## SMC

Installation \& Maintenance Manual
Digital Pressure Switch
Series ZSE60F/ISE60

## SAFETY

The Digital Pressure Switch and this manual contain essential infor mation for the protection of users and others from possible injury and property damage and to ensure correct handling. Please check that you fully understand the definition of the following messages (signs) before going on to read the text, and always folow the instructions.

## Read this manual and follow its MESSAGES

 as WARNING, CAUTION and NOTE, will be followed by important safety information that must be carefully reviewed.| AWARNING | Indicates a potetentially hazardous situation <br> which could result in death or serious <br> injury if you do not follow instructions. |
| :---: | :--- |
| ACAUTION | Indicates a potentially hazardous situation <br> which, if not avoided, may result in minor <br> injury or moderate injury. |
| NOTE | Gives you helpful information. |

## AWARNING

Do not disassemble, modify (including change of printed circuit board) or repair.
An injury or failure can result.

## Do not operate outside of the specification range <br> Fire, mafrunction or switch damage can result.

Do not operate in atmosphere of an inflammable, an explosive or corrosive gas.
Fire, an explosion and corrosion can result.
This Pressure switch is not an explosion-proof type.

## ACAUTION

Perform proper functional checks and leak tests after maintenance.
Stop operation when an abnormality is observed such that the pres
sure switch does not work properly or there is a leakage of fluid sure switch does not work properly or there is a leakage of fluid.
Safety can not be assured due to possible unexpected malfunction Perform helium leak test for the leak testing of the digital pressure switch. (ZSE60F/ISE60 series)
Use ferrule made by Crawford Fittings (trade name: Swagelock fittings) for TSJ fittings, or packing and for URJ fittings.
Otherwise safety may not be secured due to leakage from joint. When using ferrules, packings or glands made by other manufac-
ture, be sure to perform helium leak test to verify no fure, be sure to perform helium leak test to verify no
leakage.(ZSE60F/ISE60 series)

## NOTE

ure switch. -Do not drop, bring into collision with other objects or apply excessiv shock to the unit $\left(980 \mathrm{~m} / \mathrm{s}^{2}\right.$ or more)
the lead wire. (Puling trenth less the the Pressure switch by holding ead (han 49 N )
Do not use with inflammable gas or the pressure port.
-Do not use in place which oil or chemical splashes may occur.

- In case the uniti is to be placed at a location where it is exposed to water and dust insert an air tube to the air-relieving port. (Refer to Installation)
-Connect wires and cables correctly.
-Do not perform wiring while power is on
-Do not wire with power cable or high-voltage cable in the same wire oute.
Connect Terminal FG to ground when using a switching regulato obtained on the commercial marke
(hsert a noise filter (line noise filter, ferrite element or other element) between the switching regulator and pressure switch when analog ou put is used.
- Do not press the setting buttons with a sharp pointed object.
- Warm-up for 20 to 30 minutes before detecting fine pressure.
Initial drift of about $-0.5 \%$ occurs immediately after turning the power on.


Note 1: With a unit selection function
(Without a unit selection function, fixed to SI units [kPa or MPa]

|  | ZSE60F (For compound) | ISE60 (For positive) |
| :---: | :---: | :---: |
| Fluids | Air, Non-corrosive gases, Incombustible fluid |  |
| Power Supply Voltage | 12 to 24VDC, ripple (p-p) 10\% or less |  |
| Current Consumption | 55 mA or less (No Load) |  |
| Switch Output | NPN or PNP open collector output 2 output max. load current: 80 mA max. applied voltage: $30 V D C$ (NPN output) residual voltage: 1V or less (@ 80mA load current) |  |
| Repeatability | $\pm 0.2 \%$ F.S. $\pm 1$ digit or less | $\pm 0.3 \%$ F.S. $\pm$ didigit |
| Hyste Hysteresis Mode | Variable (from zero) |  |
| resis Window Comparator Mode | Fixed (3digits) (Note4) |  |
| Response Time | 2.5 ms or less (chattering-proof function working: 24, 192, 768ms selected) |  |
| Short Circuit Protection | Provided |  |
| LED Display | 3 1/2 digits 7 -segment LED display, Sampling rate: 5 times $/ 1 \mathrm{sec}$ |  |
| Indicator Accuracy | $\pm 2 \%$ F.S. $\pm 1$ digit or less ( @ ambient temperature $25 \pm 3$ PC) |  |
| Indicator | Green LED (OUT1:Illuminate ON), Red LED (OUT2:Illuminate ON) |  |
| Analog Output (Note2) | Output Voltage: 1 to 5 V $\pm 5 \%$ F.S. or less | Output Voltage: 1 to 5 V $+2.5 \%$ F.S. or less |
| Auto shift input (Note3) | Non-Voltage input (reed or | id state), input 5 ms or more |

Note2: Applicable when voltage output is selected
Note3. Apple to 0.04 psi at psi indication
Note5: Zero reset become within $\pm 0.01$ psi at psi indication.

Outline Dimensions (in mm)
Dimensions of Pressure Switch


Mounting using mountig option
Mounting by bracket


Panel Mount Type


## SE\#\#-TFI50GB-A

## Names and Functions of Individual Part

## Pressure switch

Output (OUT1) Lamp (Green): Lit when OUT1 is ON
Output (OUT2) Lamp (Red): Lit when OUT2 is ON
LED Display: Displays a flow rate, set mode status, and error code

$\Delta$ Button (UP) $\quad$| : Selects the mode and increases a set |
| :--- |
| ON/OFF value. |

$\nabla$ Button (DOWN) : Selects the mode and decreases a set
ON/FF value.

SET Button (SET) : Changes the mode and sets a set value.


## Options

Bracket A : ZS-24-A with set screws M3 • 5 L (2pcs) Bracket D : ZS-24-D with set screws M3 - 5L (2pcs)
Panel mount adapter : ZS-24-E
(with front face protective cove)

## nstallation

## Pipin

- Use Hexagon socket head plug or fitting for connection to piping -In order to connect hexagon pressure port, apply spanner pressure port hexagon part. Apply a tightening torque of $13.6 \mathrm{~N} \cdot \mathrm{~m}$ or less.



## Air tube attachment

When the pressure switch is used in a place where water and dust splashes may occur, insert tube in the air-relieving port, and provide piping to a safe position to protect the air relieving port from water and dust. "See the figure below.

-Concerning the tube, insert it in the air-relieving port at the root. SMC TU0425 (polyurethane, O.Dø4, I.Dø2.5) suits to this product.

## Mounting

Before you mount a flow switch, read "SAFETY" and "Installation" described in this chapter carefully to obtain safe and correct measurement.
-Mount the optional bracket and panel mount adapter to the Pressure switch.
hen the Pressure switch is to be placed at a location where it is exposed to water and dust, insert an optional air tube (O.D ø4, I.D 2.5) to the air-relieving port of Pressure switch.

Refer to the air tube attaching above)

## Mounting with bracket

- Fix the bracket to the Pressure switch with the set screws M3 - 5L (2pcs) as attached.
The tightening torque of the set screws must be less than $0.98 \mathrm{~N} \cdot \mathrm{~m}$.


Installation (continued)

## Mounting with Panel mount adapter



## Options

Panel mount adapter: ZS-24-E (Panel mount adapter A and B included) (with front face protective cover)

Panel Thickness
1 to 3.2 mm

## Connection

-Make connection after turning the power of
Install the lead wire separately from the route for power cable or high votage cable.
 Be sure to ground Terminal FG when using a switching regulator obtained on the commercial market.
If the analog output is connected to a switching regulator obtained on the market, switching noise will be superimposed and product specification can no longer be met. This can be prevented by inserting the switching regulator and the pressure switch, or by using a series power supply instead of a switching regulator.

## nternal Circuit and Wiring

## Output Specification

$-22$
NPN Open Collector Output 2 Outputs
Residual voltage 1V or less Analog Output 1 to 5 V
Output Impedance : Approx. $1 \mathrm{kž}$


30
AUTO SHIFT Input
Voltage Free Contact.
NPN Open Collector Output
2 Outputs
Residual voltage 1 V or less

${ }^{-62}$ PNP Open Collector Output 2 Outputs
Max. 80 mA
Residual voltage 1 V or less
Analog Output 1 to 5 V

-70
AUTO SHIFT Input
Voltage Free Contact.
PNP Open Collector Out Outputs
Max. 80 mA
Residual voltage 1 V or less


## E\#\#-TFI50GB-A

## Setting Procedure

| Measurement Mode |
| :---: |
| $\Downarrow$ |
| Initialize |
| Set output mode and response time |
| $\Downarrow$Pressure |
| Petting <br> Input a set value for pressure to perform switch output. <br> $\Downarrow$ |
| Measurement Mode |
| Detects pressure, displays values and performs switching. Other func- <br> tions such as zero clear can also be set if necessary. |

## nitialize

Press and hold the SET button longer than two seconds. Release the SET button when [ 1 no ] is displayed and initialization can begin When the units specification of model indication is M, the SI units will be fixed. If no symbol is supplied, unit is displayed [PA]. Refe to "Selecting Indication Unit." for details.

## 1. Output Mode Setting

Two output modes are available, namely, the Reverse Output mode and Non-Reverse Output mode.
The desired output mode can be set for switch outpu
The output mode currently selected will be displayed.

1) First, the output mode for OUT1 is set.

- Press $\triangle$ button or $\nabla$ button to select
non- reverse output mode or reverse output
mode.
- Set a mode with the SET button. [1no] - Set a mode with the SET button. [1no] means non-reverse means reverse output mode.

2) Then, select non-reverse output mode or reverse output mode for Se a mith the SET butto [2miarly to OUT1.
output mode and [2nc] reverse output moda Press the SET button to move on to setting a

## 2. Response Time Setting

-The response time for switch output can be set.
-Setting of the response time prevents chattering of the output. The response time currently set will be displayed. Select the desired response time by pressing the $\Delta$ or $\nabla$ button.
[2.5] [24] [192] [768]
Press the SET button to set and to move to setting of Pressure setting mode.

## 3. Pressure setting

. Pre are two methods for pressure set-up : manual andManual auto preset, either one of which can be selected. The auto preset is provided for an automatic optimum set-up bsing a sample for when the press The operation mode currently selected is displayed. Press $\Delta$ button or $\nabla$ button to select the set-up method to be used.
[ $\mathrm{n} A \mathrm{n}$ ] [AUt]
(manual set-up) (auto preset)
By pressing the SET button, the control returns to measuring mode

## Pressure setting mode

## Manual

Manually set a set value of the pressure switch
The output method is also set in accordance with the value set manually. Set The output method is also set in accordance with the value set manuay.
$\begin{aligned} & \text { 1. Selection of OUT1 setting mode } \\ & \text { Press the SET button during the }\end{aligned} \begin{aligned} & \text { Non-reverse } \\ & \text { output mode }\end{aligned}, \quad \Rightarrow \quad \Leftrightarrow$ value Press the SET button during the output mode $\quad$ Valu $\begin{aligned} & \text { Measurement mode. }[P-1] \text { and the } \\ & \text { current set value will display }\end{aligned}$
$\begin{aligned} & \text { Reverse } \\ & \text { output mode }\end{aligned} n \_\Rightarrow$ value alternately. (When the Reverse Output mode is selected in initializa tion, $\left[\mathrm{n} \_1\right]$ and the set value will display alternately.)
. Selection of set value of [P_1]
Press the $\angle$ button to increase the set value or the $\nabla$ button to decrease the set value.
Press the SET button to set the set value and to move to the setting mode for [P_2] ([n_2] in the Reverse Output mode). [P_2] and the se value will display alternately. (When the Reverse Output mode is selected in initialization, [n_2] and the set value will be displayed alternately.)
4. Selection of set value of [P_2]

Press the $\Delta$ button to increase the set value or the $\nabla$ button to decrease the set value.
5. Set up of [P_2] and move to OUT2 setting mode

Press for OUT2 Set to set the set value and to move to the setting set value will be displayed set value as in OUT1. [P_3] or [P_4] and the is selected in initializaytion alternately. (When the Reverse Output mode played alternately.)
6. Completion of a set up

Completing settings for $\left[P_{-} 1\right]$ to $\left[P_{-} 4\right]$ ( $\left[n_{-} 1\right]$ to $\left[n \_4\right]$ in the Reverse Outpu mode) will finish pressure setting and return to the Measurement mode. of compensation value. Refer to the section of Auto shift function.

## Auto Preset Setting

When auto preset is selected in Initialize, this function stores in the memor a measurement pressure as a reference value. The set value of switch is automatically set to an optimum value by repeating absorption and non-

1. Selection of OUT1 auto preset mode

Press the SET button to set pressure setting for OUT1 to auto preset. Display will switch to [API]. (When OUT1 setting is not necessary, pres $\triangle$ button and $\nabla$ button simultaneously.)
2. Preparation of unit for OUT1

Prepare a unit for which pressure for OUT1 is to be set.
3. Selection of [A1L] and pressure setting

When the SET button is pressed, [A1L] will flash. Operate the system so that the pressure changes.
4. Set up of OUT1 auto preset value and move to OUT2 auto preset mode When the SET button is pressed, the pressure is automatically read and set for $\left[P \_1\right],\left[\mathrm{P} \_2\right]$ ( $[\mathrm{n}-1],\left[\mathrm{n} \_2\right]$ in Reverse mode).
Display will switch to [AP2]. (When OUT2 setting is not necessary
press and button and simultaneously)
5. Preparation of unit for OUT2 and pressure setting

Prepare a unit for which pressure for OUT2 is to be set. Set the set value of OUT2 as in OUT1. [A2L] will flash.
6. Set up of OUT2 auto preset value

Press the SET button to set the set value of $\left[P \_33,\left[P \_4\right]\right.$ ([n_3],[n_4] in Reverse mode), and auto preset mode is finished. The mode will return to the Measurement mode.
A pressure setting value in auto preset is as follows in non-reverse output mode with OUT1. (P 1,2 is $n$ preset is as follows in non-reverse output $\mathrm{P}-1=\mathrm{A}-(\overline{\mathrm{A}}-\mathrm{B}) / 4 \quad \mathrm{~A}=$ maximum pressure value
$\left.\mathrm{P}_{2}=\mathrm{B}=\mathrm{B}+\mathrm{A}-\mathrm{B}\right) / 4 \quad \mathrm{~B}=$ minimum pressure value
For OUT2 set-up, above $\mathrm{P}_{-} 1,2$ and $\mathrm{m}_{-} 1,2$ become $\mathrm{P}_{-} 3,4$ and $n \_3,4$ respectively.

## Output Method

-Four output methods can be selected by selecting an output mode and by combining large and small set values of OUT1 and OUT2. One of these four output methods can be selected for each output.
OUT1 and OUT2 can be set independently.
One-digit flow rate conversion will be a minimum set unit. See the
specification for the minimum set units.
-When setting in the Auto Presetting mode, the Hysteresis mode will be set automatically.
In the Window Comparator mode, leave between [P_1] and [P_2] or between $\left[\mathrm{n} \_1\right]$ and $\left[\mathrm{n} \_2\right]$ a span of more than seven digits. Hysteresi in this case will be three digits fixed.
OUT2 are the same as those for OUT1, under the conditions that [ $n$ - 1 ] and [ $n \_2$ ] should be replaced by $\left[\mathrm{n} \_3\right]$ and $\left[\mathrm{n} \_4\right]$ and $\left[\mathrm{P} \_1\right]$ and $\left[\mathrm{P} \_2\right]$ should be replaced by [P_3] and [P_4].

## Selecting Indication Unit <br> If the unit specification of the model indication is

## The indicatio

Pressing the or be selected freely. the unit and will auto-
matically convert set values
The units will change in the following order
PA GF bAr PSi inH mmH
For Compound Pressure
For Positive Pressure
Press the SET button to set and to move on to Output mode setting.


## Other Functions

## Auto shift function

When the source pressure fluctuates too much, the pressure switch may not be able to operate normally. Auto shift is provided to compensate for the fluctuation of the source pressure
While measured pressure becomes the standard pressure value when auto shift input is received, this function corrects the set value ${ }^{[ } \mathrm{P}_{-}$- $]$or $\left[\mathrm{n}_{-} 1\right.$ ] and [ $\mathrm{P}_{-2}$ 2] or [ $\mathrm{n}-2$ ] of switch OUT 1, and the set value [P_3] or [n_3] and [P_4] or [n_4] of switch OUT 2 .

## With Auto Shift

Set auto shift input as Lo at the time the pressure source changes, in order to memorize the pressure change and to correct the pres sure set value, so that a correct decision emerges.


## Conditions and explanations for auto shift function

 -Keep constant pressure for 5 ms or more from the close signal of auto shift input.-At auto shift input, display indicates [000] for approx. 1 sec . Pressure value at that time is memorized as corrected value [C_5]. - With corrected value which is memorized, set value [P_1] to [P_4] or [n_1] to [ $n=4]$ are compensated.
-The span is 10 ms or less until the switch output operates after auto shift input.
When the corrected set value exceeds the accepted set range with auto shift input, the corrected value is not memorized. When xceeding the high limit the display indicates [UUU], and when exceeding the low limit the display indicates [LLL].
-When completing the pressure setting of OUT2, the corrected value and [C_5] will be displayed alternately.
Press the SET button to set and return to Measurement mode. -The Corrected value [C_5] after auto shift input setting, will be lost if the power is dis-connected, and is reset to zero (Initial value) when the power is re-supplied.

Note: There is No EEprom in the memory for the corrected value

Using with auto shift input, accepted set range is as follows:-

|  | Set pressure range | Accepted set range |
| :---: | :---: | :---: |
| For compound | -100.0 to 100.0 kPa | -100.0 to 100.0 kPa |
| For positive | -0.1 to 1.000 MPa | -1.000 to 1.000 MPa |

## ther Functions (continue)

## Peak and Bottom Hold Display Function

Maximum and minimum values are always detected and updated during measurement. Displayed values can be held. For peak hold, Press and hold the button for longer than one second to hold the maximum pressure value. The display will flash.
To reset holding, press and hold the $\Delta$ button for more than one second. The display will return to measurement mode. For bottom hold, Press and hold the $\nabla$ button for longer than one second to hold the minimum pressure value. The display will flash. To reset holding, press and hold the $\nabla$ button for more than one second. The display will return to measuremen
lock Function
This function prevents errors such as changing a set value by mis
take.
-Press and hold the SET button longer than four seconds,
Release the button when [UnL] is displayed.
Press the $\Delta$ button to set the display to [LoC
-Press the SET button to return to the Measurement mode.
-Press and hold the SET button longer than four seconds.
10 L
Release the button when [LOC] is displayed
-Press the $\Delta$ button to change the display to [unL]
-Press the SET button to return to the Measurement mode.

## Zero Clear Function

The displayed value can be adjusted to zero when pressure to be measured is within - 70 digits of the atmospheric pressure.
This function is useful because it enables the detection of pressure fluctuations larger than a certain value without being influenced by lluctuations of source pressure. Press and hold the $\Delta$ and $\nabla$ but , and retur
to Measurement mode automatically.
Error Display Function
This function displays error location and nature when a problem or

| Error name | splay oferor | Contents | Disposition |
| :---: | :---: | :---: | :---: |
|  | Eri | Over 80 mA load current is flowing to the switch output. | Turn the power off and remove the cause o the over-current, Then turn the power on. |
| Residual pressure error | Er] | Performing zero reset, the following pressure applied to ambient pressure. $[\text { ISE50/60: Over }-0.071 \mathrm{MPa}]$ <br> *After 3 sec., measurement mode | After changing the applied pressure into ambient pressure, re-perform zero reset. $\qquad$ |
| $\begin{aligned} & \text { Applied } \\ & \text { pressure } \\ & \text { error } \end{aligned}$ |  | Pressure outside of high limit or set pressure range is applied. | Reset applied pressure into within set pressure range |
|  |  | Pressure outside of low limit of set pressure range is applied. |  |
| $\begin{array}{\|l\|l\|} \text { Auto } \\ \text { shift } \\ \text { error } \end{array}$ | 18181 | Corrected set value exceeds high limit of the accepted set rang. *After 1 sec., measurement matically. | Re-set up the pressure set value so that the corrected set value which added the measuremen pressure value with auto set value does not exceed the accepted set range. |
|  | 1 | Corrected set value exceeds low limit of the accepted set range. *After 1 sec., measurement mode recovers automatically. |  |
| System error | Er | Internal data error causes this display. | Turn off the power, and turn on again. If resetting fails, an investigation bySMC is required required. |
|  | Erb | Internal data error causes this display. |  |
|  | Er 1 | Internal data error causes this display. |  |
|  | Erg | Internal data error causes this display. |  |

