# High-Precision Digital Pressure Switch

## Series ZSE40(F)/ISE40

## With anti-chattering function

The pressure values measured within the response time that are selected by the user are averaged. By comparing this average pressure value with the set pressure value, switch output is determined.

## With auto shift function

Able to transmit the output signal of a switch by not reflecting the fluctuations of the supply pressure.

## Compound pressure (ZSE40F)

Able to detect the adsorption confirmation pressure (for vacuum pressure) and the vacuum release pressure (for positive pressure) with one pressure switch.

## 3 types of piping

A wide variety of piping allows installation in various locations.

## Repeatability

±0.2% F.S. ±1 digit or less

## IP65 compliant

Dusttight, Low jetproof type

## For panel mount

Dedicated adaptor makes it easier to assemble in a panel-mount application.

# High-Precision Digital Pressure Switch
# Series ZSE40□/ISE40

## How to Order

**Set pressure range**

| | | |
|---|---|---|
| **Nil** | –0.100 to 1.000 MPa | For positive pressure |

**For Positive Pressure** **ISE40** – **01** – **22** □ – **M** □ – □

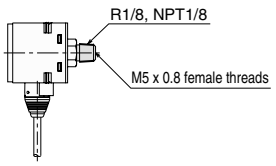
**For Vacuum/Compound Pressure** **ZSE40** □ – **01** – **22** □ – **M** □ – □

**Set pressure range**

| | | |
|---|---|---|
| **Nil** | 10.0 to –101.3 kPa | For vacuum pressure |
| **F** | –100.0 to 100.0 kPa | For compound pressure |

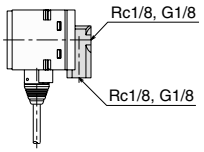
**Piping specifications**

**01:** R1/8 (with M5 female threads)
**T1:** NPT1/8 (with M5 female threads)



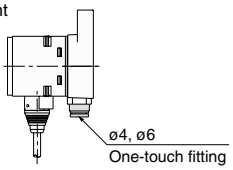

**W1 :** Rc1/8
∗ **WF1:** G1/8

Reverse pressure two directions



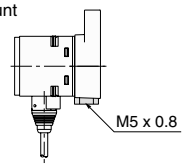

∗ **C4:** With ø4 One-touch fitting
∗ **C6:** With ø6 One-touch fitting

Wall mount




∗ **M5:** M5 x 0.8 (female threads)

Wall mount




∗ Optional

**Piping Specifications/Combination of Options Available**

| | | Piping specification | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Description | Symbol | **01** | **T1** | **W1** | **WF1** | **C4** | **C6** | **M5** |
| Bracket A | **A** | ○ | ○ | ○ | ○ | × | × | × |
| Bracket B | **B** | × | × | ○ | ○ | × | × | × |
| Bracket D | **D** | ○ | ○ | ○ | ○ | × | × | × |
| Panel mounting | **E** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Panel mount + Front protective cover | **F** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

○: Combination available ×: Combination not available

**Input/Output specifications**

| | |
|---|---|
| **22** | NPN open collector 2 outputs + analog output |
| **30** | NPN open collector 2 outputs + auto shift input |
| **62**∗ | PNP open collector 2 outputs + analog output |
| **70**∗ | PNP open collector 2 outputs + auto shift input |

∗ Optional

**Lead wire length**

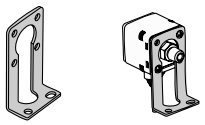
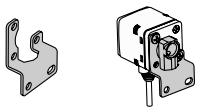
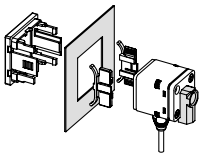
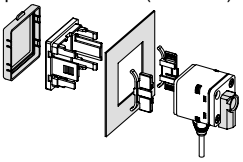
| | |
|---|---|
| **Nil** | 0.6 m |
| **L** | 3 m |

**Made to Order**

| | |
|---|---|
| **Nil** | None |
| **X119** | Extended auto shift specifications |
| **X129** | Space saving |

Refer to page 716 for details.

**Option**

| | |
|---|---|
| **Nil** | None |
| **A** | Bracket A (ZS-24-A)  |
| **B** | Bracket B (ZS-24-B)  |
| **D** | Bracket D (ZS-24-D) Please confirm the external dimensions. |
| **E** | Panel mount (ZS-22-A)  |
| **F** | Panel mount + Front protective cover (ZS-24-C)  |

∗ When optional parts only are required, order with the part numbers inside ( ).

**Unit specifications**

| | |
|---|---|
| **Nil** | With unit switching function |
| **M** | SI units only Note) |

Note) Fixed units
For vacuum/compound pressure : kPa
For positive pressure : MPa

**Note**

When equipped with auto shift function, the following ranges can be set.

| Set pressure range | Setting range |
|---|---|
| –100.0 to 100.0 kPa | –100.0 to 100.0 kPa |
| 10.0 to –101.3 kPa | –101.3 to 101.3 kPa |
| –0.1 to 1.000 MPa | –1.000 to 1.000 MPa |

## Specifications

| Model | | | **ZSE40F** (Compound pressure) | **ZSE40** (Vacuum pressure) | **ISE40** (Positive pressure) |
|---|---|---|---|---|---|
| **Rated pressure range** | | | –100.0 to 100.0 kPa | 0.0 to –101.3 kPa | 0.000 to 1.000 MPa |
| **Set pressure range** | | | –100.0 to 100.0 kPa | 10.0 to –101.3 kPa | –0.100 to 1.000 MPa |
| **Extended analog output range** | | | — | 10.0 to 0 kPa | –0.100 to 0 MPa |
| **Withstand pressure** | | | 500 kPa | | 1.5 MPa |
| **Set pressure resolution** | | **kPa** | 0.1 | | — |
| | | **MPa** | — | | 0.001 |
| **Applicable fluid** | | | Air, Non-corrosive/Non-flammable gas | | |
| **Power supply voltage** | | | 12 to 24 VDC ±10%, Ripple (p-p) 10% or less (with power supply polarity protection) | | |
| **Current consumption** | | | 55 mA or less | | |
| **Switch output** | | | NPN or PNP open collector output: 2 output | | |
| | **Max. load current** | | 80 mA | | |
| | **Max. applied voltage** | | 30 V (with NPN output) | | |
| | **Residual voltage** | | 1 V or less (with load current of 80 mA) | | |
| | **Response time** | | 2.5 ms or less (Response time selections with anti-chattering function:24 ms, 192 ms and 768 ms) | | |
| | **Short circuit protection** | | With short-circuit protection | | |
| **Repeatability** | | | ±0.2% F.S. ±1 digit or less | | |
| **Hysteresis** | **Hysteresis mode** | | Variable (0 or above) | | |
| | **Window comparator mode** | | Fix (3 digits) | | |
| **Display** | | | 3 1/2-digit, 7 segment indicator (Sampling frequency: 5 times/sec) | | |
| **Display accuracy** | | | ±2% F.S. ±1 digit or less (With ambient temperature of 25°C) | | |
| **Operation indicator light** | | | Green LED (OUT1: Lights when ON), Red LED (OUT2: Lights when ON) | | |
| **Analog output** Note 1) | | | Output voltage: 1 to 5 V<br>±5% F.S. or less (in rated pressure range)<br>Linearity: ±1% F.S. or less<br>Output impedance: Approx. 1 kΩ | Output voltage: 1 to 5 V ±2.5% F.S. or less (in rated pressure range)<br>0.6 to 1 V ±5% F.S. or less (in extended analog output range)<br>Linearity: ±1% F.S. or less<br>Output impedance: Approx. 1 kΩ | |
| **Auto shift input** Note 2) | | | No-voltage input (reed or solid state), input 5 ms or more | | |
| **Environ-mental resistance** | **Enclosure** | | IP65 | | |
| | **Ambient temperature range** | | Operating: 0 to 50°C, Stored: –10 to 60°C (with no condensation or freezing) | | |
| | **Ambient humidity range** | | Operating/Stored: 35 to 85% RH (with no condensation) | | |
| | **Withstand voltage** | | 1000 VAC for 1 min. between live parts and case | | |
| | **Insulation resistance** | | 50 MΩ or more (at 500 VDC) between live parts and case | | |
| | **Vibration resistance** | | 10 to 500 Hz at the smaller of amplitude 1.5 mm or acceleration 98 m/s² in X, Y, Z directions for 2 hrs. each (De-energized) | | |
| | **Impact resistance** | | 980 m/s² in X, Y, Z directions 3 times each (De-energized) | | |
| **Temperature characteristics** | | | ±2% F.S. or less of pressure measured at 25°C | | |
| **Port size** | | | 01: R1/8, M5 x 0.8, T1: NPT1/8, M5 x 0.8, W1: Rc1/8<br>C4: With ø4 One-touch fitting, C6: With ø4 One-touch fitting, M5: M5 female threads | | |
| **Lead wires** | | | Oil-resistant cabtire cord 5 cores, ø3.5, Cross section: 0.15 mm², Conductor O.D.: 0.97 mm | | |
| **Mass** | | | 01/T1 types approx. 60 g, W1 type approx. 80 g, C4/C6/M5 types approx. 92 g (each including 0.6 m lead wires) | | |
| **Standard** | | | Compliant with CE marking | | |

Note 1) In case of ZSE40F/ZSE40/ISE40-□-$^{22}_{62}$
Note 2) In case of ZSE40F/ZSE40/ISE40-□-$^{30}_{70}$

Note:
When equipped with auto shift function, the following ranges can be set.

| Model | Set pressure range |
|---|---|
| ZSE40F-□-$^{30}_{70}$ | –100.0 to 100 kPa |
| ZSE40-□-$^{30}_{70}$ | –101.3 to 101.3 kPa |
| ISE40-□-$^{30}_{70}$ | –1.0000 to 1.000 MPa |

## Function

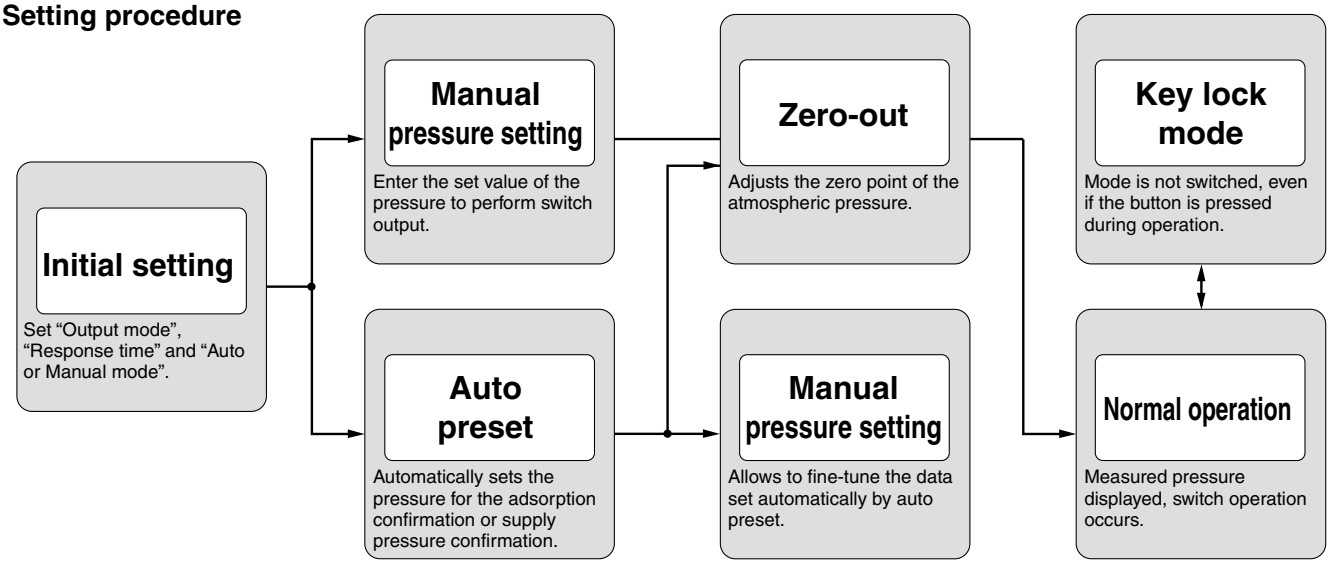
Various additional functions are available for easy measurement, switch operation and confirmation of measured values suitable for the conditions of the measured fluid.

| | |
|---|---|
| Auto shift function Note 1) | Can correct the pressure set point value of switch output according to fluctuations in the primary pressure. |
| Anti-chattering function | Prevents possible malfunction due to sudden fluctuations in the primary pressure by adjusting the response time. |
| Key lock function | Key operation can be locked to prevent any incorrect function of the operation switch. |
| Peak hold function Note 2) | Can retain the maximum pressure value displayed during measurement. |
| Bottom hold function Note 2) | Can retain the minimum pressure value displayed during measurement. |
| Zero-out function | The pressure display can be set at zero when the pressure is open to the atmosphere. |
| Unit conversion Note 1) | Can convert the display value. |

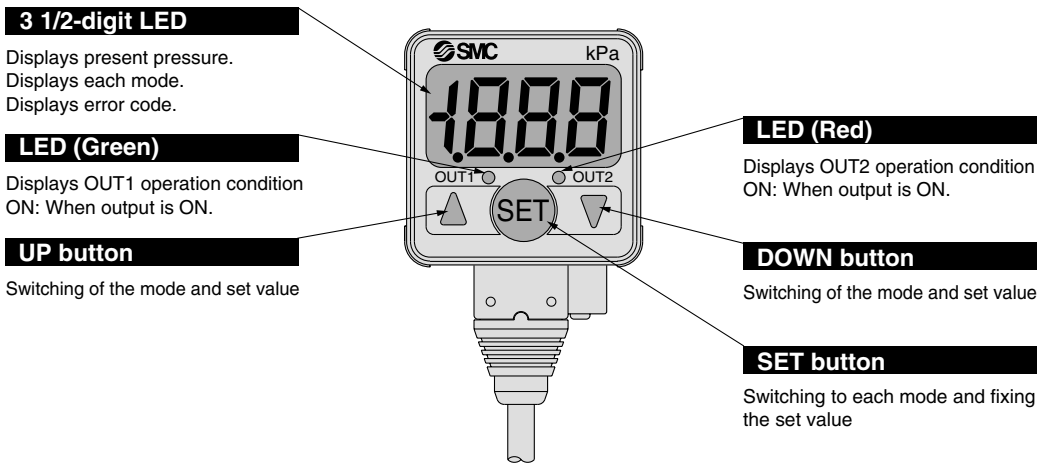
Note 1) Select and order by specifying the types and models.
Note 2) Display blinks when using the peak and bottom hold functions.

## Calibration Procedures

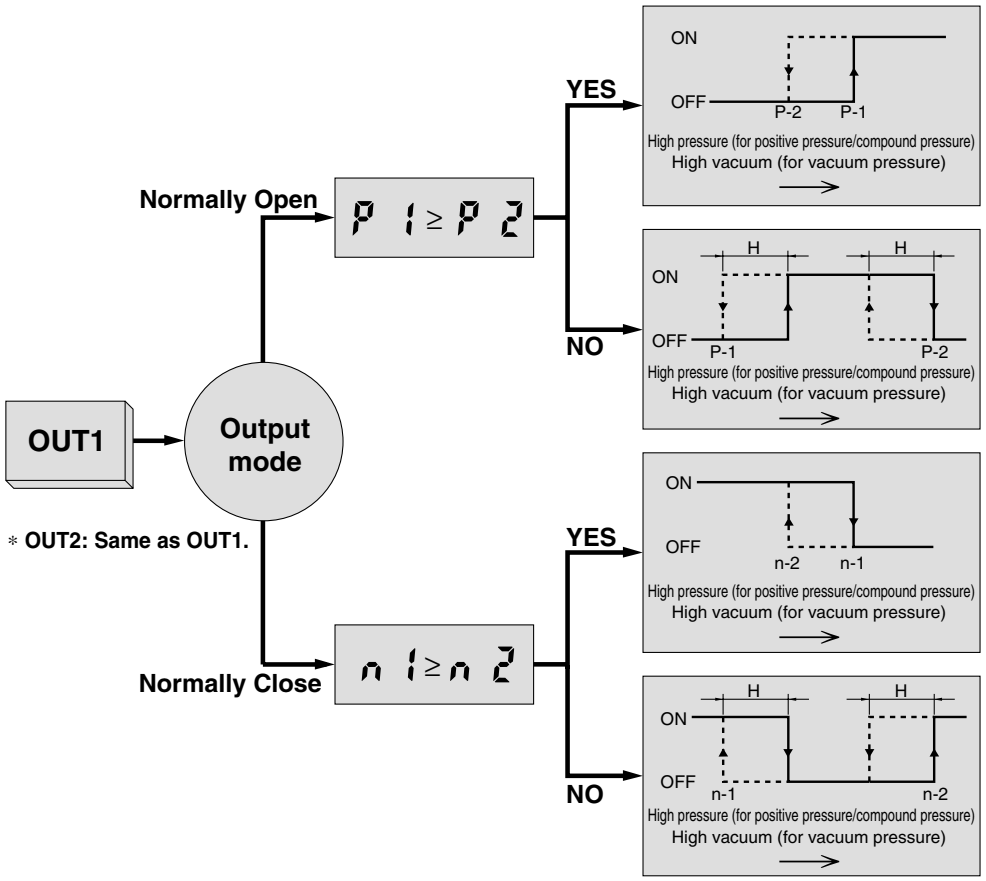
### Setting procedure




## Description



## Output Type



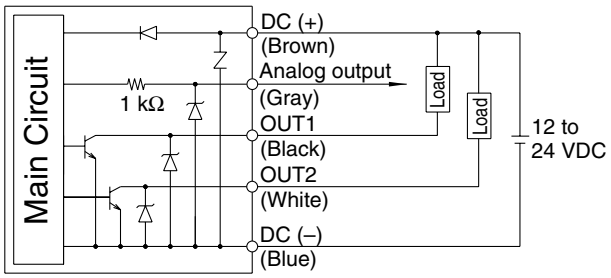

- **Hysteresis mode**
- **H (Fixed hysteresis) = 3 digits**
- **Window comparator mode**
- **Hysteresis mode**
- **H (Fixed hysteresis) = 3 digits**
- **Window comparator mode**

Note) When in hysteresis mode and window comparator mode, setting is determined automatically by comparing the small and large set pressure values P1, P2 (n1, n2).

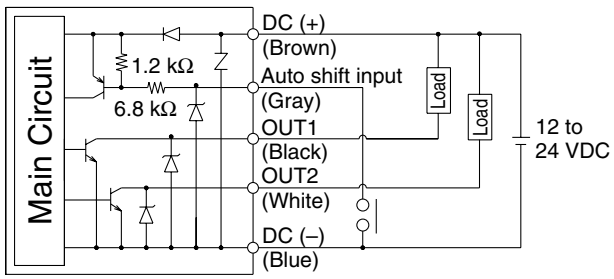


## Internal Circuits and Wiring Examples

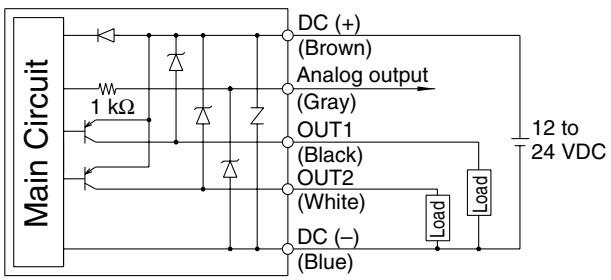
**ZSE40(F)/ISE40-□-22(L)-(M)**
**With analog output**



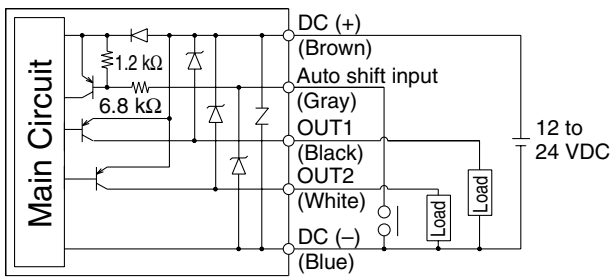

**ZSE40(F)/ISE40-□-30(L)-(M)**
**With auto shift input**




**ZSE40(F)/ISE40-□-62(L)-(M)**
**With analog output**

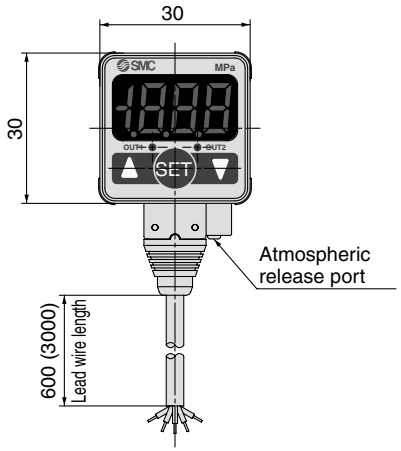


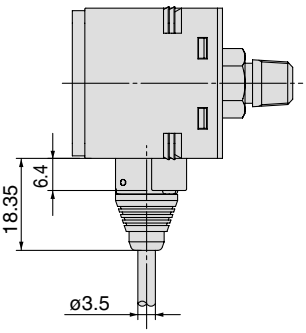

**ZSE40(F)/ISE40-□-70(L)-(M)**
**With auto shift input**

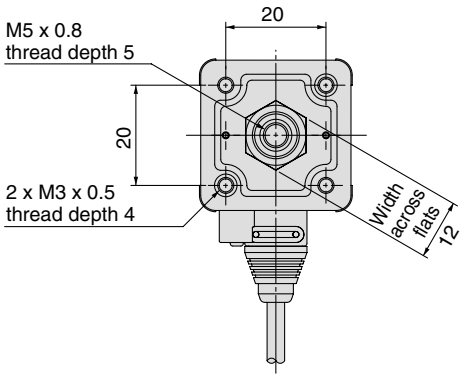


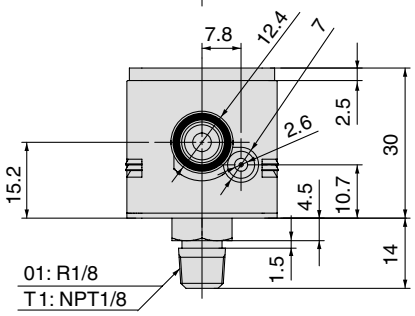
## Dimensions

### ZSE40(F)/ISE40-$^{01}_{T1}$

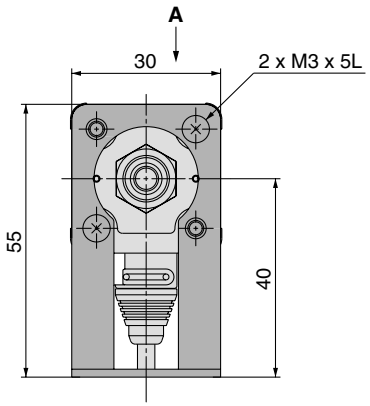


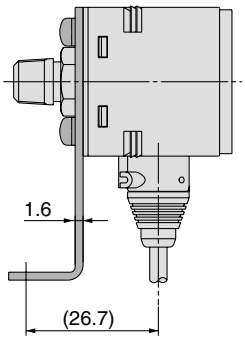



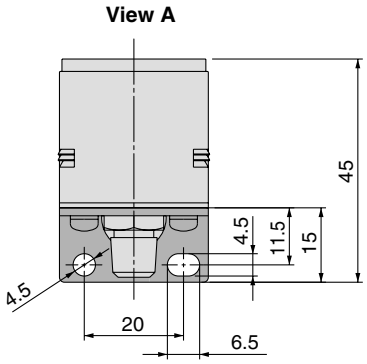



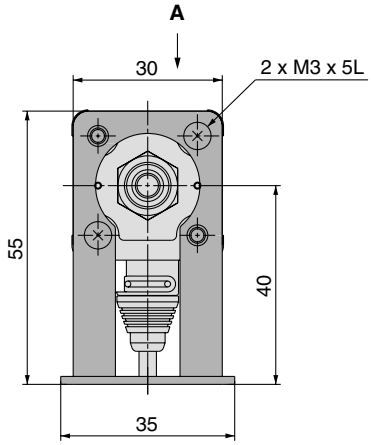

### Bracket A

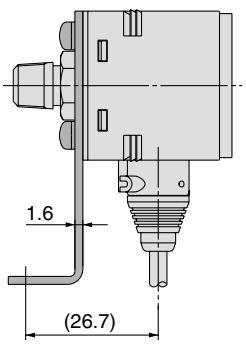


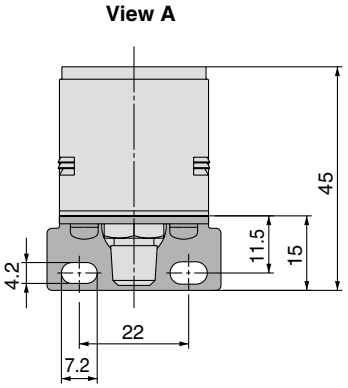




### Bracket D

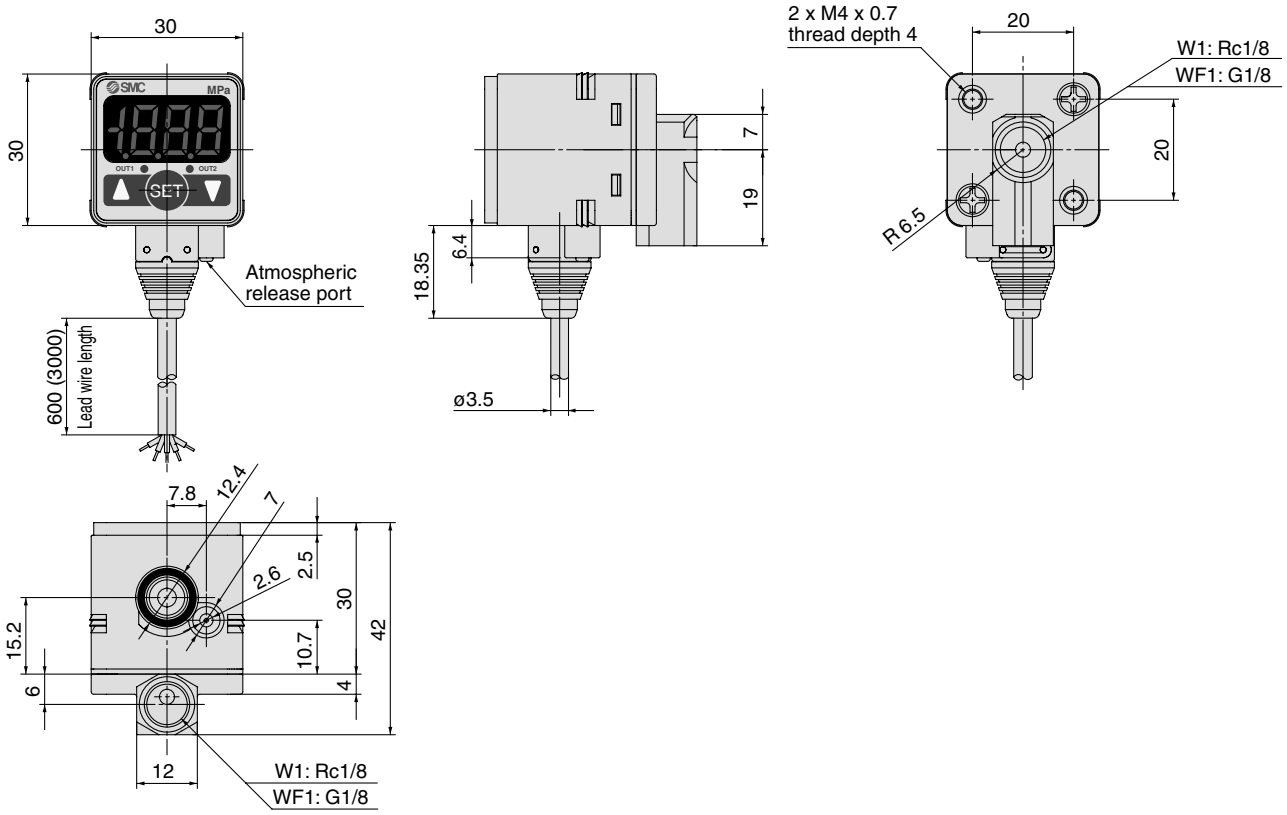


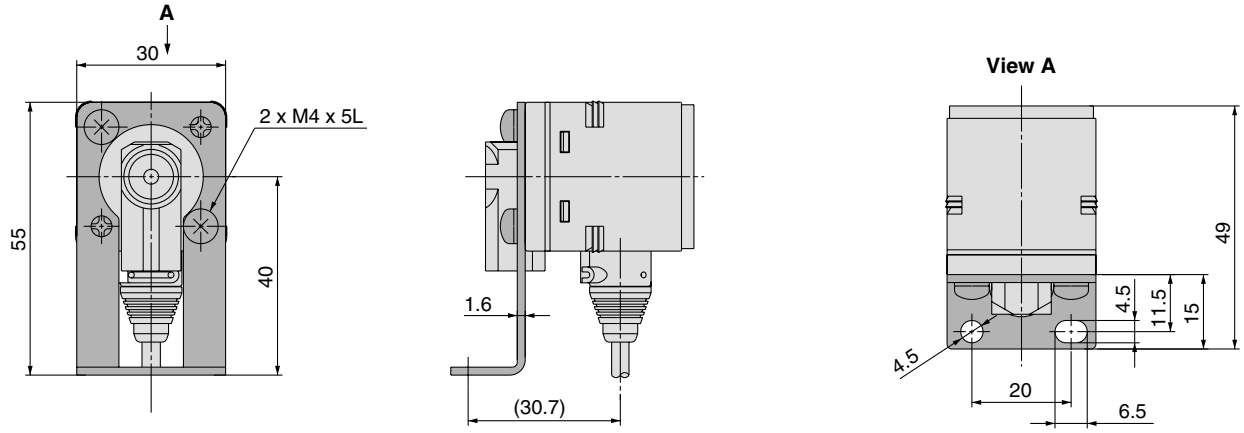



## Dimensions

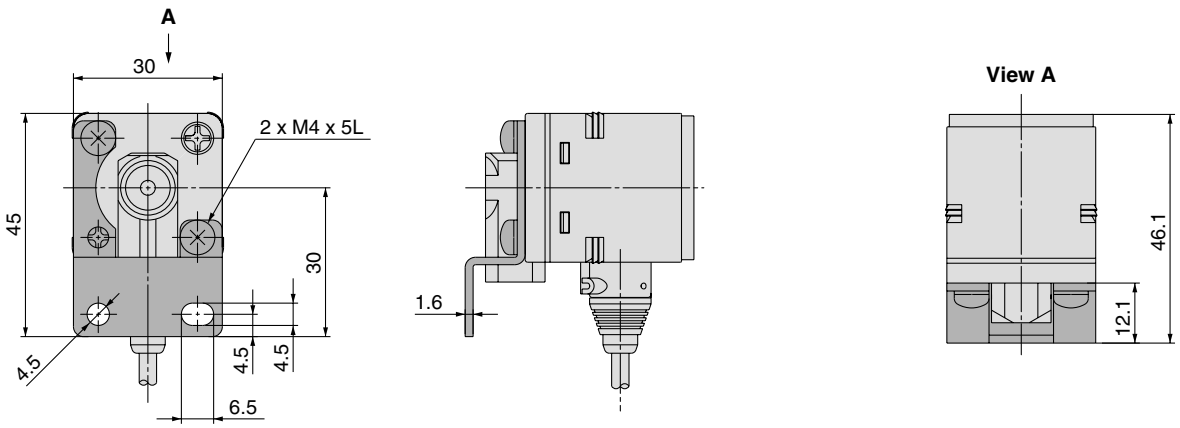
### ZSE40(F)/ISE40-$^{W1}_{WF1}$




### Bracket A

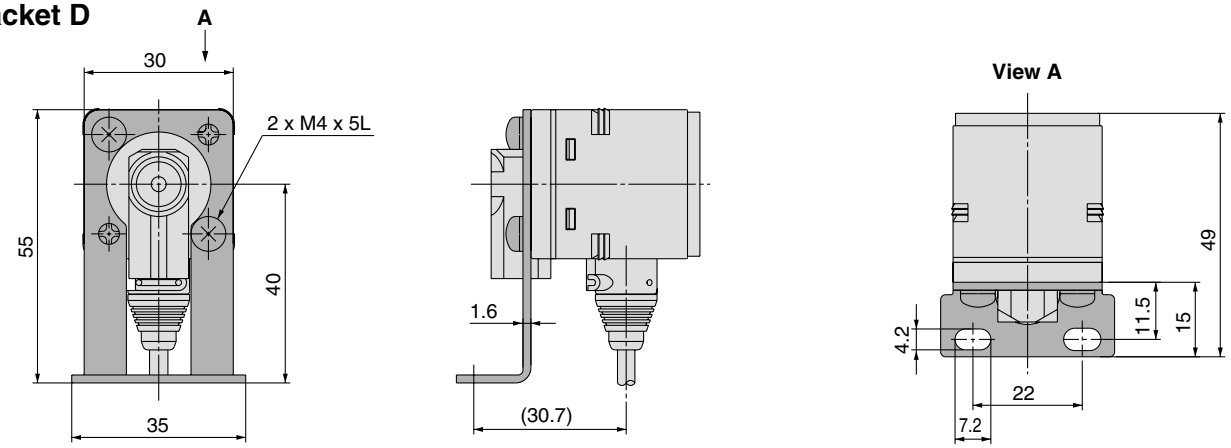



### Bracket B

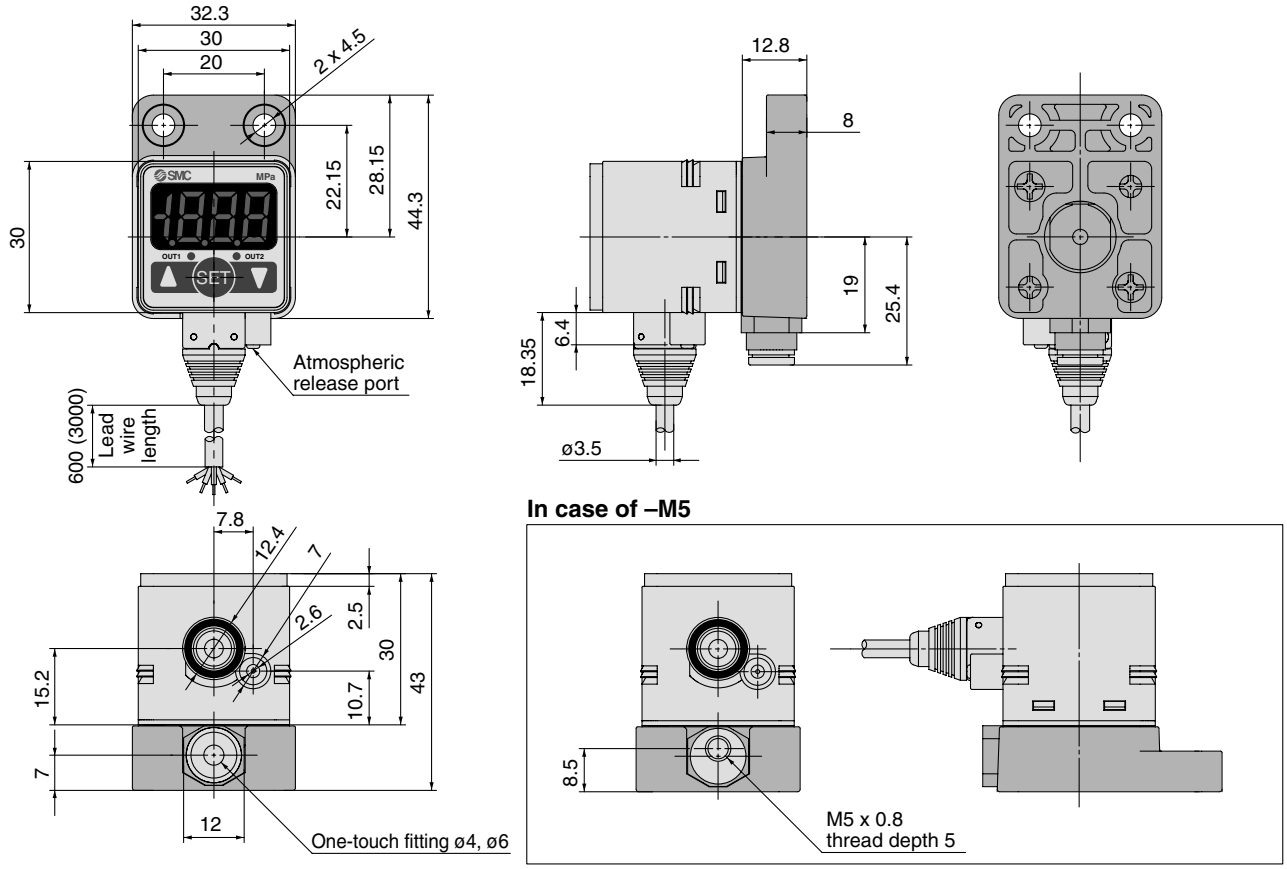


## Dimensions

### Bracket D

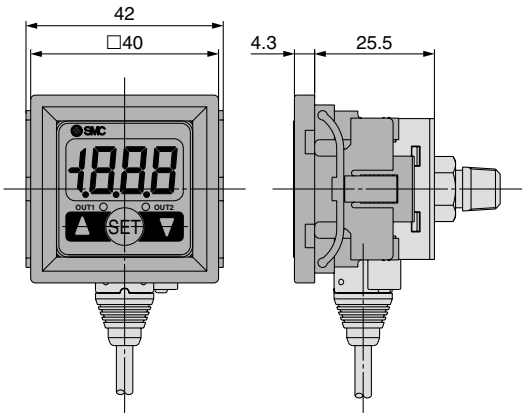



### ZSE40(F)/ISE40-C4 C6 M5

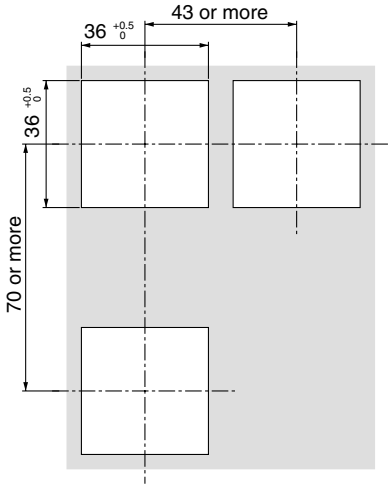


## Dimensions

### Panel mounting

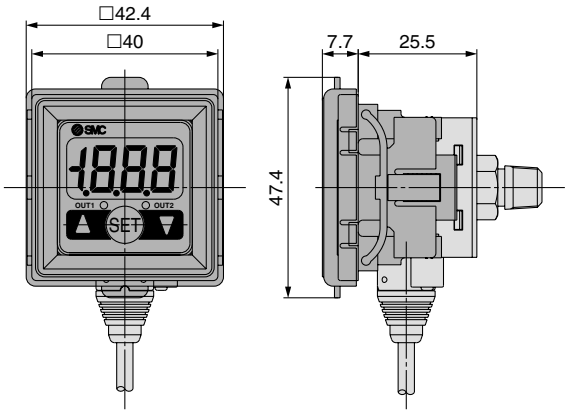



### Panel fitting dimension




Panel thickness: 1 to 3.2 mm

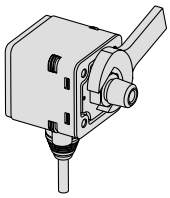
### Panel mount + Front protective cover



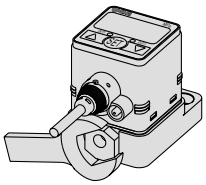
## Methods of Connecting Pipe

When connecting a hexagon socket plug or fitting on the pressure port, fix the hexagon part of the pressure port, applying a 12 mm width wrench and fasten with the torque of 8.8 N·m or less.
-W1 type has a removable pressure port base and can change the orientation of inducing pressure.

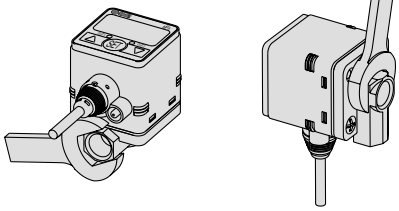
**-01, -T1 type**



**-M5 type**



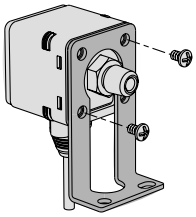
**-W1, -WF1 type**



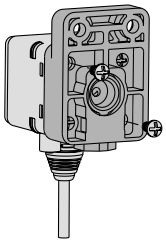
## Assembly of Mounting Bracket

When installing a mounting bracket on -01 or -W1 type, use stainless steel cross-recessed head machine screws: M3 x 5L (2 pcs.) The tightening torque should be 0.98 N·m or less.
When installing a mounting bracket on -C4, -C6, -M5, -W1 or -WF1 type, use stainless steel cross-recessed head machine screws: M4 x 5L (2 pcs.) The tightening torque should be 0.98 N·m or less.

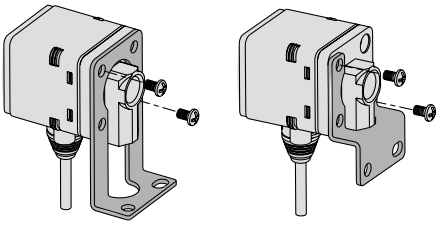
**-01, -T1 type**



**-C4, -C6, -M5 type**



**-W1, -WF1 type**



## Error Correction

Take the following corrective solutions when errors occur.

| Error description | | LCD display | Description | Solution |
|---|---|---|---|---|
| Over-current error | OUT1 | Er 1 | Current exceeding 80 mA is being applied for the load, OUT. | Shut off the power supply. After eliminating the output factor that caused the overourrent.tum the power supply back on. |
| | OUT2 | Er2 | | |
| Residual pressure error | | Er3 | When zero clear is performed, the following pressure differences have occurred. (ISE40: ±0.071 MPa or more / ZSE40(F): ±7.1 kPa or more) ∗ After displaying for approx. 3 seconds, it automatically reinstates to the measurement mode. | Only after reinstating to the atmospheric pressure, operate zero clear one more time. |
| Applied pressure error | | --- | Pressure exceeding the upper limit of the regulating pressure range is applied. | Reduce/Increase supply pressure to be within the raguleting pressure range. |
| | | ---- | Pressure below the lower limit of the regulating pressure range is applied. | |
| Auto shift error | | UUU | Pressure above the apper limit of the regulating pressure range is applied. ∗ After displaying for approx. 1 second, it returns to the measurement mode. | Reset the value, so that the sum of the applied pressure and set pressure at the time of auto shift input will not exceed the regulating pressure range. |
| | | LLL | Pressure below the lower limit of the regulating pressure range is applied. ∗ After displaying for approx. 1 second, it returns to the measurement mode. | |
| System error | | Er4 | Internal data error. | Shut off the power supply and then turn it back on. If it can not be reinstated, contact SMC for further investigation. |
| | | Er6 | Internal system error. | |
| | | Er7 | Internal data error. | |
| | | Er8 | Internal system error . | |

∗ Upper limit side and lower limit side are described in the table below. Besides, the relation between the upper limit and lower limit is reversed for the vacuum pressure only.

| | Regulating pressure range | Lower limit side | Upper limit side |
|---|---|---|---|
| Compound pressure | –100.0 to 100.0 kPa | –100.0 kPa | 100.0 kPa |
| Vacuum pressure | 10.0 to –101.3 kPa | 10.0 kPa | –101.3 kPa |
| Positive pressure | –0.100 to 1.000 MPa | –0.100 MPa | 1.000 MPa |

| | With auto shift function | | |
|---|---|---|---|
| | Set pressure range | Lower limit side | Upper limit side |
| Compound pressure | –100.0 to 100.0 kPa | –100.0 kPa | 100.0 kPa |
| Vacuum pressure | –101.3 to 101.3 kPa | 101.3 kPa | –101.3 kPa |
| Positive pressure | –1.000 to 1.000 MPa | –1.000 MPa | 1.000 MPa |

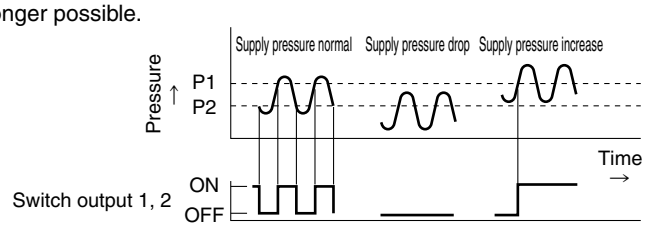
## With Auto Shift Function

### Auto shift function

Assuming the measured pressure at the time of auto shift input to be the standard pressure value, it functions to compensate the set value of switch output 1 "P_1" or "n_1" and "P_2" or "n_2", and the set value of switch output 2 "P_3" or "n_3" and "P_4" or "n_4".

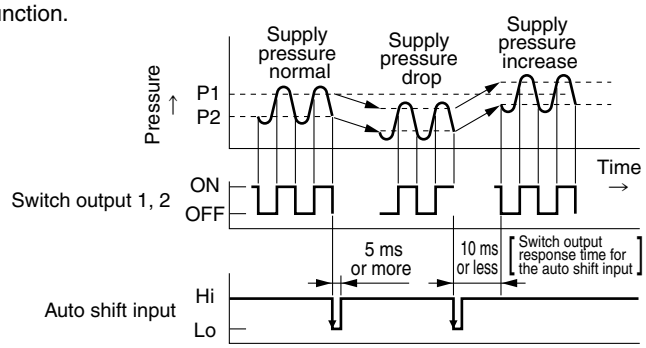
**When the auto shift is NOT used:**

When the supply pressure fluctuates, correct operation is no longer possible.




**When the auto shift is used:**

At the point when the supply pressure fluctuates, and if the auto shift input is set at "Lo", the pressure at the time is saved and the set pressure is to be compensated by that value to enable correct function.




### Auto shift function

- Keep the pressure for 5 ms or more, after the trailing edge signal of auto shift input.
- When the auto shift is activated, display panel shows "000" for approx. 1 second, and the pressure value at that point is memorized to be as a compensation value "C_5".
- The memorized compensation value makes the set value "P_1" to "P_4" or "n_1" to "n_4" to be compensated.
- Time between the auto shift input and switch output activation is 10 ms or less.
- When the set value compensated by the auto shift input exceeds the possible set range, compensation value is not saved. When the value exceeds the upper limit, "UUU" is displayed, whereas, "LLL" is displayed when it is below the lower limit.
- The compensation value "C_5" immediately after the auto shift function disappears when the power supply is turned off.
- The compensation value "C_5" for the auto shift function is reset to zero (initial value) when the power source is applied once again.

∗ EEPROM is not used to store the compensation value.

With auto shift function, allowable setting range is as follows:

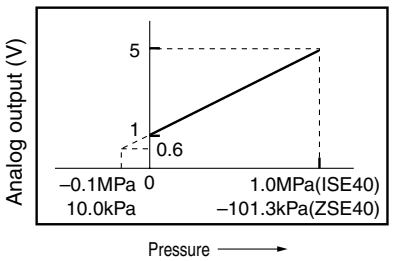
| Regulating pressure range | Set pressure range |
|---|---|
| –100.0 to 100.0 kPa | –100.0 to 100.0 kPa |
| 10.0 to –101.3 kPa | 101.3 to –101.3 kPa |
| –0.1 to –1.000 MPa | –1.000 to 1.000 MPa |



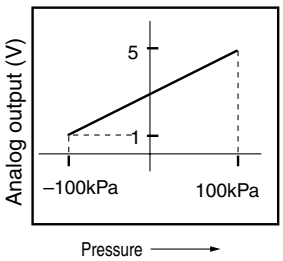
## Analog Output

Applicable model number: ZSE40(F)/ISE40-□-22/62(L)-(M)

**Series ISE40/ZSE40**




**Series ZSE40F**



# Made to Order Specifications

Please consult SMC for detailed dimensions, specifications and delivery.

## 1 Extended auto shift specifications

When the auto shift is activated and the compensated set value exceeds the regulating pressure range, the set value is automatically adjusted within the regulating pressure range.
Either 1 output (OUT 2 only) or 2 outputs (OUT 1 and 2) are available for the auto shift activation.

### How to Order

∗ Please refer to " How to Order " on page 706 for the standard specifications.

**ISE40/ZSE40(F) – □ – □ (L) – M – X119**

**Piping specifications** ∗

**Input/Output specifications** ∗

External dimensions are the same as those of standard products.

## 2 Space saving specifications

Product has larger allowable space for installing a panel mount, etc, by making a small the mold of an electrical entry beneath the housing.

### How to Order

∗ Please refer to " How to Order " on page 706 for the standard specifications.

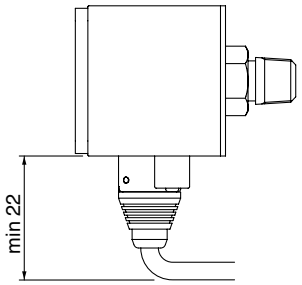
**ISE40/ZSE40(F) – □ – □ (L) – M – X129**

**Piping specifications** ∗

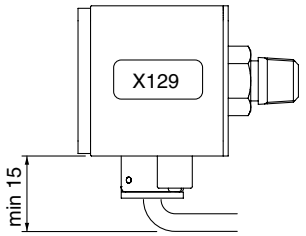
**Input/Output specifications** ∗

∗ This product is rated for IP40 enclosure. (Standard product is IP65.)

**[Standard products]**




**[This special product (X129)]**



# Series ZSE40□/ISE40
# Specific Product Precautions

**Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions and pages 687 to 691 for Pressure Switch Precautions.**

## Wiring

### ⚠ Caution

**1. When using a switching regulator on the market, make sure to ground the FG terminal.**

## Operating Environment

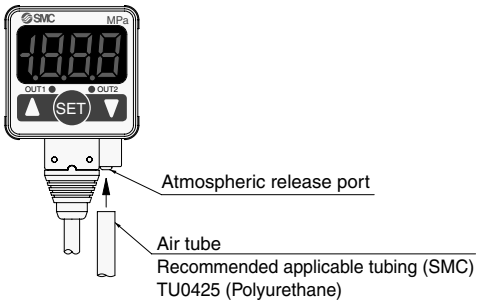
### ⚠ Warning

**1. Although this pressure switch is CE conformed product, it does not resist surges resulting from electrical storms. Please take proper precautions to prevent damage to equipment.**

### ⚠ Caution

**1. Please do not use in an environment where oil or solvent is splashed.**

**2. In places where the switch main body is splashed by water or dust, etc, may enter the switch through the atmospheric release port. Please insert ø4 tube (I.D. ø2.5) into the atmospheric release port and connect the opposite end to a cleaner environment where water, etc is not splashed. Please do not bend the tube or block the hole, this could lead to incorrect pressure measurement.**




## Other

### ⚠ Caution

**1. Immediately after the electric power is supplied, some drifting, as much as ±0.5% F.S., takes place. When used for micro pressure, allow it to warm up for about 20 to 30 minutes.**

## Regulating pressure range and rated pressure range

### ⚠ Caution

**Set the pressure within the rated pressure range.**

The regulating pressure range is the range of pressure that is possible in setting.
The rated pressure range is the range of pressure that satisfies the specifications (accuracy, linearity, etc.) on the sensor.
Although it is possible to set a value outside the rated pressure range, the specifications will not be guaranteed even if the value stays within the regulating pressure range.

| Switch | | Pressure range |
|---|---|---|
| | | −100 kPa 0 100 kPa 500 kPa 1 MPa |
| For vacuum pressure | **ZSE40** | −101.3 kPa 0 kPa<br>−101.3 kPa 10 kPa |
| For compound pressure | **ZSE40F** | −100 kPa 100 kPa<br>−100 kPa 100 kPa |
| For positive pressure | **ISE40** | 0 1 MPa<br>−100 kPa (−0.1 MPa) 1 MPa |

Rated pressure range of switch
Regulating pressure range of switch