



Operation Manual

PRODUCT NAME

Digital Pressure Switch

MODEL / Series / Product Number

ZSE30A(F)
ISE30A

SMC Corporation




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Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution", "Warning" or "Danger". They are all important notes for safety and must be followed in addition to International standards (ISO/IEC) *1) and other safety regulations.

- *1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.
- ISO 4413: Hydraulic fluid power -- General rules relating to systems.
- IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)
- ISO 10218-1992: Manipulating industrial robots -Safety.
- etc.

| | |
|--|--|
|  Caution : | CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury. |
|  Warning : | WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury. |
|  Danger : | DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury. |

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalogue.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries. If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. *2)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.

*2) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Caution

SMC products are not intended for use as instruments for legal metrology.

Products that SMC manufactures or sells are not measurement instruments that are qualified by pattern approval tests relating to the measurement laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the measurement laws of each country.

Operator

- ◆ This operation manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment. Only those persons are allowed to perform assembly, operation and maintenance.
- ◆ Read and understand this operation manual carefully before assembling, operating or providing maintenance to the product.

■ Safety Instructions

Warning

- Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.
- Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.
- Do not operate in an atmosphere containing flammable or explosive gases.
Fire or an explosion can result.
This product is not designed to be explosion proof.
- Do not use the product in a place where static electricity is a problem.
Otherwise it can cause failure or malfunction of the system.
- If using the product in an interlocking circuit:
 - Provide a double interlocking system, for example a mechanical system
 - Check the product regularly for proper operationOtherwise malfunction can result, causing an accident.
- The following instructions must be followed during maintenance:
 - Turn off the power supply
 - Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenanceOtherwise an injury can result.

Caution

■ Do not touch the terminals and connectors while the power is on.
Otherwise electric shock, malfunction or damage to the product can result.

■ After maintenance is complete, perform appropriate functional inspections and leak tests.
Stop operation if the equipment does not function properly or there is a leakage of fluid.
When leakage occurs from parts other than the piping, the product might be faulty.
Disconnect the power supply and stop the fluid supply.
Do not apply fluid under leaking conditions.
Safety cannot be assured in the case of unexpected malfunction.

■ NOTE

○ Follow the instructions given below when designing, selecting and handling the product.

● The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.

*Product specifications

● The direct current power supply to combine should be UL approved as follows.

Circuit (of Class2) which is of maximum 30 Vrms (42.4 V peak) or less, with UL1310 Class2 power supply unit or UL1585 Class2 transformer.

● The Pressure switch is a UL approved product only if it has a  mark on the body.

● Use the specified voltage.

Otherwise failure or malfunction can result.

● Do not exceed the specified maximum allowable load.

Otherwise it can cause damage or shorten the lifetime of the Pressure switch.

● Design the product to prevent reverse current when the circuit is opened or the product is forced to operate for operational check.

Reverse current can cause malfunction or damage to the product.

● Input data to the Pressure switch is not deleted, even if the power supply is cut off.

(Writing time: 1,000,000 times, Data duration: 10 years after power off)

● For the details of compressed air quality, refer to ISO 8573-1, 1.1.2 to 1.6.2: 2001.

This can cause operating failure.

If compressed air containing condensate is used, install an air dryer or drain catch before the filter and perform drainage regularly.

If drainage is not performed regularly and condensate enters the secondary side, it can cause operating failure of pneumatic equipment.

If regular drainage is difficult, the use of a filter with an auto drain is recommended.

● Applicable fluid is air, inert gases and incombustible gases.

Do not use a fluid containing chemicals, synthetic oils including organic solvent, salt and corrosive gases.
Otherwise, damage to the product and malfunction can result.

Check the details of the specifications before using.

● Use the specified measurement flow rate and operating pressure.

Otherwise it can cause damage to the pressure switch or inability to measure correctly.

● Reserve a space for maintenance.

Allow sufficient space for maintenance when designing the system.

●Product handling

*Installation

- Tighten to the specified tightening torque.
If the tightening torque is exceeded the mounting screws and brackets may be broken.
If the tightening torque is insufficient, the product can be displaced and loosen the mounting screws.
(Refer to "Mounting and Installation" on page 14.)
- Do not apply excessive stress to the product when it is mounted with a panel mount.
Otherwise damage to the product and disconnection from the panel mount can result.
- Be sure to ground terminal FG when using a commercially available switch-mode power supply.
- Do not drop, hit or apply shock to the Pressure switch.
Otherwise damage to the internal parts can result, causing malfunction.
- Do not pull the lead wire forcefully, not lift the product by pulling the lead wire. (Tensile force 35 N or less)
Hold the body when handling to avoid the damage of the Pressure switch which lead to cause the failure and malfunction.
- For piping of the Pressure switch, hold the piping with a spanner on the metal part of the piping (Piping attachment).
Holding other part with spanner leads to damage the Pressure switch.
- Eliminate any dust left in the piping by air blow before connecting the piping to the product.
Otherwise it can cause damage or malfunction.
- Do not insert metal wires or other foreign matter into the pressure measurement port.
It can damage the pressure sensor causing failure or malfunction.
- Never mount a Pressure switch in a location that will be used as a foothold.
The product may be damaged if excessive force is applied by stepping or climbing onto it.
- If the entering of foreign material to the fluid is possible, install and pipe the filter or the mist separator to the inlet to avoid failure and malfunction.

*Wiring

- Do not pull the lead wires.
In particular, never lift a Pressure switch equipped with fitting and piping by holding the lead wires.
Otherwise damage to the internal parts can result, causing malfunction or to be off the connector.
- Avoid repeatedly bending or stretching the lead wire, or placing heavy load on them.
Repetitive bending stress or tensile stress can cause the sheath of the wire to peel off, or breakage of the wire.
If the lead wire can move, fix it near the body of the product.
The recommended bend radius of the lead wire is 6 times the outside diameter of the sheath, or 33 times the outside diameter of the insulation material, whichever is larger.
Replace the damaged lead wire with a new one.
- Wire correctly.
Incorrect wiring can break the Pressure switch.
- Do not perform wiring while the power is on.
Otherwise damage to the internal parts can result, causing malfunction.
- Do not route wires and cables together with power or high voltage cables.
Otherwise the product can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line. Route the wires (piping) of the product separately from power or high voltage cables.
- Confirm proper insulation of wiring.
Poor insulation (interference from another circuit, poor insulation between terminals, etc.) can lead to excess voltage or current being applied to the product, causing damage.
- Design the system to prevent reverse current when the product is forced to operate for operational check.
Depending on the circuit used, insulation may not be maintained when operation is forced, allowing reverse current to flow, which can cause malfunction and damage the product.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage.
Do not use a cable longer than 10 m.
Wire the DC(-) line(blue) as close as possible to the power supply.
- When analogue output is used, install a noise filter (line noise filter, ferrite element, etc.) between the switch-mode power supply and this product.

*Environment

- Do not use the product in area that is exposed to corrosive gases, chemicals, sea water, water or steam.
Otherwise failure or malfunction can result.

- Do not use in a place where the product could be splashed by oil or chemicals.
If the product is to be used in an environment containing oils or chemicals such as coolant or cleaning solvent, even for a short time, it may be adversely affected (damage, malfunction, or hardening of the lead wires).
- Do not use in an area where surges are generated.
If there is equipment which generates a large amount of surge (solenoid type lifter, high frequency induction furnace, motor, etc.) close to the Pressure switch, this may cause deterioration or breakage of the internal circuit of the Pressure switch. Avoid sources of surge generation and crossed lines.
- Do not use a load which generates surge voltage.
When a surge-generating load such as a relay or solenoid is driven directly, use a Pressure switch with a built-in surge absorbing element.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Mount the product in a place that is not exposed to vibration or impact.
Otherwise failure or malfunction can result.
- Prevent foreign matter such as remnant of wires from entering the Pressure switch.
Take proper measures for the remnant not to enter the Pressure switch in order to prevent failure or malfunction.
- Do not use the product in an environment that is exposed to temperature cycle.
Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not expose the product to direct sunlight.
If using in a location directly exposed to sunlight, shade the product from the sunlight.
Otherwise failure or malfunction can result.
- Keep within the specified fluid and ambient temperatures range.
The fluid and ambient temperatures should be 0 to 50 °C. Operation under low temperature (5 °C or less) leads to cause damage or operation failure due to frozen moist in the fluid or air.
Protection against freezing is necessary. Air dryer is recommended for elimination of drain and water.
Avoid sudden temperature change even within specified temperature.
- Do not operate close to a heat source, or in a location exposed to radiant heat.
Otherwise malfunction can result.

*Adjustment and Operation

- Turn the power on after connecting a load.
Otherwise it can cause excess current causing instantaneous breakage of the Pressure switch.
- Do not short-circuit the load.
Although error is displayed when the Pressure switch load is short circuit, generated excess current lead to cause the damage of the Pressure switch.
- Do not press the setting buttons with a sharp pointed object.
It may damage the setting buttons.
- If using the product to detect very small pressure rates, warm up the product for 10 to 15 minutes first.
There will be a drift on the display and the analogue output of approximate $\pm 1\%$ immediately after the power supply is turned on, within 10 minutes.
- Perform settings suitable for the operating conditions.
Incorrect setting can cause operation failure.
For details of each setting, refer to page 21 to 46 of this manual.
- The Pressure switch is compulsory turned off for 4 seconds after power supplied.
For 4 seconds after supplying power, the measurement output is turned off.
- Do not touch the LCD during operation.
The display can vary due to static electricity.

*Maintenance

- Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.
There is a risk of unexpected malfunction.
- Perform regular maintenance and inspections.
There is a risk of unexpected malfunction.
- Perform drainage regularly.
If condensate enters the secondary side, it can cause operating failure of pneumatic equipment.
- Do not use solvents such as benzene, thinner etc. to clean the Pressure switch.
They could damage the surface of the body and erase the markings on the body.
Use a soft cloth to remove stains. For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

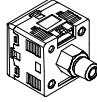
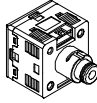
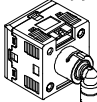
Model Indication and How to order

ISE30A - **01** - **N** -

Set pressure range

| | Symbol | Content |
|-------------------|---------|-----------------|
| Positive pressure | ISE30A | -0.1 to 1 MPa |
| Vacuum pressure | ZSE30A | 0 to -101 kPa |
| Compound pressure | ZSE30AF | -100 to 100 kPa |

Piping specification

| Symbol | Content | |
|--------|---|---|
| 01 | R1/8 (with M5 female thread) |  |
| * N01 | NPT1/8 (with M5 female thread) | |
| C4H | One-touch fitting φ4 mm and φ5/32 inch | Straight type  |
| C6H | One-touch fitting φ6 mm | |
| N7H | One-touch fitting φ1/4 inch | |
| C4L | One-touch fitting φ4 mm and φ5/32 inch | Elbow type  |
| C6L | One-touch fitting φ6 mm | |
| N7L | One-touch fitting φ1/4 inch | |

*: Made to Order

Output specification

| Symbol | Content |
|--------|---|
| N | NPN open collector 1 output |
| P | PNP open collector 1 output |
| A | NPN open collector 2 outputs |
| B | PNP open collector 2 outputs |
| * C | NPN open collector 1 output + Analog voltage output |
| * D | NPN open collector 1 output + Analog current output |
| * E | PNP open collector 1 output + Analog voltage output |
| * F | PNP open collector 1 output + Analog current output |

*: Made to Order

Unit specification

| Symbol | Content |
|--------|--|
| Nil | With unit conversion function *1 |
| M | Fixed SI unit *2 |
| * P | With unit conversion function (psi initial value) *1 |

*: Made to Order

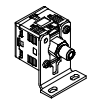


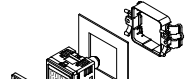
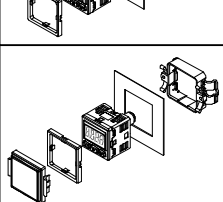
*1: The new Measurement Law prohibits the use of pressure switch with the unit conversion function in Japan.
A unit label is attached.

*2: Fixed unit kPa, MPa


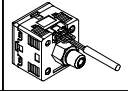
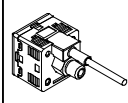
Option 3

| Symbol | Operation manual Booklet | Calibration certificate |
|--------|--------------------------|-------------------------|
| Nil | ○ | - |
| Y | - | - |
| K | ○ | ○ |
| T | - | ○ |

Option 2

| Symbol | Content | |
|--------|--|---|
| Nil | No option | |
| A1 | Bracket A |  |
| A2 | Bracket B |  |
| A3 | Bracket C |  |
| B | Panel mount adapter |  |
| D | Panel mount adapter + Front protective cover |  |

Option 1

| Symbol | Content | |
|--------|---|---|
| Nil | Without lead wire |  |
| L | With connector attached lead wire (lead wire length 2 m) *1 |  |
| G | With connector attached lead wire (lead wire length 2 m) and connector cover *1 |  |

*1: The output specification "N" or "P" is equipped with 3 cores lead wire, and 4 cores lead wire for others.

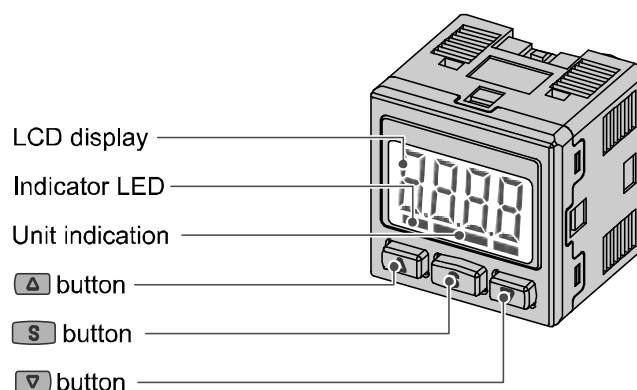
○Accessories / Part numbers

If an accessory is required independently, order with the following part number.

| Description | Part number | Remarks |
|---|-------------|------------------------------------|
| Bracket A | ZS-38-A1 | Mounting screw (M3x5L, 2 pcs) |
| Bracket B | ZS-38-A2 | Mounting screw (M3x5L, 2 pcs) |
| Bracket C | ZS-38-A3 | Mounting screw (M3x5L, 2 pcs) |
| Panel mount adapter | ZS-27-C | Mounting screw (M3x8L, 2 pcs) |
| Panel mount adapter + Front protective cover | ZS-27-D | Mounting screw (M3x8L, 2 pcs) |
| Front protective cover | ZS-27-01 | - |
| Lead wire with connector | ZS-38-3L | 3 cores for 1 output, 2 m |
| Lead wire with connector | ZS-38-4L | 4 cores for 2 outputs, 2 m |
| Lead wire with connector + connector cover | ZS-38-3G | 3 cores for 1 output, 2 m |
| Lead wire with connector + connector cover | ZS-38-4G | 4 cores for 2 outputs, 2 m |
| Lead wire with connector for copy function | ZS-38-5L | 3 cores (for copy function), 1 m |
| Lead wire with connector unit for copy function | ZS-38-U | for copy function (10 slaves max) |
| One-touch fitting ϕ 4 mm straight | ZS-38-C4H | O-ring and one-touch clip included |
| One-touch fitting ϕ 6 mm straight | ZS-38-C6H | O-ring and one-touch clip included |
| One-touch fitting ϕ 1/4 inch straight | ZS-38-N7H | O-ring and one-touch clip included |
| One-touch fitting ϕ 4 mm elbow | ZS-38-C4L | O-ring and one-touch clip included |
| One-touch fitting ϕ 6 mm elbow | ZS-38-C6L | O-ring and one-touch clip included |
| One-touch fitting ϕ 1/4 inch elbow | ZS-38-N7L | O-ring and one-touch clip included |

Summary of Product parts

Names of individual parts



Indicator LED (Green OUT1 and Red OUT2): Displays the switch output condition.

LCD display: Displays the current status of pressure, setting mode, selected indication unit and error code. Four display modes can be selected: display always in red or green, or display changing from green to red, or red to green, according to the output status.

▲ button: Selects the mode or increases the ON/OFF set value.
Press this button to change to the peak display mode.

▼ button: Selects the mode or decreases the ON/OFF set value.
Press this button to change to the bottom display mode.

S button: Press this button to change to another mode and to set a value.

Unit indication: Displays the unit currently selected. (only for kPa and MPa unit indication).

■ Definition and terminology

| | Terms | Meaning |
|---|----------------------------------|--|
| 2 | 2-colour display | 2 colours are used to indicate a value, which change according to the output status. |
| 7 | 7-segment display | When "8" is shown on the display. It is called 7-segment because 8 consists of 7 pieces of "-" (segments)". |
| A | Analogue current output | Refer to "Analogue output (function)". |
| | Analogue output function | A function to output the voltage or current in proportion to the pressure. |
| | Analogue voltage output | Refer to "Analogue output (function)". |
| | Auto preset | A function to automatically set up the pressure by having equipment hold and release a workpiece via vacuum adsorption. This function is used in an application where vacuum adsorption of a workpiece is confirmed by a Pressure switch. |
| B | Bottom value display | Displays the minimum pressure reached up to that moment. |
| C | Chattering | The problem of the switch output turning ON and OFF repeatedly around the set value at high frequency due to the effect of pulsation. |
| | Chattering prevention function | A function to delay the response time of switch output in order to prevent chattering. |
| | Copy function | A function to copy a pressure setting value and function setting (excluding fine adjustment of display value). |
| D | Digit (Minimum setting unit) | Shows how precisely the pressure can be displayed or set by the digital Pressure switch. When 1 digit = 1 kPa, the pressure is given with an increment of 1kPa, e.g., 1, 2, 3, ..., 99, 100. |
| E | Error indication | With the self-diagnostic function of the Pressure switch, this indicates that there is an error which could cause a switch failure. |
| F | Fine adjustment mode | Refer to "Fine adjustment of display value". |
| | Fine adjustment of display value | A displayed pressure value can be adjusted within the range of $\pm 5\%$ R.D. ($\pm 5\%$ of the displayed value). It is used if a true pressure value is known or to correct the difference of a displayed value of the measurement equipment nearby which measures the same pressure. |
| | F.S. (full span/full scale) | Abbreviation for full span or full scale; this means the maximum fluctuation range of the Pressure switch rated value. For example, when the output voltage is 1 to 5[V], the F.S. will be $5-1=4$ [V]. (Ref: $1\%F.S. = 4 \times 0.01 = 0.04$ [V]) |
| | Function selection mode | This is a mode in which each function is set up, and is a separate menu from the pressure setup. If the setting needs to be changed, "F*", each item can be set up. The items to be set up are: display colour, operation mode, output type, response time, display resolution, fine adjustment of display value, auto preset, power-saving mode and security code number. |
| H | Hysteresis | The difference between the pressure switch ON and OFF points, used to prevent chattering. |
| | Hysteresis mode | Refer to "List of output modes" on page 29. |
| I | Indication accuracy | The deviation between displayed pressure value and the true pressure. |
| | Indication colour | The colour of the digital display. There are four choices: normally green, normally red, green (off) to red (on), and red (off) to green (on). |

| | Terms | Meaning |
|---|-----------------------------|--|
| I | Insulation resistance | Insulation resistance of the product itself. The resistance between an electrical circuit and the pressure switch body. |
| | Indication resolution | How fine the rated pressure range can be displayed (example: If a product for 0 to 1 MPa can display pressure by 0.001 MPa, the display resolution is 1/1000.) |
| | Indicator LED | The LED that turns on when the switch output is on. |
| | Indication unit | The unit of pressure used on the display. |
| K | Key lock (function) | A function that locks the setting buttons so that no accidental setting changes can be made. |
| L | Load impedance | Refer to "Max. load impedance". |
| M | Manual set up | Manual pressure set up without using auto preset. This term is used to distinguish from the pressure set up using auto preset. |
| | Master Pressure switch | A Pressure switch whose settings are copied when using the copy function. |
| | Max. applied voltage | The maximum value of applied voltage available to the output wire of the NPN output. |
| | Max. load current | The maximum current available to the output wire of the switch output. |
| | Max. (Min.) load impedance | The maximum (minimum) load (resistance value and impedance) which can be connected to the output (output wire) of the analogue current output. |
| | Measurement mode | The condition in which the pressure is detected and displayed and the switch output is operating. |
| | Min. setting unit | Refer to "digit". |
| N | Normal output | The switch output operation in which the switch is turned on when pressure equal to or greater than the set value is detected. In the (hysteresis mode) window comparator mode, it is the operation in which the switch is turned on when pressure is within the switch output range (P1L to P1H or P2L to P2H). (Refer to "List of output modes" on page 29.) |
| | NPN (open collector) output | The switch output which uses the NPN transistor for output. |
| O | Operating mode | There are two choices, hysteresis mode and window comparator mode. |
| | Output impedance | The resistance value of a component between the voltage output element and the analogue voltage output. It is indicated as a resistance value which is converted in accordance with the condition in which resistance is directly connected to the voltage output element. There may be an error in the output voltage depending on this output impedance and the input impedance of customers' equipment. (example: If the Pressure switch with output impedance of 1 kΩ is connected to the A/D converter to detect the analogue output of 5 V, the detected voltage by the A/D converter becomes $5(V) \times 1(M\Omega)/(1(k\Omega) + 1(M\Omega)) \approx 4.995(V)$, and there is an error of approximate 0.005 V). |
| | Output type | The operation type of the switch output. Either normal output or reversed output can be selected. (Refer to "List of output modes" on page 29.) |
| P | Peak value display | Displays the maximum pressure reached up to that moment. |
| | Piping-port size | The size of the port on the switch body with which a device can be connected. |
| | PNP (open collector) output | The switch output that uses the PNP transistor for output. |

| | Terms | Meaning |
|---|---|---|
| P | Power saving mode | The condition in which the display is turned off to reduce current consumption. |
| | Pressure-sensing part | The pressure-detecting part of a pressure-detecting element. |
| | Pressure setting | The setting of pressure to determine the point at which the Pressure switch turns on and off. |
| | Proof pressure | The pressure beyond which the Pressure switch will be damaged. |
| R | Rated pressure range | The pressure range in which the Pressure switch meets the specifications. Values outside of this range can be set if they are within the set pressure range, but cannot be guaranteed to meet the product specifications. |
| | R.D. | The value currently displayed. For example, when the displayed value is 1.000, $\pm 5\%$ R.D. will be ± 0.05 , which is $\pm 5\%$ of 1.000, while for a displayed value of 0.800 it will be 0.04. |
| | Repeatability | Reproducibility of the displayed value for pressure and ON-OFF output operating point when the pressure changes. |
| | Residual voltage | The difference between the ideal ON voltage and the actual voltage when the switch output is on. It depends on the load current and ideally should be "0". |
| | Resolution | Refer to "Indication resolution". |
| | Response time | The elapsed time until the ON-OFF output begins operating, since the pressure supplied to the Pressure switch has reached the set value. Generally, the shorter the response time, the better the performance. |
| | Reversed output | The switch output operation in which the switch is turned on when pressure equal to or less than the set value is detected. In the (hysteresis mode) window comparator mode, it indicates the operation in which a switch is turned on when pressure is outside the switch output range (n1L to n1H or n2L to n2H). (Refer to "List of output modes" on page 29.) |
| | Ripple | A type of chattering. |
| S | Setting of function | Refer to "Function selection mode". |
| | Setting pressure range | The pressure range within which the switch output can be set. |
| | Slave Pressure switch | A Pressure switch whose settings are copied to when using the copy function. |
| | Switch output | Alternatively called "ON-OFF output". |
| U | Unit selection function | Function to change the unit in which the value of pressure is displayed. Only a product with this function can change the unit. A product with Unit selection function cannot be purchased if it is used within Japan. Pressure is indicated only by SI units in Japan. |
| W | Wetted part (or part exposed to fluid) | The part of the Pressure switch which is in contact with the detected fluid, such as a pressure sensor, seal, or fitting. |
| | Window comparator mode | An output type which holds the output when the pressure is within a certain range. (Refer to "List of output modes" on page 29.) |
| | Withstand voltage | The ability to withstand a voltage applied between an electrical circuit and the body. If more voltage is applied to the product, the product may be damaged. (voltage mentioned here is not power voltage to activate the product). |
| Z | Zero clear function | The function which can adjust the displayed pressure value to "0". |

Mounting and Installation

■ Installation

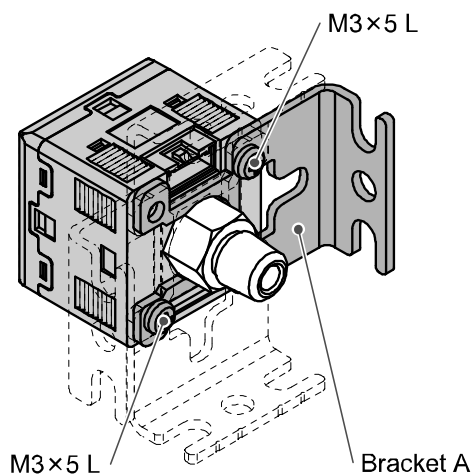
○ Mounting with bracket

*: The required tightening torque of the piping port is 7 to 9 Nm.

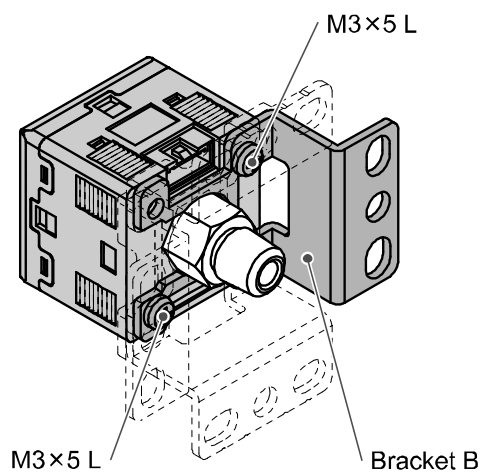
The required tightening torque of the mounting bracket screws is 0.5 to 0.7 Nm.

● Fix the bracket to the Pressure switch with the set screws M3×5 L (2 pcs) supplied.

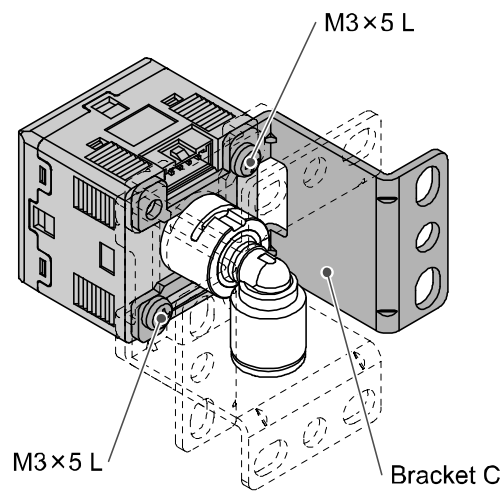
● Bracket A (Model: ZS-38-A1)



● Bracket B (Model: ZS-38-A2)



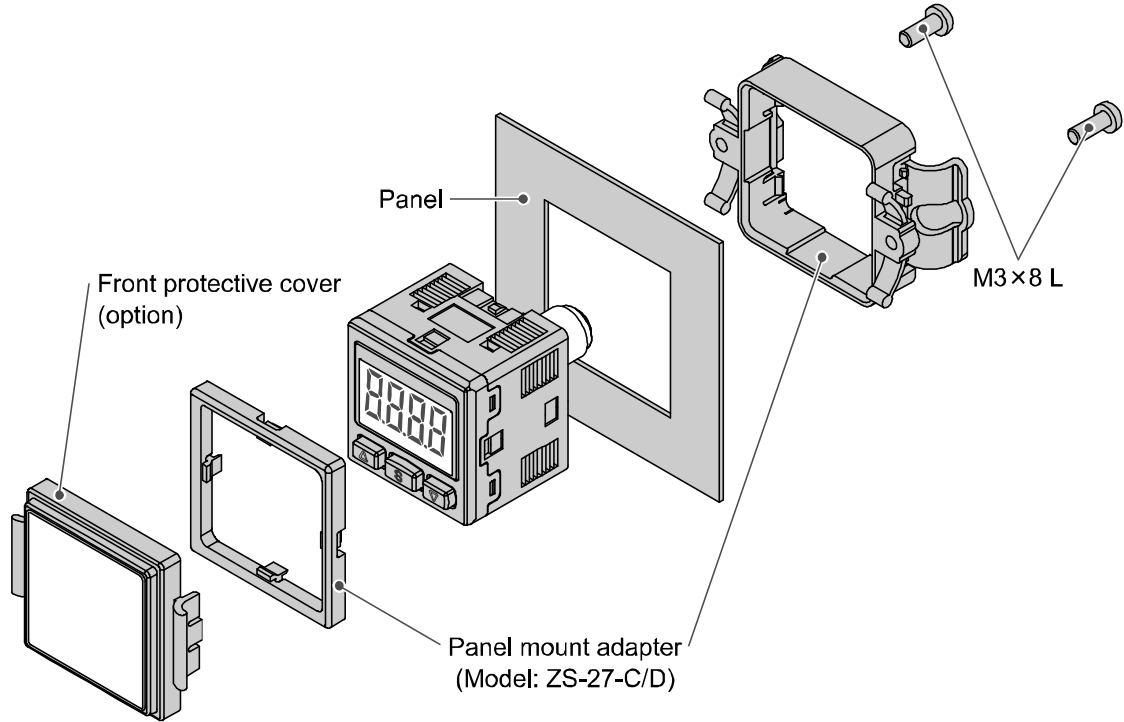
- Bracket C (Model: ZS-38-A3)



*: The bracket A/B/C can be mounted in 4 ways.

○ Mounting with panel mount adapter

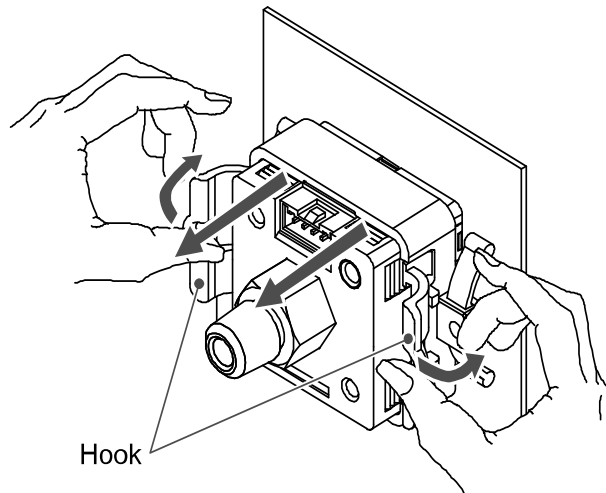
- Fix the panel mount adapter to the Pressure switch with the set screws M3×8 L (2 pcs) supplied.
- Panel mount adapter (Model: ZS-27-C)
- Panel mount adapter + Front protective cover (Model: ZS-27-D)



*: The panel mount adapter can be rotated by 90 degrees for mounting.

Note when removing the switch

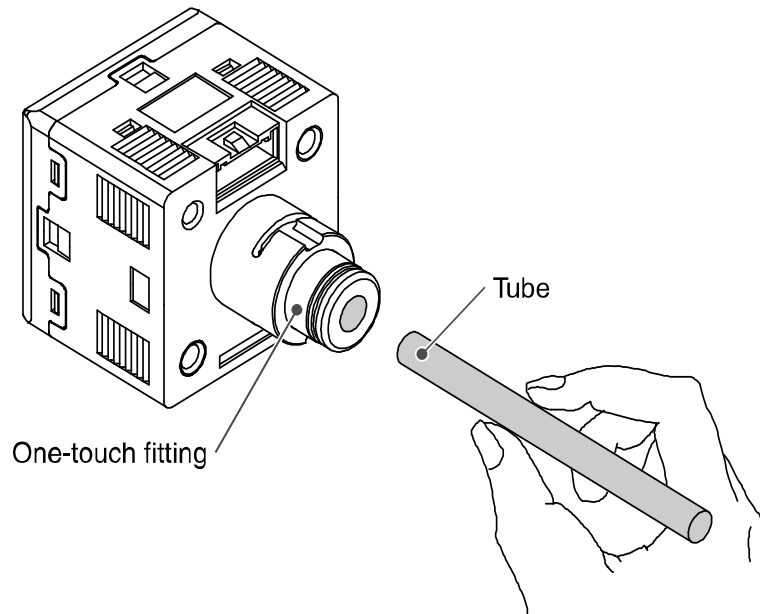
- The Pressure switch with panel mount adapter can be removed from the installation by removing 2 screws and releasing the hooks at the sides, as illustrated. Take care not to damage the Pressure switch and panel mount adapter.



■Piping

○Connection using One-touch fitting

1. Cut the tube end perpendicular.
2. Hold the tube and insert it into the One-touch fitting slowly until it bottoms out.



⚠ Warning

- Do not use the Pressure switch in a place where electrical static charge will be a problem. It can cause an error and damage to the system.

- Allow sufficient tube length to prevent twist and tensile or moment loads from being applied to the fitting or tube.
- When using a tube manufactured by a company other than SMC, check that its outside diameter tolerance satisfies the following values:
 - 1) Nylon tube: ± 0.1 mm maximum
 - 2) Soft nylon tube: ± 0.1 mm maximum
 - 3) Polyurethane tube: $+0.15$ mm/ -2 mm maximum

■Wiring

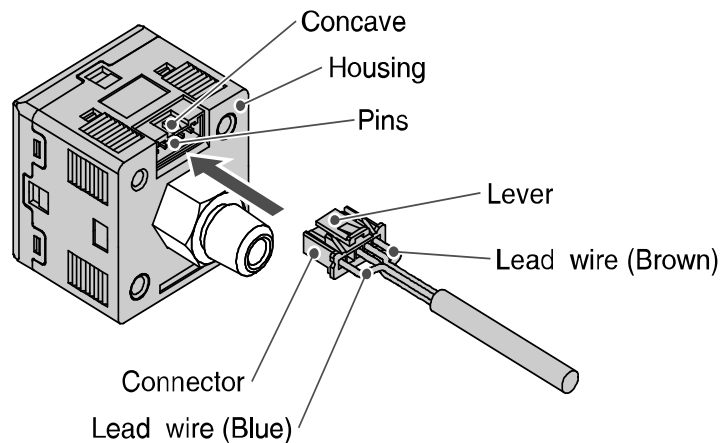
○Connection

- Connections should only be made with the power supply turned off.
- Use a separate route for the Pressure switch wiring and any power or high voltage wiring. Otherwise, malfunction may result due to noise.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply. When a switch-mode power supply is connected to the product, switching noise will be superimposed and the product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and ferrite core, between the switch-mode power supply and the product, or by using a series power supply instead of a switch-mode power supply.

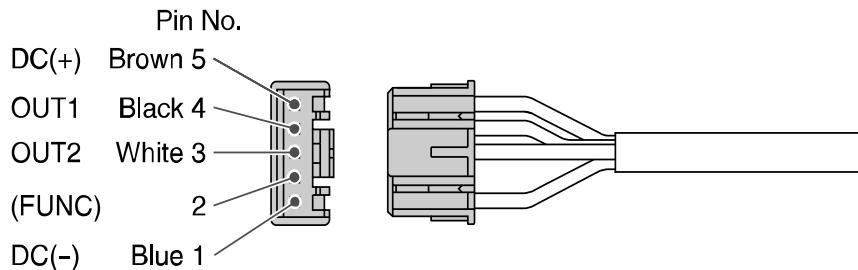
○Connector

Connecting/Disconnecting

- When mounting the connector, insert it straight into the socket, holding the lever and connector body, and push the connector until the lever hooks into the housing, and locks.
- When removing the connector, press down the lever to release the hook from the housing and pull the connector straight out.



Connector pin numbers



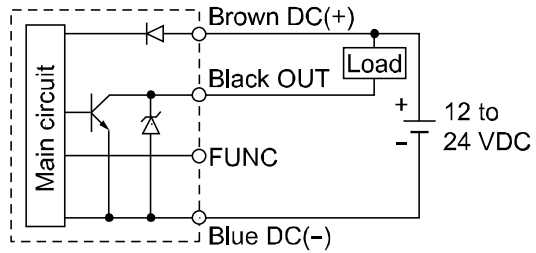
Internal circuit and wiring example

Z/ISE30A(F)-□-□-□□□□

• Output specification

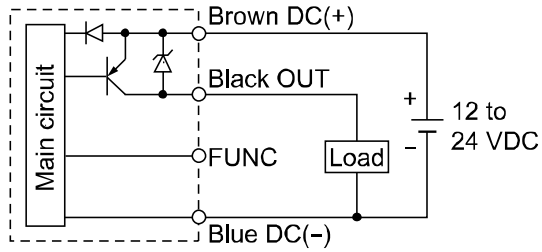
-N

NPN open collector 1 output
Max. 28 V, 80 mA
Residual voltage 1 V or less



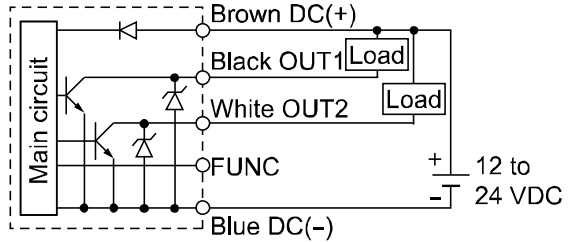
-P

PNP open collector 1 output
Max. 80 mA
Residual voltage 1 V or less



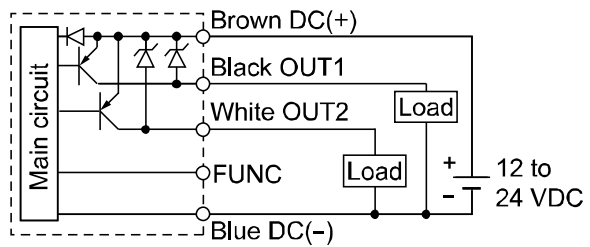
-A

NPN open collector 2 outputs
Max. 28 V, 80 mA
Residual voltage 1 V or less

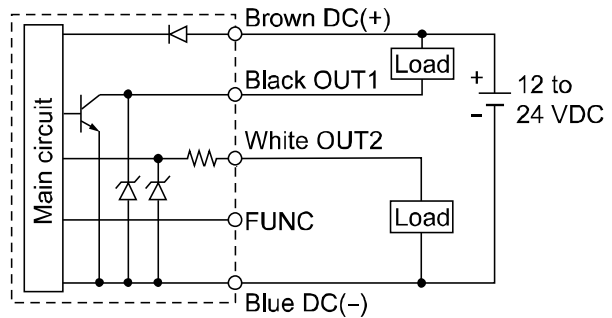


-B

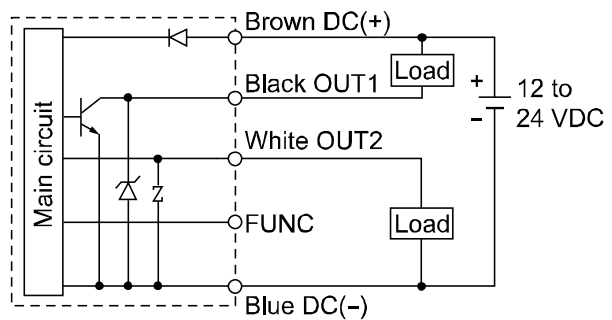
PNP open collector 2 outputs
Max. 80 mA
Residual voltage 1 V or less



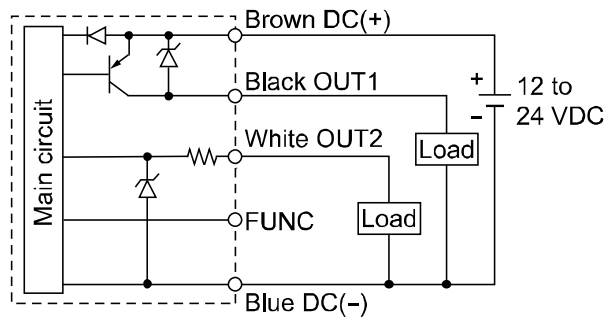
- C**
 NPN open collector 1 output
 Max. 28 V, 80 mA
 Residual voltage 1 V or less
 Analogue voltage output
 Output impedance approx. 1 k Ω



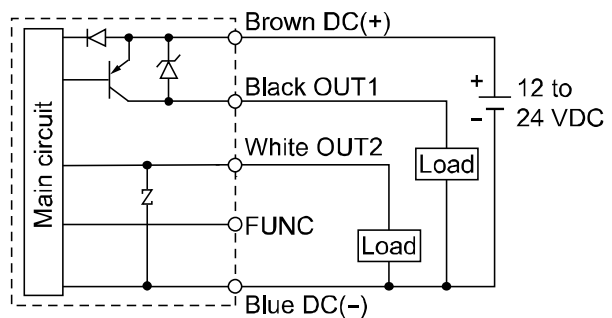
- D**
 NPN open collector 1 output
 Max. 28 V, 80 mA
 Residual voltage 1 V or less
 Analogue current output
 Max. load impedance
 300 Ω at 12 V power supply voltage
 600 Ω at 24 V power supply voltage
 Min. load impedance 50 Ω



- E**
 PNP open collector 1 output
 Max. 80 mA
 Residual voltage 1 V or less
 Analogue voltage output
 Output impedance approx. 1 k Ω



- F**
 PNP open collector 1 output
 Max. 80 mA
 Residual voltage 1 V or less
 Analogue current output
 Max. load impedance
 300 Ω at 12 V power supply voltage
 600 Ω at 24 V power supply voltage
 Min. load impedance 50 Ω

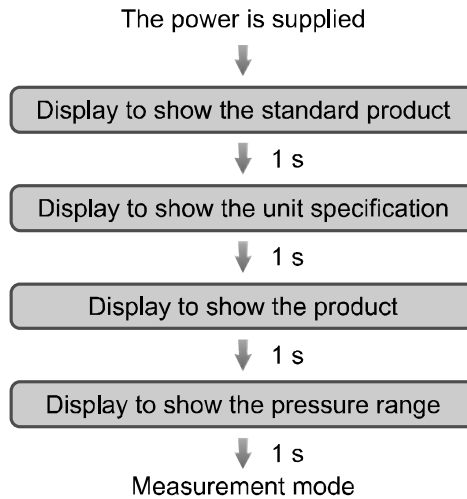


Pressure Setting

■ Measurement mode

The measurement mode is the condition where the pressure is detected and displayed, and the switch function is operating.

This is the basic mode, and other modes should be selected for setting changes and other function settings.



Setting the ON and OFF points of the Pressure switch.

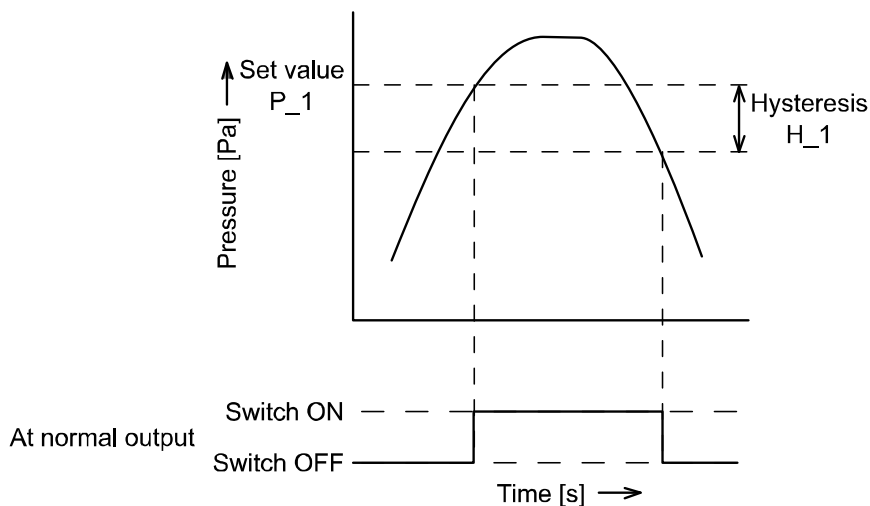
Operation

When the pressure exceeds a set point, the Pressure switch will be turned ON.

When the pressure falls below the set point by the amount of hysteresis or more, the Pressure switch will be turned OFF.

The default setting of the output set value is the central value between the atmospheric pressure and the upper limit of the rated pressure range.

If this condition, shown below, is acceptable, then keep these settings.



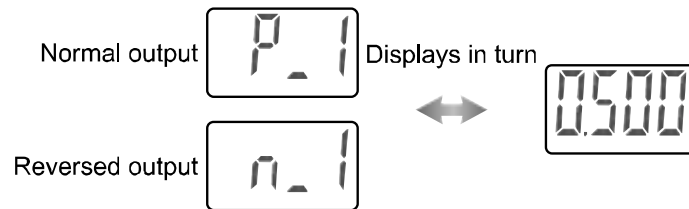
<Operation>

[Hysteresis mode]

- 1, Press the **S** button once in measurement mode.

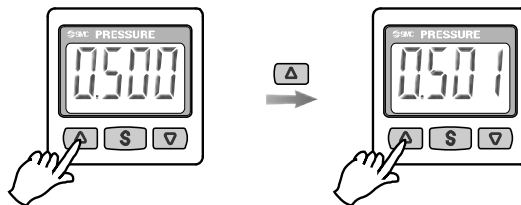


- 2, [P_1] or [n_1] and the set value are displayed in turn.

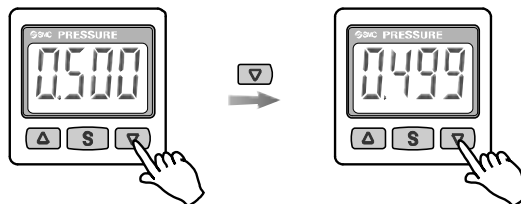


- 3, Press the **Δ** or **▽** button to change the set value.
The **Δ** button is to increase and the **▽** button is to decrease.

- Press the **Δ** button once to increase by one digit, and press it continuously to keep increasing the set value.



- Press the **▽** button once to decrease by one digit, and press it continuously to keep decreasing the set value.



4, Press the **S** button to finish the setting.

For models with 2 outputs, [P_2] or [n_2] will be displayed. Set as above.

The Pressure switch operates within a set pressure range (from P1L to P1H) during window comparator mode. Set P1L (switch lower limit) and P1H (switch upper limit) with the setting procedure above. (When reversed output is selected, [n1L] and [n1H] are displayed.)

Zero clear of Display

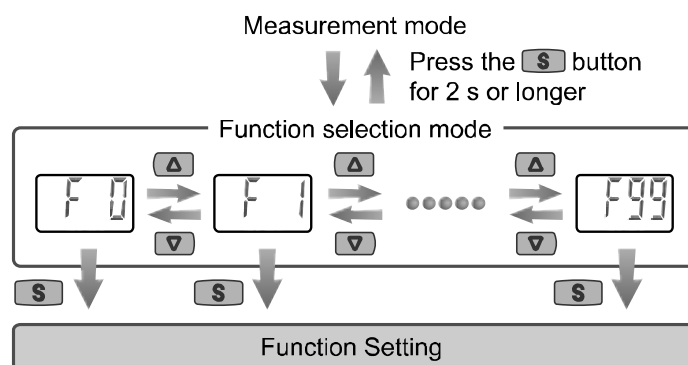
The display is reset to zero when the **Δ** and **▽** buttons are pressed simultaneously for 1 second. For the first operation, always perform zero clear with no pressure applied.

Function Setting

■ Function selection mode

In measurement mode, press the **[S]** button for 2 seconds or longer to display [F 0]. Select to display the function to be changed, [F□□].

Press the **[S]** button for 2 seconds or longer in function selection mode to return to measurement mode.



*: Some functions are not available depending on part number. All functions are displayed with [F□□] followed by the function description. If a function is not available, the function is displayed as [--].

■ Default setting

At the time of shipment, the following settings are provided.

If this condition is acceptable, then keep these settings.

To change the settings, enter function selection mode.

• [F 0] Unit selection function ➡ See page 26

| Unit specification | Model | Default setting |
|--------------------|-----------|-----------------|
| Nil or M | ISE30A | MPa |
| | ZSE30A(F) | kPa |
| P | ISE30A | psi |
| | ZSE30A(F) | |

• [F 1] Setting of OUT1 ➡ See page 27

| Item | Description | Default setting |
|------------------|---|---|
| Output mode | Select hysteresis mode or window comparator mode. | Hysteresis mode |
| Reversed output | Select reversed output. | Normal output |
| Pressure setting | Set the ON or OFF point of the switch output | ISE30A: 0.500 MPa ZSE30A: -50.5 kPa ZSE30AF: 50.0 kPa |
| Hysteresis | Set the hysteresis to prevent chattering. | ISE30A: 0.050 MPa ZSE30A: 5.1 kPa ZSE30AF: 5.0 kPa |
| Display colour | Select the display colour. | ON: Green OFF: Red |

- [F 2] Setting of OUT2 ➡ See page 30

Same setting as for [F 1] OUT1.

The display colour is linked to the setting of OUT1, and can not be set for OUT2.

- Other parameter settings

| Item | Page | Default setting |
|--|---------|-----------------|
| [F 3] Response time | page 30 | 2.5 ms |
| [F 4] Display resolution | page 31 | 1000-split |
| [F 5] Auto-preset function | page 32 | Manual |
| [F 6] Fine adjustment of display value | page 34 | 0% |
| [F 7] Power saving mode | page 35 | OFF |
| [F 8] Security code | page 36 | OFF |
| [F90] Setting of all functions | page 37 | OFF |
| [F97] Copy function | page 39 | OFF |
| [F98] Check of output | page 41 | Normal |
| [F99] Reset to the default setting | page 43 | OFF |

■[F 0] Unit selection function

Only the product with Unit selection function can be set.
 The displayed unit can be changed, and depends on the pressure range.
 (kPa/MPa units are available when the product does not have the unit selection function).

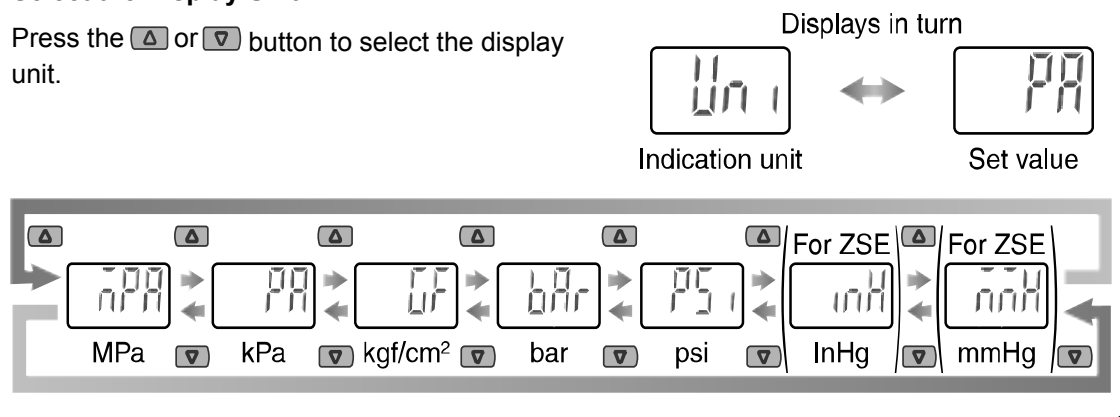
<Operation>

Press the or button in function selection mode to display [F 0].

Press the button. Move on to select the display unit.

Select the Display Unit

Press the or button to select the display unit.



Press the button to set. Return to function selection mode.

Setting of [F 0] Unit selection function completed

•Display unit and minimum setting unit

| Unit | ZSE30AF | ZSE30A | ISE30A |
|---------------------|---------|--------|--------|
| MPa | 0.001 | 0.001 | 0.001 |
| kPa | 0.1 | 0.1 | 1 |
| kgf/cm ² | 0.001 | 0.001 | 0.01 |
| bar | 0.001 | 0.001 | 0.01 |
| psi | 0.01 | 0.01 | 0.1 |
| InHg | 0.1 | 0.1 | - |
| mmHg | 1 | 1 | - |

■[F 1] Setting of OUT1

Set output method of OUT1.

The output turns on when the pressure exceeds the set value. The default setting of the output set value is the central value between the atmospheric pressure and the upper limit of the rated pressure range.



The display colour depends on the condition of OUT1.

The default setting of the display colour is as follows: green display when the output is ON and red display when the output is OFF.

For the operation of each setting, refer to "List of output modes" on page 29.

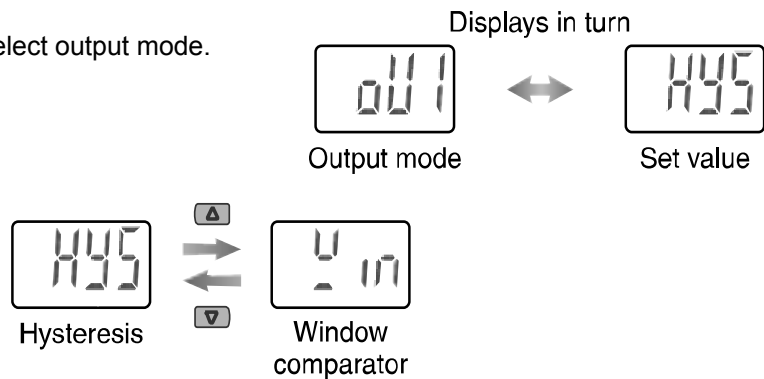
<Operation>

Press the  or  button in function selection mode to display [F 1].

Press the  button.  Move on to setting of output mode.



Select output mode

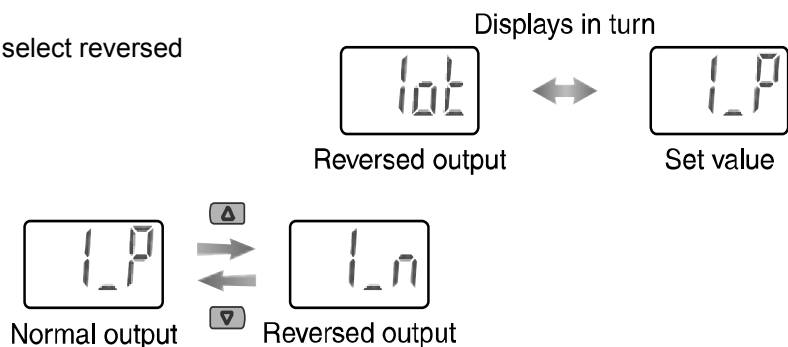
Press the  or  button to select output mode.



Press the  button to set.  Move on to setting of reversed output.

Select reversed output

Press the  or  button to select reversed output.



Press the  button to set.  Move on to setting of pressure.

Pressure Setting

Set the pressure based on the setting procedure on page 22.

"P" becomes "n" when reversed output is selected. ([P_1] → [n_1])

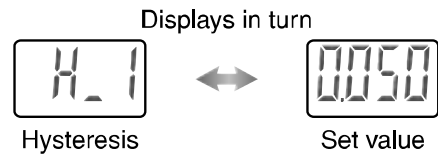
Hysteresis mode: [P_1]


Window comparator mode: [P1L][P1H]

Press the  button to set.  Move on to setting of hysteresis.

Setting of Hysteresis

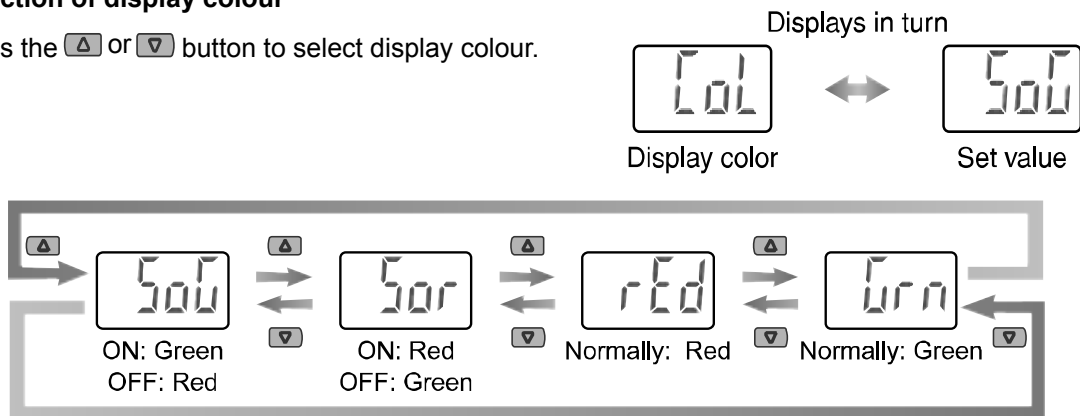
Press the  or  button to select hysteresis.



Press the  button to set. ↓ Move on to setting of display colour.


Selection of display colour


Press the  or  button to select display colour.



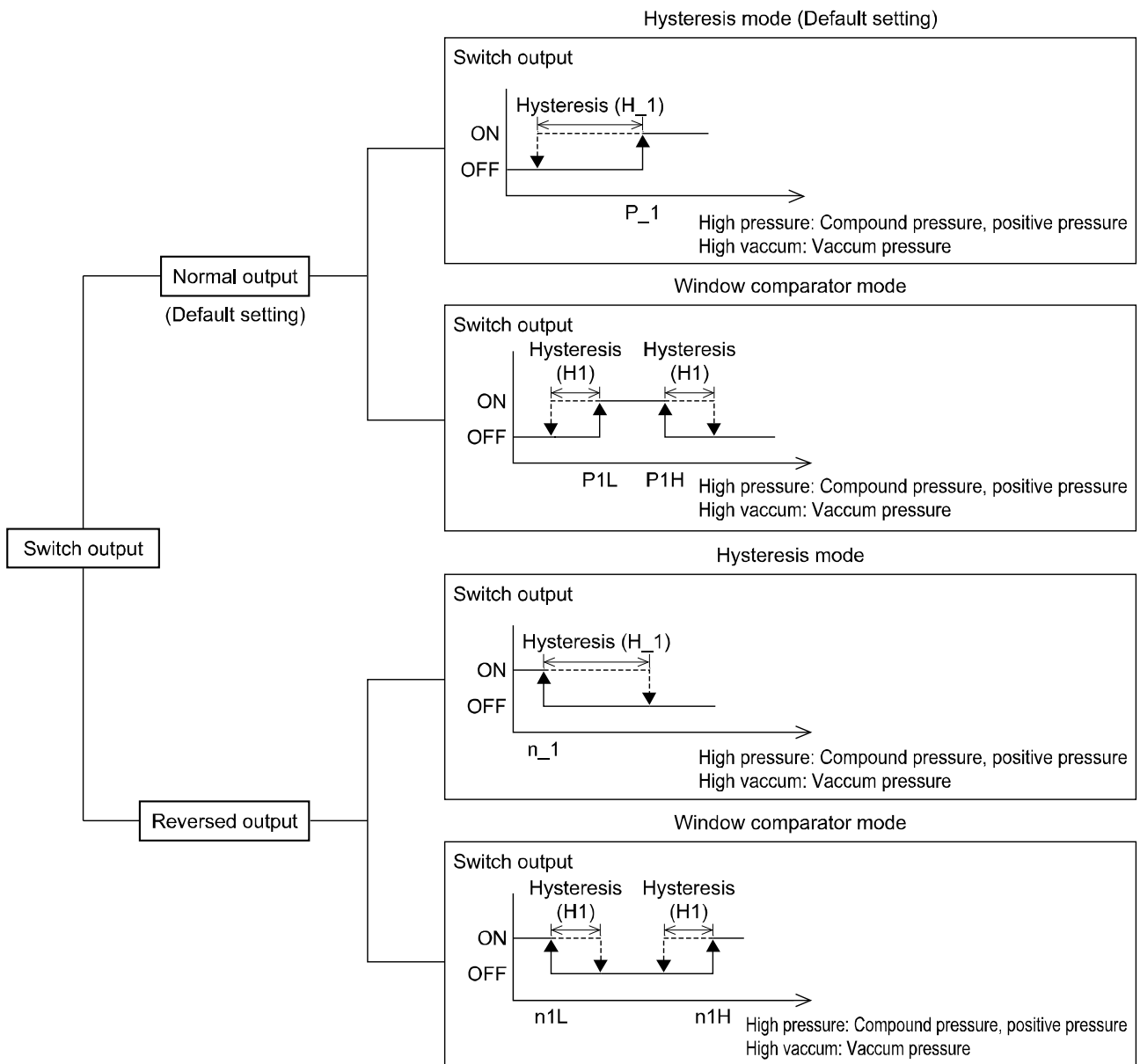
Press the  button to set. ↓ Return to function selection mode.

Setting of [F 1] operation of OUT1 completed

*1: The selected parameter becomes effective after pressing the  button.

*2: After setting, it is possible to move to measurement mode by pressing the  button for 2 seconds or longer.

•List of output modes



If the set point when the switch output is changed is outside the set pressure range due to switching between normal and reversed output, the hysteresis will automatically be compensated.

*: The above figure shows the operation of OUT1.



For the operation of OUT2, "1" shown in the figure above becomes "2". (Ex) $P_1 \rightarrow P_2$

■[F 2] Setting of OUT2

Set output method of OUT2.

The display colour is linked to the setting of OUT1, and can not be set for OUT2

<Operation>

Press the  or  button in function selection mode to display [F 2].

Press the  button  Moves on to setting of output mode

Set [F 2] based on [F 1] setting of OUT1 (page 27 to 29)



*: If there is only 1 output or the analogue output is used, the display indicates [--], and this function cannot be set.



■[F 3] Response time

Select the response time of the switch output.

Output chattering can be prevented by setting the response time.

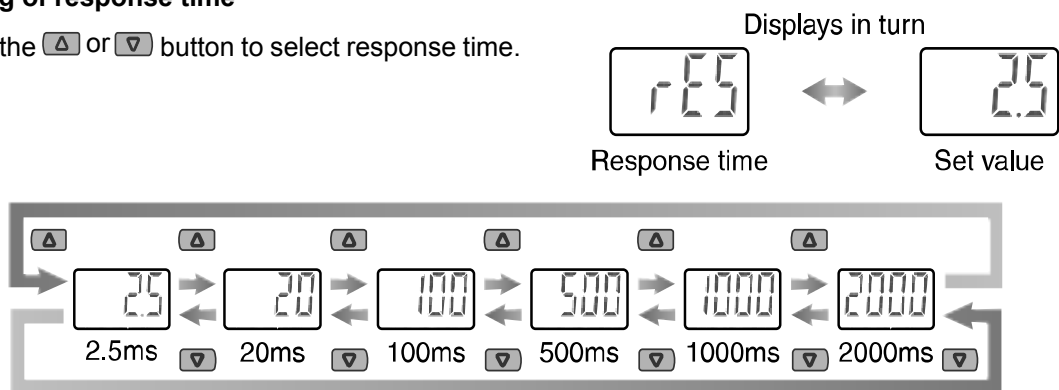
<Operation>


Press the  or  button in function selection mode to display [F 3].

Press the  button.  Move on to setting of response time.

Setting of response time

Press the  or  button to select response time.





Press the  button to set.  Return to function selection mode.



Setting of [F 3] Response time completed

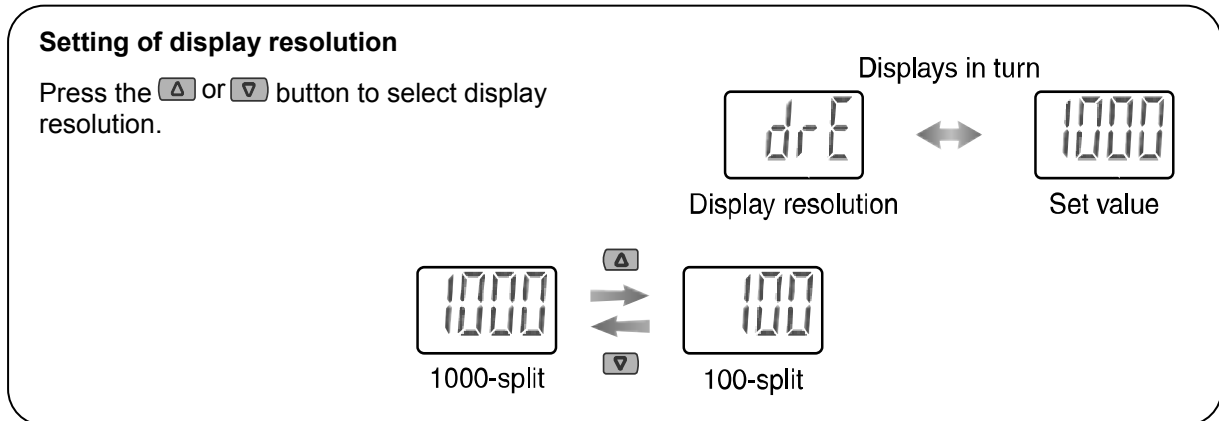
■[F 4] Display resolution


This function is used to change the pressure display resolution.
This can be used to prevent the digits from flickering on the display.

<Operation>

Press the  or  button in function selection mode to display [F 4].

Press the  button.  Move on to setting of display resolution.



Press the  button to set.  Return to function selection mode.

Setting of [F 4] Display resolution completed

*: Not selectable depending on the selected display units.



The display resolution selectable unit is MPa, kPa (for ZSE only), kgf/cm², bar, psi and inHg.
The units kgf/cm², bar, psi and inHg are selectable only for models with the unit selection function.



➡ See [F 0] Unit selection function on page 26.

■ [F 5] Auto-preset function

When hysteresis mode is selected, the auto-preset function can calculate an optimum pressure value automatically based on the on-going operation.

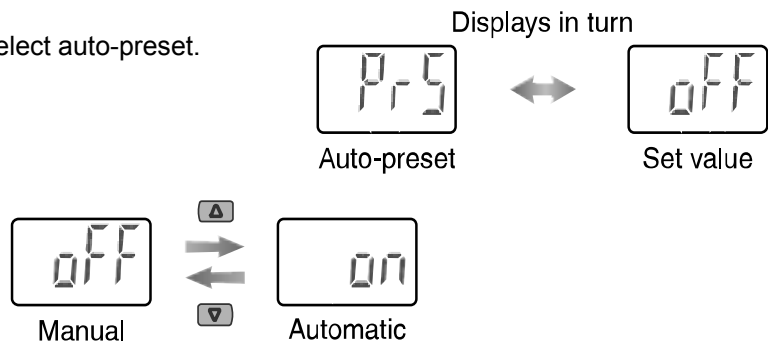
<Operation>

Press the  or  button in function selection mode to display [F 5].

Press the  button.  Move on to setting of auto-preset.


Setting of Auto-preset


Press the  or  button to select auto-preset.



Press the  button to set.  Return to function selection mode.

Setting of [F 5] Auto-preset function completed

Press the  button during measurement mode to set the pressure.

Then press the  button again to change the pressure setting, while the display is flashing.

•Auto-preset

When auto-preset is selected in function selection mode, the set pressure can be calculated and stored from a measured pressure value. The set value is automatically optimized by repeating the suction and release of the workpiece during setting.

1, Selection of auto-preset OUT1

Press the **S** button in measurement mode to display "AP1".
(If OUT1 does not need to be set, press the **Δ** and **▽** buttons simultaneously for 1 second or longer to move to "AP2").



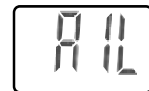
Auto-preset is ready

2, Preparation of OUT1 device

Prepare the device for which the pressure of OUT1 is to be set.

3, Setting of auto-preset value for OUT1

Press the **S** button to display "A1L".
After measurement starts, operate the device and change the pressure. When the pressure change is detected, "A1H" will appear automatically, and so continue to operate the device.
(If the **Δ** and **▽** buttons are pressed simultaneously for 1 second or longer while "A1L" is displayed, measurement is stopped and "AP2" will appear).



Auto-preset is being set

4, Selection of auto-preset OUT2

Press the **S** button to set "P_1" and "H_1" ("n_1" and "H_1" for reversed mode) and display "AP2".
(If OUT2 does not need to be set, press the **Δ** and **▽** buttons simultaneously for 1 second or longer to return to measurement mode).

5, Preparation and setting of OUT2 device

Prepare the device for which the pressure of OUT2 is to be set, and perform the setting of OUT2 in the same way as for OUT1.
After "A2L" is displayed and measurement starts, the pressure change will be detected, and "A2H" will appear automatically.
(If the **Δ** and **▽** buttons are pressed simultaneously for 1 second or longer when "A2L" is displayed, measurement is stopped and the display will return to measurement mode).

6, Completion of setting

Press the **S** button to set "P_2" and "H_2" ("n_2" and "H_2" for reversed output) and complete auto-preset mode. After that, the display will return to measurement mode.

The set values for OUT1 are displayed in auto-preset mode as follows:

| | | |
|--|--|--|
| <ul style="list-style-type: none"> •Normal output $P_1 = A - (A - B) / 4$ $H_1 = (A - B) / 2$ | <ul style="list-style-type: none"> •Reversed output $n_1 = B + (A - B) / 4$ $H_1 = (A - B) / 2$ | <ul style="list-style-type: none"> A = Max. pressure B = Min. pressure |
|--|--|--|



The set values of OUT2 become as follows "_", i.e. "P_2", "n_2", "H_2".



If this setting is not necessary, press the **Δ** and **▽** buttons simultaneously for 1 second or longer.

■[F 6] Fine adjustment of display value



This function is used to manually perform fine adjustment of the displayed pressure. It is adjustable within the range $\pm 5\%R.D.$

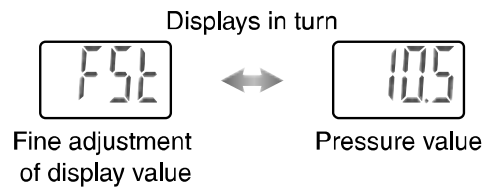
<Operation>

Press the  or  button in function selection mode to display [F 6].



Press the  button.  Move on to setting of fine adjustment of display value.

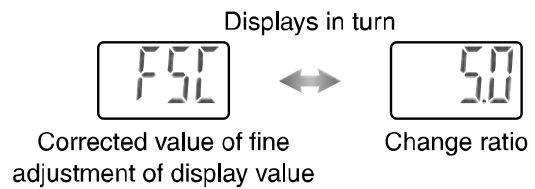
Setting of fine adjustment of display value

Press the  or  button to change the set pressure value.



Press the  button to set 

If the  and  buttons are pressed simultaneously for 1 second or longer while [FSC] is displayed, the adjusted value is set.



Press the  button to set.  Return to function selection mode.



Setting of [F 6] Fine adjustment of display value completed



■ [F 7] Power saving mode

Power saving mode is selectable.



When the Pressure switch is left for 30 seconds with no key operation, it will enter power saving mode.

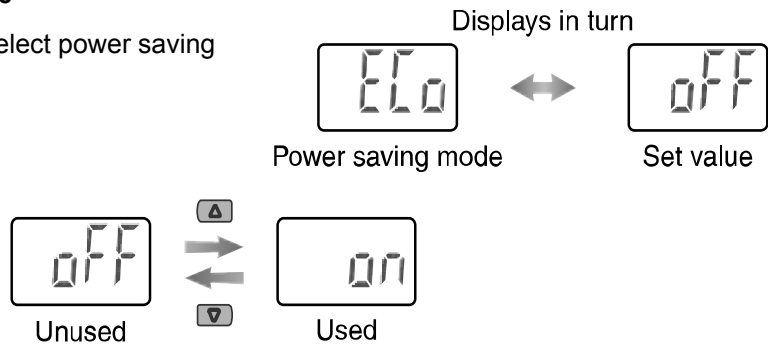
<Operation>


Press the  or  button in function selection mode to display [F 7].

Press the  button.  Move on to setting of power saving mode.

Setting of power saving mode

Press the  or  button to select power saving mode.

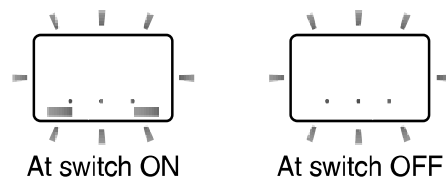


Press the  button to set.  Return to function selection mode.

Setting of [F 7] Power saving mode completed

In power saving mode, any key operation will return the normal display. If there is no key operation for 30 seconds, the display will return to power saving mode (only in measurement mode).

In power saving mode, only the decimal points and indicator LEDs will flash (the LEDs flash only when the switch is ON).






*: The indicator LEDs will flash when the switch is ON, but it is not synchronized with the output.

■[F 8] Security code

A security code can be selected, which must be entered to unlock the keys when the keys are locked.

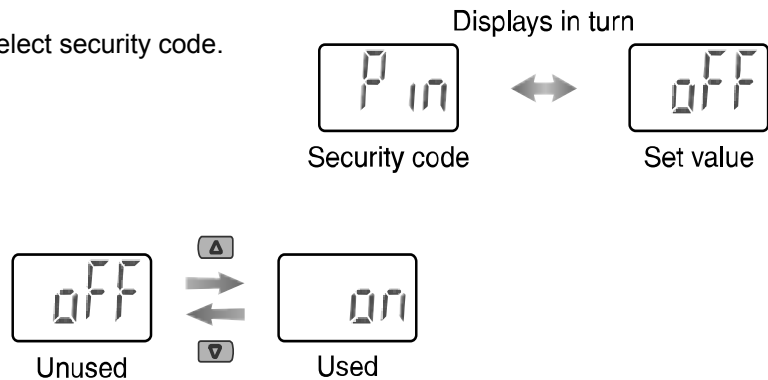
<Operation>

Press the  or  button in function selection mode to display [F 8].

Press the  button.  Move on to setting of security code.

Setting of security code

Press the  or  button to select security code.



Press the  button to set.  Return to function selection mode.

Setting of [F 8] Security code completed

If the security code is used, it becomes necessary to enter the security code to release the key lock. The security code can be decided optionally by the operator. The default setting is "0000".

Refer to page 45 for the security code input.

■ Special function setting

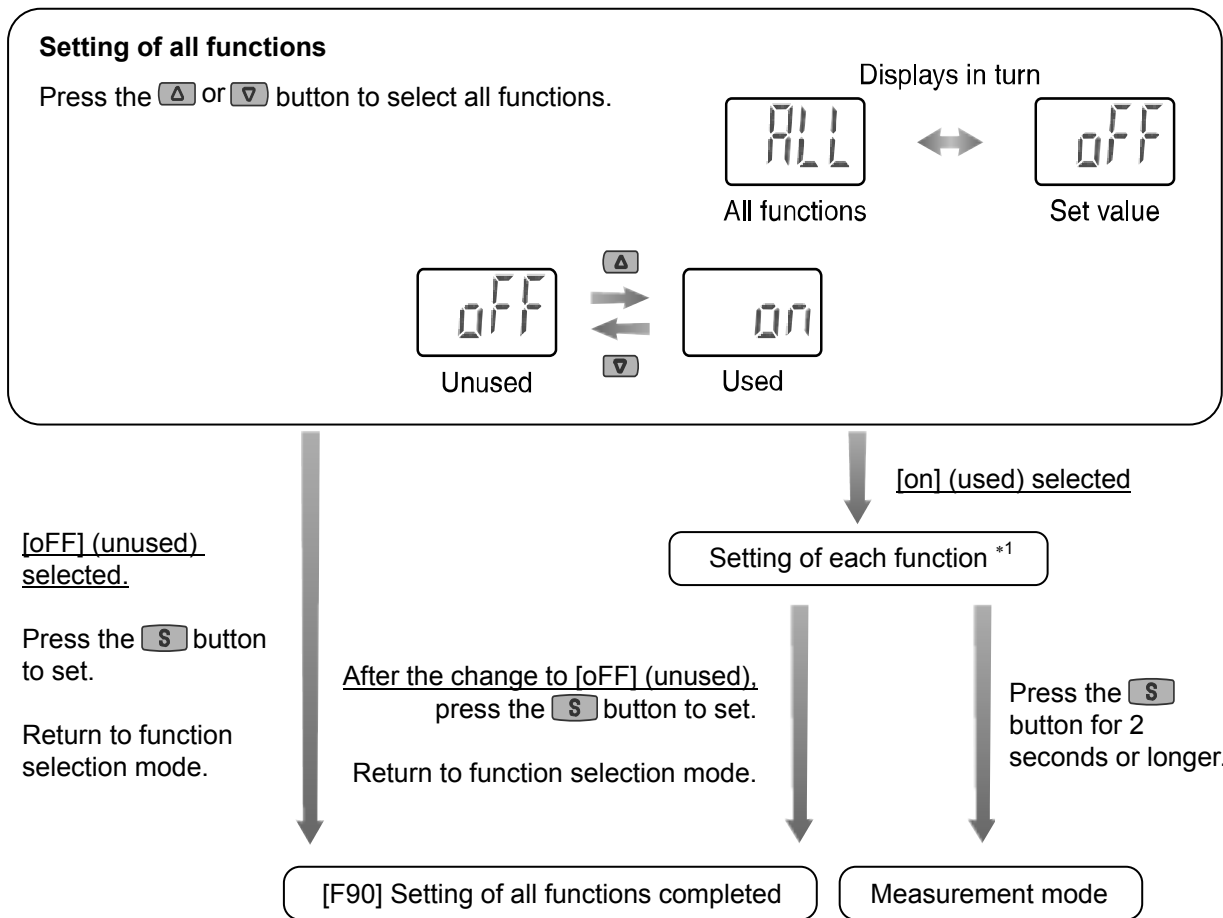
■ [F90] Setting of all functions

All functions can be set, one after the other.

<Operation>

Press the or button in function selection mode to display [F90].

Press the button. Move on to setting of all functions.



*1: Setting of functions

Every time the button is pressed, the function steps in the order of Function setting on page 38.

Set using the or buttons.

Refer to each section for further details of the setting.

•Order of Function setting

| Order | Function | Applicable model |
|-------|----------------------------------|---|
| 1 | Selection of display unit | All models |
| 2 | Select output mode (OUT1) | All models |
| 3 | Select reversed output (OUT1) | All models |
| 4 | Setting of pressure (OUT1) | All models |
| 5 | Setting of hysteresis (OUT1) | All models |
| 6 | Setting of display colour | All models |
| 7 | Select output mode (OUT2) | Only for the product with output specification of NPN2 and PNP2 |
| 8 | Select reversed output (OUT2) | |
| 9 | Setting of pressure (OUT2) | |
| 10 | Setting of hysteresis (OUT2) | |
| 11 | Response time | All models |
| 12 | Display resolution | All models |
| 13 | Auto-preset function | All models |
| 14 | Fine adjustment of display value | All models |
| 15 | Power saving mode | All models |
| 16 | Security code | All models |

*: Measurement mode will return from any setting by pressing the **S** button for 2 seconds or longer.

*: Function that will be set by the return to the measurement mode.

■ [F97] Copy function

The set values of pressure and functions (except for corrected value of fine adjustment of display value) can be copied. When the pressure range, output and unit specifications are the same, this function becomes available. The set value can be copied to up to 10 pressure switches simultaneously.

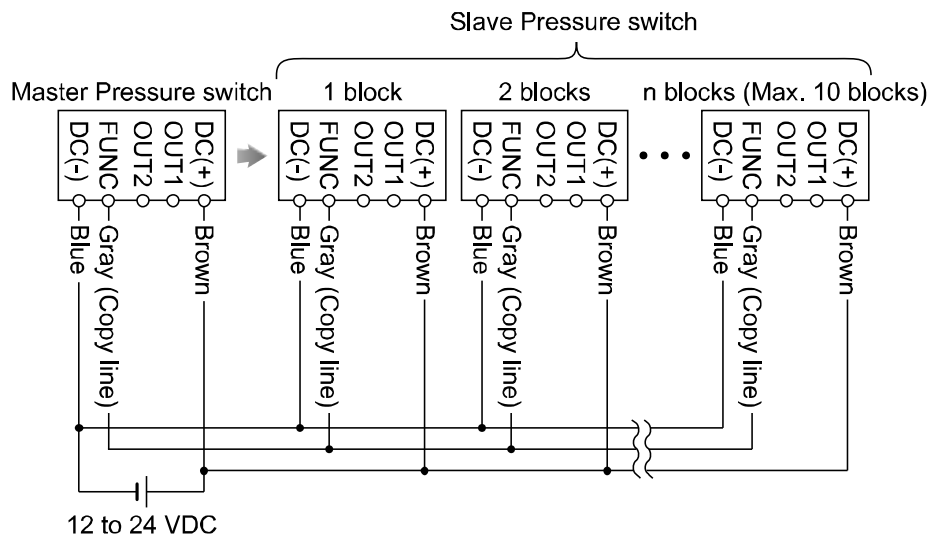
<Connection>

Connect the Pressure switches with the power supply turned off.

Connect the FUNC terminals of the master Pressure switch and the slave Pressure switches, and then turn on the power supply.

The master Pressure switch is the switch from which the setting is to be copied.

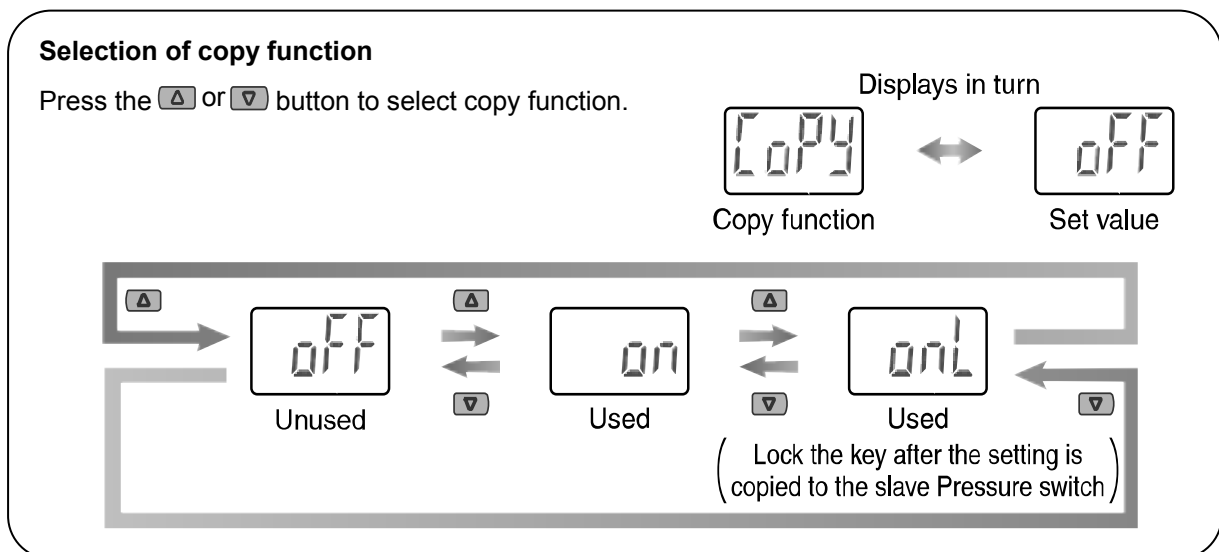
The slave Pressure switch is the switch to which the setting is to be copied.



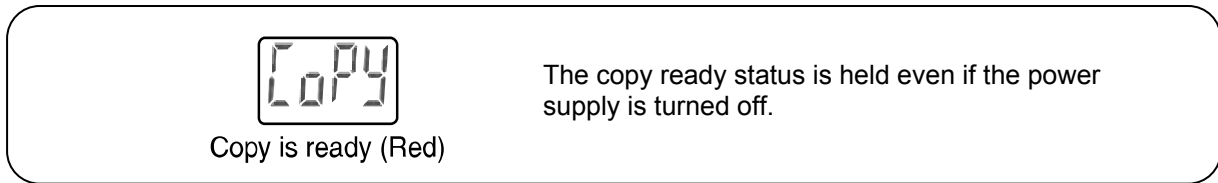
<Operation>

Press the **▲** or **▼** button of the master Pressure switch in function selection mode to display [F97].

Press the **S** button. **↓** Move on to the selection of copy function.



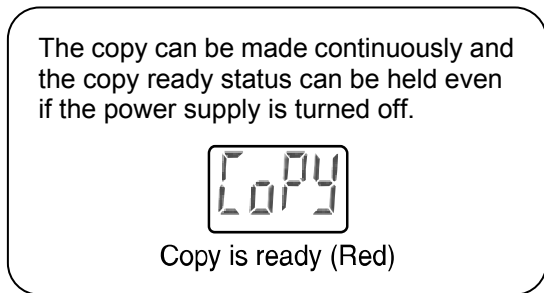
Press the **S** button to set. **↓**



Press the **S** button to start copying. ↓

| | The master Pressure switch | The slave Pressure switch |
|-----------------------|--------------------------------|----------------------------------|
| Sending/ Receiving | Flashing (Red) | Flashing (Green) |
| Copy completed | Displays in turn ↔ (Red) | Displays in turn ↔ (Green) |

Press the **S** button.



Press the **Δ** and **▽** buttons simultaneously for 1 second or longer.

Press the **S** button.

To complete the copy function, press the **Δ** and **▽** buttons simultaneously for 1 second or longer.

Setting of [F97] Copy function completed

*: If the copy to the slave pressure switch is not completed, it is detected as a copy function sending/receiving error.

Press the **Δ** and **▽** buttons simultaneously for 1 second or longer to return to measurement mode. Then, check the wiring and specifications of the switch and retry the copy function.

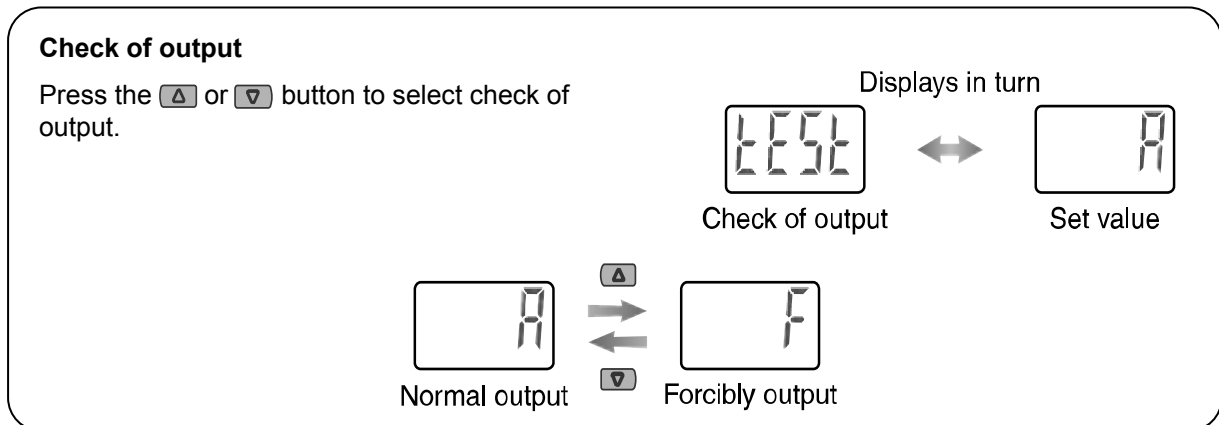
■[F98] Check of output

Output from the switch can be confirmed.
It can be selected to provide or not provide the output.

<Operation>

Press the or button in function selection mode to display [F98].

Press the button. Move on to check of output.



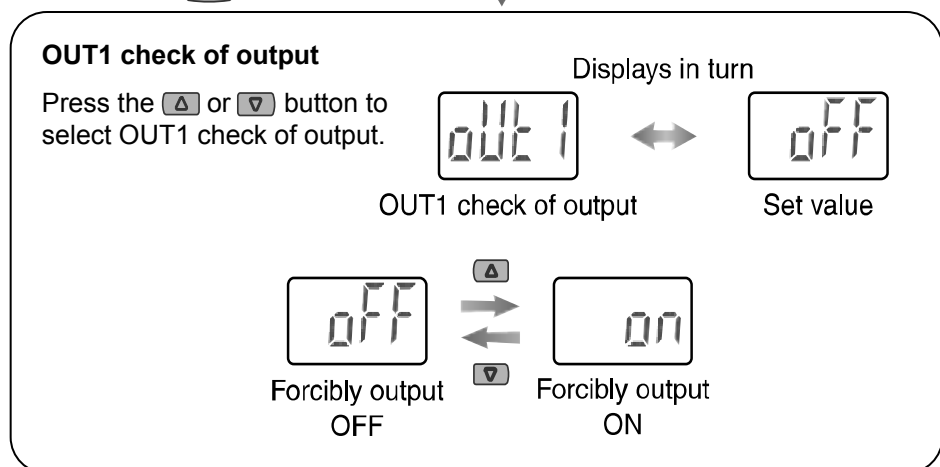
If [A] (normal output) is selected,

Press the button to set.

Return to function selection mode.

If [F] (forcibly output) is selected

Press the button to set.



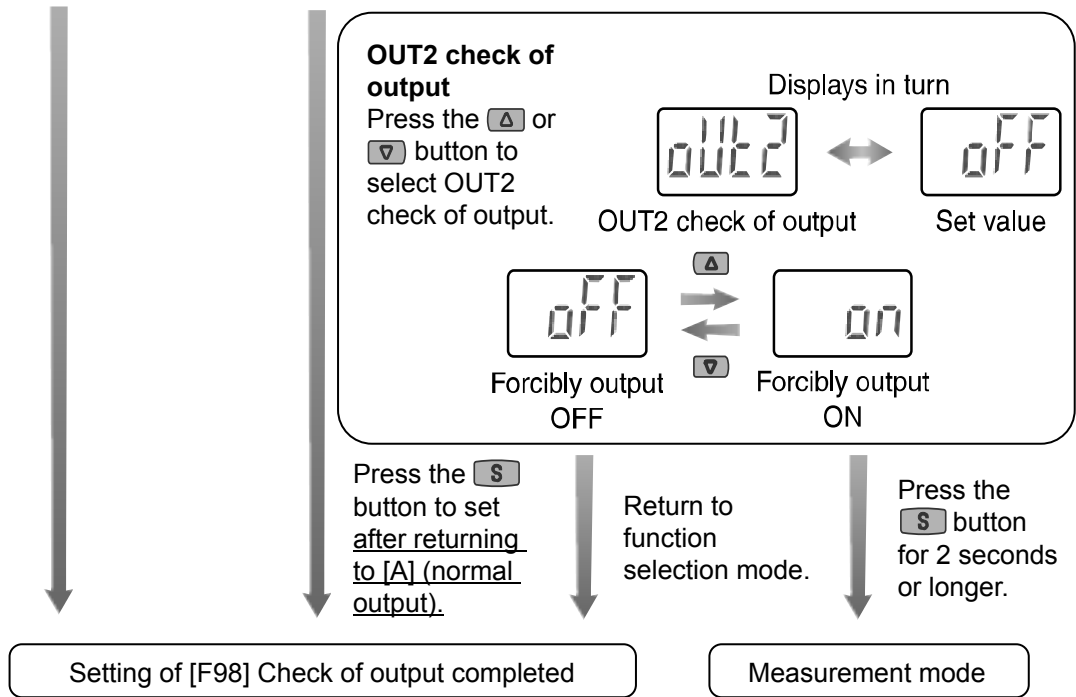
If OUT2 output is not provided,

press the button to set after returning to [A] (normal output).

Return to function selection mode.

If OUT2 output is provided,

press the button to set.






*: If the button is pressed for 2 seconds or longer, the mode is returned to measurement mode regardless of the current mode.

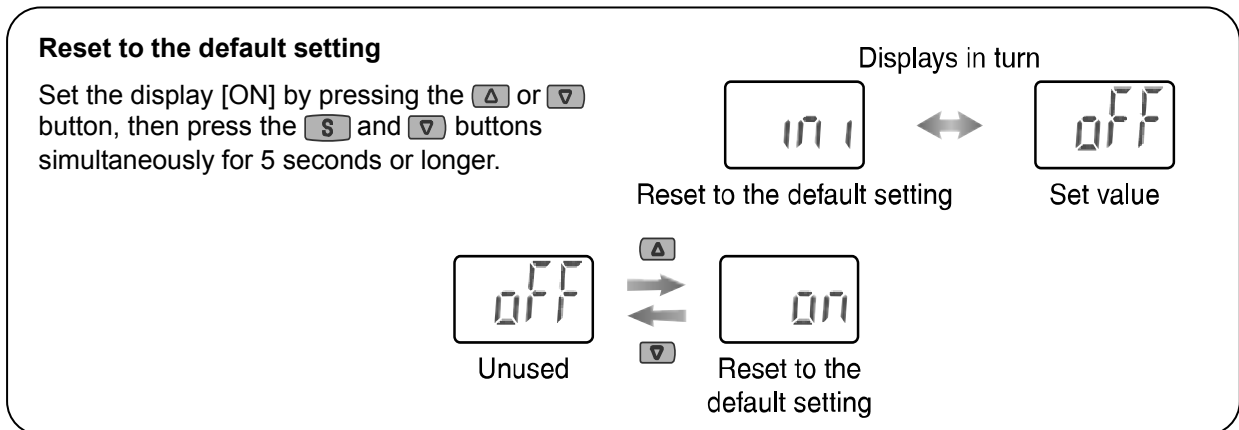
■[F99] Reset to the default setting

If the setting of the pressure switch becomes unknown, the default setting can be restored.

<Operation>

Press the  or  button in function selection mode to display [F99].

Press the  button. ↓ Move on to reset to the default setting.



[oFF] (unused) selected

Press the  button to set

Return to function selection mode.


The setting is reset to the default setting, and the mode returns to the function selection mode.


Setting of [F99] Reset to the default setting completed


Other Settings


○Peak/Bottom value display



The maximum (minimum) pressure from when the power was supplied to this moment is detected and updated. In peak/bottom display mode, this pressure is displayed.

For peak display, when the  button is pressed for 1 second or longer, the maximum pressure and "Hi" starts flashing, and is held.

To release holding the display of the maximum pressure, press the  button for 1 second or longer again to return to measurement mode.

For bottom display, when the  button is pressed for 1 second or longer, the minimum pressure and "Lo" starts flashing, and is held.



To release holding the display of the minimum pressure, press the  button for 1 second or longer again to return to measurement mode.

If the  and  buttons are pressed simultaneously for 1 second or longer while the pressure is being held, the maximum (minimum) values are reset.

○Zero clear

The displayed value can be adjusted to zero when the measured pressure is within $\pm 7\%$ F.S. ($\pm 3.5\%$ F.S. for compound pressure) of the pressure, at the time of shipment from the factory.

(A tolerance range of $\pm 1\%$ F.S. may apply due to individual product differences).


Press the  and  buttons simultaneously for 1 second or longer, to clear the display to "0".

The display will return to measurement mode automatically.

For analogue output, the analogue output will be changed along with the display.

○Key lock

The key lock function is used to prevent errors occurring due to unintentional changes of the set values. If a button operation is performed while the key lock setting is ON, "LoC" is displayed for approximately 1 second.

(When the  button is pressed, the set pressure will be displayed following "LoC").



<Operation - Without security code input->

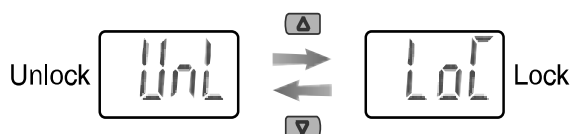
- 1, Press the  button for 5 seconds or longer in measurement mode.

The current setting "LoC" or "UnL" will be displayed.

(Selecting or releasing the key lock is carried out in a similar way).



- 2, Press the  or  button to select key lock (or key unlock).



- 3, Press the  button to store the setting.

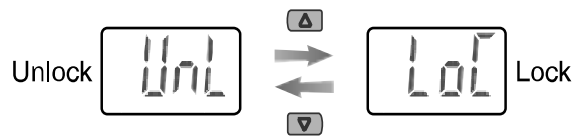
<Operation - With security code input->

•Locking

- 1, Press the **[S]** button for 5 seconds or longer in measurement mode.
The current setting “UnL” is displayed.



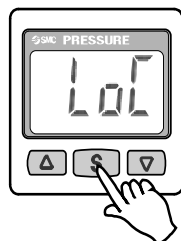
- 2, Press the **[Δ]** or **[▽]** button to select keys lock “LoC”.



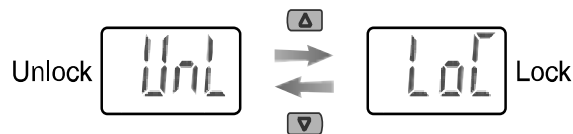
- 3, Press the **[S]** button to store the setting.

•Unlocking

- 1, Press the **[S]** button for 5 seconds or longer in measurement mode.
The current setting “LoC” is displayed.



- 2, Press the **[Δ]** or **[▽]** button to select keys unlock “UnL”.



- 3, When the **[S]** button is pressed, input of the security code will be requested.
For how to enter the security code, refer to "How to enter the security code" on page 46.



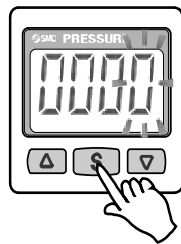
- 4, If the security code entered is correct, the display will change to “UnL”. Press any of the **[Δ]**, **[S]** or **[▽]** buttons to release the key lock and return to measurement mode.
If the security code entered is incorrect, “FAL” will be displayed and the security code must be entered again. If an incorrect security code is entered three times, “LoC” is displayed and the display will return to measurement mode.

•How to change the security code

At the time of shipment, the security code is set to “0000”, but this can be changed to any number.

<Operation>

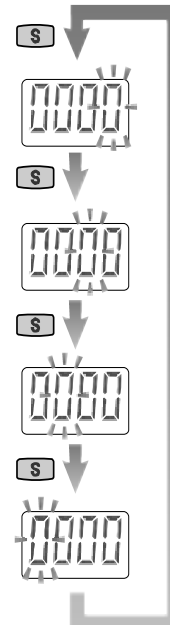
- 1, After the key lock setting has been completed, perform the first three steps in the unlocking procedure (page 45).
- 2, After the security code has been entered and the display changes to “UnL”, press the **S** and **▽** buttons simultaneously for 5 seconds or longer.
“0000” is displayed and a new security code can now be entered.
For how to enter the security code, refer to "How to enter the security code".
The new security code will be displayed.
- 3, After checking the security code is as required, press the **S** button for 1 second or longer.
The display will return to measurement mode.
At this time, if the **△** or **▽** button is pressed, any security code changes are lost, and the change of security code procedure must be repeated.



•How to enter the security code

The first digit will start flashing.
Press the **△** or **▽** button to select a value.
Press the **S** button to set and the next digit will start flashing.
(If the **S** button is pressed at the last digit, the first digit will start flashing again).

After the setting is completed, press the **S** button for 1 second or longer.
(If a key operation is not performed for 30 seconds while entering the security code, the measurement mode will return).



Maintenance

How to reset the product after a power cut or forcible de-energizing

The setting of the product will be retained as it was before a power cut or de-energizing.

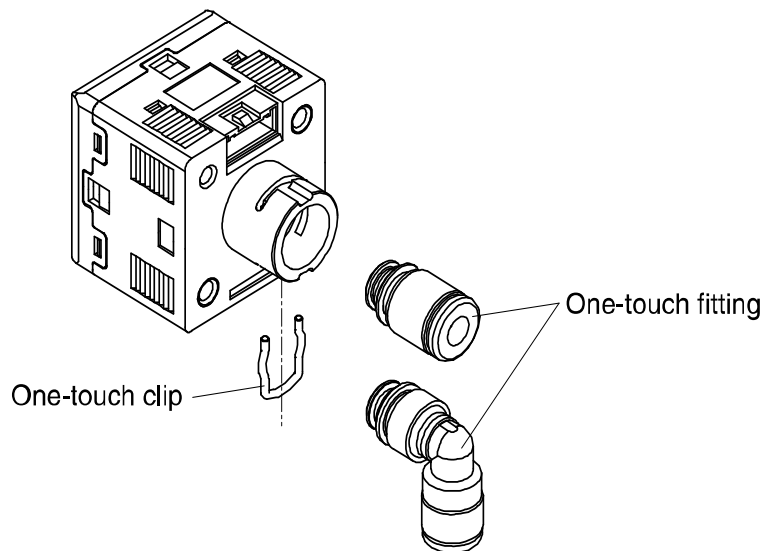
The output condition is also basically recovered to that before a power cut or de-energizing, but may change depending on the operating environment.

Therefore, check the safety of the whole installation before operating the product.

If the installation is using accurate control, wait until the product has warmed up (approximately 10 to 15 minutes).

Replacement of one-touch fitting

- The one-touch fitting has a cassette mechanism which can be replaced.
- Assembly should be performed after turning the power off, stopping the supplied fluid, exhausting the fluid within the piping, and ensuring the release to atmosphere.
- The one-touch fitting is held by a one-touch clip inserted as shown in the figure below. Remove the one-touch clip with a flat blade screwdriver, and remove the one-touch fitting. To mount the one-touch fitting, insert it to the bottom, then insert the one-touch clip.
- Take care not to damage the O-ring of the one-touch fitting.
- Supply pressure to the fitting slowly, and check if for leaks.

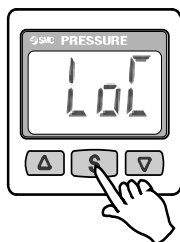


If the security code is forgotten

The following procedure can be used when the security code has been forgotten.

<Operation>

Press the **S** button for 5 seconds or longer in measurement mode.
The current setting "UnL" or "LoC" is displayed.



Press the **▲** and **▼** buttons simultaneously for 5 seconds or longer.
Then, press the **S** and **▼** buttons simultaneously for 5 seconds or longer.

*: There will be no change to the display.

(at this time, if another operation is performed or no key operation is performed for 30 seconds, the display will return to measurement mode).

Press the **▲** and **S** buttons simultaneously for 5 seconds or longer. The display will change to "0000" and the security code change mode will return.

Refer to "How to change the security code" (page 46) and select a new security code.

The new security code will be displayed.

Check the security code is as required, and press the **S** button for 1 second or longer.

The display will return to measurement mode.

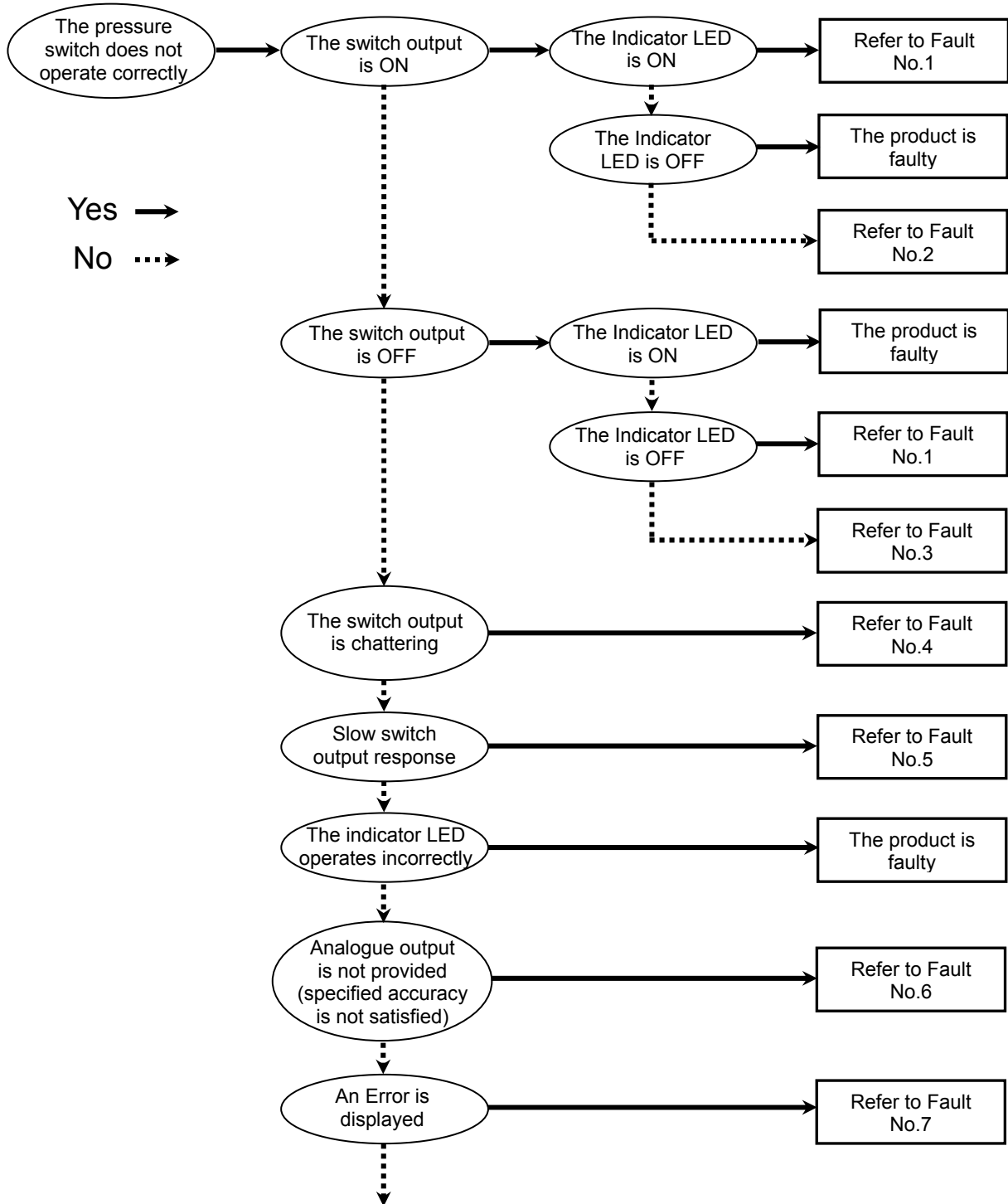
At this time, if the **▲** or **▼** button is pressed, any security code changes will be lost, and the change of security code procedure must be repeated.

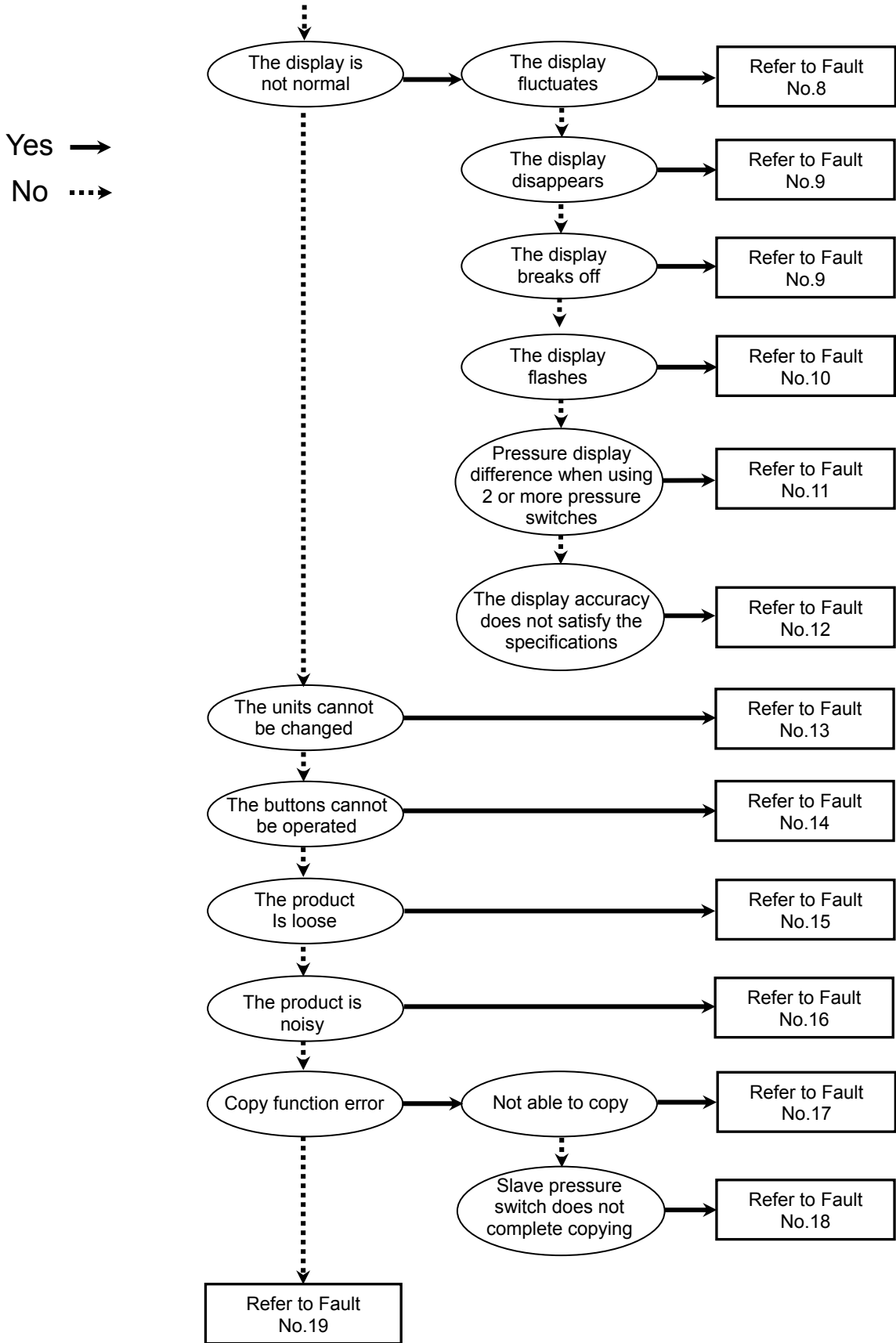
Troubleshooting

○Troubleshooting

Applicable Pressure switch: **ZSE30A(F)/ISE30A**

If the cause of the failure cannot be identified and normal operation can be recovered by replacement with a new Pressure switch, this indicates that the Pressure switch itself is faulty. Pressure switch damage can be caused by the operating environment (network construction, etc.), therefore contact SMC.





○ Faults and countermeasures

| Fault No. | Fault | Possible cause | Investigation method | Countermeasure |
|-----------|--|----------------------------|--|--|
| 1 | <ul style="list-style-type: none"> •Output remains ON. Indicator LED remains ON. •Output remains OFF. Indicator LED remains OFF. | Incorrect pressure setting | (1) Check the set pressure. (2) Check the operation mode, hysteresis and output type. (hysteresis mode / window comparator mode, normal / reversed output) | (1) Reset the pressure setting. (2) Reset the function settings. |
| | | Product failure | | Replace the product. |
| 2 | Output remains ON. Indicator LED works correctly. | Incorrect wiring | Check the wiring of the output. Check if the load is connected directly to DC(+) or DC(-). | Correct the wiring. |
| | | Product failure | | Replace the product. |
| 3 | Output remains OFF. Indicator LED works correctly. | Incorrect wiring | Check the wiring of the output. Check if the load is connected directly to DC(+) or DC(-). | Correct the wiring. |
| | | Unsuitable model selection | Check if PNP is used when NPN should have been selected, or the other way around. | Review the selected model (output type). |
| | | Broken lead wire | Check if there is bending stress applied to any parts of the lead wire. (bending radius and tensile force applied). | Correct the wiring conditions. (adjust the tensile force and increase the bending radius). |
| | | Product failure | | Replace the product. |
| 4 | Switch output generates chattering. | Incorrect wiring | Check the wiring. Check that the brown and blue wires are connected to DC(+) and DC(-) respectively, and if the output wiring is loose (contact failure). | Correct the wiring. |
| | | Incorrect settings | (1) Check the set pressure. (2) Check that the hysteresis range is not too narrow. (3) Check the response time set at initial setting. Check that the response time is not too short. | (1) Reset the pressure setting. (2) Increase the hysteresis. (3) Reset the function settings. |
| | | Product failure | | Replace the product. |
| 5 | Slow switch output response | Incorrect pressure setting | Check the pressure setting. Check that the detected pressure and the set pressure value are not the same or not too close. | Reset the pressure setting. Set the pressure setting value so it is not too close to the detected pressure. |

| Fault No. | Fault | Possible cause | Investigation method | Countermeasure |
|-----------|---|--|--|--|
| 6 | Analogue output is not provided. (specified accuracy is not satisfied). | Incorrect wiring | Check that the analogue output is connected to a load. | Correct the wiring. |
| | | Non-compliance with the load specification. | (1) Check that the correct load is connected. (2) Check that the impedance of the input equipment (A/D transformer) is suitable. | Connect a suitable load. |
| | | Insufficient warm-up time | Check if the product satisfies the specified accuracy after 10 minutes warm up time. | After energizing, the display and output can drift. For detecting fine pressures, warm up the product for 10 to 15 minutes. |
| | | Product failure | | Replace the product. |
| 7 | <ul style="list-style-type: none"> •An over current error (Er1, Er2) is displayed. •System error (Er0, Er4, Er6, Er7, Er8 or Er9) is displayed. •The display shows "HHH". •The display shows "LLL". •Residual pressure error (Er3) is displayed. | Over current to the output (Er1, Er2) | (1) Check that the switch output load current is not more than 80 mA. (2) Check that the connected load satisfies the specifications, and check the load for short circuits. (3) Check that any relay is connected with a surge voltage suppressor. (4) Check if the wiring is not in the same route as (or bundled together with) a high voltage cable or power cable. | (1), (2) Connect the load as specified. (3) Use a relay with a surge voltage suppressor or take measures to prevent noise. (4) Separate the wiring route from any high voltage cable or power cable. |
| | | Incorrect operation of the internal data of the Pressure switch (Er0, Er4, Er6, Er7, Er8, Er9) | (1) Check that there is no noise interference such as static electricity, and check for noise sources. (2) Check that the power supply voltage is within the range 12 to 24 VDC $\pm 10\%$. | (1) Remove the noise and the noise source (or take measures to prevent noise interference), and reset the product, or turn off the power supply and turn it on again. (2) Supply a correct voltage of 12 to 24 VDC $\pm 10\%$. |
| | | Applied pressure is above the upper limit (HHH). | (1) Check that the pressure is not above the upper limit of the set pressure range. (2) Check that foreign matter has not entered the piping. | (1) Adjust the pressure to within the set pressure range. (2) Take measures to prevent foreign matter from entering the piping. |
| | | Applied pressure is below the lower limit (LLL). | (1) Check that the pressure is not below the lower limit of the set pressure range. (2) Check that foreign matter has not entered the piping. | (1) Adjust the pressure to within the set pressure range. (2) Take measures to prevent foreign matter from entering the piping. |
| | | Pressure is not atmospheric pressure at zero-clear operation (Er3) | Check that during the zero clear operation, pressure above $\pm 7\%$ F.S. ($\pm 3.5\%$ F.S. for compound pressure) was not applied. | Return the applied pressure to atmospheric pressure, and retry the zero clear operation. |
| | | Product failure | | Replace the product. |

| Fault No. | Fault | Possible cause | Investigation method | Countermeasure |
|-----------|---|---|--|---|
| 8 | Displayed value fluctuates. | Incorrect power supply | Check that the power supply voltage is within the range 12 to 24 VDC $\pm 10\%$. | Supply the correct voltage of 12 to 24 VDC $\pm 10\%$. |
| | | Incorrect wiring | Check the wiring to the power supply. Check that the brown and blue wires are connected to DC(+) and DC(-) respectively and that the output wiring is not loose (contact failure). | Correct the wiring. |
| | | Factory pressure change | Check if the factory pressure has changed. | If the fluctuation is not acceptable, the pressure switch display resolution can be changed. |
| 9 | <ul style="list-style-type: none"> •Display turns OFF. •Part of the display is missing. | Incorrect power supply | Check that the power supply voltage is within the range of 12 to 24 VDC $\pm 10\%$. | Supply the correct voltage of 12 to 24 VDC $\pm 10\%$. |
| | | Power saving mode | Check if the power saving mode is selected. | Reset the function settings. |
| | | Incorrect wiring | Check the power supply wiring. Check that the brown and blue wires are connected to DC(+) and DC(-) respectively and that the output wiring is not loose (contact failure). | Correct the wiring. |
| | | Product failure | | Replace the product. |
| 10 | Display is flashing. | The peak / bottom value display mode is selected. | Check if the peak value or bottom value display mode has been selected. | Turn off the peak / bottom value display mode if not required. |
| | | Wiring failure | (1) Check the power supply wiring. (2) Check if there is bending stress applied to any parts of the lead wire. | (1) Correct the wiring (2) Correct the wiring conditions (reduce the tensile force and increase the bending radius). |
| 11 | Pressure display difference when using 2 or more Pressure switches. | Dispersion within the display accuracy range | Check if the dispersion is within the display accuracy range. | Use the fine adjustment mode to adjust the display if the dispersion is within the display accuracy range. |
| | | Product failure | | Replace the product. |

| Fault No. | Fault | Possible cause | Investigation method | Countermeasure |
|-----------|---|---|---|---|
| 12 | The pressure display accuracy does not satisfy the specifications. | Foreign matter | Check if any foreign matter has entered the pressure port. | Install a 5 μm filter to prevent foreign matter from entering the pressure port. Also, clean the filter regularly to prevent drainage deposits. |
| | | Air or fluid leakage | Check if air or fluid are leaking from the piping. | Rework the piping. If an excessive tightening torque is applied, the mounting bracket, screws or the product may be damaged. |
| | | Insufficient warm-up time | Check if the product satisfies the specified accuracy after 10 minutes warm up time. | After energizing, the display and output can drift. For detecting fine pressures, warm up the product for 10 to 15 minutes. |
| | | Product failure | | Replace the product. |
| 13 | The display units cannot be changed. | Improper model selection (selection of model without "unit selection function") | Check if there is an "-M" at the end of the part number printed on the product. | "M" in the part number means that the units cannot be changed. (kPa↔MPa can be selected) *: The unit change function is not available in Japan due to a new measurement law. *: It is fixed to the SI unit "kPa", "MPa". |
| | | Product failure | | Replace the product. |
| 14 | The buttons cannot be operated. | Key lock mode | Check if the key lock mode is turned on. | Turn off the key lock mode. |
| | | Product failure | | Replace the product. |
| 15 | The product is loose. | Incorrect installation | Check that the panel mount adapter and the product are correctly assembled. | Mount the product on the panel correctly. |
| | | Product failure | | Replace the product. |
| 16 | The product is noisy. | Air or fluid leakage | Check if air or fluid are leaking from the piping. | Rework the piping. If an excessive tightening torque is applied, the mounting bracket, screws or the product may be damaged. |
| | | Product failure | | Replace the product. |
| 17 | <ul style="list-style-type: none"> •Copy function error •Unable to copy | Incorrect wiring | (1) Check the wiring connection at the FUNC terminal. (2) Check the power supply wiring. | Correct the wiring. |
| | | Product failure | | Replace the product. |

| Fault No. | Fault | Possible cause | Investigation method | Countermeasure |
|-----------|--|--|---|---|
| 18 | Slave Pressure switch does not complete the copy function. | Incorrect wiring | (1) Check the wiring connection at the FUNC terminal. Check the power supply wiring. (2) Check the lead wire lengths. | (1) Correct the wiring. (2) The maximum transmitting distance of the copy function is 4 m. Shorten the lead wire to 4 m or less. |
| | | Improper model selected | The model number of the master Pressure switch and the slave Pressure switch are different from each other. | Check the model numbers. Copying is available when the pressure range, output specification and units specification are identical. |
| | | Too many pressure switches connected | Check the number of connected slave Pressure switches. | The number of connected products for which copying is possible is up to 10 pcs. Reduce the number to 10 pcs or less. |
| | | Product failure | | Replace the product. |
| 19 | The operation is unstable. (chattering) | Pressure source fluctuation, small hysteresis or the response time is too short. | (1) Check the set pressure (hysteresis) (2) Check the response time | (1) Check the pressure setting. (2) Reset the function settings. |
| | | Incorrect wiring or broken lead wire | (1) Check the power supply wiring. (2) Check if there is bending stress applied to any parts of the lead wire. | (1) Correct the wiring (2) Correct the wiring conditions (reduce the tensile force and increase the bending radius). |
| | | Product failure | | Replace the product. |

○Error indication

This function is to display error location and content when a problem or an error occurs.

| Error Name | Error Display | Error Type | Troubleshooting Method |
|-------------------------|--|--|--|
| Over current Error | Er1 Er2 | The switch output load current is more than 80 mA. | Turn the power off and remove the cause of the over current. Then turn the power on. |
| Residual Pressure Error | Er3 | During zero clear operation, pressure above $\pm 7\%$ F.S. ($\pm 3.5\%$ F.S. for compound pressure) has been applied. After 1 second, the mode will return to measurement mode. The zero clear range can vary $\pm 1\%$ F.S. with individual product differences. | Perform zero clear operation again after restoring the applied pressure to an atmospheric pressure condition. |
| Pressurizing Error | HHH | Pressure has exceeded the upper limit of the set pressure range. | Adjust the applied pressure to a level within the set pressure range. |
| | LLL | Pressure has exceeded the lower limit of the set pressure range. | |
| System Error | Er0 Er4 Er6 Er7 Er8 Er9 | Displayed in the case of an internal data error. | Turn the power off and turn it on again. If resetting fails, an investigation by SMC Corporation will be required. |

If the error can not be reset after the above measures are taken, then please contact SMC.

Specification

■ Specifications

| Model No. | ZSE30A (vacuum) | ZSE30AF (compound) | ISE30A (positive pressure) | |
|-----------------------------|---|--|---|-------------------------------|
| Rated pressure range | 0.0 to -101.0 kPa | -100.0 to 100.0 kPa | -0.100 to 1.000 MPa | |
| Set pressure range | 10.0 to -105.0 kPa | -105.0 to 105.0 kPa | -0.105 to 1.050 MPa | |
| Withstand pressure | 500 kPa | 500 kPa | 1.5 MPa | |
| Minimum display unit | 0.1 kPa | 0.1 kPa | 0.001 MPa | |
| Applicable fluid | Air, inert gases and incombustible gases | | | |
| Power supply voltage | 12 to 24 VDC $\pm 10\%$, ripple (p-p) 10% or less (protected against reverse connection) | | | |
| Current consumption | 40 mA or less | | | |
| Switch output | NPN or PNP open collector output : 1 output NPN or PNP open collector output : 2 outputs (selectable) | | | |
| Max. load current | 80 mA | | | |
| Max. applied voltage | 28 V (NPN output) | | | |
| Residual voltage | 1 V or less (at 80 mA load current) | | | |
| Response time | 2.5 ms or less (with anti-chatter function: 20, 100, 500, 1000 or 2000 ms selected) | | | |
| Short circuit protection | Provided | | | |
| Repeatability | $\pm 0.2\%$ F.S. ± 1 digit | | | |
| Hysteresis | 0 to variable *1 | | | |
| Hysteresis mode | | | | |
| Window comparator mode | | | | |
| Analogue output | Voltage output *2 | Output Voltage (rated pressure range) | 1 to 5 V $\pm 2.5\%$ F.S. | 0.6 to 5 V $\pm 2.5\%$ F.S. |
| | | Linearity | $\pm 1\%$ F.S. | |
| | | Output impedance | approx. 1 k Ω | |
| | Current output *3 | Output current (rated pressure range) | 4 to 20 mA $\pm 2.5\%$ F.S. | 2.4 to 20 mA $\pm 2.5\%$ F.S. |
| | | Linearity | $\pm 1\%$ F.S. | |
| | | Load impedance | Max. load impedance: 300 Ω (at power supply voltage of 12 VDC) 600 Ω (at power supply voltage of 24 VDC) Min. load impedance: 50 Ω | |
| Display | 4 digits, 7-segment, dual-colour display (red/green) | | | |
| Display accuracy | $\pm 2\%$ F.S. ± 1 digit (at ambient temperature 25 ± 3 °C) | | | |
| Indicator LED | LED is ON when output is ON OUT1: Green OUT2: Red | | | |
| Environment | Enclosure | IP40 | | |
| | Ambient temperature range | Operation: 0 to 50 °C, Storage: -10 to 60 °C (no condensation or freezing) | | |
| | Ambient humidity range | Operation, Storage: 35 to 85%RH (no condensation) | | |
| | Withstand voltage | 1000 VAC, 1 minute between terminals and housing | | |
| | Insulation resistance | 50 M Ω or more at 500 VDC between terminals and housing | | |
| Temperature characteristics | $\pm 2\%$ F.S. (25 °C reference) | | | |
| Lead wire | Oil resistant vinyl cabtyre cable 3 cores $\phi 3.5$, 2 m 4 cores Sectional area of conductor: 0.15 mm ² (AWG26) Outside diameter of insulator: 1.0 mm | | | |
| Standard | CE, UL/CSA, RoHS | | | |

*1: If the applied voltage fluctuates around the set value, the hysteresis must be set to more than the fluctuation width. Otherwise, chattering will occur.

*2: If analogue voltage output is selected, the analogue current output cannot be selected.

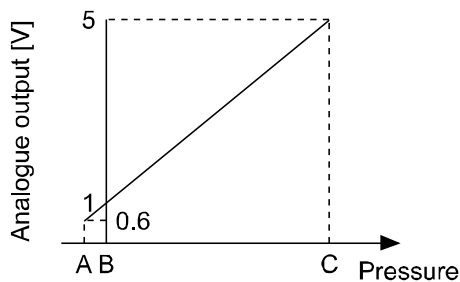
*3: If analogue current output is selected, the analogue voltage output cannot be selected.

○Piping specifications

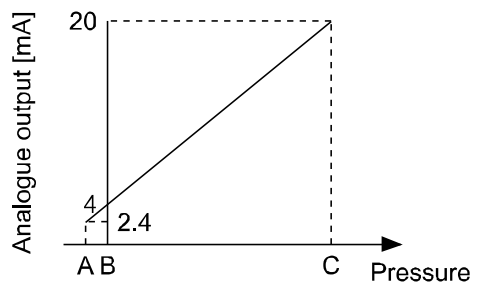
| Model No. | 01 | N01 | C4H | C6H | N7H | C4L | C6L | N7L |
|-----------------------------------|---|--|---|---------------------|-------|-----------|---------------------|--------------------|
| Port size | R1/8 M5×0.8 | NPT1/8 M5×0.8 | - | - | - | - | - | - |
| | One-touch fitting straight type | - | - | φ4 mm φ5/32 inch | φ6 mm | φ1/4 inch | - | - |
| | One-touch fitting elbow type | - | - | - | - | - | φ4 mm φ5/32 inch | φ6 mm φ1/4 inch |
| Material of wetted parts | Pressure sensing part | Silicone | | | | | | |
| | Piping port | C3602 (electroless nickel plating) O-ring: HNBR | PBT, POM, SUS304, C3604 (electroless nickel plating) O-ring: NBR | | | | | |
| Weight | With lead wire and connector attached (3-core, 2 m) | 81 g | 70 g | 71 g | 73 g | 75 g | 73 g | 75 g |
| | With lead wire and connector attached (4-core, 2 m) | 85 g | 74 g | 75 g | 77 g | 79 g | 77 g | 79 g |
| | Without lead wire and connector | 43 g | 32 g | 33 g | 35 g | 37 g | 35 g | 37 g |

○Analogue output

Voltage output



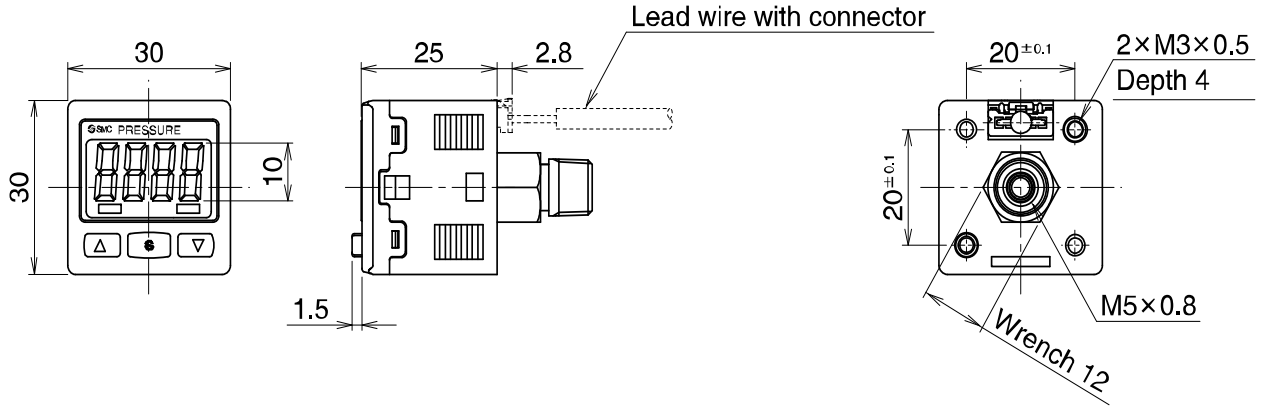
Current output



| Range | Rated pressure range | A | B | C |
|-------------------|------------------------|----------|----------|----------|
| Vacuum | 0.0 to -101.0 kPa | - | 0 | -101 kPa |
| Compound | -100.0kPa to 100.0 kPa | - | -100 kPa | 100 kPa |
| Positive pressure | -0.100 to 1.000 MPa | -0.1 MPa | 0 | 1 MPa |

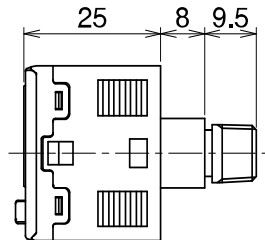
■Dimensions

○Body dimensions



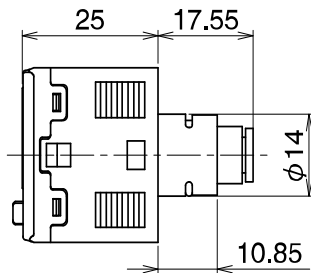
01/N01 type

01: R1/8
N01: NPT1/8



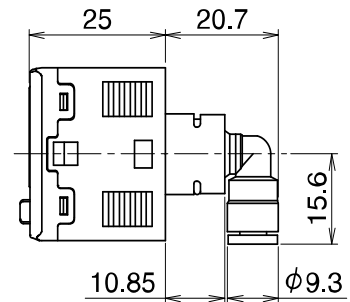
C4H type

One-touch fitting
φ4 mm, φ5/32 inch
straight



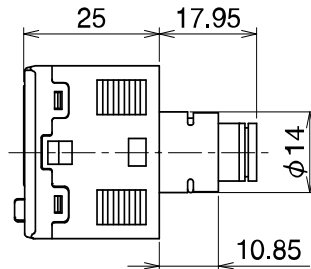
C4L type

One-touch fitting
φ4 mm, φ5/32 inch
elbow



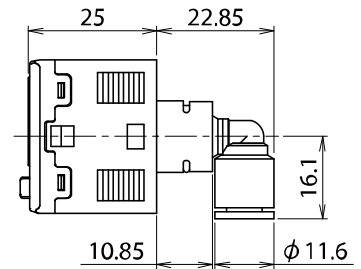
C6H type

One-touch fitting
φ6 mm straight



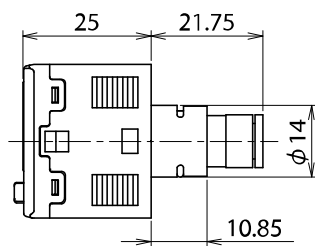
C6L type

One-touch fitting
φ6 mm elbow



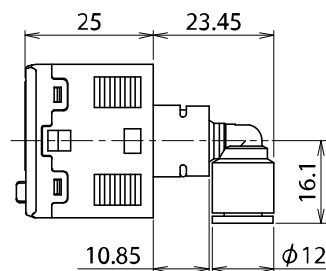
N7H type

One-touch fitting
φ1/4 inch straight



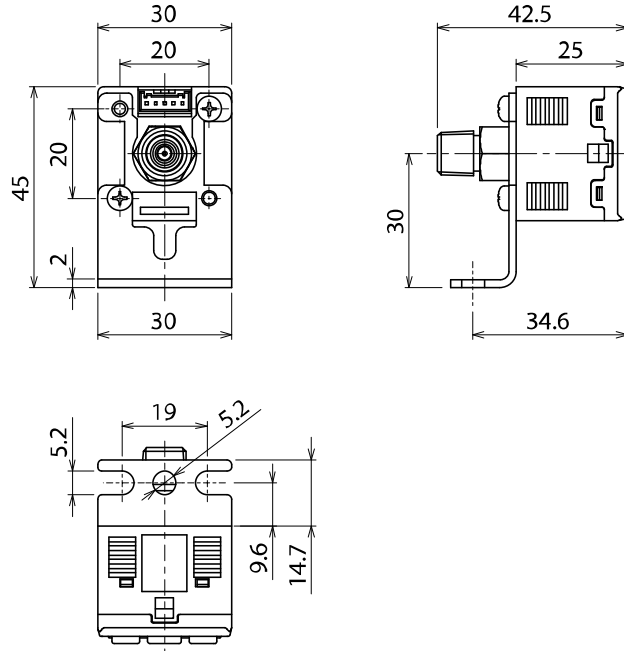
N7L type

One-touch fitting
φ1/4 inch elbow

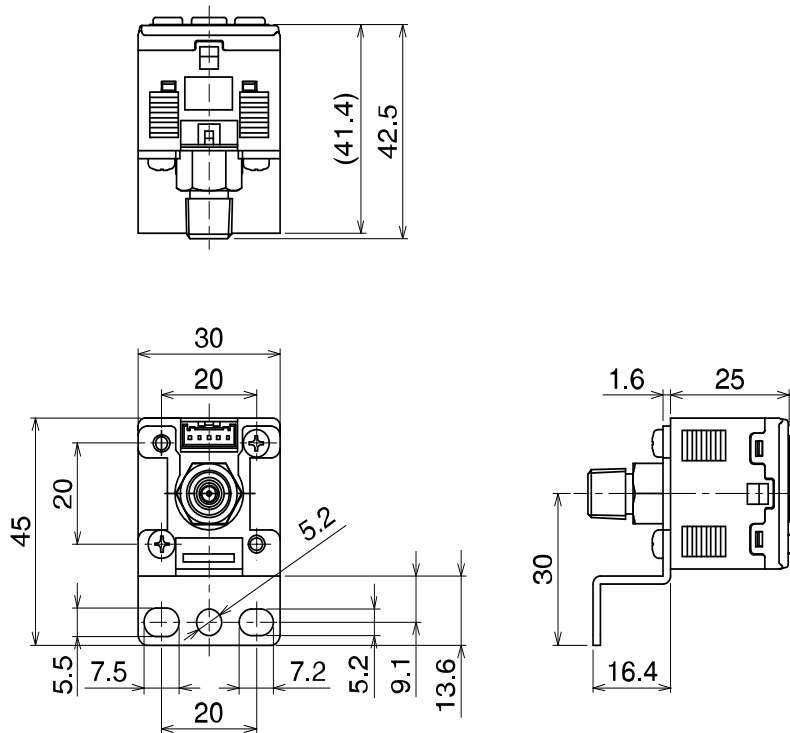


○ Mounting brackets

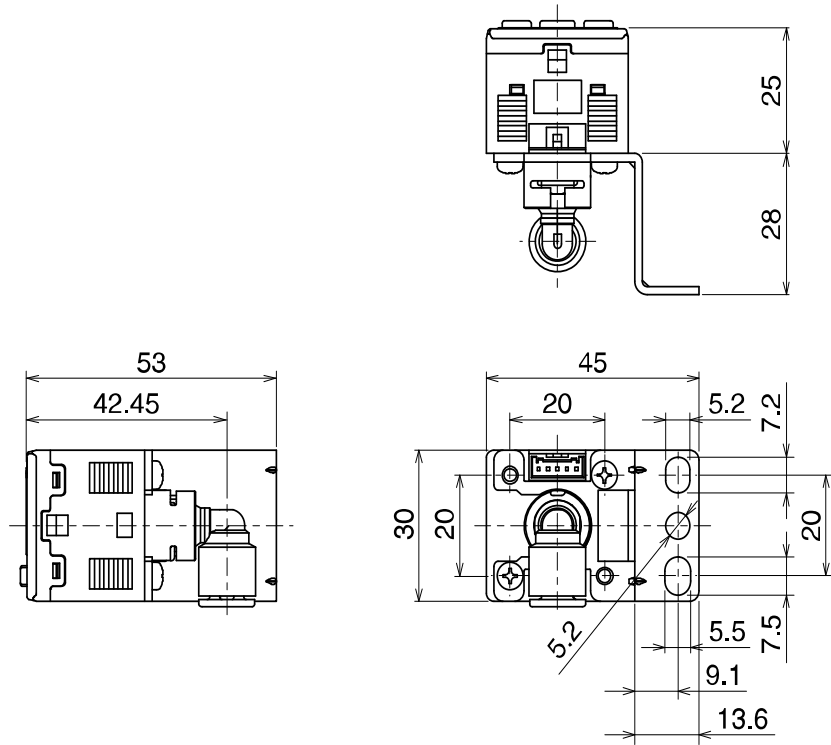
● Bracket A



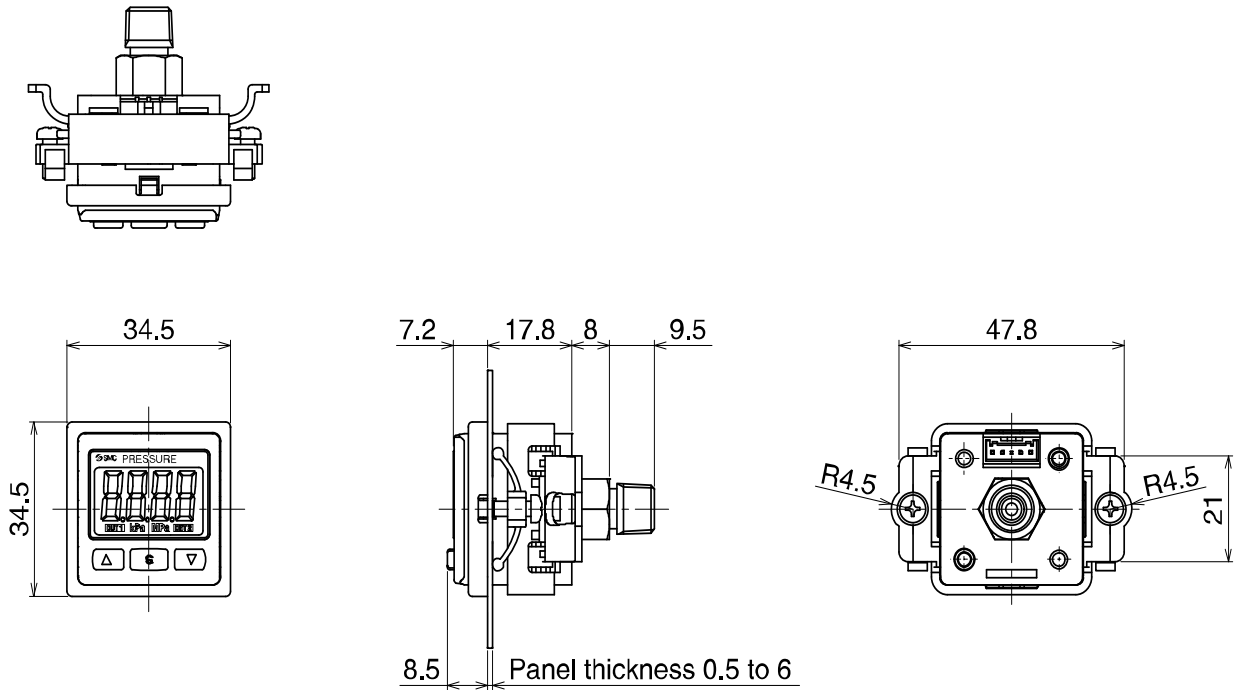
● Bracket B



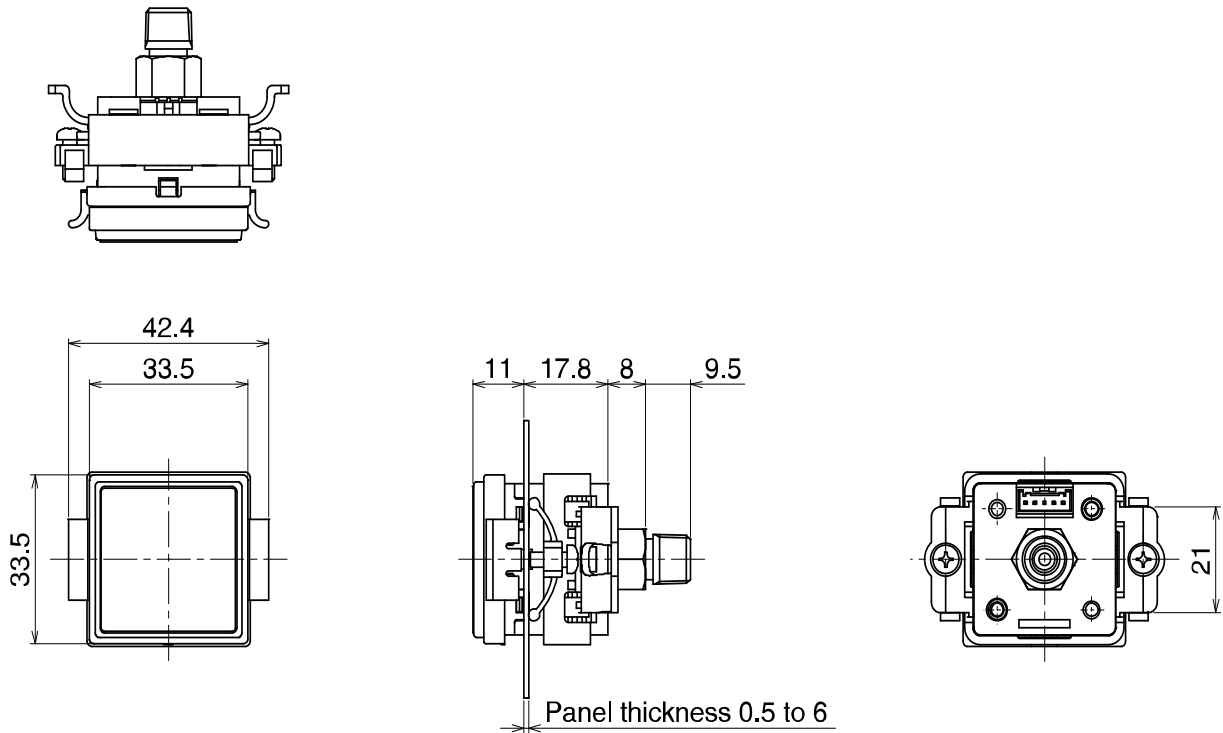
•Bracket C



○Panel mount adapter

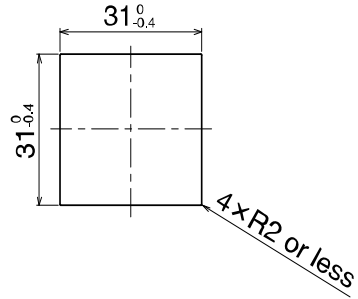


○Panel mount adapter + Front protective cover



Panel cut-out dimensions

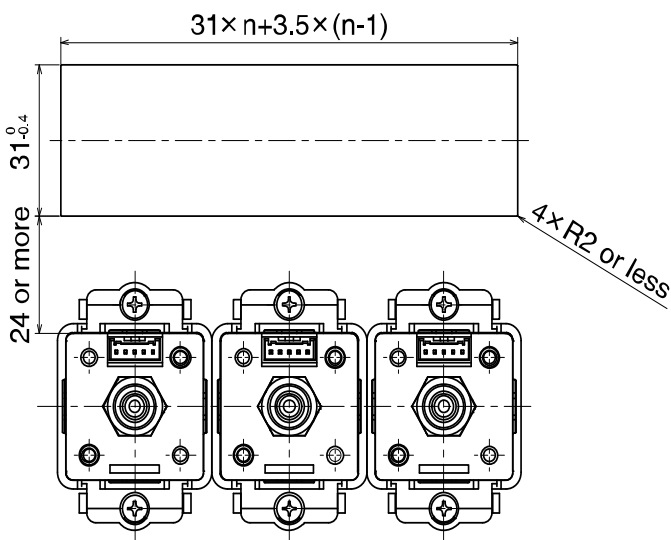
Single Pressure switch



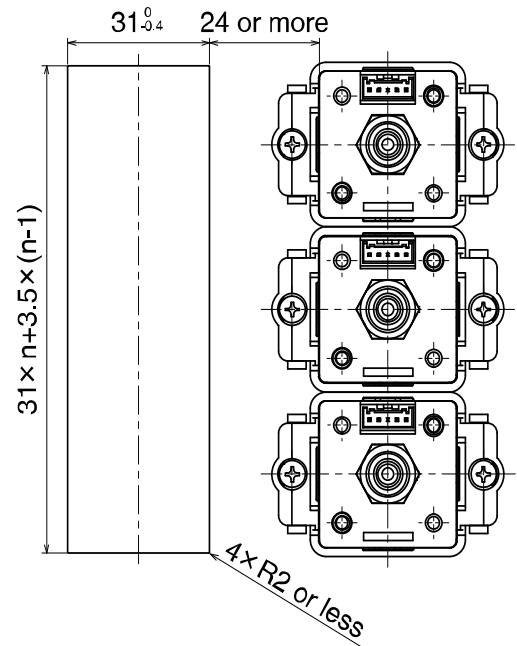
Two or more in a row

n : The number of the Pressure switch

<Horizontal>



<Vertical>



Revision history

- A: Modified errors in text.
Add the bracket type C.
- B: Revision.
- C: Modified errors in text.
- D: Change of Limited warranty and Disclaimer.
- E: Contents are added.
- F: Measurement laws are added.

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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