

Display Type Pressure Sensors



PSAN Series PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- Pressure measurement of any gas, liquid or oil (except substances which may corrode stainless steel 304/316L)
- Auto shift function: with change in the original pressure, the external input adjusts the determined level to match the change in pressure (only available in models with auto shift/hold function)
- Hold function: hold current display value or control output
- Forced output control mode for device testing and maintenance
- One-touch connector type for easy wiring and maintenance
- Zero-point adjustment function, peak value monitoring function, chattering prevention function

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow instructions may result in serious injury or death

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)**
Failure to follow this instruction may result in personal injury, economic loss or fire.
- 02. Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
Failure to follow this instruction may result in explosion or fire.
- 03. Install on a device panel or to a pressure port directly to use.**
Failure to follow this instruction may result in fire.
- 04. Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.
- 05. Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
- 06. Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire or electric shock.

⚠ Caution Failure to follow instructions may result in injury or product damage

- 01. Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
- 02. Use a dry cloth to clean the unit, and do not use water or organic solvent.**
Failure to follow this instruction may result in fire.
- 03. This product is designed to detect the pressure of noncorrosive medium. Do not use for corrosive medium.**
Failure to follow this instruction may result in product damage.
- 04. Keep the product away from metal chip, dust, and wire residue which flow into the unit.**
Failure to follow this instruction may result in fire or product damage.

Cautions during Use

- Follow instructions in 'Cautions during Use'.
Otherwise, it may cause unexpected accidents.
- 12 - 24 VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Use the product, 3 sec after supplying power.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.
- Wire as short as possible and keep away from high voltage lines or power lines, to prevent inductive noise.
- This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max 2,000 m
 - Pollution degree 3
 - Installation category II

Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website.

P S A N - ① ② ③ ④ ⑤ - ⑥

① Medium / Port fitting position

No mark: Pneumatic type (gas) / Back
D: Pneumatic type (gas) / Bottom
B: Fluid type (liquid, gas) / Back
L: Fluid type (liquid, gas) / Bottom

④ Control output

No mark: NPN open collector output
P: PNP open collector output

⑤ Option input / output

V: Voltage output
A: Current output
H: External input

② Pressure type and Range

	Pressure	Rated range
01	Static	0.0 to 100.0 kPa
1	Static	0 to 1,000 kPa
V01	Negative	0.0 to -101.3 kPa
C01	Compound	-101.3 to 100.0 kPa

③ Pressure port

Port	Medium	
	Pneumatic	Fluid
R1/8	○	○
Rc1/8	○	-
NPT1/8	○	○
7/16-20UNF	-	○
9/16-18UNF	-	○

⑥ Wiring

No mark: Cable type (fluid type)
C: Connector type

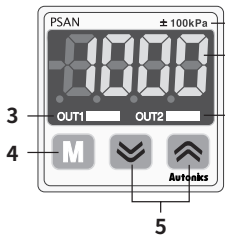
Product Components

- Product
- Instruction manual
- Unit sticker
- Connector type: Bracket A / B, Connector wiring (PSO-C01)
- Cable type: Bracket C

Sold Separately

- Front cover (PSO-P01), Panel bracket (PSO-B02/B03)
- Pneumatic type: M5 gender (PSO-Z01)

Unit Descriptions

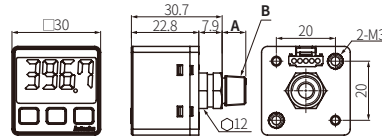


- 1. Pressure range (sticker)**
- 2. Display part (red)**
Run mode: Displays PV (present value), SV (setting value)
Setting mode: Displays parameter and setting value
- 3. Output indicator (OUT1: red, OUT2: green)**
Turns ON when the corresponding control output is ON.
- 4. [M] key**
Enters parameter group, selects item and returns run mode.
- 5. [▼], [▲] key**
Sets preset of output operation mode, runs the mode or changes parameter.

Dimensions

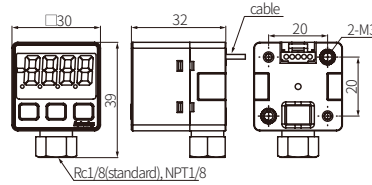
- Unit: mm, For the detailed drawings, follow the Autonics website.

■ Pneumatic type, back port, connector type

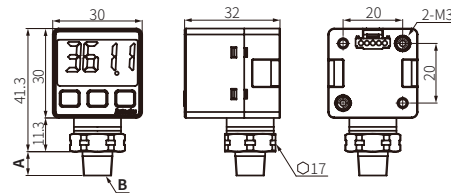


Port	A	B
Rc1/8 (standard)	0	-
NPT1/8	0	Inner M5 tap
R1/8	8	Inner M5 tap

■ Pneumatic type, bottom port, connector type

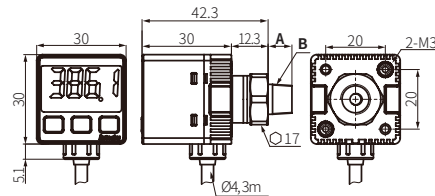


■ Fluid type, bottom port, connector type



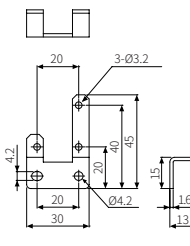
Port	A	B
R1/8 (standard)	8	Inner M5 tap
NPT1/8	8	Inner M5 tap
7/16-20UNF	11	-

■ Fluid type, back port, cable type

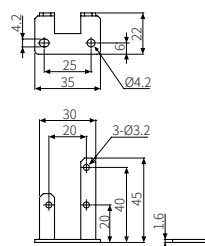


Port	A	B
R1/8 (standard)	8	Inner M5 tap
9/16-18UNF	15.4	-

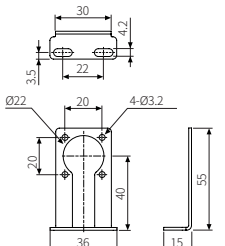
■ Bracket A



■ Bracket B



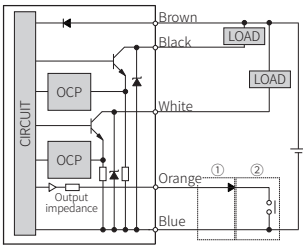
■ Bracket C



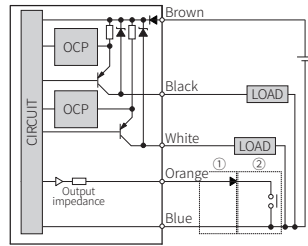
Connections

Color	Function
Brown	+V
Blue	0V
Black	OUT 1
White	OUT 2
Orange	Option input / output

NPN open collector output



PNP open collector output



- ①: Option voltage / current output model, ②: Option external input model
- OCP (over current protection circuit)
- There is no short circuit protection circuit. Do not connect directly to power or capacitive loads.
- The control output is abnormal when the control output circuit is shorted or over current is supplied.
- Pay attention to the input impedance of the connected device when using analog voltage output. Be sure to the voltage drop due to the resistance of the wiring when extending the wiring.

Installation

One-touch fitting

Pneumatic type	Fluid type
<p>12 mm spanner</p>	<p>17 mm spanner</p>

Connect the metal part with a spanner so that no large force is applied to the unit body. (tightening torque: ≤ 10 N m, it may cause malfunction.)

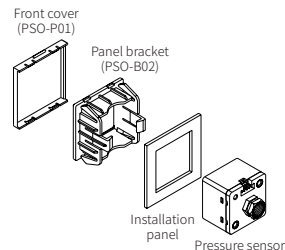
Bracket

Use spring washers and hexagon wrench bolts (tightening torque: ≤ 3 N m) to select and install a bracket suitable for your environment.

Connector type	Cable type
<ul style="list-style-type: none"> Bracket A 	<ul style="list-style-type: none"> Bracket B
	<ul style="list-style-type: none"> Bracket C

Installation configuration

- Sold separately: Front cover (PSO-P01), Panel bracket (PSO-B02/B03)
- Panel thickness: 0.8 to 3.5 mm



Wiring

- Do not pull the wiring with a force of more than 30 N.

Error

Display	Cause	Troubleshooting
Err 1	When external pressure is input while adjusting zero point.	Try again after removing external pressure.
Err 2	When overload is applied on control output	Remove overload.
Err 3	When 'ST1', 'ST2' setting range is not met in auto sensitivity setting mode.	Check setting conditions and set proper setting values.
HHHH	When applied pressure exceeds high-limit of display pressure range.	Apply pressure within display pressure range.
LLLL	When applied pressure exceeds low-limit of display pressure range.	
-HH-	Auto shift correction error.	Set the corrected setting value within setting pressure range.
-LL-		
-HL-		

Specifications

Model	PSAN-□V01C□□□□□□	PSAN-□01C□□□□□□	PSAN-□1□□□□□□□□	PSAN-□C01□□□□□□
Pressure Type	Pneumatic type model: Gauge pressure Fluid type model: Gauge pressure ⁰¹⁾ or sealed gauge pressure ⁰²⁾			
Pressure	Negative	Static	Compound	
Min display unit	0.1 kPa	0.1 kPa	1 kPa	0.1 kPa
Rated pressure range	0.0 to -101.3 kPa	0.0 to 100.0 kPa	0 to 1,000 kPa	-101.3 to 100.0 kPa
Display & setting pressure range	5.0 to -101.3 kPa	-5.0 to 110.0 kPa	-101.3 to 1,100 kPa	-101.3 to 110.0 kPa
Display type	7 Segment LED, 4 1/2 digit			
Display accuracy	-10 to 0 °C: $\leq \pm 1\%$ F.S., 0 to 50 °C: $\leq \pm 0.5\%$ F.S.			
Max. pressure	Rated pressure $\times 2$	Rated pressure $\times 2$	<ul style="list-style-type: none"> Pneumatic type: Rated pressure $\times 1.5$ Fluid type: Rated pressure $\times 2$ 	Rated pressure $\times 2$

01) Only for static pressure, rated pressure range 100.0 kPa model

02) The unit is sealed structure. It is based on atmospheric pressure 101.3 kPa.

Applicable medium	Pneumatic type (air, non-corrosive gas)	Fluid type (non-corrosive gas and fluid that do not corrode stainless steel 316L)
Connection type	Connector type	Cable type / connector type
Cable	$\varnothing 4$ mm, 5-core, 2 m	Connector type: $\varnothing 4$ mm, 5-core, 2 m Cable type: $\varnothing 4$ mm, 5-core, 3 m
Wire spec.	AWG24 (0.08 mm, 40-core), insulator diameter: $\varnothing 1$ mm	
Material	Front case: PC Back case: (back port) PC / (bottom port) PBT+GF15% Pressure port: Brass-nickel plated	Front case: PC Back case: PA6 Pressure port: SUS304/SUS316L
Protection structure	Connector type: IP40 (IEC standard)	Connector type: IP40 (IEC standard) Cable type: IP65 (IEC standard)
Approval	CE ENEC	
Unit weight (packaged)	Back port: ≈ 80 g (≈ 165 g) Bottom port: ≈ 85 g (≈ 170 g)	Connector type: ≈ 88 g (≈ 173 g) Cable type: ≈ 90 g (≈ 167 g)

Power supply	12 - 24 VDC \equiv (ripple P-P: $\leq 10\%$)
Allowable voltage range	90 to 110% of rated voltage
Current consumption	≤ 50 mA ⁰¹⁾
Control output	NPN open collector output / PNP open collector output model
Load voltage	≤ 30 VDC \equiv
Load current	≤ 100 mA
Residual voltage	NPN: ≤ 1 VDC \equiv , PNP: ≤ 2 VDC \equiv
Hysteresis	According to output operation mode ⁰²⁾
Repeat error	$\pm 0.2\%$ F.S. \pm min display interval
Response time	2.5, 5, 100, 500, 1000 ms
Protection circuit	Output short over-current protection circuit
Insulation resistance	≥ 50 M Ω (500 VDC \equiv megger)
Dielectric strength	1,000 VAC \sim 50 / 60 Hz for 1 min
Vibration	1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Ambient temperature	-10 to 50 °C, Storage: -20 to 60 °C (no freezing or condensation)
Ambient humidity	30 to 80%RH, Storage: 30 to 80%RH (no freezing or condensation)

01) Current output: ≤ 75 mA

02) Refer to 'Output operation mode'. ± 1 digit error may occur due to pressure unit operation.

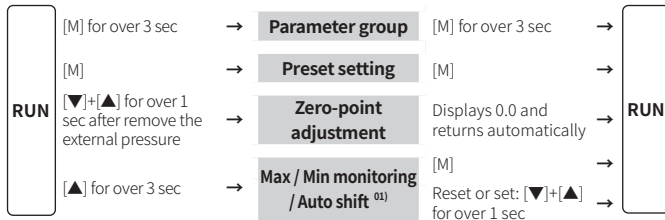
Analog output	Voltage (1 - 5 VDC \equiv $\pm 2\%$ F.S)	Current (DC 4 - 20mA $\pm 2\%$ F.S)
Output impedance	1 k Ω	-
Linearity	$\leq \pm 1\%$ F.S	$\leq \pm 1\%$ F.S
Zero-point	≤ 1 VDC \equiv $\pm 2\%$ F.S.	\leq DC 4 mA $\pm 2\%$ F.S.
Span	≤ 4 VDC \equiv $\pm 2\%$ F.S.	\leq DC 16 mA $\pm 2\%$ F.S.
Resolution	1/1000 or 1/2000 (different by pressure type and display unit)	
Response time	50 ms	70 ms

Minimum Display Interval

Pressure	Negative		Static				Compound		
	0.1 kPa	1 kPa	0.1 kPa	1 kPa	1 kPa	1 kPa	1 kPa	1 kPa	
Min display interval	0.1 kPa	1 kPa	0.1 kPa	1 kPa	1 kPa	1 kPa	1 kPa	1 kPa	
Resolution	1/1000	1/2000	1/1000	1/2000	1/1000	1/2000	1/1000	1/2000	
MPa	-	-	0.001	-	0.001	-	-	-	
kPa	0.1	-	0.1	-	1	-	-	0.1	
kgf/cm ²	0.001	-	0.001	-	0.01	-	-	0.001	
bar	0.001	-	0.001	-	0.01	-	-	0.001	
psi	-	0.01	-	0.01	-	0.1	-	0.02	
mmHg	-	0.4						-	0.8
inHg	-	0.02						-	0.03
mmH ₂ O ⁰¹⁾	0.1	-						-	0.1

01) Multiply display value by 100.

Mode Setting



01) Max. / Min. pressure value is available to check by monitoring.
 [Option external input model] Auto shift judgment level checking / setting is available when P-9 External input terminal is set as SHFT. (no input displays 0)

Parameter Setting

- Some parameter are activated / deactivated depending on other parameters. Refer to the description.
- The setting item name and setting value are cross-displayed on the display part.
- It returns to RUN mode when there is no additional key input for 60 sec in each parameter group.
- Guaranteed write life: 100,000 times
- [M] key: Saves setting value and moves to next parameter
- [▼], [▲] key: Selects setting value

Parameter	Display	Default	Setting range
P-1 Display unit	Unit	MPa kPa	[Negative / Compound pressure model] kPa, KGc: kgf/cm ² , bar, psi, mmHg, inHg, H2O: mmH ₂ O [Static pressure model] MPa, kPa, KGc: kgf/cm ² , bar, psi
P-2 OUT operation mode	OUT mode	HYS, M WIN, W HY-W, W AUTO, A F.OUT, F	HYS, M: Hysteresis WIN, W: Window comparison output HY-W, W: Hysteresis-Window comparison output AUTO, A: Auto sensitivity setting F.OUT, F: Forced output control
P-3 Output type	OUT type	OUT1 OUT2	OUT1 Normally open OUT2 Normally open
P-4 Response time	SPD	2.5	2.5, 5.0, 100, 500, 1,000 ms
P-5 Voltage low limit scale	R-L	0.0	[Option voltage output model] Min. rated pressure ≤ Low limit scale ≤ 90% of rated pressure
P-6 Voltage high limit scale	R-H	1.0	[Option voltage output model] Low limit scale setting value + 10% of rated pressure ≤ High limit scale ≤ Max. rated pressure
P-7 Current low limit scale	R-L	0.0	[Option current output model] Min. rated pressure ≤ Low limit scale ≤ 90% of rated pressure
P-8 Current high limit scale	R-H	1.0	[Option current output model] Low limit scale setting value + 10% of rated pressure ≤ High limit scale ≤ Max. rated pressure
P-9 External input terminal	EXT	HOLD	[Option external input model] HOLD: Hold SHFT: Auto shift
P-10 Auto shift output ⁰¹⁾	SHO	OFF	[Option external input model] OUT1, OUT2, ALL
P-11 Lock	LOC	LOC1	LOC1: Parameter, preset, zero-point adjustment setting lock / Monitoring value reset lock LOC2: Parameter lock (available to check setting value) OFF

01) Condition: P-9. External input terminal SHFT setting

Preset setting

Setting method

- Setting name and value are cross-displayed in SV display part.

 - Set the operation mode in P-2 OUT operation mode.
 - Enter the preset setting mode by pressing [M] key from RUN mode.
 - Select the setting item by [M] key and change the preset by [▼] or [▲] key.
 - Press [M] key to save setting or no key input over 60 sec not to save setting and return to RUN mode. (except forced output control mode)

Preset setting by operation mode

Operation mode	Preset	Setting range
Hysteresis	Pressure detection level 1	5 E 1 Min. display pressure < ST1 ≤ Max. display pressure
	Hysteresis level 1	H Y S 1 Min. display pressure ≤ HYS1 < ST1
	Pressure detection level 2	5 E 2 Min. display pressure < ST2 ≤ Max. display pressure
	Hysteresis level 2	H Y S 2 Min. display pressure ≤ HYS2 < ST2
Window comparison output ⁰¹⁾	Pressure detection low limit 1	L O - 1 Min. display pressure ≤ LO-1 ≤ Max. display pressure - (3 × Min display interval)
	Pressure detection high limit 1	H I - 1 LO-1 + (3 × Min display interval) ≤ HI-1 ≤ Max. display pressure
	Pressure detection low limit 2	L O - 2 Min. display pressure ≤ LO-2 ≤ Max. display pressure - (3 × Min display interval)
	Pressure detection high limit 2	H I - 2 LO-2 + (3 × Min display interval) ≤ HI-2 ≤ Max. display pressure
Hysteresis-Window comparison output ⁰²⁾	Pressure detection level 1	5 E 1 Min. display pressure < ST1 ≤ Max. display pressure
	Hysteresis level 1	H Y S 1 Min. display pressure ≤ HYS1 < ST1
	Pressure detection low limit	L O 0 Min. display pressure ≤ LOW ≤ Max. display pressure - (3 × Min display interval)
	Pressure detection high limit	H I 0 H Low + (3 × Min display interval) ≤ HIGH ≤ Max. display pressure
Auto sensitivity setting	Pressure level 1	5 E 1 Min. display pressure ≤ ST1 ≤ Max. display pressure - 1% of rated pressure
	Pressure level 2 ⁰³⁾	5 E 2 ST1 + 1% of rated pressure ≤ ST2 ≤ Max. display pressure
	Pressure detection level	5 E E Auto setting SET = $\frac{ST1+ST2}{2}$ • Manual setting is possible by [▼] or [▲] key.
Forced output control ⁰⁴⁾	F.O.U.T	- • Manual ON/OFF for OUT1/2 is possible by [▼] or [▲] key.

01) Hysteresis: 1 (min display interval, fixed)

02) ST1 = HYS1, actual hysteresis is 1 (min. display interval)

03) When error appears, check setting conditions and set proper setting values.

04) [Option external input model] Forced output does not support external input terminal.

Precaution

- The preset value (default) of the changed operation mode is set when changing P-2 OUT operation mode setting.
- Preset value is converted as the changed unit automatically when changing P-1 Display unit setting.
- Preset is reset when changing P-9 External input terminal setting.

Default setting value

Operation mode	Preset	Negative	Static		Compound
		0.1 kPa	0.1 kPa	1 kPa	0.1 kPa
Hysteresis	5 E 1	-50.0	50.0	500	50.0
	H Y S 1	0.0	0.0	0	-50.0
	5 E 2	-50.0	50.0	500	50.0
	H Y S 2	0.0	0.0	0	-50.0
Window comparison output	L O - 1	0.0	0.0	0	-50.0
	H I - 1	-50.0	50.0	500	50.0
	L O - 2	0.0	0.0	0	-50.0
Hysteresis-Window comparison output	H I - 2	-50.0	50.0	500	50.0
	5 E 1	-50.0	50.0	500	50.0
	H Y S 1	0.0	0.0	0	-50.0
	L O 0	0.0	0.0	500	-50.0
Auto sensitivity setting	H I 0 H	-50.0	50.0	0	50.0
	5 E 1	0.0	0.0	0	-50.0
	5 E 2	-50.0	50.0	500	50.0
	5 E E	-25.0	25.0	250	0.0
Forced output control	F.O.U.T	-	-	-	-

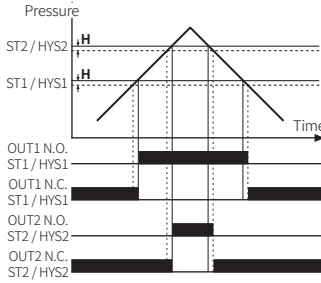
Output Operation mode

Change the output operation mode to change pressure detection method.

ON: **OFF:** **H:** Hysteresis **A:** Min display interval

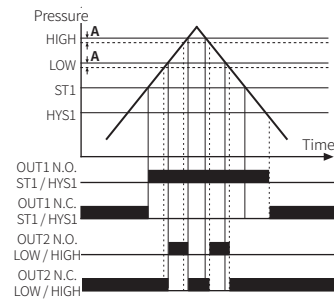
■ Hysteresis

- Set the hysteresis for pressure detection directly.
- Setting: Pressure detection level (ST1, ST2), Hysteresis (HYS1, HYS2)



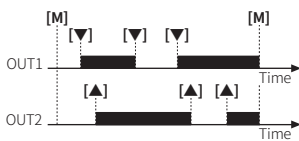
■ Hysteresis - Window comparison output

- It is available both hysteresis mode and window comparison output mode operations.
- Setting: Pressure detection level (ST1), Hysteresis (HYS1), High limit (HIGH), Low limit (LOW)



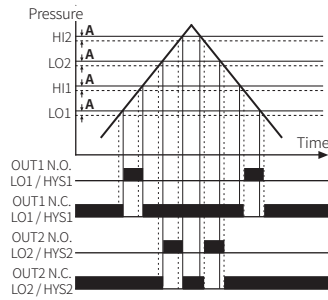
■ Forced output control

- It displays the present pressure with forcibly holding comparing output OFF regardless of setting value.
- Manual ON/OFF for OUT1/2 is possible by [M], [▼] or [▲] key during forced output control operation.



■ Window comparison output

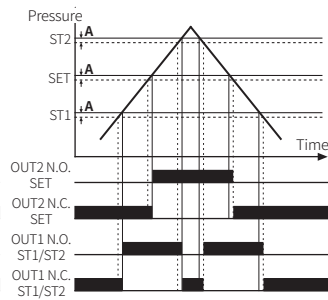
- It detects pressure at the desired range.
- Hysteresis is fixed as min. display interval.
- Setting: High limit (HI1, HI2), Low limit (LO1, LO2)



■ Auto sensitivity setting

- This function is to set the proper position (SET) automatically by applied pressure from two positions (ST1, ST2).
- Hysteresis is fixed as min. display interval.

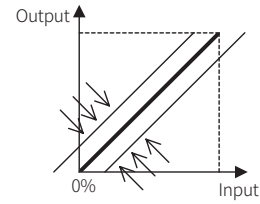
$$SET = \frac{ST1 + ST2}{2}$$



Zero-point Adjustment

With the pressure port open, the current pressure value on display is set to zero forcibly by removing deviations from opening the pressure port. Zero-point adjustment affects analog output.

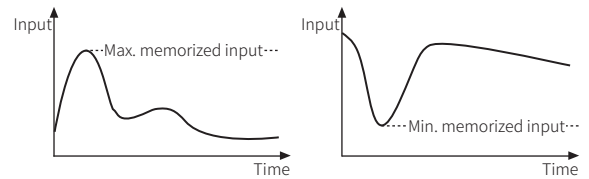
- For precise measurement, execute zero-point adjustment periodically.



Maximum / Minimum Value Monitoring

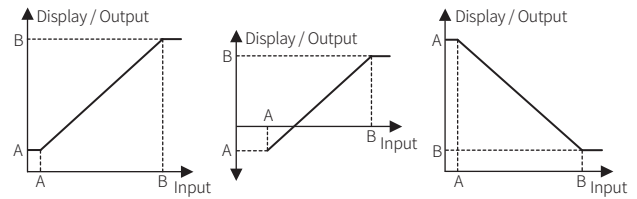
In order to identify abnormal conditions of the system that are not easily identified or to diagnose the max. / min. input that has occurred, save the value and notify it.

- When the memorized max. / min. pressure is higher / lower than the rated pressure, it displays 'HHHH' / 'LLLL'.



Display / Output Scale

Customizes the scale of display / output value from rated output range. If the measured input is a, b, and the arbitrary values to be displayed are A, B, the display / output value are outputted for input a and b linearly (a = A, b = B).



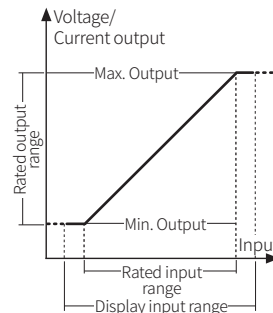
Response Time

Prevents chattering of the output by changing the response time of the control output and pressure display value.

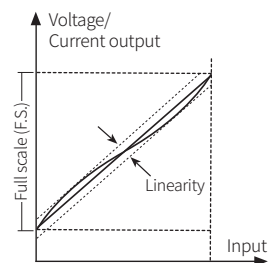
When the response time is longer, the number of digital filter increase, so stable measurement is possible, but the measured value may differ from the actual input value.

Analog Output Characteristic

■ Input - Output



■ Linearity

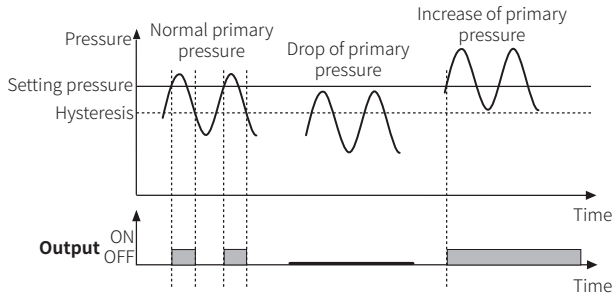


External Input

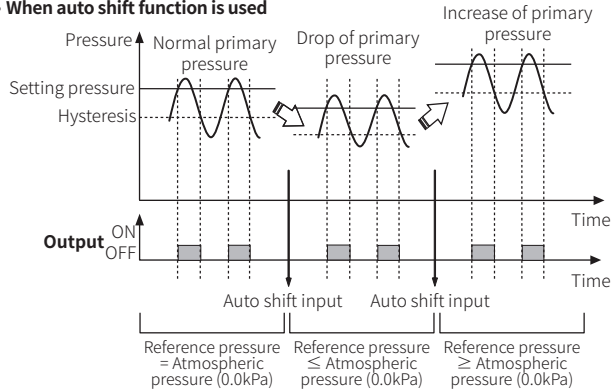
Auto shift

The judgment level is corrected by applying the standard pressure which is set when external input signal is applied.

When auto shift is not used



When auto shift function is used



Remote zero

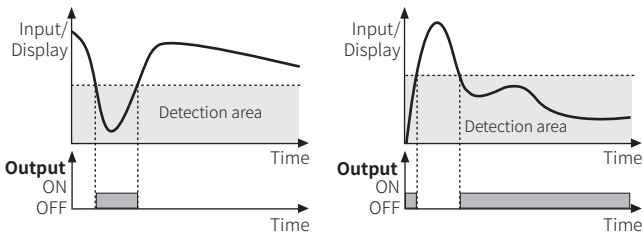
Executes zero-point adjustment function when external input signal is applied.

Hold

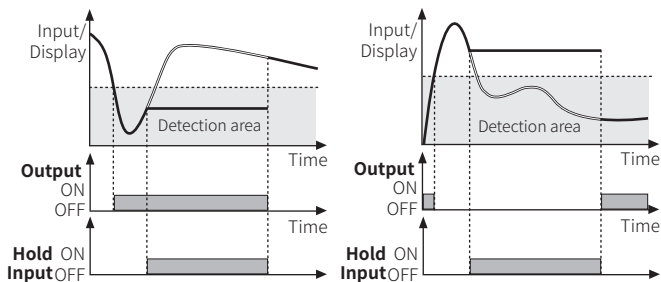
Holds current display value and control output when external input signal is applied.

Input: ——— Display: ———

When hold function is not used



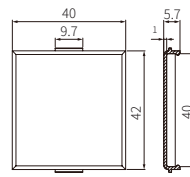
When hold function is used



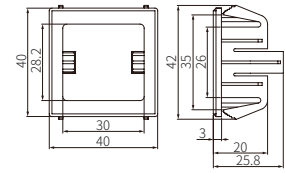
Sold Separately: Protection cover / Panel brackets

• Unit: mm, For the detailed drawings, follow the Autonics website.

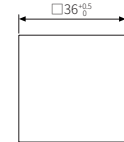
Front cover (PSO-P01)



Panel bracket (PSO-B02/B03)

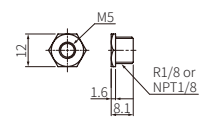


Panel cut-out



Panel Thickness:
0.8 to 3.5 mm

M5 gender (PSO-Z01)



Pressure Conversion Chart

	Pa	kgf/cm ²	mmHg	mmH ₂ O	psi	bar	inHg
Pa	1	0.000010197	0.007501	0.101972	0.00014504	0.00001	0.0002953
kgf/cm ²	98066.5	1	735.5592	10000.0005	14.223393	0.980665	28.959025
mmHg	133.3224	0.001359	1	13.595099	0.019337	0.001333	0.039370
mmH ₂ O	9.80665	0.000099	0.073556	1	0.00142	0.000098	0.002896
psi	6894.733	0.070307	51.71475	703.016716	1	0.068947	2.036014
bar	100000.0	1.019716	750.062	10197.1626	14.503824	1	29.529988
inHg	3386.388	0.034532	25.40022	345.315507	0.491156	0.033864	1

• 1,000,000 Pa = 1,000 kPa = 1 MPa

Segment Table

The segments displayed on the product indicate the following meanings. It may differ depending on the product.

7 Segment				11 Segment				12 Segment				16 Segment			
0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7
8	9	A	B	8	9	A	B	8	9	A	B	8	9	A	B
C	D	E	F	C	D	E	F	C	D	E	F	C	D	E	F
G	H	I	J	G	H	I	J	G	H	I	J	G	H	I	J
K	L	M	N	K	L	M	N	K	L	M	N	K	L	M	N
O	P	Q	R	O	P	Q	R	O	P	Q	R	O	P	Q	R
S	T	U	V	S	T	U	V	S	T	U	V	S	T	U	V
W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z