Pressure Detection Equipment

For Gas | **For Gas and Liquid** | **Monitor (Controller)**

INDEX

Pressure Sensor Product Variations

Applicable fluids

For Gas
Silicon diaphragm

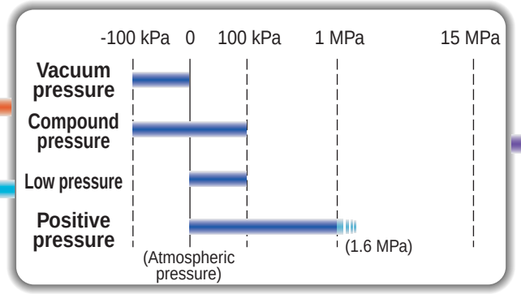
- Air, Nitrogen, Argon, Carbon dioxide

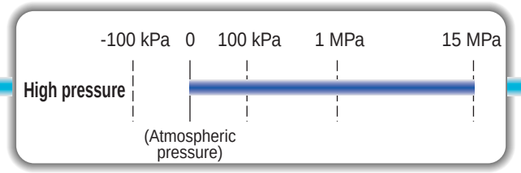
For Gas and Liquid
Stainless steel diaphragm

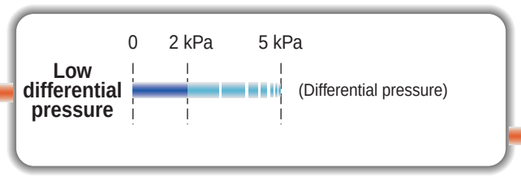
- Liquids such as water, oil, etc. Air, Nitrogen, Argon, Carbon dioxide
- Anti-corrosiveness, Airtightness

Pressure range

"Pressure range and application examples" Pages 138 to 140







Product type

Digital

Output type: Switch output, Analog output, Digital display

- Sensor/Display self-contained
- Numerically displays the setting and measurement values.

Switch

Output type

- Sensor only product
- ON/OFF confirmed by LED

Sensor

Output type

- Sensor only product
- Can be connected to a separate monitor.

Monitor

Output type

- Sensor type display
- Numerical control can be placed in a distant location.

Corresponding model

For Air	For Air/Liquid
Page 134	Page 134
• Series Z/ISE30 • Series Z/ISE40 • Series ISE70 • Series Z/ISE3	• Series Z/ISE80 • Series Z/ISE50 • Series Z/ISE60 • Series ISE75 (for high pressure)
Page 135	
• Series Z/ISE1 • Series Z/ISE2 • Series PS1000/1100	
Page 136	Page 136
• Series PSE530 • Series PSE540 • Series PSE550	• Series PSE560
Page 137	
[For 1 ch] • Series PSE300 [For 4 ch] • Series PSE200	

Functions and environment

Page 144		Pages 134 to 137
Functions	Auto shift function, Auto preset function, Display calibration function, Key lock function, Anti-chattering function, Peak/Bottom hold function	Refer to "General Performance Table".
Page 143		
Adaptable to different environments	Clean room, Copper free/Fluorine free, Oil free, Silicon free, Fluorine free, Low density ozone gas compatible	

General Performance Table (For Gas)

Model Selection Table

Self-contained Type

Model	ZSE30 ISE30	ZSE40(F) ISE40	ISE70	ISE75 ISE75H	ZSE80(F) ISE80(H)	ZSE50F ISE50	ZSE60F ISE60	ZSE3 ISE3	ZSE1 ISE1	ZSE2 ISE2	ZSP1	PS1000 PS1100
Fluid	General pneumatic			General fluids				General pneumatic				
Calibration method	Push-button calibration								Trimmer calibration			
Set pressure range	–101 to 101 kPa –0.1 to 1 MPa	–100 to 100 kPa 10 to –101.3 kPa –0.1 to 1 MPa	0 to 1 MPa	0.4 to 10 MPa 0.5 to 15 MPa	–110 to 110 kPa 10 to –111 kPa –0.105 to 1.1 MPa –0.105 to 2.2 MPa	–100 to 100 kPa –0.1 to 1 MPa		0 to 98 kPa 0 to 0.98 MPa 0 to –101 kPa	0 to 100 kPa 0 to 1 MPa 0 to –101 kPa		–20 to –101 kPa	–0.1 to 0.45 MPa –0.1 to 0.4 MPa
Power supply voltage	12 to 24 VDC±10% (Ripple ±10% or less)											
Temperature characteristics (based on 25°C)	±2% F.S. or less (0 to 50°C)			±3% F.S. or less (0 to 50°C)				±3% F.S. or less (0 to 60°C)				±3% F.S. or less (0 to 60°C)
Repeatability	ZSE30: ±0.2% F.S ± 2 digit or less ISE30: ±0.2% F.S ± 1 digit or less	±0.2% F.S. ±1digit or less	±0.5% F.S.		±0.2% F.S.±1 digit or less			±1% F.S. or less				
Hysteresis	Hysteresis mode: Variable Window comparator mode: Variable	Hysteresis mode: Variable Window comparator mode: Fixed (3 digits) Digit is min. calibration unit.	Hysteresis mode: Variable Window comparator mode: Variable		Hysteresis mode: Variable Window comparator mode: Fixed (3 digits) Digit is min. calibration unit.				Variable 1 to 10% Fixed 3% F.S. or less	Fixed 3% F.S. or less	Fixed 0.5 kPa	Fixed 4% F.S.
Output	NPN/PNP open collector Analog voltage output Analog current output	NPN/PNP open collector Analog voltage output	1 setting NPN/PNP 2 settings NPN/PNP open collector PNP open collector		NPN/PNP open collector Analog voltage output Analog current output	NPN/PNP open collector Analog voltage output		NPN open collector Analog voltage output	NPN/PNP open collector Analog voltage output	NPN/PNP open collector	NPN open collector	2-wire type
Display (Resolution)	2-color LCD display (0.1%)	LED display (0.1%)	2-color LCD display (1%)		2-color LCD display (0.1%)	LED display (0.1%)		LCD display (1%)				
Enclosure	IP40	IP65	IP67		IP65			IP40				IP40
Note	Panel mounting possible Selectable pressure unit Anti-chattering function Display calibration function	Panel mounting possible Selectable pressure unit Anti-chattering function Auto shift function Compound pressure	Selectable pressure unit Anti-chattering function Display calibration function		R thread, URJ, TSJ Panel mounting possible Selectable pressure unit Anti-chattering function Auto shift function Display calibration function Eco mode	R thread Panel mounting possible Selectable pressure unit Anti-chattering function Auto shift function	URJ TSJ Panel mounting possible Selectable pressure unit Anti-chattering function Auto shift function	For use with ZX ejector Self-diagnostic function Failure diagnostic output function Peak hold Bottom hold	For use with ZM ejector	For use with ZX or ZR ejector	Small diameter nozzles Adsorption confirmation For use with ZX ejector	
Page	P. 695	P. 705	P. 719	P. 719	P. 729	P. 747	P. 747	P. 763	P. 773	P. 779	P. 787	P. 791

General Performance Table (For Gas and Liquid)

Model Selection Table

Sensor

Model	PSE53□	PSE54□	PSE550	PSE56□
				
Fluid	General pneumatic		General pneumatic	General fluids
Calibration method				
Set pressure range	0 to 1 MPa 0 to –101 kPa 0 to 101 kPa –101 to 101 kPa	0 to 1 MPa 0 to –101 kPa –100 to 100 kPa	0 to 2 kPa	0 to 1 MPa 0 to –101 kPa –100 to 100 kPa 0 to 500 kPa
Power supply voltage	12 to 24 VDC±10% (Ripple ±10% or less)			
Temperature characteristics (based on 25°C)	±2% F.S. or less (0 to 50°C)		±3% F.S. or less (0 to 50°C)	±2% F.S. or less (0 to 50°C) ±3%F.S. or less (–10 to 60°C)
Repeatability	±1% F.S. or less	±0.2% F.S. or less	±0.3% F.S. or less	±0.2% F.S. or less
Hysteresis				
Output	Analog voltage output		Analog voltage output Analog current output	
Display (Resolution)				
Enclosure	IP40		IP40	IP65
Note				
Page	P. 825	P. 831	P. 834	P. 837

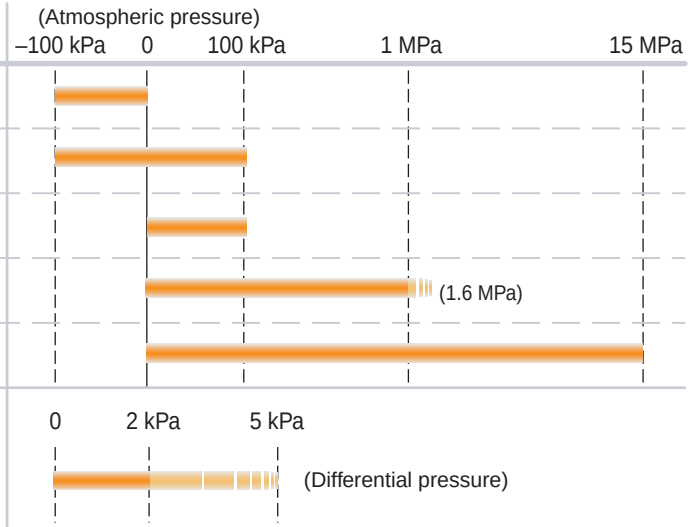
Model Selection Table

Monitor (Controller)

Model	PSE200	PSE300
		
Sensor input amount	4 inputs	1 input
Calibration method	Push-button calibration	
Set pressure range	–0.1 to 1 MPa 10 to –101 kPa –101 to 101 kPa –10 to 100 kPa	–0.1 to 1 MPa 10 to –101 kPa –101 to 101 kPa –10 to 100 kPa –50 to 500 kPa –0.2 to 2 kPa
Power supply voltage	12 to 24 VDC±10% (Ripple ±10% or less)	
Temperature characteristics (based on 25°C)	±0.5% F.S. or less (0 to 50°C)	
Repeatability	±0.1% F.S. ±1 digit or less	±0.1% F.S. or less
Hysteresis	Hysteresis mode: Variable Window comparator mode: Fixed (3 digits)	Hysteresis mode: Variable Window comparator mode: Variable
Output	NPN/PNP open collector 1 CH: 2 outputs 2 to 4 CH: 1 output	NPN/PNP open collector 2 outputs Analog voltage output Analog current output
Display (Resolution)	Single-color LCD display (0.1%)	2-color LCD display (0.1%)
Enclosure	Front only IP65 The rest IP40	IP40
Note	Panel mounting possible Auto shift function Display calibration function Anti-chattering function Copy function Selectable pressure unit	Panel mounting possible DIN rail mountable Auto shift function Display calibration function Anti-chattering function Selectable pressure unit
Page	6 P. 840	6 P. 846

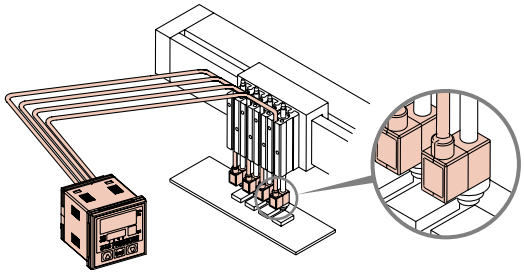
Pressure Range and Application Examples

Application examples	Pressure range
• Absorption confirmation	Vacuum pressure
• Absorption confirmation (confirmation of release pressure)	Compound pressure
• Workpiece placement verification	Low pressure
• Supply pressure confirmation • Leak test	Positive pressure
• Liquid coolant pressure control	High pressure
• Monitoring filter clogging • Level detection of a liquid	Low differential pressure



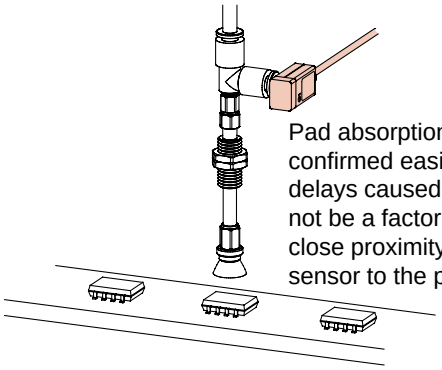
Absorption Confirmation

Sensor installed close to a pad
(No. 1)



Due to the small size, the sensor can be installed close to a pad.
Calibration is easy with the auto preset function.

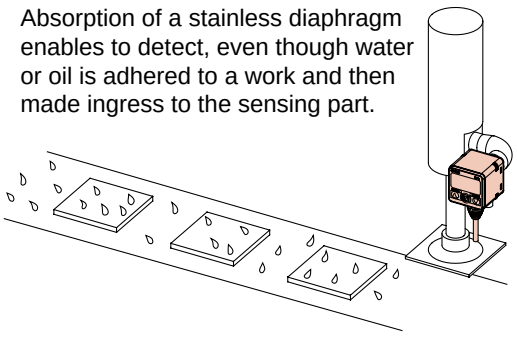
Sensor installed close to a pad
(No. 2)



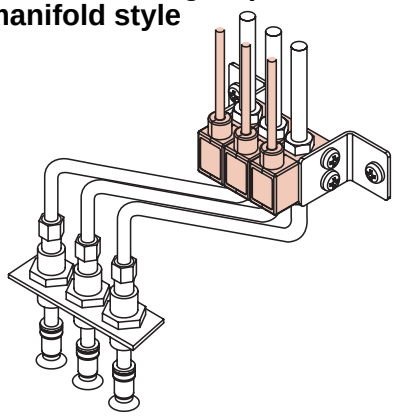
Pad absorption can be confirmed easily. Response delays caused by piping will not be a factor, due to the close proximity of the sensor to the pad.

Absorption confirmation of a workpiece absorbed with moisture

Absorption of a stainless diaphragm enables to detect, even though water or oil is adhered to a work and then made ingress to the sensing part.

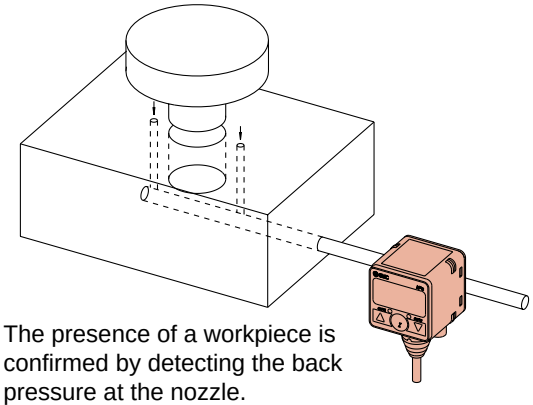


Installation of a group of sensors in a manifold style



Placement Verification

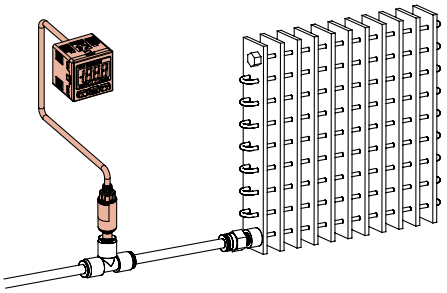
Confirmation of a workpiece presence simply



The presence of a workpiece is confirmed by detecting the back pressure at the nozzle.

Leak Test

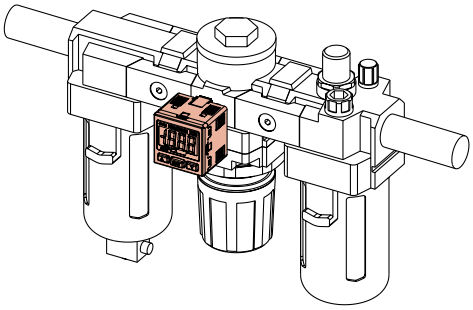
Inspection of a radiator



A low pressure sensor (PSE532-☐) is used to detect minute differences. The auto shift function reduces the influence of fluctuations in the supply pressure.

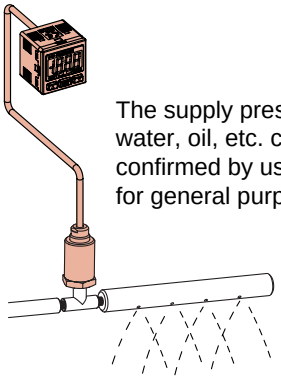
Supply Pressure Confirmation

Confirmation of airline supply pressure



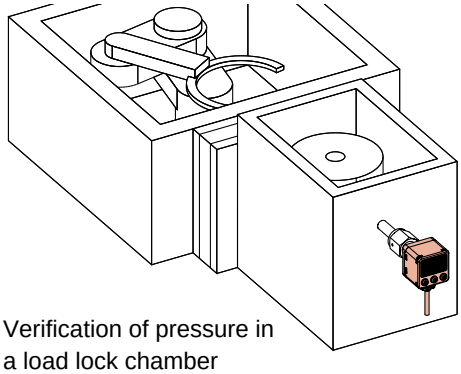
The line pressure can be adjusted by monitoring the digital readout which provides a visual verification of the operating pressure. The output can be programmed to respond to supply pressure drops, etc.

Confirmation of supply pressure in washing line



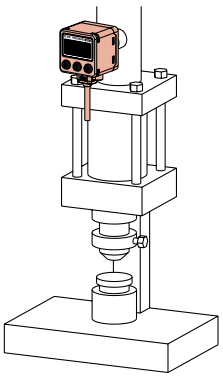
The supply pressure of water, oil, etc. can be confirmed by using a sensor for general purpose fluids.

Confirmation of atmospheric pressure for a load lock chamber



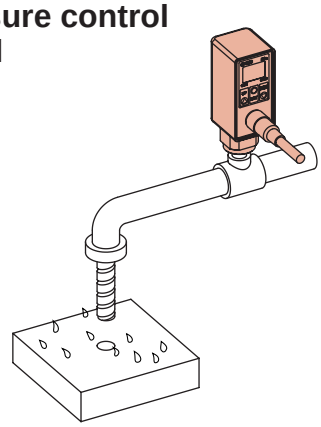
Verification of pressure in a load lock chamber
(vacuum spare chamber of the main chamber)

Verifies caulking by a hydraulic cylinder

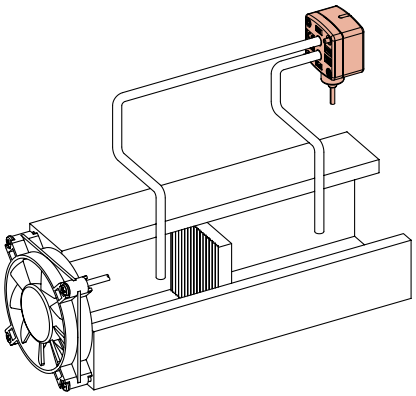


Liquid Coolant Pressure Control

Liquid pressure control of a gun drill

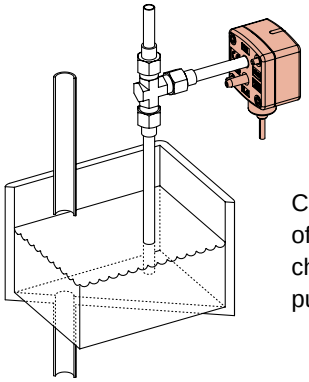


Monitoring Filter Clogging



The filtration and replacement periods can be controlled by monitoring the clogging of the filter.

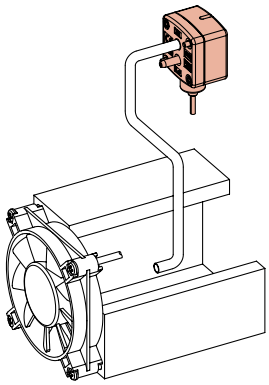
Level Detection of a Liquid



Can detect the level of a liquid through changes in the purge pressure.

Air Flow Control

Series PSE550



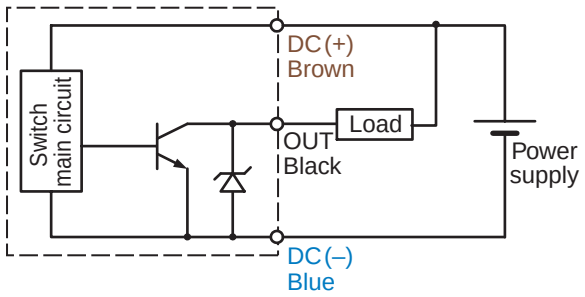
Can monitor the air flow in the duct and control air blasts.

Output Type

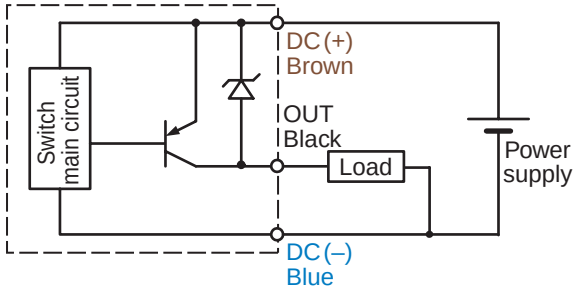
Switch output (ON/OFF output)

• Detects when the limit value exceeds the set value and generates an output for a switch.

NPN output type



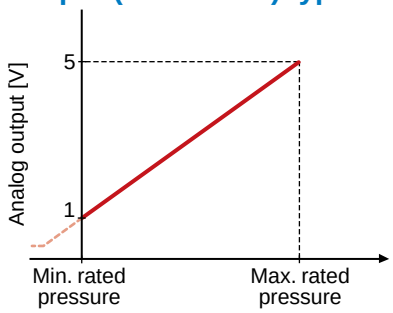
PNP output type



Analog output

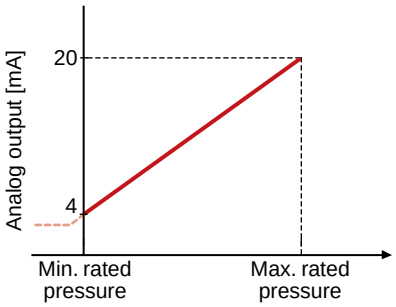
• The voltage, and current output are in proportion to the pressure.

Voltage output (1 to 5 V DC) type



Current output (4 to 20 mA DC) type

Effective for long distance transmission (more than 10 m).



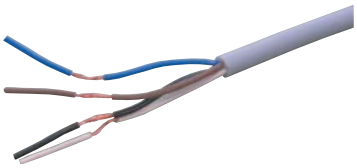
Wiring Specifications

Cable end option

Standard

Tinned

Half-stripped



Made to Order

We can provide the cable with a connector from the shown manufacturers. (Tyco Electronics AMP K.K., Molex, J.S.T. Mfg. Co., Ltd., Hirose Electric Co., Ltd., 3M, etc.)

Pre-wired — Made to Order

We will prepare the cable with a M8 or M12 connector.

M8 connector

M12 connector

Available with 2 to 4-wire sensors.
(5-wire sensors can be used without using 1 wire.)

Cable length

Standard

0.6 m, 2 m, and 3 m

Made to Order

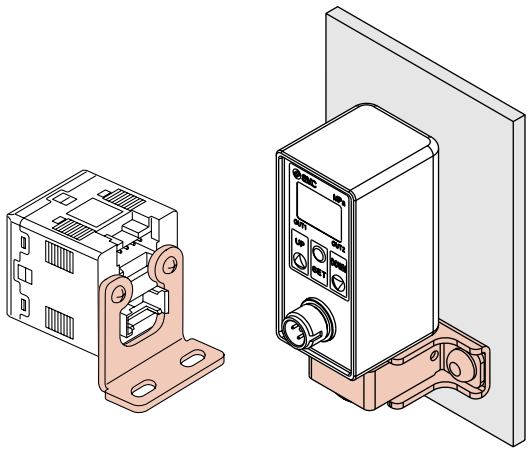
Available up to 10 m.

Flexible cable — Made to Order

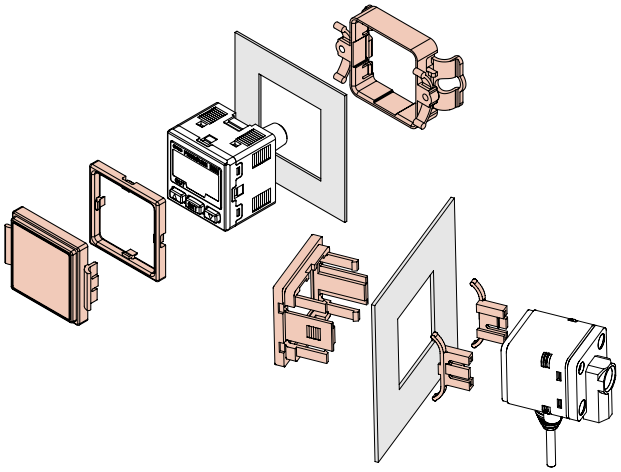
The flexible cables (robot cable) are suited for applications having excessive movement or bends.

Type of Mounting

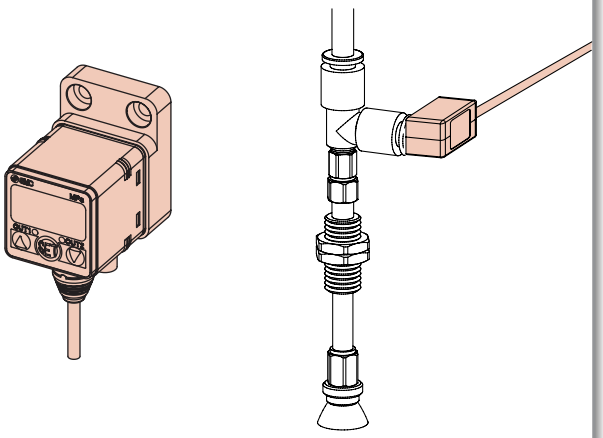
Bracket



Panel mount



Direct mount



Type of Piping

Fittings

Steel piping is available with PT thread (R thread/Rc thread), NPT thread, NPTF thread, PF thread (G thread), TSJ thread, URJ thread, and M thread.

Compatible with 1/8 or 1/4 inch port size, but not with M thread.

M thread is available with 3 mm or 5 mm.

One-touch fittings/Plug-in reducer

One-touch fittings

Straight and elbow fittings are available in mm and inch diameter.

Plug-in reducer

Compatible with the smaller size ø4, ø6.
Can be connected with One-touch fitting directly.
Easy handling. Maintenance is good.

Adaptable to Different Environments

Clean room — Series 10-

Application
- To prevent particles from entering a clean room.

Details
- After inspection, blowing with a high purity air (Clean/Class 100) is performed inside of a clean environment.
- Packaging consists of an antistatic protection bag, which is double packaged before being shipped.
- Grease free for the wetted parts' seals

Copper free, Fluorine free — Series 20-

Application
- Suitable in environments where copper ions are not allowed. For example, CRT manufacturing or front-end semiconductor manufacturing process equipment.

Details
- Application of material which does not include copper in wetted parts (or electroless nickel plated treatment).

Oil free — Made to Order

Application
- Suitable in environments where oils are not allowed. For example, in a nitrogen or oxygen supply line.

Details
- Any components which include oil are not used. (e.g. NBR coated with oil, etc.)
- No grease is used in the product assembly. (Grease free)

Silicon free — Made to Order

Application
- Suitable in environments where siloxane, the gas emitted from silicon, is not permitted.

Details
- Any components which contain silicon are not used.
- Since a pressure sensor with a silicon diaphragm is not permitted, one with a stainless steel diaphragm is used.

Fluorine free — Made to Order

Application
- Suitable in environments where fluorine based resins can not be used.

Details
- Fluorine based greases are not used.
- FKM is not used for the seals.

Low density ozone gas compatible — Made to Order

Application
- Suitable in environments where low density ozone gas is generated.

Details
- FKM is used for the seals.
- Sensor parts and resin materials are the same as those used for standard products.

Functions

Auto shift function

Summary

Function to correct the pressure setting of the switch output when there is a pressure fluctuation in the main line.

For example, when the main line pressure increases by 50 kPa, at the time of auto shift signal input, the pressure setting will be increased by 50kPa, accordingly.

Application

For compensating for the main line pressure fluctuation during absorption confirmation.

Auto preset function

Summary

Function to automatically optimize the setting for absorption confirmation.

Application

To easily setup the absorption confirmation.

Display calibration function

Summary

Function to prevent inconsistent output values and to allow the adjustment of the display values.

Application

When multiple sensors are used, the differences among the units can be eliminated and the displayed valves for each sensor can be adjusted to read the same.

Key lock function

Summary

Function to prevent the changing of settings other than those for normal key operations.

Application

For preventing a malfunction due to unauthorised changes in set-up.

Anti-chattering function

Summary

Function to prevent detection of any momentary pressure fluctuation. Averages the pressure values detected during the response time, which is set by the user.

[Response time]
Selectable from 20 ms, 160 ms, 640 ms, or 1280 ms.

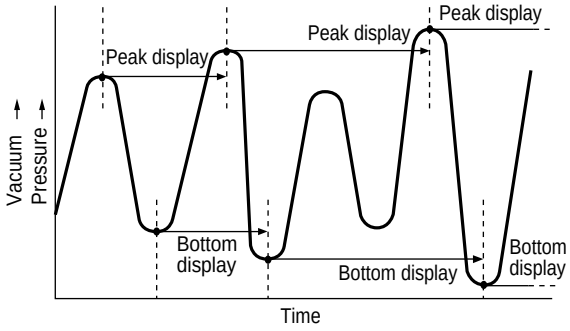
Application

For preventing a momentary fluctuation in the main line pressure from being detected as an abnormal pressure during the actuator's or ejector's operation.

Peak/Bottom hold function

Summary

Function to detect and display the fluctuating pressure peak (maximum value) and bottom (minimum value).



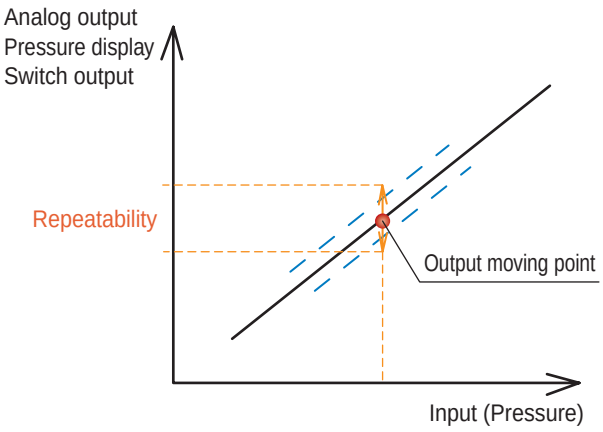
Application

- For confirming the maximum or minimum pressure being measured.

Accuracy

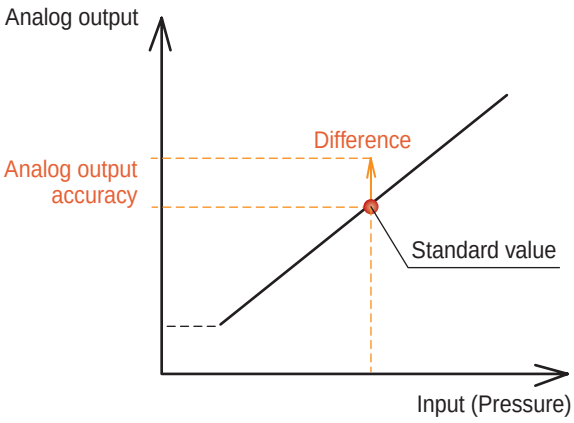
Repeatability

This graph shows the repeatability of an analog output, pressure display and a switch (ON-OFF) output's moving point. The pressure is increased or decreased under normal temperature (25°C).



Analog output accuracy

This graph shows the difference between the analog output voltage (current) standard value versus the input pressure, at a normal temperature (25°C).



Glossary of Terms

UL/CSA standards

UL and CSA standards have been applied in North America (U.S.A. and Canada) symbolizing safety of electrical products, and are defined to mainly prevent danger from an electrical shock or fire, resulting from trouble with the electrical products. The power supply of the SI unit is 24 V DC, which does not meet the voltage requirement for the electrical shock category. However, measures against a fire hazard have been taken.
Some SI units are **UL/CSA** certified.

CE marking

CE marked products or equipment that are imported to countries that are EU members must conform to the EC directives.
SMC products are subject to either or both the low power voltage directive (regarding electrical safety) and the EMC directive (regarding noise conformity).
The operating voltage of the sensors is 24 V DC, therefore it is not subjected to the low voltage directive (50 to 1000 V AC or 75 to 1500 V DC).
The sensors undergo EMC testing by a third party and bears the **CE marking** (self-declaration).
Since the product is a component which is ultimately integrated into the user's equipment machine or facility, the user must confirm that the product conforms to the EC directive.

Enclosure

The **enclosure** is rated according to the IP (International Protection) standards (IEC60529) which defines protection against dust or water.

IP40: Is not protected against the water intrusion, even though a wire exceeding 1.0 mm in diameter can not enter.

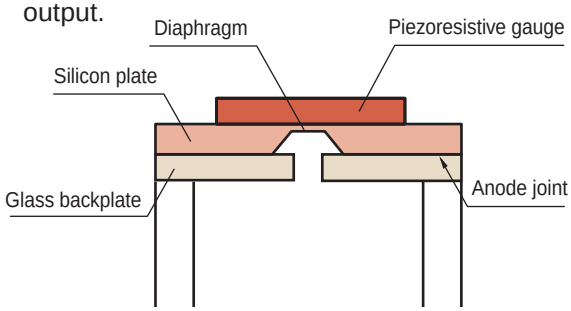
IP65: Powdered dust cannot enter the enclosure and the enclosure is not affected by water sprayed from all directions.

IP67: Powdered dust cannot enter the enclosure, as well as water, even though the enclosure is immersed in water with a specified pressure and time.

Working Principle of Pressure Sensors

Silicon diaphragm pressure sensor

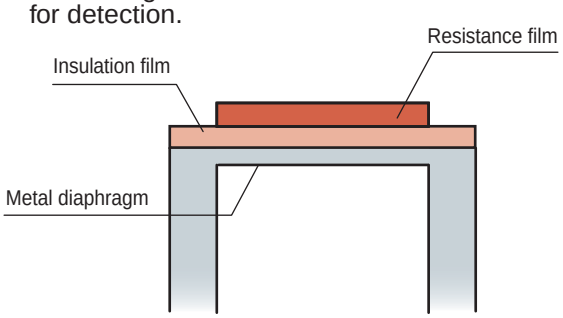
- The diffused piezoresistive gauge is formed like four bridges on a monocrystal silicon plate.
- The silicon plate consists of the diaphragm. If a pressure is applied, the diaphragm will deform.
- Changes in the resistance values of the piezoresistive element, which is caused by the surface strain generated by the diaphragm deformation, are detected and used as an output.



Silicon diaphragm sensor construction

Stainless steel diaphragm pressure sensor

- The bridge circuit is formed during the construction of the insulation film, electric pole film and resistance film on the stainless steel diaphragm.
- If a pressure is applied, the diaphragm will deflect and the resistance value of the strain gauge will change.
- The changes in the resistance values are output for detection.



Stainless steel diaphragm sensor construction

Pressure Type

- There are two types of pressures: The Gauge Pressure, and Absolute Pressure. The gauge pressure is based on the atmospheric pressure. Whereas the absolute pressure is based on the absolute vacuum. (The gauge pressure will change in accordance with the atmospheric pressure change.)
- All of our products are made based on the gauge pressure.