CKD

New Products

Compact Flow Rate Sensor

RAPIFLOW® FSM3 Series (Stainless Steel Body)

Diversified

High performance

User-friendly

IO-Link Compatible

CKD Corporation

CC-1381A

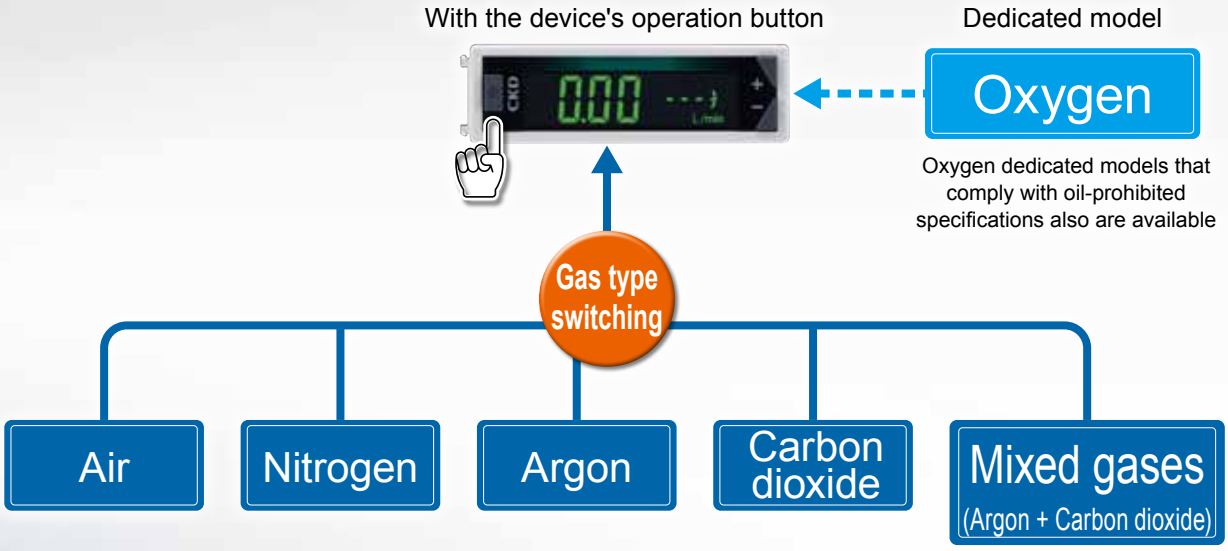
Diversified

Ideal for management of inert gases that are difficult to outgas

Five gas types can be measured with this single unit

Air, nitrogen, argon, carbon dioxide and gas mixture (Ar: CO_2 (8:2) are 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.

High precision/high-speed response

Repeatability: Within ±1% F.S.
Display accuracy: Within ±3% F.S.
Response time : 50 msec

Reduced pressure loss

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

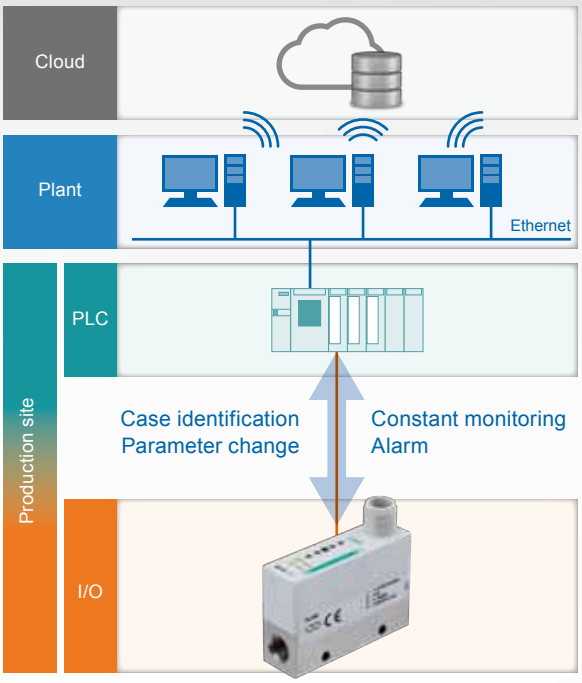
Bi-directional fluid measurement

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

Wide selection of fittings

Fitting and screw-in types are included in the lineup

JXR barbed fitting

Double barbed fitting

Screw-in

Easy mounting (option)

DIN rail mount

Panel mount

Mounting bracket

Space saving

Needle valve integrated

Examples of solutions

Leakage inspection

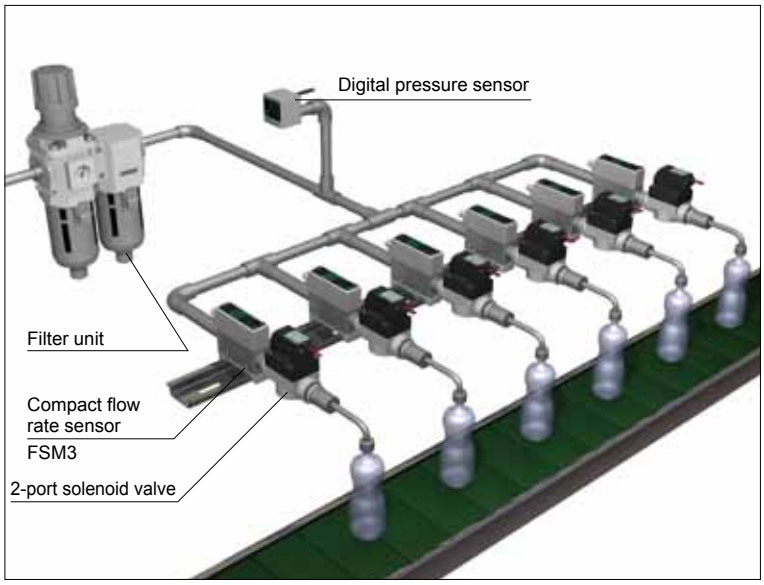
The drinking water container is filled with gas to detect leaks.

Filter unit

Digital pressure sensor

2-port solenoid valve

Compact flow rate sensor



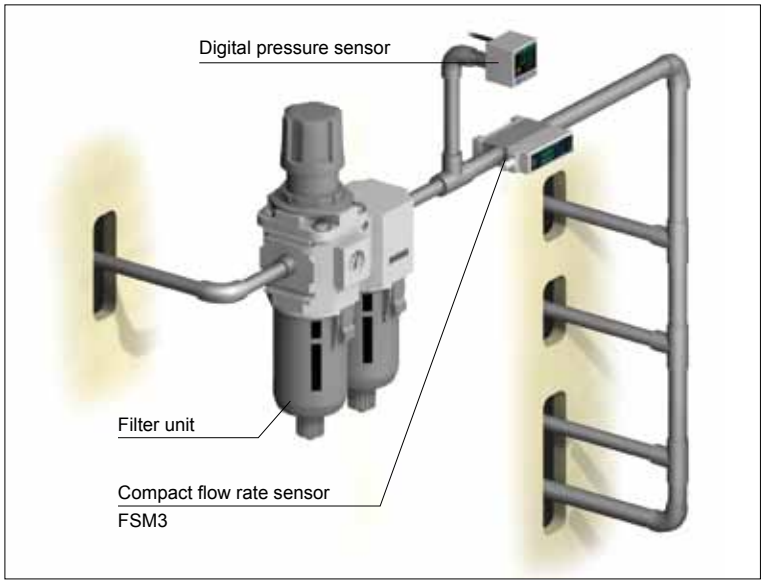
Air consumption management

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

Filter unit

Digital pressure sensor

Compact flow rate sensor



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)

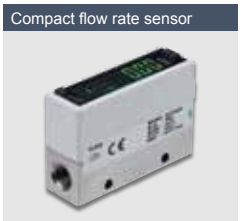
Biochemical culture apparatus

CO_2 flow rate is measured to promote the photosynthesis of organisms.

Inline clean filter

Digital pressure sensor

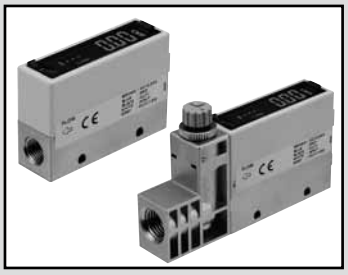
Compact flow rate sensor



Compact flow rate sensor (RAPIFLOW) FSM3 Series

Appearance	Applicable fluids	Flow rate adjustment valve	Clean-room specifications	
			P70	P80
LCD display 	Air/nitrogen	●	●	●
		●	●	●
		●	●	●
		●	●	●
		●	●	●
		●	●	●
		●	●	●
		●	●	●
Bar display 			●	●
			●	●
			●	●
			●	●
			●	●
			●	●
			●	●
			●	●
IO-Link 			●	●
			●	●
			●	●
			●	●
			●	●
			●	●
			●	●
			●	●

	Port size	Max. flow rate (L/min)									Page
		0.5	1	2	5	10	20	50	100	200	
	Rc1/8	●	●	●	●	●	●	●			1
	Rc1/4							●	●	●	
	G1/8	●	●	●	●	●	●	●			
	G1/4							●	●	●	
	NPT1/8	●	●	●	●	●	●	●			
	NPT1/4							●	●	●	
	1/4" double barbed fitting	●	●	●	●	●	●	●	●	●	
	1/4" JXR male fitting	●	●	●	●	●	●	●	●	●	
	Rc1/8	●	●	●	●	●	●	●			7
	Rc1/4							●	●	●	
	G1/8	●	●	●	●	●	●	●			
	G1/4							●	●	●	
	NPT1/8	●	●	●	●	●	●	●			
	NPT1/4							●	●	●	
	1/4" double barbed fitting	●	●	●	●	●	●	●	●	●	
	1/4" JXR male fitting	●	●	●	●	●	●	●	●	●	
	Rc1/8	●	●	●	●	●	●	●			13
	Rc1/4							●	●	●	
	G1/8	●	●	●	●	●	●	●			
	G1/4							●	●	●	
	NPT1/8	●	●	●	●	●	●	●			
	NPT1/4							●	●	●	
	1/4" double barbed fitting	●	●	●	●	●	●	●	●	●	
	1/4" JXR male fitting	●	●	●	●	●	●	●	●	●	



Compact flow rate sensor (RAPIFLOW)

FSM3 Series

LCD display

● Stainless steel body (flow rate range: 500 mL/min to 200 L/min)

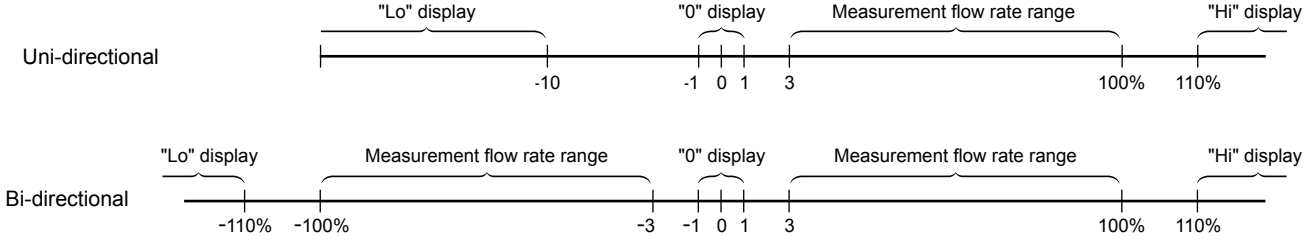
CE RoHS

LCD display specifications

Descriptions			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]								
			[B]								
			005	010	020	050	100	200	500	101	201
Flow direction	[C]	U	Uni-direction								
		B	Bi-direction								
Measurement flow rate range (□/min) *1	[C]	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
		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
Display			4 digit + 4 digit 2 color LCD								
Flow rate display range (□/min) *2	[C]	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
		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
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
Working conditions		Applicable fluids *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								
			Oxygen (When oxygen specifications are selected, the clean-room specifications of Ⓜ cannot be selected. Specifications automatically become oil-prohibited specifications.)								
		Temperature range	0 to 50°C (no condensation)								
		Pressure range	−0.07 to 1.00 MPa								0 to 1.00 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. (−0.07 to 1.00 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 1.00 MPa, 0.35 MPa reference)
Response time *8			50 msec or less (setting response time OFF)								
Switch output	[G]	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		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			φ3.7, AWG26 or equivalent × 5-conductor (connector), insulator O.D. φ1.0								
Functions *12			① Gas type selection, ② Setting details 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, max. 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 *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) relative humidity 65%). (With gas types other than air, this is 0°C 1 barometric pressure (101 kPa) relative humidity 0%)

*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^3) on the primary side (upstream side) of this product. (Refer to page 42 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.

*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 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 type and current output type.

*11: Current for when 24 VDC is connected, and no load is applied. The current consumption varies 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 type switching function cannot be set on an oxygen type.)

Gas type	Flow direction	Full scale flow rate	Analog output	
			Voltage	Current
Air Nitrogen Argon Argon 80% + Carbon dioxide 20%	Uni-direction	0 to 100%	1 to 5 V	4 to 20 mA
	Bi-direction	−100 to 100%		
Carbon dioxide	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 "Copy function" setting is selected at "Ⓖ Output specifications".
Note that the "External input" function is not available on models on which the "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.

*16: Refer to page 32 for weight.

How to order

FSM3 - L 005 U 2 AA 1 A 1 N - B M R - P80

Model No. FSM3

Ⓐ Display — L

Ⓑ Flow rate range (full scale flow rate) — 005

Ⓒ Flow direction — U

Ⓓ Body material/applicable fluids — 2

Ⓔ Port size — AA

Ⓕ Piping direction — 1

Ⓖ Output specifications — A

Ⓗ Unit specifications — 1

Ⓘ Valve option — N

Ⓙ Cable — B

Ⓚ Mounting attachment — M

Ⓛ Attached documents — R

Ⓜ Clean-room specifications — P80

Code	Content
Ⓐ Display	
L	Liquid crystal display
Ⓑ Flow rate range (full scale flow rate)	
005	500 mL/min
010	1 L/min
020	2 L/min
050	5 L/min
100	10 L/min
200	20 L/min
500	50 L/min
101	100 L/min
201	200 L/min
Ⓒ Flow direction	
U	Uni-direction
B	Bi-direction

Ⓓ Body material/applicable fluids

	Body material	Applicable fluids
2	SUS	Air (gas switchable)
3	SUS	Oxygen (oil-prohibited specifications)

Ⓔ Port size	
AA	Rc1/8
BA	Rc1/4
AB	G1/8 *2
BB	G1/4 *2
AC	NPT1/8
BC	NPT1/4
AD	1/4" double barbed fitting (50 L/min or less)
BD	1/4" double barbed fitting (50 L/min or more)
AE	1/4" JXR male fitting (50 L/min or less)
BE	1/4" JXR male fitting (50 L/min or more)
Ⓕ Piping direction	
1	Straight

Ⓖ Output specifications

	Analog output	Switch output	Copy function
A	1 point (Voltage output) 1-5 V	1 point (NPN)	With
B		2 points (NPN)	-
C		1 point output (PNP)	With
D		2-point output (PNP)	-
E	1 point Current output 4-20 mA	1 point (NPN)	With
F		2 points (NPN)	-
G		1 point output (PNP)	With
H		2-point output (PNP)	-

Ⓗ Unit specifications	
1	SI units only
2	With unit switching function (overseas models only) *3
Ⓘ Valve option	
N	None
T	With needle valve
Ⓙ Cable	
Blank	None
A	5-conductor 1 m
B	5-conductor 3 m
Ⓚ Mounting attachment *4	
Blank	None
H	Bracket
K	Panel mount
L	Panel mounting (for needle valve integrated type)
M	DIN rail mount
Ⓛ Attached documents	
Blank	None
R	Company certification
S	Company certification + Traceability certification
Ⓜ Clean-room specifications *7	
Blank	None
P70	Anti-dust generation *5
P80	Oil free *6

[Example of model No.]

FSM3-L005U2AA1A1N-BMR-P80

Model: RAPIFLOW FSM3 Series

Ⓐ Display	L	: Liquid crystal display
Ⓑ Flow rate range	005	: 500 mL/min
Ⓒ Flow direction	U	: Uni-direction
Ⓓ Body material/applicable fluids	2	: SUS/air
Ⓔ Port size	AA	: Rc1/8
Ⓕ Piping direction	1	: Straight
Ⓖ Output specifications	A	: Analog voltage output ×1, NPNSwitch output ×1, With copy function
Ⓗ Unit specifications	1	: SI units only
Ⓘ Valve option	N	: None
Ⓙ Cable	B	: 5-conductor 3 m
Ⓚ Mounting attachment	M	: DIN rail mount
Ⓛ Attached documents	R	: Company certification
Ⓜ 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: Use G1/8 fittings having a thread length of 6 mm or less. Use G1/4 fittings having a thread length of 9 mm or less.
*3: Models with the unit switching function are not sold in Japan.
*4: Optional parts are provided with the product. They are not attached to the product.
*5: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*6: In addition to P70 specifications, wetted section materials are degreased and cleaned.
*7: This cannot be selected on an oxygen (blank only).

Flow rate range and port size

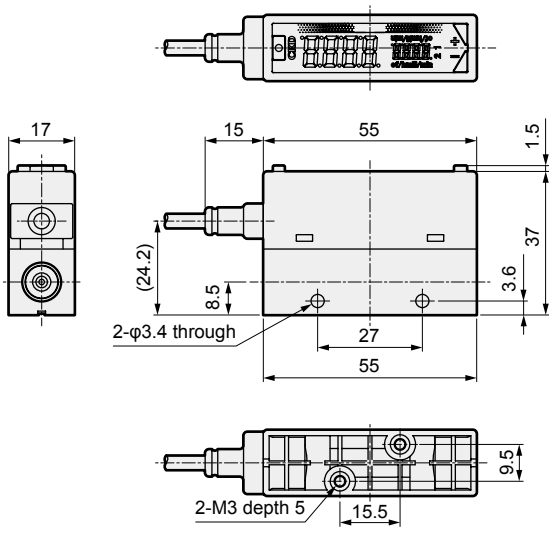
		Ⓔ Port size									
		AA	BA	AB	BB	AC	BC	AD	BD	AE	BE
		Rc1/8	Rc1/4	G1/8	G1/4	NPT1/8	NPT1/4	1/4" double barbed fitting		1/4" JXR male fitting	
Ⓑ Flow rate range	005	●		●		●		●		●	
	010	●		●		●		●		●	
	020	●		●		●		●		●	
	050	●		●		●		●		●	
	100	●		●		●		●		●	
	200	●		●		●		●		●	
	500	●	●	●	●	●	●	●	●	●	●
	101		●		●		●		●		●
	201		●		●		●		●		●

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

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

● FSM3-L[B][C]$^{2}_{3}$/AA1/AB1/AC1

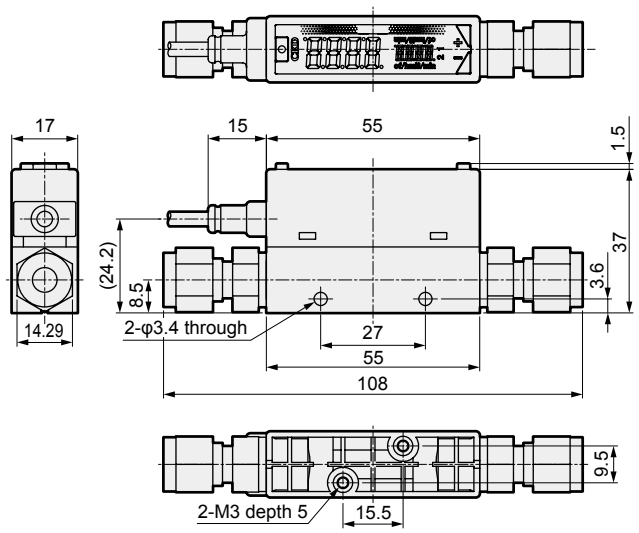
(Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Port size: Straight 1/4" double barbed fitting

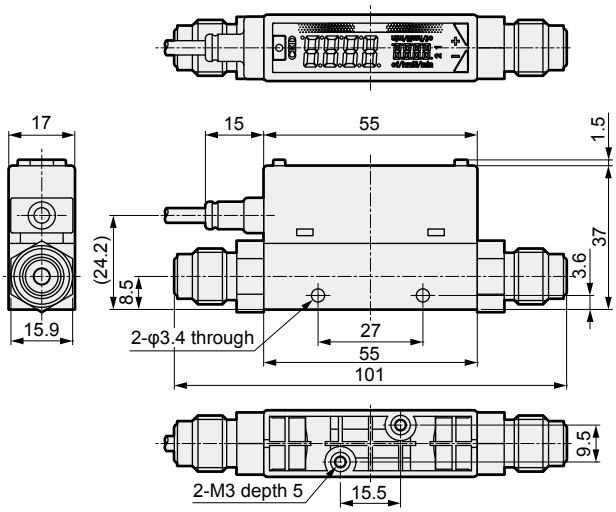
● FSM3-L[B][C]$^{2}_{3}$/AD1

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



Port size: Straight 1/4" JXR male fitting

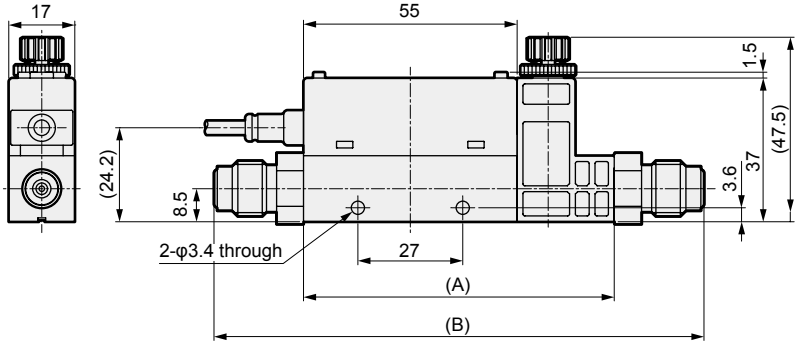
● FSM3-L[B][C]$^{2}_{3}$/AE1 (Full scale flow rate: 500mL/min, 1, 2, 5, 10, 20, 50 L/min)



Solenoid valve with needle dimensions

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

● FSM3-L[B][C]$^{2}_{3}$/AA1/AB1/AC1/AD/AE[G][H]T (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50L/min)



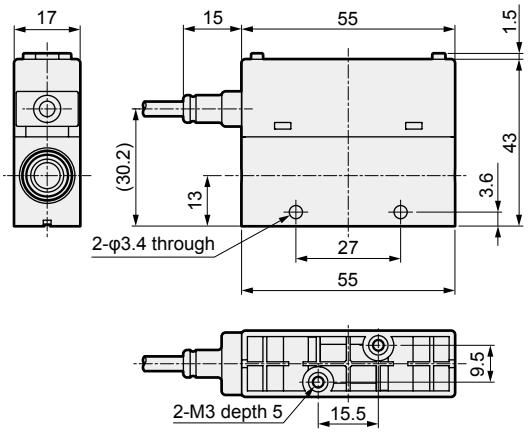
Port size	Dimension (A)	Dimension (B)
Rc 1/8	80	-
G 1/8	80	-
NPT 1/8	80	-
1/4" double barbed fitting	80	133
1/4" JXR male fitting	80	126

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

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

● FSM3-L[B][C]$^{2}_{3}$/BA1/BB1/BC1

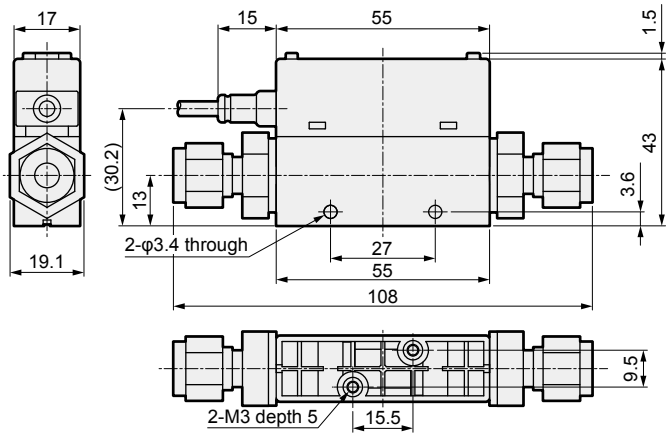
(Full scale flow rate: 50, 100, 200 L/min)



Port size: Straight 1/4" double barbed fitting

● FSM3-L[B][C]$^{2}_{3}$/BD1

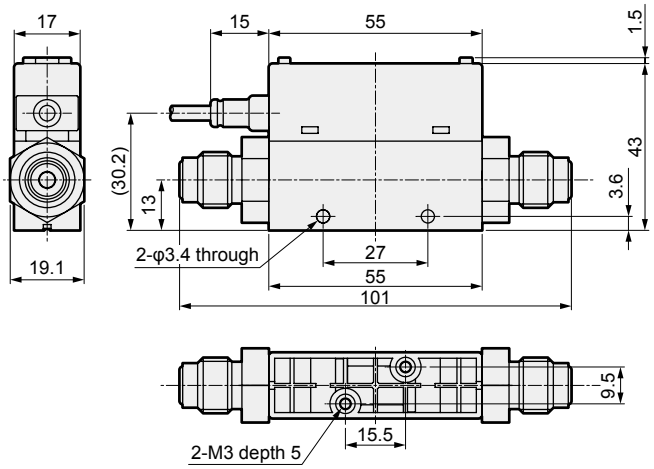
(Full scale flow rate: 50, 100, 200 L/min)



Port size: Straight 1/4" JXR male fitting

● FSM3-L[B][C]$^{2}_{3}$/BE1

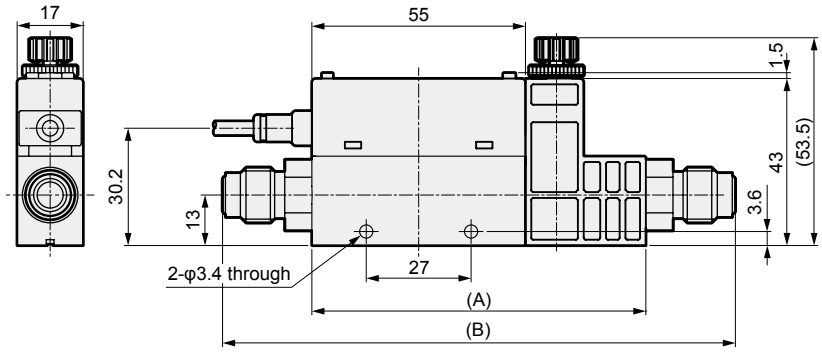
(Full scale flow rate: 50, 100, 200 L/min)



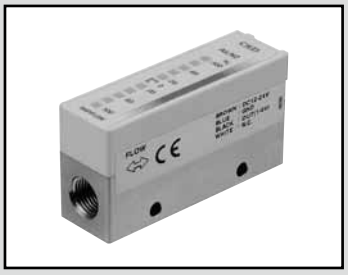
Solenoid valve with needle dimensions

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

● FSM3-L[B][C]$^{2}_{3}$/BA1/BB1/BC1/BD/BE[G][H]T (Full scale flow rate: 50, 100, 200 L/min)



Port size	Dimension (A)	Dimension (B)
Rc 1/4	86	-
G 1/4	86	-
NPT 1/4	86	-
1/4" double barbed fitting	86	139
1/4" JXR male fitting	86	132



Compact flow rate sensor (RAPIFLOW)

FSM3 Series

Bar display

● Stainless steel body (flow rate range: 500 mL/min to 200 L/min)

CE RoHS

Bar display specifications

Descriptions			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]								
			[B]								
			005	010	020	050	100	200	500	101	201
Flow direction	[C]	U	Uni-direction								
		B	Bi-direction								
Measurement flow rate range (□/min) *1	[C]	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
		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
Display			LED bar display								
Working conditions		Applicable fluids *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 Ⓜ cannot be selected. Specifications automatically become oil-prohibited specifications.)								
		Temperature range	0 to 50°C (no condensation)								
		Pressure range	−0.07 to 1.00 MPa								0 to 1.00 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. (−0.07 to 1.00 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 1.00 MPa, 0.35 MPa reference)
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		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			φ3.7, AWG26 or equivalent × 4-conductor (connector), insulator O.D. φ1.0								
Degree of protection			IP40 or equivalent (IEC standard)								
Protection circuit *9			Power supply reverse connection protection								
Vibration resistance			10 to 150 Hz, max. 100 m/s^2, 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) relative humidity 65%).
*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^3) on the primary side (upstream side) of this product. (Refer to page 42 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.
*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.
*8: Current for when 24 VDC is connected, and no load is applied. The current consumption varies 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.
*12: Refer to page 32 for weight.

How to order

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

Model No.
Ⓐ Display
Ⓑ Flow rate range (full scale flow rate)
Ⓒ Flow direction
Ⓓ Body material/applicable fluids
Ⓔ Port size
Ⓕ Piping direction
Ⓖ Output specifications
Ⓗ Unit specifications
Ⓘ Valve option
Ⓙ Cable
Ⓚ Mounting attachment
Ⓛ Attached documents
Ⓜ Clean-room specifications

Code	Content
Ⓐ Display	
B	Bar display
Ⓑ Flow rate range (full scale flow rate)	
005	500 mL/min
010	1 L/min
020	2 L/min
050	5 L/min
100	10 L/min
200	20 L/min
500	50 L/min
101	100 L/min
201	200 L/min
Ⓒ Flow direction	
U	Uni-direction
B	Bi-direction
Ⓓ Body material/applicable fluids	
	Body material / Applicable fluids
2	SUS / Air
3	SUS / Oxygen (oil-prohibited specifications)
Ⓔ Port size	
AA	Rc1/8
BA	Rc1/4
AB	G1/8 *3
BB	G1/4 *3
AC	NPT1/8
BC	NPT1/4
AD	1/4" double barbed fitting (50 L/min or less)
BD	1/4" double barbed fitting (50 L/min or more)
AE	1/4" JXR male fitting (50 L/min or less)
BE	1/4" JXR male fitting (50 L/min or more)
Ⓕ Piping direction	
1	Straight
Ⓖ Output specifications	
J	Analog voltage output × 1 point
K	Analog current output × 1 point
Ⓗ Unit specifications	
1	SI units only
Ⓘ Valve option	
N	None
Ⓙ Cable	
Blank	None
C	4-conductor 1 m
D	4-conductor 3 m
Ⓚ Mounting attachment *4	
Blank	None
H	Bracket
M	DIN rail mount
Ⓛ Attached documents	
Blank	None
R	Company certification
S	Company certification + Traceability certification
Ⓜ Clean-room specifications *7	
Blank	None
P70	Anti-dust generation *5
P80	Oil free *6

[Example of model No.]
FSM3-B005U2AA1J1N-DHS-P70
Model: RAPIFLOW FSM3 Series

Ⓐ Display	B	: Bar display
Ⓑ Flow rate range	005	: 500mL/min
Ⓒ Flow direction	U	: Uni-direction
Ⓓ Body material/applicable fluids	2	: SUS/air
Ⓔ Port size	AA	: Rc1/8
Ⓕ Piping direction	1	: Straight
Ⓖ Output specifications	J	: Analog voltage output ×1
Ⓗ Unit specifications	1	: SI units only
Ⓘ Valve option	N	: None
Ⓙ Cable	D	: 4-conductor 3 m
Ⓚ Mounting attachment	H	: Bracket
Ⓛ Attached documents	S	: Company certification + Traceability certification
Ⓜ 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".
*3: Use G1/8 fittings having a thread length of 6 mm or less. Use G1/4 fittings having a thread length of 9 mm or less.
*4: Optional parts are provided with the product. They are not attached to the product.
*5: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*6: In addition to P70 specifications, wetted section materials are degreased and cleaned.
*7: This cannot be selected on an oxygen (blank only).

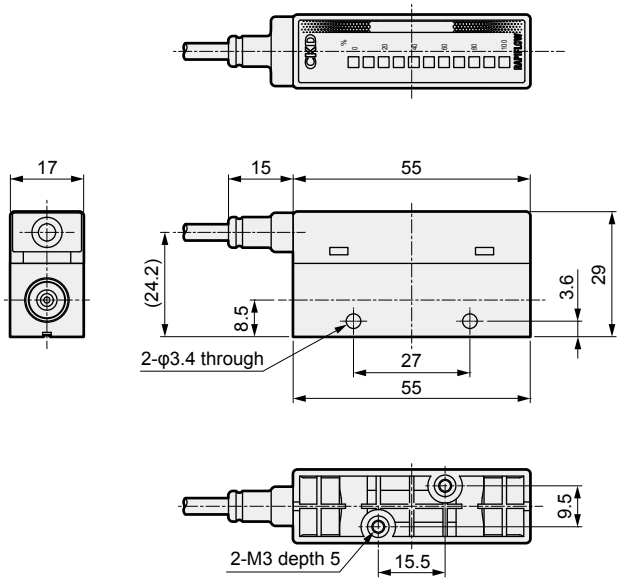
Flow rate range and port size

		Ⓔ Port size									
		AA	BA	AB	BB	AC	BC	AD	BD	AE	BE
		Rc1/8	Rc1/4	G1/8	G1/4	NPT1/8	NPT1/4	1/4" double barbed fitting		1/4" JXR male fitting	
Ⓑ Flow rate range	005	●		●		●		●		●	
	010	●		●		●		●		●	
	020	●		●		●		●		●	
	050	●		●		●		●		●	
	100	●		●		●		●		●	
	200	●		●		●		●		●	
	500	●	●	●	●	●	●	●	●	●	●
	101		●		●		●		●		●
	201		●		●		●		●		●

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

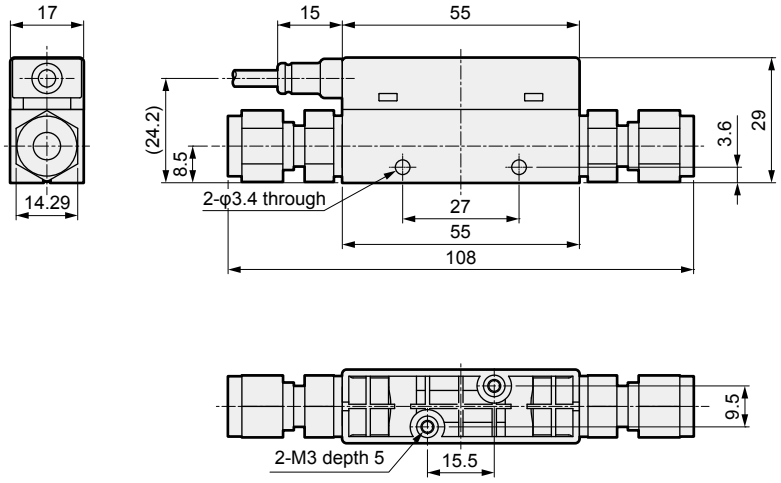
Port size: Straight Rc1/8, G1/8, NPT1/8

● FSM3-B[B][C]$\frac{2}{3}$/AA1/AB1/AC1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



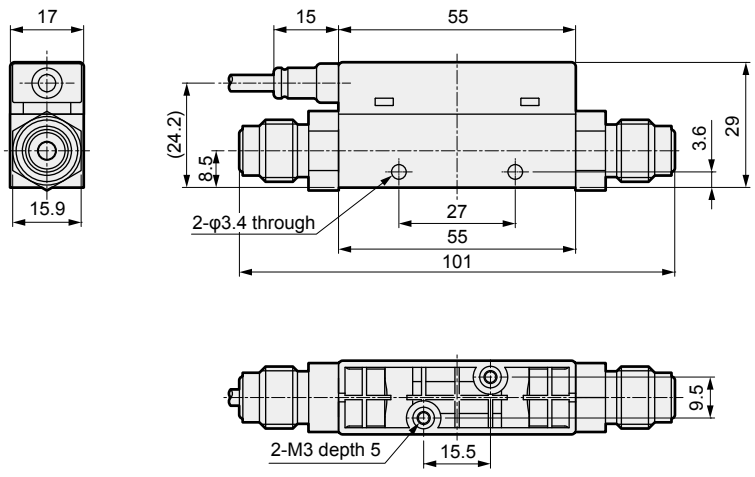
Port size: Straight 1/4" double barbed fitting

● FSM3-B[B][C]$\frac{2}{3}$/AD1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Port size: Straight 1/4" JXR male fitting

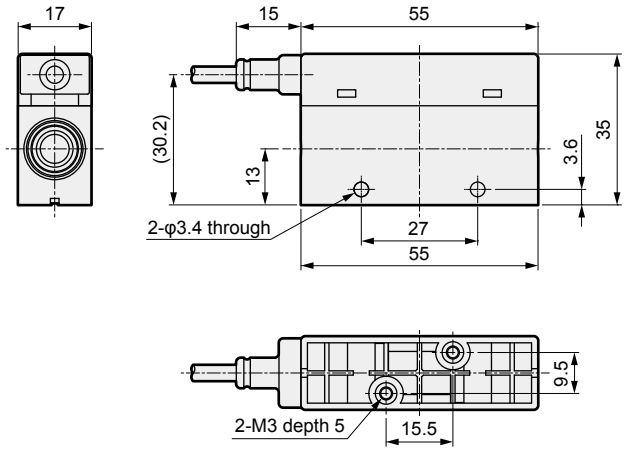
● FSM3-B[B][C]$\frac{2}{3}$/AE1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



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

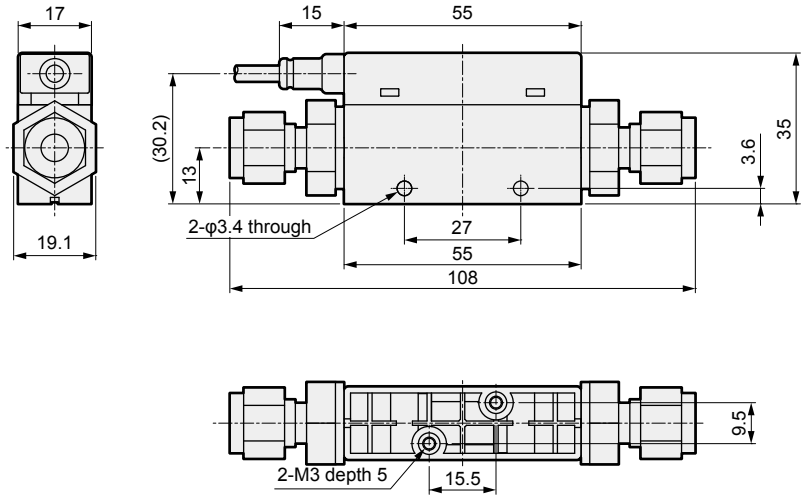
Port size: Straight Rc1/4, G1/4, NPT1/4

● FSM3-B□□$\frac{2}{3}$/BA1/BB1/BC1 (Full scale flow rate: 50, 100, 200 L/min)



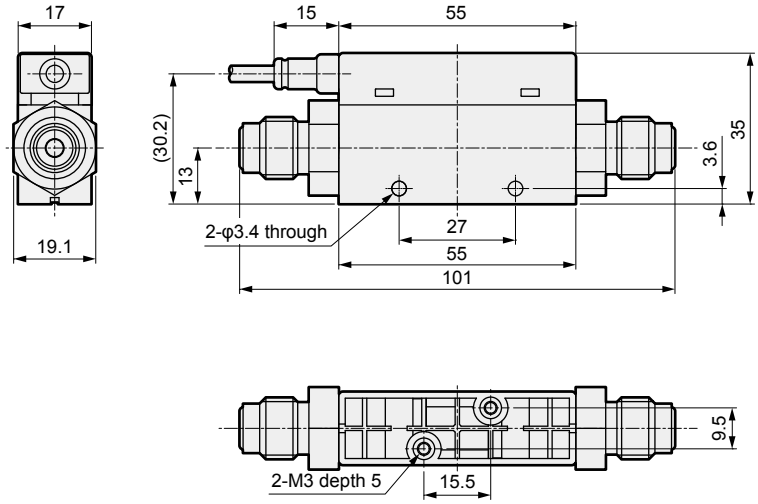
Port size: Straight 1/4" double barbed fitting

● FSM3-B□□$\frac{2}{3}$/BD1 (Full scale flow rate: 50, 100, 200 L/min)



Port size: Straight 1/4" JXR male fitting

● FSM3-B□□$\frac{2}{3}$/BE1 (Full scale flow rate: 50, 100, 200 L/min)



Compact flow rate sensor (RAPIFLOW)

FSM3 Series

IO-Link

● Stainless steel body (flow rate range: 500 mL/min to 200 L/min)

IO-Link type specifications

Descriptions			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]								
			[B]								
			005	010	020	050	100	200	500	101	201
Flow direction	[C]	U	One way								
		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
		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 200L
Display			LED display (power and status indicators)								
Working conditions		Applicable fluids *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 Ⓜ cannot be selected. Specifications automatically become oil-prohibited specifications.)								
		Temperature range	0 to 50°C (no condensation)								
		Pressure range	−0.07 to 1.00 MPa								0 to 1.00 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. (-0.07 to 1.00 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 1.00 MPa, 0.35 MPa reference)
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-sided connector cable (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, max. 100 m/s^2, 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 36 for communication specifications.

*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%). (With gas types other than air, this is 20°C 1 barometric pressure (101 kPa) relative humidity 0%)

*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^3) on the primary side (upstream side) of this product. (Refer to page 42 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.

*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 37.)
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 type cannot be switched on an oxygen type.)

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%	One way	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	One way	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.

*15: Refer to page 32 for weight.

How to order

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

Model No.
Ⓐ Display
Ⓑ Flow rate range (full scale flow rate)
Ⓒ Flow direction
Ⓓ Body material/applicable fluids
Ⓔ Port size
Ⓕ Piping direction
Ⓖ Output specifications
Ⓗ Unit specifications
Ⓘ Valve option
Ⓙ Cable
Ⓚ Mounting attachment
Ⓛ Attached documents
Ⓜ Clean-room specifications

Code	Content
Ⓐ Display	
C	IO-Link
Ⓑ Flow rate range (full scale flow rate)	
005	500 mL/min
010	1 L/min
020	2 L/min
050	5 L/min
100	10 L/min
200	20 L/min
500	50 L/min
101	100 L/min
201	200 L/min
Ⓒ Flow direction	
U	Uni-direction
B	Bi-direction
Ⓓ Body material/applicable fluids	
	Body material / Applicable fluids
2	SUS / Air (gas switchable)
3	SUS / Oxygen (oil-prohibited specifications)
Ⓔ Port size	
AA	Rc1/8
BA	Rc1/4
AB	G1/8 *2
BB	G1/4 *2
AC	NPT1/8
BC	NPT1/4
AD	1/4" double barbed fitting (50 L/min or less)
BD	1/4" double barbed fitting (50 L/min or more)
AE	1/4" JXR male fitting (50 L/min or less)
BE	1/4" JXR male fitting (50 L/min or more)
Ⓕ Piping direction	
1	Straight
Ⓖ Output specifications	
L	IO-Link communication
Ⓗ Unit specifications	
1	SI units only
Ⓘ Valve option	
N	None
Ⓙ Cable	
Blank	None
G	M12 both-sided connector cable (3 m)
Ⓚ Mounting attachment *3	
Blank	None
H	Bracket 1
M	DIN rail mount
Ⓛ Attached documents	
Blank	None
R	Company certification
S	Company certification + Traceability certification
Ⓜ Clean-room specifications *6	
Blank	None
P70	Anti-dust generation *4
P80	Oil free *5

[Example of model No.]
FSM3-C005U2AA1L1N-GHR-P70
Model: RAPIFLOW FSM3 Series

Ⓐ Display	C	: IO-Link
Ⓑ Flow rate range	005	: 500 mL/min
Ⓒ Flow direction	U	: Uni-direction
Ⓓ Body material/applicable fluids	2	: SUS/air
Ⓔ Port size	AA	: Rc1/8
Ⓕ Piping direction	1	: Straight
Ⓖ Output specifications	L	: IO-Link
Ⓗ Unit specifications	1	: SI units only
Ⓘ Valve option	N	: None
Ⓙ Cable	G	: M12 both-sided connector cable (3 m)
Ⓚ Mounting attachment	H	: Bracket
Ⓛ Attached documents	R	: Company certification
Ⓜ 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: Use G1/8 fittings having a thread length of 6 mm or less. Use G1/4 fittings having a thread length of 9 mm or less.
*3: Optional parts are provided with the product. They are not attached to the product.
*4: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*5: In addition to P70 specifications, wetted section materials are degreased and cleaned.
*6: This cannot be selected on an oxygen (blank only).

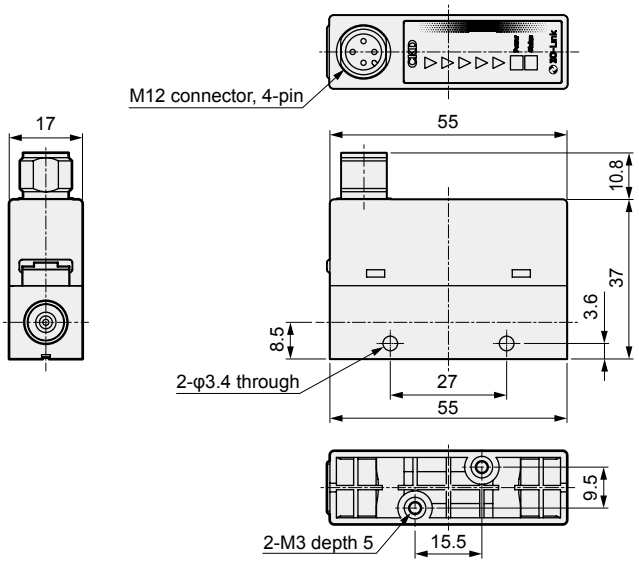
Flow rate range and port size

		Ⓔ Port size									
		AA	BA	AB	BB	AC	BC	AD	BD	AE	BE
		Rc1/8	Rc1/4	G1/8	G1/4	NPT1/8	NPT1/4	1/4" double barbed fitting		1/4" JXR male fitting	
Ⓑ Flow rate range	005	●		●		●		●		●	
	010	●		●		●		●		●	
	020	●		●		●		●		●	
	050	●		●		●		●		●	
	100	●		●		●		●		●	
	200	●		●		●		●		●	
	500	●	●	●	●	●	●	●	●	●	●
	101		●		●		●		●		●
	201		●		●		●		●		●

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

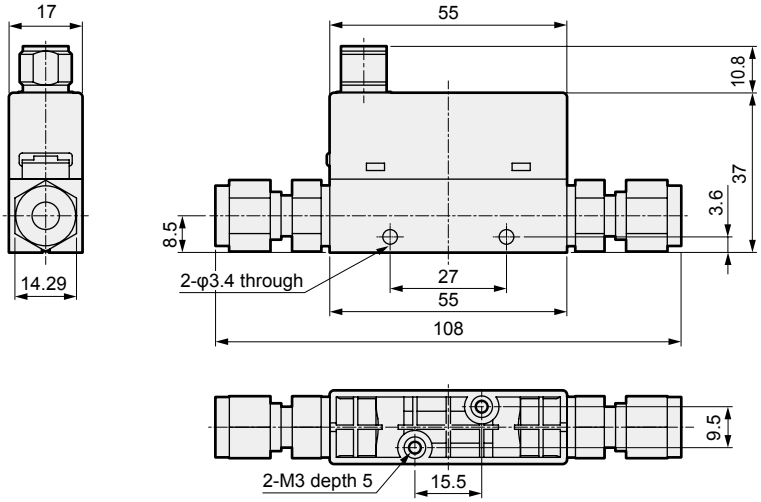
Port size: Straight Rc1/8, G1/8, NPT1/8

● FSM3-C[B][C]$\frac{2}{3}$/AA1/AB1/AC1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



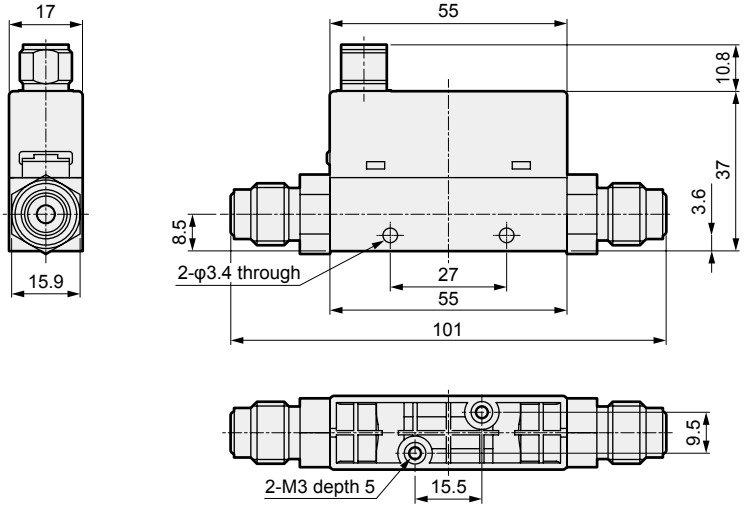
Port size: Straight 1/4" double barbed fitting

● FSM3-C[B][C]$\frac{2}{3}$/AD1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Port size: Straight 1/4" JXR male fitting

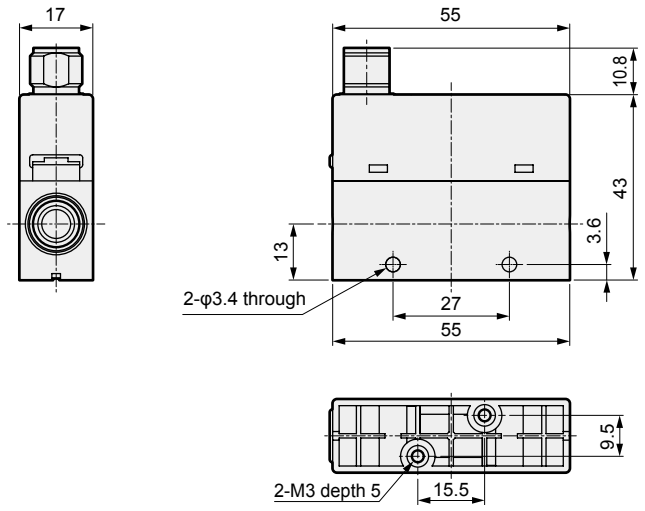
● FSM3-C[B][C]$\frac{2}{3}$/AE1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Dimensions (IO-Link) (flow rate range: 50 L/min to 200 L/min)

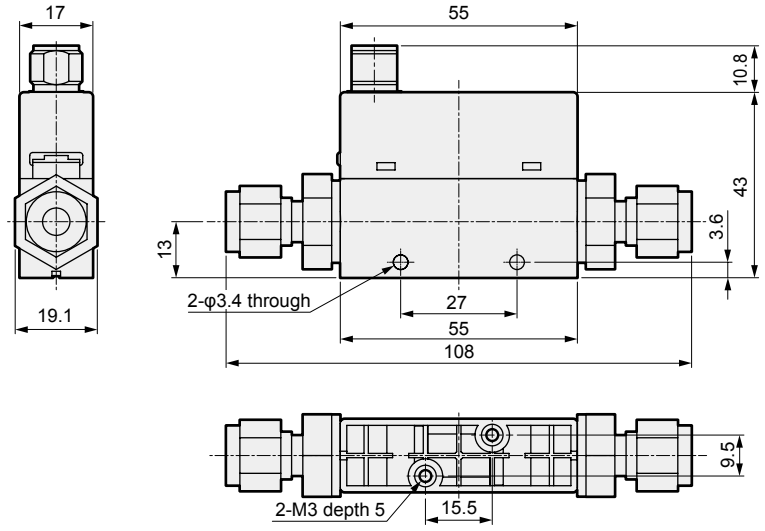
Port size: Straight Rc1/4, G1/4, NPT1/4

● FSM3-C[B][C]$\frac{2}{3}$/BA1/BB1/BC1 (Full scale flow rate: 50, 100, 200 L/min)



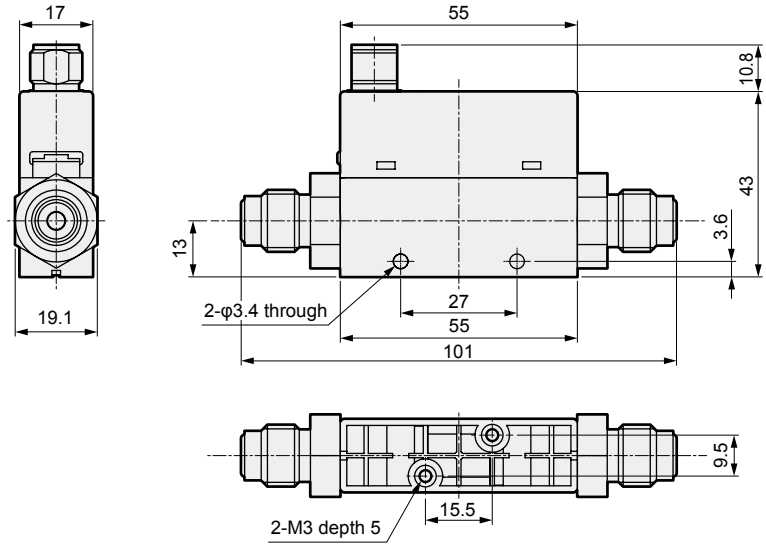
Port size: Straight 1/4" double barbed fitting

● FSM3-C[B][C]$\frac{2}{3}$/BD1 (Full scale flow rate: 50, 100, 200 L/min)



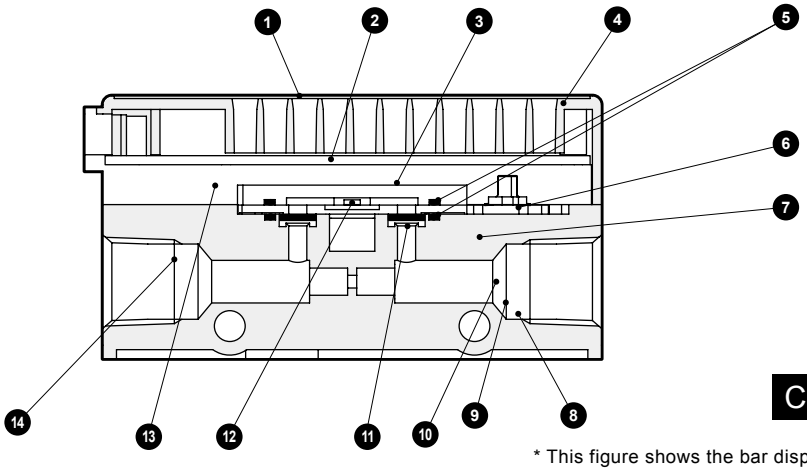
Port size: Straight 1/4" JXR male fitting

● FSM3-C[B][C]$\frac{2}{3}$/BE1 (Full scale flow rate: 50, 100, 200 L/min)



Internal structure

● FSM3-B005 to 500

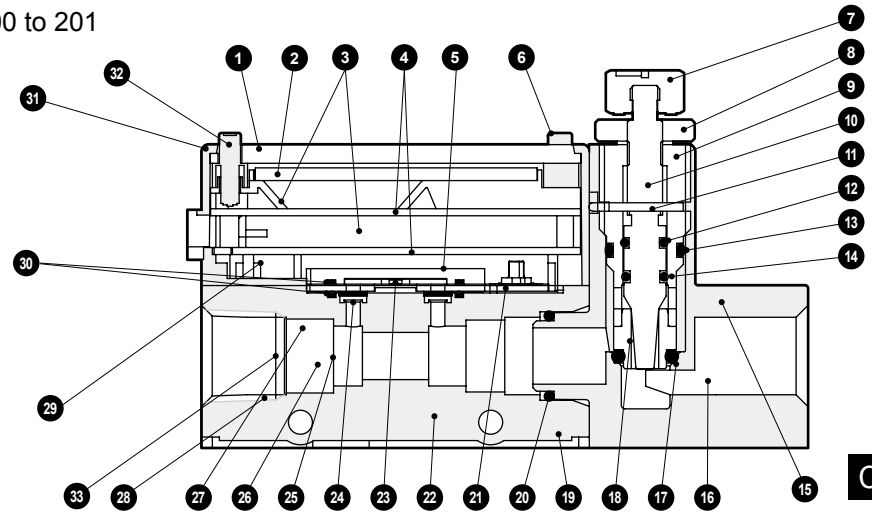


Cannot be disassembled

* 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

● FSM3-L500 to 201



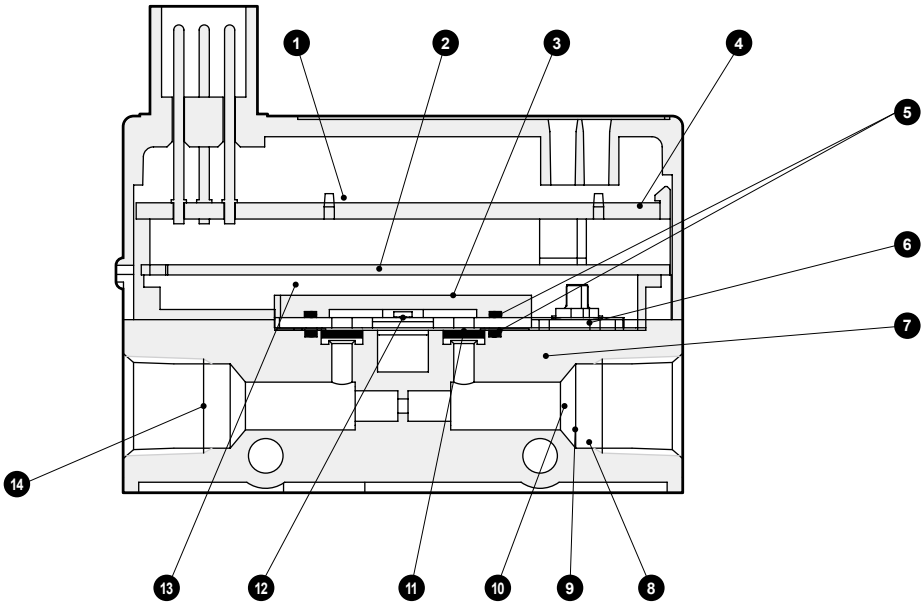
Cannot be disassembled

* This figure shows the bar display w/ 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	Glass epoxy resin
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			

Internal structure

● FSM3-C005 to 500

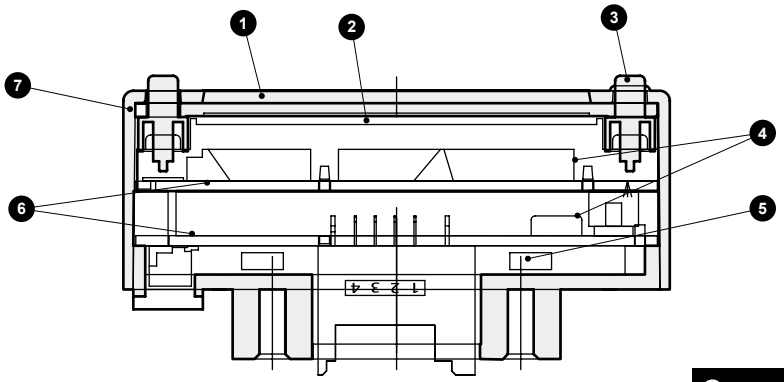


Cannot be disassembled

* 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

● Separate display FSM2-D-□



Cannot be disassembled

Main parts list

* The part materials are subject to change without notice.

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

Compact flow rate sensor (RAPIFLOW)

FSM2 Series

Separate display

RoHS

Separated display specifications

Descriptions				Separate 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, 1500	
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				φ3.7, AWG26 or equivalent × 5-conductor (connector), insulator O.D. φ1.0	
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. φ1.0 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 FSM2 display separated type is connected. (Default state)
The FSM3 bar display, 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.
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 cable size is different so the separate compatible sensor connection connector (e-con) is 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 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.

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 m³/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 m³/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
	Display resolution		1 mℓ/min		0.01 ℓ/min				0.1 ℓ/min						1 ℓ/min			0.01 m³/min	0.01 mℓ/min		0.1 mℓ/min	
Integrating functions*2	Display range		9999999 mℓ		99999.99 ℓ				999999.9 ℓ						9999999 ℓ			99999.99 m³	99999.99 mℓ		999999.9 mℓ	
	Display resolution		1 mℓ		0.01 ℓ				0.1 ℓ						1 ℓ			0.01 m³	0.01 mℓ		0.1m ℓ	
	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 output (1 to 5 V). 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

- Ⓐ Output
- Ⓑ Analog output
- Ⓒ Cable
- Ⓓ Bracket
- Ⓔ Clean-room specifications

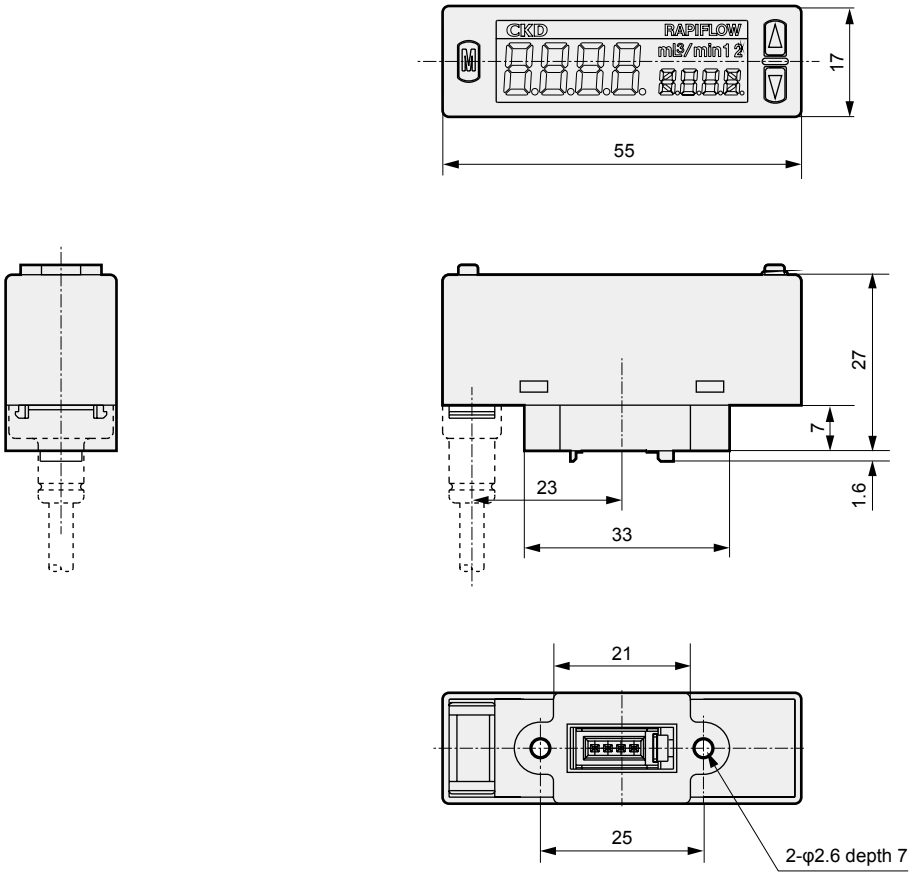
Code	Content
Ⓐ Output	
N	Switch output (NPN) 2 points, analog output 1 point
P	Switch output (PNP) 2 points, analog output 1 point
Ⓑ Analog output	
V	Voltage output (1 to 5 V)
A	Current output (4 to 20 mA)
Ⓒ Cable	
Blank	None
1	1 m
3	3 m
Ⓓ Bracket	
Blank	None
P	Panel mounting kit
Ⓔ Clean-room specifications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

⚠ CAUTION

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

Separated display dimensions

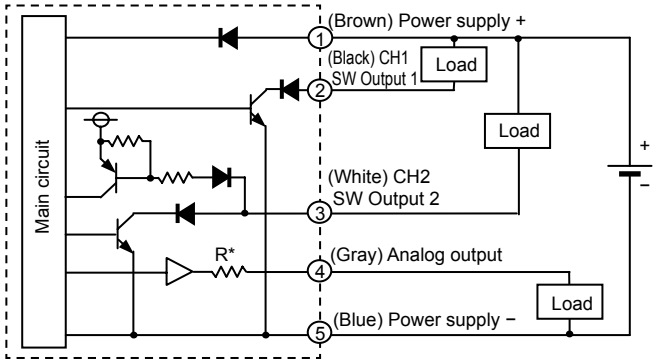
●FSM2-D-□



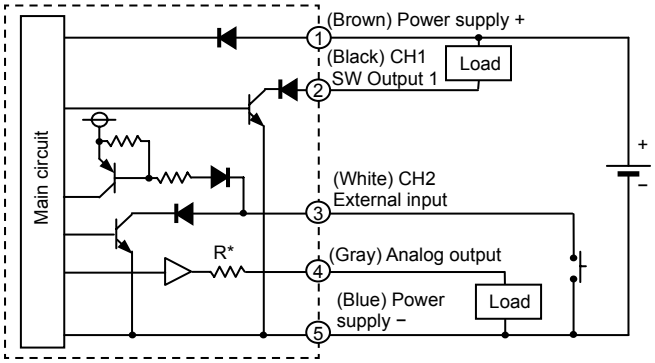
Example of internal circuit and load connection

●FSM3-L□□□□□B/F/□□ (LCD display NPN output)
FSM2-D-N□-□ (separated display NPN output)

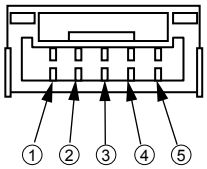
[CH2 is used as SW output]



[CH2 is used as external input]



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

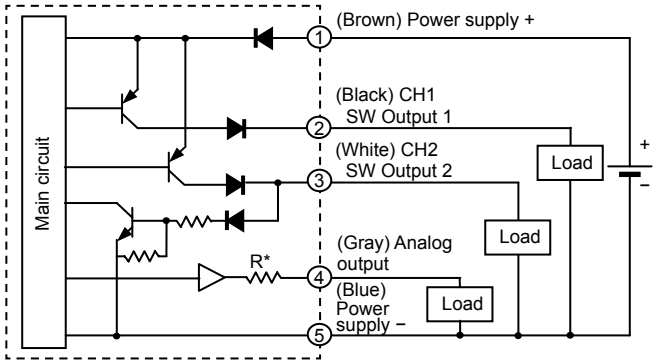


(FSM3 side)
(FSM2-D side)

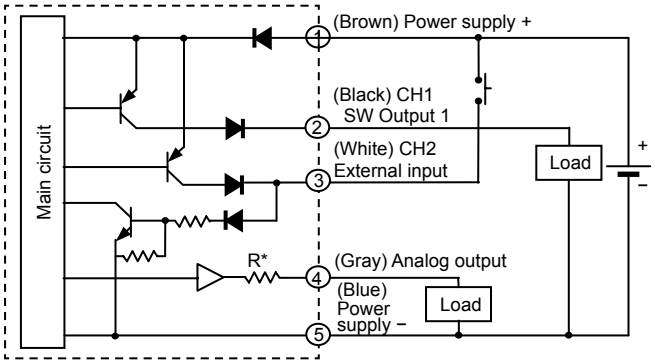
Terminal No.	Option cable color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	CH1 (switch output 1: max. 50 mA)
③	White	CH2 (switch output 2: max. 50 mA, or external input)
④	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ or more Current output: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

●FSM3-L□□□□□D/H/□□ (LCD display PNP output)
FSM2-D-P□-□ (separated display PNP output)

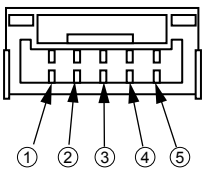
[CH2 is used as SW output]



[CH2 is used as external input]



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

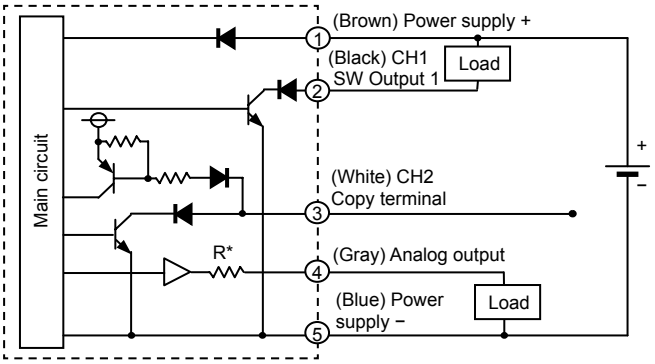


(FSM3 side)
(FSM2-D side)

Terminal No.	Option cable 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)

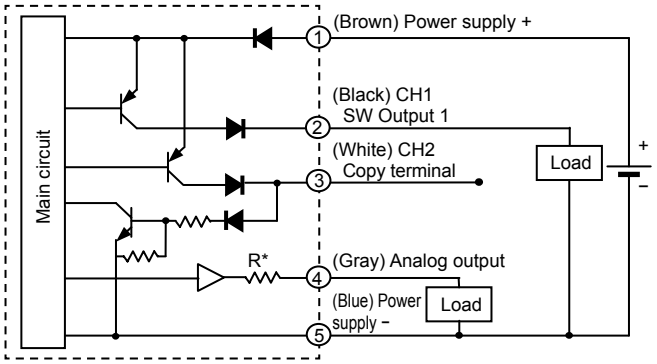
Example of internal circuit and load connection

●FSM3-L□□□□□A/E/□□
(LCD display, NPN output, with copy function)

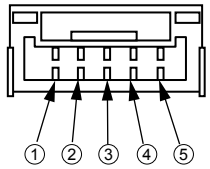


* Analog output voltage output R: approx. 1 kΩ
Current output R: approx. 100 Ω

●FSM3-L□□□□□C/G/□□
(LCD display, PNP output, with copy function)



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

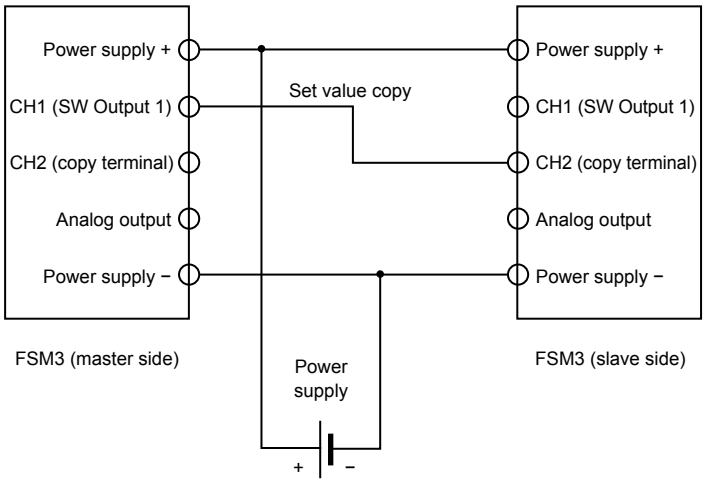


(FSM3 side)

Terminal No.	Option cable 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 copy function)

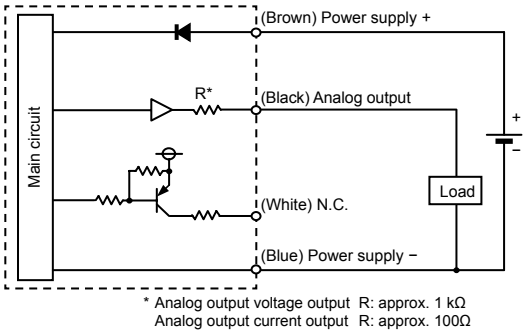
[When using set value copy function]



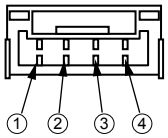
Connect the SW output 1 terminal on the master side to the external input terminal on the slave side.

Example of internal circuit and load connection

●FSM3-B□□□□□J/K/□□ (bar display)



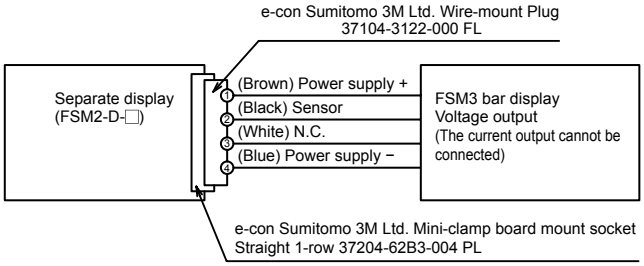
* Analog output voltage output R: approx. 1 kΩ
Analog output current output R: approx. 100Ω



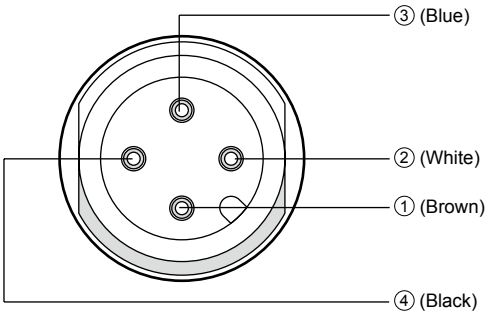
(FSM3 side)

Terminal No.	Option cable color	Name
①	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
②	Black	Analog output Voltage output: 1 to 5 V Load impedance 50 kΩ and over Current output: 4 to 20 mA Load impedance 300 Ω or less
③	White	N.C.
④	Blue	Power supply − (GND)

●Connecting the separated display and FSM3 bar display

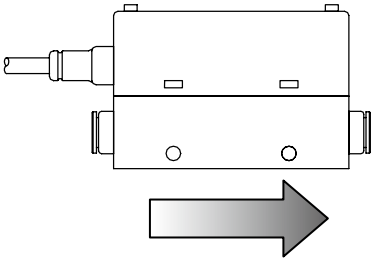
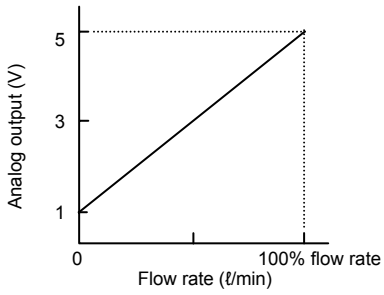
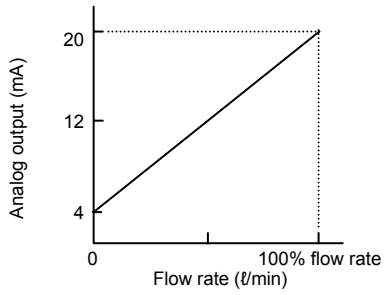
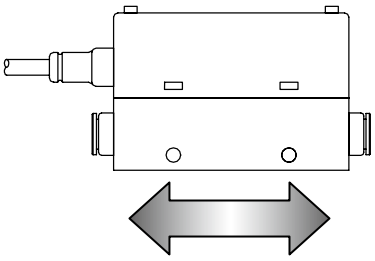
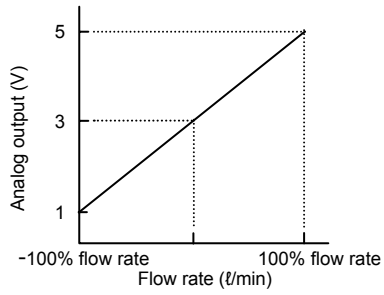
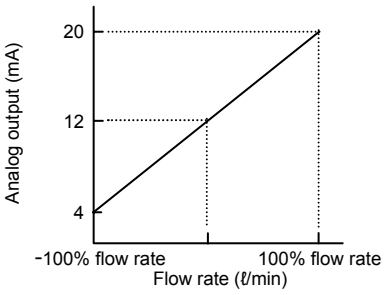


●FSM3-C□□□□□L□□ (IO-Link)



Terminal No.	Cable 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)

Analog output characteristics

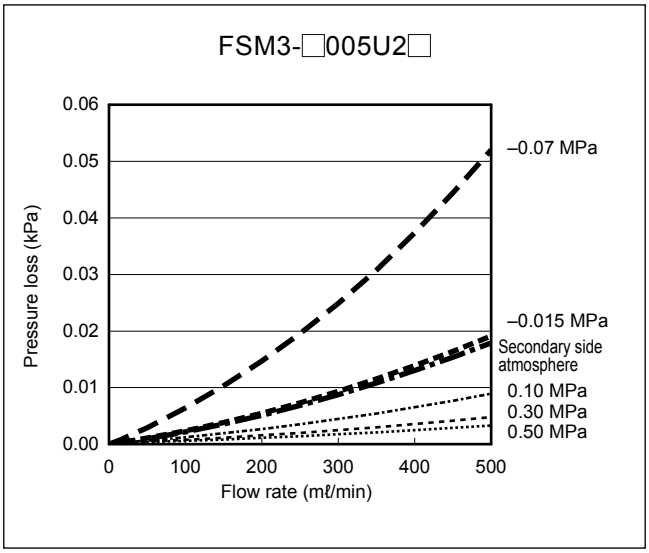
Flow direction	Voltage output	Current output
[Uni-directional] 		
[Bi-directional] 		

*1: The full scale of the uni-directional is 0 to 100%, and full scale of the bi-directional 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 34 for details.

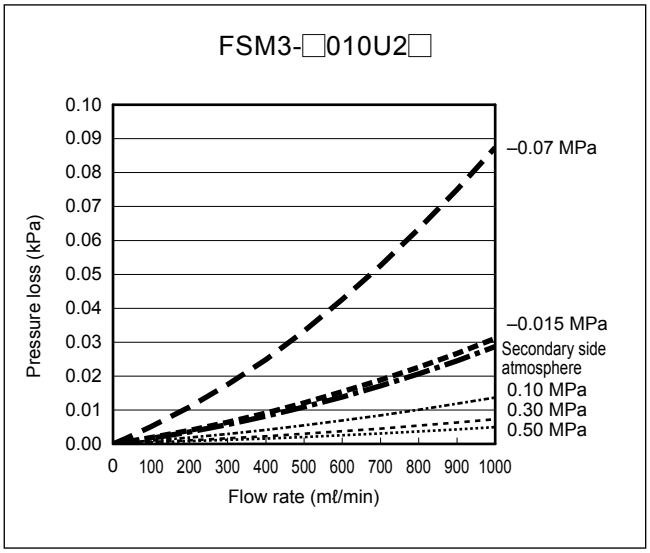
*2: Refer to page 2 for details of analog output when carbon dioxide is switched to.

Pressure loss characteristics

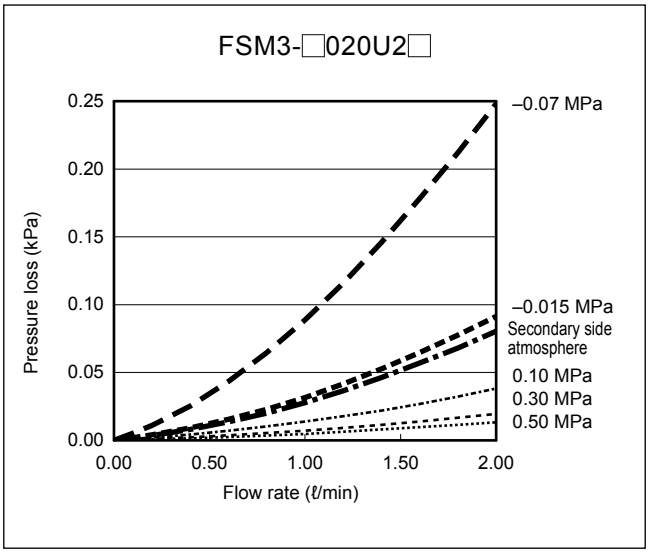
FSM3-□005U2□



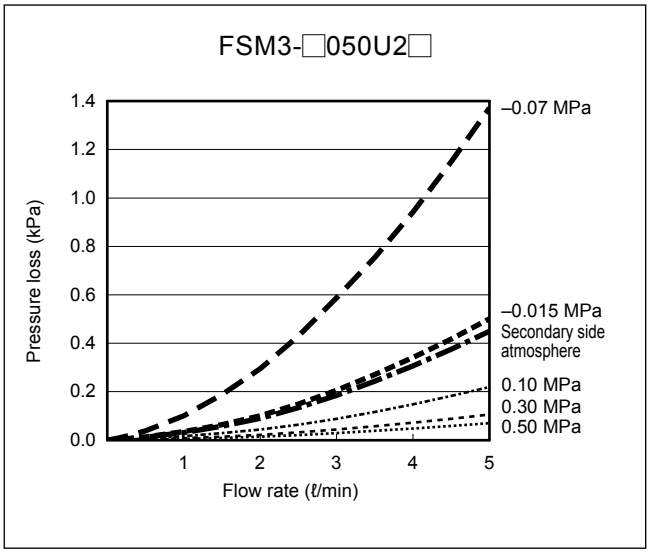
FSM3-□010U2□



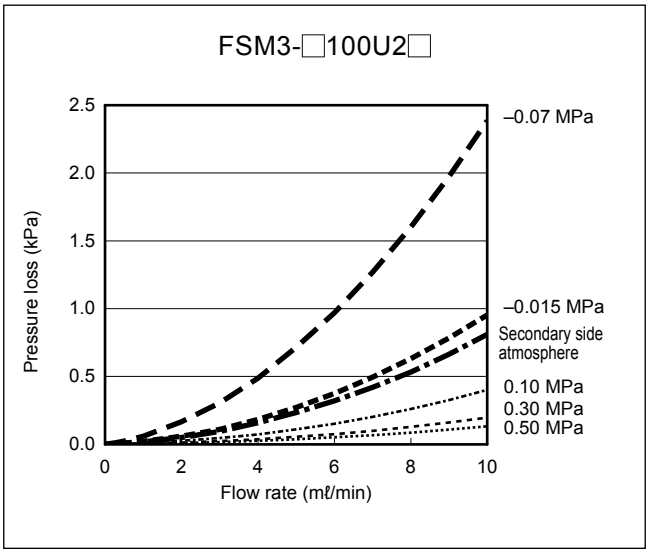
FSM3-□020U2□



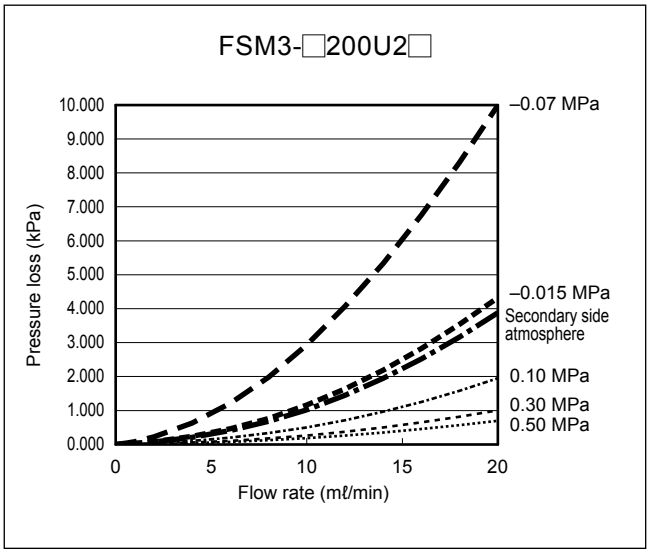
FSM3-□050U2□



FSM3-□100U2□

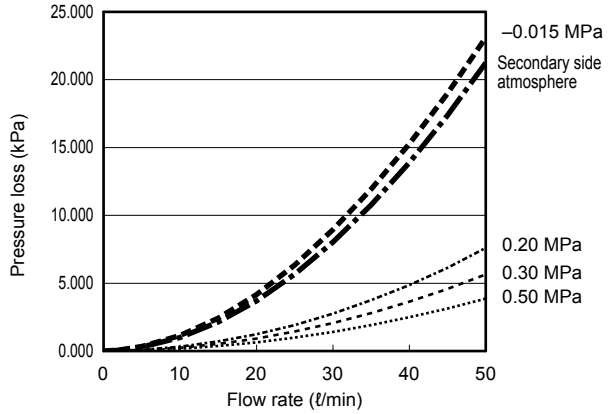


FSM3-□200U2□

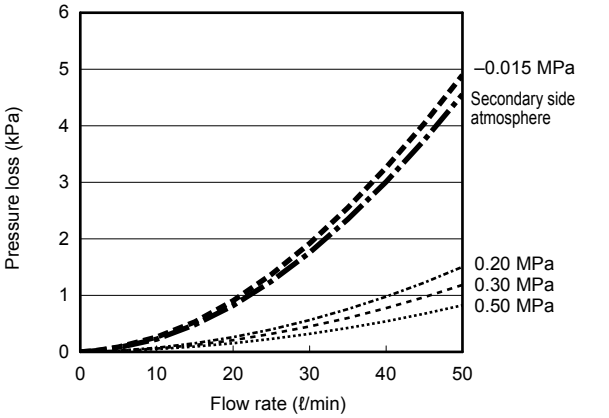


Pressure loss characteristics

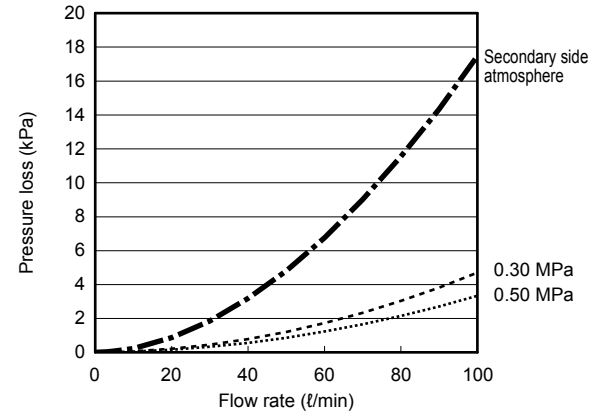
FSM3-□500U2□



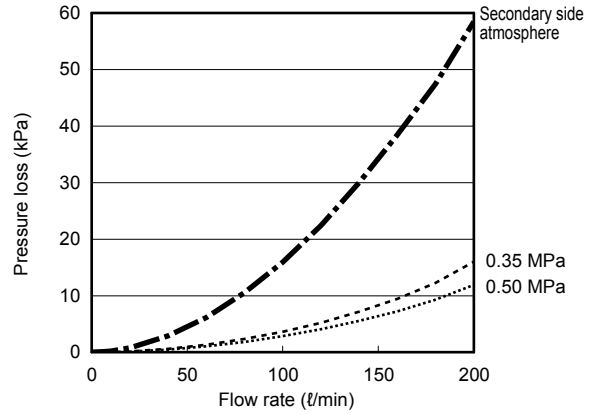
FSM3-□500U2□



FSM3-□101U2□



FSM3-□201U2□



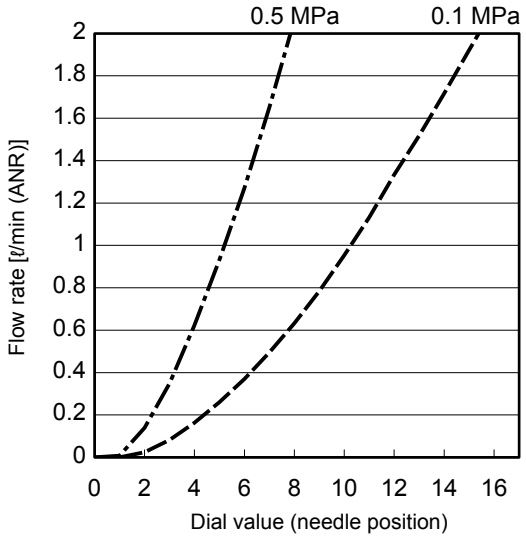
Pressure loss characteristics

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

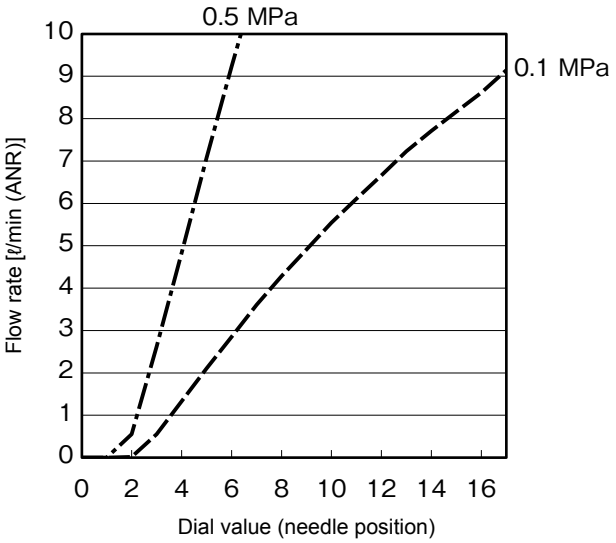
Gas	Specific gravity
Argon	1.38
Carbon dioxide	1.53
Argon 80% Carbon dioxide 20%	1.41

Needle valve flow characteristics (for air, nitrogen gas)

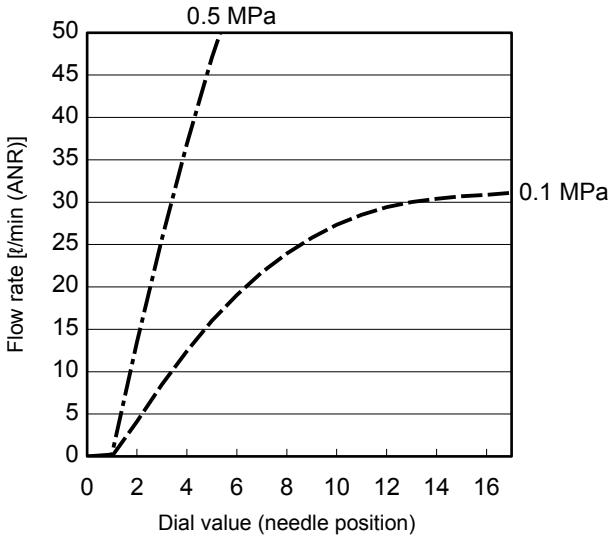
● FSM3-L005/010/020U2AA



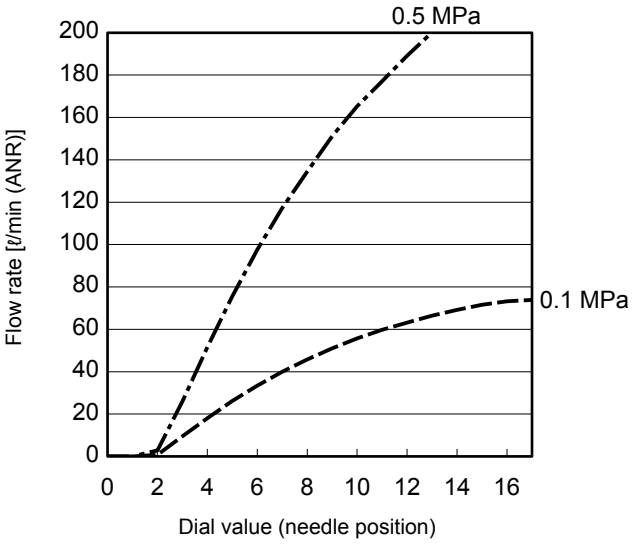
● FSM3-L050/100U2AA



● FSM3-L200/500U2AA

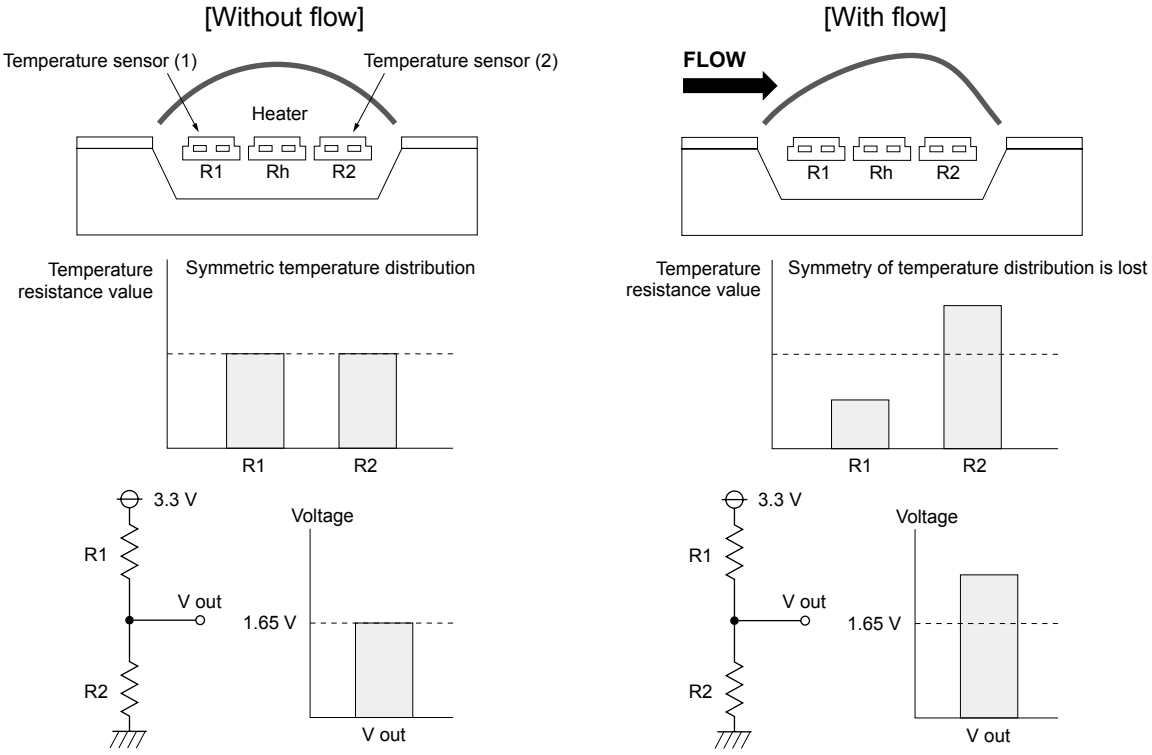


● FSM3-L500/101/201U2BA



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.

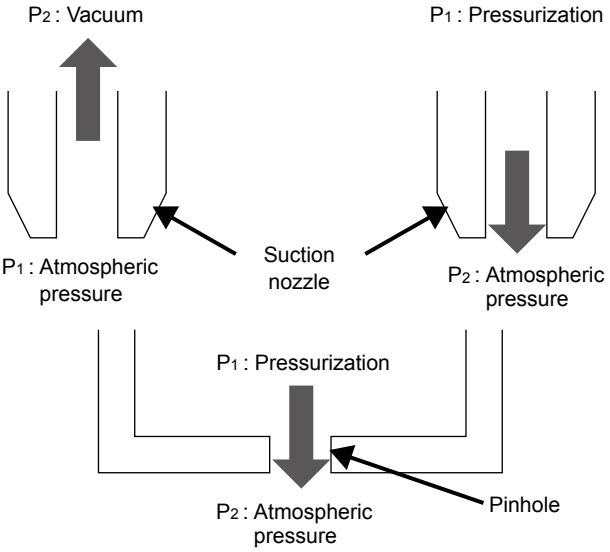
● For $P1 \geq 1.89P_2$ (acoustic velocity)

$Q = 113.2 \times S \times P_1$

● For $P1 < 1.89P_2$ (subsonic velocity)

$Q = 226.4 \times S \times \sqrt{P_2 (P1 - P_2)}$

Q : Flow rate ℓ/min
P_1 : Primary side absolute pressure MPa
P_2 : Secondary side absolute pressure MPa
S : Effective cross-sectional area of nozzle (pinhole) mm^2



● Example of calculation

The figure below shows the calculated value of flow rate when the nozzle diameter is φ0.1 to 2 and P2 is varied.

	P_1 (MPa) Absolute pressure	P_1 (MPa) Gauge pressure	P_2 (MPa) Absolute pressure	P_2 (MPa) Gauge pressure	Acoustic velocity/ subsonic velocity	Calculated flow rate value (ℓ/min)								
						φ0.1	φ0.2	φ0.3	φ0.4	φ0.5	φ0.7	φ1	φ1.5	φ2
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.

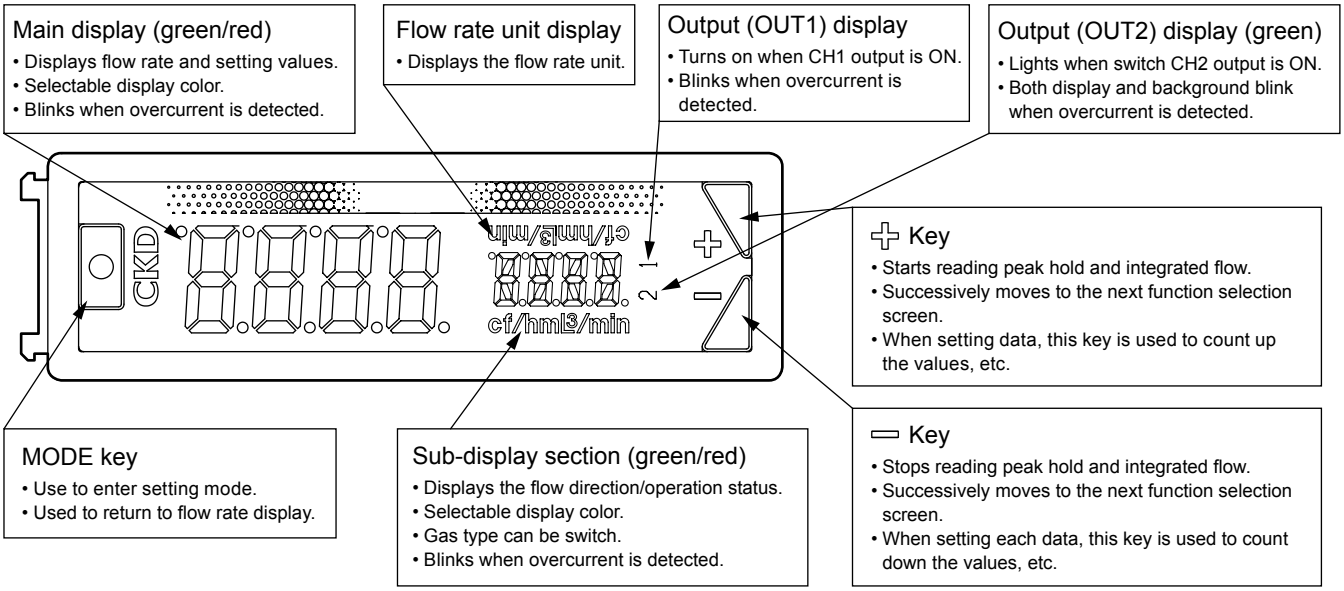
Product weight

[Unit: g]

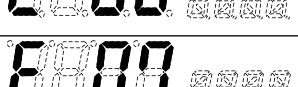
Fitting		LCD display	Bar display	IO-Link
Model No.	Content			
AA	Rc1/8	100	90	95
	Rc1/8 with needle valve	165	-	-
BA	Rc1/4	115	105	110
	Rc1/4 with needle valve	200	-	-
AB	G1/8	100	90	95
BB	G1/4	110	100	105
AC	NPT 1/8	100	90	95
BC	NPT 1/4	115	105	110
AD	1/4" double barbed fitting (500 mL/min to 50 L/min)	155	145	150
BD	1/4" double barbed fitting (50 L/min to 200 L/min)	190	180	190
AE	1/4" JXR male fitting (500 mL/min to 50 L/min)	155	145	150
BE	1/4" JXR male fitting (50 L/min to 200 L/min)	190	180	190

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 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 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 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 memory reading or writing.	Then 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.
	Sensor abnormality has occurred.	Then 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.
	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)

Descriptions	Explanation	Default setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	Instantaneous flow rate display
Peak hold function	Max. and min. values for the flow rate within a set interval are displayed.	
CO_2 discharge display	How much CO_2 is being discharged can be learned by setting the power, discharge pressure, flow rate, and conversion coefficient of the compressor. (reference value obtained by calculation) This is available only when the gas type is set to air.	
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.	

● SET mode

No.	Descriptions	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 operation: Green At switch output 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 condition (ANR): Converted into volumetric flow rate at 20°C, 1 barometric pressure and relative humidity of 65% (Relative humidity for gases other than shall be 0% relative humidity.) Reference state (NOR): Converted into volumetric flow rate at 0°C, 1 barometric pressure	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 s to 1 s. If the display flickers, it may be improved by setting a longer display refresh cycle.	0.25 sec
F.11	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 switching	The gas to be measured can be switched. (The gas type cannot be switched on an oxygen type.)	There is no setting on the air and oxygen type.
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_2 discharge calculation setting	The CO_2 discharge in air calculation can be set. Set the output, discharge pressure, flow rate, and conversion coefficient of the compressor in use.	Power: 0.2 kW Discharge pressure: 0.1 MPa Flow rate: 100 L/min Conversion coefficient: 0.000 kg (CO_2)/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

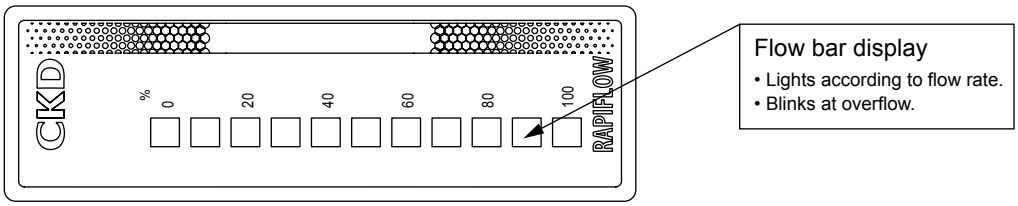
No.	Descriptions	Explanation	Default setting
F.91	Forced output function	Use this function to forcibly turn the switch output ON and confirm the wiring connection or initial operation of the input device.	-
F.92	Zero adjustment	The zero point deviation is corrected.	Adjust value: 0
F.93	Copy function	Operations, set values, etc. can be easily 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

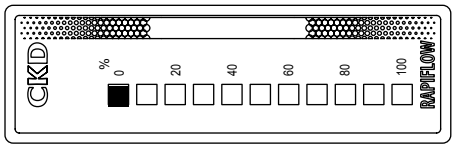
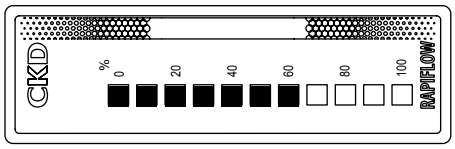
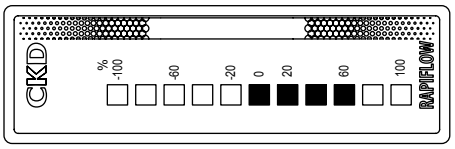
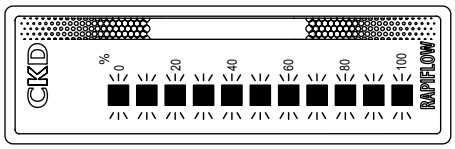
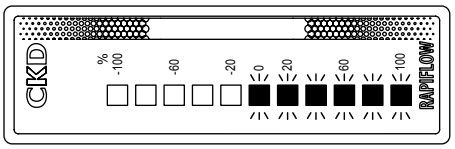
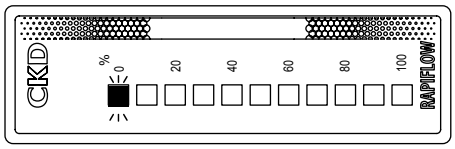
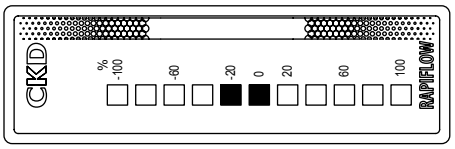
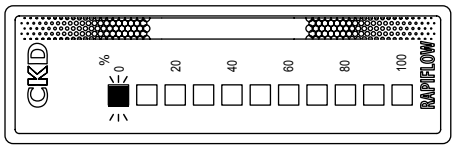
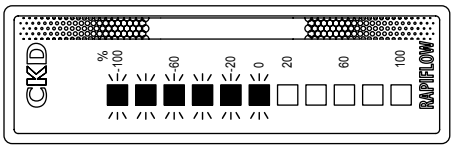
Descriptions	Explanation	Default setting
Setting monitor function	Details set in the SET mode can be confirmed. (Setting details cannot be edited.)	-

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

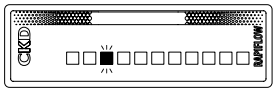
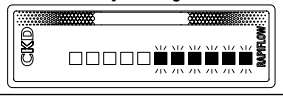
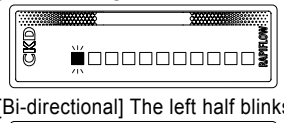
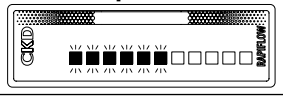
● Names of display parts



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

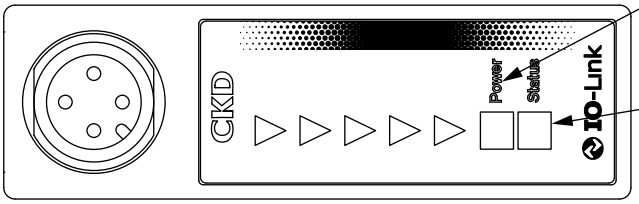
Flow rate	Uni-direction	Bi-directional
0%		
+60% (Forward direction)		
+110% (Forward direction) Blinks at overflow. *Blinks at +110% F.S. or more.		
−10% (Reverse direction)		
−110% (Reverse direction)		

● Error code

Error code	Cause	Countermeasures
The third from left blinks 	An abnormality 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.
[Uni-direction] All blink 	The flow rate exceeds the flow rate display range.	Reduce the instantaneous flow rate value to within the flow rate range.
[Bi-directional] The right half blinks 	Sensor failure	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.
[Uni-direction] The leftmost blinks 	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.
[Bi-directional] The left half blinks 	Sensor failure	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.

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

● 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 ... Lights when the flow rate exceeds the specified range within 10%. Lights when a warning occurs.
- Red..... Lights when the flow rate exceeds the specified range by 10% or more. Lights when an error occurs.

* Lamp goes out when the flow rate is 3% (±3%).

● Communication specifications

Descriptions	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 byte
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
Data range (□/min)	[B]	U	0 to 550 mL	0 to 1100 mL	0.00 to 2.20 L	0.00 to 5.50 L	0.00 to 11.00 L	0.0 to 22.0 L	0.0 to 55.0 L	0.0 to 110.0 L	0 to 220 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

*The data range changes when CO_2 is set as the gas type. Refer to page 14.
*Download the IO-Link configuration files (IODD) from the CKD website (http://www.ckd.co.jp/).

Optional products

Discrete option model No. method

FSM3 - **K** - **P70**

Ⓐ Option

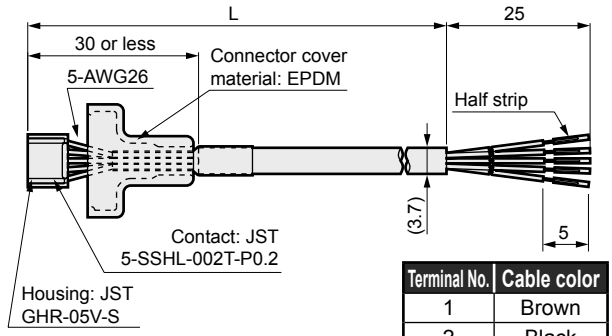
Ⓑ Clean-room specifications

Code	Content
Ⓐ Option	
A	5-conductor cable 1 m (for LCD display)
B	5-conductor cable 3 m (for LCD display)
C	4-conductor cable 1 m (for bar display)
D	4-conductor cable 3 m (for bar display)
G	M12 both-sided connector cable (3 m) (for IO-Link)
H	Bracket
K	Panel mounting kit 1
L	Panel mounting kit 2
M	DIN rail mountingkit
Ⓑ Clean-room specifications	
Blank	None
P70	Anti-dust generation (FSM3-G-P70 cannot be selected.)

Cable optional dimensions

● FSM3-A, B

5-conductor cable (for LCD display, for separated display)



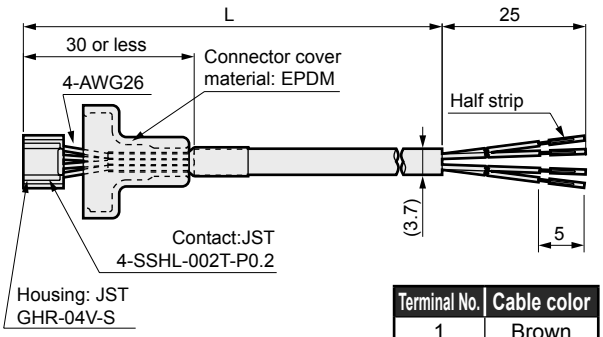
Model No.	L dimensions	Weight g
FSM3-A	1040 ±20	21
FSM3-B	3040 ±20	57

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

Cable optional dimensions

● FSM3-C, D

4-conductor cable (for bar display)

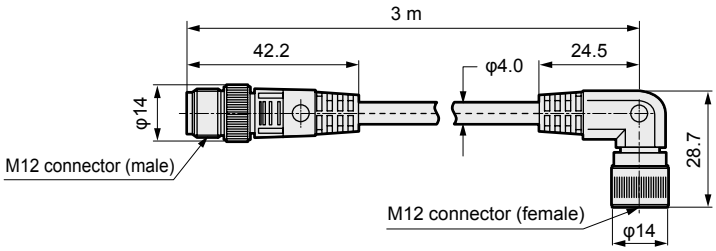


Model No.	L dimensions	Weight g
FSM3-C	1040 ±20	19
FSM3-D	3040 ±20	52

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

● FSM3-G

(M12 both-sided connector cable)

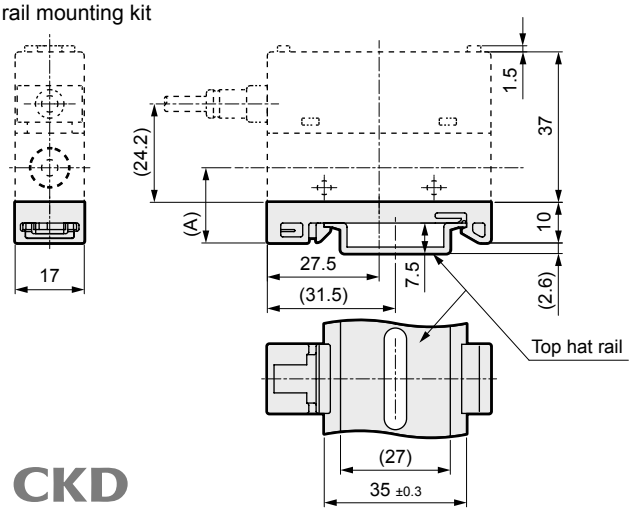


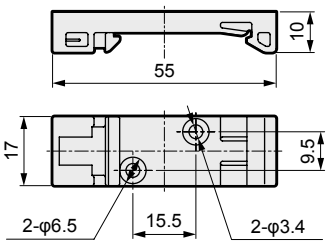
Terminal No.	Cable color
1	Brown
2	White
3	Blue
4	Black

Dimensions with options

● FSM3-M

DIN rail mounting kit



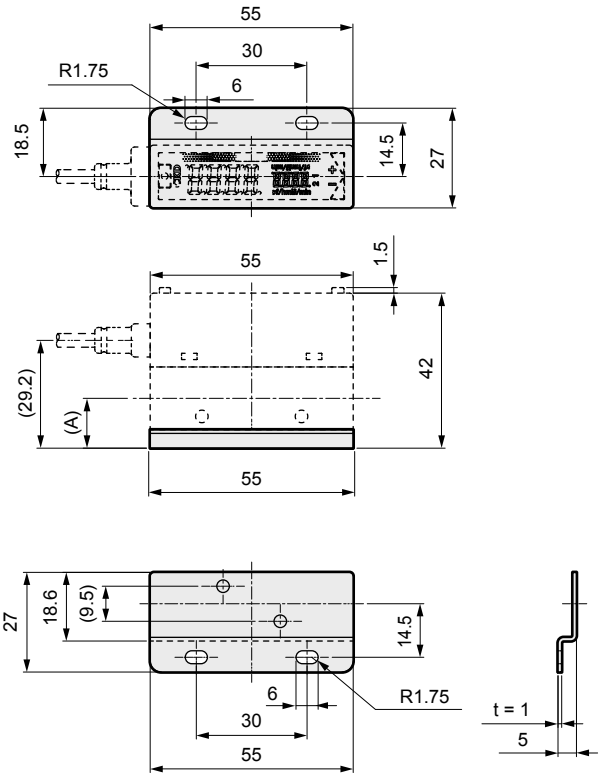


Model No.	Dimension (A)
FSM3-□□□1/AA1/AB1/AC1/AD/AE	18.5
FSM3-□□□1/BA1/BB1/BC1/BD/BE	23.0

Dimensions with options

● FSM3-H

Bracket 1

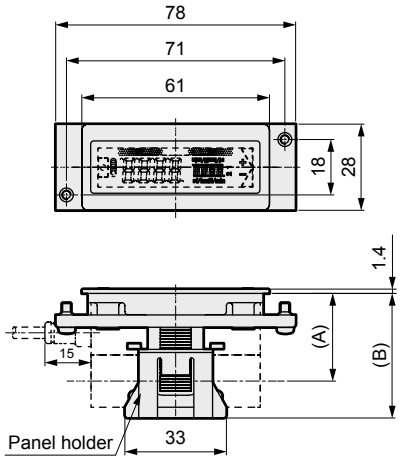


Model No.	Dimension (A)
FSM3-□□□1/AA1/AB1/AC1/AD/AE	13.5
FSM3-□□□1/BA1/BB1/BC1/BD/BE	18.0

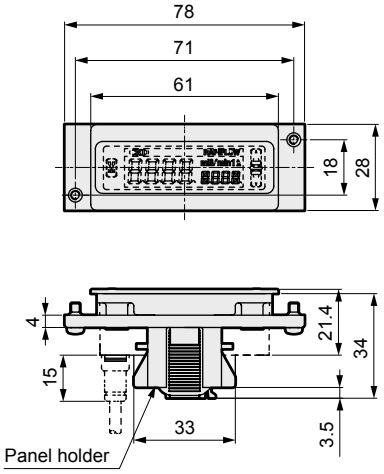
● FSM3-K

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

• LCD display



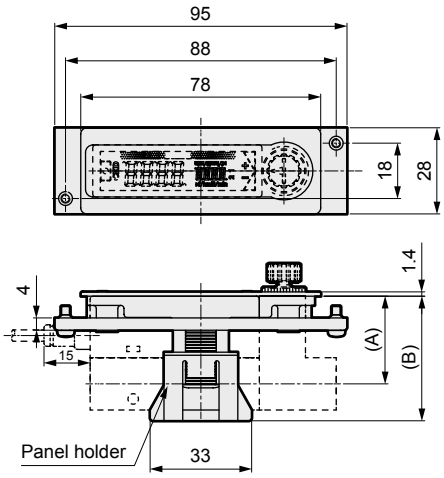
• Separated display



● FSM3-L

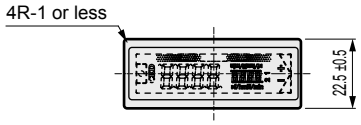
Panel mounting kit 2 (for needle valve integrated)

• Needle valve integrated

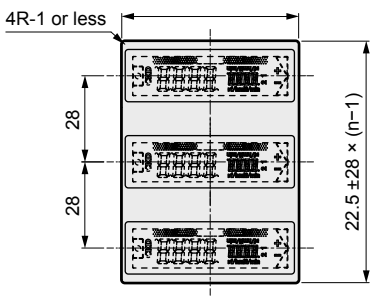


[Panel cut dimension]

In case of single installation



In case of continuous installation



Model No.	Dimension (A)	Dimension (B)
FSM3-□□□1/AA1/AB1/AC1/BC1/AD/AE/□□□/N/T	28.5	40.5
FSM3-□□□1/BA1/BB1/BC1/BD/BE/□□□/N/T	30	46.5

Inline clean filter Stainless steel

FCS500 Series

● Port size: Rc1/8, Rc1/4

JIS Code

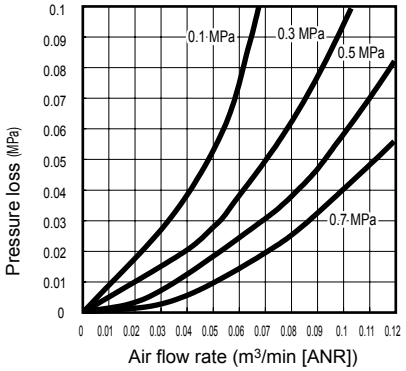
RoHS CAD

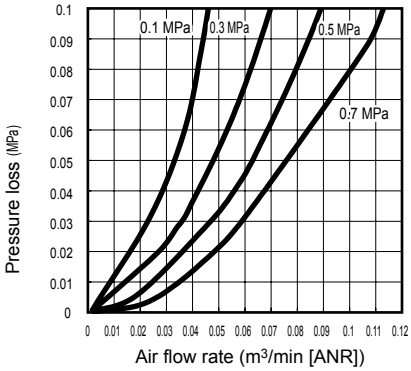
Specifications

Descriptions		FCS500-66-P90 FCS500-66-P94	FCS500-88-P90 FCS500-88-P94
Working fluid		Compressed air, N_2	
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_2)	
Differential pressure-resistant	MPa	0.5	
Working pressure	MPa	−0.095 to 1.5 (Compressed air), −0.095 to 0.99 (N_2)	
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

- FCS500: Model No. (clean-room specifications) (oil-prohibited specifications)
- 88: Ⓐ Port size
- B: Ⓑ Attached
- P90: Ⓒ Clean-room specifications

Ⓐ Port size	
66	IN side/OUT side port size Rc1/8
88	IN side/OUT side port size Rc1/4

Ⓑ Attached	
Blank	None
B	Bracket, mounting screw

Ⓒ Clean-room specifications		
	Structure/treatment	Material limitations
P90	Stainless steel Oil free	-
P94	Stainless steel Oil free	Use of copper-, silicon-, or halogen-based materials (e.g. fluorine,, chlorine, orbromine) is not possible

Note: "P94" is a custom order product.

Inline clean filter

FCS1000 Series

● Port size: Rc1/4, Rc3/8, R1/4, R3/8
Push-in fitting φ8, φ10, φ12

JIS Code

RoHS CAD

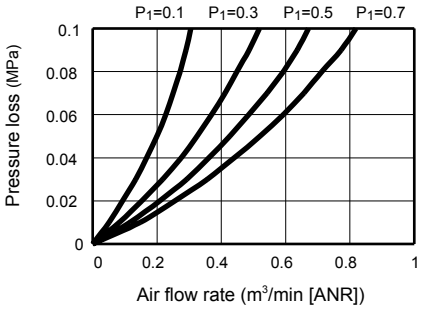
Specifications

Descriptions			Stainless steel (custom order) FCS1000- (*1) (*2) -P90 FCS1000- (*1) (*2) -P94
Working fluid			Compressed air, N_2
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 (N_2)
Differential pressure-resistant		MPa	0.5
Working pressure		MPa	−0.095 to 1.5 (Compressed air), −0.095 to 0.99 (N_2)
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

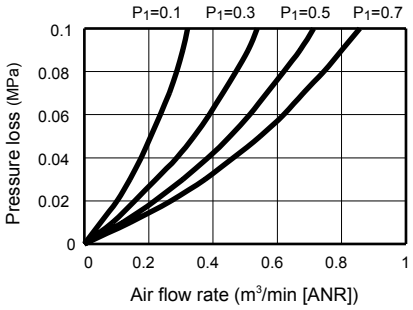
*1: Initial flow rate at primary pressure 0.7 MPa and pressure drop 0.03 MPa. (Differs according to port size.)

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

- FCS1000: Model No. (clean-room specifications) (oil-prohibited specifications)
- Ⓐ IN side port size
- Ⓑ OUT side port size
- Ⓒ Clean-room specifications

Ⓐ IN side port size	
8	Rc1/4
10	Rc3/8

Ⓑ OUT side port size	
8	Rc1/4
10	Rc3/8

Ⓒ 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 the product appropriately to ensure that the CKD product is used safely. 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.)

❶ 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.
❷ 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 (General rules for pneumatic systems)
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.

❶ Inspect and service the machine and devices after confirming safety of all systems related to this product.
❷ Note that there may be hot or charged sections even after operation is stopped.
❸ 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.
❹ When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety, such as pop-out prevention measures, is secured.

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.

Pneumatic components: Warning and Cautions

Always read this section before use.

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.

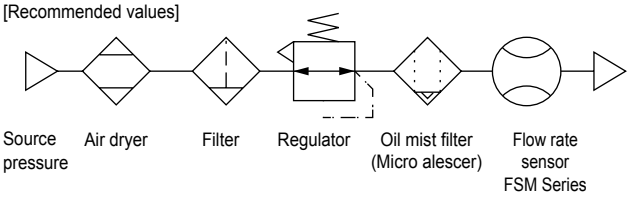
■ With fluids other than the applicable fluid, accuracy is merely a reference value.

■ 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 JISB8392-1: 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 alescer) 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 values]



■ 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°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.

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%.
  (With gas types other than air, this is 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

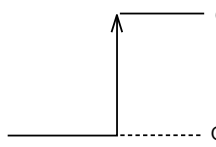
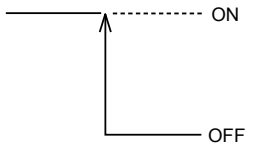
⚠ CAUTION

- This valve cannot be used as a stop valve that requires no leakage. Slight leakage is allowed for in this product's specifications.
- The flow path in the needle valve is not completely free of dust generation. A final clean filter should be used in circuits where dust generation could be a problem.

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	ON at setting value or more	ON at setting value or less
		
	Atmospheric pressure side / High vacuum side	Flowrate 0 side / High flow rate side

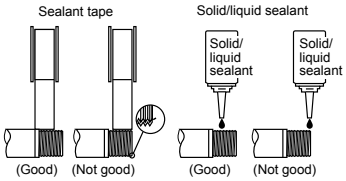
Mounting,installation and adjustment

Mounting

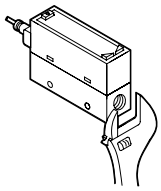
⚠ CAUTION

- Always attach the pipes before starting wiring.
- Align the fluid flow direction to the direction indicated on the pipe when connecting the pipes.
- Installing the regulator/solenoid valve, etc., immediately before this product affects characteristics and might cause error. Provide a straight piping section if required.
- 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 screw. 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.



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



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

[Reference value]

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

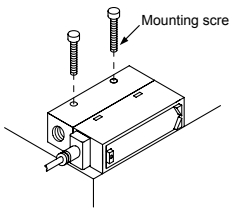
- Be sure to connect a fitting even when using the metal body with the OUT side opened. The port filter could come off.
- Make sure that the leakage detection solution does not enter the inside of this product when inspecting the pipe for leaks.
- Do not turn fittings while fluid pressure is still applied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

Mounting

⚠ CAUTION

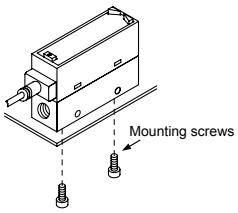
- The LCD display type flow rate meter uses a liquid crystal display. This may be difficult to read depending on the angle.
- Do not install multiple product bodies in close contact. The generation of heat on each part could cause the product's temperature to rise, hastening changes in characteristics 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.
- This product can be installed in any direction; top, bottom, left, or right.

Lateral mounting (use of through hole)

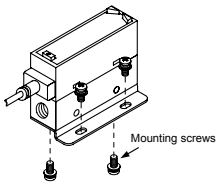


Tighten the mounting screw with a tightening torque of 0.5 N·m.

Vertical mounting (use of female thread on bottom surface)

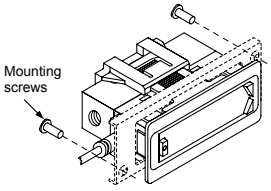


Bracket mounting (use of dedicated bracket)

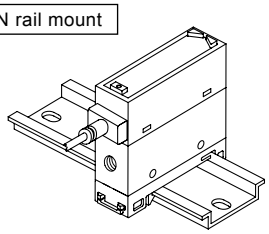


For FSM3-□005 to 201
Single bracket model No.: FSM3-H
Tighten the mounting screw with a tightening torque of 0.5 N·m.

Panel mounting



DIN rail mount



Tighten the set 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.

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

  (FSM3-□V output impedance: Ro = 1 kΩ
  Load internal impedance: Rx = 1 MΩ

  $$\text{Output value} = \left(1 - \frac{Ro}{Ro + Rx}\right) \times 100\%$$

  $$= \left(1 - \frac{1\ k\Omega}{1\ k\Omega + 1\ M\Omega}\right) \times 100\% \quad \text{Output value error} \Rightarrow \text{approx. } 0.1\%$$

- 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.
- Check that stress (7 N and over) is not directly applied to cable leadouts or connectors.
- Always attach the connector bar after connecting the connector.
- The power supply for the metal body (stainless steel body, aluminum 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 F.G. 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, excessive 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 F.G.
- 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.

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 assessment of this product is performed by using a cable pairing a power supply line and a signal line, treating this cable as a signal line.
- 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.

■ If the output setting value is changed, control system devices could operate unintentionally. Stop devices before changing settings.

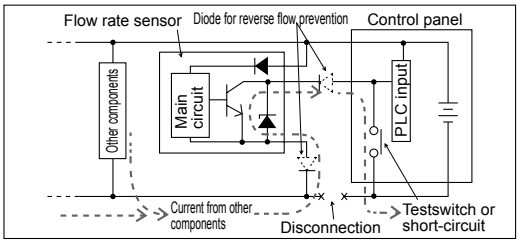
■ Analog output continues even if the flow rate range is exceeded. With the display integrated, "Hi" or "Lo" will be displayed. With display separated, the bar display will blink.
Note that this is outside guaranteed precision.

■ 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.

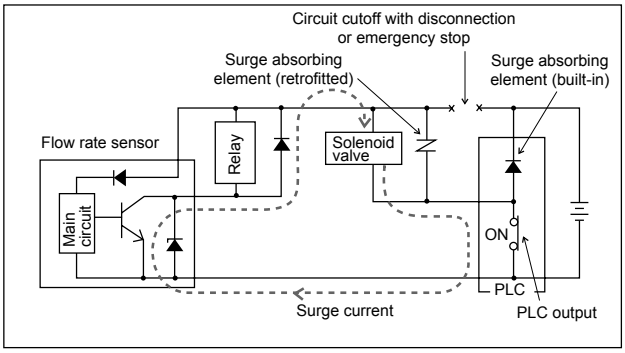
■ Perform gas type switching after replacing the inside of the flow path with the actual gas used.

■ 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.

■ 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.

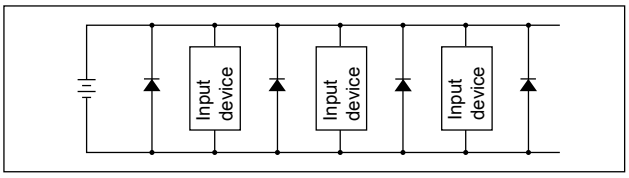


Take the following countermeasures as followings to prevent damages caused by reverse current.

(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

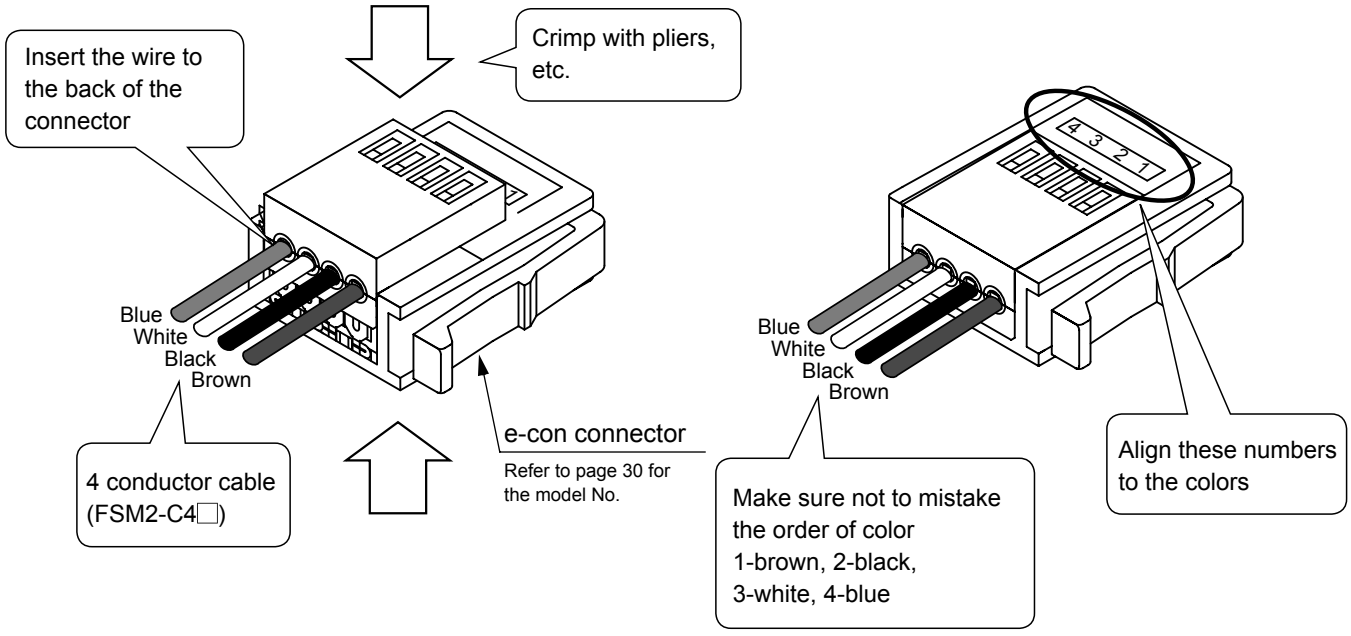
⚠ CAUTION

■ 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 doesn't operate properly. When using the FSM3, use the bar display type 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 cable, 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 and over onto the cable.

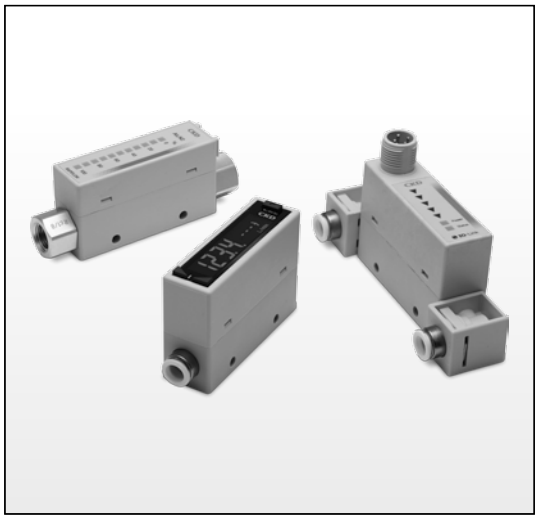
MEMO

MEMO

Related products

Compact flow rate sensor RAPIFLOW® FSM3 Series

Catalog No. CC-1235A



Compact flow rate sensor 3 series for supporting various applications

- Five gas types can be measured on a single unit
- Reduced pressure loss
- High precision/high-speed response
- Bi-directional fluid measurement
- LCD can be rotated for ease of viewing
- Wide selection of fittings

Compact flow rate controller (RAPIFLOW) FCM Series

Catalog No. CB-024SA

- 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

Inline clean filter FCS500/FCS1000 Series

Catalog No. CB-024SA

Ideal as a final filter (for air or inert gases) for various clean applications

- **0.01 µm high precision filtration, 99.99% removal efficiency**
  Hollow fiber membrane element has enabled 0.01 µm high precision filtration and 99.99% removal efficiency.
- **Long service life**
  Considerably longer service life. Approximately five times longer than the flat membrane type.
- **Compact/lightweight/large flow rate**
  Three to ten times filtration area enables larger flow rate and less pressure loss than the flat membrane type of the same capacity. If the flow rate is the same, the hollow fiber membrane type can be more compact and lighter.
- **Oil-prohibited specifications**
  Parts are all degreased and cleaned. The manufacturing processes from assembling to packaging are performed in clean room.
- **Easy maintenance**
  As the case of resin type is transparent, it is easy to visually check for dirt of the element.
- **Wide range of choices**
  Two kinds of flow rate (500 and 1000 Series), resin and stainless steel materials, and the mounting options of push-in fitting, male thread piping and female thread piping are available.

Related products

Electro pneumatic regulator EVS2 Series

Catalog No. CC-993A

Compact and lightweight
Compact size (W30 × D50 × H39) electro pneumatic regulator weighing only 90 g Downsize and lighten your equipment with this model.

Long service life
3x compared with conventional models (in-house comparison)

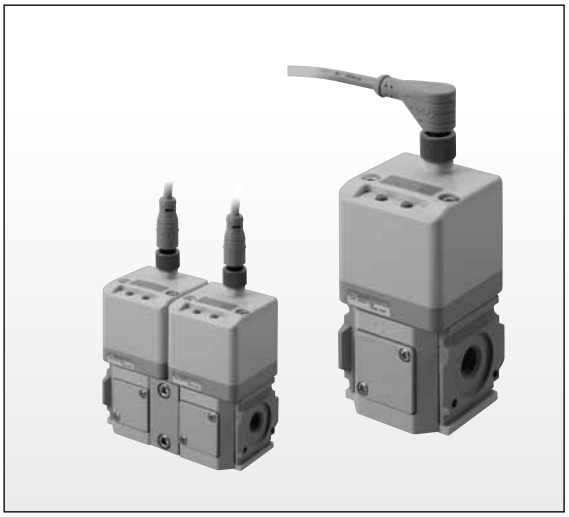
High precision/high-speed response
High precision and high-speed response control of fluid pressure using electric signals.
Provides 0.3% F.S. repeatability, 0.1% F.S. resolution, 0.1 sec. response time (without load).

2-color display of the operational status
On the 2-color operation indicator, green means the pressure is within the set value and red means the pressure is outside the set value or an error status.

Easy to pipe/wire
Push-in cartridge fitting and M12 connector have improved work efficiency.

High precision electro pneumatic regulator EVR Series

Catalog No. CC-1174A



High precision pressure precision
- Hysteresis: 0.3%F.S., linearity: ±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: ±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)

Digital pressure sensor PPX Series

Catalog No. CB-024SA

Increased visibility

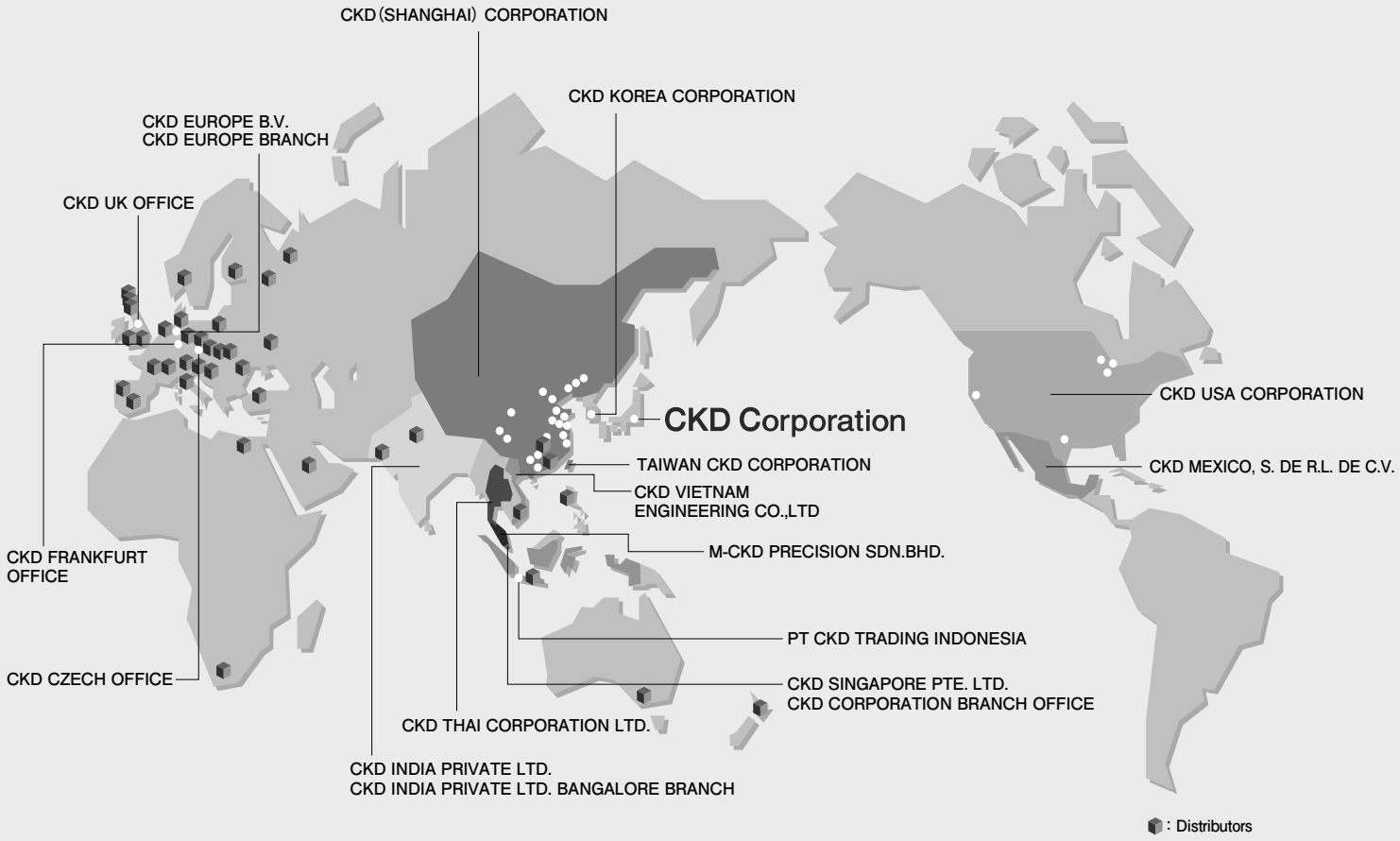
Analog current output is added to the high-function type

Power consumption is further reduced

Direct setting with 2-screen display

Copy function helpful for reducing work processes and preventing misoperation

WORLD-NETWORK



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