**Autonics**

# DIGITAL PRESSURE SENSOR
# PSA/PSB SERIES
## INSTRUCTION MANUAL


Thank you for choosing our Autonics product.
**Please read the following safety considerations before use.**

## ■ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

⚠ **Warning** Failure to follow these instructions may result in serious injury or death.
⚠ **Caution** Failure to follow these instructions may result in personal injury or product damage.

### ⚠ Warning

1. **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.
2. **Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
   Failure to follow this instruction may result in explosion or fire.
3. **Install on a device panel or to a pressure port directrly to use.**
   Failure to follow this instruction may result in fire.
4. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in fire.
5. **Check 'Connections' before wiring.**
   Failure to follow this instruction may result in fire.
6. **Do not disassemble or modify the unit.**
   Failure to follow this instruction may result in fire.

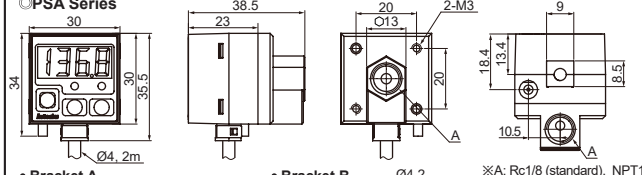
### ⚠ Caution

1. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or product damage.
2. **Use dry cloth to clean the unit, and do not use water or organic solvent.**
   Failure to follow this instruction may result in fire.
3. **This product is designed to detect the pressure of noncorrosive gas. Do not use for corrosive gas.**
   Failure to follow this instruction may result in product damage.
4. **Keep metal chip, dust, and wire residue from flowing into the unit.**
   Failure to follow this instruction may result in fire or product damage.

## ■ Dimensions

(unit: mm)

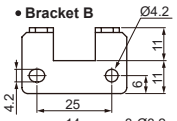
◎**PSA Series**




※A: Rc1/8 (standard), NPT1/8 (option)

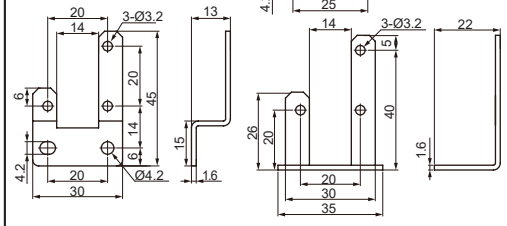
• **Bracket A**

• **Bracket B**



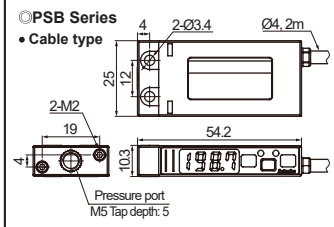

• **Panel cut-out**


(panel thickness: 0.8 to 3.5mm)

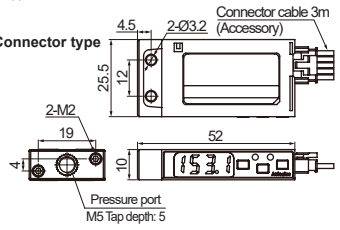



◎**PSB Series**

• **Cable type**

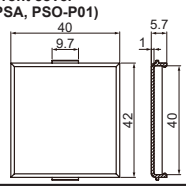



• **Connector type**

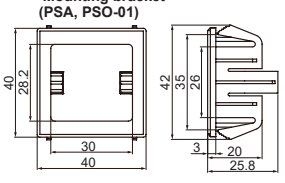



◎**Sold separately**

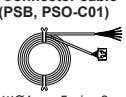
• **Front cover (PSA, PSO-P01)**




• **Mounting bracket (PSA, PSO-01)**




• **Connector cable (PSB, PSO-C01)**

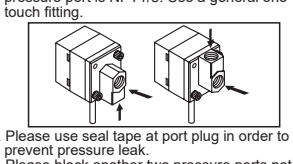


※Ø4mm, 5-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø1mm)

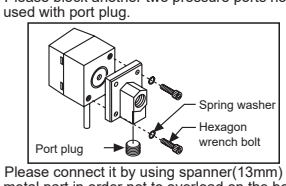
## ■ Installation

◎**PSA Series**

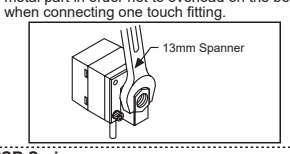
1. When installing pressure port it is able to bring pressure from 3 directions by changing the mounting direction of the pressure port.
2. Standard pressure port is Rc1/8 and option pressure port is NPT1/8. Use a general one-touch fitting.



3. Please use seal tape at port plug in order to prevent pressure leak.
4. Please block another two pressure ports not used with port plug.



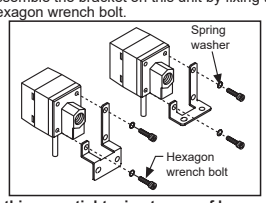

5. Please connect it by using spanner(13mm) at the metal part in order not to overload on the body when connecting one touch fitting.




⚠**Caution**

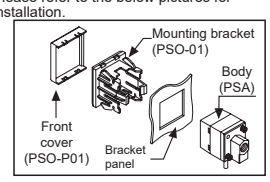
**The tightening torque of one touch fitting should be Max. 10N·m.**
**It may cause mechanical trouble.**

6. PSA Series has 2 kinds of brackets so it is able to install it in two different ways.
7. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing the hexagon wrench bolt.



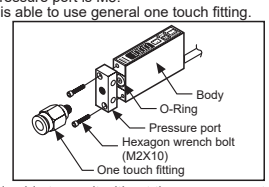

**In this case, tightening torque of hexagon wrench should be max. 3N·m.**
**It may cause mechanical trouble.**

8. Front cover (PSO-P01) and mounting bracket (PSO-01) are sold separately.
   Please refer to the below pictures for installation.

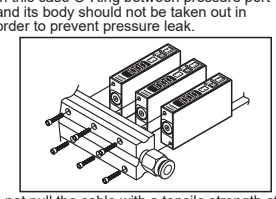



◎**PSB Series**

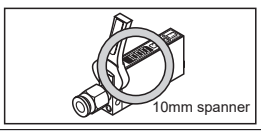
1. Pressure port is M5.
   It is able to use general one touch fitting.




2. It is able to use it without the pressure port according to environment.
   In this case O-Ring between pressure port and its body should not be taken out in order to prevent pressure leak.

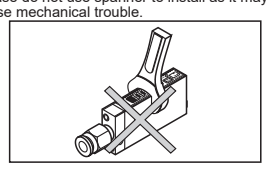


3. Please connect it by using spanner(10mm) at pressure port in order not to overload on the body when connecting one touch fitting.




⚠**Caution**

The tightening torque of one touch fitting and hexagon wrench should be Max. 5N·m and 2N·m. It may cause mechanical trouble.
Please do not use spanner to install as it may cause mechanical trouble.



※Do not pull the cable with a tensile strength of 30N or over.
※**The above specifications are subject to change and some models may be discontinued without notice.**
※**Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).**

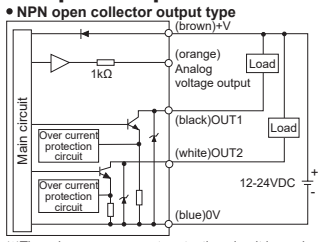
## ■ Specifications

| | | | | | |
|---|---|---|---|---|---|
| Pressure type | | Gauge pressure | | | |
| | | Negative pressure type | Standard pressure type | | Compound pressure type |
| Model※1 | NPN open collector output | PSA-V01□<br>PSB-V01□<br>PSB-V01C-□ | PSA-01-□<br>PSB-01-□<br>PSB-01C-□ | PSA-1-□<br>PSB-1-□<br>PSB-1C-□ | PSA-C01-□<br>PSB-C01-□<br>PSB-C01C-□ |
| | PNP open collector output | PSA-V01P-□<br>PSB-V01P-□<br>PSB-V01CP-□ | PSA-01P-□<br>PSB-01P-□<br>PSB-01CP-□ | PSA-1P-□<br>PSB-1P-□<br>PSB-1CP-□ | PSA-C01P-□<br>PSB-C01P-□<br>PSB-C01CP-□ |
| Rated pressure range | | 0.0 to -101.3kPa | 0.0 to 100.0kPa | 0 to 1,000kPa | -100.0 to 100.0kPa |
| Display pressure range | | 5.0 to -101.3kPa | -5.0 to 110.0kPa | -50 to 1,100kPa | -101.2 to 110.0kPa |
| Max. pressure range | | 2 times of rated pressure | | 1.5 times of rated pressure | 2 times of rated pressure |
| Applicable fluid | | Air, Non-corrosive gas | | | |
| Power supply | | 12-24VDC⎓ ±10%(Ripple P-P: max. 10%) | | | |
| Current consumption | | Max. 50mA | | | |
| Control output | | NPN or PNP open collector output<br>• Load voltage: Max. 30VDC⎓ • Load current: Max. 100mA<br>• Residual voltage -NPN: Max. 1VDC⎓, PNP: Max. 2VDC | | | |
| | Hysteresis※2 | 1digit fixed(2digits for psi unit) | | | 2digits fixed |
| | Repeat error | ±0.2% F.S. ±1digit | | | ±0.2% F.S.±2digits |
| | Response time | Selectable 2.5ms, 5ms, 100ms, 500ms | | | |
| | Short circuit protection | Built-in | | | |
| Analog output | | • Output voltage: 1-5VDC⎓ ±2% F.S. • Linear: Within ±2% F.S.<br>• Zero point: Within 1VDC⎓ ±2% F.S. • Span: Within 4VDC⎓ ±2% F.S.<br>• Resolution: Approx. 1/200 • Output impedance: 1kΩ | | | |
| Display digit | | 3½ digit LED | | | |
| Display method | | 7 Segment LED | | | |
| Min. display interval | | 1digit(psi unit: 2 digits are fixed) | | | 2digits |
| Pressure unit | | kPa, kgf/cm², bar, psi, mmHg, mmH₂O, inHg | kPa, kgf/cm², bar, psi | | kPa, kgf/cm², bar, psi, mmHg, mmH₂O, inHg |
| Display accuracy | | 0 to 50°C: Max. ±1% F.S., -10 to 0°C: Max. ±2% F.S. | | | |
| Vibration | | 1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours | | | |
| Environ-ment | Ambient temperature | -10 to 50, Storage: -20 to 60°C | | | |
| | Ambient humidity | 35 to 85%RH, Storage: 35 to 85%RH | | | |
| Material | | • PSA - Case: PC, Pressure port: die-cast (Zn)<br>• PSB - Case, Pressure port, Cover: IXEF • PSB-C - Case, Pressure port, Cover: IXEF | | | |
| Protection | | IP40(IEC standard) | | | |
| Cable | Cable type | Ø4mm, 5-wire, Length: 2m(AWG 24, core diameter: 0.08mm, number of cores: 40, insulation diameter: Ø1mm) | | | |
| | Connector type | 5-wire, Length: 3m(AWG 24, insulation diameter: Ø1.4mm) | | | |
| Weight※3 | | PSA : Approx. 200g(approx. 120g), PSB : Approx. 160g(approx. 70g), PSB-C : Approx. 160g (approx. 70g) | | | |

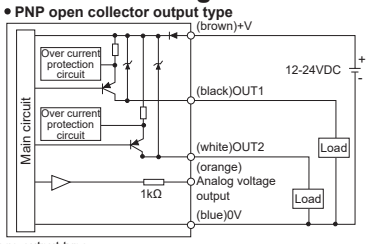
※1: □ is pressure port type. PSA standard: Rc1/8, PSA option: NPT1/8, PSB standard: M5.
※2: In hysteresis output mode, detection difference is variable.
※3: The weight is with packaging and the weight in parentheses is only unit weight.
※F.S.: Rated pressure. ※There may be ±1digit error in hysteresis by pressure unit calculation error.
※The specification of pressure port for PSA Series is marked on the upper part of the case.
※For using mmH₂O unit, multiply display value by 100.
※Environment resistance is rated at no freezing or condensation.

## ■ Input/Output Circuit and Connection Diagram

• **NPN open collector output type**

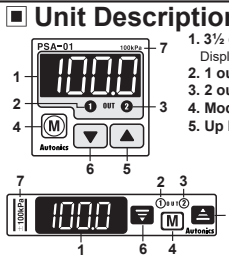



• **PNP open collector output type**




※There is no over current protection circuit in analog voltage output type.
Do not connect this unit to power source or capacitive load directly.
※Please observe input impedance of connected equipment when using analog voltage output.
And be sure with voltage drop by resistance of extended wire.
※If short-circuit the control output terminal or supply current over the rated specification, control signal is abnormal due to the current protection circuit

## ■ Unit Descriptions




1. **3½ digit LED display(red)**:
   Displays sensing pressure, every setting value and display error
2. **1 output indicator(red)**: Output 1 is ON, LED will be ON
3. **2 output indicator(PSA: red, PSB: green)**: Output 2 is ON, LED will be ON
4. **Mode key**: Enter to parameter or preset setting mode, and save setting value
5. **Up key**: Sets the setting value to upper step in preset setting or pressure unit, output mode, response time, analog output scale, key lock, peak hold value, bottom hold value display in parameter setting
6. **Down key**
   :Sets setting value to lower step in preset setting or pressure unit, output mode, response time, analog output scale, key lock, peak hold, bottom hold display in parameter setting.
7. **Range of rating pressure**: It is possible to change the pressure unit in pressure sensor. Please use different unit label for your application.

## ■ Functions

◎**Pressure unit change**
PS□-V01(C)(P) and PS□-C01(C)(P) has 7 kinds of pressure unit and PS□-01(C)(P) and PS□-1(C)(P) has 4 kinds of pressure unit. Please select the proper unit for application.
• PS□-V01(C)(P), PS□-C01(C)(P) : kPa, kgf/cm², bar, psi, mmHg, inHg, mmH₂O
• PS□-01(C)(P), PS□-1(C)(P) : kPa, kgf/cm², bar, psi
※When using mmH₂O unit, multiply display value by 100.

◎**Output mode change**
There are 6 kinds of control output mode in order to provide the various detection.
Select a mode for your proper application.
• Hysteresis mode[F-1] : When variable hysteresis is required for pressure detection.
• Automatic sensitivity setting mode[F-2]: When it is required to set detecting sensitivity automatically at proper position.
• Independent 2 output mode[F-3, F-4, F-5]: When it is required to detect pressure from two positions with one product.
• Window comparison output mode[F-6] : When it is required to detect pressure in a certain area.

◎**Response time change (chattering prevention)**
It can prevent chattering of control output by changing response time. It is able to set 4 kinds of response time (2.5, 5, 100, 500ms) and if the response time is getting longer, the sensing will be more stable by increasing the number of digital filter.

◎**Analog output scale setting**
It is not fixed the analog output(1-5VDC) scale as the rated pressure range but this is a function to change properly for user's application. When the position [A-1] for 1VDC output and the position [A-5] for 5VDC output are set, the pressure range of A-1 to A-5 is to 1-5VDC analog output.

◎**Key lock**
This unit has 2 kinds of key lock function in order to prevent wrong operation.
• LoC: All keys are locked, it is impossible to change any parameter setting/preset, zero point adjustment, peak hold and bottom hold. (enables to change ↓EY mode only)
• PRL: It is impossible to change parameter setting/preset, zero point adjustment. (Enables to check peak hold and bottom hold, and to change ↓EY mode)
• UnL: All of the setting is available, all keys are unlocked.

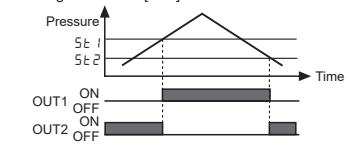
◎**Zero point adjustment**
This function is to set the display value of pressure at zero when port is opened to atmospheric pressure. Zero point adjustment affects analog output voltage.

◎**Peak hold and bottom hold function**
This function is to diagnosis malfunction of the system caused by parasitic pressure or to check through memorizing the max./min. pressure that occurred in the system.

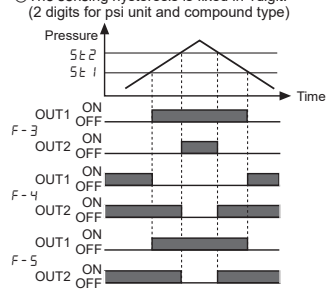
## ■ Output Operation Mode

※PSA/PSB Series has 6 kinds of output operation mode, please use proper output operation mode in accordance with sensing.

• **Hysteresis mode[F-1]**
It can be set for pressure sensing level [St1] and sensing differences [St2].

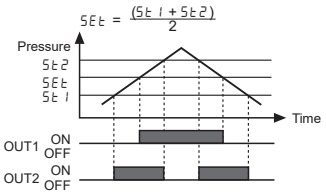



• **Independent 2 output mode[F-3, F-4, F-5]**
①St1 and St2 can be set independently within display pressure range. One is for control, the other is for alarm or optional control.
②The sensing hysteresis is fixed in 1digit.
(2 digits for psi unit and compound type)

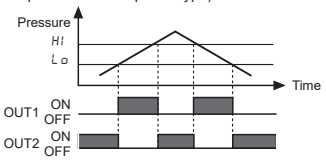



• **Automatic sensitivity setting mode[F-2]**
①This function is to set pressure sensing level to the proper position automatically. It is set by received pressure from two positions[St1, St2].
②The sensing hysteresis is fixed in 1digit.
(2 digits for psi unit and compound type)
③The pressure sensing level [SEt] is shown in the following calculation.

$$SEt = \frac{(St1 + St2)}{2}$$




• **Window comparison output mode[F-6]**
①It is able to set High-limit value[Hi ], Low limit value [Lo] of pressure sensing level in this mode.
②The sensing hysteresis is fixed to 1digit.(2 digits for psi unit and compound type)

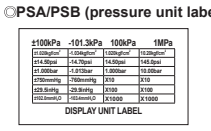



## ■ Error

| Error display | Description | Countermeasures |
|---|---|---|
| Er1 | If external pressure applied, when adjusting Zero point | Please try again after external pressure removing |
| Er2 | When overloaded on control output | Remove overload |
| Er3 | When the setting condition is not matched at automatic sensitivity setting mode | Set proper setting value after checking setting condition |
| HHH | When the applied pressure exceeds the upper display pressure range up | Apply pressure within display pressure range |
| LLL | When the applied pressure exceeds the lower display pressure range down | |

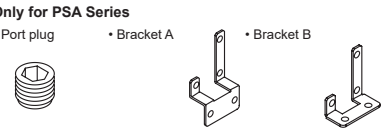
## ■ Accessory

◎**PSA/PSB (pressure unit label)**

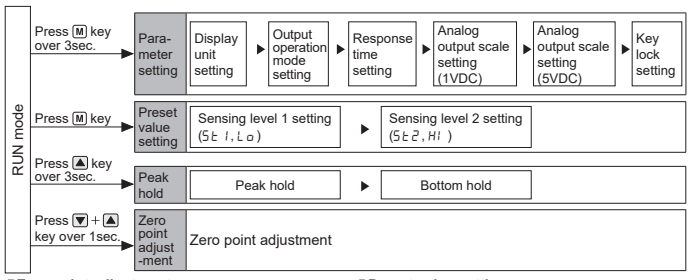



◎**Only for PSA Series**

• Port plug • Bracket A • Bracket B



## ■ Setting



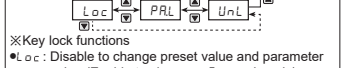

◎**Zero point adjustment**
1. In state of atmospheric pressure during RUN mode, press ▼ key and ▲ key at the same time for over 1sec.
2. When the zero point adjustment is completed, it will display 00 and return to RUN mode automatically.

※If executing zero point adjustment when external pressure has been applied, Er1 will be flashing. Please execute zero point again in state of atmospheric pressure.
※Please execute zero point adjustment regularly.

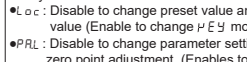
◎**Parameter setting**
1. Set to pressure display unit, output operation mode, response time(chattering prevention), analog output scales or key lock.
2. Please set parameter after unlocking key lock function when key lock function is set.
(please see below key lock setting)

**RUN mode**
↓ Press M key over 3 sec.

**Display unit [Unt]**
• Unt and previously set unit will flash in turn every 0.5 sec.
• Press ▲ or ▼ key to select the unit.
※Negative pressure, compound pressure:

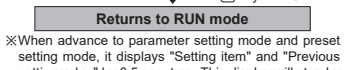



※Standard pressure



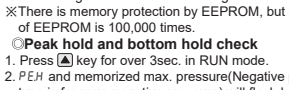

(Press M key momentarily, the unit will be saved, then move to the next mode.)
※For using mmH₂O unit, multiply display value by 100.
↓ M

**Output operation mode [oUt]**
• oUt and previous output operation mode will flash by turning on.(0.5sec.)
• Select the output operation mode with ▲, ▼ key.




(Press M key momentarily, the response time will be saved, then move to the next mode.)
↓ M

**Response time [SPd]**
• SPd and the previous response time will flash by turning on.(0.5sec.)
• Select the response time with ▲, ▼ key.




(Press M key momentarily, the response time will be saved, then move to the next mode.)
↓ M

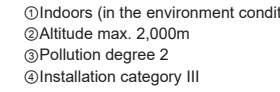
**Analog output scale (1VDC) [A-1]**
• A-1 and the previous pressure will flash by turning on.(0.5sec.)
• Set the pressure which will output 1VDC with ▲, ▼ key.
• Set range : Min. value of rated pressure ≤ [A-1] ≤ 90% of rated pressure

(Press M key momentarily, the selected pressure is set as 1VDC scales, then move to the next mode.)
↓ M

**Analog output scale (5VDC) [A-5]**
• A-5 and the previous pressure will flash by turning on.(0.5sec.)
• Set the pressure which will output 5VDC by ▲, ▼ key.
• Set range: [A-1]+10% of rated pressure ≤ [A-5]≤Max. value of rated pressure

(Press M key momentarily, the selected pressure is set as 5VDC scales, then move to the next mode.)
↓ M

**Key lock [↓EY]**
• ↓EY and the previous key lock will flash by turning on(0.5sec.)
• Select key lock with ▲, ▼ key.




※Key lock functions
• Loc : Disable to change preset value and parameter value (Enable to change ↓EY mode only)
• PRL : Disable to change parameter setting/preset, zero point adjustment. (Enables to check peak hold and bottom hold, and to change ↓EY mode)
• UnL : Enable to change preset value and parameter value(Lock off)

↓ Press M key over 3 sec.

**Returns to RUN mode**

※When advance to parameter setting mode and preset setting mode, it displays "Setting item" and "Previous setting value" by 0.5 sec. turn. This display will stop by pressing ▼ or ▲ key(Display setting value), if any key is untouched for over 1 sec., it will display old value by 0.5sec. turn again.
※When M key is pressed for 3sec. during setting, it will return to RUN mode with memorizing on EEPROM. However, when there is any key is untouched for 60sec., it turns to RUN mode with keeping the previous setting value not current setting value.
※There is memory protection by EEPROM, but life cycle of EEPROM is 100,000 times.

◎**Peak hold and bottom hold check**
1. Press ▲ key for over 3sec. in RUN mode.
2. PEH and memorized max. pressure(Negative pressure type is for max. negative pressure) will flash by turning on (0.5sec.) then display peak hold value.
3. boH and memorized min. pressure(Negative pressure type is for min. negative pressure) will flash by turning on (0.5sec.) then display bottom hold value.
4. If pressing ▲ key one time shortly, memorized peak hold and bottom hold value will be removed then return to RUN mode.

※When the peak hold and bottom hold value is over the max. display pressure value, it displays HHH. On the opposite, it displays LLL. Please remove peak hold and bottom hold value by using ▲ key.

◎**Preset value setting**
1. Set the pressure sensing level.
2. Set preset value after unlocking key lock when key lock function is set.
(please refer to the key lock setting)
3. Be sure that the setting method is different by each output operation mode.

■ **When hysteresis mode [F-1] and independent 2 output mode [F-3, F-4, F-5]**

**RUN mode**
↓ M

**Pressure sensing level 1**
• St1 and previous set sensing level 1 flash in 0.5sec. by turns.
• Set the pressure sensing level 1 by ▲ or ▼ key.
• Set range: Min. display pressure < St1 ≤ Max. display pressure

(Press M key momentarily, sensing level 1 will be saved, then move to the next mode.)
↓ M

**Pressure sensing level 2**
• St2 and previous set sensing level 2 flash in 0.5sec. by turns.
• Set the pressure sensing level 2 by ▲ or ▼ key.
• Set range: Hysteresis mode → Min. display pressure ≤ St2 < St1
Independent 2 output mode → Min. display pressure < St2 ≤ Max. display pressure

(Press M key momentarily, sensing level 2 will be saved, then move to the next mode.)
↓ M

**Returns to RUN mode**

■ **Automatic sensitivity setting mode [F-2]**

**RUN mode**
↓ M

**Pressure sensing level 1**
• St1 and previous set sensing level 1 flash in 0.5sec. by turns.
• Apply the required pressure[St1] within the rated pressure.
• Press ▲ key shortly one time, current sensing pressure is set as sensing level 1. St1 and the set sensing level1 flash by turn (0.5sec.).
• Set range: Min. display pressure < St1 ≤ Max. display pressure-1%of rated pressure

↓ M

**Pressure sensing level 2**
• St2 and previous set sensing level 2 flash in 0.5sec. by turns.
• Apply the required pressure[St2] within the rated pressure.
• Press ▲ key shortly one time, current sensing pressure is set as sensing level 2. St2 and the set sensing level1 flash by turn (0.5sec.).
• Set range:St1 +1% of rated pressure ≤ St2 ≤Max. display pressure

※If differences of between St1 and sensing level are not enough, Er3 flashes 3 times then retruns to St2 setting. Please re-execute the setting for the condition.
※It is possible to set repeatedly by ▲ key, the last setting is set as the sensing level 2.

↓ M

**Automatic sensitivity and fine adjustment**
• St2 and sensing level [SEt] flash in 0.5sec. by turns.
SEt = (St1 + St2) / 2
• Adjust sensing level [SEt] by ▲, ▼ key, when fine adjustment of the sensing level [SEt] is required. (adjustment range: between St1 and St2)

↓ M

**Returns to RUN mode**

※When checking the value of sensing level 1, 2 [St1, St2] and automatic sensitivity setting value[SEt], press M key shortly and continuously.
※Example of the setting in automatic sensitivity setting mode (to check absorption of component by vacuum pressure): The state of removed target is St1 and the state of absorbing target is St2. By ▲ key, sensing level [SEt] value is set in the between St1 and St2 automatically.

■ **Window comparison output mode [F-6]**

**RUN mode**
↓ M

**Pressure sensing level 1**
• Lo and previous set sensing level 1 flash in 0.5sec. by turns.
• Set the pressure sensing level 1 by ▲ or ▼ key.
• Set range: Min. display pressure ≤ Lo < Max. display pressure

(Press M key momentarily, sensing level 1 will be saved, then move to the next mode.)
↓ M

**Pressure detecting level 2**
• Hi and previous set sensing level 1 flash in 0.5sec. by turns.
• Set the pressure sensing level 2 by ▲ or ▼ key.
• Set range: Lo < Hi ≤ Max. display pressure

(Press M key momentarily, sensing level 1 will be saved, then move to RUN mode.)
↓ M

**Returns to RUN mode**

※If no key is touched for 60sec., it will return to RUN mode. [Automatic sensitivity setting mode [F-2] is exception)
※When changing the display unit, preset value will be calculated according to the display unit.
※Whenever key touched one time, it is increased(decreased) as 1 digit(2 digits for psi unit and compound pressure) but it will be continuously increasing(decreasing) by pressing ▲ (▼) key constantly.

## ■ Cautions during Use

1. Follow instructions in 'Cautions during Use'.
   Otherwise, It may cause unexpected accidents.
2. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 3 sec after supplying power.
4. When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.
5. Wire as short as possible and keep away from high voltage lines or power lines, to prevent inductive noise.
6. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category III

## ■ Main Products

■ Photoelectric Sensors
■ Fiber Optic Sensors
■ Door Sensors
■ Door Side Sensors
■ Area Sensors
■ Proximity Sensors
■ Pressure Sensors
■ Rotary Encoders
■ Connector/Sockets
■ Graphic/Logic Panels
■ Field Network Devices
■ Control Switches/Lamps/Buzzers
■ Switching Mode Power Supplies
■ Laser Marking System(Fiber, $CO_2$, Nd:YAG)
■ Laser Welding/Cutting System
■ Temperature Controllers
■ Temperature/Humidity Transducers
■ SSR/Power Controllers
■ Counters
■ Timers
■ Panel Meters
■ Tachometer/Pulse(Rate) Meters
■ Display Units
■ Sensor Controllers
■ I/O Terminal Blocks & Cables
■ Stepper Motors/Drivers/Motion Controllers

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