For liquids

Clamp-on Type Flow Sensor

New

IP65 IP67 IO-Link

Benefit from the eight "zeros" with clamp mounting!

Zero piping work

Zero leakage

Zero clogging

Zero pressure loss

Zero fluid contact

Zero fluid contact parts material concerns

Zero foreign matter entry into piping

Rated flow rate range from **zero** L/min

"Easy mounting and retrofitting"
Reduced installation work

PFUW Series

SMC

CAT.ES100-167A

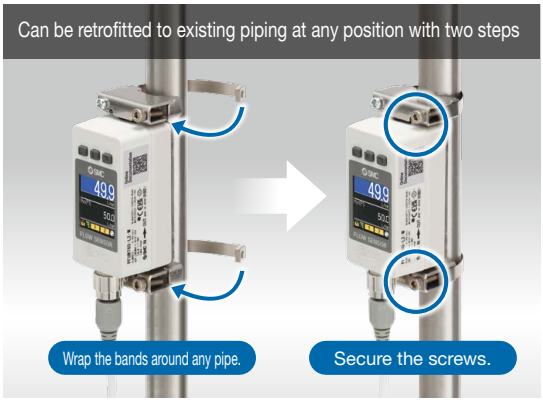
Benefit from the 8 “zeros” with clamp mounting!

No piping work required

- *Zero piping work*
- *Zero leakage*

Can be easily mounted to piping with only 2 bands and 2 screws!

Can be retrofitted to existing piping at any position with two steps



No sensor inside piping required ▶ Not affected by water hammer

- *Zero clogging*
- *Zero pressure loss*

No contact with fluid in piping

- *Zero fluid contact*
- *Zero fluid contact parts material concerns*
- *Zero foreign matter entry into piping*

- *Rated flow rate range from zero L/min*

Can detect when there is no fluid flowing in piping (0 L/min)

Model	Applicable port size		Flow range [L/min]
	Nominal A	Nominal B	0.5 5 10 40 100
PFUW760	15A	1/2"	0 — 60
PFUW711	20A	3/4"	0 — 100

Types of compatible piping

Port size		
Flow rate	Nominal A	Nominal B
60 L type	15A	1/2"
100 L type	20A	3/4"

Applicable fluids

General liquids

Beverage | Oil | Antifreeze | Chemical liquids | Water | High-pressure fluids

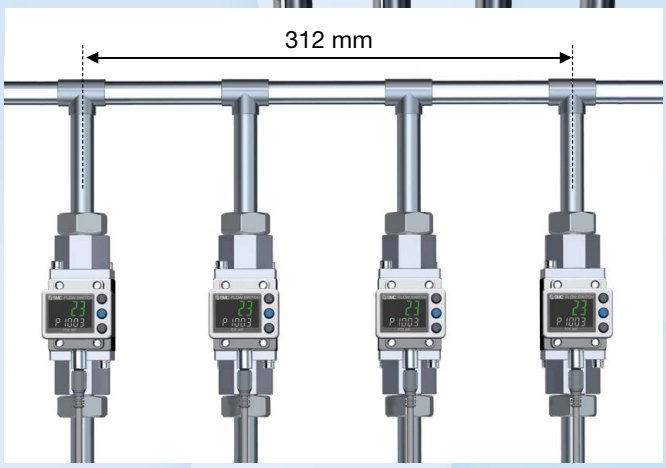
Can be mounted in close proximity (Reduced installation space)

Screw-in piping
PF3W711

Tool interference when mounting the screw-in type

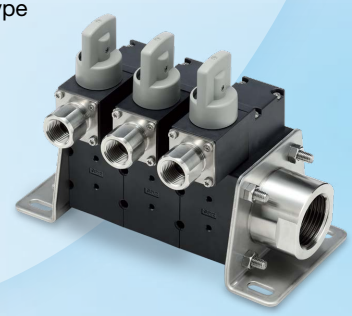
Clamp-on type
PFUW711

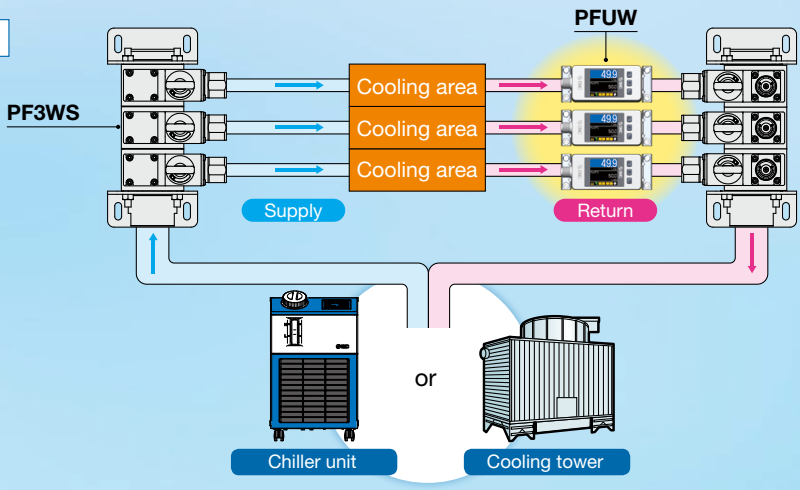
Space saving
168 mm (54%) shorter



Example For use in combination with manifolds for water

Supply type
PF3WS





Color display/2-screen display supported

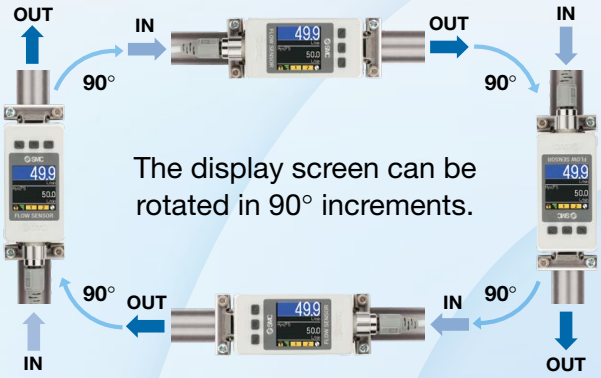
For the confirmation of the instantaneous flow rate, set value, and accumulated flow rate at a glance

Main screen
Instantaneous flow rate

Sub screen
Set value, accumulated flow rate, etc.

Size	Resolution/Color
1.44 inch	128 x 128/RGB

Improved visibility and operability



The color display allows for improved visibility. And the 2-screen display allows you to check the status at a glance.

Main screen
Instantaneous flow rate value

Sub screen
Set value
IO-Link status
Accumulated flow rate value
Peak/bottom value
Line name

Instantaneous flow rate value

Blue background with white characters	Red background with white characters	Black background with green characters	Black background with red characters	Black background with white characters
49.9 L/min Hys(P1) 50.0 L/min	49.9 L/min IO-Link mode SIO	49.9 L/min Accumulated value 123,456 L	49.9 L/min Peak 61.0 L/min Bottom 5.0 L/min	49.9 L/min Line name ABCDEFG
Set value	IO-Link status	Accumulated flow rate value	Peak/bottom value	Line name

Ultrasonic reception strength display: Ultrasonic indicator

The product mounting status can be confirmed at a glance via the ultrasonic reception strength.

The ultrasonic detection level varies depending on the piping type, fluid, piping condition, and product mounting status (tightness of the clamping screws).

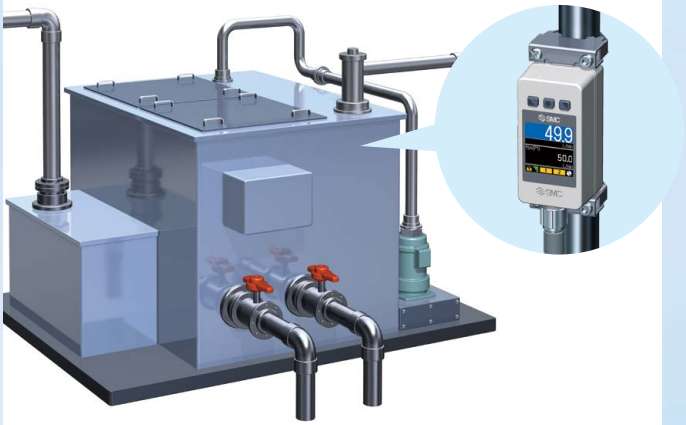
Icon	Ultrasonic detection level	Description	Note
	Level 0	Detection is disabled.	The ultrasonic detection level is low. Check the piping condition and product mounting status, and also check whether the piping is full of fluid and whether there are bubbles or foreign matter in the fluid.
	Level 1	Low stability	Check the piping condition and product mounting status. Depending on the piping condition, changing the piping mounting position may improve the ultrasonic detection level.
	Level 2	Medium stability	Recommended value Stable measurement is possible.
	Level 3	High stability	Recommended value Stable measurement is possible.
	Level 4	Excessive ultrasonic detection	The ultrasonic detection level is too high. Flow measurement may become unstable. Change the ultrasonic transmission level (F11 Power) to “Low.”

Applications

For the cooling of processing machines (casting machines)

For the beverage management of filler machines

For drainage management



For the cooling of welding guns

For the cooling of PET bottle molding machines

For coolant management

Applicable fluids General liquids: Beverage, Oil, Antifreeze, Chemical liquids, Water, High-pressure fluids

IO-Link Compatible PFUW7□-□□-□□

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Supports the IO-Link communication protocol

Configuration File (IODD File*1)
· Manufacturer · Product part no.
· Set value

*1 **IODD File**
IODD is an abbreviation of IO Device Description. This file is necessary for setting the device and connecting it to a master. Save the IODD file on the PC to be used to set the device prior to use.

IO-Link
IO-Link is an open communication interface technology between the sensor/actuator and the I/O terminal that is an international standard, IEC 61131-9.

Device settings can be set by the master.
- Threshold value
- Operation mode, etc.
- Flow rate command value

Read the device data.
- Switch ON/OFF signal and analog value
- Device information: Manufacturer, Product part number, Serial number, etc.
- Normal or abnormal device status
- Cable breakage

IO-Link Master

IO-Link Compatible Device: Digital Flow Switch

For the confirmation of the status via the input process data

Input Process Data

Bit offset	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
Item	Accumulated measurement value, upper (PD)															

Bit offset	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
Item	Accumulated measurement value, lower (PD)															

Bit offset	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Item	Flow rate measurement value (PD)															

Bit offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Item	System error	Error	Fixed output	Ultrasonic error	Reservation		Flow rate diagnosis	Accumulation diagnosis	Flow rate unit	Ultrasonic intensity			Instantaneous 2	Instantaneous 1	Accumulated 2	Accumulated 1

Bit offset	Item	Note
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 intensity indicator	0 to 4
7	Flow rate unit	0: L/min 1: gal/min
8	Diagnosis (Accumulated flow rate)	0: Within range 1: Out of range
9	Diagnosis (Instantaneous flow rate)	0: Within range 1: Out of range
12	Ultrasonic measurement error	0: No error 1: error
13	Fixed output	0: OFF 1: ON
14	Error (Other than system error)	0: OFF 1: ON
15	Error (System error)	0: OFF 1: ON
16 to 31	Instantaneous flow rate measurement value	Signed 16 bit
32 to 47	Accumulated flow rate measurement value (lower)	Unsigned 32 bit
48 to 63	Accumulated flow rate measurement value (upper)	Unsigned 32 bit

Diagnosis items
· Over current error · Outside of rated flow range/accumulated flow range · Internal product malfunction · Outside of zero-clear range

Communication with master	IO-Link communication status	Status			Screen display	Description
Yes		IO-Link mode	Normal	Operate	IO-Link mode Operate	Normal communication status
				Start up	IO-Link mode StartUp	At the start of communication
				Preoperate	IO-Link mode PreOperate	
			Abnormal	Version does not match	Err 15 IO-Link version error	The IO-Link version does not match that of the master.
No				Communication disconnection	IO-Link mode Operate	Normal communication was not received for 1 s or longer.
					IO-Link mode StartUp	
					IO-Link mode PreOperate	
	OFF	SIO mode			IO-Link mode SIO	General switch output

* If the version of the connected IO-Link master is something other than "V1.1," the display will show an error.

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For liquids Clamp-on Type Flow Sensor *PFUW Series*

IO-Link

For liquids Clamp-on Type Flow Sensor

PFUW Series

IP65 IP67

How to Order

PFUW7 60 – L1 □ – M □

Rated flow range

Symbol	Rated flow range	Applicable port size	
		Nominal A	Nominal B
60	0 to 60 L/min	15A	1/2"
11	0 to 100 L/min	20A	3/4"

Calibration certificate*5

Symbol	Calibration certificate
Nil	–
A	●

*5 The certificate is in both English and Japanese.

Output specification

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

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

Unit specification

Symbol	Description
Nil	Units selection function*3
M	SI unit only*4

*3 This product is for overseas use only. (The SI unit type is provided for use in Japan in accordance with the New Measurement Act.) The unit can be changed.
Instantaneous flow: L/min ⇔ gal/min
Accumulated flow: L ⇔ gal

*4 Fixed unit Instantaneous flow: L/min
Accumulated flow: L

Option

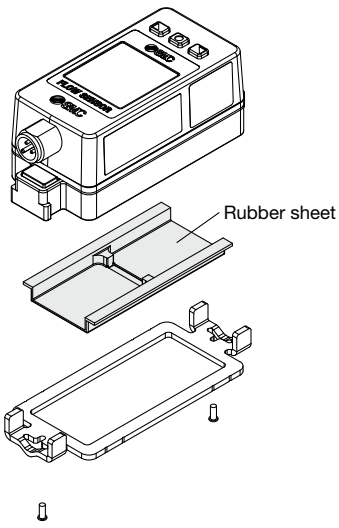
Symbol	Description
Nil	With lead wire with M12 connector (3 m)
N	Without lead wire with M12 connector
Q	With lead wire with M12-M12 connector (3 m)*2

*2 One side has an M12 (socket), and the other side has an M12 (plug) lead wire with a connector.

Options/Part Nos.

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

Part no.	Option	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



For flow switch precautions and specific product precautions, refer to the “Operation Manual” on the SMC website.

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 fluid*2		General liquids (Water, Oil, Chemical liquids, etc.)	
	Fluid temperature range		0 to 90°C (No freezing or condensation)	
Flow	Detection method		Ultrasonic method (Propagation time difference method)	
	Rated flow range		0 to 60 L/min (Flow under 0.6 L/min is displayed as 0.0 L/min)*3	0 to 100 L/min (Flow under 1.0 L/min is displayed as 0.0 L/min)*3
	Display/Set flow rate range	Instantaneous flow rate	–3 to 84 L/min	–5 to 140 L/min
		Accumulated flow	0 to 999,999,999 L	
	Display/Minimum setting unit	Instantaneous flow rate	0.1 L/min	
		Accumulated flow	1 L	
	Zero cut-off range		0 to ±10% F.S. (Select per 1% F.S. for the maximum rated flow rate.)	
	Accumulated volume per pulse (Pulse width = 50 msec.)		1 L/pulse	
	Accumulated value hold function		Interval of 2 or 5 minutes can be selected.*4	
Accuracy*5	Flow rate accuracy		±3.0% F.S.	
	Analog output accuracy		±3.0% F.S.	
	Repeatability		±2.0% F.S.	
	Temperature characteristics		±5.0% F.S. (25°C standard)	
Analog output*6	Output type		Voltage output: Select from 1 to 5 V or 0 to 10 V*7, Current output: 4 to 20 mA	
	Impedance	Voltage output	Output impedance: Approx. 1 kΩ	
		Current output	Max. load impedance: 600 Ω at power supply voltage of 24 V	
External input*8	Input type		Input voltage: NPN setting: 0.4 V or less (Reed or Solid state) PNP setting DC (+) -1 V or more	
	Input mode		Select from accumulated value external reset, peak/bottom reset, or zero-clear.	
	Input time		30 ms or more	
Switch output	Output type		Select from NPN or PNP open collector.	
	Output mode		Select from hysteresis, window comparator, accumulated output, accumulated pulse output, error output, or switch output OFF modes.	
	Switch operation		Select from normal output or reversed output.	
	Max. load current		80 mA	
	Max. applied voltage (NPN only)		30 VDC	
	Internal voltage drop (Residual voltage)		1.5 V or less (at load current of 80 mA)	
	Delay time*9		5 ms or less, variable from 0 to 60 s/0.01 s increments	
	Hysteresis*10		Variable from 0	
	Protection		Switch output power supply polarity protection, over current protection	
Electrical	Power supply voltage		18 to 30 VDC	
	Current consumption		85 mA or less	
	Protection		Power supply polarity protection	
Display	Display mode		Main screen: Instantaneous flow rate display Sub screen: 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 color: White/Orange/Red/Green/Blue, 90/180/270° rotatable, Display values updated 10 times per second	
Digital filter*12			Select from 0.5, 1.0, 2.5, 5, 10, 30, or 60 s.	
Environmental resistance	Enclosure		IP65/IP67	
	Withstand voltage		250 VAC for 1 min between terminals and housing	
	Insulation resistance		2 MΩ or more between terminals and housing (with 50 VDC)	
	Operating temperature range		Operating: 0 to 50°C, Stored: –10 to 60°C (No freezing or condensation)	
	Operating humidity range		Operating/Stored: 35 to 85% R.H. (No condensation)	
Standards			CE/UKCA marking	
Material			Detection part: Special rubber, Mounting bracket: Stainless steel 304	
Weight			Body: 165 g, Mounting bracket: 46 g (PFUW760), 45 g (PFUW711) Lead wire with connector: +90 g	

*1 Detection may be unstable depending on the piping type and condition. (e.g. lining pipe or coating pipe)
The recommended piping materials are as shown below.
· Metal piping: SGP, stainless steel 304 (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 Set point range will change according to the setting of the zero cut-off function.

*4 When using the accumulated value hold function, use the operating conditions to calculate the product life, and do not exceed it. The maximum update limit of the memory device is 1 million times. If the product is operated 24 hours per day, the product life will be as follows:
· 2 min interval: life is calculated as 2 min x 1 million = 2 million min = approx. 3.8 years
· 5 min interval: life is calculated as 5 min x 1 million = 5 million min = approx. 9.5 years
If the accumulated value external reset is repeatedly used, the product life will be shorter than the calculated life.

*5 This is the guaranteed value under our equipment conditions. Errors may occur depending on the operating conditions (piping type, condition, fluid, temperature).
The specifications are for when the flow velocity distribution is stable.
Pulsation from equipment and flow velocity distribution fluctuations are not included.

*6 When using a product with an analog output

*7 When selecting 0 to 10 V, refer to the analog output graph for the allowable load current.

*8 Switch output or external input can be selected by pressing the buttons.

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

*10 If the flow fluctuates around the set value, the hysteresis must be set to a value more than the fluctuating width. Otherwise, chattering will occur.

*11 Setting is only possible for models with the units selection function.

*12 The time for the digital filter can be set to the sensor input. The response time indicates when the set value is 90% in relation to the step input.

* Products with tiny scratches, marks, or display color or brightness variations which do not affect the performance of the product are verified as conforming products.

Specifications

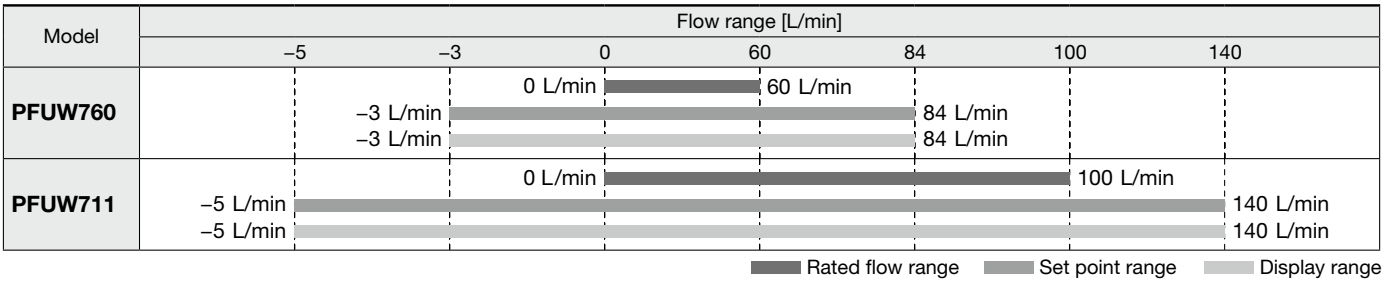
Communication Specifications (IO-Link mode)

IO-Link type	Device
IO-Link version	V1.1
Communication speed	COM2 (38.4 kbps)
Configuration file	IODD file*1
Minimum 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
Vendor ID	131 (0 x 0083)

Device ID*2	PFUW760-L1□-□□: 667 (0 x 029B) PFUW760-L2□-□□: 668 (0 x 029C) PFUW760-L3□-□□: 669 (0 x 029D) PFUW760-L4□-□□: 670 (0 x 029E) PFUW711-L1□-□□: 671 (0 x 029F) PFUW711-L2□-□□: 672 (0 x 02A0) PFUW711-L3□-□□: 673 (0 x 02A1) PFUW711-L4□-□□: 674 (0 x 02A2)

*1 The configuration file can be downloaded from the SMC website: https://www.smcworld.com
*2 The device ID differs according to each product type.

Flow Range



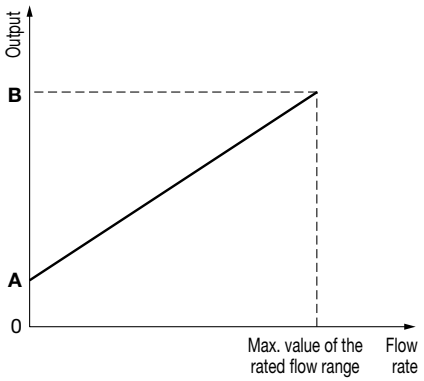
Flow Rate / Analog Output

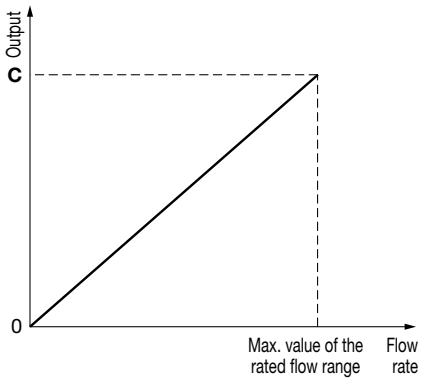
	A	B
Voltage output (1 to 5 V)*1	1 V	5 V
Current output*1	4 mA	20 mA

	0 L/min	C
Voltage output (0 to 10 V)*1, *3	0 V	10 V

Model	Min. value of the rated flow range	Max. value of the rated flow range
PFUW760	0 L/min	60 L/min
PFUW711	0 L/min	100 L/min

*1 Analog output accuracy is within ±3% F.S.
*2 Analog output is not affected by the zero-cut function settings.
*3 The analog 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.

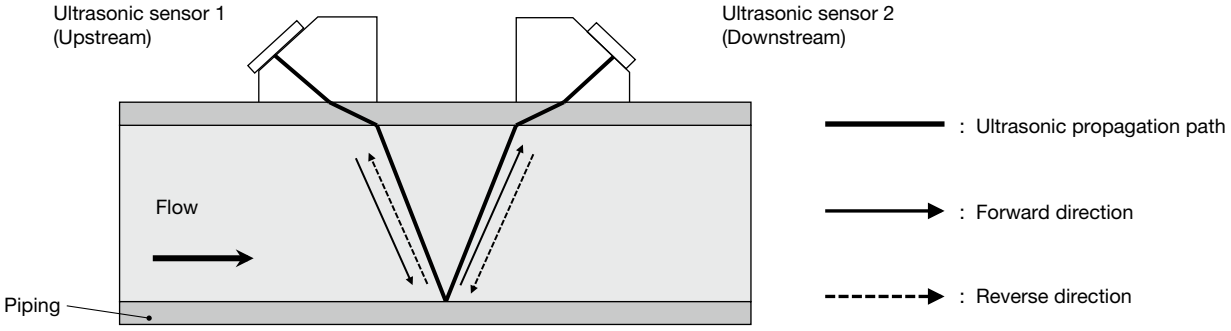




Flow Rate Measurement Method

Ultrasonic propagation time difference method

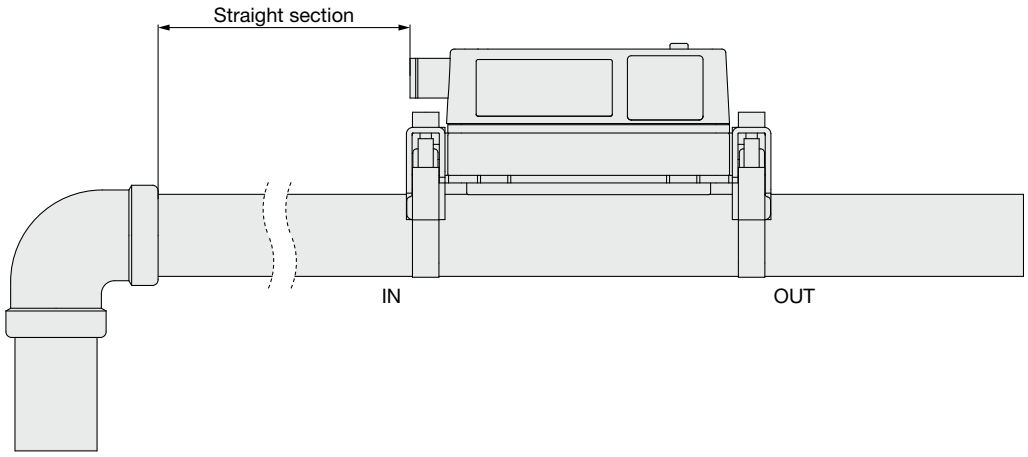
When fluid flows, a difference in signal propagation time is created in the forward and reverse directions.
Basically, the ultrasonic propagation time in the forward direction is shorter, and the propagation time in the reverse direction is longer.
The ultrasonic propagation time difference method measures this difference in propagation time, and the flow rate is calculated from the flow velocity determined from the time difference and the cross-sectional area of the channel.



Piping Characteristics (Reference Data)

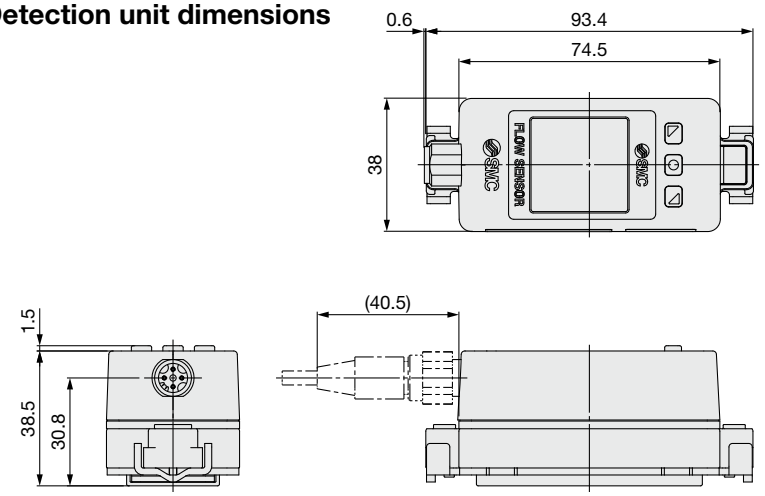
If it is allowable for the display accuracy to be within ±5% F.S., a straight section is not required.

* These are the results using our equipment. Under different conditions, the results may vary.
* The “straight section” refers to a section of piping without any bends or rapid changes in the cross sectional area.

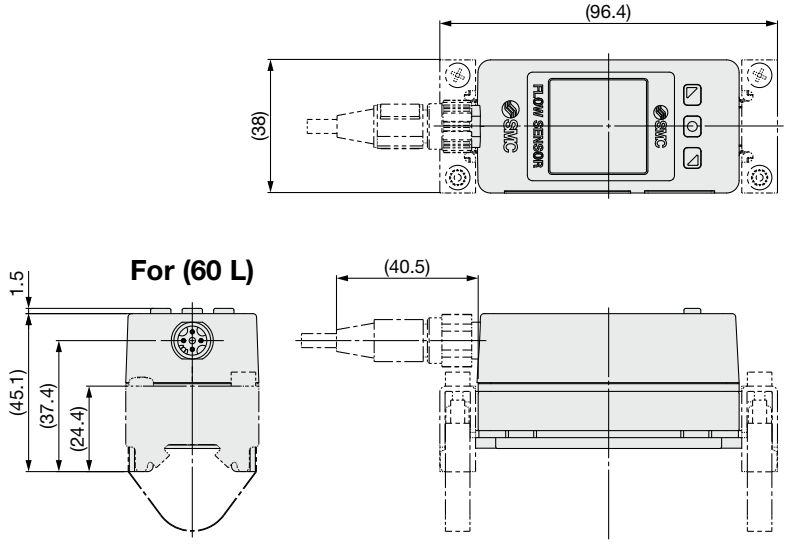


Dimensions

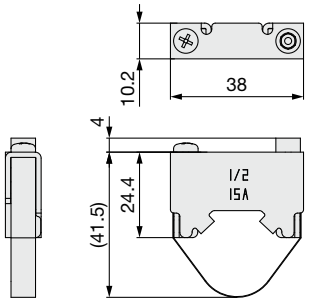
Detection unit dimensions



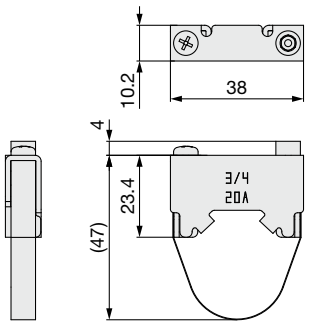
Dimensions with mounting brackets included



Clamp assembly (ZS-57-60LR)

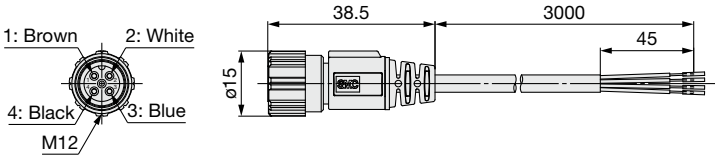


Clamp assembly (ZS-57-11LR)



Dimensions

ZS-37-A
Lead wire with M12 connector



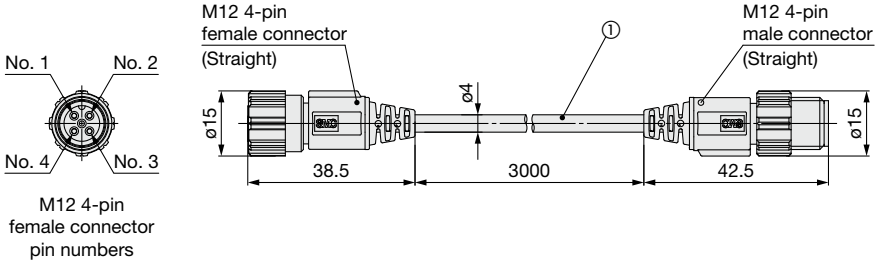
Pin no.	Pin name	Wire color
1	DC(+)	Brown
2	OUT2	White
3	DC(–)	Blue
4	OUT1	Black

∗ 4-wire type lead wire with M12 connector used for the PFUW series

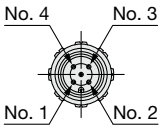
Cable Specifications

Conductor	Nominal cross section	AWG23
Insulator	**O.D.**	Approx. 1.1 mm
	Color	Brown, Blue, Black, White
Sheath	**Finished O.D.**	ø4

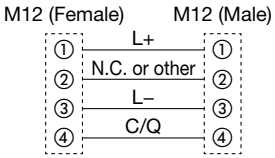
ZS-49-A
Lead wire with M12-M12 connector



M12 4-pin female connector pin numbers



M12 4-pin male connector pin numbers



Wiring diagram

∗ For wiring, refer to the “Operation Manual” on the SMC website: https://www.smcworld.com

⚠ 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.

⚠ 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.

*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.

⚠ 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.

⚠ 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 allowed 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.

⚠ Safety Instructions	Be sure to read the "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" before use.

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