No.DOC1066729

Operation Manual

PRODUCT NAME

Clamp-on Type Flow sensor

MODEL / Series / Product Number

PFUW7#

SMC Corporation

Table of Contents

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: Robots and robotic devices - Safety requirements for industrial robots - Part 1:Robots
etc.

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

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

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

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

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

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

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

4. SMC products cannot be used beyond their specifications. They are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not allowed.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, combustion equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.

Safety Instructions

⚠ Caution

SMC develops, designs, and manufactures products to be used for automatic control equipment, and provides them for peaceful use in manufacturing industries.
Use in non-manufacturing industries is not allowed.
Products SMC manufactures and sells cannot be used for the purpose of transactions or certification specified in the Measurement Act of each country.
The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

Limited warranty and Disclaimer

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

***2) Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

Compliance Requirements

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

■About operators

(1) This Operation Manual is intended for those who have knowledge and experience of machinery using pneumatic equipment, and have sufficient knowledge and experience of assembly, operation and maintenance of such equipment.
Only those persons are allowed to perform assembly, operation and maintenance.
(2) Read and understand this Operation Manual carefully before assembling, operating or providing maintenance to the product.

■Safety Instructions

⚠Warning

■Do not disassemble, modify (including replacing the circuit board) or repair.
Otherwise, an injury or failure can result.

■Do not use the product outside of the specifications.
Fire, malfunction, or damage to the product may result.
Check the specifications before use.

■Do not use in an environment where flammable, explosive or corrosive gases are present.
Fire or an explosion may result.
The product is not designed to be explosion proof.

■Do not use the product in a place where static electricity is a problem.
Otherwise failure or malfunction of the system can result.

■If using the product in an interlocking circuit:
•Provide a double interlocking system, for example a mechanical system.
•Check the product 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 fluid supply and then conduct maintenance.
Otherwise an injury can result.

⚠Caution

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

■Do not touch a metallic part of the product or piping when hot fluid is used.
Otherwise, this can cause burns.
Check that the piping is cooled down before touching it.

■After maintenance is complete, perform appropriate functional inspections and a leak test.
Stop operation if the equipment does not function correctly or there is leakage of fluid.
When leakage occurs from parts other than the piping, the product might be faulty.
Cut off the power supply and stop the fluid supply.
Do not apply fluid if the system is leaking.
Otherwise, an unexpected malfunction may occur and safety cannot be assured.

■Precautions for Handling

○Follow the instructions given below for the selection and handling of the product.

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

∗Product specifications

•For the combined DC power supply, use the followingUL-certified products: .
Circuit (class 2) with maximum 30 Vrms (42.4 V peak) or less, which uses a class 2 power supply unit in accordance with UL1310 or class 2 transformer in accordance with UL 1585 as the power supply

•The product is a UL-certified product only if it has a c UL us mark on the product body or name plate.

•Use the product at the specified voltage。
If used at a voltage other than the specified voltage, there is a risk of failure or malfunction。
Insufficient supply voltage may not drive the load due to the voltage drop inside the product.
Check the operating voltage of the load before use.

•Do not use a load that exceeds the maximum load voltage and current.
Doing so may damage the product or shorten its lifespan.

•Data stored by the product will not be deleted, even if the power supply is turned off. (Number of rewrites: 1,000,000 times maximum).

•Do not touch the piping or product part when the fluid is at high temperature.
It may lead to burnt.

•Be sure to operate the product within the specified operating temperature range.

•Reserve a space for maintenance.
Design the system to allow the required space for maintenance.

∗Notes on the measured fluid

•When using high viscosity, high turbidity, foaming liquids, or slurry liquids, conduct a preliminary check because the liquid will affect the reliability of the detection. Check in advance before use.

•When the fluid temperature increases or the fluid pressure drops, bubbles may be generated in the fluid which may affect the detection reliability.

●Product Handling

∗Mounting

•If a commercially available switching power supply is used, be sure to ground the frame ground (FG) terminal.

•Do not use where the product is subjected to vibration or impact.

Otherwise damage to the internal components may result, causing malfunction.

•Do not pull the lead wire forcefully, or lift the product by the lead wire.

The product will be damaged, leading to failure and malfunction.

•Refer to the flow direction of the fluid indicated on the product label for installation and piping.

However, it is possible to change the direction of fluid flow even when mounted in the opposite direction.

Hold the product body when handling.

The product will be damaged, leading to failure and malfunction.

•Mounting with the display facing upwards or downwards is not recommended.

Mounting facing upwards is susceptible to air bubbles, which may affect the measurement.

(This is not a problem if the flow path is completely full of water.)

Note that downward mounting may cause premature damage due to water dripping.

•When mounting the product vertically, fluid must flow from the bottom to the top.

Otherwise, accurate measurement may not be possible due to trapped air bubbles.

(There should not be a problem as long as the fluid passage is completely filled with fluid.)

•Never mount the product in a place that will be used as a foothold during piping.

The product may be damaged if excessive force is applied by stepping or climbing onto it.

•Design and install the product so that liquid always fills the detection passage.

If the fluid contains air bubbles, check the degree of influence before use.

•Install the product on a surface free from seams (trace of welding) or rust. Presence of seam or rust may affect the reliability of detection.

On the other hand, avoid installing the product to a location with damage such as dents.

•Tighten to the specified tightening torque.

If the tightening torque exceeds the specified tightening torque range, the mounting screws, brackets, product, etc. may be damaged.

On the other hand, tightening to a torque below the tightening torque range may allow the product mounting position to be displaced, which may change the accuracy.

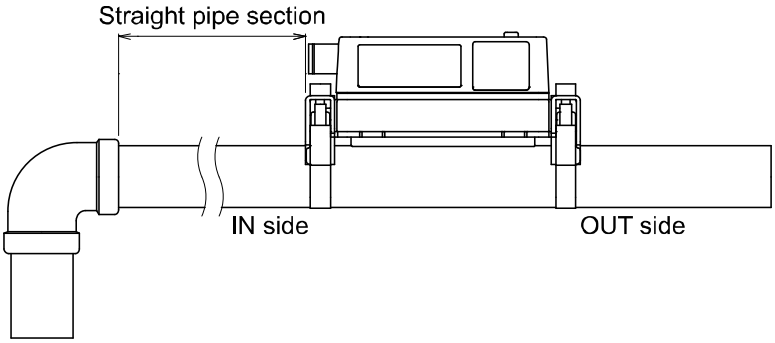
(Refer to Mounting and Installation (page 19).)

•Do not install multiple products close to each other in series. Otherwise, detection signal interference may affect the reliability of detection.

•If the display accuracy is acceptable within ±5% F.S., a straight tube section is not required.

∗: Results obtained in our facilities. Results may differ under other conditions.

∗: Straight pipe section means no bending pipes or sudden changes in pipe cross-sectional area.



∗Wiring (Including connecting/disconnecting of the connectors)

•Do not pull hard on the lead wire.

Especially never lift the product equipped with fitting and piping by holding the lead wires.
Otherwise damage to the internal components may result, causing malfunction or connectors dropping off.

•Avoid repeatedly bending, stretching or applying a heavy object to the lead wire.

Repetitive bending stress or tensile stress can cause the sheath of the wire to peel off, or breakage of the wire.
If the lead wire can move, fix it near the product.
The recommended bend radius of the lead wire is 6 times the outside diameter of the sheath, or 33 times the outside diameter of the insulation material, whichever is larger.
Replace the damaged lead wire with a new one.

•Wire correctly.

Incorrect wiring may cause malfunction or damage to the product.

•Do not perform wiring while the power is on.

Otherwise damage to the internal components may result, causing malfunction.

•Do not route wires and cables together with power or high voltage cables.

Route the wires of the product separately from power or high voltage cables to prevent noise and surge of signal lines from entering the product.

•Confirm correct insulation of wiring.

Poor insulation (interference with other circuits, poor insulation between terminals, etc.) can apply excessive voltage or current to the product causing damage.

•Keep wiring as short as possible to prevent interference from noise and surge voltage.

Do not use a cable longer than 20 m.
Wire the DC(–) line (blue) as close as possible to the power supply.

•When the analogue output is used, install a noise filter (line noise filter, ferrite element, etc.) between the switch-mode power supply and the product.

∗Operating environment

•Do not use the product in an environment where the product is constantly exposed to water splashes.
Otherwise failure or malfunction can result. Take measures such as use of a cover.

•Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.
These may cause failure or malfunction.

•Do not use in an area where electrical surges are generated.
When there are machines or equipment that generate large surges near the product (magnetic type lifter, high frequency inductive furnace, motor, etc.), this can result in deterioration and damage of the internal circuit elements. Take protective measures to isolate the surge sources and prevent the lines from coming into close contact.

•Do not use a load which generates a surge voltage.
When a surge-generating load such as a relay or solenoid is driven directly, use a load with a built-in surge suppressor.

•The product is CE/UKCA marked but is not immune to lightning strikes. Take measures against lightning strikes in the system.

•Mount the product in a location that is not affected by vibration or impact.
Otherwise, a failure or malfunction may be caused.

•Do not use the product in the presence of a magnetic field.
Otherwise, a malfunction of the product may be caused.

•Do not use the product in an environment that is exposed to temperature cycles.
Temperature cycles other than ordinary changes in temperature can adversely affect the internal components of the product.

•Do not expose the product to direct sunlight.
If using in a location directly exposed to sunlight, shade the product from the sunlight.
Otherwise, a malfunction may be caused.

•Keep within the specified temperature range.
If the temperature of the fluid is lower than the ambient temperature, condensation will be generated which may damage the product or cause malfunction.
Protection against freezing is necessary.
Avoid abrupt temperature changes even within the specified temperature range. Otherwise it can cause damage or malfunction.

•Do not operate close to a heat source, or in a location exposed to radiant heat.
Otherwise malfunction can result.

•Do not install multiple pieces of the product close to each other.
Otherwise, the temperature of the product may rise, resulting in a failure or malfunction.

∗Adjustment and operation

•Connect the load before turning the power supply on.

•Do not short-circuit the load.

•Do not press the setting buttons with a sharp pointed object.
This may damage the setting buttons.

•Supply power under no flow conditions.

•The output from the product is forcefully turned off for 3 seconds after the power is supplied.

•Perform settings suitable for the operating conditions.
Incorrect setting can cause operation failure.

•At the time of initial setting and flow rate setting, the product will switch the measurement output according to the condition before setting.
Check the influence on the product, and then configure the setting.
The control system should be turned off as necessary before setting.

•Do not touch the LCD during operation.
The display can vary due to static electricity.

∗Maintenance

•Perform regular maintenance and inspections.
There is a risk of unexpected failure of components due to the malfunction of equipment and machinery.

•Before performing maintenance or inspection, confirm the safety by turning off the power supply and stopping the flow of fluid.
There is a risk of unintended malfunction of equipment.

•Do not use solvents such as benzene, thinner, etc. to clean the product.
This may damage the surface of the body or erase the markings on the body.
Use a soft cloth to remove stains.
For heavy stains, use a damp cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

Model Indication and How to Order

PFUW7 [60] – [L1] [ ] – [ ] [ ]

Rated flow range

Model	Rated flow range	Piping diameter	
		A Type	B Type
60	0 to 60 L/min	15 A	1/2B
11	0 to 100 L/min	20 A	3/4B

Output specifications

Model	OUT1	OUT2
L1	IO-Link/NPN/PNP	–
L2	IO-Link/NPN/PNP	NPN/PNP/External input
L3	IO-Link/NPN/PNP	Analogue output (1 to 5 V ⇔ 0 to 10 V) *1
L4	IO-Link/NPN/PNP	Analogue output (4 to 20 mA)

*1: 1 to 5 V or 0 to 10 V can be selected by pressing the buttons. The default setting is 1 to 5 V.

Option

Model	Description
Nil	With lead wire with M12 connector (3m)
N	None
Q	With lead wire with M12-M12 connector (3m) *2

*2: One end has an M12 (socket) connector and the other end has an M12 (plug) connector.

Unit specification

Model	Description
Nil	With unit conversion function *3
M	SI unit fixed *4

*3: This product will not be sold for use in Japan in accordance with the new measurement law (SI unit in Japan).
Convertible unit, instantaneous flow: L/min ⇔ gal/min
Accumulated flow: L ⇔ gal

*4: Fixed unit, instantaneous flow: L/min
Accumulated flow: L

Calibration certificate *5

Model	Description
Nil	None
A	With Calibration certificate

*5: Written in both Japanese and English

Option

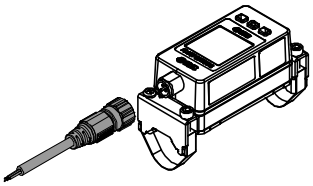
•Options / Part numbers

When only optional parts are required, order with the part numbers listed below.

Part number	Options	Note
ZS-37-A	Lead wire with M12 connector	Length: 3 m
ZS-49-A	Lead wire with M12-M12 connector	Male/female conversion, Length: 3 m
ZS-57-60LR	Clamp assembly set 60	Left/right mounting bracket set (for the 60 L range)
ZS-57-11LR	Clamp assembly set 100	Left/right mounting bracket set (for the 100 L range)
ZS-57-A	Rubber sheet	Replacement parts

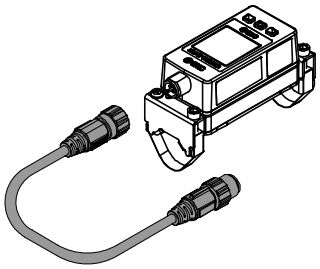
With lead wire with M12 connector (3 m)

ZS-37-A



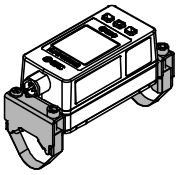
With lead wire with M12-M12 connector (3 m)

ZS-49-A



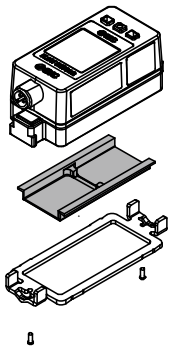
Clamp assembly set 60/100

ZS-57-60LR
ZS-57-11LR



Rubber sheet

ZS-57-A



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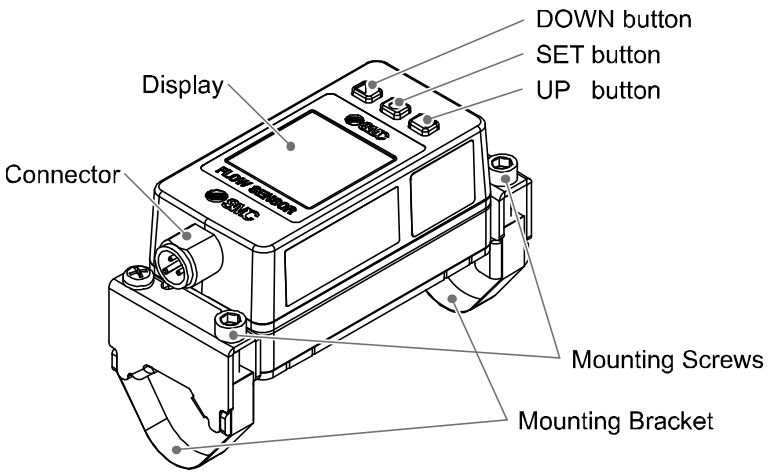
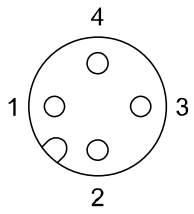
Names and Functions of Product Parts

Body



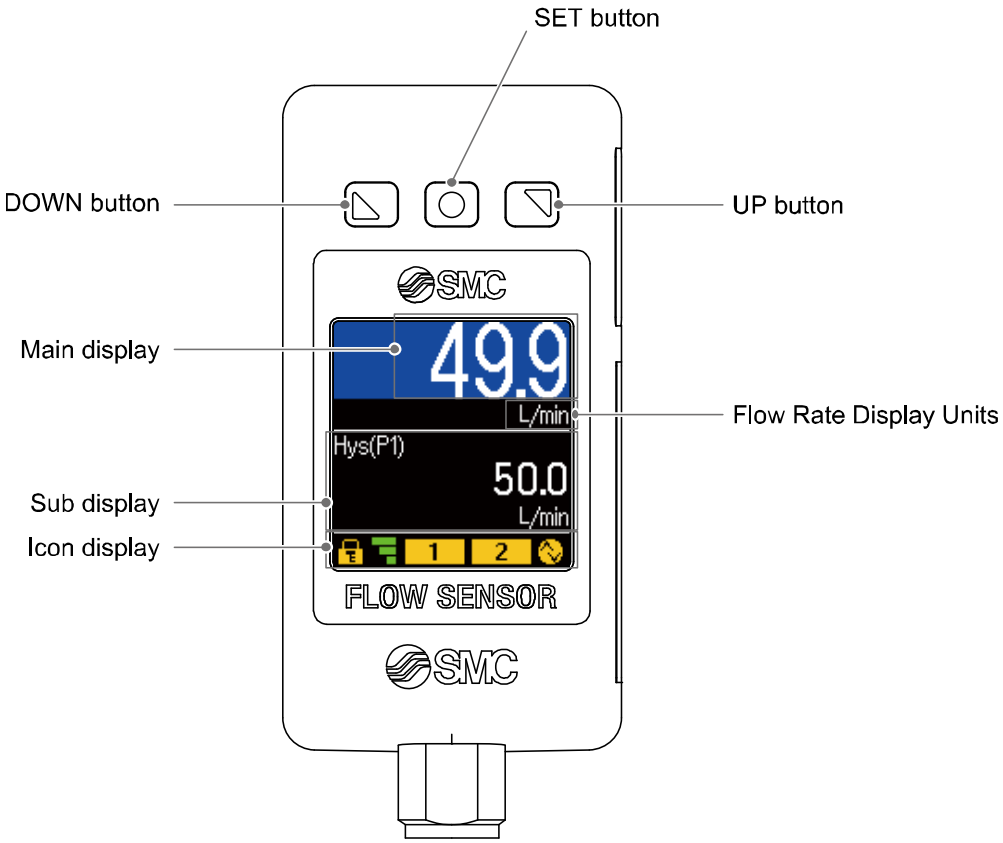
Connector pin numbers
(on the product)



1	DC(+)
2	OUT2(Not connected/Switch output/Analogue output/ External input)
3	DC(–)
4	OUT1 (C/Q)

Description	Function
Display	Refer to the figure below.
Connector	Lead wire with M12 connection.
UP button DOWN button	Use this button to select the mode and the display shown on the Sub display, or increase or decrease the numerical value. The assignment of the UP and DOWN buttons changes depending on the display rotation angle. For details, refer to "Display rotation angle setting" on page 64.
SET button	Press this button to change the mode and to set a value.

Display



Description	Function
Main display	Displays the flow rate value and the error code.
Sub display	Set value, displays the peak/bottom hold value, accumulated flow rate value, IO-Link mode, and line name.
Icon display	Displays the function status. Refer to the next page for details.
Flow Rate Display Units	Indicates the units currently selected.
UP button*	Selects the mode and the display shown on the Sub display, and increases the switch point value.
SET button	Press this button to change the mode and to set a value.
DOWN button*	Selects the mode and the display shown on the Sub display, and decreases the switch point value.

*: If the reversed display has been selected, the UP and DOWN button functions will be reversed.

Icon	Name	Description
	Key-lock	Turns ON when the buttons are locked.
	Ultrasonic indicator	This icon represents the ultrasonic detection level (stability).  Level 0 Level 1 Level 2 Level 3 Level 4 •Level 0: Detection is disabled. •Level 1: Low stability •Level 2: Medium stability •Level 3: High stability •Level 4: Excessive ultrasonic detection Ultrasonic detection levels vary depending on the pipe type, the fluid, the condition of the pipework, the product's installation, and whether or not bubbles are present in the fluid. If the ultrasonic detection level is low, check the piping condition and product installation. Depending on the piping condition, changing the piping installation position may change the ultrasonic detection level.
	OUT1 status	The LED is ON when the output1 is ON.
	OUT2 status	The LED is ON when the output2 is ON.
	IO-Link status	Yellow: Communicating with IO-Link White: Connecting to IO-Link (including communication disruption) Light is OFF: Not connected with IO-Link

○IO-Link status and displayed content

Communication with master	IO-Link status	Status			Displayed content	Content
Yes		IO-Link mode	Normal	Operate		Normal communication status (Output PD disabled)
						Normal communication status (Output PD enabled)
				Start up		At the start of communication
				Preoperate		
			Error	Version does not match		IO-Link version does not match with master
No				Communication shut-off		Normal communication was not received (for more than 1 second).
						
						
						
	Light is OFF	SIO mode				General switch output

○IO-Link communication indication

Contents indicated	Content
DS read	Data storage uploading
DS write	Data storage downloading
BP read	Block parameter uploading
BP write	Block parameter downloading
Factory reset	Receiving Restore Factory Reset
Zero clear	Receiving Zero Clear
Accumulate reset	Receiving Accumulate Reset
Peak/Bottom clear	Receiving Peak Bottom Reset
Application reset	Receiving Application Reset

∗: When the operation is completed, the display will return to normal.

■Definition and Terminology

	Term	Definition
A	Accumulated flow	The total amount of fluid that has passed through the device. If an instantaneous flow of 10 L/min continues for 5 minutes, the accumulated flow will be 10 × 5 = 50 L.
	Accumulated pulse output	A type of output where a pulse is generated every time a predefined accumulated flow passes. It is possible to calculate the total accumulated flow by counting the pulses.
	Accumulated value external reset	A function to remotely reset the accumulated value from an external signal.
	Accumulated value hold time	A function to store the cumulative flow rate in the product's internal memory at certain time intervals. When the power is turned on, the data in the internal memory is read and integration starts from that value. The time interval for storage can be selected from 2 or 5 minutes.
	Analogue output	Outputs a value proportional to the flow rate. When the analogue output is in the range of 1 to 5 V, it will vary between 1 to 5 V according to the rate of flow. The same for analogue output of 4 to 20 mA.
C	Cavitation	A phenomenon that may occur in a fluid moving at a high speed. In the areas within the fluid where the pressure is low, vapor bubbles form and then rapidly collapse. If cavitation occurs in the piping, it will affect the accuracy and can disable measurement (Measurement error) in some cases.
	Chattering	The phenomenon of the switch output turning ON and OFF repeatedly around the set value at high frequency due to pulsation.
D	Delay time	The set time from when the flow rate applied to the flow switch reaches the set value, until the ON-OFF output actually operates. Delay time setting can prevent the output from chattering.
	Digital filter	Function to add digital filtering to deal with the fluctuations in flow rate values. This function moderates the displayed value fluctuations in response to sudden rises in flow rate. When using the function, digital filtering is also reflected in the ON/OFF of the switch output. Output chattering or flicker in the measurement mode display can be reduced by setting the digital filter. The response time indicates when the set value is 90% in relation to the step input.
	Display flow range	Indicates the range that can be displayed.
E	Error output	Turns the switch output to OFF when an error is displayed. Refer to "Error display" on page 96. For details of error codes.
F	F.S.	Full scale in the case of flow rate, meaning the max. flow rate in the rated control flow range. Full span in the case of the analogue output, meaning the variation width of analogue output from zero flow rate to the max. rated control flow. For example, when the analogue output is 1 to 5 V, F.S. = 5 V – 1 V = 4 V. (Reference: 1%F.S. = 4 V x 1% = 0.04 V)
H	Hysteresis	The difference between ON and OFF points used to prevent chattering. Hysteresis can be effective in avoiding the effects of pulsation.
	Hysteresis mode	Mode where the switch output will turn ON when the flow is greater than the set value, and will turn off when the flow falls below (set value – hysteresis value).

	Term	Definition
I	Instantaneous flow	The flow passing per unit of time. If it is 10 L/min, there is a flow of 10 L passing through the device in 1 minute.
	Insulation resistance	Insulation resistance of the product. The resistance between the electrical circuit and the case.
	Internal voltage drop	The voltage drop across the product (and therefore not applied to the load), when the switch output is ON. The voltage drop will vary depending on the load current, and ideally should be 0 V.
K	Key-lock function	Function that prevents changes to the settings (disables button operation).
L	Lowest configurable increment	Shows how precisely the set values and display values can be displayed. If the minimum setting unit is 1 L/min, the display will change in 1 L/min steps, such as 10, 11, and 12 L/min.
M	Max. (Min.) load impedance	The maximum (minimum) load (resistance value and impedance) which can be connected to the output (output wire) of the analogue current output.
	Maximum applied voltage	The maximum voltage that can be connected to the output of an NPN device.
	Maximum load current	The maximum current that can flow to the output (output line) of the switch output.
	Measurement mode	Operating condition in which the flow rate is detected and displayed, and the switch function is operating.
O	Operating fluid temperature	Range of fluid temperature that can flow through the product.
	Operating humidity range	Humidity range in which the product will operate normally.
	Operating temp. range	Ambient temperature range in which the product will operate normally.
R	Rated flow range	The flow range within which the product will meet all published specifications.
	Repeatability	Indicates the reproducibility of the display or analogue output value, when the measured value is repeatedly increased and decreased.
	Response time	Indicates the time it takes to reach 90% of the target flow rate.
S	Set flow range	The range of settable ON/OFF points (threshold values) for products with a switch output.
	Switch output	Output type that has only 2 conditions, ON or OFF. In the ON condition an indicator LED will show, and any connected load will be powered. In the OFF condition, there will be no indicator LED and no power supplied to the load. An output showing such behavior is called a switch output.
T	Temperature characteristics	Indicates the amount of variation between the displayed value and analogue output value when the ambient temperature changes.
U	Ultrasonic indicator	This is an icon that represents the intensity of ultrasonic waves.
	Unit selection function	A function to select display units other than the international unit (SI unit) specified In the new Japanese measurement law. Only SI units are available in Japan.
W	Window comparator mode	An operating mode in which the switch output is turned on and off depending on whether the flow is inside or outside the range of two set values.
	Withstand voltage	A measure of the product's resistance to a voltage applied between the electrical circuit and case. Durability in withstanding voltage. The product may be damaged if a voltage above this value is applied. (The withstand voltage is different to the power supply voltage used to operate the product).
Z	Zero-clear function	This function adjusts the displayed flow rate to zero.
	Zero-cut function	This function forces the indication to zero when the flow rate indication is close to zero.

Mounting and Installation

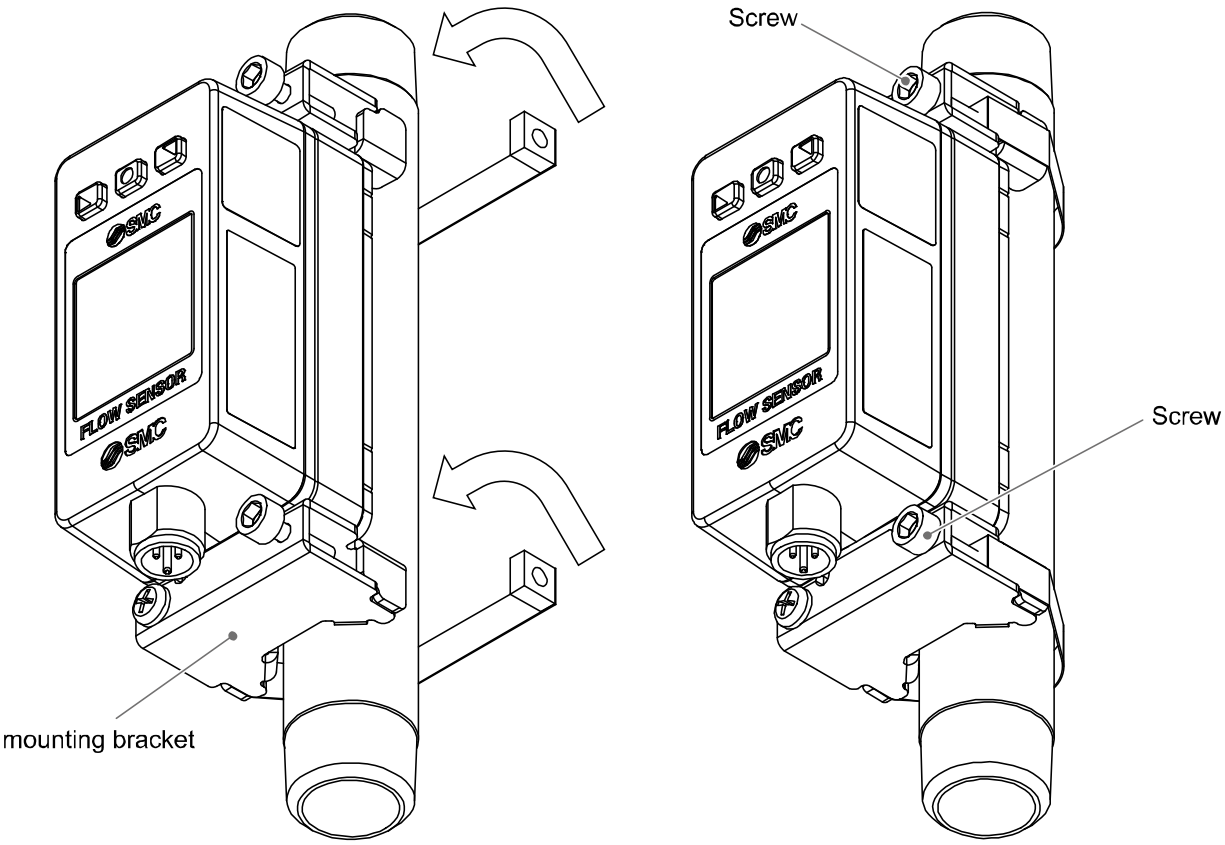
■Installation

Step 1

•Refer to the flow direction of the fluid indicated on the product label during installation.
Even when the product is installed in the opposite direction, it is possible to change the fluid flow direction.
For details, refer to page 32 “Setting of [F0 System].”

Step 2

•Mount the product using the mounting brackets supplied.
The recommended tightening torque of the screws must be 76 cN•m ±5 cN•m.



■Wiring Method

Connections

•Connections should only be made with the power supply turned off.

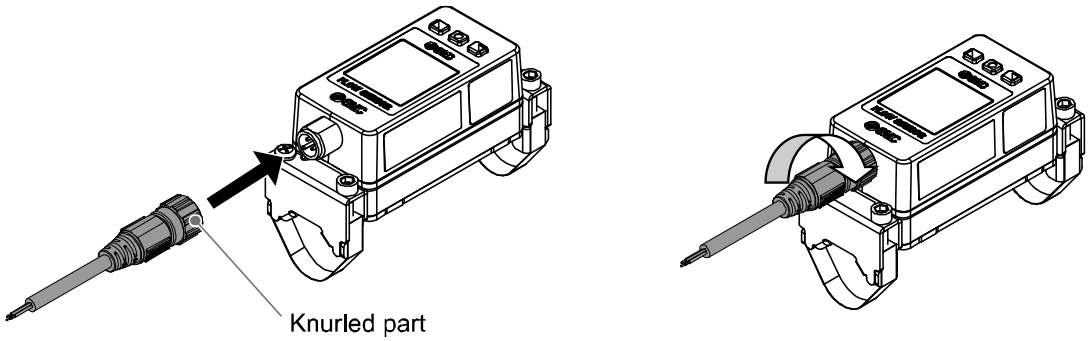
•Use a separate route for the product wiring and any power or high voltage wiring. If wires and cables are routed together with power or high voltage cables, malfunction may result due to noise.

•If a commercially available switching power supply is used, be sure to ground the frame ground (FG) terminal. If a commercially available switch-mode 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.

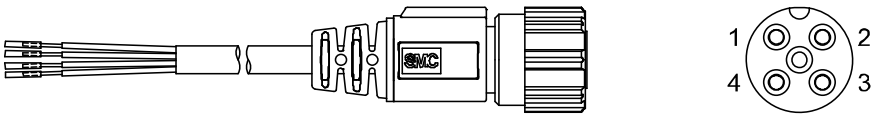
Connecting/disconnecting the connector

•Align the key of the lead wire connector with the key groove on the product connector, and insert the connector straight in. Turn the knurled part clockwise. Connection is complete when the knurled part is fully tightened. Check that the connection is not loose.

•To disconnect the connector, loosen the knurled part and pull the connector straight out.



Connector pin numbers (lead wire) (ZS-37-A, ZS-49-A)



When used as a switch output device

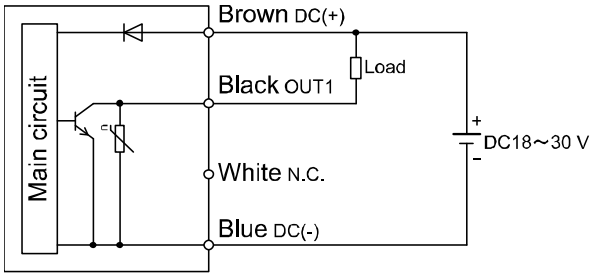
Pin number	Wire colour	Name	Description
1	Brown	DC(+)	18 to 30 VDC
2	White	OUT2	Not connected/Switch output/Analogue output/ External input
3	Blue	DC(-)	0 VDC
4	Black	OUT1	Switch output

When used as an IO-Link device

Pin number	Wire colour	Name	Description
1	Brown	DC(+)	18 to 30 VDC
2	White	OUT2	Not connected/Switch output/Analogue output/ External input
3	Blue	DC(-)	0 VDC
4	Black	C/Q	Communication data (IO-Link)/Switch output(SIO)

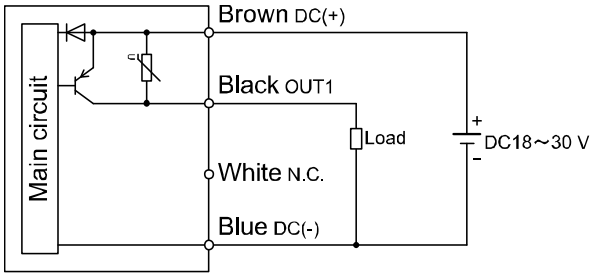
Internal circuit and wiring examples

PFUW7#-L1#-##(NPN output)



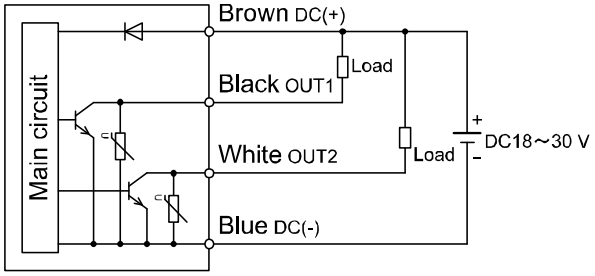
Maximum applied voltage: 30 V
Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less

PFUW7#-L1#-##(PNP output)



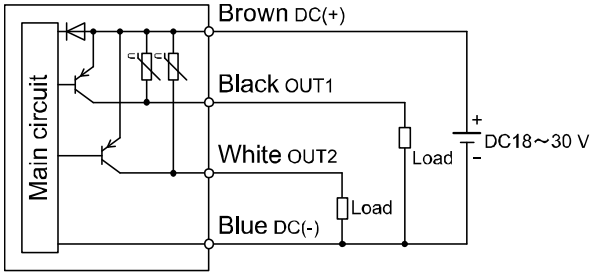
Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less

PFUW7#-L2#-##(NPN2 output)



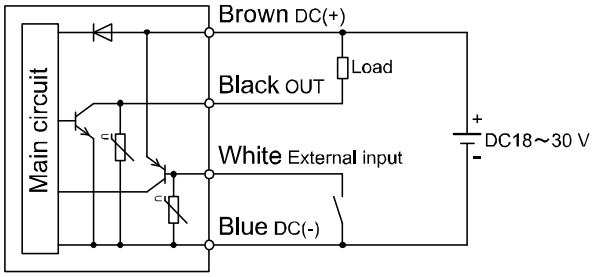
Maximum applied voltage: 30 V
Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less

PFUW7#-L2#-##(PNP2 output)



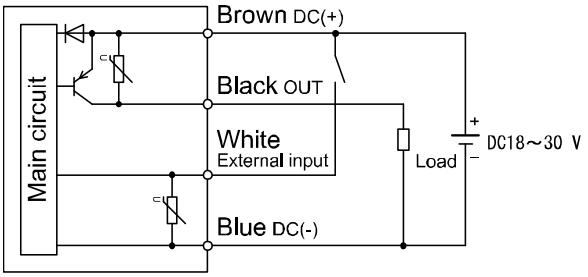
Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less

PFUW7#-L2#-## (NPN + External input)



Maximum applied voltage: 30 V,
Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less
External input: input voltage of 0.4 V or less,
30 msec. or more
Contact: reed or solid state switch

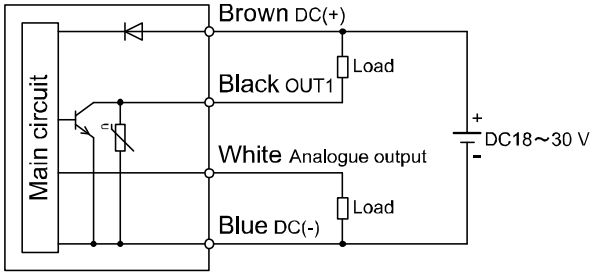
PFUW7#-L2#-## (PNP + External input)



Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less
External input voltage: DC(+) -1 V or more,
30 msec. or more
Contact: reed or solid state switch

PFUW7#-L3/L4#-##((NPN output)

・L3: NPN + analogue voltage output
L4: NPN + analogue current output

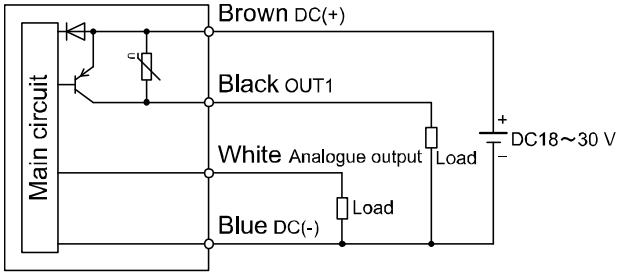


Maximum applied voltage: 30 V,
Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less

L3: analogue output: 1 to 5 V or 0 to 10 V can be selected
Output impedance: approx. 1 kΩ
L4: analogue output: 4 to 20 mA
Load impedance: 50 to 600 Ω

PFUW7#-L3/L4#-##((PNP output)

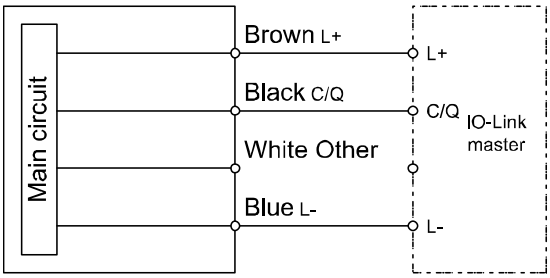
・L3: PNP + analogue voltage output
L4: PNP + analogue current output



Maximum load current: 80 mA
Internal voltage drop: 1.5 V or less

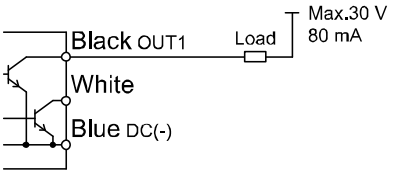
L3: analogue output: 1 to 5 V or 0 to 10 V can be selected
Output impedance: approx. 1 kΩ
L4: analogue output: 4 to 20 mA
Load impedance: 50 to 600 Ω

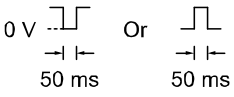
When used as an IO-Link device



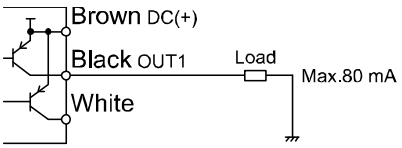
Example of wiring for accumulated pulse output

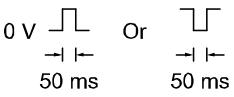
PFUW7#-L1/L2/L3/L4#-## (When NPN output is selected)





PFUW7#-L1/L2/L3/L4#-## (When PNP output is selected)





Outline of Settings [Measurement Mode]

Power is supplied

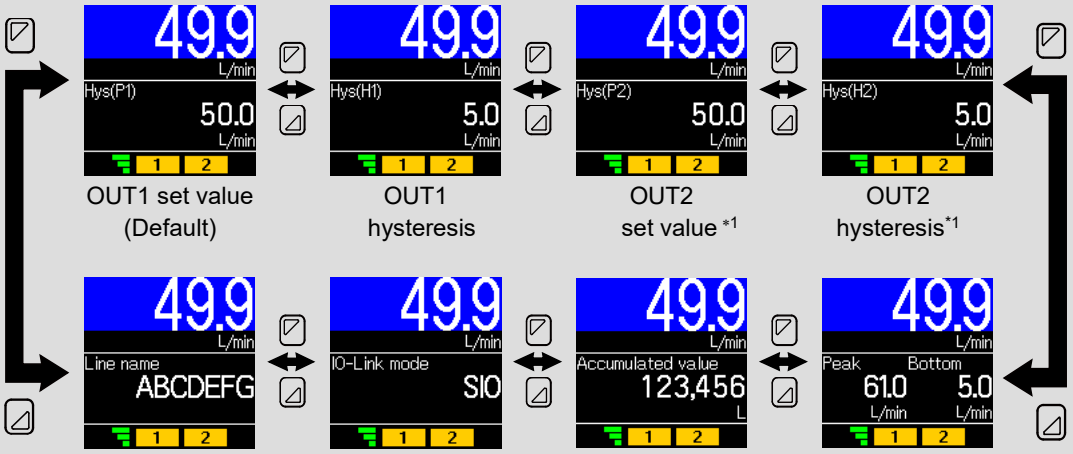
The each output are forced to turn OFF for 3 seconds after turning on the power supply, and the SMC logo appears.

[Measurement mode]

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

Sub display

In measurement mode, the content of the Sub display can be selected by pressing the UP or DOWN button.



∗1: Output specification: only for L2

∗2: Only when line name is ON.

Press the SET button for between 2 and 4 seconds.

Mode selection

Press the UP or DOWN button to select the item and then press the SET button.

[Easy setup]

Shifts to the easy setup mode (simple setting mode). Set functions.
(Refer to page 27)

[Function]

Shifts to function selection mode. Set functions.
(Refer to page 29)

[Key lock]

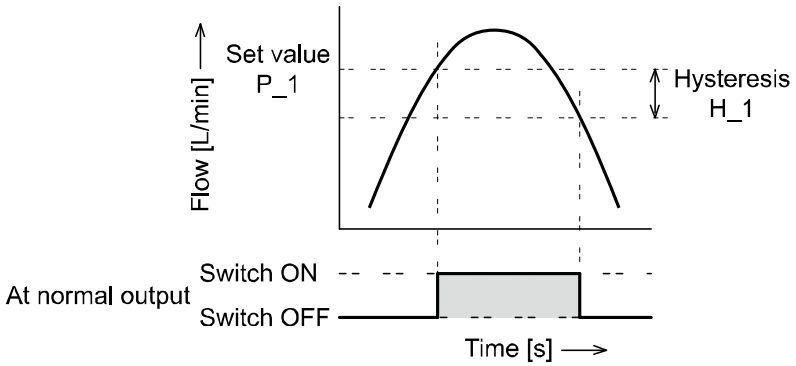
Shifts to key-lock setting mode. Set restrictions for button operation.
(Refer to page 74)

No. DOC1066729

Flow Setting

Switch operation

When the flow exceeds the set value, the switch will turn ON.
When the flow 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 flow switch when the flow reaches the centre of the rated flow range.
If this condition shown below, is acceptable, then keep these settings.



●PFUW760

Item	Default Settings
[P_1] Set value of OUT1	30.0 L/min
[H_1] Hysteresis of OUT1	3.0 L/min
[P_2] Set value of OUT2 *	30.0 L/min
[H_2] Hysteresis of OUT2 *	3.0 L/min

●PFUW711

Item	Default Settings
[P_1] Set value of OUT1	50.0 L/min
[H_1] Hysteresis of OUT1	5.0 L/min
[P_2] Set value of OUT2 *	50.0 L/min
[H_2] Hysteresis of OUT2 *	5.0 L/min

∗: OUT2 indicates the value when a product with L2 output specification is used.

∗: For hysteresis, refer to [F1 Switch1] Setting of OUT1 (page 36), [F2 Switch2] Setting of OUT2 (page 43).

3 step setting mode

3 step setting mode

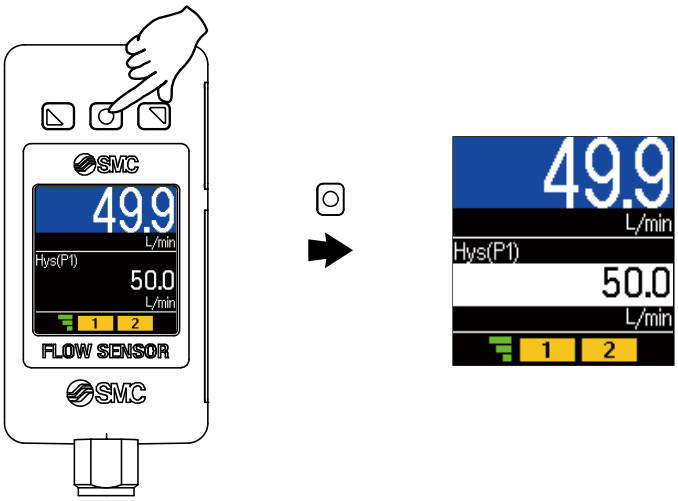
In this mode, the set values can be input in just three steps.
Use this mode if the product is to be used immediately, after changing only the set values.
(The current flow rate value is displayed on the main display)

<Operation>

"3 step setting mode (hysteresis mode)"

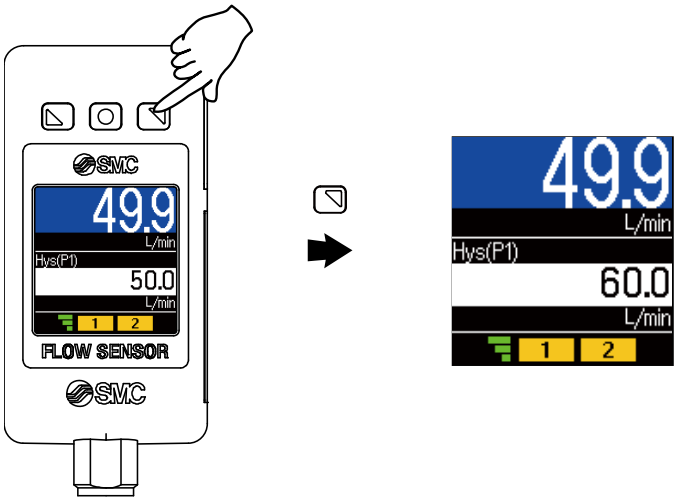
In the 3 step setting mode, the set value (P1 or N1, P2 or N2) and hysteresis (H1 or H2) can be changed.
Set the items to be changed on the sub display (set value or hysteresis) using the UP or DOWN buttons in advance.
To change the set value, follow the operation below. The hysteresis setting can be changed in the same way.

(1) Press the SET button once when the item to be changed is displayed on the sub display. The background of the setting value section turns white.

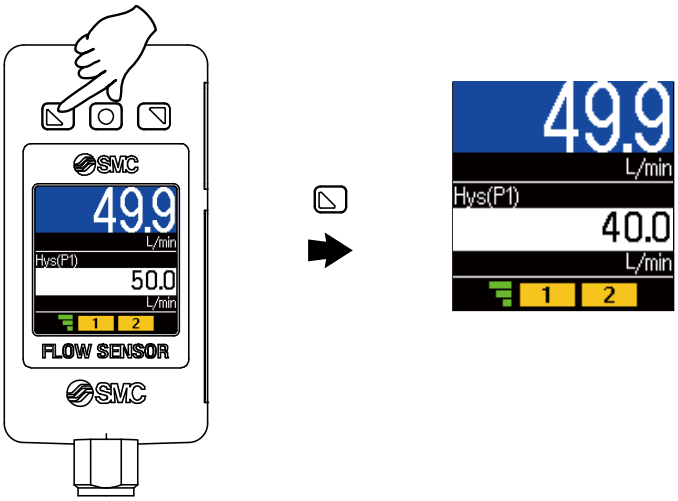


(2) Press the UP or DOWN button to change the set value.
The UP button is used to increase the set value and the DOWN button is used to decrease the set value.

●Press the UP button once to increase the value by one. Press and hold it to continuously increase the value.



●Press the DOWN button once to decrease the value by one. Press and hold it to continuously decrease the value.



●Press and hold the UP and DOWN buttons simultaneously for 1 second or longer, [Snap shot] will be displayed and the setting will automatically set the same value as the current flow rate value (Snap Shot function (refer to page 76)).
After this operation, it is also possible to adjust the value by pressing the UP and DOWN buttons.

(3) Press the SET button to complete the setting.

Simple Setting Mode [Easy setup]

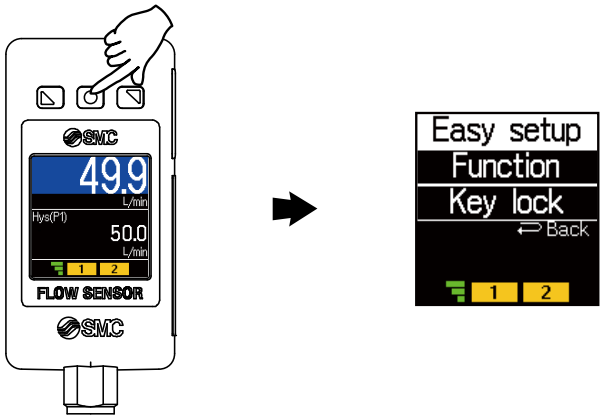
<Operation>

"Simple Setting Mode (hysteresis mode)"

In the Simple Setting Mode, it is possible to change the settings in order for the output set values of the currently set SW output operation mode.

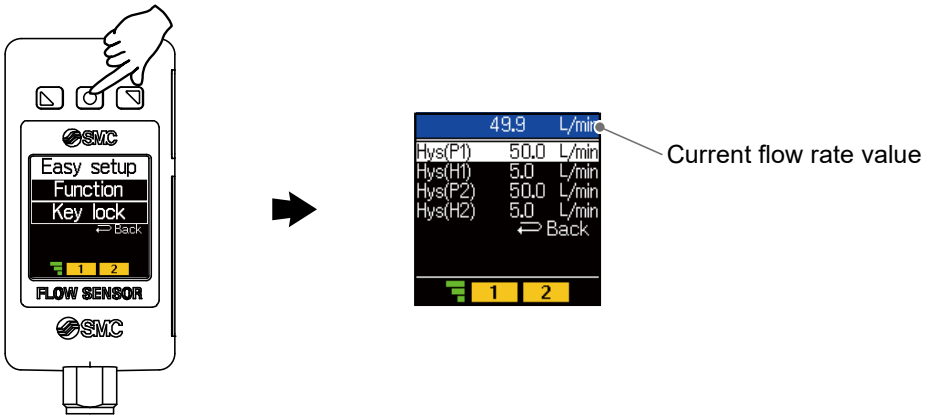
∗: The set value and hysteresis can be changed.

(1) Press the SET button for between 2 and 4 seconds in measurement mode.
The mode selection screen below will be displayed.



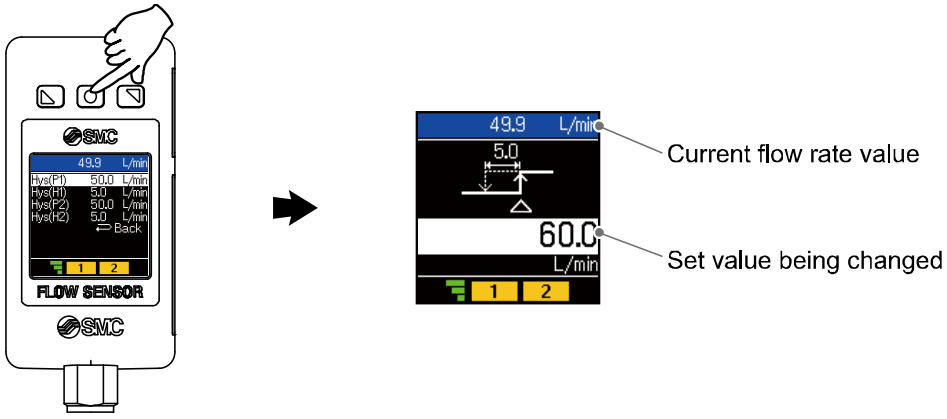
(2) Select [Easy setup] and press the SET button.
The screen for changing set values and hysteresis is displayed.

∗: For models with L2 output specification, [Hys(P2)] or [Hys(H2)] will be displayed.



(3) Select [Hys(P1)] and press the SET button.

∗: To set the hysteresis, select [Hys(H1)]. The indication in the parentheses changes depending on the setting conditions.

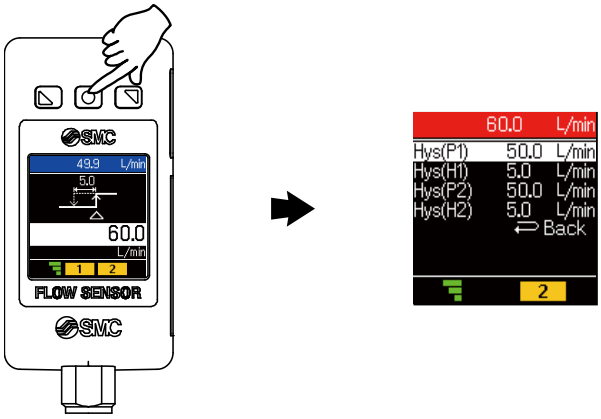


(4) Press the UP or DOWN button and change the set value.

The UP button is used to increase the set value and the DOWN button is used to decrease the set value.

(The snap shot function can be used. (Refer to page 76)

Press the SET button to complete the setting.



(5) To return to measurement mode, select [Back] and press the SET button.

Or it is also possible to return to the measurement mode by holding down the SET button for 2 seconds or longer.

∗: For models with L2 output specification, [P_2] or [n_2] will also be displayed. Set these at the same time.
(This is not displayed when OUT2 is used as the external input function [External in].)

∗: For any of the items (1) to (4), after enabling the setting by pressing the SET button, it is possible to enter measurement mode by holding down the SET button for 2 seconds or longer.

∗: Window comparator mode and accumulated output mode, it is also possible to configure the settings in the same manner as above.
(If the integrated pulse output mode, error output mode or switch output OFF mode is used, [Easy setup] is not displayed.)

∗: Note that the set value will apply a limit to the value entered for hysteresis, and vice versa.

∗: For more detailed settings, set each function in the function selection mode (page 29).

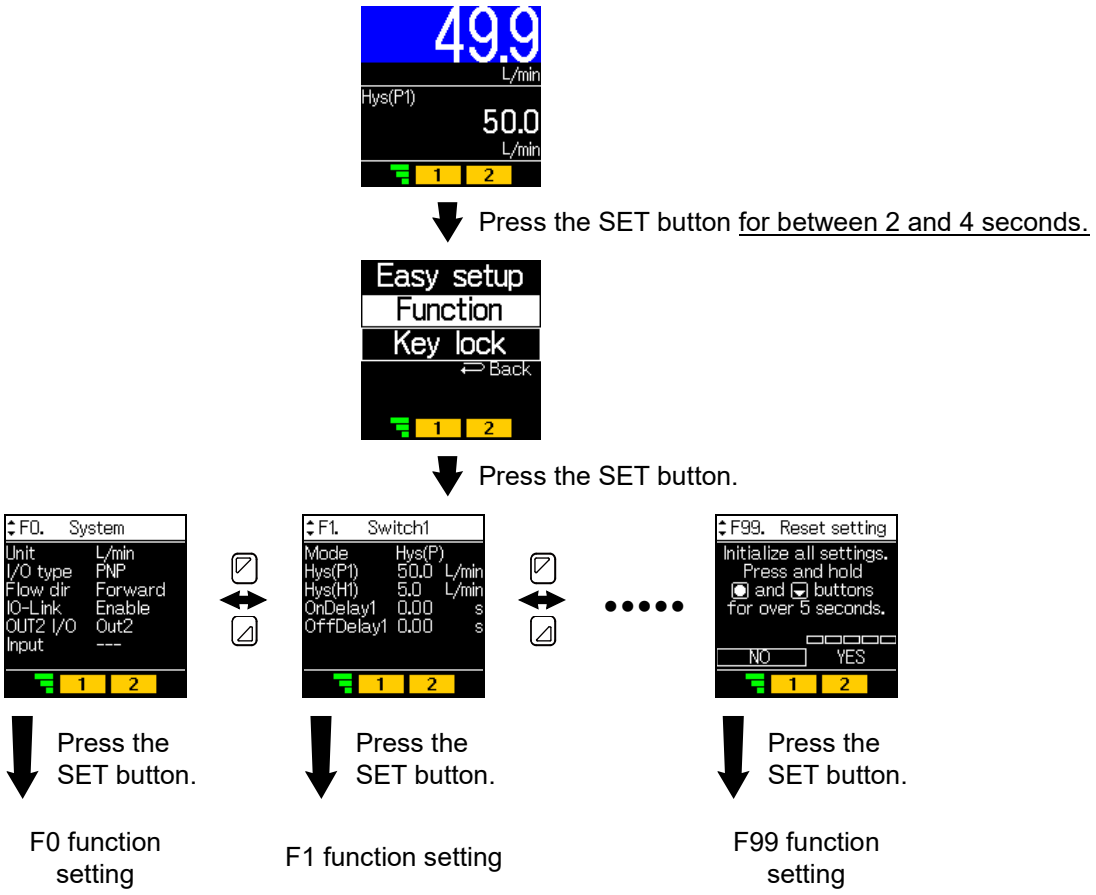
[Function Selection Mode] to Change Settings

Function Selection Mode

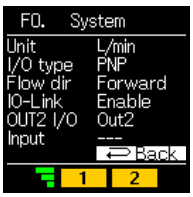
In this mode, each function setting can be changed separately.

In measurement mode, press the SET button for between 2 and 4 seconds, and then select [Function] to enter function selection mode.

By pressing the UP or DOWN button to change the number, each function that you want to change can be selected.



After setting [F∗] is completed

To return to function selection mode:	To return to measurement mode:
Use the UP or DOWN button to select [Back] 	Press the SET button for at least 2 seconds.

∗: Some functions are not supported on models with specific product numbers.
When functions are not available or cannot be selected, [- - -] will be displayed or nothing will be displayed.

■Factory default setting

The factory default settings are as follows.
If these settings are acceptable, retain for use.
To change a setting, enter the function selection mode.

No	Function	Item	Default setting	Page
[F0]	System settings	[Unit] Flow rate display units *1	[L/min] L/min(L)	Page 32
		[I/O TYPE] NPN/PNP set value	[PNP] PNP output	
		[Flow dir] Fluid flow direction	[Forward] Forward direction	
		[IO-Link] IO-Link enable/disable setting	[Enable] Enable	
		[OUT2 I/O] SW2 input/output selection *2	[Out2] Out2 output	
		[Input] SW2 external input *2	[- - -] External input not set	
[F1]	Switch1 settings (OUT1)	[Mode] Output mode selection	[Hys(P)] Hysteresis mode	Page 36
		[Hys(P1)] Set value	[ ] 50% of maximum rated flow PFUW760: 30.0 L/min PFUW711: 50.0 L/min	
		[Hys(H1)] Hysteresis	[ ] 5% of maximum rated flow PFUW760: 3.0 L/min PFUW711: 5.0 L/min	
		[OnDelay1] ON delay time	[0.00] 0.00 s	
		[OffDelay1] OFF delay time	[0.00] 0.00 s	
[F2]	Switch2 settings*2 (OUT2)	[Mode] Output mode selection	[Hys(P)] Hysteresis mode	Page 43
		[Hys(P2)] Set value	[ ] 50% of maximum rated flow PFUW760: 30.0 L/min PFUW711: 50.0 L/min	
		[Hys(H2)] Hysteresis	[ ] 5% of maximum rated flow PFUW760: 3.0 L/min PFUW711: 5.0 L/min	
		[OnDelay2] ON delay time	[0.00] 0.00 s	
		[OffDelay2] OFF delay time	[0.00] 0.00 s	
[F10]	Measurement settings	[Filter] Digital filter	[1.0] 1.0 s	Page 50
		[Zero cut] Zero cut	[1] 1%F.S.cut	
		[Resolution] Display resolution	[High] PFUW760: 600 resolution PFUW711: 1000 resolution	
[F11]	Ultrasonic measurement setting	[Power] Ultrasonic transmission power	[High] Transmission power: High	Page 52
		[Schedule] Piping schedule	[SGP] SGP piping	
		[Span adj] Measurement value inclination fine adjustment	[0.0] Inclination adjustment rate: 0.0%	
[F22]	Analogue output settings	[Type] Analogue output switch *3	[1 to 5 V] 1 to 5 V voltage output (Voltage output type) [4 to 20 mA] 4 to 20 mA current output (Current output type) *: The current output type cannot be changed.	Page 54
		[Free span] Analogue free range *3	[ ] 100% of maximum rated flow PFUW760: 60.0 L/min PFUW711: 100.0 L/min	
[F30]	Accumulated flow (rate) settings	[Save intvl] Accumulation storage	[No save] Not to hold	Page 56
		[Disp mode] Accumulated display direction	[Increment] Addition direction	

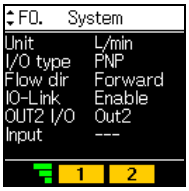
No	Function	Item	Default setting	Page
[F50]	Instantaneous SW bit 1 setting	[Mode] Output mode selection	[Hys(P)] Hysteresis mode	Page 58
		[Hys(P1)] Set value	[ ] 50% of maximum rated flow PFUW760: 30.0 L/min PFUW711: 50.0 L/min	
		[Hys(H1)] Hysteresis	[ ] 5% of maximum rated flow PFUW760: 3.0 L/min PFUW711: 5.0 L/min	
		[OnDelay1] ON delay time setting	[0.00] 0.00 s	
		[OffDelay1] OFF delay time setting	[0.00] 0.00 s	
[F51]	Instantaneous SW bit 2 setting	[Mode] Output mode selection	[Hys(P)] Hysteresis mode	Page 59
		[Hys(P2)] Set value	[ ] 50% of maximum rated flow PFUW760: 30.0 L/min PFUW711: 50.0 L/min	
		[Hys(H2)] Hysteresis	[ ] 5% of maximum rated flow PFUW760: 3.0 L/min PFUW711: 5.0 L/min	
		[OnDelay2] ON delay time setting	[0.00] 0.00 s	
		[OffDelay2] OFF delay time setting	[0.00] 0.00 s	
[F52]	Accumulation SW 1/2 bit setting	[Sw1] Set value	[0] 0 L	Page 60
		[Sw2] Set value	[0] 0 L	
[F80]	Display settings	[Color] Selection of measurement value display colour	[1onB.offR] OUT1 output ON = white characters on blue background, OFF = white characters on red background	Page 61
		[Display] Display OFF setting	[ON] Display ON	
		[Rotation] Display rotation angle setting	[0deg] Rotation angle 0°	
		[Brightness] Display brightness setting	[100%] Brightness 100%	
		[Line name] Line name display setting	[OFF] No line name displayed	
[F81]	PIN code settings	[PIN code] Selection of PIN code	[OFF] Not used	Page 66
[F91]	Device information	-	Information check (No settings)	Page 67
[F96]	Input check	-	Input check (No settings)	Page 69
[F98]	Output check	-	[Normal] Normal output	Page 70
[F99]	Reset to factory default settings	-	[NO] Not to be reset	Page 73

∗1: This setting is only available for models with the units selection function.
∗2: This setting is only available for models with L2 output specification.
∗3: This function is available for models with analogue output.

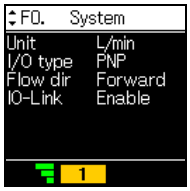
■[F0 System] System settings

Set the following items:
(1) Flow rate display units setting
(2) NPN/PNP set value
(3) Fluid flow direction setting
(4) IO-Link enable/disable setting
(5) SW2 input/output selection setting
(6) SW2 external input setting

<Operation>
Press the UP or DOWN button in function selection mode to select [F0 System].



Screen with L2 output specification



Screen other than L2 output specification

Press the UP or DOWN button to select the item and then press the SET button.

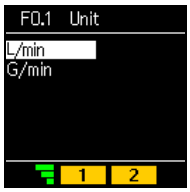
Shifts to the setting of each item.

(1) Flow rate display unit settings

Select [Unit].

Press the SET button.

Press the UP or DOWN button to select the flow rate display units.



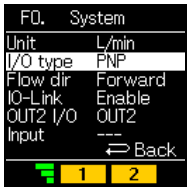
∗: For models which are fixed to SI units, [G/min] cannot be selected.

Press the SET button.

Returns to the [F0 System] settings.

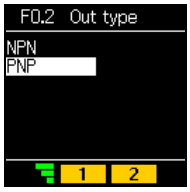
(2) NPN/PNP set value

Select [I/O type].



Press the SET button.

Press the UP or DOWN button to select the required SW output type.



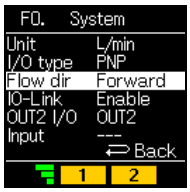
NPN: NPN output
PNP: PNP output

Press the SET button.

Returns to the [F0 System] settings.

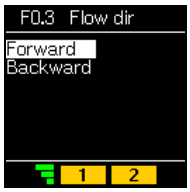
(3) Fluid flow direction setting

Select [Flow dir].



Press the SET button.

Press the UP or DOWN button to select the required fluid flow direction.



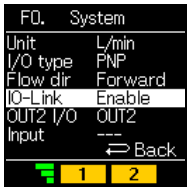
Forward: forward direction
Backward: backward direction

Press the SET button.

Returns to the [F0 System] settings.

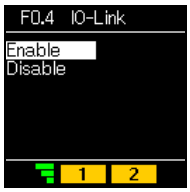
(4) IO-Link enable / disable setting

Select [IO-Link].



Press the SET button.

Press the UP or DOWN button to select the required IO-Link setting.



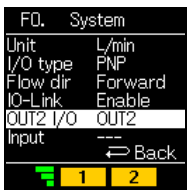
Enable: IO-Link enable
Disable: IO-Link disable
∗: When changing the setting from disable to enable, the switch output turns OFF for 100 µs.

Press the SET button.

Returns to the [F0 System] settings.

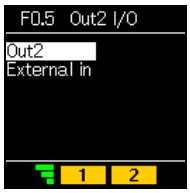
(5) SW2 input/output selection setting (only with L2 output specification)

Select [OUT2 I/O]



Press the SET button.

Press the UP or DOWN button to select the required OUT2 output type.



OUT2: OUT2 SW output
External in: OUT2 external input function

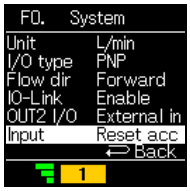
Press the SET button.

Returns to the [F0 System] settings.

(6) SW2 external input setting (only with L2 output specification)

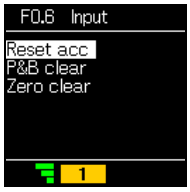
Select [Input]

∗: This can be selected when the [OUT2 I/O] setting is set to “External in.”



Press the SET button.

Press the UP or DOWN button to select details of the external input setting.



Reset acc: accumulation reset
P&B clear: peak/bottom clear
Zero clear: zero clear

Press the SET button.

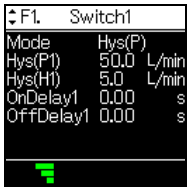
Returns to the [F0 System] settings.

Completion of the [F0 System] setting

■[F1 Switch1] OUT1 settings

Set the output mode of OUT1.

<Operation>
Operate the UP or DOWN button in function selection mode to select [F1 Switch1].

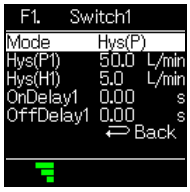


Press the UP or DOWN button to select an item and press the SET button.

Shifts to the output operation setting.

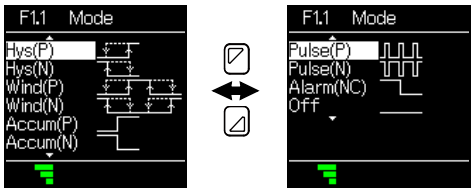
Output operation settings

Select [Mode].



Press the SET button.

Press the UP or DOWN button to select the required output mode.



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Hys(P): Turns ON the switch output once the instantaneous flow rate reaches or exceeds the set value. (Hysteresis mode)
Hys(N): Turns OFF the switch output once the instantaneous flow rate reaches or exceeds the set value. (Hysteresis mode)
Wind(P): Turns ON the switch output if the instantaneous flow rate is between the two set values. (Window comparator mode)
Wind(N): Turns OFF the switch output if the instantaneous flow rate is between the two set values. (Window comparator mode)
Accum (P): When the accumulated flow (rate) is the set value or more, the switch output is turned ON. (Accumulated output mode)
Accum (N): When the accumulated flow (rate) is the set value or more, the switch output is turned OFF. (Accumulated output mode)
Pulse (P): The switch output is turned ON for 0.05 seconds for each accumulated pulse conversion value. (Accumulated pulse output mode)
Pulse (N): The switch output is turned OFF for 0.05 seconds for each accumulated pulse conversion value. (Accumulated pulse output mode)
Alarm (NC): The switch output is turned OFF when an error code is displayed *. (Error output mode)
Off: The switch output is always turned OFF. (Switch output OFF mode)

Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

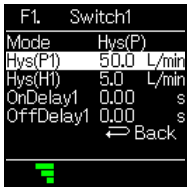
If Hys(P)/Hys(N) is selected → page 37
If Wind(P)/Wind(N) is selected → page 39
If Accum(P)/Accum(N) is selected → page 42

If any other item is selected → The setting is completed. Select [Back] to return to function selection mode.

▪ If Hys(P)/Hys(N) is selected　Setting of [F1] and [F50]

(1) Flow setting

Select [Hys(P1)].



Press the SET button.

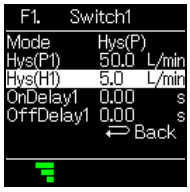
Press the UP or DOWN button to change the value.

Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

(2) Hysteresis setting

Select [Hys(H1)].



Press the SET button.

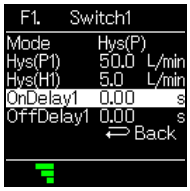
Press the UP or DOWN button to change the value.

Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

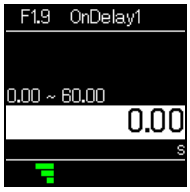
(3) On-delay setting

Select [OnDelay1].



Press the SET button.

Press the UP or DOWN button to change the value.



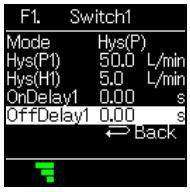
∗: On-delay time setting range: 0.00 to 60.00 [s]

Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

(4) Off-delay setting

Select [OffDelay1].



Press the SET button.

Press the UP or DOWN button to change the value.

∗: Off-delay time setting range: 0.00 to 60.00 [s]

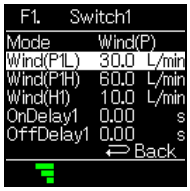
Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

▪ If Wind(P)/Wind(N) is selected　Setting of [F1] and [F50]

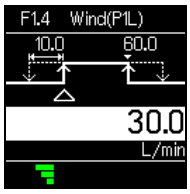
(1) Setting of flow rate (lower limit value)

Select [Wind(P1L)].



Press the SET button.

Press the UP or DOWN button to change the value.

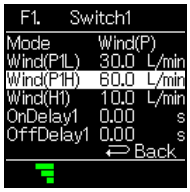


Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

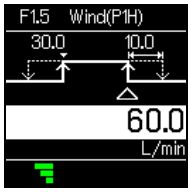
(2) Setting of flow rate (upper limit value)

Select [Wind(P1H)].



Press the SET button.

Press the UP or DOWN button to change the value.

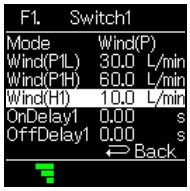


Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

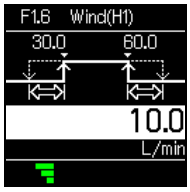
(3) Hysteresis setting

Select [Wind(H1)].



Press the SET button.

Press the UP or DOWN button to change the value.

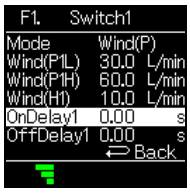


Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

(4) On-delay setting

Select [OnDelay1].



Press the SET button.

Press the UP or DOWN button to change the value.

∗: On-delay time setting range: 0.00 to 60.00 [s]

Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

(5) Off-delay setting

Select [OffDelay1].

Press the SET button.

Press the UP or DOWN button to change the value.

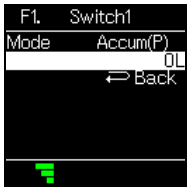
∗: Off-delay time setting range: 0.00 to 60.00 [s]

Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

•When Accum (P)/Accum (N) (Accumulated output mode) is selected Setting of [F1]

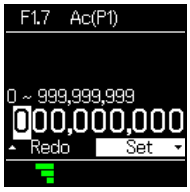
(1) Setting the threshold value



Press the SET button.

Press the UP or DOWN button to change the value for all digits.

Press the SET button.



Press the SET button.

Returns to the [F1 Switch1] OUT1 settings.

Completion of the [F1 Switch1] OUT1 settings

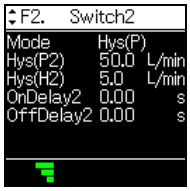
■[F2 Switch2] OUT2 settings

Set the output mode of OUT2.

∗: For models with output specifications other than L2, [F2 Switch2] will not be displayed.

<Operation>

Press the UP or DOWN button in function selection mode to select [F2 Switch2].

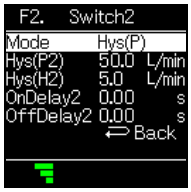


Press the UP or DOWN button to select an item and press the SET button.

Shifts to the output operation setting.

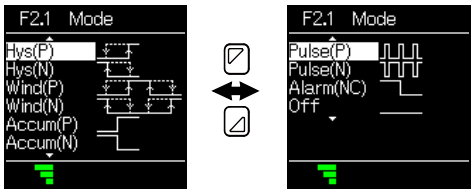
Output operation settings

Select [Mode].



Press the SET button.

Press the UP or DOWN button to select the required output mode.



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The details of the output operation are the same as those when [F1 Switch1] OUT1 is set.

Press the SET button.

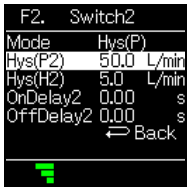
Returns to the [F2 Switch2] OUT2 settings.

If Hys(P)/Hys(N) is selected → page 44
If Wind(P)/Wind(N) is selected → page 46
If Accum(P)/Accum(N) is selected → page 49
If any other item is selected → The setting is completed. Select [Back] to return to function selection mode.

・If Hys(P)/Hys(N) is selected　Setting of [F2] and [F51]

(1) Flow setting

Select [Hys(P2)].



Press the SET button.

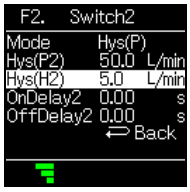
Press the UP or DOWN button to change the value.

Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

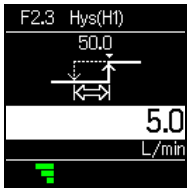
(2) Hysteresis setting

Select [Hys(H2)].



Press the SET button.

Press the UP or DOWN button to change the value.

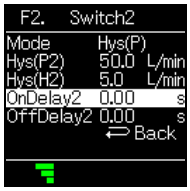


Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

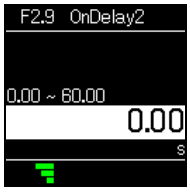
(3) On-delay setting

Select [OnDelay2].



Press the SET button.

Press the UP or DOWN button to change the value.



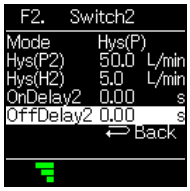
∗: On-delay time setting range: 0.00 to 60.00 [s]

Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

(4) Off-delay setting

Select [OffDelay2].



Press the SET button.

Press the UP or DOWN button to change the value.

∗: Off-delay time setting range: 0.00 to 60.00 [s]

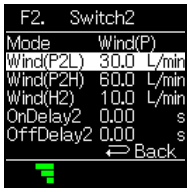
Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

▪ If Wind(P)/Wind(N) is selected　Setting of [F2] and [F51]

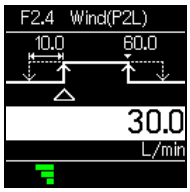
(1) Setting of flow rate (lower limit value)

Select [Wind(P2L)].



Press the SET button.

Press the UP or DOWN button to change the value.

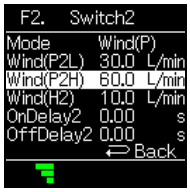


Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

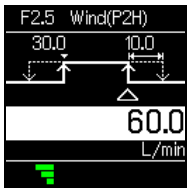
(2) Setting of flow rate (upper limit value)

Select [Wind(P2H)].



Press the SET button.

Press the UP or DOWN button to change the value.

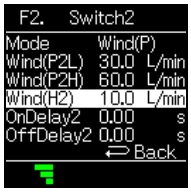


Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

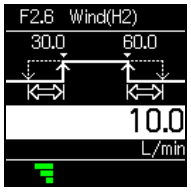
(3) Hysteresis setting

Select [Wind(H2)]



Press the SET button.

Press the UP or DOWN button to change the value.

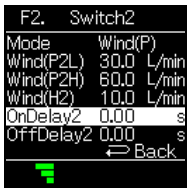


Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

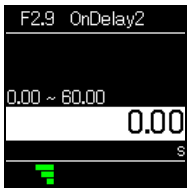
(4) On-delay setting

Select [OnDelay2].



Press the SET button.

Press the UP or DOWN button to change the value.



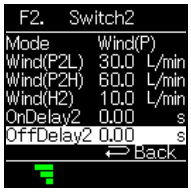
∗: On-delay time setting range: 0.00 to 60.00 [s]

Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

(5) Off-delay setting

Select [OffDelay2].



Press the SET button.

Press the UP or DOWN button to change the value.

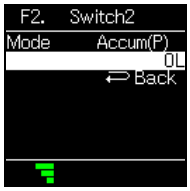
∗: Off-delay time setting range: 0.00 to 60.00 [s]

Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

▪ If Accum(P)/Accum(N) (accumulation output mode) is selected　Setting of [F2]

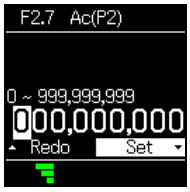
(1) Setting the threshold value



Press the SET button.

Press the UP or DOWN button to change the value for all digits.

Press the SET button.



Press the SET button.

Returns to the [F2 Switch2] OUT2 settings.

Completion of the [F2 Switch2] OUT2 settings

■[F10 Measure] Measurement settings

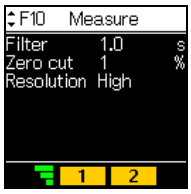
The following items can be set.

(1) Digital filter setting
The digital filter can be selected for flow rate detection.
Output chattering or display flickering in measurement mode can be reduced by setting the digital filter.

(2) Zero cut setting
This function forces a zero display when the flow is within 0 to 10% of the flow rate range.

(3) Display resolution setting
It is possible to change the minimum setting unit.

<Operation>
Press the UP or DOWN button in function selection mode to select [F10 Measure].



Press the UP or DOWN button to select the required item, and press the SET button.

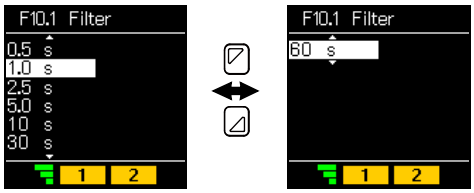
The display switches to the setting of the corresponding item.

(1) Digital filter setting

Select [Filter].

Press the SET button.

Press the UP or Down button to select the required digital filter time.



Page 1 Page 2

Digital filter time setting: 0.5, 1.0, 2.5, 5.0, 10.0, 30.0, and 60.0 s

Press the SET button.

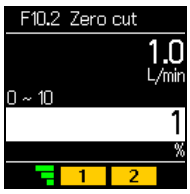
Returns to the [F10 Measure] settings.

(2) Zero cut setting

Select [Zero cut].

Press the SET button.

Press the UP or DOWN button to change the zero cut value.



Zero cut set value: 0 to 10% (1% increments)

Press the SET button.

Returns to the [F10 Measure] settings.

(3) Display resolution setting

Select [Resolution].

Press the SET button.

Press the UP or DOWN button to select the required display resolution.

High: PFUW760: 600 resolution, PFUW711: 1000 resolution
Low: PFUW760: 60 resolution, PFUW711: 100 resolution

Press the SET button.

Returns to the [F10 Measure] settings.

Returns to the [F10 Measure] settings

■[F11 Ultrasonic] Ultrasonic measurement setting

The following items can be set.

(1) Ultrasonic transmission power setting
It is possible to change the ultrasonic transmission power to High or Low level.
When the ultrasonic indicator indicates Level 4, switch the ultrasonic transmission power to “Low.”
For details, refer to “Names and Functions of Product Parts” on page 15.

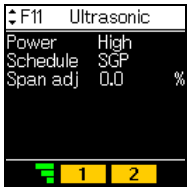
(2) Piping schedule setting
Select the type of piping to which the product is mounted.

(3) Fine adjustment of Measurement value inclination
The inclination of the flow rate measurement value can be set within the range ±40% R.D.
The accuracy may be affected if the piping in use is not included in the piping schedule settings. It may also be affected by conditions such as the condition of the pipework, the position of seam (weld marks) and the tightening of the mounting bracket.
In this case, it is possible to conduct fine adjustment by changing the inclination of the flow rate measurement value.
When using schedules other than SUS Sch20, Sch40 and Sch80, see below for set values.
However, as the set values vary depending on the condition of the pipework and the presence or absence of seams (weld marks), these values are for reference only.

Flow range	Schedule			Span adj		
	Sch5 t≈1.65mm	Sch10 t≈2.1mm	Sch160 t≈4.7mm	Sch5 t≈1.65mm	Sch10 t≈2.1mm	Sch160 t≈4.7mm
PFUW760	SUS40	SUS40	SUS80	26.3%	32.3%	-29.5%
PFUW711	SUS40	SUS40	SUS80	3.3%	24.3%	-31.5%

∗: t: Pipe wall thickness

<Operation>
Press the UP or DOWN button in function selection mode to select [F11 Ultrasonic].

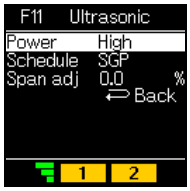


Press the UP or DOWN button to select the required item, and press the SET button.

Shifts to the settings of each item.

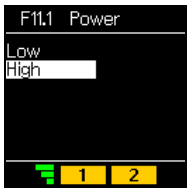
(1) Ultrasonic transmission power setting

Select [Power].



Press the SET button.

Press the UP or DOWN button to select the required ultrasonic transmission power level.

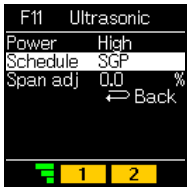


Press the SET button.

[F11 Ultrasonic] Returns to the setting of ultrasonic measurement.

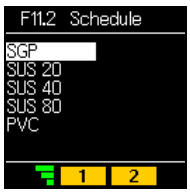
(2) Piping schedule setting

Select [Schedule].



Press the SET button.

Press the UP or DOWN button to select the required piping type.



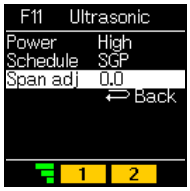
Piping types: SGP, SUS_Sch20, SUS_Sch40, SUS_Sch80, PVC (vinyl chloride)

Press the SET button.

[F11 Ultrasonic] Returns to the setting of ultrasonic measurement.

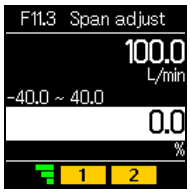
(3) Fine adjustment of Measurement value inclination

Select [Span adj].



Press the SET button.

Press the UP or DOWN button to change the value of the inclination adjustment rate.



Inclination adjustment rate of flow rate measurement value: −40.0 to 40.0% (0.1% increments)

Press the SET button.

[F11 Ultrasonic] Returns to the setting of ultrasonic measurement.

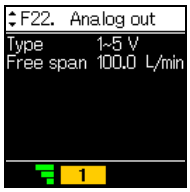
[F11 Ultrasonic] Completion of setting of ultrasonic measurement

■[F22 Analog out] Analogue output settings

Change the analogue output set value and analogue free span range.

<Operation>

Press UP or DOWN button in function selection mode to select [F22 Analog out].



Press the UP or DOWN button to select an item and press the SET button.

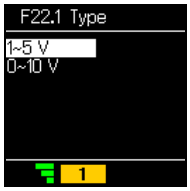
Shifts to the settings of each item.

(1) Analogue output setting (voltage output only)

Select [Type].

Press the SET button.

Press the UP or DOWN button to select the required analogue output rating.



∗: When using current output, [4-20 mA] is displayed and the setting cannot be changed.

Press the SET button.

Returns to the [F22 Analog out] analogue output settings.

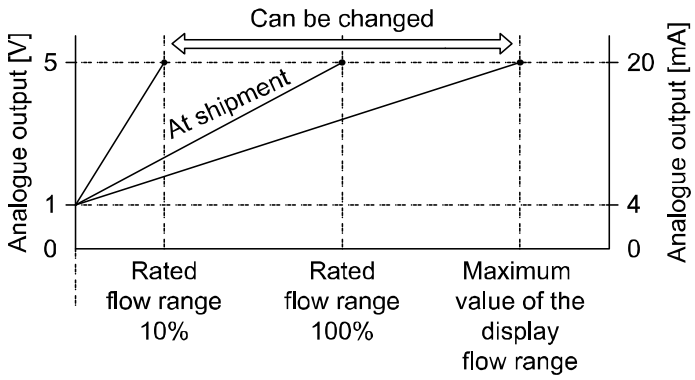
(2) Setting of the analogue free span function

Select [Free span].

Press the SET button.

Press the UP or DOWN button to change the value.

Press the UP and DOWN button to set a flow rate value that outputs 5 V (10 V) or 20 mA.
The entered flow rate value can be set in the range of 10% rated flow range to the maximum value of the display flow range.



Press the SET button.

Returns to the [F22 Analog out] analogue output settings.

Completion of the [F22 Analog out] analogue output settings

■[F30 Accumulate] Accumulated flow (rate) settings

The accumulated flow rate value can be held for intervals of 2 or 5 minutes.

<Operation>

Press the UP or DOWN button in function selection mode to select [F30 Accumulate].

Press the UP or DOWN button to select an item and press the SET button.

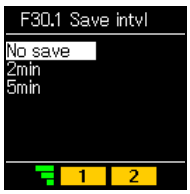
Shifts to the settings of each item.

(1) Setting of the accumulated value hold function

Select [Save intvl].

Press the SET button.

Press the UP or DOWN button to select the required accumulated value hold function.

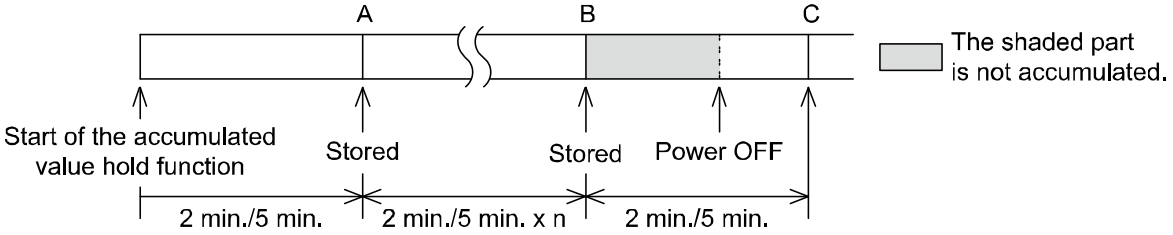


No save: The accumulated flow (rate) is not stored.
2 min: The accumulated flow (rate) is stored at 2 minutes intervals.
5 min: The accumulated flow (rate) is stored at 5 minutes intervals.

∗: When using the accumulated value hold function, calculate the product life from the operating conditions, and use the product within its life.
The maximum access limit of the memory device is approximately 1 million cycles.
•Data stored every 5 minutes: 5 minutes x 1 million times = 5 million minutes = 9.5 years approx.
•Data stored every 2 minutes: 2 minutes x 1 million times = 2 million minutes = 3.8 years approx.

∗: The value is stored in memory every 2 or 5 minutes.
If the power supply is turned off, the accumulated flow since the last time it was stored will be lost.

∗: When the power supply is turned on again, the accumulated flow count will start from the last value recorded at B.



Press the SET button.

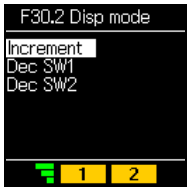
Returns to the [F30 Accumulate] accumulated flow (rate) settings.

(2) Accumulated addition/subtraction setting

Select [Disp mode].

Press the SET button. ↓

Press the UP or DOWN button to select an item.



Increment: Displays the accumulated measurement in the addition direction.
Dec SW1: Displays the value in the subtraction direction with respect to the OUT1 accumulated setting value.
Dec SW2: Displays the value in the subtraction direction with respect to the OUT2 accumulated setting value.

∗: For models with output specification other than L2, [Dec SW2] will not be displayed.

Press the SET button. ↓

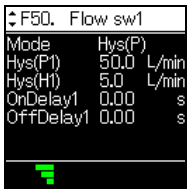
Returns to the [F30 Accumulate] accumulated flow (rate) settings. ↓

Completion of the [F30 Accumulate] accumulated flow (rate) setting

■[F50 Flow sw1] Instantaneous SW bit 1 setting

This function can only be changed when IO-Link is enabled (set via [F0]).
If the output operation mode of OUT1 setting in [F1 Switch1] is set to hysteresis mode (Hys(P), Hys(N)) or window comparator mode (Wind(N), Wind(P)), this function is interlocked with the [F1 Switch1] setting.

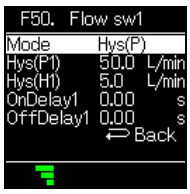
<Operation>
Press the UP or DOWN button in function selection mode to select [F50 Flow sw1].



Press the UP or DOWN button to select an item and press the SET button. → Moves on to the setting of output operation.

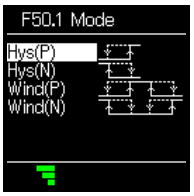
Setting of output operation

Select [Mode].



Press the SET button.

Press the UP or DOWN button to select an item.



Hys(P): Turns ON the switch output when the instantaneous flow rate exceeds the set value. (Hysteresis mode)
Hys(N): Turns OFF the switch output when the instantaneous flow rate exceeds the set value. (Hysteresis mode)
Wind(P): Turns ON the switch output if the instantaneous flow rate is between the range of two set values. (Window comparator mode)
Wind(N): Turns OFF the switch output if the instantaneous flow rate is between the range of two set values. (Window comparator mode)

Press the SET button.

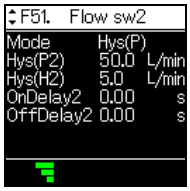
Returns to the setting of [F50 Flow sw1] instantaneous SW bit 1.

If Hys(P)/Hys(N) is selected →page 37
If Wind(P)/Wind(N) is selected →page 39

■[F51 Flow sw2] Instantaneous SW bit 2 setting

This function can only be changed when IO-Link is enabled (setting via [F0]).
If the output operation mode of OUT2 setting in [F2 Switch2] is set to hysteresis mode (Hys(P), Hys(N)) or window comparator mode (Wind(N), Wind(P)), this function is interlocked with the [F2 Switch2] setting.

<Operation>
Press the UP or DOWN button in function selection mode to select [F51 Flow sw2].

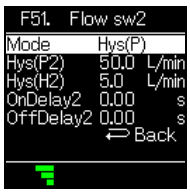


Press the UP or DOWN button to select an item and press the SET button.

Moves on to the setting of output operation.

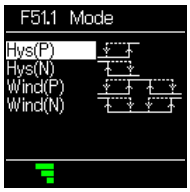
Setting of output operation

Select [Mode].



Press the SET button.

Press the UP or DOWN button to select an item.



Hys(P): Turns ON the switch output when the instantaneous flow rate exceeds the set value. (Hysteresis mode)
Hys(N): Turns OFF the switch output when the instantaneous flow rate exceeds the set value. (Hysteresis mode)
Wind(P): Turns ON the switch output if the instantaneous flow rate is between the range of two set values. (Window comparator mode)
Wind(N): Turns OFF the switch output if the instantaneous flow rate is between the range of two set values. (Window comparator mode)

Press the SET button.

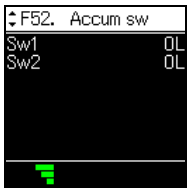
Returns to setting of [F51 Flow sw2] instantaneous SW bit 2.

If Hys(P)/Hys(N) is selected → page 44
If Wind(P)/Wind(N) is selected → page 46

■[F52 Accum sw] Accumulation SW1/2 bit setting

This function can only be changed when IO-Link is enabled (setting via [F0]).
When the output operation mode of OUT1/2 setting of [F1/2] is set to accumulated output mode (Accum(P), Accum(N), this function is interlocked with the [F1/2] setting.

<Operation>
Press the UP or DOWN button in function selection mode to select [F52 Accum sw].

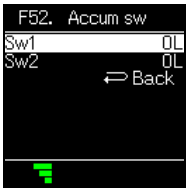


Press the UP or DOWN button to select Sw1 or Sw2, and press the SET button.

Moves on to the setting of the accumulation SW bit.

Sw1 threshold value setting

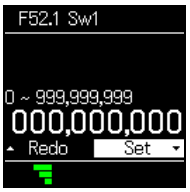
Press the UP or DOWN button to select an item.



Press the SET button.

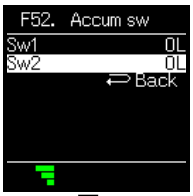
Press the UP or DOWN button to change the value for all digits.

Press the SET button



Sw2 threshold value setting

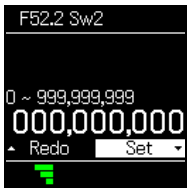
Press the UP or DOWN button to select an item.



Press the SET button.

Press the UP or DOWN button to change the value for all digits.

Press the SET button



■[F80 Display] Display settings

Set the display function.

(1) Display colour setting
The display colour can be selected.

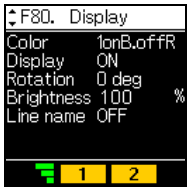
(2) Display OFF setting
Display OFF mode can be selected.
This function will turn the display OFF if no buttons are pressed for 30 seconds.

(3) Display rotation angle setting
It is possible to rotate the display to 0, 90, 180, and 270 degrees.
Use this function when the displayed value is difficult to read due to the installation conditions of the product.

(4) Screen brightness setting
It is possible to change the screen brightness.

(5) Line name display setting
Line names can be added to the default display items.
A line name can be entered (up to seven characters).

<Operation>
Press the UP or DOWN button in function selection mode to select [F80 Display].

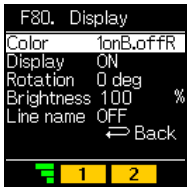


Press the UP or DOWN button to select an item and press the SET button.

Shifts to the settings of each item.

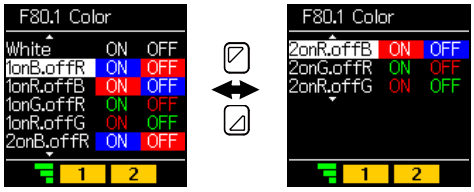
(1) Display colour setting

Select [Color].



Press the SET button.

Press the UP or DOWN button to select a desired display colour.



Page 1 Page 2

White: Fixed white characters on black background
1onB,offR: OUT1 output ON = white characters on blue background, OFF = white characters on red background
1onR,offB: OUT1 output ON = white characters on red background, OFF = white characters on blue background
1onG,offR: OUT1 output ON = green characters on black background, OFF = red characters on black background
1onR,offG: OUT1 output ON = red characters on black background, OFF = green characters on black background
2onB,offR: OUT2 output ON = white characters on blue background, OFF = white characters on red background
2onR,offB: OUT2 output ON = white characters on red background, OFF = white characters on blue background
2onG,offR: OUT2 output ON = green characters on black background, OFF = red characters on black background
2onR,offG: OUT2 output ON = red characters on black background, OFF = green characters on black background

∗: For models with output specification other than L2, [2onB,offR], [2onR,offB], [2onG,offR], and [2onR,offG] will not be displayed.

Press the SET button.

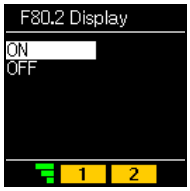
Returns to the [F80 Display] settings.

(2) Display OFF setting

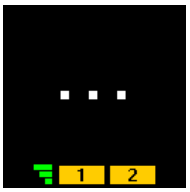
Select [Display].

Press the SET button.

Press the UP or DOWN button
to select the display OFF mode.



ON: Normal display.
OFF: Shifts to display off mode.
In measurement mode, [・ ・ ・] is displayed.
Each icon turns on according to the status at a lower brightness.
With the display OFF mode, when a key operation is performed, normal operation is available. When a key operation is not performed for 30 seconds, the display will return to the display OFF mode.
(Only in measurement mode)



Display OFF mode

Press the SET button.

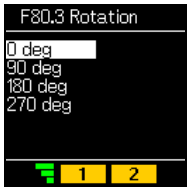
Returns to the [F80 Display] settings.

(3) Display rotation angle setting

Select [Rotation].

Press the SET button.

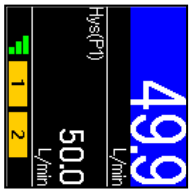
Press the UP or DOWN button to select the required rotation angle.



DOWN UP

0°

DOWN UP

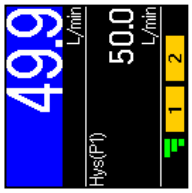


90°

UP DOWN

180°

UP DOWN



270°

The assignment of the UP and DOWN buttons changes depending on the display rotation angle.

Press the SET button.

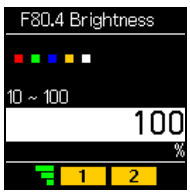
Returns to the [F80 Display] settings.

(4) Display brightness setting

Select [Brightness].

Press the SET button.

Press the UP or DOWN button to change the value.



∗: The value can be changed in a range between 10 and 100%.(10% increments)

Press the SET button.

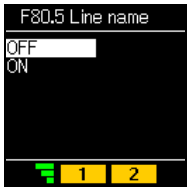
Returns to the [F80 Display] settings.

(5) Line name display setting

Select [Line name].

Press the SET button.

Press the UP or DOWN button to select an item.



When [OFF] is selected:
Press the SET button to save the setting.

When [ON] is selected:
Press the SET button to save the setting.

Press the SET button.

Press the UP or DOWN button to change the character for all.

Press the SET button.

Returns to the [F80 Display] settings.

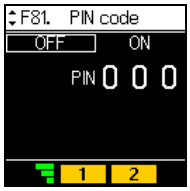
Completion of the [F80 Display] settings

■[F81 PIN code] PIN code settings

Set the PIN code used for the key lock function.

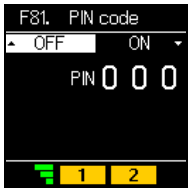
<Operation>

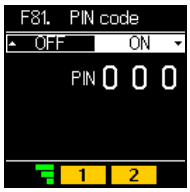
Operate the UP or DOWN button in function selection mode to select [F81 PIN code].



Press the SET button. ↓ Shifts to the PIN code setting.

PIN code setting
Press the UP or DOWN button to select an item.



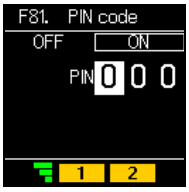


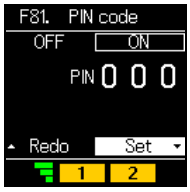
OFF: PIN code is not used.
ON: Shifts to the PIN code setting.

When [OFF] is selected:
Press the SET button to return to function selection mode.

When [ON] is selected:
Press the SET button to move on to checking the PIN code setting.

Checking the PIN code setting
Press the UP or DOWN button to enter the current PIN code.
(The factory default setting is 000.)

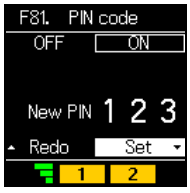




If the PIN code entered is incorrect, [PIN mismatch] will be displayed, and the PIN code must be entered again.
If the wrong PIN code is entered 3 times, [Failed 3 times] is displayed and the device returns to function selection mode.

Press the SET button. ↓

Entering a new PIN code
Press the UP or DOWN button to enter a new PIN code.



Press the SET button. ↓ Returns to function selection mode.

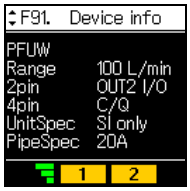
Completion of the [F81 PIN code] PIN code setting

■[F91 Device info] Checking device information

The device information can be checked.

<Operation>

Operate the UP or DOWN button in function selection mode to select [F91 Device info].



Press the SET button. ⬇ Shifts to the checking of device information.

Checking the device information

Press the UP or DOWN button to select an item.

Page 1 Page 2 Page 3

Press the SET button on one of the pages. ⬇ Returns to function selection mode.

Completion of the [F91 Device info] device information check

[F91] Details of items

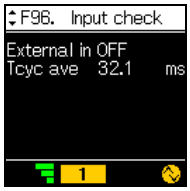
Item	Name	Indication	Remarks
PFUW	Series name		
Range	Range	60 L/min	PFUW760
		100 L/min	PFUW711
2pin	Output specification	N.C.	Output specification: L1
		OUT2 I/O	Output specification: L2
		VoltageOut	Output specification: L3
		CurrentOut	Output specification: L4
4pin	Output specification	C/Q	
UnitSpec	Units specification	SI Only	Fixed to SI units
		Select	With units selection function
PipeSpec	Piping specification	15A	PFUW760
		20A	PFUW711
Serial No.	Serial number	Hexadecimal number indication in up to eight digits	
Device ID	Device ID	0x00029B(667)	PFUW760-L1#-##
		0x00029C(668)	PFUW760-L2#-##
		0x00029D(669)	PFUW760-L3#-##
		0x00029E(670)	PFUW760-L4#-##
		0x00029F(671)	PFUW711-L1#-##
		0x0002A0(672)	PFUW711-L2#-##
		0x0002A1(673)	PFUW711-L3#-##
		0x0002A2(674)	PFUW711-L4#-##
HW Ver.	Hardware Rev.	1.00	
FW Ver.	Firmware Rev.	1.00	
Vendor ID	Vendor ID	131	
IO-Link	IO-Link version	V1.1	
Comm spd	Communication speed	COM2	
Work hour	Running time	*** h	

■[F96 Input check] Checking input signal

The input signal can be checked.

<Operation>

Operate the UP or DOWN button in function selection mode to select [F96 Input check].



[External in]

ON: External input switching is set to “in” and external input signal is input (output specification: L2 only)

OFF: External input switching is set to “in” and external input signal is not input (output specification: L2 only)

---: External input is set to other than “in” setting.

No display: Output specification is other than L2.

[Tcyc ave]

Cycle time measurement value (displayed as [- - -] during SIO mode)

↓

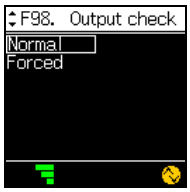
Completion of the [F96 Input check] input signal check

■[F98 Output check] Checking output signal

The operation of the system can be checked by forcibly switching the output ON/OFF operation without applying the flow rate.

<Operation>

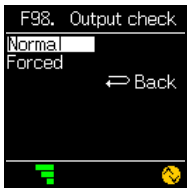
Operate the UP or DOWN button in function selection mode to select [F98 Output check].



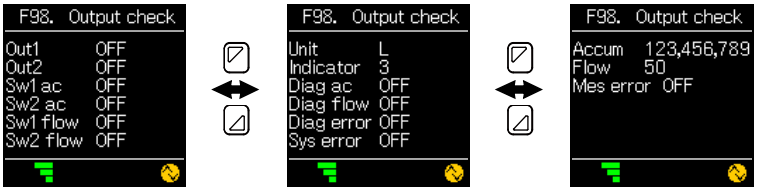
Press the SET button. ↓ Shifts to the settings of each item.

Normal output

Check the current output signal.
Select [Normal].



Press the SET button. ↓



Page 1 Page 2 Page 3

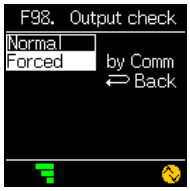
Press the SET button on one of the pages. ↓

Returns to the [F98 Output check] output signal check.

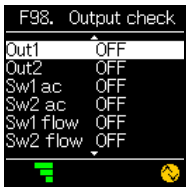
Forced output

The output signal can be forcibly changed.
Select [Forced].

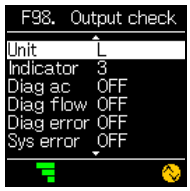
∗: When the output has been checked via IO-Link communication, "by Comm" appears by the side of "Forced."



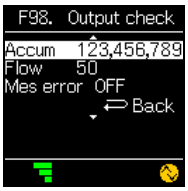
Press the SET button.



Page 1



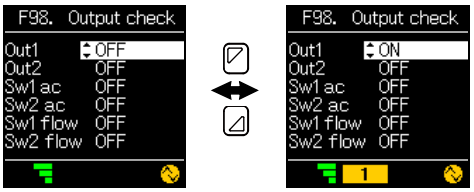
Page 2



Page 3

Press the SET button on page 1.

The output of the set item switches.



Press the SET button.

Press the Back button on pages 3.

Returns to the [F98 Output check] output signal check.

Completion of the [F98 Output check] output signal check

∗: The output set with forced output returns to the current output if the device returns to [F98 Output check] or measurement mode.

[F98] Details of items

Item	Description	Setting		Remarks
Out1	Hardware output	ON/OFF		
Out2	Hardware output	ON/OFF		When output specification is L2
AnalogOut	Analogue output	Voltage type	1.0 V/5.0 V or 0.0 V/10.0 V	When output specification is L3
		Current type	4 mA/20 mA	When output specification is L4
Sw1 ac	Accumulation SW1 judgment	ON/OFF		
Sw2 ac	Accumulation SW2 judgment	ON/OFF		
Sw1 flow	Flow rate SW judgment	ON/OFF		
Sw2 flow	Flow rate SW judgment	ON/OFF		
Unit	Flow rate display unit	L/Gal		
Indicator	Ultrasonic intensity	0 to 4		
Diag ac	Accumulation diagnosis	ON/OFF		
Diag flow	Flow rate diagnostics	ON/OFF		
Diag error	Error diagnosis (other than system error)	ON/OFF		
Sys error	Error diagnosis (system error)	ON/OFF		
Accum	Accumulated measurement process data	0/999999999		
Flow	Flow rate measurement process data	0/4000		
Mes error	Ultrasonic measurement error	ON/OFF		

∗: In process data bit switching SIO mode, items other than Out1, Out2, and AnalogOut will be displayed as “- - -” and cannot be changed.

■[F99 Reset setting] Resetting to the factory default settings

If the product settings are uncertain, the factory default values can be restored.

<Operation>

Press the UP or DOWN button in function selection mode to display [F99 Reset setting].

Press the SET button. ⇩ Shifts to resetting to the factory default settings.

Resetting to the factory default settings

Press the UP or DOWN button to select [YES].

Press the SET button. ⇩

Press and hold the DOWN and SET buttons <u>for 5 seconds</u>.

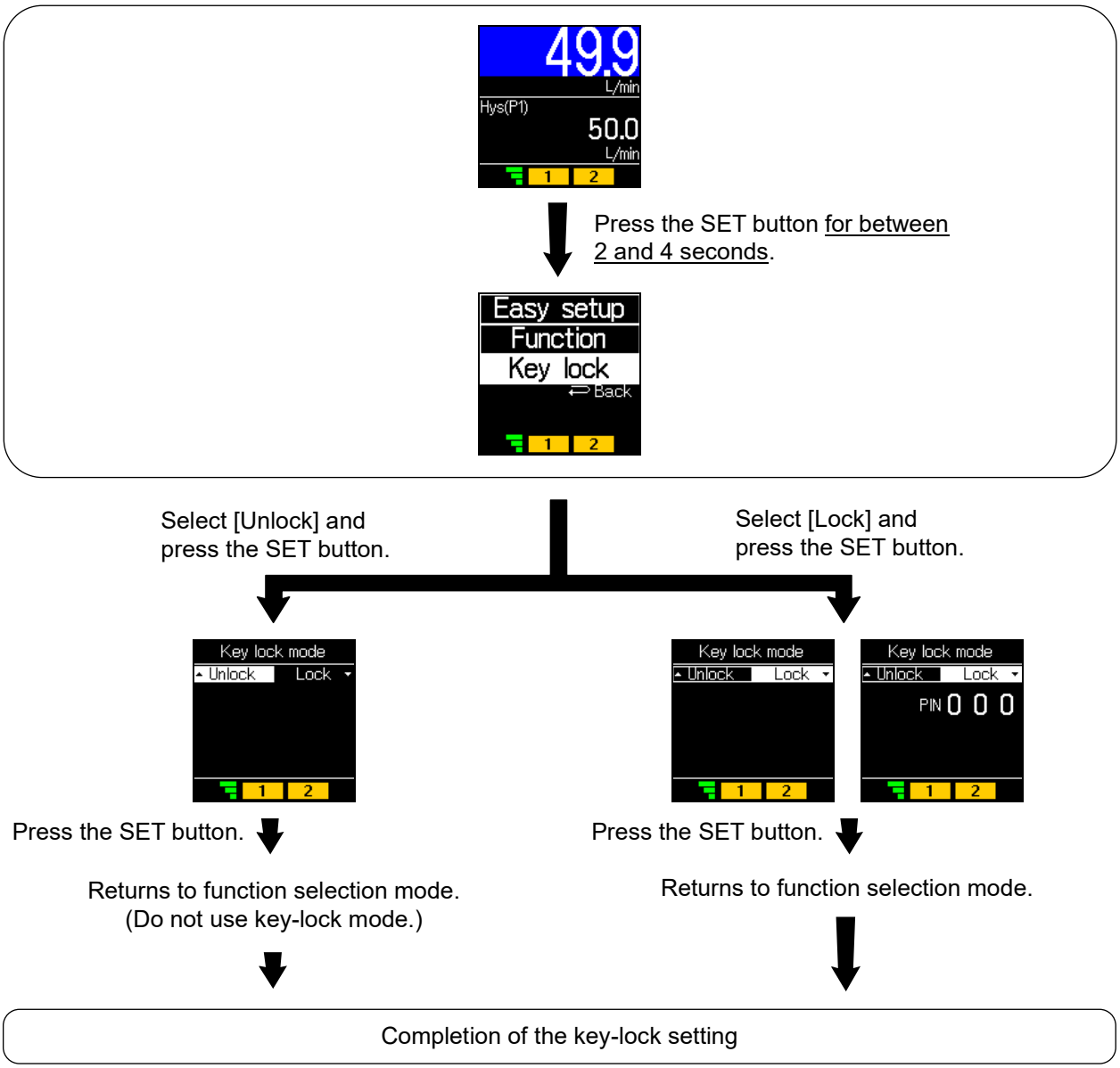
⇩

Press the SET button. ⇩ Returns to function selection mode.

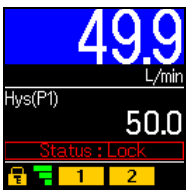
Completion of the [F99 Reset setting] resetting to the factory default settings

[Key-Lock Setting Mode] to Limit Button Operations

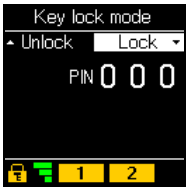
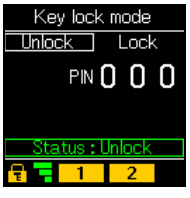
What is key-lock mode?
In key-lock mode, settings other than those for key-lock operations cannot be changed. The key lock function is used to prevent errors occurring due to unintentional changes of the set values.
In measurement setting mode, press the SET button for between 2 and 4 seconds, and then select [Key lock] to enter Key-lock setting mode.



∗: An icon appears in the lower left in key-lock mode.
∗: When the SET button is pressed or a reset operation is performed, [Status: Lock] is displayed and the operation is disabled.



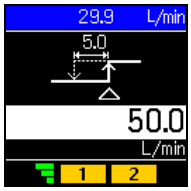
•Unlocking

When the PIN code setting is OFF	When the PIN code setting is ON
 Press the SET button <u>for at least 5 seconds but no more than 7 seconds</u>.  Press the UP or DOWN button to select [Unlock].  Press the SET button. The key-lock is cancelled and the device returns to function selection mode.	 Press the SET button <u>for at least 5 seconds but no more than 7 seconds</u>.  Press the UP or DOWN button to select [Unlock].  Press the SET button.  Press the UP or DOWN and SET button to enter the current PIN code.  Press the SET button.  Press the SET button. The key-lock is cancelled and the device returns to function selection mode.

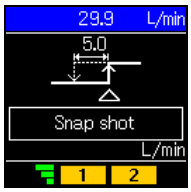
Other Settings

○Snap shot function

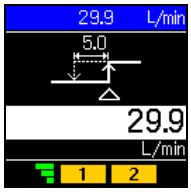
The current flow rate value can be set as the switch output ON/OFF set point.
When the displayed threshold values have been set ([F1 Switch1] OUT1 setting and [F2 Switch2] OUT2 setting) in the simple setting mode or function selection mode, press and hold the UP and DOWN buttons simultaneously for 1 second or longer. [Snap shot] will be displayed, and the switch output ON/OFF set point will automatically change to the current flow rate value.



Press and hold the UP and DOWN buttons for 1 second or longer.



Release the button.



Output mode	Setting item	Display	Snap shot function
Hysteresis mode	OUT1 and OUT2 set values	P_1(n_1)、P_2(n_2)	○
	Hysteresis	H_1、H_2	○
Window comparator mode	OUT1 and OUT2 set values	P1L(n1L)、P1H(n1H) P2L(n2L)、P2H(n2H)	○
	Hysteresis	H1、H2	×

・OUT1 set value and OUT2 set value

The value is set to the same value as the display value (current flow rate value).
(Depending on the hysteresis value, there may be a range in which the current flow rate value cannot be set. In that case, the value is set to the closest value).

・Hysteresis

The hysteresis is calculated and set using the formula below.

Normal output: (OUT 1 (2) set value) - (current flow rate value) Reversed output: (current flow rate value) - (OUT 1 (2) set value)

If the result of the calculation is 0 or less, [Error] is displayed and the set value is not changed.
After setting, adjustment is also possible by pressing the UP or DOWN buttons.

○Reset operation

When the sub screen displays the accumulated flow rate or peak/bottom display, simultaneously press and hold the SET and DOWN buttons for 1 second or longer to display [Reset] on the sub display, to allow the value to be reset.

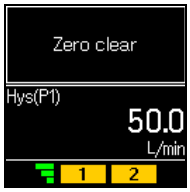
The accumulated flow rate and peak/bottom values will be reset even when the power supply is turned OFF.

When accumulated flow rate is displayed	When peak/bottom value is displayed
 Press and hold the SET and DOWN buttons for 1 second or longer.  Release the button. 	 Press and hold the SET and DOWN buttons for 1 second or longer.  Release the button. 

○Zero-clear function

The measured flow rate display value can be cleared to zero by pressing and holding the UP and DOWN buttons simultaneously for 1 second or longer in measurement mode. The value can be adjusted within the range ±10%F.S. from the default condition.

Press and hold the UP and DOWN buttons simultaneously for 1 second or longer.



Release the button.

Maintenance

How to reset the product after a power loss or when the power has been unexpectedly removed
The settings for the product are retained in memory prior to the power loss or de-energizing of the product. The output condition is also recoverable to that prior to the power loss or de-energizing. However, this may change depending on the operating environment. Therefore, check the safety of the whole installation before operating the product.

IO-Link Specifications

■IO-Link function overview

○Communication function

This product can check the commanded flow rate setting as well as the measurement value, diagnostic information, and switch output status through the cyclic data communication via the IO-Link system.

○Product status monitoring function

This function can monitor the product status via IO-Link.

- Multiple error statuses (internal hardware errors, etc.) can be monitored.
- Multiple warning conditions can be detected (flow rate measurement error, etc.).

○Data storage function

The data storage function stores the IO-Link device parameter settings to the IO-Link master.
With the IO-Link data storage function, the IO-link device can be replaced easily without re-setting the equipment construction or setting the parameters.
When the device parameters are set and downloaded to the device using the IO-Link setting tool, the parameters will be uploaded to the data storage in the master by the system command after download (backup instruction by the communication command).
When the device is replaced with the same type of IO-Link device due to failure, the parameter settings stored in the master are downloaded automatically, and the device can be operated using the parameter settings of the previous device.
Device parameter setting is applicable to 3 types of back-up levels of the master setting ("Inactive", "Back-up/Restore", "Restore").
"Back-up" implies the activation of an upload and "restore" implies a download.

■Communication Specifications

IO-Link type	Device
IO-Link version	V1.1
Communication speed	COM2 (38.4 kbps)
Min. cycle time	4.5 ms
Process data length	Input Data：8 bytes、Output Data：0 bytes
On request data communication	Available
Data storage function	Available
Event function	Available

■Process data

Process data is the data which is exchanged periodically between the master and device.
In this product, the process data consists of the following.
•Input process data (hereafter "PD_IN")

○PD_IN

Bit offset	Item	Remarks
0	Accumulated OUT1 output	0: Less than the set value 1: Greater than the set value
1	Accumulated OUT2 output	0: Less than the set value 1: Greater than the set value
2	Instantaneous OUT1 output	0: OFF 1: ON
3	Instantaneous OUT2 output	0: OFF 1: ON
4 to 6	Ultrasonic indicator	0 to 4
7	Flow rate unit	0: L/min 1: gal/min
8	Accumulated flow rate diagnosis	0: Within range 1: Out of range
9	Instantaneous flow rate diagnosis	0: Within range 1: Out of range (HHH/LLL)
12	Ultrasonic measurement error diagnosis	0: Normal 1: Abnormal
13	Fixed output	0: Normal output 1: Fixed output
14	Error diagnosis	0: Normal 1: Abnormal
15	System error diagnosis	0: Normal 1: Abnormal
16 to 31	Instantaneous flow rate measurement value	16-bit signed integer
32 to 47	Accumulated flow rate measurement value (lower)	32-bit unsigned integer
48 to 63	Accumulated flow rate measurement value (upper)	32-bit unsigned integer

Bit offset	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
Item	Accumulated flow rate measurement value, upper (32-bit unsigned integer)															

Bit offset	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
Item	Accumulated flow rate measurement value, lower (32-bit unsigned integer)															

Bit offset	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Item	Instantaneous flow rate measurement value (16-bit signed integer)															

Bit offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Item	System error diagnosis	Error diagnosis	Fixed output	Ultrasonic measurement error diagnosis	0	0	Instantaneous flow rate diagnosis	Accumulated flow rate diagnosis	Flow rate unit	Ultrasonic indicator			Instantaneous OUT2 output	Instantaneous OUT1 output	Accumulated OUT2 output	Accumulated OUT1 output

•The process data of this product is in Big-Endian.
When the transmission method of the upper communication is Little-Endian, the byte order will be swapped.
Refer to the table below for the Endian type of the major upper communication.

Endian type	Upper communication protocol
Big-Endian type	Such as PROFIBUS and PROFINET
Little-Endian type	Such as EtherNET/IP, EtherCAT and CC-Link IE Field

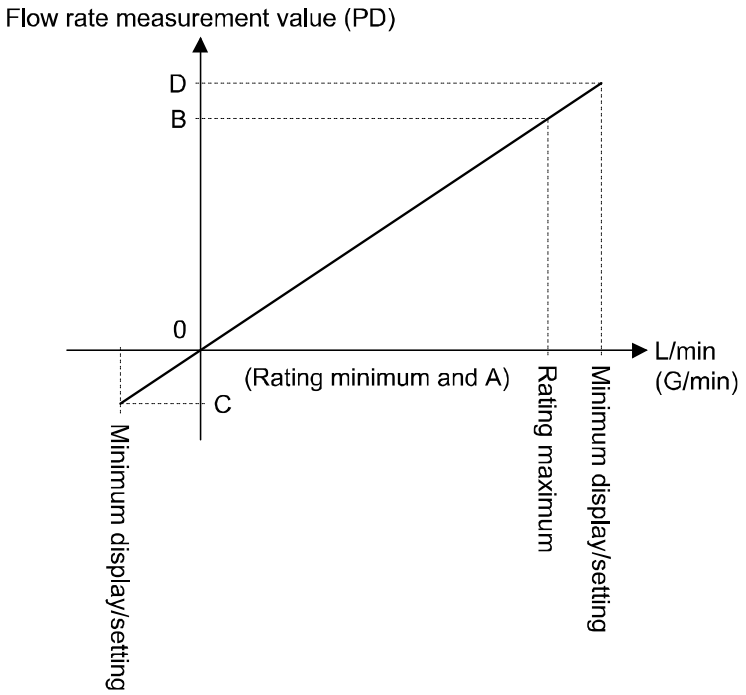
○Flow rate measurement value

Target	Unit	Range	Flow rate measurement value					
			Rated flow rate range			Display/settable range		
			Min.	to	Max.	Min.	to	Max.
Instantaneous flow	L/min	60 L/min	0.0	to	60.0	-3.0	to	84.0
		100 L/min	0.0	to	100.0	-5.0	to	140.0
	G/min	60 L/min	0.00	to	15.85	-0.80	to	22.20
		100 L/min	0.00	to	26.42	-1.30	to	37.00
Accumulated flow	L	60 L/min	0	to	999999999	0	to	999999999
		100 L/min						
	G	60 L/min	0	to	999999999	0	to	999999999
		100 L/min						

○PD value

Target	PD value					
	Rated flow rate range			Display/settable range		
	A	to	B	C	to	D
Instantaneous flow	0	to	4000	-200	to	5600
Accumulated flow	0	to	999999999	0	to	999999999

●Relationship between flow rate and PD



○Conversion formula for process data and measurement/command value

(1) Conversion formula for process data to measurement/command value: Pr = a x (PD) + b

(2) Conversion formula for measurement/command value to process data: (PD) = (Pr – b) / a

Pr: Measurement value and command value
PD: Measurement value (process data)
a: Inclination
b: Intercept

[Inclination and intercept to the units specification]

Target	Units	Range	Inclination a	Intercept b
Instantaneous flow	L/min	60 L/min	0.015	0
		100 L/min	0.025	0
	G/min	60 L/min	0.003962583	0
		100 L/min	0.006604305	0
Accumulated flow	L	60 L/min	1	0
		100 L/min		
	G	60 L/min	1	0
		100 L/min		

[Calculation example]

(1) Conversion from process data to flow rate measurement/command value
(When range: 60 L/min, unit specification: L/min, PD = 500)

Pr = a × (PD) + b
= 0.015 × 500 + 0
= 7.5 [L/min]

(2) Conversion from flow rate measurement/command value to process data
(When range: 100 L/min, unit specification: G/min, Pr = 2.0 [G/min])

(PD) = (Pr - b) / a
= [2.0 - (0)]/(0.006604305)
≈ 303

■IO-Link parameter settings

○IODD file

IODD (I/O Device Description) is a definition file which provides all properties and parameters required for establishing functions and communication of the device.
The IODD includes the main IODD file and a set of image files such as vendor logo, device picture and device icon.
The IODD file for this product is as follows:

Product number	IODD file *
PFUW7**-**-**	SMC-PFUW7**-**-**-yyyymmdd-IODD1.1

: "" indicates the product model which corresponds to each IODD file.
*: "yyyymmdd" indicates the date of creation of the file, with yyyy, mm, and dd representing the year, month, and date, respectively.

The IODD file can be downloaded from the SMC website (https://www.smcworld.com).

○Service data

The tables below indicate the parameters which can be read or written by simple access parameter (direct parameters page) and ISDU parameters which are applicable to various parameters and commands.

●Direct parameters page 1

DPP1 address	Access	Parameter name	Default (decimal number)	Description
0x07	R	Vendor ID	0x0083(131)	"SMC Corporation"
0x08				
0x09	R	Device ID	0x00029B(667) 0x00029C(668) 0x00029D(669) 0x00029E(670) 0x00029F(671) 0x0002A0(672) 0x0002A1(673) 0x0002A2(674)	PFUW760-L1*-** PFUW760-L2*-** PFUW760-L3*-** PFUW760-L4*-** PFUW711-L1*-** PFUW711-L2*-** PFUW711-L3*-** PFUW711-L4*-**
0x0A				
0x0B				

●ISDU parameters

Index (decimal number)	Subindex	Access *1	Parameter	Initial value	Note
0x0002 (2)	0	W	System command	-	Refer to "System command". (Page 85)
0x000C (12)	0	R/W	Device access lock	0x0000	Refer to "Device access lock parameter". (Page 85)
0x0010 (16)	0	R	Vendor name	SMC Corporation	
0x0011 (17)	0	R	Vendor text	www.smcworld.com	
0x0012 (18)	0	R	Product name	Example PFUW760-L1x-xx	
0x0013 (19)	0	R	Product ID	Example PFUW760-L1x-xx	
0x0014 (20)	0	R	Product text	Flow sensor	
0x0015 (21)	0	R	Serial number	Example "xxxxxxxx"	•Indicated in 8 digits •16 octets fixed character string
0x0016 (22)	0	R	Hardware version	HW-Vx.y	x: Major revision number y: Minor revision number
0x0017 (23)	0	R	Software version	FW-Vx.y	x: Major revision number y: Minor revision number
0x0018 (24)	0	R/W	Application specific tag	ALL "*"	Can be changed arbitrarily
0x0024 (36)	0	R	Device status parameter	-	Refer to "Device status parameter". (Page 85)
0x0025 (37)	0	R	Detailed device status parameter	-	Refer to "Device details status parameter"(Page 86)
0x0028 (40)	0	R	Process data input	-	The latest process data can be read.

*1: R: Read; W: Write

●System command (Index 2)

In the ISDU index 0x0002 SystemCommand (system command), the command shown in the table below will be issued.

The button for each system command is displayed on the IO-Link setting tool (excluding "ParamDownloadStore").

Click the button to send the system command to the product.

The Writeable commands are shown below.

Data type: 8 bit UInteger

Value	Definition of status	Description
128	Device Reset	Restart the device
129	Application Reset	Reset the peak/bottom value Reset the accumulated flow value
130	Restore Factory Reset	Reset of a set value to the factory default value
131	Back to box	Initialization of set values to factory defaults (waiting for power supply to be reconnected). When Waiting for PowerCycle is displayed, the flow measurement and output functions are switched off.
160	Zero Clear	Zero-clear
170	Peak Bottom Reset	Reset of the peak/bottom value
190	Accumulate Reset	Reset of the accumulated flow value

●Device access lock parameter (Index 12)

The conditions for device access lock are as follows.

Data type: 16 bit Record

Value	Description
0	Key lock release, DS lock release (initial value)
2	Key lock release, DS lock
8	Key lock, DS lock release
10	Key lock, DS Lock

[Key-lock]

Function that prevents changes to the flow sensor settings (disables button operations).

When the keys are locked, setting changes or restoration of data storage (rewriting of parameter settings) through communication can still be performed.

[Lock data storage (DS lock)]

When the "Data storage" is locked, the data storage function of the flow sensor is disabled.

In this case, access is rejected for data storage backup and restore.

●Device status parameter (Index 36)

The readable device statuses are as follows.

Data type: 8 bit UInteger

Value	Definition of status	Description
0	Normal operation	–
1	Maintenance is required	Not available
2	Out of specification	Outside the flow rate range Below the flow rate range
3	Function check	Not supported
4	Failure or problem	Internal failure of flow sensor

●Device details status parameter (Index 37)
Event details of the readable device statuses are as follows.

Layout	Event	Event class		Event code
		Definition	Value	
1	Internal failure or problem	Error	0xF4	0x8D03
2	Internal failure or problem	Error	0xF4	0x8D0F
3	Internal failure or problem	Error	0xF4	0x8D04
4	Internal failure or problem	Error	0xF4	0x8D05
5	Internal failure or problem	Error	0xF4	0x8D01
6	Internal failure or problem	Error	0xF4	0x8D06
7	Internal failure or problem	Error	0xF4	0x8D0C
8	Device ID error	Error	0xF4	0x8D0D
9	Sensor error	Error	0xF4	0x8CD0
10	OUT2 over current	Error	0xF4	0x8CC0
11	Measurement error	Error	0xE4	0x8DA4
12	Above the accumulated flow measurement	Danger	0xE4	0x8D80
13	Above the instantaneous flow measurement	Danger	0xE4	0x8C10
14	Below the instantaneous flow measurement	Danger	0xE4	0x8C30
15	Test event A	Danger	0xE4	0x8CA0
16	Test event B	Danger	0xE4	0x8CA1
17	Data storage upload request	Notification	0x54	0xFF91

●Product original parameter

Index		Sub index	Access *1	Parameter	Data type *2	Initial value	Data storage *3	Setting value *4	Remarks
dec	hex								
1000	0x03E8	0	R/W	Units (Units setting)	U8	0	Y	0: L/min(L) 1: G/min	When the units selection function is not available, read/write to an unselectable item is rejected.
1030	0x0406	0	R/W	OUT2 I/O (Switching of external input)	U8	0	Y	0: OUT2 1: External in	SW2 input/output selection setting
1010	0x03F2	0	R/W	Colour (Display colour selection)	U8	1	Y	0: white (always white characters) 1: 1onB, offR (Blue background when OUT1 is on) 2: 1onR, offB (Red background when OUT1 is on) 3: 1onG, offR (Green characters when OUT1 is on) 4: 1onR, offG (Red characters when OUT1 is on) 5: 2onB, offR (Blue background when OUT2 is on) 6: 2onR, offB (Red background when OUT2 is on) 7: 2onG, offR (Green characters when OUT2 is on) 8: 2onR, offG (Red characters when OUT2 is on)	Display colour setting
1020	0x03FC	0	R/W	I/O type (Selection of NPN/PNP)	U8	1	Y	0: NPN 1: PNP	NPN/PNP set value
1200	0x04B0	0	R/W	Switch1 (OUT1 output setting)	U8	0	Y	0: Flow (instantaneous output) 1: AC(p) (Accumulated output normal rotation) 2: AC(N) (Accumulated output reverse rotation) 3: PLS(P) (Accumulated pulse normal rotation) 4: PLS(N) (Accumulated pulse reverse rotation) 5: Alarm(NC) (Error output) 6: Off (output off)	Setting of OUT1
1210	0x04BA	0	R/W	OUT1_mode (Selection of OUT1 output mode)	U8	0	Y	0: Hys(P) (Hysteresis normal rotation) 1: Hys(N) (Hysteresis reverse rotation) 2: Wind(P) (Window comparator normal rotation) 3: Wind(N) (Window comparator reverse rotation)	Setting of instantaneous SW bit 1

●Product individual parameters (continued)

Index		Sub index	Access *1	Parameter		Data type *2	Initial value	Data storage *3	Setting value *4	Remarks
dec	hex									
1220	0x04C4	1	R/W	OUT1 Setting	OUT1_Hys(P/N1) (Hysteresis set value)	U16	2000	Y	Setting range -200 to 5600	
		2	R/W		OUT1_Hys(H1) (Hysteresis tolerance)	U16	200	Y	Setting range 0 to 5800	
		3	R/W		OUT1_Wind(P/N1L) (Lower limit of window comparator)	U16	1200	Y	Setting range -200 to 5600	
		4	R/W		OUT1_Wind(P/N1H) (Upper limit of window comparator)	U16	2400	Y	Setting range -200 to 5600	
		5	R/W		OUT1_Wind(H1) (Window comparator hysteresis tolerance)	U16	400	Y	Setting range 0 to 2900	
		6	R/W		OUT1_OnDelay1 (ON delay time)	U16	0	Y	Setting range 0 to 6000	
		7	R/W		OUT1_OffDelay1 (Off delay time)	U16	0	Y	Setting range 0 to 6000	
1300	0x0514	0	R/W		OUT1_AC_L (Accumulated output set value L)	U32	0	Y	Setting range 0 to 999999999	Units specification (Unit): when “L/min” is selected
1310	0x051E	0	R/W		OUT1_AC_G (Accumulated output set value G)	U32	0	Y	Setting range 0 to 999999999	Units specification (Unit): when “G/min” is selected
1400	0x0578	0	R/W	OUT2 Setting	Switch2 (OUT2 output setting)	U8	0	Y	0: Flow (instantaneous output) 1: AC(p) (Accumulated output normal rotation) 2: AC(N) (Accumulated output reverse rotation) 3: PLS(P) (Accumulated pulse normal rotation) 4: PLS(N) (Accumulated pulse reverse rotation) 5: Alarm(NC) (Error output) 6: Off (output off)	Setting of OUT2
1410	0x0582	0	R/W		OUT2_mode (Selection of OUT2 output mode)	U8	0	Y	0: Hys(P) (Hysteresis normal rotation) 1: Hys(N) (Hysteresis reverse rotation) 2: Wind(P) (Window comparator normal rotation) 3: Wind(N) (Window comparator reverse rotation)	Instantaneous SW bit 2 setting

●Product individual parameters (continued)

Index		Sub index	Access *1	Parameter		Data type *2	Initial value	Data storage *3	Setting value *4	Remarks
dec	hex									
1420	0x058C	1	R/W	OUT2 Setting	OUT2_Hys(P/N2) (Hysteresis set value)	U16	2000	Y	Setting range -200 to 5600	
		2	R/W		OUT2_Hys(H2) (Hysteresis tolerance)	U16	200	Y	Setting range 0 to 5800	
		3	R/W		OUT2_Wind(P/N2L) (Lower limit of window comparator)	U16	1200	Y	Setting range -200 to 5600	
		4	R/W		OUT2_Wind(P/N2H) (Upper limit of window comparator)	U16	2400	Y	Setting range -200 to 5600	
		5	R/W		OUT2_Wind(H2) (Window comparator hysteresis)	U16	400	Y	Setting range 0 to 2900	
		6	R/W		OUT2_OnDelay2 (ON delay time)	U16	0	Y	Setting range 0 to 6000	
		7	R/W		OUT2_OffDelay2 (Off delay time)	U16	0	Y	Setting range 0 to 6000	
1500	0x05DC	0	R/W		OUT2_AC_L (Accumulated output set value L)	U32	0	Y	Setting range 0 to 999999999	Units specification (Unit): when “L/min” is selected
1510	0x05E6	0	R/W		OUT2_AC_G (Accumulated output set value G)	U32	0	Y	Setting range 0 to 999999999	Units specification (Unit): when “G/min” is selected
1600	0x0640	0	R/W	Accumulated Disp mode (Accumulated flow rate display setting)		U8	0	Y	0: Add 1: Dec1 2: Dec2	
1800	0x0708	0	R/W	Filter (Digital filter)		U8	0	Y	0: 0.5 1: 1.0 2: 2.5 3: 5.0 4: 10.0 5: 30.0 6: 60.0	
1810	0x0712	0	R/W	Span adj (Measurement value inclination fine adjustment)		U16	0	Y	Setting range -400 to +400	0.1% increments

●Product individual parameters (continued)

Index dec	Index hex	Sub index	Access *1	Parameter	Data type *2	Initial value	Data storage *3	Setting value *4	Remarks
2000	0x07D0	1	R/W	Line name (Display of line name)	U8	0	Y	0 : OFF 1 : ON	
		2	R/W	Sub display (Sub screen display)	U8	0	Y	OUT1 Setting indication 0: Hysteresis set value 1: Hysteresis tolerance 2: Lower limit of window comparator 3: Upper limit of window comparator 4: Window comparator hysteresis 5: Accumulated output set value 6: Accumulated pulse conversion value 7: Error indication 8: Output OFF	
								OUT2 Setting indication 9: Hysteresis set value 10: Hysteresis tolerance 11: Lower limit of window comparator 12: Upper limit of window comparator 13: Window comparator hysteresis 14: Accumulated output set value 15: Accumulated pulse conversion value 16: Error indication 17: Output OFF	
								18: Flow peak/bottom flow rate display 19: Accumulated flow rate display 20: IO-Link mode display 32: Line name display	
2010	0x07DA	0	R/W	Resolution (Display resolution)	U8	0	Y	0: High normal resolution 1: Low lower resolution (1/10)	
2020	0x07E4	0	R/W	Rotation (Display rotation angle setting)	U8	0	Y	0: 0 deg 1: 90 deg 2: 180 deg 3: 270 deg	
2030	0x07EE	0	R/W	Zero cut (Zero cut setting)	U8	1	Y	Setting range 0 to 10	1% increments
2040	0x07F8	0	R/W	Input (External input setting)	U8	1	Y	0: Reset acc 1: Reset p&b 2: Zero clear	
2060	0x080C	0	R/W	Brightness (Screen brightness setting)	U16	10	Y	Setting range 1 to 10	10% increments
2100	0x0834	0	R/W	AOUT_Type (Setting of analogue output)	U8	0	Y	0: 1 to 5 V 1: 0 to 10 V	Setting of analogue output (Voltage output type only)
2110	0x083E	0	R/W	AOUT_Freespan (Analogue output free range set value)	U16	4000	Y	Setting range 400 to 5600	
2200	0x0898	0	R/W	AC_Save (Accumulated value hold setting)	U8	0	Y	0: oFF (not held) 1: 2 min 2: 5 min	
2370	0x0942	0	R/W	Flow dir (Selection of flow direction)	U8	0	Y	0: Forward (forward direction) 1: Reverse (reverse direction)	
2400	0x0960	0	R/W	Display (Display OFF setting)	U8	0	Y	0: ON 1: OFF (display OFF)	
2410	0x096A	1	R/W	Security code: PIN (Use or not-use)	U8	0	Y	0: Not used 1: In use	
		2	R/W	Security code: PIN code (Security code)	U16	0	Y	Setting range 0 to 999	

●Product individual parameters (continued)

Index		Sub index	Access *1	Parameter		Data type *2	Initial value	Data storage *3	Setting value *4	Remarks
dec	hex									
2420	0x0974	1	R/W	Line name characters	1st letter (left end)	U8	65	Y	Setting range 32 to 126	92, 94, and 96 cannot be set
		2	R/W		2nd letter	U8	65	Y		
		3	R/W		3rd letter	U8	65	Y		
		4	R/W		4th letter	U8	65	Y		
		5	R/W		5th letter	U8	65	Y		
		6	R/W		6th letter	U8	65	Y		
		7	R/W		7th letter	U8	65	Y		
4500	0x1194	0	R/W	Schedule (Piping schedule setting)		U8	0	Y	0: SGP 1: Sch20 2: Sch40 3: Sch80 4: PVC 5: Special	5: Special can only be selected for special product
4501	0x1195	0	R/W	Ultrasonic_Power (Change of transmission power)		U8	1	Y	0: Low 1: High	
10000	0x2710	0	R	Work_hour (Running time)		U32	–	N	0 to 876000	Return the current running time [h]
7000	0x1B58	0	W	OUT Test (Output check)		U8	0	N	0: Normal output 1: Fixed output	The PD bit becomes 1 when a fixed output has been received.
7010	0x1B62	0	W	Toggle (Toggle output)		U8	–	N	0: Accumulated flow rate 1: Instantaneous flow rate 16: OUT1 hardware 17: OUT2 hardware 32: Accumulated SW1 bit 33: Accumulated SW2 bit 34: Instantaneous SW1 bit 35: Instantaneous SW2 bit 80: Analogue output 208: Display unit bit 210: Reception strength indicator 211: Ultrasonic measurement error 224: Accumulated diagnosis bit 225: Flow rate diagnosis bit 254: Error bit 255: System error bit	
7100	0x1BBC	0	R	Analogue output value		U16	–	N	Voltage output: 0.1 V increments Current output: 1 mA increments	The current analogue output value is returned
8000	0x1F40	0	R	Instantaneous flow rate PD conversion formula Inclination a		F32	–	N	Refer to Table “Inclination and intercept to the unit specification.” (Page 82)	
8010	0x1F4A	0	R	Instantaneous flow rate PD conversion formula Intercept b		F32	–	N	Refer to Table “Inclination and intercept to the unit specification.” (Page 82)	
8020	0x1F54	0	R	Instantaneous flow peak value		S16	–	N	-200 to 5600	The conversion method from the communication value to the actual measurement value is the same as the method for process data.
8030	0x1F5E	0	R	Instantaneous flow bottom value		S16	–	N		
8060	0x1F7C	0	R	Accumulated flow rate PD conversion formula Inclination a		F32	–	N	Refer to Table “Inclination and intercept to the unit specification.” (Page 82)	Accumulated PD × Accumulated value conversion factor = Current accumulated flow rate value
8070	0x1F86	0	R	Accumulated flow rate PD conversion formula Intercept b		F32	–	N	Refer to Table “Inclination and intercept to the unit specification.” (Page 82)	

●Product individual parameters (continued)

Index		Sub index	Access *1	Parameter		Data type *2	Initial value	Data storage *3	Setting value *4	Remarks
dec	hex									
8090	0x1F9A	0	R	Range information reading	Acquisition of all of data below	U16	–	N	Acquisition of values below	
		1	R		Lower limit of rated range	U16	–	N	0	
		2	R		Upper limit of rated range	U16	–	N	4000	
		3	R		Lower limit of measurable range	U16	–	N	-200	
		4	R		Upper limit of measurable range	U16	–	N	5600	
		5	R		Lower limit of settable range	U16	–	N	-200	
		6	R		Upper limit of settable range	U16	–	N	5600	

∗1: R means Read and W means Write.

∗2: Refer to table below for symbols.

Symbol	Data type (IO-Link standard)	Data length Bit[byte]	Description
U8	UIntegerT	8[1]	Unsigned integer
U16		16[2]	
U32		32[4]	
S16	IntegerT	16[2]	Signed integer
F32	Float32T	32[4]	Floating point number

∗3: "Y" indicates that the parameter setting data is saved to the master, and "N" indicates that the parameter is not saved.

∗4: Read/write to unselectable items will be rejected depending on the product No.

Troubleshooting

If a product operation failure occurs, please confirm the cause of the problem from the following table.
If a cause applicable to the problem cannot be identified and normal operation can be recovered by replacement with a new product, this indicates that the product itself was faulty.
Problems with the product may be due to the operating environment (network configuration, etc.). Please consult SMC.

○Troubleshooting list

Problem	Possible cause	Investigation method	Countermeasures
The display turns off Part of the display is missing	Incorrect power supply	Check if the power supply voltage is within 18 to 30 VDC.	Supply the power supply voltage of 18 to 30 VDC.
	Incorrect wiring	Check the power supply wiring. Check if the brown and blue wires are connected to DC(+) and DC(−) respectively, and if the wiring is secure.	Check and correct the wiring.
	Display OFF mode	Check the setting to see if display OFF mode is selected.	Set up the product again. (Page 23)
	Lead wire is broken		Replace the lead wire.
	The product failed		Replace the product.
Displayed or analogue values are unstable or show abnormal values	Entry of foreign matter	Check whether foreign matter has entered or adhered.	Use a filter to prevent foreign matter from entering or adhering. Periodically discharge the foreign matter on the filter so that it does not accumulate.
	Piping in the reverse direction	Check the fluid direction.	Mount the product so that the fluid flow direction is the same as the arrow indicated on the product label. The fluid flow direction can be changed via setting. (Page 33)
	Entry of air bubbles	Check the fluid for air bubbles.	Remove the air bubbles from the fluid before use.
	The product failed		Replace the product.
	Insufficient fluid flow	Confirm whether the fluid path is full.	Fill the fluid path with fluid.
	Type and condition of pipework	Checking the type and condition of pipework.	The lined or coated pipes may cause unstable measurements. The product must also be mounted on a corrosion-free surface.
	Poorly tightened pipework clamps	Check ultrasonic indicator level. (page 15)	Change ultrasonic transmission power setting. (page 52) Check the tightening torque. (76 cN•m ± 5 cN•m)
	Poor installation of product	Check the position of the pipe clamps.	Avoid mounting the product in positions where there are dents or other damage.
	Location of seams (weld marks)	Locate seams (weld marks).	Mount the product on a surface free of seams (weld marks).
	Effect of turbulence	Checking the length of the straight pipe on the primary side of the product.	Provide a straight pipe section on the IN side of the product. (page 8) Do not install valves, couplers or anything else that disturbs the flow path on the IN side of the product.

Problem	Possible cause	Investigation method	Countermeasures
A flow rate indication is displayed even when the flow rate is zero.	Insufficient tightening of piping clamp	Check the level of the ultrasonic wave indicator. (Page 15) Check the condition of the piping clamp.	Change the ultrasonic transmission power setting. (Page 52) Check the tightening torque. (76 cN•m ±5 cN•m) Or perform zero-clear. (Page 77)
	Defective installation of product	Check the piping clamp position.	Avoid installing the product to a location with damage such as dents.
	Location of seams (weld marks)	Locate seams (weld marks).	Mount the product on a surface free of seams (weld marks).
Analogue/switch output does not output Analogue/switch output is unstable	Incorrect wiring	Check the output wiring. Check if the analogue output is connected to the white wire, the switch output (in SIO mode) is connected to the black wire, and that the wire is not loose.	Check and correct the wiring.
	Incorrect NPN or PNP specification	Check the output switch setting for the switch output NPN or PNP.	Select the switch output according to the operating conditions.
	Lead wire is broken		Replace the lead wire.
	Wire is broken inside the product		Replace the product.
Buttons do not work	Key-lock mode is activated	Check if the key-lock function is turned on.	Deactivate key-lock mode. (Page 74)
	Button failure		Replace the product.
The units cannot be selected	Model selection (model selected does not have units selection function)	Check that the product No. printed on the product is equipped with units selection function.	Units selection function is not available for models which are fixed to SI units. ∗: The units selection function is not for use in Japan due to a new measurement law. ∗: Fixed SI unit: L/min.
The mode does not shift to IO-Link mode while using IO-Link communication	IO-Link enable/disable setting is set to Disable	Check the IO-Link enable/disable setting.	Set the IO-Link enable/disable setting to Enable.
The mode shifts to IO-Link mode when not using IO-Link communication	Erroneous detection due to noise	Check the possible application of noise or if there is a noise source.	Remove the noise and noise source. Set the IO-Link enable/disable setting to Disable.

○Troubleshooting list (IO-Link communication function)

Problem	Displayed content	Problem possible causes	Investigation method	Countermeasures
IO-Link indicator light: Off	-	Incorrect wiring	Check the connection of the connector.	Correct the cable wiring.
		Power supply error to the IO-Link master	Check the power supply voltage to the IO-Link master.	Supply 18 to 30 VDC to the IO-Link master.
IO-Link indicator light:	-	Failure of the IO-Link wiring which is not in use	Check the connection and cable condition of the IO-Link cable.	Additionally tighten the IO-Link cable. (Replace the cable if it is broken.)
		IO-Link master and product version are not matched	Check the IO-Link version of the master and device.	Match the master IO-Link version to the device. *1
	 	Communication mode is not transferred to the Operation mode	Check the setting of the data storage access lock and data storage backup level of the master.	Release the data storage access lock. Or deactivate the setting of the data storage backup level of the master port.
Data is swapped by byte	-	Program data assignment is incorrect	Check that the Endian type on the master upper level communication transmission format is Big Endian type or Little Endian type.	Assign the program data based on the Endian type of the transmission format of the master upper level communication. Or set to the master byte swap setting. (Refer to page 79 or the Endian type of the upper level communication.)

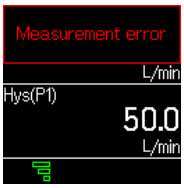
*1: When the product is connected to the IO-Link master with version "V1.0", an error will be generated.

■Warning/Error display

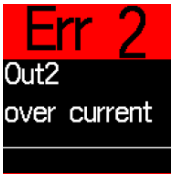
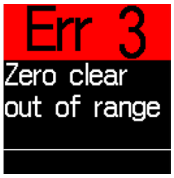
This function is to display error location and content when a problem or error has occurred.

∗: If the error cannot be reset after the following measures are taken, or errors other than the following are displayed, please contact SMC for further investigation.

○Warning display

Warning name	Warning display	Description	Measures	Control operation in the event of an error
Above the instantaneous flow measurement (HHH) (LLL)		A flow rate exceeding the upper limit of the display flow range is applied.	Reduce the flow.	Continuing
		A flow rate below the lower limit of the display flow range is applied.	Apply flow in the correct direction. Set the correct flow rate direction using the [F0_Flow dir] function.	Continuing
Accumulated flow warning (Reached accum max) (Reached accum low)		The accumulated value exceeded the accumulated flow range. (For accumulated increment)	Reset the accumulated flow. (Press and hold the SET and DOWN buttons simultaneously for 1 second or longer.)	Continuing
		The accumulated value has reached the set accumulated value. (For accumulated decrement)		Continuing
Measurement cannot be made (Measurement error)		Measurement impossible due to sensor/piping/fluid factors.	Check the tightness of the mounting fittings, the presence of air bubbles, whether the flow channel is full of water and whether the rubber sheet is broken.	Continuing

○Error display

Error name	Error display	Description	Measures	Control operation in the event of an error
System error (Err0,4,6,7,8,10, 40,82,83)		An internal data error has occurred.	Turn off the power and check for any noise source, and then turn on the power again. If the failure cannot be solved, contact SMC.	Stop
OUT1 Over current error (Err1)		The OUT1 switch output load current has exceeded 80 mA.	Remove the cause of the excessive current in the output.	Continuing
OUT2 Over current error (Err2)		The OUT2 switch output load current has exceeded 80 mA.	Remove the cause of the excessive current in the output.	Continuing
Zero clear error (Err3)		During a zero clear operation, a flow rate exceeding ±10%F.S. is applied.	Perform the zero-clear operation again when the flow rate is not applied.	Continuing
Version does not match (Err15)		The IO-Link version does not match with the master.	Align the master IO-Link version to the device.	Continuing

Specifications

Model			PFUW760	PFUW711
Piping	Applicable piping material *1		Metal piping, Hard resin piping	
	Piping diameter	A Type	15A	20A
		B Type	1/2B	3/4B
Fluid	Applicable fluids *2		General liquids (Water, Oil, Chemical liquids, etc.)	
	Fluid temperature range		0 to 90 °C (No freezing and condensation)	
Flow	Detection method		Ultrasonic (propagation time difference method)	
	Rated flow range		0 to 60 L/min (Less than 0.6 L/min is displayed as 0.0 L/min) *3	0 to 100 L/min (Less than 1.0 L/min is displayed as 0.0 L/min) *3
	Display/ setting flow range	Instantaneous flow	-3 to 84 L/min	-5 to 140 L/min
		Accumulated flow	0 to 999,999,999 L	
	Minimum display/ setting unit	Instantaneous flow	0.1 L/min	
		Accumulated flow	1 L	
	Zero cut range		0 to ±10%F.S. (selected in 1%F.S. increments relative to the maximum rated flow rate)	
	Converted value of integrated pulse (pulse width = 50 ms)		1 L/pulse	
	Accumulated value hold time		Select from 2 min. or 5 min. intervals *4	
Accuracy *5	Display accuracy		±3.0%F.S.	
	Analogue output accuracy		±3.0%F.S.	
	Repeatability		±2.0%F.S.	
	Temperature characteristics		±5.0%F.S. (25 °C reference)	
Analogue output *6	Output type		Voltage output: Select from 1 to 5 V and 0 to 10 V *7, Current output: 4 to 20 mA	
	Impedance	Voltage output	Output impedance: approx. 1 kΩ	
		Current output	Maximum load impedance: 600 Ω (at 24 VDC)	
	Response time		Linked with digital filter setting value	
External input *8	Input type		Input voltage: When set to NPN: 0.4 V or less (with or without contact) When set to PNP: DC(+) -1 V or more	
	Input mode		Select from accumulated external value reset, peak/bottom reset, and zero-clear	
	Input time		30 ms or more	
Switch output	Output type		Select from NPN or PNP open collector output	
	Output mode		Select from hysteresis or window comparator mode, accumulated flow output, accumulated pulse output, error output and switch output OFF	
	Switch operation		Select from forward or reverse output	
	Max. load current		80 mA	
	Max. applied voltage (Only NPN)		30 VDC	
	Internal voltage drop (Residual voltage)		1.5 V or less (at 80 mA load current)	
	Delay time *9		5 ms or less, variable from 0 to 60 s / 0.01 s increments	
	Hysteresis *10		Variable from 0	
	Protection		Protection of switch output reverse connection, over current protection	

Model			PFUW760	PFUW711
Electrical spec.	Power supply voltage		18 to 30 VDC	
	Current consumption		85 mA or less	
	Protection		Power supply polarity protection	
Display	Display mode		Main display: Instantaneous flow rate display Sub display: Select from Set flow rate display, Accumulated flow rate display, etc.	
	Unit *11	Instantaneous flow	L/min, gal/min	
		Accumulated flow	L, gal	
	Display		Display method: LCD: Display colour: white/orange/red/green/blue, 90/180/270° rotatable Display update cycle 10 times/sec.	
Digital filter *12			Select from 0.5, 1.0, 2.5, 5, 10, 30, 60 s	
Environmental resistance	Enclosure rating		IP65/IP67 (IEC 60529)	
	Withstand voltage		250 VAC for 1 minute between terminals and housing	
	Insulation resistance		2 MΩ or more between terminals and housing (with 50 VDC)	
	Operating temperature range		Operation: 0 to 50 °C, Storage: -10 to 60 °C (no freezing or condensation)	
	Operating humidity range		Operation, storage: 35 to 85% R.H. (no condensation)	
Standard			CE/UKCA marked	
Materials			Detection part: Special rubber, Clamp assembly set: SUS304	
Weight	Detection Unit		Approx. 165 g	
	Clamp assembly set		Approx. 46 g	Approx. 45 g

∗1: Depending on the type and condition of the pipework, such as the lined or coated pipes, detection may be unstable.
Recommended piping materials are as follows.
•Metal piping: SGP, SUS304 (Sch20/40/80)
•Hard resin piping: VP, HIVP, HTVP.
For other types of piping, adjust via "F11" the measurement value inclination fine adjustment function.

∗2: The detection may become unstable if the fluid contains a large amount of foreign matter or air bubbles.

∗3: Fluctuates in conjunction with the zero-cut function setting.

∗4: When using the accumulated value hold function, calculate the product life from the operating conditions, and use the product within its life. The maximum access limit of the memory device is 1 million cycles. If the product is operated 24 hours per day, the product life will be as follows:
•Data memorized every 2 minutes - - - 2 minutes x 1 million times = 2 million minutes = 3.8 years
•Data memorized every 5 minutes - - - 5 minutes x 1 million times = 5 million minutes = 9.5 years
If the accumulated flow external reset is also repeatedly used, the product life will be shorter.

∗5: This is the guaranteed value under our equipment conditions. Errors may occur depending on the operating conditions (piping type, condition, fluid, temperature).
Specification based on stable flow velocity distribution. Pulsations and fluctuations in flow velocity distribution due to equipment factors are not included.

∗6: This function is available when the model includes an analogue output.

∗7: When selecting 0 to 10 V, refer to the analogue output graph for the allowable load current.

∗8: Switch output or External input can be selected by pressing the corresponding buttons.

∗9: The time can be set from when the instantaneous flow rate reaches the set value to when the switch output operates.

∗10: If the flow rate fluctuates around the set value, chattering will occur unless a value greater than the fluctuating range is set.

∗11: This is only available for models with the units selection function.

∗12: The digital filter time can be set for the sensor input, this is 90% response time to step input.

∗13: SMC strive to improve quality, but products with tiny scratches or smear on the appearance, or variation in the display colour or brightness, which does not affect the performance of the product, are verified as conforming products.

○Cable specification of lead wire with M12 connector (Part number ZS-37-A、ZS-49-A)

Items		Specifications
Conductor	Nominal cross section	AWG23
Insulator	O.D.	Approx. 1.1 mm
Sheath	Material	Oil-resistant PVC
Outer diameter		ϕ4

■Characteristics data

●Flow rate/Analogue Output

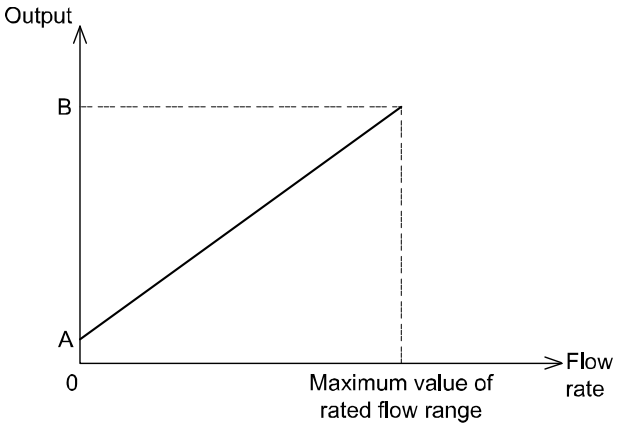
	A	B
Voltage output (1 to 5 V)	1 V	5 V
Current output	4 mA	20 mA

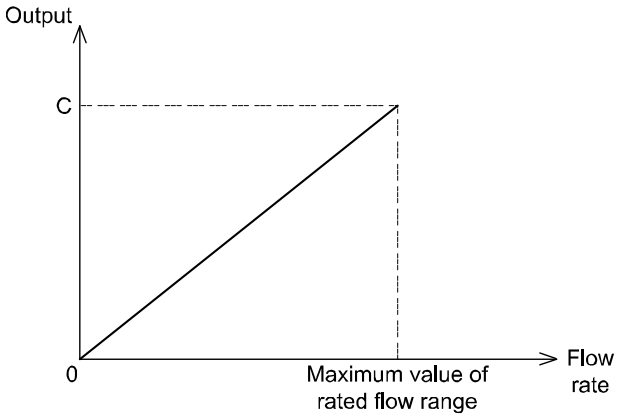
	0 L/min	C
Voltage output (0 to 10 V) *1	0 V	10 V

*1: Analogue output accuracy is within ±3% F.S.

*2: Analogue output is not affected by the zero-cut function setting.

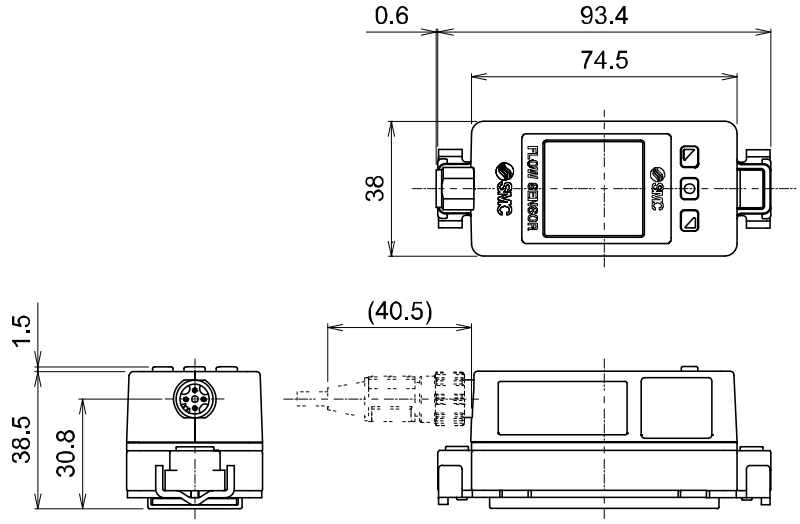
*3: The analogue output current from the connected equipment should be 20 μA or less when selecting 0 to 10 V.
When 20 μA or more current flows, it is possible that the accuracy is not satisfied at less than or equal to 0.5 V.





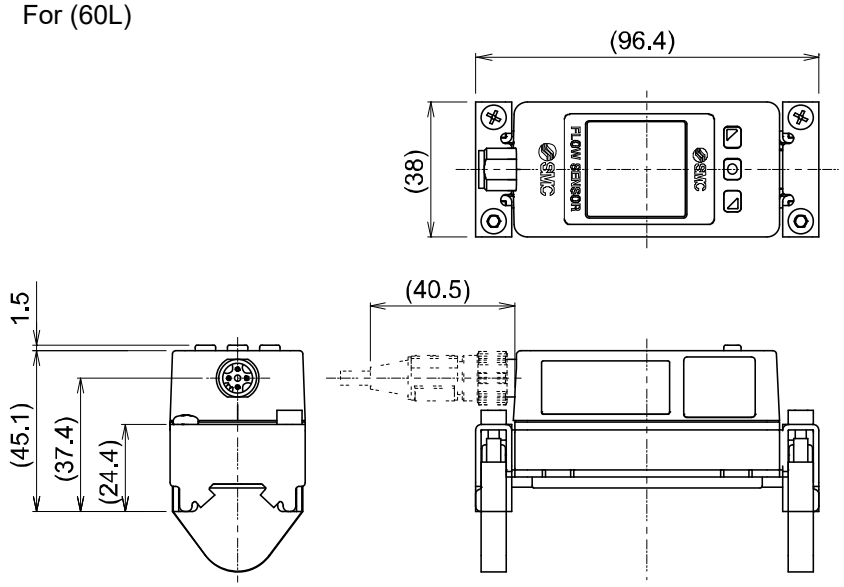
■Dimensions

Detection unit dimensions

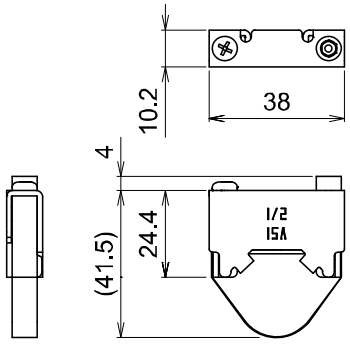


Dimensions with clamp assembly set mounted

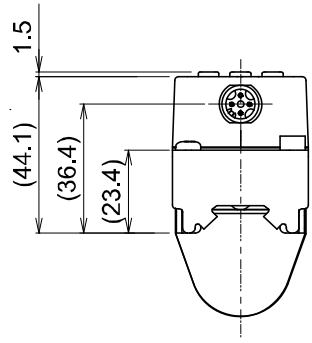
For (60L)



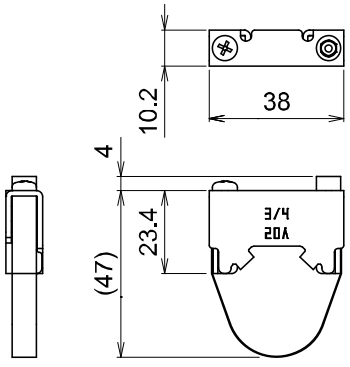
Clamp assembly set
(ZS-57-60LR)



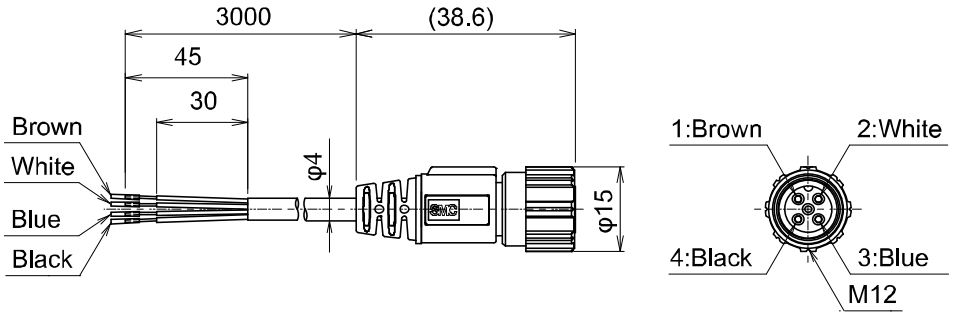
For (100L)



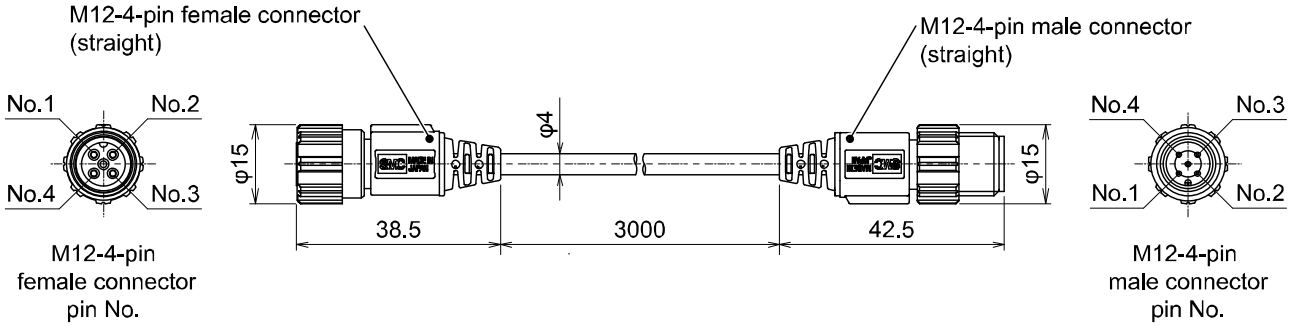
Clamp assembly set
(ZS-57-11LR)



Lead wire with M12 connector (ZS-37-A)



Lead wire with M12-M12 connector (ZS-49-A)



Revision history

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