

## Compact Flow Rate Sensor

RAPIFLOW<sup>®</sup> FSM3 Series



Diversified

High performance

User-friendly



 **IO-Link** Compatible

# Diversified

## Five types of gases can be measured with just one unit

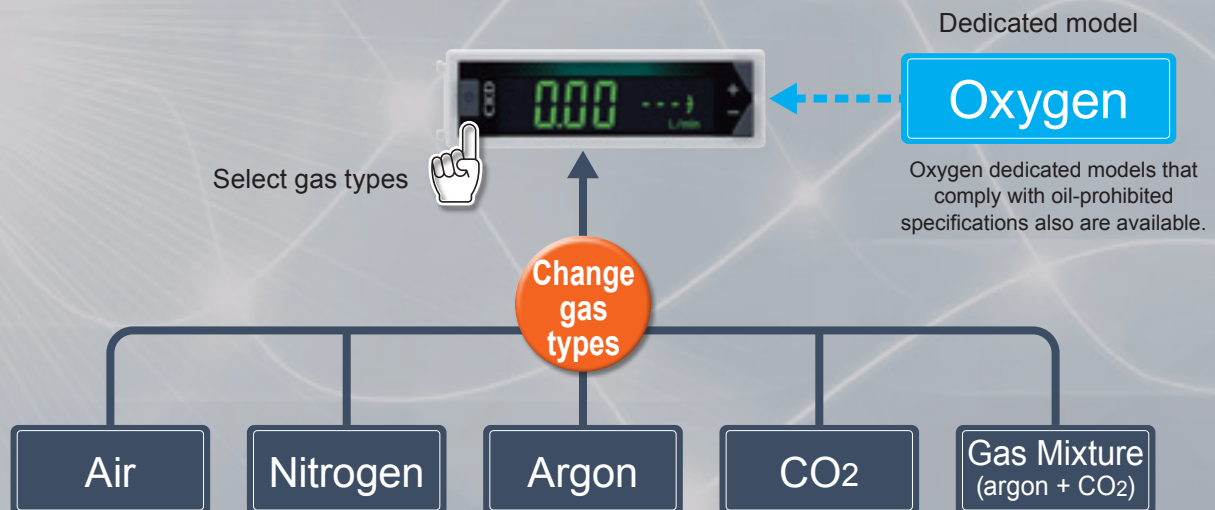
Gas type switching function (LCD display, IO-Link) (full scale flow rate 200 L/min or less model)

Air, nitrogen, argon, carbon dioxide, gas mixture (mixture of Ar: CO<sub>2</sub> (8:2)) supported with this single flow rate sensor.

Gas types can be switched by operating buttons on the body.

In the IO-Link specifications, the gas type can be changed remotely from a host controller.

\* For details on mixing ratios, contact CKD.



# High performance



MEMS stands for Micro Electro Mechanical Systems or the technology of microscopic devices to which microprocessing technology, that is used in the manufacture of semiconductor, is applied.

## Clean-room specifications

Anti-dust generation packaging (P70) and oil-prohibited specifications (P80) are included in the product lineup as standard

Sensors can be used selectively according to the grade of the apparatus.

## Compatible with outgas

Stainless steel body does not use resin in the flow path, making it ideal for processes that are difficult to outgas.

## High precision/high-speed response

Repeatability: Within  $\pm 1\%$  F.S.

Display accuracy: Within  $\pm 3\%$  F.S.

Response time: 50 msec

## Reduced pressure loss

A re-designed flow path results in up to a 50% reduction

## Bi-directional fluid measurement

Contributes to reducing tact time

The flow direction can be measured as desired.

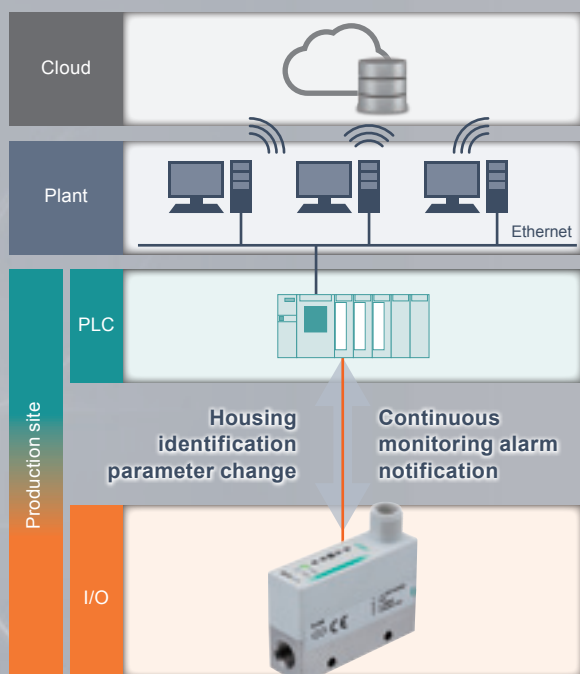




## IO-Link model now included in series

IO-Link is a digital communication specification for on-site sensors and actuators in plants. (IEC61131-9)

This enables the transmission of parameters and event data that could not be transmitted by analog communication.



### Features of IO-Link



Continuous monitoring is enabled by the use of digital data.



Parameters can be set or changed via a network, allowing apparatus to be remote-controlled.



The model No., serial No. or other unit-unique information can be confirmed on the network.



Settings can be copied from a master (scanner) unit. This frees the operator from the trouble of having to reset parameters during maintenance.



Device failures and disconnections can be confirmed.



It is possible to connect by changing to an Ethernet network, enabling the creation of an IoT system.

# User-friendly

## LCD can be rotated for ease of viewing

The display can be inverted.



## Easy mounting (option)

DIN rail mount

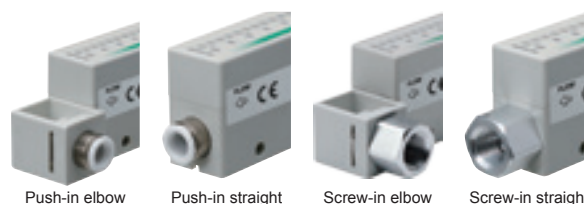


Panel mount



## Wide selection of fittings

Resin body



Stainless steel body



# Examples of solutions

## Leakage inspection

The drinking water container is filled with gas to detect leaks.

Filter unit



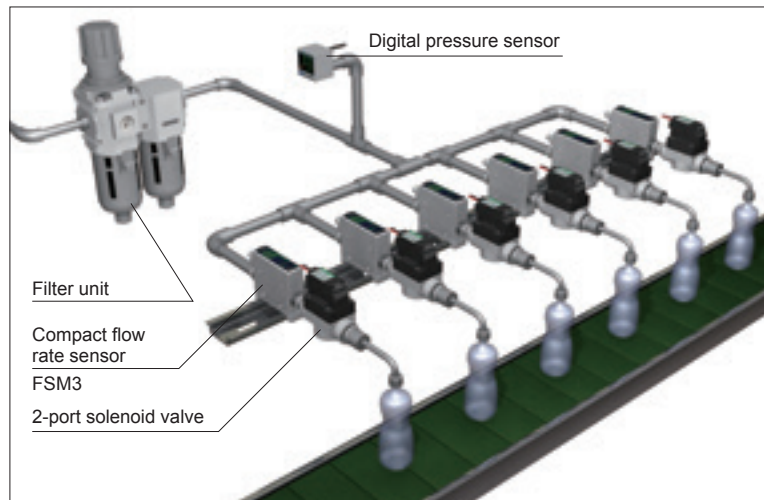
Digital pressure sensor



2-port solenoid valve



Compact flow rate sensor



## Air consumption management

The air consumption of facilities that use pneumatic devices is monitored.

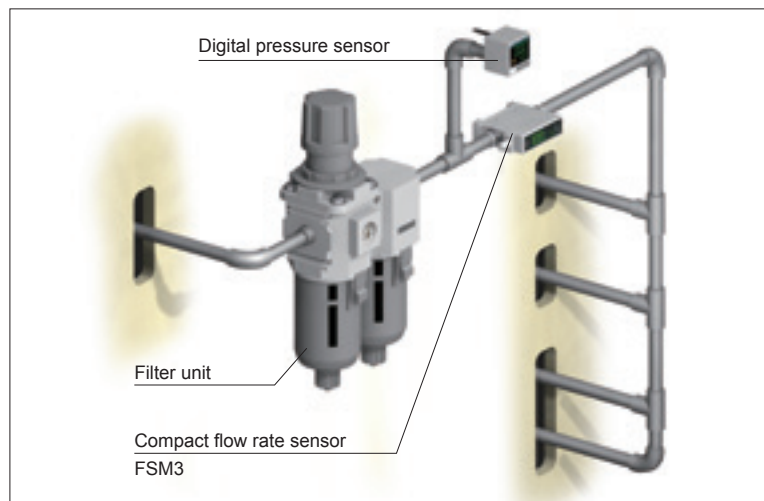
Filter unit



Digital pressure sensor



Compact flow rate sensor



## Painting air flow rate control

Change the air pressure and controls flow rate used during coating with the electro-pneumatic regulator.

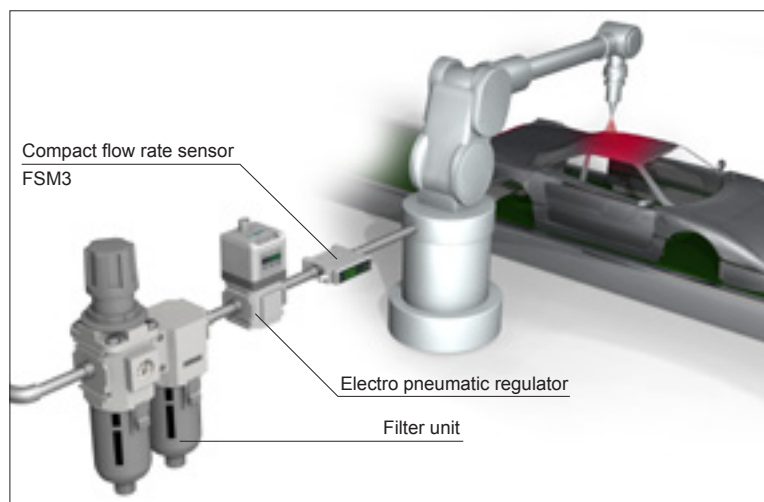
Filter unit



Electro pneumatic regulator



Compact flow rate sensor





## Biochemical culture apparatus

CO<sub>2</sub> flow rate is measured to promote the photosynthesis of organisms.

Inline clean filter



Digital pressure sensor



Compact flow rate sensor



Compact flow rate sensor  
FSM3



## Arc welding

Manages argon, gas mixtures (argon + carbon dioxide), and other shielding gases.

Rotary clamp cylinder



Guided cylinder



Cylinder switch with connector



Compact flow rate sensor (IO-Link model)



Compact flow  
rate sensor  
(IO-Link model)  
FSM3



## Electronic part installation

Control the tension of gold wire for installing electronic parts.

Inline clean filter



Digital pressure sensor



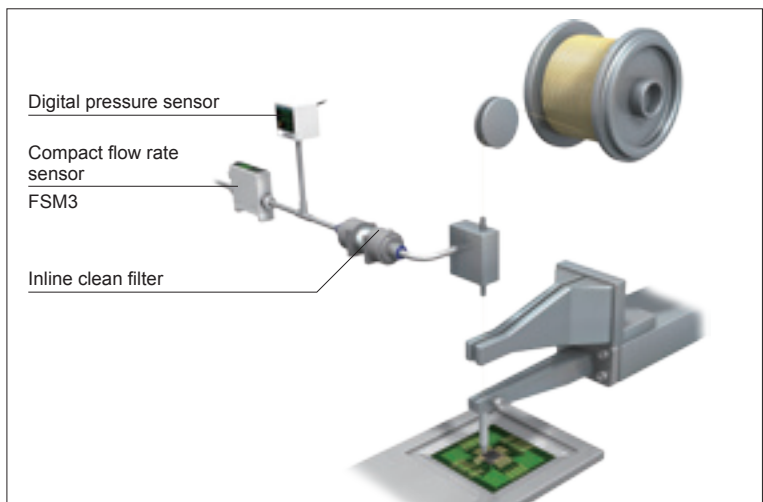
Compact flow rate sensor





Digital pressure sensor

Compact flow rate  
sensor  
FSM3

Inline clean filter



# Series variation Compact flow rate sensor (RAPIFLOW) FSM3 Series

	Appearance	Applicable fluid	Flow rate adjustment valve *1	EXA connecting fitting *2
Resin body	<div> <div>LCD display</div> <div>Bar display</div> <div>IO-Link</div>  </div>	Air Nitrogen Carbon dioxide Argon Gas mixture (argon + carbon dioxide)	●	
			●	
			●	
			●	
			●	
			●	
			●	
			●	●
			●	
			●	
			●	
Stainless steel body	<div> <div>LCD display</div> <div>Bar display</div> <div>IO-Link</div>  </div>	(1) Air Nitrogen Carbon dioxide Argon Gas mixture (argon + carbon dioxide)	●	
			●	
			●	
			●	
			●	
			●	
		(2) Oxygen		
			●	
			●	

\*1: Compatible with LCD display

\*2: Compatible with LCD display and bar display

LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety Precautions	Related products
	Resin body				Stainless steel body								

CKD Intro2



Compact flow rate sensor RAPIFLOW

# FSM3 Series

LCD display

● Resin body (flow rate range: 500 mL/min to 1000 L/min)



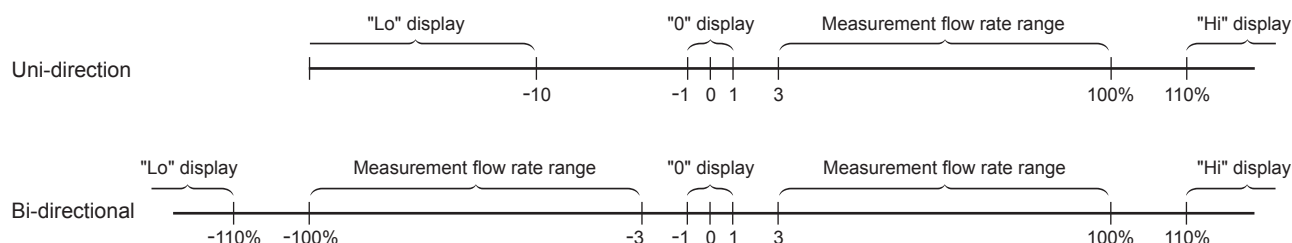
## LCD display specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]											
			[B]											
			005	010	020	050	100	200	500	101	201	501	102	
Flow direction	[C]	U	Uni-direction											
		B	Bi-direction											
Measurement flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L	
		B	-500 to -15, 15 to 500 mL	-1000 to -30, 30 to 1000 mL	-2.00 to -0.06, 0.06 to 2.00 L	-5.00 to -0.15, 0.15 to 5.00 L	-10.00 to -0.30, 0.30 to 10.00 L	-20.0 to -0.6, 0.6 to 20.0 L	-50.0 to -1.5, 1.5 to 50.0 L	-100.0 to -3.0, 3.0 to 100.0 L	-200 to -6, 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L	
Display			4 digit + 4 digit 2 color LCD											
Flow rate display range (□/min) *2	[B]	U	-49 to 549 mL	-99 to 1099 mL	-0.19 to 2.19 L	-0.49 to 5.49 L	-0.99 to 10.99 L	-1.9 to 21.9 L	-4.9 to 54.9 L	-9.9 to 109.9 L	-19 to 219 L	-49 to 549 L	-99 to 1099 L	
		B	-549 to 549 mL	-1099 to 1099 mL	-2.19 to 2.19 L	-5.49 to 5.49 L	-10.99 to 10.99 L	-21.9 to 21.9 L	-54.9 to 54.9 L	-109.9 to 109.9 L	-219 to 219 L	-549 to 549 L	-1099 to 1099 L	
Integration display *3		Display range	0 to ±9999999 mL		0.00 to ±99999.99 L			0.0 to ±999999.9 L			0 to ±9999999 L			
		Pulse output rate	5 mL	10 mL	0.02 L	0.05 L	0.1 L	0.2 L	0.5 L	1 L	2 L	5 L	10 L	
Working conditions		Applicable fluid *4	Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2)											
			nitrogen, argon, carbon dioxide, gas mixture (argon + carbon dioxide)										-	
		Temperature range	0 to 50°C (no condensation)											
		Pressure range	-0.09 to 0.75 MPa											
		Proof pressure	1 MPa											
Operating ambient temperature/humidity			0 to 50 °C, 90% RH or less											
Storage temperature			-10 to 60°C											
Accuracy *5 (Fluid: in dry air)		Accuracy *6	Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")											
		Repeatability *7	Within ±1% F.S. (Secondary side released to atmosphere)											
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)											
		Pressure characteristics	Within ±5% F.S. (where secondary side is released to atmosphere)									Within ±5% F.S. (0.35 MPa standard)		
Response time		*8	50 msec or less (setting response time OFF)											
Switch output		A, B, E, F	NPN open collector output (50 mA or less, voltage drop 2.4 V or less)											
		C, D, G, H	PNP open collector output (50 mA or less, voltage drop 2.4 V or less)											
Analog output *9	[G]	A, B, C, D	1 to 5 V voltage output (connecting load impedance 50 kΩ or more)											
		E, F, G, H	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)											
Power supply voltage *10		A, B, C, D	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less											
		E, F, G, H	24 VDC (21.6 to 26.4 V) ripple rate 1% or less											
Current consumption			*11	45 mA or less										
Lead wire			ø3.7, AWG26 or equivalent × 5-conductor (connector), insulator O.D. ø1.0											
Functions			*12	① Gas type selection, ② setting copy function, ③ flow rate integration, ④ peak hold, etc.										
Degree of protection			IP40 or equivalent (IEC standard)											
Protection circuit			*13	Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection										
Vibration resistance			10 to 150 Hz, 100 m/s <sup>2</sup> , 2 hours each in X, Y, Z directions											
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8											
Mounting	Mounting orientation *14		Unrestricted in vertical/horizontal direction											
	Straight piping section *15		Not required											



\*1: The value converted to volumetric flow rate at standard condition (20°C, 1 barometric pressure (101 kPa), 65%RH).  
(20°C, 1 atmospheric pressure (101 kPa), 0%RH with a type of gas other than air.)

\*2: Display at each flow rate is as follows.



\*3: The integrated flow is a calculated (reference) value. When using the integrated save function, take care to prevent the number of saves from exceeding the access count limit of the storage device (1 million times). (Changes to the settings are counted in number of accesses.)

$$\text{Number of saves} = \frac{\text{Usage time}}{5 \text{ mins}} < 1 \text{ million times}$$

When the instantaneous flow rate is 1% or less, the flow rate is counted as integrated flow rate.

\*4: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.). To maintain the function of this product, install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil content 0.1 mg/m<sup>3</sup>) on the primary side (upstream side) of this product. (Refer to page 74 for details on recommended circuit.)

\*5: Compressed air is used for adjusting and inspecting this product. Accuracy for gas types other than air is a guideline.

\*6: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy.

Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ±3% F.S.

Consider separately according to the working environment and working conditions.

\*7: Repeatability calculated during a short time. Change over time is not included. (Refer to the product specifications for details.)

\*8: The actual response time changes depending on the piping conditions. As a guideline, the response time setting can be selected within the range 50 msec to 1.5 sec.

\*9: The output impedance of the output impedance of the analog output voltage output is approximately 1 kΩ. If the impedance of the connecting load is small, output and error increase. Check error with the impedance of the connecting load before using.

\*10: The power supply voltage specifications differ for the voltage output and current output types.

\*11: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.

\*12: The gas type switching function enables switching to argon, carbon dioxide and a gas mixture of argon 80% + carbon dioxide 20%. The full scale flow rate and analog output after changing are as follows. (Note that the 500 L/min and 1,000 L/min models do not have a gas change function.)

Gas type	Flow direction	Full scale flow rate	Analog output	
			Voltage	Current
<ul style="list-style-type: none"> <li>Air</li> <li>Nitrogen</li> <li>Argon</li> <li>Argon 80% + carbon dioxide 20%</li> </ul>	Uni-direction	0 to 100%	1 to 5 V	4 to 20 mA
	Bi-direction	-100 to 100%		
<ul style="list-style-type: none"> <li>Carbon dioxide</li> </ul>	Uni-direction	0 to 50%	1 to 3 V	4 to 12 mA
	Bi-direction	-50 to 50%	2 to 4 V	8 to 16 mA

The "Setting copy function" setting is selected at "Ⓔ Output specifications".

Note that the "External input" function is not available on models on which the "Setting copy function" is enabled.

\*13: This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.

\*14: This product measures changes in heat distribution that are caused by flow.

When this product is mounted in a vertical orientation, convective flow may affect heat distribution or cause the zero point to deviate.

\*15: Accuracy may be affected by the piping conditions. To perform measurement with greater accuracy, install a straight pipe with a piping I.D. ten times larger. With the 500 L/min and 1,000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

\*16: Refer to page 59 for weight.

## How to order

**FSM3 - L 005 U 1 BH 1 A 1 N - B M R - P80**

Model No.

**B** Flow rate ranges (full scale)

**A** Display

**C** Flow direction

**D** Body material / applicable fluid

**E** Port size

**F** Piping direction

**G** Output specifications

**H** Unit specifications

**I** Valve option

**J** Lead wire

**K** Mounting attachments

**L** Attached documents

**M** Clean-room Specifications

[Example of model No.]

**FSM3-L005U1BH1A1N-BMR-P80**

Model: RAPIFLOW FSM3 Series

**A** Display L : Liquid crystal display  
**B** Flow rate 005 : 500 mL/min  
**C** Flow direction U : Uni-direction  
**D** Body material / applicable fluid 1 : Resin/air  
**E** Port size BH : Push-in (ø4 mm for tube)  
**F** Piping direction 1 : Straight  
**G** Output specifications A : Analog voltage output ×1, NPN switch output ×1, setting copy function  
**H** Unit specifications 1 : SI units only  
**I** Valve option N : None  
**J** Lead wire B : 5-conductor 3 m  
**K** Mounting attachment M : DIN rail mount  
**L** Attached documents R : Company certification  
**M** Clean-room specifications P80 : Oil free

## Precautions for model No. selection

- \*1: Refer to the correspondence table on the following page when selecting the model.
- \*2: For "B: bi-directional" models, **I** the only valve option is "N: none". Note that "T: with needle valve" and "E: EXA connecting fitting" cannot be selected.
- \*3: The G thread connection shape is compliant with ISO16030 standards.
- \*4: Please refer to the external dimension diagram (Pages 5 to 7) for the G thread connection shape when making a selection. (The G thread connection shape is compliant with JIS B 2351-1, O types.)
- \*5: Note that if you mount the elbow fitting in an upward position, it will interfere with the connector, and if you mount the elbow fitting in a downward position, it will interfere with the DIN rail mounting.
- \*6: Models with the unit switching function are not sold in Japan.
- \*7: Connection to solenoid valves (EXA Series) is possible with the dedicated fitting. Refer to page 69.
- \*8: Be sure to set EXA to the OUT side of the product. Use a lead wire for the EXA coil option. The DIN terminal box cannot be mounted because it will cause interference. After making sure it is connected firmly, confirm that there is no external leakage.
- \*9: **M** Clean-room specifications "P70" and "P80" cannot be selected.
- \*10: Note that the bracket mounting position may interfere with the elbow fitting.
- \*11: Optional parts are provided with the product. They are not assembled with the product.
- \*12: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
- \*13: In addition to P70 specifications, wetted section materials are degreased and cleaned.

Code	Description
<b>A Display</b>	
L	Liquid crystal display

<b>B Flow rate ranges (full scale)</b>			
005	500 mL/min	500	50 L/min
010	1000 mL/min	101	100 L/min
020	2 L/min	201	200 L/min
050	5 L/min	501	500 L/min
100	10 L/min	102	1000 L/min
200	20 L/min		

<b>C Flow direction</b>		<b>*2</b>	
U	Uni-direction		
B	Bi-direction		

<b>D Body material / applicable fluid</b>		
	Body material	Applicable fluid
1	Resin	Air (gas switchable)

<b>E Port size</b>			
BH	Push-in (for ø4 mm tube)	AF	G1/8 *3
CH	Push-in (for ø6 mm tube)	BF	G1/4 *3
DH	Push-in (for ø8 mm tube)	CF	G1/2 *3
EH	Push-in (for ø10 mm tube)	AB	G1/8 *4
HH	Push-in (for ø1/4" tube)	BB	G1/4 *4
JH	Push-in (for ø3/8" tube)	CB	G1/2 *4
AA	Rc1/8	AC	NPT1/8
BA	Rc1/4	BC	NPT1/4
CA	Rc1/2	CC	NPT1/2

<b>F Piping direction</b>		<b>*5</b>	
1	Straight		
2	Elbow		

<b>G Output specifications</b>			
	Analog output	Switch output	Setting copy function
A	1 point	1 point (NPN)	With
B	(Voltage	2 points (NPN)	—
C	output)	1-point output (PNP)	With
D	1-5 V	2-points output (PNP)	—
E	1 point	1 point (NPN)	With
F	Current output	2 points (NPN)	—
G	4-20 mA	1-point output (PNP)	With
H		2-points output (PNP)	—

<b>H Unit specifications</b>		<b>*6</b>	
1	SI units only		
2	With unit switching function (overseas models only)		

<b>I Valve option</b>		<b>*2</b>	
N	None		
T	With needle valve (only for models 200 L or less)		
E	EXA connecting fitting (EXA sold separately)		*7, *8, *9

<b>J Lead wire</b>			
Blank	None		
A	5-conductor 1 m		
B	5-conductor 3 m		

<b>K Mounting attachments</b>		<b>*10, *11</b>	
Blank	None		
H	Bracket 1 (for models 200 L or less)		
J	Bracket 2 (for 500 or 1000 L models)		
K	Panel mounting (for sensor products of models 200 L or less)		
L	Panel mounting (for needle valves of models 200 L or less)		
M	DIN rail mounting (for models 200 L or less)		

<b>L Attached documents</b>			
Blank	None		
R	Company certification		
S	Company certification + Traceability certification		

<b>M Clean-room specifications</b>			
Blank	None		
P70	Anti-dust generation		*12
P80	Oil free		*13

Compatibility of flow rate ranges and port sizes, needle valve options, and EXA connection fittings

		E Port sizes F Piping direction															
		BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
B Flow rate code	005	●○	●○			●○		●○	●○			●○		●○			●○
	010	●○	●○			●○		●○	●○			●○		●○			●○
	020	●○	●○			●○		●○	●○			●○		●○			●○
	050	●○	●○			●○		●○	●○			●○		●○			●○
	100	●○	●○			●○		●○	●○			●○		●○			●○
	200	●○	●○			●○		●○	●○			●○		●○			●○
	500		●○	●○		●○			●○	●○		●○		●○	●○★		●○
	101			●○	●○		●○			●○	●○		●○		●○★		
	201			●○	●○		●○			●○	●○		●○		●○★		
	501															●	
	102															●	
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
	005		●○			●○		●○			●○		●○			●○	
	010		●○			●○		●○			●○		●○			●○	
	020		●○			●○		●○			●○		●○			●○	
	050		●○			●○		●○			●○		●○			●○	
	100		●○			●○		●○			●○		●○			●○	
	200		●○			●○		●○			●○		●○			●○	
	500	●○	●○	●○		●○	●○	●○	●○		●○	●○	●○	●○		●○	●○
	101	●○		●○			●○		●○			●○		●○			●○
	201	●○		●○			●○		●○			●○		●○			●○
	501				●					●					●		
	102				●					●					●		

●: Port compatibility ○: Needle valve option compatibility ★: EXA connection fitting compatibility

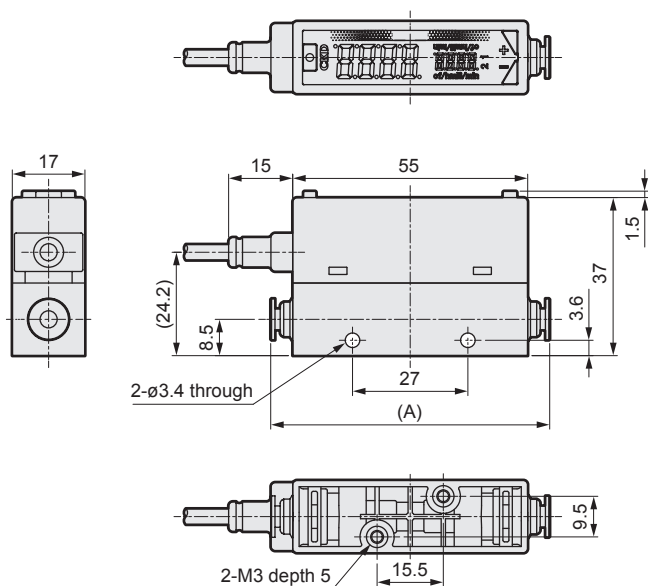
Compatibility table of port sizes and clean-room specifications

		E Port size F Piping direction															
		BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
Clean-room specifications	Blank	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P80	●	●					●	●					●	●	●	●
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
	Blank	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P80	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

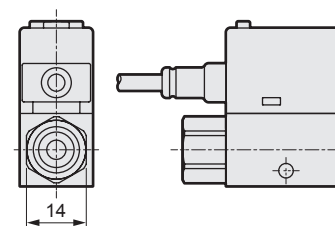
## Dimensions (LCD display)

Port sizes: Straight  $\varnothing 4$  mm,  $\varnothing 6$  mm,  $\varnothing 1/4$ ", Rc1/8, G1/8, NPT1/8

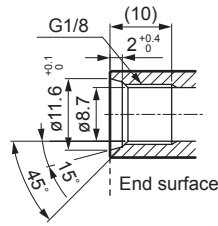
● FSM3-L[ ][ ]1/BH1/CH1/HH1/AA1/AF1/AB1/AC1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Rc1/8, NPT1/8, G1/8 (AB1)

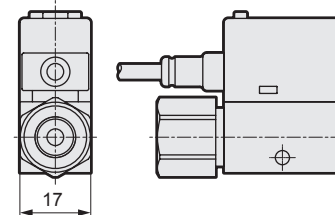


G thread shape (AB)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

G1/8 (AF1)

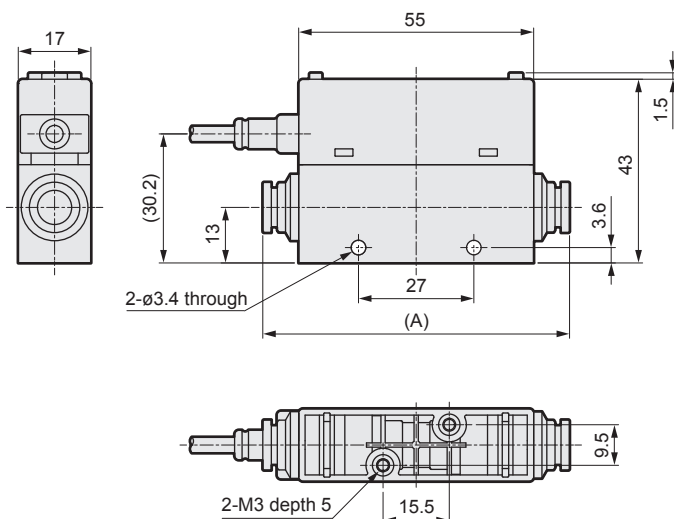


Model No.	Fitting	Dimension (A)
FSM3-L[ ][ ]1BH1	Push-in $\varnothing 4$ mm	(65)
FSM3-L[ ][ ]1CH1	Push-in $\varnothing 6$ mm	(67.2)
FSM3-L[ ][ ]1HH1	Push-in $1/4$ "	(70.4)
FSM3-L[ ][ ]1AA1	Rc1/8	(75)
FSM3-L[ ][ ]1AF1	G1/8	(87)
FSM3-L[ ][ ]1AB1	G1/8	(87)
FSM3-L[ ][ ]1AC1	NPT1/8	(75)

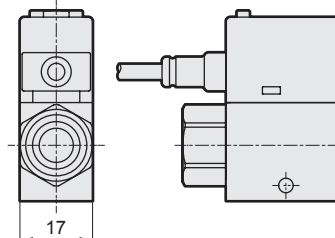
Port sizes: Straight  $\varnothing 8$  mm,  $\varnothing 10$  mm,  $\varnothing 3/8$ ", Rc1/4, G1/4, NPT1/4

● FSM3-L[ ][ ]1/DH1/EH1/JH1/BA1/BF1/BB1/BC1 (Full scale flow rates: 50, 100, 200 L/min)

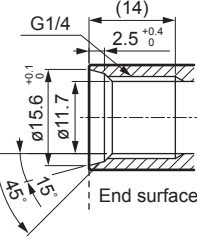
\* The dedicated adaptor for the EXA connection type is the secondary side (to the right in the figure below).  
For connection dimensions, refer to page 69.



Rc1/4, NPT1/4, G1/4 (BB1)

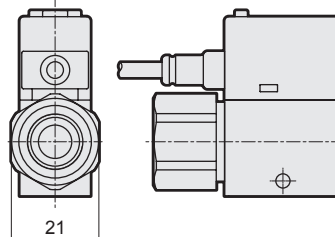


G thread shape (BB)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

G1/4 (BF1)

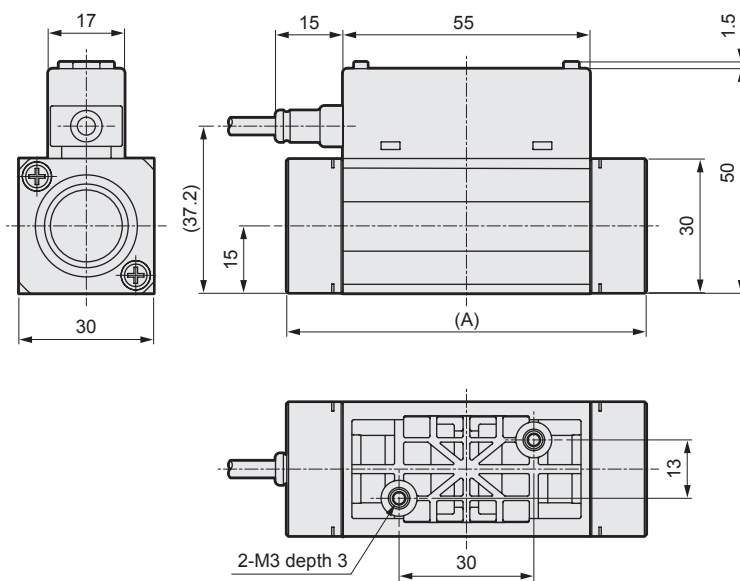


Model No.	Fitting	Dimension (A)
FSM3-L[ ][ ]1DH1	Push-in $\varnothing 8$ mm	(70.6)
FSM3-L[ ][ ]1EH1	Push-in $\varnothing 10$ mm	(82.1)
FSM3-L[ ][ ]1JH1	Push-in $3/8$ "	(83.4)
FSM3-L[ ][ ]1BA1	Rc1/4	(75)
FSM3-L[ ][ ]1BF1	G1/4	(89)
FSM3-L[ ][ ]1BB1	G1/4	(89)
FSM3-L[ ][ ]1BC1	NPT1/4	(75)

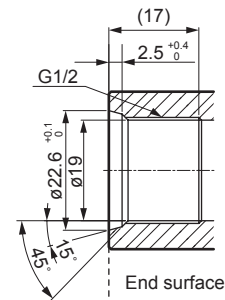
### Dimensions (LCD display)

Port sizes: Straight Rc1/2, G1/2, NPT1/2

● FSM3-L[ ][ ]1/CA1/CF1/CB1/CC1 (Full scale flow rates: 500, 1000 L/min)

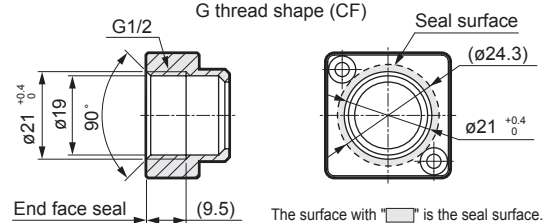


G thread shape (CB)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

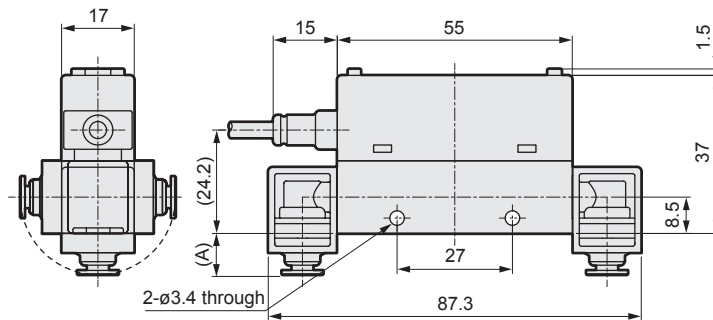
G thread shape (CF)



Model No.	Fitting	Dimension (A)
FSM3-L[ ][ ]1CA1	Rc1/2	(80)
FSM3-L[ ][ ]1CF1	G1/2	(80)
FSM3-L[ ][ ]1CB1	G1/2	(95.4)
FSM3-L[ ][ ]1CC1	NPTG1/2	(80)

Port sizes: Elbow ø4 mm, ø6 mm, ø1/4", Rc1/8, G1/8, NPT1/8

● FSM3-L[ ][ ]1/BH2/CH2/HH2/AA2/AF2/AB2/AC2 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



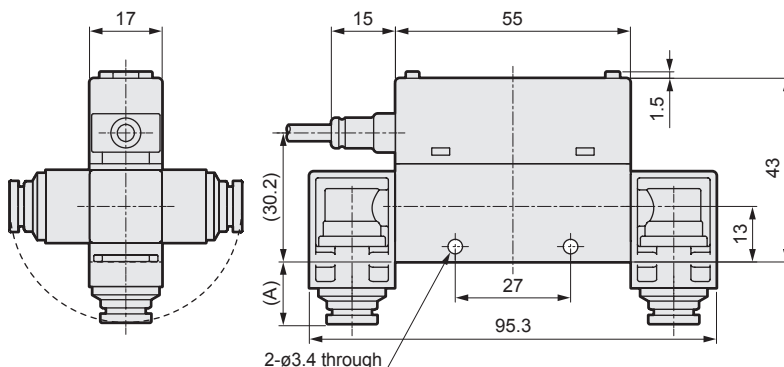
\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

Model No.	Fitting	Dimension (A)
FSM3-L[ ][ ]1BH2	Push-in ø4 mm	(9.5)
FSM3-L[ ][ ]1CH2	Push-in ø6 mm	(10.6)
FSM3-L[ ][ ]1HH2	Push-in 1/4"	(12.2)
FSM3-L[ ][ ]1AA2	Rc1/8	(14.5)
FSM3-L[ ][ ]1AF2	G1/8 *	(20.5)
FSM3-L[ ][ ]1AB2	G1/8 *	(20.5)
FSM3-L[ ][ ]1AC2	NPT1/8	(14.5)

\*Please refer to the straight type for the G thread shape.

Port sizes: Elbow ø8 mm, ø10 mm, ø3/8", Rc1/4, G1/4, NPT1/4

● FSM3-L[ ][ ]1/DH2/EH2/JH2/BA2/BF2/BB2/BC2 (Full scale flow rates: 50, 100, 200 L/min)



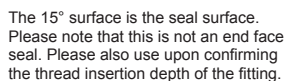
\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

Model No.	Fitting	Dimension (A)
FSM3-L[ ][ ]1DH2	Push-in ø8 mm	(13.6)
FSM3-L[ ][ ]1EH2	Push-in ø10 mm	(19.3)
FSM3-L[ ][ ]1JH2	Push-in 3/8"	(20.0)
FSM3-L[ ][ ]1BA2	Rc1/4	(15.8)
FSM3-L[ ][ ]1BF2	G1/4 *	(22.8)
FSM3-L[ ][ ]1BB2	G1/4 *	(22.8)
FSM3-L[ ][ ]1BC2	NPT1/4	(15.8)

\*Please refer to the straight type for the G thread shape.

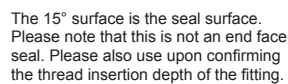


● FSM3-L BC1/BH1/CH1/HH1/AA1/AF1/AB1/AC1/GHT (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Model No.	Fitting	Dimension (A)
FSM3-L□□1BH1	Push-in ø4 mm	(90)
FSM3-L□□1CH1	Push-in ø6 mm	(92.2)
FSM3-L□□1HH1	Push-in 1/4"	(95.4)
FSM3-L□□1AA1	Rc1/8	(100)
FSM3-L□□1AF1	G1/8	(112)
FSM3-L□□1AB1	G1/8	(112)
FSM3-L□□1AC1	NPT1/8	(100)

● FSM3-L BC1/DH1/EH1/JH1/BA1/BF1/BB1/BC1/GHT (Full scale flow rates: 50, 100, 200 L/min)



Model No.	Fitting	Dimension (A)
FMS3-L-□1DH1	Push-in ø8 mm	(101.6)
FMS3-L-□1EH1	Push-in ø10 mm	(113.1)
FMS3-L-□1JH1	Push-in 3/8"	(114.4)
FMS3-L-□1BA1	Rc1/4	(106)
FMS3-L-□1BF1	G1/4	(120)
FMS3-L-□1BB1	G1/4	(120)
FMS3-L-□1BC1	NPT1/4	(106)

LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products
Resin body				Stainless steel body									



Compact flow rate sensor RAPIFLOW

# FSM3 Series

Bar display

● Resin body (flow rate range: 500 mL/min to 1000 L/min)



## Bar display specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measurement flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15, 15 to 500 mL	-1000 to -30, 30 to 1000 mL	-2.00 to -0.06, 0.06 to 2.00 L	-5.00 to -0.15, 0.15 to 5.00 L	-10.00 to -0.30, 0.30 to 10.00 L	-20.0 to -0.6, 0.6 to 20.0 L	-50.0 to -1.5, 1.5 to 50.0 L	-100.0 to -3.0, 3.0 to 100.0 L	-200 to -6, 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display			LED bar display										
Working fluid		Applicable fluid *2	Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2), nitrogen gas										
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 0.75 MPa										
		Proof pressure	1 MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy		Accuracy *3	Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")										
		Repeatability *4	Within ±1% F.S. (Secondary side released to atmosphere)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (where secondary side is released to atmosphere)									Within ±5% F.S. (0.35 MPa standard)	
Response time		*5	50 msec or less										
Analog output *6	[G]	J	1 to 5 V voltage output (connecting load impedance 50 kΩ or more)										
		K	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)										
Power supply voltage *7	[G]	J	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less										
		K	24 VDC (21.6 to 26.4 V) ripple rate 1% or less										
Current consumption *8			45 mA or less										
Lead wire			ø3.7, AWG26 or equivalent × 4-conductor (connector), insulator O.D. ø1.0										
Degree of protection			IP40 or equivalent (IEC standard)										
Protection circuit *9			Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, 100 m/s <sup>2</sup> , 2 hours each in X, Y, Z directions										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting	Mounting orientation *10		Unrestricted in vertical/horizontal direction										
	Straight piping section *11		Not required										

- \*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) 65%RH)
- \*2: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.). To maintain the function of this product, install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil content 0.1 mg/m<sup>3</sup>) on the primary side (upstream side) of this product. (Refer to page 74 for details on recommended circuit.)
- \*3: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy.  
Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ±3% F.S.  
Consider separately according to the working environment and working conditions.
- \*4: Repeatability calculated during a short time. Change over time is not included. (Refer to the product specifications for details.)
- \*5: The actual response time changes depending on the piping conditions.
- \*6: The output impedance of the output impedance of the analog output voltage output is approximately 1 kΩ. If the impedance of the connecting load is small, output and error increase. Check error with the impedance of the connecting load before using.
- \*7: The power supply voltage specifications differ for the voltage output and current output types.
- \*8: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.
- \*9: This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.
- \*10: This product measures changes in heat distribution that are caused by flow.  
When this product is mounted in a vertical orientation, convective flow may affect heat distribution or cause the zero point to deviate.
- \*11: Accuracy may be affected by the piping conditions. To perform measurement with greater accuracy, install a straight pipe with a piping I.D. ten times larger. With the 500 L/min and 1,000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.
- \*12: Refer to page 59 for weight.

Resin body	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Stainless steel body	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Separated display	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Technical data	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Operating method	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Optional products	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Safety precautions	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Related products	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure

## How to order

**FSM3 - B 005 U 1 BH 1 J 1 N - D H S - P70**

Model No.

**B** Flow rate ranges (full scale)

**A** Display

**C** Flow direction

**D** Body material / applicable fluid

**E** Port size

[Example of model No.]

**FSM3-B005U1BH1J1N-DHS-P70**

Model: RAPIFLOW FSM3 Series

**A** Display      **B** : Bar display

**B** Flow rate      005 : 500 mL/min

**C** Flow direction      **U** : Uni-direction

**D** Body material / applicable fluid      **1** : Resin/air

**E** Port size      **BH** : Push-in (ø4 mm for tube)

**F** Piping direction      **1** : Straight

**G** Output specifications      **J** : Analog voltage output x1      **G** Output specifications

**H** Unit specifications      **1** : SI units only

**I** Valve option      **N** : None

**J** Lead wire      **D** : 4-conductor 3 m

**K** Mounting attachment      **H** : Bracket

**L** Attached documents      **S** : Company certification + Traceability certification

**M** Clean-room specifications      **P70** : Anti-dust generation

## ⚠ Precautions for model No. selection

\*1: Refer to the correspondence table on the following page when selecting the model.

\*2: When using in combination with a separated display (FSM2-D), select "J": analog voltage output x 1 point".

\*3: For "B": bi-directional models, "I" the only valve option is "N: none". Note that "E: EXA connecting fitting" cannot be selected.

\*4: The G thread connection shape is compliant with ISO16030 standards.

\*5: Please refer to the external dimension diagram (Pages 13 to 14) for the G thread connection shape when making a selection. (The G thread connection shape is compliant with JIS B 2351-1, O types.)

\*6: Note that if you mount the elbow fitting in an upward position, it will interfere with the connector, and if you mount the elbow fitting in a downward position, it will interfere with the DIN rail mounting.

\*7: Connection to solenoid valves (EXA Series) is possible with the dedicated fitting. Refer to page 69.

\*8: Be sure to set EXA to the OUT side of the product.

Use a lead wire for the EXA coil option. The DIN terminal box cannot be mounted because it will cause interference. After making sure it is connected firmly, confirm that there is no external leakage.

\*9: "M" Clean-room specifications "P70" and "P80" cannot be selected.

\*10: "Panel mount" option cannot be selected. Note that the bracket mounting position may interfere with the elbow fitting.

\*11: Optional parts are provided with the product. They are not assembled with the product.

\*12: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).

\*13 In addition to P70 specifications, wetted section materials are degreased and cleaned.

Code	Description
<b>A Display</b>	
<b>B</b>	Bar display

<b>B Flow rate ranges (full scale)</b>			
<b>005</b>	500 mL/min	<b>500</b>	50 L/min
<b>010</b>	1000 mL/min	<b>101</b>	100 L/min
<b>020</b>	2 L/min	<b>201</b>	200 L/min
<b>050</b>	5 L/min	<b>501</b>	500 L/min
<b>100</b>	10 L/min	<b>102</b>	1000 L/min
<b>200</b>	20 L/min		

<b>C Flow direction</b>		<b>*3</b>
<b>U</b>	Uni-direction	
<b>B</b>	Bi-direction	

<b>D Body material / applicable fluid</b>		
	Body material	Applicable fluids
<b>1</b>	Resin	Air

<b>E Port size</b>			
<b>BH</b>	Push-in (for ø4 mm tube)	<b>AF</b>	G1/8 *4
<b>CH</b>	Push-in (for ø6 mm tube)	<b>BF</b>	G1/4 *4
<b>DH</b>	Push-in (for ø8 mm tube)	<b>CF</b>	G1/2 *4
<b>EH</b>	Push-in (for ø10 mm tube)	<b>AB</b>	G1/8 *5
<b>HH</b>	Push-in (for ø1/4" tube)	<b>BB</b>	G1/4 *5
<b>JH</b>	Push-in (for ø3/8" tube)	<b>CB</b>	G1/2 *5
<b>AA</b>	Rc1/8	<b>AC</b>	NPT1/8
<b>BA</b>	Rc1/4	<b>BC</b>	NPT1/4
<b>CA</b>	Rc1/2	<b>CC</b>	NPT1/2

<b>F Piping direction</b>	
<b>1</b>	Straight
<b>2</b>	Elbow
	<b>*6</b>

<b>G Output specifications</b>		<b>*2</b>
<b>J</b>	Analog voltage output x 1 point	
<b>K</b>	Analog current output x 1 point	

<b>H Unit specifications</b>	
<b>1</b>	SI units only

<b>I Valve option</b>		<b>*3</b>
<b>N</b>	None	
<b>E</b>	EXA connecting fitting (EXA sold separately) *7, *8, *9	

<b>J Lead wire</b>	
<b>Blank</b>	None
<b>C</b>	4-conductor 1 m
<b>D</b>	4-conductor 3 m

<b>K Mounting (not assembled)</b>		<b>*10, *11</b>
<b>Blank</b>	None	
<b>H</b>	Bracket 1 (for models 200 L or less)	
<b>J</b>	Bracket 2 (for 500 or 1000 L models)	
<b>M</b>	DIN rail mounting (for models 200 L or less)	

<b>L Attached documents</b>	
<b>Blank</b>	None
<b>R</b>	Company certification
<b>S</b>	Company certification + Traceability certification

<b>M Clean-room specifications</b>	
<b>Blank</b>	None
<b>P70</b>	Anti-dust generation
<b>P80</b>	Oil free
	<b>*13</b>



Compatibility table of flow rate ranges and port sizes, and EXA connection fittings

		E Port sizes F Piping direction															
		BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
B Flow rate codes	005	●	●			●		●	●			●		●			●
	010	●	●			●		●	●			●		●			●
	020	●	●			●		●	●			●		●			●
	050	●	●			●		●	●			●		●			●
	100	●	●			●		●	●			●		●			●
	200	●	●			●		●	●			●		●			●
	500		●	●		●			●	●		●		●	●★		●
	101			●	●		●			●	●		●		●★		
	201			●	●		●			●	●		●		●★		
	501															●	
	102															●	
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
	005		●			●		●			●		●			●	
	010		●			●		●			●		●			●	
	020		●			●		●			●		●			●	
	050		●			●		●			●		●			●	
	100		●			●		●			●		●			●	
	200		●			●		●			●		●			●	
	500	●	●	●		●	●	●	●		●	●	●	●		●	●
	101	●		●			●		●			●		●			●
	201	●		●			●		●			●		●			●
	501				●					●					●		
	102				●					●					●		

● : Port compatibility ★ : EXA connection fitting compatibility

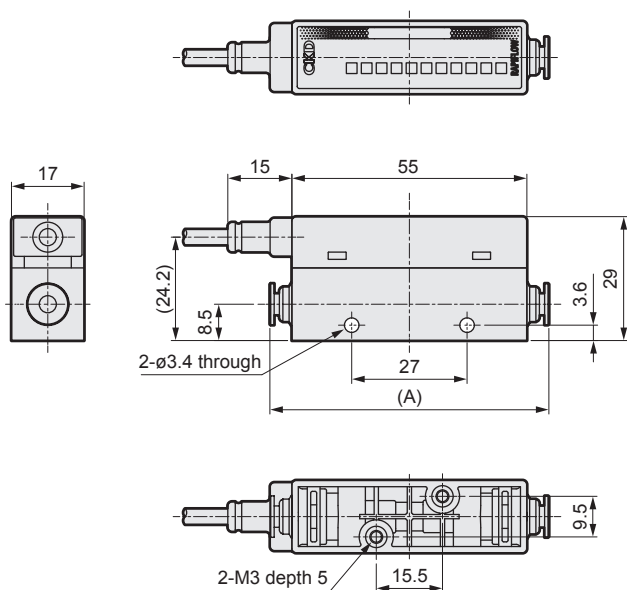
Compatibility table of port sizes and clean-room specifications

		E Port size F Piping direction															
		BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
M Clean-room specifications	Blank	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P80	●	●					●	●					●	●	●	●
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
	Blank	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P80	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

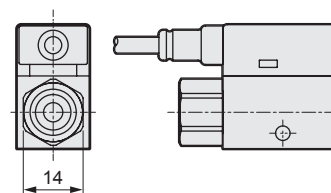
## Dimensions (bar display)

Port sizes: Straight  $\varnothing 4$  mm,  $\varnothing 6$  mm,  $\varnothing 1/4$ ", Rc1/8, G1/8, NPT1/8

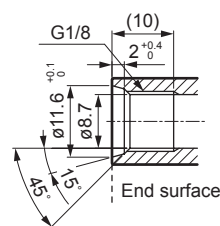
● FSM3-B[ ]1/BH1/CH1/HH1/AA1/AF1/AB1/AC1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Rc1/8, NPT1/8, G1/8 (AB1)

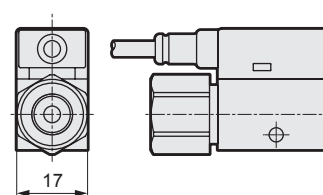


G thread shape (AB)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

G1/8 (AF1)



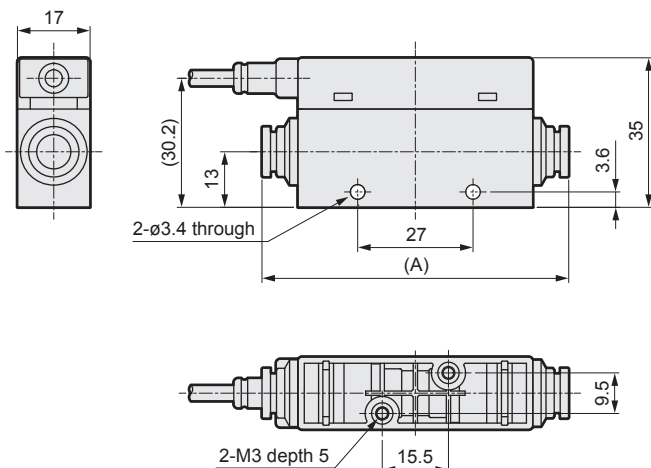
Model No.	Fitting	Dimension (A)
FSM3-B[ ]1BH1	Push-in $\varnothing 4$ mm	(65)
FSM3-B[ ]1CH1	Push-in $\varnothing 6$ mm	(67.2)
FSM3-B[ ]1HH1	Push-in 1/4"	(70.4)
FSM3-B[ ]1AA1	Rc1/8	(75)
FSM3-B[ ]1AF1	G1/8	(87)
FSM3-B[ ]1AB1	G1/8	(87)
FSM3-B[ ]1AC1	NPT1/8	(75)

Port sizes: Straight  $\varnothing 8$  mm,  $\varnothing 10$  mm,  $\varnothing 3/8$ ", Rc1/4, G1/4, NPT1/4

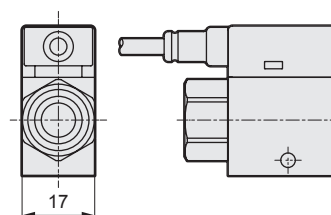
● FSM3-B[ ]1/DH1/EH1/JH1/BA1/BF1/BB1/BC1 (Full scale flow rates: 50, 100, 200 L/min)

\* The dedicated adaptor for the EXA connection type is the secondary side (to the right in the figure below).

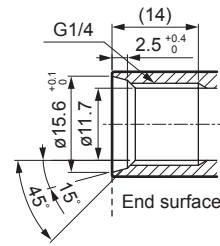
For connection dimensions, refer to page 69.



Rc1/4, NPT1/4, G1/4 (BB1)

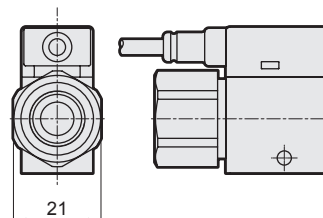


G thread shape (BB)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

G1/4 (BF1)

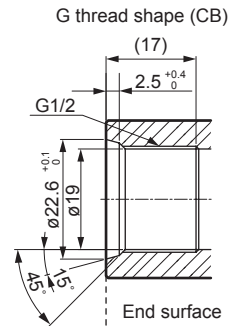
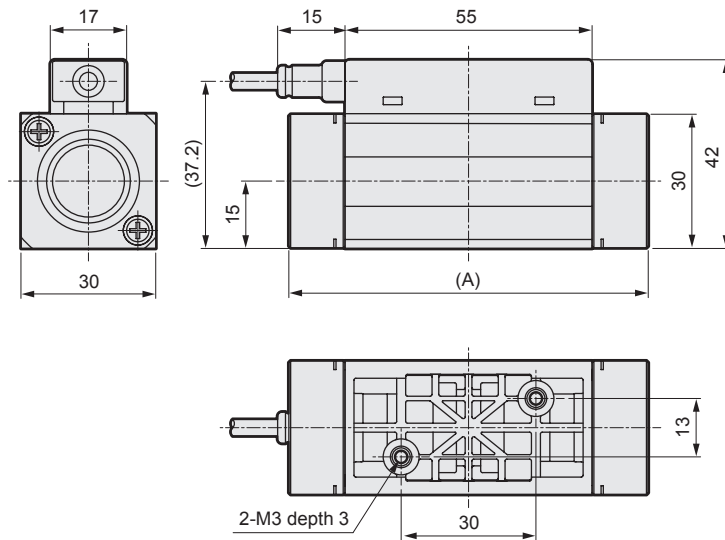


Model No.	Fitting	Dimension (A)
FSM3-B[ ]1DH1	Push-in $\varnothing 8$ mm	(70.6)
FSM3-B[ ]1EH1	Push-in $\varnothing 10$ mm	(82.1)
FSM3-B[ ]1JH1	Push-in 3/8"	(83.4)
FSM3-B[ ]1BA1	Rc1/4	(75)
FSM3-B[ ]1BF1	G1/4	(89)
FSM3-B[ ]1BB1	G1/4	(89)
FSM3-B[ ]1BC1	NPT1/4	(75)

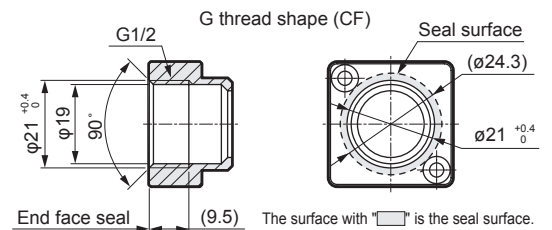
### Dimensions (bar display)

Port sizes: Straight Rc1/2, G1/2, NPT1/2

● FSM3-B□□1/CA1/CF1/CB1/CC1 (Full scale flow rates: 500, 1000 L/min)



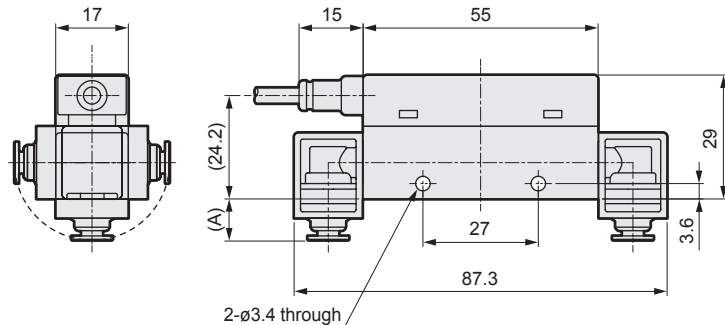
The 15° surface is the seal surface. Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.



Model No.	Fitting	Dimension (A)
FSM3-B□□1CA1	Rc1/2	(80)
FSM3-B□□1CF1	G1/2	(80)
FSM3-B□□1CB1	G1/2	(95.4)
FSM3-B□□1CC1	NPT1/2	(80)

Port sizes: Elbow ø4 mm, ø6 mm, ø1/4", Rc1/8, G1/8, NPT1/8

● FSM3-B□□1/BH2/CH2/HH2/AA2/AF2/AB2/AC2 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



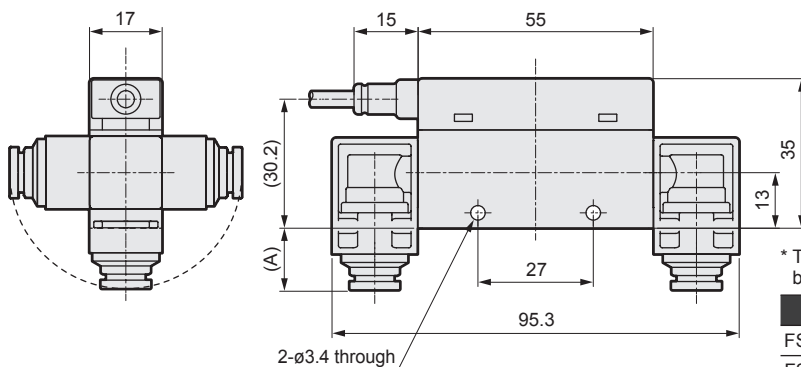
\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

Model No.	Fitting	Dimension (A)
FSM3-B□□1BH2	Push-in ø4 mm	(9.5)
FSM3-B□□1CH2	Push-in ø6 mm	(10.6)
FSM3-B□□1HH2	Push-in 1/4"	(12.2)
FSM3-B□□1AA2	Rc1/8	(14.5)
FSM3-B□□1AF2	G1/8 *	(20.5)
FSM3-B□□1AB2	G1/8 *	(20.5)
FSM3-B□□1AC2	NPT1/8	(14.5)

\*Please refer to the straight type for the G thread shape.

Port sizes: Elbow ø8 mm, ø10 mm, ø3/8", Rc1/4, G1/4, NPT1/4

● FSM3-B□□1/DH2/EH2/JH2/BA2/BF2/BB2/BC2 (Full scale flow rates: 50, 100, 200 L/min)



\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

Model No.	Fitting	Dimension (A)
FSM3-B□□1DH2	Push-in ø8 mm	(13.6)
FSM3-B□□1EH2	Push-in ø10 mm	(19.3)
FSM3-B□□1JH2	Push-in 3/8"	(20.0)
FSM3-B□□1BA2	Rc1/4	(15.8)
FSM3-B□□1BF2	G1/4 *	(22.8)
FSM3-B□□1BB2	G1/4 *	(22.8)
FSM3-B□□1BC2	NPT1/4	(15.8)

\*Please refer to the straight type for the G thread shape.



Compact flow rate sensor RAPIFLOW

# FSM3 Series

IO-Link

● Resin body (flow rate range: 500 mL/min to 1000 L/min)



## IO-Link specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measurement flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15, 15 to 500 mL	-1000 to -30, 30 to 1000 mL	-2.00 to -0.06, 0.06 to 2.00 L	-5.00 to -0.15, 0.15 to 5.00 L	-10.00 to -0.30, 0.30 to 10.00 L	-20.0 to -0.6, 0.6 to 20.0 L	-50.0 to -1.5, 1.5 to 50.0 L	-100.0 to -3.0, 3.0 to 100.0 L	-200 to -6, 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display			LED display (power and status indicators)										
Working fluid	Applicable fluid *2		Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2)										
			nitrogen, argon, carbon dioxide, gas mixture (argon + carbon dioxide)										-
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 0.75 MPa										
	Proof pressure	1 MPa											
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy *3 (Fluid: in dry air)	Accuracy *4	Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")											
	Repeatability *5	Within ±1% F.S. (Secondary side released to atmosphere)											
	Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)											
	Pressure characteristics	Within ±5% F.S. (where secondary side is released to atmosphere)										Within ±5% F.S. (0.35 MPa standard)	
Response time *6		50 msec or less											
Power supply voltage		18 to 30 VDC (ripple rate 1% or less)											
Current consumption *7		45 mA or less											
Lead wire *8		M12 both-end connector lead wire (3 m), AWG#23 or equivalent, 4-conductor											
Functions *9		① Gas type selection, ② flow rate integration, ③ peak hold, etc.											
Degree of protection		IP40 or equivalent (IEC standard)											
Protection circuit *10		Power supply reverse connection protection											
Vibration resistance *11		10 to 150 Hz, 100 m/s², 2 hours each in X, Y, Z directions											
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting	Mounting orientation *12	Unrestricted in vertical/horizontal direction											
	Straight piping section *13	Not required											

\* Refer to page 65 for communication specifications.

- \*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) 65%RH) (20°C, 1 atmospheric pressure (101 kPa), 0%RH with a type of gas other than air.)
- \*2: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.). To maintain the function of this product, install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil content 0.1 mg/m<sup>3</sup>) on the primary side (upstream side) of this product. (Refer to page 74 for details on recommended circuit.)
- \*3: Compressed air is used for adjusting and inspecting this product. Accuracy for gas types other than air is a guideline.
- \*4: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy.  
Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ±3% F.S.  
Consider separately according to the working environment and working conditions.
- \*5: Repeatability calculated during a short time. Change over time is not included. (Refer to the product specifications for details.)
- \*6: The actual response time changes depending on the piping conditions.
- \*7: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.
- \*8: The male end is straight, and the female end is angled. (Refer to page 67.)  
Tighten the M12 connector at a torque of 0.5 N·m or less.  
Note, however, that using excessive force to tighten the connector can cause it to break.
- \*9: The gas type switching function enables switching to argon, carbon dioxide and a gas mixture of argon 80% + carbon dioxide 20%.  
The measurement flow rate ranges after switching are as follows. (Note that the 500 L/min and 1,000 L/min models do not have a gas change function.)

Gas type	Flow direction	Measurement flow rate range (□/min)							
		005	010	020	100	200	500	101	201
• Air • Nitrogen • Argon • Argon 80% + carbon dioxide 20%	Uni-direction	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L
	Bi-direction	-500 to -15 mL	-1000 to -30 mL	-2.00 to -0.06 L	-10.00 to -0.30 L	-20.0 to -0.6 L	-50.0 to -1.5 L	-100.0 to -3.0 L	-200 to -6 L
		15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L
• Carbon dioxide	Uni-direction	15 to 250 mL	30 to 500 mL	0.06 to 1.00 L	0.30 to 5.00 L	0.6 to 10.0 L	1.5 to 25.0 L	3.0 to 50.0 L	6 to 100 L
	Bi-direction	-250 to -15 mL	-500 to -30 mL	-1.00 to -0.06 L	-5.00 to -0.30 L	-10.0 to -0.6 L	-25.0 to -1.5 L	-50.0 to -3.0 L	-100 to -6 L
		15 to 250 mL	30 to 500 mL	0.06 to 1.00 L	0.30 to 5.00 L	0.6 to 10.0 L	1.5 to 25.0 L	3.0 to 50.0 L	6 to 100 L

The integrating flow is a reference value.

When using the integrated save function, take care to prevent the number of saves from exceeding the access count limit of the storage device (1 million times).

(Changes to the settings are counted in number of accesses.)

$$\text{Number of saves} = \frac{\text{Usage time}}{5 \text{ mins}} < 1 \text{ million times}$$

- \*10: This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.
- \*11: A communication error might occur depending on the vibration conditions. Install this product as far as possible in a place not subject to vibration.
- \*12: This product measures changes in heat distribution that are caused by flow.  
When this product is mounted in a vertical orientation, convective flow may affect heat distribution or cause the zero point to deviate.
- \*13: Accuracy may be affected by the piping conditions. To perform measurement with greater accuracy, install a straight pipe with a piping I.D. ten times larger. With the 500 L/min and 1,000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.
- \*14: Refer to page 59 for weight.

Resin body	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Stainless steel body	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Separated display	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Technical data	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Operating method	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Optional products	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Safety precautions	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
Related products	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure
	LCD display	Bar display	IO-Link	Internal structure



## How to order

**FSM3 - C 005 U 1 BH 1 L 1 N - G H R - P70**

Model No.

**A** Display

**B** Flow rate ranges  
(full scale)

**C** Flow direction

**D** Body material / applicable fluid

**E** Port size

**F** Piping direction

**G** Output specifications

**H** Unit specifications

**I** Valve option

**J** Lead wire

**K** Mounting  
(not assembled)

**L** Attached documents

**M** Clean-room specifications

[Example of model No.]

**FSM3-C005U1BH1L1N-GHR-P70**

Model: RAPIFLOW FSM3 Series

**A** Display C : IO-Link

**B** Flow rate 005 : 500 mL/min

**C** Flow direction U : Uni-direction

**D** Body material / applicable fluid 1 : Resin/air

**E** Port size BH : Push-in  
(ø4 mm for tube)

**F** Piping direction 1 : Straight

**G** Output specifications L : IO-Link

**H** Unit specifications 1 : SI units only

**I** Valve option N : None

**J** Lead wire G : M12 both-end lead wire with connector (3 m)

**K** Mounting attachment H : Bracket

**L** Attached documents R : Company certification

**M** Clean-room specifications P70 : Anti-dust generation

## ⚠ Precautions for model No. selection

- \*1: Refer to the correspondence table on the following page when selecting the model.
- \*2: The G thread connection shape is compliant with ISO16030 standards.
- \*3: Please refer to the external dimension diagram (Pages 19 to 20) for the G thread connection shape when making a selection. (The G thread connection shape is compliant with JIS B 2351-1, O types.)
- \*4: Note that if you mount the elbow fitting in an upward position, it will interfere with the connector, and if you mount the elbow fitting in a downward position, it will interfere with the DIN rail mounting.
- \*5: Note that the bracket mounting position may interfere with the elbow fitting.
- \*6: Optional parts are provided with the product. They are not assembled with the product.
- \*7: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
- \*8: In addition to P70 specifications, wetted section materials are degreased and cleaned.

Code	Description
<b>A Display</b>	
<b>C</b>	IO-Link

<b>B Flow rate ranges (full scale)</b>			
<b>005</b>	500 mL/min	<b>500</b>	50 L/min
<b>010</b>	1000 mL/min	<b>101</b>	100 L/min
<b>020</b>	2 L/min	<b>201</b>	200 L/min
<b>050</b>	5 L/min	<b>501</b>	500 L/min
<b>100</b>	10 L/min	<b>102</b>	1000 L/min
<b>200</b>	20 L/min		

<b>C Flow direction</b>	
<b>U</b>	Uni-direction
<b>B</b>	Bi-direction

<b>D Body material / applicable fluid</b>		
	Body material	Applicable fluid
<b>1</b>	Resin	Air (gas switchable)

<b>E Port size</b>			
<b>BH</b>	Push-in (for ø4 mm tube)	<b>AF</b>	G1/8 *2
<b>CH</b>	Push-in (for ø6 mm tube)	<b>BF</b>	G1/4 *2
<b>DH</b>	Push-in (for ø8 mm tube)	<b>CF</b>	G1/2 *2
<b>EH</b>	Push-in (for ø10 mm tube)	<b>AB</b>	G1/8 *3
<b>HH</b>	Push-in (for ø1/4" tube)	<b>BB</b>	G1/4 *3
<b>JH</b>	Push-in (for ø3/8" tube)	<b>CB</b>	G1/2 *3
<b>AA</b>	Rc1/8	<b>AC</b>	NPT1/8
<b>BA</b>	Rc1/4	<b>BC</b>	NPT1/4
<b>CA</b>	Rc1/2	<b>CC</b>	NPT1/2

<b>F Piping direction</b>	
<b>1</b>	Straight
<b>2</b>	Elbow *4

<b>G Output specifications</b>	
<b>L</b>	IO-Link communication

<b>H Unit specifications</b>	
<b>1</b>	SI units only

<b>I Valve option</b>	
<b>N</b>	None

<b>J Lead wire</b>	
<b>Blank</b>	None
<b>G</b>	M12 both-end lead wire with connector (3 m)

<b>K Mounting (not assembled) *5, *6</b>	
<b>Blank</b>	None
<b>H</b>	Bracket 1 (for models 200 L or less)
<b>J</b>	Bracket 2 (for 500 or 1000 L models)
<b>M</b>	DIN rail mounting (for models 200 L or less)

<b>L Attached documents</b>	
<b>Blank</b>	None
<b>R</b>	Company certification
<b>S</b>	Company certification + Traceability certification

<b>M Clean-room specifications</b>	
<b>Blank</b>	None
<b>P70</b>	Anti-dust generation *7
<b>P80</b>	Oil free *8

### Flow rate ranges and port sizes

		E Port sizes F Piping direction															
		BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
B Flow rate codes	005	●	●			●		●	●			●		●			●
	010	●	●			●		●	●			●		●			●
	020	●	●			●		●	●			●		●			●
	050	●	●			●		●	●			●		●			●
	100	●	●			●		●	●			●		●			●
	200	●	●			●		●	●			●		●			●
	500		●	●		●			●	●		●		●	●		●
	101			●	●		●			●	●		●		●		
	201			●	●		●			●	●		●		●		
	501															●	
	102															●	
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
	005		●			●		●			●		●			●	
	010		●			●		●			●		●			●	
	020		●			●		●			●		●			●	
	050		●			●		●			●		●			●	
	100		●			●		●			●		●			●	
	200		●			●		●			●		●			●	
	500	●	●	●		●	●	●	●		●	●	●	●		●	●
	101	●		●			●		●			●		●			●
	201	●		●			●		●			●		●			●
	501				●					●					●		
	102				●					●					●		

● : Port size compatibility

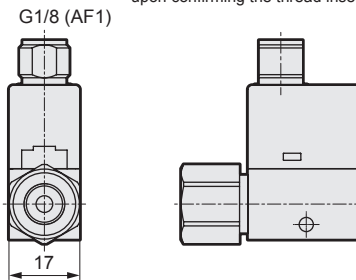
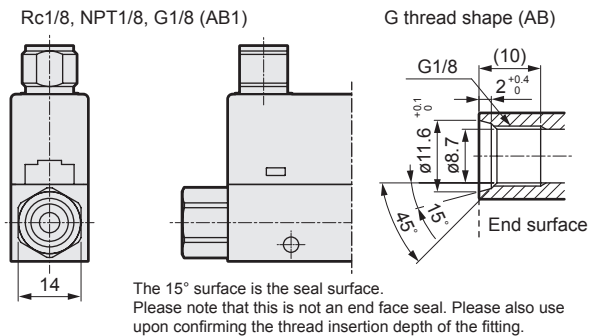
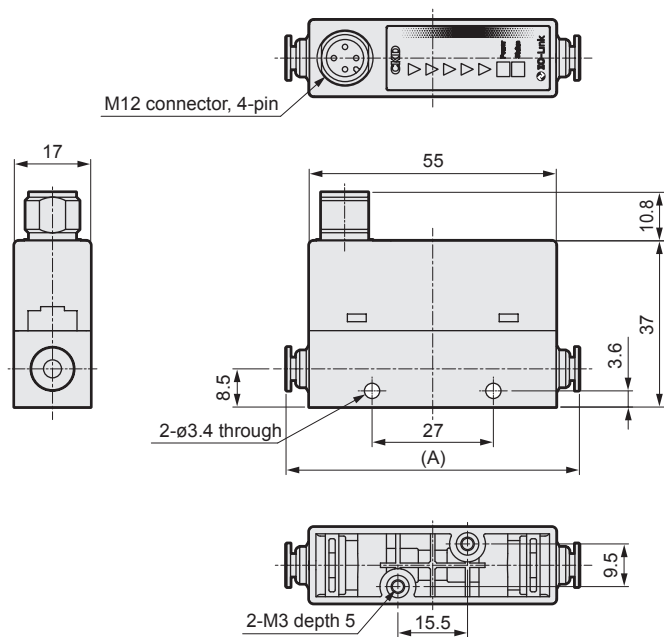
### Compatibility table of port sizes and clean-room specifications

		E Port sizes F Piping direction															
		BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
M Clean-room specifications	Blank	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P80	●	●					●	●					●	●	●	●
		BA2	AF1	BF1	CF1	AF2	BF2	AB1	BB1	CB1	AB2	BB2	AC1	BC1	CC1	AC2	BC2
	Blank	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	P80	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

## Dimensions (IO-Link)

Port sizes: Straight  $\varnothing 4$  mm,  $\varnothing 6$  mm,  $\varnothing 1/4"$ , Rc1/8, G1/8, NPT1/8

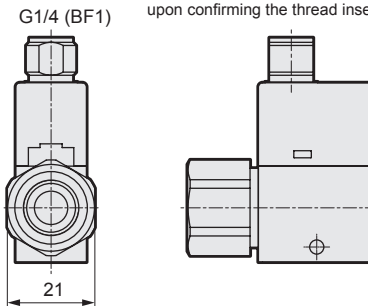
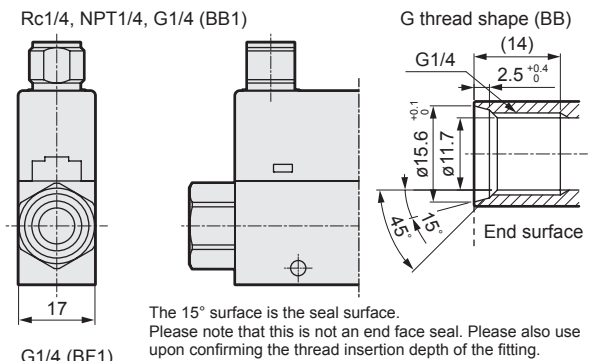
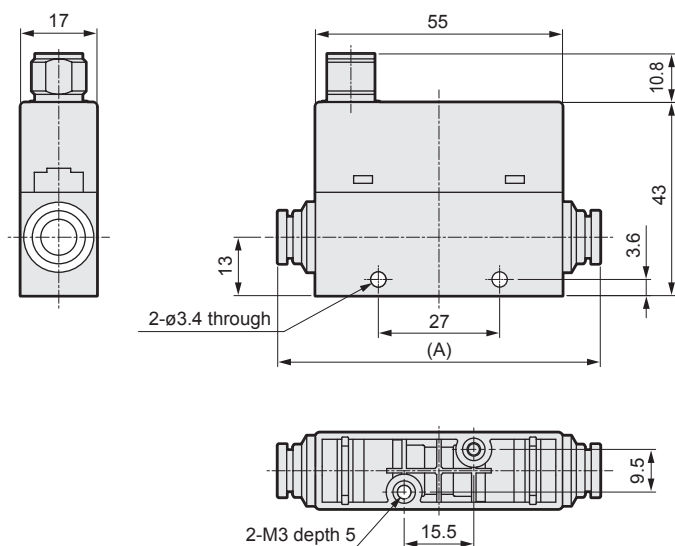
- FSM3-C BC1/BH1/CH1/HH1/AA1/AF1/AB1/AC1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Model No.	Fitting	Dimension (A)
FSM3-C-□□1BH1	Push-in ø4 mm	(65)
FSM3-C-□□1CH1	Push-in ø6 mm	(67.2)
FSM3-C-□□1HH1	Push-in 1/4"	(70.4)
FSM3-C-□□1AA1	Rc1/8	(75)
FSM3-C-□□1AF1	G1/8	(87)
FSM3-C-□□1AB1	G1/8	(87)
FSM3-C-□□1AC1	NPT1/8	(75)

Port sizes: Straight ø8 mm, ø10 mm, ø3/8", Rc1/4, G1/4, NPT1/4

- FSM3-C BC1/DH1/EH1/JH1/BA1/BF1/BB1/BC1 (Full scale flow rates: 50, 100, 200 L/min)

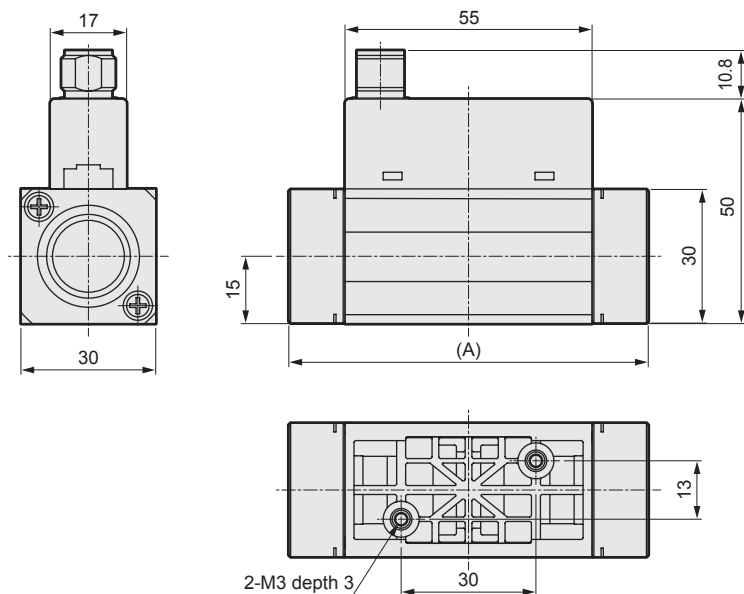


Model No.	Fitting	Dimension (A)
FMS3-C-□□1DH1	Push-in ø8 mm	(70.6)
FMS3-C-□□1EH1	Push-in ø10 mm	(82.1)
FMS3-C-□□1JH1	Push-in 3/8"	(83.4)
FMS3-C-□□1BA1	Rc1/4	(75)
FMS3-C-□□1BF1	G1/4	(89)
FMS3-C-□□1BB1	G1/4	(89)
FMS3-C-□□1BC1	NPT1/4	(75)

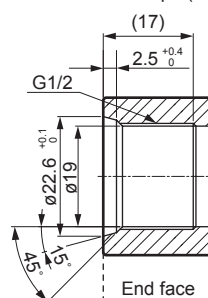
### Dimensions (IO-Link)

Port sizes: Straight Rc1/2, G1/2, NPT1/2

● FSM3-C□□1/CA1/CF1/CB1/CC1 (Full scale flow rates: 500, 1000 L/min)

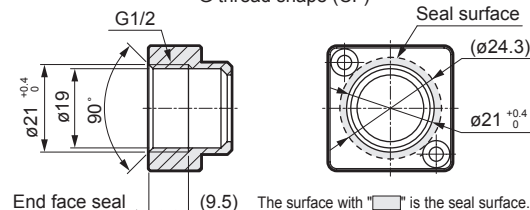


G thread shape (CB)



The 15° surface is the seal surface. Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

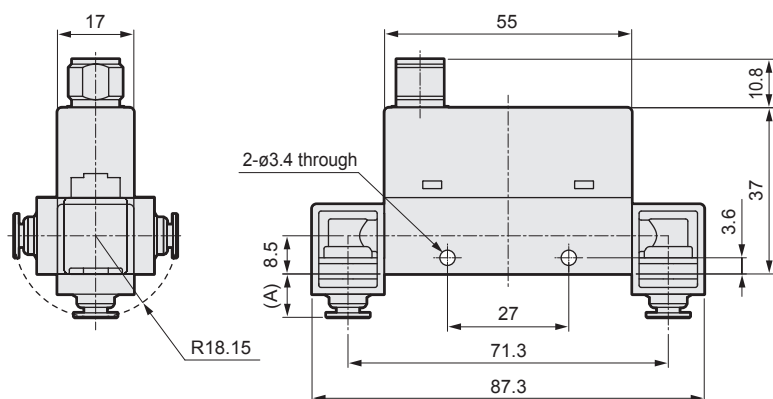
G thread shape (CF)



Model No.	Fitting	Dimension (A)
FSM3-C□□1CA1	Rc1/2	(80)
FSM3-C□□1CF1	G1/2	(80)
FSM3-C□□1CB1	G1/2	(95.4)
FSM3-C□□1CC1	NPT1/2	(80)

Port sizes: Elbow ø4 mm, ø6 mm, ø1/4", Rc1/8, G1/8, NPT1/8

● FSM3-C□□1/BH2/CH2/HH2/AA2/AF2/AB2/AC2 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



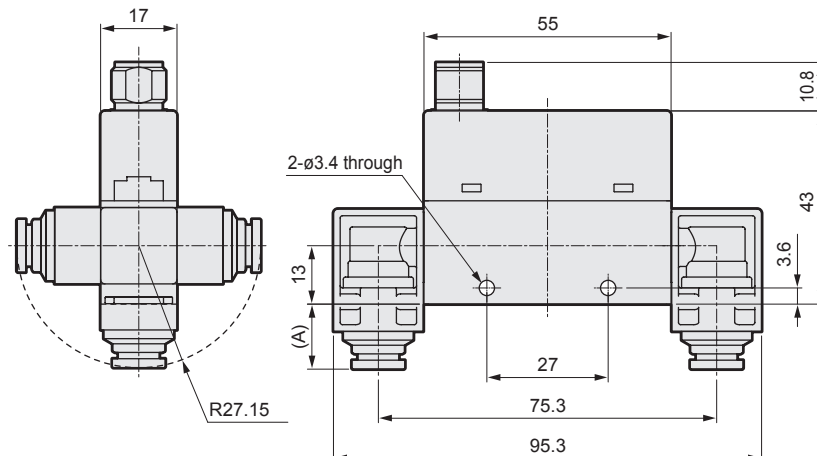
\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

Model No.	Fitting	Dimension (A)
FSM3-C□□1BH2	Push-in ø4 mm	(9.5)
FSM3-C□□1CH2	Push-in ø6 mm	(10.6)
FSM3-C□□1HH2	Push-in 1/4"	(12.2)
FSM3-C□□1AA2	Rc1/8	(14.5)
FSM3-C□□1AF2	G1/8 *	(20.5)
FSM3-C□□1AB2	G1/8 *	(20.5)
FSM3-C□□1AC2	NPT1/8	(14.5)

\*Please refer to the straight type for the G thread shape.

Port sizes: Elbow ø8 mm, ø10 mm, ø3/8", Rc1/4, G1/4, NPT1/4

● FSM3-C□□1/DH2/EH2/JH2/BA2/BF2/BB2/BC2 (Full scale flow rates: 50, 100, 200 L/min)



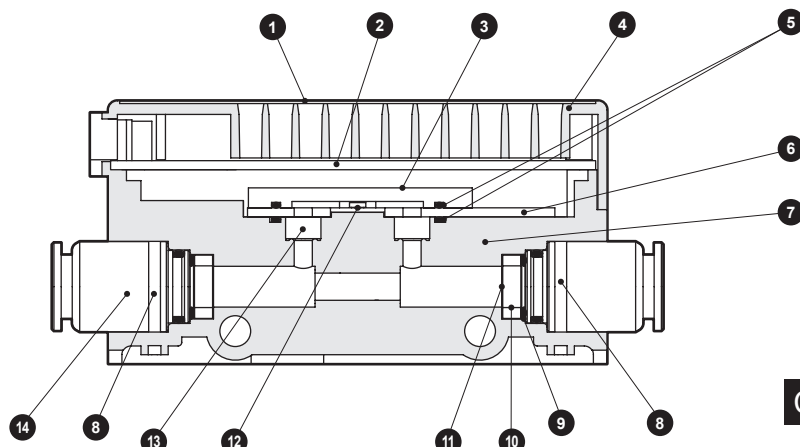
\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

Model No.	Fitting	Dimension (A)
FSM3-C□□1DH2	Push-in ø8 mm	(13.6)
FSM3-C□□1EH2	Push-in ø10 mm	(19.3)
FSM3-C□□1JH2	Push-in 3/8"	(20.0)
FSM3-C□□1BA2	Rc1/4	(15.8)
FSM3-C□□1BF2	G1/4 *	(22.8)
FSM3-C□□1BB2	G1/4 *	(22.8)
FSM3-C□□1BC2	NPT1/4	(15.8)

\*Please refer to the straight type for the G thread shape.

## Internal structure

### ● FSM3-B005 to 500



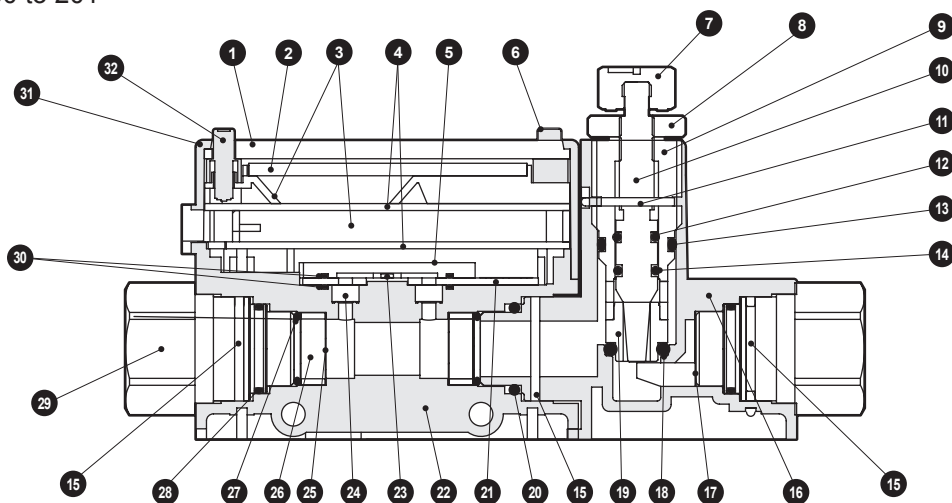
Cannot be disassembled

\* This figure shows the bar display with straight fitting.  
\* The part materials are subject to change without notice.

No.	Part name	Material	No.	Part name	Material
1	Front sheet	PET film	8	Fitting fixing pin	Stainless steel
2	Electronic circuit board	Glass epoxy resin	9	O-ring	* Fluoro rubber
3	Sensor cover	* Stainless steel	10	Spacer	* Aluminum
4	Case	Polyamide resin	11	Port filter	* Stainless steel
5	Gasket	* Fluoro rubber	12	Sensor chip	* Semiconductor silicon
6	Sensor board	* Glass epoxy resin	13	Bypass filter	* Stainless steel
7	Sensor body	* Polyamide resin	14	Fitting	-

\* A cleaning component with P80 specifications.

### ● FSM3-L500 to 201



Cannot be disassembled

\* This figure shows the LCD display with needle valve.  
\* The part materials are subject to change without notice.

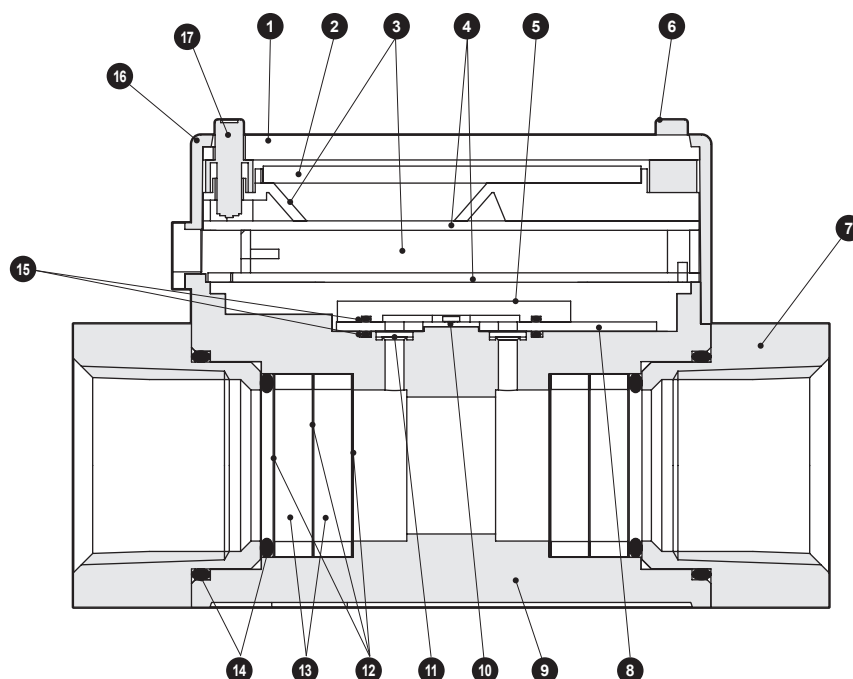
No.	Part name	Material	No.	Part name	Material
1	Liquid crystal cover	Acrylic resin	17	Port filter	* Stainless steel
2	Liquid crystal	-	18	O-ring	* Fluoro rubber
3	Base spacer	Polycarbonate resin	19	Orifice	* Copper alloy/nickeling
4	Electronic circuit board	Glass epoxy resin	20	O-ring	* Fluoro rubber
5	Sensor cover	* Stainless steel	21	Sensor board	* Glass epoxy resin
6	Switch	Ethylene/propylene rubber	22	Sensor body	* Polyamide resin
7	Knob	Polybutylene terephthalate	23	Sensor chip	* Semiconductor silicon
8	Lock nut	Copper alloy/nickeling	24	Bypass filter	* Stainless steel
9	Needle guide	* Copper alloy/nickeling	25	Port filter	* Stainless steel
10	Needle	* Copper alloy/nickeling	26	Spacer	* Aluminum
11	Fixing pin	Stainless steel	27	O-ring	* Fluoro rubber
12	O-ring	* Fluoro rubber	28	O-ring	* Fluoro rubber
13	O-ring	* Fluoro rubber	29	Fitting (Rc1/4)	* Aluminum
14	O-ring	* Fluoro rubber	30	Gasket	* Fluoro rubber
15	Fitting fixing pin	Stainless steel	31	Case	Polyamide resin
16	Needle valve body	* Polyamide resin	32	Switch	Ethylene/propylene rubber

\* A cleaning component with P80 specifications.



### Internal structure

#### ● FSM3-L501/102



**Cannot be disassembled**

\* This figure shows the LCD display.

\* The part materials are subject to change without notice.

No.	Part name	Material	No.	Part name	Material
1	Liquid crystal cover	Acrylic resin	10	Sensor chip *	Semiconductor silicon
2	Liquid crystal	—	11	Bypass filter *	Stainless steel
3	Base spacer	Polycarbonate resin	12	Port filter *	Stainless steel
4	Electronic circuit board	Glass epoxy resin	13	Spacer *	Aluminum
5	Sensor cover *	Stainless steel	14	O-ring *	Fluoro rubber
6	Switch	Ethylene/propylene rubber	15	Gasket *	Fluoro rubber
7	Fitting (Rc1/2) *	Aluminum	16	Case	Polyamide resin
8	Sensor board *	Glass epoxy resin	17	Switch	Ethylene/propylene rubber
9	Sensor body *	Polyamide resin			

\* A cleaning component with P80 specifications.



Compact flow rate sensor RAPIFLOW

# FSM3 Series

LCD display

● Stainless steel body (flow rate range: 500 mL/min to 1000 L/min)

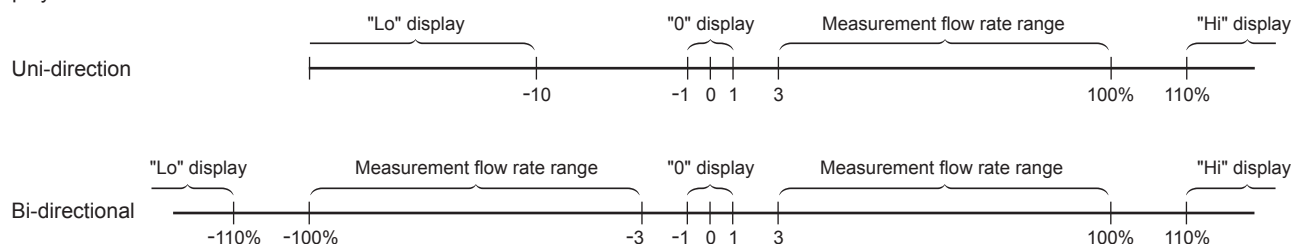


## LCD display specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]											
			[B]											
			005	010	020	050	100	200	500	101	201	501	102	
Flow direction	[C]	U	Uni-direction											
		B	Bi-direction											
Measurement flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L	
		B	-500 to -15, 15 to 500 mL	-1000 to -30, 30 to 1000 mL	-2.00 to -0.06, 0.06 to 2.00 L	-5.00 to -0.15, 0.15 to 5.00 L	-10.00 to -0.30, 0.30 to 10.00 L	-20.0 to -0.6, 0.6 to 20.0 L	-50.0 to -1.5, 1.5 to 50.0 L	-100.0 to -3.0, 3.0 to 100.0 L	-200 to -6, 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L	
Display			4 digit + 4 digit 2 color LCD											
Flow rate display range (□/min) *2	[B]	U	-49 to 549 mL	-99 to 1099 mL	-0.19 to 2.19 L	-0.49 to 5.49 L	-0.99 to 10.99 L	-1.9 to 21.9 L	-4.9 to 54.9 L	-9.9 to 109.9 L	-19 to 219 L	-49 to 549 L	-99 to 1099 L	
		B	-549 to 549 mL	-1099 to 1099 mL	-2.19 to 2.19 L	-5.49 to 5.49 L	-10.99 to 10.99 L	-21.9 to 21.9 L	-54.9 to 54.9 L	-109.9 to 109.9 L	-219 to 219 L	-549 to 549 L	-1099 to 1099L	
Integration display *3	Display range		0 to ±9999999 mL			0.00 to ±99999.99 L			0.0 to ±999999.9 L			0 to ±9999999 L		
	Pulse output rate		5 mL	10 mL	0.02 L	0.05 L	0.1 L	0.2 L	0.5 L	1 L	2 L	5 L	10 L	
Working conditions		Applicable fluid *4	Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2), nitrogen gas											
			Argon, carbon dioxide, and gas mixture (argon + carbon dioxide)										-	
		Temperature range	Oxygen (When oxygen specifications are selected, the clean-room specifications of ㉔ cannot be selected. Specifications automatically become oil-prohibited specifications.)										-	
			0 to 50°C (no condensation)											
			-0.09 to 1.00 MPa										-0.09 to 0.75 MPa	
Proof pressure		1.5 MPa												
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less											
Storage temperature			-10 to 60°C											
Accuracy *5 (Fluid: in dry air)	Accuracy *6		Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")											
	Repeatability *7		Within ±1% F.S. (Secondary side released to atmosphere)											
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)											
	Pressure characteristics		Within ±5% F.S. (where secondary side is released to atmosphere)									Within ±5% F.S. (0.35 MPa standard)		
Response time		*8	50 msec or less (setting response time OFF)											
Switch output		A, B, E, F	NPN open collector output (50 mA or less, voltage drop 2.4 V or less)											
		C, D, G, H	PNP open collector output (50 mA or less, voltage drop 2.4 V or less)											
Analog output *9	[G]	A, B, C, D	1 to 5 V voltage output (connecting load impedance 50 kΩ or more)											
		E, F, G, H	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)											
Power supply voltage *10		A, B, C, D	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less											
		E, F, G, H	24 VDC (21.6 to 26.4 V) ripple rate 1% or less											
Current consumption *11			45 mA or less											
Lead wire			ø3.7, AWG26 or equivalent x 5-conductor (connector), insulator O.D. ø1.0											
Functions *12			① Gas type selection, ② Setting copy function, ③ Flow rate integration, ④ Peak hold, etc.											
Degree of protection			IP40 or equivalent (IEC standard)											
Protection circuit *13			Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection											
Vibration resistance			10 to 150 Hz, 100 m/s <sup>2</sup> , 2 hours each in X, Y, Z directions											
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8											
Mounting	Mounting orientation *14		Unrestricted in vertical/horizontal direction											
	Straight piping section *15		Not required											

\*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) 65%RH).  
(20°C, 1 atmospheric pressure (101 kPa), relative humidity 0%RH with a type of gas other than air.)

\*2: Display at each flow rate is as follows.



\*3: The integrated flow is a calculated (reference) value. When using the integrated save function, take care to prevent the number of saves from exceeding the access count limit of the storage device (1 million times). (Changes to various settings also are counted in the access count.)

$$\text{Number of saves} = \frac{\text{Usage time}}{5 \text{ mins}} < 1 \text{ million times}$$

When the instantaneous flow rate is 1% or less, the flow rate is counted as integrated flow rate.

\*4: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.). To maintain the function of this product, install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil content 0.1 mg/m<sup>3</sup>) on the primary side (upstream side) of this product. (Refer to page 74 for details on recommended circuit.)

The sensor for oxygen gas is a custom model. To prevent ignition accidents, do not allow oxygen to flow again when a fluid other than oxygen has flown even once.

\*5: Compressed air is used for adjusting and inspecting this product. Accuracy for gas types other than air is a guideline.

\*6: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy.

Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ±3% F.S.

Consider separately according to the working environment and working conditions.

\*7: Repeatability calculated during a short time. Change over time is not included. (Refer to the product specifications for details.)

\*8: The actual response time changes depending on the piping conditions. As a guideline, the response time setting can be selected within the range 50 msec to 1.5 sec.

\*9: The output impedance of the output impedance of the analog output voltage output is approximately 1 kΩ. If the impedance of the connecting load is small, output and error increase. Check error with the impedance of the connecting load before using.

\*10: The power supply voltage specifications differ for the voltage output and current output types.

\*11: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.

\*12: The gas type switching function enables switching to argon, carbon dioxide and a gas mixture of argon 80% + carbon dioxide 20%. The full scale flow rate and analog output after changing are as follows. (Note that the gas change function cannot be set with the 500 L/min, and 1000 L/min oxygen models.)

Gas	Flow direction	Full scale flow rate	Analog output	
			Voltage	Current
<ul style="list-style-type: none"> <li>Air</li> <li>Nitrogen</li> <li>Argon</li> <li>Argon 80% + carbon dioxide 20%</li> </ul>	Uni-direction	0 to 100%	1 to 5 V	4 to 20 mA
	Bi-direction	-100 to 100%		
<ul style="list-style-type: none"> <li>Carbon dioxide</li> </ul>	Uni-direction	0 to 50%	1 to 3 V	4 to 12 mA
	Bi-direction	-50 to 50%	2 to 4 V	8 to 16 mA

The "Setting copy function" setting is selected at "Ⓒ Output specifications".

Note that the "External input" function is not available on models on which the "Setting copy function" is enabled.

\*13: This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.

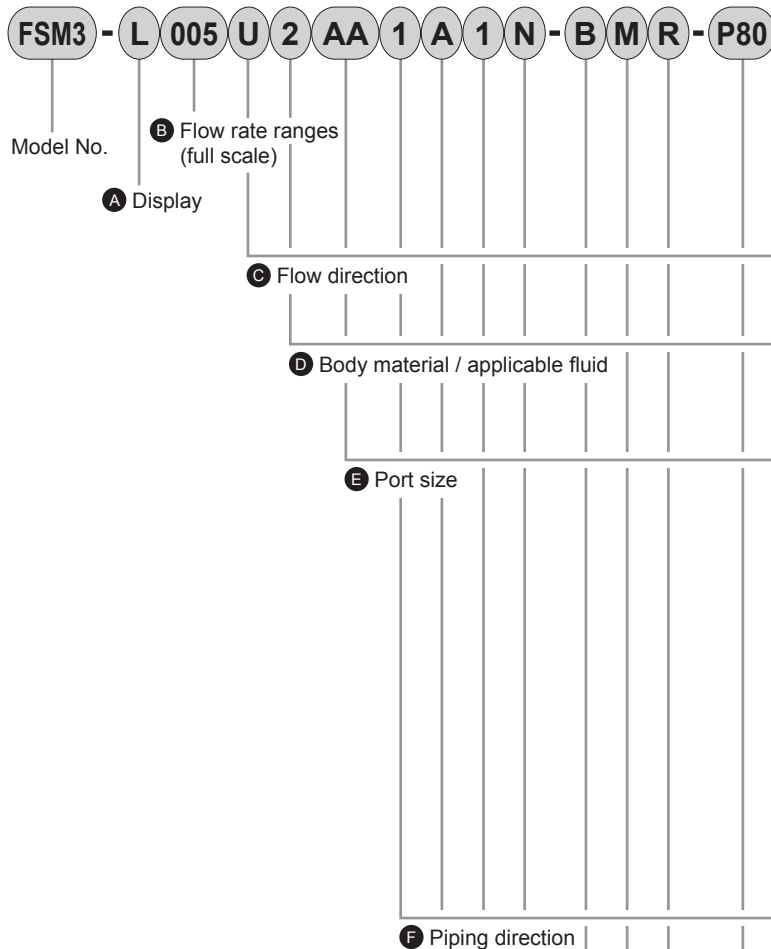
\*14: This product measures changes in heat distribution that are caused by flow.

When this product is mounted in a vertical orientation, convective flow may affect heat distribution or cause the zero point to deviate.

\*15: Accuracy may be affected by the piping conditions. To perform measurement with greater accuracy, install a straight pipe with a piping I.D. ten times larger. With the 500 L/min and 1,000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

\*16: Refer to page 59 for weight.

## How to order



### [Example of model No.]

#### FSM3-L005U2AA1A1N-BMR-P80

Model: RAPIFLOW FSM3 Series

- A** Display L : Liquid crystal display
- B** Flow rate 005 : 500 mL/min
- C** Flow direction U : Uni-direction
- D** Body material / applicable fluid 2 : SUS/air
- E** Port size AA : Rc1/8
- F** Piping direction 1 : Straight
- G** Output specifications A : Analog voltage output ×1, NPN switch output ×1, setting copy function
- H** Unit specifications 1 : SI units only
- I** Valve option N : None
- J** Lead wire B : 5-conductor 3 m
- K** Mounting attachment M : DIN rail mount
- L** Attached documents R : Company certification
- M** Clean-room specifications P80 : Oil free

## Precautions for model No. selection

- \*1: Refer to the correspondence table on the following page when selecting the model.
- \*2: The only **I** valve option is "N: None" with models where the flow direction is "B: Bidirectional" and models where the applicable fluid is oxygen.
- \*3: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
- \*4: The G thread connection shape is compliant with ISO16030 standards.
- \*5: Please refer to the external dimension diagram (Page 27) for the G thread connection shape when making a selection. (The G thread connection shape is compliant with JIS B 2351-1, O types.)
- \*6: Models with the unit switching function are not sold in Japan.
- \*7: Optional parts are provided with the product. They are not assembled to the product.
- \*8: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
- \*9: In addition to P70 specifications, wetted section materials are degreased and cleaned.
- \*10: No oxygen type can be selected (None only).

Code	Description		
<b>A Display</b>			
L	Liquid crystal display		
<b>B Flow rate ranges (full scale)</b>			
005	500 mL/min	500	50 L/min
010	1000 mL/min	101	100 L/min
020	2 L/min	201	200 L/min
050	5 L/min	501	500 L/min
100	10 L/min	102	1000 L/min
200	20 L/min		
<b>C Flow direction</b> *2			
U	Uni-direction		
B	Bi-direction		
<b>D Body material / applicable fluid</b>			
	Body material	Applicable fluid	
2	SUS	Air (gas switchable)	
3	SUS	Oxygen (oil-prohibited specifications) *3	
<b>E Port size</b>			
AA	Rc1/8		
BA	Rc1/4		
CA	Rc1/2		
AF	G1/8	*4	
BF	G1/4	*4	
CF	G1/2	*4	
AB	G1/8	*5	
BB	G1/4	*5	
CB	G1/2	*5	
AC	NPT1/8		
BC	NPT1/4		
CC	NPT1/2		
AD	1/4" double barbed fitting (50 L/min or less)		
BD	1/4" double barbed fitting (50 to 200 L/min)		
AE	1/4" JXR male fitting (50 L/min or less)		
BE	1/4" JXR male fitting (50 to 200 L/min)		
<b>F Piping direction</b>			
1	Straight		
<b>G Output specifications</b>			
	Analog output	Switch output	Setting copy function
A	1 point	1 point (NPN)	With
B	(Voltage output) 1-5 V	2 points (NPN)	—
C		1-point output (PNP)	With
D		2-points output (PNP)	—
E		1 point (NPN)	With
F	(Current	2 points (NPN)	—
G	output)	1-point output (PNP)	With
H	4-20 mA	2-points output (PNP)	—
<b>H Unit specifications</b>			
1	SI units only		
2	With unit switching function (overseas models only) *6		
<b>I Valve option</b> *2, *10			
N	None		
T	With needle valve (only for models 200 L or less)		
<b>J Lead wire</b>			
Blank	None		
A	5-conductor 1 m		
B	5-conductor 3 m		
<b>K Mounting (not assembled)</b> *7			
Blank	None		
H	Bracket 1 (for models 200 L or less)		
J	Bracket 2 (for 500 or 1000 L models)		
K	Panel mounting (for sensor products of models 200 L or less)		
L	Panel mounting (for needle valves of models 200 L or less)		
M	DIN rail mounting (for models 200 L or less)		
<b>L Attached documents</b>			
Blank	None		
R	Company certification		
S	Company certification + Traceability certification		
<b>M Clean-room specifications</b> *10			
Blank	None		
P70	Anti-dust generation		*8
P80	Oil free		*9

### Flow rate ranges and port sizes

		E Port sizes															
		AA	BA	CA	AF	BF	CF	AB	BB	CB	AC	BC	CC	AD	BD	AE	BE
		Rc1/8	Rc1/4	Rc1/2	G1/8	G1/4	G1/2	G1/8	G1/4	G1/2	NPT1/8	NPT1/4	NPT1/2	1/4" Double barbed fitting	1/4" JXR Male fitting		
B Flow rate codes	005	●○			●○			●○			●○			●○		●○	
	010	●○			●○			●○			●○			●○		●○	
	020	●○			●○			●○			●○			●○		●○	
	050	●○			●○			●○			●○			●○		●○	
	100	●○			●○			●○			●○			●○		●○	
	200	●○			●○			●○			●○			●○		●○	
	500	●○	●○		●○	●○		●○	●○		●○	●○		●○	●○	●○	●○
	101		●○			●○			●○			●○			●○		●○
	201		●○			●○			●○			●○			●○		●○
	501			●			●			●			●				
	102			●			●			●			●				

●: Port size compatibility ○: Needle valve option compatibility

LCD display	Bar display	IO-Link	Internal structure
LCD display	Bar display	IO-Link	Internal structure
Separated display	Technical data	Operating method	Optional products
Safety precautions	Related products		

## Dimensions (LCD display) (flow rate range: 500 mL/min to 50 L/min)

Port sizes: Straight Rc1/8, G1/8, NPT1/8

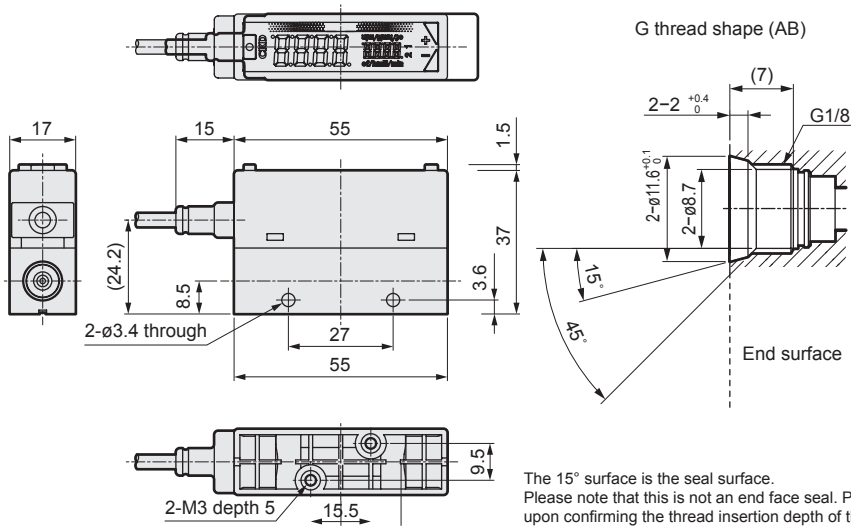
● FSM3-L $\overline{\text{B}}\overline{\text{C}}\overline{\text{C}}_2$ /AA1/AB1/AC1

(Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)

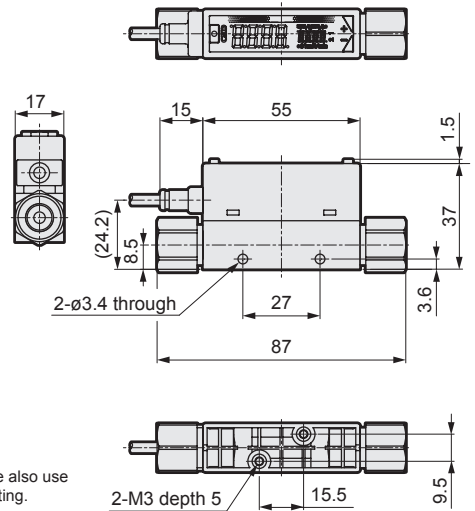
Port size: Straight G1/8

● FSM3-L $\overline{\text{B}}\overline{\text{C}}\overline{\text{C}}_2$ /AF1

(Full scale flow rates: 500mL/min, 1, 2, 5, 10, 20, 50L/min)



Port size: Straight G1/8 (AF1)



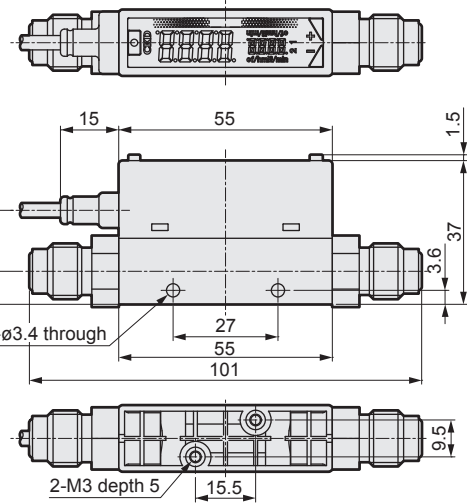
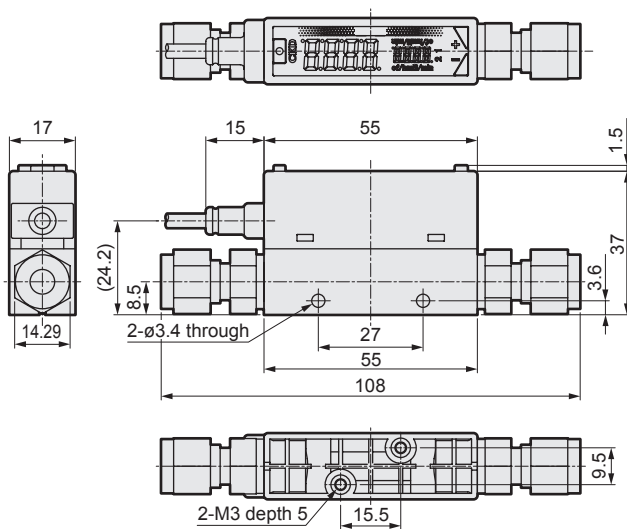
Port size: Straight 1/4" double barbed fitting

● FSM3-L $\overline{\text{B}}\overline{\text{C}}\overline{\text{C}}_2$ /AD1

(Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)

Port size: Straight 1/4" JXR male fitting

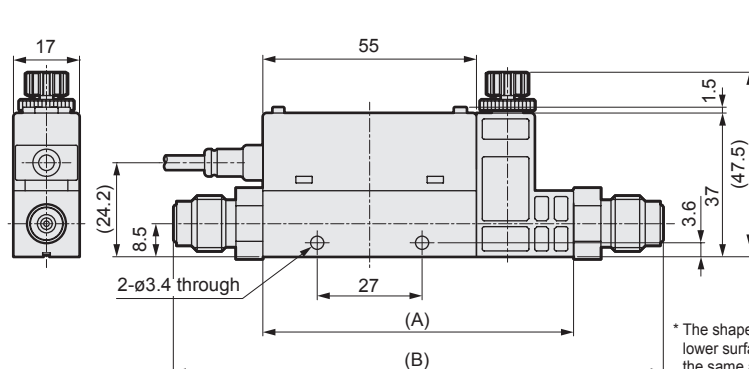
● FSM3-L $\overline{\text{B}}\overline{\text{C}}\overline{\text{C}}_2$ /AE1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



## Solenoid valve with needle dimensions

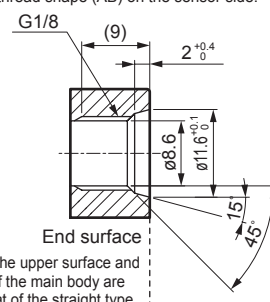
Port sizes: Rc1/8, G1/8, NPT1/8, 1/4" double barbed fitting, 1/4" JXR male fitting

● FSM3-L $\overline{\text{B}}\overline{\text{C}}\overline{\text{C}}_2$ /AA1AF1/AB1/AC1/AD/AE $\overline{\text{G}}\overline{\text{H}}\overline{\text{T}}$  (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



G thread shape (AB \*needle valve side)

\*Refer to the figure above for the G thread shape (AB) on the sensor side.



The 15° surface is the seal surface. Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

Port size	Dimension (A)	Dimension (B)
Rc 1/8	80	-
G 1/8 (AF1)	80	132
G 1/8 (AB1)	80	-
NPT 1/8	80	-
1/4"	80	133
Double barbed fitting	80	126
1/4"	80	126
JXR male fitting	80	126

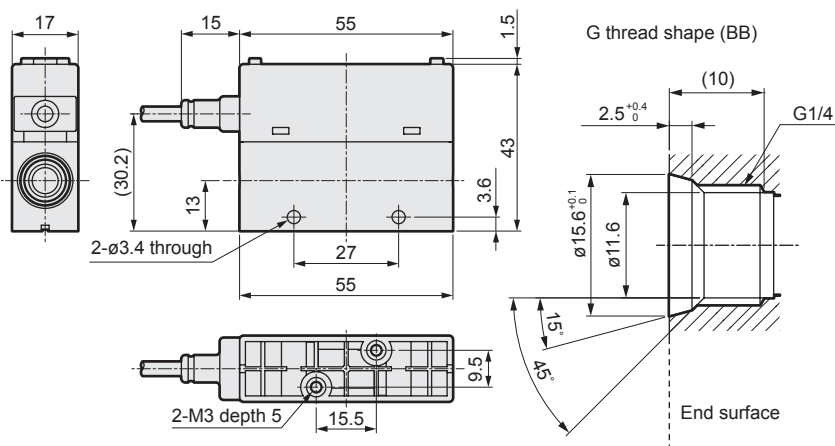


### Dimensions (LCD display) (flow rate range: 50 L/min to 200 L/min)

Port sizes: Straight Rc1/4, G1/4, NPT1/4

● FSM3-L[B][C]<sup>2</sup>/BA1/BB1/BC1

(Full scale flow rates: 50, 100, 200 L/min)

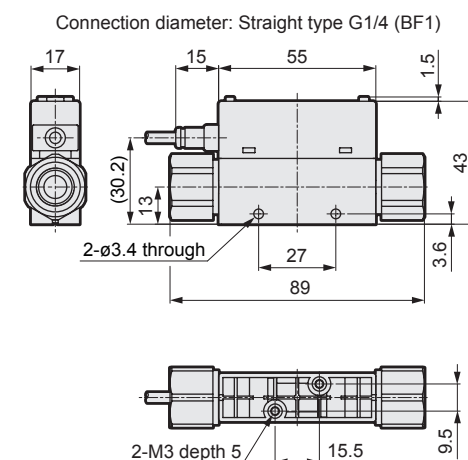


The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

Port size: Straight G1/4 (BF1)

● FSM3-L[B][C]<sup>2</sup>/BF1

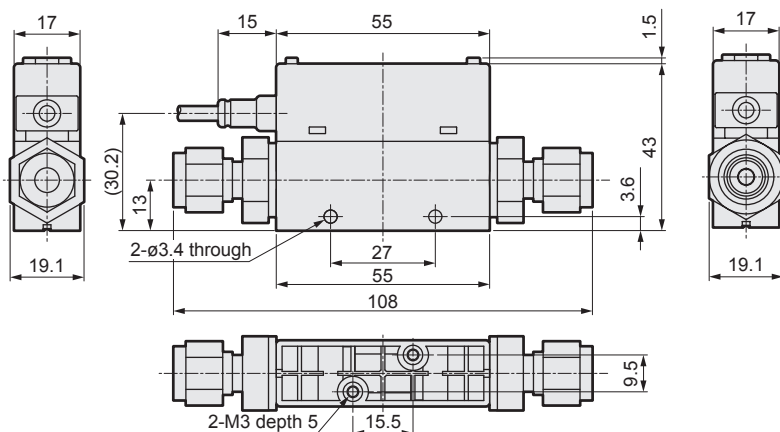
(Full scale flow rates: 50, 100, 200 L/min)



Port size: Straight 1/4" double barbed fitting

● FSM3-L[B][C]<sup>2</sup>/BD1

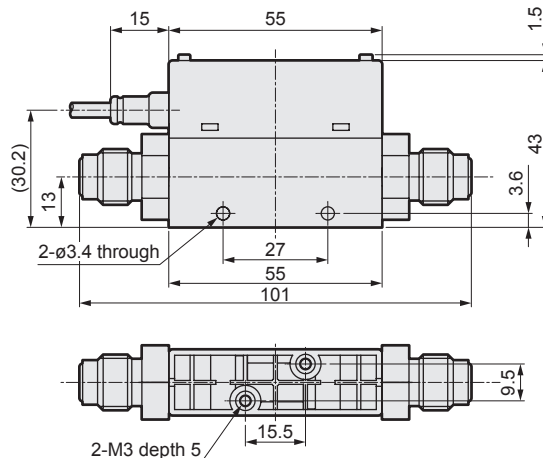
(Full scale flow rates: 50, 100, 200 L/min)



Port size: Straight 1/4" JXR male fitting

● FSM3-L[B][C]<sup>2</sup>/BE1

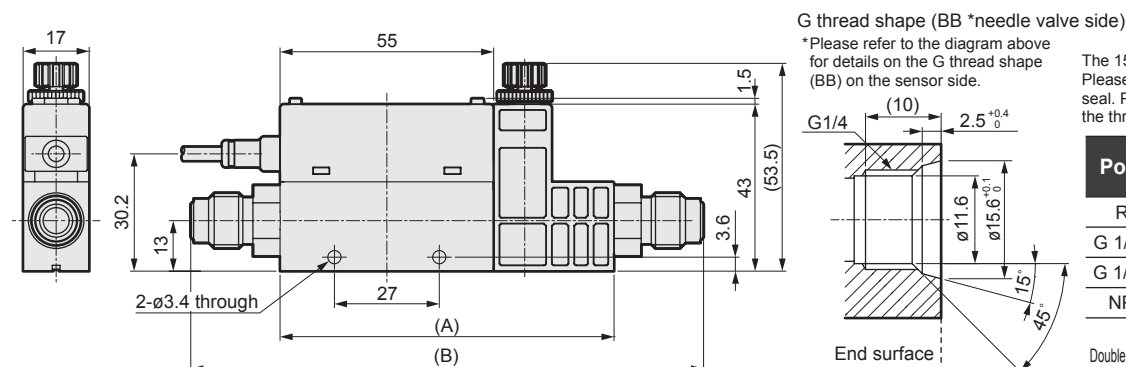
(Full scale flow rates: 50, 100, 200 L/min)



### Solenoid valve with needle dimensions

Port sizes: Rc1/4, G1/4, NPT1/4, 1/4" double barbed fitting, 1/4" JXR male fitting

● FSM3-L[B][C]<sup>2</sup>/BA1/BF1/BB1/BC1/BD/BE[G][H]T (Full scale flow rates: 50, 100, 200 L/min)



G thread shape (BB \*needle valve side)

\*Please refer to the diagram above for details on the G thread shape (BB) on the sensor side.

The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

Port size	Dimension (A)	Dimension (B)
Rc 1/8	86	-
G 1/4 (BF1)	86	120
G 1/4 (BB1)	86	-
NPT 1/4	86	-
1/4" Double barbed fitting	86	139
1/4" JXR male fitting	86	132

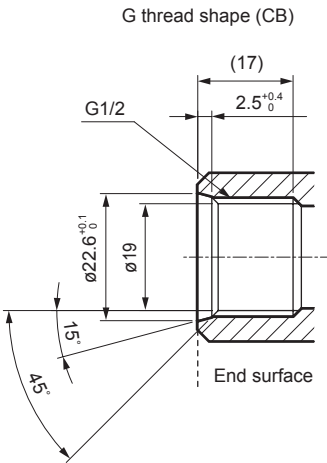
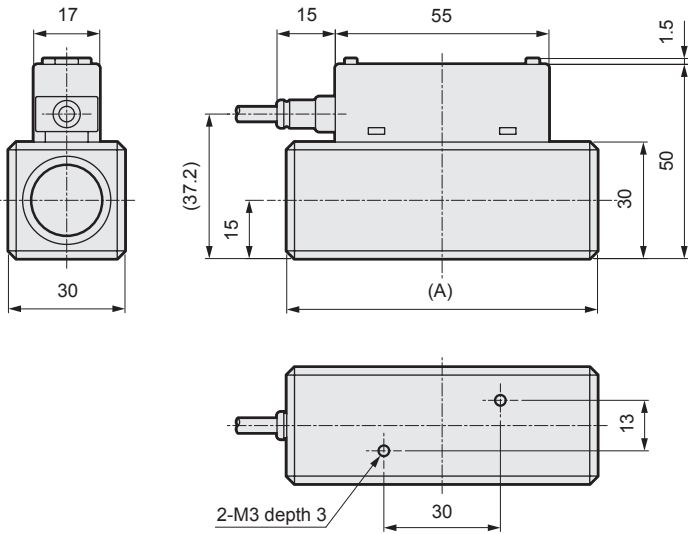
\* The shapes of the upper surface and lower surface of the main body are the same as that of the straight type.

LCD display	Resin body	Bar display	IO-Link	Internal structure
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Stainless steel body	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Separated display	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Technical data	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Operating method	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Optional products	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Safety precautions	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display	Related products	IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display
Bar display		IO-Link	Internal structure	LCD display

Dimensions (LCD display) (flow rate range: 500 L/min to 1000 L/min)

Port sizes: Straight Rc1/2, G1/2, NPT1/2

- FSM3-L [ ] [ ] 2/CA1/CF1/CB1/CC1
- (Full scale flow rates: 500,1000L/min)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

Model No.	Port size	Dimension (A)
FSM3-L [ ] [ ] 2CA1	Rc1/2	(80)
FSM3-L [ ] [ ] 2CF1	G1/2	(80)
FSM3-L [ ] [ ] 2CB1	G1/2	(95.4)
FSM3-L [ ] [ ] 2CC1	NPT1/2	(80)

LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products
Resin body				Stainless steel body									



Compact flow rate sensor RAPIFLOW

# FSM3 Series

Bar display

● Stainless steel body (flow rate range: 500 mL/min to 1000 L/min)



## Bar display specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measurement flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15, 15 to 500 mL	-1000 to -30, 30 to 1000 mL	-2.00 to -0.06, 0.06 to 2.00 L	-5.00 to -0.15, 0.15 to 5.00 L	-10.00 to -0.30, 0.30 to 10.00 L	-20.0 to -0.6, 0.6 to 20.0 L	-50.0 to -1.5, 1.5 to 50.0 L	-100.0 to -3.0, 3.0 to 100.0 L	-200 to -6, 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display			LED bar display										
Working conditions		Applicable fluid *2	Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2), nitrogen gas										
			Oxygen (When oxygen specifications are selected, the clean-room specifications of ㊄ cannot be selected. Specifications automatically become oil-prohibited specifications.)										-
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 1.00 MPa										-0.09 to 0.75 MPa
		Proof pressure	1.5 MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy		Accuracy *3	Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")										
		Repeatability *4	Within ±1% F.S. (Secondary side released to atmosphere)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (where secondary side is released to atmosphere)										Within ±5% F.S. (0.35 MPa standard)
Response time		*5	50 msec or less										
Analog output *6	[G]	J	1 to 5 V voltage output (connecting load impedance 50 kΩ or more)										
		K	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)										
J		12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less											
K		24 VDC (21.6 to 26.4 V) ripple rate 1% or less											
Power supply voltage *7													
Current consumption *8			45 mA or less										
Lead wire			ø3.7, AWG26 or equivalent × 4-conductor (connector), insulator O.D. ø1.0										
Degree of protection			IP40 or equivalent (IEC standard)										
Protection circuit		*9	Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, 100 m/s <sup>2</sup> , 2 hours each in X, Y, Z directions										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting	Mounting orientation *10		Unrestricted in vertical/horizontal direction										
	Straight piping section *11		Not required										

- \*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) 65%RH).  
(20°C, 1 atmospheric pressure (101kPa), relative humidity 0%RH with a gas other than air.)
- \*2: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.). To maintain the function of this product, install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil content 0.1 mg/m<sup>3</sup>) on the primary side (upstream side) of this product. (Refer to page 74 for details on recommended circuit.)  
The sensor for oxygen gas is a custom model. To prevent ignition accidents, do not allow oxygen to flow again when a fluid other than oxygen has flown even once.
- \*3: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy.  
Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ±3% F.S.  
Consider separately according to the working environment and working conditions.
- \*4: Repeatability calculated during a short time. Change over time is not included. (Refer to the product specifications for details.)
- \*5: The actual response time changes depending on the piping conditions.
- \*6: The output impedance of the output impedance of the analog output voltage output is approximately 1 kΩ. If the impedance of the connecting load is small, output and error increase. Check error with the impedance of the connecting load before using.
- \*7: The power supply voltage specifications differ for the voltage output and current output types.
- \*8: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.
- \*9: This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.
- \*10: This product measures changes in heat distribution that are caused by flow.  
When this product is mounted in a vertical orientation, convective flow may affect heat distribution or cause the zero point to deviate.
- \*11: Accuracy may be affected by the piping conditions. To perform measurement with greater accuracy, install a straight pipe with a piping I.D. ten times larger. With the 500 L/min and 1,000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.
- \*12: Refer to page 59 for weight.

Resin body	LCD display
	Bar display
	IO-Link
	Internal structure
Stainless steel body	LCD display
	Bar display
	IO-Link
	Internal structure
Separated display	
Technical data	
Operating method	
Optional products	
Safety precautions	
Related products	

## How to order

**FSM3 - B 005 U 2 AA 1 J 1 N - D H S - P70**

Model No.

**A** Display

**B** Flow rate ranges (full scale)

**C** Flow direction

**D** Body material / applicable fluid

**E** Port size

**F** Piping direction

**G** Output specifications

**H** Unit specifications

**I** Valve option

**J** Lead wire

**K** Mounting (not assembled)

**L** Attached documents

**M** Clean-room specifications

Code	Description
------	-------------

### A Display

**B** Bar display

### B Flow rate ranges (full scale)

<b>005</b>	500 mL/min	<b>500</b>	50 L/min
<b>010</b>	1000 mL/min	<b>101</b>	100 L/min
<b>020</b>	2 L/min	<b>201</b>	200 L/min
<b>050</b>	5 L/min	<b>501</b>	500 L/min
<b>100</b>	10 L/min	<b>102</b>	1000 L/min
<b>200</b>	20 L/min		

### C Flow direction

**U** Uni-direction

**B** Bi-direction

### D Body material / applicable fluid

	Body material	Applicable fluid
<b>2</b>	SUS	Air
<b>3</b>	SUS	Oxygen (oil-prohibited specifications) *3

### E Port size

<b>AA</b>	Rc1/8
<b>BA</b>	Rc1/4
<b>CA</b>	Rc1/2
<b>AF</b>	G1/8
<b>BF</b>	G1/4
<b>CF</b>	G1/2
<b>AB</b>	G1/8
<b>BB</b>	G1/4
<b>CB</b>	G1/2
<b>AC</b>	NPT1/8
<b>BC</b>	NPT1/4
<b>CC</b>	NPT1/2
<b>AD</b>	1/4" double barbed fitting (50 L/min or less)
<b>BD</b>	1/4" double barbed fitting (50 to 200 L/min)
<b>AE</b>	1/4" JXR male fitting (50 L/min or less)
<b>BE</b>	1/4" JXR male fitting (50 to 200 L/min)

### F Piping direction

**1** Straight

### G Output specifications

<b>J</b>	Analog voltage output × 1 point
<b>K</b>	Analog current output × 1 point

### H Unit specifications

**1** SI units only

### I Valve option

**N** None

### J Lead wire

<b>Blank</b>	None
<b>C</b>	4-conductor 1 m
<b>D</b>	4-conductor 3 m

### K Mounting (not assembled)

<b>Blank</b>	None
<b>H</b>	Bracket 1 (for models 200 L or less)
<b>J</b>	Bracket 2 (for 500 or 1000 L models)
<b>M</b>	DIN rail mounting (for models 200 L or less)

### L Attached documents

<b>Blank</b>	None
<b>R</b>	Company certification
<b>S</b>	Company certification + Traceability certification

### M Clean-room specifications

<b>Blank</b>	None
<b>P70</b>	Anti-dust generation
<b>P80</b>	Oil free

## [Example of model No.]

### FSM3-B005U2AA1J1N-DHS-P70

Model: RAPIFLOW FSM3 Series

<b>A</b> Display	<b>B</b> : Bar display
<b>B</b> Flow rate	<b>005</b> : 500 mL/min
<b>C</b> Flow direction	<b>U</b> : Uni-direction
<b>D</b> Body material / applicable fluid	<b>2</b> : SUS/air
<b>E</b> Port size	<b>AA</b> : Rc1/8
<b>F</b> Piping direction	<b>1</b> : Straight
<b>G</b> Output specifications	<b>J</b> : Analog voltage output × 1
<b>H</b> Unit specifications	<b>1</b> : SI units only
<b>I</b> Valve option	<b>N</b> : None
<b>J</b> Lead wire	<b>D</b> : 4-conductor 3 m
<b>K</b> Mounting attachment	<b>H</b> : Bracket
<b>L</b> Attached documents	<b>S</b> : Company certification + Traceability certification
<b>M</b> Clean-room specifications	<b>P70</b> : Anti-dust generation

## ! Precautions for model No. selection

- \*1: Refer to the correspondence table on the following page when selecting the model.
- \*2: When using in combination with a separated display (FSM2-D), select "J".
- \*3: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
- \*4: The G thread connection shape is compliant with ISO16030 standards.
- \*5: Please refer to the external dimension diagram (Page 35) for the G thread connection shape when making a selection. (The G thread connection shape is compliant with JIS B 2351-1, O types.)
- \*6: Optional parts are provided with the product. They are not assembled with the product.
- \*7: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
- \*8: In addition to P70 specifications, wetted section materials are degreased and cleaned.
- \*9: This cannot be selected on an oxygen type (blank only).



### Flow rate ranges and port sizes

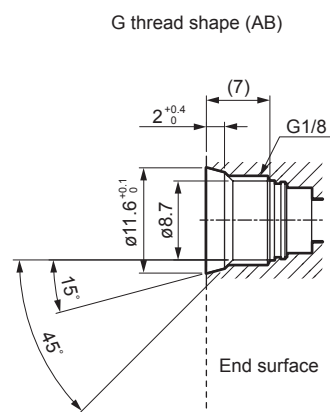
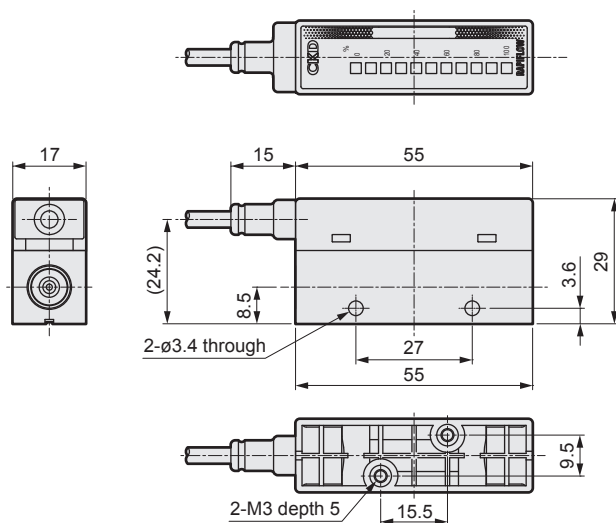
		E Port sizes															
		AA	BA	CA	AF	BF	CF	AB	BB	CB	AC	BC	CC	AD	BD	AE	BE
		Rc1/8	Rc1/4	Rc1/2	G1/8	G1/4	G1/2	G1/8	G1/4	G1/2	NPT1/8	NPT1/4	NPT1/2	1/4" Double barbed fitting	1/4" JXR Male fitting		
B Flow rate codes	005	●			●			●			●			●		●	
	010	●			●			●			●			●		●	
	020	●			●			●			●			●		●	
	050	●			●			●			●			●		●	
	100	●			●			●			●			●		●	
	200	●			●			●			●			●		●	
	500	●	●		●	●		●	●		●	●		●	●	●	●
	101		●			●			●			●			●		●
	201		●			●			●			●			●		●
	501			●			●			●			●				
102			●			●			●			●					

LCD display	Bar display	IO-Link	Internal structure
LCD display	Bar display	IO-Link	Internal structure
Separated display	Technical data	Operating method	Optional products
Safety precautions	Related products		

## Dimensions (bar display) (flow rate range: 500 mL/min to 50 L/min)

Port sizes: Straight Rc1/8, G1/8, NPT1/8

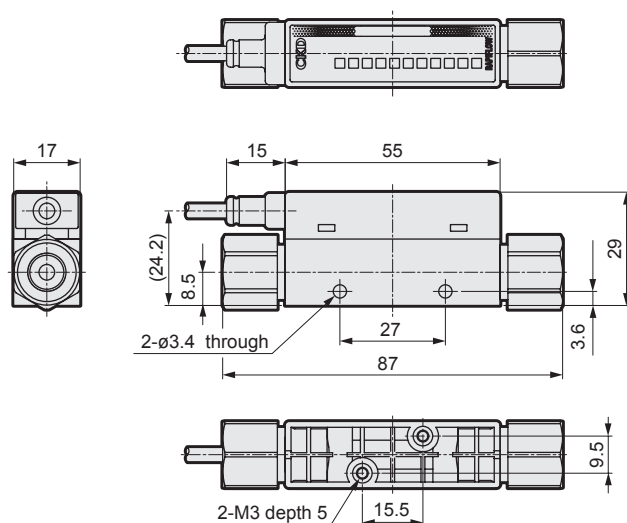
● FSM3-B $\frac{1}{2}$ /AA1/AB1/AC1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



The 15° surface is the seal surface.  
Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

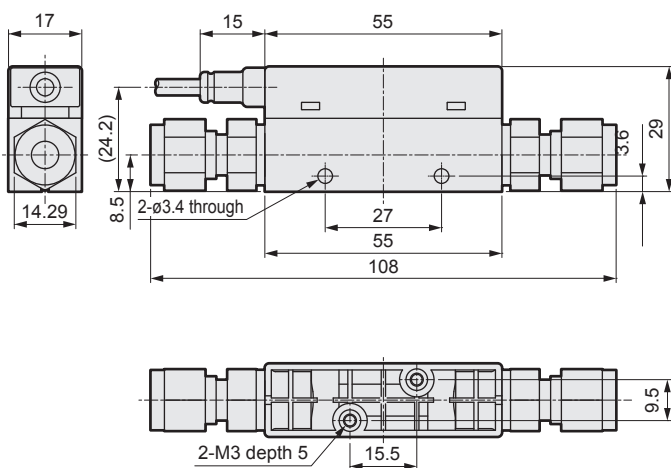
Port size: Straight G1/8

● FSM3-B $\frac{1}{2}$ /AF1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



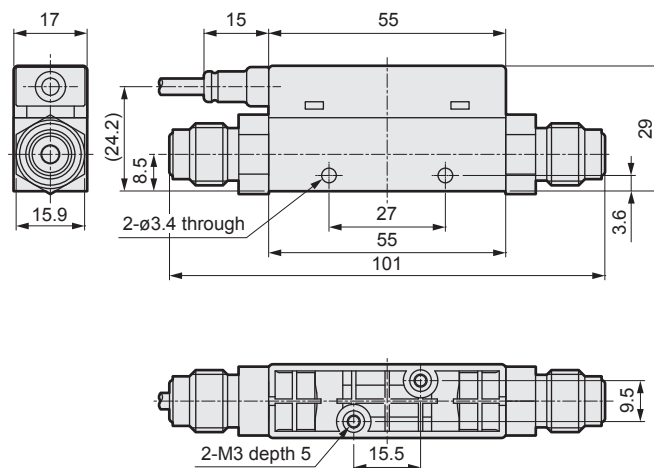
Port size: Straight 1/4" double barbed fitting

● FSM3-B $\frac{1}{2}$ /AD1  
(Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Port size: Straight 1/4" JXR male fitting

● FSM3-B $\frac{1}{2}$ /AE1  
(Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)

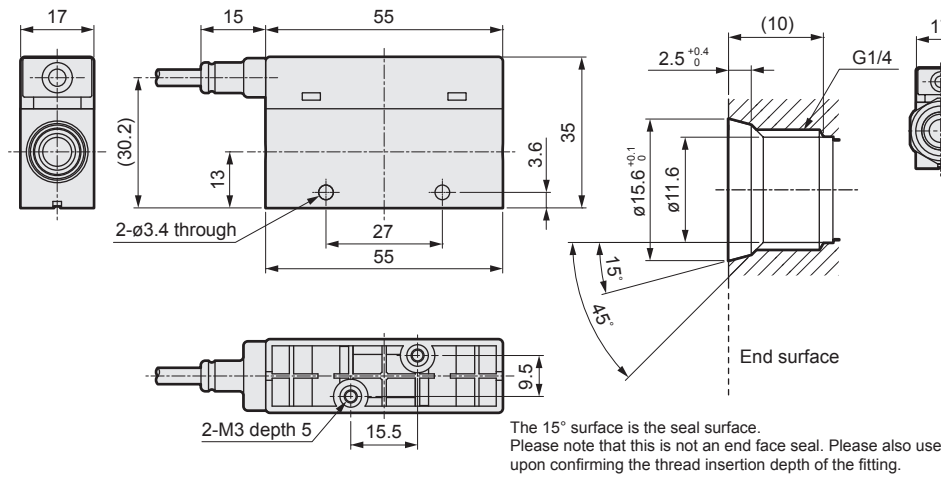


### Dimensions (bar display) (flow rate range: 50 L/min to 1000 L/min)

Port sizes: Straight Rc1/4, G1/4, NPT1/4

● FSM3-B $\square$  $\square$  $\square$ 2/BA1/BB1/BC1 (Full scale flow rates: 50, 100, 200 L/min)

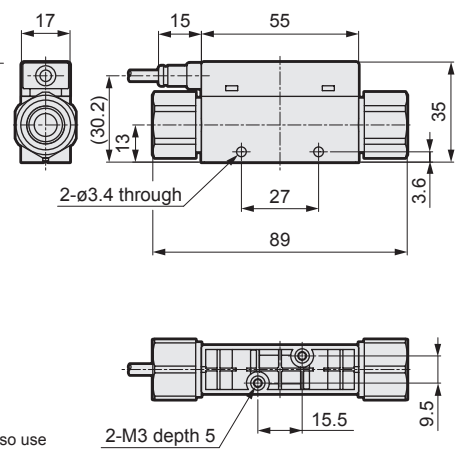
G thread shape (BB)



Port size: Straight G1/4

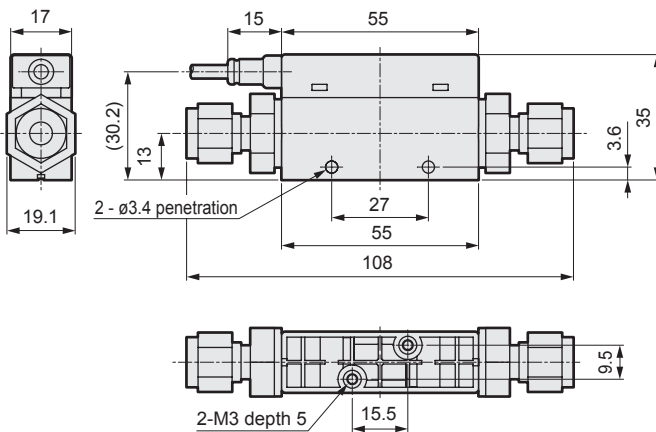
● FSM3-B $\square$  $\square$  $\square$ 2/BF1

(Full scale flow rates: 50, 100, 200 L/min)



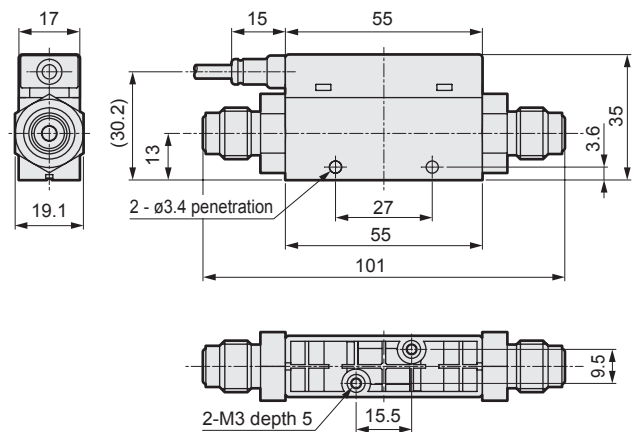
Port size: Straight 1/4" double barbed fitting

● FSM3-B $\square$  $\square$  $\square$ 2/BD1 (Full scale flow rates: 50, 100, 200 L/min)



Port size: Straight 1/4" JXR male fitting

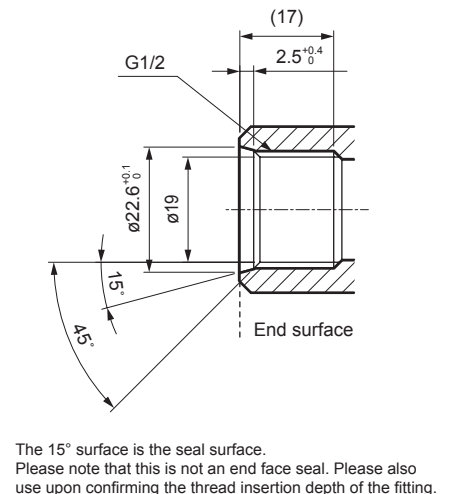
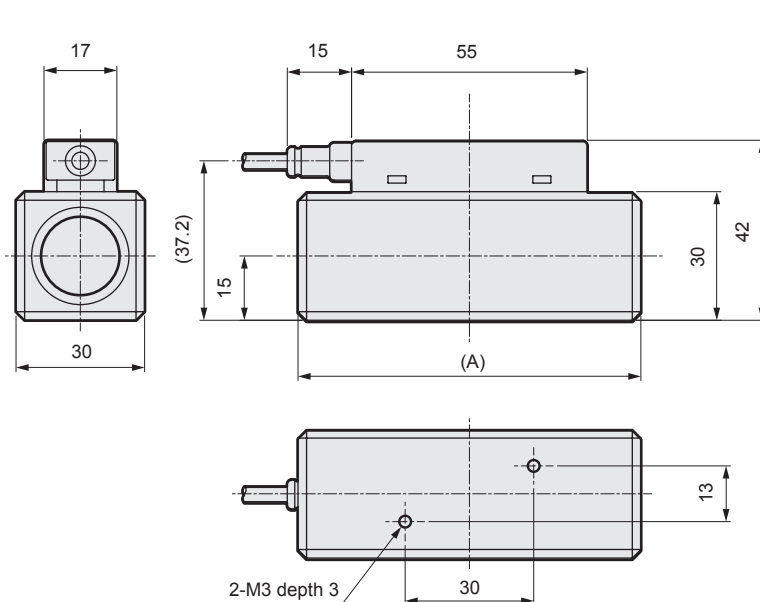
● FSM3-B $\square$  $\square$  $\square$ 2/BE1 (Full scale flow rates: 50, 100, 200 L/min)



Port sizes: Straight Rc1/2, G1/2, NPT1/2

● FSM3-B $\square$  $\square$  $\square$ 2/CA1/CF1/CB1/CC1 (Full scale flow rates: 500, 1000 L/min)

G thread shape (CB)



The 15° surface is the seal surface. Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

Model No.	Port size	Dimension (A)
FSM3-B $\square$ $\square$ $\square$ 2CA1	Rc1/2	(80)
FSM3-B $\square$ $\square$ $\square$ 2CF1	G1/2	(80)
FSM3-B $\square$ $\square$ $\square$ 2CB1	G1/2	(95.4)
FSM3-B $\square$ $\square$ $\square$ 2CC1	NPT1/2	(80)



Compact flow rate sensor RAPIFLOW

# FSM3 Series

IO-Link

● Stainless steel body (flow rate range: 500 mL/min to 1000 L/min)



## IO-Link specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]											
			[B]											
			005	010	020	050	100	200	500	101	201	501	102	
Flow direction	[C]	U	Uni-direction											
		B	Bi-direction											
Measurement flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L	
		B	-500 to -15, 15 to 500 mL	-1000 to -30, 30 to 1000 mL	-2.00 to -0.06, 0.06 to 2.00 L	-5.00 to -0.15, 0.15 to 5.00 L	-10.00 to -0.30, 0.30 to 10.00 L	-20.0 to -0.6, 0.6 to 20.0 L	-50.0 to -1.5, 1.5 to 50.0 L	-100.0 to -3.0, 3.0 to 100.0 L	-200 to -6, 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L	
Display			LED display (power and status indicators)											
Working conditions	Applicable fluid *2		Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2), nitrogen gas											
			Argon, carbon dioxide, and gas mixture (argon + carbon dioxide)										-	
			Oxygen (When oxygen specifications are selected, the clean-room specifications of ㊄ cannot be selected. Specifications automatically become oil-prohibited specifications.)										-	
	Temperature range	0 to 50°C (no condensation)												
	Pressure range	-0.09 to 1.00 MPa										-0.09 to 0.75 MPa		
Proof pressure	1.5 MPa													
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less											
Storage temperature			-10 to 60°C											
Accuracy *3	Accuracy *4	Within ±3% F.S. (Secondary side released to atmosphere) (The scope of warranty is in accordance with the "measurement flow rate range.")												
	Repeatability *5	Within ±1% F.S. (Secondary side released to atmosphere)												
	Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)												
	Pressure characteristics	Within ±5% F.S. (where secondary side is released to atmosphere)										Within ±5% F.S. (0 to 0.75 MPa, 0.35 MPa standard)		
Response time *6		50 msec or less												
Power supply voltage		18 to 30 VDC (ripple rate 1% or less)												
Current consumption *7		45 mA or less												
Lead wire *8		M12 both-end connector lead wire (3 m), AWG#23 or equivalent, 4-conductor												
Functions *9, *10		① Gas type selection, ② Flow rate integration, ③ Peak hold, etc.												
Degree of protection		IP40 or equivalent (IEC standard)												
Protection circuit *11		Power supply reverse connection protection												
Vibration resistance *12		10 to 150 Hz, 100 m/s <sup>2</sup> , 2 hours each in X, Y, Z directions												
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8											
Mounting	Mounting orientation *13	Unrestricted in vertical/horizontal direction												
	Straight piping section *14	Not required												

\* Refer to page 65 for communication specifications.

- \*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) 65%RH). (20°C, 1 atmospheric pressure (101kPa), 0%RH with a gas other than air.)
- \*2: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.). To maintain the function of this product, install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil content 0.1 mg/m<sup>3</sup>) on the primary side (upstream side) of this product. (Refer to page 74 for details on recommended circuit.)
- The sensor for oxygen gas is a custom model. To prevent ignition accidents, do not allow oxygen to flow again when a fluid other than oxygen has flown even once.
- \*3: Compressed air is used for adjusting and inspecting this product. Accuracy for gas types other than air is a guideline.
- \*4: Accuracy is based on a CKD standard flow rate meter. It does not indicate absolute accuracy.
- Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy of ±3% F.S.
- Consider separately according to the working environment and working conditions.
- \*5: Repeatability calculated during a short time. Change over time is not included. (Refer to the product specifications for details.)
- \*6: The actual response time changes depending on the piping conditions.
- \*7: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.
- \*8: The male end is straight, and the female end is angled. (Refer to page 67.)
- Tighten the M12 connector at a torque of 0.5 N·m or less.
- Note, however, that using excessive force to tighten the connector can cause it to break.
- \*9: The gas type switching function enables switching to argon, carbon dioxide and a gas mixture of argon 80% + carbon dioxide 20%.
- The measurement flow rate ranges after switching are as follows. (Note that the gas change function cannot be set with the 500 L/min, and 1000 L/min oxygen models.)

Gas type	Flow direction	Measurement flow rate range (□/min)							
		005	010	020	100	200	500	101	201
• Air • Nitrogen • Argon • Argon 80% + carbon dioxide 20%	Uni-direction	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L
	Bi-direction	-500 to -15 mL	-1000 to -30 mL	-2.00 to -0.06 L	-10.00 to -0.30 L	-20.0 to -0.6 L	-50.0 to -1.5 L	-100.0 to -3.0 L	-200 to -6 L
		15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L
• Carbon dioxide	Uni-direction	15 to 250 mL	30 to 500 mL	0.06 to 1.00 L	0.30 to 5.00 L	0.6 to 10.0 L	1.5 to 25.0 L	3.0 to 50.0 L	6 to 100 L
	Bi-direction	-250 to -15 mL	-500 to -30 mL	-1.00 to -0.06 L	-5.00 to -0.30 L	-10.0 to -0.6 L	-25.0 to -1.5 L	-50.0 to -3.0 L	-100 to -6 L
		15 to 250 mL	30 to 500 mL	0.06 to 1.00 L	0.30 to 5.00 L	0.6 to 10.0 L	1.5 to 25.0 L	3.0 to 50.0 L	6 to 100 L

- \*10: The integrated flow is a calculated (reference) value. When using the integrated save function, take care to prevent the number of saves from exceeding the access count limit of the storage device (1 million times). (Changes to various settings also are counted in the access count.)
- $$\text{Number of saves} = \frac{\text{Usage time}}{5 \text{ mins}} < 1 \text{ million times}$$
- When the instantaneous flow rate is 1% or less, the flow rate is counted as integrated flow rate.
- \*11: This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.
- \*12: A communication error might occur depending on the vibration conditions. Install this product as far as possible in a place not subject to vibration.
- \*13: This product measures changes in heat distribution that are caused by flow.
- When this product is mounted in a vertical orientation, convective flow may affect heat distribution or cause the zero point to deviate.
- \*14: Accuracy may be affected by the piping conditions. To perform measurement with greater accuracy, install a straight pipe with a piping I.D. ten times larger. With the 500 L/min and 1,000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.
- \*15: Refer to page 59 for weight.

## How to order

**FSM3 - C 005 U 2 AA 1 L 1 N - G H R - P70**

Model No.

**A** Display

**B** Flow rate ranges (full scale)

**C** Flow direction

**D** Body material / applicable fluid

**E** Port size

**F** Piping direction

**G** Output specifications

**H** Unit specifications

**I** Valve option

**J** Lead wire

**K** Mounting (not assembled)

**L** Attached documents

**M** Clean-room specifications

Code	Description
<b>A Display</b>	
<b>C</b>	IO-Link

<b>B Flow rate ranges (full scale)</b>			
<b>005</b>	500 mL/min	<b>500</b>	50 L/min
<b>010</b>	1000 mL/min	<b>101</b>	100 L/min
<b>020</b>	2 L/min	<b>201</b>	200 L/min
<b>050</b>	5 L/min	<b>501</b>	500 L/min
<b>100</b>	10 L/min	<b>102</b>	1000 L/min
<b>200</b>	20 L/min		

<b>C Flow direction</b>	
<b>U</b>	Uni-direction
<b>B</b>	Bi-direction

<b>D Body material / applicable fluid</b>		
	Body material	Applicable fluid
<b>2</b>	SUS	Air (gas switchable)
<b>3</b>	SUS	Oxygen (oil-prohibited specifications) *2

<b>E Port size</b>	
<b>AA</b>	Rc1/8
<b>BA</b>	Rc1/4
<b>CA</b>	Rc1/2
<b>AF</b>	G1/8
<b>BF</b>	G1/4
<b>CF</b>	G1/2
<b>AB</b>	G1/8
<b>BB</b>	G1/4
<b>CB</b>	G1/2
<b>AC</b>	NPT1/8
<b>BC</b>	NPT1/4
<b>CC</b>	NPT1/2
<b>AD</b>	1/4" double barbed fitting (50 L/min or less)
<b>BD</b>	1/4" double barbed fitting (50 to 200 L/min)
<b>AE</b>	1/4" JXR male fitting (50 L/min or less)
<b>BE</b>	1/4" JXR male fitting (50 to 200 L/min)

<b>F Piping direction</b>	
<b>1</b>	Straight

<b>G Output specifications</b>	
<b>L</b>	IO-Link communication

<b>H Unit specifications</b>	
<b>1</b>	SI units only

<b>I Valve option</b>	
<b>N</b>	None

<b>J Lead wire</b>	
<b>Blank</b>	None
<b>G</b>	M12 both-end lead wire with connector (3 m)

<b>K Mounting (not assembled) *5</b>	
<b>Blank</b>	None
<b>H</b>	Bracket 1 (for models 200 L or less)
<b>J</b>	Bracket 2 (for 500 or 1000 L models)
<b>M</b>	DIN rail mounting (for models 200 L or less)

<b>L Attached documents</b>	
<b>Blank</b>	None
<b>R</b>	Company certification
<b>S</b>	Company certification + Traceability certification

<b>M Clean-room specifications *8</b>	
<b>Blank</b>	None
<b>P70</b>	Anti-dust generation *6
<b>P80</b>	Oil free *7

## [Example of model No.]

### FSM3-C005U2AA1L1N-GHR-P70

Model: RAPIFLOW FSM3 Series

<b>A</b> Display	<b>C</b> : IO-Link
<b>B</b> Flow rate	005 : 500 mL/min
<b>C</b> Flow direction	<b>U</b> : Uni-direction
<b>D</b> Body material / applicable fluid	<b>2</b> : SUS/air
<b>E</b> Port size	<b>AA</b> : Rc1/8
<b>F</b> Piping direction	<b>1</b> : Straight
<b>G</b> Output specifications	<b>L</b> : IO-Link
<b>H</b> Unit specifications	<b>1</b> : SI units only
<b>I</b> Valve option	<b>N</b> : None
<b>J</b> Lead wire	<b>G</b> : M12 both-end lead wire with connector (3 m)
<b>K</b> Mounting attachment	<b>H</b> : Bracket
<b>L</b> Attached documents	<b>R</b> : Company certification
<b>M</b> Clean-room specifications	<b>P70</b> : Anti-dust generation

## ⚠ Precautions for model No. selection

- \*1: Refer to the correspondence table on the following page when selecting the model.
- \*2: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
- \*3: The G thread connection shape is compliant with ISO16030 standards.
- \*4: Please refer to the external dimension diagram (Page 41) for the G thread connection shape when making a selection. (The G thread connection shape is compliant with JIS B 2351-1, O types.)
- \*5: Optional parts are provided with the product. They are not assembled with the product.
- \*6: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
- \*7: In addition to P70 specifications, wetted section materials are degreased and cleaned.
- \*8: This cannot be selected on an oxygen type (blank only).



### Flow rate ranges and port sizes

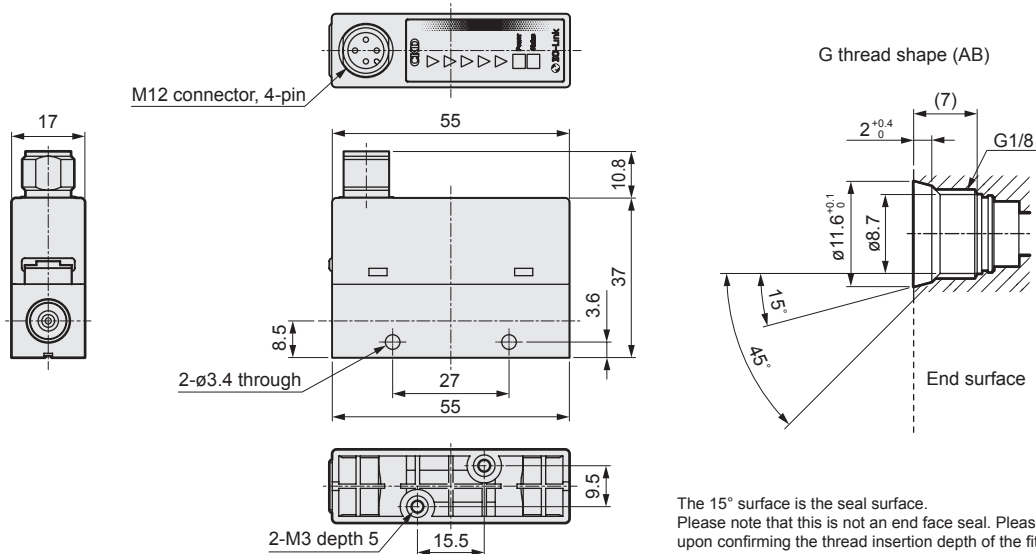
		E Port sizes															
		AA	BA	CA	AF	BF	CF	AB	BB	CB	AC	BC	CC	AD	BD	AE	BE
		Rc1/8	Rc1/4	Rc1/2	G1/8	G1/4	G1/2	G1/8	G1/4	G1/2	NPT1/8	NPT1/4	NPT1/2	1/4" Double barbed fitting	1/4" JXR Male fitting		
B Flow rate codes	005	●			●			●			●			●		●	
	010	●			●			●			●			●		●	
	020	●			●			●			●			●		●	
	050	●			●			●			●			●		●	
	100	●			●			●			●			●		●	
	200	●			●			●			●			●		●	
	500	●	●		●	●		●	●		●	●		●	●	●	●
	101		●			●			●			●			●		●
	201		●			●			●			●			●		●
	501			●			●			●			●				
102			●			●			●			●					

LCD display	Bar display	IO-Link	Internal structure
Resin body			
LCD display	Bar display	IO-Link	Internal structure
Stainless steel body			
Separated display			
Technical data			
Operating method			
Optional products			
Safety precautions			
Related products			

## Dimensions (IO-Link) (flow rate range: 500 mL/min to 50 L/min)

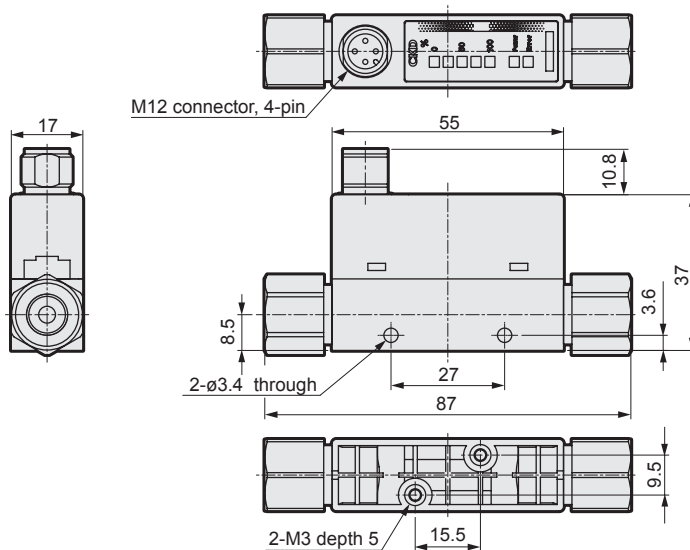
Port sizes: Straight Rc1/8, G1/8, NPT1/8

● FSM3-C $\square$  $\square$  $\square$  $\square$ /AA1/AB1/AC1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



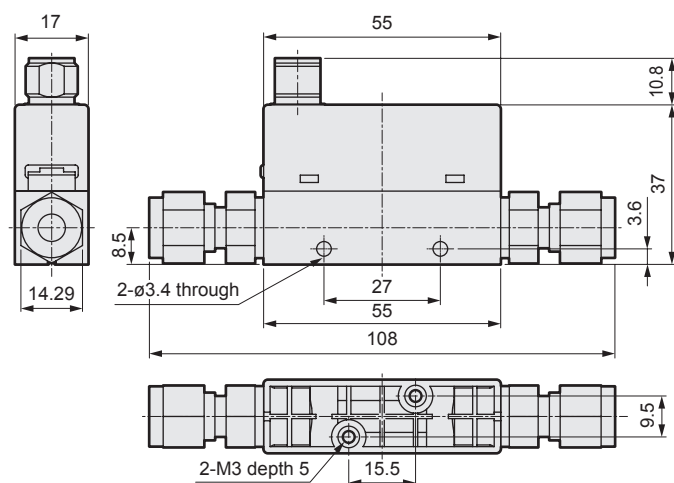
Port size: Straight G1/8

● FSM3-B $\square$  $\square$  $\square$  $\square$ /AF1 (Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



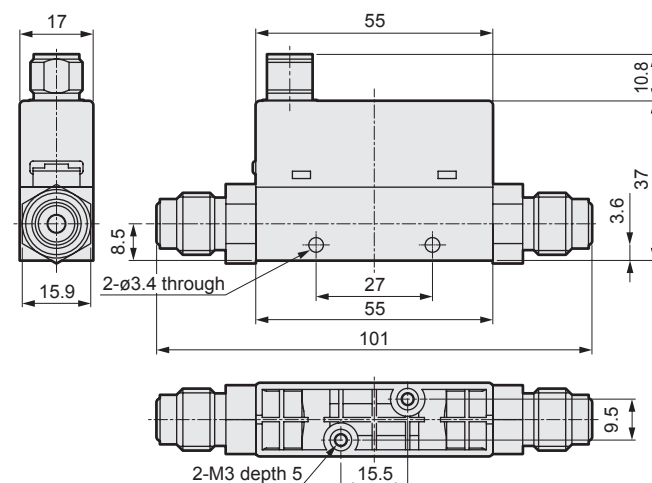
Port size: Straight 1/4" double barbed fitting

● FSM3-C $\square$  $\square$  $\square$  $\square$ /AD1  
(Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Port size: Straight 1/4" JXR male fitting

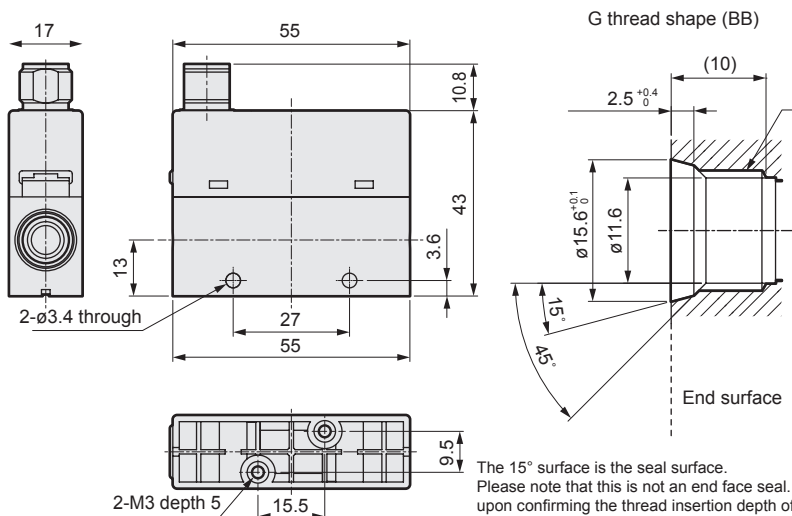
● FSM3-C $\square$  $\square$  $\square$  $\square$ /AE1  
(Full scale flow rates: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



### Dimensions (IO-Link) (flow rate range: 50 L/min to 1000 L/min)

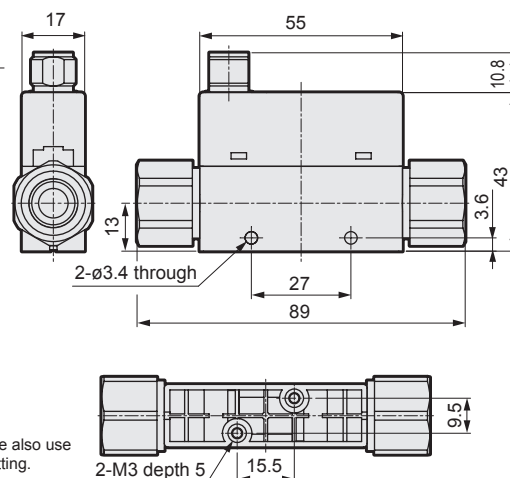
Port sizes: Straight Rc1/4, G1/4, NPT1/4

● FSM3-C□□□<sup>2</sup>/BA1/BB1/BC1 (Full scale flow rates: 50, 100, 200 L/min)



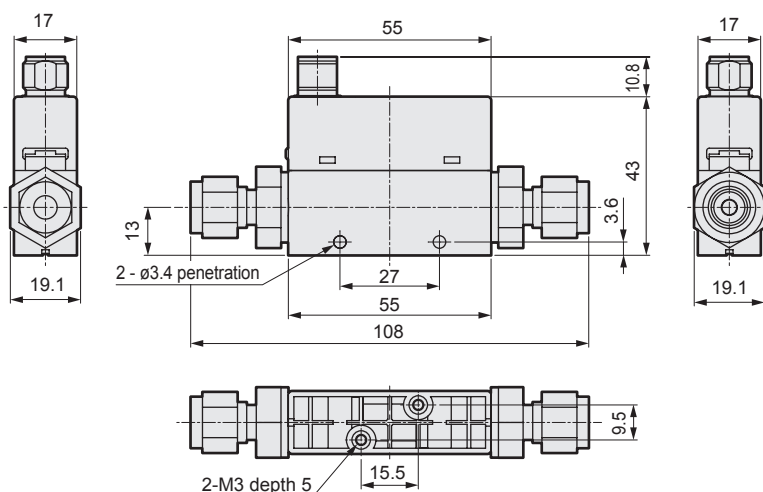
Port sizes: Straight G1/4

● FSM3-C□□□<sup>2</sup>/BF1 (Full scale flow rates: 50, 100, 200 L/min)



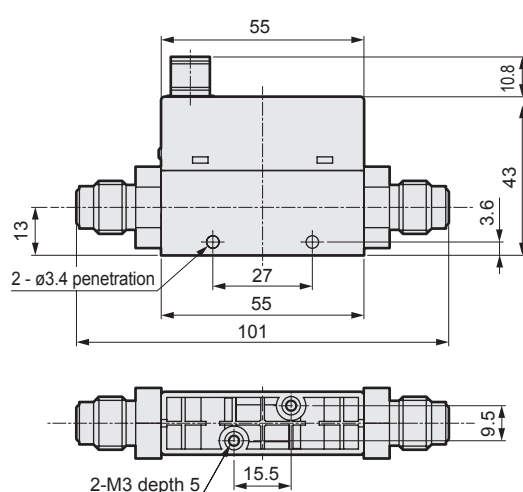
Port sizes: Straight 1/4" double barbed fitting

● FSM3-C□□□<sup>2</sup>/BD1 (Full scale flow rates: 50, 100, 200 L/min)



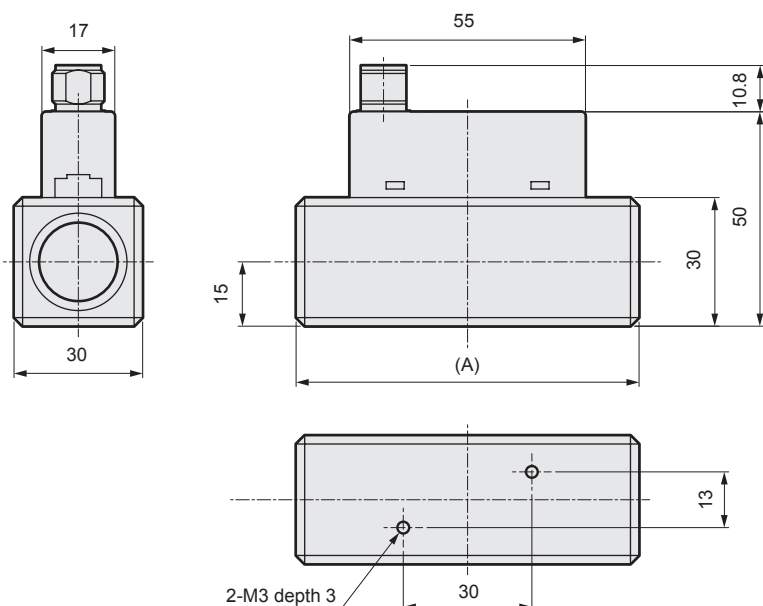
Port size: Straight 1/4" JXR male fitting

● FSM3-C□□□<sup>2</sup>/BE1 (Full scale flow rates: 50, 100, 200 L/min)

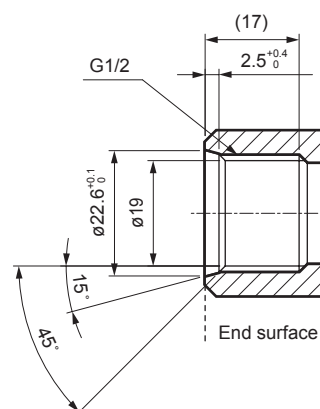


Port sizes: Straight Rc1/2, G1/2, NPT1/2

● FSM3-C□□□<sup>2</sup>/CA1/CF1/CB1/CC1 (Full scale flow rates: 500, 1000 L/min)



G thread shape (CB)

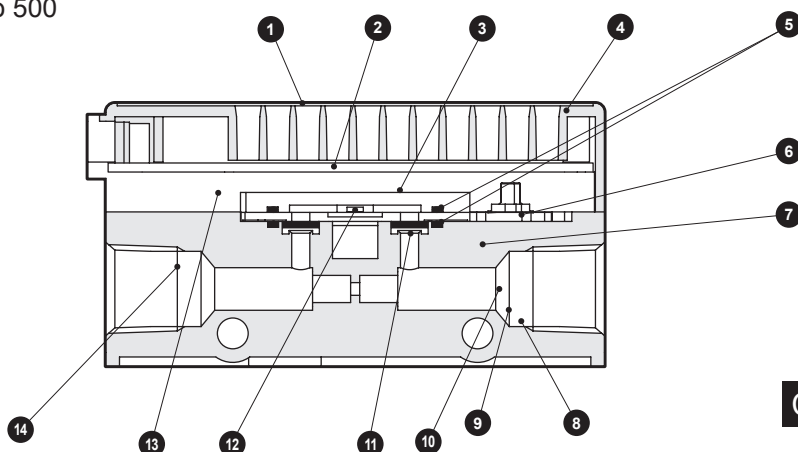


The 15° surface is the seal surface. Please note that this is not an end face seal. Please also use upon confirming the thread insertion depth of the fitting.

Model No.	Port size	Dimension (A)
FSM3-C□□□ <sup>2</sup> CA1	Rc1/2	(80)
FSM3-C□□□ <sup>2</sup> CF1	G1/2	(80)
FSM3-C□□□ <sup>2</sup> CB1	G1/2	(95.4)
FSM3-C□□□ <sup>2</sup> CC1	NPT1/2	(80)

## Internal structure

### ● FSM3-B005 to 500



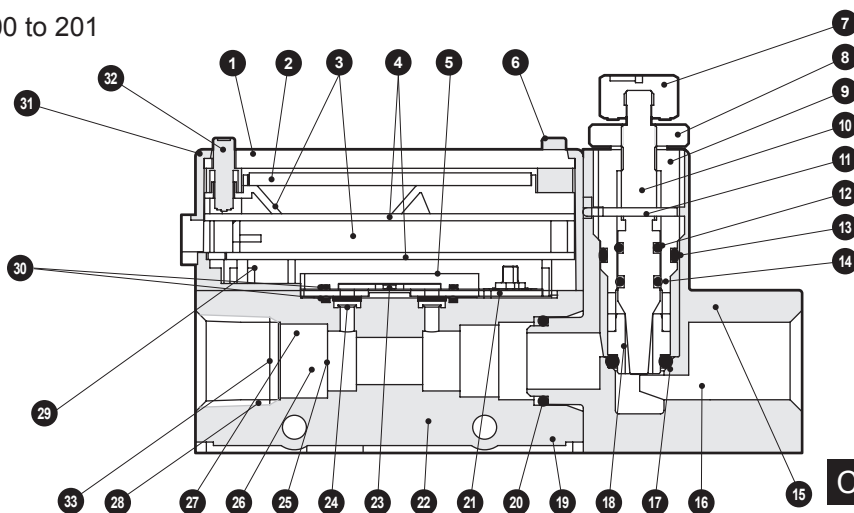
\* This figure shows the bar display.

\* The part materials are subject to change without notice.

No.	Part name	Material	No.	Part name	Material
1	Front sheet	PET film	8	O-ring	Fluoro rubber
2	Electronic circuit board	Glass epoxy resin	9	Spacer	Stainless steel
3	Sensor cover *	Stainless steel	10	Filter	Stainless steel
4	Case	Polyamide resin	11	Filter	Stainless steel
5	Gasket *	Fluoro rubber	12	Sensor chip	Semiconductor silicon
6	Sensor board *	Alumina	13	Circuit board holder	Polyamide resin
7	Sensor body *	Stainless steel	14	C-snap ring	Stainless steel

\* A cleaning component with P80 specifications.

### ● FSM3-L500 to 201



\* This figure shows the LCD display with needle valve.

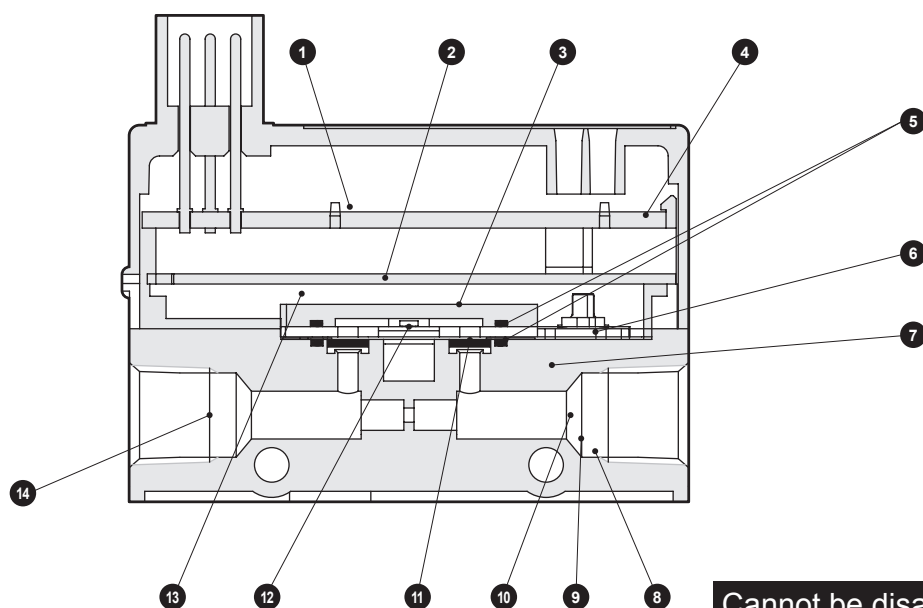
\* The part materials are subject to change without notice.

No.	Part name	Material	No.	Part name	Material
1	Liquid crystal cover	Acrylic resin	18	Orifice	Tetra fluoro resin
2	Liquid crystal	-	19	Fitting fixing pin	Stainless steel
3	Base spacer	Polycarbonate resin	20	O-ring	Fluoro rubber
4	Electronic circuit board	Glass epoxy resin	21	Sensor board	Alumina
5	Sensor cover *	Stainless steel	22	Sensor body	Stainless steel
6	Switch	Ethylene/propylene rubber	23	Sensor chip	Semiconductor silicon
7	Knob	Polybutylene terephthalate	24	Filter	Stainless steel
8	Lock nut	Copper alloy/nickeling	25	Filter	Stainless steel
9	Needle guide *	Stainless steel	26	Spacer	Stainless steel
10	Needle *	Stainless steel	27	O-ring	Fluoro rubber
11	Fixing pin	Stainless steel	28	O-ring	Fluoro rubber
12	O-ring *	Fluoro rubber	29	Circuit board holder	Polyamide resin
13	O-ring *	Fluoro rubber	30	Gasket	Fluoro rubber
14	O-ring *	Fluoro rubber	31	Case	Polyamide resin
15	Needle valve body *	Stainless steel	32	Switch	Ethylene/propylene rubber
16	Filter *	Stainless steel	33	C-snap ring	Stainless steel
17	O-ring *	Fluoro rubber			

\* A cleaning component with P80 specifications.

### Internal structure

#### ● FSM3-C005 to 500

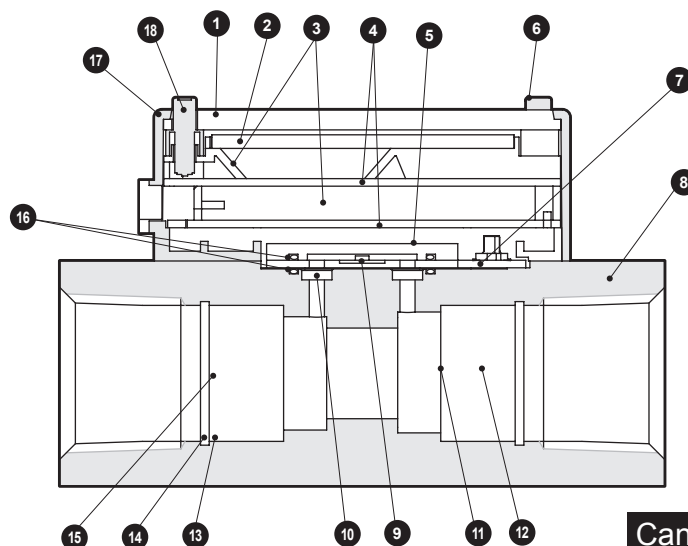


\* This figure shows the IO-Link display.  
\* The part materials are subject to change without notice.

No.	Part name	Material	No.	Part name	Material
1	Front sheet	PET film	8	O-ring	Fluoro rubber
2	Electronic circuit board	Glass epoxy resin	9	Spacer	Stainless steel
3	Sensor cover *	Stainless steel	10	Filter	Stainless steel
4	Case	Polyamide resin	11	Filter	Stainless steel
5	Gasket *	Fluoro rubber	12	Sensor chip	Semiconductor silicon
6	Sensor board *	Alumina	13	Circuit board holder	Polyamide resin
7	Sensor body *	Stainless steel	14	C-snap ring	Stainless steel

\* A cleaning component with P80 specifications.

#### ● FSM3-L501, 102



\* This figure shows the LCD display.  
\* The part materials are subject to change without notice.

No.	Part name	Material	No.	Part name	Material
1	Liquid crystal cover	Acrylic resin	10	Filter	Stainless steel
2	Liquid crystal	-	11	Filter	Stainless steel
3	Base spacer	Polycarbonate resin	12	Spacer	Stainless steel
4	Electronic circuit board	Glass epoxy resin	13	O-ring	Fluoro rubber
5	Sensor cover *	Stainless steel	14	C-snap ring	Stainless steel
6	Switch	Ethylene/propylene rubber	15	O-ring holder	Stainless steel
7	Sensor board *	Alumina	16	Gasket	Fluoro rubber
8	Sensor body *	Stainless steel	17	Case	Polyamide resin
9	Sensor chip	Semiconductor silicon	18	Switch	Ethylene/propylene rubber

\* A cleaning component with P80 specifications.



Compact flow rate sensor RAPIFLOW

# FSM2 Series

Separated display

RoHS

## Separated display specifications

Item				Separated display FSM2-D-[*1][*2]-□-[*3]		
Settable flow rate range				*1	mL	5, 10, 50, 100, 500, 1000
					L	2, 4, 5, 10, 12, 20, 25, 32, 50, 100, 200, 500, 1000
					m <sup>3</sup>	1.5
Operating ambient temperature/humidity				0 to 50°C		
Display				4 digit + 4 digit 2 color LCD		
Input voltage				1 to 5 V		
Output	Switch output	*1	N	Output 2 points (NPN open collector output, 50 mA or less, voltage drop 2.4 V or less)		
			P	Output 2 points (PNP open collector output, 50 mA or less, voltage drop 2.4 V or less)		
	Analog output	*2	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ or more) *6		
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)		
Power supply voltage		*2	V	12 to 24 VDC (10.8 to 26.4 V)		
			A	24 VDC (21.6 to 26.4 V)		
Current consumption				*2	40 mA or less (when 24 VDC is connected, and no load is connected)	
Lead wire				ø3.7, AWG26 or equivalent × 5-conductor (connector), insulator O.D. ø1.0		
Functions				Flow rate display, flow rate display peak hold, switch output, analog output		
Degree of protection				IEC standards IP40 or equivalent		
Protection circuit				*3	Power supply reverse connection protection	
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8		
Accessory				1 sensor connection connector (e-con), conforming cable AWG24 to 26, insulator O.D. ø1.0 to 1.2		
Weight (main body only)				Approx. 40 g		
Clean-room specifications				*4 *3	P70	Anti-dust generation

\*1: The flow rate range, flow direction, and gas type are automatically recognized only when the FSM3 bar display type and FSM2 separated display type are connected. (Default state)

The FSM-H Series, FSM-V Series and WFK3000 Series flow rate ranges are supported in addition, but automatic recognition is not. Always set the product's flow rate range, flow direction and gas type before use.

The connectable flow rate ranges are shown in "Display for each flow rate range" below.

The "Gas Type Setting" function of this product is not a "Gas Type Switching" function that switches the sensor characteristics to match the gas type.

If a "Gas Type Switching" function is required, use the LCD display type.

When the sensor section is changed, the previous flow rate range settings, etc., will still be recorded. Always reset the settings before using.

\*2: Current for when 24 VDC is connected, and no load is connected. The current consumption varies depending on how the load is connected.

\*3: This product's protection circuit is effective only for specific mis-connections and a load short-circuit. It does not provide protection against various mis-connections.

\*4: [P70] Anti-dust generation (product surface is degreased and cleaned before packing. Heat sealed into antistatic bag in clean bench (Class 1000 or higher).)

\*5: When connecting to the FSM-V Series or WFK3000 Series, the lead wire size is different so a separate compatible sensor connection connector (e-con) will be required. Contact your nearest CKD sales office or dealer.

The attached sensor connection connector (e-con) can be used with the FSM2 Series, FSM3 Series and FSM-H Series.

\*6: The output impedance of the analog output section is approx. 1 kΩ. If the impedance of the connecting load is small, output and error increase. Check error with the impedance of the connecting load before using.

\*7: The gas type display shows "Ai" (air, N2) when a connection is made with FSM3 bar display type oxygen specifications, but it can still be used without any problems.

## Display for each flow rate range

Flow rate display	Display range	One way	0 to 500 mL/min	0 to 1000 mL/min	0 to 2.00 L/min	0 to 4.00 L/min	0 to 5.00 L/min	0 to 10.00 L/min	0 to 12.0 L/min	0 to 20.0 L/min	0 to 25.0 L/min	0 to 32.0 L/min	0 to 50.0 L/min	0 to 100.0 L/min	0 to 200 L/min	0 to 500 L/min	0 to 1000 L/min	0 to 1.50 m <sup>3</sup> /min	0 to 5.00 mL/min	0 to 10.00 mL/min	0 to 50.0 mL/min	0 to 100.0 mL/min
			Bi-direction	-500 to 500 mL/min	-1000 to 1000 mL/min	-2.00 to 2.00 L/min	-5.00 to 5.00 L/min	-10.00 to 10.00 L/min	-	-20.0 to 20.0 L/min	-	-	-50.0 to 50.0 L/min	-100.0 to 100.0 L/min	-200 to 200 L/min	-500 to 500 L/min	-1000 to 1000 L/min	-1.50 to 1.50 m <sup>3</sup> /min	-5.00 to 5.00 mL/min	-10.00 to 10.00 mL/min	-50.0 to 50.0 mL/min	-100.0 to 100.0 mL/min
Integrating functions*2	Display resolution			1 mL/min		0.01 L/min				0.1 L/min					1 L/min			0.01 m <sup>3</sup> /min	0.01 mL/min		0.1 mL/min	
	Display range			9999999 mL		99999.99 L				999999.9 L					9999999 L			99999.99 m <sup>3</sup>	99999.99 mL		999999.9 mL	
	Display resolution			1 mL		0.01 L				0.1 L					1 L			0.01 m <sup>3</sup>	0.01 mL		0.1 mL	
	Integrated pulse output rate			5 mL 10 mL		0.02 L 0.04 L 0.05 L 0.1 L				0.12 L 0.2 L 0.25 L 0.32 L 0.5 L 1 L					2 L 5 L 10 L 15 L			0.05 mL 0.1 mL 0.5 mL 1 mL				

\* The corresponding sensor is the voltage (1 to 5 V) type. If the current output or other voltage output is connected, it will not operate properly.

\*1: The flow rate display is rounded off at approximately ±1% or less (forced zero).

\*2: The accumulated flow is a calculated (reference) value. It is reset when the power is turned OFF.



## How to order

**FSM2 - D - N V - 3 P - P70**

**A** Output

**B** Analog output

**C** Lead wire

**D** Bracket

**E** Clean-room specifications

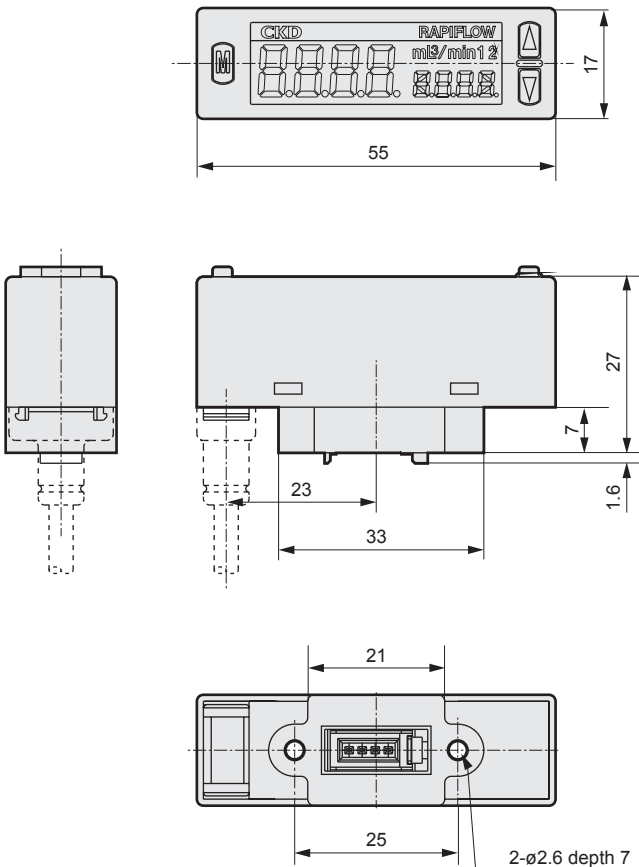


### CAUTION

The corresponding sensor is the voltage (1 to 5 V). If the current output type or other voltage output type is connected, it doesn't operate properly. When using the FSM3, use the bar display type voltage output type.

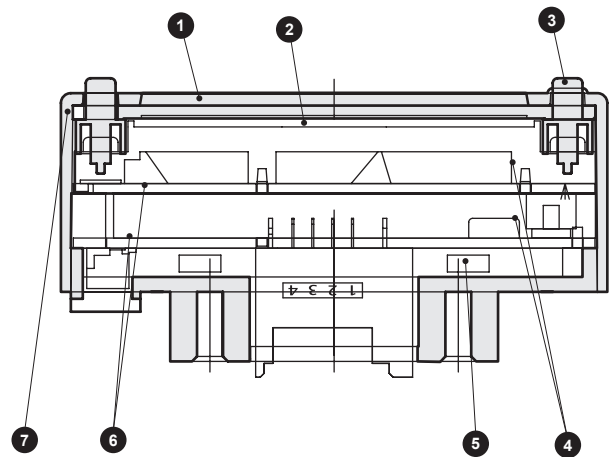
Code	Description
<b>A Output</b>	
<b>N</b>	Switch output (NPN) 2 points, analog output 1 point
<b>P</b>	Switch output (PNP) 2 points, analog output 1 point
<b>B Analog output</b>	
<b>V</b>	Voltage output (1-5 V)
<b>A</b>	Current output (4 to 20 mA)
<b>C Lead wire</b>	
<b>Blank</b>	None
<b>1</b>	1 m
<b>3</b>	3 m
<b>D Bracket</b>	
<b>Blank</b>	None
<b>P</b>	Panel mounting kit
<b>E Clean-room specifications</b>	
<b>Blank</b>	None
<b>P70</b>	Anti-dust generation

## Dimensions



## Internal structure and parts list

### ● FSM2-D



**Cannot be disassembled**

\* The part materials are subject to change without notice.

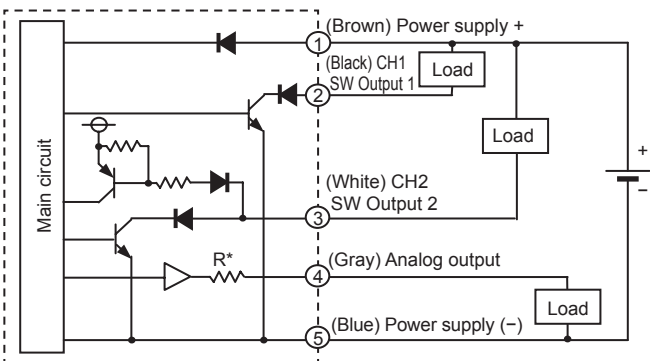
### Main parts list

No.	Part name	Material
1	Liquid crystal cover	Acrylic resin
2	Liquid crystal	-
3	Switch	Ethylene/propylene rubber
4	Base spacer	Polycarbonate resin
5	Back surface cover	Polyamide resin
6	Electronic circuit board	-
7	Case	ABS Resin

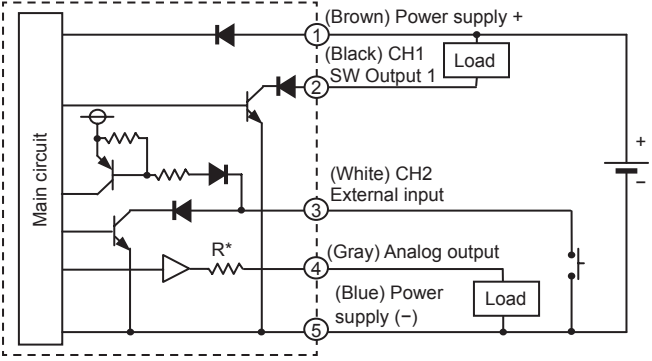
Example of internal circuit and load connection

●FSM3-L□□□□□B/F/□□ (LCD display NPN output)

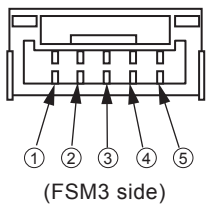
[CH2 is used as SW output]



[CH2 is used as external input]



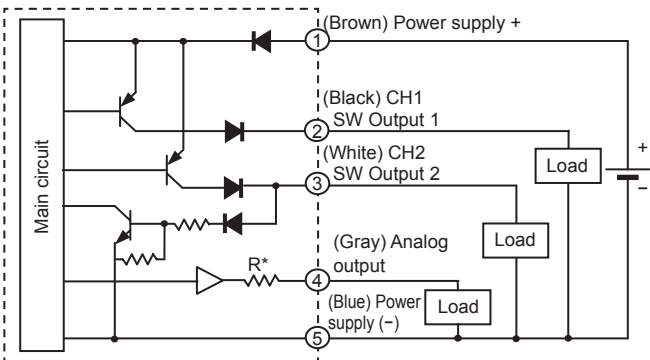
\* Analog output voltage output R: approx. 1 kΩ  
Current output R: approx. 100 Ω



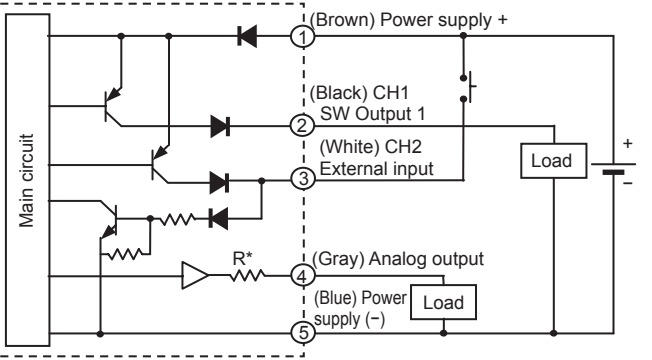
Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (switch output 2: max. 50 mA, or external input)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: 4 to 20 mA load impedance 300 Ω or less
⑤	Blue	Power supply - (GND)

●FSM3-L□□□□□D/H/□□ (LCD display PNP output)

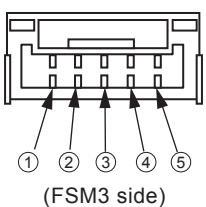
[CH2 is used as SW output]



[CH2 is used as external input]



\* Analog output voltage output R: approx. 1 kΩ  
Current output R: approx. 100 Ω

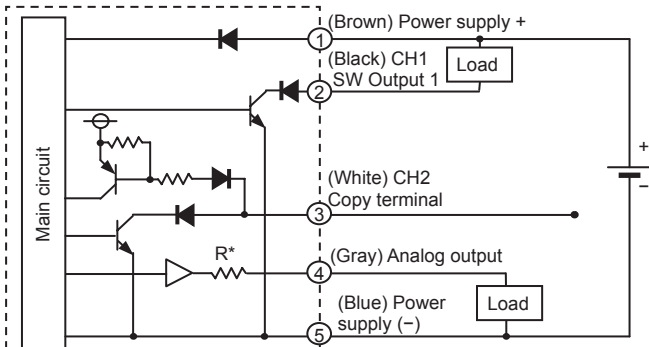


Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (switch output 2: max. 50 mA, or external input)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: 4 to 20 mA load impedance 300 Ω or less
⑤	Blue	Power supply - (GND)

### Example of internal circuit and load connection

#### ● FSM3-L[ ][ ][ ][ ][ ]A/E/[ ][ ]

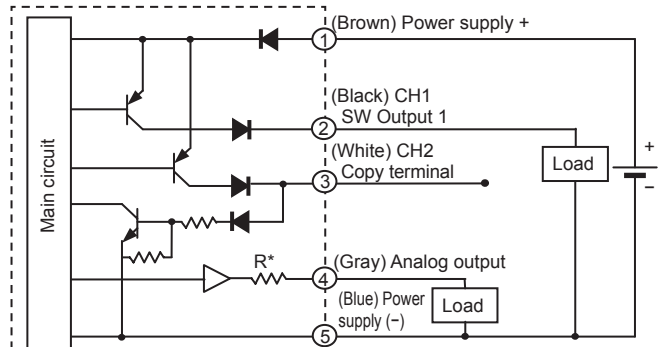
(LCD display, NPN output, with setting copy function)



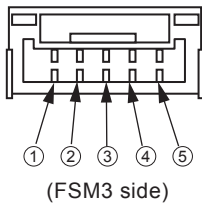
\* Analog output voltage output R: approx. 1 kΩ  
Current output R: approx. 100 Ω

#### ● FSM3-L[ ][ ][ ][ ][ ]C/G/[ ][ ]

(LCD display, PNP output, with setting copy function)



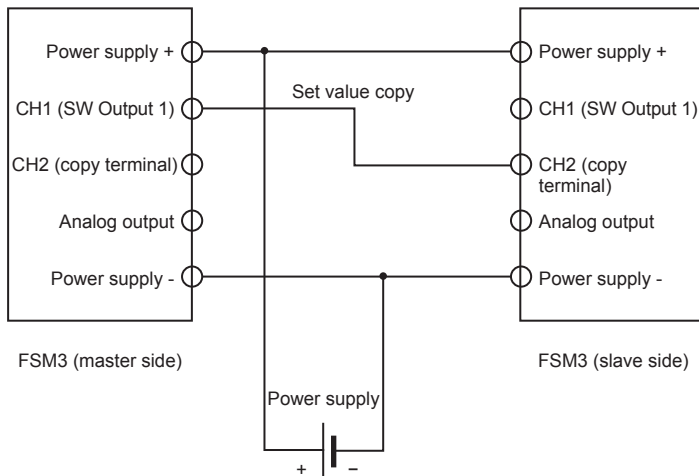
\* Analog output voltage output R: approx. 1 kΩ  
Current output R: approx. 100 Ω



Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (copy terminal)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: 4 to 20 mA load impedance 300 Ω or less
⑤	Blue	Power supply - (GND)

#### ● FSM3-L[ ][ ][ ][ ][ ]A/C/E/G/[ ][ ] (LCD display, with setting copy function)

[When using setting copy function]



Connect CH1 (SW output 1) on the master side to CH2 (copy terminal) on the slave side and power ON the sensor to use the setting copy function (F93).

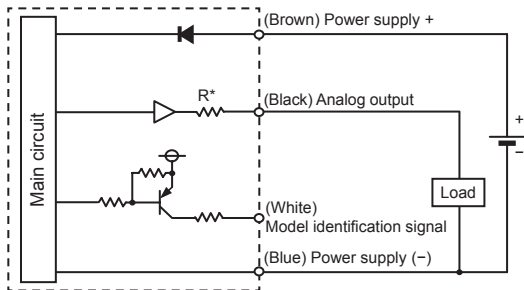
Please be sure to make this connection only when using the setting copy function.

If copying is done while load is connected with the CH1, or switching is done while connected with the CH1 and CH2 as described in the load connection example above, there may be unexpected behavior on the equipment side or malfunctioning with the equipment and FSM3.

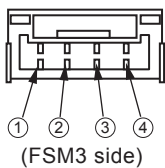
Please be sure to never use it when it is connected to a copy terminal.

## Example of internal circuit and load connection

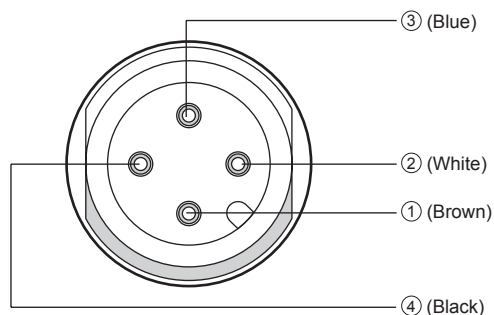
### ● FSM3-B [ ] [ ] [ ] [ ] J/K [ ] [ ] (bar display)



Terminal No.	Option lead wire color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	Analog output Voltage output: 1-5 V Load impedance 50 kΩ and over Current output: 4 to 20 mA Load impedance 300 Ω or less
③	White	Model identification signal It will not connect during use with a single unit.
④	Blue	Power supply - (GND)

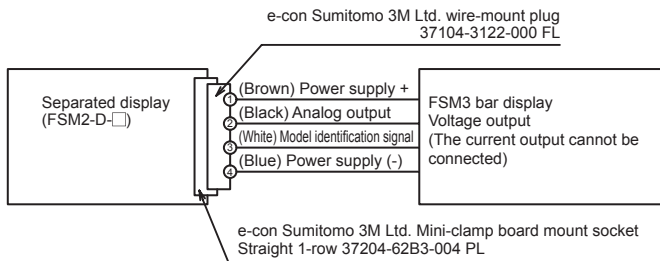


### ● FSM3-C [ ] [ ] [ ] [ ] L [ ] [ ] (IO-Link)

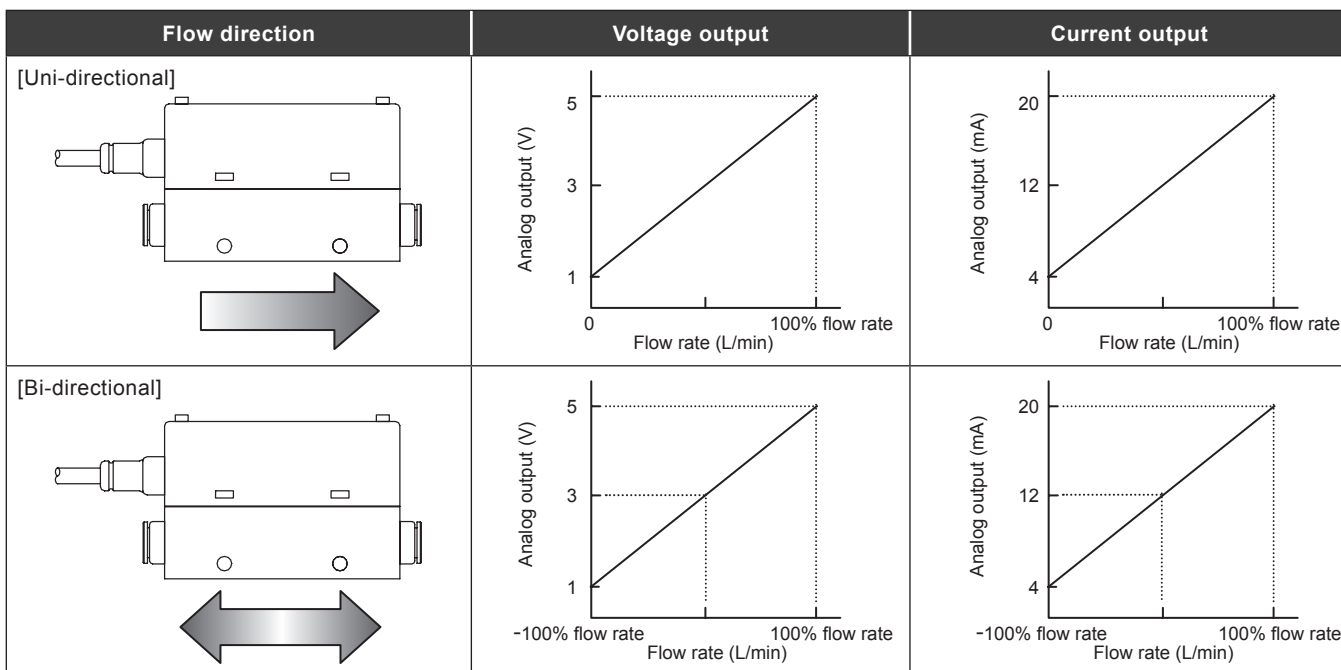


Terminal No.	Lead wire color	Name
①	Brown	Power supply + (18 to 30 V)
②	White	N.C.
③	Blue	Power supply - (GND)
④	Black	C/Q (IO-Link)

### ● Connecting the separated display and FSM3 bar display



## Analog output characteristics



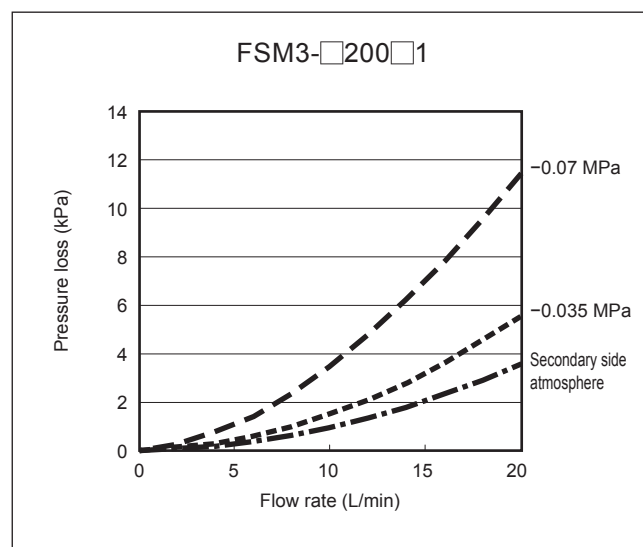
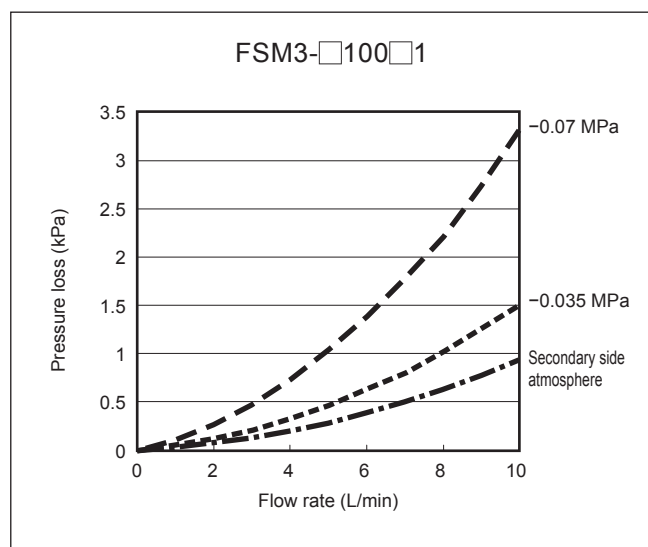
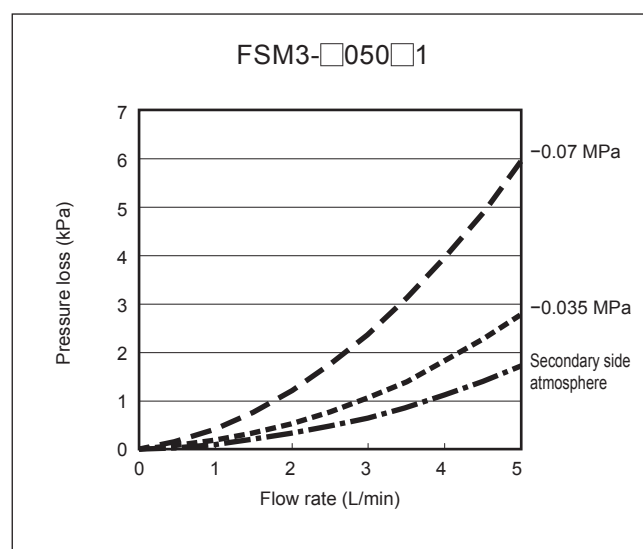
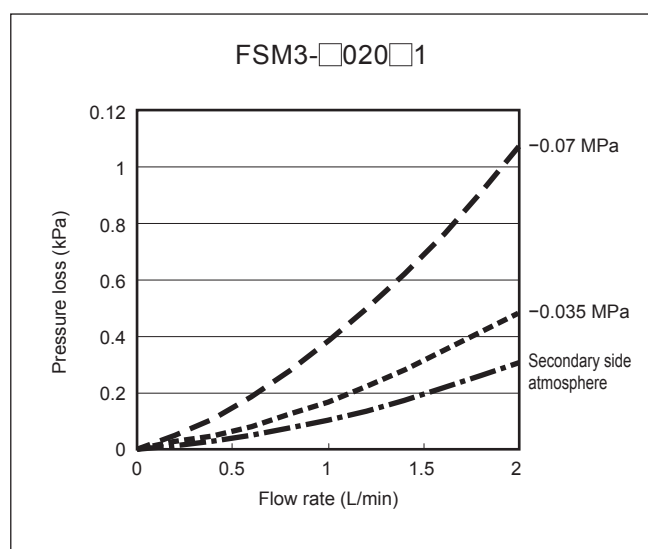
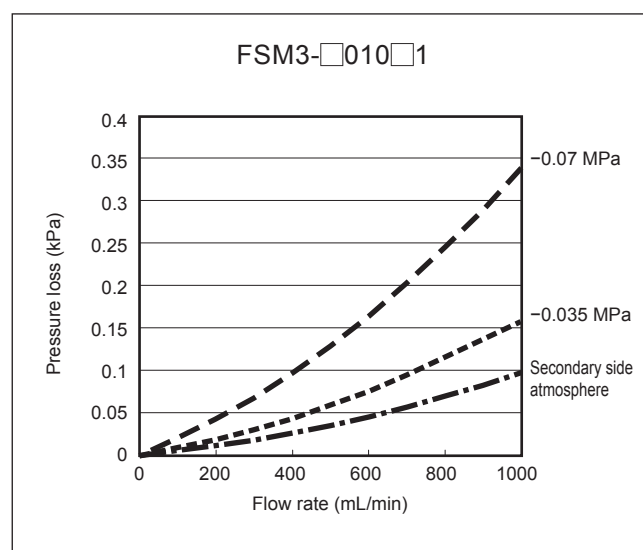
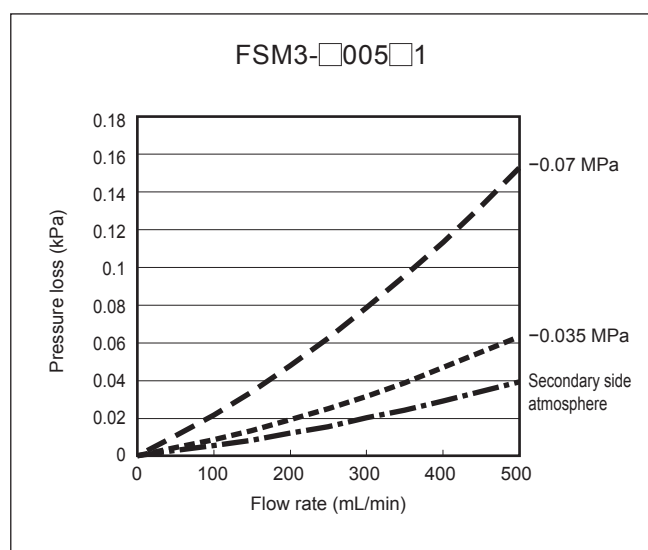
\*1: The full scale of the uni-directional type is 0 to 100%, and full scale of the bi-directional type is -100% to 100%.

With the display integrated bi-directional type, output can be switched to uni-directional with the button settings. The value after switching is a reference value. Refer to page 62 for details.

\*2: Refer to page 2 for details of analog output when carbon dioxide is switched to.

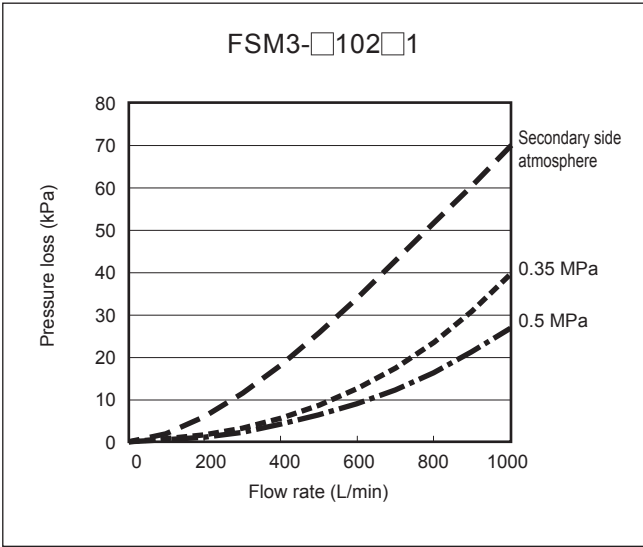
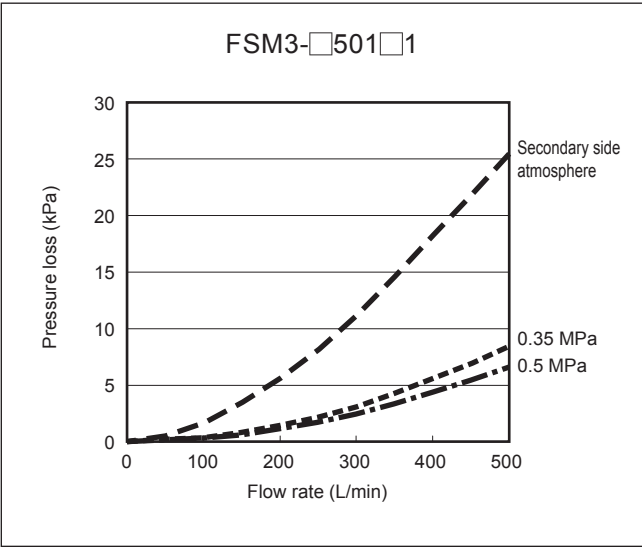
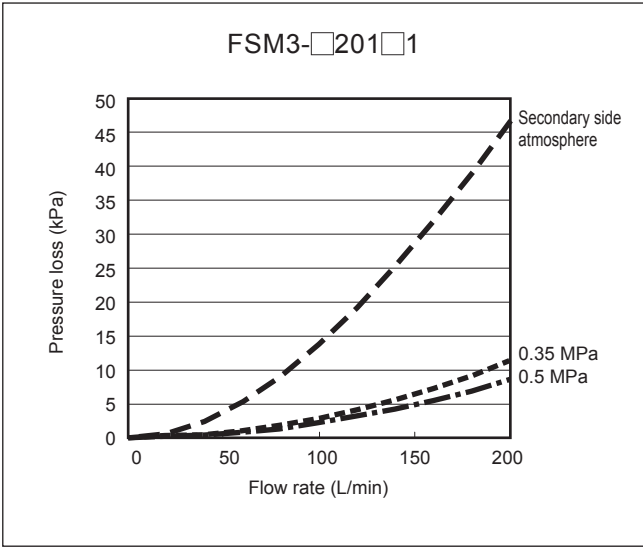
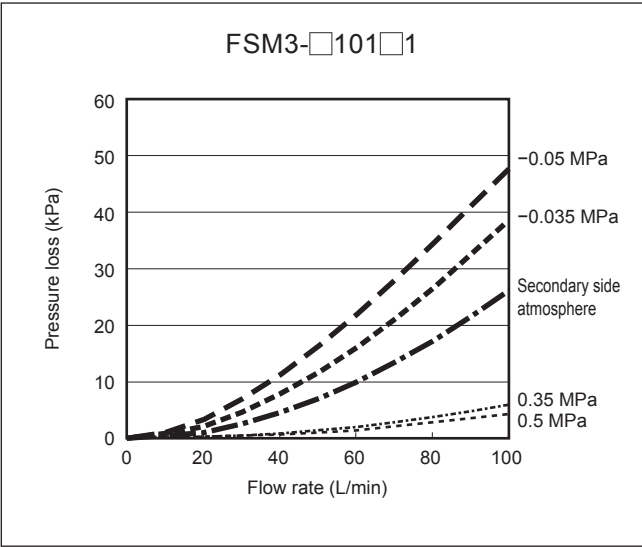
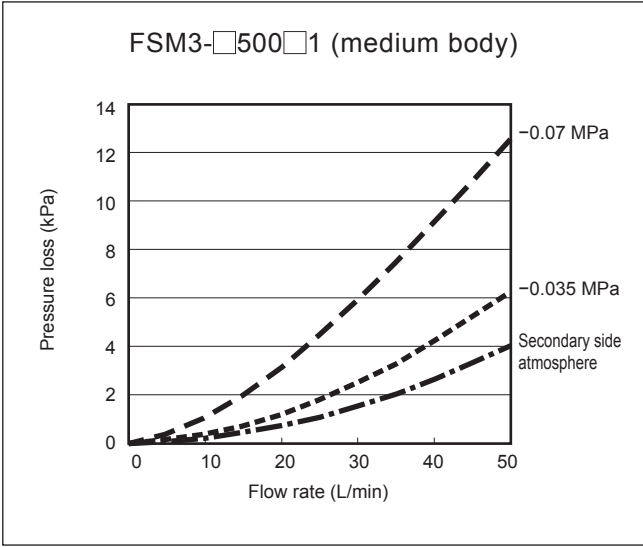
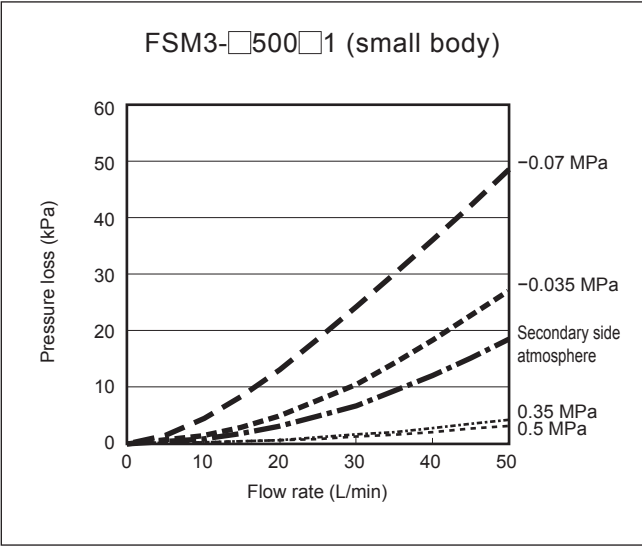
\*3: Outputs are made even outside the measurement flow range with analog outputs. Although accuracy is not guaranteed, outputs can be made with a voltage type with a minimum of about 0.6 V and a maximum of about 5.4 V, and with a current type with a minimum of about 2.4 mA and a maximum of about 21.6 mA.

### Pressure loss characteristics (resin body, air)

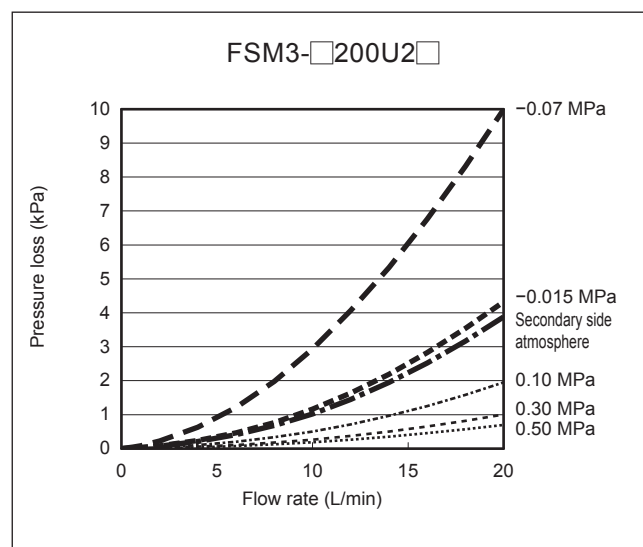
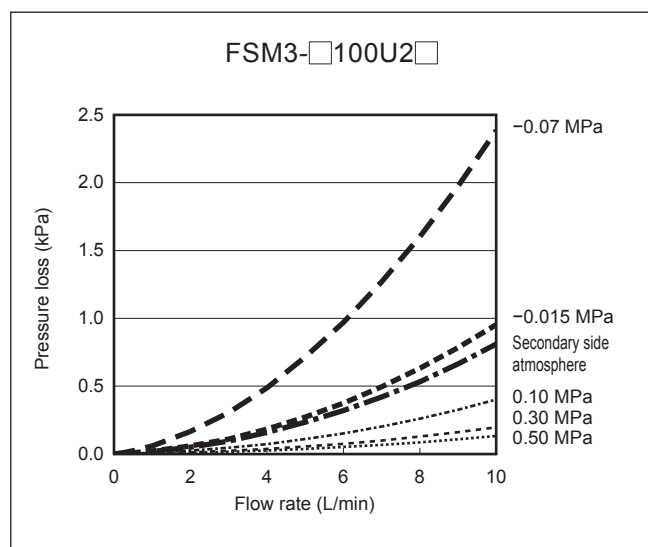
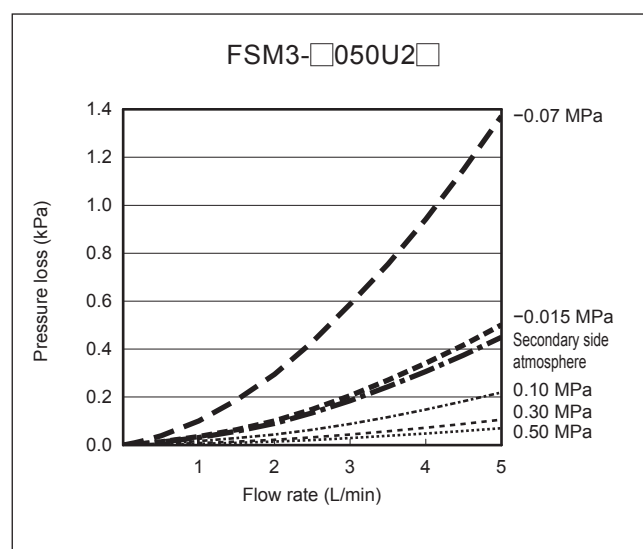
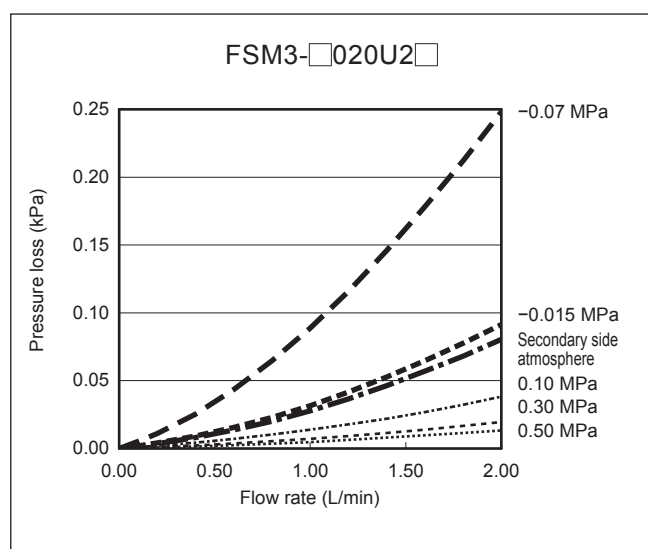
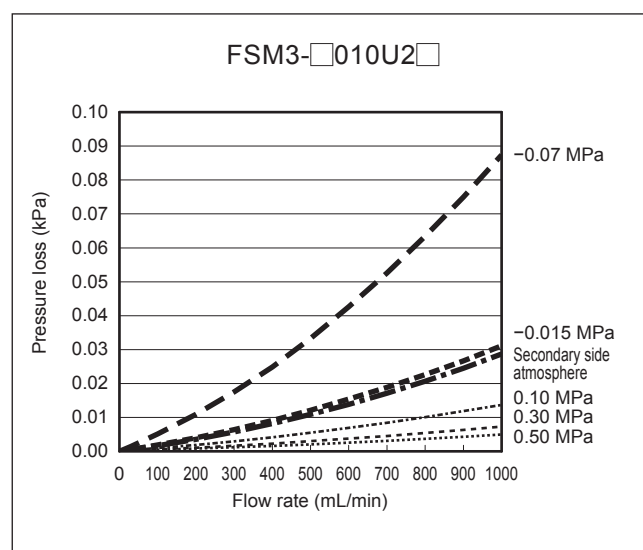
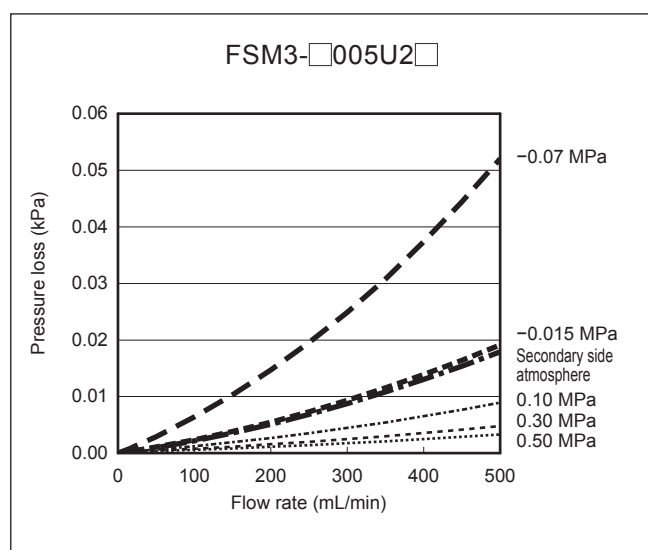


LCD display	Bar display	IO-Link	Internal structure
Resin body			
LCD display	Bar display	IO-Link	Internal structure
Stainless steel body			
Separated display			
Technical data			
Operating method			
Optional products			
Safety precautions			
Related products			

Pressure loss characteristics (resin body, air)



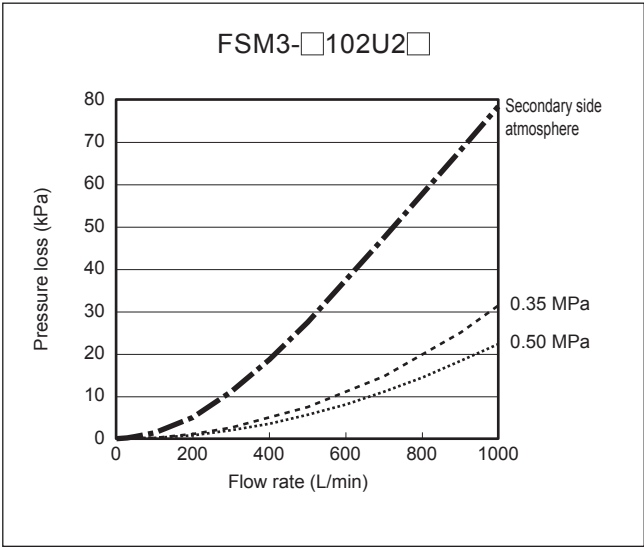
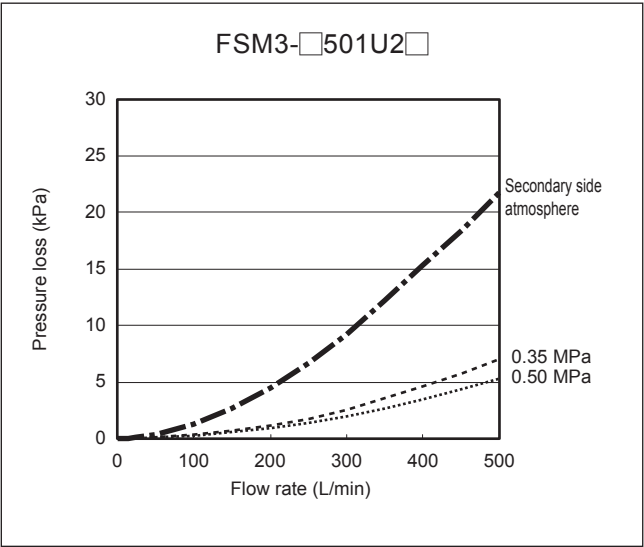
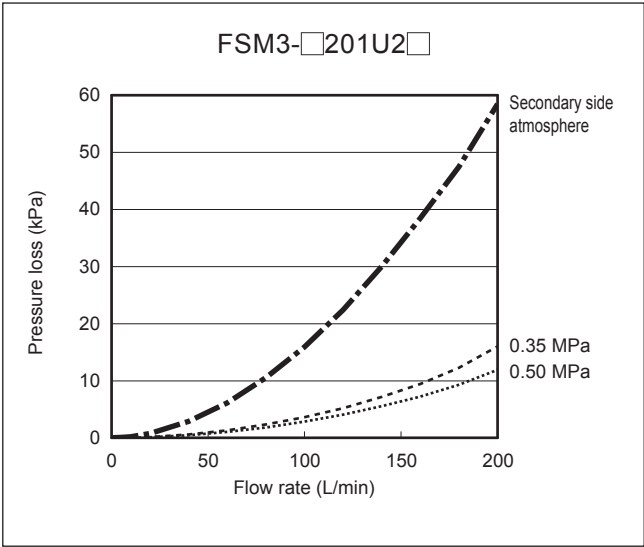
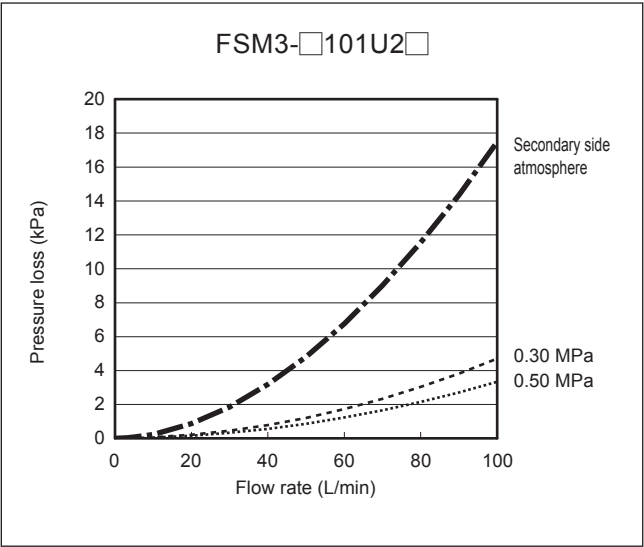
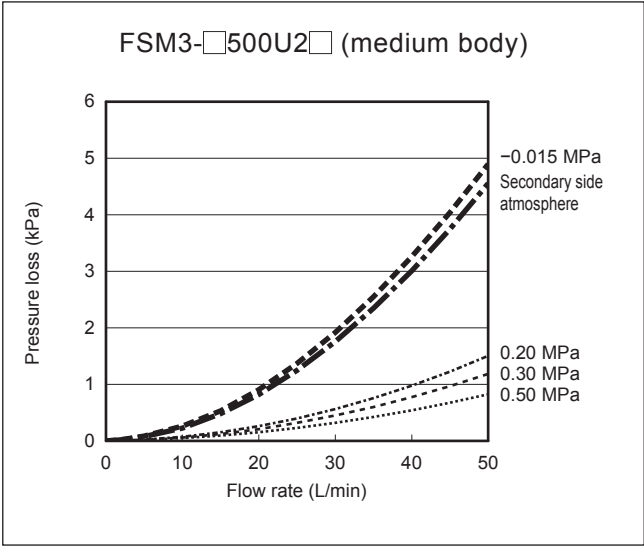
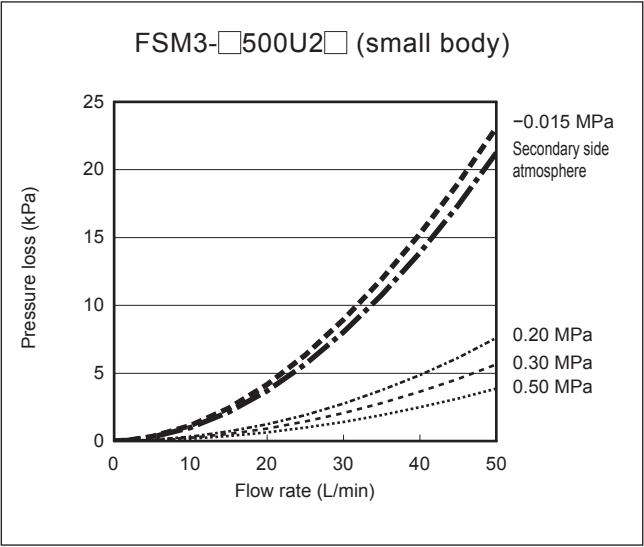
### Pressure loss characteristics (stainless steel body, air)



LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products
Resin body				Stainless steel body									



Pressure loss characteristics (stainless steel body, air)



Pressure loss characteristics

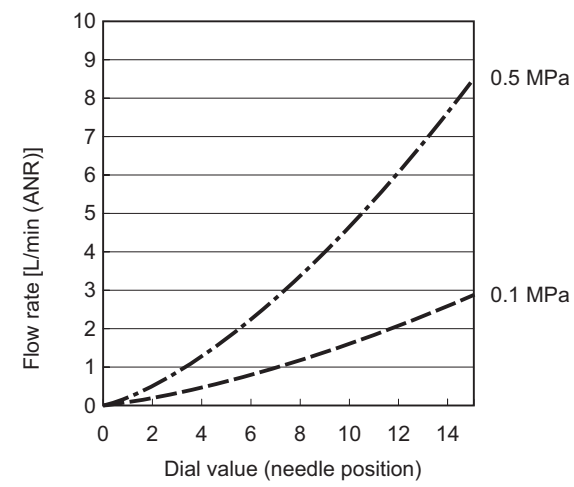
The graph shows the data obtained in air.  
With gases other than air, as a guideline multiply specific gravity as follows.

Gas	Specific gravity
Argon	1.38
Carbon dioxide	1.53
Argon 80% Carbon dioxide 20%	1.41

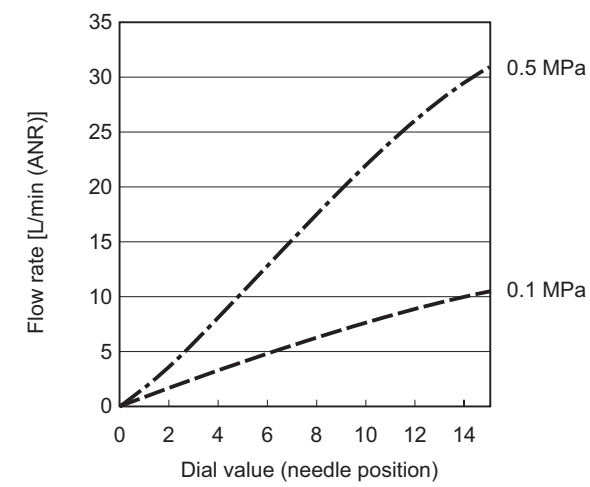
Resin body	LCD display
	Bar display
	IO-Link
	Internal structure
Stainless steel body	LCD display
	Bar display
	IO-Link
	Internal structure
Separated display	
Technical data	
Operating method	
Optional products	
Safety precautions	
Related products	

Needle valve flow characteristics (resin body) (for air, nitrogen gas)

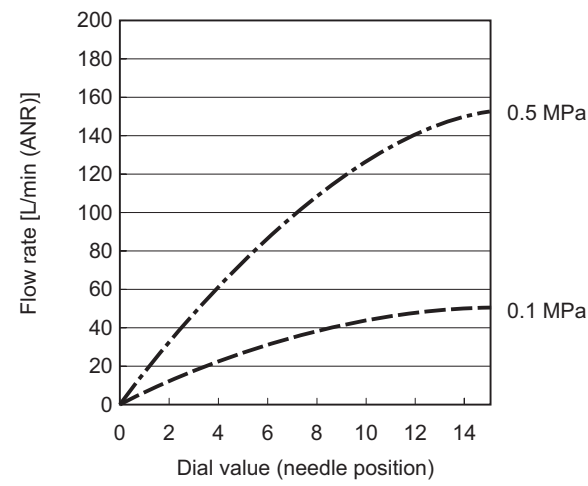
● FSM3-L005/010/020



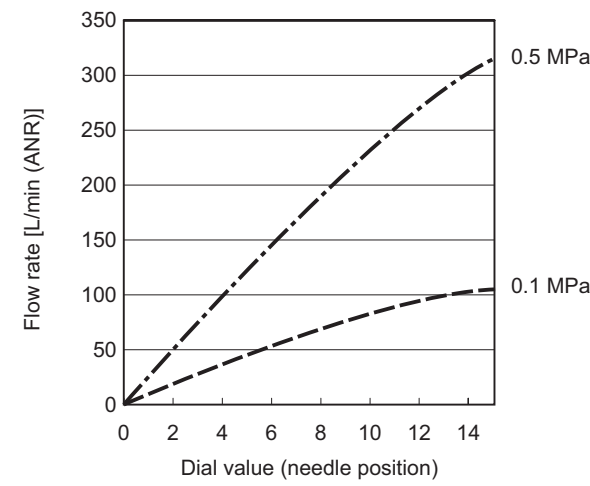
● FSM3-L050/100



● FSM3-L200/500-H04/H06

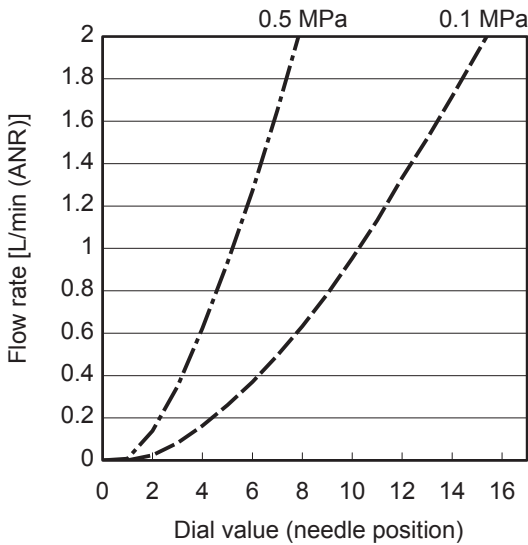


● FSM3-L500/101/201-H08/H10

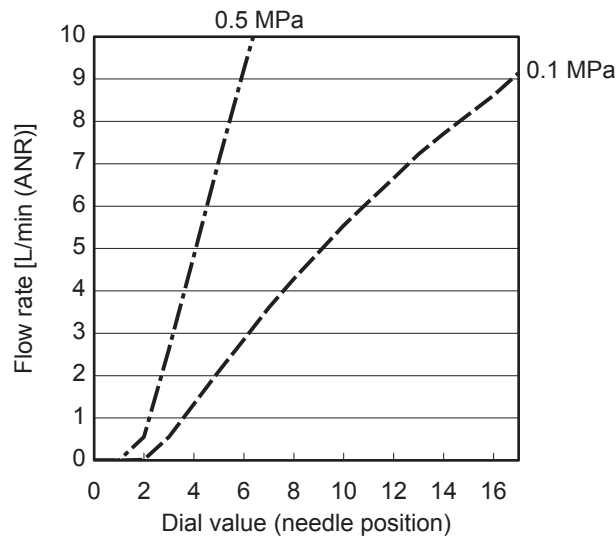


Needle valve flow characteristics (stainless steel body) (for air, nitrogen gas)

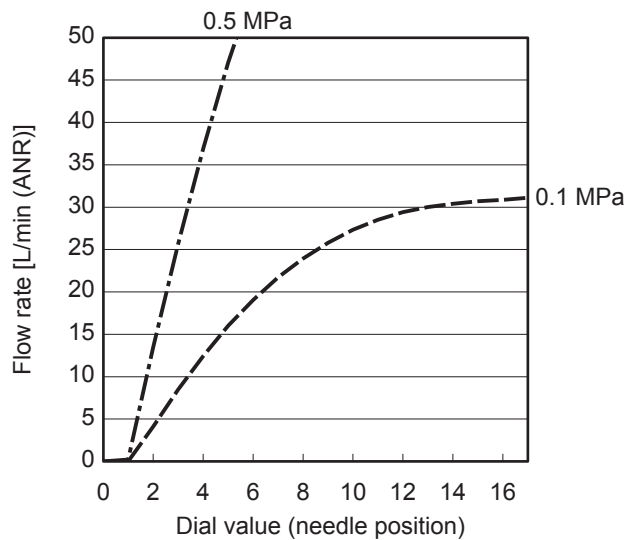
● FSM3-L005/010/020U2AA



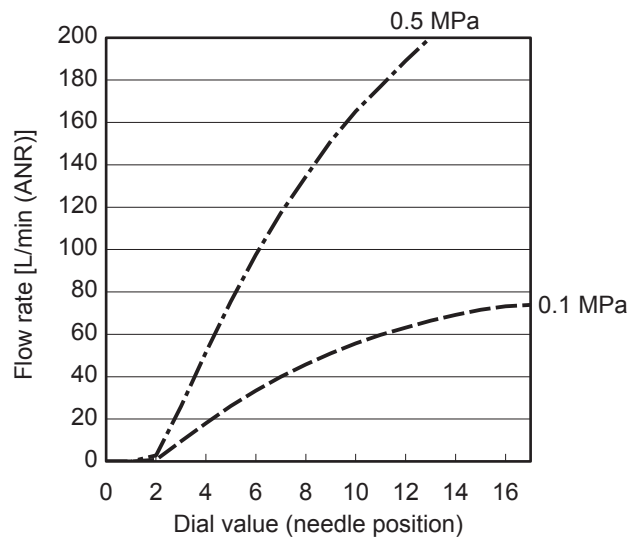
● FSM3-L050/100U2AA



● FSM3-L200/500U2AA



● FSM3-L500/101/201U2BA

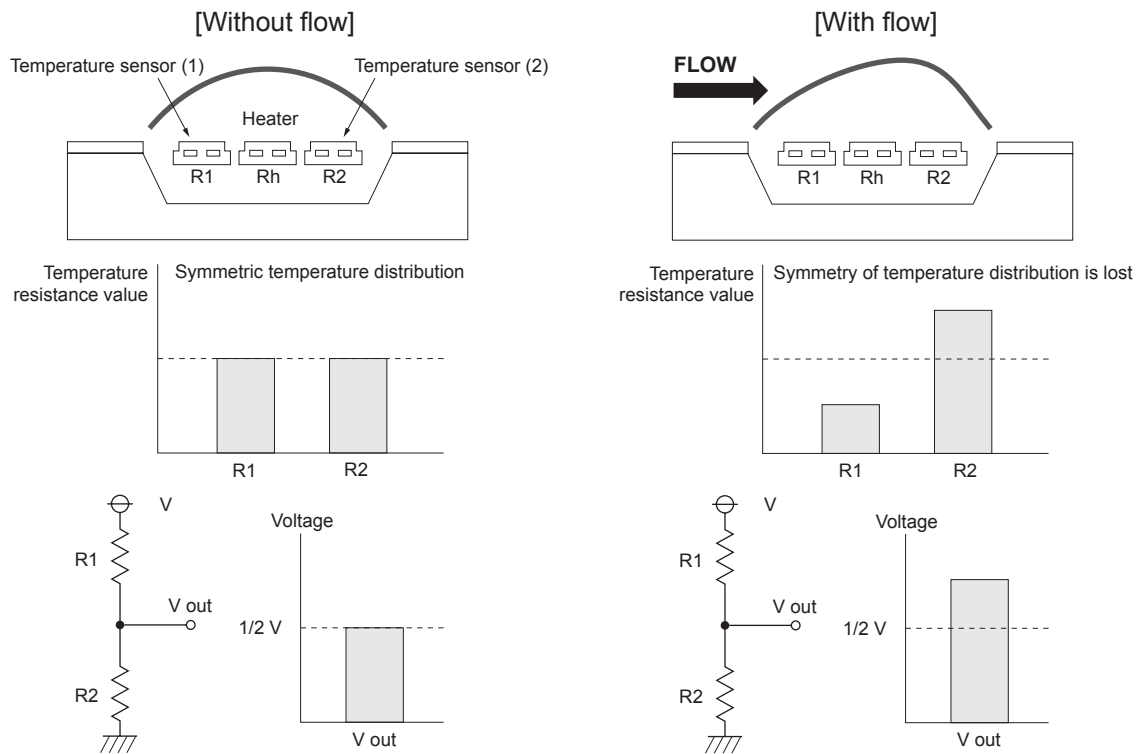


LCD display	Bar display	IO-Link	Internal structure
LCD display	Bar display	IO-Link	Internal structure
Separated display	Technical data	Operating method	Optional products
Safety precautions	Related products		

Measurement principle of FSM3 Series

The FSM3 Series incorporates a platinum sensor chip machined with silicon micro-machining. The sensor is thermally insulated from the silicon substrate. The heating capacity is extremely low, enabling high sensitivity with a high-speed response.

At the sensor, two temperature sensors are arranged with a heater in between. Platinum, which has a resistance that changes based on temperature, is used for the temperature sensor. When the heater is turned ON and heating occurs, the temperature distribution is symmetrical to the center of the heater if there is no flow. When flow is received, the symmetrical property of the temperature distribution is lost, temperature upstream from the heater drops, and temperature downstream rises. This temperature difference appears as the difference in temperature sensor resistance, and varies with the flow rate. When the flow is reversed, the temperature difference (difference in resistance) is inverted. By using this method, the bi-directional flow rate can be detected. This method is suitable for detecting a relatively small flow rate.



# 1 Flow rate sensor selection method

Use as a guide for selection of the flow rate range when using the flow rate sensor for suction/unload confirmation or leakage inspection, etc., with the suction nozzle.

The flow rate can be calculated using the effective cross-sectional area of nozzle (pinhole) and the pressure difference inside and outside of nozzle.

- For  $P_1 \geq 1.89P_2$  (acoustic velocity)

$$Q = 113.2 \times S \times P_1$$

- For  $P_1 < 1.89P_2$  (subsonic velocity)

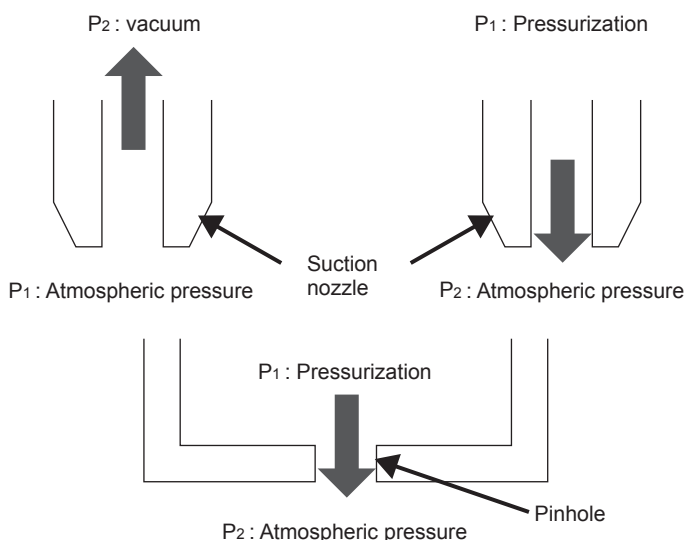
$$Q = 226.4 \times S \times \sqrt{P_2 (P_1 - P_2)}$$

Q : Flow rate L/min

P<sub>1</sub> : Primary side absolute pressure MPa

P<sub>2</sub> : Secondary side absolute pressure MPa

S : Effective cross-sectional area of nozzle (pinhole) mm<sup>2</sup>



## ● Example of calculation

The figure below shows the calculated value of flow rate when the nozzle diameter is  $\phi 0.1$  to 2 and P<sub>2</sub> is varied.

	P <sub>1</sub> (MPa) Absolute pressure	P <sub>1</sub> (MPa) Gauge pressure	P <sub>2</sub> (MPa) Absolute pressure	P <sub>2</sub> (MPa) Gauge pressure	Acoustic velocity/subsonic velocity	Calculated flow rate value (L/min)								
						ø0.1	ø0.2	ø0.3	ø0.4	ø0.5	ø0.7	ø1	ø1.5	ø2
Vacuum	0.1013	0	0.0313	-0.07	Acoustic velocity	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007
	0.1013	0	0.0413	-0.06	Acoustic velocity	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007
	0.1013	0	0.0513	-0.05	Acoustic velocity	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007
	0.1013	0	0.0613	-0.04	Subsonic velocity	0.088	0.352	0.792	1.408	2.200	4.312	8.800	19.801	35.202
	0.1013	0	0.0713	-0.03	Subsonic velocity	0.082	0.329	0.740	1.315	2.055	4.028	8.220	18.494	32.878
	0.1013	0	0.0813	-0.02	Subsonic velocity	0.072	0.287	0.645	1.147	1.792	3.512	7.166	16.125	28.666
	0.1013	0	0.0913	-0.01	Subsonic velocity	0.054	0.215	0.483	0.859	1.343	2.631	5.370	12.083	21.480
Blow (leakage inspection)	0.1113	0.01	0.1013	0	Subsonic velocity	0.057	0.226	0.509	0.905	1.414	2.772	5.657	12.727	22.626
	0.1213	0.02	0.1013	0	Subsonic velocity	0.080	0.320	0.720	1.280	2.000	3.920	8.000	17.999	31.998
	0.1413	0.04	0.1013	0	Subsonic velocity	0.113	0.453	1.018	1.810	2.828	5.543	11.313	25.454	45.252
	0.1613	0.06	0.1013	0	Subsonic velocity	0.139	0.554	1.247	2.217	3.464	6.789	13.856	31.175	55.423
	0.1813	0.08	0.1013	0	Subsonic velocity	0.160	0.640	1.440	2.560	4.000	7.840	15.999	35.998	63.996
	0.2013	0.1	0.1013	0	Acoustic velocity	0.179	0.716	1.610	2.862	4.472	8.765	17.888	40.248	71.552
	0.3013	0.2	0.1013	0	Acoustic velocity	0.268	1.071	2.410	4.284	6.694	13.119	26.774	60.242	107.096
	0.4013	0.3	0.1013	0	Acoustic velocity	0.357	1.426	3.209	5.706	8.915	17.474	35.660	80.236	142.641
	0.5013	0.4	0.1013	0	Acoustic velocity	0.445	1.782	4.009	7.127	11.137	21.828	44.547	100.230	178.186
	0.6013	0.5	0.1013	0	Acoustic velocity	0.534	2.137	4.809	8.549	13.358	26.182	53.433	120.224	213.731

(CAUTION)

- When there is a leakage in the piping, etc., the actual flow rate becomes larger than the calculated value. When selecting the flow rate, consider the amount of leakage in the piping.
- When there is a portion narrower than the suction nozzle diameter in the middle of the piping, the flow rate may be reduced to lower than the calculated value. In addition, suction confirmation, etc., may become impossible.
- The effective cross-sectional area is just a guideline. When the nozzle is long and thin, the effective cross-sectional area becomes smaller than the opening area.
- The response time is determined by the inner volume of the piping from the flow rate sensor to suction nozzle (pinhole). For high-speed detection, reduce the inner volume of the piping as much as possible by installing a flow rate sensor near the suction nozzle, etc.

## Product weight

### ■ Resin body

[Unit: g]

Model No.	Fitting Description	LCD display		Bar display	IO-Link
		Without needle valve	With needle valve		
BH1	Push-in (for ø4 mm straight)	60	90	50	50
CH1	Push-in (for ø6 mm straight)	50	80	40	50
DH1	Push-in (for ø8 mm straight)	80	120	70	80
EH1	Push-in (for ø10 mm straight)	80	120	70	80
HH1	Push-in (for ø1/4" straight)	60	90	50	50
JH1	Push-in (for ø3/8" straight)	80	120	70	80
AA1	Rc1/8 Straight	60	90	50	50
BA1	Rc1/4 Straight	60	100	50	60
CA1	Rc1/2 Straight	120	–	110	120
AF1	G1/8 Straight	70	100	60	70
BF1	G1/4 Straight	85	125	75	85
CF1	G1/2 Straight	120	–	110	120
AB1	G1/8 Straight	60	90	50	60
BB1	G1/4 Straight	70	110	60	70
CB1	G1/2 Straight	140	–	130	140
AC1	NPT1/8 Straight	50	80	50	50
BC1	NPT1/4 Straight	60	100	50	60
CC1	NPT1/2 Straight	120	–	110	120
BH2	Push-in (for ø4 mm elbow)	70	100	60	60
CH2	Push-in (for ø6 mm elbow)	60	90	50	60
DH2	Push-in (for ø8 mm elbow)	100	140	90	90
EH2	Push-in (for ø10 mm elbow)	100	140	90	100
HH2	Push-in (for ø1/4" elbow)	70	100	60	60
JH2	Push-in (for ø3/8" elbow)	100	140	90	100
AA2	Rc1/8 Elbow	70	100	60	60
BA2	Rc1/4 Elbow	80	120	70	80
AF2	G1/8 Elbow	80	110	70	80
BF2	G1/4 Elbow	105	145	95	105
AB2	G1/8 Elbow	70	100	60	70
BB2	G1/4 Elbow	90	130	80	90
AC2	NPT1/8 Elbow	70	100	60	60
BC2	NPT1/4 Elbow	80	120	70	80

### ■ Stainless steel body

[Unit: g]

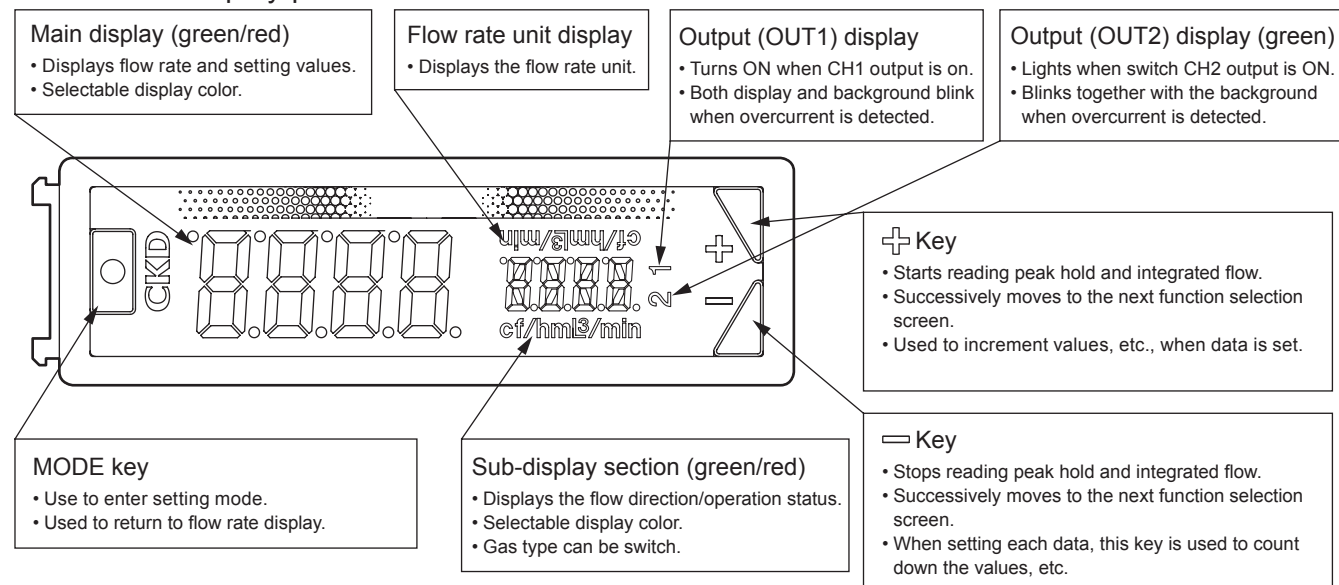
Model No.	Fitting Description	LCD display		Bar display	IO-Link
		Without needle valve	With needle valve		
AA1	Rc1/8 Straight	100	165	90	95
BA1	Rc1/4 Straight	115	200	105	110
CA1	Rc1/2 Straight	420	–	410	420
AF1	G1/8 Straight	155	220	145	150
BF1	G1/4 Straight	190	275	180	185
CF1	G1/2 Straight	420	–	410	420
AB1	G1/8 Straight	100	165	90	95
BB1	G1/4 Straight	110	195	100	105
CB1	G1/2 Straight	440	–	430	440
AC1	NPT 1/8 Straight	100	165	90	95
BC1	NPT 1/4 Straight	115	200	105	110
CC1	NPT 1/2 Straight	420	–	410	420
AD1	1/4" double barbed fitting (500 mL/min to 50 L/min)	155	220	145	150
BD1	1/4" double barbed fitting (50 L/min to 200 L/min)	190	275	180	190
AE1	1/4" JXR male fitting (500 mL/min to 50 L/min)	155	220	145	150
BE1	1/4" JXR male fitting (50 L/min to 200 L/min)	190	275	180	190



LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products
Resin body				Stainless steel body									

## Names and functions of display/operation section (LCD display)

### Names of display parts



### Error code

Error code	Cause	Countermeasures
	The flow rate exceeds the flow rate display range.	Reduce the instantaneous flow rate value to within the flow rate range.
	Sensor has failed.	Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	The flow rate is below the lower limit of the flow rate display range.	Increase the instantaneous flow rate value to within the flow rate range.
	Sensor has failed.	Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	An error occurred during CPU processing.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	The zero adjustable range has been exceeded.	Make sure to set the flow rate to zero, and then perform the zero adjustment.
	An error occurred during EEPROM reading or writing operation.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	An error occurred during memory reading or writing.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	Sensor abnormality has occurred.	Then turn power ON again. If the abnormality is not resolved, a probable cause is a product failure. Replace the product. If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.
	Copying of settings failed.	Check connections and perform the operation again.
	Button operation is locked.	Release the lock before operating the buttons.
	A password is set.	Enter the set password. *Take care not to forget your password.
	Blinking of output display (Switch output is not output)	The switch output's overcurrent protection circuit has operated. Check whether load current exceeds the rating. Correctly connect, then turn the power ON again.

## Names and functions of display/operation section (LCD display)

The functions and various settings are made during the normal flow rate display and during each mode.  
Each mode is divided into a maintenance mode, SET mode and setting monitor mode according to the frequency of use.

### ● Normal operation (RUN mode)

Item	Explanation	Default setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	Display (measuring)
Peak hold function	Max. and min. values for the flow rate within a set interval are displayed.	Non-display (stopped)
CO <sub>2</sub> discharge display	By setting the power, discharge pressure, and flow rate of the compressor, as well as the power to CO <sub>2</sub> conversion coefficient, you can learn how much CO <sub>2</sub> is being discharged. (reference value obtained by calculation) This is available only when the gas type is set to air.	Non-display (stopped)
Integrating flow display	The integrated flow can be displayed. The switch output function includes a function to turn the switch ON/OFF at a level higher than the recommended cumulative value, and an integrated pulse function to output the pulse at a set cumulative value.	Non-display (measuring)

### ● SET Mode

No.	Item	Explanation	Default setting
F.01	Selection of CH1 operation	Select the CH1 setting. Switch output operation and integrated pulse can be set.	Without switch output
F.02	Selection of CH2 operation	Select the CH2 setting. Select whether to use CH2 as a switch output, or to use as an external input (integrated value reset/auto reference).	Without switch output
F.03	Integrating function settings	Whether to continuously acquire integrated flow values or set a time can be selected. Whether or not to hold that data also can be selected.	Continuous acquisition: Data hold OFF
F.04	Sub-screen display setting	Set the sub-display section's display method. The display can be switched to "flow direction", "reference state", "gas type", or "numbering display".	Flow direction
F.05	Display color setting	Set the display color. (red, green) The color for a normal display and for switch output ON can be set.	At normal: Green At switch ON: Red
F.06	Setting of flow rate direction (Bi-directional type)	Setting the flow rate direction. Setting available for bi-directional, one-side forward direction or one-side reverse direction.	Bi-direction
F.07	Display inversion function	The LCD display can be flipped vertically.	Standard display
F.08	Reference state setting	Whether to set standard state or reference state can be selected. Standard state (ANR): Converted into volumetric flow rate at 20°C, 1 barometric pressure, 65%RH (For gas types other than air: 20°C, 1 barometric pressure, 0% RH) Reference state (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure, 0%RH	ANR
F.09	Unit setting (overseas models only)	The unit can be set. Can be selected from L/min and cf/h (cf/min).	Domestic model: L/min Overseas model: L/min
F.10	Display cycle setting	The digital display refresh cycle can be set in three stages from 0.25 sec to 1 sec. If the display flickers, it may be improved by setting a longer display refresh cycle.	0.25 sec
F.11	Analog output Setting response time	Set the response time. Analog output can be set in seven steps from 0.05 sec to approx. 1.50 sec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	0.05 sec
F.12	Numbering setting	Numbering can be set.	0000
F.13	Gas type switch	The measured gas can be switched. (Model with full scale flow rate of 200 L/min or below) (The gas type cannot be switched on an oxygen type.)	Air
F.14	Setting ECO mode	ECO mode can be set. If the buttons are not operated for approx. one minute, the ECO mode will activate and turn OFF the display's backlight. Current consumption can be reduced with this mode.	OFF
F.15	CO <sub>2</sub> discharge calculation setting	The CO <sub>2</sub> discharge calculation can be set. Set you compressor power, discharge pressure, flow rate, and CO <sub>2</sub> conversion coefficient.	• Power: 0.20 KW • Pressure : 0.10 MPa • Flow rate: 100 L/min • Conversion factor: 0.000 kg (CO <sub>2</sub> ) /kwh
F.16	Lock setting	The key lock and password methods can be set. Use these selectively depending on the working environment.	OFF
F.17	Peak hold setting	Whether to continuously acquire peak hold values or set a time can be selected. Whether or not to hold that data also can be selected.	Continuous acquisition: Data hold OFF

### ● Maintenance mode

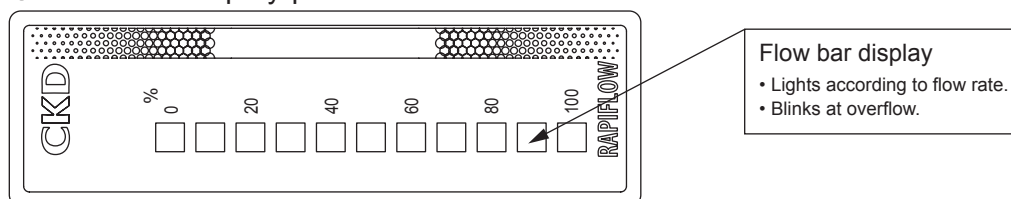
No.	Item	Explanation	Default setting
F.91	Forced output function	Use this function to forcibly turn the switch output ON and confirm the wiring connection or initial operation of the input device.	-
F.92	Zero adjustment	The zero point deviation is corrected.	Adjust value: 000
F.93	Setting copy function	Set values can be copied if the model supports copying between two FSM3's. (Copying is possible only between products with the same model No.)	-
F.99	Reset function	Returns settings to their default states.	-

### ● Setting monitor mode

Item	Explanation	Default setting
Setting monitor function	Details set in the SET mode can be confirmed. (Setting details cannot be edited.)	-

### Names and functions of display/operation section (bar display type)

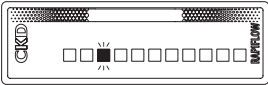


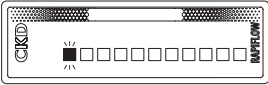

- Names of display parts



[Example] Display in the case of FSM3-B101□□□□□□□.

Flow rate	Uni-direction	Bi-directional
0%		
+60% (Forward direction)		
+110% (Forward direction) Blinks at overflow. * Blinks at +110% F.S. or more.		
-10% (Reverse direction)		
-110% (Reverse direction)		

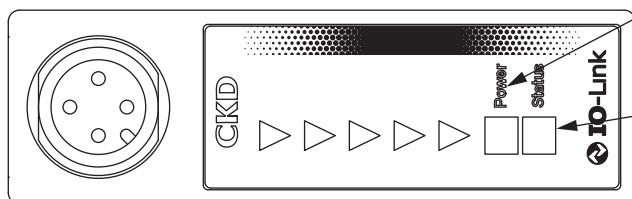
- Error code

Error code	Cause	Countermeasures
<p>The third from left blinks</p> 	An abnormality occurred during memory reading or writing.	<p>Then turn power ON again.</p> <p>If the abnormality is not resolved, a probable cause is a product failure. Replace the product.</p> <p>If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.</p>
<p>[Uni-direction] All blink</p> 	The flow rate exceeds the flow rate display range.	Reduce the instantaneous flow rate value to within the flow rate range.
<p>[Bi-directional] The right half blinks</p> 	Sensor failure	<p>Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product.</p> <p>If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.</p>
<p>[Uni-direction] The leftmost blinks</p> 	The flow rate is below the lower limit of the flow rate display range.	Increase the instantaneous flow rate value to within the flow rate range.
<p>[Bi-directional] The left half blinks</p> 	Sensor failure	<p>Confirm that the flow rate is within the flow rate range, and turn power ON again. If the error is not resolved, a probable cause is a product failure. Replace the product.</p> <p>If you feel that there is an abnormality with the product, stop use and contact your CKD branch or dealer.</p>

LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products
Resin body				Stainless steel body									

## Names and functions of display/operation section (IO-Link)

### ● IO-Link



#### Power lamp (green)

- Lights when power supply is ON.
- Blinks during IO-Link communication.

#### Status lamp (green, orange, red)

- Green ..... Lights when the flow rate is within the specified range.
  - Orange .... On when the flow rate exceeds 100% F.S. and is 110% F.S. or below.
  - Red ..... On when the flow rate exceeds 110% F.S. Lights when an error occurs.
- \* The lamp turns off when the flow rate is under  $\pm 3\%$  F.S.

### ● Communication specifications

Item	Details
Communication protocol	IO-Link
Communication protocol version	V1.1
Transmission bit rate	COM2 (38.4 kbps)
Port	Class A
Process data length (input)	4 bytes
Process data length (output)	0 byte
Min. cycle time	5 ms
Data storage	1 kbyte
SIO mode support	None

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Data name	MSB															LSB
	Instantaneous flow rate															
Data range	Refer to Table 1															
Format	Integer 16															

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data name	Error	WARNING	-	-	-	-	Switch output		Vacant							
							2	1								
Data range	True/False															
Format	Boolean															

Data range (Table 1)

		005	010	020	050	100	200	500	101	201	501	102
Data range (□/min)	U	-50 to 550 mL	-100 to 1100 mL	-0.20 to 2.20 L	-0.50 to 5.50 L	-1.00 to 11.00 L	-2.0 to 22.0 L	-5.0 to 55.0 L	-10.0 to 110.0 L	-20 to 220 L	-50 to 550 L	-100 to 1100 L
	B	-550 to 550 mL	-1100 to 1100 mL	-2.20 to 2.20 L	-5.50 to 5.50 L	-11.00 to 11.00 L	-22.0 to 22.0 L	-55.0 to 55.0 L	-110.0 to 110.0 L	-220 to 220 L	-550 to 550 L	-1100 to 1100 L

\* The data range changes when CO<sub>2</sub> is set as the gas type. Refer to page 38.

\* Download the IO-Link configuration files (IODD) from the CKD website (<https://www.ckd.co.jp/>).

Item	Explanation	Default setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	–
Integrating flow display	Displays the integrating flow counted after indicating to start logging.	Stop
Instantaneous flow rate peak value display (Peak hold function)	Displays the maximum and minimum instantaneous flow rate values during the period between indicating to start logging and stop logging.	Stop
Error display	Displays the error details.	–
Warning display (WARNING)	Displays the warning details.	–
Power ON time display	Displays the total power ON time from the start of use. This time is not reset even if the power turns OFF. (Also not reset when using the reset setting)	–
Operation for switch output function	The switch output operation function can be set. This function can be used to monitor whether the flow rate is within the set range or monitor whether it exceeds the set flow rate.	Not set
Flow rate standard setting	The flow rate standard can be selected. Standard condition (ANR): Converted into volumetric flow rate at 20°C, 1 barometric pressure, 65% RH (For gas types other than air: 20°C, 1 barometric pressure, 0% RH) Standard condition (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure, 0% RH	ANR
Gas type switch	The measured gas can be switched. (Model with full scale flow rate of 200 L/min or below. The gas type cannot be switched on an oxygen type)	Air
Change travel average (Setting response time)	The travel average when measuring can be set. The average can be set in seven steps from 50 msec to 1500 msec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	50msec
Lock setting	Parameter Lock can be set, which disables changing the parameters of the unit. Data Storage Lock can be set, which prohibits uploading and downloading set values to the master. (Parameter Lock and Data Storage Lock and be set simultaneously)	Not set
Zero adjustment	The zero point deviation is compensated. (within $\pm 10\%$ F.S.)	Not set
Data storage function	Uploading set values to the master and downloading set values from the master are possible. (Can be copied by the same model No.)	–
Reset function	Returns the settings to the factory settings. (Cannot reset while Parameter Lock is enabled)	–
Unit identification function	The model No., serial No. or other unit-unique information can be confirmed on the network.	–

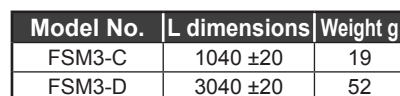


FSM3 - K - P70

- **B** Clean-room specifications

## Lead wire dimensions

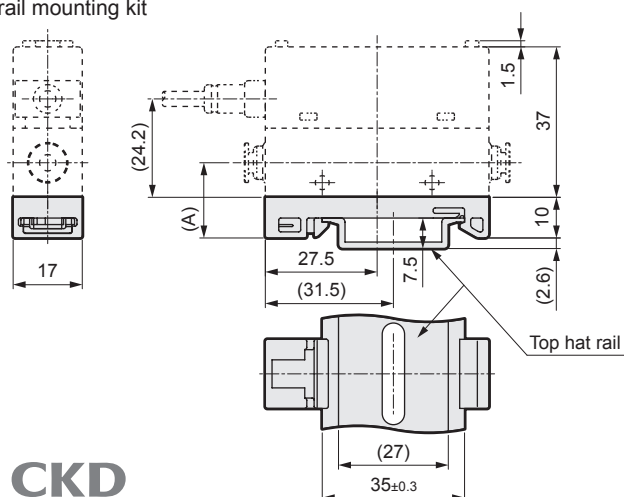
4-conductor lead wire (for bar display)



Terminal No.	Cable color
1	Brown
2	Black
3	White
4	Blue

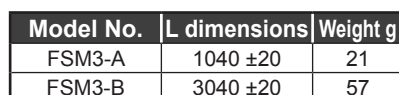
## ● FSM3-M

DIN rail mounting kit



● FSM3-A, B

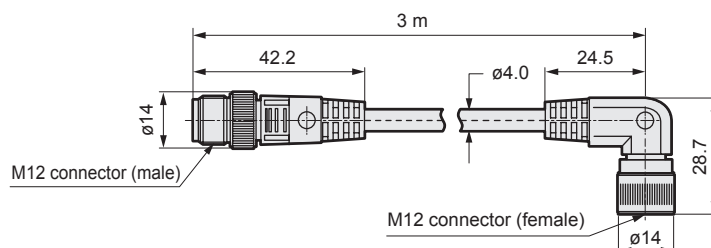
5-conductor lead wire (for LCD display, for separated display)



Terminal No.	Cable color
1	Brown
2	Black
3	White
4	Gray
5	Blue

## ● FSM3-G

(M12 both-end lead wire with connector)



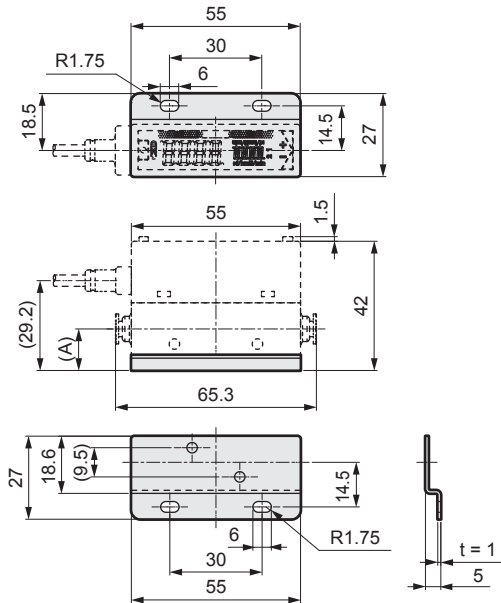
Terminal No.	Cable color
1	Brown
2	White
3	Blue
4	Black

Model No.	Dimension (A)
FSM3-□□□1/BH1/CH1/HH1/AA1/AB1/AC1	18.5
FSM3-□□□1/DH1/EH1/JH1/BA1/BB1/BC1	23.0

## Dimensions with options

### ● FSM3-H

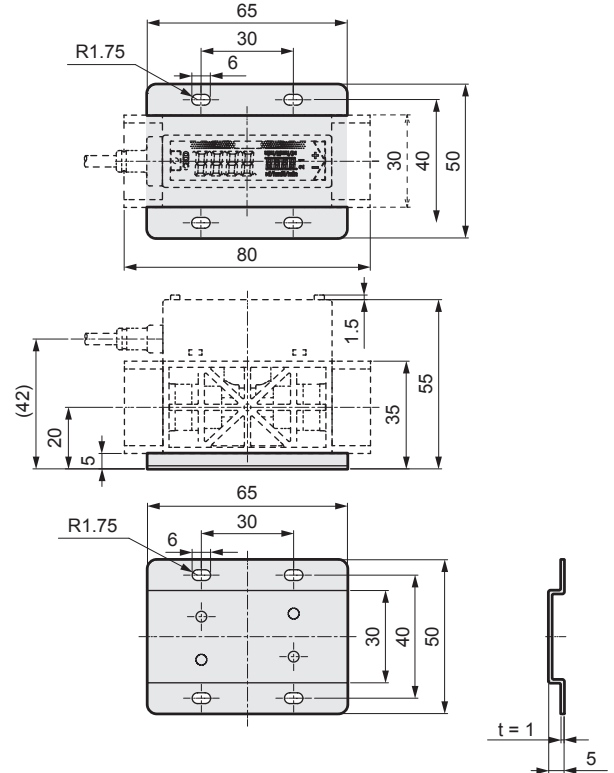
Bracket 1 (for models 200 L or less)



Model No.	Dimension (A)
FSM3-□□□1/BH1/CH1/HH1/AA1/AB1/AC1	13.5
FSM3-□□□1/DH1/EH1/JH1/BA1/BB1/BC1	18.0

### ● FSM3-J

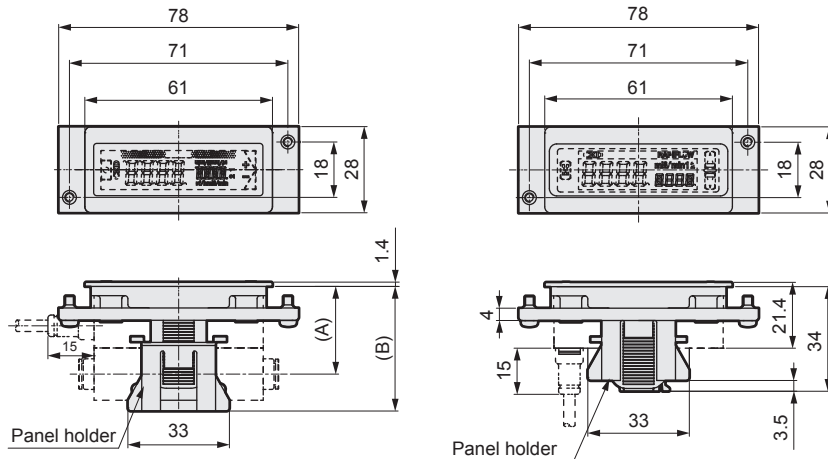
Bracket 2 (for models 500 or 1000 L)



### ● FSM3-K

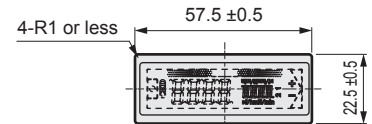
Panel mounting kit 1 (for LCD display, separated display)

- LCD display
- Separated display

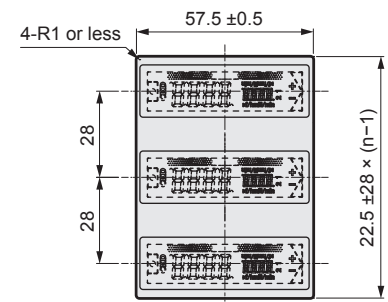


[Panel cut dimension]

In case of single installation



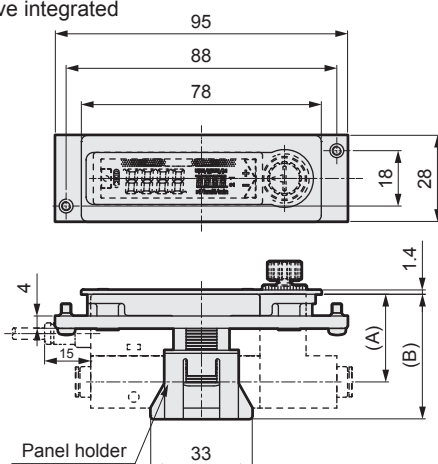
For continuous installation



### ● FSM3-L

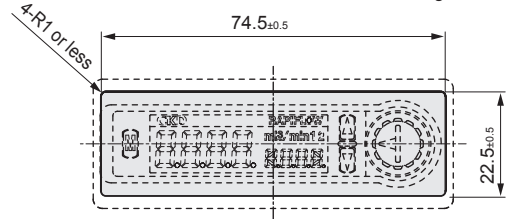
Panel mounting kit 2 (for needle valve integrated)

- Needle valve integrated



[Panel cut dimension]

In case of single installation



Model No.	Dimension (A)	Dimension (B)
FSM3-□□□1/BH2/CH2/HH2/AA2/AB2/AC2/□□□/N/T	28.5	40.5
FSM3-□□□1/DH2/EH2/JH2/BA2/BB2/BC2/□□□/N/T	30	46.5



Pilot operated 2-port solenoid valve for compressed air

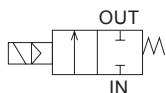
# EXA Series screw-in connection body

- NC (normally closed)
- Port size: Rc1/4, 3/8



## JIS symbol

- NC (normally closed)



## How to order

**EXA - 02 - 1 2C - 3**

Model No.

**A** Port size

**B** Sealant/pilot operated combination

**C** Coil option

**D** Voltage

Code	Description
<b>A Port size</b>	
<b>02</b>	Rc1/4
<b>03</b>	Rc3/8
<b>B Sealant/pilot operated combination</b>	
<b>0</b>	H-NBR, internal exhaust specifications
<b>1</b>	H-NBR, external exhaust specifications*1
<b>C Coil option *2</b>	
<b>2C</b>	Standard Lead wire (without surge suppressor)
<b>D Voltage *2</b>	
<b>1</b>	100 VAC
<b>3</b>	24 VDC
<b>4</b>	12 VDC

\*1: Check the pressure specifications.

\*2: Please contact us for support with G threads and NPT threads.

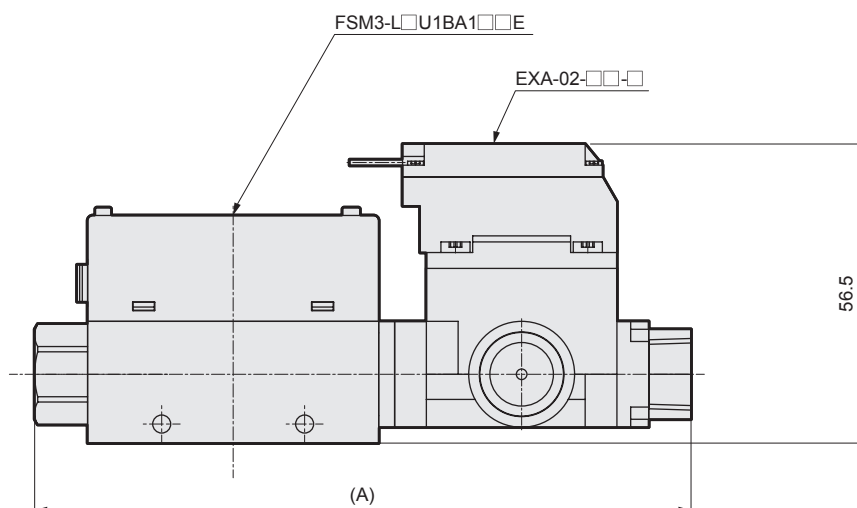
\* For the connection method of FSM3, check the FSM3 instruction manual.

[Example of model No.]

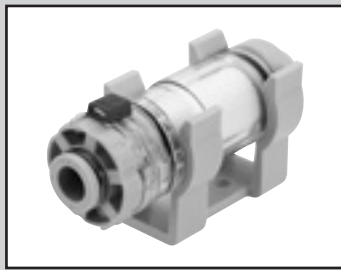
**EXA-02-12C-3**

- A** Port size : Rc1/4
- B** Sealant/pilot operated combination : H-NBR/external exhaust specifications
- C** Coil option : Lead wire (without surge suppressor)
- D** Voltage : DC24V

## FSM3 connection dimensions



Configuration	Dimension (A)
FSM3+EXA-02	124
FSM3+EXA-03	130



Inline filter

# FSL Series

● Port size:  $\varnothing 4$  to  $\varnothing 10$

JIS symbol



RoHS

## Specifications

Item	FSL100		FSL200		FSL500		
Port size mm	$\varnothing 4$	$\varnothing 6$	$\varnothing 4$	$\varnothing 6$	$\varnothing 6$	$\varnothing 8$	$\varnothing 10$
Working fluid	Air						
Operating ambient temperature range °C	0 to 50 (no freezing)						
Max. working pressure MPa	0.8 (*1)						
Vacuum working pressure kPa	-100						
Proof pressure MPa	1.2						
Nominal filtration rating $\mu\text{m}$	10 (Collection efficiency 95%)						
Filtration area $\text{cm}^2$	4.7		7.5		12.7		
Recommended processing flow rate (*2) L/min (ANR)	10		15	20	25	50	60
Weight g	8	8.5	20.5	21.5	34.5	33.5	39

\*1: The max. working pressure is the value at 20°C.

When using in other temperature ranges, refer to the "Relation of working temperature and max. working pressure" on the "Pneumatic, Vacuum and Auxiliary Components (catalog No. CB-024SA)" page.

\*2: Initial flow rate at initial pressure loss 3 kPa or less under negative pressure.

## How to order

**FSL 500 - 1010 - B**

● Series      ● Optional parts

● Vacuum side port size  
- Pad side port size

Code	Description
<b>A Series</b>	
100	FSL100 Series
200	FSL200 Series
500	FSL500 Series
<b>B Vacuum side port size - Pad side port size</b>	
44	Push-in fitting $\varnothing 4$ - Push-in fitting $\varnothing 4$
66	Push-in fitting $\varnothing 6$ - Push-in fitting $\varnothing 6$
88	Push-in fitting $\varnothing 8$ - Push-in fitting $\varnothing 8$
1010	Push-in fitting $\varnothing 10$ - Push-in fitting $\varnothing 10$
<b>C Optional parts</b>	
Blank	None
B	Bracket

## ◆ Series port size combination table

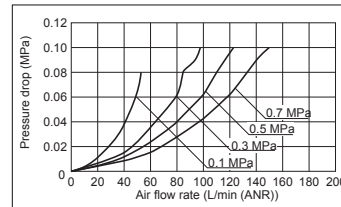
Port size Model No.	44	66	88	1010
FSL100	●	●		
FSL200	●	●		
FSL500		●	●	●

indicates not available.

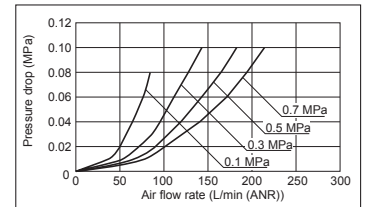
## Flow characteristics

\* The flow characteristics graph gives reference values and does not guarantee the values.

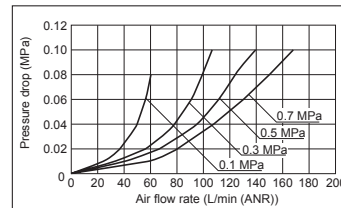
### ● FSL100-44



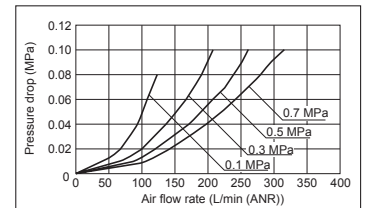
### ● FSL100-66



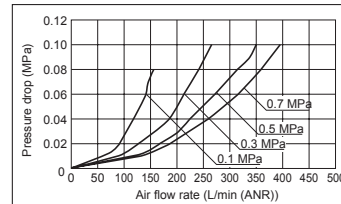
### ● FSL200-44



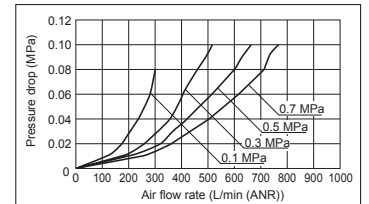
### ● FSL200-66



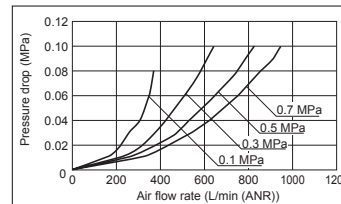
### ● FSL500-66



### ● FSL500-88



### ● FSL500-1010



CKD



Inline clean filter Stainless steel

# FCS500 Series

● Port size: Rc1/8, Rc1/4

JIS symbol



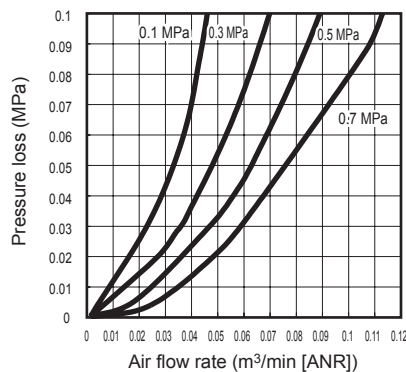
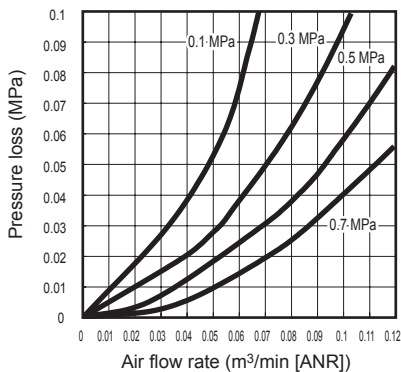
## Specifications

Item		FCS500-66-P90 FCS500-66-P94	FCS500-88-P90 FCS500-88-P94
Working fluid		Compressed air, N <sub>2</sub>	
IN side bore size (*1)		Rc1/8	Rc1/4
OUT side bore size (*2)		Rc1/8	Rc1/4
Proof pressure	MPa	2.25 (Compressed air), 1.5 (N <sub>2</sub> )	
Differential pressure-resistant	MPa	0.5	
Working pressure	MPa	-0.095 to 1.5 (Compressed air), -0.095 to 0.99 (N <sub>2</sub> )	
Ambient/fluid temperatures	°C	5 to 45	
Filtration	μm	0.01 (removal efficiency 99.99%)	
Processing flow rate	ℓ/min (ANR) *1	50	80
Weight	g	100	100
Material	Body	Stainless steel	
	Case	Stainless steel	
	Element	Polypropylene + urethane	
Assembling/inspection/packaging		Integrated production in cleanroom	
Cleaning		Degreasing	

\*1: Initial flow rate at primary pressure 0.7 MPa and pressure drop 0.03 MPa.

\*2: Maximum working pressure varies with working temperature. Check graphs showing the relationship of working temperature and maximum working pressure.

## Flow characteristics



## How to order

**FCS500 - 88 - B - P90**

Model No.  
(clean-room  
specifications)  
(oil-prohibited  
specifications)

**A** Port size

**B** Optional parts  
(not assembled)

**C** Clean-room  
specifications

### A Port size

<b>66</b>	IN side/OUT side port size Rc1/8
<b>88</b>	IN side/OUT side port size Rc1/4

### B Optional parts (not assembled)

<b>Blank</b>	None
<b>B</b>	Bracket, mounting screw

### C Clean-room specifications

	Structure/treatment	Material limitations
<b>P90</b>	Stainless steel Oil free	—
<b>P94</b>	Stainless steel Oil free	Use of copper-, silicon-, or halogen-based materials (e.g. fluorine, chlorine, or bromine) is not possible

Note: "P94" is a made-to-order product.



Inline clean filter

# FCS1000 Series

- Port size: Rc1/4, Rc3/8, R1/4, R3/8  
Push-in fitting ø8, ø10, ø12

JIS symbol



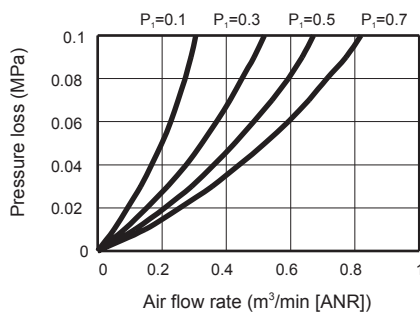
## Specifications

Item		Stainless steel (custom order)	
		FCS1000-(*) (*)-P90 FCS1000-(*) (*)-P94	
Working fluid		Compressed air, N2	
IN side bore size (*1)		Select from Rc1/4 and Rc3/8	
OUT side bore size (*2)			
Proof pressure	MPa	2.25 (Compressed air), 1.5 (N2)	
Differential pressure-resistant	MPa	0.5	
Working pressure	MPa	−0.095 to 1.5 (Compressed air), −0.095 to 0.99 (N2)	
Ambient/fluid temperatures	°C	5 to 45	
Filtration	μm	0.01 (removal efficiency 99.99%)	
Processing flow rate	ℓ/min (ANR)	300 to 400 *1	
Weight	kg	0.5	
Material	Body	Stainless steel	
	Case	Stainless steel	
	Element	Polypropylene + urethane	
Assembling/inspection/packaging		Integrated production in cleanroom	
Cleaning		Degreasing	

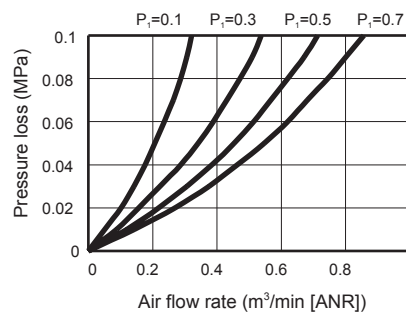
\*1: Initial flow rate at primary pressure 0.7 MPa and pressure drop 0.03 MPa. (Differs according to port size.)

## Flow characteristics

- FCS1000-88
- FCS1000-88-P90-P94



- FCS1000-1010
- FCS1000-1010-P90-P94



## How to order

- Stainless steel (custom order)

**FCS1000 - 8 8 - P90**

Model No.  
(clean-room  
specifications)  
(oil-prohibited  
specifications)

A IN side  
Port size

B OUT side  
Port size

C Clean-room  
specifications

### A IN side port size

8	Rc1/4
10	Rc3/8

### B OUT side port size

8	Rc1/4
10	Rc3/8

### C Clean-room specifications

	Structure/treatment	Material limitations
P90	Stainless steel material used Oil free	-
P94	Stainless steel material used Oil free	Use of copper-, silicon-, or halogen-based materials (e.g. fluorine, chlorine, or bromine) is not possible





# Safety Precautions

Always read this section before use.

When designing and manufacturing a device using CKD products, the manufacturer is obligated to check that device safety mechanism, pneumatic control circuit, or water control circuit and the system operated by electrical control that controls the devices is secured.

It is important to select, use, handle, and maintain CKD products appropriately to ensure their safe usage. Observe warnings and precautions to ensure device safety.

Check that device safety is ensured, and manufacture a safe device.



## WARNING

- 1** This product is designed and manufactured as a general industrial machine part.  
It must be handled by an operator having sufficient knowledge and experience in handling.
  - 2** Use this product in accordance with specifications.  
This product must be used within its stated specifications. In addition, never modify or additionally machine this product. This product is intended for use in general industrial machinery equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments.  
(Note that this product can be used when CKD is consulted prior to use and the customer consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.)
    - ①** Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, devices or applications in contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications.
    - ②** Use for applications where life or assets could be significantly affected, and special safety measures are required.
  - 3** Observe organization standards and regulations, etc. related to the safety of device design and control, etc.  
ISO4414, JIS B 8370 (Pneumatic fluid power - General rules and safety requirements for systems and their components)  
JFPS2008 (Principles for pneumatic cylinder selection and use)  
Including High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, body standards and regulations, etc.
  - 4** Do not handle, pipe, or remove devices before confirming safety.
    - ①** Inspect and service the machine and devices after confirming safety of all systems related to this product.
    - ②** Note that there may be hot or charged sections even after operation is stopped.
    - ③** When inspecting or servicing the device, turn OFF the energy source (air supply or water supply), and turn OFF power to the facility. Discharge any compressed air from the system, and pay attention to possible water leakage and leakage of electricity.
    - ④** When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety is secured, such as through pop-out prevention measures.
  - 5** Observe warnings and cautions in the following pages to prevent accidents.
- The precautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.



**DANGER:** When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, and when there is a high degree of emergency to a warning.



**WARNING:** If handled incorrectly, a dangerous situation may occur, resulting in death or serious injury.



**CAUTION:** When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation. Every item provides important information and must be observed.

## Limited warranty and disclaimer

- 1** Warranty period  
This warranty shall be valid for one year after delivery to the customer's designated site.
- 2** Scope of warranty  
If any faults, found to be the responsibility of CKD, occur during the above warranty term, the product shall be replaced, the required replacement parts provided free of charge, or shall be repaired at the CKD factory free of charge.  
This Limited Warranty will not apply to:
  - (1) Failures due to use outside the conditions and environments set forth in the catalog or these specifications.
  - (2) Failures resulting from factors other than this product.
  - (3) Failures caused by improper use of the product.
  - (4) Failures resulting from modifications or repairs made without CKD consent.
  - (5) Failures caused by matters that could not be predicted with the technologies in practice when the product was delivered.
  - (6) Failures resulting from natural disasters or accidents for which CKD is not liable.The warranty covers the actually delivered product, and does not cover any damage resulting from losses induced by faults in the delivered product.
- 3** Compatibility check  
The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.





## Safety precautions

# Pneumatic components: Warning and Cautions

Always read this section before use.

Please see Page 63 in the preface for general precautions on air pressure equipment.

## Product-specific precautions: Compact flow sensor FSM3 series

### Design/selection

#### Working fluids

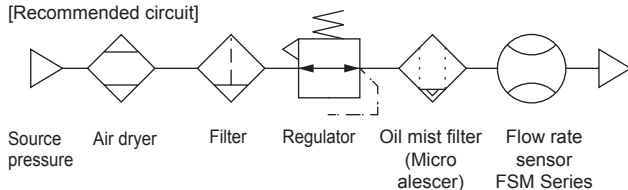
##### DANGER

- Do not use this product for flammable fluids.

##### WARNING

- This product cannot be used as a business meter.  
Do not use this product for commercial transactions as it is not compliant with the Measurement Act. Intended applications include industrial sensors.
- Do not use fluids which are not applicable.
- Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist.
- Depending on the fluid, retaining the fluid for long periods could adversely affect the performance. Do not seal the fluid in the pipe for long periods of time.
- When using compressed air, use clean air that complies with JIS B 8392-1: 2012 Class 1.1.1 to 1.6.2. As compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.), install a filter, air dryer, and oil mist filter (micro alescerc) on the primary side (upstream side) of the sensor. The sensor's mesh rectifies flow in the pipe. It does not filter out foreign matter, so provide a filter.

[Recommended circuit]



- Working pressure/flow rate range  
Applications exceeding the max. working pressure and specified flow rate range may result in faults. Use this product only within the specified range. If energized in a vacuum state of  $-0.07$  MPa or less, the sensor's heat dissipation performance will suffer, leading to degradation of the sensor.
- When using a valve on the primary side of the sensor, use only valves with oil-prohibited specifications. This sensor could malfunction or fail if exposed to splattering grease, oil, etc. As friction powder may be generated depending on the valve, mount a filter to prevent the powder from entering the sensor.

- The sensor for oxygen gas is a custom model.  
To prevent ignition accidents, treat the inside of the flow paths on oxygen models in accordance with oil free specifications. Do not allow oxygen gas to flow again when a fluid other than oxygen has flown even once.
- When using with liquefied gases such as carbon dioxide, always vaporize the gas. Failure may result if liquefied gas enters the product.

#### Working environment

##### DANGER

- Explosion-proof environments  
Never use this product in an explosive gas atmosphere. The structure is not explosion-proof, and explosions or fires could occur.

##### WARNING

- Corrosive environments  
Do not use this product in an atmosphere containing corrosive gases such as sulfur dioxide.
- Ambient/fluid temperatures  
Use ambient temperature/fluid temperature from  $0$  to  $50^{\circ}\text{C}$  within specified range.  
Even if the temperature is within the specified range, do not use this product if the ambient temperature and fluid temperature could suddenly change and cause dew to condense.
- Drip-proof environments  
The degree of protection of this product is equivalent to IP40. Do not install this product where water, salt, dust, or swarf is present or in a pressurized or depressurized environment. The product cannot be used with large temperature variations or high temperature/humidity since condensation may occur inside the body.

LCD display	Bar display	IO-Link	Internal structure
Resin body			
LCD display	Bar display	IO-Link	Internal structure
Stainless steel body			
Separated display			
Technical data			
Operating method			
Optional products			
Safety precautions			
Related products			

LCD display	Resin body	Internal structure	Stainless steel body	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products
Bar display		IO-Link		Bar display					
IO-Link		Internal structure		IO-Link					
Bar display		LCD display		Bar display					

## Flow rate unit

### CAUTION

- This product's flow rate is measured at a mass flow rate unaffected by temperature or pressure. The unit is L/min, but this is the display when the mass flow rate is converted to volumetric flow rate at 20°C, 1 barometric pressure (101 kPa), and relative humidity of 65%. (Conditions for gas types other than air are 20°C, 1 barometric pressure (101 kPa), relative humidity 0%)

## Overflow

### CAUTION

- With each series, the sensor can handle an overflow double the measured range. If dynamic pressure is applied near the maximum working pressure (when a pressure difference exceeding the max. working pressure is applied between primary and secondary sides), the sensor may operate abnormally. If dynamic pressure is applied, such as when a workpiece is filled for leakage inspection, provide a bypass circuit or restrictor so that dynamic pressure is not applied to the sensor.

## Integrated needle valve

### CAUTION

- This valve cannot be used as a stop valve that requires no leakage. Slight leakage is allowed for in this product's specifications.
- Please be sure to use needle valves as fixed apertures as they do not become linear in accordance with the number of rotations.

## Use for suction confirmation, etc.

### CAUTION

- Provide an air filter upstream from suction to prevent the entry of foreign matter.
- Consider the atmospheric dew point and the product's ambient temperature, and use the product under conditions in which dew does not condense in pipes.
- When this product is used for vacuum applications such as air suction, do not bend the tube near the push-in fitting. If stress is applied to the tube near the push-in fitting, insert an insert ring into the tube, and connect the tube to the push-in fitting.

- Select the flow rate range based on the operating vacuum pressure and suction nozzle.

- Response time may be delayed by the piping volume between the suction nozzle and this product. In this case, take countermeasures to reduce piping capacity.

- When the suction confirmation sensor is switched from a pressure sensor (switch) to a flow rate sensor (switch), sensor output (switch output) logic will be reversed. Refer to the drawing below. Note that the PLC sequence program must be changed or revised. If source pressure or vacuum source is not supplied when device power is turned on, "flow rate 0" = "sensor output (switch output) ON" status is set at the flow rate sensor (switch). Check that this is not a problem with the PLC sequence program, etc.

	Pressure sensor(switch)	Flow rate sensor(switch)
Suction confirmation	<p>ON at setting value or more</p> <p>Atmospheric pressure side      High vacuum side</p>	<p>ON at setting value or less</p> <p>Flowrate 0 side      High flow rate side</p>

## Others

### CAUTION

- The flow path is not completely free of dust generation. A final clean filter should be used in circuits where dust generation could be a problem.

### Mounting, installation and adjustment

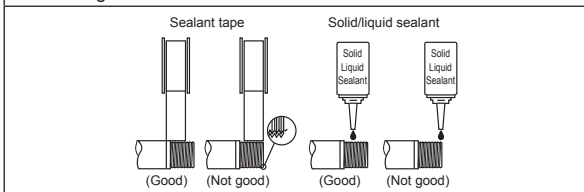
#### Piping

#### CAUTION

- Always attach the pipes before starting wiring.
- Align the fluid flow direction to the direction indicated on the pipe when connecting the pipes.
- Do not install the regulator/solenoid valve, etc., immediately before this product. Generated drift may cause errors. Provide a straight pipe with approx. 10 times the bore size when necessary.
- Before installing piping, clean out the pipes using air blower to remove all foreign matter and cutting chips from the pipes. The rectifier or sensor chip could be damaged if a large amount of foreign matter, cutting chips, etc., enters.
- Check that sealant tape or sealant material does not get inside during piping.

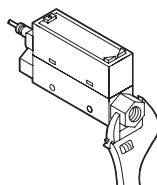
\* When using for clean room specifications, make sure that the sealant material matches the system.

When winding fluoro resin sealing tape around threads, wind sealing tape once or twice, leaving two to three threads open at the end of the thread. Press tape with your fingernail tip to stick it onto threads. When using liquid sealant, leave one to two threads open from the end, and avoid applying too much. Check that the sealant does not get on device threads.



- The resin body screw-in fittings of this product are compliant with push-in fittings for pneumatic pressure. Do not use this product for pneumatic pressure circuits with steel pipe connections. If this product is used for steel pipe connection, the misalignment of the IN side steel pipe bore and OUT side steel pipe bore will cause excessive force to be applied to the body, as well as external leakage, risking damage to the product.

- Attach a wrench to metal sections when tightening pipes so that force is not applied to the resin section.



#### [Reference value]

Port thread	Tightening torque N·m
Rc1/8 (G1/8)	3 to 5
Rc1/4	6 to 8
Rc1/2	16 to 18

- Refer to the torque below so that excessive screw-in torque or load torque is not applied to the connection port.

- When using a push-in fitting, accurately insert tube and confirm that it cannot be pulled out. Cut the tube at a right angle with a dedicated cutter before use.

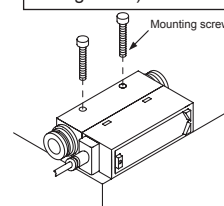
- Be sure to connect a fitting even when using the metal body with the OUT side opened. The port filter could become detached.
- Make sure that the leakage detection solution does not enter the inside of this product when inspecting the pipe for leaks.
- Do not turn fittings while fluid pressure is still applied to this product. Doing so might result in external leakage.

#### Mounting

#### CAUTION

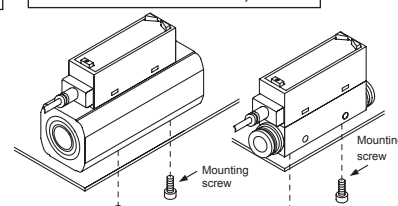
- The LCD display type flow rate meter uses a liquid crystal display. This may be difficult to read depending on the angle.
- Do not install multiple product bodies in close contact. The generation of heat on each part could cause the product's temperature to rise, hastening changes in characteristics or deterioration of the resin material. When using the products in a row, set intervals of distance of 10 mm and over.
- Although the mounting is "unrestricted in vertical/horizontal direction", the flow rate may vary depending on difference in the mounting orientation or piping conditions.

#### Lateral mounting (use of through hole)

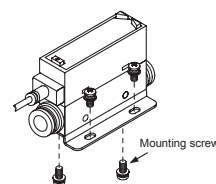


Tighten the mounting screw with a tightening torque of 0.5 N·m.

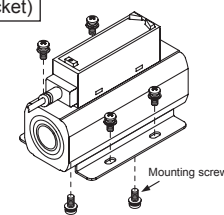
#### Vertical mounting (use of female thread on bottom surface)



#### Bracket mounting (use of dedicated bracket)

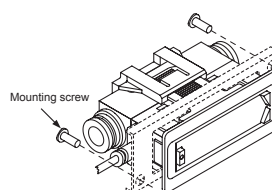


For FSM3-□005 to 201  
Bracket model No.: FSM3-B1  
Tighten the mounting screw with a tightening torque of 0.5 N·m.

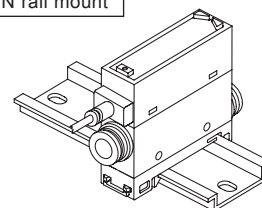


For FSM3-□501 and 102  
Bracket model No.: FSM3-B2

#### Panel mounting



#### DIN rail mount



Tighten the mounting screw with a tightening torque of 0.06 N·m. Complete the piping before assembly.

If the pipes are connected after assembly, excessive stress will be applied and may damage the product.

When using the panel mounting method, make sure that vibration is not applied to the product. When using on a stainless steel body, the vibration will be amplified and could damage the product.

LCD display	Bar display	IO-Link	Internal structure	LCD display	Bar display	IO-Link	Internal structure	Separated display	Technical data	Operating method	Optional products	Safety precautions	Related products

LCD display	Resin body	
Bar display		
IO-Link		
Internal structure	Stainless steel body	
LCD display		
Bar display		
IO-Link		
Internal structure		
Separated display		
Technical data		
Operating method		
Optional products		
Safety precautions		
Related products		

- Note that if you mount the elbow fitting in a downward position, it may interfere with the DIN rail mounting.
- Note that the bracket mounting position may interfere with the elbow fitting.

## Wiring

### ⚠ DANGER

- Use power supply voltage and output within the specified voltage.  
If voltage exceeding the specified voltage is applied, the sensor could malfunction or be damaged, or electrical shock or fire could occur. Do not use any load that exceeds the rated output. Otherwise, output damage or fire may result.
- Stop the control device and equipment and turn power OFF before wiring. Starting operation suddenly could cause unpredictable and dangerous operation. Conduct an energized test with controls and machine devices stopped, and set target switch data. Be sure to discharge any accumulated electrostatic charge among personnel, tools, or equipment before and during work. Connect and wire bending resistant material, such as robot wire material for movable sections.

### ⚠ WARNING

- Install the product and wiring away from sources of noise, such as power distribution wires. Provide separate countermeasures for surge applied to the power cable. The display or output could fluctuate.
- Do not short-circuit the load. Failure to observe this could result in rupture or burning.
- The output impedance of the analog output voltage output type is approximately 1 kΩ. If the impedance of the connecting load is small, output error increases. Check error with the impedance of the connecting load before using. (The analog output current output type is excluded.)

#### Example of calculation

$$\begin{aligned}
 & \left( \begin{array}{ll} \text{FSM3-voltage output impedance: } R_o = 1 \text{ k}\Omega & \\ \text{Load internal impedance} & : R_x = 1 \text{ M}\Omega \end{array} \right. \\
 & \text{Output value} = \left( 1 - \frac{R_o}{R_o + R_x} \right) \times 100\% \\
 & = \left( 1 - \frac{1 \text{ k}\Omega}{1 \text{ k}\Omega + 1 \text{ M}\Omega} \right) \times 100\% \Rightarrow \text{error approx. } 0.1\%
 \end{aligned}$$

- Check wiring insulation.  
Check that wires do not come into contact with other circuits, that no ground faults occur, and that the insulator between terminals is not defective. Overcurrent could flow in and damage the sensor.
- Check line color when wiring. As incorrect wiring could result in sensor damage and malfunctions, check wire color against the instruction manual before wiring.

- Use a stabilized DC power supply within the specified rating that has been insulated from the AC power supply. A non-insulated power supply could result in electrical shock. If power is not stabilized, the peak value could be exceeded. This could damage the product or impair accuracy.
- The power supply for the metal body (stainless steel body) type is a DC stabilized power supply completely isolated from the AC primary side. Connect either the + side or - side of the power to the FG. Between the metal body internal power circuit and metal body, a varistor (limit voltage approx. 40 V) is connected to prevent dielectric breakdown of the sensor. Do not conduct a withstand voltage test or insulation resistance test between the internal power circuit and metal body. Disconnect wiring first if this testing is required. An excessive potential difference between power and metal body will burn internal parts. After installing, connecting and wiring the metal body, electrical welding of the equipment/frame or short-circuit accidents, etc., could cause welding current, transient high voltage caused by welding, or surge voltage, etc., to run through the wiring, ground wire, or fluid path connected between such devices, damaging wires or devices. Conduct any work such as electrical welding after removing this device and disconnecting all electric wires connected to the FG.
- Do not use at levels exceeding the power supply voltage range. If voltage exceeding this range or AC power is applied, the controller could rupture or burn.
- Check that stress (7 N and over) is not directly applied to lead wire leadouts or connectors.
- Please be sure to attach the connector cover after connecting the connector when using an LCD display type or bar display type.
  - The L-shaped cable connector does not rotate. Be sure to never turn it.
  - Please be sure to turn the power OFF before pulling the M12 connector out or inserting it.
  - Please be sure to hold the connector part of the M12 connector when pulling it out or inserting it. Do not pull out by the cable.
  - When fitting the M12 connector; securely position the convex part of the connector terminal on the main body side with the concave part of the cable connector terminal before inserting, and fasten clockwise while holding the knurled part so that the screw threads do not become damaged.
  - Please note that the connector on the main body side can be damaged if the M12 connector is screwed in too tightly. Suggested torque: 0.4 to 0.49 N·m
  - Please keep the length of the wiring between the master and device (the product) 20 m long or shorter when extending the M12 connector cable.



### During adjustment

#### CAUTION

- If switches are operated when fluid is pulsating or flow rate is otherwise unstable, operation may be unstable. In this case, provide sufficient margin between the two setting values and avoid setting switches in an unstable area. Confirm that switch operation is stable before use.

### Integrated needle valve

#### CAUTION

- Do not turn the knob forcibly when fully closing or opening it (0.05 N·m or less). Do not use the lock nut to adjust the needle. Otherwise this could cause needle galling or damage.
- The set flow rate may be unstable if turning the dial of the needle valve forcibly when fully closing. Do not turn the knob forcibly.

## During Use & maintenance

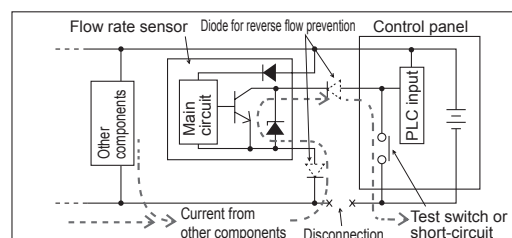
#### WARNING

- Working conditions for CE compliance  
This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:  
Conditions
  - The evaluation of this product is performed by using a lead wire that has a power supply line and a signal line paired to assess the product's performance.
  - This product is not equipped with surge immunity. Implement surge protection measures on the system side.
- Do not disassemble or modify this product. Doing so could result in faults.
- Output accuracy is affected by temperature characteristics and heat generated when energized. Provide a standby time (5 minutes or more) after turning the power ON for use.
- Immediately after power is turned ON, this product does not start flow rate detection switch operation for approx. 5 seconds to complete self-diagnosis. Provide a control circuit/program that ignores signals for at approximately five seconds after power is turned ON.

#### CAUTION

- If a problem occurs during operation, immediately turn power OFF, stop use, and contact your dealer.
- This product uses a micro-sensor chip, and must be installed where it will not be subject to dropping, impact or vibration. Handle this product as a precision component during installation and transportation.
- Keep this product's flow rate within the rated flow range.
- Use this product within the working pressure range.
- Do not turn the product's fitting while the fluid pressure is ON, since it may cause external leakage. Also avoid use that may cause the fitting to rotate during operation.

- If the output setting value is changed, control system devices could operate unintentionally. Stop devices before changing settings.
- Analog output continues even if the flow rate range is exceeded. With the LCD display, "Hi" or "Lo" will be displayed. With the bar display, the bar display will blink.  
Note that this is outside the guaranteed precision.
- The accuracy may vary from the initial status depending on the working environment or working conditions. It is recommended to check the operation of the product periodically.
- The sensor chip will degrade when used for a long time and cause the detected flow rate to vary. Periodically inspect the sensor chip.
- Replace the working gas in the flow paths before changing the gas type.
- Pay attention to the reverse current caused by disconnected wires/wiring resistance. If other devices, including a flow rate sensor, are connected to the same power supply as the flow rate sensor, and the switch output wire and power cable negative (-) side are short-circuited to check the operation of the control panel input unit, or if the power cable negative (-) side is disconnected, reverse current could flow to the flow rate sensor's switch output circuit and cause damage.

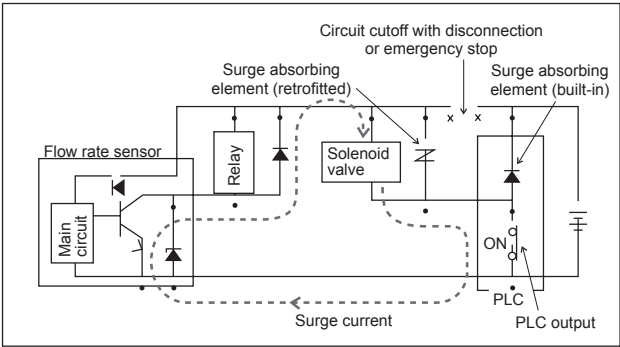


- Take countermeasures as followings to prevent damages caused by reverse current.
  - ① Avoid centralizing current at the power cable, especially the minus side power cable, and use as thick a cable as possible.
  - ② Limit the number of devices connected to the same power supply as the flow rate sensor.
  - ③ Insert a diode parallel to the flow rate sensor's output line to prevent the reverse current.
  - ④ Insert a diode parallel to the flow rate sensor power wire's minus (-) side to prevent the reverse current.

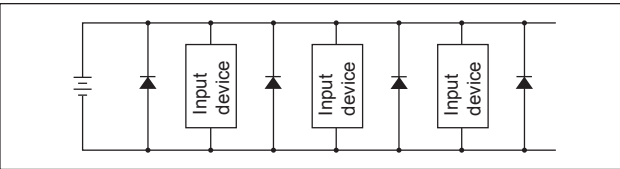
LCD display	Bar display	IO-Link	Internal structure
Resin body			
LCD display	Bar display	IO-Link	Internal structure
Stainless steel body			
Separated display			
Technical data			
Operating method			
Optional products			
Safety precautions			
Related products			

LCD display	Resin body
Bar display	
IO-Link	
Internal structure	
LCD display	Stainless steel body
Bar display	
IO-Link	
Internal structure	
Separated display	Technical data
Operating method	Optional products
Safety precautions	Related products

■ Care must be taken for surge current leading. When flow rate sensor power is shared with an inductive load that generates surges, such as a solenoid valve or relay, if the circuit is cut off while the inductive load is functioning, surge current could enter the switch output circuit and cause damage depending on where the surge absorbing element is installed.



- Take the following countermeasures as followings to prevent damages caused by reverse current.
- ① Separate the power supply for output including the inductive load, such as the solenoid valve and relay, and input, such as the flow rate sensor.
  - ② If a separate power supply cannot be used, directly install a surge absorption element for all inductive loads. Consider that the surge absorption element connected to the PLC, etc., protects only the individual device.
  - ③ Connect a surge absorption element to the following places on the power wiring as shown below as a measure against disconnections in unspecific areas.



When the devices are connected to a connector, the output circuit could be damaged by the above phenomenon if the connector is disconnected while the power is ON. Turn the power OFF before connecting or disconnecting the connector.

- When using the LCD display type, do not press down on the display section. This may lead to failure.
- The case is made of resin. Do not use solvent, alcohol or detergent in cleaning, since the resin could absorb it. There is a risk of affecting the resin. Wipe off dirt with a rag soaked in a diluted neutral detergent solution and wrung out well.

Integrated needle valve

CAUTION

- Vibration could cause the needle to turn and the flow rate to change.

## Product-specific cautions: Separated display FSM2-D Series

### Design/selection

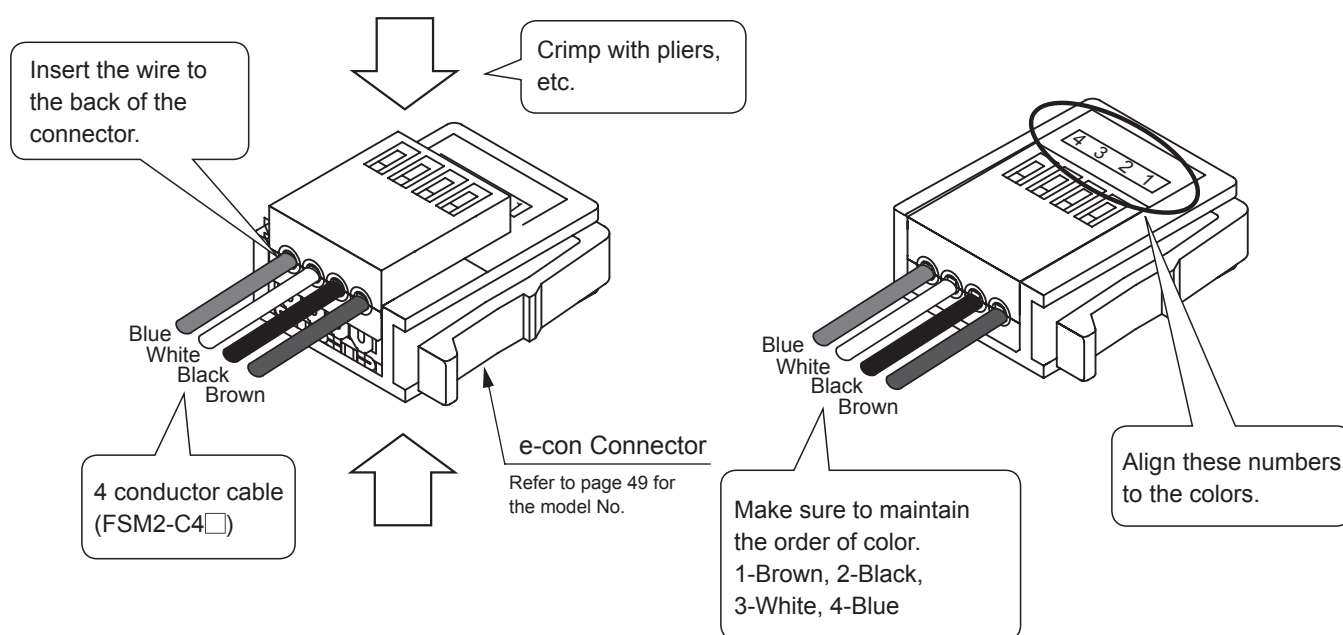
#### CAUTION

- The corresponding sensor is the voltage output (1 to 5 V) type. If the current output type or other voltage output type is connected, it will not operate properly. When using the FSM3, use the bar display voltage output type.

### Mounting, installation and adjustment

#### CAUTION

- Cut the half-strip section at the end of the e-con connector wiring before use. Insert the wire through to the back of the connector, and securely crimp with pliers, etc.  
The wire sheath does not need to be removed.  
Check that the pin No. and wire color are correct before crimping.  
Incorrect wiring can lead to sensor or separated indicator damage, faults or malfunction.



\* The e-con connector is attached with the separated display.

- When attaching or removing the lead wire, hold the connector instead of the cable.  
Holding the cable could result in a contact fault, broken wire or short-circuit, etc., could damage the sensor or separated indicator, or cause malfunctions.
- Do not apply a load of 15 N or over on the lead wire.

LCD display	Bar display	IO-Link	Internal structure
Resin body			
LCD display	Bar display	IO-Link	Internal structure
Stainless steel body			
Separated display	Technical data	Operating method	Optional products
			Safety precautions
			Related products



LCD display	Resin body	
Bar display		
IO-Link		
Internal structure		
LCD display	Stainless steel body	
Bar display		
IO-Link		
Internal structure		
Separated display	Technical data	
Operating method		
Optional products		
Safety precautions		
Related products	Related products	

## Related products

### Compact flow rate controller (RAPIFLOW) FCM Series

- Compact, high-speed, high-precision
- Compatible with various fluids
- Supports 0.5-second high-speed control
- Equipped with digital display that allows control state to be confirmed at a glance
- Wide range of models achieved by built-in microcomputer

Catalog No. CB-024SA



### High precision electro pneumatic regulator EVR Series

- High precision pressure precision
  - Hysteresis: 0.3%F.S., linearity:  $\pm 0.5\%$ F.S., resolution: 0.1%F.S., repeatability: 0.2%F.S.
- Improved temperature stability and durability
  - Hysteresis: 0.3%F.S., linearity:  $\pm 0.5\%$ F.S., resolution: 0.1%F.S., repeatability: 0.2%F.S.
- Equipped with new functions
  - Residual pressure 0 when the input signal is 0%F.S. Pressure control pattern is selectable.
- Easy operation
  - "Zero point adjustment", "Span point adjustment" and "pressure control patterns" can be operated by two buttons.
- Compatibility/installation
  - Compatible mounting with conventional product (EV2500)
  - Two types of connectors are available. (straight and radial, 1 m and 3 m each)

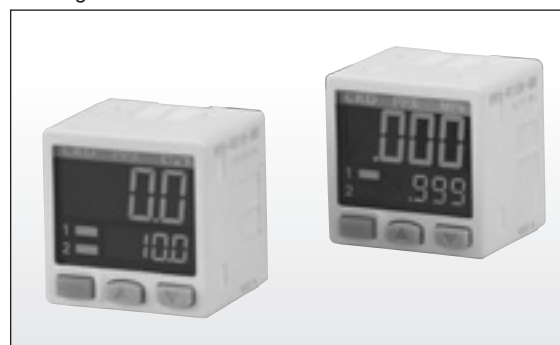
Catalog No. CC-1174A



### Digital pressure sensor PPX Series

- IO-Link compatible
- Increased visibility
- Analog current output is added to the high-function type
- Power consumption is further reduced
- Direct setting with 2-screen display
- Copy function helpful for reducing work processes and preventing misoperation

Catalog No. CB-024SA

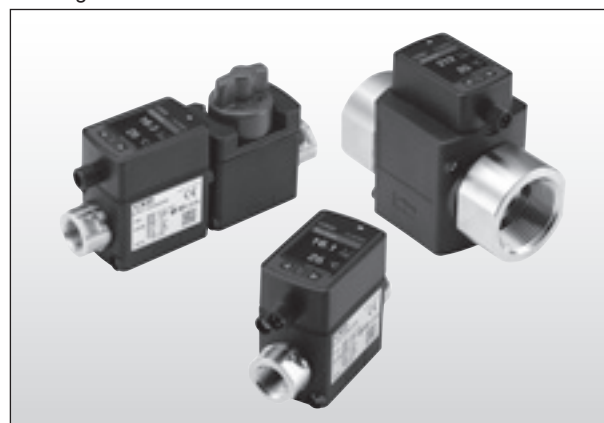


### IO-Link related products

#### Karman vortex type flow rate sensor for water WFK2 Series

- IO-Link compatible
- Compatible with a wide range of flow rates (0.4 to 250 L/min)
- Water temperature measuring feature is standard for all models
- Manual valve with easy flow rate adjustment provided
- Handles water up to 95°C
- The liquid crystal display can be rotated 90° at a time without moving the body
- Easy to read 2-screen color liquid crystal display that shows set values, temperature, etc. simultaneously

Catalog No.CC-1342A



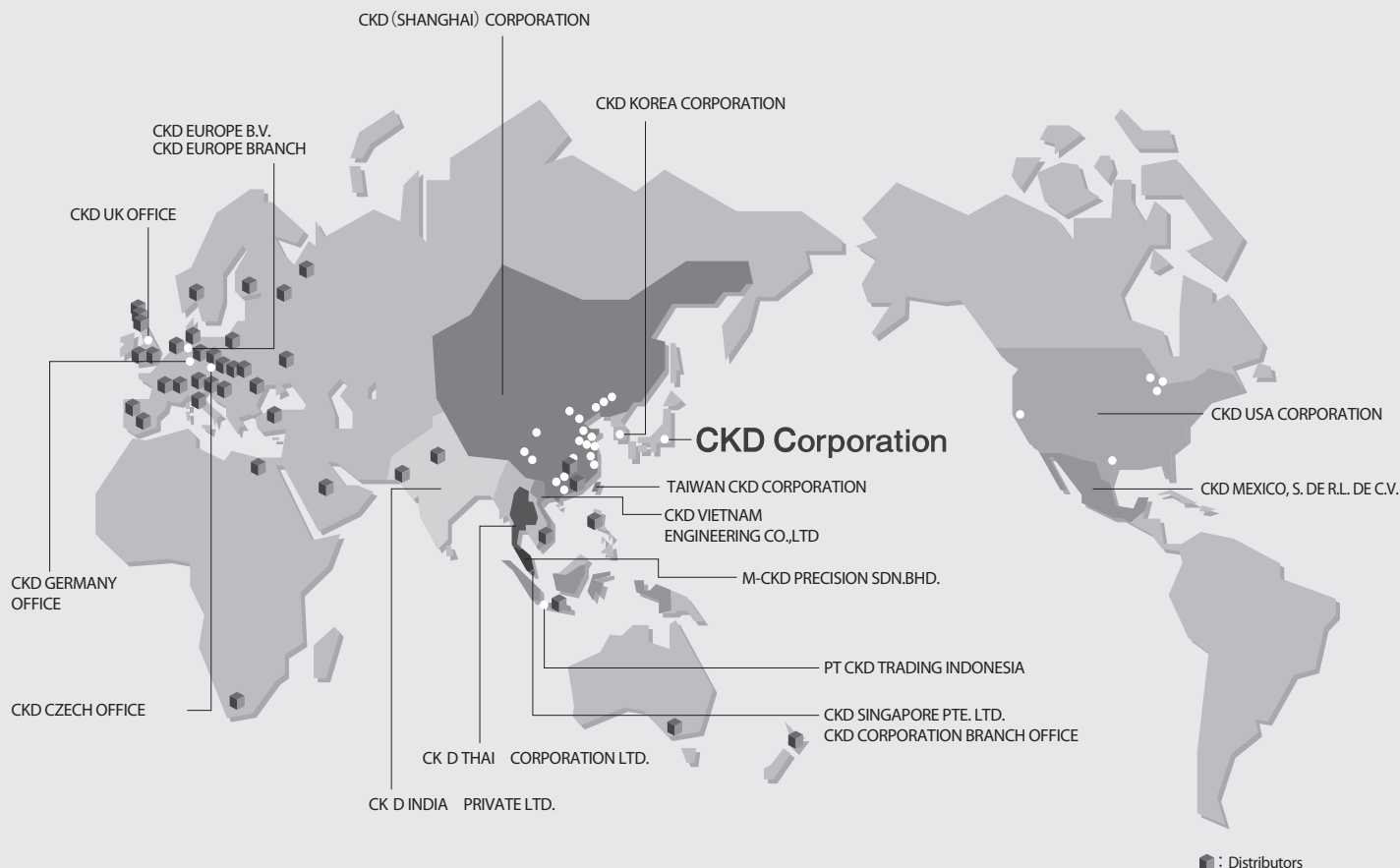
#### Digital gap switch GPS3 Series

- IO-Link compatible
- High precision 2-point output (threshold setting available for two distant points within the detection range scale)
- This single unit allows finish surface roughness and material surface roughness setting within the detection range scale from 0.03 mm and 0.4 mm. Short-range types are newly added. (Detection range scale: 0.02 mm to 0.15 mm)
- High maintainability (direct blow available. The structure allows disassembly for cleaning at orifice clogging occurrences. A function is provided to indicate the highly probable location of clogging by the blinking lamp.)

Catalog No.CC-1291A



LCD display	Bar display	IO-Link	Internal structure
Resin body			
LCD display	Bar display	IO-Link	Internal structure
Stainless steel body			
Separated display	Technical data	Operating method	Optional products
Safety precautions			
Related products			



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- 昆山事務所 (KUNSHAN OFFICE)
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- 南京事務所 (NANJING OFFICE)
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