Glossary of Terms/Technical Information

Glossary of Terms

Technical Information

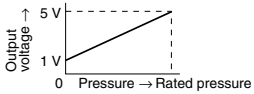
Glossary of Terms

A

Absolute pressure
The pressure based on the absolute vacuum condition (0 standard).

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 page 192 11.

Auto shift function
Refer to "Technical Information" on page 193 12.

C

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 for wiring by a lead wire with a connector.

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.

Diffusion type semi-conductor pressure sensor
Pressure sensor, which sensor part (sensor chip) for detecting the pressure is formed by the diffusion resistance on a diaphragm made of silicone.

Digit (Minimum displayable unit)
When displaying pressure by Digital Pressure Switch, it indicates how fine it can display or set. In case of 1 digit = 1 kPa, it is displayed like 1, 2, 3 . . . 99, 100, with displaying every 1 kPa.

Digital pressure switch
The pressure switch manages signals via a sensor using a micro computer like a CPU, it indicates pressure value 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.

Extended analog output
Pressure range that exceeds the rated pressure range, which analog output corresponds.

F

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]
(Reference: 1% F.S. = 4 x 0.01 = 0.04 [V])

Failure predict output function
Refer to "Technical information" on page 192 10.

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

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 gas.

Gauge pressure
Pressure converted as the atmospheric pressure to be the reference value (0).

Grommet
No worry about coming it off with vibration, etc.

H

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

Hysteresis mode
Refer to “Technical Information” on page 190 5.

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.

K

Key lock mode
It is the function to prevent from malfunctioning. Commands other than unlocking key lock mode by pressing the botton can not to be accepted.

L

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

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

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.

M

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

Minimum displayable pressure unit (digit)
Minimum unit to indicate pressure. 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 pressure unit (digit)
The least possible unit to set pressure value on the digital pressure switch. If the minimum 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.

NPN output
Refer to “Technical Information” on page 189 4.

Normal output mode
Refer to “Technical Information” on page 190 5, 6.

O

ON-OFF output
Refer to “Technical Information” on page 188 3. Switch output.

Open collector
Internally the output wire and terminal are directly connected to collector of output transistor. (Refer to Fig. (1) and (2).)

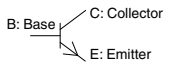


Fig. (1) NPN type

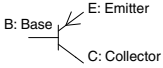


Fig. (2) PNP type

Operating humidity range
Humidity range for normal operation.

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.

Orifice
Restriction for controlling flow of fluid.

Glossary of Terms

P

Panel mounting
To allow a product to be mounted on a panel in an appealing and secure fashion.
SMC panel mount type is designed in advance for easy installment on a panel.

Peak high display mode
Refer to “Technical Information” on page 190 7.

Peak low display mode
Refer to “Technical Information” on page 190 7.

PNP output
Refer to “Technical Information” on page 189 4.

Proof pressure
A pressure exceeding the upper limit. It will result in damage to product.

Protective construction
Refer to “Technical Information” on page 195 15.

R

Reducer
One of the connection types. Connect 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 “Technical Information” on page 191 9.

Residual voltage
Voltage occurred in COM and output when the switch output is in ON state. It varies depending on an applied load current. It is ideal to be “0”.

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

Reversed output mode
Refer to “Technical Information” on page 190 5, 6.

Ripple
A small AC voltage superimposed on top of DC voltage.
In the case of Fig. (3), ripple 10% means
V' ≥ V"
V'/V x 100 = 10%
When no pulsation has occurred, ripple is 0%.

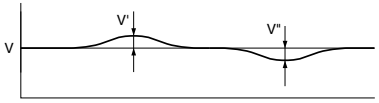


Fig. (3)

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.

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.

Stainless diaphragm
Material of a diaphragm for detecting pressure is made of stainless steel.

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

Supply power voltage
Voltage range for normal operation.

SUS ∗∗∗
Symbol classifying the grade of stainless steel.

Switch output
Refer to “Technical Information” on page 188 3, ON-OFF

T

Temperature characteristics
Refer to “Technical Information” on page 191 8.

The amount of leakage
As an example, testing for detecting leakage is called a leak test.

TSJ
This is a compression fitting.

Turning angle of setting trimmer
The maximum number of turns of the trimmer when adjusting the setpoint. The greater the turning angle, the finer the possible adjustments.

U

Unit conversion
Refer to “Technical Information” on page 196 16.

URJ fitting
This is a face seal fitting.

V

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

Vibration resistance
The amount of vibration a device can withstand without damage.

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 “Technical Information” on page 190 6.

Z

Zero-out
Reset of the display to zero at atmospheric pressure.

0-9

2-wire type pressure switch
Refer to “Technical Information” on page 194 13.

Technical Information

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**

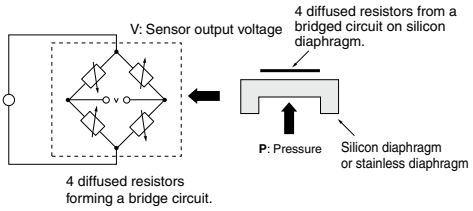
This sensor is used in dry air and inert gas applications. Four diffused resistors form a bridge circuit on a silicon diaphragm. When pressure is applied, the diaphragm is deflected causing the diffused resistors to change resistance. An electrical signal, which is proportional to the pressure change,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

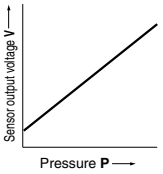
Characteristics: Quick response
Long service life
Compact

● **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 service life
Wide variety of applicable fluid





When the diaphragm is deformed by applying the pressure, the resistance value varies, causing the sensor output to change. Generally, the bridge circuit is formed so that the sensor output voltage becomes larger as the pressure increases. (Refer to 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.

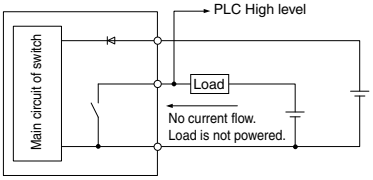


Fig. (1) Equivalent circuit of a NPN type switch with the output off

Fig. (2) shows an equivalent circuit of a NPN switch with the output on. In this circuit the load is powered. Besides, the input part of PLC becomes low level. PLC detects the signal change from high to low and then can proceed to the next process. The point at which the output is switched is variable freely within the allowable setting range. For the ON-OFF output, there is a PNP type beside a NPN type. About the difference between NPN and PNP, refer to page 189.

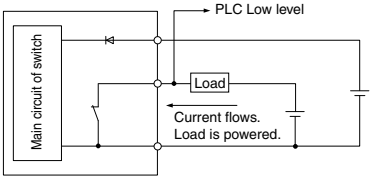
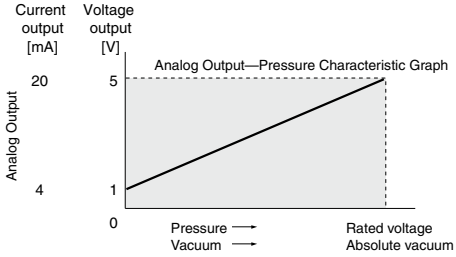


Fig. (2) Equivalent circuit of a NPN type switch with the output on

● **Analog output**

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



4 Difference between NPN and PNP output

● **NPN**

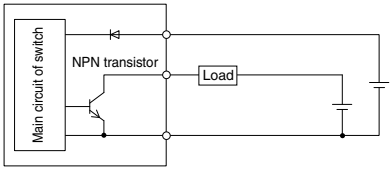


Fig. (1) Connection example of NPN output

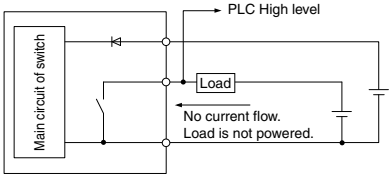


Fig. (2) Equivalent circuit of an NPN switch with the output off

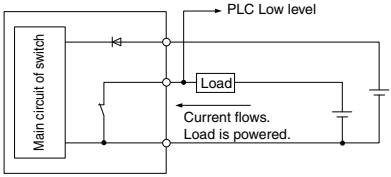


Fig. (3) Equivalent circuit of an NPN switch with the output on

Fig. (1) shows an example of a 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) (PLC uses the one for VaCOM.)

● **PNP**

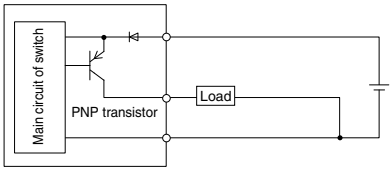


Fig. (4) Connection example of PNP output

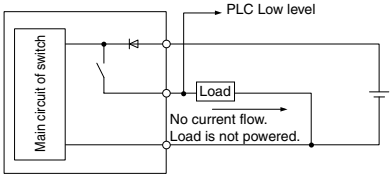


Fig. (5) Equivalent circuit of a PNP switch with the output off

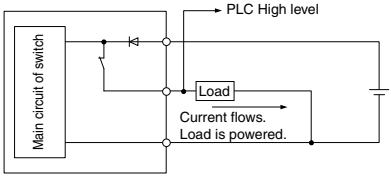
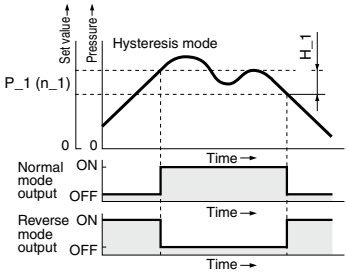


Fig. (6) Equivalent circuit of a PNP switch with the output on

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) (PLC uses the one for GNDCOM.)

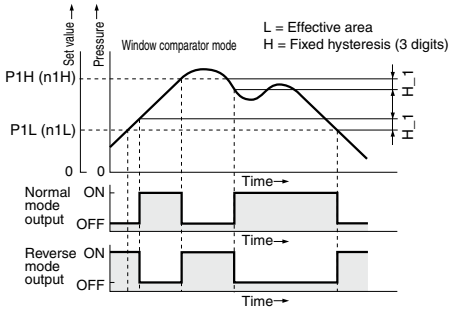
5 Hysteresis mode

The operation mode shown in the Fig. on the right is called “Hysteresis Mode”.
The hysteresis is the difference between the ON and OFF set values that has been set so as not to detect the air pulsation.
In the Normal Mode, when the output turns ON, the output remains ON until the pressure reaches a level (ON set value - hysteresis) or less. It is said that the chattering prevention effect becomes higher as the hysteresis becomes larger. For 2-output type, the OUT1 operates with the data set for “P_1” and “H_1” while the OUT2 operates with the data set for “P_2” and “H_2”. Additionally, in the Reverse Mode, the output operates in the exactly reverse order of the Normal Mode and “n_1·n_2” is displayed.
(The setting procedure may vary depending on the product series. So, make the setting after checking the specifications of each product.)

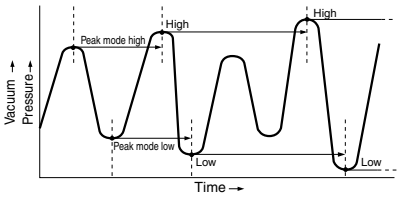


6 Window comparator mode

The operation mode shown in the Fig. on the right is called “Window Comparator Mode”. The window comparator mode uses an output format that retains the output when the pressure is within a certain range. This is suitable for the pressure control, in which the pressure is not too large or too small. (For example, the window comparator mode can be utilized for the supply pressure control.)
For 2-output type, the OUT1 operates with the data set for “P1L”, “P1H”, and “hysteresis H_1” while the OUT2 operates with the data set for “P2L”, “P2H”, and “hysteresis H_2”. Additionally, in the Reverse Mode, the output operates in the exactly reverse order of the Normal Mode and “n1L·n1H·n2L·n2H” is displayed.
(The setting procedure may vary depending on the product series. So, make the setting after checking the specifications of each product.)



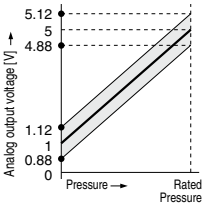
7 Peak high and peak low display modes



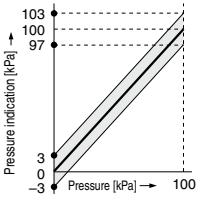
Under most operating conditions the pressure will vary over time (see graph). The highest pressure measured is stored and displayed as “Peak Mode High”. The lowest pressure measured is stored and displayed as “Peak Mode Low”.

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) When the property at the temperature characteristic condition ±3.0 [% F.S.] and 25[°C] is expressed by the bold line in the chart above, how much temperature effect will the analog output voltage receive? It can be determined.
Example: Analog output = 1 to 5 [V]
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 ±120 [mV]. Since this is the maximum value, the error will actually occur within the range enclosed by the thin line in the chart above.



Example) When the property at the temperature characteristic condition ±3.0 [% F.S.] and 25[°C] is expressed by the bold line in the chart above, how much temperature effect will the analog output voltage receive? The chart above illustrates the example when 100 [kPa], F.S. = 100 – 0 = 100 [kPa], ±3.0% F.S. = 100 x 0.03 = ±3 [kPa]. It means that if the temparature is changed within the range of 0 to 50[°C], the error will occur at the max. ±3 [kPa]. Since this is the maximum value, the error will actually occur within the range enclosed by the thin line in the chart above.

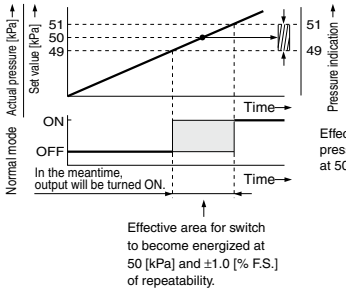
We explained by giving 2 examples. As for temperature characteristics, the smaller this value is, the smaller the error would be. That means it is strong against the temperature changes.

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.]
F.S. = 100 [kPa] – 0 [kPa] = 100 [kPa]
±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 chart below.)

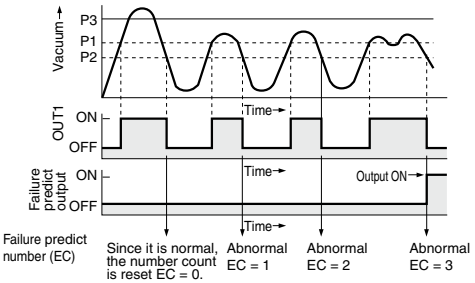
Note: If the pressure switch allows an error of 1 [% F.S.], the output turns ON at 51 [kPa]. Taking the repeatability into account, the output turns ON at 50 to 52 [kPa] and, in the same way, the pressure display turns 50 [kPa] at 49 to 51 [kPa]. (Refer to the chart below.)
Thus, the smaller the repeatability, the more precision in reproduction the product achieves.



10 Failure predict function

In the case of performance decrement caused by clogging up the silencer of vacuum system (ejector), cracking of vacuum pad, or decreasing the vacuum reaching degree by leakage from vacuum piping, it detects the abnormality quickly and send out the output to the outside right before the system comes to a stop.
In case the ON-OFF output is in the normal mode, when the failure predict output switches ON (over P1), and the pressure turns OFF without reaching the failure predict pressure (P3), the number of failure predict detection is counted. When it is consecutively counted up to the failure predict numbers (EC) preset, the failure predict output will turn ON. When a switch turns ON, (over P1) and the pressure exceeds the failure predict pressure (P3), the count of failure predict numbers will be reset.

Ex.) When an error count (number of the failure predict) (EC) is set to be 3.

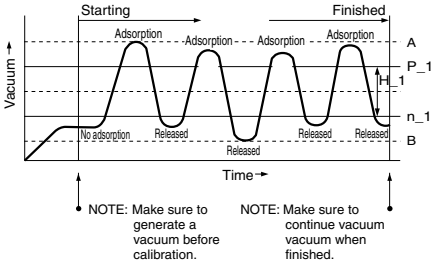


11 Auto preset function

Auto preset function enables automatic selection of the optimum set point value when the pressure switch is used for adsorption confirmation simply by repeating the adsorption and release cycle with the workpiece.
Refer to the catalog and operation manual for how to enter the auto preset mode. This section describes calculation of the set value.

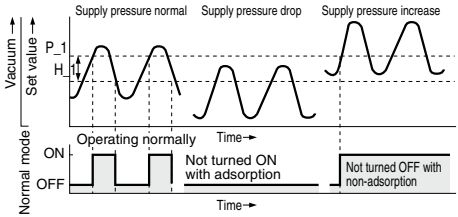
How to Calculate the Set Value

A = Max. pressure value in auto preset mode
B = Tentative min. pressure value in auto preset mode
P_1 (P_2) =A– (A – B)/4 or n_1 (n_2) =B + (A – B)/4
H_1 (H_2) =| (A – B)/2|
Manual adjustment is possible after finishing in the auto preset mode.



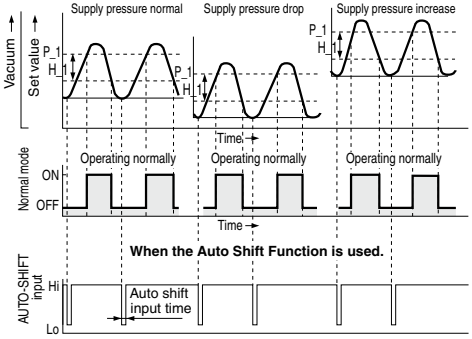
12 Auto shift function

The auto switch function is the function to regard the pressure value at the point of this signal being input as the benchmark and to display and conduct switching. For example, it will be used to take countermeasures against the main line pressure fluctuation. If the main line pressure is fluctuated, the performance of an ejector will vary and also the pressure will cange at the non-adsorption case. Therefore, the phenomenon that switching is not done will take place, even if a workpiece is in suction. (Refer to the chart below.) The auto shift function is utilized like this case.



When the Auto Shift Function is NOT used.

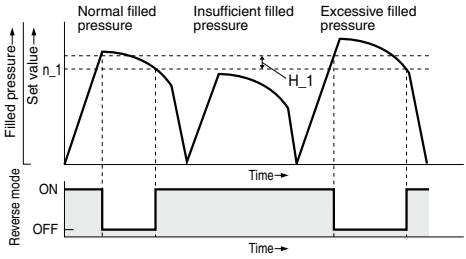
If the auto shift function is used, switching will be done by regarding the point of this signal being input as the benchmark. Therefore, switching can be surely done as long as the auto shift signal is being input at the non-adsorption case.
In case the auto shift is not at all used, switching is done just on the basis of either larger or smaller than the set value. Meanwhile, when the auto shift is used, switching will be done by whether to fluctuate by the set value from the benchmark (from the time of inputting auto shift). (Refer to the chart below.)



When the Auto Shift Function is used.

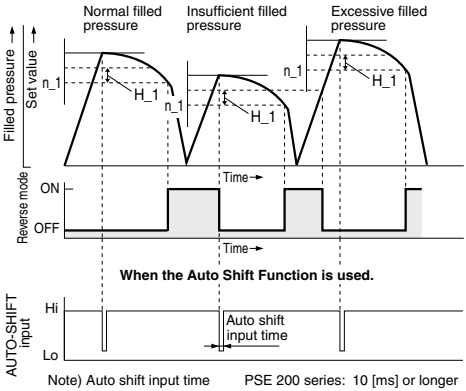
Note) Auto shift input time PSE 200 series: 10 [ms] or longer
Other series: 5 [ms] or longer

Another application for the auto shift 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 leakproof, 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 Auto shift 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 the Auto Shift Function is NOT used.

To combat fluctuations in initial pressure level, the auto shift feature 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 at which the auto shift feature is activated, the output is energized. Refer to the chart below.



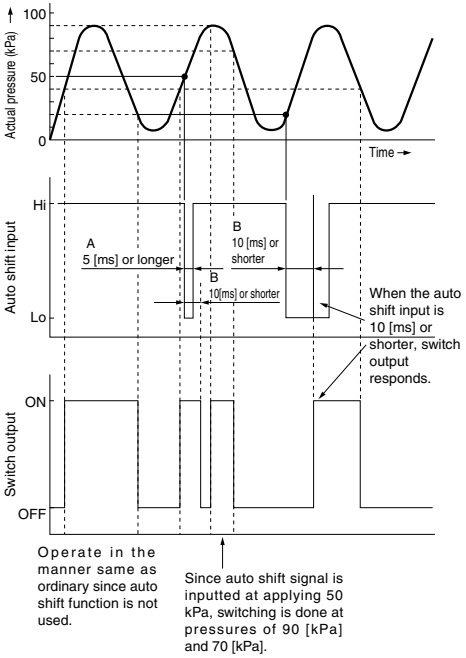
When the Auto Shift Function is used.

Note) Auto shift input time PSE 200 series: 10 [ms] or longer
Other series: 5 [ms] or longer

12 Auto shift function

How to Activate the Auto Shift Function
Connect the auto shift input with GND for at least 5 [ms] (PSE200: at least 10 [ms]).
Based on the pressure at this moment, switching will be done.

Example: The figure below is based on the condition of set values as P_1 = 40 [kPa] and H_1 = 20 [kPa].



Note) PSE 200 series A: 10 [ms] or longer
B: 15 [ms] or shorter

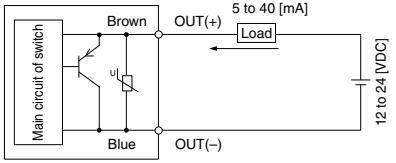
13 2-wire pressure switch connections

A 3-wire type switch is a switch that has an output line other than the positive and negative lines that supply the electricity. When there are 2 outputs, 4 lines will be required in total. This type of switch belongs to the family of 3-wire type switches. 2-wire type switches have only positive and negative wires that are used for supplying the electricity from the power source and for providing the output as well.

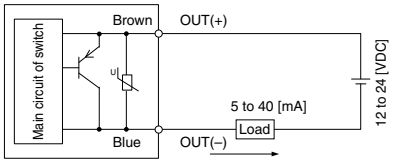
The 2-wire type works with both the sinking type (current runs into the switch) and the sourcing type (current is flown out of the switch). It is dependant upon whether a load is connected with the positive or negative side. These switches are known for high speed response, longevity, and they can reduce wiring work.

⚠Caution

"PS1000, PS1100, PS1200"
The load current range for a PS1000 and PS1100 is between 5 [mA] and 40 [mA].
If 40 [mA] is exceeded the output transistor could be damaged. Besides, do not connect a PLC, which can detect 1 [mA], since there is a leak current of 1 [mA] in OFF state.

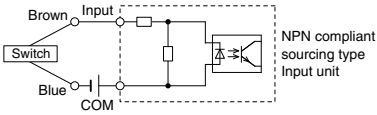


Connection example when used as a sinking type

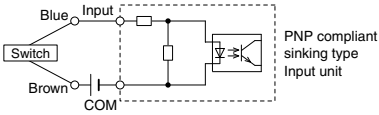


Connection example when used as a sourcing type

Connection example with PLC



Connection example with NPN compliant, sourcing type input unit

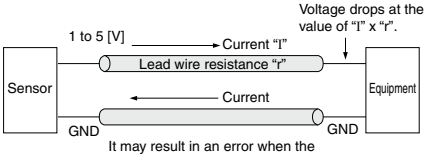


Connection example with PNP compliant, sinking type input unit

14 Voltage and current output pressure sensors

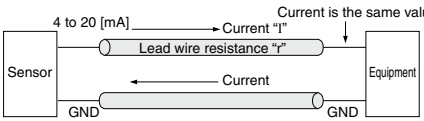
Voltage output signal is a voltage signal in the range of 1 to 5 [V]. The signal has to be converted by an A/D converter for pressure display or switch output. Current output signal is a current signal in the range of 4 to 20 [mA]. The signal is transformed into a voltage signal before being converted by a A/D converter for pressure display or switch output.

Advantages and Disadvantages (Long distance applications)
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.



Connection of the voltage output

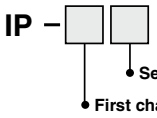
It appears that it would be of benefit to reduce the current flow as much as possible, however if the current is reduced too much other problems, such as inductive noise from external devices, occur. Result: Voltage outputs are not suitable for long distance applications. SMC's analog outputs are all of the voltage variety, but tests have proven that there is no problem in applications of 10 [m] or less.



Connection of the current output

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.

15 Protective construction



● **First Characteristics:**
Degrees of protection against solid foreign objects

0	Non-protected
1	Protected against solid foreign objects of 50 mm ø and greater
2	Protected against solid foreign objects of 12 mm ø and greater
3	Protected against solid foreign objects of 2.5 mm ø and greater
4	Protected against solid foreign objects of 1.0 mm ø and greater
5	Dust-protected
6	Dusttight

● **Second Characteristics:**
Degrees of protection against water

0	Non-protected	—
1	Protected against vertically falling water drops	Dripproof type 1
2	Protected against vertically falling water drops when enclosure tilted up to 15°	Dripproof type 2
3	Protected against rainfall when enclosure tilted up to 60°	Rainproof type
4	Protected against splashing water	Splashproof type
5	Protected against water jets	Low jetproof type
6	Protected against powerful water jets	Strong jetproof type
7	Protected against the effects of temporary immersion in water	Immersible type
8	Protected against the effects of continuous immersion in water	Submersible type

Example) In the case of stipulated as IP65, we can know the degrees of protection is dusttight and water jetproof on the grounds that the first characteristic numeral is 6 and the second characteristic numeral is 5 respectively, that gives it will not be adversely affected by direct water jets from any direction.

16 Pressure units conversion (Approximation)

Unit								
Pa (N/m²)	kPa	MPa	bar	kgf/cm²	atm	mmH₂O 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}	1.4503×10^{-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 x 10	1.0197 x 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 x 10
9.8067×10^{4}	9.8067 x 10	9.8067×10^{-2}	9.8067×10^{-1}	1	9.6784×10^{-1}	1×10^{4}	7.3556×10^{2}	1.4217 x 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 x 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 x 10	1	1.9330×10^{-2}
6.8951×10^{3}	6.8951	6.8951×10^{-3}	6.8951×10^{-2}	7.0338×10^{-2}	6.7999×10^{-2}	7.0324×10^{2}	5.1733 x 10	1

Ex. 1) Convert the units of 350 [mmHg] to [kPa].
1 [mmHg] = 1.3332×10^{-1} [kPa]
$1.3332 \times 10^{-1} \times 350 =$ 46.662 [kPa]
Ex. 2) Convert the units of 80 [kPa] to [kgf/cm²].
1 [kPa] = 1.0197×10^{-2} [kgf/cm²]
$1.01972 \times 10^{-2} \times 80 =$ 0.81576 [kgf/cm²]

17 Operable fluids by pressure switch for general purpose fluids

Stainless steel

Metal exists in nature as ore (like oxide or sulfide). This means that oxide or sulfide is more stable than pure metal. Accordingly, metallic material chemically oxidizes (metallic constituent becomes ion and melts out). It corrodes in the natural environment.

Even though corrosion of metal easily occurs in an environment where oxidizing tendency is stronger, some kinds of metal have a characteristic for which corrosion never happens if the 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 304 or stainless steel 316L for the fittings where in contact with fluids as well as stainless steel 630 or stainless steel 316L for diaphragm of sensor part.

Corrosion resistance performance of both stainless steel 304 and stainless steel 630 is almost the same level in anti-corrosiveness property.

⚠ Caution

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