Digital Flow Switch

Operation Manual

PF3W7

Thank you for purchasing an SMC PF3W7 Series Digital Flow Switch.
Please read this manual carefully before operating the product and make sure you understand its capabilities and limitations.
Please keep this manual handy for future reference.

To obtain more detailed information about operating this product, please refer to the SMC website (URL http://www.smcworld.com) or contact SMC directly.

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) and other safety regulations.

⚠ **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.

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 with flammable or highly permeable fluids.
Fire, explosion, damage or corrosion can result.

■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 operation.
Otherwise 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 befor performing maintenance.
Otherwise 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.

■Do not touch the piping or its connected parts when the fluid is at high temperature.
This can cause burns.
Ensure the piping cools sufficiently before touching.

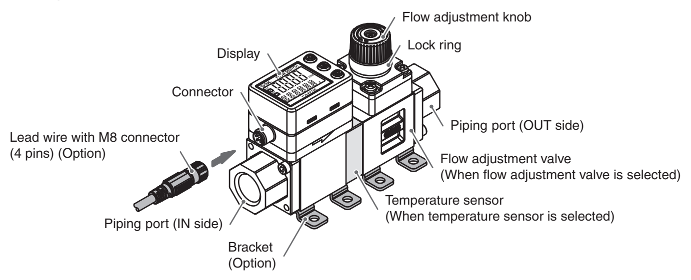
■After maintenance is complete, perform appropriate functional inspections and leak tests.
Stop operation if the equipment does not function properly or there is a leakage of fluid.
When leakage occurs from parts other than the piping, the product might be faulty.
Disconnect the power supply and stop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

■NOTE

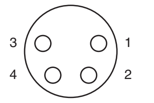
- The direct current power supply to be used should be UL approved as follows. Circuit (of class 2) which is of maximum 30 Vrms (42.4 V peak), with UL 1310 class 2 power supply unit or UL 1585 class 2 transformer.
- The product is a ⓊⓁ approved product only if it has a ⓊⓁ mark on the body.

Summary of Product parts

Body



Flow adjustment knob
Lock ring
Display
Connector
Lead wire with M8 connector
(4 pins) (Option)
Piping port (OUT side)
Flow adjustment valve
(When flow adjustment valve is selected)
Temperature sensor
(When temperature sensor is selected)
Piping port (IN side)
Bracket
(Option)

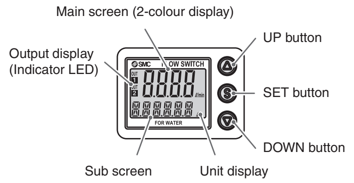


Pin number of the connector at the body side

1	DC(+)
2	OUT2
3	DC(-)
4	OUT1

Element	Description
Connector	Connector for electrical connections.
Lead wire with M8 connector	Lead wire to supply power and transmit output signals.
Piping port	Port to connect the fluid inlet at IN and fluid outlet at OUT.
Bracket	Bracket for mounting the product.
Temperature sensor	Sensor for detecting the fluid temperature.
Flow adjustment valve	Restricting valve to adjust the flow rate.
Flow adjustment knob	Knob for adjusting the flow rate.
Lock ring	Ring for locking the flow adjustment valve.
Display	Refer to the below.

Display



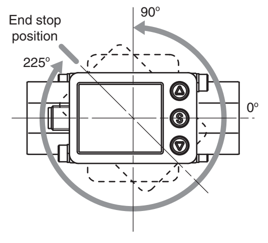
Element	Description
Main screen (2-colour display)	Displays the flow, the status of setting mode and error indication.
Sub screen	Displays the accumulated flow, set value, peak/bottom value, fluid temperature and line names.
Output display (Indicator LED)	Displays the output status of OUT1 and OUT2. When ON: Orange LED turns on.
Unit display	Displays the unit selected.
UP button	Selects a mode and the display shown at the sub screen, and increases the ON/OFF set values.
SET button	Press this button to select mode and to confirm a set value.
DOWN button	Selects a mode and the display shown at the sub screen, and decreases the ON/OFF set values.

Mounting and Installation

Refer to the product catalogue or SMC website (URL http://www.smcworld.com) for more detailed information.

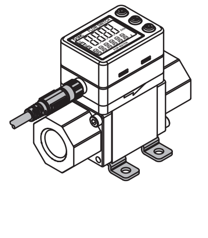
Installation
•Use the product within the specified operating pressure range and temperature range.
•Proof pressure could vary according to the fluid temperature.
Check the characteristics data for operating pressure and proof pressure.

Mounting
•Never mount the product in a location where it will be used as a support.
•Mount the product so that the fluid flows in the direction indicated by the arrow on the side of the body.
•Check the flow characteristics data for pressure loss and the straight inlet pipe length effect on accuracy, to determine inlet piping requirements.
•Do not sharply reduce the piping size.
•The monitor with integrated display can be rotated. It can be set at 90° intervals clockwise and anticlockwise, and also at 45° and 225°. Rotating the display with excessive force will damage the end stop.



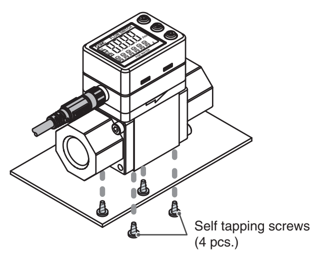
■Installation

Bracket mounting (PF3W704/720/740)
Mount the product (with bracket) using the mounting screws supplied (M4 x 4 pcs.).
For models with flow adjustment valve attached, fix using 8 mounting screws.
Bracket thickness is approx. 1.5 mm.



Bracket mounting (PF3W711)
Mount the product (with bracket) using the mounting screws supplied (M5 x 4 pcs.).
Bracket thickness is approx. 2 mm.

Direct mounting (PF3W704/720/740)
Mount using the self tapping screws (nominal size: 3.0 x 4 pcs.) for installation.
For models with flow adjustment valve attached, mount using 8 self tapping screws.
The tightening torque must be 0.5 to 0.7 Nm.



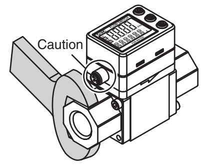
Direct mounting (PF3W711)
Mount using the self tapping screws (nominal size: 4.0 x 4 pcs.) for installation.
The tightening torque must be 1 to 1.2 Nm.

The self tapping screws cannot be re-used.

Refer to the outline dimension drawing for mounting hole size.
Refer to the product catalogue or SMC website (URL http://www.smcworld.com) for more detailed information.

■Piping

When connecting piping to the product, a spanner should be used on the metal piping attachment only.
Using a spanner on other parts may damage the product.
In particular, do not let the spanner come into contact with the M8 connector.
The connector can be easily damaged.



Width across flats of attachment

3/8	24 mm
1/2	27 mm
3/4	32 mm
1	41 mm
1 1/4	54 mm
1 1/2	54 mm

Tighten to the specified torque for piping.
The tightening torque for connection threads is shown in the table below.

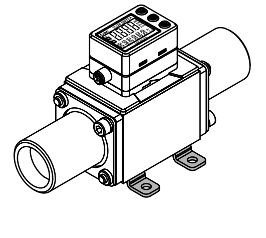
Nominal thread size	Tightening torque
Rc(NPT)3/8	22 to 24 Nm
Rc(NPT)1/2	28 to 30 Nm
Rc(NPT)3/4	28 to 30 Nm
Rc(NPT)1	36 to 38 Nm
Rc(NPT)1 1/4	40 to 42 Nm
Rc(NPT)1 1/2	48 to 50 Nm

If the tightening torque is exceeded, the product can be broken. If the correct tightening torque is not applied, the fittings may become loose.

Avoid any sealing tape getting inside the piping.
Ensure there is no leakage from loose piping.

⚠ Caution

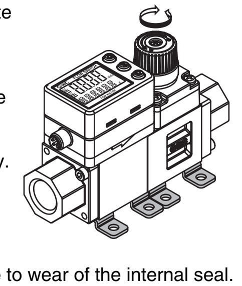
Vinyl chloride piping
•Mounting and joining of the vinyl chloride fitting (union)
The vinyl chloride fitting (union) must be mounted and joined by an engineer with sufficient knowledge. Be sure to confirm that there is no leakage from the fitting after mounting and joining. If it is mounted and joined by a person who does not have sufficient knowledge and skills, it may lead to failure such as leakage.



•When selecting adhesive for the vinyl chloride fitting (union), confirm that its heat resistance and endurance are compatible with the operating temperature of the fluids used.
Otherwise, this may cause leakage and damage.

■How to adjust the flow rate (when a flow adjustment valve is mounted)

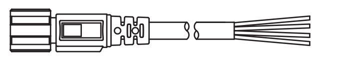
(1) Rotate the knob of the valve to adjust the flow rate to the target value.
(2) Be sure to confirm that there is no fluid leakage generated after adjustment.
(When fluid leakage is generated, open and close the valve several times for re-adjustment, and confirm that there is no fluid leakage.)
(3) Tighten the lock ring to fix the valve as necessary.

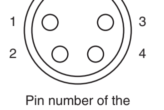


The flow adjustment valve is not designed for applications that require daily and repetitive adjustment.
If the valve is adjusted frequently, fluid may leak due to wear of the internal seal.

■Wiring

Wiring of connector
Connections should only be made with the power supply turned off.
Use separate routes for the Flow 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.





Pin number of the connector at the cable side

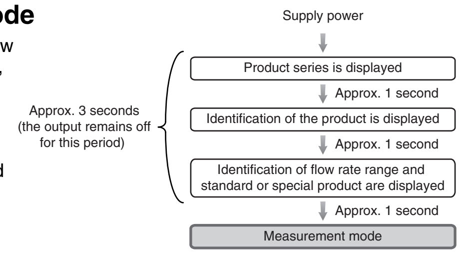
1	DC(+): Brown
2	OUT2: White
3	DC(-): Blue
4	OUT1: Black

*: When using the lead wire with M8 connector included with the PF3W7 series.

Flow (Temperature) Setting

■Measurement mode

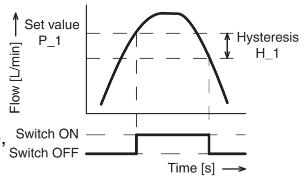
The mode in which the flow is detected and displayed, and the switch function is operating.
This is the basic operating mode; other modes should be selected for set-point and other function setting changes.



Supply power
Product series is displayed
Approx. 1 second
Identification of the product is displayed
Approx. 1 second
Identification of flow rate range and standard or special product are displayed
Approx. 1 second
Measurement mode
Approx. 3 seconds
(the output remains off
for this period)

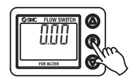
Setting the ON and OFF points of the switch output.

Switch operation
When the flow exceeds the set value, the switch will be turned ON.
When the flow falls below the set value by the amount of hysteresis or more, the switch will be turned OFF.
If the operation shown the right is acceptable, please keep this setting.

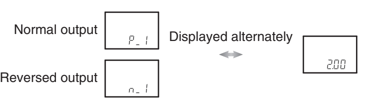


<Operation>

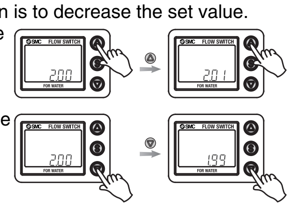
1. Press the Ⓢ button in measurement mode to display set values.



2. [P_1] or [n_1] and the set value are displayed alternately.



3. Press the Ⓐ or Ⓥ button to change the set value.
The Ⓐ button is to increase and the Ⓥ button is to decrease the set value.
•Press the Ⓐ button once to increase by one digit, press and hold to continuously increase.
•Press the Ⓥ button once to decrease by one digit, press and hold to continuously decrease.



4. Press the Ⓢ button to finish the setting.

The switch turns on within a set flow range (from P1L to P1H) during window comparator mode. Set P1L (switch lower limit) and P1H (switch upper limit) using the setting procedure above.
When reversed output is selected, the main screen displays [n1L] and [n1H].

To set accumulated output functions, refer to the product catalogue or SMC website (URL http://www.smcworld.com) for more detailed information.

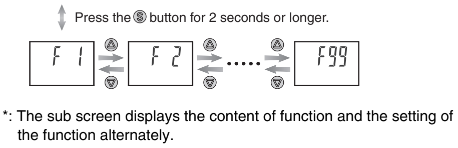
For models with 2 outputs, [P_2] or [n_2] will be displayed. Set as above.

For models with the temperature sensor attached, [tn] will be displayed.
When the fluid temperature falls below the set value, the output turns ON.
*: If a button operation is not performed for 30 seconds during the change of setting, the set value will start flashing.

Setting of Functions

■Function selection mode

In measurement mode, when the Ⓢ button is pressed for 2 seconds or longer, [F 1] is displayed.
This [F□□] indicates the mode for changing each functional setting.
Press the Ⓢ button for 2 seconds or longer to return to measurement mode.



*: The sub screen displays the content of function and the setting of the function alternately.

The function number is increased and decreased by the Ⓐ and Ⓥ buttons.
Display the required function number and press the Ⓢ button.

■Default settings

The default settings are provided as follows. If these settings are acceptable, retain for use. To change setting, refer to SMC website (URL http://www.smcworld.com) for more detailed information or contact us.

●[F 1] Setting of OUT1

Item	Content	Default setting
Output mode	Selects the switch output type from: Instantaneous flow (either hysteresis or window comparator mode), accumulated flow or accumulated pulse.	Hysteresis mode
Reversed output	Selects which type of switch output is used, normal or reverse.	Normal output
Set value	Sets the ON or OFF point of the switch output.	50% of rated flow
Hysteresis	Setting of hysteresis can prevent chattering.	5% of rated flow
Display colour	The display colour of the main screen can be selected.	Output ON: Green Output OFF: Red

●[F 2] Setting of OUT2

Item	Content	Default setting
Output mode	Selects the switch output type from: Instantaneous flow (either hysteresis or window comparator mode), accumulated flow or accumulated pulse.	Hysteresis mode
Reversed output	Selects which type of switch output is used, normal or reverse.	Normal output
Set value	Sets the ON or OFF point of the switch output.	50% of rated flow
Hysteresis	Setting of hysteresis can prevent chattering.	5% of rated flow

*: Display colour is linked to the setting of OUT1, and can not be selected.

•With the temperature sensor

Item	Content	Default setting
Output mode	Selects the switch output type for fluid temperature from either hysteresis or window comparator mode.	Hysteresis mode
Reversed output	Selects which type of switch output is used, normal or reverse.	Reversed output
Set value	Sets the ON or OFF point of the switch output.	50 °C
Hysteresis	Setting of hysteresis can prevent chattering.	5 °C

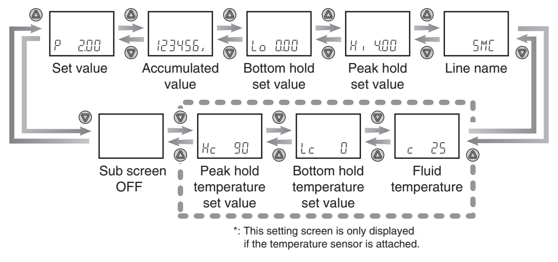
●Other parameter settings

Item	Default setting / With the temperature sensor in parenthesis
[F 3] Response time setting	1 second
[F10] Selection of sub screen	Display of set value (Display of fluid temperature)
[F20] Setting of external input	Accumulated flow external reset
[F22] Setting of analogue output	Free range analogue output for instantaneous flow: OFF * (Analogue output for fluid temperature)
[F30] Storing of accumulated flow	OFF [not held]
[F80] Setting of power saving mode	No setting [display is turned on]
[F81] Setting of security code	OFF
[F82] Input of line name	No name [******]
[F90] Setting of all functions	OFF
[F98] Output check	OFF
[F99] Reset to the default settings	OFF

*: When the temperature sensor is attached, the free range analogue output function for fluid temperature is not available.

■Display of sub screen

In measurement mode, the display of the sub screen can be temporarily changed by pressing the Ⓐ or Ⓥ buttons.
*: After 30 seconds, it will automatically reset to the display selected in [F10].



Set value
Accumulated
value
Bottom hold
set value
Peak hold
set value
Line name
Sub screen
OFF
Peak hold
temperature
set value
Bottom hold
temperature
set value
Fluid
temperature
*: This setting screen is only displayed
if the temperature sensor is attached.

The set values and accumulated output of OUT2 cannot be displayed.
(Example for 4 L/min type the above)

Other Settings

○**Key-lock function**
To set this function, refer to SMC website (URL http://www.smcworld.com) for more detailed information or contact us.

Maintenance

How to reset the product after a power cut or when the power has been unexpectedly removed
The settings of the product are retained from before the power cut or de-energizing.
The output condition also recovers to that before the power cut or de-energizing, but may change depending on the operating environment.
Therefore, check the safety of the whole system before operating the product.

Specification

Refer to the product catalogue or SMC website (URL http://www.smcworld.com) for more detailed information about product specifications.

Dimensions

Refer to the product catalogue or SMC website (URL http://www.smcworld.com) for more detailed information about dimensions.

Troubleshooting

■Error indication

Error Name	Display	Content	Remedy
OUT1 over current error	Er 1	A load current of 80 mA or more is flowing to the switch output (OUT1).	Turn the power off and remove the cause of the over current. Then turn the power on again.
OUT2 over current error	Er 2	A load current of 80 mA or more is flowing to the switch output (OUT2).	
Excessive instantaneous flow	HHH	The applied flow rate is above approx. 140% of the rated flow rate.	Reset applied flow to a level within the display range.
Excessive accumulated flow	999999 / 999 (Displayed alternately)	The accumulated flow range is exceeded. (In some flow ranges, the decimal point may flash.)	Clear the accumulated flow once. (This will not be a problem if the accumulated flow is not used.)
Temperature upper limit exceeded	cHHH	The fluid temperature is above 110 °C.	Reduce the fluid temperature.
Temperature lower limit exceeded	cLLL	The fluid temperature is below -10 °C.	Rise the fluid temperature.
System error	Er 0 Er 4 Er 6 Er 8	Displayed in the case of an internal data error.	Turn the power off and turn it on again. If the failure cannot be solved, contact SMC for repair.
Temperature sensor failure	Er 12	The temperature sensor is damaged.	

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

Refer to the SMC website (URL http://www.smcworld.com) for more detailed information about product troubleshooting.

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