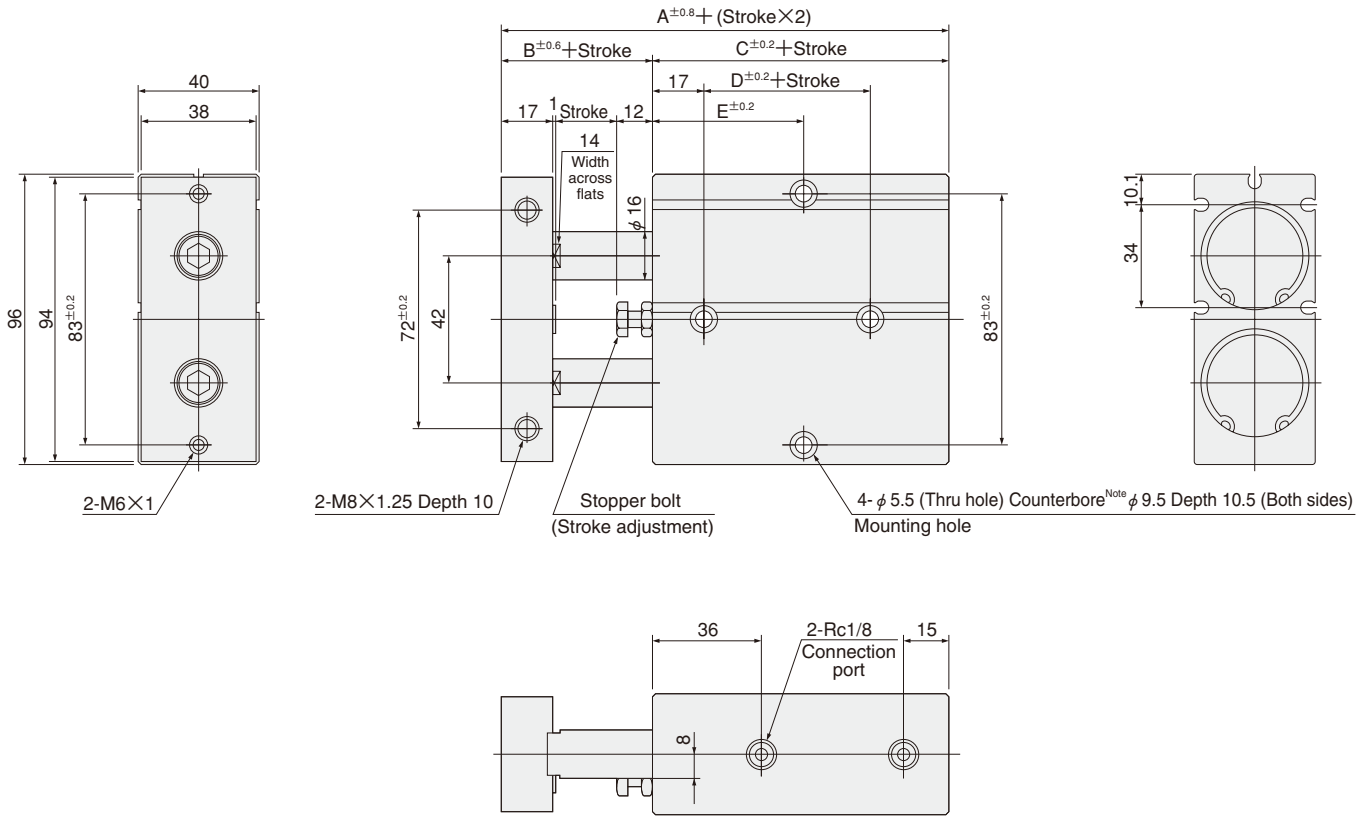


Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
	16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth 4.6	6.2 $^{+0.1}_0$	8	3	6.2 $^{+0.05}_{-0.15}$
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	8.2 $^{+0.1}_0$	10	3	8.2 $^{+0.05}_{-0.15}$	M6 × 1 Depth 8
25 [0.984]	34	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	10.2 $^{+0.1}_0$	12	3	10.2 $^{+0.05}_{-0.15}$	M6 × 1 Depth 8

# Dimensions of Double Acting Type (mm)

●  $\phi 32$

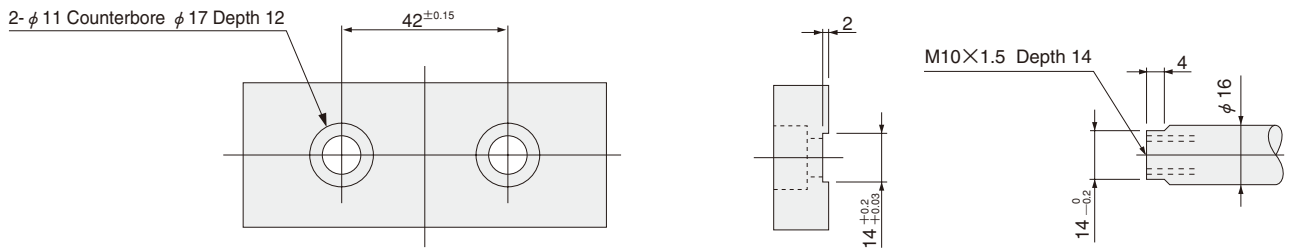
CAD TBDA32



Code Stroke Bore mm [in.]	A	B	C	D	E										
					10	20	30	40	50	60	70	80	90	100	
32 [1.260]	108	30	78	35	45	50	55	60	65	70	75	80	85	90	

Note: The counterbore depth is measured from the upper surface of the body.

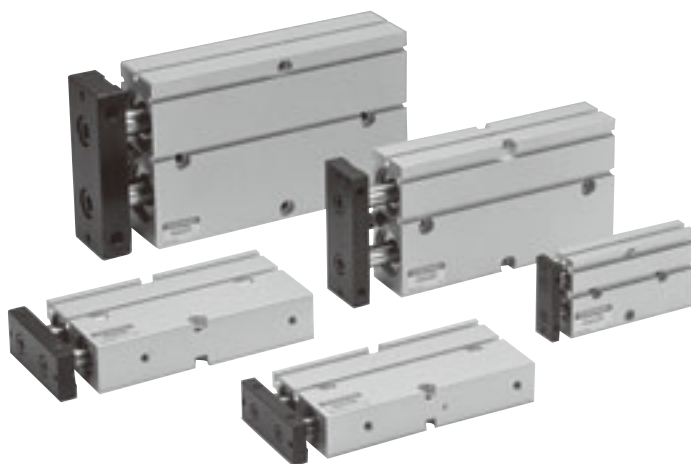
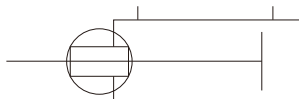
# Dimensions of Rod End (mm)



# TWIN ROD CYLINDERS B SERIES

## Double Acting Long Bushing Type

### Symbol



TWIN ROD CYLINDERS B SERIES

### Specifications

Item	Bore size mm [in.]				
	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operation type	Double acting type				
Media	Air				
Mounting type	Side mount				
Operating pressure range MPa [psi.]	0.2~0.7 [29~102]	0.15~0.7 [22~102]			
Proof pressure MPa [psi.]	1.05 [152]				
Operating temperature range °C [°F]	0~60 [32~140]				
Operating speed range mm/s [in./sec.]	100~500 [3.9~19.7]				
Cushion	Rubber bumper				
Lubrication	Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)				
Non-rotating accuracy	±0.4°	±0.3°			
Stroke adjusting range mm [in.]	-5~0 [-0.197~0] (To the specification stroke)				
Port size	M5×0.8			Rc1/8	

### Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke	mm
			Pull side stroke adjusting range
10	10, 20, 30, 40, 50, 60, 70	130	-5~0
16	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	
20	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	
25	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	
32	10, 20, 30, 40, 50, 60, 70 80, 90, 100	200	

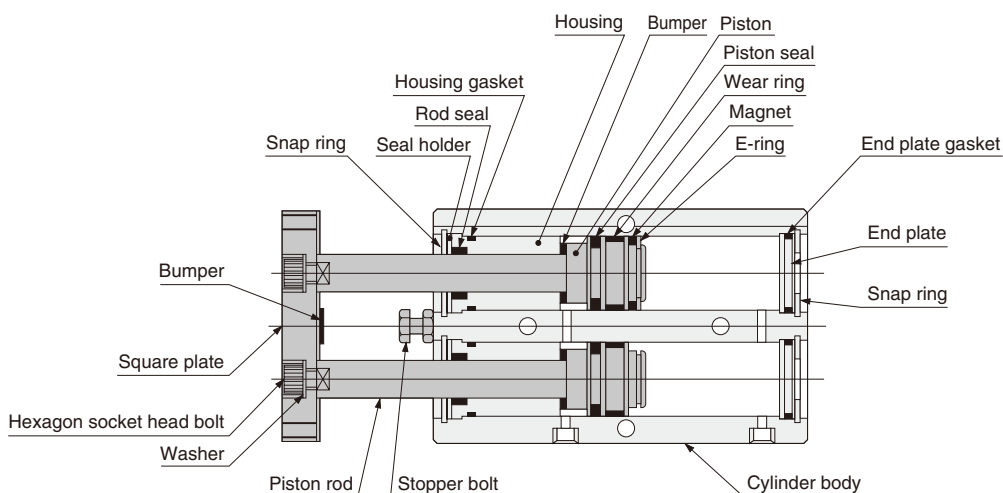
Note: Consult us for delivery of strokes that exceed the standard strokes.

### Order Codes

<b>TBDAM</b>	<b>16×30</b>	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	Bore size × Stroke			Lead wire length A : 1000mm [39in.] B : 3000mm [118in.]	Number of sensor switches 1 — With 1 sensor switch 2 — With 2 sensor switches					
			Sensor switch Blank — No sensor switch							
			<b>ZE135</b> — 2-lead wire, Solid state type	with indicator lamp	DC10~28V	Horizontal lead wire				● For details of sensor switches, see p.1544.
			<b>ZE235</b> — 2-lead wire, Solid state type	with indicator lamp	DC10~28V	Vertical lead wire				
			<b>ZE155</b> — 3-lead wire, Solid state type	with indicator lamp	DC4.5~28V	Horizontal lead wire				
			<b>ZE255</b> — 3-lead wire, Solid state type	with indicator lamp	DC4.5~28V	Vertical lead wire				
			<b>ZE101</b> — 2-lead wire, Reed switch type	without indicator lamp	DC5~28V AC85~115V	Horizontal lead wire				
			<b>ZE201</b> — 2-lead wire, Reed switch type	without indicator lamp	DC5~28V AC85~115V	Vertical lead wire				
			<b>ZE102</b> — 2-lead wire, Reed switch type	with indicator lamp	DC10~28V AC85~115V	Horizontal lead wire				
			<b>ZE202</b> — 2-lead wire, Reed switch type	with indicator lamp	DC10~28V AC85~115V	Vertical lead wire				

Note: In the double acting long bushing type, the magnet for sensor switch is built-in.

## Inner Construction and Major Parts



## Major Parts and Materials

Parts	Materials
	For standard specification
Cylinder body	Aluminum alloy (anodized)
Piston	Aluminum alloy (chromic acid anodic oxide coating)
Wear ring	Plastic
Piston rod	Steel (chrome plated)
Gasket	Synthetic rubber (NBR)
Seal holder	Mild steel (nickel plated)
Housing	Aluminum alloy (chromic acid anodic oxide coating)
End plate	Plastic (aluminum alloy (anodized) for only $\phi 32$ [1.260in.])
Seal	Synthetic rubber (NBR)
Snap ring	Steel (nickel plated)
Magnet	Plastic magnet
E-ring	Stainless steel
Washer	Steel (nickel plated)
Square plate	Mild steel (nickel plated)
Bumper <sup>Note</sup>	Synthetic rubber (NBR)
Stopper bolt	Mild steel (zinc plated)

Note: Not available in a bore size of 10mm [0.394in.].

## Seals

Item	Rod seal	Piston seal	End plate gasket	Housing gasket
Quantity	2	2	2	2
Bore mm				
10	PIU-6	COP-10L	1.5×9	1.5×9
16	PIU-8	PWP-16	1.5×14.5	1.5×13
20	PIU-10	PWP-20	1.5×18	1.5×17
25	PIU-12	PWP-25	1.5×23	1.5×22
32	PIU-16	PWP-32	2×31.5	2×28.5

## Mass

Bore size mm [in.]	Zero stroke mass <sup>Note 1</sup>	Additional mass		
		Additional mass for each 10mm [0.394in.] stroke	Mass of 1 sensor switch <sup>Note 2</sup>	
			ZE□□□A	ZE□□□B
10 [0.394]	119 [4.20]	18 [0.63]	15 [0.53]	35 [1.23]
16 [0.630]	244 [8.61]	27 [0.95]		
20 [0.787]	388 [13.69]	36 [1.27]		
25 [0.984]	568 [20.04]	51 [1.80]		
32 [1.260]	1354 [47.76]	93 [3.28]		

Notes: 1. The above table is for the standard strokes.

2. There are 2 types of sensor switch lead wire lengths.

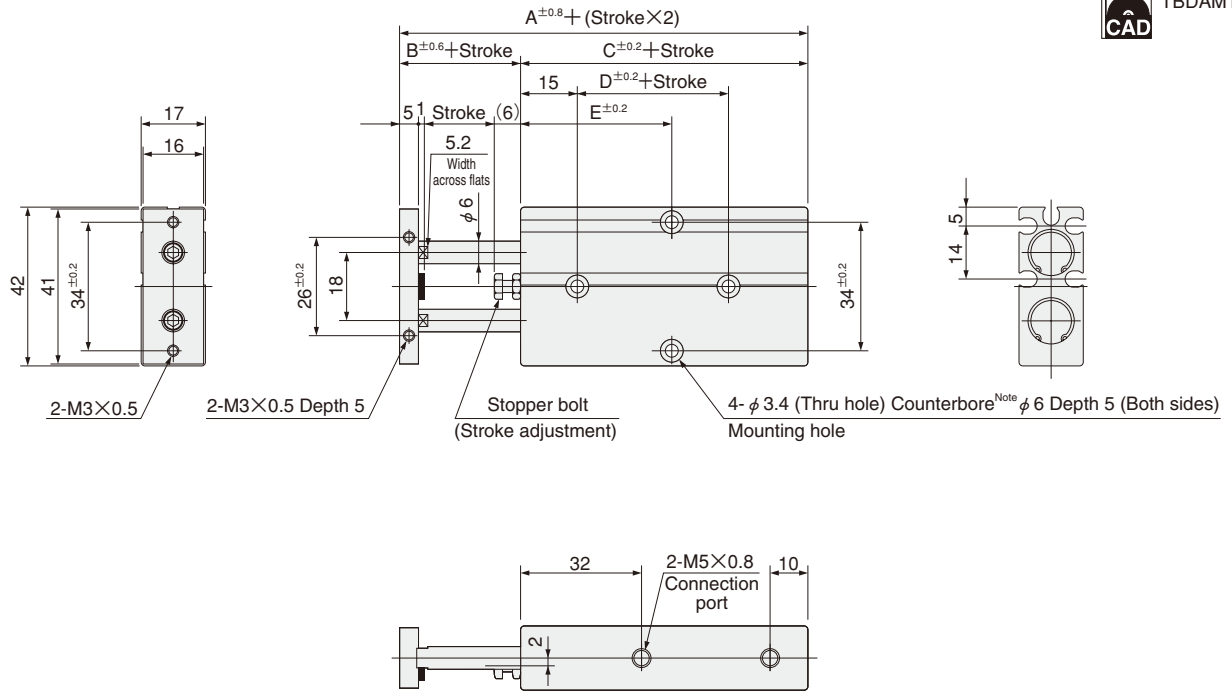
A : 1000mm [39in.], B : 3000mm [118in.]

Calculation example: The mass of bore size of 20mm, and stroke of 60mm, with 2 sensor switches (ZE135A),  
 $388 + (36 \times 6) + (15 \times 2) = 634\text{g}$  [22.36oz.]

Stroke  
10

# Dimensions of Double Acting Long Bushing Type (mm)

●  $\phi 10$



TWIN ROD CYLINDERS B SERIES

Stroke Bore mm [in.]	Code				E						
	A	B	C	D	10	20	30	40	50	60	70
10 [0.394]	68	12	56	25	25	40	45	50	55	60	65

Note: The counterbore depth is measured from the upper surface of the body.

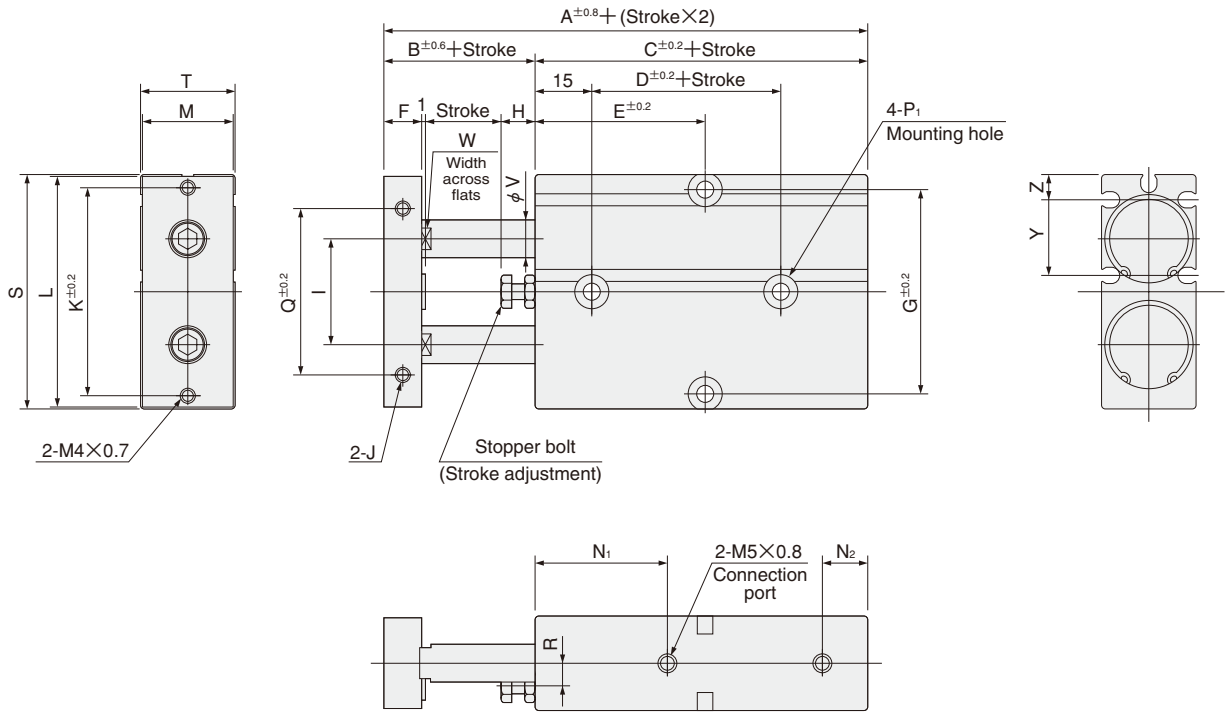
# Dimensions of Rod End (mm)





# Dimensions of Double Acting Long Bushing Type (mm)

●  $\phi 16 \sim \phi 25$

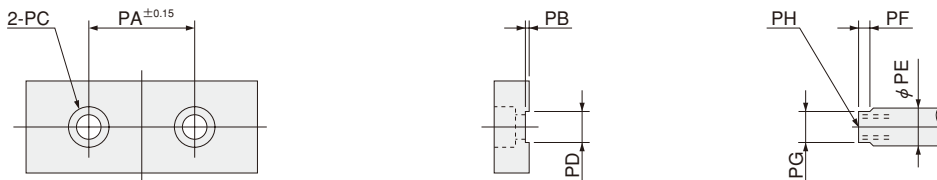


Code Stroke Bore mm [in.]	A	B	C	D	E										F	G	H	I	J	K	L	M
	10	20	30	40	50	60	70	80	90	100												
16 [0.630]	78	15	63	30	40	45	50	55	60	65	70	75	80	85	8	47	6	24	M4×0.7 Depth 5	47	53	20
20 [0.787]	88	20	68	30	45	45	45	50	55	60	65	70	75	80	10	55	9	28	M4×0.7 Depth 5	55	61	24
25 [0.984]	91	19	72	40	50	50	50	55	60	65	70	75	80	85	10	66	8	34	M5×0.8 Depth 6	66	72	29

Code Bore mm [in.]	N <sub>1</sub>	N <sub>2</sub>	P <sub>1</sub> Note		Q	R	S	T	V	W	Y	Z
16 [0.630]	32	10	φ 4.5 (Thru hole) Counterbore φ 8 Depth 5.5 (Both sides)		34	4	54	21	8	6.2	18.5	5.7
20 [0.787]	35	12	φ 4.5 (Thru hole) Counterbore φ 8 Depth 5.5 (Both sides)		44	6	62	25	10	8.2	20	6.8
25 [0.984]	40	12	φ 4.5 (Thru hole) Counterbore φ 9 Depth 6 (Both sides)		56	7	73	30	12	10.2	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

# Dimensions of Rod End (mm)

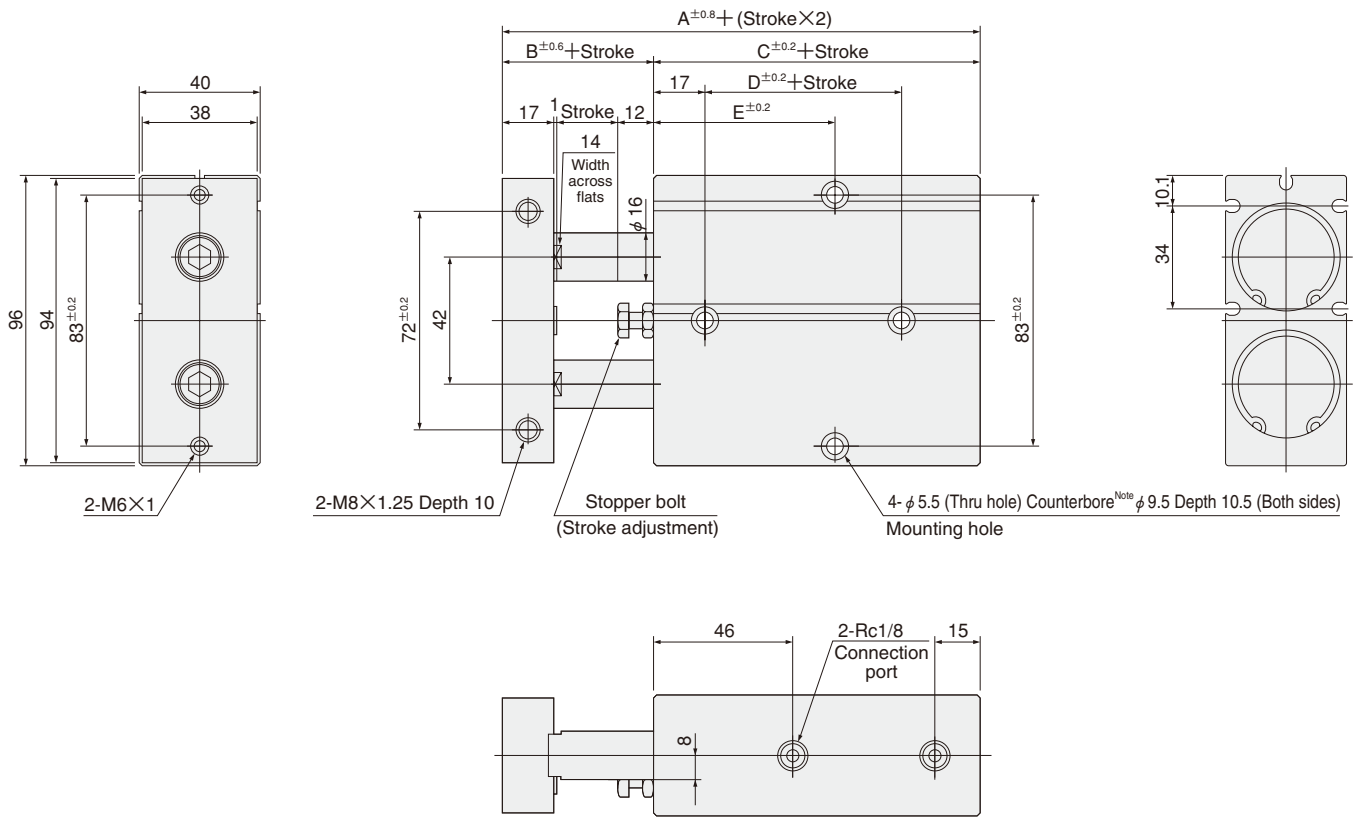


Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
16 [0.630]	24	1	φ 4.3 Counterbore φ 7.8 Depth 4.6	6.2 <sup>+0.1</sup> <sub>0</sub>	8	3	6.2 <sup>-0.05</sup> <sub>-0.15</sub>	M4 × 0.7 Depth 6
20 [0.787]	28	1	φ 6.5 Counterbore φ 11 Depth 6.8	8.2 <sup>+0.1</sup> <sub>0</sub>	10	3	8.2 <sup>-0.05</sup> <sub>-0.15</sub>	M6 × 1 Depth 8
25 [0.984]	34	1	φ 6.5 Counterbore φ 11 Depth 6.8	10.2 <sup>+0.1</sup> <sub>0</sub>	12	3	10.2 <sup>-0.05</sup> <sub>-0.15</sub>	M6 × 1 Depth 8

# Dimensions of Double Acting Long Bushing Type (mm)

●  $\phi$  32

TBDAM32  

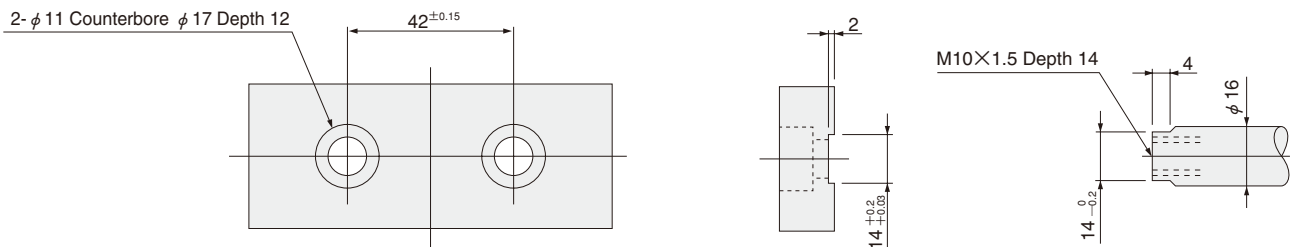



TWIN ROD CYLINDERS B SERIES

Code Stroke Bore mm [in.]	A	B	C	D	E									
					10	20	30	40	50	60	70	80	90	100
32 [1.260]	118	30	88	45	55	60	65	70	75	80	85	90	95	100

Note: The counterbore depth is measured from the upper surface of the body.

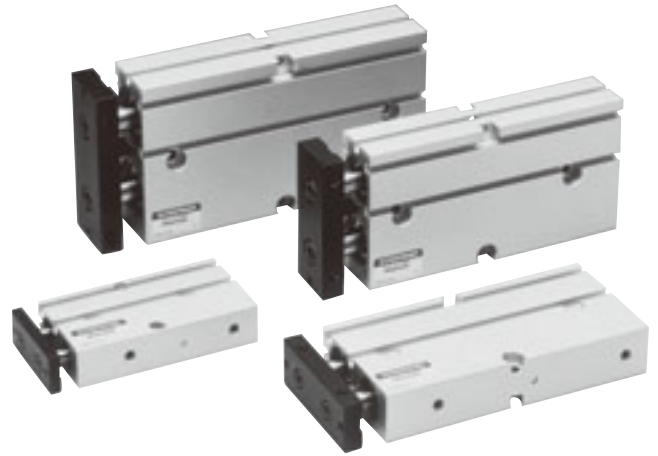
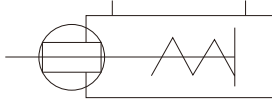
## Dimensions of Rod End (mm)



# TWIN ROD CYLINDERS B SERIES

## Single Acting Push Type

### Symbol



### Specifications

Item	Bore size mm [in.]			
	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
Operation type	Single acting push type			
Media	Air			
Mounting type	Side mount			
Operating pressure range MPa [psi.]	0.25~0.7 [36~102]	0.2~0.7 [29~102]		
Proof pressure MPa [psi.]	1.05 [152]			
Operating temperature range °C [°F]	0~60 [32~140]			
Operating speed range mm/s [in./sec.]	100~500 [3.9~19.7]			
Cushion	Rubber bumper <sup>Note</sup>			
Lubrication	Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)			
Non-rotating accuracy	±0.4°	±0.3°		
Stroke adjusting range mm [in.]	-5~0 [-0.197~0] (To the specification stroke)			
Port size	M5×0.8			

Note: For the 10mm [0.394in.] bore size, rubber bumper is only installed at the pull side. Piston side bumper is not available.

### Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke	mm
			Pull side stroke adjusting range
10	10, 20, 30, 40, 50, 60	60	-5~0
16	10, 20, 30, 40, 50, 60	60	
20	10, 20, 30, 40, 50, 60	60	
25	10, 20, 30, 40, 50, 60	60	

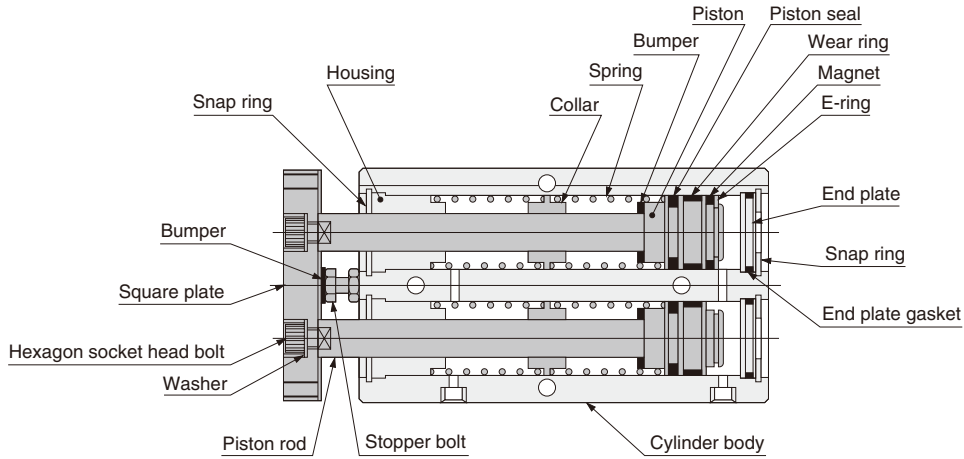
### Order Codes

<b>TBSA</b>	<b>16×30</b>	-							
	Bore size × Stroke			Lead wire length A : 1000mm [39in.] B : 3000mm [118in.]	Number of sensor switches 1 — With 1 sensor switch 2 — With 2 sensor switches				
			Sensor switch Blank — No sensor switch						
			<b>ZE135</b> — 2-lead wire, Solid state type with indicator lamp	DC10~28V	Horizontal lead wire				
			<b>ZE235</b> — 2-lead wire, Solid state type with indicator lamp	DC10~28V	Vertical lead wire				
			<b>ZE155</b> — 3-lead wire, Solid state type with indicator lamp	DC4.5~28V	Horizontal lead wire				
			<b>ZE255</b> — 3-lead wire, Solid state type with indicator lamp	DC4.5~28V	Vertical lead wire				
			<b>ZE101</b> — 2-lead wire, Reed switch type without indicator lamp	DC5~28V AC85~115V	Horizontal lead wire				
			<b>ZE201</b> — 2-lead wire, Reed switch type without indicator lamp	DC5~28V AC85~115V	Vertical lead wire				
			<b>ZE102</b> — 2-lead wire, Reed switch type with indicator lamp	DC10~28V AC85~115V	Horizontal lead wire				
			<b>ZE202</b> — 2-lead wire, Reed switch type with indicator lamp	DC10~28V AC85~115V	Vertical lead wire				

● For details of sensor switches, see p.1544.

Note: In the single acting push type, the magnet for sensor switch is built-in.

# Inner Construction and Major Parts



## Major Parts and Materials

Parts	Materials
Cylinder body	Aluminum alloy (anodized)
Piston	Aluminum alloy (chromic acid anodic oxide coating)
Wear ring	Plastic
Piston rod	Steel (chrome plated)
Gasket	Synthetic rubber (NBR)
Housing	Aluminum alloy (special wear-resistant treatment)
End plate	Plastic
Seal	Synthetic rubber (NBR)
Snap ring	Steel (nickel plated)
Magnet	Plastic magnet
Spring	Piano wire
Collar	Plastic
E-ring	Stainless steel
Washer	Steel (nickel plated)
Square plate	Mild steel (nickel plated)
Bumper <sup>Note</sup>	Synthetic rubber (NBR)
Stopper bolt	Mild steel (zinc plated)

Note: For the 10mm [0.394in.] bore size, piston side bumper is not available.

## Seals

Item	Piston seal		End plate gasket	
	Quantity	Bore mm	Quantity	Bore mm
<b>10</b>	2	COP-10L	2	1.5×9
<b>16</b>	2	PWP-16	2	1.5×14.5
<b>20</b>	2	PWP-20	2	1.5×18
<b>25</b>	2	PWP-25	2	1.5×23

## Mass

Bore size mm [in.]	Basic mass <sup>Note1</sup>						Additional mass	
	Stroke mm						Mass of 1 sensor switch <sup>Note2</sup>	
	10	20	30	40	50	60	ZE□□□A	ZE□□□B
<b>10 [0.394]</b>	117 [4.13]	137 [4.83]	157 [5.54]	197 [6.95]	217 [7.65]	237 [8.36]	15 [0.53]	35 [1.23]
<b>16 [0.630]</b>	230 [8.11]	257 [9.07]	288 [10.16]	344 [12.13]	369 [13.02]	394 [13.90]		
<b>20 [0.787]</b>	372 [13.12]	407 [14.36]	442 [15.59]	521 [18.38]	556 [19.61]	591 [20.85]		
<b>25 [0.984]</b>	557 [19.65]	603 [21.27]	649 [22.89]	760 [26.81]	814 [28.71]	868 [30.62]		

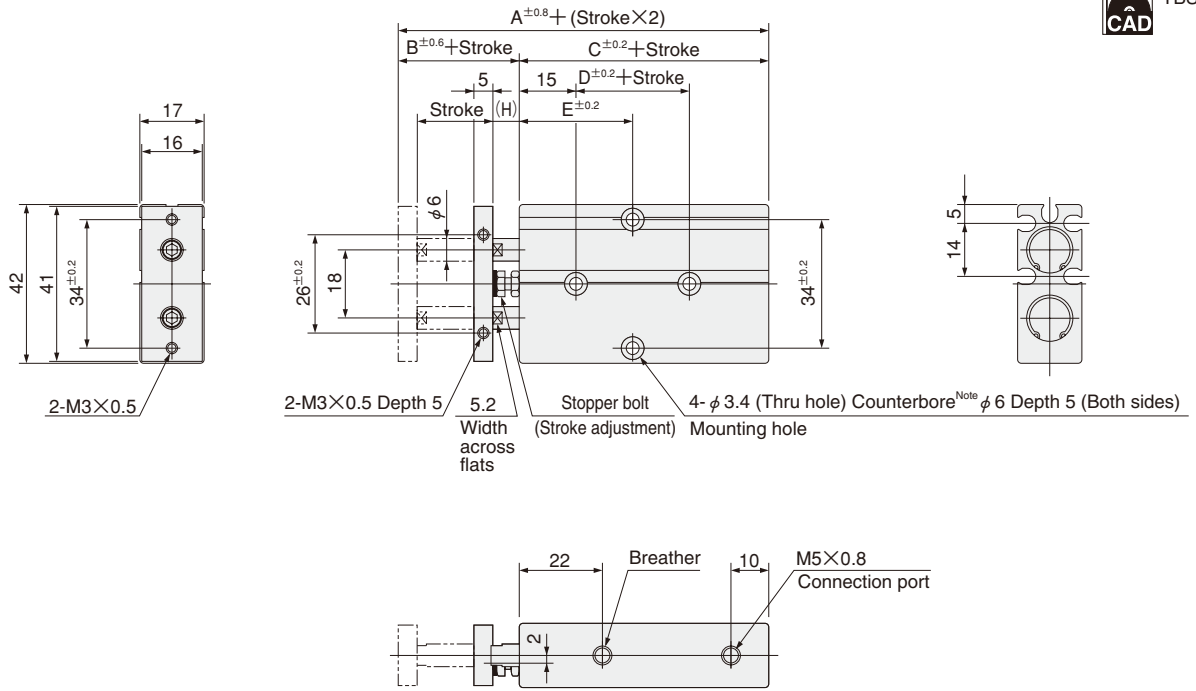
Notes: 1. The above table is for the standard strokes.

2. There are 2 types of sensor switch lead wire lengths.  
A : 1000mm [39in.], B : 3000mm [118in.]

Calculation example: The mass for bore size of 20mm, and stroke of 60mm, with 2 sensor switches (ZE135A),  
591+(15×2)=621g [21.90oz.]

# Dimensions of Single Acting Push Type (mm)

●  $\phi 10$



Stroke mm [in.]	Code		A		B		C		D		E				H	
	10~30	40~60	10~30	40~60	10~30	40~60	10~30	40~60	10	20	30	40	50	60	10~30	40~60
10 [0.394]	58	66	12	10	46	56	10	20	30	30	35	45	50	55	7	5

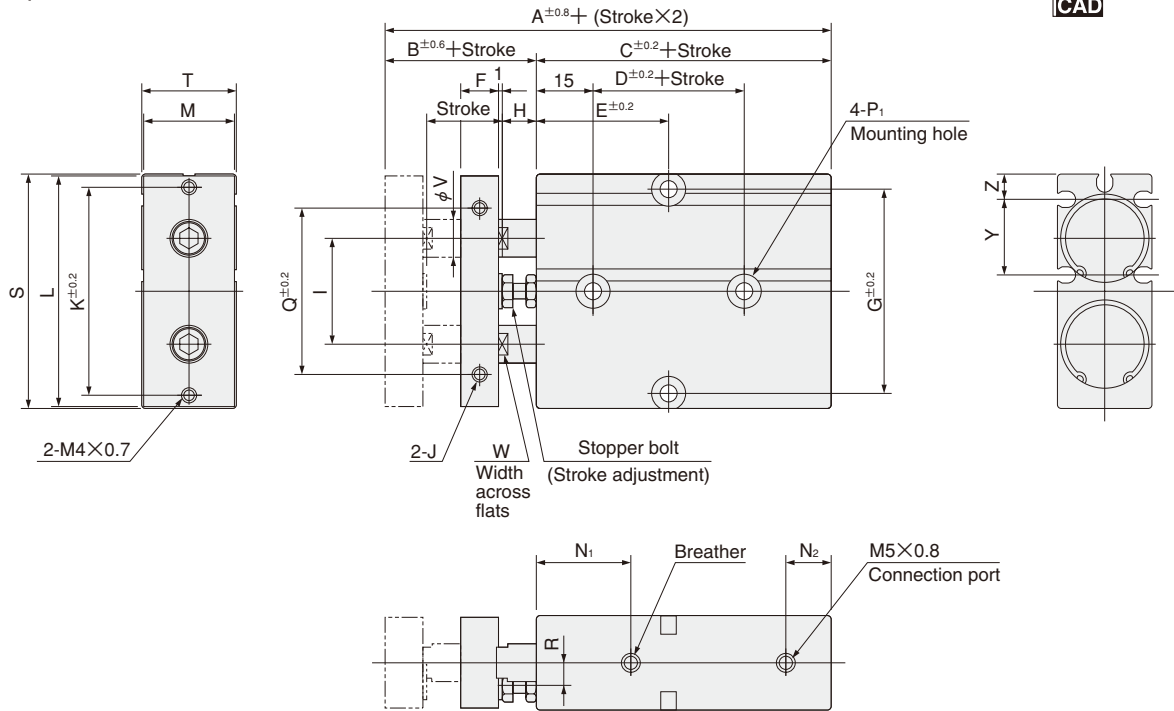
Note: The counterbore depth is measured from the upper surface of the body.

# Dimensions of Rod End (mm)



# Dimensions of Single Acting Push Type (mm)

●  $\phi 16 \sim \phi 25$



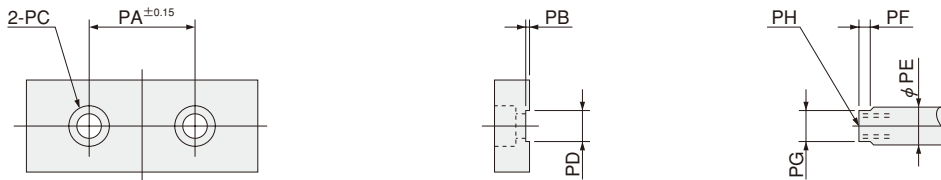
TWIN ROD CYLINDERS B SERIES

Code Stroke Bore mm [in.]	A		B	C		D		E						F	G	H	I	J
	10~30	40~60		10~30	40~60	10~30	40~60	10	20	30	40	50	60					
16 [0.630]	68	78	15	53	63	20	30	30	35	40	50	55	60	8	47	6	24	M4×0.7 Depth 5
20 [0.787]	78	88	20	58	68	20	30	35	35	40	50	55	60	10	55	9	28	M4×0.7 Depth 5
25 [0.984]	81	91	19	62	72	30	40	40	40	45	55	60	65	10	66	8	34	M5×0.8 Depth 6

Code Bore mm [in.]	K	L	M	N <sub>1</sub>	N <sub>2</sub>	P <sub>1</sub> Note				Q	R	S	T	V	W	Y	Z
	16 [0.630]	47	53	20	22	10	$\phi 4.5$ (Thru hole)	Counterbore $\phi 8$	Depth 5.5	(Both sides)	34	4	54	21	8	6.2	18.5
20 [0.787]	55	61	24	25	12	$\phi 4.5$ (Thru hole)	Counterbore $\phi 8$	Depth 5.5	(Both sides)	44	6	62	25	10	8.2	20	6.8
25 [0.984]	66	72	29	30	12	$\phi 4.5$ (Thru hole)	Counterbore $\phi 9$	Depth 6	(Both sides)	56	7	73	30	12	10.2	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

# Dimensions of Rod End (mm)



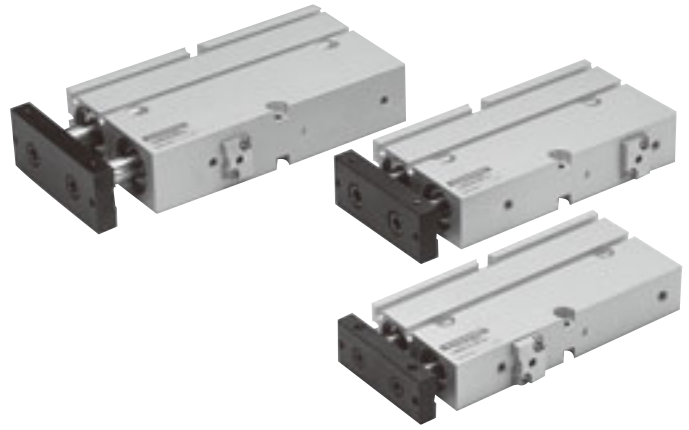
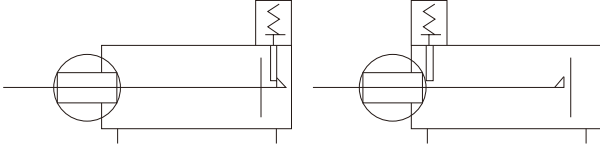
Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth 4.6	$6.2^{+0.1}_0$	8	3	$6.2^{+0.05}_{-0.15}$	M4 × 0.7 Depth 6
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	$8.2^{+0.1}_0$	10	3	$8.2^{+0.05}_{-0.15}$	M6 × 1 Depth 8
25 [0.984]	34	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	$10.2^{+0.1}_0$	12	3	$10.2^{+0.05}_{-0.15}$	M6 × 1 Depth 8

# TWIN ROD CYLINDERS B SERIES END KEEP CYLINDERS

## Double Acting Type

### Symbols

- Head side end keep
- Rod side end keep



### Specifications

Item	Bore size mm [in.]	16 [0.630]	20 [0.787]	25 [0.984]
Operation type		Double acting type		
Media		Air		
Mounting type		Side mount		
Operating pressure range MPa [psi.]		0.15~0.7 [22~102]		
Proof pressure MPa [psi.]		1.05 [152]		
Operating temperature range °C [°F]		0~60 [32~140]		
Operating speed range mm/s [in./sec.]		100~500 [3.9~19.7]		
Cushion		Rubber bumper		
Lubrication		Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)		
Non-rotating accuracy		±0.3°		
Stroke adjusting range	-HL	No stroke adjustment, fixed stroke. <sup>Note</sup>		
	-RL	-5~0 [-0.197~0] (To the specification stroke)		
Max. holding force (At end keep) N [lbf.]		96.1 [21.6]	151 [33.9]	235.4 [52.9]
Backlash (At end keep) mm [in.]		1 [0.039] MAX.		
Port size		M5×0.8		

Note: The stopper bolt is locked into position. Do not attempt to loosen it.

### Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke	Pull side stroke adjusting range	
			-HL	-RL
16	10, 20, 30, 40, 50, 60, 70, 80	180	—	-5~0
20	10, 20, 30, 40, 50, 60, 70, 80	180	—	-5~0
25	10, 20, 30, 40, 50, 60, 70, 80	180	—	-5~0

Note: Consult us for delivery of strokes that exceed the standard strokes.

### Order Codes

<b>TBDAK</b>	<b>16×30</b>	-	-				
	<b>Bore size × Stroke</b>						
							<b>Number of sensor switches</b> 1 — With 1 sensor switch 2 — With 2 sensor switches
							<b>Lead wire length</b> A : 1000mm [39in.] B : 3000mm [118in.]
							<b>Sensor switch</b> Blank — No sensor switch
							<b>End keep position</b> HL — Head side end keep RL — Rod side end keep
							<b>ZE135</b> — 2-lead wire, Solid state type with indicator lamp DC10~28V Horizontal lead wire
							<b>ZE235</b> — 2-lead wire, Solid state type with indicator lamp DC10~28V Vertical lead wire
							<b>ZE155</b> — 3-lead wire, Solid state type with indicator lamp DC4.5~28V Horizontal lead wire
							<b>ZE255</b> — 3-lead wire, Solid state type with indicator lamp DC4.5~28V Vertical lead wire
							<b>ZE101</b> — 2-lead wire, Reed switch type without indicator lamp DC5~28V AC85~115V Horizontal lead wire
							<b>ZE201</b> — 2-lead wire, Reed switch type without indicator lamp DC5~28V AC85~115V Vertical lead wire
							<b>ZE102</b> — 2-lead wire, Reed switch type with indicator lamp DC10~28V AC85~115V Horizontal lead wire
							<b>ZE202</b> — 2-lead wire, Reed switch type with indicator lamp DC10~28V AC85~115V Vertical lead wire

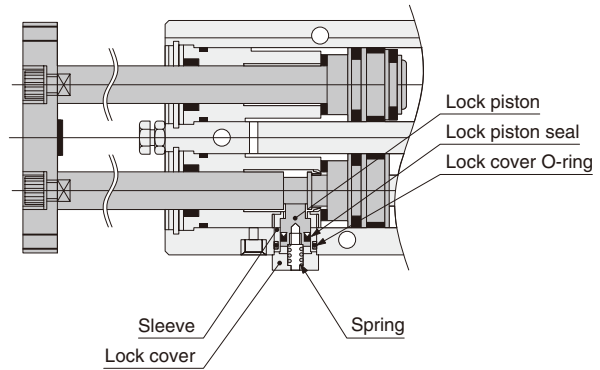
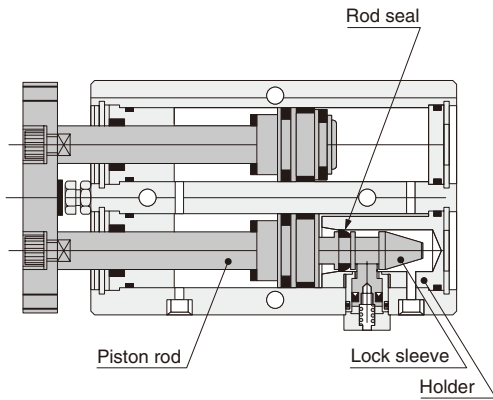
● For details of sensor switches, see p.1544.

Note: In the end keep cylinder, the magnet for sensor switch is built-in.

# Inner Construction and Major Parts

## ● -HL : Head side end keep

## ● -RL : Rod side end keep



## Major Parts and Materials

Parts	Materials
Piston rod	-HL Steel (chrome plated)
	-RL Steel (chrome plated after heat treatment)
Lock sleeve (Only for -HL)	Steel (heat treated)
Holder (Only for -HL)	Aluminum alloy (anodized)
Lock piston	Steel (chrome plated after heat treatment)
Sleeve	Aluminum alloy (anodized)
Spring	Stainless steel
Lock cover	Aluminum alloy (anodized)
Lock piston seal	Synthetic rubber (NBR)
Rod seal	Synthetic rubber (NBR)
Lock cover O-ring	Synthetic rubber (NBR)

Note: For details of items not listed in the above, see p.760.

## Seals

Item	Rod seal	Piston seal	End plate gasket	Rod seal	Housing gasket	Lock piston seal
Bore mm \ Quantity	2	2	2	1	2	1
16	PIU-8	PWP-16	1.5×14.5	MYN-6	1.5×13	MYN-5
20	PIU-10	PWP-20	1.5×18	MYN-8	1.5×17	MYN-5
25	PIU-12	PWP-25	1.5×23	MYN-10	1.5×22	MYN-5

## Mass

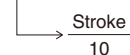
Bore size mm [in.]		Zero stroke mass <sup>Note1</sup>	Additional mass		g [oz.]	
			Additional mass for each 10mm [0.394in.] stroke	Mass of 1 sensor switch <sup>Note 2</sup>		
				ZE□□□A	ZE□□□B	
16 [0.630]	-HL : Head side end keep	233 [8.22]	35 [1.23]	15 [0.53]	35 [1.23]	
	-RL : Rod side end keep	258 [9.10]	33 [1.16]			
20 [0.787]	-HL : Head side end keep	365 [12.87]	50 [1.76]			
	-RL : Rod side end keep	384 [13.54]	49 [1.73]			
25 [0.984]	-HL : Head side end keep	633 [22.33]	52 [1.83]			
	-RL : Rod side end keep	661 [23.32]	51 [1.80]			

Notes: 1. The above table is for the standard strokes.

2. There are 2 types of sensor switch lead wire lengths.

A : 1000mm [39in.], B : 3000mm [118in.]

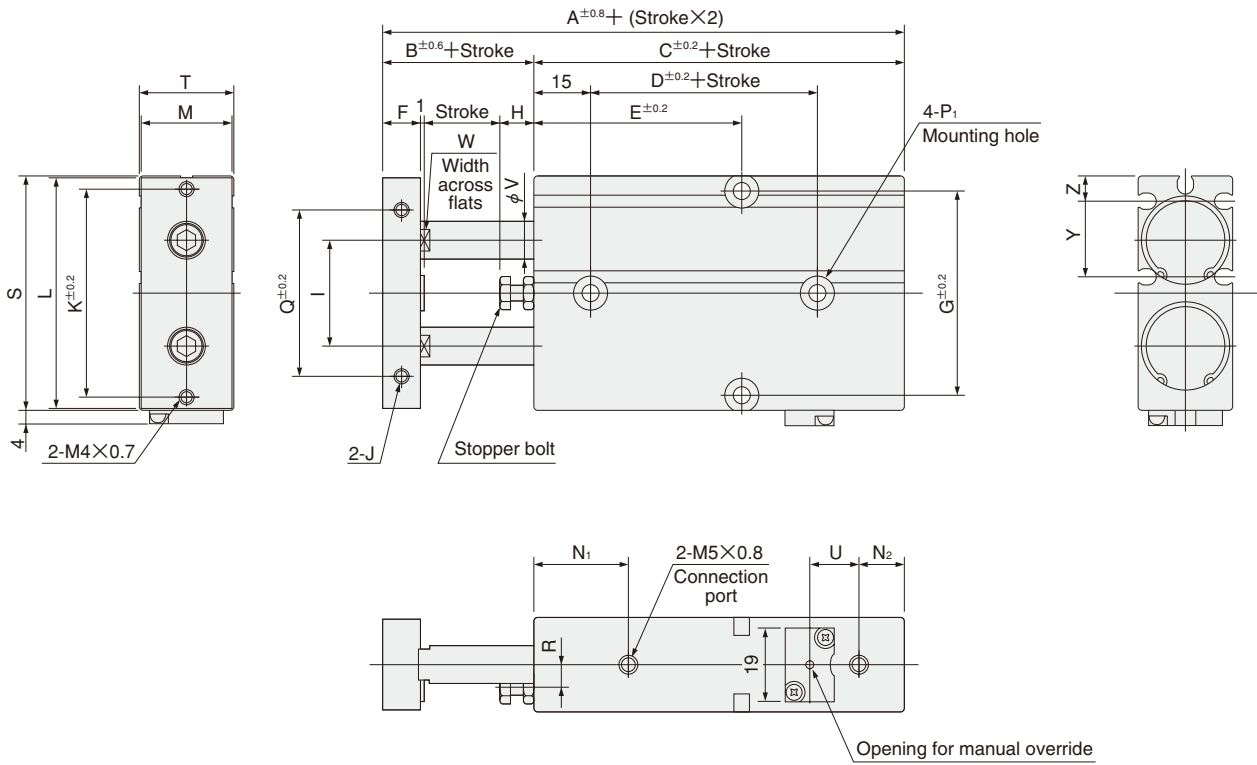
Calculation example: The mass for a head side end keep cylinder, bore size of 20mm, and stroke of 60mm, with 2 sensor switches (ZE135A),  
 $365 + (50 \times 6) + (15 \times 2) = 695\text{g} [24.51\text{oz.}]$





# -HL : Dimensions of Head Side End Keep Cylinder (mm)

●  $\phi 16 \sim \phi 25$

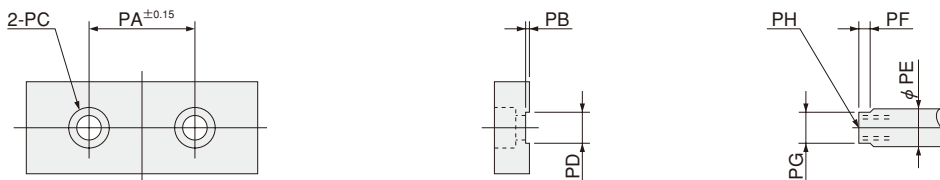


Code Stroke Bore mm [in.]	A	B	C	D	E								F	G	H	I	J	K	L	M
					10	20	30	40	50	60	70	80								
16 [0.630]	88	15	73	40	40	45	50	55	60	65	70	75	8	47	6	24	M4×0.7 Depth 5	47	53	20
20 [0.787]	98	20	78	40	40	45	50	55	60	65	70	75	10	55	9	28	M4×0.7 Depth 5	55	61	24
25 [0.984]	101	19	82	50	45	50	55	60	65	70	75	80	10	66	8	34	M5×0.8 Depth 6	66	72	29

Code Bore mm [in.]	N <sub>1</sub>	N <sub>2</sub>	P <sub>1</sub> <sup>Note</sup>	Q	R	S	T	U	V	W	Y	Z
16 [0.630]	22	10	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth 5.5 (Both sides)	34	4	54	21	13	8	6.2	18.5	5.7
20 [0.787]	25	12	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth 5.5 (Both sides)	44	6	62	25	13	10	8.2	20	6.8
25 [0.984]	30	12	$\phi 4.5$ (Thru hole) Counterbore $\phi 9$ Depth 6 (Both sides)	56	7	73	30	10	12	10.2	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

## Dimensions of Rod End (mm)



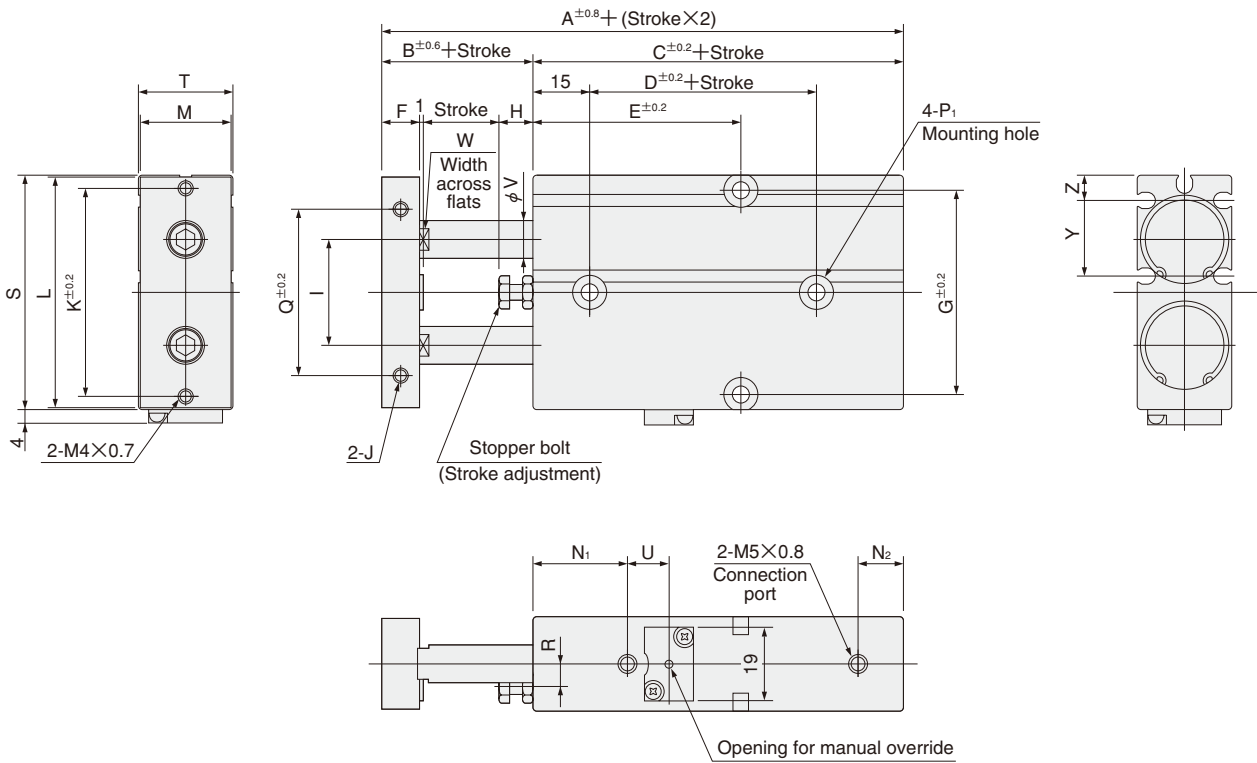
Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth 4.6	$6.2^{+0.1}_0$	8	3	$6.2^{+0.05}_{-0.15}$	M4 × 0.7 Depth 6
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	$8.2^{+0.1}_0$	10	3	$8.2^{+0.05}_{-0.15}$	M6 × 1 Depth 8
25 [0.984]	34	1	$\phi 6.5$ Counter bore $\phi 11$ Depth 6.8	$10.2^{+0.1}_0$	12	3	$10.2^{+0.05}_{-0.15}$	M6 × 1 Depth 8

# -RL : Dimensions of Rod Side End Keep Cylinder (mm)

●  $\phi 16 \sim \phi 25$



TWIN ROD CYLINDERS B SERIES

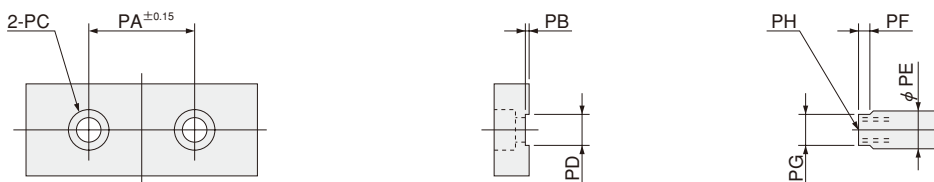


Code Stroke Bore mm [in.]	A	B	C	D	E								F	G	H	I	J	K	L	M
					10	20	30	40	50	60	70	80								
16 [0.630]	88	15	73	40	45	45	50	55	60	65	70	75	8	47	6	24	M4×0.7 Depth 5	47	53	20
20 [0.787]	98	20	78	40	45	45	50	55	60	65	70	75	10	55	9	28	M4×0.7 Depth 5	55	61	24
25 [0.984]	101	19	82	50	50	50	55	60	65	70	75	80	10	66	8	34	M5×0.8 Depth 6	66	72	29

Code Bore mm [in.]	N <sub>1</sub>	N <sub>2</sub>	P <sub>1</sub> Note				Q	R	S	T	U	V	W	Y	Z
16 [0.630]	22	10	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth 5.5 (Both sides)				34	4	54	21	11	8	6.2	18.5	5.7
20 [0.787]	25	12	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth 5.5 (Both sides)				44	6	62	25	11	10	8.2	20	6.8
25 [0.984]	30	12	$\phi 4.5$ (Thru hole) Counterbore $\phi 9$ Depth 6 (Both sides)				56	7	73	30	9	12	10.2	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

## Dimensions of Rod End (mm)

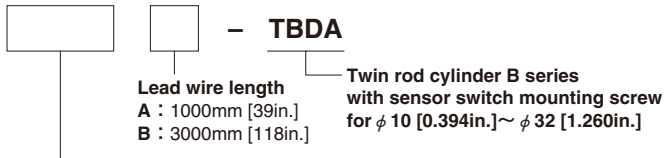


Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth 4.6	$6.2^{+0.1}_{-0.15}$	8	3	$6.2^{+0.05}_{-0.15}$	M4 × 0.7 Depth 6
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	$8.2^{+0.1}_{-0.15}$	10	3	$8.2^{+0.05}_{-0.15}$	M6 × 1 Depth 8
25 [0.984]	34	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	$10.2^{+0.1}_{-0.15}$	12	3	$10.2^{+0.05}_{-0.15}$	M6 × 1 Depth 8

# SENSOR SWITCHES

## Solid State Type, Reed Switch Type

### Order Codes



#### Sensor switch

<b>ZE135</b> — 2-lead wire, Solid state type with indicator lamp	DC10~28V	Horizontal lead wire	<b>ZE155</b> — 3-lead wire, Solid state type with indicator lamp	DC4.5~28V	Horizontal lead wire
<b>ZE235</b> — 2-lead wire, Solid state type with indicator lamp	DC10~28V	Vertical lead wire	<b>ZE255</b> — 3-lead wire, Solid state type with indicator lamp	DC4.5~28V	Vertical lead wire
<b>ZE101</b> — 2-lead wire, Reed switch type without indicator lamp	DC5~28V AC85~115V	Horizontal lead wire	<b>ZE102</b> — 2-lead wire, Reed switch type with indicator lamp	DC10~28V AC85~115V	Horizontal lead wire
<b>ZE201</b> — 2-lead wire, Reed switch type without indicator lamp	DC5~28V AC85~115V	Vertical lead wire	<b>ZE202</b> — 2-lead wire, Reed switch type with indicator lamp	DC10~28V AC85~115V	Vertical lead wire

● For details of the sensor switches, see p.1544.

### Sensor Switch Operating Range, Response Differential, and Maximum Sensing Location

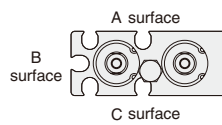
#### ● Operating range: $\ell$

The distance the piston travels in one direction, while the switch is in the ON position.

#### ● Response differential: C

The distance between the point where the piston turns the switch ON and the point where the switch is turned OFF as the piston travels in the opposite direction.

#### ● Sensor switch mounting surface



#### ● Solid state type

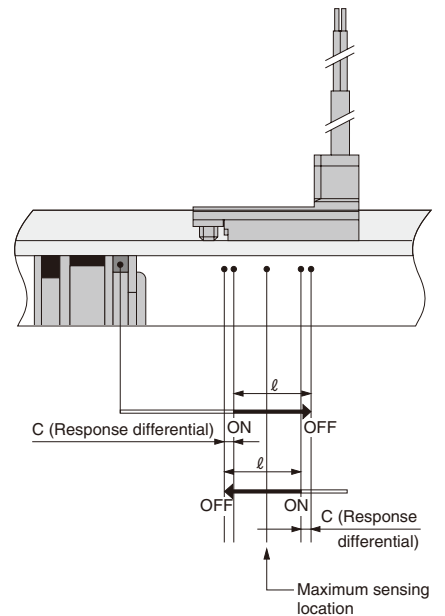
Item	Mounting surface	Bore size mm [in.]				
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operating range : $\ell$	A and C surface	2.5~6 [0.098~0.236]			2.5~6.5 [0.098~0.256]	5~12 [0.197~0.472]
	B surface	2.5~4 [0.098~0.157]	2~4.5 [0.079~0.177]	2.5~5.5 [0.098~0.217]	4~9 [0.157~0.354]	
Response differential : C	—	1.0 [0.039] or less	1.2 [0.047] or less	1.5 [0.059] or less	2.0 [0.079] or less	
Maximum sensing location <sup>Note</sup>	—	6 [0.236]				

Note: The above table shows reference values.

#### ● Reed switch type

Item	Bore size mm [in.]	mm [in.]				
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operating range : $\ell$		6~8.5 [0.236~0.335]		6~8 [0.236~0.315]	7~9.5 [0.276~0.374]	12~16.5 [0.472~0.650]
Response differential : C		1.5 [0.059] or less			2.5 [0.098] or less	
Maximum sensing location <sup>Note</sup>		10 [0.394]				

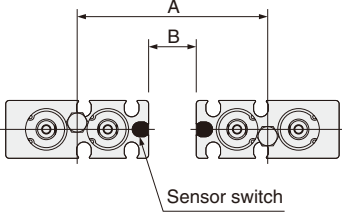
Note: The above table shows reference values.

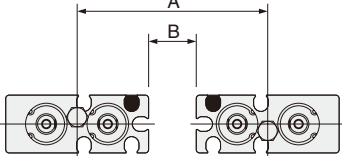


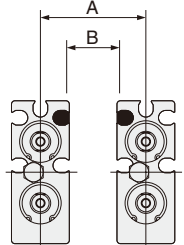
# When Mounting Cylinders with Sensor Switches in Close Proximity

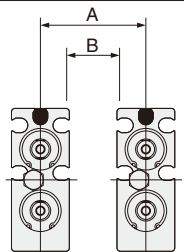
When mounting cylinders in close proximity, install the cylinder so that it should not be at or below the values in the following table.

mm [in.]

Status of mounting in close proximity	Code	Bore size	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
		Type					
	<b>A</b>	Solid state type	53 [2.09]	66 [2.60]	73 [2.87]	87 [3.43]	119 [4.69]
		Reed switch type	48 [1.89]	60 [2.36]	68 [2.68]	81 [3.19]	109 [4.29]
	<b>B</b>	Solid state type	11 [0.43]	12 [0.47]	11 [0.43]	14 [0.55]	23 [0.91]
		Reed switch type	6 [0.24]		8 [0.31]		13 [0.51]

	<b>A</b>	Solid state type	47 [1.85]	59 [2.32]	65 [2.56]	77 [3.03]	107 [4.21]
		Reed switch type	42 [1.65]	54 [2.13]	62 [2.44]	73 [2.87]	96 [3.78]
	<b>B</b>	Solid state type	5 [0.20]		3 [0.12]	4 [0.16]	11 [0.43]
		Reed switch type	0				

	<b>A</b>	Solid state type	28 [1.10]	33 [1.30]	36 [1.42]	44 [1.73]	65 [2.56]
		Reed switch type	22 [0.87]	27 [1.06]	30 [1.18]	37 [1.46]	53 [2.09]
	<b>B</b>	Solid state type	11 [0.43]	12 [0.47]	11 [0.43]	14 [0.55]	25 [0.98]
		Reed switch type	5 [0.20]	6 [0.24]	5 [0.20]	7 [0.28]	13 [0.51]

	<b>A</b>	Solid state type	21 [0.83]	24 [0.94]	25 [0.98]	30 [1.18]	44 [1.73]
		Reed switch type	17 [0.67]	21 [0.83]	25 [0.98]	30 [1.18]	40 [1.57]
	<b>B</b>	Solid state type	4 [0.16]	3 [0.12]	0		4 [0.16]
		Reed switch type	0				

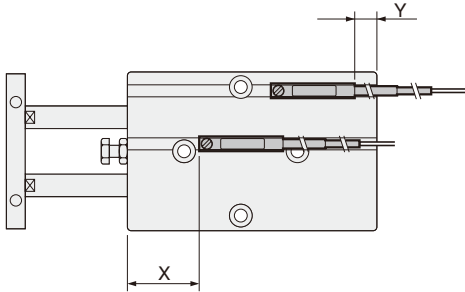
Remark: For mounting in configurations other than the above, consult us.

# Mounting Location of End of Stroke Detection Sensor Switch

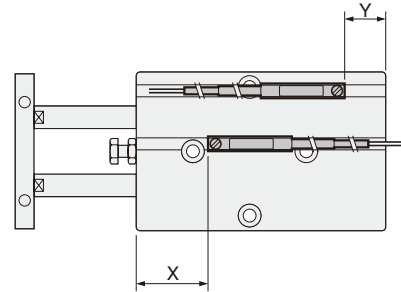
When the sensor switch is mounted in the locations shown below (the figures in the tables are reference values), the magnet comes to the maximum sensing location of the sensor switch at the end of the stroke.

## ● Double acting type

■ When the lead wires are pulled from the head side.



■ When the lead wire of the head side detection sensor switch only is pulled from the rod side.



### Standard cylinder

#### ● Solid state type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	27.5 [1.083]	33.5 [1.319]	37.5 [1.476]	42.5 [1.673]	52 [2.047]
Y	3.5 [0.138]	4.5 [0.177]	5.5 [0.217]	4.5 [0.177]	11 [0.433]

#### ● Reed switch type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	23.5 [0.925]	29.5 [1.161]	33.5 [1.319]	38.5 [1.516]	48 [1.890]
Y	0.5 [0.020]	1.5 [0.059]	2.5 [0.098]	1.5 [0.059]	8 [0.315]

#### ● Solid state type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	27.5 [1.083]	33.5 [1.319]	37.5 [1.476]	42.5 [1.673]	52 [2.047]
Y	6.5 [0.256]	7.5 [0.295]	8.5 [0.335]	7.5 [0.295]	14 [0.551]

#### ● Reed switch type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	23.5 [0.925]	29.5 [1.161]	33.5 [1.319]	38.5 [1.516]	48 [1.890]
Y	2.5 [0.098]	3.5 [0.138]	4.5 [0.177]	3.5 [0.138]	10 [0.394]

### Double acting long bushing type

#### ● Solid state type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	37.5 [1.476]	43.5 [1.713]	47.5 [1.870]	52.5 [2.067]	62 [2.441]
Y	3.5 [0.138]	4.5 [0.177]	5.5 [0.217]	4.5 [0.177]	11 [0.433]

#### ● Reed switch type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	33.5 [1.319]	39.5 [1.555]	43.5 [1.713]	48.5 [1.909]	58 [2.283]
Y	0.5 [0.020]	1.5 [0.059]	2.5 [0.098]	1.5 [0.059]	8 [0.315]

#### ● Solid state type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	37.5 [1.476]	43.5 [1.713]	47.5 [1.870]	52.5 [2.067]	62 [2.441]
Y	6.5 [0.256]	7.5 [0.295]	8.5 [0.335]	7.5 [0.295]	14 [0.551]

#### ● Reed switch type mm [in.]

Code \ Bore	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
X	33.5 [1.319]	39.5 [1.555]	43.5 [1.713]	48.5 [1.909]	58 [2.283]
Y	2.5 [0.098]	3.5 [0.138]	4.5 [0.177]	3.5 [0.138]	10 [0.394]

### End keep cylinder

#### ● Solid state type mm [in.]

End keep position	Bore			
	Code	16 [0.630]	20 [0.787]	25 [0.984]
-HL : Head side end keep	X	33.5 [1.319]	37.5 [1.476]	42.5 [1.673]
	Y	24.5 [0.965]	25.5 [1.004]	24.5 [0.965]
-RL : Rod side end keep	X	53.5 [2.106]	57.5 [2.264]	62.5 [2.461]
	Y	4.5 [0.177]	5.5 [0.217]	4.5 [0.177]

#### ● Reed switch type mm [in.]

End keep position	Bore			
	Code	16 [0.630]	20 [0.787]	25 [0.984]
-HL : Head side end keep	X	29.5 [1.161]	33.5 [1.319]	38.5 [1.516]
	Y	21.5 [0.846]	22.5 [0.886]	21.5 [0.846]
-RL : Rod side end keep	X	49.5 [1.949]	53.5 [2.106]	58.5 [2.303]
	Y	1.5 [0.059]	2.5 [0.098]	1.5 [0.059]

#### ● Solid state type mm [in.]

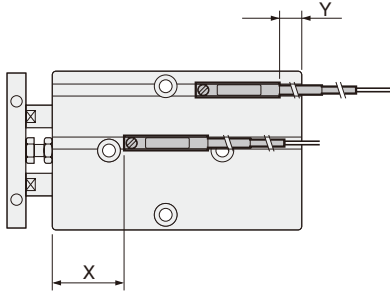
End keep position	Bore			
	Code	16 [0.630]	20 [0.787]	25 [0.984]
-HL : Head side end keep	X	33.5 [1.319]	37.5 [1.476]	42.5 [1.673]
	Y	27.5 [1.083]	28.5 [1.122]	27.5 [1.083]
-RL : Rod side end keep	X	53.5 [2.106]	57.5 [2.264]	62.5 [2.461]
	Y	7.5 [0.295]	8.5 [0.335]	7.5 [0.295]

#### ● Reed switch type mm [in.]

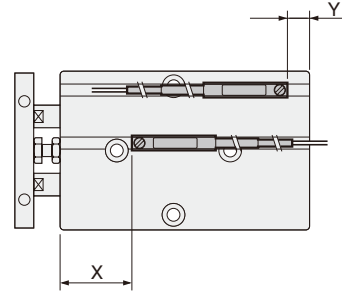
End keep position	Bore			
	Code	16 [0.630]	20 [0.787]	25 [0.984]
-HL : Head side end keep	X	29.5 [1.161]	33.5 [1.319]	38.5 [1.516]
	Y	23.5 [0.925]	24.5 [0.965]	23.5 [0.925]
-RL : Rod side end keep	X	49.5 [1.949]	53.5 [2.106]	58.5 [2.303]
	Y	3.5 [0.138]	4.5 [0.177]	3.5 [0.138]

● **Single acting push type**

■ When the lead wires are pulled from the head side.



■ When the lead wire of the head side detection sensor switch only is pulled from the rod side.



● **Solid state type**

mm [in.]

Stroke	Code	Bore			
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
10, 20, 30	X	27.5 [1.083]	33.5 [1.319]	37.5 [1.476]	42.5 [1.673]
	Y	3.5 [0.138]	4.5 [0.177]	5.5 [0.217]	4.5 [0.177]
40, 50, 60	X	39.5 [1.555]	43.5 [1.713]	47.5 [1.870]	52.5 [2.067]
	Y	1.5 [0.059]	4.5 [0.177]	5.5 [0.217]	4.5 [0.177]

● **Solid state type**

mm [in.]

Stroke	Code	Bore			
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
10, 20, 30	X	27.5 [1.083]	33.5 [1.319]	37.5 [1.476]	42.5 [1.673]
	Y	6.5 [0.256]	7.5 [0.295]	8.5 [0.335]	7.5 [0.295]
40, 50, 60	X	39.5 [1.555]	43.5 [1.713]	47.5 [1.870]	52.5 [2.067]
	Y	4.5 [0.177]	7.5 [0.295]	8.5 [0.335]	7.5 [0.295]

● **Reed switch type**

mm [in.]

Stroke	Code	Bore			
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
10, 20, 30	X	23.5 [0.925]	29.5 [1.161]	33.5 [1.319]	38.5 [1.516]
	Y	0.5 [0.020]	1.5 [0.059]	2.5 [0.098]	1.5 [0.059]
40, 50, 60	X	35.5 [1.398]	39.5 [1.555]	43.5 [1.713]	48.5 [1.909]
	Y	-1.5 [-0.059]	1.5 [0.059]	2.5 [0.098]	1.5 [0.059]

● **Reed switch type**

mm [in.]

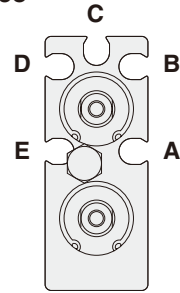
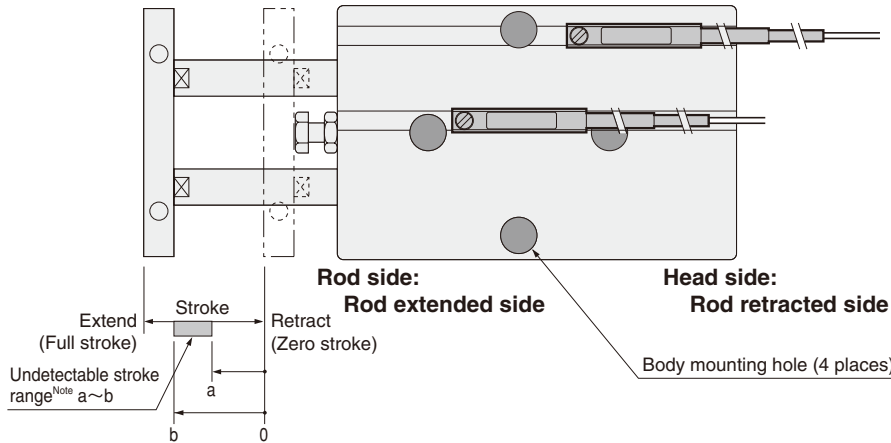
Stroke	Code	Bore			
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
10, 20, 30	X	23.5 [0.925]	29.5 [1.161]	33.5 [1.319]	38.5 [1.516]
	Y	2.5 [0.098]	3.5 [0.138]	4.5 [0.177]	3.5 [0.138]
40, 50, 60	X	35.5 [1.398]	39.5 [1.555]	43.5 [1.713]	48.5 [1.909]
	Y	0.5 [0.020]	3.5 [0.138]	4.5 [0.177]	3.5 [0.138]

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting type (TBDA), single acting push type (TBSA)

■ In the case of using 4 mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.] and  $\phi 32$  [1.260in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

● Solid state type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

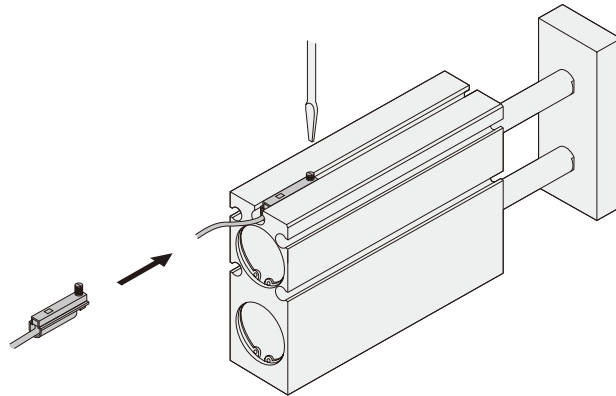
(mm)

Stroke	Mounting groove	$\phi 10$			$\phi 16$			$\phi 20$			$\phi 25$			$\phi 32$		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	○	○	○	×	△	△	○	○	△	○	△	△	×	△	△
	Rod side	×	×	×	×	△	△	×	×	△	○	△	△	×	△	△
20	Head side	○	○	○	×	○	○	○	○	△	○	△	△	×	○	△
	Rod side	○	×	×	○	×	×	○	×	×	○	△	△	○	×	×
30	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
40	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	○	○	○	×	○
60	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	○	○	×	×	△	×	×	○	△	○	△	×	△	△
	Rod side	×	×	×	×	×	△	×	×	×	△	×	△	×	△	△
20	Head side	×	○	○	×	○	○	×	○	△	○	○	△	×	○	△
	Rod side	○	×	×	○	×	×	○	×	×	○	×	△	○	×	△
30	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
40	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	×	○	×	×	○	×	×	○	×	×
60	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	△	△	△	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	△	△	△	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	△	△	△	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	△	△	△	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	△	△	△	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	△	△	△	×	○	○	×	○	○	○	○	×	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

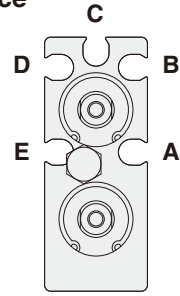
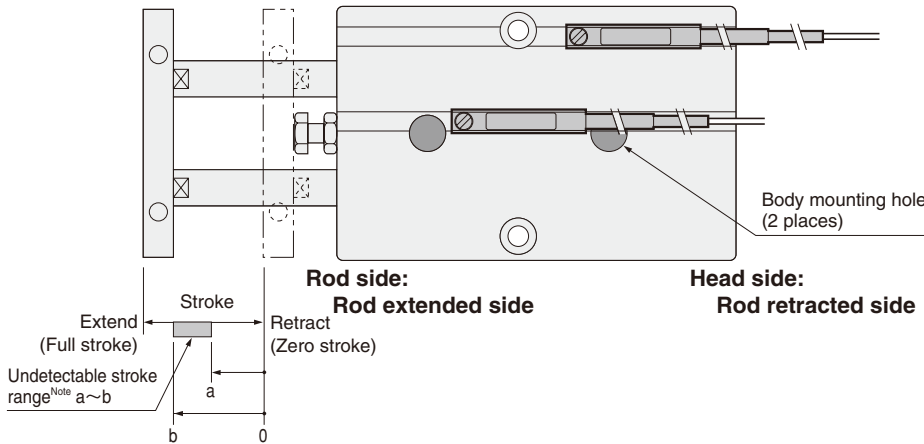


# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting type (TBDA), single acting push type (TBSA)

### In the case of using 2 center mounting holes on the body

### ● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

#### Caution

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.] and  $\phi 32$  [1.260in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

### ● Solid state type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

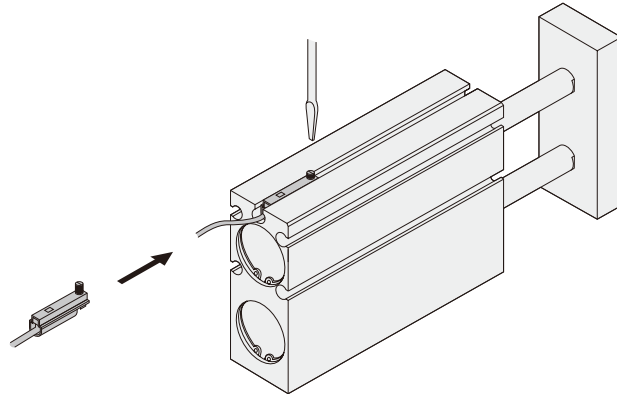
(mm)

Stroke	Mounting groove	$\phi 10$			$\phi 16$			$\phi 20$			$\phi 25$			$\phi 32$		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
20	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
40	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
50	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
60	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

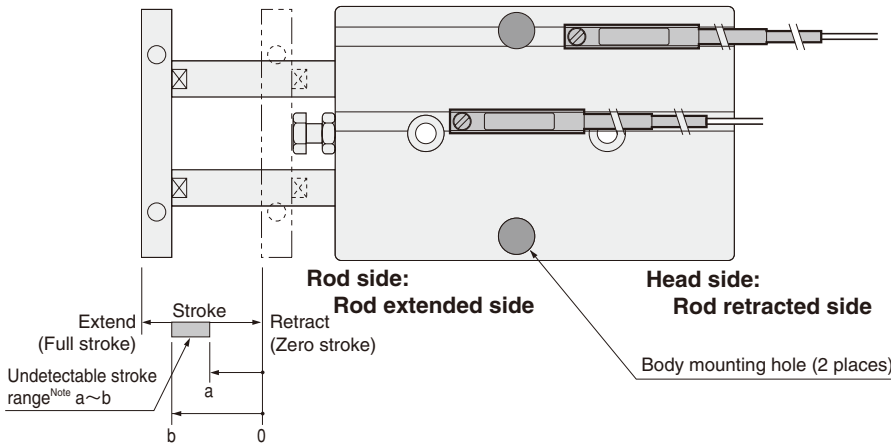
Bore size		φ 10			φ 16			φ 20			φ 25			φ 32		
Stroke	Mounting groove	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
		E	D	—	E	D	—	E	D	—	E	D	—	E	D	—
10	Head side	×	△	△	×	△	△	×	△	△	△	△	△	×	△	△
	Rod side	×	△	△	×	△	△	×	△	△	△	△	△	×	△	△
20	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
40	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
50	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
60	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	—	—	—	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	—	—	—	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	—	—	—	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	—	—	—	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	—	—	—	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	—	—	—	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

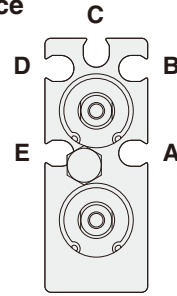
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting type (TBDA), single acting push type (TBSA)

■ In the case of using 2 mounting holes on the body (one on each side)



● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

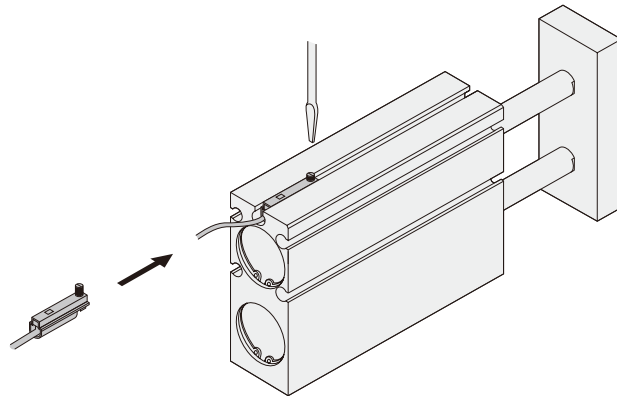
(mm)

Bore size	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	○	○	○	○	△	△	△	○	△	△	○	△	△	○	△	△
	Rod side	○	×	×	○	△	△	△	△	×	×	○	△	△	○	△	△
20	Head side	○	○	○	○	○	○	○	○	△	△	○	△	△	○	△	△
	Rod side	○	×	×	○	×	×	○	×	×	×	○	△	△	○	×	×
30	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	×	×	○	○	○	○	×	×
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

## ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



## ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	△	○	○	△	×	△	△	○	○	△	○	△	△	△	△	△
	Rod side	△	×	×	△	×	△	△	×	×	△	×	△	△	△	△	△
20	Head side	○	○	○	○	○	○	○	○	△	○	○	○	○	○	△	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
30	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×	○
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○	○

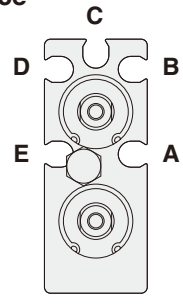
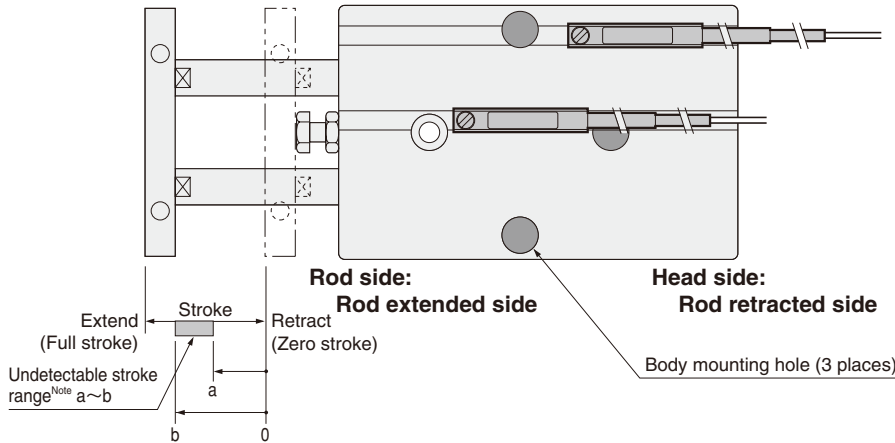
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting type (TBDA), single acting push type (TBSA)

■ In the case of using 3 head side mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

### ● Solid state type

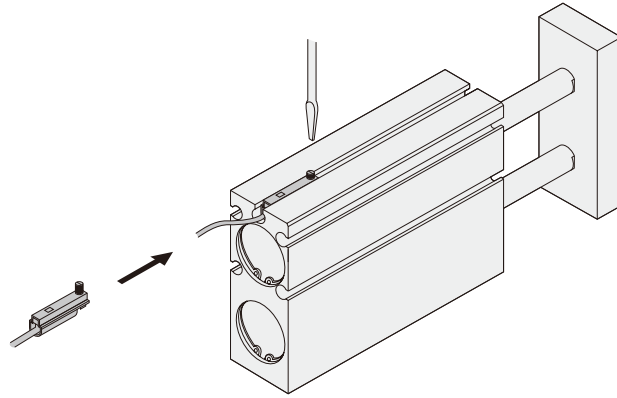
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	○	○	○	×	△	△	○	○	△	○	△	△	×	△	△
	Rod side	×	×	×	×	△	△	×	×	△	○	△	△	×	△	△
20	Head side	○	○	○	×	○	○	○	○	△	○	△	△	×	△	△
	Rod side	○	×	×	○	×	×	○	×	△	○	△	△	○	×	△
30	Head side	○	○	○	×	○	○	○	○	△	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
40	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	○
60	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○
70	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

## ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



## ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

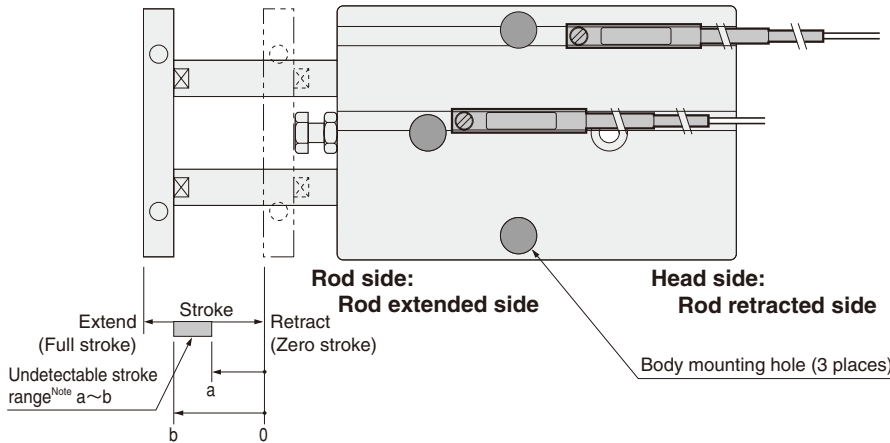
Bore size Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	○	○	×	×	△	×	○	○	△	○	△	×	△	△
	Rod side	×	×	×	×	×	△	×	×	×	△	×	△	×	△	△
20	Head side	×	○	○	×	○	○	×	○	△	○	○	△	×	○	△
	Rod side	○	×	×	○	×	×	○	×	△	○	×	△	○	×	△
30	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
40	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	○
60	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

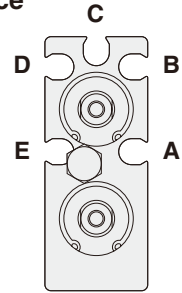
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting type (TBDA), single acting push type (TBSA)

■ In the case of using 3 rod side mounting holes on the body



● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

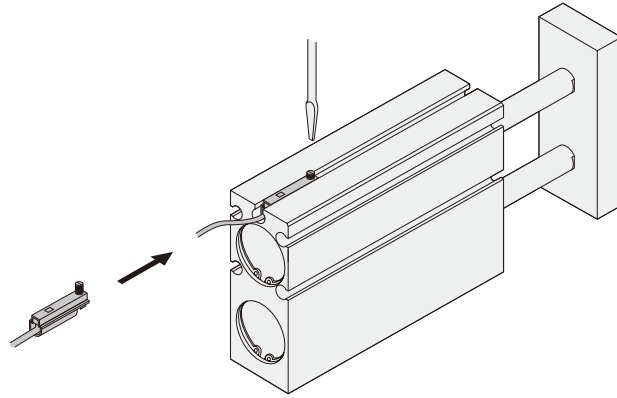
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	○	○	○	○	△	△	△	○	△	△	○	△	△	○	△	△
	Rod side	○	×	×	○	△	△	△	△	×	×	○	△	△	○	△	△
20	Head side	○	○	○	○	○	○	○	○	△	△	○	△	△	○	△	△
	Rod side	○	×	×	○	×	×	○	×	×	×	○	△	△	○	×	×
30	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	×	×	○	○	○	○	×	×
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

## ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



## ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	△	○	○	△	×	△	△	○	○	△	△	△	△	△	△	△
	Rod side	△	×	×	△	×	△	△	×	×	△	×	△	△	△	△	△
20	Head side	○	○	○	○	○	○	○	○	△	○	○	△	○	○	△	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
30	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×	○
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

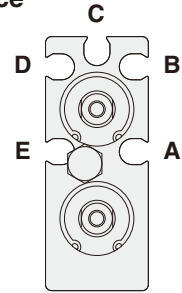
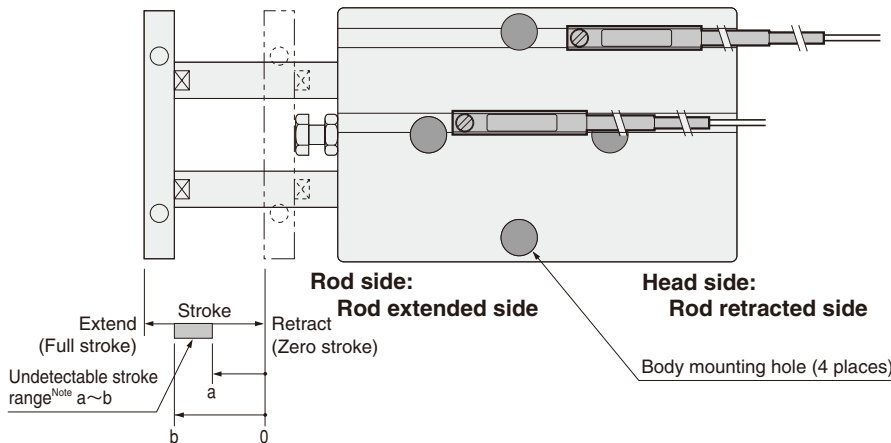


# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting long bushing type (TBDAM)

■ In the case of using 4 mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.] and  $\phi 32$  [1.260in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

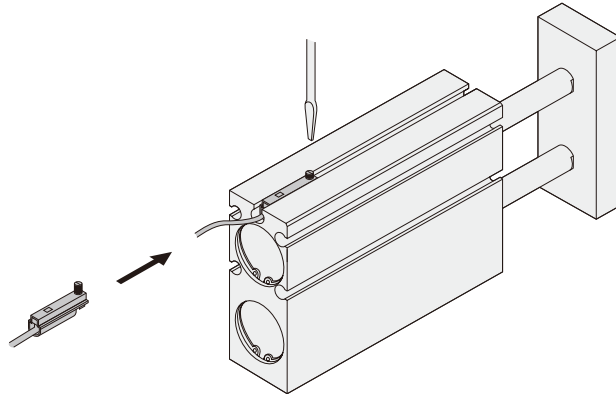
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	$\phi 10$			$\phi 16$			$\phi 20$			$\phi 25$			$\phi 32$		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	△	○	×	△	△	○	○	△	○	△	△	×	△	△
	Rod side	×	△	○	×	△	△	×	×	×	○	△	△	×	△	△
20	Head side	×	○	○	×	○	○	○	○	△	○	△	△	×	○	△
	Rod side	○	×	×	○	×	×	○	×	×	○	△	△	○	×	△
30	Head side	×	○	○	×	○	○	○	○	△	○	○	○	×	○	△
	Rod side	○	×	×	○	×	×	○	×	△	○	○	○	○	×	×
40	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	×	×	×	○	×	×	○	×	○
60	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	△	△	×	×	△	×	○	○	△	△	△	×	△	△
	Rod side	×	△	△	×	×	△	×	×	×	△	△	△	×	△	△
20	Head side	×	○	○	×	○	○	×	○	△	○	△	○	×	○	△
	Rod side	○	×	×	○	×	×	○	×	○	○	○	○	○	×	○
30	Head side	×	○	○	×	○	○	×	○	△	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	○	○	○	○	○	×	○
40	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	○	×	×	○	○	×	○
50	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	○
60	Head side	×	○	○	×	○	○	×	○	△	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	○	○
70	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

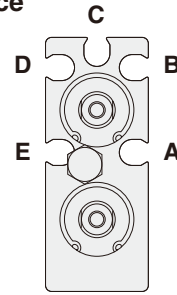
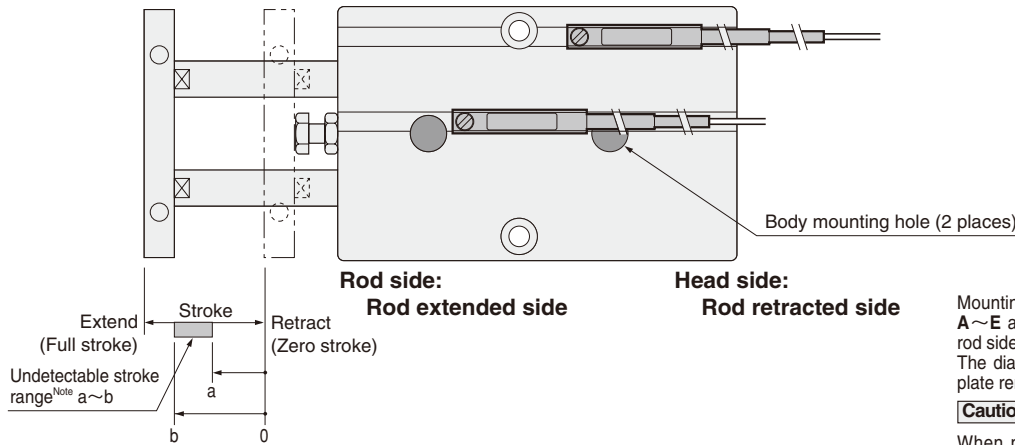
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting long bushing type (TBDAM)

■ In the case of using 2 center mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.] and  $\phi 32$  [1.260in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

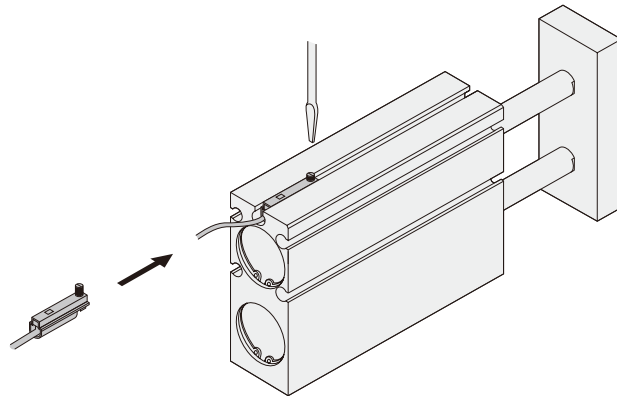
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Mounting groove	$\phi 10$			$\phi 16$			$\phi 20$			$\phi 25$			$\phi 32$		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	△	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	×	△	○	×	○	○	×	○	○	○	○	○	×	○	○
20	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
40	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
50	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
60	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	△	△	△	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

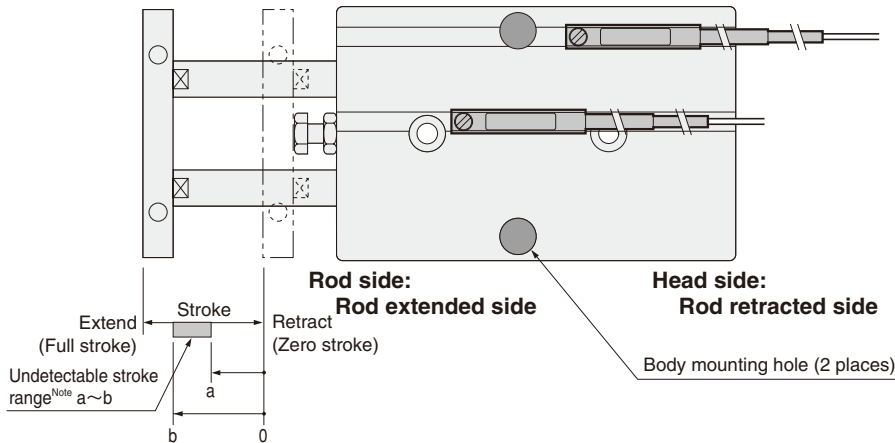
Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	△	△	×	△	△	×	△	△	△	△	△	×	△	△
	Rod side	×	△	△	×	△	△	×	△	△	△	△	△	×	△	△
20	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
40	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
50	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
60	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	△	△	△	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	△	△	△	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

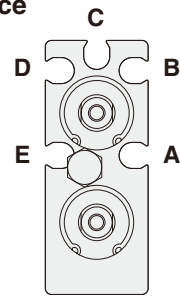
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting long bushing type (TBDAM)

**In the case of using 2 mounting holes on the body (one on each side)**



**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

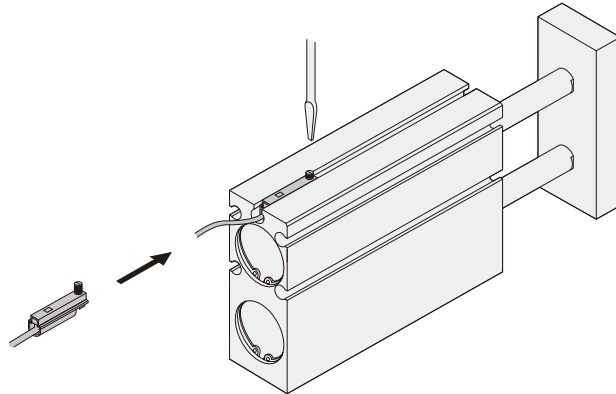
○ : Mountable   △ : Either head side or rod side   × : Unmountable   — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	○	△	○	○	△	△	△	△	△	○	△	△	○	△	△
	Rod side	○	△	○	○	△	△	△	△	△	○	△	△	○	△	△
20	Head side	○	○	○	○	○	○	○	△	△	○	△	△	○	△	△
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
30	Head side	○	○	○	○	○	○	○	△	△	○	△	△	○	△	△
	Rod side	○	○	×	○	×	×	○	×	△	○	△	△	○	×	×
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	△	△	△	△	×	△	△	○	△	○	△	△	△	△	△	△
	Rod side	△	△	△	△	×	△	△	×	×	△	×	△	△	△	△	△
20	Head side	○	○	○	○	○	○	○	△	○	△	○	△	○	△	○	△
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
30	Head side	○	○	○	○	○	○	○	△	○	△	○	△	○	△	○	△
	Rod side	○	×	×	○	×	×	○	×	△	○	×	×	○	×	×	○
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×	○
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

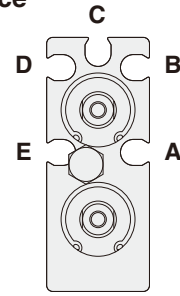
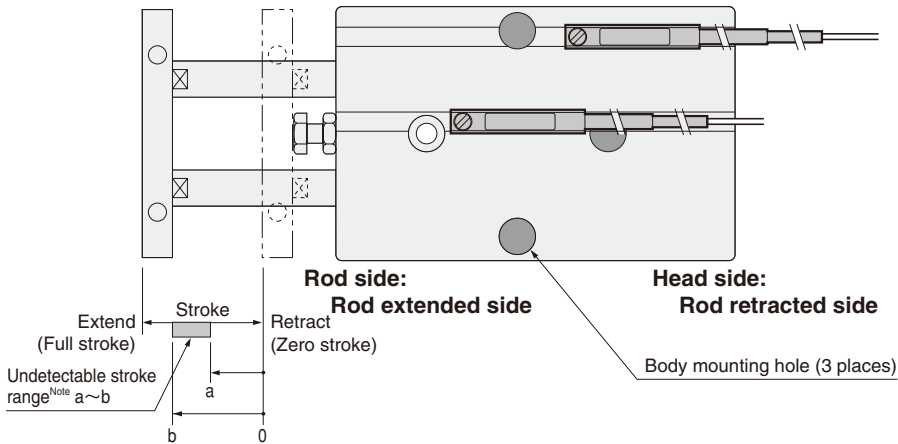
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting long bushing type (TBDAM)

**In the case of using 3 head side mounting holes on the body**

**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

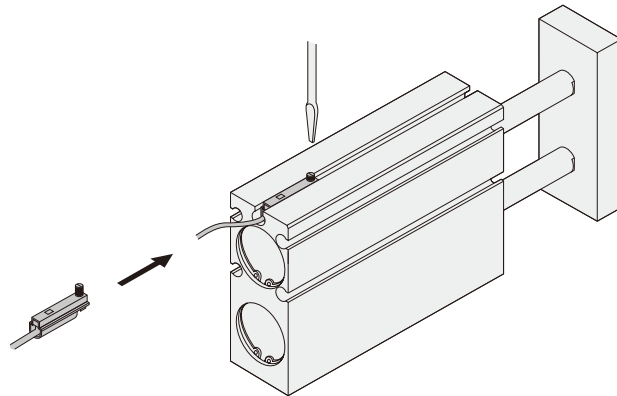
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	△	○	×	△	△	○	○	△	○	△	△	×	△	△
	Rod side	×	△	○	×	△	△	×	×	×	○	△	△	×	△	△
20	Head side	×	○	○	×	○	○	○	○	△	○	△	△	×	○	△
	Rod side	○	×	×	○	×	×	○	×	×	○	△	△	○	×	×
30	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
40	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×
50	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	×	×	×	○	○	○	○	×	○
60	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	×	○	○	×	○	○	○	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
10	Head side	×	△	△	×	×	△	×	○	○	△	○	△	×	△	△
	Rod side	×	×	△	×	×	△	×	×	×	△	×	△	×	△	△
20	Head side	×	○	○	×	○	○	×	○	△	○	○	△	×	○	△
	Rod side	○	×	×	○	×	×	○	×	△	○	×	△	○	×	△
30	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	×	×	○	×	△	○	×	△	○	×	×
40	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	×	×	○	○	○	○	×	×	○	×	×	○	×	×
50	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×
60	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	×	○	○	×	○	○	×	○	○	○	○	○	×	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

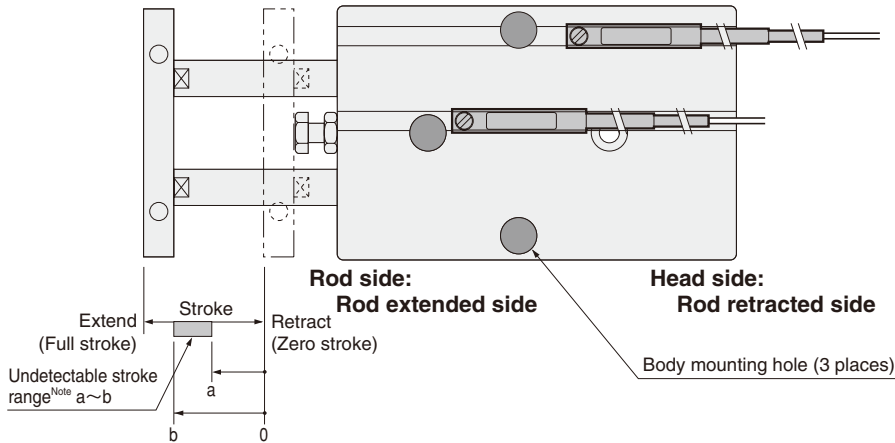


# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Double acting long bushing type (TBDAM)

**In the case of using 3 rod side mounting holes on the body**

**● Sensor switch mounting surface C**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

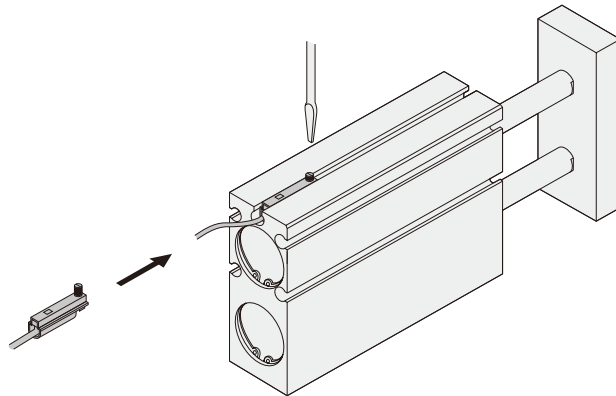
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	○	△	○	○	△	△	△	○	△	△	○	△	△	○	△	△
	Rod side	○	△	○	○	△	△	△	△	×	×	○	△	△	○	△	△
20	Head side	○	○	○	○	○	○	○	○	△	△	○	△	△	○	△	△
	Rod side	○	×	×	○	×	×	○	×	×	×	○	△	△	○	×	×
30	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	×	○	×	×	○	×	×
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	×	○	×	×	○	×	×
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	○	○	○	○	×	○
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 10			φ 16			φ 20			φ 25			φ 32			
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
10	Head side	△	△	△	△	×	△	△	○	△	○	△	△	△	△	△	△
	Rod side	△	△	△	△	×	△	×	×	△	×	△	△	△	△	△	△
20	Head side	○	○	○	○	○	○	○	△	○	△	○	○	○	○	△	△
	Rod side	○	×	×	○	×	×	○	×	△	○	×	×	○	×	×	△
30	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
40	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○	×	×	○	×	×	○
50	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	×	×	○	×	×	○	×	×	○
60	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
170	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
180	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
190	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200	Head side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

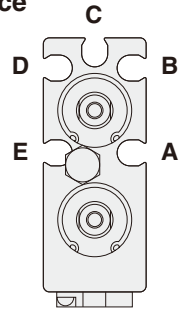
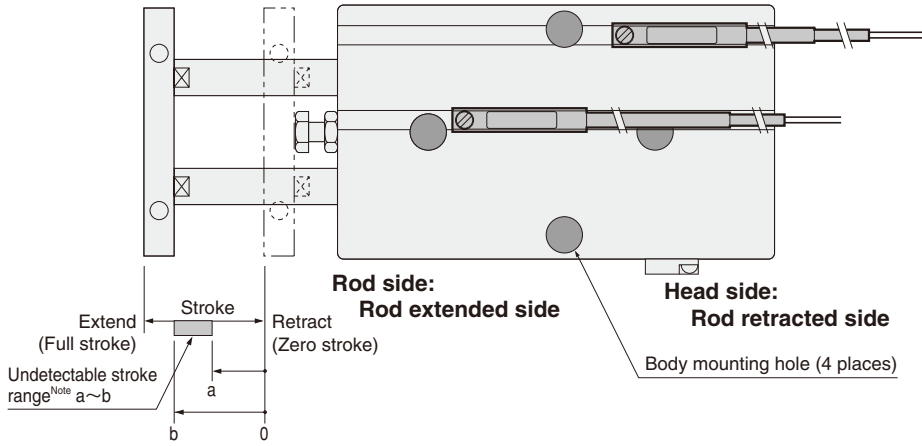
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Head side end keep cylinder (TBD AK-HL)

■ In the case of using 4 mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

### ● Solid state type

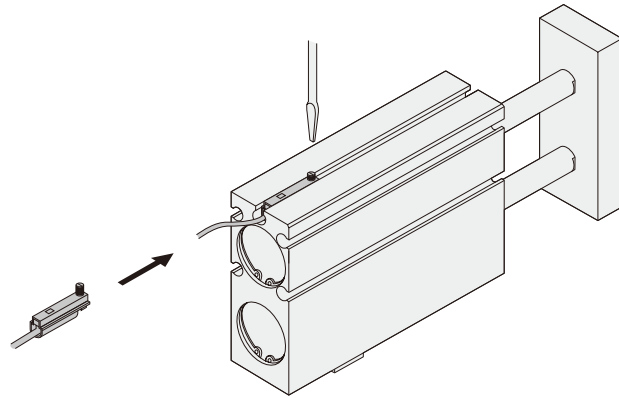
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Stroke	Mounting groove			$\phi 16$			$\phi 20$			$\phi 25$		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	A	B	C	A	B	C	A	B	C
10	Head side	△	○	○	Groove A (E) : 0~10 Groove B (D) : 2~10 Groove C : 4~10	△	○	○	Groove A (E) : 2~10 Groove B (D) : 6~10 Groove C : 8~10	○	○	○	Groove A (E) : — Groove B (D), C : 7~10
	Rod side	△	×	×		△	×	×		○	×	×	
20	Head side	△	○	○	Groove A (E) : 0~12 Groove B (D) : 7~20 Groove C : 9~20	△	○	○	Groove A (E) : 2~15 Groove B (D) : 11~20 Groove C : 13~20	○	○	○	Groove A (E) : — Groove B (D), C : 12~20
	Rod side	△	×	×		△	×	×		○	×	×	
30	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 12~26 Groove C : 14~24	○	○	○	Groove A (E) : 2~15 Groove B (D) : 16~30 Groove C : 18~30	○	○	○	Groove A (E) : — Groove B (D), C : 17~29
	Rod side	○	○	○		○	×	×		○	○	○	
40	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 17~31 Groove C : 19~29	○	○	○	Groove A (E) : 2~15 Groove B (D) : 21~37 Groove C : 23~35	○	○	○	Groove A (E) : — Groove B (D), C : 22~34
	Rod side	○	○	○		○	○	○		○	○	○	
50	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 22~36 Groove C : 24~34	○	○	○	Groove A (E) : 2~15 Groove B (D) : 26~42 Groove C : 28~40	○	○	○	Groove A (E) : — Groove B (D), C : 27~39
	Rod side	○	○	○		○	○	○		○	○	○	
60	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 27~41 Groove C : 29~39	○	○	○	Groove A (E) : 2~15 Groove B (D) : 31~47 Groove C : 33~45	○	○	○	Groove A (E) : — Groove B (D), C : 32~44
	Rod side	○	○	○		○	○	○		○	○	○	
70	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 32~46 Groove C : 34~44	○	○	○	Groove A (E) : 2~15 Groove B (D) : 36~52 Groove C : 38~50	○	○	○	Groove A (E) : — Groove B (D), C : 37~49
	Rod side	○	○	○		○	○	○		○	○	○	
80	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 37~51 Groove C : 39~49	○	○	○	Groove A (E) : 2~15 Groove B (D) : 41~57 Groove C : 43~55	○	○	○	Groove A (E) : — Groove B (D), C : 42~54
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 42~56 Groove C : 44~54	○	○	○	Groove A (E) : 2~15 Groove B (D) : 46~62 Groove C : 48~60	○	○	○	Groove A (E) : — Groove B (D), C : 47~59
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 47~61 Groove C : 49~59	○	○	○	Groove A (E) : 2~15 Groove B (D) : 51~67 Groove C : 53~65	○	○	○	Groove A (E) : — Groove B (D), C : 52~64
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 52~66 Groove C : 54~64	○	○	○	Groove A (E) : 2~15 Groove B (D) : 56~72 Groove C : 58~70	○	○	○	Groove A (E) : — Groove B (D), C : 57~69
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 57~71 Groove C : 59~69	○	○	○	Groove A (E) : 2~15 Groove B (D) : 61~77 Groove C : 63~75	○	○	○	Groove A (E) : — Groove B (D), C : 62~74
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 62~76 Groove C : 64~74	○	○	○	Groove A (E) : 2~15 Groove B (D) : 66~82 Groove C : 68~80	○	○	○	Groove A (E) : — Groove B (D), C : 67~79
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 67~81 Groove C : 69~79	○	○	○	Groove A (E) : 2~15 Groove B (D) : 71~87 Groove C : 73~85	○	○	○	Groove A (E) : — Groove B (D), C : 72~84
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 72~86 Groove C : 74~84	○	○	○	Groove A (E) : 2~15 Groove B (D) : 76~92 Groove C : 78~90	○	○	○	Groove A (E) : — Groove B (D), C : 77~89
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 77~91 Groove C : 79~89	○	○	○	Groove A (E) : 2~15 Groove B (D) : 81~97 Groove C : 83~95	○	○	○	Groove A (E) : — Groove B (D), C : 82~94
	Rod side	○	○	○		○	○	○		○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable   △ : Either head side or rod side   × : Unmountable   — : Fully detectable within stroke

(mm)

Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	E	D	C	E	D	C	E	D	C
10	Head side	△	×	○	Groove A (E) : 0~10 Groove B (D) : 2~10 Groove C : —	△	○	○	Groove A (E) : 0~10 Groove B (D) : 4~10 Groove C : 6~10	△	○	○	Groove A (E) : — Groove B (D), C : 6~10
	Rod side	△	×	×		△	×	×		△	×	×	
20	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 5~20 Groove C : 7~20	○	○	○	Groove A (E) : 0~17 Groove B (D) : 9~20 Groove C : 11~20	○	○	○	Groove A (E) : — Groove B (D), C : 11~20
	Rod side	○	×	×		○	×	×		○	×	×	
30	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 10~29 Groove C : 12~27	○	○	○	Groove A (E) : 0~17 Groove B (D) : 14~30 Groove C : 16~30	○	○	○	Groove A (E) : — Groove B (D), C : 16~30
	Rod side	○	○	○		○	×	×		○	×	×	
40	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 15~34 Groove C : 17~32	○	○	○	Groove A (E) : 0~17 Groove B (D) : 19~39 Groove C : 21~37	○	○	○	Groove A (E) : — Groove B (D), C : 21~36
	Rod side	○	○	○		○	○	○		○	○	○	
50	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 20~39 Groove C : 22~37	○	○	○	Groove A (E) : 0~17 Groove B (D) : 24~44 Groove C : 26~42	○	○	○	Groove A (E) : — Groove B (D), C : 26~41
	Rod side	○	○	○		○	○	○		○	○	○	
60	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 25~44 Groove C : 27~42	○	○	○	Groove A (E) : 0~17 Groove B (D) : 29~49 Groove C : 31~47	○	○	○	Groove A (E) : — Groove B (D), C : 31~46
	Rod side	○	○	○		○	○	○		○	○	○	
70	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 30~49 Groove C : 32~47	○	○	○	Groove A (E) : 0~17 Groove B (D) : 34~54 Groove C : 36~52	○	○	○	Groove A (E) : — Groove B (D), C : 36~51
	Rod side	○	○	○		○	○	○		○	○	○	
80	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 35~54 Groove C : 37~52	○	○	○	Groove A (E) : 0~17 Groove B (D) : 39~59 Groove C : 41~57	○	○	○	Groove A (E) : — Groove B (D), C : 41~56
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 40~59 Groove C : 42~57	○	○	○	Groove A (E) : 0~17 Groove B (D) : 44~64 Groove C : 46~62	○	○	○	Groove A (E) : — Groove B (D), C : 46~61
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 45~64 Groove C : 47~62	○	○	○	Groove A (E) : 0~17 Groove B (D) : 49~69 Groove C : 51~67	○	○	○	Groove A (E) : — Groove B (D), C : 51~66
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 50~69 Groove C : 52~67	○	○	○	Groove A (E) : 0~17 Groove B (D) : 54~74 Groove C : 56~72	○	○	○	Groove A (E) : — Groove B (D), C : 56~71
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 55~74 Groove C : 57~72	○	○	○	Groove A (E) : 0~17 Groove B (D) : 59~79 Groove C : 61~77	○	○	○	Groove A (E) : — Groove B (D), C : 61~76
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 60~79 Groove C : 62~77	○	○	○	Groove A (E) : 0~17 Groove B (D) : 64~84 Groove C : 66~82	○	○	○	Groove A (E) : — Groove B (D), C : 66~81
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 65~84 Groove C : 67~82	○	○	○	Groove A (E) : 0~17 Groove B (D) : 69~89 Groove C : 71~87	○	○	○	Groove A (E) : — Groove B (D), C : 71~86
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 70~89 Groove C : 72~87	○	○	○	Groove A (E) : 0~17 Groove B (D) : 74~94 Groove C : 76~92	○	○	○	Groove A (E) : — Groove B (D), C : 76~91
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 75~94 Groove C : 77~92	○	○	○	Groove A (E) : 0~17 Groove B (D) : 79~99 Groove C : 81~97	○	○	○	Groove A (E) : — Groove B (D), C : 81~96
	Rod side	○	○	○		○	○	○		○	○	○	

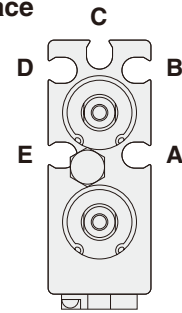
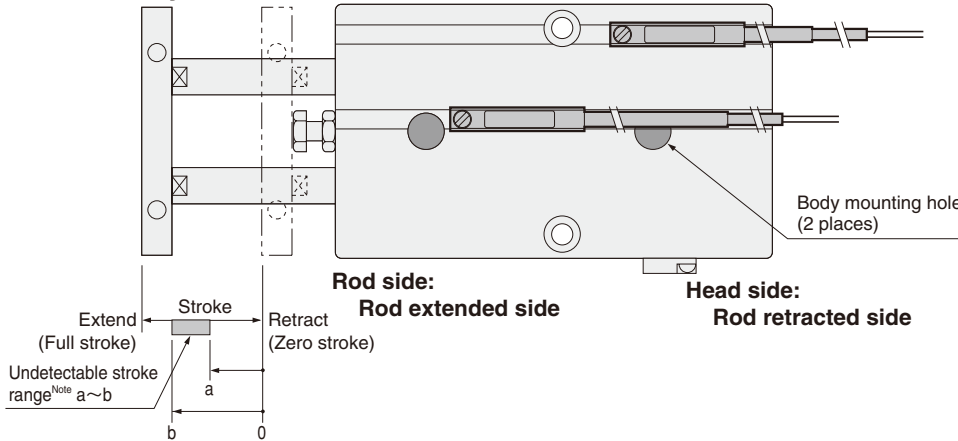
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Head side end keep cylinder (TBD-DAK-HL)

■ In the case of using 2 center mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

● Solid state type

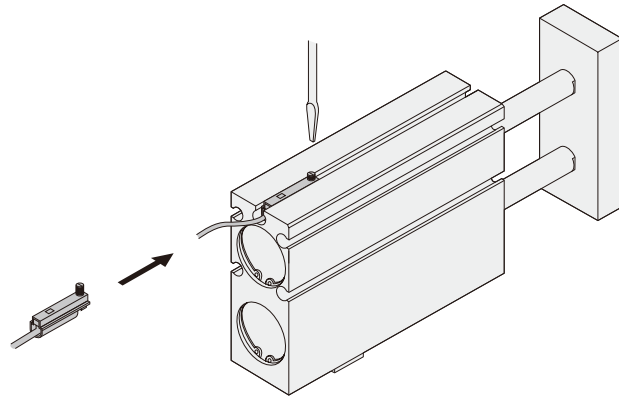
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Stroke	Mounting groove			$\phi 16$			$\phi 20$			$\phi 25$		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	A	B	C	A	B	C	A	B	C
10	Head side	△	○	○	Groove A (E) : 0~10 Groove B (D), C : —	△	○	○	Groove A (E) : 2~10 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	△	○	○		△	○	○		○	○	○	
20	Head side	△	○	○	Groove A (E) : 0~12 Groove B (D), C : —	△	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	△	○	○		△	○	○		○	○	○	
30	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
40	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
50	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
60	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
70	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
80	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

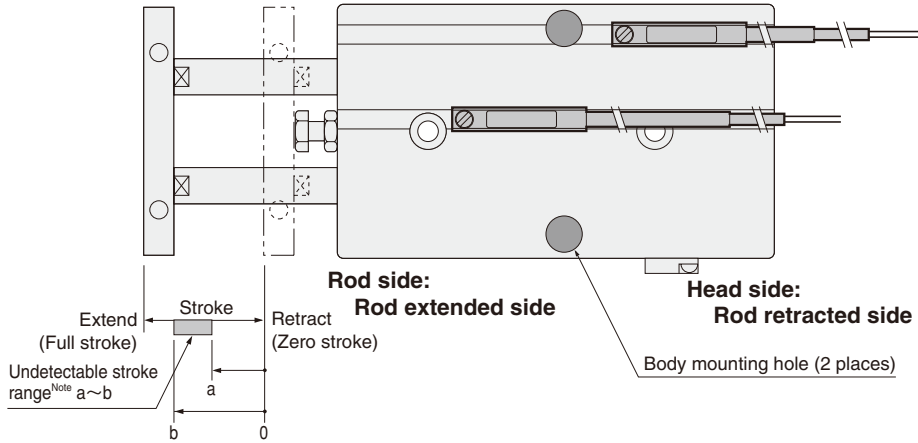
Bore size	Stroke	Mounting groove	φ 16			φ 20			φ 25		
			A	B	C	A	B	C	A	B	C
			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
10	Head side		△	△	△	△	△	△	△	△	△
	Rod side		△	△	△	△	△	△	△	△	△
20	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
30	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
40	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
50	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
60	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
70	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
80	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
90	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
100	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
110	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
120	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
130	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
140	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
150	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○
160	Head side		○	○	○	○	○	○	○	○	○
	Rod side		○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

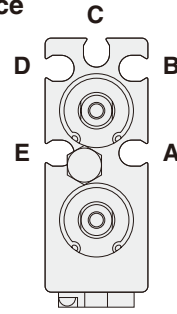
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Head side end keep cylinder (TBD-DAK-HL)

■ In the case of using 2 mounting holes on the body (one on each side)



● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

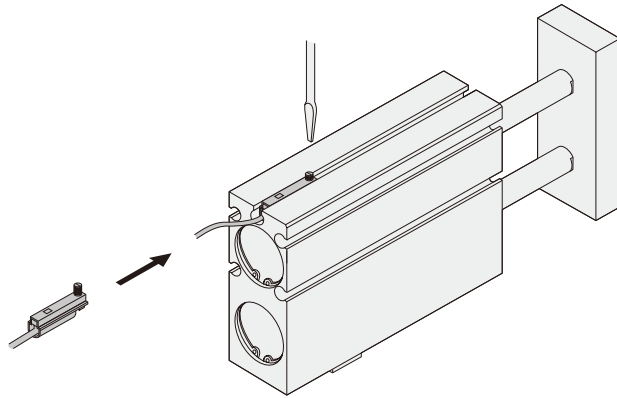
(mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25			
		A	B	C	A	B	C	A	B	C	
10	Head side	○	○	○	△	○	○	○	○	○	○
	Rod side	○	×	×	△	×	×	○	×	×	○
20	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×	○
30	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	×	×	○	○	○	○
40	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
50	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
60	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25								
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch								
		E	D	C	E	D	C	E	D	C	E	D	C						
10	Head side	△	×	○	Groove A (E) : — Groove B (D) : 0~10 Groove C : 2~10			△	○	○	Groove A (E) : — Groove B (D) : 4~10 Groove C : 6~10			△	○	○	Groove A (E) : — Groove B (D), C : 6~10		
	Rod side	△	×	×				△	×	×				△	×	×			
20	Head side	○	○	○	Groove A (E) : — Groove B (D) : 5~20 Groove C : 7~20			○	○	○	Groove A (E) : — Groove B (D) : 9~20 Groove C : 11~20			○	○	○	Groove A (E) : — Groove B (D), C : 11~20		
	Rod side	○	×	×				○	×	×				○	×	×			
30	Head side	○	○	○	Groove A (E) : — Groove B (D) : 10~29 Groove C : 12~27			○	○	○	Groove A (E) : — Groove B (D) : 14~30 Groove C : 16~30			○	○	○	Groove A (E) : — Groove B (D), C : 16~30		
	Rod side	○	○	○				○	×	×				○	×	×			
40	Head side	○	○	○	Groove A (E) : — Groove B (D) : 15~34 Groove C : 17~32			○	○	○	Groove A (E) : — Groove B (D) : 19~39 Groove C : 21~37			○	○	○	Groove A (E) : — Groove B (D), C : 21~36		
	Rod side	○	○	○				○	○	○				○	○	○			
50	Head side	○	○	○	Groove A (E) : — Groove B (D) : 20~39 Groove C : 22~37			○	○	○	Groove A (E) : — Groove B (D) : 24~44 Groove C : 26~42			○	○	○	Groove A (E) : — Groove B (D), C : 26~41		
	Rod side	○	○	○				○	○	○				○	○	○			
60	Head side	○	○	○	Groove A (E) : — Groove B (D) : 25~44 Groove C : 27~42			○	○	○	Groove A (E) : — Groove B (D) : 29~49 Groove C : 31~47			○	○	○	Groove A (E) : — Groove B (D), C : 31~46		
	Rod side	○	○	○				○	○	○				○	○	○			
70	Head side	○	○	○	Groove A (E) : — Groove B (D) : 30~49 Groove C : 32~47			○	○	○	Groove A (E) : — Groove B (D) : 34~54 Groove C : 36~52			○	○	○	Groove A (E) : — Groove B (D), C : 36~51		
	Rod side	○	○	○				○	○	○				○	○	○			
80	Head side	○	○	○	Groove A (E) : — Groove B (D) : 35~54 Groove C : 37~52			○	○	○	Groove A (E) : — Groove B (D) : 39~59 Groove C : 41~57			○	○	○	Groove A (E) : — Groove B (D), C : 41~56		
	Rod side	○	○	○				○	○	○				○	○	○			
90	Head side	○	○	○	Groove A (E) : — Groove B (D) : 40~59 Groove C : 42~57			○	○	○	Groove A (E) : — Groove B (D) : 44~64 Groove C : 46~62			○	○	○	Groove A (E) : — Groove B (D), C : 46~61		
	Rod side	○	○	○				○	○	○				○	○	○			
100	Head side	○	○	○	Groove A (E) : — Groove B (D) : 45~64 Groove C : 47~62			○	○	○	Groove A (E) : — Groove B (D) : 49~69 Groove C : 51~67			○	○	○	Groove A (E) : — Groove B (D), C : 51~66		
	Rod side	○	○	○				○	○	○				○	○	○			
110	Head side	○	○	○	Groove A (E) : — Groove B (D) : 50~69 Groove C : 52~67			○	○	○	Groove A (E) : — Groove B (D) : 54~74 Groove C : 56~72			○	○	○	Groove A (E) : — Groove B (D), C : 56~71		
	Rod side	○	○	○				○	○	○				○	○	○			
120	Head side	○	○	○	Groove A (E) : — Groove B (D) : 55~74 Groove C : 57~72			○	○	○	Groove A (E) : — Groove B (D) : 59~79 Groove C : 61~77			○	○	○	Groove A (E) : — Groove B (D), C : 61~76		
	Rod side	○	○	○				○	○	○				○	○	○			
130	Head side	○	○	○	Groove A (E) : — Groove B (D) : 60~79 Groove C : 62~77			○	○	○	Groove A (E) : — Groove B (D) : 64~84 Groove C : 66~82			○	○	○	Groove A (E) : — Groove B (D), C : 66~81		
	Rod side	○	○	○				○	○	○				○	○	○			
140	Head side	○	○	○	Groove A (E) : — Groove B (D) : 65~84 Groove C : 67~82			○	○	○	Groove A (E) : — Groove B (D) : 69~89 Groove C : 71~87			○	○	○	Groove A (E) : — Groove B (D), C : 71~86		
	Rod side	○	○	○				○	○	○				○	○	○			
150	Head side	○	○	○	Groove A (E) : — Groove B (D) : 70~89 Groove C : 72~87			○	○	○	Groove A (E) : — Groove B (D) : 74~94 Groove C : 76~92			○	○	○	Groove A (E) : — Groove B (D), C : 76~91		
	Rod side	○	○	○				○	○	○				○	○	○			
160	Head side	○	○	○	Groove A (E) : — Groove B (D) : 75~94 Groove C : 77~92			○	○	○	Groove A (E) : — Groove B (D) : 79~99 Groove C : 81~97			○	○	○	Groove A (E) : — Groove B (D), C : 81~96		
	Rod side	○	○	○				○	○	○				○	○	○			

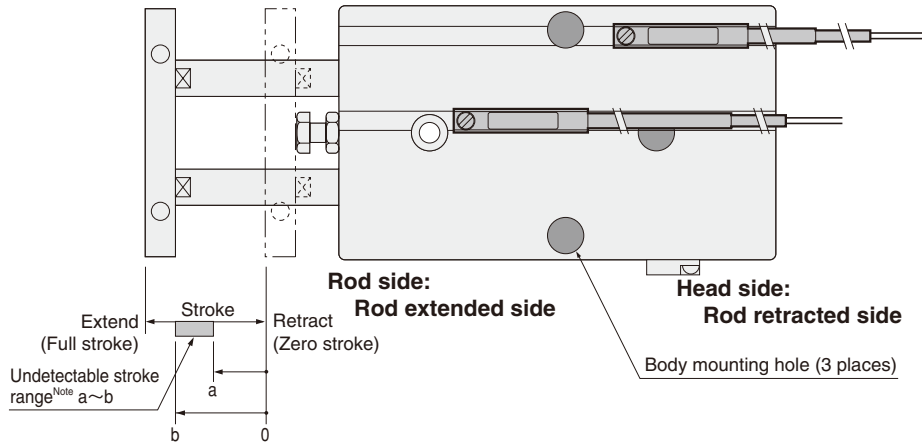
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.



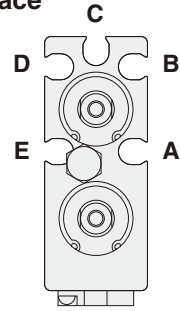
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Head side end keep cylinder (TBD-DAK-HL)

**In the case of using 3 head side mounting holes on the body**



**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

○ : Mountable   △ : Either head side or rod side   × : Unmountable   — : Fully detectable within stroke

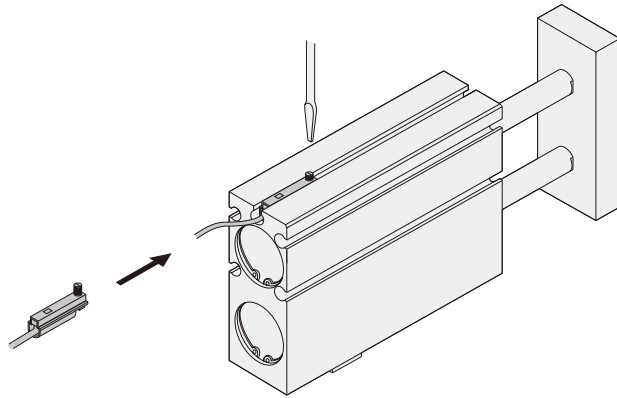
(mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25		
		A	B	C	A	B	C	A	B	C
10	Head side	△	○	○	△	○	○	○	○	○
	Rod side	△	×	×	△	×	×	○	×	×
20	Head side	△	○	○	△	○	○	○	○	○
	Rod side	△	×	×	△	×	×	○	×	×
30	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	×	×	○	○	○
40	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
50	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
60	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

## ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



## ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

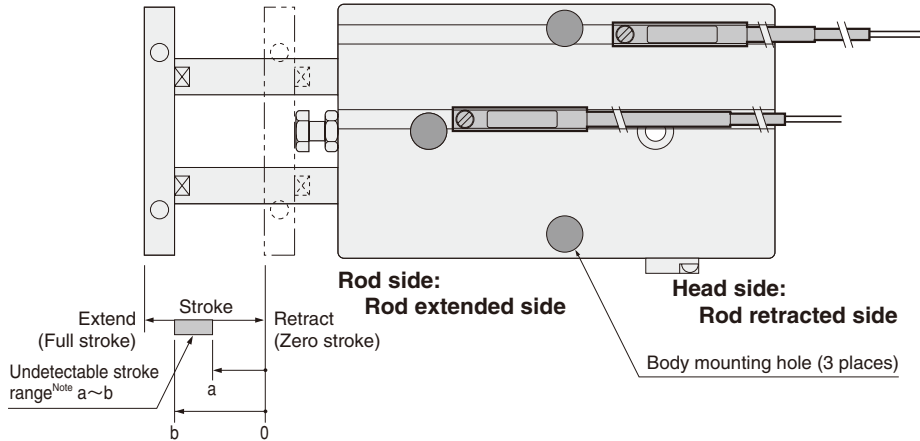
Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25								
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch								
		E	D	C	E	D	C	E	D	C	E	D	C						
10	Head side	△	×	○	Groove A (E) : 0~10 Groove B (D) : 0~10 Groove C : 2~10			△	○	○	Groove A (E) : 0~10 Groove B (D) : 4~10 Groove C : 6~10			△	○	○	Groove A (E) : — Groove B (D), C : 6~10		
	Rod side	△	×	×				△	×	×				△	×	×			
20	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 5~20 Groove C : 7~20			○	○	○	Groove A (E) : 0~17 Groove B (D) : 9~20 Groove C : 11~20			○	○	○	Groove A (E) : — Groove B (D), C : 11~20		
	Rod side	○	×	×				○	×	×				○	×	×			
30	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 10~29 Groove C : 12~27			○	○	○	Groove A (E) : 0~17 Groove B (D) : 14~30 Groove C : 16~30			○	○	○	Groove A (E) : — Groove B (D), C : 16~30		
	Rod side	○	○	○				○	×	×				○	×	×			
40	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 15~34 Groove C : 17~32			○	○	○	Groove A (E) : 0~17 Groove B (D) : 19~39 Groove C : 21~37			○	○	○	Groove A (E) : — Groove B (D), C : 21~36		
	Rod side	○	○	○				○	○	○				○	○	○			
50	Head side	○	○	○	Groove A (E) : 2~14 Groove B (D) : 20~39 Groove C : 22~37			○	○	○	Groove A (E) : 0~17 Groove B (D) : 24~44 Groove C : 26~42			○	○	○	Groove A (E) : — Groove B (D), C : 26~41		
	Rod side	○	○	○				○	○	○				○	○	○			
60	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 25~44 Groove C : 27~42			○	○	○	Groove A (E) : 0~17 Groove B (D) : 29~49 Groove C : 31~47			○	○	○	Groove A (E) : — Groove B (D), C : 31~46		
	Rod side	○	○	○				○	○	○				○	○	○			
70	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 30~49 Groove C : 32~47			○	○	○	Groove A (E) : 0~17 Groove B (D) : 34~54 Groove C : 36~52			○	○	○	Groove A (E) : — Groove B (D), C : 36~51		
	Rod side	○	○	○				○	○	○				○	○	○			
80	Head side	○	○	○	Groove A (E) : 0~12 Groove B (D) : 35~54 Groove C : 37~52			○	○	○	Groove A (E) : 0~17 Groove B (D) : 39~59 Groove C : 41~57			○	○	○	Groove A (E) : — Groove B (D), C : 41~56		
	Rod side	○	○	○				○	○	○				○	○	○			
90	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 40~59 Groove C : 42~57			○	○	○	Groove A (E) : 0~17 Groove B (D) : 44~64 Groove C : 46~62			○	○	○	Groove A (E) : — Groove B (D), C : 46~61		
	Rod side	○	○	○				○	○	○				○	○	○			
100	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 45~64 Groove C : 47~62			○	○	○	Groove A (E) : 0~17 Groove B (D) : 49~69 Groove C : 51~67			○	○	○	Groove A (E) : — Groove B (D), C : 51~66		
	Rod side	○	○	○				○	○	○				○	○	○			
110	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 50~69 Groove C : 52~67			○	○	○	Groove A (E) : 0~17 Groove B (D) : 54~74 Groove C : 56~72			○	○	○	Groove A (E) : — Groove B (D), C : 56~71		
	Rod side	○	○	○				○	○	○				○	○	○			
120	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 55~74 Groove C : 57~72			○	○	○	Groove A (E) : 0~17 Groove B (D) : 59~79 Groove C : 61~77			○	○	○	Groove A (E) : — Groove B (D), C : 61~76		
	Rod side	○	○	○				○	○	○				○	○	○			
130	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 60~79 Groove C : 62~77			○	○	○	Groove A (E) : 0~17 Groove B (D) : 64~84 Groove C : 66~82			○	○	○	Groove A (E) : — Groove B (D), C : 66~81		
	Rod side	○	○	○				○	○	○				○	○	○			
140	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 65~84 Groove C : 67~82			○	○	○	Groove A (E) : 0~17 Groove B (D) : 69~89 Groove C : 71~87			○	○	○	Groove A (E) : — Groove B (D), C : 71~86		
	Rod side	○	○	○				○	○	○				○	○	○			
150	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 70~89 Groove C : 72~87			○	○	○	Groove A (E) : 0~17 Groove B (D) : 74~94 Groove C : 76~92			○	○	○	Groove A (E) : — Groove B (D), C : 76~91		
	Rod side	○	○	○				○	○	○				○	○	○			
160	Head side	○	○	○	Groove A (E) : 0~14 Groove B (D) : 75~94 Groove C : 77~92			○	○	○	Groove A (E) : 0~17 Groove B (D) : 79~99 Groove C : 81~97			○	○	○	Groove A (E) : — Groove B (D), C : 81~96		
	Rod side	○	○	○				○	○	○				○	○	○			

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

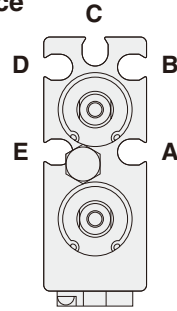
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Head side end keep cylinder (TBD AK-HL)

**In the case of using 3 rod side mounting holes on the body**



**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

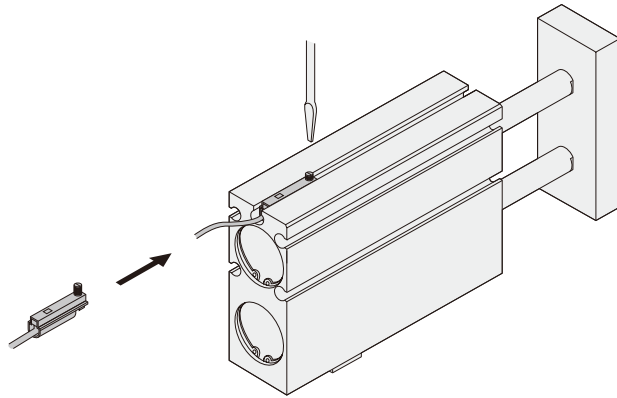
○ : Mountable   △ : Either head side or rod side   × : Unmountable   — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25		
		A	B	C	A	B	C	A	B	C
10	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×
20	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×
30	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	×	×	○	○	○
40	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
50	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
60	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
70	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25								
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch								
		E	D	C	E	D	C	E	D	C	E	D	C						
10	Head side	△	×	○	Groove A (E) : — Groove B (D) : 0~10 Groove C : 2~10			△	○	○	Groove A (E) : — Groove B (D) : 4~10 Groove C : 6~10			△	○	○	Groove A (E) : — Groove B (D), C : 6~10		
	Rod side	△	×	×				△	×	×				△	×	×			
20	Head side	○	○	○	Groove A (E) : — Groove B (D) : 5~20 Groove C : 7~20			○	○	○	Groove A (E) : — Groove B (D) : 9~20 Groove C : 11~20			○	○	○	Groove A (E) : — Groove B (D), C : 11~20		
	Rod side	○	×	×				○	×	×				○	×	×			
30	Head side	○	○	○	Groove A (E) : — Groove B (D) : 10~29 Groove C : 12~27			○	○	○	Groove A (E) : — Groove B (D) : 14~30 Groove C : 16~30			○	○	○	Groove A (E) : — Groove B (D), C : 16~30		
	Rod side	○	○	○				○	×	×				○	×	×			
40	Head side	○	○	○	Groove A (E) : — Groove B (D) : 15~34 Groove C : 17~32			○	○	○	Groove A (E) : — Groove B (D) : 19~39 Groove C : 21~37			○	○	○	Groove A (E) : — Groove B (D), C : 21~36		
	Rod side	○	○	○				○	○	○				○	○	○			
50	Head side	○	○	○	Groove A (E) : — Groove B (D) : 20~39 Groove C : 22~37			○	○	○	Groove A (E) : — Groove B (D) : 24~44 Groove C : 26~42			○	○	○	Groove A (E) : — Groove B (D), C : 26~41		
	Rod side	○	○	○				○	○	○				○	○	○			
60	Head side	○	○	○	Groove A (E) : — Groove B (D) : 25~44 Groove C : 27~42			○	○	○	Groove A (E) : — Groove B (D) : 29~49 Groove C : 31~47			○	○	○	Groove A (E) : — Groove B (D), C : 31~46		
	Rod side	○	○	○				○	○	○				○	○	○			
70	Head side	○	○	○	Groove A (E) : — Groove B (D) : 30~49 Groove C : 32~47			○	○	○	Groove A (E) : — Groove B (D) : 34~54 Groove C : 36~52			○	○	○	Groove A (E) : — Groove B (D), C : 36~51		
	Rod side	○	○	○				○	○	○				○	○	○			
80	Head side	○	○	○	Groove A (E) : — Groove B (D) : 35~54 Groove C : 37~52			○	○	○	Groove A (E) : — Groove B (D) : 39~59 Groove C : 41~57			○	○	○	Groove A (E) : — Groove B (D), C : 41~56		
	Rod side	○	○	○				○	○	○				○	○	○			
90	Head side	○	○	○	Groove A (E) : — Groove B (D) : 40~59 Groove C : 42~57			○	○	○	Groove A (E) : — Groove B (D) : 44~64 Groove C : 46~62			○	○	○	Groove A (E) : — Groove B (D), C : 46~61		
	Rod side	○	○	○				○	○	○				○	○	○			
100	Head side	○	○	○	Groove A (E) : — Groove B (D) : 45~64 Groove C : 47~62			○	○	○	Groove A (E) : — Groove B (D) : 49~69 Groove C : 51~67			○	○	○	Groove A (E) : — Groove B (D), C : 51~66		
	Rod side	○	○	○				○	○	○				○	○	○			
110	Head side	○	○	○	Groove A (E) : — Groove B (D) : 50~69 Groove C : 52~67			○	○	○	Groove A (E) : — Groove B (D) : 54~74 Groove C : 56~72			○	○	○	Groove A (E) : — Groove B (D), C : 56~71		
	Rod side	○	○	○				○	○	○				○	○	○			
120	Head side	○	○	○	Groove A (E) : — Groove B (D) : 55~74 Groove C : 57~72			○	○	○	Groove A (E) : — Groove B (D) : 59~79 Groove C : 61~77			○	○	○	Groove A (E) : — Groove B (D), C : 61~76		
	Rod side	○	○	○				○	○	○				○	○	○			
130	Head side	○	○	○	Groove A (E) : — Groove B (D) : 60~79 Groove C : 62~77			○	○	○	Groove A (E) : — Groove B (D) : 64~84 Groove C : 66~82			○	○	○	Groove A (E) : — Groove B (D), C : 66~81		
	Rod side	○	○	○				○	○	○				○	○	○			
140	Head side	○	○	○	Groove A (E) : — Groove B (D) : 65~84 Groove C : 67~82			○	○	○	Groove A (E) : — Groove B (D) : 69~89 Groove C : 71~87			○	○	○	Groove A (E) : — Groove B (D), C : 71~86		
	Rod side	○	○	○				○	○	○				○	○	○			
150	Head side	○	○	○	Groove A (E) : — Groove B (D) : 70~89 Groove C : 72~87			○	○	○	Groove A (E) : — Groove B (D) : 74~94 Groove C : 76~92			○	○	○	Groove A (E) : — Groove B (D), C : 76~91		
	Rod side	○	○	○				○	○	○				○	○	○			
160	Head side	○	○	○	Groove A (E) : — Groove B (D) : 75~94 Groove C : 77~92			○	○	○	Groove A (E) : — Groove B (D) : 79~99 Groove C : 81~97			○	○	○	Groove A (E) : — Groove B (D), C : 81~96		
	Rod side	○	○	○				○	○	○				○	○	○			

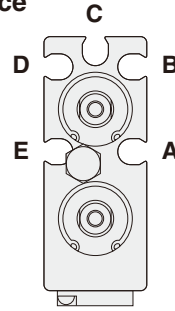
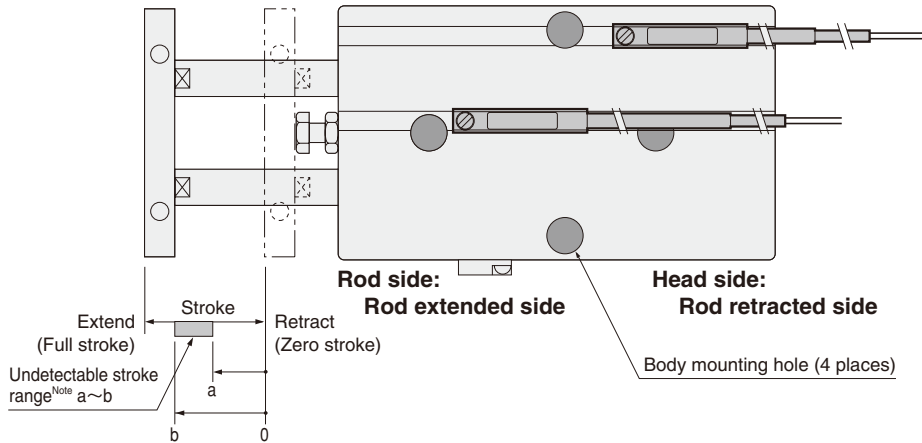
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Rod side end keep cylinder (TBD-RL)

■ In the case of using 4 mounting holes on the body

● Sensor switch mounting surface



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

### ● Solid state type

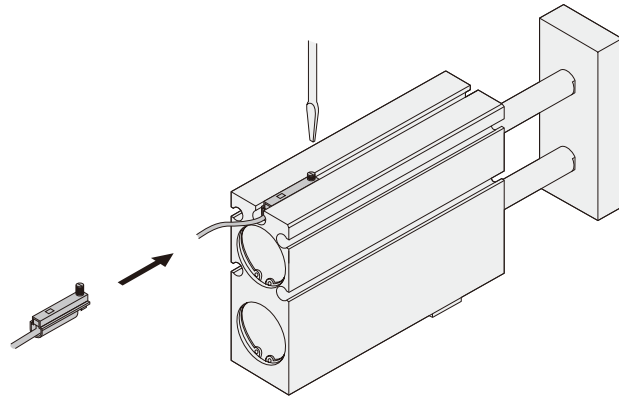
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Stroke	Mounting groove			$\phi 16$			$\phi 20$			$\phi 25$		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	E	D	C	E	D	C	E	D	C
10	Head side	×	△	△	Groove A (E) : 0~10 Groove B (D) : — Groove C : —	○	△	○	Groove A (E) : 2~10 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	×	△	△		×	△	○		○	○	○	
20	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : 2~15 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
30	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : 2~15 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
40	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 37~40 Groove C : 39~40	○	○	○	Groove A (E) : 2~15 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	×		○	○	○		○	○	○	
50	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 42~50 Groove C : 44~50	○	○	○	Groove A (E) : 2~15 Groove B (D) : 46~50 Groove C : 48~50	○	○	○	Groove A (E) : — Groove B (D), C : 47~50
	Rod side	○	×	×		○	×	×		○	×	×	
60	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 47~60 Groove C : 49~60	○	○	○	Groove A (E) : 2~15 Groove B (D) : 51~60 Groove C : 53~60	○	○	○	Groove A (E) : — Groove B (D), C : 52~60
	Rod side	○	×	×		○	×	×		○	×	×	
70	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 52~66 Groove C : 54~64	○	○	○	Groove A (E) : 2~15 Groove B (D) : 56~70 Groove C : 58~70	○	○	○	Groove A (E) : — Groove B (D), C : 57~69
	Rod side	○	○	○		○	×	×		○	○	○	
80	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 57~71 Groove C : 59~69	○	○	○	Groove A (E) : 2~15 Groove B (D) : 61~77 Groove C : 63~75	○	○	○	Groove A (E) : — Groove B (D), C : 62~74
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 62~76 Groove C : 64~74	○	○	○	Groove A (E) : 2~15 Groove B (D) : 66~82 Groove C : 68~80	○	○	○	Groove A (E) : — Groove B (D), C : 67~79
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 67~81 Groove C : 69~79	○	○	○	Groove A (E) : 2~15 Groove B (D) : 71~87 Groove C : 73~85	○	○	○	Groove A (E) : — Groove B (D), C : 72~84
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 72~86 Groove C : 74~84	○	○	○	Groove A (E) : 2~15 Groove B (D) : 76~92 Groove C : 78~90	○	○	○	Groove A (E) : — Groove B (D), C : 77~89
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 77~91 Groove C : 79~89	○	○	○	Groove A (E) : 2~15 Groove B (D) : 81~97 Groove C : 83~95	○	○	○	Groove A (E) : — Groove B (D), C : 82~94
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 82~96 Groove C : 84~94	○	○	○	Groove A (E) : 2~15 Groove B (D) : 86~102 Groove C : 88~100	○	○	○	Groove A (E) : — Groove B (D), C : 87~99
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 87~101 Groove C : 89~99	○	○	○	Groove A (E) : 2~15 Groove B (D) : 91~107 Groove C : 93~105	○	○	○	Groove A (E) : — Groove B (D), C : 92~104
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 92~106 Groove C : 94~104	○	○	○	Groove A (E) : 2~15 Groove B (D) : 96~112 Groove C : 98~110	○	○	○	Groove A (E) : — Groove B (D), C : 97~109
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 97~111 Groove C : 99~109	○	○	○	Groove A (E) : 2~15 Groove B (D) : 101~117 Groove C : 103~115	○	○	○	Groove A (E) : — Groove B (D), C : 102~114
	Rod side	○	○	○		○	○	○		○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	E	D	C	E	D	C	E	D	C
10	Head side	×	△	△	Groove A (E) : 0~10 Groove B (D) : — Groove C : —	×	△	△	Groove A (E) : 0~10 Groove B (D) : — Groove C : —	△	△	△	Groove A (E) : — Groove B (D), C : —
	Rod side	×	△	△		×	△	△		△	△	△	
20	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : — Groove C : —	×	○	○	Groove A (E) : 0~17 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
30	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 29~30 Groove C : —	×	○	○	Groove A (E) : 0~17 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	○		○	○	○		○	○	○	
40	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 35~40 Groove C : 37~40	×	○	○	Groove A (E) : 0~17 Groove B (D) : 39~40 Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	×		○	×	○		○	○	○	
50	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 40~50 Groove C : 42~50	×	○	○	Groove A (E) : 0~17 Groove B (D) : 44~50 Groove C : 46~50	○	○	○	Groove A (E) : — Groove B (D), C : 46~60
	Rod side	○	×	×		○	×	×		○	×	×	
60	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 45~60 Groove C : 47~60	×	○	○	Groove A (E) : 0~17 Groove B (D) : 49~60 Groove C : 51~60	○	○	○	Groove A (E) : — Groove B (D), C : 51~60
	Rod side	○	×	×		○	×	×		○	×	×	
70	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 50~69 Groove C : 52~67	×	○	○	Groove A (E) : 0~17 Groove B (D) : 54~70 Groove C : 56~70	○	○	○	Groove A (E) : — Groove B (D), C : 56~70
	Rod side	○	○	○		○	×	×		○	×	×	
80	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 55~74 Groove C : 57~72	×	○	○	Groove A (E) : 0~17 Groove B (D) : 59~79 Groove C : 61~77	○	○	○	Groove A (E) : — Groove B (D), C : 61~76
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 60~79 Groove C : 62~77	×	○	○	Groove A (E) : 0~17 Groove B (D) : 64~84 Groove C : 66~82	○	○	○	Groove A (E) : — Groove B (D), C : 66~81
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 65~84 Groove C : 67~82	×	○	○	Groove A (E) : 0~17 Groove B (D) : 69~89 Groove C : 71~87	○	○	○	Groove A (E) : — Groove B (D), C : 71~86
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 70~89 Groove C : 72~87	×	○	○	Groove A (E) : 0~17 Groove B (D) : 74~94 Groove C : 76~92	○	○	○	Groove A (E) : — Groove B (D), C : 76~91
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 75~94 Groove C : 77~92	×	○	○	Groove A (E) : 0~17 Groove B (D) : 79~99 Groove C : 81~97	○	○	○	Groove A (E) : — Groove B (D), C : 81~96
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 80~99 Groove C : 82~97	×	○	○	Groove A (E) : 0~17 Groove B (D) : 84~104 Groove C : 86~102	○	○	○	Groove A (E) : — Groove B (D), C : 86~101
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 85~104 Groove C : 87~102	×	○	○	Groove A (E) : 0~17 Groove B (D) : 89~109 Groove C : 91~107	○	○	○	Groove A (E) : — Groove B (D), C : 91~106
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 90~109 Groove C : 92~107	×	○	○	Groove A (E) : 0~17 Groove B (D) : 94~114 Groove C : 96~112	○	○	○	Groove A (E) : — Groove B (D), C : 96~111
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 95~114 Groove C : 97~112	×	○	○	Groove A (E) : 0~17 Groove B (D) : 99~119 Groove C : 101~117	○	○	○	Groove A (E) : — Groove B (D), C : 101~116
	Rod side	○	○	○		○	○	○		○	○	○	

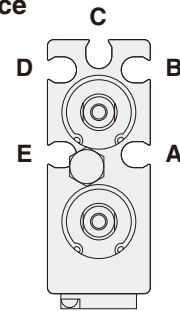
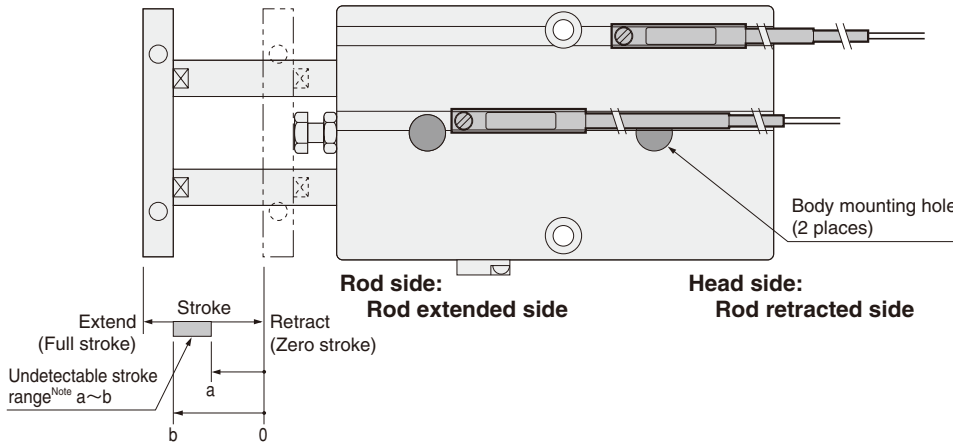
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Rod side end keep cylinder (TBD-RL)

**In the case of using 2 center mounting holes on the body**

**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Caution**

When mounting a sensor switch in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening body mounting bolts, to avoid interference between the sensor switch and the bolts.

This procedure is not necessary for  $\phi 25$  [0.984in.], however, where no interference occurs.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

**● Solid state type**

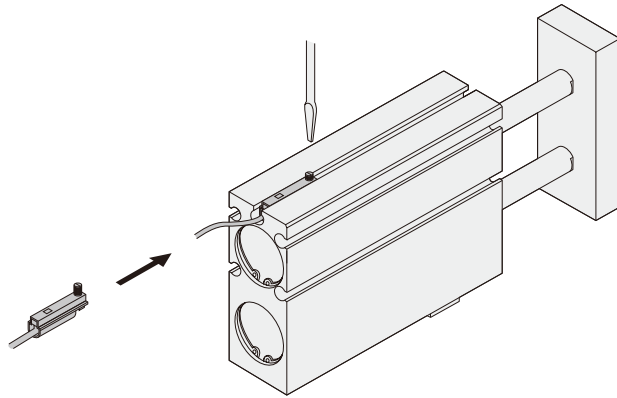
○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Bore size	Stroke	Mounting groove			$\phi 16$			$\phi 20$			$\phi 25$		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	A	B	C	E	D	C	E	D	C
10	Head side	×	○	○	Groove A (E) : 0~10 Groove B (D), C : —	○	○	○	Groove A (E) : 2~10 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	×	○	○		×	○	○		○	○	○	
20	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
30	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
40	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
50	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
60	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
70	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
80	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D), C : —	○	○	○	Groove A (E) : 2~15 Groove B (D), C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke (mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25		
		A	B	C	A	B	C	A	B	C
10	Head side	×	○	○	×	○	○	△	○	○
	Rod side	×	○	○	×	○	○	△	○	○
20	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
30	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
40	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
50	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
60	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
70	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
80	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
90	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
100	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
110	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
120	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
130	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
140	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
150	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
160	Head side	×	○	○	×	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○

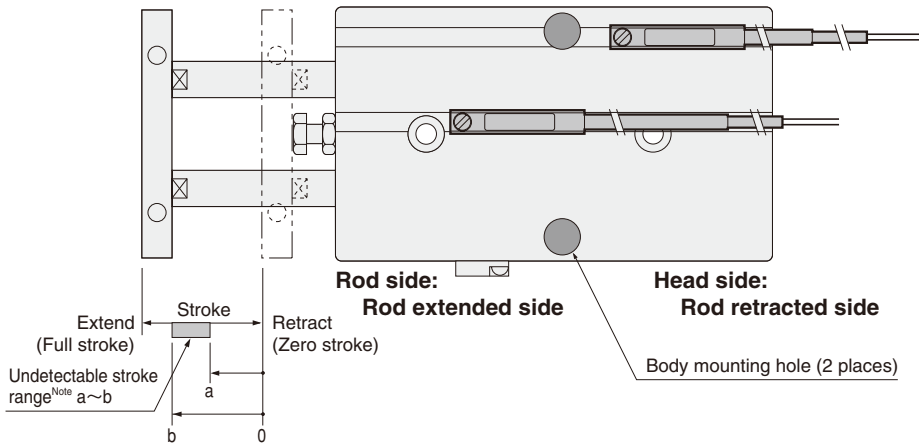
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.



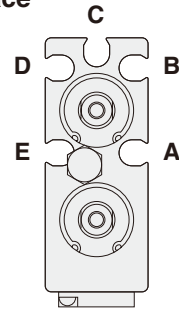
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Rod side end keep cylinder (TBD-RL)

**In the case of using 2 mounting holes on the body (one on each side)**



**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

○ : Mountable   △ : Either head side or rod side   × : Unmountable   — : Fully detectable within stroke

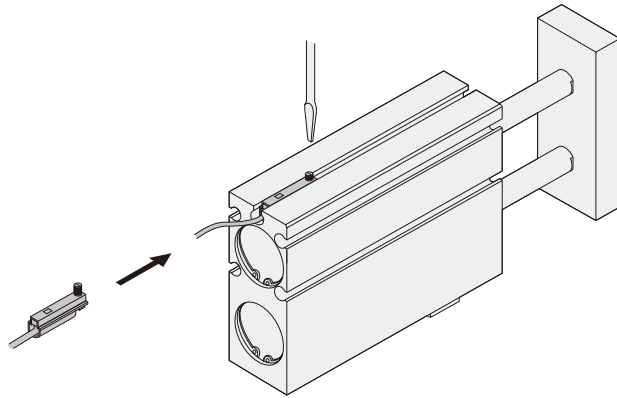
(mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25		
		A	B	C	A	B	C	A	B	C
10	Head side	○	△	△	△	△	○	○	○	○
	Rod side	○	△	△	△	△	○	○	○	○
20	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
30	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
40	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	○	○	○	○	○
50	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×
60	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×
70	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	×	×	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

## ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



## ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	E	D	C	E	D	C	E	D	C
10	Head side	△	△	△	Groove A (E) : — Groove B (D) : — Groove C : —	△	△	△	Groove A (E) : — Groove B (D) : 8~10 Groove C : 10	△	△	△	Groove A (E) : — Groove B (D), C : —
	Rod side	△	△	△		△	△	△		△	△	△	
20	Head side	○	○	○	Groove A (E) : — Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
30	Head side	○	○	○	Groove A (E) : — Groove B (D) : 29~30 Groove C : 22~30	○	○	○	Groove A (E) : — Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	○		○	○	○		○	○	○	
40	Head side	○	○	○	Groove A (E) : — Groove B (D) : 35~40 Groove C : 37~40	○	○	○	Groove A (E) : — Groove B (D) : 39~40 Groove C : 31~40	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	×		○	×	×		○	○	○	
50	Head side	○	○	○	Groove A (E) : — Groove B (D) : 40~50 Groove C : 42~50	○	○	○	Groove A (E) : — Groove B (D) : 44~50 Groove C : 46~50	○	○	○	Groove A (E) : — Groove B (D), C : 46~50
	Rod side	○	×	×		○	×	×		○	×	×	
60	Head side	○	○	○	Groove A (E) : — Groove B (D) : 45~60 Groove C : 47~60	○	○	○	Groove A (E) : — Groove B (D) : 49~60 Groove C : 51~60	○	○	○	Groove A (E) : — Groove B (D), C : 51~60
	Rod side	○	×	×		○	×	×		○	×	×	
70	Head side	○	○	○	Groove A (E) : — Groove B (D) : 50~69 Groove C : 52~67	○	○	○	Groove A (E) : — Groove B (D) : 54~70 Groove C : 56~70	○	○	○	Groove A (E) : — Groove B (D), C : 56~70
	Rod side	○	○	○		○	×	×		○	×	×	
80	Head side	○	○	○	Groove A (E) : — Groove B (D) : 55~74 Groove C : 57~72	○	○	○	Groove A (E) : — Groove B (D) : 59~79 Groove C : 61~77	○	○	○	Groove A (E) : — Groove B (D), C : 61~76
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	○	○	○	Groove A (E) : — Groove B (D) : 60~79 Groove C : 62~77	○	○	○	Groove A (E) : — Groove B (D) : 64~84 Groove C : 66~82	○	○	○	Groove A (E) : — Groove B (D), C : 66~81
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	○	○	○	Groove A (E) : — Groove B (D) : 65~84 Groove C : 67~82	○	○	○	Groove A (E) : — Groove B (D) : 69~89 Groove C : 71~87	○	○	○	Groove A (E) : — Groove B (D), C : 71~86
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	○	○	○	Groove A (E) : — Groove B (D) : 70~89 Groove C : 72~87	○	○	○	Groove A (E) : — Groove B (D) : 74~94 Groove C : 76~92	○	○	○	Groove A (E) : — Groove B (D), C : 76~91
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	○	○	○	Groove A (E) : — Groove B (D) : 75~94 Groove C : 77~92	○	○	○	Groove A (E) : — Groove B (D) : 79~99 Groove C : 81~97	○	○	○	Groove A (E) : — Groove B (D), C : 81~96
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	○	○	○	Groove A (E) : — Groove B (D) : 80~99 Groove C : 82~97	○	○	○	Groove A (E) : — Groove B (D) : 84~104 Groove C : 86~102	○	○	○	Groove A (E) : — Groove B (D), C : 86~101
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	○	○	○	Groove A (E) : — Groove B (D) : 85~104 Groove C : 87~102	○	○	○	Groove A (E) : — Groove B (D) : 89~109 Groove C : 91~107	○	○	○	Groove A (E) : — Groove B (D), C : 91~106
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	○	○	○	Groove A (E) : — Groove B (D) : 90~109 Groove C : 92~107	○	○	○	Groove A (E) : — Groove B (D) : 94~114 Groove C : 96~112	○	○	○	Groove A (E) : — Groove B (D), C : 96~111
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	○	○	○	Groove A (E) : — Groove B (D) : 95~114 Groove C : 97~112	○	○	○	Groove A (E) : — Groove B (D) : 99~119 Groove C : 101~117	○	○	○	Groove A (E) : — Groove B (D), C : 101~116
	Rod side	○	○	○		○	○	○		○	○	○	

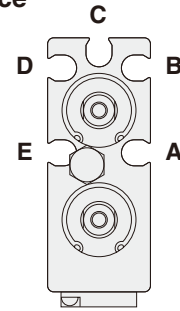
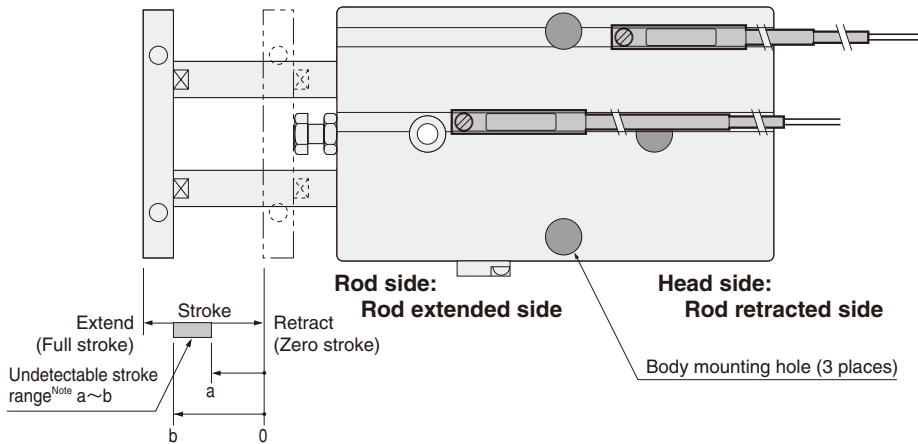
Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Rod side end keep cylinder (TBD-RL)

**In the case of using 3 head side mounting holes on the body**

**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

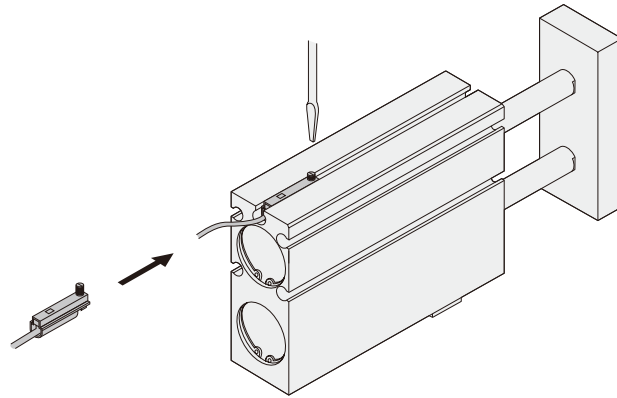
(mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25			
		A	B	C	A	B	C	A	B	C	
10	Head side	×	△	△	○	△	○	○	○	○	Groove A (E) : 0~10 Groove B (D) : — Groove C : —
	Rod side	×	△	△	×	△	○	○	○	○	
20	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : — Groove C : —
	Rod side	○	○	○	○	○	○	○	○	○	
30	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : — Groove C : —
	Rod side	○	○	○	○	○	○	○	○	○	
40	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 37~40 Groove C : 39~40
	Rod side	○	×	×	○	○	○	○	○	○	
50	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 42~50 Groove C : 44~50
	Rod side	○	×	×	○	×	×	○	×	×	
60	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 47~60 Groove C : 49~60
	Rod side	○	×	×	○	×	×	○	×	×	
70	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 52~66 Groove C : 54~64
	Rod side	○	○	○	○	×	×	○	○	○	
80	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 57~71 Groove C : 59~69
	Rod side	○	○	○	○	○	○	○	○	○	
90	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 62~76 Groove C : 64~74
	Rod side	○	○	○	○	○	○	○	○	○	
100	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 67~81 Groove C : 69~79
	Rod side	○	○	○	○	○	○	○	○	○	
110	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 72~86 Groove C : 74~84
	Rod side	○	○	○	○	○	○	○	○	○	
120	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 77~91 Groove C : 79~89
	Rod side	○	○	○	○	○	○	○	○	○	
130	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 82~96 Groove C : 84~94
	Rod side	○	○	○	○	○	○	○	○	○	
140	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 87~101 Groove C : 89~99
	Rod side	○	○	○	○	○	○	○	○	○	
150	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 92~106 Groove C : 94~104
	Rod side	○	○	○	○	○	○	○	○	○	
160	Head side	×	○	○	○	○	○	○	○	○	Groove A (E) : 0~12 Groove B (D) : 97~111 Groove C : 99~109
	Rod side	○	○	○	○	○	○	○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lbf].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

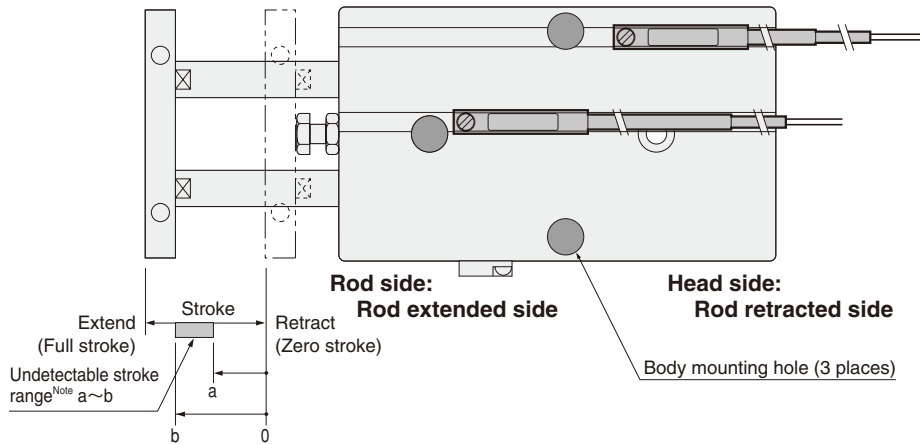
Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	E	D	C	E	D	C	E	D	C
10	Head side	×	△	△	Groove A (E) : 0~10 Groove B (D) : — Groove C : —	×	△	△	Groove A (E) : 0~10 Groove B (D) : — Groove C : —	△	△	△	Groove A (E) : — Groove B (D), C : —
	Rod side	×	△	△		×	△	△		△	△	△	
20	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : — Groove C : —	×	○	○	Groove A (E) : 0~17 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
30	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 29~30 Groove C : 22~30	×	○	○	Groove A (E) : 0~17 Groove B (D) : — Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	○		○	○	○		○	○	○	
40	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 35~40 Groove C : 37~40	×	○	○	Groove A (E) : 0~17 Groove B (D) : 39~40 Groove C : 31~40	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	×	×		○	×	×		○	○	○	
50	Head side	×	○	○	Groove A (E) : 2~14 Groove B (D) : 40~50 Groove C : 42~50	×	○	○	Groove A (E) : 0~17 Groove B (D) : 44~50 Groove C : 46~50	○	○	○	Groove A (E) : — Groove B (D), C : 46~50
	Rod side	○	×	×		○	×	×		○	×	×	
60	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 45~60 Groove C : 47~60	×	○	○	Groove A (E) : 0~17 Groove B (D) : 49~60 Groove C : 51~60	○	○	○	Groove A (E) : — Groove B (D), C : 51~60
	Rod side	○	×	×		○	×	×		○	×	×	
70	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 50~69 Groove C : 52~67	×	○	○	Groove A (E) : 0~17 Groove B (D) : 54~70 Groove C : 56~70	○	○	○	Groove A (E) : — Groove B (D), C : 56~70
	Rod side	○	○	○		○	×	×		○	×	×	
80	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 55~74 Groove C : 57~72	×	○	○	Groove A (E) : 0~17 Groove B (D) : 59~79 Groove C : 61~77	○	○	○	Groove A (E) : — Groove B (D), C : 61~76
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 60~79 Groove C : 62~77	×	○	○	Groove A (E) : 0~17 Groove B (D) : 64~84 Groove C : 66~82	○	○	○	Groove A (E) : — Groove B (D), C : 66~81
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	×	○	○	Groove A (E) : 0~12 Groove B (D) : 65~84 Groove C : 67~82	×	○	○	Groove A (E) : 0~17 Groove B (D) : 69~89 Groove C : 71~87	○	○	○	Groove A (E) : — Groove B (D), C : 71~86
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 70~89 Groove C : 72~87	×	○	○	Groove A (E) : 0~17 Groove B (D) : 74~94 Groove C : 76~92	○	○	○	Groove A (E) : — Groove B (D), C : 76~91
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 75~94 Groove C : 77~92	×	○	○	Groove A (E) : 0~17 Groove B (D) : 79~99 Groove C : 81~97	○	○	○	Groove A (E) : — Groove B (D), C : 81~96
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 80~99 Groove C : 82~97	×	○	○	Groove A (E) : 0~17 Groove B (D) : 84~104 Groove C : 86~102	○	○	○	Groove A (E) : — Groove B (D), C : 86~101
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 85~104 Groove C : 87~102	×	○	○	Groove A (E) : 0~17 Groove B (D) : 89~109 Groove C : 91~107	○	○	○	Groove A (E) : — Groove B (D), C : 91~106
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 90~109 Groove C : 92~107	×	○	○	Groove A (E) : 0~17 Groove B (D) : 94~114 Groove C : 96~112	○	○	○	Groove A (E) : — Groove B (D), C : 96~111
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	×	○	○	Groove A (E) : 0~14 Groove B (D) : 95~114 Groove C : 97~112	×	○	○	Groove A (E) : 0~17 Groove B (D) : 99~119 Groove C : 101~117	○	○	○	Groove A (E) : — Groove B (D), C : 101~116
	Rod side	○	○	○		○	○	○		○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

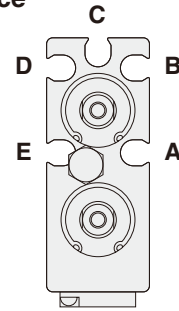
# Mountable or Unmountable Sensor Switch and Undetectable Stroke Range at End of Stroke

## Rod side end keep cylinder (TBDAK-RL)

**In the case of using 3 rod side mounting holes on the body**



**● Sensor switch mounting surface**



Mounting a sensor switch in any of the grooves A~E allows detection at either the head side or rod side stroke end, and intermediate positions. The diagram shows the rod side with the square plate removed.

**Note: The undetectable stroke range is the value measured from the zero stroke with 1 sensor switch installation.**

## ● Solid state type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

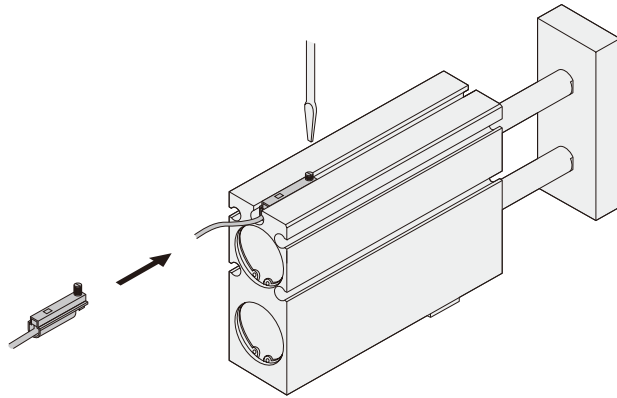
(mm)

Stroke	Mounting groove	φ 16			φ 20			φ 25		
		A	B	C	A	B	C	A	B	C
10	Head side	○	△	△	△	△	○	○	○	○
	Rod side	○	△	△	△	△	○	○	○	○
20	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
30	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
40	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	○	○	○	○	○
50	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×
60	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	×	×	○	×	×	○	×	×
70	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	×	×	○	○	○
80	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
90	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
100	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
110	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
120	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
130	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
140	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
150	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○
160	Head side	○	○	○	○	○	○	○	○	○
	Rod side	○	○	○	○	○	○	○	○	○

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

### ■ Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of 0.1~0.2N·m [0.9~1.8in·lb].



### ● Reed switch type

○ : Mountable    △ : Either head side or rod side    × : Unmountable    — : Fully detectable within stroke

(mm)

Bore size	Stroke	Mounting groove			φ 16			φ 20			φ 25		
		A	B	C	Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch			Undetectable stroke range of sensor switch		
		E	D	C	E	D	C	E	D	C	E	D	C
10	Head side	△	△	△	Groove A (E) : — Groove B (D) : 8~10 Groove C : —	△	△	△	Groove A (E) : — Groove B (D) : 8~10 Groove C : 10	△	△	△	Groove A (E) : — Groove B (D), C : —
	Rod side	△	△	△		△	△	△		△	△	△	
20	Head side	○	○	○	Groove A (E) : — Groove B (D) : 15~20 Groove C : 17~20	○	○	○	Groove A (E) : — Groove B (D) : 18~20 Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : —
	Rod side	○	○	○		○	○	○		○	○	○	
30	Head side	○	○	○	Groove A (E) : — Groove B (D) : 29~30 Groove C : —	○	○	○	Groove A (E) : — Groove B (D) : 24~30 Groove C : 26~30	○	○	○	Groove A (E) : — Groove B (D), C : 26~30
	Rod side	○	×	○		○	○	○		○	○	○	
40	Head side	○	○	○	Groove A (E) : — Groove B (D) : 35~40 Groove C : 37~40	○	○	○	Groove A (E) : — Groove B (D) : 39~40 Groove C : —	○	○	○	Groove A (E) : — Groove B (D), C : 31~40
	Rod side	○	×	×		○	×	○		○	○	○	
50	Head side	○	○	○	Groove A (E) : — Groove B (D) : 40~50 Groove C : 42~50	○	○	○	Groove A (E) : — Groove B (D) : 44~50 Groove C : 46~50	○	○	○	Groove A (E) : — Groove B (D), C : 46~50
	Rod side	○	×	×		○	×	×		○	×	×	
60	Head side	○	○	○	Groove A (E) : — Groove B (D) : 45~60 Groove C : 47~60	○	○	○	Groove A (E) : — Groove B (D) : 49~60 Groove C : 51~60	○	○	○	Groove A (E) : — Groove B (D), C : 51~60
	Rod side	○	×	×		○	×	×		○	×	×	
70	Head side	○	○	○	Groove A (E) : — Groove B (D) : 50~69 Groove C : 52~67	○	○	○	Groove A (E) : — Groove B (D) : 54~70 Groove C : 56~70	○	○	○	Groove A (E) : — Groove B (D), C : 56~70
	Rod side	○	○	○		○	○	×		○	×	×	
80	Head side	○	○	○	Groove A (E) : — Groove B (D) : 55~74 Groove C : 57~72	○	○	○	Groove A (E) : — Groove B (D) : 59~79 Groove C : 61~77	○	○	○	Groove A (E) : — Groove B (D), C : 61~76
	Rod side	○	○	○		○	○	○		○	○	○	
90	Head side	○	○	○	Groove A (E) : — Groove B (D) : 60~79 Groove C : 62~77	○	○	○	Groove A (E) : — Groove B (D) : 64~84 Groove C : 66~82	○	○	○	Groove A (E) : — Groove B (D), C : 66~81
	Rod side	○	○	○		○	○	○		○	○	○	
100	Head side	○	○	○	Groove A (E) : — Groove B (D) : 65~84 Groove C : 67~82	○	○	○	Groove A (E) : — Groove B (D) : 69~89 Groove C : 71~87	○	○	○	Groove A (E) : — Groove B (D), C : 71~86
	Rod side	○	○	○		○	○	○		○	○	○	
110	Head side	○	○	○	Groove A (E) : — Groove B (D) : 70~89 Groove C : 72~87	○	○	○	Groove A (E) : — Groove B (D) : 74~94 Groove C : 76~92	○	○	○	Groove A (E) : — Groove B (D), C : 76~91
	Rod side	○	○	○		○	○	○		○	○	○	
120	Head side	○	○	○	Groove A (E) : — Groove B (D) : 75~94 Groove C : 77~92	○	○	○	Groove A (E) : — Groove B (D) : 79~99 Groove C : 81~97	○	○	○	Groove A (E) : — Groove B (D), C : 81~96
	Rod side	○	○	○		○	○	○		○	○	○	
130	Head side	○	○	○	Groove A (E) : — Groove B (D) : 80~99 Groove C : 82~97	○	○	○	Groove A (E) : — Groove B (D) : 84~104 Groove C : 86~102	○	○	○	Groove A (E) : — Groove B (D), C : 86~101
	Rod side	○	○	○		○	○	○		○	○	○	
140	Head side	○	○	○	Groove A (E) : — Groove B (D) : 85~104 Groove C : 87~102	○	○	○	Groove A (E) : — Groove B (D) : 89~109 Groove C : 91~107	○	○	○	Groove A (E) : — Groove B (D), C : 91~106
	Rod side	○	○	○		○	○	○		○	○	○	
150	Head side	○	○	○	Groove A (E) : — Groove B (D) : 90~109 Groove C : 92~107	○	○	○	Groove A (E) : — Groove B (D) : 94~114 Groove C : 96~112	○	○	○	Groove A (E) : — Groove B (D), C : 96~111
	Rod side	○	○	○		○	○	○		○	○	○	
160	Head side	○	○	○	Groove A (E) : — Groove B (D) : 95~114 Groove C : 97~112	○	○	○	Groove A (E) : — Groove B (D) : 99~119 Groove C : 101~117	○	○	○	Groove A (E) : — Groove B (D), C : 101~116
	Rod side	○	○	○		○	○	○		○	○	○	

Note: The undetectable stroke range appears due to interference between the sensor switch and the body mounting bolts.

# Handling Instructions and Precautions

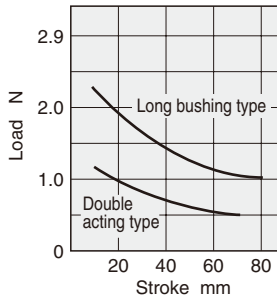


## Mounting and adjustment

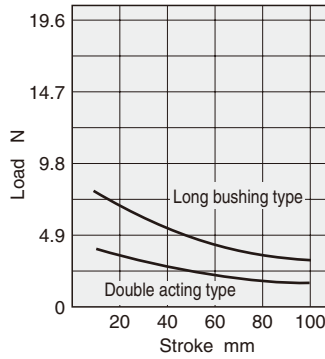
### Allowable lateral load

The lateral (side) load on the rod end should be at or below the graph values listed below.

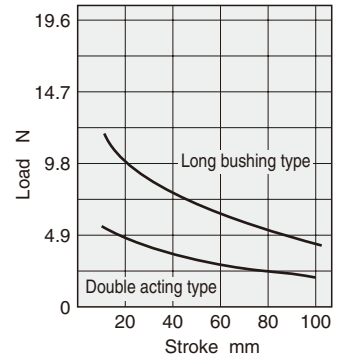
$\phi$  10 [0.394in.]



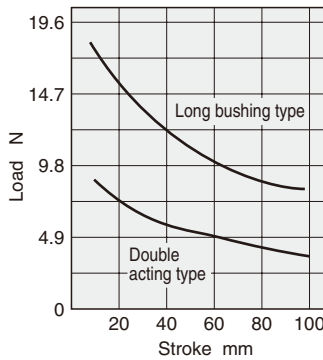
$\phi$  16 [0.630in.]



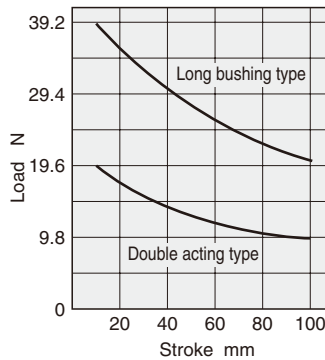
$\phi$  20 [0.787in.]



$\phi$  25 [0.984in.]



$\phi$  32 [1.260in.]



Remark: The  $\phi$  16~ $\phi$  25 double acting standard types also include end keep cylinders.

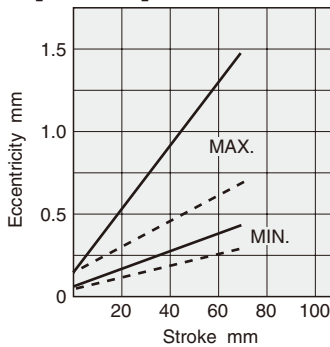
1N = 0.2248lbf.  
1mm = 0.0394in.

### Square plate eccentricity

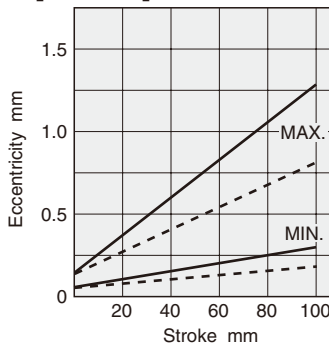
For the eccentricity of the square plate without load, use the graph values listed below as guides.

———— Double acting type    - - - - - Long bushing type

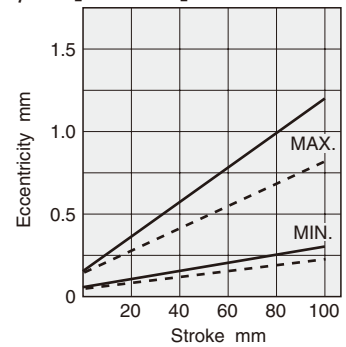
$\phi$  10 [0.394in.]



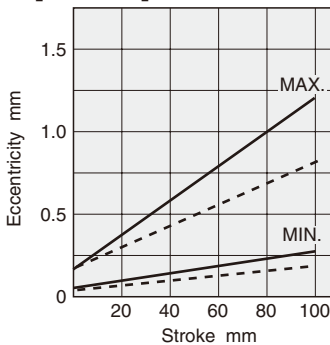
$\phi$  16 [0.630in.]



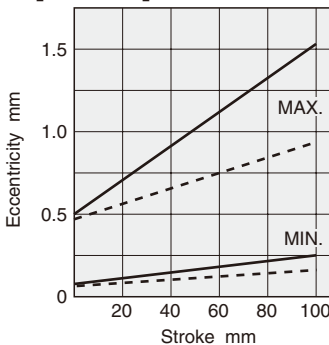
$\phi$  20 [0.787in.]



$\phi$  25 [0.984in.]



$\phi$  32 [1.260in.]



Remark: The  $\phi$  16~ $\phi$  25 double acting standard types also include end keep cylinders.

1mm = 0.0394in.



## Mounting and adjustment

### Mounting

1. While any mounting direction is allowed, the mounting surface should always be flat. Twisting or bending during mounting may disturb the accuracy and may also result in air leaks or improper operation.
2. Care should be taken that scratches or dents on the cylinder's mounting surface may damage its flatness.
3. The hexagon socket head bolt on the rod end square plate has been mounted with a conical washer. Always confirm that the rod end square plate and hexagon socket head bolts are secured before using the cylinder.

### Stroke adjustment

On the Twin Rod cylinder, stroke adjusting is easy within a range of  $-5 \sim 0$ mm [ $-0.197 \sim 0$ in.] (with the exception of -HL: Head side end keep cylinder). Turn the stopper bolt to the left (counterclockwise) to shorten the stroke. Use a lock nut to tighten and secure the stopper in place after adjustment. Do not tighten the bolt to the right (clockwise) beyond the standard position. The stroke at shipping is set to the standard stroke. Do not adjust it to larger than the standard stroke. On the end keep cylinder, avoid application using an external stopper installed on the lock side to adjust the stroke, because it could cause the lock to be incapable of operating.

### Cylinder speed

Use the cylinder at a speed of 500mm/s [19.7in./sec.] or less (use a speed controller for adjustment). For high speeds (500mm/s [19.7in./sec.]), install an external stopper, etc., to prevent direct shocks to the cylinder. Consult us if the situation will not permit installation of an external stopper, etc.



## Control circuit for the end keep cylinder

1. For control of the twin rod end keep cylinder, we recommend the use of 2-position, 4-, 5-port valves. Avoid the use of control circuit with ABR connection (exhaust center) 3-position valves that exhaust air from 2 delivery ports.
2. Always use meter-out control for speed control. Meter-in control may result in failure of the locking mechanism to release.
3. Always set the air pressure to 0.15MPa [22psi.] or larger.

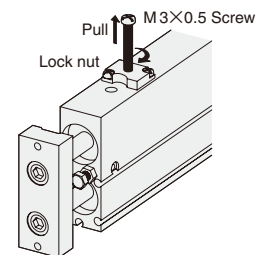
Notes: 1. It is dangerous to supply air to a connection port on a side with a locking mechanism while the cylinder has already been exhausted, because the piston rod may suddenly extend (or retract). In addition, since the lock piston could also cause galling of the lock piston and piston rod, resulting in defective operation, always supply air to the connection port on the opposite the one adjacent to the locking mechanism to ensure applying back pressure.

2. When restarting operations after air has been exhausted from the cylinder due to completion of operations or to an emergency stop, always start by supplying air to a connection port on the opposite the one adjacent to the locking mechanism.
3. Connect the valve port A (NC) to the connection port on the side with the locking mechanism.



## Manual operation of locking mechanism

While the locking mechanism is normally released automatically through cylinder operations, it can also be released manually. For manual release, insert an M3×0.5 screw that has 30mm [1.18in.] screw length into the opening for manual override, thread it in about 3 turns into the internal lock piston, and then pull up the screw. To maintain the manual override for adjustment, etc., thread the locknut onto the screw and, with the locking mechanism in a released state, tighten the locknut against the cylinder.



- Notes: 1. It is dangerous to release the lock when load (weight) is present on the piston rod, because it may cause the unintended piston rod's extension (or retraction). In this case, always supply air to the connection port opposite the one adjacent to the locking mechanism before releasing the locking mechanism.
2. If the locking mechanism cannot easily be released even with manual override, it could be the result of galling of the lock piston and piston rod. In this case, supply air to the connection port opposite the one adjacent to the locking mechanism before releasing the locking mechanism.
  3. Water, oil, dust, etc., intruding through the opening for manual override may be a cause of defective locks or other erratic operation. If using in locations subject to dripping water, dripping oil, etc., or large amounts of dust, use a cover to protect the unit.



## Handling Instructions and Precautions

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### Sensor switch

1. In the standard cylinder, the magnet for sensor switch is built-in. Mounting a sensor switch will enable use in sensor switch applications.
2. Do not use a sensor switch mounting screw to secure the sensor switch into the body mounting hole. The sensor switch mounting screw could fall out.



### General precautions

#### Media

1. Always thoroughly blow off (use compressed air) the tubing before piping. Entering chips, sealing tape, rust, etc., generated during piping work could result in air leaks or other defective operation.
2. Use air for the media. For the use of any other media, consult us.
3. Air used for the cylinder should be clean air that contains no deteriorated compressor oil, etc. Install an air filter (filtration of a minimum 40  $\mu\text{m}$ ) near the cylinder or valve to remove collected liquid or dust. In addition, drain the air filter periodically. Collected liquid or dust entering the cylinder may cause improper operation.

#### Lubrication

The product can be used without lubrication, if lubrication is required, use Turbine Oil Class 1 (ISO VG32) or equivalent. Avoid using spindle oil or machine oil.

#### Atmosphere

1. If using in locations subject to dripping water, dripping oil, etc., or to large amounts of dust, use a cover to protect the unit.
2. The product cannot be used when the media or ambient atmosphere contains any of the substances listed below.  
Organic solvents, phosphate ester type hydraulic oil, sulphur dioxide, chlorine gas, or acids, etc.

**Criteria for selection**

Select the cylinder bore according to the allowable load at the maximum cylinder operating speed.

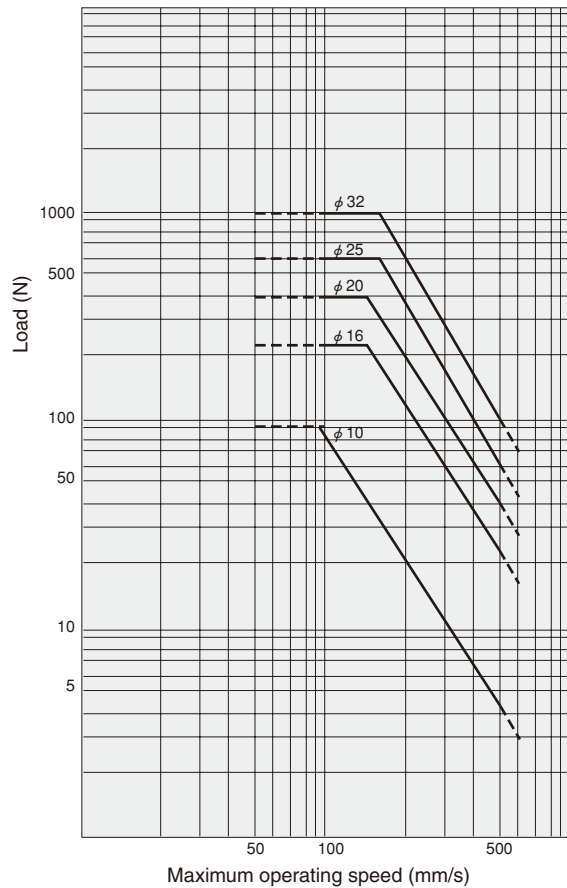
**<Precautions>**

- ① Always use a speed controller for the cylinder, and control the speed to within a range of 100~500mm/s [3.9~19.7in./sec.].
- ② When a lateral (side) load is applied to the piston rod, select a bore size within the allowable lateral load range (see the graphs on p.821).

When the load has exceeded the allowable value during use, always install an external stopper (shock absorber, etc.) to prevent direct shocks to the cylinder.

**<Precautions>**

- ① For the external stopper (shock absorber, etc.), select a stopper with sufficient absorbing capacity.
- ② Consult us if the situation will not permit the installation of an external stopper.
- ③ When a lateral (side) load is applied to the piston rod, limit within the allowable lateral load range (see the graphs on p.821).

**<Allowable load>****<How to read the graph>**

When a 59N [13.2lb.] load is carried with  $\phi 20$  [0.787in.], the maximum operating speed must be set to 400mm/s [15.7in./sec.] or less.

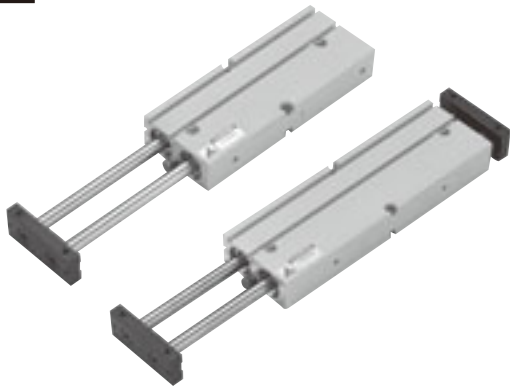
- ※ The maximum load in the graph is when air pressure of 0.7MPa [102psi.] is applied to the cylinder push side. The load will decrease in applications such as retracted side operations and lower air pressure applications.

1N = 0.2248lbf.  
1mm/s = 0.0394in./sec.





CAD drawing data catalog  
is available.



# KOGANEI

## ACTUATORS GENERAL CATALOG



# TWIN ROD CYLINDERS B SERIES CONTENTS

ALPHA TWIN ROD CYLINDERS B SERIES

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**Caution**

Before use, be sure to read the "Safety Precautions" on p. 57.

# Plus precision



We have added advanced positioning precision and high rigidity to the pneumatic actuator.

The Koganei Alpha Series further enhances the drive module concept, supporting superior applications in FA line design, labor savings in manufacturing, and higher performance.

## TWIN ROD CYLINDERS B SERIES

### Linear ball bearings are used for the rod bearing.

The use of linear ball bearings for the rod bearing and high carbon chrome bearing steel for the piston rod assures high rod end deflection precision even during full strokes. In addition, this eliminates bearing wear and maintains the initial inherent accuracy.



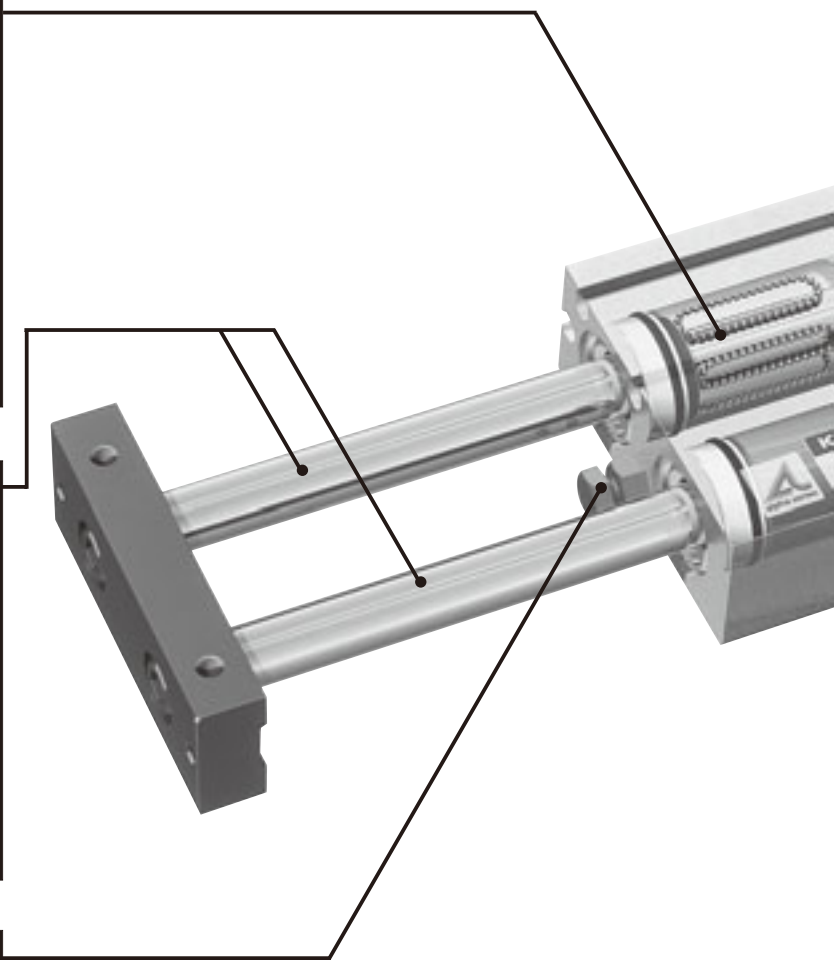
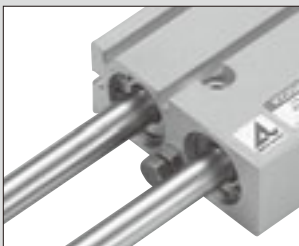
### Two rods achieve non-rotating accuracy of $\pm 0.1^\circ$ .

Rational construction features 2 piston rods that prevent rotation and work together as guides.



### Stopper bolt allows for stroke adjusting even after mounting.

Adjusting the stopper bolt makes stroke adjustment possible within a range of  $-5 \sim 0$ mm [ $-0.197 \sim 0$  in.] (one side). Boosts operating efficiency when mounting and adjusting.



**FLAT  
SQU  
P**

### SINGLE ROD TYPE

ATBDA Bore size × Stroke



※ Features 2 linear ball bearings for the rod bearing.

### DOUBLE ROD TYPE

ATBDAD Bore size × Stroke



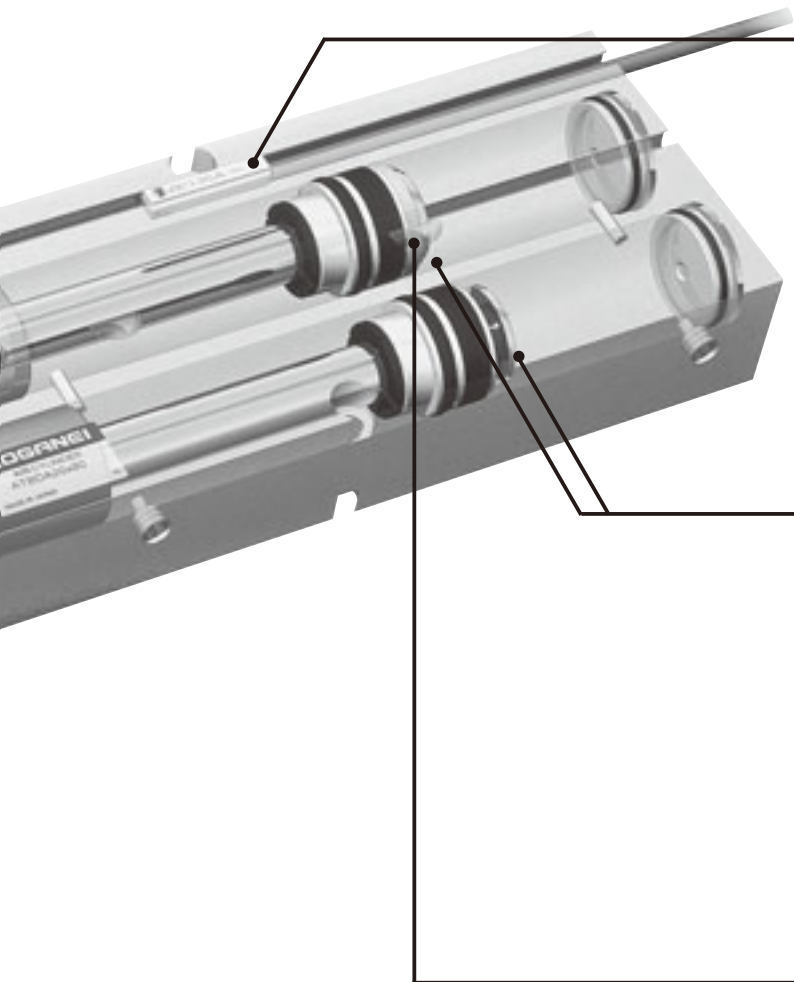
※ Features linear ball bearings (total of 4) for the rod bearing on both sides of the body.

### DOUBLE ROD TYPE (With sub-plate)

ATBDAD Bore size × Stroke -P



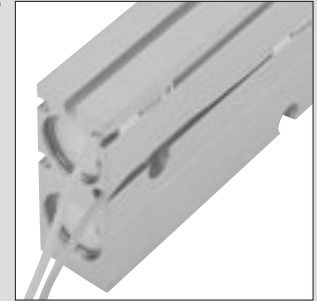
※ Features linear ball bearings (total of 4) for the rod bearing on both sides of the body.



### Embedded sensor switch

The embedded sensor switch is mountable. Moreover, mounting grooves are located in 5 locations on 3 surfaces of the body for various mounting requirements.

※ Sensor switch is optional.



### Double-piston construction

Uses a double-piston construction to double the thrust of single piston cylinders, and achieve a space-efficient, flat, square body. It works in conjunction with a rational non-rotating construction to contribute to more compact, lightweight mechanical devices.



### The magnet for sensor switch is standard equipment.

In the standard type, the magnet for sensor switch is built-in. Mounting a sensor switch will enable use in sensor switch applications.



**ARE  
POWERFUL**

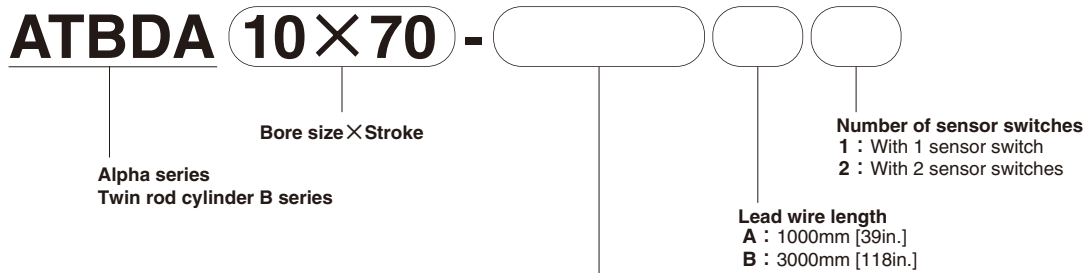
# ALPHA SERIES TWIN ROD CYLINDERS B SERIES

## Single Rod Type

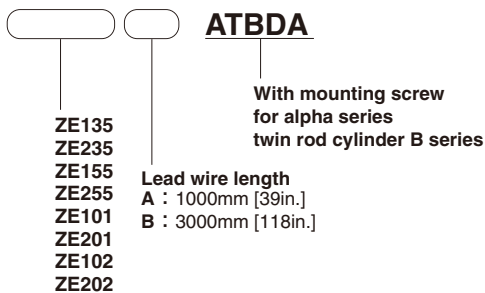
### Specifications

Item	Bore size mm [in.]				
	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operation type	Double acting type				
Media	Air				
Mounting type	Side mount				
Operating pressure range	MPa [psi.]	0.2~0.7 [29~102]		0.15~0.7 [22~102]	
Proof pressure	MPa [psi.]	1.05 [152]			
Operating temperature range	°C [°F]	0~60 [32~140]			
Operating speed range	mm/s [in./sec.]	100~500 [3.9~19.7]			
Cushion	Rubber bumper				
Lubrication	Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)				
Non-rotating accuracy	±0.1° (At applying no load)				
Stroke adjusting range	mm [in.]	-5~0 [-0.197~0] (To the specification stroke)			
Port size	M5×0.8				Rc1/8

### Order Codes



#### ● Order codes for sensor switch only



#### Sensor switch

**Blank** : No sensor switch

<b>ZE135</b> : 2-lead wire	Solid state type	with indicator lamp	Horizontal lead wire	DC10 ~28V
<b>ZE235</b> : 2-lead wire	Solid state type	with indicator lamp	Vertical lead wire <sup>Note</sup>	DC10 ~28V
<b>ZE155</b> : 3-lead wire	Solid state type	with indicator lamp	Horizontal lead wire	DC4.5 ~28V
<b>ZE255</b> : 3-lead wire	Solid state type	with indicator lamp	Vertical lead wire <sup>Note</sup>	DC4.5 ~28V
<b>ZE101</b> : 2-lead wire	Reed switch type	without indicator lamp	Horizontal lead wire	DC5 ~28V, AC85 ~115V
<b>ZE102</b> : 2-lead wire	Reed switch type	with indicator lamp	Horizontal lead wire	DC10 ~28V, AC85 ~115V
<b>ZE201</b> : 2-lead wire	Reed switch type	without indicator lamp	Vertical lead wire <sup>Note</sup>	DC5 ~28V, AC85 ~115V
<b>ZE202</b> : 2-lead wire	Reed switch type	with indicator lamp	Vertical lead wire <sup>Note</sup>	DC10 ~28V, AC85 ~115V

Note: In the vertical lead wire type, the lead wire protrudes perpendicular to the sensor switch.

● For details of sensor switches, see p.1544.

### Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke <sup>Note</sup>	Pull side stroke adjusting range
10	10, 20, 30, 40, 50, 60, 70	140	-5~0
16	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	200	
20			
25			
32			

Note: Consult us for delivery of strokes that exceed the standard strokes.

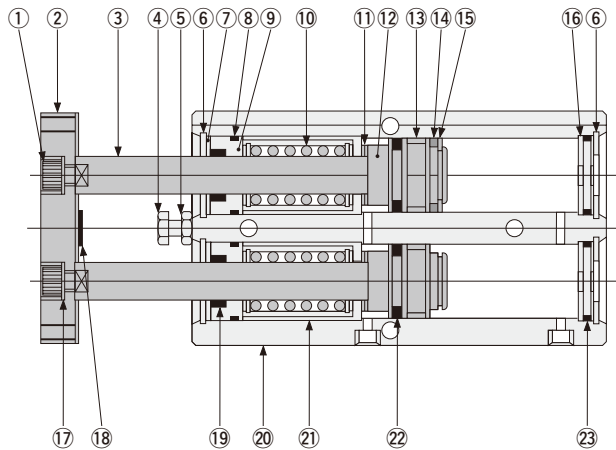
# Mass

g [oz.]

Bore size mm [in.]	Zero stroke mass	Additional mass		
		Additional mass for each 10mm [0.394in.] stroke	Mass of 1 sensor switch	
			ZE□□□A	ZE□□□B
10 [0.394]	132 [4.66]	18 [0.63]	15 [0.53]	35 [1.23]
16 [0.630]	312 [11.01]	24 [0.85]		
20 [0.787]	477 [16.83]	33 [1.16]		
25 [0.984]	762 [26.88]	50 [1.76]		
32 [1.260]	1630 [57.50]	91 [3.21]		

Remarks: 1. Values in the above table show the mass for the standard stroke.  
2. The mass of the magnet for sensor switch is included into the zero stroke mass.

# Inner Construction



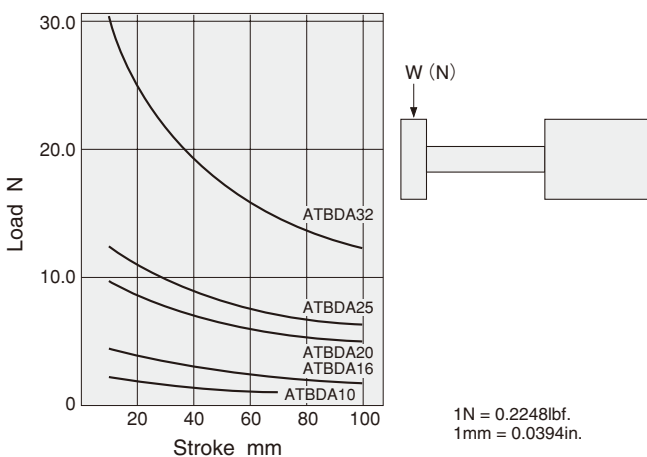
No.	Parts	Materials
①	Hexagon socket head bolt	Steel (φ 10, 20, 25 nickel plated; φ 16, 32 black oxide)
②	Square plate	Mild steel (nickel plated)
③	Piston rod	Steel (quenched)
④	Stopper bolt	Steel (zinc plated)
⑤	Lock nut	Steel (zinc plated)
⑥	Snap ring	Steel (nickel plated)
⑦	Seal holder	Mild steel (nickel plated)
⑧	O-ring	Synthetic rubber (NBR)
⑨	Housing	Aluminum alloy (chromic acid anodic oxide coating)
⑩	Bearing	Made by NSK <sup>Note1</sup>
⑪	Bumper (B) <sup>Note2</sup>	Synthetic rubber (NBR)
⑫	Piston	Aluminum alloy (chromic acid anodic oxide coating)
⑬	Wear ring	Plastic
⑭	Magnet	Plastic magnet
⑮	E-ring	Stainless steel
⑯	End plate	Plastic (only φ 32 is an aluminum alloy [anodized])
⑰	Washer	Steel (nickel plated)
⑱	Bumper (A) <sup>Note2</sup>	Synthetic rubber (NBR)
⑲	Rod seal	Synthetic rubber (NBR)
⑳	Cylinder body	Aluminum alloy (anodized)
㉑	Sleeve <sup>Note2</sup>	Brass
㉒	Piston seal	Synthetic rubber (NBR)
㉓	O-ring	Synthetic rubber (NBR)

Notes: 1. Bearing types in use  
For φ 10: LB6NY, For φ 16: LB8NY, For φ 20: LB10NY,  
For φ 25: LB12NY, For φ 32: LB16NY  
2. Not available in a bore size of 10mm [0.394in.].

# Allowable Lateral Load for ATBDA

The lateral (side) load on the rod end square plate should be at or below the graph values shown below.

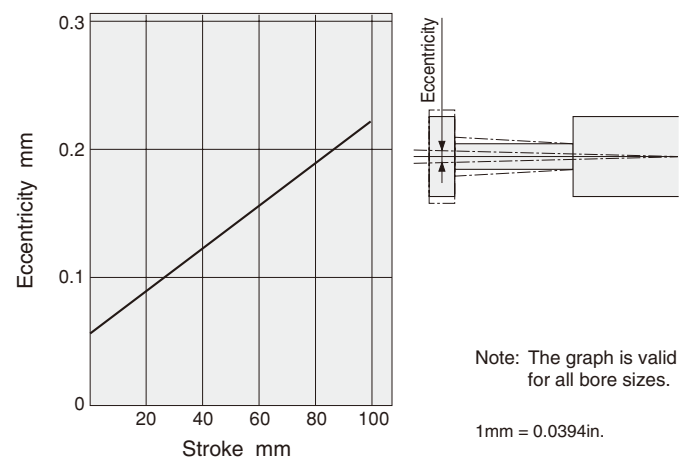
● φ 10, φ 16, φ 20, φ 25, φ 32



# Allowable Eccentricity at Square Plate for ATBDA

For the eccentricity of the square plate without applying load, use the graph values shown below as guides.

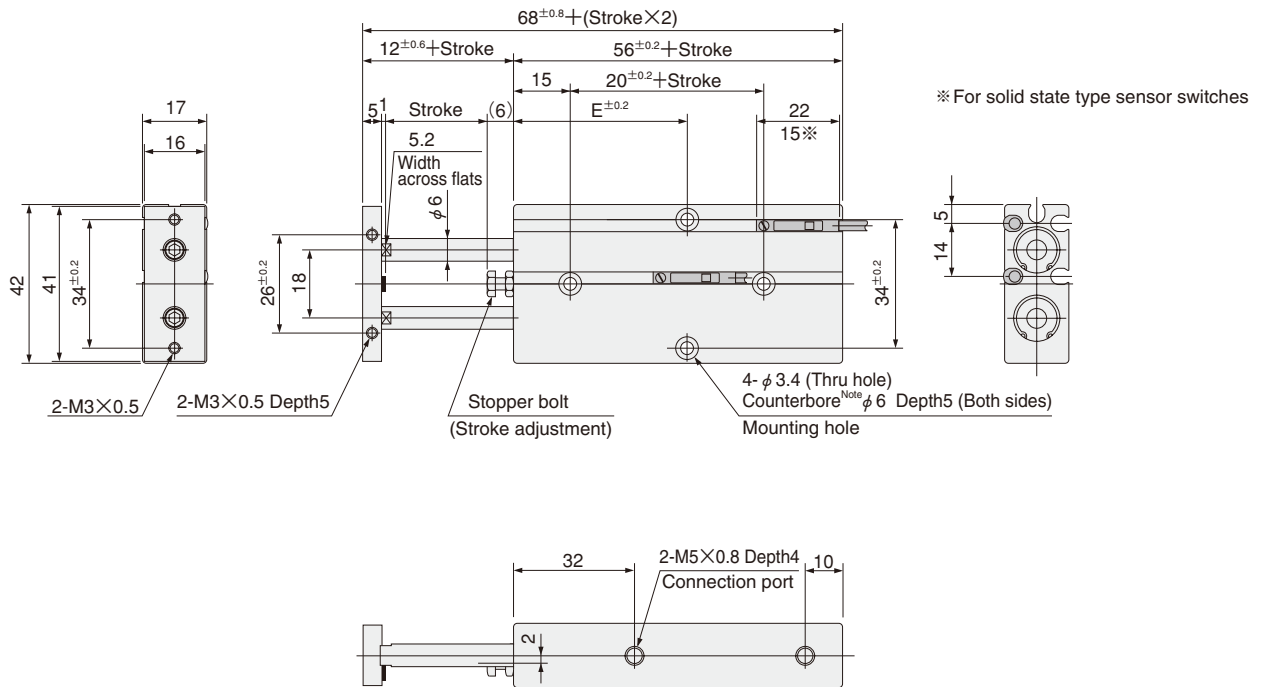
● φ 10, φ 16, φ 20, φ 25, φ 32





# Dimensions of ATBDA (mm)

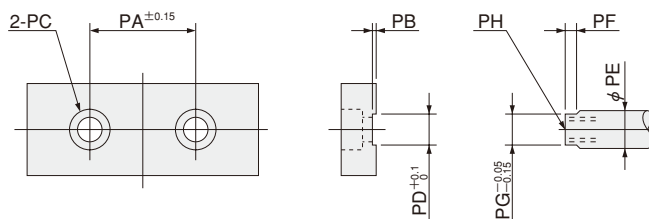
●  $\phi 10$  ● Double acting type



Stroke Bore mm [in.]	Code		E						
	10	20	30	40	50	60	70		
10 [0.394]	40	40	45	50	55	60	65		

Note: The counterbore depth is measured from the upper surface of the body.

## Dimensions of Rod End Portion



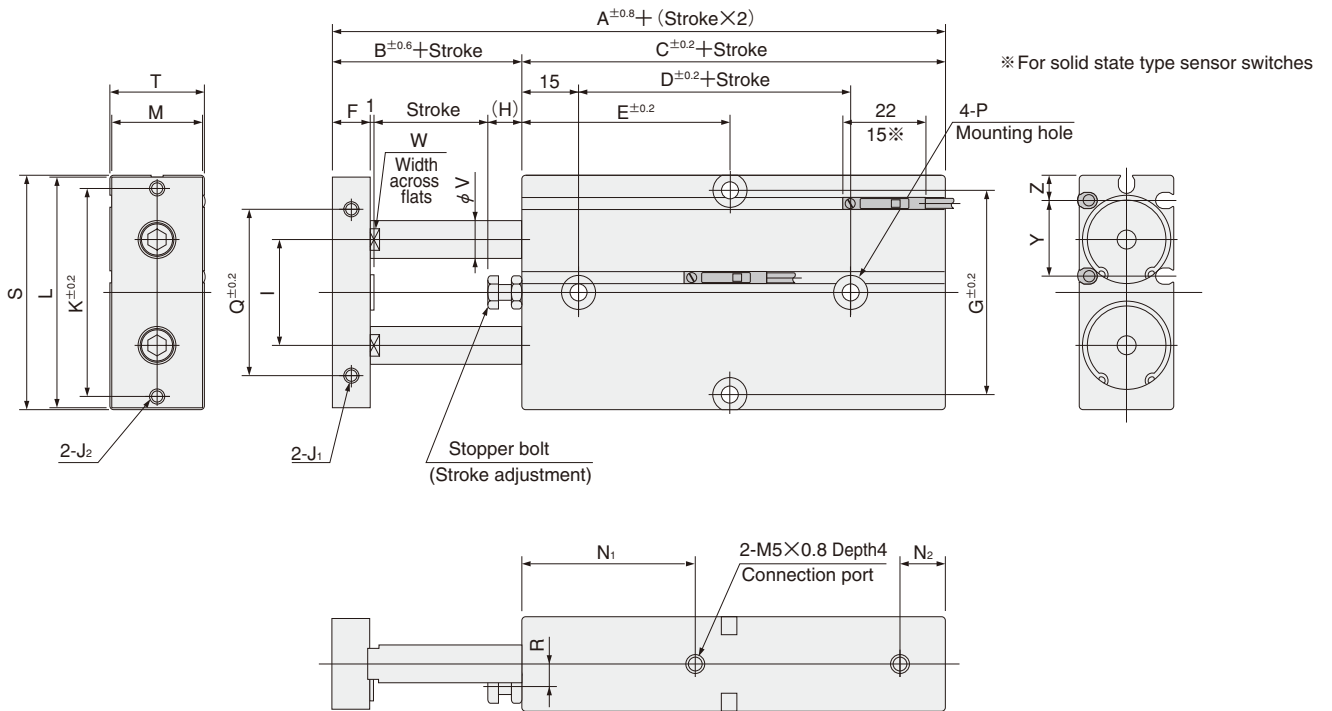
Bore mm [in.]	Code	mm							
		PA	PB	PC	PD	PE	PF	PG	PH
10 [0.394]	18	0.5	$\phi 3.3$ Counterbore $\phi 6.2$ Depth 3.5	5.2	6	3	5.2	M3 $\times$ 0.5 Depth 6	
16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth 4.6	6.2	8	3	6.2	M4 $\times$ 0.7 Depth 8	
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	8.2	10	3	8.2	M6 $\times$ 1 Depth 9	
25 [0.984]	34	1	$\phi 6.5$ Counterbore $\phi 11$ Depth 6.8	10.2	12	3	10.2	M6 $\times$ 1 Depth 9	
32 [1.260]	42	2	$\phi 11$ Counterbore $\phi 17$ Depth 12	14	16	4	14	M10 $\times$ 1.5 Depth 14	

# Dimensions of ATBDA (mm)

●  $\phi 16$ ,  $\phi 20$ ,  $\phi 25$  ● Double acting type



ALPHA TWIN ROD CYLINDERS B SERIES



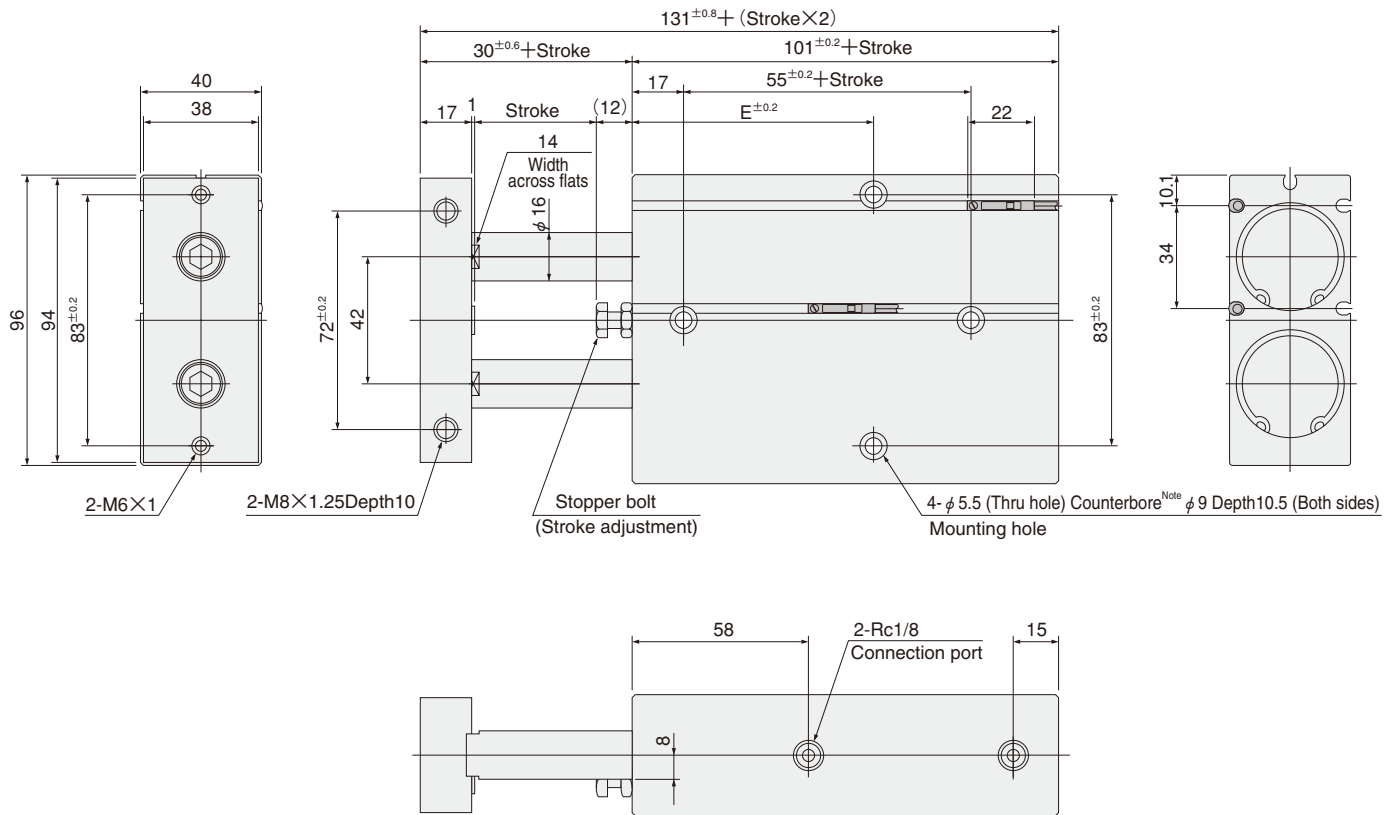
Code Stroke Bore mm [in.]	A	B	C	D	E										F	G	H	I	J <sub>1</sub>	J <sub>2</sub>	K
	10	20	30	40	50	60	70	80	90	100											
16 [0.630]	88	15	73	40	50	50	50	55	60	65	70	75	80	85	8	47	6	24	M4×0.7 Depth5	M4×0.7	47
20 [0.787]	100	20	80	40	55	55	55	60	65	70	75	80	85	90	10	55	9	28	M4×0.7 Depth5	M4×0.7	55
25 [0.984]	103	19	84	50	55	55	55	60	65	70	75	80	85	90	10	66	8	34	M5×0.8 Depth6	M4×0.7	66

Code Bore mm [in.]	L	M	N <sub>1</sub>	N <sub>2</sub>	P <sup>Note</sup>					Q	R	S	T	V	W	Y	Z
						$\phi$ 4.5 (Thru hole)	Counterbore $\phi$ 8	Depth	(Both sides)								
16 [0.630]	53	20	39	10	$\phi$ 4.5 (Thru hole)	Counterbore $\phi$ 8	Depth5.5	(Both sides)	34	4	54	21	8	6.2	18.5	5.7	
20 [0.787]	61	24	46	12	$\phi$ 4.5 (Thru hole)	Counterbore $\phi$ 8	Depth5.5	(Both sides)	44	6	62	25	10	8.2	20	6.8	
25 [0.984]	72	29	48	12	$\phi$ 4.5 (Thru hole)	Counterbore $\phi$ 9	Depth6.0	(Both sides)	56	7	73	30	12	10.2	22.5	8.3	

Note: The counterbore depth is measured from the upper surface of the body.

# Dimensions of ATBDA (mm)

●  $\phi 32$  ● Double acting type



Code	E									
Stroke Bore mm [in.]	10	20	30	40	50	60	70	80	90	100
<b>32 [1.260]</b>	70	70	75	80	85	90	95	100	105	110

Note: The counterbore depth is measured from the upper surface of the body.

# ALPHA SERIES TWIN ROD CYLINDERS B SERIES

## Double Rod Type

### Specifications

Item	Bore size mm [in.]	16 [0.630]	20 [0.787]	25 [0.984]
	Operation type		Double acting type	
Media		Air		
Mounting type		Side mount		
Operating pressure range	MPa [psi.]	0.15~0.7 [22~102]		
Proof pressure	MPa [psi.]	1.05 [152]		
Operating temperature range	°C [°F]	0~60 [32~140]		
Operating speed range	mm/s [in./sec.]	100~500 [3.9~19.7]		
Cushion		Rubber bumper		
Lubrication		Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)		
Non-rotating accuracy		±0.1° (At applying no load)		
Stroke adjusting range	mm [in.]	-10~0 [-0.394~0] (To the specification stroke)		
Port size		M5×0.8		

### Order Codes

**ATBDAD 16×70** -        

**Alpha series Twin rod cylinder B series double rod type**

**Bore size × Stroke**

**Sub-plate**  
P : With sub-plate  
Blank : No sub-plate

**Number of sensor switches**  
1 : With 1 sensor switch  
2 : With 2 sensor switches

**Lead wire length**  
A : 1000mm [39in.]  
B : 3000mm [118in.]

● **Order codes for sensor switch only**

**ATBDA**

**With mounting screw for alpha series twin rod cylinder B series**

**ZE135**  
**ZE235**  
**ZE155**  
**ZE255**  
**ZE101**  
**ZE201**  
**ZE102**  
**ZE202**

**Lead wire length**  
A : 1000mm [39in.]  
B : 3000mm [118in.]

**Sensor switch**  
Blank : No sensor switch

<b>ZE135</b> : 2-lead wire Solid state type with indicator lamp	Horizontal lead wire	DC10 ~28V
<b>ZE235</b> : 2-lead wire Solid state type with indicator lamp	Vertical lead wire <sup>Note</sup>	DC10 ~28V
<b>ZE155</b> : 3-lead wire Solid state type with indicator lamp	Horizontal lead wire	DC4.5 ~28V
<b>ZE255</b> : 3-lead wire Solid state type with indicator lamp	Vertical lead wire <sup>Note</sup>	DC4.5 ~28V
<b>ZE101</b> : 2-lead wire Reed switch type without indicator lamp	Horizontal lead wire	DC5~28V, AC85~115V
<b>ZE102</b> : 2-lead wire Reed switch type with indicator lamp	Horizontal lead wire	DC10~28V, AC85~115V
<b>ZE201</b> : 2-lead wire Reed switch type without indicator lamp	Vertical lead wire <sup>Note</sup>	DC5~28V, AC85~115V
<b>ZE202</b> : 2-lead wire Reed switch type with indicator lamp	Vertical lead wire <sup>Note</sup>	DC10~28V, AC85~115V

Note: In the vertical lead wire type, the lead wire protrudes perpendicular to the sensor switch.

● For details of sensor switches, see p.1544.

### Bore Size and Stroke

Bore size	Standard strokes	Maximum available stroke <sup>Note</sup>	Pull side stroke adjusting range
16	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	200	-10~0
20			
25			

Note: Consult us for delivery of strokes that exceed the standard strokes.

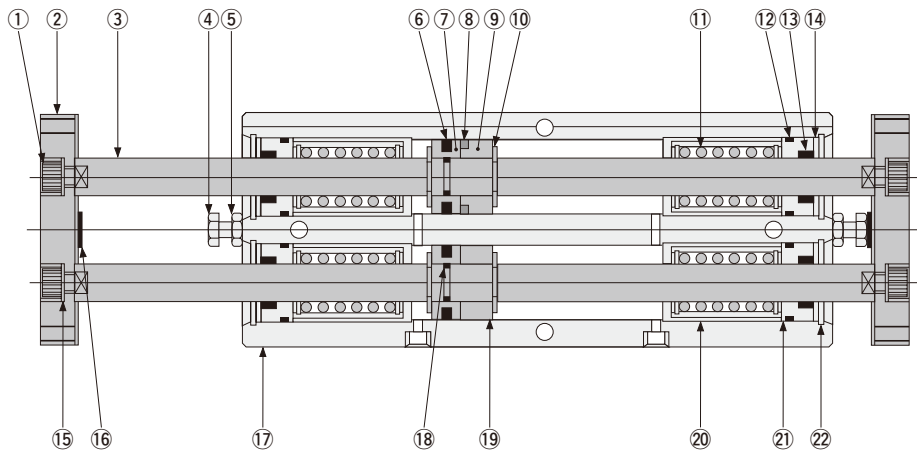
# Mass

g [oz.]

Bore size mm [in.]	Zero stroke mass	Additional mass			
		Additional mass for each 10mm [0.394in.] stroke	Mass of 1 sensor switch		Mass of sub-plate (For with sub-plate option)
			ZE□□□A	ZE□□□B	
16 [0.630]	410 [14.46]	44 [1.55]	15 [0.53]	35 [1.23]	164 + (2.23 × Stroke) [5.78 + (0.0787 × Stroke)]
20 [0.787]	855 [30.16]	47 [1.66]			272 + (3.2 × Stroke) [9.59 + (0.1129 × Stroke)]
25 [0.984]	1330 [46.91]	67 [2.36]			332 + (3.8 × Stroke) [11.71 + (0.1340 × Stroke)]

- Remarks: 1. Values in the above table show the mass for the standard strokes.  
 2. The mass of the magnet for sensor switch is included into the zero stroke mass.  
 3. The unit of the stroke is 1mm [0.0394in.] for the calculation of the mass of the sub-plate.

# Inner Construction



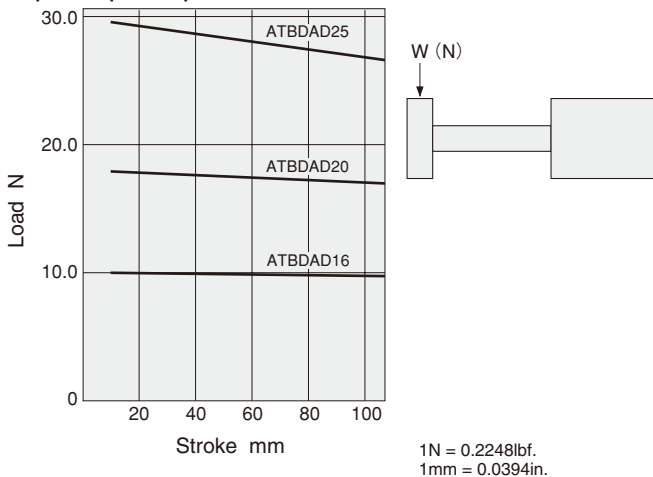
No.	Parts	Materials
①	Hexagon socket head bolt	Steel (φ 10, 20, 25 nickel plated; φ 16, 32 black oxide)
②	Square plate	Mild steel (nickel plated)
③	Piston rod	Steel (quenched)
④	Stopper bolt	Steel (zinc plated)
⑤	Lock nut	Steel (zinc plated)
⑥	Piston seal	Synthetic rubber (NBR)
⑦	Piston	Aluminum alloy (anodized)
⑧	Magnet	Plastic magnet
⑨	Holder	Aluminum alloy (anodized)
⑩	E-ring	Stainless steel
⑪	Bearing	Made by NSK <sup>Note</sup>
⑫	O-ring	Synthetic rubber (NBR)
⑬	Rod seal	Synthetic rubber (NBR)
⑭	Seal holder	Mild steel (nickel plated)
⑮	Washer	Steel (nickel plated)
⑯	Bumper (A)	Synthetic rubber (NBR)
⑰	Cylinder body	Aluminum alloy (anodized)
⑱	O-ring	Synthetic rubber (NBR)
⑲	Spacer	Aluminum alloy (anodized)
⑳	Sleeve	Brass
㉑	Housing	Aluminum alloy (chromic acid anodic oxide coating)
㉒	Snap ring	Steel (nickel plated)

Note : Bearing types in use For φ 16----LB8NY  
 For φ 20----LB10NY  
 For φ 25----LB12NY  
 ※ The sub-plate material is aluminum alloy (black anodized).

## Allowable Lateral Load for ATBDAD □

The lateral (side) load on the rod end square plate should be at or below the graph values shown below.

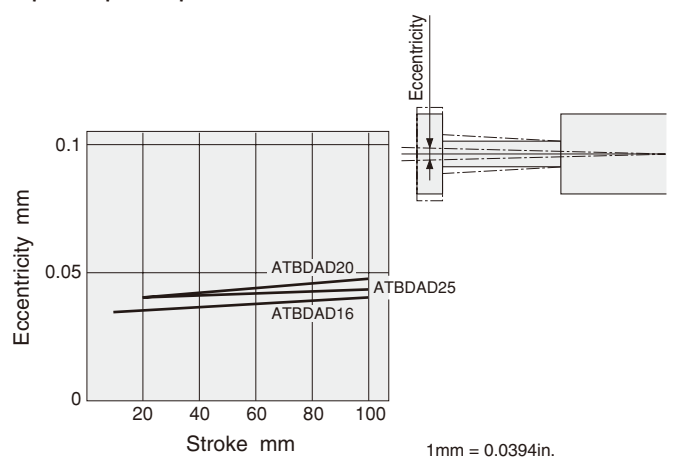
● φ 16, φ 20, φ 25



## Allowable Eccentricity at Square Plate for ATBDAD □

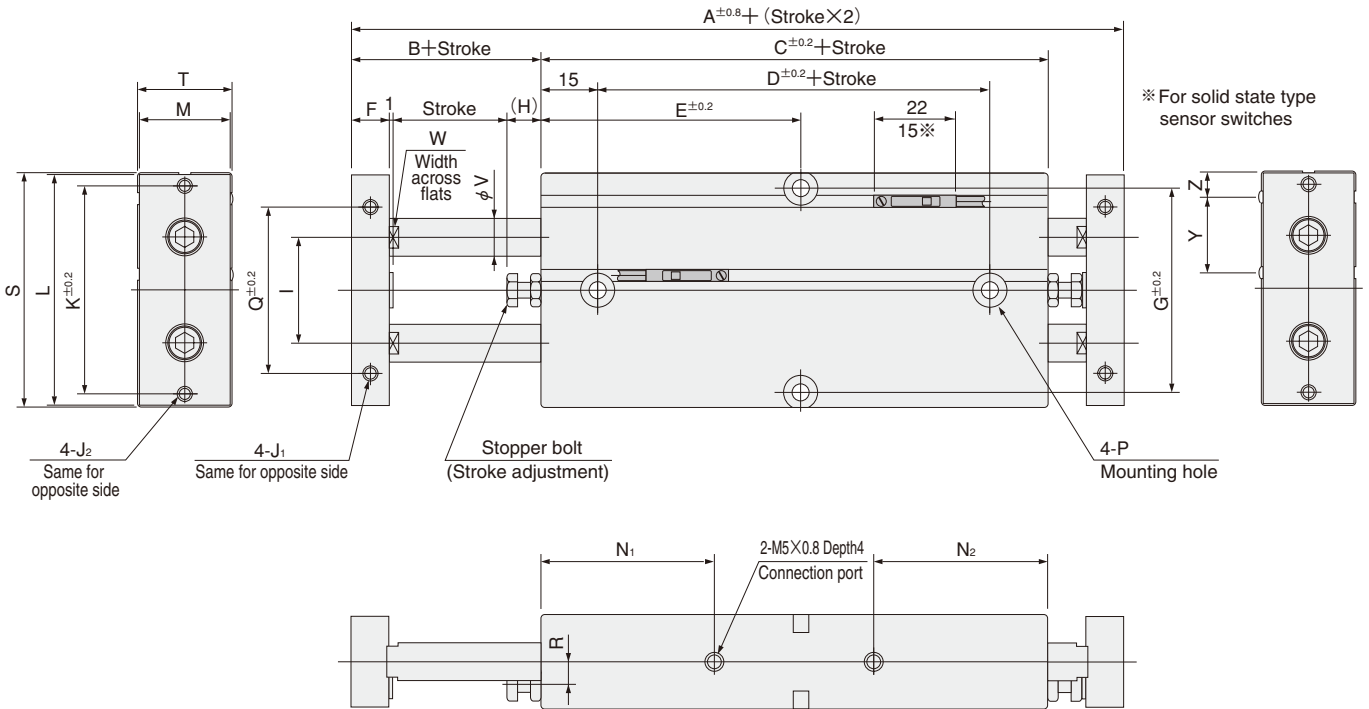
For the eccentricity of the square plate without applying load, use the graph values shown below as guides.

● φ 16, φ 20, φ 25



# Dimensions of ATBDAD (mm)

●  $\phi 16$ ,  $\phi 20$ ,  $\phi 25$  ● Double acting type ● No sub-plate



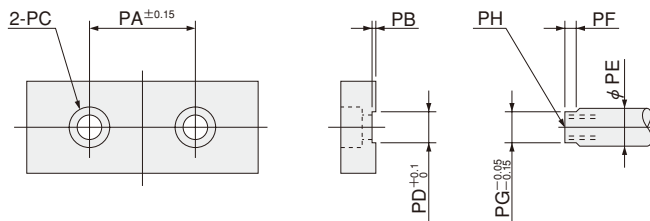
ALPHA TWIN ROD CYLINDERS B SERIES

Code Stroke Bore mm [in.]	A	B	C	D	E										F	G	H	I	J <sub>1</sub>	J <sub>2</sub>	K
	10	20	30	40	50	60	70	80	90	95	100	105	110								
16 [0.630]	135	15	105	75	60	65	70	75	80	85	90	95	100	105	8	47	6	24	M4×0.7 Depth5	M4×0.7	47
20 [0.787]	156	20	116	85	65	70	75	80	85	90	95	100	105	110	10	55	9	28	M4×0.7 Depth5	M4×0.7	55
25 [0.984]	162	19	124	90	65	70	75	80	85	90	95	100	105	110	10	66	8	34	M5×0.8 Depth6	M4×0.7	66

Code Bore mm [in.]	L	M	N <sub>1</sub>	N <sub>2</sub>	P <sup>Note</sup>				Q	R	S	T	V	W	Y	Z
					$\phi 4.5$ (Thru hole)	Counterbore	$\phi 8$ Depth5.5	(Both sides)								
16 [0.630]	53	20	39	39	$\phi 4.5$ (Thru hole)	Counterbore	$\phi 8$ Depth5.5	(Both sides)	34	4	54	21	8	6.2	18.5	5.7
20 [0.787]	61	24	46	46	$\phi 4.5$ (Thru hole)	Counterbore	$\phi 8$ Depth5.5	(Both sides)	44	6	62	25	10	8.2	20	6.8
25 [0.984]	72	29	48	48	$\phi 4.5$ (Thru hole)	Counterbore	$\phi 9$ Depth6.0	(Both sides)	56	7	73	30	12	10.2	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

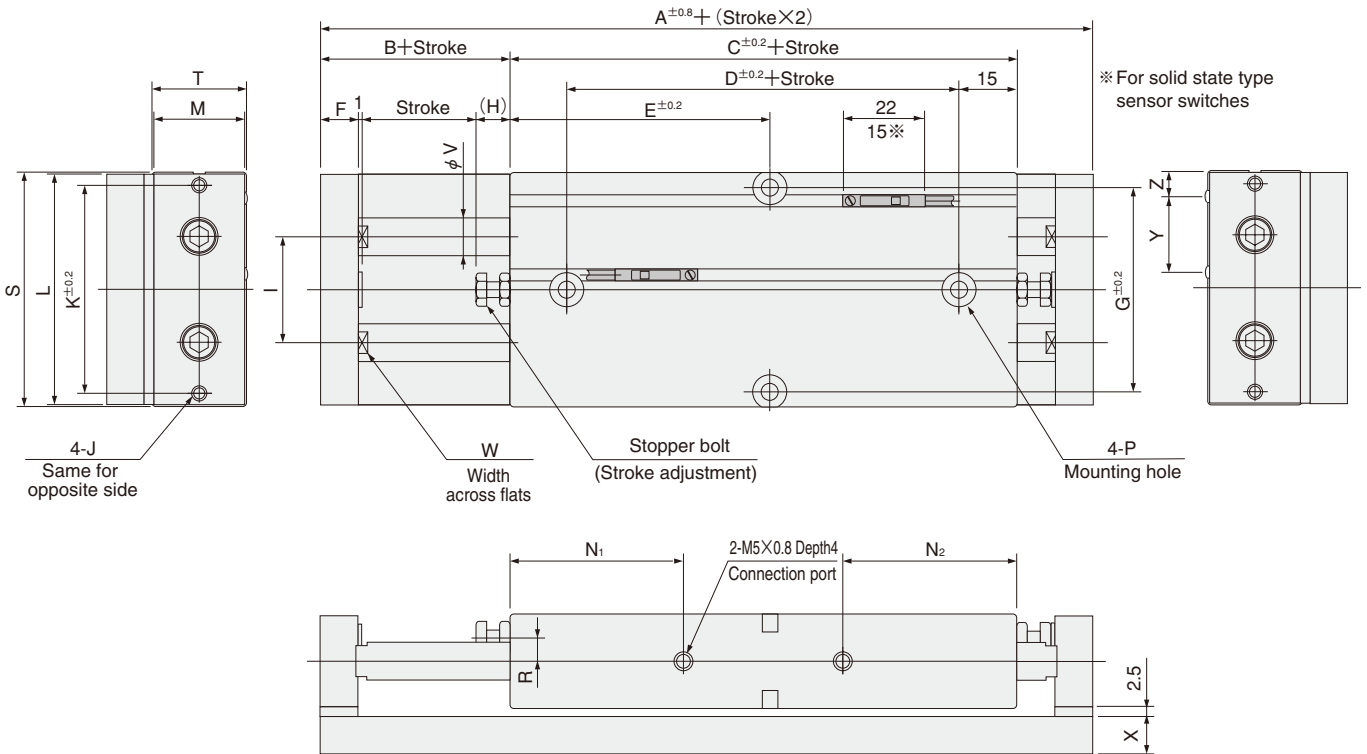
## Dimensions of Rod End Portion



Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
	16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth4.6	6.2	8	3	6.2
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth6.8	8.2	10	3	8.2	M6×1 Depth9
25 [0.984]	34	1	$\phi 6.5$ Counterbore $\phi 11$ Depth6.8	10.2	12	3	10.2	M6×1 Depth9

# Dimensions of ATBDAD (mm)

●  $\phi 16$ ,  $\phi 20$ ,  $\phi 25$  ● Double acting type ● With sub-plate

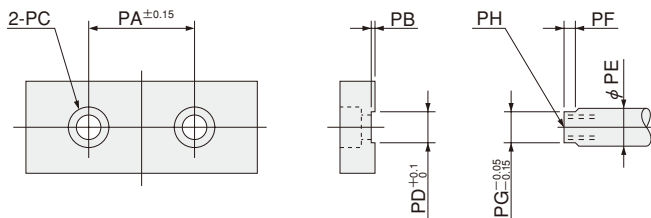


Code Stroke Bore mm [in.]	A	B	C	D	E									F	G	H	I	J	K	
					10	20	30	40	50	60	70	80	90	100						
16 [0.630]	135	15	105	75	60	65	70	75	80	85	90	95	100	105	8	47	6	24	M4×0.7	47
20 [0.787]	156	20	116	85	65	70	75	80	85	90	95	100	105	110	10	55	9	28	M4×0.7	55
25 [0.984]	162	19	124	90	65	70	75	80	85	90	95	100	105	110	10	66	8	34	M4×0.7	66

Code Bore mm [in.]	L	M	N <sub>1</sub>	N <sub>2</sub>	P <sup>Note</sup>				R	S	T	V	W	X	Y	Z
16 [0.630]	53	20	39	39	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth5.5 (Both sides)				4	54	21	8	6.2	8	18.5	5.7
20 [0.787]	61	24	46	46	$\phi 4.5$ (Thru hole) Counterbore $\phi 8$ Depth5.5 (Both sides)				6	62	25	10	8.2	10	20	6.8
25 [0.984]	72	29	48	48	$\phi 4.5$ (Thru hole) Counterbore $\phi 9$ Depth6.0 (Both sides)				7	73	30	12	10.2	10	22.5	8.3

Note: The counterbore depth is measured from the upper surface of the body.

## Dimensions of Rod End Portion



Code Bore mm [in.]	PA	PB	PC	PD	PE	PF	PG	PH
	16 [0.630]	24	1	$\phi 4.3$ Counterbore $\phi 7.8$ Depth4.6	6.2	8	3	6.2
20 [0.787]	28	1	$\phi 6.5$ Counterbore $\phi 11$ Depth6.8	8.2	10	3	8.2	M6×1 Depth9
25 [0.984]	34	1	$\phi 6.5$ Counterbore $\phi 11$ Depth6.8	10.2	12	3	10.2	M6×1 Depth9

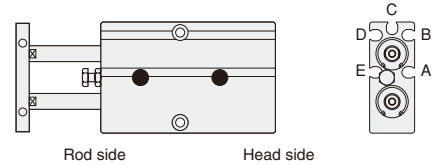




## ■ When the body is secured via 2 mounting holes on the center line

### ● ATBDA (Single rod type)

Note: When the body is secured via 2 mounting holes on its center line and a sensor switch is installed in the A or E groove's rod extended side (the rod side of the body), ensure that the sensor switch is installed inside the groove between body mounting holes before tightening mounting bolts of the body, to avoid interference between the sensor switch and the bolts. This procedure is not necessary for  $\phi 25$  [0.984in.] and  $\phi 32$  [1.260in.], where no interference occurs.



### ● Solid state type (ZE135, ZE155, ZE235, ZE255)

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 10$				Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$				Bore size $\phi 32$			
Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove		
	A	B	C		A	B	C		A	B	C		A	B	C		A	B	C
10	Head side	○	○	10~200	Head side	×	○	10	Head side	○	○	10~200	Head side	○	○	10~200	Head side	○	○
	Rod side	×	○		Rod side	○	○		Rod side	×	○		Rod side	○	○		Rod side	○	○
20~140	Head side	○	○	20~200	Head side	○	○	20~200	Head side	○	○	20~200	Head side	○	○	20~200	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○

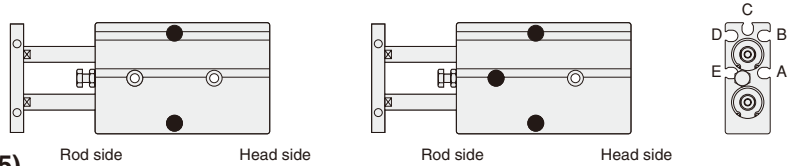
### ● Reed switch type (ZE101, ZE102, ZE201, ZE202)

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 10$				Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$				Bore size $\phi 32$			
Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove		
	A	B	C		A	B	C		A	B	C		A	B	C		A	B	C
10	Head side	×	△	10	Head side	×	△	10	Head side	×	△	10	Head side	△	△	10~200	Head side	○	○
	Rod side	×	△		Rod side	○	△		Rod side	○	△		Rod side	△	△		Rod side	○	○
20~140	Head side	×	○	20~200	Head side	×	○	20~200	Head side	×	○	20~200	Head side	○	○	20~200	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○

## ■ When the body is secured via 2 side mounting holes or 3 rod side mounting holes

### ● ATBDA (Single rod type)



### ● Solid state type (ZE135, ZE155, ZE235, ZE255)

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 10$				Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$				Bore size $\phi 32$			
Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove		
	A	B	C		A	B	C		A	B	C		A	B	C		A	B	C
10	Head side	○	○	10	Head side	○	○	10	Head side	○	△	10	Head side	○	△	10	Head side	○	△
	Rod side	○	×		Rod side	○	×		Rod side	○	△		Rod side	○	△		Rod side	○	△
20	Head side	○	○	20	Head side	○	○	20	Head side	○	△	20	Head side	○	△	20	Head side	○	○
	Rod side	○	×		Rod side	○	×		Rod side	○	△		Rod side	○	○		Rod side	○	○
30	Head side	○	○	30	Head side	○	○	30	Head side	○	○	30	Head side	○	○	30	Head side	○	○
	Rod side	○	×		Rod side	○	×		Rod side	○	○		Rod side	○	○		Rod side	○	○
40	Head side	○	○	40	Head side	○	○	40	Head side	○	○	40	Head side	○	○	40	Head side	○	○
	Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	○
50~140	Head side	○	○	50	Head side	○	○	50	Head side	○	○	50	Head side	○	○	50~200	Head side	○	○
	Rod side	○	○		Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	×
60~200	Head side	○	○	60	Head side	○	○	60	Head side	○	○	60	Head side	○	○	60	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	×		Rod side	○	×		Rod side	○	×
70~200	Head side	○	○	70	Head side	○	○	70	Head side	○	○	70	Head side	○	○	70	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	×		Rod side	○	×		Rod side	○	×
80~200	Head side	○	○	80~200	Head side	○	○	80~200	Head side	○	○	80~200	Head side	○	○	80~200	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○

### ● Reed switch type (ZE101, ZE102, ZE201, ZE202)

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 10$				Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$				Bore size $\phi 32$			
Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove			Stroke	Mounting groove		
	A	B	C		A	B	C		A	B	C		A	B	C		A	B	C
10	Head side	△	○	10	Head side	△	○	10	Head side	△	○	10	Head side	△	△	10	Head side	○	△
	Rod side	△	×		Rod side	△	×		Rod side	△	×		Rod side	△	×		Rod side	△	△
20	Head side	○	○	20	Head side	○	○	20	Head side	○	○	20	Head side	○	○	20	Head side	○	△
	Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	○
30	Head side	○	○	30	Head side	○	○	30	Head side	○	○	30	Head side	○	○	30	Head side	○	○
	Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	○
40	Head side	○	○	40	Head side	○	○	40	Head side	○	○	40	Head side	○	○	40	Head side	○	○
	Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	○
50~140	Head side	○	○	50	Head side	○	○	50	Head side	○	○	50	Head side	○	○	50~200	Head side	○	○
	Rod side	○	○		Rod side	○	×		Rod side	○	×		Rod side	○	×		Rod side	○	×
60~200	Head side	○	○	60	Head side	○	○	60	Head side	○	○	60	Head side	○	○	60	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	×		Rod side	○	×		Rod side	○	×
70~200	Head side	○	○	70	Head side	○	○	70	Head side	○	○	70	Head side	○	○	70	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	×		Rod side	○	×		Rod side	○	×
80~200	Head side	○	○	80~200	Head side	○	○	80~200	Head side	○	○	80~200	Head side	○	○	80~200	Head side	○	○
	Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○		Rod side	○	○

**When the body is secured via 4 mounting holes**

**When the body is secured via 2 side mounting holes**

**When either the extended side or the retracted side of the body is secured via 3 mounting holes**

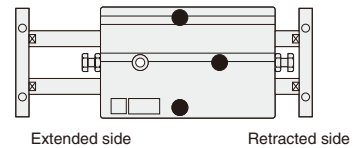
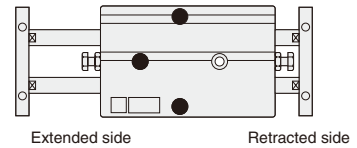
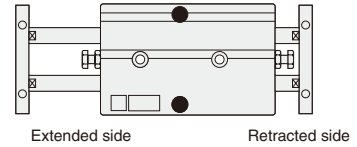
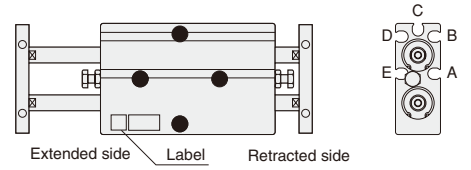
**● ATBDAD (Double rod type)**

Note: When the body is secured via 4 mounting holes and a sensor switch is installed in the A or E groove, ensure that the sensor switch is installed inside the groove between body mounting holes before tightening mounting bolts of the body, to avoid interference between the sensor switch and the bolts. This procedure is not necessary for  $\phi 25$  [0.984in.], where no interference occurs.

**● Solid state type (ZE135, ZE155, ZE235, ZE255)**

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$						
Mounting groove		A	B	C	Mounting groove		A	B	C	Mounting groove		A	B	C
Stroke		E	D		Stroke		E	D		Stroke		E	D	
10	Extended side	○	×	×	10	Extended side	○	×	×	10	Extended side	○	×	×
	Retracted side	○	×	×		Retracted side	○	×	×		Retracted side	○	○	○
20~200	Extended side	○	○	○	20~200	Extended side	○	○	○	20	Extended side	○	×	×
	Retracted side	○	○	○		Retracted side	○	○	○		Retracted side	○	○	○
										30~200	Extended side	○	○	○
										Retracted side	○	○	○	○



**● Reed switch type (ZE101, ZE102, ZE201, ZE202)**

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$						
Mounting groove		A	B	C	Mounting groove		A	B	C	Mounting groove		A	B	C
Stroke		E	D		Stroke		E	D		Stroke		E	D	
10	Extended side	△	×	×	10	Extended side	△	×	×	10	Extended side	△	×	×
	Retracted side	△	×	×		Retracted side	△	×	×		Retracted side	△	○	○
20	Extended side	○	○	○	20	Extended side	○	○	○	20	Extended side	○	×	×
	Retracted side	○	×	○		Retracted side	○	×	○		Retracted side	○	○	○
30~200	Extended side	○	○	○	30~200	Extended side	○	○	○	30~200	Extended side	○	○	○
	Retracted side	○	○	○		Retracted side	○	○	○		Retracted side	○	○	○

**When the body is secured via 2 mounting holes on the center line**

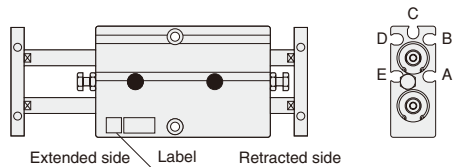
**● ATBDAD (Double rod type)**

Note: When the body is secured via 2 mounting holes on its center line and a sensor switch is mounted in the A or E groove, ensure that the sensor switch is installed inside the groove between body mounting holes before tightening mounting bolts of the body, to avoid interference between the sensor switch and the bolts. This procedure is not necessary for  $\phi 25$  [0.984in.], where no interference occurs.

**● Solid state type (ZE135, ZE155, ZE235, ZE255)**

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$						
Mounting groove		A	B	C	Mounting groove		A	B	C	Mounting groove		A	B	C
Stroke		E	D		Stroke		E	D		Stroke		E	D	
10~200	Extended side	○	○	○	10~200	Extended side	○	○	○	10~200	Extended side	○	○	○
	Retracted side	○	○	○		Retracted side	○	○	○		Retracted side	○	○	○



**● Reed switch type (ZE101, ZE102, ZE201, ZE202)**

○ : Mountable    △ : Either head side or rod side    × : Unmountable

Bore size $\phi 16$				Bore size $\phi 20$				Bore size $\phi 25$						
Mounting groove		A	B	C	Mounting groove		A	B	C	Mounting groove		A	B	C
Stroke		E	D		Stroke		E	D		Stroke		E	D	
10	Extended side	△	△	△	10	Extended side	△	△	△	10	Extended side	△	△	△
	Retracted side	△	△	△		Retracted side	△	△	△		Retracted side	△	△	△
20~200	Extended side	○	○	○	20~200	Extended side	○	○	○	20~200	Extended side	○	○	○
	Retracted side	○	○	○		Retracted side	○	○	○		Retracted side	○	○	○

# Sensor Switch Operating Range, Response Differential, and Maximum Sensing Location

**● Operating range :  $\ell$**

The distance the piston travels in one direction, while the switch is in the ON position.

**● Response differential : C**

The distance between the point where the piston turns the switch ON and the point where the switch is turned OFF as the piston travels in the opposite direction.

**● Solid state type**

Item	Bore size Mounting surface	mm [in.]				
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operating range : $\ell$	A surface	2.5~6 [0.098~0.236]	2.5~6 [0.098~0.236] (2~5 [0.079~0.197])	2.5~6.5 [0.098~0.256] (2~5.5 [0.079~0.217])	2.5~6.5 [0.098~0.256] (2~5.5 [0.079~0.217])	5~12 [0.197~0.472]
	C surface	2.5~4 [0.098~0.157]	2~4.5 [0.079~0.177] (1.5~4 [0.059~0.157])	2.5~5.5 [0.098~0.217] (2~4.5 [0.079~0.177])	2.5~5.5 [0.098~0.217] (2~4.5 [0.079~0.177])	4~9 [0.157~0.354]
Response differential : C	—	1.0 [0.039] or less	1.2 [0.047] or less	1.5 [0.059] or less	2.0 [0.079] or less	2.0 [0.079] or less
Max. sensing location <sup>Note</sup>	—	6 [0.236]				

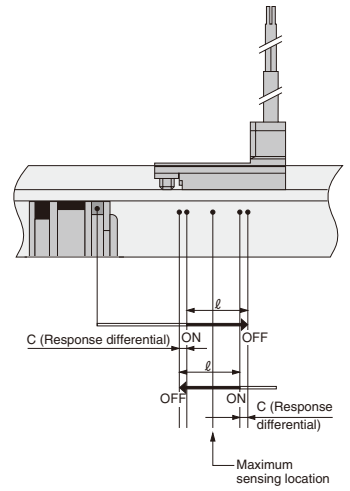
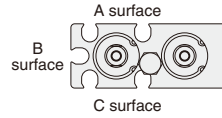
Figures in parentheses ( ) are for the double rod type.  
Note: The above table shows reference values.

**● Reed switch type**

Item	Bore size	mm [in.]				
		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
Operating range : $\ell$	6~8.5 [0.236~0.335]	6~8.5 [0.236~0.335] (3~6 [0.118~0.236])	6~8 [0.236~0.315] (3.5~7.5 [0.138~0.295])	7~9.5 [0.276~0.374] (4~8.5 [0.157~0.335])	12~16.5 [0.472~0.650]	12~16.5 [0.472~0.650]
Response differential : C	—	1.5 [0.059] or less				2.5 [0.098] or less
Max. sensing location <sup>Note</sup>	—	10 [0.394]				

Figures in parentheses ( ) are for the double rod type.  
Note: The above table shows reference values.

**● Sensor switch mounting surface**



## When Mounting Cylinders with Sensor Switches in Close Proximity

When mounting cylinders with magnets in close proximity, install the cylinders with magnets so that it should not be below the values shown in the following table.

Status of installation in close proximity	Code	Bore size Type	mm [in.]					
			10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]	
	A	Solid state type	53 [2.09]	66 [2.60]	73 [2.87]	87 [3.43]	119 [4.69]	
		Reed switch type	48 [1.89]	60 [2.36]	68 [2.68]	81 [3.19]	109 [4.29]	
	B	Solid state type	11 [0.43]	12 [0.47]	11 [0.43]	14 [0.55]	23 [0.91]	
		Reed switch type	6 [0.24]			8 [0.31]	13 [0.51]	
	A	Solid state type	47 [1.85]	59 [2.32]	65 [2.56]	77 [3.03]	107 [4.21]	
		Reed switch type	42 [1.65]	54 [2.13]	62 [2.44]	73 [2.87]	96 [3.78]	
	B	Solid state type	5 [0.20]			3 [0.12]	4 [0.16]	11 [0.43]
		Reed switch type	0					
	A	Solid state type	28 [1.10]	33 [1.30]	36 [1.42]	44 [1.73]	65 [2.56]	
		Reed switch type	22 [0.87]	27 [1.06]	30 [1.18]	37 [1.46]	53 [2.09]	
	B	Solid state type	11 [0.43]	12 [0.47]	11 [0.43]	14 [0.55]	25 [0.98]	
		Reed switch type	5 [0.20]	6 [0.24]	5 [0.20]	7 [0.28]	13 [0.51]	
	A	Solid state type	21 [0.83]	24 [0.94]	25 [0.98]	30 [1.18]	44 [1.73]	
		Reed switch type	17 [0.67]	21 [0.83]	25 [0.98]	30 [1.18]	40 [1.57]	
	B	Solid state type	4 [0.16]	3 [0.12]	0		4 [0.16]	
		Reed switch type	0					

Remark: For mounting in configurations other than the above, consult us.

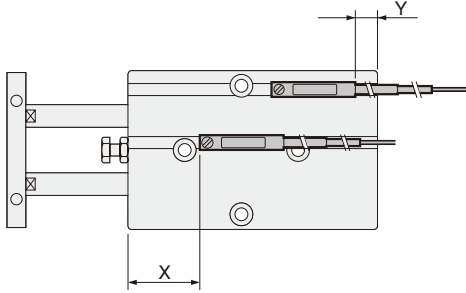
# Mounting Location of End of Stroke Detection Sensor Switch

When the sensor switch is mounted in the locations shown below (the figures in the tables are reference values), the magnet comes to the maximum sensing location of the sensor switch at the end of the stroke.

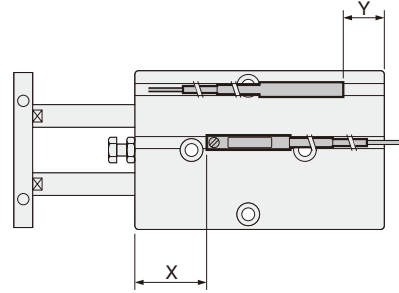
**Caution:** For the mountabilities of sensor switches, see p.838~840.

## ● ATBDA

■ When the lead wires are pulled from the head side.



■ When the lead wire of the head side detection sensor switch only is pulled from the rod side.



**● Solid state type** mm [in.]

Code	Bore size	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
<b>X</b>		36.5 [1.437]	48 [1.890]	57 [2.244]	62 [2.441]	71 [2.795]
<b>Y</b>		4.5 [0.177]	10 [0.394]	8 [0.315]	7 [0.276]	15 [0.591]

**● Solid state type** mm [in.]

Code	Bore size	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
<b>X</b>		36.5 [1.437]	48 [1.890]	57 [2.244]	62 [2.441]	71 [2.795]
<b>Y</b>		7.5 [0.295]	13 [0.512]	11 [0.433]	10 [0.394]	18 [0.709]

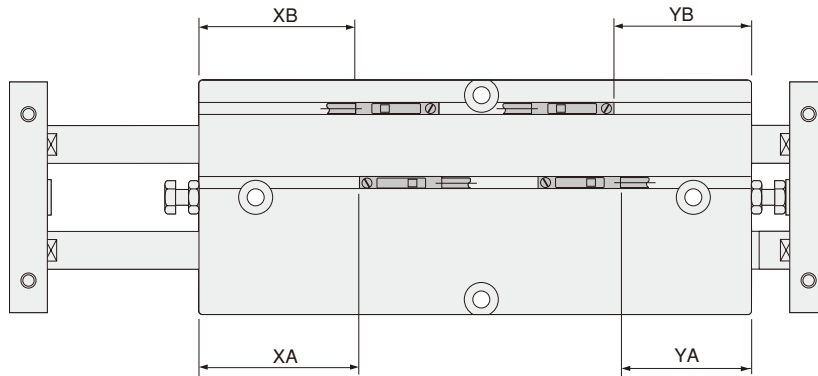
**● Reed switch type** mm [in.]

Code	Bore size	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
<b>X</b>		32.5 [1.280]	44 [1.732]	53 [2.087]	58 [2.283]	67 [2.638]
<b>Y</b>		1.5 [0.059]	7 [0.276]	5 [0.197]	4 [0.157]	12 [0.472]

**● Reed switch type** mm [in.]

Code	Bore size	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]
<b>X</b>		32.5 [1.280]	44 [1.732]	53 [2.087]	58 [2.283]	67 [2.638]
<b>Y</b>		3.5 [0.138]	9 [0.354]	7 [0.276]	6 [0.236]	14 [0.551]

## ● ATBDAD



**● Solid state type** mm [in.]

Code	Bore size	16 [0.630]	20 [0.787]	25 [0.984]
<b>XA</b>		47 [1.85]	53 [2.09]	58 [2.28]
<b>XB</b>		44 [1.73]	50 [1.97]	55 [2.17]
<b>YA</b>		43 [1.69]	48 [1.89]	51 [2.01]
<b>YB</b>		46 [1.81]	51 [2.01]	54 [2.13]

**● Reed switch type** mm [in.]

Code	Bore size	16 [0.630]	20 [0.787]	25 [0.984]
<b>XA</b>		43 [1.69]	49 [1.93]	54 [2.13]
<b>XB</b>		41 [1.61]	47 [1.85]	52 [2.05]
<b>YA</b>		40 [1.57]	45 [1.77]	48 [1.89]
<b>YB</b>		42 [1.65]	47 [1.85]	50 [1.97]



## Mounting and adjustment

### Mounting

1. While any mounting direction is allowed, the mounting surface should always be flat. Twisting or bending during mounting may disturb the accuracy and may also result in air leaks or improper operation.
2. Care should be taken that scratches or dents on the cylinder's mounting surface may damage its flatness.
3. The hexagon socket head bolt on the rod end square plate has been mounted with a conical washer. Always confirm that the rod end square plate and hexagon socket head bolts are secured before using the cylinder.

### Stroke adjustment

On the Twin Rod cylinder, stroke adjusting is easy within a range of  $-5\sim 0\text{mm}$  [ $-0.197\sim 0\text{in.}$ ] (in the double rod end type,  $-10\sim 0$  [ $-0.394\sim 0\text{in.}$ ]). Turn the stopper to the left (counterclockwise) to shorten the stroke. Use a lock nut to tighten and secure the stopper in place after adjustment. Do not screw the bolt to the right (clockwise) beyond the standard position. The stroke at delivery is set to the standard stroke. Do not adjust it to larger than the standard stroke.

**Caution:** Never use with the stopper bolt removed.

### Cylinder speed

Use the cylinder at or below the speed of  $500\text{mm/s}$  [ $19.7\text{in./sec.}$ ] (use a speed controller for adjustment). For high speeds ( $500\text{mm/s}$  [ $19.7\text{in./sec.}$ ]), install an external stopper, etc., to prevent applying direct shocks to the cylinder. Consult us if the situation will not permit installation of an external stopper, etc.

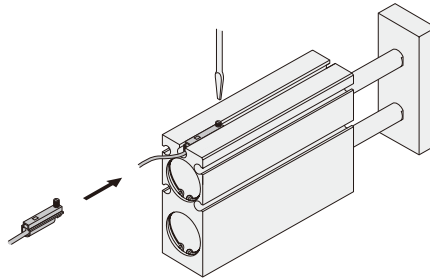


## Sensor switch

1. In the standard cylinder, the magnet for sensor switch is built-in. Mounting a sensor switch will enable use in sensor switch applications.
2. Do not use the body mounting hole to secure the sensor switch with its mounting screw. The sensor switch mounting screw could fall out.

### Moving sensor switch

- Loosening the mounting screw allows the sensor switch to be moved along the switch mounting groove of the cylinder body.
- Tighten the mounting screw with a tightening torque of  $0.1\sim 0.2\text{N}\cdot\text{m}$  [ $0.9\sim 1.8\text{in}\cdot\text{lbf}$ ].



## General precautions

### Piping

Always thoroughly blow off (use compressed air) the tubing before piping. Entering chips, sealing tape, rust, etc., generated during piping work could result in air leaks or other defective operation.

### Media

1. Use air for the media. For the use of any other media, consult us.
2. Air used for the cylinder should be clean air that contains no deteriorated compressor oil, etc. Install an air filter (filtration of a minimum  $40\ \mu\text{m}$ ) near the cylinder or valve to remove collected liquid or dust. In addition, drain the air filter periodically. Collected liquid or dust entering the cylinder may cause improper operation.

### Lubrication

The product can be used without lubrication, if lubrication is required, use Turbine Oil Class 1 (ISO VG32) or equivalent. Avoid using spindle oil or machine oil.

### Atmosphere

1. If using in locations subject to dripping water, dripping oil, etc., or to large amounts of dust, use a cover to protect the unit.
2. The product cannot be used when the media or ambient atmosphere contains any of the substances listed below.  
Organic solvents, phosphate ester type hydraulic oil, sulphur dioxide, chlorine gas, or acids, etc.