

## MS99



30 V DC and lower rated voltage specification only

RoHS

### Fine differential pressure switch

- Wide setting range due to employment of multi-start thread.
- Standardization of the contact has eliminated the need to specify the normal load and fine load.
- High accuracy has been achieved.
- Exchange of base makes it possible to connect various pipes (for exchangeable base type only).
- Products compatible with EC directive (CE marking) are also available (30 V DC and lower rated voltage specification).



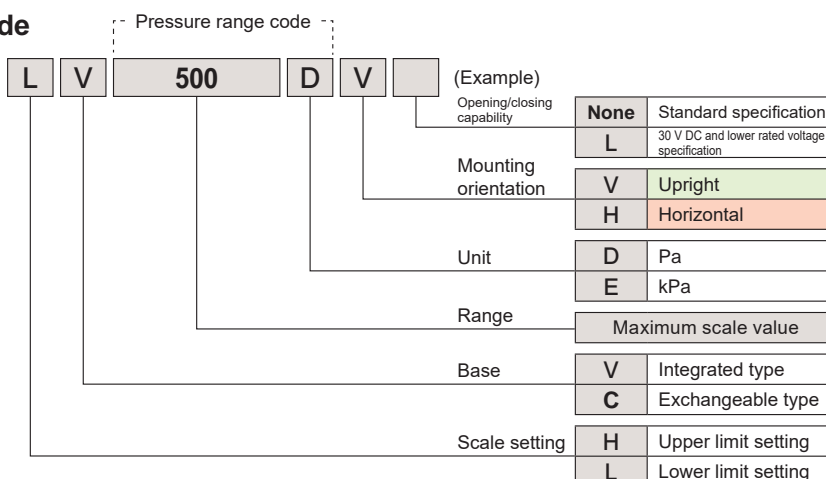
**Model MS99 V**  
(Integrated base type)



**Model MS99 C**  
(Exchangeable base type)

### Product code

**MS99**



**<Main application fields>**

- General factory management equipment
- Negative pressure for dust collector/differential pressure of air conditioner
- Filter pressure loss management
- Precision machine manufacturing line
- Building air conditioning control equipment

**<Usage>**

- Detection of clogging of air filter
- Room pressure measurement in a clean room
- Measurement of clogging of bug filter
- Measurement of dynamic pressure at ventilation/exhaust device

\*(Refer to pages 114 to 117)

◆When making an inquiry or placing an order, specify the above product code.

- List of products
- WO81
- WO71
- FR51A
- MS99
- MS99S
- MS61A-RA
- QDP33
- EMD8A
- EMD7
- EMT1
- EMTGP1
- EMT1H
- EMT6
- EMP5A
- EMRT1
- HWS15A
- Accessories
- Application
- Precautions
- Maintenance

## Specifications

Model	Integrated base type, for upper limit setting	Integrated base type, for lower limit setting	Exchangeable base type, for upper limit setting	Exchangeable base type, for lower limit setting
	MS99HV	MS99LV	MS99HC	MS99LC
<b>Pressure unit</b> <b>Pressure measurement method</b> <b>Pressure-receiving element</b> <b>Contact material</b> <b>Measured gas</b> <b>Pressure setting method</b> <b>Mounting orientation</b> <b>Operating ambient temperature</b> <b>Operating ambient humidity</b> <b>Exterior material</b> <b>Durable vibration</b> <b>Durable impact</b> <b>Insulation resistance</b> <b>Withstand voltage</b>	Pa, kPa Differential pressure method Diaphragm Silver alloy/gold plating Air and noncorrosive gas (liquid cannot be measured) Setting by dial with scale Upright or horizontal -10°C to +60°C (no freezing allowed) 90% RH or below (no condensation allowed) Model V Polycarbonate Model C Polycarbonate and polyamide		<b>Compatible pipe</b> <b>Terminal screw size</b> <b>Base polarity</b> <b>Mass</b> <b>Accessories</b> <b>Conforming standards</b> <b>Protection level</b> <b>Cable clamp mounting screw size</b>	Model V • Vinyl pipe or rubber pipe (inner diameter of 4 mm) Model C • Vinyl pipe or rubber pipe (inner diameter of 6 mm) Base for resin vinyl pipe (already mounted on instrument) • Metallic pipe (outer diameter of 6 ± 0.1 mm) Separately sold base for metallic pipe is necessary. • Hard tube (outer diameter 6 × inner diameter 4 mm) Separately sold base for metallic pipe and inner sleeve set (refer to page 95) or push-in joint is necessary. M4 (mountable terminal: outer diameter of φ8 or below) Indicating high-pressure side and low-pressure side with "H" and "L" marks, respectively, at the piping connection base part. Model V Approx. 170 g Model C Approx. 190 g None (cable clamp is separately sold) UL standard UL and C-UL recognition component Requirement standard No. .... UL508 File No. .... E240648 *Acquired as open-type enclosure. RoHS directive Equivalent to IP54 (at time of acquisition of cable clamp) M15 P=1

Pressure range code	Pressure range	Mounting orientation <small>*It is necessary to specify the orientation at the time of order placement for all ranges.</small>	Scale setting accuracy (at 23°C)	Repeatability	Maximum operating pressure difference	Pressure-receiving element material	Withstanding pressures of instrument body and pressure-receiving element (Refer to page 118)
120 D	20–120 Pa	Horizontal or Upright	±5.0 Pa	±2.0 Pa	25.0 Pa	Silicone rubber	10 kPa
200 D	20–200 Pa		±9.0 Pa	±2.0 Pa	25.0 Pa		
300 D	30–300 Pa		±13.5 Pa	±3.0 Pa	30.0 Pa		
500 D	50–500 Pa		±22.5 Pa	±5.0 Pa	45.0 Pa		
1000 D	100–1000 Pa		±45 Pa	±10 Pa	70 Pa		
3 E	0.3–3 kPa		±0.135 kPa	±0.030 kPa	0.300 kPa	20 kPa	
5 E	0.5–5 kPa		±0.225 kPa	±0.050 kPa	0.450 kPa		
10 E	1–10 kPa		±0.45 kPa	±0.10 kPa	0.70 kPa		
30 E	3–30 kPa		±1.35 kPa	±0.30 kPa	3.00 kPa		

◆For use environment, refer to page 118.

## Opening/closing capability [standard specification]

Load	Rated voltage	Specifications	Resistance load	Induction load
Standard load	30 V DC	Contact configuration SPDT (single-pole double-throw) Electric service life 100,000 times or more	0.8 A	150 mA (Time constant 7 ms)
	100 V AC		5 A	60 mA (Power factor 0.6)
	250 V AC		5 A	—
Minute load	30 V DC 125 V AC		100 mA	—

## Rating certified with safety standard (UL) [Standard specification]

Rating
125 V DC–0.5 A RES 250 V AC–5 A RES

## Opening/closing capability [30 V DC and lower rated voltage specification]


Load	Rated voltage	Specifications	Resistance load	Induction load
Standard load	30 V DC	Contact configuration SPDT (single-pole double-throw) Electric service life 100,000 times or more	0.8 A	150 mA (Time constant 7 ms)
Minute load			100 mA	—

## Rating certified with safety standard (UL) [30 V DC and lower rated voltage specification]

Rating
30 V DC–0.5 A RES

\*To enhance the contact reliability of the contact under minute load condition, gold plating is applied to the contact surface. If the instrument is used with a voltage or current exceeding the rating at the time of use of minute load, the gold plating will be broken and the contact reliability of the contact under minute load condition will be degraded.

Under minute load conditions, do not use such a product that has been used any number of times under normal load conditions.

 Caution	<ul style="list-style-type: none"> <li>In an induction load circuit, such as a relay, there is a possibility of contact problems with a contact due to back electromotive force or inrush current at the time of opening or closing. Therefore, be sure to insert a protective circuit for surge absorption, such as a diode and varistor.</li> <li>If silicone gas or organic gas is contained in the measured gas, such an organic substance that may lead to defective contact of a contact that is caused by arc energy at the time of contact opening/closing. If offensive gas is contained in the measured gas, malfunctioning due to defective contact of a contact or corrosion of the internal mechanism may occur. If any of the above gases exist in the measured gas or surrounding environment, discuss the use of a model with the built-in lead switch MS61A-RA, whose contact is less subject to the external atmosphere.</li> </ul>
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## MS99

List of products

WO81

WO71

FR51A

MS99

MS99S

MS61A-RA

QDP33

EMD8A

EMD7

EMT1

EMTGP1

EMT1H

EMT6

EMP5A

EMRT1

HWS15A

Accessories

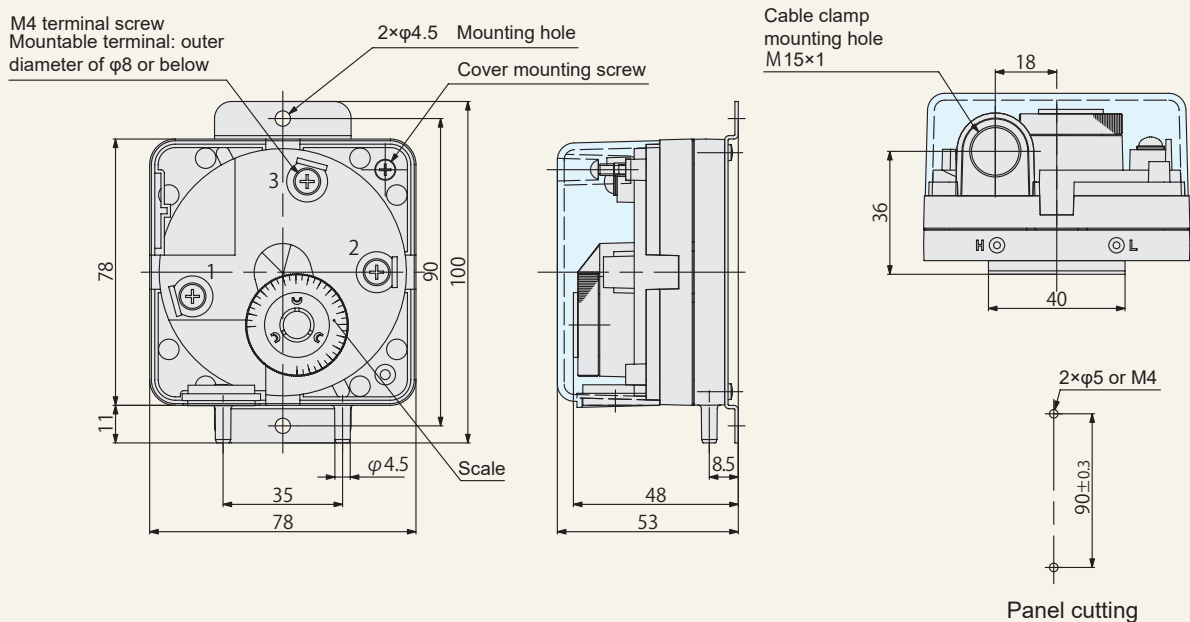
Application

Precautions

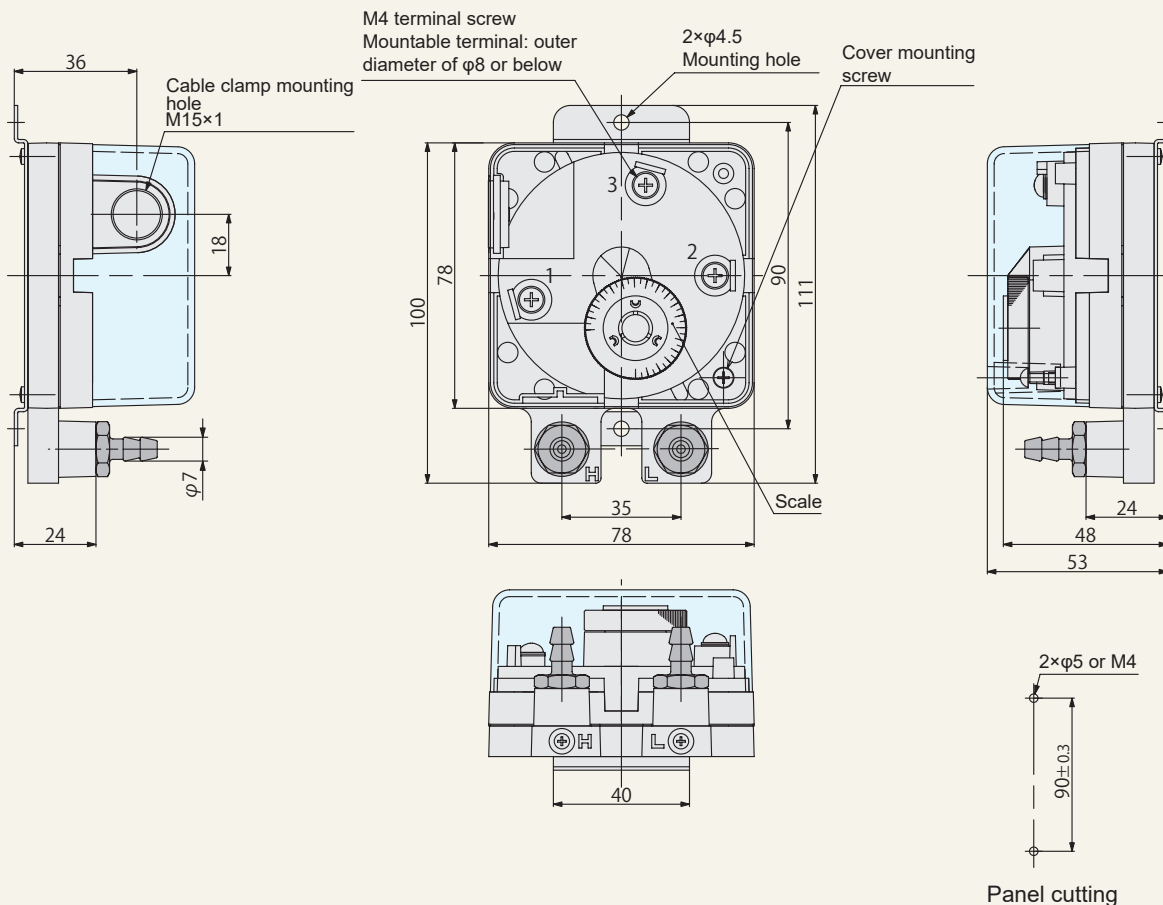
Maintenance

### External dimension drawing

#### Model MS99 V (integrated base type)



#### Model MS99 C (exchangeable base type)



Caution

Base tightening torque: 1 N·m

Terminal screw tightening torque: 0.7 to 1.0 N·m

Do not tighten to a torque that exceeds the specified value because doing so breaks the instrument body. (Refer to page 120)

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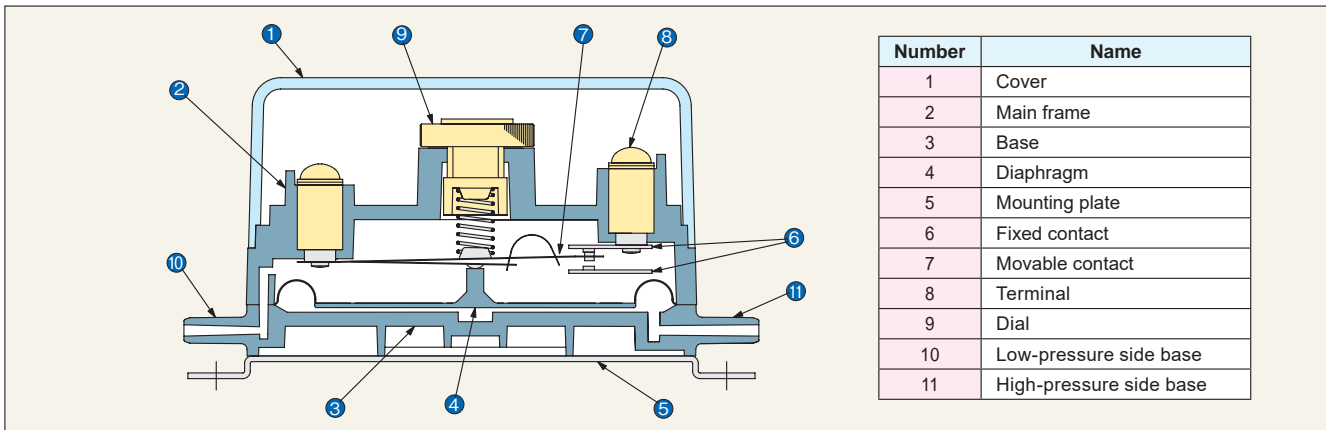
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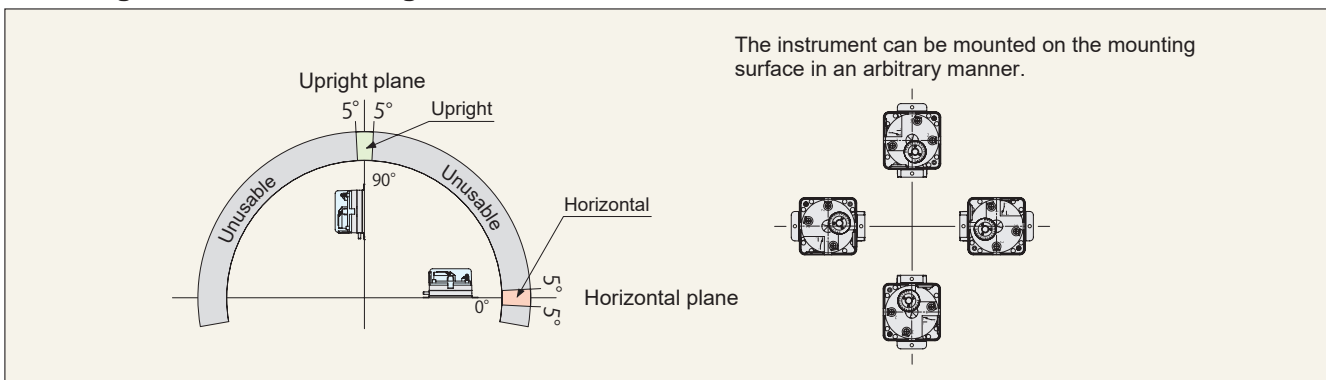
Maintenance

### Overview of structure



### Mounting orientation and range

It is necessary to specify the orientation at the time of order placement for all ranges.



### Accessories dedicated to MS99

RoHS

#### Mounting plate

(Auxiliary item)

Dedicated to V type and C type

This is already installed at the time of purchase of the instrument.  
This cannot be used for Model MS99S.

Item number	Material
ADPL99-01	Aluminum/steel

#### Cover

(Auxiliary item)

This is already installed at the time of purchase of the instrument.

Item number	Material
TCA-99	Polycarbonate/steel

#### Cable clamp holder

(Auxiliary item)

This is already installed at the time of purchase of the instrument.

Item number	Material
ADPA-MS99	Polycarbonate

#### Cable clamp (Ohm Electric Co., Ltd.)

Mounting hole diameter:  $\phi 15$   
Mounting screw: M15 P=1

[External dimension at time of mounting]

[Schematic figure of mounted cable clamp]

Only by changing the orientation of the transparent cover, it is possible to change the wiring direction.

At time of mounting of cable clamp, protection level is equivalent to IP54.

Item number	Compatible electric wire diameter	Material
OA-W15M-04	$\phi 2-4$	Nylon 66
OA-W15M-05	$\phi 3-5$	Polypropylene
OA-W15M-07	$\phi 5-7$	NBR

**Caution**

- In mounting of the cable clamp to the instrument body, the supplied locknut is not used.
- When extracting the wire in the base direction on Model MS99 C (exchangeable base type), the installation is disabled because the base and the cable clamp interfere with each other.

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EMD7

EMT1

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EMT1H

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Accessories



Application



Precautions



Maintenance



### Accessories for C type RoHS



VT base									
(Auxiliary item)									
									
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<p>A vinyl pipe or rubber pipe with an inner diameter of 6 mm can be connected. This is already installed at the time of purchase of the instrument.</p>									



VR base																			
High-pressure side		Low-pressure side																	
																			
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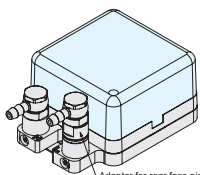
PT base																			
High-pressure side		Low-pressure side																	
																			
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<p>The tube mounting part is a push-in joint. For piping, use the separately sold tube (refer to page 112) or a tube compatible with JIS B 8381-1. (Connectable tube outer diameter: 6 mm)</p>																			

PR base																			
High-pressure side		Low-pressure side																	
																			
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<p>The tube mounting part is a rotary elbow push-in joint. The piping is the same as that for the PT base. (Connectable tube outer diameter: 6 mm)</p>																			

MT base																			
High-pressure side		Low-pressure side																	
																			
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<p>A metallic pipe, such as copper pipe and aluminum pipe with an outer diameter of <math>6 \pm 0.1</math> mm, can be connected. However, for stainless steel pipe, use an MTW base. When connecting with a plastic pipe (outer diameter 6 mm <math>\times</math> inner diameter 4 mm), remove the brass sleeve and use the separately sold resin inner sleeve set (XIN6<math>\times</math>4; refer to page 111).</p>																			

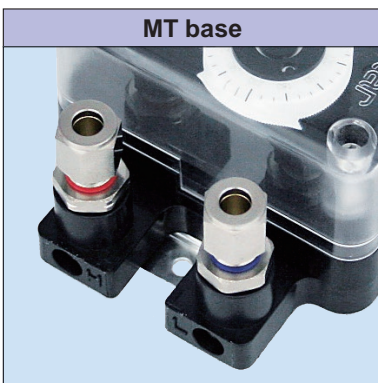
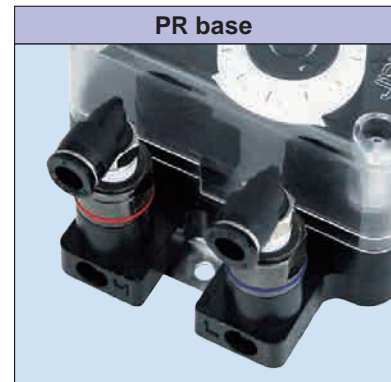
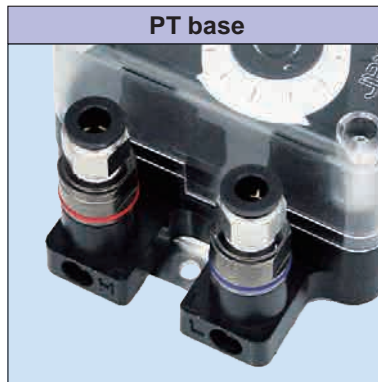
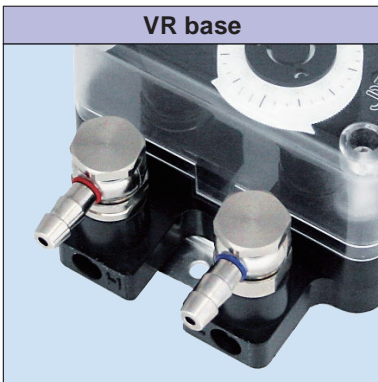
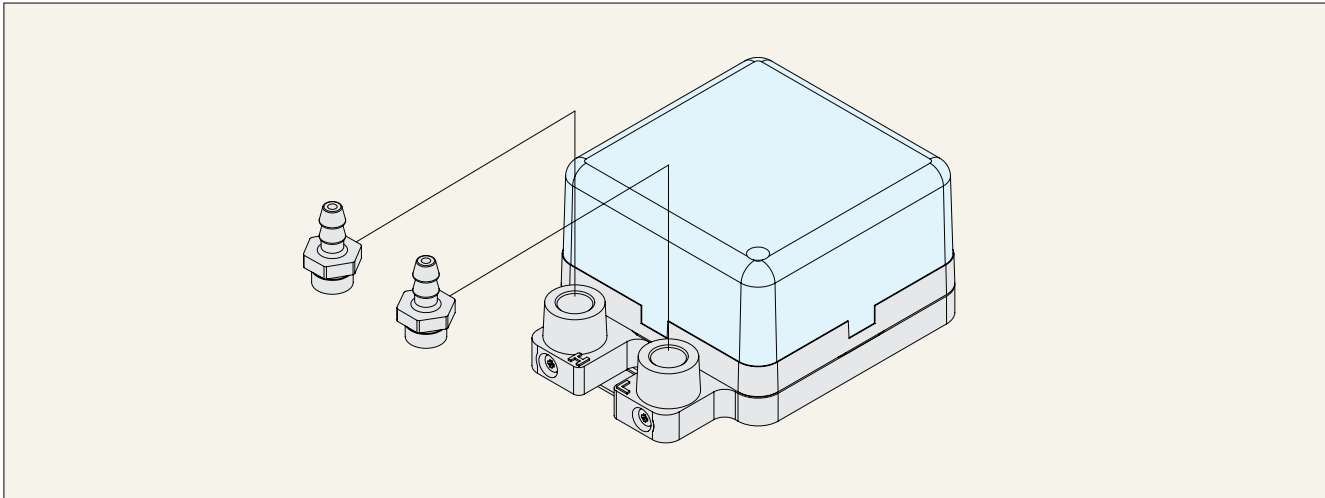
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<p>This is used to connect a stainless steel pipe with an outer diameter of <math>6 \pm 0.1</math> mm.</p>																			

Adapter for rear face piping																			
High-pressure side		Low-pressure side																	
																			
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Item number	Material																		
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<p>When a rotary base is used, it is possible to provide a step so that pipes do not contact each other even when they cross each other. (Figure on the right)</p>																			
																			



### Example of mounting of type C base



**Caution**

- Even when the bases are exchanged with each other, the high-pressure side and low-pressure side polarities cannot be changed. The base polarities are indicated with an "H" mark on the high-pressure side and an "L" mark on the low-pressure side at their respective base mounting parts.
- Base tightening torque: 1 N·m Sealing cap tightening torque: 0.5 N·m  
Do not tighten to a torque that exceeds the specified value because doing so breaks the instrument body. (Refer to page 120)

List of products

WO81

### Protection of switch contact

- To reduce the noise generated at the time of opening/closing of the load and lengthen the service life of the contact by decreasing the generation of nitric acid gas and carbide, a contact protection circuit is used. However, it will have an opposite effect if it is not used correctly.
- When a contact protection circuit is used, the operation time of the load may be slightly delayed. Representative examples of a contact protection circuit are provided below.

WO71

### Representative examples of a contact protection circuit

Circuit example		Applicable power source		Points to note when applying/selecting circuit
		DC	AC	
	Varistor method	○	○	<ul style="list-style-type: none"> <li>○ This method prevents a voltage equal to or exceeding the varistor's limit voltage from being applied between the contacts. In this method, the return time of the induction load on the relay is slightly delayed.</li> <li>○ From the selection materials from varistor manufacturers, select a varistor with a rating that matches the power voltage and load capacity.</li> </ul>
	C/R method	○	○	<ul style="list-style-type: none"> <li>○ In this method, the operation/return time is slightly delayed if the load is an induction load such as relay.</li> <li>○ The CR values should be around C: 0.5 μF/A and R: 1.0 Ω/V with respect to the contact current and contact voltage, respectively, as a guide. However, as these values vary depending on the property of the load and other conditions, check the values through experiment and select an appropriate model.</li> </ul>
	Diode method	○	✗	<ul style="list-style-type: none"> <li>○ In this method, the back electromotive force of the induction load is canceled by the load resistance through a diode to prevent high voltage from being applied between contacts. In this method, the return time of induction load is more delayed compared to the varistor type and CR method.</li> <li>○ Select a diode whose rating current is equal to or greater than the load current and whose reverse breakdown voltage is 10 times the power voltage or greater.</li> </ul>
	Diode + Zener diode method	○	✗	<ul style="list-style-type: none"> <li>○ The diode method is effective when the return time of the induction load on the relay is excessively delayed. Select a Zener diode whose Zener voltage is almost equal to the power voltage as a guide. However, if the load increases, a Zener diode whose reverse surge power is great is required. Therefore, this method has a limit, and attention needs to be paid when selecting this method.</li> </ul>

FR51A

MS99

MS99S

MS61A-RA

QDP33

EMD8A

EMD7

EMT1

### Examples of bad contact protection circuit

	Condenser method	○ This method is very effective for extinction of an arc at the time of release of the contact, but the charging current flows to the condenser when contacting the contact, making the contact likely to be welded and shortening the contact service life.
		○ This method is very effective for extinction of an arc at the time of release of the contact, but short-circuit current in power storage capacity stored in the condenser flows when contacting the contact, making the contact likely to be welded and shortening the contact service life.

EMTGP1

EMT1H

EMT6

EMP5A

EMRT1

HWS15A

Accessories

Application

Precautions

Maintenance

## Notes on contact material

To enhance the contact reliability of the contact under minute load condition, gold plating is applied to the contact surface. If the instrument is used with a voltage or current exceeding the rating at the time of use of minute load, the gold plating may break, and the contact reliability of the contact under minute load conditions may degrade.



Under minute load conditions, do not use such a product that has been used any number of times under normal load conditions.

## Configuration of switch contact

- The contact configuration of this instrument is as shown on the right.
- The state in which the differential pressure (pressure) is not applied to the instrument is referred to as normal condition.
- In the normal condition, the section between contact 1 (COM.) and contact 2 (N.C.) is closed, and the section between contact 1 (COM.) and contact 3 (N.O.) is open.
- When the differential pressure increases and reaches the set pressure, the contact is switched, the section between contact 1 (COM.) and contact 2 (N.C.) turns to be open, and the section between contact 1 (COM.) and contact 3 (N.O.) turns to be closed.

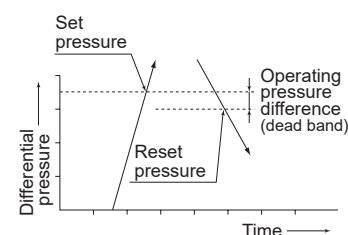
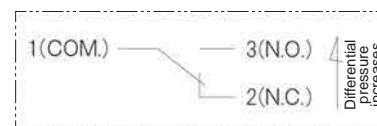


Figure for explanation of operating pressure difference

## Upper limit setting and lower limit setting

The pressure at which the electric contact of the switch is triggered as the differential pressure (pressure) applied to the instrument has increased from zero is referred to as the set pressure.

Then, the pressure at which the contact has returned to the former state as the differential pressure has decreased from the use condition at a pressure greater than the set pressure and the electric contact has been triggered is referred to as the reset pressure.

The set pressure and reset pressure mentioned above are not the same values but are slightly different from each other. This difference is referred to as the operating pressure difference (dead band).

This instrument has two variations: one with the scale of setting dial set to the set pressure; and the other with the scale set to the reset pressure.

This instrument with the scale set to the set pressure is referred to as the instrument for upper limit setting and the instrument with the scale set to the reset pressure is referred to as the instrument for lower limit setting.

When the setting pressure is set to 1 kPa in the pressure range of 1 to 10 kPa as an example (the operating pressure difference is assumed to be 0.7 kPa)

Scale setting	Setting dial scale adjustment	Contact action
<b>Instrument for upper limit setting</b>	Adjustment is made by means of set pressure.	When the differential pressure increases, the section between 3 (N.O.) and 1 (COM.) closes at 1 kPa. Then, when the differential pressure decreases, the section between 3 (N.O.) and 1 (COM.) opens at 0.3 kPa.
<b>Instrument for lower limit setting</b>	Adjustment is made by means of reset pressure.	When the differential pressure increases, the section between 3 (N.O.) and 1 (COM.) closes at 1.7 kPa. Then, when the differential pressure decreases, the section between 3 (N.O.) and 1 (COM.) opens at 1 kPa.



It is not possible to change from the upper limit setting to the lower limit setting and vice versa.

## Reset time

Reset time refers to the time it takes to reach the reset pressure (the electric contact is reset) when the differential pressure is suddenly reduced to zero from the set pressure. In this instrument, the reset time is approx. 3 seconds at 20 Pa and approx. 1 second at 50 Pa and greater. (However, the reset time is for the instrument body only, not including the pipe.) Therefore, a response faster than this time is impossible.

## Contact rating

If the contact capacity in the specification is exceeded, additionally connect the secondary relay. In general, the smaller the voltage and current are, the longer the contact service life is. A Manostar switch cannot directly shut off a circuit whose voltage exceeds 250 V AC.

## Measured gas

If offensive gas (nitric acid, hydrogen sulfide, sulfurous acid, ammonia, chlorine, etc.) is contained in the measured gas, malfunctioning due to defective contact of a contact or corrosion of the internal mechanism may occur. If the measured gas is highly humid, nitric acid may be produced due to an arc at the time of opening/closing of the contact, which may lead to similar defective contact or malfunctioning. Therefore, avoid the use of highly humid measured gas.

If the measured gas contains silicone gas generated from silicone (oil, grease, filler, etc.), silicone oxide may be generated and accumulated at the contact due to an arc at the time of opening/closing of the contact, which may lead to defective contact of a contact. Therefore, remove the silicone gas generation source or implement arc suppression measures.



## Warranty

### Warranty period

The warranty period for our product is one (1) year from delivery to the location specified by the orderer who makes a direct transaction with us.

### Scope of warranty

If any failure or defect attributable to us becomes clear during the above warranty period, we will repair the product or supply a substitute product free of charge. However, even during the warranty period, we will exclude the product from the scope of the warranty if the failure or defect corresponds to any of the following:

- (1) The failure or defect was caused by an unreasonable condition, environment, handling, or usage not mentioned in the instruction manual, specifications, and our product catalog.
- (2) The failure or defect was caused by a factor other than our product.
- (3) The failure or defect was caused by a modification or repair conducted by a party other than us.
- (4) The failure or defect was caused by an event that could not be foreseen at the scientific and technical levels at the time of product shipment from us.
- (5) The failure or defect was caused by an external factor not attributable to us, such as acts of God and disasters.

Please note that the warranty mentioned here means the warranty for our individual product, and damage provoked by a failure or defect of the product is excluded from the scope of the warranty.

\*This warranty is valid only in Japan.

## Application and usage

Our products are designed and manufactured as general-purpose instruments for general industries.

Therefore, our products are not intended for the following uses, and our products used in such a manner are outside the scope of application.

- (1) Equipment that is anticipated to greatly affect lives and properties, such as nuclear power generation, aviation, railways, marine vessels, vehicles, and medical devices
- (2) Utilities that include electricity, gas, and service water
- (3) Use in outdoor locations and under similar conditions or environments other than those stipulated in the instruction manual
- (4) Usage to which considerable safety consideration and attention equivalent to (1) and (2) above need to be given

## Service

### Scope of service

Because the product price does not include service expenses, such as the dispatch of engineers, we will separately charge for the expenses in the following cases:

- (1) Instruction for installation and adjustment and a witnessed test run
- (2) Maintenance inspection, adjustments, and repairs
- (3) Technical guidance and technical education
- (4) Witnessed inspections of products at our factory

<<Note>> The product specifications and information in this catalog are subject to change without prior notice for product improvement or other reasons.

● For order placement, contact

General agent  **Manostar Shop Co., Ltd.**

1-2-3 Nishishiriike-cho, Nagata-ku, Kobe City, Hyogo 653-0031  
TEL. +81-78-621-7000 FAX. +81-78-621-7788

Manufacturer  **Yamamoto Electric Works Co., Ltd.**

1-2-3 Nishishiriike-cho, Nagata-ku, Kobe City, Hyogo 653-0031  
TEL. +81-78-631-6000 FAX. +81-78-631-6020