Model selection

Base model No.			Flow rate range				Display function	Flow path material	Piping connection method	Fluid type	Signal type	Connector type	Optional functions 1	Optional functions 2	Optional functions 3	Code	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
F	7	M															
			9	0	1	0											Measurable flow rate range: 0.1–10 mL/min
			9	0	3	0											Measurable flow rate range: 0.3–30 mL/min
			9	0	5	0											Measurable flow rate range: 0.5–50 mL/min
							A										No display (equipped with an LED status indicator)
								Q									Fused quartz glass, PFA, PTFE
									1								Fitting for fluororesin tubes SUPER-300 Type Pillar fitting P series (made by Nippon Pillar Packing Co., Ltd.) Outer dia. 3 mm, inner dia. 2 mm
									2								Fitting for fluororesin tubes SUPER-300 Type Pillar fitting P series (made by Nippon Pillar Packing Co., Ltd.) Outer dia. 1/8 in., inner dia. 0.086 in.
										0							Water (H_2O)
											0						Analog output, digital input, digital output
												1					Waterproof connector: HR30-6R-6P(71)
													0				None
														0			None
															0		None
															D		With inspection certificate
															Y		With inspection certificate and traceability certificate
																0	Product version

Parts included

The following parts are included with the product.

Mounting bracket	× 1
Union nuts	× 2
Sleeves	× 2 (size depends on the model of the main unit)

Parts sold separately

Part Name	Part No.	Remarks
PVC-insulated cable, 2 m	F9Y7HP1	Waterproof connector made by Hirose Electric Co., Ltd.; HR30-6P-6S(71)
Fluororesin-insulated cable, 2 m	F9Y7HF1	
Fitting (metric system), 2 pieases	F9Y7F1	With sleeves and union nuts (outer dia.: 3 mm; inner dia.: 2 mm); same as included parts
Fitting (inch system), 2 pieases	F9Y7F2	With sleeves and union nuts (outer dia.: 1/8 in.; inner dia.: 0.086 in.); same as included parts
Mounting bracket	F9Y7B1	Same as included part
Fluororesin tube assembly (metric system), 2 pieases	F9Y7T1	Tube assembly with sleeve inserted (outer dia.: 3 mm; inner dia.: 2 mm; length: 500 mm)
Fluororesin tube assembly (inch system), 2 pieases	F9Y7T2	Tube assembly with sleeve inserted (outer dia.: 1/8 in.; inner dia.: 0.086 in.; length: 500 mm)
Fluororesin tube assembly for metal pipes (female screw adaptor), 2 pieases	F9Y7T3	Set including an adaptor for metal pipes and a fluoriresin tube (outer dia.: 1/8 in., tube langth : 200 mm) (adaptor : Rc 1/8 fitting, wetted material SUS316)
Fluororesin tube assembly for metal pipes (male screw adaptor), 2 pieases	F9Y7T5	Set including an adaptor for metal pipes and a fluoriresin tube (outer dia.: 1/8 in., tube langth : 200 mm) (adaptor : R 1/8 fitting, wetted material SUS316)
Fluororesin tube assembly (φ4 mm tube) for quick-connect tube fitting, 2 pieases	F9Y7T6	Set consists of a quick-connect tube fitting and a fluororesin tube Quick-connect tube fitting: for a 4 mm dia. tube (wetted material: SUS316), tube: outer dia. 1/8 in., length: 200 mm
Adapter for loader communication cable	F9Y7A1	Cable adapter used for setting up and monitoring the F7M using the PC loader. SLP-F7M Smart Loader Package for F7M is necessary to download it from the Azbil Corporation's website and install it. https://www.azbil.com/products/factory/factory-product/flowmeter/rate-liquid/f7m/index.html
USB loader cable	81441177-001	USB cable for usage of Adapter for loader communication cable. Use Rev. 05 or later version of the USB loader cable.


F9Y7HP1


F9Y7T1


F9Y7T3


F9Y7T6


F9Y7A1

* USB cable connected with PC is needed to order separately.

Please read “Terms and Conditions” from the following URL before ordering and use.
https://www.azbil.com/products/factory/order.html

Azbil Corporation
Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan

URL: https://www.azbil.com

1st Edition : Dec. 2017-SO
6th Edition : May. 2024-SO

azbil

Thermal Micro Flow Rate Liquid Flow Meter

Model F7M

Thermal Micro Flow Rate Liquid Flow Meter, achieving high-functionality measurement and usability

Measures micro flow rates of several mL/min

Compact, light-weight, and easy to install

Flexible installation and wide range of fluids

Straight flow path

Azbil Corporation

Thermal

Micro Flow Rate Liquid Flow Meter

Model F7M

Features & Merits of the Model F7M

Combining a thermal MEMS sensor with a proven track record in gas flowmeters and a flow path made of highly corrosion-resistant fused quartz glass, this product measures both the instantaneous flow rate and the totalized flow of liquids with micro flow rates of **several mL/min**, which has been difficult to do with a high degree of reproducibility using traditional measurement methods. Compared with conventional methods, the measurement method used by this new product is **less susceptible to changes in the fluid state (e.g., bubbles, pulsations, and fluid temperature)** (although it may be necessary to change the settings parameters), and **micro flow rates can be measured easily**. Measuring the flow rates allows for **more reliable data management** by replacing alternative measures, such as managing the pump rotation speed, measuring the weight, and managing the fluid supply time. In addition, it is possible to monitor the health of the liquid transfer system using the event function of the flow meter.

Measures micro flow rates of several mL/min

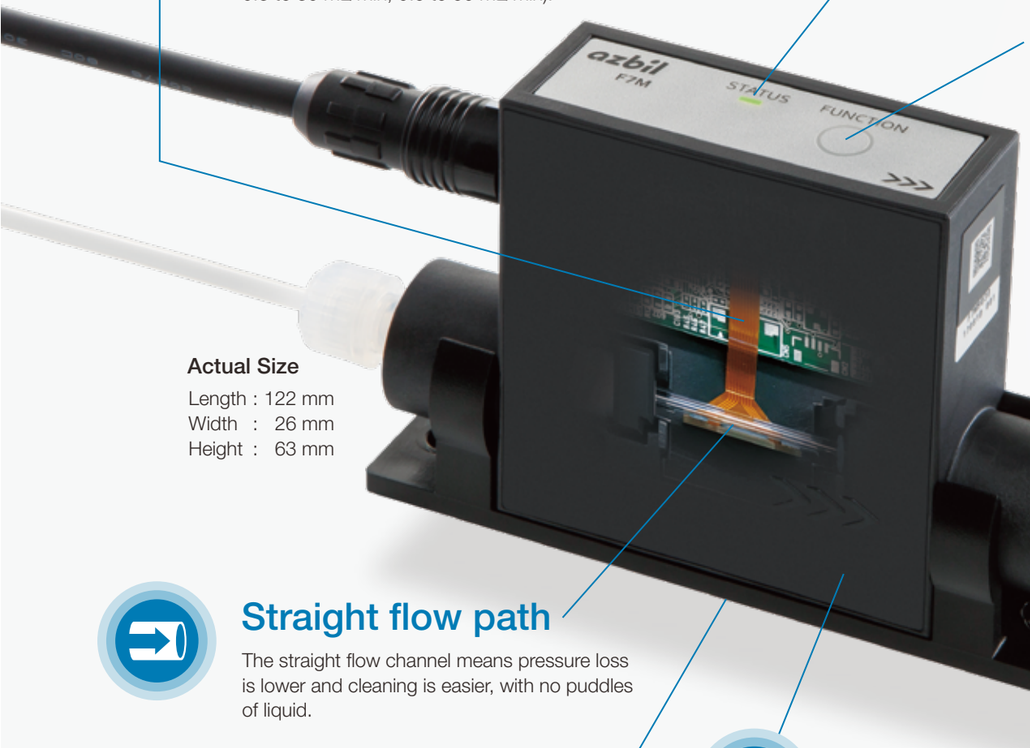
Operates on the thermal measurement principle using MEMS sensing technology. The **measurement of micro flow rates of several mL/min**, which traditionally has been difficult, is now possible (Measurement range: 0.1 to 10 mL/min, 0.3 to 30 mL/min, 0.5 to 50 mL/min).

LED indicator

: Operating normally
: Warning
: Alarm
: Error

Switch

Used to adjust the zero point and automatically set the flow rate correction factor when measuring a fluid other than water.



Actual Size

Length : 122 mm
Width : 26 mm
Height : 63 mm

Straight flow path

The straight flow channel means pressure loss is lower and cleaning is easier, with no puddles of liquid.

Compact, light-weight, and easy to install

- This model is more compact and lighter than its predecessors.
- By using the included mounting bracket, it can be easily installed on a surface (for horizontal pipe connection).
- It can also be installed for vertical pipe connection.
- A separate converter (amplifier) is not required.

Flexible installation and wide range of fluids

- Compliant with IP65 protection rating.
- Exterior contains no metal, providing improved resistance to corrosive fluids, allowing use in environments with liquid spray.
- Can be used for **a variety of fluids**, so long as they do not corrode **fused quartz glass** (the material of the flow path) or **fluororesin** (the material of the fitting). The sensor does not come into contact with any fluids.

■ Product Overview

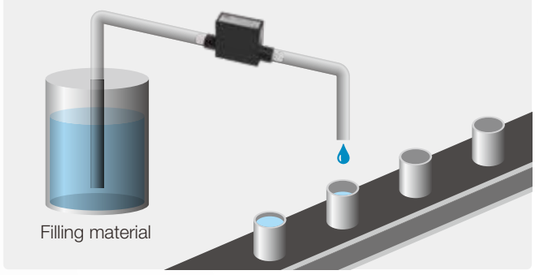
[Measurable flow rate range] 0.1–10 mL/min, 0.3–30 mL/min or 0.5–50 mL/min

[Measurable fluid] Water (H_2O)
For fluids other than water, the output may shift, depending on its thermal conductivity. Zero-point adjustment and the correction factor setting allow measurements to be taken with a degree of reproducibility that is as high as that for water. (However, accuracy is guaranteed only for water.)

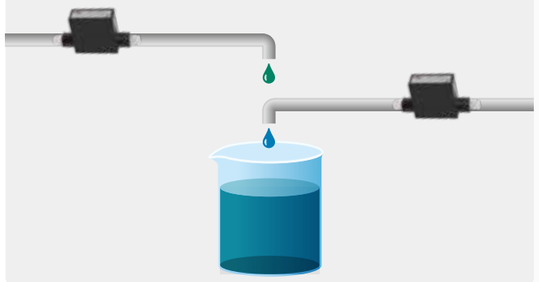
[Pipe connection method] Fluororesin tube (outer dia.: 3 mm; inner dia.: 2 mm or outer dia.: 1/8 in.; inner dia.: 0.086 in.)

■ Application

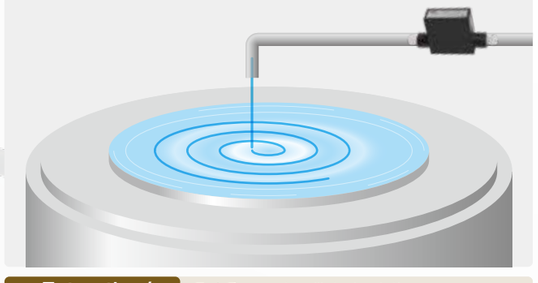
Filling Ex.) Electrolytic solutions



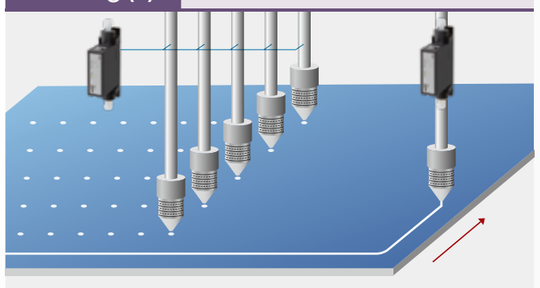
Mixing/Diluting Ex.) Cleaning solutions, chemical agents



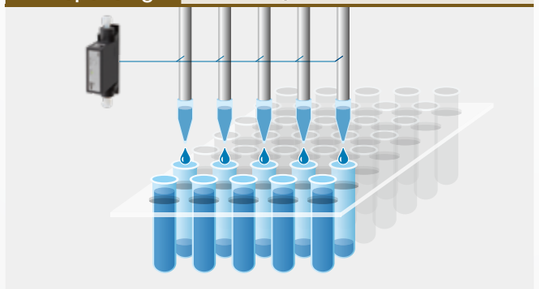
Coating (1) Ex.) Resist solutions, coating agents



Coating (2) Ex.) Lubricants, inks, sealants



Extracting/ Dispensing Ex.) Reagents, diluted solutions, cleaning solutions

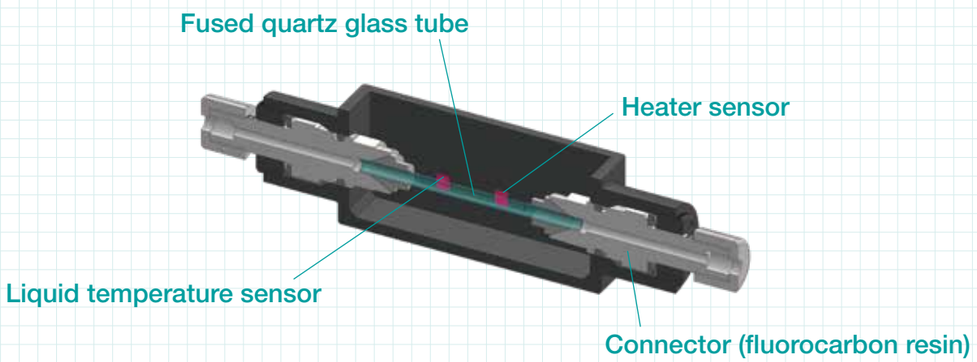


Spraying (2) Ex.) Sterilization solutions, release agents, fluxes

The application drawings above are conceptual images only. When installing this product, see the mounting orientation instructions on page 7.

MEASUREMENT PRINCIPLE

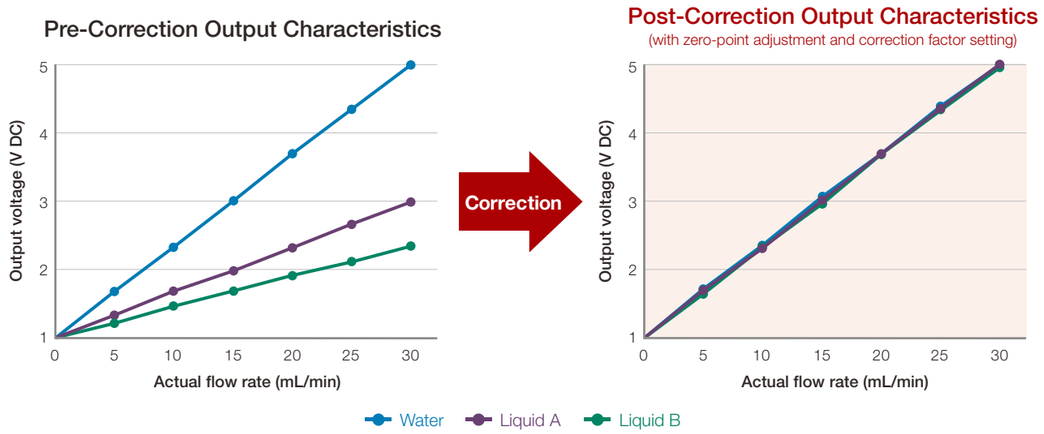
Combining a thermal MEMS sensor that is commonly used for gas flow meters and a flow path that is made of highly corrosion-resistant quartz glass, the product uses a method of measuring micro flow rates that is less susceptible to changes in the fluid state and more reliable.



- ☐ Heater surface **temperature is constantly controlled to keeps sit at a fixed value** that is slightly higher than the fluid temperature.
- ☐ Heat dissipation from the heater **changes depending on the flow rate**.
- ☐ As the flow rate rises, the amount of heat transferred to the fluid increases, and the power consumption of the heater increases.
- ☐ By measuring the heater's power consumption, the **flow rate can be calculated**.
  (Heat dissipation from the heater is quite small that it does not heat the fluid.)

Output Characteristics Before and After Correction

The measurable range varies according to the thermal conductivity of the fluid, but the output characteristics can be adjusted by using the correction function. (See the conceptual diagrams below.)
For correction factor setting is necessary to use SLP-F7M Smart Loader Package for F7M.

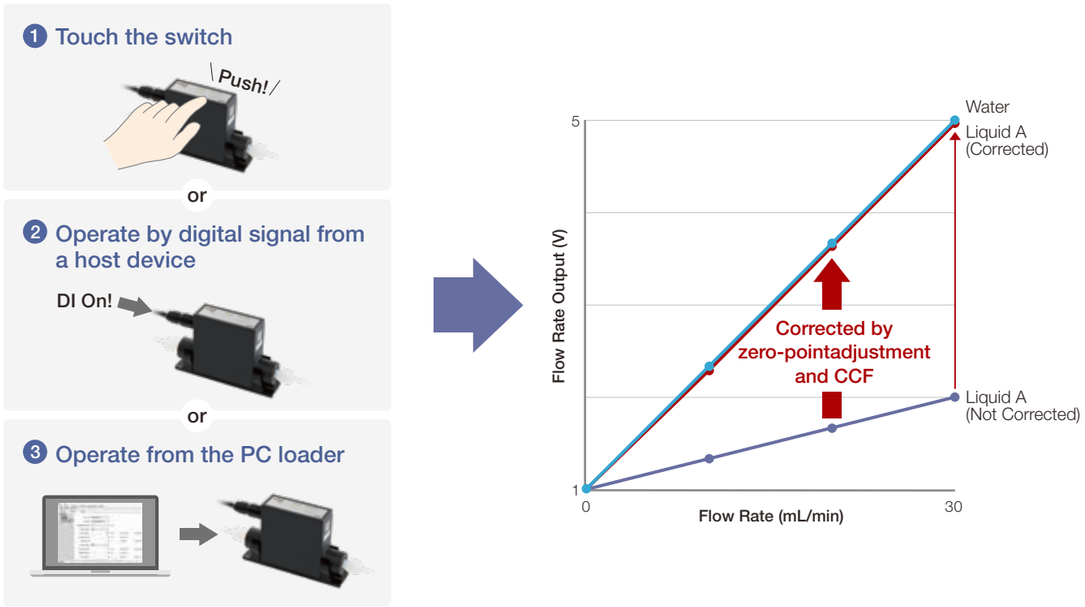


USEFUL FUNCTION

function 1 Easily adjustable flow rate correction for various liquids

Automatic setting of flow rate correction factor (CCF)

Flowmeter zero point and flow rate correction factor are automatically adjusted for the liquid to be measured.

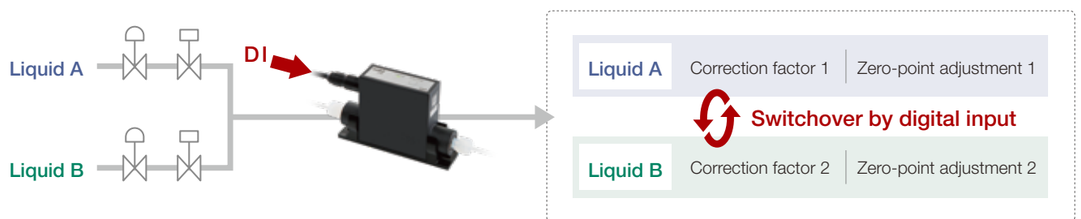


Note: This function does not guarantee the accuracy of the flow rate after the CCF has been set. It should be used as a guide for setting the CCF. For fluids whose thermal conductivity is lower than 0.138 W/mK (equivalent to 100 % isopropyl alcohol), there may be a large error.

function 2 One model F7M can measure the flow rates of 2 types of liquid

Liquid type selection

Using a digital signal from the host device to switch the CCF, 1 flowmeter can measure the flow rates of 2 types of liquid.



Product specifications

Model No.		F7M9010	F7M9030	F7M9050
Measurable flow rate range (for H_2O)		10 mL/min	30 mL/min	50 mL/min
Measurable fluid		Fluid that does not clog the flow path or damage the glass tube or corrode the wetted part materials. If any fluid adheres to the inner surface of the flow path, a measurement error may occur. In addition, if there are bubbles in the fluid or pulsation, output fluctuations or shifts may occur, depending on the amount.		
Accuracy-guaranteed fluid		H_2O (water)		
Measurement accuracy*1 (typical values under standard conditions)*2		±5 % rdg (at 2 mL/min or more) ±1 % FS (at less than 2 mL/min)	±5 % rdg (at 6 mL/min or more) ±1 % FS (at less than 6 mL/min)	±5 % rdg (at 10 mL/min or more) ±1 % FS (at less than 10 mL/min)
Measurable flow rate range (for H_2O)		0.1–11.5 mL/min (1–115 % FS)	0.3–34.5 mL/min (1–115 % FS)	0.5–57.5 mL/min (1–115 % FS)
Accuracy-guaranteed flow rate range (for H_2O)		0.2–10 mL/min *4 *5	0.6–30 mL/min *4 *5	1.0–50 mL/min *4 *5
Reproduceability*3 (typical values under standard conditions)*2		±1 % rdg. (at 20 % or more of the FS) ±0.2 % FS (at less than 20 % of the FS)		
Response time		1.0 s typ. (63.2 % response)		
Temperature characteristics		±0.5 % rdg/°C when fluid and ambient temperature are in the 10–35 °C range and comparison is with output obtained at fluid temperature of 23 °C while other conditions are identical.		
Fluid pressure range		0 to 500 kPa (gauge)		
Pressure resistance		700 kPa (gauge)		
Mounting orientation		Horizontal or vertical (flow direction: bottom to top) With vertical mounting, an output shift of about ±1 % rdg occurs in measurements compared with horizontal mounting.		
Piping connection method (for applicable tubes)		PFA tube fitting, SUPER-300 series P-type (made by Nippon Pillar Packing Co., Ltd.) Applicable tubes: Metric system products (outer dia.: 3 mm; inner dia.: 2 mm) or inch system products (outer dia.: 1/8 in.; inner dia.: 0.086 in.)		
Operating conditions	Fluid temperature	5–50 °C *6		
	Ambient temperature	5–50 °C *6		
	Ambient humidity	10–90 %RH (without condensation on the exterior or the product) *6		
	Vibration	None		
	Shock (mechanical)	None		
Transport and storage conditions	Ambient temperature	5–60 °C		
	Ambient humidity	10–90 %RH		
	Vibration resistance	4.9 m/s^2		
	Shock resistance	490 m/s^2 (when packaged)		
Required straight pipe length (for H_2O)		50 mm straight pipe is required upstream of this device.		
Fitting pullout strength		30N		
Power		Rating: 24 Vdc; allowable power range: 21.6–26.4 Vdc (ripple: 2.5 % or less); power consumption: 0.7 W max.		
Analog output	Output signal	1–5 Vdc		
	Maximum output voltage	5.6 Vdc (115 %) (at the upper limit of the measurable flow rate range)		
	Required external load resistance	250 kΩ or more		
	Output value update cycle	10 ms		
	Output resolution	0.01 % max.		
Digital output	Number of outputs	1		
	Function types	1) Upper/lower limit flow rate event with hysteresis setting function; 2) upper/lower limit flow rate event; 3) totalized flow pulse output; and 4) output event when a problem occurs. (Function allocation settings can be changed using the PC loader.)		
	Output ratings	30 Vdc and 30 mA or less (NPN open collector with non-isolated output; contacts open when power is off)		
	Integrating flow pulse	Pulse weight: 0.01, 0.1, 1, and 10 mL/P (pulse width: 5ms typ, 100 Hz max.) (setting can be changed using the PC loader)		
Digital input	Number of inputs	1, for zero point adjustment only		
	External circuit type	Non-voltage contacts or open collector		
Protection rating		IP65		
Weight		85 g		
Standards and regulations compliance		EN61326-1, EN61326-2-3		

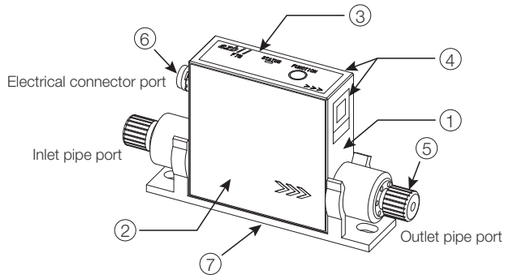
*1. Instrumental error in thae volumetric instantaneous flow rate compared with values obtained with Azbil's standard fluid flow rate equipment as a reference.
*2. Standard conditions are the measurement conditions from (1) to (9) below.
*3. Reproduceability represents an instrumental dispersion in the instantaneous flow rate output under the measurement conditions (1) to (9), with the device remains connected to the piping.
(1) fluid: water (H_2O); (2) fluid temperature: 23 °C; (3) no bubbles or pulsation in the fluid; (4) ambient temperature: 23 °C;
(5) fluid pressure: 250 kPa; (6) vibration: 0 m/s^2; (7) stabilization period before measurement : 2 hours or more at ambient temperature 23 °C, 30 minutes or more after power-on, and also 10 minutes or more after supplied flow stabilized.; (8) mounting orientation: horizontal pipe, device top panel facing upward;
(9) output signal : instantaneous flow rate (analog 1 to 5 Vdc);
*4. This device cannot measure the flow rate for a fluid that flows in the reverse direction. If the flow direction is reversed, the device will output a flow rate that is not equal to the regular forward flow rate without indicating an error.
*5. For a flow rate that is below the minimum measurable range, the output signal is fixed at 0 % (= 1 V).
*6. Depending on the ambient humidity,condensation can occur if the temperature of the fluid drops below the ambient temperature.

SELECTION PRECAUTIONS

(1) Do not apply pressure in excess of the operating conditions described in the specifications or use this device at a temperature outside the specified range. In addition, take care when using this device not to drop it or subject it to vibration or impact in excess of the operating conditions. Otherwise, the quartz glass tube used for the device's fluid path may be damaged or the seal portion of the fluid path may deteriorate, causing the device to leak internally or externally or to malfunction, or causing an external device to catch fire or malfunction.
(2) Install this device in a place where it will not be subject to vibration. Otherwise, measurements will be incorrect and device malfunction or failure may occur.
(3) Take appropriate measures to ensure that the fluid is not contaminated with foreign matter. If rust, oil mist, or other foreign matter from the pipes enters and adheres to this device, a measurement error may occur or the device may be damaged. If there is a possibility of foreign matter entering this device, install a filter upstream of the device or take other appropriate measures. Be sure to inspect and replace the filter at regular intervals.
(4) If malfunction of this device can be expected to result in loss or damage, use appropriate redundancy in the system design.

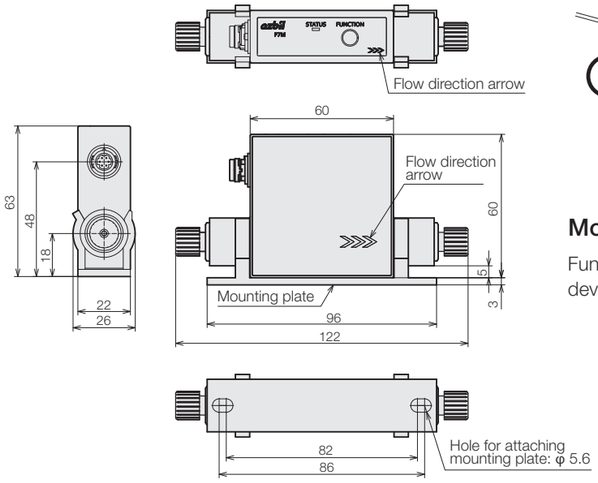
* In addition to the information provided above, precautions, mounting precautions, and other relevant information can be found in the users' manual (detailed version), document No. CP-SP-1421E. Please refer to this manual also when selecting a model.

Parts and material



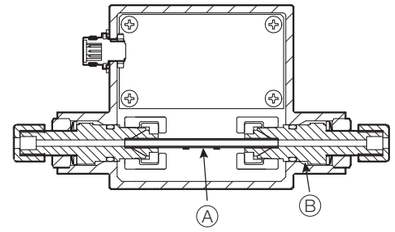
No.	Item	Material	Notes
1	Housing	PPS resin with glass	Epoxy resin adhesive connects the cover to the housing.
2	Cover	PPS resin with glass	
3	Protective sheet	PET resin film	—
4	Label	PET resin film	—
5	Union nut of fitting	PFA	—
6	Waterproof connector	PPS resin, PBT resin, polyacetal resin, chloroprene rubber	HR30-6R-6P (71), made by Hirose Electric Co., Ltd.
7	Mounting bracket	PC resin	—

External dimensions



*1. Mounting screws are not included (specification: screw head height of 5 mm max.).

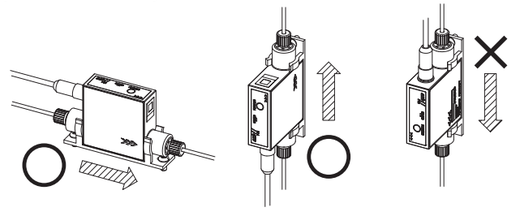
Material of wetted parts



No.	Item	Material	Notes
A	Sensor tube	Fused quartz glass	—
B	Fitting	PFA, PTFE	The material used for the included sleeves is PFA.

Mounting orientation

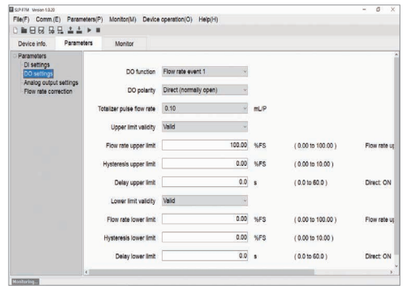
Install this device in the orientation shown below. The operation panel can face any direction.



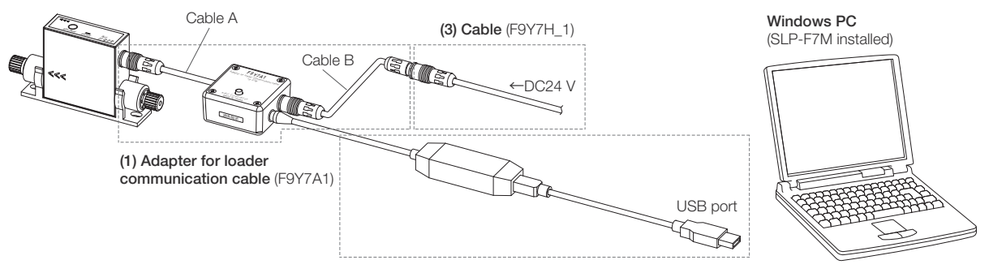
Flow direction: horizontal
Flow direction: bottom to top
Flow direction: top to bottom

Model slp-f7m smart loader package for f7m

Functions : Setting the parameters, monitoring the flow rate and device status



When using the PC loader



*(1), (2), (3) are separately available.
*Cables A and B are included with (1).