SMC Electronic Switch Series Variations

Model Selection Table

Self-contained Style

Model	ZSE1 ISE1	ZSE2 ISE2	PS1000 PS1100	GS40	ZSP1	ISA	ZSE3 ISE3
							
Fluid	General pneumatic						
Calibration method	Trimmer calibration						
Calibration pressure range	0 to 100kPa 0 to 1MPa –101 to 0kPa		–0.1 to 0.45MPa –0.1 to 0.4MPa	0 to 0.98 MPa	–101 to –20kPa	0.1 to 0.2MPa (Detection zone 10 to 300μm)	0 to 98kPa 0 to 0.98MPa –101 to 0kPa
Voltage	12 to 24V DC (Ripple ±10% or less)						
Temperature characteristics	±3% F.S.or less (0 to 60°C)	±3% F.S.or less (5 to 40°C) ±5% F.S. or less (0 to 60°C)	±3% F.S.or less (0 to 60°C)	±3% F.S. or less (5 to 40°C) ±5% F.S. or less (0 to 60°C)		±10 μm (0 to 60°C)	±3% F.S.or less (0 to 60°C)
Repeatability	±1% F.S. or less						
Hysteresis	Variable 1 to 10% Fixed 3% F.S. or less	Fixed ±3% F.S. or less	Fixed 4% F.S.	Fixed ±3% F.S. or less	Fixed 0.5kPa	10μm or less	
Output type	NPN/PNP Open collector Analog output	NPN/PNP Open collector	2 wire type	NPN Open collector		NPN/PNP Open collector	NPN Open collector Analog output
Display (Resolution)				LCD (1%)		LED Level meter	LCD (1%)
IP Rating						IP66	
Note	For use with ZM ejector	For use with ZX or ZR ejector		Digital display User selectable units	Adsorption confirmation switch For use with ZX ejector	Position Confirmation 6-station manifold available	For use with ZX ejector Self diagnosis function Failure diagnostic output function Peak hold Bottom hold
Page	**3.9-1 to 3.9-4**	**3.10-1 to 3.10-6**	**3.7-1, 3.7-2**	**3.6-1 to 3.6-4**	**3-11-1 to 3.11-4**	**3.8-1 to 3.8-8**	**3.5-1 to 3.5-8**

					Separate Style	
ZSE4 ISE4	**ZSE4B ISE4B**	**ZSE4E ISE4E**	**ZSE5B ISE5B**	**ZSE6B ISE6B**	**PSE10□ + PSE51□** Controller	**PSE10□ + PSE520**
						
			General purpose fluids		General pneumatic	General purpose fluids
Push-button calibration					Push-button calibration	
to 100kPa to 1MPa 01 to 0kPa	–10 to 100kPa –0.1 to 1MPa –101 to 10kPa		–100 to 100kPa –0.1 to 1MPa		–10 to 100kPa –0.1 to 1MPa –101 to 10kPa	–0.1 to 1MPa
±3% F.S. or less (0 to 50°C)					±2% F.S. or less (Total) (0 to 50°C) ∗Total of controller and sensor	±3.5% F.S. or less (Total) (0 to 50°C) ∗Total of controller and sensor
					±0.5% F.S. or less (Total)	
ysteresis mode: Variable /indow comparator mode: Fixed (3 digits) Digit is min. calibration unit.			Hysteresis mode: Variable Window comparator mode: Fixed (3 digits: ISE5B/6B) (2 digits: ZSE5B/6B) ∗Digit is min. calibration unit.		Hysteresis mode: Variable Window comparator mode: Fixed (2% F.S.)	
NPN/PNP Open collector Analog output					NPN/PNP Open collector 2 output x 2CH	
LCD (1%)	With backlight LCD (1%)	LED (1%)	With backlight LCD (1%)		LED (0.1%)	
For use with ZSE/ISE4□D only					Controller front IP66	Controller front IP66 Sensor part IP65
For use with ZL ejector Panel mounting possible Display unit selectable Self diagnostic Auto preset (ZSE4E/ISE4E only) Peak hold Bottom hold			PT thread Panel mounting possible Display unit selectable Peak hold Bottom hold	URJ TSJ Panel mounting possible Display unit selectable Peak hold Bottom hold	Panel mounting possible Display unit selectable Self diagnosis Auto preset Peak hold Bottom hold	
3.2-15 to 3.2-20	**3.2-9 to 3.2-14**	**3.2-1 to 3.2-8**	**3.3-1 to 3.3-8**	**3.4-1 to 3.4-6**	**3.1-1 to 3.1-14**	

SMC Mechanical Pressure Switch Series Variation

Model Selection Table

Positive Pressure

Model	IS1000	IS3000	ISG11□/ISG21□
			
Fluid	General pneumatic		
Calibration method			
Calibration pressure range	0.1 to 0.4MPa	0.1 to 0.7MPa	0.01 to 0.3MPa
Voltage	to 100V DC to 100V AC	24 to 125V DC 100 to 250V AC	
Repeatability	±5% F.S.	±5% F.S.	±3% F.S.
Hysteresis (Calibration range of ISG)	0.08MPa or less	0.05MPa or less	0.01 to 0.2MPa
Contact	1a	1ab	
IP Rating			
Note	Optional calibration Pressure range 0.1 to 0.6MPa (-X202)	Micro-load type available Available indicator light	
Page	**3.12-1, 3.12-2**	**3.12-3, 3.1-4**	

		Negative Pressure	
ISG12□/ISG22□ 	**ISG13□/ISG23□** 	**ISG19□/ISG29□** 	**ZSM1** 
General purpose fluids			General pneumatic
Pressure adjustment screw			
0.02 to 0.7MPa	0.05 to 1.0MPa	–100 to –7kPa	–80 to –27kPa
24 to 220V DC 100 to 550V AC			10 to 26V DC (ZSM1-115) 100V AC (ZSM1-121)
±3% F.S.	±3% F.S.	±3% F.S.	±10% F.S.
0.02 to 0.35MPa (Without pointer scale) 0.02 to 0.45MPa (With pointer scale)	0.03 to 0.4MPa (Without pointer scale) 0.03 to 0.6MPa (With pointer scale)	7 to 53kPa	15kPa or less (ZSM1-115) 20kPa or less (ZSM1-121)
1a1b			NPN open collector (ZSM1-115) 1a (ZSM1-121)
Available ISG2□□ only			
2ab contact type (option) With light (Refer to Series IS2761.)			ZM ejector
3.12-5 to 3.12-8			3.13-1 to 3.13-3

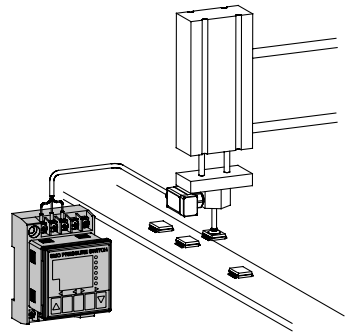
Application Examples

The applications shown below are for reference only.
Application requirements should be considered for appropriate model selection.

Adsorption Confirmation

1 Sensor installed close to the pad

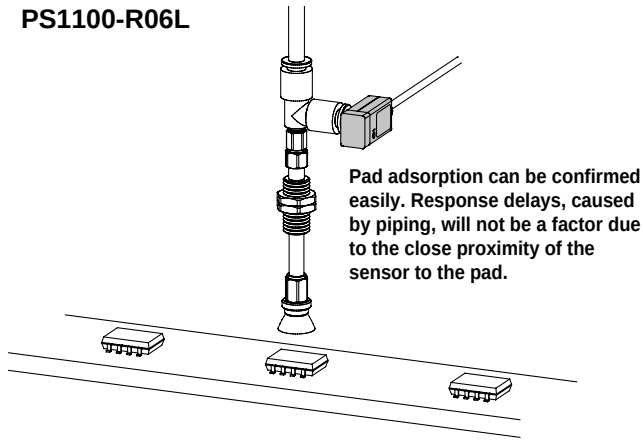
PSE511 + PSE100



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

2 Sensor installed close to the pad

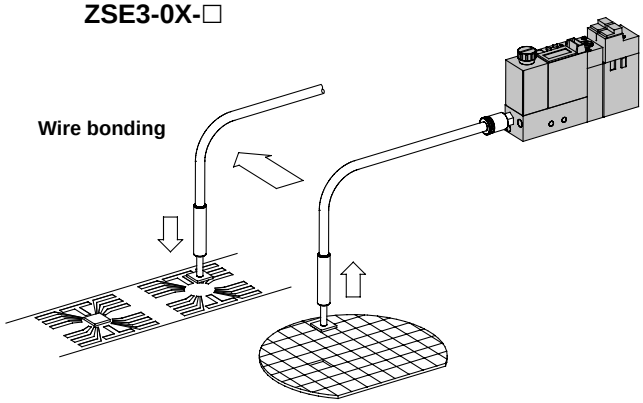
PS1100-R06L



Pad adsorption 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.

3 Vacuum ejector unit with integral vacuum switch

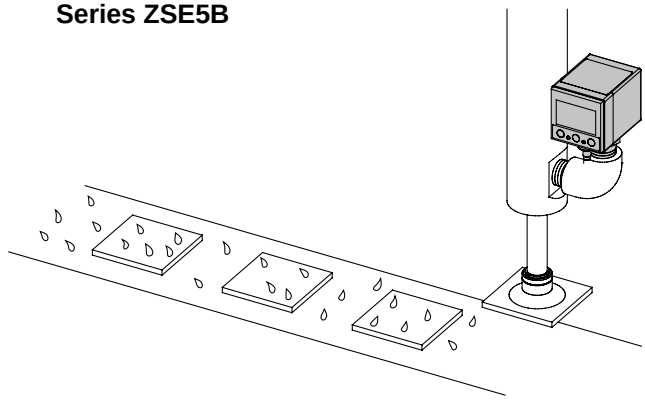
ZSE3-0X-□



The vacuum switch is an integral part of the vacuum ejector, small package, integrated vacuum filter.

4 Adsorption confirmation of work covered with water/oil

Series ZSE5B

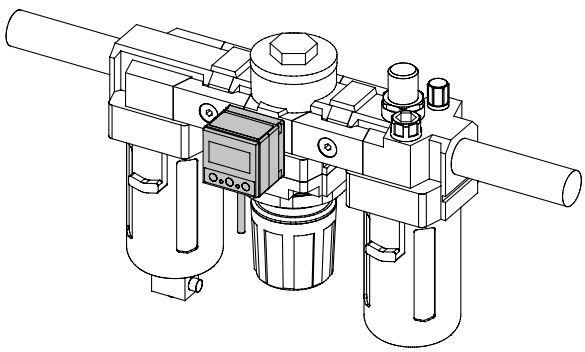


Due to the use of stainless steel for the wetted parts it is possible to handle work covered with water/oil.

Supply Pressure Confirmation

5 Confirmation of supply pressure in air line

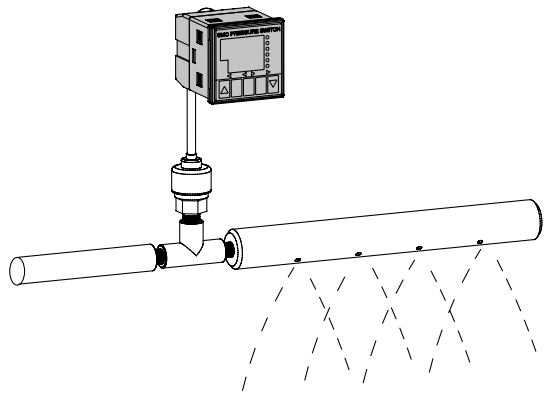
Series ISE4□



Pressure can be easily adjusted by monitoring the digital readout. Visual verification of the operating pressure. Output can be programmed to respond to supply pressure drops, etc.

6 Confirmation of supply pressure in a washing line operation

PSE520 + PSE100

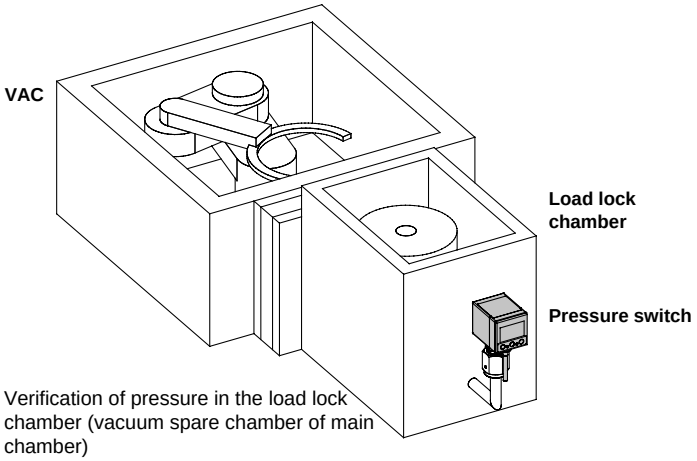


The supply pressure of water, oil, etc. can be confirmed with the sensor for general purpose fluids.

Supply Pressure Confirmation

7 Confirmation of atmospheric pressure for load lock chamber

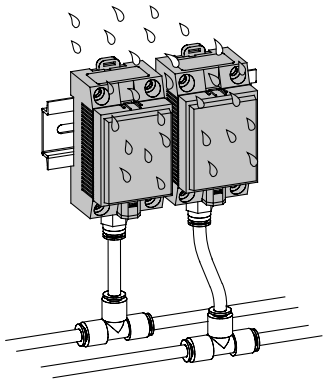
Series ZSE6B



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

8 Installation in adverse environments

Series ISE/ZSE4□D

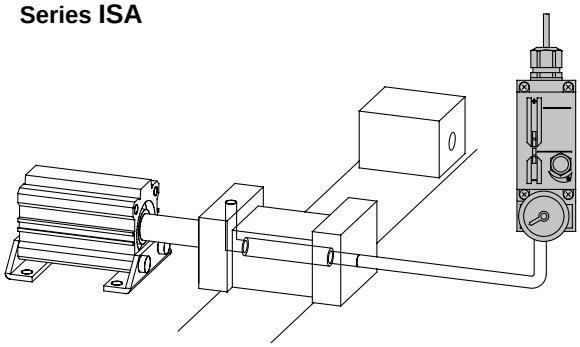


The series ISE4□D/ZSE4□D can be used in an adverse environment (exposure to dust and water), due to its IP66 rating.

Leak Test

9 Confiramation of small diameter holes

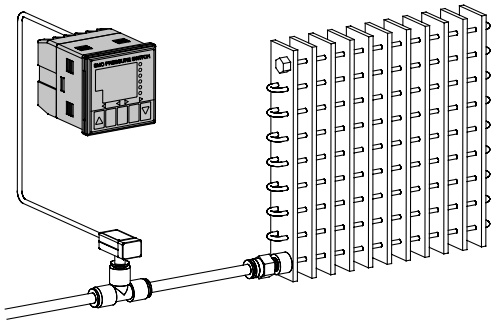
Series ISA



Back pressure sensor is used to confirm the completion of machining process for small diameter holes.

10 Radiator inspection

PSE512 + PSE100

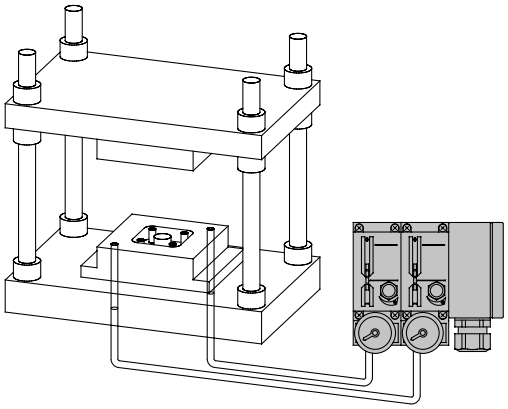


Low pressure sensor(PSE512-□) is used to detected minute differentiations. Primary pressure fluctuations are ignored due to the auto-shift function.

Work Placement Confirmation

11 Confirmation of correct work placement

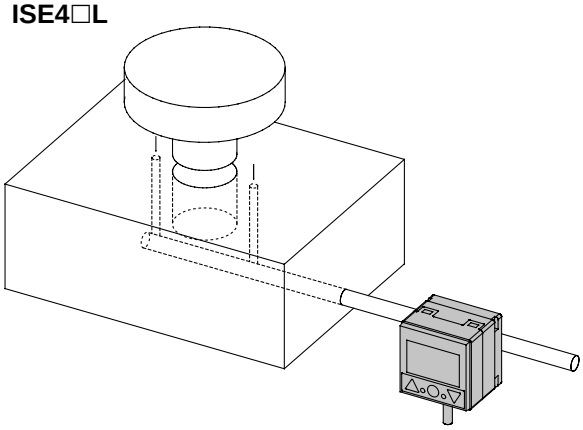
Series ISA



In high temperature applications, such as a die casting operation, the sensor can be mounted in a safe location.

12 Confirmation of work presence

ISE4□L



Presence of work is confirmed by detecting back pressure at the nozzle.

Pressure Switch/Precautions ①

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalog, and refer to text for precautions on every series.

System Design

⚠Warning

❶Operate the switch only within the specified supply voltage limits.

If supply voltage exceeds the rated voltage the switch might malfunction or could be damaged. It could also become a fire hazard.

❷Do not exceed the max. allowable load specification.

A load exceeding the max. load specification can lead to immediate damage to the switch or could shorten its operating life span considerably.

❸Do not use a load that generates a voltage surge.

The output section of the switch has built-in protection against voltage surges. This surge protection is only designed to absorb occasional surges. If inductive loads are being used, please use a switch which is specifically designed for that purpose.

❹Verify the process medium.

The switches do not have an explosion proof rating. To prevent a possible fire hazard, do not use these switches in flammable fluid or gas applications.

❺Do not use the switch outside the specified pressure range.

Damage to the switch may occur if the pressure sensor is subjected to higher pressures than its design parameters.

Installation

⚠Warning

❶If air leakage is present or increasing or the equipment is not operating properly, do not continue to use the equipment and check for the cause of the problem.

Verify proper installation after air and power is connected. The switch should be checked for proper operation and possible air leaks immediately after the initial installation.

❷Tightening torque

When installing the product, please follow the listed torque specifications. If torque is exceeded, damage to the mounting screw, mounting bracket or the switch itself may occur. If the screws are not tightened enough, the switch may come loose during operation.

Connection thread: M5, Rc(PT), NPT, NPTF

Please follow the torque ratings listed in the table below.

Thread	Tightening torque (Nm)
M5	1/6 rotations after tightening by hand
1/8	7 to 9
1/4	12 to 14
3/8	22 to 24

❸Apply wrench only to the metal hex. section when installing the switch.

DO NOT apply wrench to the plastic part of the main housing of the switch.

Wiring

⚠Warning

❶Verify the color and terminal number when wiring.

Wrong electrical hook-up can cause the switch to be damaged or malfunction.

❷Do not repeatably pull or bend the lead wire.

Repeated pulling or bending of the lead wire may cause some of the wires to break. If the lead wire of a grommet style switch is damaged, the whole switch has to be replaced.

❸Check the wiring for possible short circuits.

If some of the wires are short circuited, the switch may be damaged due to excessive current flow.

Environment

⚠Warning

❶Do not use the switch in hazardous environment.

In its standard configuration the pressure switch is not explosion proof. The presence of explosive gases therefore excludes the application of the switch.

Maintenance

⚠Warning

❶Verify proper operation of the switch on a regular basis.

Unexpected problems with a machine or equipment can be minimized by verifying the operation of the switch on a regular basis.

❷Interlock circuit

Set a few switches simultaneously when using in the interlock circuit to ensure the operation in such a case that one of switch is broken. Verify the operation of the switch and interlock function on a regular basis.

Digital Pressure Switch/Precautions ①

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalog, and refer to text for precautions on every series.

Selection

⚠Warning

❶Internal drop voltage

All of SMC's solid state pressure switches exhibit some level of internal voltage drop. On a three wire (four wire) switch this voltage level is low. However on a two wire switch this voltage level can be several volts. To ensure that the load connected to the switch is supplied with a adequate supply voltage, please use the following formula.

Power voltage − Internal drop voltage > Load operating voltage

❷Leakage current

A two wire switch design requires a minimal amount of current (1 mA or less) to flow through the switch in the OFF condition. This is necessary to power the electronic circuit of the switch. Normally this does not cause any problems. However if the switch is connected to the load that requires a current smaller than this leakage current to operate, the load would be energized even if the switch is in the OFF condition.

Load operating current > Switch leakage current

⚠Caution

❶Adsorption confirmation switch for presence of workpieces.

Use the Air Catch Sensor (back pressure sensor) Series ISA (dust/splash proof type) for correct placement of workpieces.

❷The calibration data is stored in an EDPROM.

The EDPROM is rated to keep its memory for up to 100,000 hours (approx. 11 years) without having power supplied.

Installation

⚠Warning

❶DO NOT drop or apply excessive force (1000m/s²) to the switch when handling.

Any damage to the switch, internal or external, could cause the switch to malfunction.

❷When handling the switch, hold it by the switch body and not the cable.

The tensile strength of the connection from cable to switch is 49N. If the applied force exceeds this specification, damage to the switch will occur.

❸Operation

Please refer to the operation manual on how to calibrate the switch using the push-buttons.

❹DO NOT touch the LCD readout.

Static electricity could cause the readout to change.

❺Calibration potentiometer (ISE/ZES1, ISE/ZSE2, PSI1□00)

When adjusting the potentiometer, please be careful not to turn the adjustment screw past its stop, otherwise damage to the potentiometer might occur.

❻Pressure port

DO NOT insert a wire or a similar item into pressure port.

Wiring

⚠Warning

❶Avoid close proximity to power or high voltage lines.

Electrical interface might cause the switch to malfunction.

❷DO NOT connect the power supply to the output wire directly. (2 wire switch)

If the switch changes to the ON condition without having a load connected, damage will occur due to excessive current flow.

❸Do not short-circuit the load. (3 wire switch)

The digital pressure switches will display an error code if the load is short-circuited, but it is impossible to protect the switch from wiring mistakes.

Keep in mind that pressure switches could be damaged if the load is short-circuited. Pay special attention when connecting the positive power supply wire (Brown) and the output wire (Black).

Digital Pressure Switch/Precautions ②

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalog, and refer to text for precautions on every series.

Piping

⚠Caution

❶Air hook-up

If the switch is used in a panel application, excessive stress might be exerted to the switch body by the bending of the air lines like plastic tubing, etc. Please prevent this form occurring by following proper installation guidelines.

Air Supply

⚠Warning

❶Check the temperature of the fluid to be monitored and the ambient temperature.

The operating temperature and ambient temperature for a digital pressure switch are 0 to 50°C and 0 to 60°C for all other pressure switches. Water vapors in the circuit to be measured may freeze if the temperature goes below 5°C and could damage the O ring or cause the switch to malfunction. The installation of an air dryer is recommended to remove any kind of moisture. Do not use in an environment where there would be a sudden change in the ambient temperature.

❷Vacuum switch

A short positive pressure pulse of up to 0.5MPa will not effect the performance of the switch. A continuous positive pressure of 0.2MPa will cause damage to the switch.

Environment

⚠Warning

❶Do not apply the switch in an environment where voltage surges are generated.

Installation of the switch in an area with surge voltage generating equipment such as electromagnetic lifters, high frequency induction furnaces, motors etc. could cause immediate damage to the switch or cause the switch to malfunction after a period of time. Some type of surge protection is recommended.

❷The switches are not waterproof in their standard configuration.

When requiring such environments, use water and dust resistant styles.

Maintenance

⚠Caution

❶Replacement of filter element

If the operation of the switch deteriorates due to clogging of the filter, replace the filter element (ZX1-FE). This only applies to the vacuum switches ZSE2, ZSP1 and ZSE3 when used with the ZX series vacuum ejector.

❷Cleaning of switch body

Wipe off the dirt with a soft cloth. If the dirt does not come off easily, use a synthetic detergent diluted with water. Use a soft dry cloth to wipe and dry the switch body afterwards.

Air Checker
Electronic Pressure Switch

Series PS1000
(For positive pressure)

PS1100
(For vacuum)

For General Pneumatics

Small, lightweight
electronic pressure switch

Extremely compact (1/3 size comparing with series ZSE2)

13W X 10H X 30L (mm) ⟨Standard type without connection part⟩

2 wire switch

Applicable to either NPN or PNP output.

Easy mounting

Plug-in port for One-touch fittings.

Wide calibration range

Calibration: –0.1 to 0.45MPa is possible
with one pressure switch.

High visibility

A large LED indicator for high visibility.

How to Order

PS □ 00 — R06 L

Output specifications

10	2 wire system (for positive pressure)
11	2 wire system (for vacuum and residual pressure)

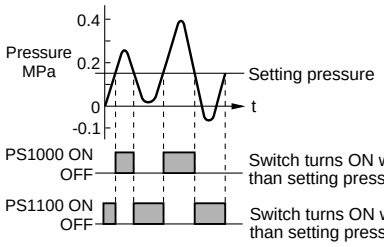
Port size

R06	ø6 reducer
R07	1/4 inch reducer

Lead wire length

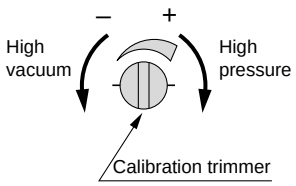
L	3m

Switch specifications



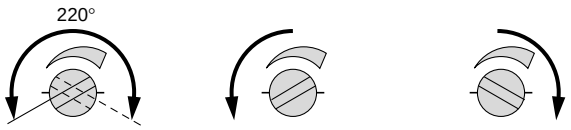
Pressure Switch Calibration

- Use the calibration adjustment to set ON pressure.
- Rotate clockwise to increase pressure setpoint. For setting vacuum, rotate counterclockwise.
- Use a bladed screw driver to adjust the setpoint.



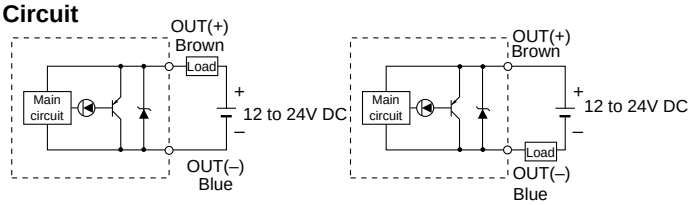
Trimmer

Rotation angle of the trimmer is 220°.
There is a stop provided to prevent the trimmer to rotate beyond it limits. Rotation beyond the limit can damage the trimmer. Adjust the trimmer gently within the rotation angle.

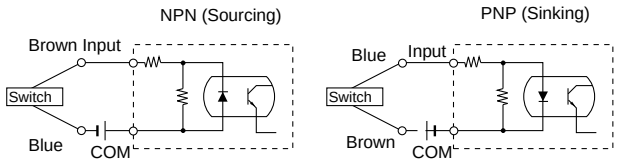


Internal Circuit/Wiring

Circuit



Example connection with a PLC



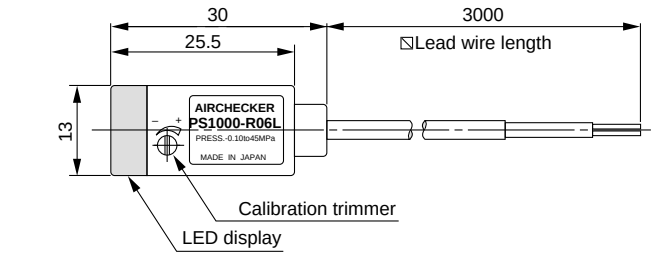
Specifications

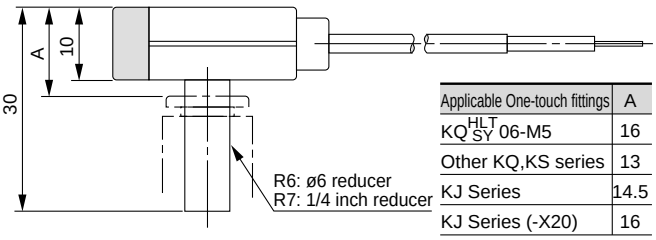
Model	PS1000-□L	PS1100-□L
Switch output	Present prss.≥Setting prss.: ON	Present prss.≤Setting prss.: ON
Max. pressure	1MPa	
Oper. Press. range	–0.1 to 0.45MPa	–0.1 to 0.4MPa
Fluid	Air, Non corrosive gas	
Operating display	ON: When red LED turns on	
Temp. specs.	±3% F.S. or less	
Repeatability	±1% F.S. or less	
Hysteresis	4% F.S.	
Load voltage	12 to 24V DC (Ripple ±10% or less)	
Load current	5 to 40mA	
Leakage	1mA or less	
Int. voltage drop	5V or less	
Operating temp.range	0 to 60°C (No condensation)	
Insulation resistance	Between external terminals and case 2MΩ (500V DC at megameter)	
Voltage resistance	Between external terminals and case 1000V AC 50/60Hz for 1 min.	
Vibration resistance	10 to 500Hz Pulse width 1.5mm or acceleration 98m/s^2 (at the smaller vibration) in X, Y, Z directions (2 hours)	
Shock resistance	980m/s^2 X, Y, Z directions (3 times for each direction)	
Weight	5g (Excluding lead wire)	
Port size	ø6 reducer, 1/4 inch reducer	
Construction	IP40	
Lead wire	Grommet oil-proof cabtire cord 2 wires ø2.55, 0.18mm^2, 3m	

⚠Caution

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instructions, precautions on the products mentioned in this catalog and common precautions, and refer to p.3.0-7 to p.3.0-9 for precautions on every series.

Dimensions



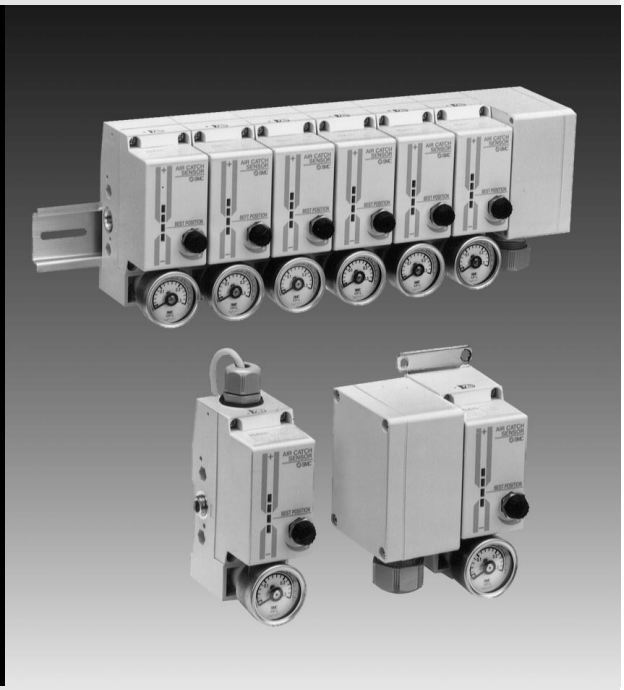


Applicable One-touch fittings	A
KQ$^{H}_{S}$$^{L}_{Y}$06-M5	16
Other KQ,KS series	13
KJ Series	14.5
KJ Series (-X20)	16

Air Catch Sensor

Series ISA

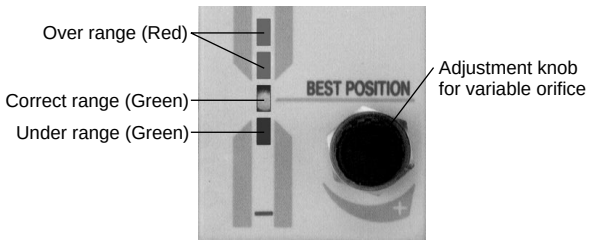
For Detection of Work Presence



Due to the construction of the sensor, fluctuations in the supply pressure do not influence operations.
Non contact style sensor for applications requiring confirmation of work present for machining operations.

LED Bar graph for easy calibration

The LED bar graph indicator in conjunction with the adjustment knob for the variable orifice allows for easy and correct calibrations.



Reliable detection of a 10μm gap

The operation of the Air-Catch Sensor is stable during supply pressure fluctuations due to the internal air bridge circuit and solid state sensors.

Up to 6 Air-Catch Sensors can be manifold mounted for centralized wiring and piping.

Mounting orientation

Due to the use of a pressure sensor, stable detection is guaranteed regardless of mounting orientation.

Wide detection range

Applicable to 10 to 300 μm

Enclosure IP66

Dust proof and drip proof

How to Order

Individual/Centralized Wiring **ISA** □ — □ □ — 01 □

Output specifications

11	NPN open collector 1 output
15	PNP open collector 1 output

Station 1 to 6

Wiring specifications

—	Individual wiring (Without terminal block box)
L	Centralized wiring (With terminal block box on left side)
R	Centralized wiring (With terminal block box on right side)

Option

—*	Applicable to DIN rail
B	With bracket
G	With gauge

∗Order DIN rail separately.

Example 1) NPN output, 4 stations, centralized wiring with terminal block box on left side, with bracket and gauge.

ISA11-4L-01BG

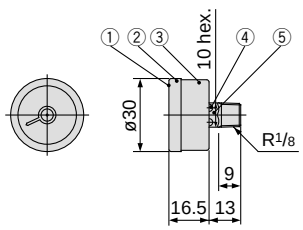
Example 2) PNP output, single unit individual wiring, with gauge.

ISA15-1-01G

Accessories (Optional)

· Bracket ISA-1-A
· Gauge G33-3-01
· DIN rail ISA-2-1 to 7

· Gauge/G33-3-01

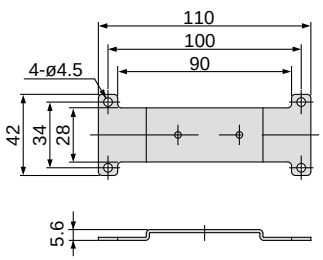


Description

No.	Description	Material
①	Cover	Glass
②	Front rim	Stainless steel
③	Retaining rim	Stainless steel
④	Cross recessed round head screw	Stainless steel
⑤	Stub	Brass

· Bracket/ISA-1-A

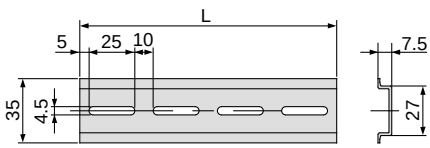
Material: SPC
(Nickel plated)



∗ Part no. includes M3 X 8 tapping screws (2 pcs.)

· DIN rail/ISA-2-1 to 7

Material: Aluminum

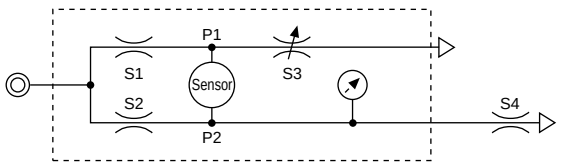


Part No.	L	Applicable model
ISA-2-1	105	ISA□-1
ISA-2-2	140	ISA□-2/ISA□-1$^{L}_{R}$
ISA-2-3	175	ISA□-3/ISA□-2$^{L}_{R}$
ISA-2-4	210	ISA□-4/ISA□-3$^{L}_{R}$
ISA-2-5	245	ISA□-5/ISA□-4$^{L}_{R}$
ISA-2-6	280	ISA□-6/ISA□-5$^{L}_{R}$
ISA-2-7	315	ISA□-6$^{L}_{R}$

Specifications

Fluid		Dry air (Filtered through a 5μm filter)
Operating pressure range		0.05 to 0.2MPa
Recommended pressure range		0.1 to 0.2MPa
Detection zone		10 to 300 μm
Repeatability including temperature characteristics		±10μm (for 0 to 60°C on the basis of 25°C)
Hysteresis		Less than 10 μm (Detection distance 10 to 150 μm)
Detection nozzle size		ø1.0 standard (Refer to p.3.8-7 when nozzle size is changed)
Indicator light		Operation indicator light (lighting under ON condition) Deflection level indicator light
Power supply voltage		12 to 24 V DC (Ripple less than ±10%)
Current consumption		Less than 30 mA (Output ON, LED ON)
Output	**ISA11**	NPN open collector less than 30V 80mA
	ISA15	PNP open collector less than 80mA
Operating temperature range		0 to 60°C (No condensation)
Operating humidity range		35 to 85% RH
Noise resistance		1000 Vp-p Pulse width 1μS, Standing 1ns pulse
Voltage resistance		1000V AC 50/60Hz for one minute between external terminals and case
Insulation resistance		2MΩ or more (at 500VDC megameter) between external terminals and case
Vibration resistance		10 to 500Hz vibration width 1.5mm or 9.8m/s^2 to X, Y, Z directions 2 hours for each direction
Impact resistance		980 m/s^2 X, Y, Z direction, 3 times for each direction
Cable		Oil-proof chloroethylene cable (ø3.4, 0.2mm^2, 5m)
Weight		250g (Including gauge, 5m lead wire)
Port size		Rc 1/8
Enclosure		IP66 (Dust proof and drip proof)
Flow consumption	**Supply pressure**	16ℓ/min at 0.10 MPa
		21ℓ/min at 0.15 MPa
		25ℓ/min at 0.20 MPa

Operation Principles

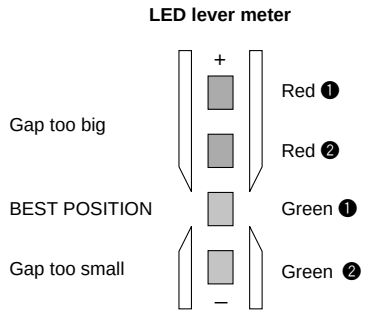


S1, S2: Fixed orifice
S3: Variable orifice (Set via adjustment knob)
S4: Detection nozzle

The bridge circuit is constructed as shown in the diagram. Position the work piece in front of the nozzle (S4).
With a gap gauge adjust the distance between work piece and the nozzle. Remove the gauge and balance the bridge circuit (P1 = P2) by adjusting the variable orifice (S3) via the adjustment knob. By moving the work piece away from the nozzle (S4) a pressure differential (P1 ≧ P2) is created. As soon as the work piece is moved within the detection range of the Air-Catch Sensor the back pressure P2 increases. If P2 is equal or greater than P1, the switch output is 'ON'. As soon as the work piece is outside of the detection zone the switch output is 'OFF'.

Method of Calibration

The Air-Catch Sensor is adjusted using the LED bar graph and the adjustment knob.

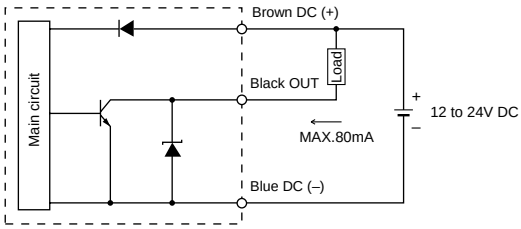


(1) Place the gap gauge on the detection nozzle for precise adjustment.
(2) Confirm applied air pressure. If the variable orifice is closed (turn the adjustment knob counterclockwise), all LED's are off.
(3) When opening the variable orifice (turn the adjustment knob clockwise) the LED's will light up in the following order:
Red ❶, Red ❷, Green ❶, Green ❷
(4) When the LED Green ❶ is on, the output is energized. This should conclude the calibration.
(5) Confirm calibration setting by removing the gap gauge from the nozzle. The LED Green ❶ should go off. Place the gap gauge on to the detection nozzle again, the Green ❶ LED should light up again.
(6) Secure the setting of the adjustment knob with the spanner nut.

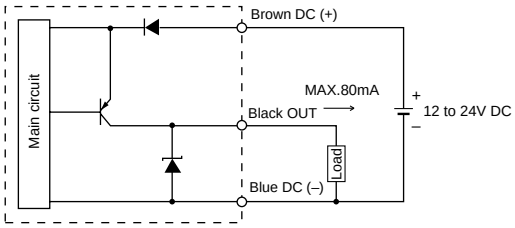
Internal Circuit/Wiring

The lead wire colors indicated inside "( )" are old colors prior to compliance with the IEC standard.

NPN Open Collector (Sinking)

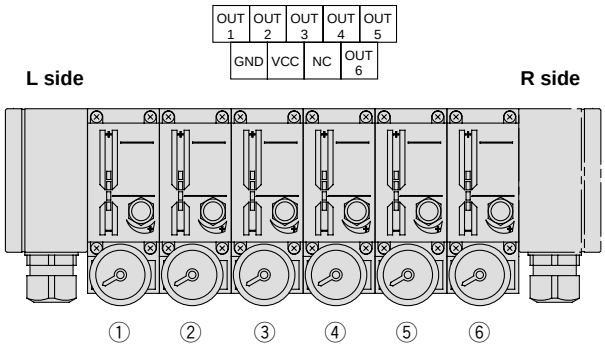


PNP Open Collector (Sourcing)



Centralized Wiring Style

Relation between terminal block wiring in terminal box and switch is shown below.



⚠ Precautions

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instruction and common precaution of the products mentioned in this catalog, and refer to p.3.0-7 to 3.0-9 for precautions on every series.

Installation

⚠Caution

①Do not allow water, cutting oil, etc. to flow back from the detection nozzle to the switch body. Always mount switch body higher than detection nozzle if possible.

Piping

⚠Caution

①**Piping materials**

Do not mount any equipment or fittings between the switch body and the detection nozzle in order to avoid leaks and pressure drops. Do not use one-touch fittings in applications where these fittings might be exposed to liquid being sprayed onto them.

Supply Pressure

⚠Caution

① **Supply air**

Be careful not to allow any foreign materials into the supply of the Air Catch Sensor. Contamination of the sensor will decrease the sensor's accuracy.

Especially important when measuring small bore orifices. Use dry and filtered (5μm) supply air.

②**Operating pressure**

Do not exceed the max. operating pressure of 0.2 MPa. Damage to the solid state pressure sensor may occur.

Environment

⚠Caution

①If the Air Catch Sensor is mounted in an enclosure, make sure that the exhaust port is open to atmospheric pressure to avoid malfunction due to possible pressure build-up inside the enclosure.

②Connect the tubing via the M5 fittings to the Air Catch Sensor. Place the tubing in such a way that no water, oil, etc. can enter the sensor. The Air Catch Sensor is rated IP66. However in order to achieve this rating the gauge has to be removed from the sensor screw a fitting into the gauge port and run tubing to the gauge. When remove mounting the gauge keep the tubing as short as possible otherwise the response time will increase.

Maintenance

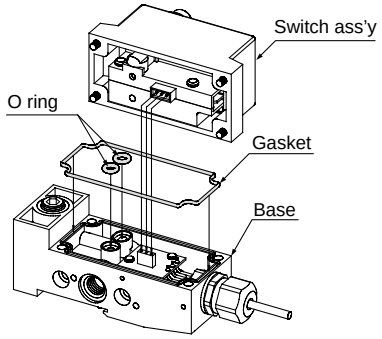
⚠Caution

①After removing the 4 mounting screws (M4 X 8) pull the switch body off vertically.

If the switch body is pulled off in an angle the connector pins may be bent.

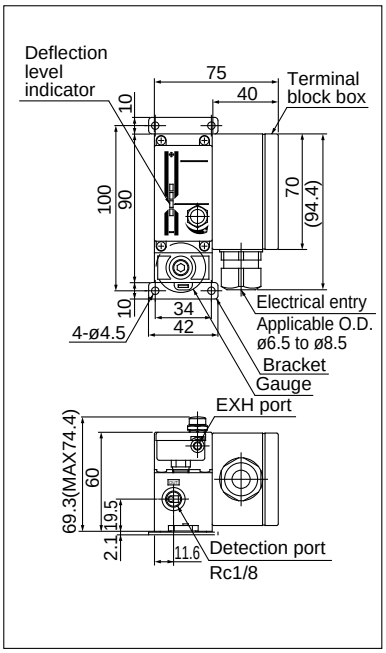
②When mounting the switch body onto the base, be careful that the body is lowered vertically onto the base and the connector pins are not bent. Tighten the 4 mounting screws equally (M4 X 8).

Note) Do not forget to insert the seals prior to mounting the body onto the base. (Tightening torque is 0.45 Nm.)



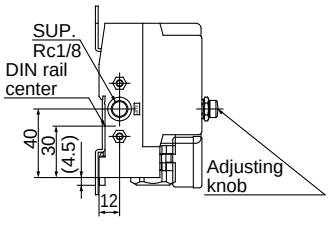
Dimensions/Centralized Wiring (Terminal Block Box Style)

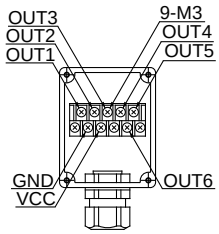
Unit



2 station manifold, if the terminal block is located on the right side of the manifold assembly, the mounting bracket is located on the second Air-Catch Sensor. If the terminal block is located on the left side of the manifold assembly, the mounting bracket is located on the first Air-Catch Sensor.
For manifolds with more than 2 stations, the mounting brackets are located on the first and last Air-Catch Sensor.

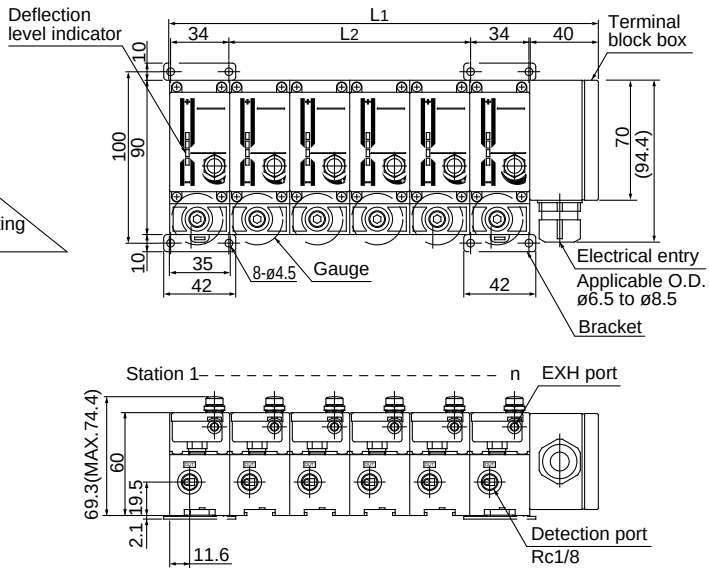
With bracket





Terminal block box wiring

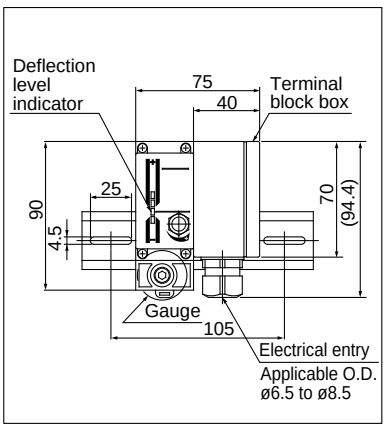
Manifold



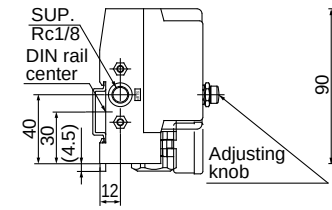
Dimensions

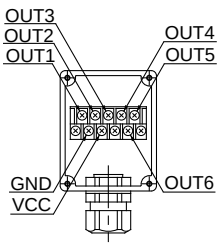
Station	2	3	4	5	6
L1	110	145	180	215	250
L2	–	36	71	106	141

Unit



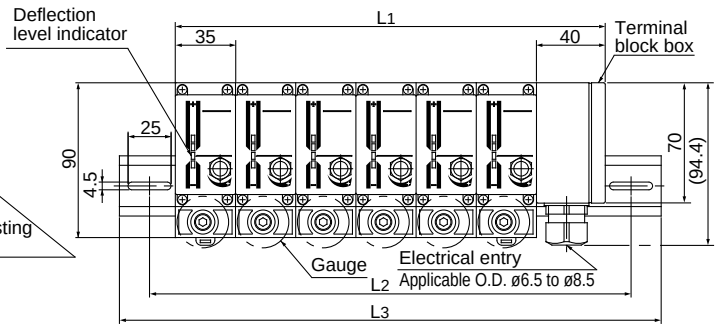
With DIN rail

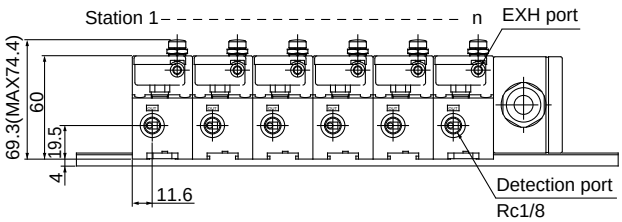




Terminal block box wiring

Manifold



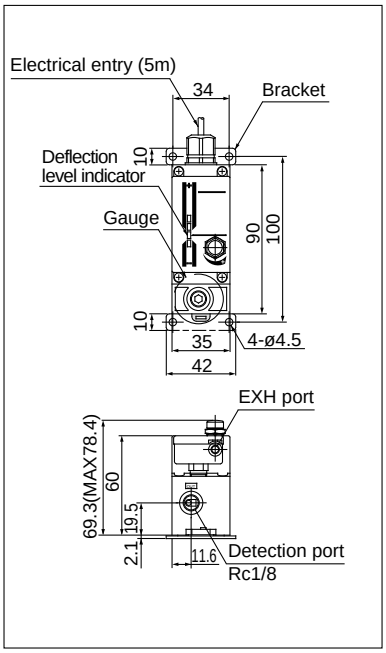


Dimensions/With DIN rail

Station	2	3	4	5	6
L1	110	145	180	215	250
L2	140	175	210	245	280
L3	175	210	245	280	315

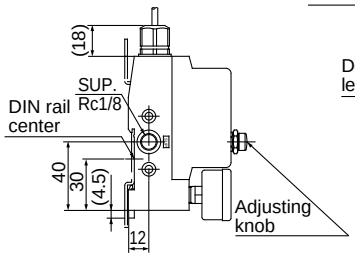
Dimensions/Individual Wiring (Lead Wire Style)

Unit

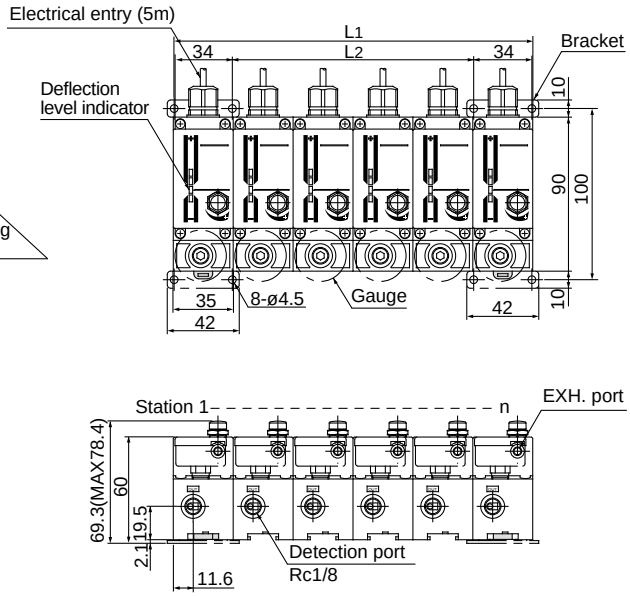


For 2 station manifold, the mounting bracket is located on the first Air-Catch Sensor.
For manfolds with more than 2 stations, the mounting brackets are located on the first and last Air-Catch Sensor.

With bracket



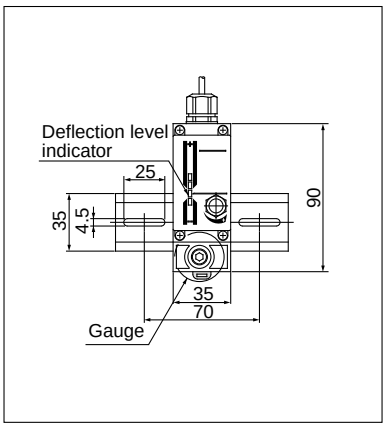
Manifold



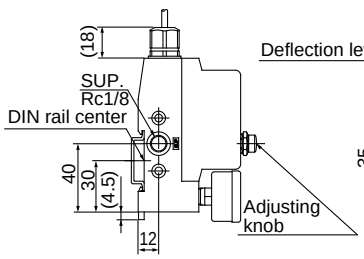
Dimensions

Station	2	3	4	5	6
L1	70	105	140	175	210
L2	–	36	71	106	141

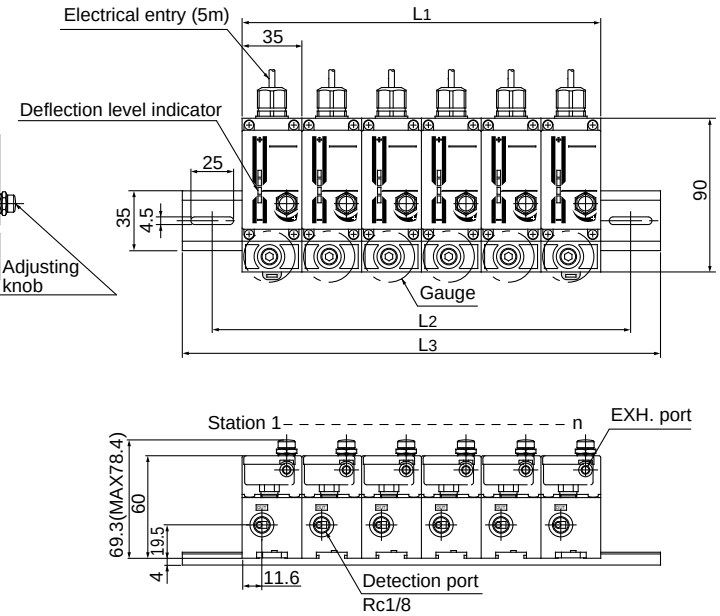
Unit



With DIN rail



Manifold



Dimensions/With DIN rail

Station	2	3	4	5	6
L1	70	105	140	175	210
L2	105	140	175	210	245
L3	140	175	210	245	280

Guide for Use/Design Data

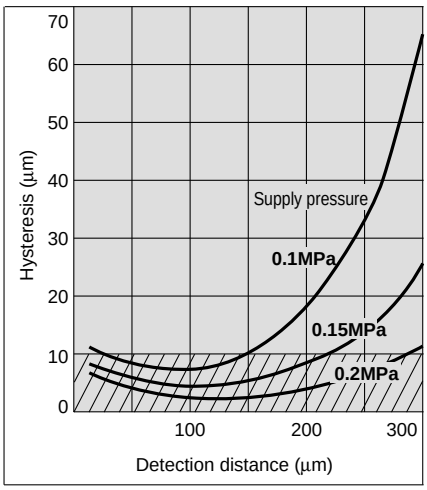
When designing a pneumatic circuit with an Air-Catch Sensor, please refer to the data below.
The detection distance for the Air-Catch Sensor is between 10 to 300µm.
When the supply pressure of the nozzle diameter changes reliable detection is not possible.

Nozzel Diameter and Detection Distance

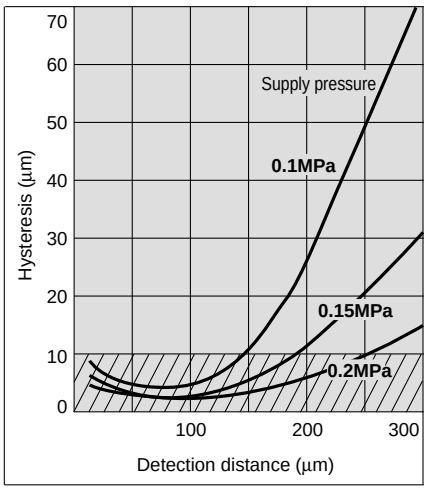
The graphs below show the hysteresis in relationship to the detection distance.
When high accuracy is required, design the system so the hysteresis is within the 10µm detection distance.
When the Hysteresis exceeds 10µm use the Air-Catch Sensor as a confirmation of position of work piece.

▨: Stable adjustment range

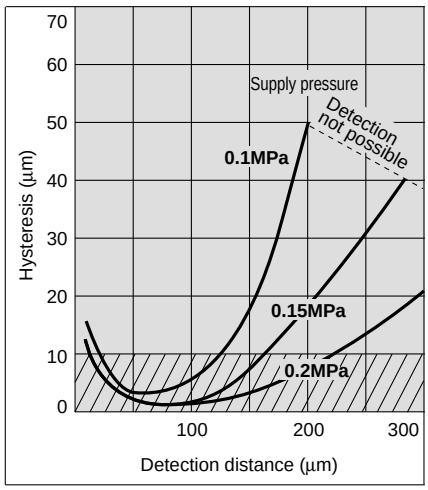
Detection side nozzle: ø1.0
Detection side piping: ø6 X ø4 tubing



Detection side nozzle: ø1.5
Detection side piping: ø6 X ø4 tubing



Detection side nozzle: ø2.0
Detection side piping: ø6 X ø4 tubing



Example 1) When requiring 300µm detection, select the detection nozzle of ø1.0 with supply pressure 0.2MPa.
Example 2) When requiring 10µm detection, select the detection nozzle of ø1.5.

Nozzle Shape

Nozzle shape should be designed as follows.
Pay attention to detection surface and the chamfer of nozzle hole as shown in Fig.1 since they can affect performance.

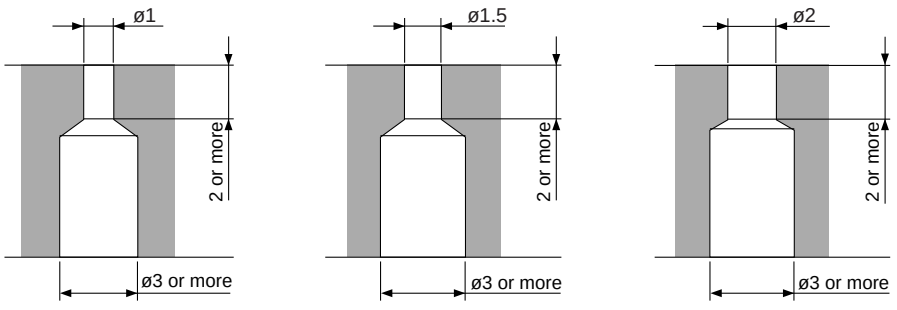
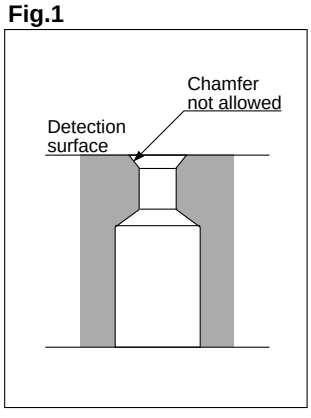


Fig.1



Response Time

The response time is dependent on the detection distance and the piping length. The supply pressure and the nozzle diameter do not influence the response time. Table 2 shows the response time for different detection distance settings and a constant piping length. Table 3 shows the response time when the detection distance is constant but the piping length changes. As can be seen from the graphs below, if the piping length is kept short and the detection distance is small, the response time is faster.

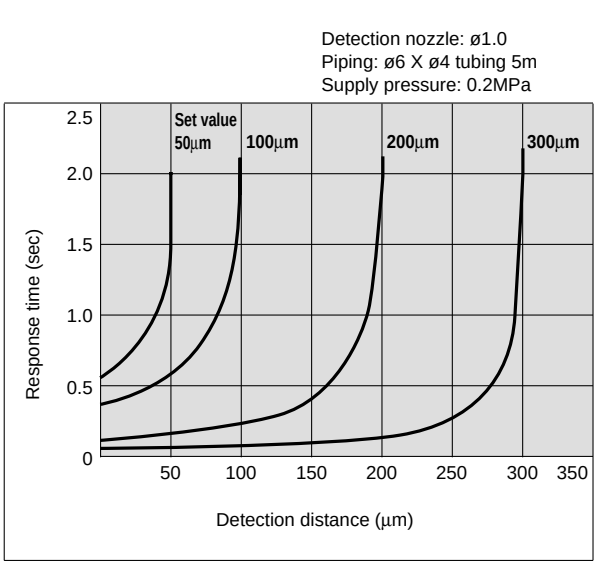


Fig.2 Detection distance vs. Response time

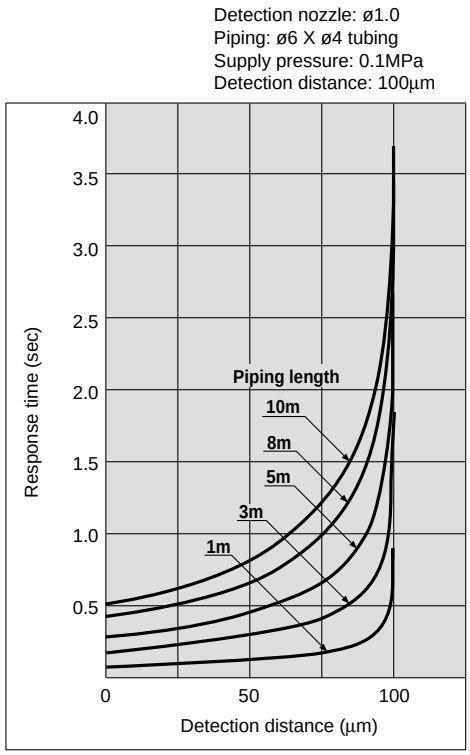
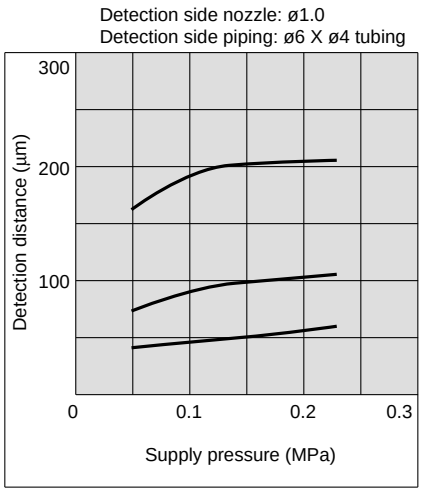
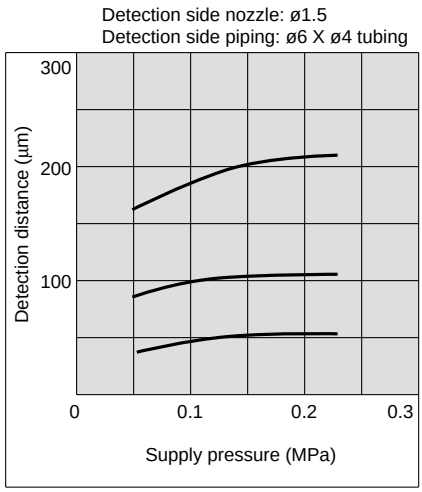


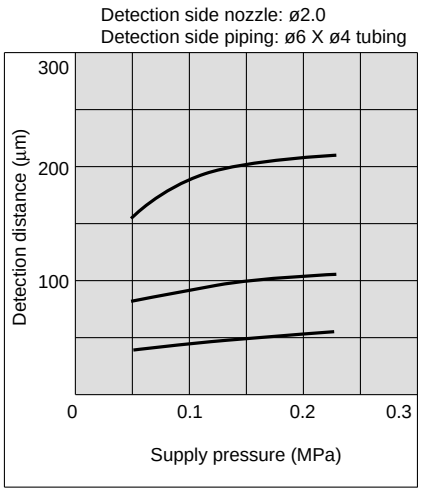
Fig.3 Response time vs. Piping length

Supply Pressure vs. Detection Distance

The graphs below show the detection distance for different supply pressure setting.







Compact Pressure Switch

Series ZSE1

(For vacuum)

ISE1

(For positive pressure)

For General Pneumatics

Can be integrated with ZM vacuum system.

Quick response

10mS

High accuracy

± 3% F.S. (Full Span)

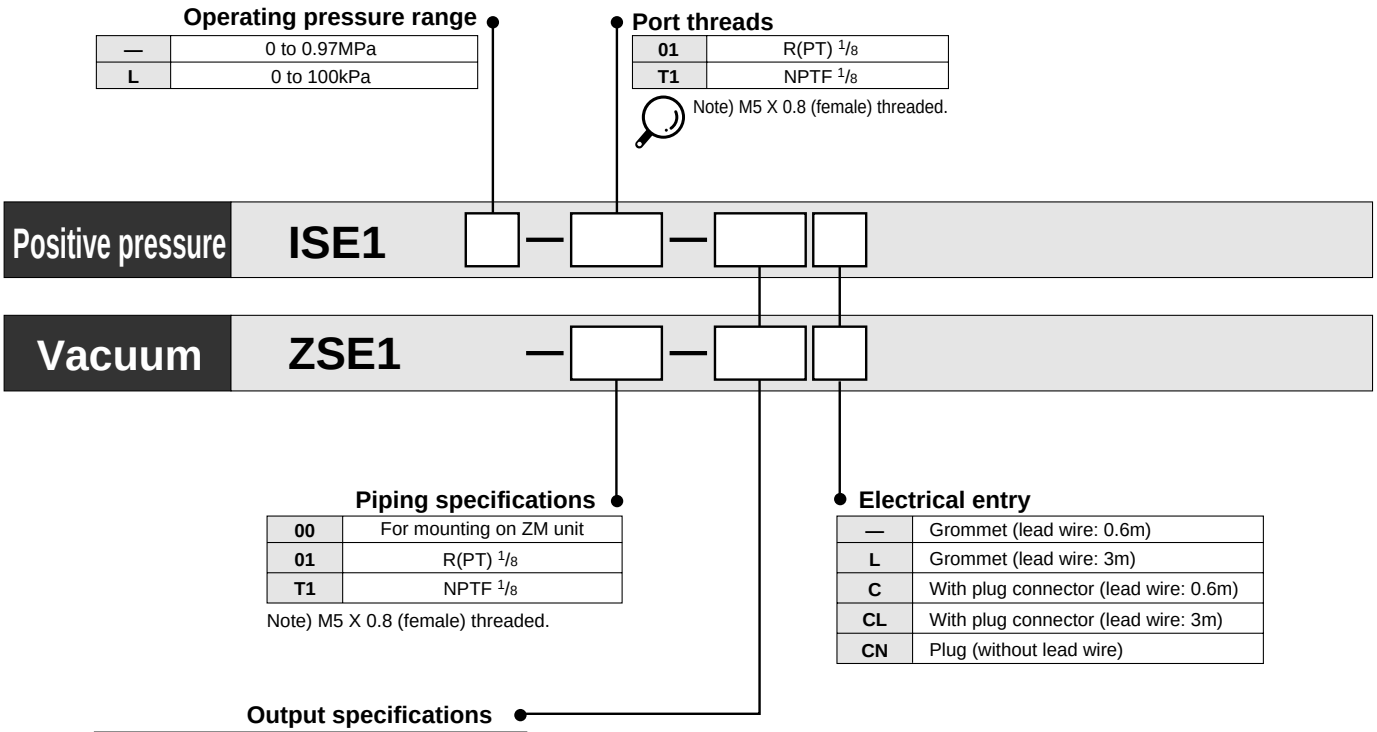
Adjustable hysteresis

1 to 10% of set pressure

Easy and simple wiring

Connector style

How to Order



With Connector/How to Order

●Without lead wire (Connector 1 pc., Socket 4 pcs.) ··· **ZS-20-A**

●With lead wire·····**ZS-20-5A -** □

Note) When ordering switch with 5m long lead wire, indicate both part numbers.
Ex.) ZSE1-01-15CN····1 pc.
ZS-20-5A-50·····1 pc.

Lead wire length

—	0.6m
30	3m
50	5m

ZSE1/ISE1 Specifications

Model		ZSE1	ISE1L	ISE1
Operating pressure range		–101kPa to 0	0 to 100kPa	0 to 1MPa
Max. pressure		200kPa		1MPa
Temperature characteristics		± 3% F.S.		
Power supply		12 to 24V DC (Ripple ±10% or less)		
Current consumption		17mA or less at 24V DC 2 output: 25mA or less at 24V DC		
Port size		01: R(PT)1/8, M5 X 0.8 T1: NPTF1/8, M5 X 0.8 00: ZM ejector mounted style		
Operating temperature range		0 to 60°C (No condensation)		
Lead wire	Grommet	Grommet oil resistant vinyl cabtire code –14, –15, –55: ø3.4, 0.2 mm² – 16, –17, –18, –19: ø3.5, 0.14 mm²		
	Plug connector	Heat resistant electrical wire ø1.55, 0.31 mm²		

∗There is no influence on switch even if 0.5MPa of vacuum pressure is supplied instantly to the switch in vacuum use.

Output Specifications

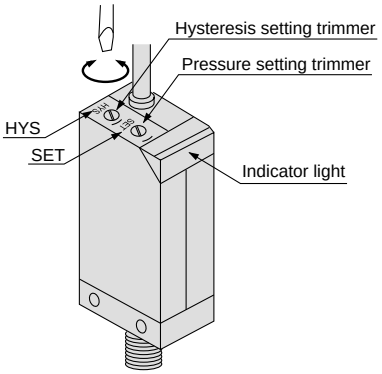
Model	–14	–15	–16	–17	–18	–19	–55
Output method	NPN Open Collector 30V, 80mA						PNP Open Collector ≤ 80mA
Hysteresis	1 to 10% of set press. (Variable)		3% F.S. or less (Fixed)		1 to 10% of set prss. (Variable)		1-10% of set press.
Analog output	None				1 to 5V		None
Number of outputs	1		2		1		
Indicator light	ON: when output is ON (Red)		ON: when output is ON(OUT1: Red, OUT2: Green)		ON: when output is ON (Red)		
Trimmer adjustment	3 revolutions	200	3 revolutions	200	3 revolutions	200	

How to Set Pressure

●Rotate SET potentiometer (trimmer) clockwise to increase (high vacuum pressure) the ON point. Do not apply excessive force when adjusting the trimmer with a screwdriver.

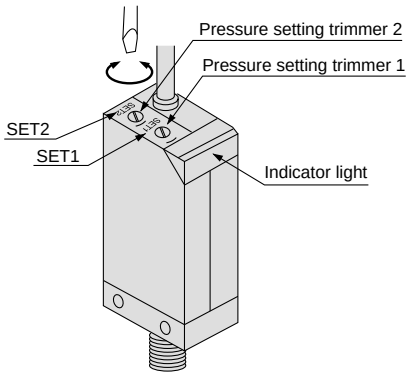
ISE1-□□-14, -15, -18, -19

●Switches with variable hysteresis can be adjusted by means of the HYS potentiometer in the range 1 to 10% of the ON set point.
●Adjust ON setting, adjust hysteresis, and then re-adjust ON setting for best results.

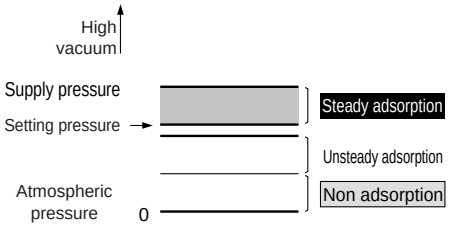


ISE1-□□-16, -17

●For swich type "-16" or "-17", rotating SET1 will adjust ON setting for OUT1 (Black lead wire, Red LED) and SET2 will adjust ON setting for OUT2 (White lead wire, Green LED).



●Set the possible min. pressure for adsorption in case of the use for adsorption confirmation. If setting the pressure lower than that, switch becomes ON in case that adsorption is not completely done. If setting the pressure higher than that, switch does not become ON though absorbing workpieces in good matter.



●Regarding the pressure setting

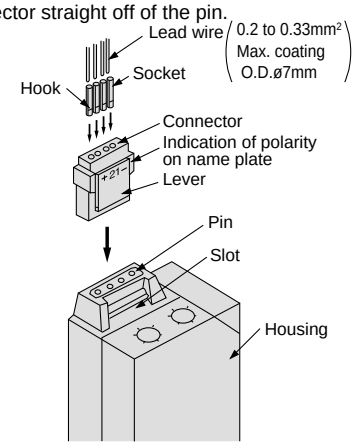
⚠ Caution

Observe the following precautions for setting the vacuum pressure: Use your fingertips to gently turn the screwdriver. Do not use a screwdriver with a large grip or with a tip that does not fit into the trimmer groove.

How to Use Connector

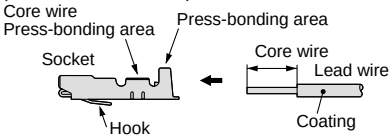
❶Connection

●When assembling the connector to the switch housing, push the connector straight onto the pins until the lever locks into the housing slot.
●When removing the connector from the switch housing, push the lever down to unlock it from the slot and then withdraw the connector straight off of the pin.



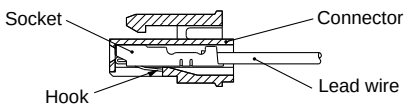
❷Press bonding socket to lead wire.

Strip the end of the lead wire 3.2 to 3.7mm long.
Put wire into socket taking care to prevent the lead wire insulation from entering the core wire pressure bonding area.
Press bond using press-bonding tool (Part No. DXTI70-75-1.)



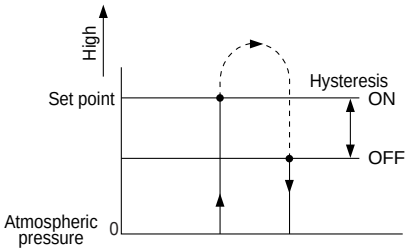
❸Assembly of socket to connector.

●Assembling
Push socket into hole in connector until the hook of the socket locks into the connector. (The socket hook will spring open inside the connector) Gently pull lead wire back to confirm that socket is locked in position.
●Disassembling
When disassembling socket from connector, push the hook of the socket down with a small dia. instrument. Pull socket out by means of the lead wire. If the socket is to be re-used, bend hook of the socket out to its original position before re-assembling.



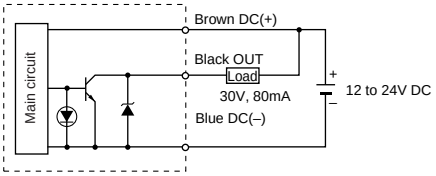
Hysteresis

Hysteresis is the pressure difference between the ON and the OFF pressure of the output signal. The set pressure is the pressure selected to switch from OFF to ON condition.

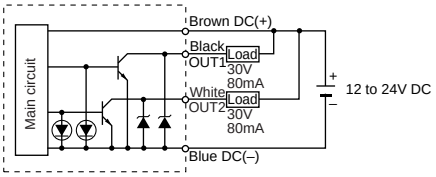


Internal Circuit and Wiring

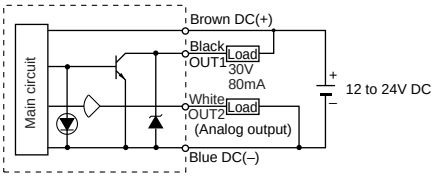
ISE1-□-14, -15



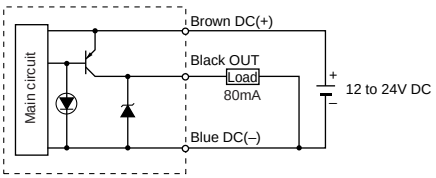
ISE1-□-16, -17



ISE1-□-18, -19



ISE1-□-55

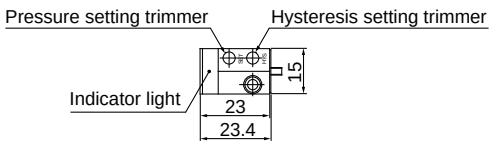


⚠Caution

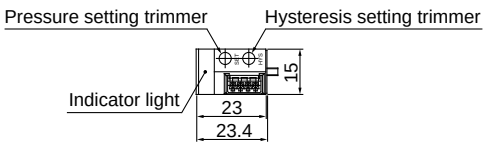
Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalog, and refer to p.3.0-7 to 3.0-9 for precautions on every sereis.

Dimensions

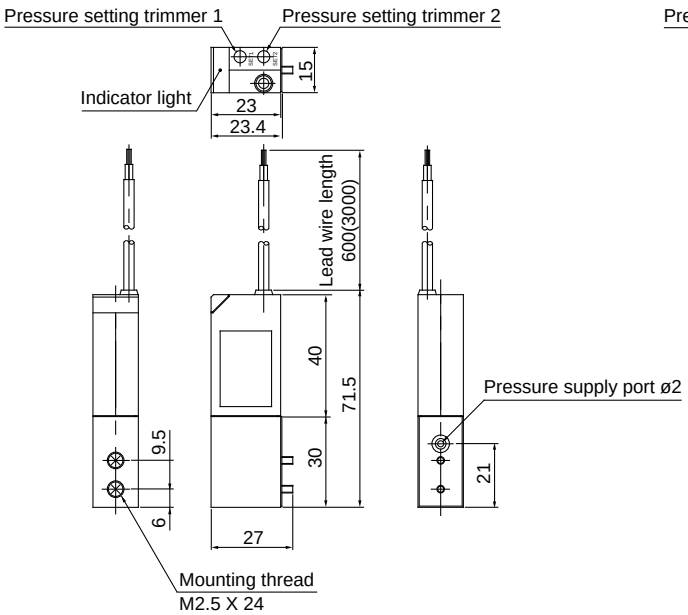
Grommet style
ZSE1-00 -14, -15, -18, -19



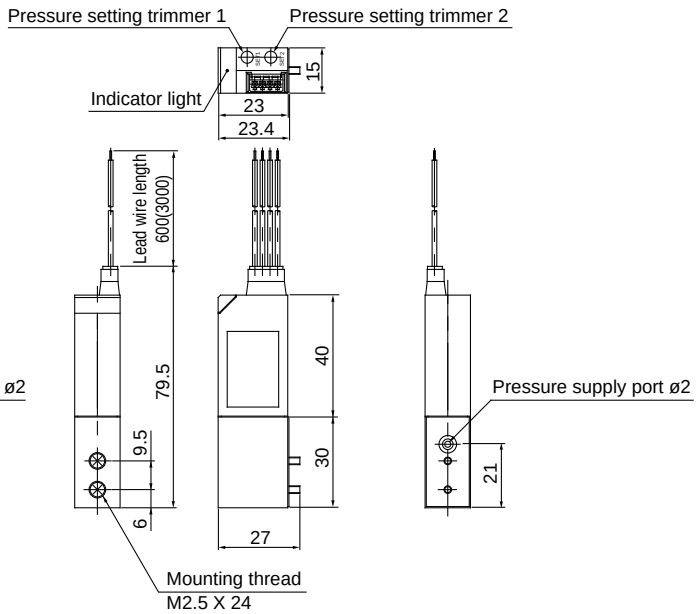
Connector style
ZSE1-00 -14C, -15C, -18C, -19C



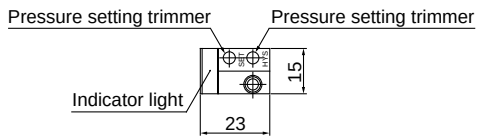
ZSE1-00 -16, -17



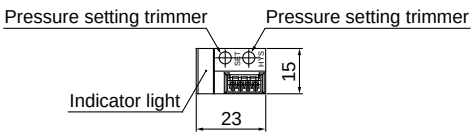
ZSE1-00 -16C, -17C



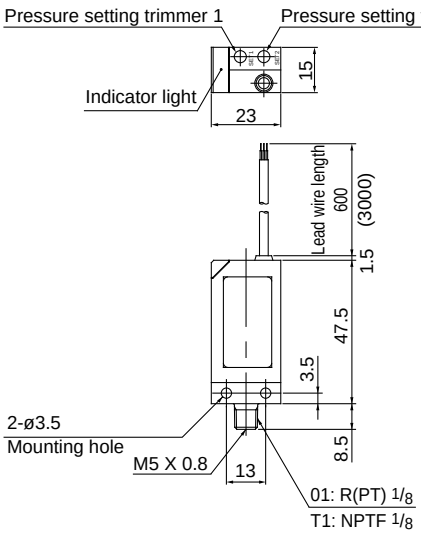
Grommet style
IZ SE1-01T1-14, -15, -18, -19



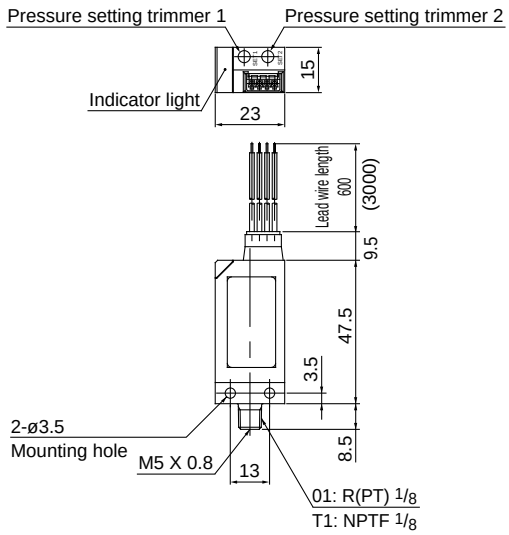
Connector style
IZ SE1-01T1-14C, -15C, -18C, -19C



IZ SE1-01 -16, -17



IZ SE1-01 -16C, -17C



Compact Pressure Switch

Series ZSE2

(For vacuum)

ISE2

(For positive pressure)

For General Pneumatics

Can be integrated with ZX or ZR vacuum system.

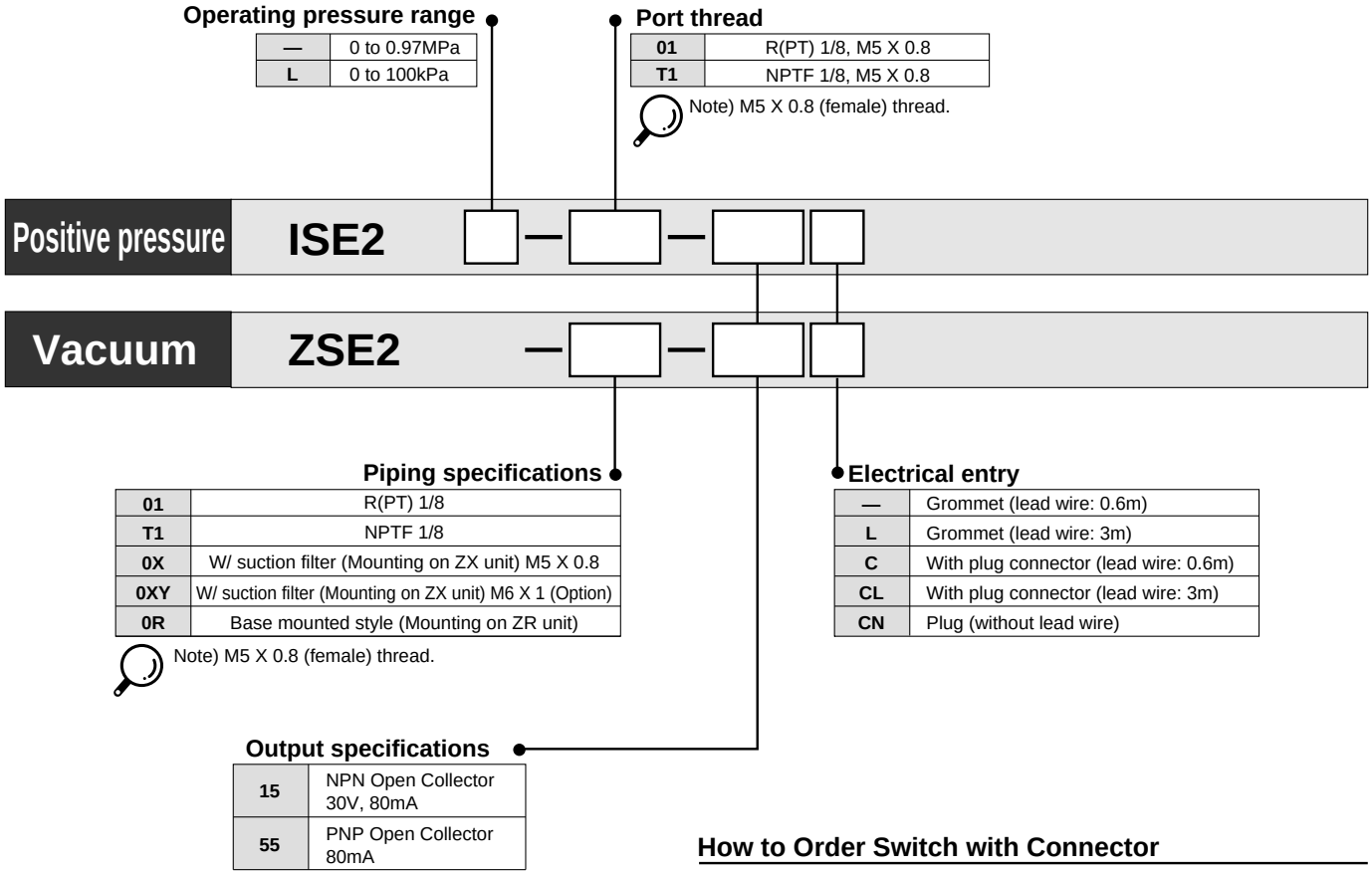
Quick response

10mS

Easy and simple wiring

Connector style

How to Order



How to Order Switch with Connector

- Without lead wire (Connector 1 pc., Socket 3 pcs.) ·····**ZS-10-A**
- With lead wire ·····**ZS-10-5A-□**

Note) When ordering switch with 5m long lead wire, indicate both part numbers.

Ex.) ZSE2-01-15CN·····**1 pc.**
ZS-10-5A-50·····**1 pc.**

Lead wire length

—	0.6m
30	3m
50	5m

⚠Caution

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalog, and refer to p.3.0-7 to 3.0-9 for precautions on every series.

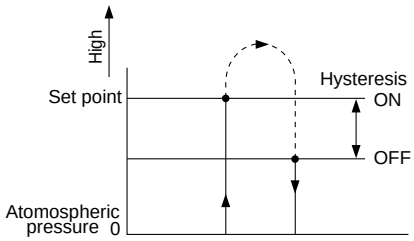
Specifications

Model		ZSE2	ISE2L	ISE2
Operating pressure range		–101kPa to 0	0 to 100kPa	0 to 1MPa
Max. pressure		200kPa		1MPa
Accuracy		±3% F.S. (5 to 40°C), ±5% F.S. (0 to 60°C)		
Hysteresis		3% F.S. or less (Fixed)		
Power supply		12 to 24V DC (Ripple ± 10% or less)		
Output		–15: NPN Open collector 30V 80mA, –55: PNP Open collector 80mA		
Indicator light		ON: When output is ON(Red)		
Current consumption		17mA or less at 24V DC		
Operating temperature range		0 to 60°C (No condensation)		
Port size		01: R(PT) 1/8, M5 X 0.8 T1: NPTF1/8, M5 X 0.8 0X: With suction filter (For mounting on ZX unit) 0R: Base mounted style (For mounting on ZR unit)		
Lead wire	Grommet	Grommet oil-resistant vinyl cabtire code 3 wires ø3.4, 0.2mm²		
	Plug connector	Heat-resistant vinyl electrical wire ø1.55, 0.31mm²		

∗ In case of vacuum use, there is no influence on the switch if 0.5MPa of pressure is supplied instantly.

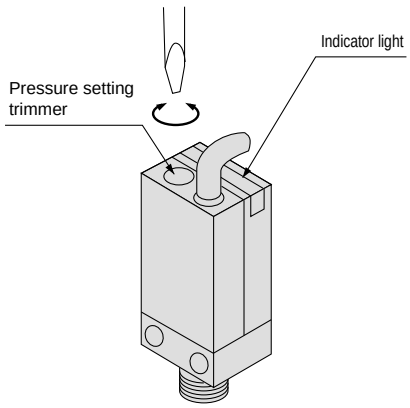
Hysteresis

Hysteresis is the pressure difference between the ON pressure and the OFF pressure of the output signal. The set pressure is the pressure selected to switch from OFF to ON condition.

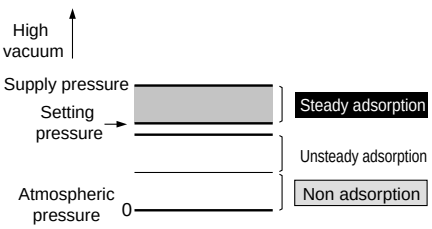


How to Set Pressure

●Rotate SET potentiometer (trimmer) clockwise to increase (high vacuum pressure) the ON point.



●Set the possible min. pressure for adsorption confirmation. If setting the pressure lower than that, switch becomes ON in case that adsorption is not completely done. If setting the pressure higher than that, switch does not become ON even though it may absorb workpieces.



●Regarding the pressure setting

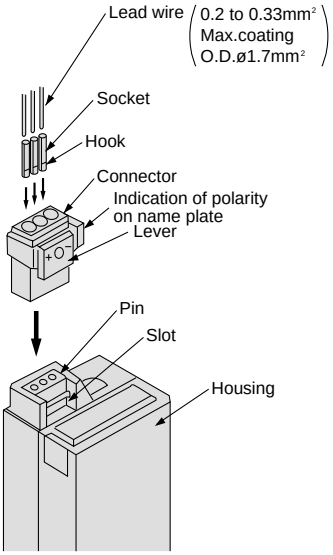
⚠ Caution

Observe the following precautions for setting the vacuum pressure: Use your fingertips to gently turn the screwdriver. Do not use a screwdriver with a large grip or with a tip that does not fit into the trimmer groove because this could strip the groove.

How to Use Connector

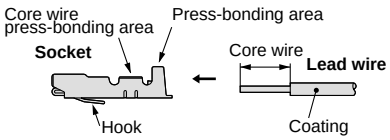
❶ Connection

●When assembling the connector to the switch housing, push the connector straight onto the pins until the lever locks into the housing slot.
●When removing the connector from the switch housing, push the lever down to unlock it from the slot and then withdraw the connector straight off of the pin.



❷ Press bonding socket to lead wire.

●Strip the end of the lead wire 3.2 to 3.7mm long.
●Put wire into socket taking care to prevent the lead wire insulation from entering the core wire pressure bonding area.
●Press bond using press-bonding tool.
Part No. DXT170-75-1.



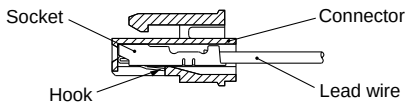
❸ Assembly of socket to connector

●Assembling

Push socket into the hole in the connector until the hook of the socket locks into the connector. (The socket hook will spring open inside the connector) Gently pull lead wire back to confirm that socket is locked in position.

●Disassembling

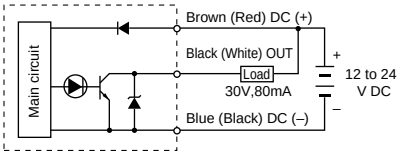
When disassembling socket from connector, push the hook of the socket down with a small dia. instrument. Pull socket out by means of the lead wire. If the socket is to be re-used, bend hook of the socket out to its original position before reassembling.



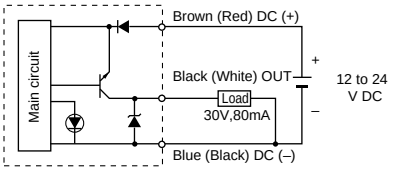
Internal Circuit and Wiring

Lead wire colors inside ( ) are those prior to conformity with IEC standards.

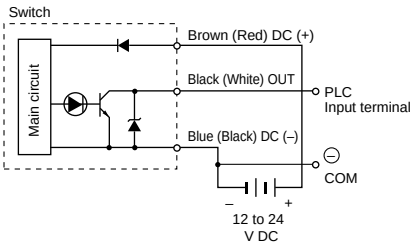
"–15" NPN Open Collector



"–55" PNP Open Collector



Connection with Sequence Controller at "–" Common Terminal



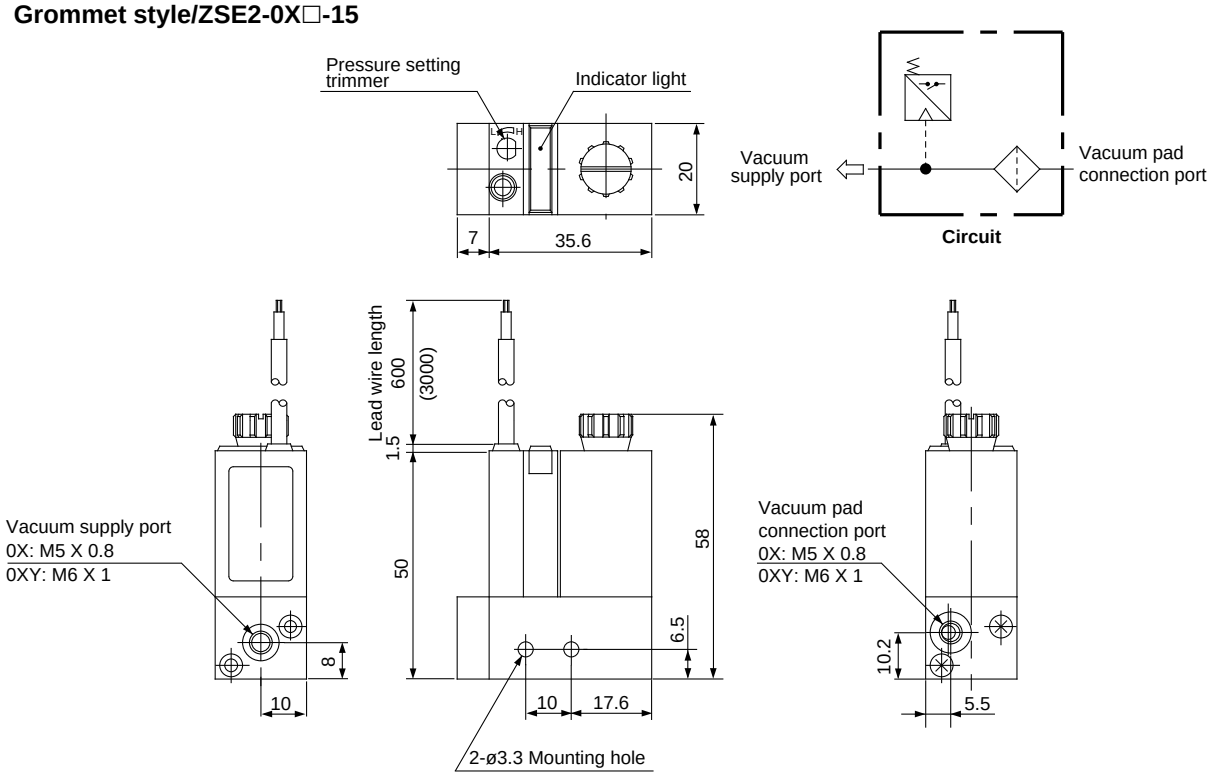
●Filter case

⚠Caution

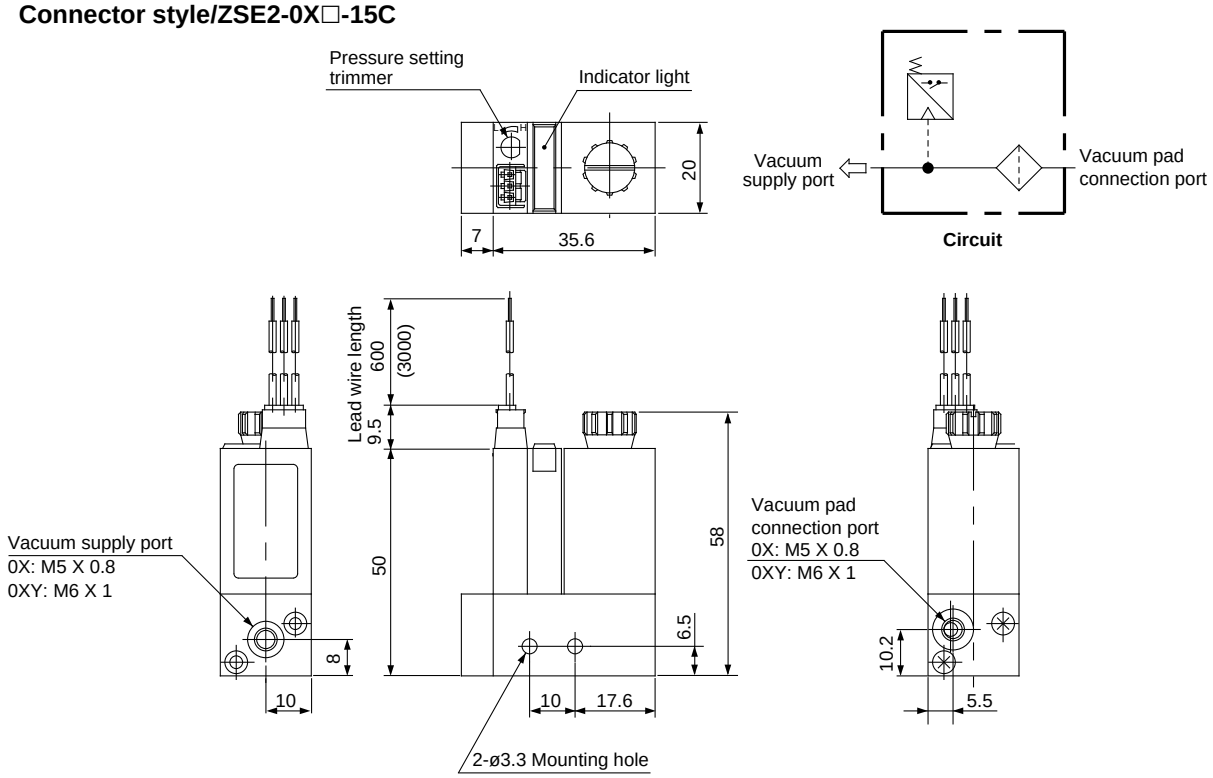
①Do not use with thinner, carbon tetrachloride, chloroform, acetate, aniline, cyclohexane, trichloroethylene, sulfuric acid, lactic acid and watermiscible cutting fluid (alkaline).
②Keep out of the direct rays of the sun.

Dimensions/With Suction Filter: ZSE2-0X□

Grommet style/ZSE2-0X□-15

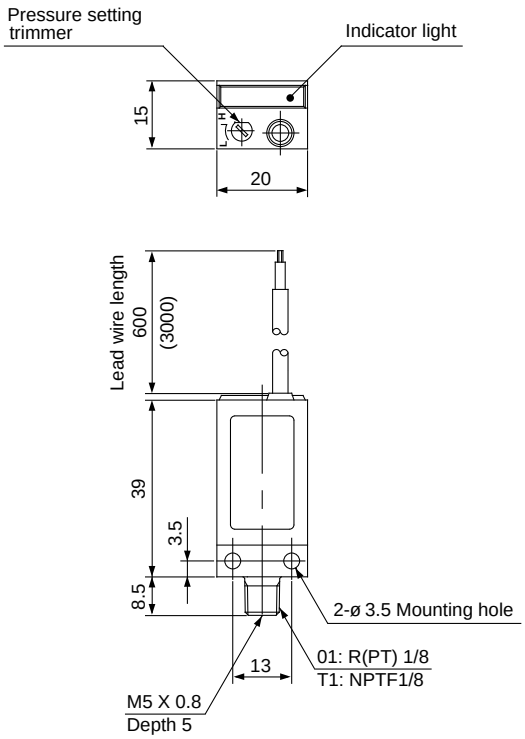


Connector style/ZSE2-0X□-15C

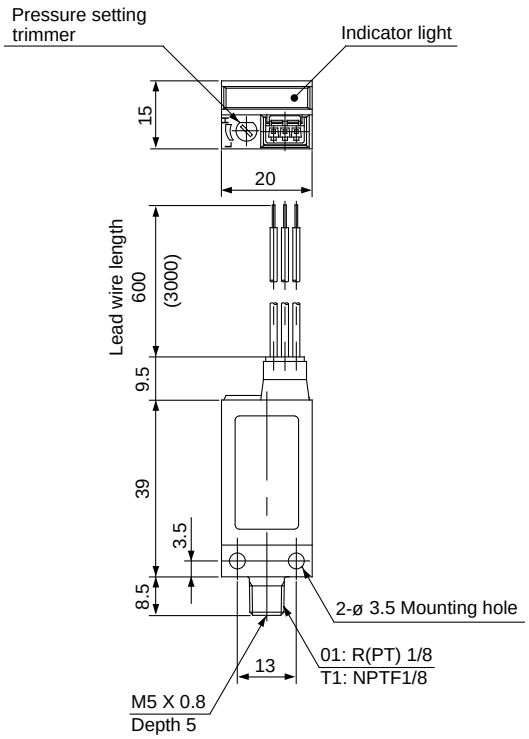


Dimensions/Standard: ZSE2-$^{01}_{T1}$

Grommet style/ZSE2-$^{01}_{T1}$-15

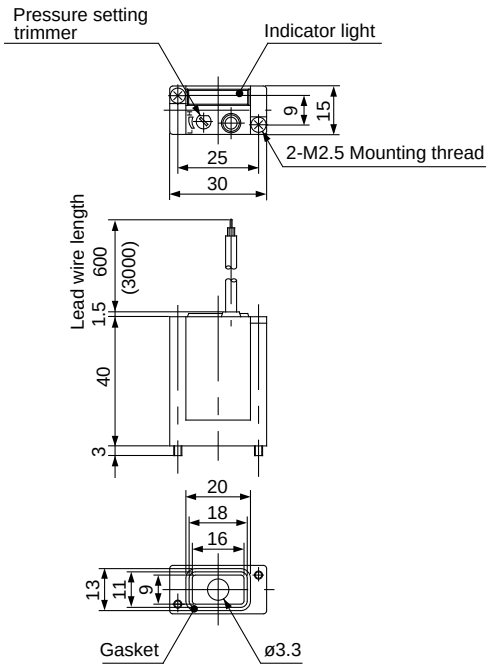


Connector style/ZSE2-$^{01}_{T1}$-15C

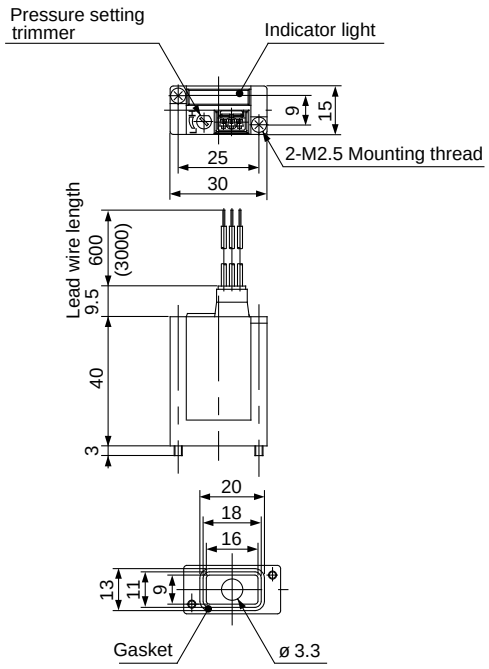


Dimensions/Base Mounted Style: ZSE2-0R

Grommet style/ZSE2-0R-15

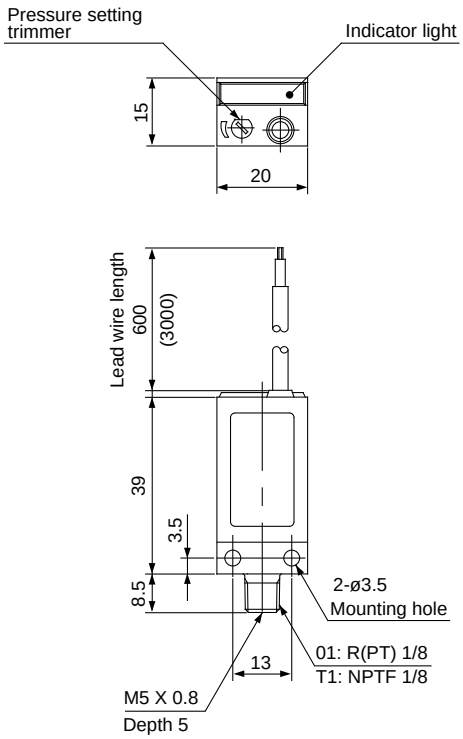


Connector style/ZSE2-0R-15C

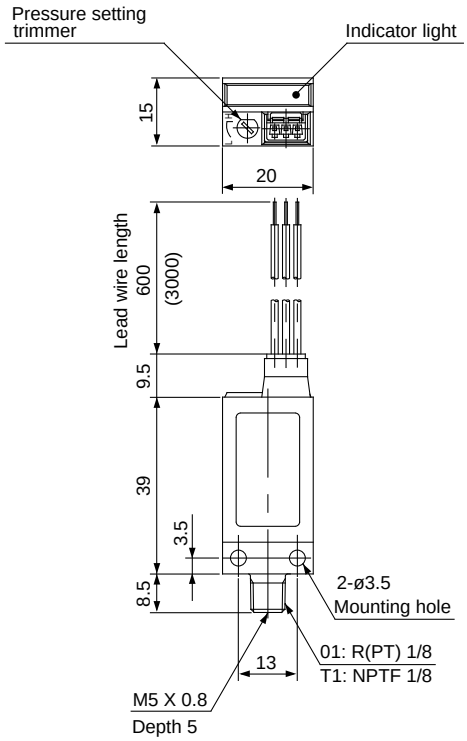


Dimensions/ISE2□-$^{01}_{T1}$

Grommet style/ISE2□-$^{01}_{T1}$-15



Connector style/ISE2□-$^{01}_{T1}$-15C



Adsorption Confirmation Switch

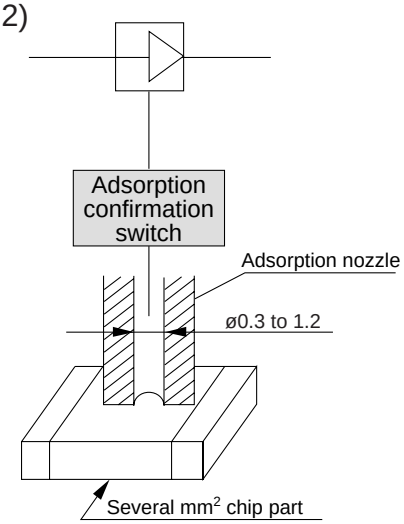
Series ZSP1

For General Pneumatics

Can be integrated with
ZX ejector system

Best suited for small diameter nozzles

(ø0.3 to ø1.2)



Suction filter comes as standard

How to Order

Vacuum **ZSP1** — □ □ — **15** □

Available nozzle diameter

S	ø0.3 to ø0.7
B	ø0.5 to ø1.2

Connection

0X	With suction filter M5 X 0.8 (For mounting on ZX ejector)
0XY	With suction filter M6 X 1 (For mounting on ZX ejector)

Output specifications

15	NPN Open Collector 30V, 80mA

Electrical entry

—	Grommet (lead wire: 0.6m)
L	Grommet (lead wire: 3m)
C	With plug connector (lead wire: 0.6m)
CL	With plug connector (lead wire: 3m)
CN	Plug (without lead wire)

⚠ Precautions

Be sure to read before handling.
Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalog, and p.3.0-7 to 3.0-9 for precautions on every series.

⚠ Caution

If positive pressure is applied to the switch, such as a vacuum break, the output will turn ON (illuminating the indicator light). Therefore, make sure that the output will not negatively affect the equipment.

With Connector/How to Order

●Without lead wire (Connector 1pc. Socket 3pcs.)····· **ZS-10-A**

●With lead wire ····· **ZS-10-5A-□**

Lead wire length

—	0.6m
30	3m
50	5m

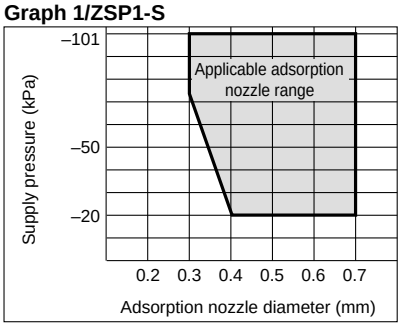
Note) When ordering switch with 5m long lead wire, Indicate both part numbers.
Ex.)**ZSP1-□0X-15CN**····· 1pc.
ZS-10-5A-50·····1pc.

Specifications

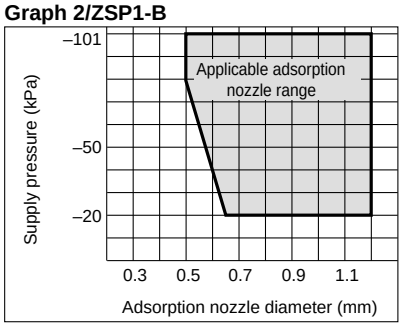
Model		**ZSP1-S**	**ZSP1-B**
Fluid		Air	
Operating pressure range		–20 to –101kPa	
Applicable adsorption nozzle dia.		ø0.3 to ø0.7 (Refer to the graph 1 on p.3.11-3)	ø0.5 to ø1.2 (Refer to the graph 2 on p.3.11-3)
Hysteresis		0.5kPa	
Internal orifice		ø0.5	ø0.8
Supply voltage		12 to 24V DC (Ripple ±10% or less)	
Output		NPN Open collector 30V, 80mA	
Indicator light		ON: When output is ON.	
Current consumption		17mA or less at 24V DC	
Operating temperature range		0 to 60°C (No dewing)	
Port size		M5 X 0.8	
Lead wire	**Grommet**	Grommet oil-resistant vinyl cabtire code 3 wire, ø3.4, 0.2mm^2	
	Plug connector	Heat-resistant vinyl electrical wire ø1.55, 0.31mm^2	

Applicable Adsorption Nozzle Diameter Range

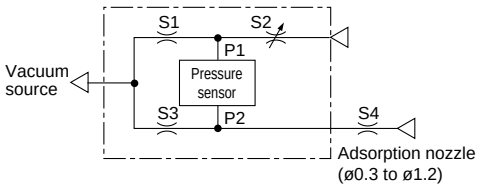
Graph 1/ZSP1-S



Graph 2/ZSP1-B



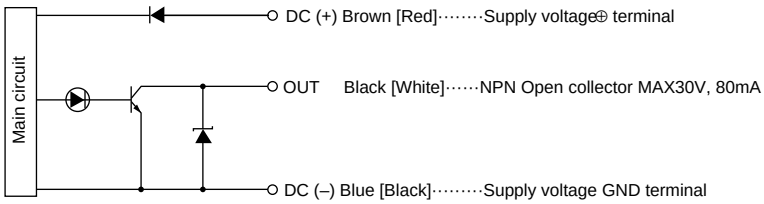
Air Pressure Circuit/Principle



The air pressure forms a bridge circuit inside the unit with a vacuum applied to the circuit, but with the adsorption nozzle "S4" open, adjust needle "S2" so that (Pi≅P2). When parts are adsorbed by nozzle "S4", the resulting (P2-P1) differential will be detected by the pressure sensor.

Internal Circuit and Wiring

Lead wire colors inside [ ] are those prior to conformity with IEC standards.

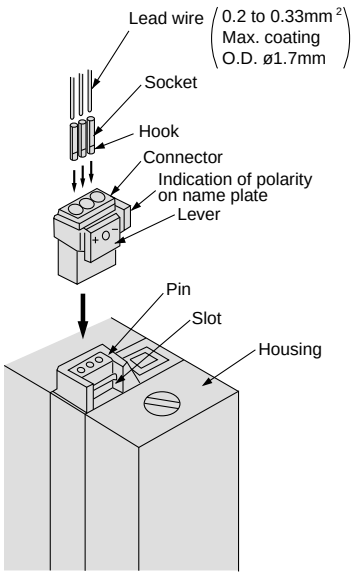


How to Use Connector

❶ Connection

●When assembling the connector to the switch housing, push the connector straight onto the pins until the lever locks into the housing slot.

●When removing the connector from the switch housing, push the lever down to unlock it from the slot and then withdraw the connector straight off of the pin.

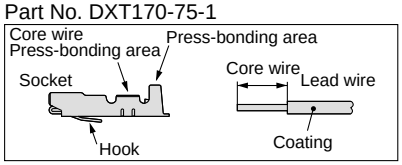


❷ Press bonding socket to lead wire.

●Strip the end of the lead wire 3.2 to 3.7mm long.

●Put wire into socket taking care to prevent the lead wire insulation from entering the core wire pressure bonding area.

●Press bond using press-bonding tool. Part No. DXT170-75-1



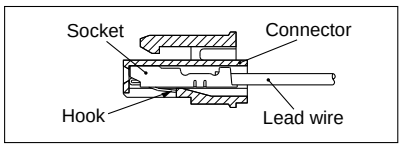
❸ Assembly of socket to connector

●Assembling

Push socket into hole in connector until the hook of the socket locks into the connector. (The socket hook will spring open inside the connector.) Gently pull lead wire back to confirm that socket is locked in position.

●Disassembling

When disassembling socket form connector, push the hook of the socket down with a small dia. instrument. Pull socket out by means of the lead wire. If the socket is to be re-used, bend hook of the socket out to its original position before re-assembling.

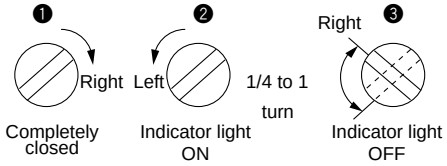


How to Set Adsorption Confirmation Adjustment Needle

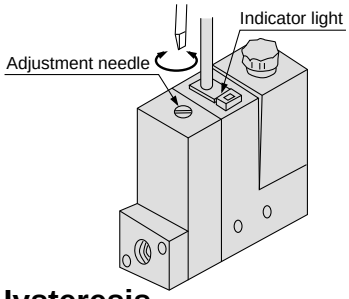
❶Supply the vacuum and electrical power source to the unit. Rotate adjustment needle clockwise until it stops.

❷With the adsorption nozzle away from the workpiece (open), turn the adjustment needle counterclockwise until the indicator light turns on.

❸From the above "2" position, turn the adjustment needle 1/4 to 1 turn clockwise.

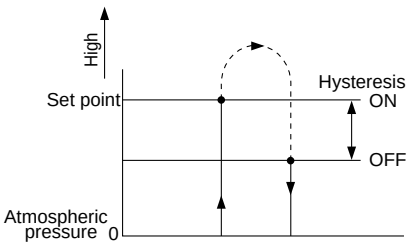


❹Re-adjust the needle so the indicator light turns ON only when the work adsorption is steady.



Hysteresis

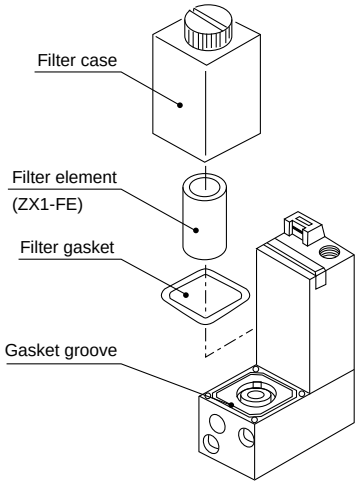
Hysteresis is the pressure difference between the ON pressure and the OFF pressure of the output signal. The set pressure is the pressure selected to switch from OFF to ON condition.



Filter Element Replacement

If the filter element becomes clogged, leading to a reduced adsorption force or delayed response time, stop the operation and re-place the element. (Element part number ZX1-FE)

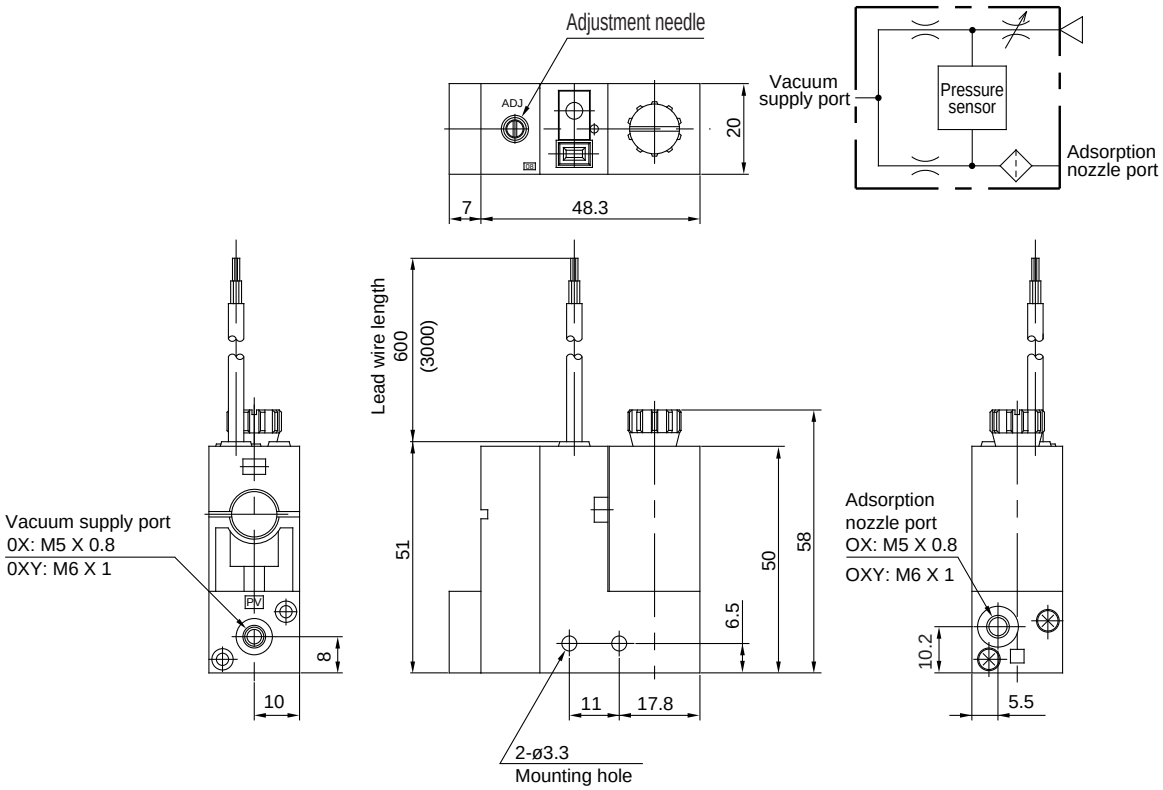
Verify that the filter gasket is placed properly in the gasket groove before installing an element.



Dimensions

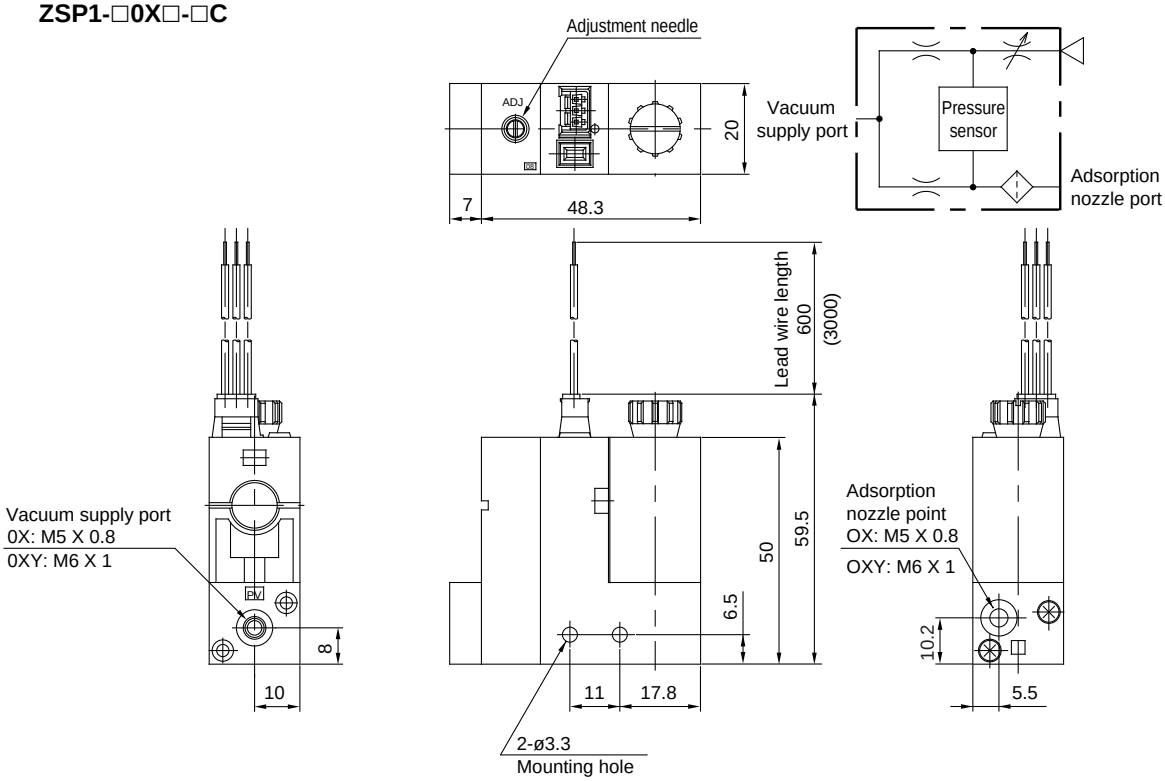
Grommet style

ZSP1-□0X□-□



Connector style

ZSP1-□0X□-□C



Mechanical Style Pressure Switch

Series IS1000

Long life: 5 million cycles

IS1000-01 IS1000-01-X202

Specifications

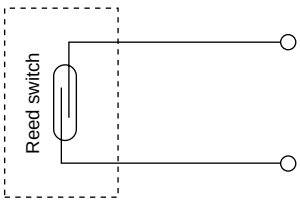
Model	IS1000-01
Proof pressure	1.0MPa
Max. pressure	0.7MPa
Operating pressure range	0.1 to 0.4MPa
Hysteresis	0.08MPa
Repeatability	±0.05MPa
Contact	1a
Electrical entry	Grommet, Lead wire length 0.5m (Standard)
Fluid	Air
Ambient and fluid temperature	–5 to 60°C (No freezing)
Port size	R(PT)1/8
Weight	74g

Switch Characteristics

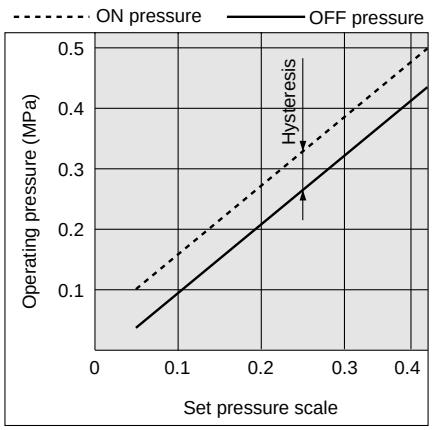
Max. contact capacity	2V AC, 2W DC		
Voltage	24V AC/DC or less	48V AC/DC	100V AC/DC
Max. operating current	50mA	40mA	20mA
Shock resistance	30G		

Electrical Circuit

Up to 100V AC/DC



Operating Pressure Range



How to Order

IS1000 — 01 S — ☐

Port size

01	R(PT) 1/8
N01	NPT 1/8

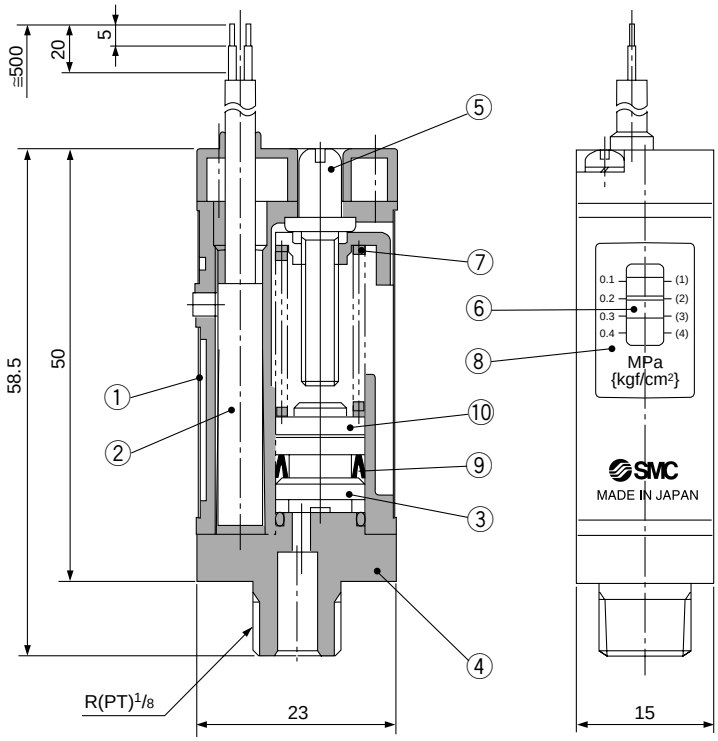
Sealant

—	None
S	With sealant

Optional

X201	Lead wire length 3m
X202	Operating pressure range 0.1 to 0.6MPa
X215	Lead wire length 3m Operating pressure range 0.1 to 0.6MPa

Construction



Components

No.	Description	Material
①	Shield plate	Rolled steel plate
②	Switch ass'y	—
③	Piston	Oil polyacetal
④	PT fittings	Zinc die cast
⑤	Adjustment screw	Brass (Electrical nickel plated)
⑥	Pointer	Vinyl chloride
⑦	Spring	Stainless steel 304-WPB
⑧	Scale plate	Rigid vinyl chloride
⑨	Miniseal Y type	NBR
⑩	Magnet	Rare earth magnet

⚠ Precautions

Be sure to read before handling.
Refer to p.0-26 and 0-27 for Safety Instructions and common precautions, on the products mentioned in this catalog, and refer to p.3.0-7 to 3.0-9 for precautions on every series.

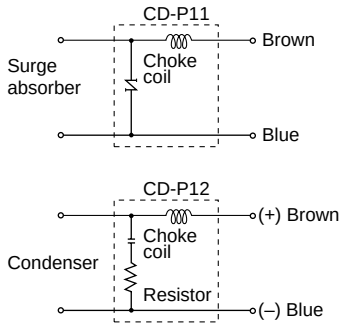
Wiring

⚠Warning

①Connect load before connecting with power source.
②In the case of induction load or lead wire exceeding 5m long, the following contact protection box should be used.

Part No.	Voltage	Lead wire length
CD-P11	100V AC	Switch side: 0.5m
CD-P12	24V DC	Load side: 0.5m

③Internal circuit of contact protection box

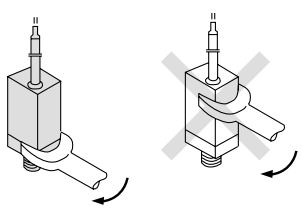


④How to connect contact protection box
Connect the lead wires from the body and the contact protective box side indicated "SWITCH".
Lead wire should be as short as possible, within 1m.

Installation/Piping

⚠Warning

①When changing piping by hand, hold body.
Electrical wire must not be subjected to excessive force.
②Do not drop nor apply an excessive force.
③Tighten IS1000-01 applying the spanner on the PT fitting part.



Air Supply

⚠Warning

①Do not use with corrosive gases or fluids.
②Avoid use in vacuum applications. Switch may implode.

Pressure Setting

⚠Caution

①Set pressure scale at the value of the Pressure drop.
②When detecting ON-pressure signal, note that set pressure on scale plate plus ON-OFF differencial (Hysteresis) will be ON-pressure signal.

Environment

⚠Warning

①Avoid using a switch in a magnetic environment. It may cause a malfunction.
②Do not use in an environment with water or splashing oil to avoid malfunction or damage to switch caused by corrosion of the electric circuit.

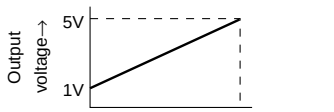
Glossary

A

Absolute pressure
The pressure based on the absolute vacuum condition (0 standard).
Absolute pressure display mode on Series PSE100 is a mode where display is based on the atmospheric pressure.

Accuracy
The maximum difference between the true value and that indicated by an instrument is the measure of the instrument's accuracy. It is expressed as a percentage of the full-scale value of the reading according to the type of instrument.

Analog output function
A voltage or current output which has a value proportional to the measured pressure.



Graph 1

Auto preset function
Refer to Technical Information on p.3.14-9.

Autoshift function
Refer to Technical Information on p.3.14-10.

C

Channel selection function
Refer to Technical Information on p.3.14-11.

Chattering
If the ON and OFF setpoints are of identical value with no hysteresis, "chattering" occurs. Chattering refers to the repeated change of an output from "High" to "Low" at a high frequency.

Condensation
Natural phenomenon. Humidity in the air collects on colder surfaces and liquefies.

Connection port size
Size of the process connection on the switch.

Connector
Type of an electrical connection .

Current consumption
Maximum current needed for normal operation.
Does not include the load current.

D

Detection range
Distance at which an instrument such as the Air Catch Sensor is operational.

Deviation level indicator light
The indicator light which shows how much the current value differs from the setting value in Air Catch Sensor.

Diffused semiconductor
Resistors are diffused onto a silicon chip forming a bridge circuit. Pressure exerted onto the silicon chip cause the bridge circuit to become unbalanced. The changes is proportional to the pressure.

Digit (Minimum display unit)
Minimum unit to indicate pressure.

Digital pressure Switch
The pressure switch manages signals via a sensor using a micro computer like a CPU, it indicates pressure valve in digital output, ON-OFF.

DIN rail
The rail equivalent to DIN Standard in Germany. The products introduced in this catalogue are corresponding to 35[mm] width type.

E

Ejector
Simple piece of equipment to generate a vacuum. Positive air pressure is used to generate a vacuum. No moving parts.

F

Failure predict output function
Refer to Technical information on p.3.14-9.

Frequency response
The inverse number of response time.
The higher the frequency becomes, the shorter the response time becomes.

F.S.
F.S. is the abbreviation for Full Span or Full Scale. The maximum fluctuation width.
EX.) When output voltage is 1 to 5[V],
F.S. = The max. voltage – The min. voltage
= 5[V] – 1[V]
= 4[V]

Full scale
Same meaning as F.S.

Full span
Same meaning as F.S.

G

Gas contact part
Wetted parts. Parts that are in contact with the process fluid.

Grommet
Type of electrical entry.

H

Hysteresis
The difference between the "OFF" state and "ON" state value at a given setpoint value.

I

Input impedance
The impedance at the input terminals of a circuit, transmission line, etc., "seen" by a signal source, expressed in ohms.

Insulation resistance
Resistance between electrical circuit and the body.

Internal voltage drop
Caused by the resistance of an electrical part in an electronic circuit. Example is a 2 wire pneumatic pressure switch.

Glossary

L

Leakage current
Current flow at the "OFF" state. Ideally, this value is "0".

Liquid contact part
Wetted parts. Parts that are in contact with the process fluid.

Load
Electrical appliance connected to the output, e.g. relay, solenoid, etc.

Load current
Current flow through the electrical appliance once the output is energized.

Load impedance
Resistance of the load that impedes the current flow.

Load lock chamber
Vacuum chamber located in front of the main vacuum chamber in semiconductor production line. Prevents main vacuum chamber to be contaminated (loss of vacuum) during the loading and unloading process.

Load voltage
Voltage supplied to load.

Lock-out mode
Prevents unauthorized or accidental change of calibration data.

M

Max. operating pressure
Max. operating pressure the unit is designed for. Exceeding this pressure could result in malfunction of or damage to the unit.

Minimum displayable pressure unit
The least possible unit to display on the digital pressure switch. If the min. display unit is 1[kPa], display indicates in each 1[kPa] (by [kPa]) i.e. 0, 1, 2, 3,⋯99, 100[kPa].

Minimum setting unit (digit)
The least possible unit to set pressure value on the digital pressure switch. If the min. setting unit is 1[kPa], setting is possible only with integer multiplies of that number i.e. 1, 2, 3,⋯ (Not available 1.5, 2.5,⋯)

N

Noise resistance
Amount of electrical noise, an electrical appliance can withstand without malfunctioning.

Non reversed output mode
Refer to the Technical Information on p.3.14-8.

Normal mode
Refer to the Technical Information on p.3.14-8.

NPN output
Refer to the Technical Information on p.3.14-7.

O

ON-OFF output
Refer to the Technical Explanation on p.3.14-6. Switch output.

Open collector
Internally the output wire and terminal are directly connected to collector of output transistor. (Refer to the fig.2 and 3.)

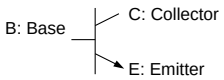


Fig.2 NPN type

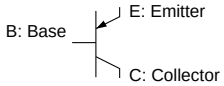


Fig.3 PNP type

Operating humidity range
Humidity range for proper operation of equipment.

Operating indicator light
LED indicator is on when ON-OFF output is ON.

Operating pressure range
Pressure range. The unit was designed to operate in.

Operating temperature range
Temperature range for normal operation.

Operating voltage
Voltage range for normal operation.

Orifice
Restriction for controlling flow of fluid.

P

Panel mounting
To allow a product to be mounted on a panel in an appealing and secure fashion.

Peak indication part
Refer to the Technical Information on p.3.14-8.

PNP output
Refer to the Technical Information on p.3.14-7.

Protective construction
Refer to the Technical Information on p.3.14-13.

R

Reducer
One of the connection types. Connects directly to the "One-touch" fittings.

Reed switch
Type of switch in which two strips of magnetic material sealed inside a glass tube are caused to come into contact by the magnetic field of a nearby magnet.

Relative pressure
Converted pressure value based on any own decided standard pressure. When based on the Absolute vacuum, it is called Absolute pressure, while based on the Atmospheric pressure, it is called Gauge pressure.

Repeatability
Refer to the Technical Information on p.3.14-9.

Residual voltage
Voltage drop over the output transistor when the output is "on".

Response time
The inverse number of frequency response. The shorter the response time becomes, the higher the frequency becomes.

Reversed output mode
Refer to the "Hysteresis mode" and "Window comparator mode" in Technical Information on p.3.14-8.

Ripple
A small AC voltage superimposed on top of a DC voltage.
In case of Fig.4, ripple 10% means
V' ≧ V"
V'/V X 100 = 10%
When no pulsation is happened, ripple is 0%.

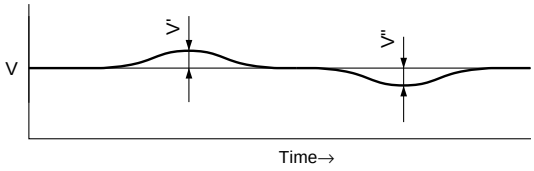


Fig.4

S

Self diagnostic function
Error message is displayed if the unit is operated outside its designed operational envelope.

Sequence controller (PLC)
Programmable logic controller. Depending on application, it can utilize inputs from pressure or limit switches and control outputs executing a control program down loaded in its memory.

Setpoints
The number of the ON-OFF output points in one product. Product with 2 setting points means 2 output style.

Setpoint adjustment angle
The number of turns. The potentiometer can be rotated normally given in degrees e.g. 270° for a standard potentiometer.

Shock resistance
The amount or severity of shock, an appliance can withstand without damage.

Solid state switch
Typically a transistor. A solid state switch does not have any mechanical parts.

Suction filter
Filter installed between the vacuum pad and the ejector to prevent dust entry to the ejector.

SUS ***
JIS symbol classifying the grade of stainless steel.

Switch output
Refer to the Technical Information on p.3.14-6. ON-OFF output.

T

Temperature characteristics
Refer to the Technical Information on p.3.14-9.

TSJ
Abbreviation of Tube Swage Lock Fitting.

U

Unit conversion
Refer to the Technical Information on p.3.14-13.

URJ
Abbrevation of Union Ring Joint and means VCR fitting. VCR is a registered trademark of Cajon Co.

V

Vacuum breaking pressure
Positive pressure added for releasing the work or quickly returning to atomospheric pressure after breaking the vacuum condition.

Voltage resistance
Maximum voltage level when voltage runs between electrical circuit and body. The value indicates strength against voltage. If higher voltage runs, product may be damaged. (In this case, voltage is different from power supply voltage to operate product.)

W

Window comparator mode
Refer to the Technical Information on p.3.14-8.

Z

Zero out (Zero ADJ)
Reset of the display to zero at atmospheric pressure.

1 Outline

The Pressure Switch detects pressure of gases or liquids. Built-in circuitry allows for the adjustment of set points and outputs. Outputs are ON-OFF solid state or reed switch type outputs. Some models feature analog outputs. The pressure is detected using solid state, metal diaphragm or piston type sensors.
Applications for pressure switches are numerous and include areas such as positioning, leakage testing, supply pressure verification, etc.

2 How pressure is detected

●Solid state sensor

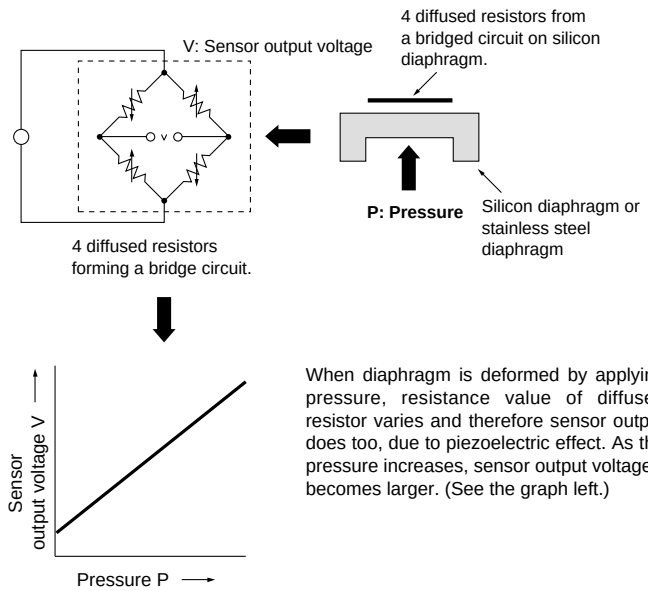
This sensor is used in dry air and inert gas applications. Four diffused resistors form a bridge circuit on a silicon diaphragm. When pressure is applied, the diaphragm is deflected causing the diffused resistors to change resistance (piezoelectric effect). An electrical signal, which is proportional to the pressure change, is inputted during normal operation.

Characteristics: Quick response
Long life
Compact

●Stainless steel diaphragm pressure sensor

This sensor is used in humid air, water or oil. Four diffused resistors form a bridged circuit on a stainless steel diaphragm. All pressured parts are made of stainless steel.
Pressure detection is identical to the silicon diffused sensor with the exception that the resistors are diffused on to the stainless steel diaphragm.

Characteristics: Quick response
Long life
Wide variety of applicable fluid



When diaphragm is deformed by applying pressure, resistance value of diffused resistor varies and therefore sensor output does too, due to piezoelectric effect. As the pressure increases, sensor output voltage becomes larger. (See the graph left.)

3 Difference between ON-OFF and Analog output

●ON-OFF output

ON-OFF output is also referred to as switch output.
Fig.1 shows an equivalent circuit of a NPN switch with the output off. In this circuit the load is not powered, because there is no current flow. Negative potential is not connected. When using a PLC, the input section sees a high level.

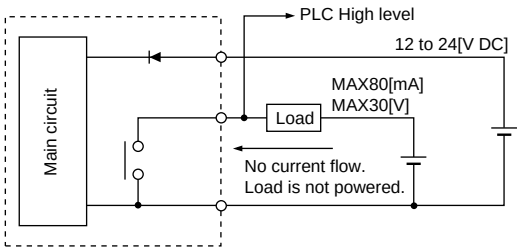


Fig.1 Equivalent circuit of a NPN type switch with the output off

Fig.2 shows an equivalent circuit of a NPN switch with the output on. In this circuit the load is powered. When using a PLC, the input section sees a low level.
Another type of a switch output is a PNP switch. Refer to Difference between NPN and PNP Output on the next page.

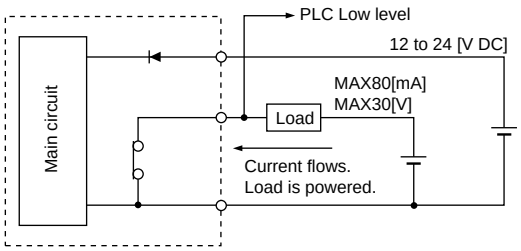
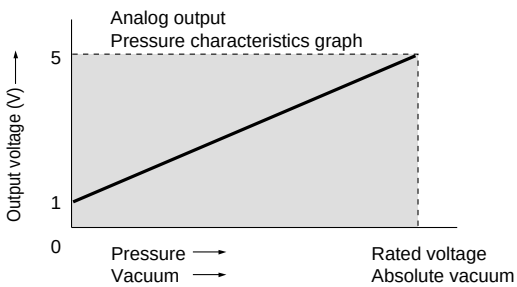


Fig.2 Equivalent circuit of a NPN type switch with the output on

●Analog output

An analog output provides an output voltage that is proportional to the pressure measured by the sensor.



ZSE5B/6B: –100[kPa] to 100[kPa] = 1 to 5 [V]

4 Difference between NPN and PNP output

●NPN

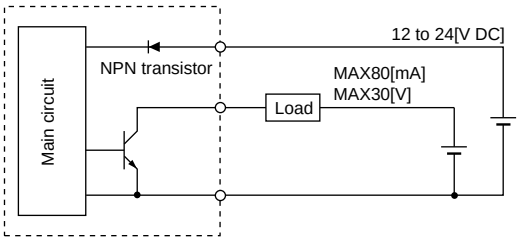


Fig.1 Connection example of NPN output

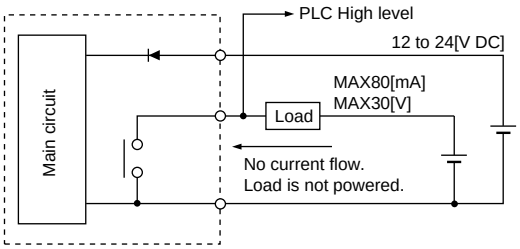


Fig.2 Equivalent circuit of an NPN switch with the output off

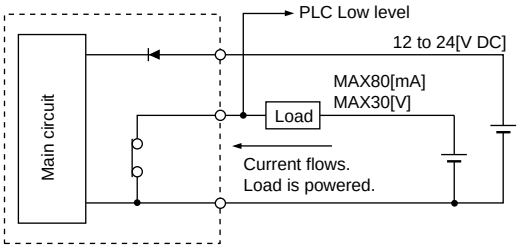


Fig.3 Equivalent circuit of an NPN switch with the output on

Fig.1 shows an example of an NPN switch.
The solid state switch output is an open collector output. The NPN refers to type of output transistor used.
Fig.3 shows the equivalent circuit with the output transistor in its ON state.
The current for the load flows in (sinks) to the transistor. The NPN type of output is also referred to as the "Sinking Type".
In order for this circuit to work, the other side of the load has to be connected to the positive terminal of a power source.
The diagram on the left shows two power sources, one for the load and one for the switch. In actual applications it will cause no problem to use one source for both.
Summary: An NPN output has the current flowing from the load into the transistor when energized. (Sinking type)

●PNP

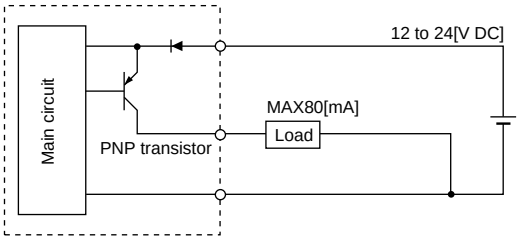


Fig.4 Connection example of PNP output

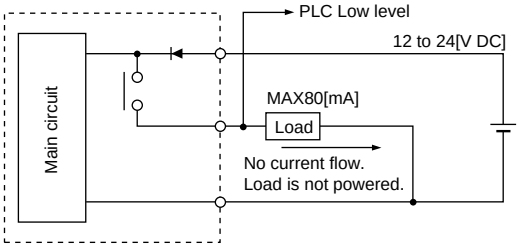


Fig.5 Equivalent circuit of a PNP switch with the output off

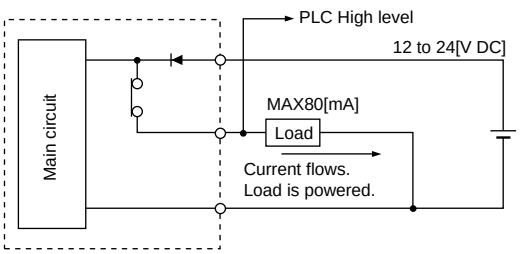


Fig.6 Equivalent circuit of a PNP switch with the output on

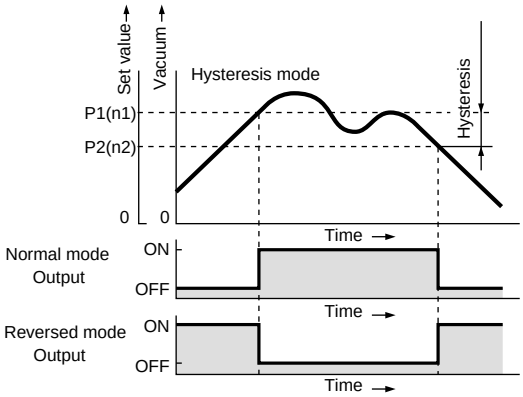
Fig.4 shows an example of a PNP switch
The solid state switch output is an open collector type output. The PNP refers to the type of output transistor used.
Fig.6 shows the equivalent circuit with the output transistor in its ON state.
The current for the load flows out (sources) of the transistor. The PNP type of output is also referred to as the "Sourcing Type".
In order for this circuit to work the other side of the load has to be connected to the negative common.
Summary: A PNP output has the current flowing from the transistor to the load when energized (Sourcing type).

5 Hysteresis mode

Hysteresis is the difference between the ON and OFF value of an output. This is necessary to prevent the switch from "Chattering" once the setpoint is reached.
In the case of "Normal Mode", the output remains ON until the pressure falls to a level below the setpoint minus the hysteresis. This means the output will be turned off at a specific pressure which can be calculated as follows:

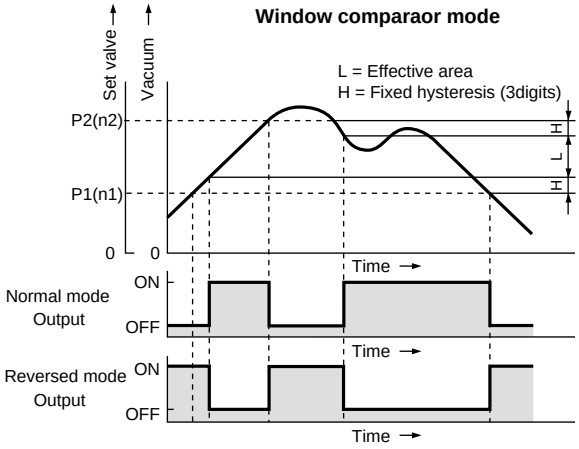
OFF switch point = setpoint – hysteresis

"Reversal Mode" is defined as: ON switch point = setpoint – hysteresis



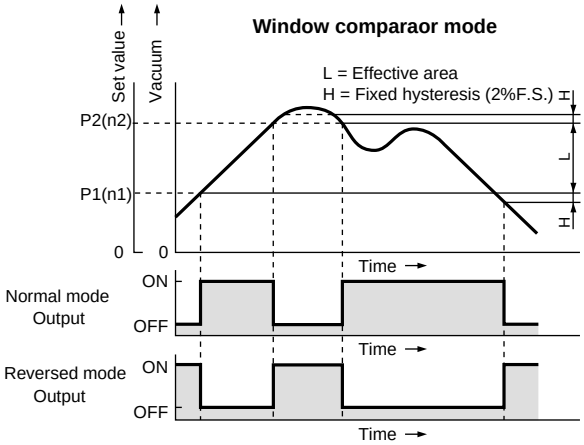
6 Window comparator mode

This mode is used when the output has to stay ON within a certain pressure range. The hysteresis is fixed (3 digits) (ZSE5B/6B: 2 digits).
When calibrating the switch make sure that calibration point P1 is at least 7 digits different than calibration point P2. The effective area of operation is shown in the graph and is marked with "L".
If the difference between P1 and P2 is less than 6 digits, this mode will not operate.
In case of a switch with 2 outputs, the Output 2 is using calibration points P3 and P4.
"Reversal Mode" reverses above operation.
Window Comparator Mode can be applied in situations where the supply pressure has to be within a certain range.



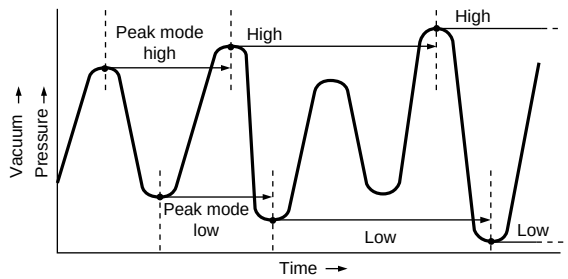
High Accuracy Switch Series PSE

This mode is used when the output has to stay ON within a certain pressure range. The hysteresis for these switches is fixed at 2% F.S.
The effective area of operation is shown in the graph and is marked with "L".



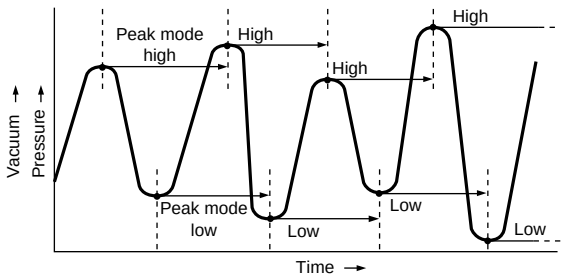
7 Peak display mode

●Z/ISE3, Z/ISE4, 4B, 4E, Z/ISE5B, 6B



Under most operating conditions the pressure will vary over time (see graph). The highest pressure measured is stored and displayed as "Peak Mode High". The lowest pressure measured is stored and displayed as "Peak Mode Low".

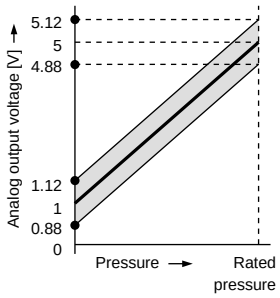
●PSE100



Summary: Pressure fluctuations are constantly monitored and the maximum or minimum pressures updated. This function allows the user to record the quality of his pressure regulation before performing any kind of calibration procedures.
Applications include the control of pressure in a caulking operation.

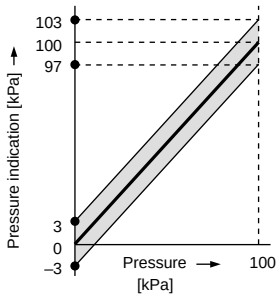
8 Temperature characteristics

The temperature characteristic is defined as the change in linearity over a given temperature range. All data given in a technical specification sheet is based on 25[°C]. The temperature range is dependent on the product series. Normally SMC products are rated from 0 to 50[°C] or 0 to 60[°C].



Example: Analog output = 1 to 5[V]
Temperature characteristic = ±3[% F.S.]
F.S. = 5[V] – 1[V] = 4[V]
±3[%F.S.] = 4 X 0.03 = ±0.12[V]

The output error induced by the temperature change can be as much as ±0.12[V].



Example: Pressure display = 100[kPa]
Temperature characteristic = ±3[%F.S.]
F.S. = 100[kPa] – 0[kPa] = 100[kPa]
±3[%F.S.] = 100[kPa] X 0.03 = ±3[kPa]

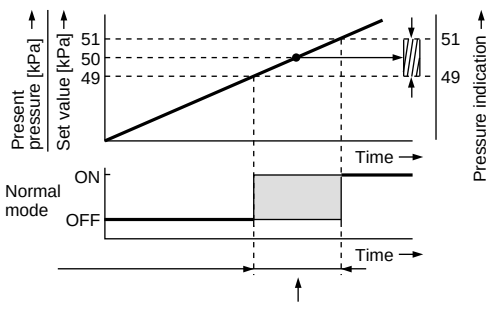
The display error induced by the temperature change can be as much as ±3[kPa].

9 Repeatability

The repeatability is defined as the ability of an instrument to provide the same output every time for the same input. Usually given as a percentage of the full scale value.

Example: Full scale reading 100[kPa]
Setpoint for output 50[kPa]
Repeatability ±1[%F.S.]
±1[%F.S.] = 100 [kPa] X 0.01 = ±1[kPa]

The deviation from the setpoint is +/– 1[kPa]. this means that the output can become energized anywhere between 49 to 51[kPa]. (Refer to the graph below.)

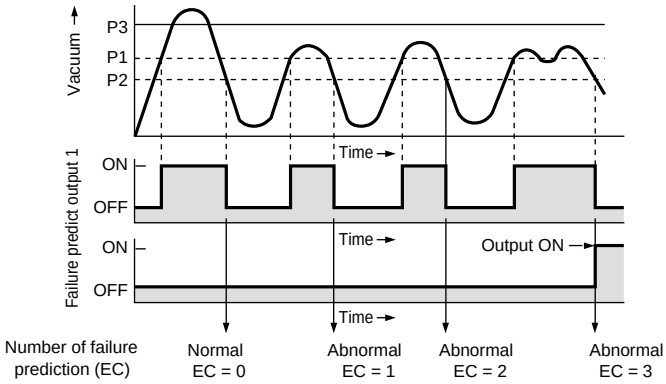


Effective area of pressure indication at 50[kPa].

Effective area for switch to become energized.

10 Failure predict function

The failure predict function allows the user to anticipate possible maintenance requirements. How does it work?
In a vacuum application, for example, the degrees of vacuum could deteriorate over a period of time for various reasons. In an application where the set point P1 is at 500[mmHg] and second setpoint P3 is set at 600[mmHg] every time the generated vacuum goes below 600[mmHg] a counter records the intance. If the counter reaches a preset limit, the failure predict output becomes energized signaling a potential problem, even though normal operation of the process has not yet been compromised.
When the failure predict output is energized and the vacuum pressure reaches or exceeds the pressure set at P3, the counter is reset.

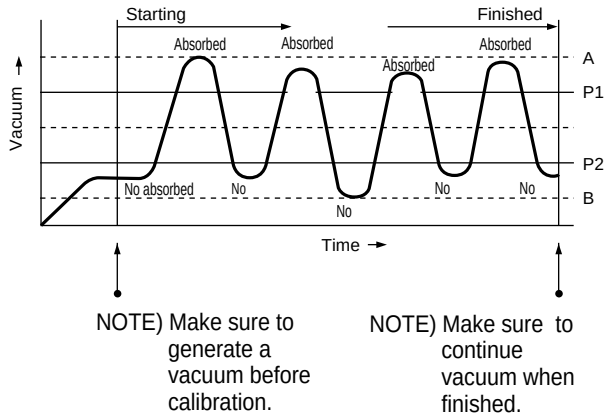


11 Auto preset function

Auto preset function enables the automatic selection of the most suited set point value when the pressure switch is used for adsorption confirmation, which is obtained only by repeating the work adsorption and release. How to operate the auto preset mode: Refer to the catalog and Operating Manual.

How to calculate the setting value
A = Max. pressure value in auto preset mode
B = Tentative min. pressure value in auto preset mode
P1 = A–(A–B)/4 P2 = B+(A–B)/4

Manual adjustment is possible after set point auto preset mode.



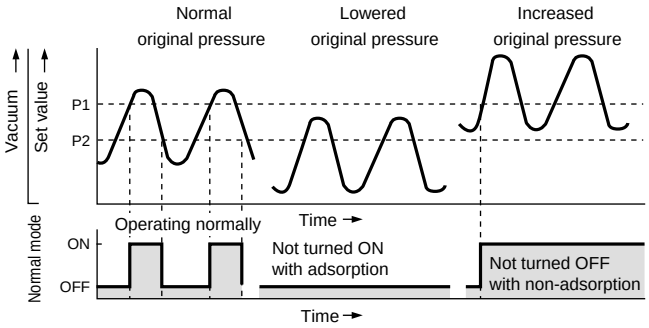
NOTE) Make sure to generate a vacuum before calibration.

NOTE) Make sure to continue vacuum when finished.

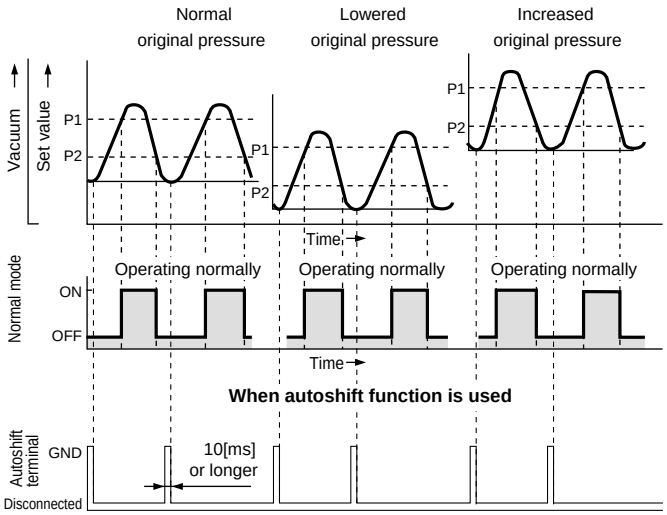
NOTE) In case of using this function on PSE100, input the autoshift signal while work is not absorbed.

12 Autoshift function

The Autoshift function allows the setpoints of a pressure switch to be referenced to a pressure level other than atmospheric pressure.
When enabling the Autoshift function a pressure reading is taken of the current measured pressure level and used as an offset for all the setpoints. This feature is especially useful in vacuum applications.
Vacuum ejectors are dependent on their supply pressure for vacuum generation. Fluctuations in supply pressure means fluctuations in vacuum pressure. This could cause a vacuum switch, applied as an vacuum adsorption switch not to see a workpiece that has been adsorbed. The autoshift function allows the switch to be compensated for the change in vacuum pressure. Refer to figures below.

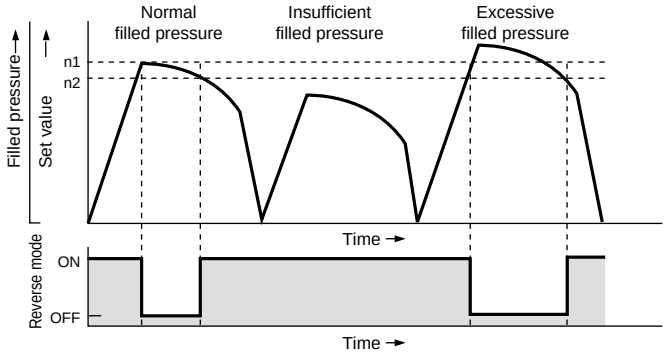


When autoshift function is not used



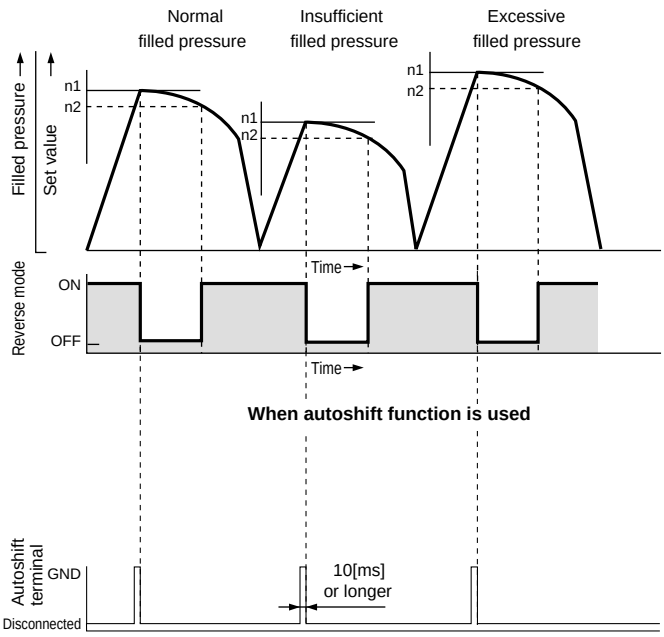
When autoshift function is used

Another application for the Autoshift function would be the testing for leaks.
Under normal circumstances a vessel charged with compressed air to a certain pressure will stay pressurized at the same pressure level unless the vessel has a leak. If the vessel has a small leak the pressure will decrease over time. No vessel is absolutely leak proof, therefore leakage testing is done measuring the amount of pressure drop over a period of time.
Using a pressure switch, an output can be generated as soon as the pressure level decreases by 1[kPa], for example. Without the Autoshift function the vessel has to be charged to the exact pressure level every time. If the initial pressure level is too high the output of the switch does not become energized at all or becomes energized after an excessive amount of time. If the pressure is too low the output is always energized. In either case it is impossible to determine if the vessel is good or bad.



When autoshift function is not used

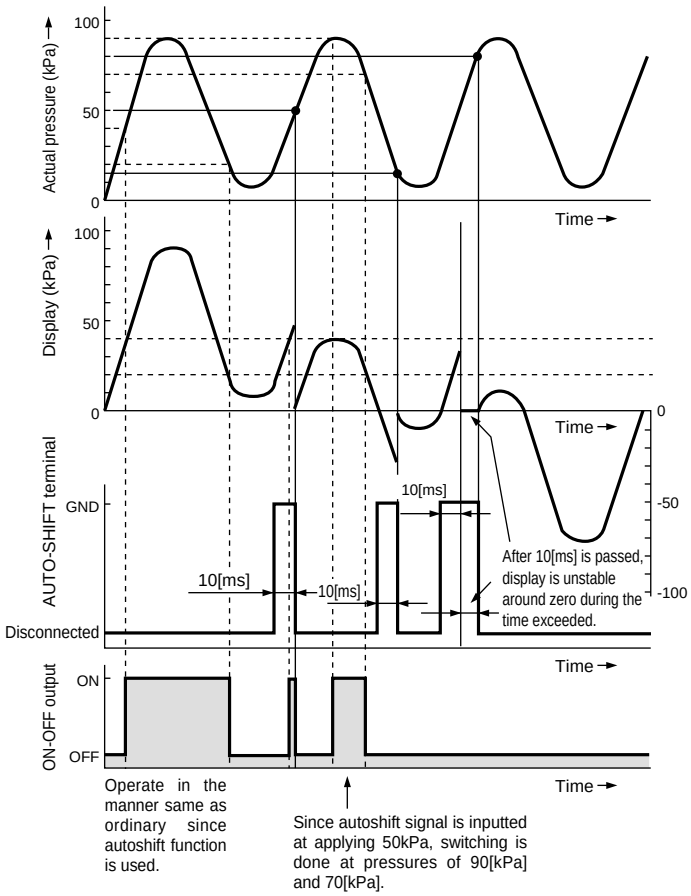
To combat fluctuations in initial pressure level, the Autoshift features is activated as soon as the vessel is charged. The initial pressure level is now used as a reference. As soon as the pressure drops by 1[kPa] (see example above.) from the point the Autoshift feature is activated the output is energized.
Refer to figures below.



When autoshift function is used

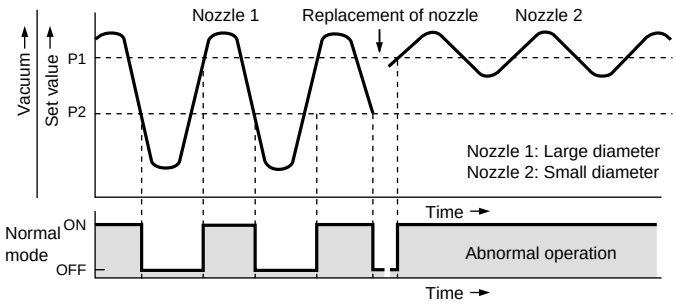
How to activate the Autoshift function
Pull the AUTO-SHIFT input to GND for at least 10[ms]. The Autoshift feature is activated by the rising flank of the Autoshift input. The Display and Setpoints are now based on the pressure at the moment of release after Autoshift input.

Example: The figure below is based on the condition of set values as
P1 = 40[kPa] and P2 = 20[kPa].

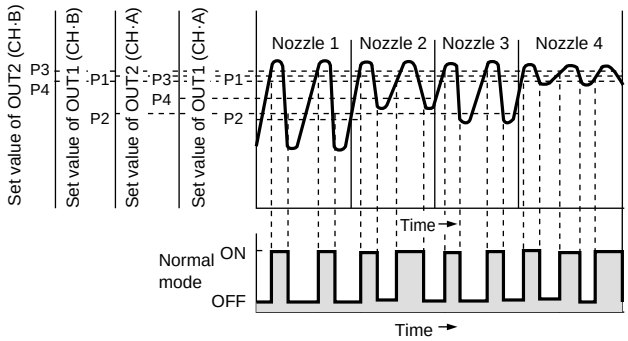


13 Channel selection function

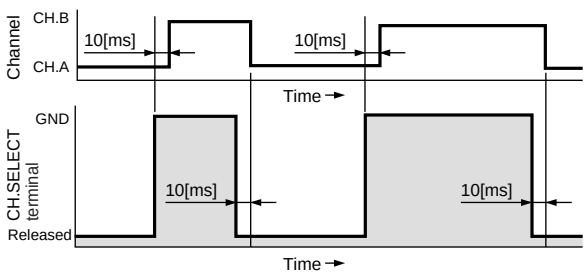
Channel Selection Function is explained with an example when adsorbing work. The pressure on the nozzle varies according to the nozzle diameter. It is necessary to change the setting pressure whenever changing the nozzle size in line. But in reality, it is impossible to stop the line only for change of nozzle. Pressure switches are required for each nozzle to change the pressure without stopping the line. Channel Selection Function is adopted for that case.



It is also available for adjusting one nozzle to the different form of works. When there are two types of nozzles, OUT1 and OUT2 are adopted without any problems like OUT1 for Nozzle 1 and OUT2 for Nozzle 2. When more than 3 types of nozzle are needed, A and B channels are available for selection; thus 2 outputs X 2 channels = 4 outputs are available. Certain switching can be obtained by selecting the output corresponding to the nozzle as the graph above.



How to select the channel
When the CH.SELECT terminal is open state, CH.A is selected, while when connecting with GND, CH.B is selected. It takes 10[ms] to switch the channel.



14 2-wire pressure switch connections

There are two basic styles of switches; 3-wire switches and 2-wire switches
On a 3-wire switch the switch is powered separately from the load compared to a 2-wire switch which is powered in line to the load. 3-wire switch connection:

Brown Lead····Pos. supply voltage connection for switch
Blue Lead·····Neg. supply voltage connection for switch
Black Lead·····Output connection

SMC also offers switches with two outputs. These switches have 4 wires, but fall into the category of 3-wire switches.

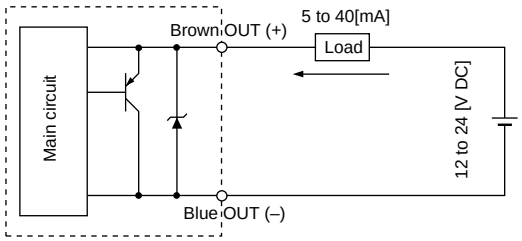
Brown Lead····Pos. supply voltage connection for switch
Blue Lead·····Neg. supply voltage connection for switch
Black Lead·····Output No.1 connection
White Lead·····Output No.2 connection

2-wire switch connection:

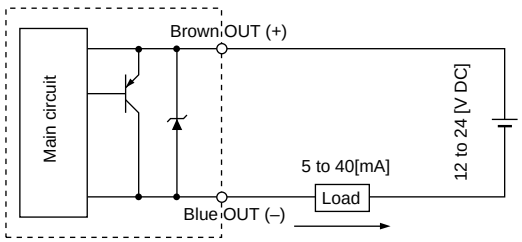
Brown Lead····Pos. connection. Connect to +V. Connect to load, if load is to be connected between +V and switch
Blue Lead·····Neg. connection. Connect to –V. Connect to load, if load is to be connected between –V and switch
Characteristics: Quick response
Long life
Simple and easy wiring

⚠ Note

"PS1000, PS1100"
The load current range for a PS1000 and PS1100 is between 5[mA] to 40[mA]. If 40[mA] is exceeded the output transistor could be damaged. The leakage current of these switches is 1[mA]. If these switches are used as inputs on a PLC, make sure that the input card allows for a leakage current of at least 1[mA] or greater, otherwise the input card might detect the leakage current as a ON condition of the switch.

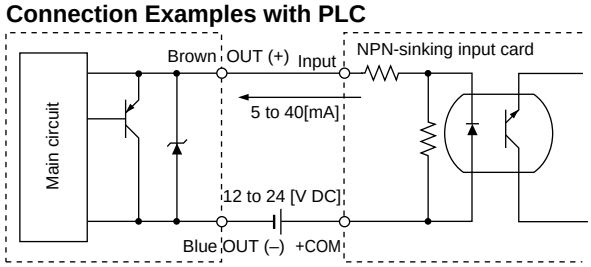


Connection in a sinking application

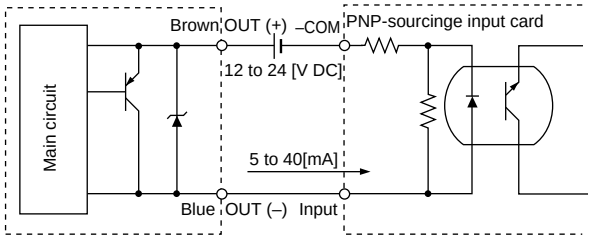


Connection in a sourcing application

Connection Examples with PLC



NPN-sinking input card



PNP-sourcing input card

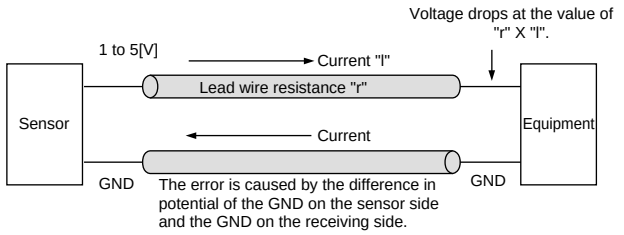
15 Voltage and current output pressure sensors

Voltage
Output signal is a voltage signal in the range of 1 to 5[V].
The signal has to be converted by a A/D converter for pressure display or switch output.

Current
Output signal is a current signal in the range of 4 to 20[mA].
The signal is transformed into a voltage signal before being converted by a A/D converter for pressure display or switch output.

Advantages and disadvantages
(Long distance applications)

• Voltage



Connection of the voltage

When the voltage signal has to travel any amount of distance, voltage drops occur due to the resistance of the lead wire. The voltage drop increases proportional with the resistance of the wire and thus proportional with the length of the wire.

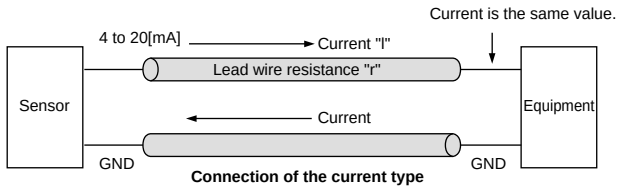
Voltage drop = Current X Resistance (Lead wire)

It appears that it would be of benefit to reduce the current flow as much as possible, however if the current is reduced too much other problems, such as inductive noise from external devices, occur.

Result: Voltage outputs are not suitable for long distance applications.

SMC's analog outputs are all of the voltage variety, but tests have proven that there is no problem in applications of 10[m] or less.

• Current



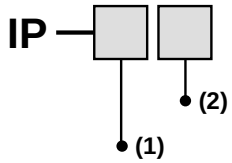
Connection of the current type

The current flow is the same regardless of the distance.
The cost of a current system is higher, because the voltage signal has to be converted to a current signal on one end of the transmission line, then on the other end it has to be converted to a voltage signal again.

The packaging size of a current sensor might be larger due to the size of the additional parts.

The voltage drop is calculated as follows:
Voltage drop = Current X Resistance

16 Protective construction



(1)Degree of Protection against Contact and Entrance of Solid Foreign Bodies

0	No protection
1	Protection against foreign objects > 50[mm].
2	Protection against foreign objects > 12[mm].
3	Protection against foreign objects > 2.5[mm].
4	Protection against foreign objects > 1.0[mm].
5	Protection against harmful deposits of dust.
6	Protection against penetration of dust.

(2) Degree of Protection against Ingress of Liquid

0	No protection	—
1	Protection against drops of condensed water.	drip proof 1
2	Protection against drops of liquid when housing is tilted to 15° from vertical.	drip proof 2
3	Protection against rain at angle < 60° from vertical.	splash proof
4	Protection against splashing from any direction.	spray proof
5	Protection against water jets from any direction.	jet proof
6	Protection against conditions on ships' decks. Water from heavy seas will not enter.	water proof
7	Protection against immersion in water. Water will not enter under stated conditions of pressure and time.	water tight
8	Protection against indefinite immersion in water under a specified pressure.	under water

18 Operating fluids for general purposes

Stainless Steel

Metal exists as ore like oxide or sulfide form in the nature. It means oxide or sulfide form is more stable than pure metal form.
Accordingly, metallic material chemically oxides (metallic constituent becomes ion and melts out); corrodes in the natural environment.
Even though corrosion of metal easily occurs in the environment where oxidizing tendency is stronger, some kinds of metal have a characteristics that corrosion never happens if level of oxidizing goes higher than a specific point. In such a case, it is called "metal in passive state".
Stainless steel has corrosion resistance because of a thin coat of passive state on its surface.
However, there does not exist stainless steel with absolute corrosion resistance; therefore, many types of stainless steel have been developed for improved corrosion resistance performance.
SMC Pressure Switch and Pressure Sensor for general purpose fluids have adopted stainless steel SUS304 for the fittings where in contact with fluids as well as SUS630 for diaphragm of sensor part.
Corrosion resistance performance of both SUS304 and SUS630 is almost the same level.

⚠ Caution

SMC Pressure Switch and Pressure Sensor do not have explosion-proof construction; do not use flammable gases or liquids.

17 Pressure Units Table

Units								
Pa (N/m^2)	**kPa**	**MPa**	**bar**	**kgf/cm^2**	**atm**	**mmH_2O or mmAq**	**mmHg or Torr**	**PSI**
1	1×10^{-3}	1×10^{-6}	1×10^{-5}	1.0197×10^{-5}	9.8692×10^{-6}	1.0197×10^{-1}	7.5006×10^{-3}	1.4500×10^{-4}
1×10^3	1	1×10^{-3}	1×10^{-2}	1.0197×10^{-2}	9.8692×10^{-3}	1.0197×10^2	7.5006	1.4503×10^{-1}
1×10^6	1×10^3	1	1×10	1.0197×10	9.8692	1.0197×10^5	7.5006×10^3	1.4503×10^2
1×10^5	1×10^2	1×10^{-1}	1	1.0197	9.8692×10^{-1}	1.0197×10^4	7.5006×10^2	1.4503×10
9.8067×10^4	9.8067×10	9.8067×10^{-2}	9.8067×10^{-1}	1	9.6784×10^{-1}	1×10^4	7.3556×10^2	1.4217×10
1.0133×10^5	1.0133×10^2	1.0133×10^{-1}	1.0133	1.0332	1	1.0332×10^4	7.6000×10^2	1.4706×10
9.8067	9.8067×10^{-3}	9.8067×10^{-6}	9.8067×10^{-5}	1×10^{-4}	9.6784×10^{-5}	1	7.3556×10^{-2}	1.4220×10^{-3}
1.3332×10^2	1.3332×10^{-1}	1.3332×10^{-4}	1.3332×10^{-3}	1.3595×10^{-3}	1.3158×10^{-3}	1.3595×10	1	1.9330×10^{-2}

Ex.1) Convert the units of 350[mmHg] to [kPa].
1 [mmHg] = 1.3332×10^{-1}
$1.3332 \times 10^{-1} \times 350 =$ 46.662 [kPa]

Ex.2) Convert the units of 80[kPa] to [kgf/cm^2].
1 [kPa] = 1.0197×10^{-2}[kgf/cm^2]
$1.01972 \times 10^{-2} \times 80 =$ 0.81576 [kgf/cm^2]