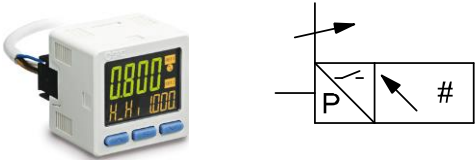




ORIGINAL INSTRUCTIONS

Instruction Manual
High Precision Digital Pressure Switch
Series ZSE20C(F) / ISE20C(H)



The intended use of this digital pressure switch is to measure, monitor and display pressure and to provide an output signal.

1 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 and safety requirements for systems and their components.
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. Part 1: General requirements.
ISO 10218-1: Robotics-Safety requirements - Part 1: Industrial robots.
- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
 - Keep this manual in a safe place for future reference.

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

Warning

- Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.
- This product is class A equipment intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted or radiated disturbances.
Otherwise electric shock, malfunction or product damage can result.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more safety instructions.

2 Specifications

2.1 General specifications

| Product No. | | ZSE20C (Vacuum pressure) | ZSE20CF (Compound pressure) | ISE20C (Positive pressure) | ISE20CH (Positive pressure) |
|------------------------------------|--|--|--------------------------------|--|--------------------------------|
| Applicable fluid | | Fluids which do not corrode SUS630, SUS304 | | | |
| Pressure | Rated pressure range | 0.0 to -101.0 kPa | -100.0 to 100.0 kPa | -0.100 to 1.000 MPa | -0.100 to 2.000 MPa |
| | Display/Set pressure range | 10.0 to -105.0 kPa | -105.0 to 105.0 kPa | -0.105 to 1.050 MPa | -0.105 to 2.100 MPa |
| | Display/Min. setting unit | 0.1 kPa | | 0.001 MPa | |
| | Proof pressure | 500 kPa | | 2 MPa | 4 MPa |
| Power supply | Power supply voltage | 12 to 24 VDC (±10%), ripple max. 10% (p-p) | | | |
| | Current consumption | 35 mA or less | | | |
| | Protection | Polarity protection | | | |
| Accuracy | Display accuracy | ±2%F.S. ±1 digit (at ambient temperature 25±3 °C) | | | |
| | Repeatability | ±0.2%F.S. ±1 digit | | | |
| | Analogue output accuracy | ±2.5%F.S. (at ambient temperature 25±3 °C) | | | |
| | Analogue output linearity | ±1%F.S. | | | |
| | Temperature characteristics | ±3%F.S. (25 °C standard) | | | |
| Switch output | Output type | Select from NPN or PNP open collector output | | | |
| | Output mode | Hysteresis mode, window comparator mode, error output, switch output off | | | |
| | Switch operation | Normal output, reversed output | | | |
| | Maximum load current | 80 mA | | | |
| | Maximum applied voltage | 30 V (during NPN output) | | | |
| | Internal voltage drop (Residual voltage) | 1.5 V or less (Load current 80 mA) | | | |
| | Delay time *1 | 1.5 ms or less, Variable at 0 to 60 s/0.01 s step | | | |
| | Hysteresis | Hysteresis mode | Variable from 0 *2 | | |
| | | Window comparator mode | | | |
| | Short circuit protection | Provided | | | |
| Display | Unit *3 | MPa, kPa, kgf/cm ² , bar, psi, InHg, mmHg | | MPa, kPa, kgf/cm ² , bar, psi | |
| | Display type | LCD | | | |
| | Number of displays | 3-screen display (Main display, sub display x 2) | | | |
| | Display colour | 1) Main display: Red/Green 2) Sub display: Orange | | | |
| | Number of display digits | Main display: 4 digits (7-segments) Sub display: 4 digits (Upper 1 digit 11-segments, 7-segments for other) | | | |
| | Operation light | LED is ON when switch output is ON (OUT1, OUT2: Orange) | | | |
| Digital filter *4 | Variable at 0 to 30 s/0.01 s step | | | | |
| Environment | Enclosure | IP65 | | | |
| | Withstand voltage | 250 VAC for 1 minute between terminals and housing | | | |
| | Insulation resistance | 2 MΩ or more between terminals and housing (with 50 VDC megger) | | | |
| | Ambient temperature range | Operation: -5 to 50 °C, Storage: -10 to 60 °C (No condensation or freezing) | | | |
| | Operating humidity range | Operation, Storage: 35 to 85%RH (No condensation) | | | |
| Length of lead wire with connector | | 2 m | | | |

- ^{*1}: Value without digital filter (at 0 ms).
^{*2}: If the applied pressure fluctuates around the set value, the hysteresis must be set to a value more than the amount of fluctuation or chattering will occur.
^{*3}: This setting is only available for models with the units selection function. Only MPa or kPa is available for models without this function.
^{*4}: The response time indicates when the set value is 90% in relation to the step input.

2 Specifications (continued)

2.2 Piping / Weight specifications

| Product No. | 02(L) | N02(L) | F02(L) | C01(L) | A2(L) | B2(L) |
|---|---|--|--------|--------|--|---------|
| Port size | R1/4 | NPT 1/4 | G1/4 | Rc1/8 | URJ 1/4 | TSJ 1/4 |
| Materials in fluid contact part (pressure-sensing part) | | Pressure sensor: SUS630, Fitting: SUS304 | | | | |
| Weight | Body (rear piping) | 51 g | 51 g | 48 g | 47 g | 54 g |
| | Body (bottom piping) | 77 g | 78 g | 74 g | 65 g | 81 g |
| | Lead wire with connector | +39 g | | | | |
| Leakage | 1 x 10 ⁻⁵ Pa • m ³ /s | | | | 1 x 10 ⁻¹⁰ Pa • m ³ /s | |

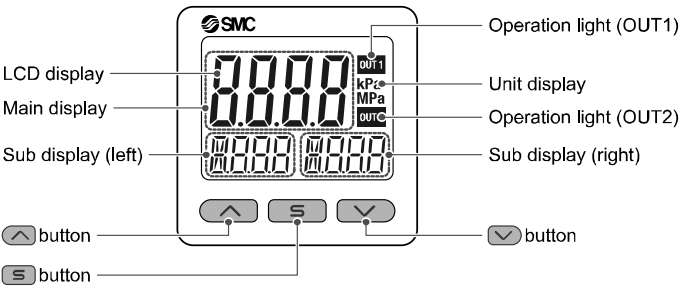
2.3 Cable specifications

| | |
|----------------------------|--|
| Conductor area | 0.15 mm ² (AWG26) |
| Insulator outside diameter | 1.0 mm |
| Colour | Brown, Blue, Black, White, Grey (5 core) |
| Sheath outside diameter | φ3.5 |

Warning

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

3 Name and function of product parts



- Operation light: Displays the switch operating condition.
LCD display: Displays the current status of pressure, setting mode, selected display units and error code.
4 types of display can be selected for the main display: Single colour of constant red or green; or switching from red to green or green to red corresponding to the output. The indication for the sub display is orange.
Main display: Displays pressure measurement values and error codes. (2-colour display)
Sub display (left): Displays items. (Orange)
Sub display (right): Displays set values, peak and bottom values. (Orange)
UP button: Increases mode and ON/OFF set values.
DOWN button: Decreases mode and ON/OFF set values.
SET button: Press this button to change mode and to confirm settings.
Unit display: Indicates the units currently selected (only for kPa and MPa).

4 Installation

4.1 Installation

Warning

Do not install the product unless the safety instructions have been read and understood.

4.1.1 Mounting

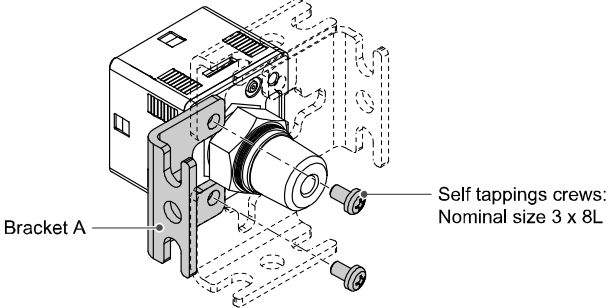
- Mount the optional bracket and panel mount adapter to the pressure switch.
- When the pressure switch is to be mounted in a place where water and dust splashes occur, insert a tube into the atmospheric vent port of the pressure switch (refer to “Tube attachment”).

4.1.2 Mounting with bracket

- Mount the bracket to the body with mounting screws (Self tapping screws: Nominal size 3 x 8L (2 pcs)), then set the body to the specified position.
*: Tighten the bracket mounting screws to a torque of 0.5 ±0.05 N•m. Self-tapping screws are used and should not be re-used several times.

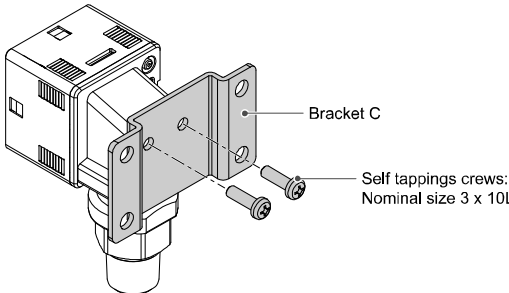
• Rear Piping

- Bracket A (Part No.: ZS-46-A1)



• Bottom Piping

- Bracket C (Part No.: ZS-46-E)

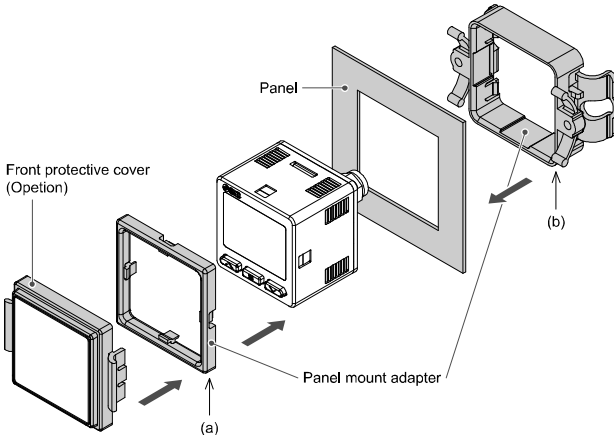


4.1.3 Mounting with panel mount adapter

• Rear Piping

- Mount part (a) to the front of the body and fix it. Then insert the body with (a) into the panel until (a) comes into contact with the panel front surface. Next, mount part (b) to the body from the rear and insert it until (b) comes into contact with the panel.

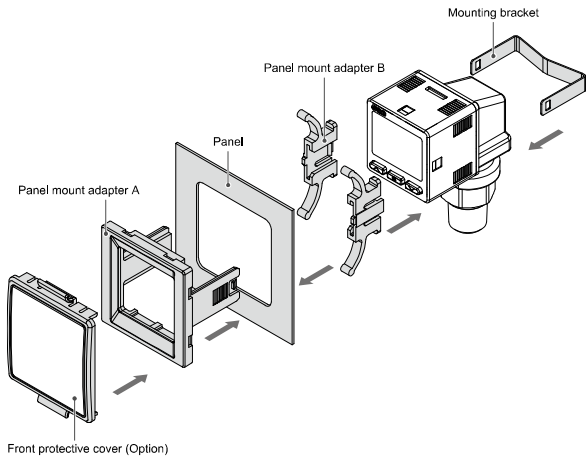
- Panel mount adapter (Part No.: ZS-46-B)
Panel mount adapter + Front protective cover (Part No.: ZS-46-D)



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

4 Installation (continued)

- **Bottom Piping**
- Hold a panel between panel mount adapter A and B.
- Then insert pressure switch and mounting bracket into the panel in that order.
- Panel mount adapter (Part No.: ZS-35-B)
Panel mount adapter + Front protective cover (Part No.: ZS-35-E)



4.2 Environment



Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact. Check the product specifications.
- Do not mount in a location exposed to radiant heat.

4.3 Piping

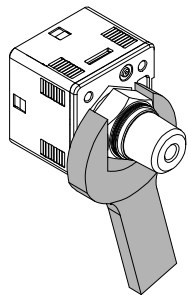


Caution

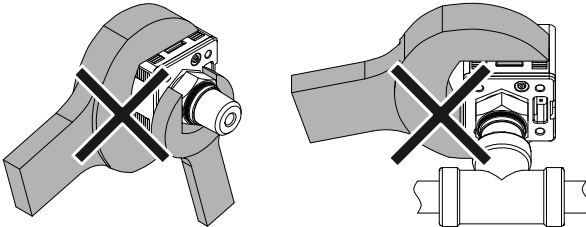
- Before piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1 thread exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

• Connection using screw type fitting

- Connect suitable piping to the port.
- To connect the hexagon socket head plug or fitting to the pressure port, hold the hexagon part of the pressure port with a suitable spanner. Apply a tightening torque of 8 to 12 N•m.



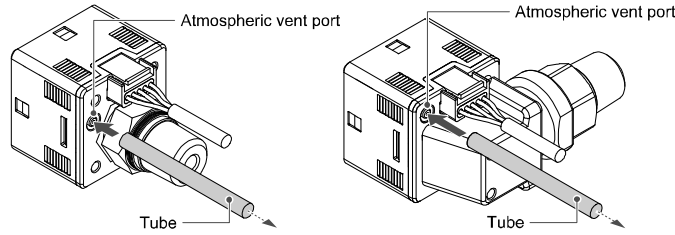
When tightening, do not hold the pressure switch body with a spanner.



4 Installation (continued)

4.3.1 Tube attachment

- When the pressure switch is used in a place where water and dust splashes may occur, insert a tube in the atmospheric vent port, and position the other end of the tube at safe position to protect the vent port from water and dust (see the figure bottom).
- *: The tube should be inserted to the end of the atmospheric vent port.
- *: SMC TU0425 (polyurethane, O.D ϕ 4, I.D ϕ 2.5) is a suitable tubing.



Direct the tube to a safe position to protect from water and dust.

4.3.2 Wiring connections

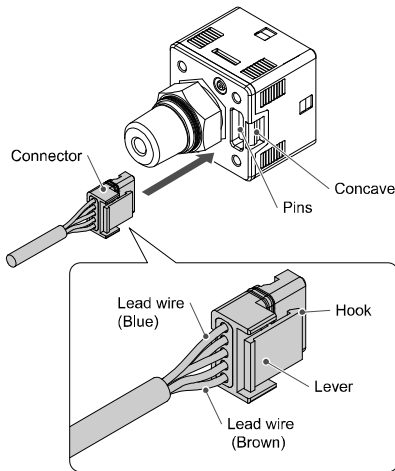
- Connections should be made with the power supply turned off.
- Use a separate route for the product wiring and any power or high voltage wiring. Otherwise, malfunction may result due to noise.
- If a commercially available switching power supply is used, be sure to ground the frame ground (FG) terminal. If the switching power supply is connected for use, switching noise will be superimposed and it will not be able to meet the product specifications. In that case, insert a noise filter such as a line noise filter/ferrite between the switching power supplies or change the switching power supply to a series power supply.

4.3.3 How to use connector

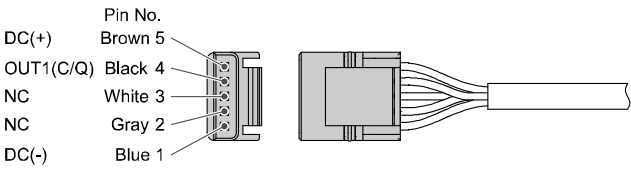
Connector attachment / detachment

- When connecting the connector, insert it straight onto the pins, holding the lever and connector body, and lock the connector by pushing the lever hook into the concave groove on the housing.
- To detach the connector, remove the hook from the groove by pressing

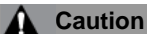
the lever downward, and pull the connector straight out.



Connector pin numbers



4.4 Lubrication



Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, use turbine oil Class 1 (no additive), ISO VG32. Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

5 Settings

Power is supplied.



The product code is displayed for approximately 3 sec. after supplying power.

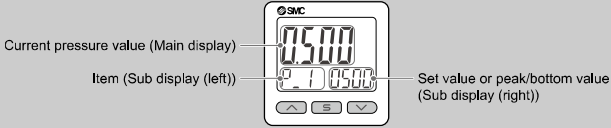
*: Within approximately 0.2 second after power-on, the switch starts.



[Measurement mode]

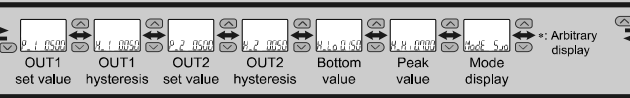
Detects the pressure after power is supplied and indicates the display and switch operating status. This is the basic mode; other modes should be selected for set-point changes and other function settings.

Measurement mode screen



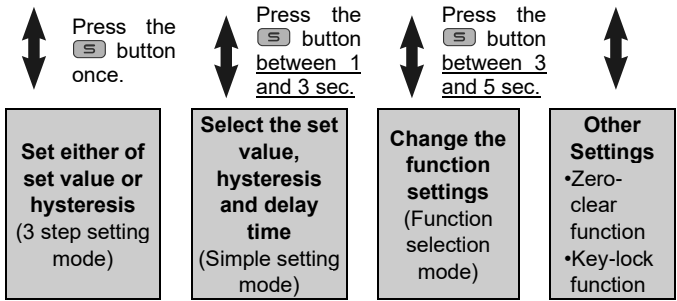
Sub display

In measurement mode, the display of the sub display can be temporarily changed by pressing the or buttons.



*: One arbitrary display mode can be added to the sub display by setting the [F10] sub display setting.

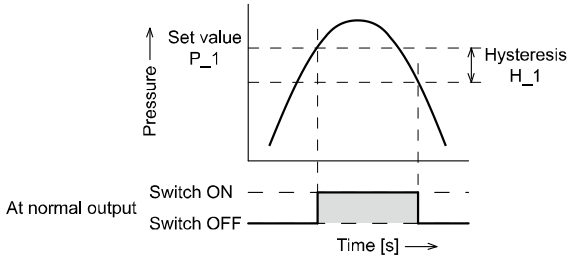
If the sub display is switched during the arbitrary display setting, the display will be returned to the arbitrary display 30 seconds later. (The default setting does not include arbitrary display.)



- *: The outputs will continue to operate during setting.
- *: If a button operation is not performed for 3 seconds during the setting, the display will flash. (This is to prevent the setting from remaining incomplete if, for instance, an operator were to leave during setting.)
- *: 3 step setting mode, simple setting mode and function selection mode settings are reflected each other.

5.1 Default Pressure setting

When the pressure exceeds the set value, the switch will turn on. When the pressure falls below the set value by the amount of hysteresis or more, the switch will turn off. The default setting is to turn on the pressure switch when the pressure reaches the center of the atmospheric pressure and upper limit of the rated pressure range. If this condition, shown to the below, is acceptable, then keep these settings.

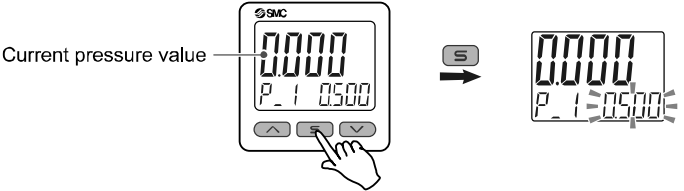


6 3 step Setting mode

[3 step setting mode (hysteresis mode)]

In the 3 step setting mode, the set value (P_1 or n_1, P_2 or n_2) and hysteresis (H_1 or H_2) can be changed. Set the items on the sub display (set value or hysteresis) with or button. When changing the set value, follow the operation below. The hysteresis setting can be changed in the same way.

(1) Press the button once when the item to be changed is displayed on the sub display. The set value on the sub display (right) will start flashing.



(2) Press the or button to change the set value. The set value can be increased with button and can be reduced with button. When the and buttons are pressed and held simultaneously for 1 second or longer, the set value is displayed as [- -], and the set value will be the same as the current pressure value automatically (snap shot function). Afterwards, it is possible to adjust the value by pressing the or button.

(3) Press the button to complete the setting. The Pressure switch turns on within a set pressure range (from P1L to P1H) during window comparator mode.

Set P1L, the lower limit of the switch operation, and P1H, the upper limit of the switch operation and WH1 (hysteresis) following the instructions given above. (When reversed output is selected, the sub display (left) shows [n1L] and [n1H].)

*: Set OUT2 in the same way. (ex. P_2, H_2)
Setting of the normal/reverse output switching and hysteresis/window comparator mode switching are performed with the function selection mode [F 1] Setting of OUT1 or [F 2] Setting of OUT2.

7 Simple Setting mode

[Simple setting mode (hysteresis mode)]

(1) Press and hold the button between 1 and 3 seconds in measurement mode. [SEt] is displayed on the main display. When the button is released while in the [SEt] display, the current pressure value is displayed on the main display, [P_1] or [n_1] is displayed on the sub display (left), and the set value is displayed on the sub display (right) (Flashing).



(2) Change the set value with or button and press the button to set the value. Then, the setting moves to hysteresis setting. (The snap shot function can be used).

(3) Change the set value with or button and press the button to set the value. Then, the setting moves to the delay time of the switch output. (The snap shot function can be used).



(4) The delay time of the switch output can be selected by pressing the or button at the ON and OFF point of the switch output.

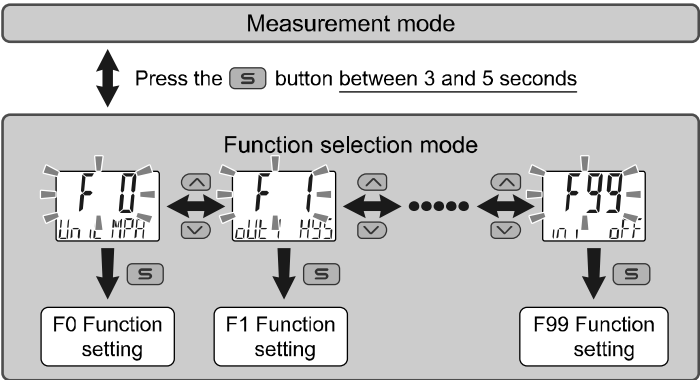
Delay time setting can prevent the output from chattering. The delay time can be set in the range 0.00 to 60.00 sec. in 0.01 sec. increments.

(5) Press the button for 2 seconds or longer to complete the setting. (If the button is pressed for less than 2 seconds, the setting will move to the OUT2 setting).

In the window comparator mode, set P1L, the lower limit of the switch operation, and P1H, the upper limit of the switch operation, WH1 (hysteresis) and dt1 (delay time) following the instructions above. (When reversed output is selected, the sub display (left) shows [n1L] and [n1H]). *: Set OUT2 in the same way.

8 Function Selection mode

In measurement mode, press the  button between 3 and 5 seconds, to display [F 0]. Select to display the function to be changed [F□□]. Press and hold the  button for 2 seconds or longer in function selection mode to return to measurement mode.



*: Some products do not have all the functions. If no function is available or selected due to configuration of other functions, [- - -] is displayed on the sub display (right).

8.1 Default Function settings

The default setting is as follows.

If no problem is caused by this setting, keep these settings.

- [F 0] Display units, switch output specifications and diagnostic information selection function.

| Units specification | Pressure range | Default setting |
|---------------------|----------------|-----------------|
| "Nil" or M | ISE20C(H) | MPa |
| | ZSE20C(F) | kPa |
| P | ISE20C(H) | psi |
| | ZSE20C(F) | |

- [F 1] Setting of OUT1

| Item | Default setting |
|------------------|--------------------------------|
| Output mode | Hysteresis mode |
| Reversed output | Normal output |
| Pressure setting | ISE20C : 0.500 MPa |
| | ZSE20C : -50.5 kPa |
| | ZSE20CF : 50.0 kPa |
| | ISE20CH : 1.000 MPa |
| Hysteresis | ISE20C : 0.050 MPa |
| | ZSE20C : 5.1 kPa |
| | ZSE20CF : 5.0 kPa |
| | ISE20CH : 0.100 MPa |
| Delay time | 1.5 msec |
| Display colour | OUT1 ON: Green / OUT1 OFF: Red |

- [F 2] Setting of OUT2 is the same setting as [F 1] OUT1.

- Other parameter settings

| Item | Default setting |
|--|---------------------|
| [F 3] Digital filter setting | 0.00 s |
| [F 4] Auto-preset function | Not used |
| [F 6] Fine adjustment of display value | 0% |
| [F10] Sub display setting | std (Standard) |
| [F11] Display resolution setting | 1000-split |
| [F14] Zero cut-off setting | 0.0 |
| [F80] Power saving mode | OFF |
| [F81] Security code | OFF |
| [F90] Setting of all functions | OFF |
| [F96] Number of pressurizing errors | - |
| [F98] Output check | N/A (normal output) |
| [F99] Reset to default settings | OFF |

9 Other Settings

- Snap shot function**

The current pressure value can be stored to the switch output ON/OFF set point.

- Peak/bottom value indication**

The maximum (minimum) pressure when the power is supplied is detected and updated.

- Zero clear function**

The displayed value can be adjusted to zero if the measured pressure is within $\pm 7\%$ F.S ($\pm 3.5\%$ F.S. for compound pressure) of the zero point

- Key-lock function**

The key-lock function is used to prevent errors occurring due to unintentional changes of the set values.

For further details refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>).

10 How to Order

Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for How to order information.

11 Outline Dimensions

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for Outline Dimensions.

12 Maintenance

12.1 General Maintenance



Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

13 Limitations of Use

13.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.



Caution

- SMC products are not intended for use as instruments for legal metrology.**
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

14 Product disposal

This product shall not be disposed of as municipal waste. Check your local regulations and guidelines to dispose of this product correctly, in order to reduce the impact on human health and the environment.

15 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor / importer.

SMC Corporation

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
SMC Corporation, 1-5-5, Kyobashi, Chuo-ku, Tokyo 104-0031, JAPAN
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