CKD

SMALL SIZE FLOW SENSOR

RAPIFLOW® FSM3 Series

- LCD display type
- Bar display type
- IO-Link type

INSTRUCTION MANUAL

SM-662466-A/6

- Read this Instruction Manual before using the product.
- Especially, read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **"RAPIFLOW® FSM3 Series" compact size flow rate sensor**.
This Instruction Manual contains basic items such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing a device using this product, the customer is responsible to manufacture a safe device. To achieve this, please verify the safety of electric control system is secured, which controls the mechanical mechanism of the device and, pneumatic pressure control circuit or water control circuit.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations including the followings.

ISO 4414, JIS B 8370 and JFPS 2008 (the latest edition of each standard)
High Pressure Gas Safety Law, Occupational Safety and Health Law, and other safety regulations, organization standards and regulations.

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this,

thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ DANGER	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ WARNING	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ CAUTION	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

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

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ WARNING

This product must be handled only by those who have enough knowledge and experience.
This product was designed and manufactured as a general industrial machinery equipment and parts.

This product must be used within its stated specifications.
Do not use out of the specifications unique to this product. 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 in outdoors or for use under the following conditions or environments.
(Note that this product can be used when CKD is consulted prior to its usage and the customer consents to CKD product specifications. However, even in that case, the customer should provide safety measures to avoid danger to prevent danger in the event of failures.)

- Devices and usage that directly contact nuclear power, railways, aviation, ships, vehicles, medical machines, beverages and foods.
- Use for applications requiring safety, including amusement, emergency cutoff circuits, press machines, brake circuits, and items used for safety measures.
- Use for applications where life or assets could be significantly affected, and special safety measures are required.

Do not handle this product, and remove piping / devices before confirming the safety.

- Conduct inspections and maintenance of machines and devices only after confirming the safety of all systems related to this product. Also, turn the power OFF of supply air, supply water, and applicable facilities that are energy sources. Make sure to exhaust compressed air inside the system and be cautious of water and electricity leakages.
- As it is possible that there are high temperature parts and charged parts even after operation is stopped, be cautious when handling this product and removing piping / devices.
- Before starting / restarting machines and devices that a pneumatic pressure device is used, make sure to confirm the system safety is secured with pop-out prevention measures, etc.

Always adopt a fail safe mechanism when this product is used under a condition that a failure leads to significant accidents.

⚠ CAUTION

Withstand pressure differs depending on each series.
Make sure to select the right product.

Be cautious of the followings when using with dynamic pressure near the maximum working pressure.
With each series, the sensor can handle an overflow double the measures 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 work piece is filled for leakage inspection, provide a bypass circuit or restrictor so that dynamic pressure is not applied to the sensor.

The needle valve cannot be used as the stop valve that leakage is required to be zero.
The specifications of this product allows leakage to some extent.

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

Use in a normal flow that does not include irregular fluctuations.
Measuring the pulsating flow rate may cause errors in the measured flow rate. Restrict the flow rate with the fixed orifice and needle valve, etc., and use it in a laminar flow state.

⚠ CAUTION

The flow rate is fluctuating, the measured flow rate value will also fluctuate.

If the actual flow rate is fluctuating, the measured flow rate value will also fluctuate.
Either increase the FSM3 display cycle or response time, or average the analog output on the device. In particular, note that control valves such as solenoid valves can be easily generated when used near a circuit or pump that opens and closes quickly and frequently.

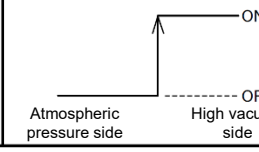
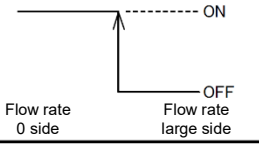
Be cautious of the followings when using for suction verification, etc.

[1] Mount an air filter upstream from suction in compliance with use conditions to prevent the entry of foreign matter.

[2] 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.

[3] 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 insertion ring into the tube, and connect the tube to the push-in fitting.

[4] When the 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 verification	ON at setting value or more	ON at setting value or less
		

[5] Select the flow rate range based on the operating vacuum pressure and suction nozzle diameter.
Refer to **"3.4 Flow rate theory calculation method"**.

[6] Response speed may be delayed by the piping volume between the suction nozzle and this product. In this case, take countermeasures to reduce piping capacity.

Precautions regarding used fluid

⚠ DANGER

Do not make a gas flow within the explosion limit.

Explosion accident may be generated.

When using a product with no oil-prohibited processing, do not flow oxygen gas.

It may cause fires. In addition, even if a product is treated with oil-prohibited processing, when a gas except for oxygen gas is flowed once, do not use with oxygen gas again.

⚠ WARNING

Do not use this product as a transaction meter.

As it does not comply with Japanese Measurement Law and equivalent regulations of other countries, do not use for commercial transactions. Use the product only as the sensor for industry fields.

Appropriate fluid temperature is within 0 to 50°C.

Do not use in places where dew is generated by sudden temperature change even within the temperature range.

Do not use fluids besides applicable fluids.

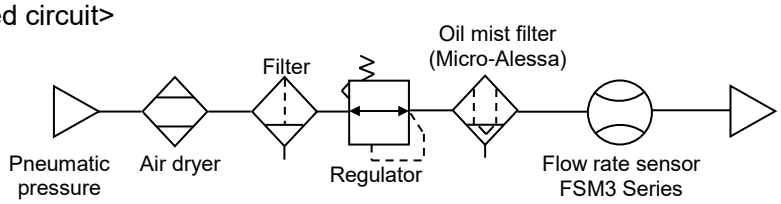
When fluids besides applicable fluids are used, the accuracy specification cannot be guaranteed.

Be cautious of purification level of fluid.

- 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 a long time could adversely affect the performance. Do not seal the fluid in the pipe for long periods of time.
- If this product is contaminated by foreign objects (dust and water drops inside piping, oil mist, etc.), the accuracy and control performance may deteriorate and cause failure. If it may be contaminated by foreign objects, attach a filter, air dryer and oil mist filter on the primary side (upstream) of this product.
- When using compressed air, use clean air that complies with JIS B 8392-1：2012(ISO 8573-1：2010) [Class 1:1:1 to 1:6:2].
- As drain (water, oxidized oil and foreign objects) may be contained in the compressed air from the compressor, use this product by attaching a filter air dryer and oil mist filter (Micro-Alessa) on the primary side (upstream).

The mesh (wire mesh) inside this product is to rectify the flow inside piping, and therefore, it cannot be used to remove the flowed-in foreign objects.

<Recommended circuit>



Use this product after verifying the working pressure range and flow rate range.

- If used in maximum working pressure or more, minimum working pressure or less, and outside of specified flow rate range, it may cause failures.
- If energized in a vacuum state of -0.09 MPa or less, the sensor’s heat dissipation will suffer, leading to degradation of the sensor.

When using a valve on the primary side of this product, use a valve with oil-prohibited specification and attach a filter.

This product may malfunction and result in failure due to grease on the valve, diffused oil, and abrasion powder generated from the valve.

When using the valve with liquified gases such as carbon dioxide, always vaporize the gas.

Faults could result if the liquified gas enters this product.

Precautions regarding maintenance

⚠CAUTION

Do not use solvents, alcohol, and cleaning detergents to clean this product.
The case is made of resin. The resin could absorb these chemicals. Wipe off dirt with a rag soaked in a diluted neutral detergent solution and wrung out well.

Verify the flow rate accuracy periodically.
It is recommended to verify the flow rate accuracy periodically. Depending on the customer's use environment and condition, the accuracy may fluctuate from the first time. Also, if used for a long time, the accuracy may fluctuate due to sensor chip deterioration.

Displayed flow rate on this product is a value of mass flow rate converted to volume flow rate. It is displayed by converting measured mass flow rate to the volume flow rate at 20°C, 1 atmospheric pressure (101kPa), and relative humidity 65% RH (Gas types besides air uses 20°C, 1 atmospheric pressure (101kPa), and 0% RH).

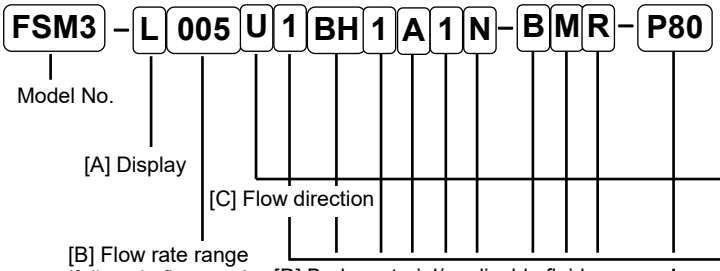
CONTENTS

1. PRODUCT OVERVIEW

1.1 Model No. display

1.1.1 LDC display type (FSM3-L Series)

■ **Resin body type**



<Example of model No.>

FSM3-L005U1BH1A1N-BMR-P80

Model: RAPIFLOW FSM3 Series
[A] Display : Liquid crystal display
[B] Flow rate range (full scale flow rate)
: 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids
: Resin/air
[E] Connection port size
: Push-in
(φ4 mm for tube)
[F] Piping direction : Straight
[G] Output specifications
: Analog voltage output x 1
NPN switch output x 1
With setting copy function
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : 5-conductor 3 m
[K] Mounting attachments
: DIN rail mount
[L] Attached documents : Inspection certification
[M] Clean-room specifications
: Oil-prohibited process

■Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: For “B: bi-direction” models on the flow direction, [I] Valve option is “N: None” only. Note that “T: with needle valve” and “E: EXA connecting fitting” cannot be selected.
*3: The G screw connection shape complies with ISO16030.
*4: Check G screw connection shape with "1.4 Dimensions" when selecting.
(The G screw connection shape complies with JIS B 2351-1 O type)
*5: Note that the elbow fitting will interfere with the case when installed upward and with the DIN rail installation when installed downward.
*6: Models with the unit switching function are not sold in Japan.
*7: Connection to solenoid valve (EXA series) is possible with the dedicated fitting.
Refer to "1.4 Dimensions".
*8: Be sure to set EXA to the OUT side of the product.
Use a lead wire for the EXA coil option.
The DIN terminal box cannot be mounted because it will cause interference.
After making sure it is connected firmly, confirm that there is no mis-connection and external leakage.
*9: [M] Clean-room specifications “P.70” and “P.80” cannot be selected.
*10: Note that the bracket mounting position may interference with the elbow fitting.
*11: Optional parts are provided with the product. They are not mounted to the product.
*12: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*13: In addition to P.70 specifications, the gas contact parts are degreased and cleaned.

Code	Content
[A] Display	
L	Liquid crystal display

[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		

[C] Flow direction	*2
U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids		
	Body material	Applicable fluids
1	Resin	Air (gas type can be switched)

[E] Connection port size				
BH	Push-in (for φ 4 mm tube)	**AF**	G1/8	*3
CH	Push-in (for φ 6 mm tube)	**BF**	G1/4	*3
DH	Push-in (for φ 8 mm tube)	**CF**	G1/2	*3
EH	Push-in (for φ 10 mm tube)	**AB**	G1/8	*4
HH	Push-in (for φ 1/4” tube)	**BB**	G1/4	*4
JH	Push-in (for φ 3/8” tube)	**CB**	G1/2	*4
AA	Rc1/8	**AC**	NPT1/8	
BA	Rc1/4	**BC**	NPT1/4	
CA	Rc1/2	**CC**	NPT1/2	

[F] Piping direction	
1	Straight
2	Elbow *5

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

[H] Unit specifications	
1	SI units only
2	With unit switching function (overseas models only) *6

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

[J] Lead wire	
Blank	None
A	5-conductor 1 m
B	5-conductor 3 m

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

[L] Attached documents	
Blank	None
R	Company certification
S	Company certification + Traceability certification

[M] Clean-room specifications	
Blank	None
P70	Anti-dust generation *12
P80	Oil-prohibited processing *13

Compatibility table of flow rate range and port size, needle valve option, and EXA connection fitting

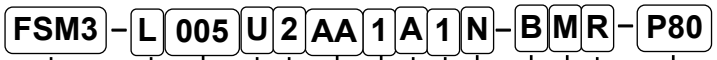
[B] Flow rate range	[E] Port size [F] Piping direction															
	BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
005	●○	●○			●○		●○	●○			●○		●○			●○
010	●○	●○			●○		●○	●○			●○		●○			●○
020	●○	●○			●○		●○	●○			●○		●○			●○
050	●○	●○			●○		●○	●○			●○		●○			●○
100	●○	●○			●○		●○	●○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

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

Compatibility table of port size and clean-room specifications

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

■ Stainless steel body type



Model No.

[A] Display

[B] Flow rate range (full scale flow rate)

[C] Flow direction

[D] Body material/applicable fluids

[E] Port size

[F] Piping direction

[G] Output specifications

[H] Unit specifications

[I] Valve option

[J] Lead wire

[K] Mounting attachments

[L] Attached documents

[M] Clean-room specifications

Code	Content
[A] Display	
L	Liquid crystal display

[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		

[C] Flow direction	*2
U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids		
	Body material	Applicable fluids
2	SUS	Air (Gas type can be switched)
3	SUS	Oxygen (Oil-prohibited specification) *3

[E] Port size	
AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
AF	G1/8 *4
BF	G1/4 *4
CF	G1/2 *4
AB	G1/8 *5
BB	G1/4 *5
CB	G1/2 *5
AC	NPT1/8
BC	NPT1/4
CC	NPT1/2
AD	1/4" double barbed fitting (50 L/min or less)
BD	1/4" double barbed fitting (50 to 200 L/min)
AE	1/4" JXR male fitting (50 L/min or less)
BE	1/4" JXR male fitting (50 to 200 L/min)

[F] Piping direction	
1	Straight

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

[H] Unit specifications	
1	SI units only
2	With unit switching function (overseas models only) *6

[I] Valve option	*2, *10
N	None
T	With needle valve (only for models 200 L or less)

[J] Lead wire	
Blank	None
A	5-conductor 1 m
B	55-conductor 3 m3m

[K] Mounting attachments	注 7
Blank	None
H	Bracket 1 (for models 200 L or less)
J	Bracket 2 (for 500 or 1000 L models)
K	Panel mounting (for sensor products of models 200 L or less)
L	Panel mounting (for needle valves of models 200 L or less)
M	DIN rail mounting (for models 200 L or less)

[L] Attached documents	
Blank	None
R	Inspection certification
S	Inspection certification + Traceability certification

[M] Clean-room specifications	*10
Blank	None
P70	Anti-dust generation *8
P80	Oil-prohibited processing *9

<Example of model No.>

FSM3-L005U2AA1A1N-BMR-P80

Model: RAPIFLOW FSM3 Series
[A] Display : Liquid crystal display
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids
: SUS/air
[E] Port size : Rc1/8
[F] Piping direction : Straight
[G] Output specifications
: Analog voltage output x 1
NPN switch output x 1
With setting copy function
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : 5-conductor 3 m
[K] Mounting attachments
: DIN rail mount
[L] Attached documents
: Inspection certification
[M] Clean-room specifications
: Oil-prohibited processing

■Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: For the model that the flow direction is "B: Bi-direction" and the application fluid is oxygen, "[I] Valve option" becomes "N: None" only.
Note that "T: With needle value" cannot be selected.
*3: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*4: The G screw connection shape complies with ISO 16030.
*5: Check the G screw connection shape with "1.4 Dimensions" when selecting.
(The G screw connection shape complies with JIS B 2351-1 O type)
*6: Models with the unit switching function are not sold in Japan.
*7: Optional parts are provided with the product. They are not mounted to the product.
*8: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*9: In addition to P.70 specifications, the contact gas parts are degreased and cleaned.
*10: This cannot be selected on an oxygen type (blank only).

Flow rate range and port size

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

● :Connection port compatibility ○ :Needle valve option compatibility

■ Environment-resistant specifications

FSM3 – L 005 U 4 AA 1 A 1 N – BJR – P80 – EX

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

<Example of model No.>
FSM3-L005U4AA1A1N-BJR-P80-EX
Model: RAPIFLOW FSM3 Series
[A] Display : Liquid crystal display
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids : SUS (Environment -resittant specs)/air
[E] Port size : Rc1/8
[F] Piping direction : Straight
[G] Output specifications : Analog voltage output x 1 NPN switch output x 1 With setting copy function
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : 5-conductor 3 m
[K] Mounting attachments : Bracket 2
[L] Attached documents : Inspection certification
[M] Clean-room specifications : Oil-prohibited processing
[#] Option (ATEX Compliant) : ATEX Compliant

Code	Content

[A] Display

L	Liquid crystal display

[B] Flow rate range (full scale flow rate)

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

[C] Flow direction *2

U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids

	Body material	Applicable fluids
4	SUS (Environment-resistant specs)	Air (Gas type can be switched)
5	SUS (Environment-resistant specs)	Oxygen (Oil-prohibited specification) *2

[E] Port size

AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
AF	G1/8 *3
BF	G1/4 *3
CF	G1/2 *3
AC	NPT1/8
BC	NPT1/4
CC	NPT1/2

[F] Piping direction

1	Straight

[G] Output specifications

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

[H] Unit specifications

1	SI units only
2	With unit switching function (overseas models only) *4

[I] Valve option

N	None

[J] Lead wire

Blank	None
A	5-conductor 1 m
B	5-conductor 3 m

[K] Mounting attachments *5

Blank	None
J	Bracket 2

[L] Attached documents

Blank	None
R	Inspection certification
S	Inspection certification + Traceability certification

[M] Clean-room specifications *8

Blank	None	
P70	Anti-dust generation	*6
P80	Oil-prohibited processing	*7

[#] Option (ATEX Compliant)

Blank	None	
EX	ATEX Compliant	*9

■Precautions for model No. selection

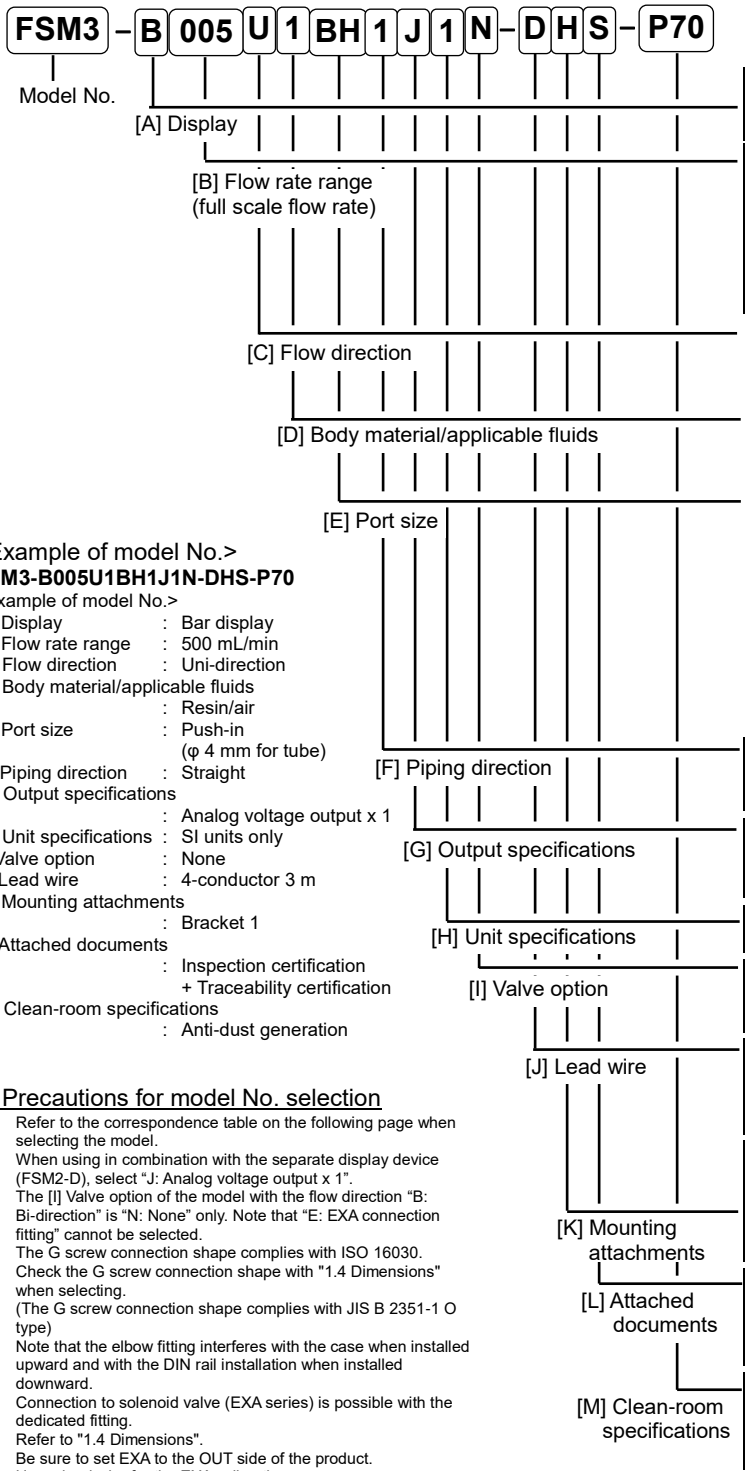
*1: Refer to the correspondence table on the following page when selecting the model.
*2: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*3: The G screw connection shape complies with ISO 16030.
*4: Models with the unit switching function are not sold in Japan.
*5: Optional parts are provided with the product. They are not mounted to the product.
*6: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*7: In addition to P.70 specifications, the contact gas parts are degreased and cleaned.
*8: This cannot be selected on an oxygen type (blank only).
*9: Refer to "Option (ATEX Compliant)" on page 61 for specifications.

Flow rate range and port size

		Ⓔ Port size								
		AA	BA	CA	AF	BF	CF	AC	BC	CC
		Rc1/8	Rc1/4	Rc1/2	G1/8	G1/4	G1/2	NPT1/8	NPT1/4	NPT1/2
Ⓑ Flow rate range	005	●			●			●		
	010	●			●			●		
	020	●			●			●		
	050	●			●			●		
	100	●			●			●		
	200	●			●			●		
	500		●			●			●	
	101		●			●			●	
	201		●			●			●	
	501			●			●			●
	102			●			●			●

1.1.2 Bar display (FSM3-B series)

■ Resin body type



<Example of model No.>
FSM3-B005U1BH1J1N-DHS-P70
<Example of model No.>
[A] Display : Bar display
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids : Resin/air
[E] Port size : Push-in (φ 4 mm for tube)
[F] Piping direction : Straight
[G] Output specifications : Analog voltage output x 1
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : 4-conductor 3 m
[K] Mounting attachments : Bracket 1
[L] Attached documents : Inspection certification + Traceability certification
[M] Clean-room specifications : Anti-dust generation

Code	Content
[A] Display	
B	Bar display

[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		

[C] Flow direction *3	
U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids		
	Body material	Applicable fluids
1	Resin	Air

[E] Port size			
BH	Push-in (for φ 4 mm tube)	**AF**	G1/8 *4
CH	Push-in (for φ 6 mm tube)	**BF**	G1/4 *4
DH	Push-in (for φ 8 mm tube)	**CF**	G1/2 *4
EH	Push-in (for φ 10 mm tube)	**AB**	G1/8 *5
HH	Push-in (for φ 1/4" tube)	**BB**	G1/4 *5
JH	Push-in (for φ 3/8" tube)	**CB**	G1/2 *5
AA	Rc1/8	**AC**	NPT1/8
BA	Rc1/4	**BC**	NPT1/4
CA	Rc1/2	**CC**	NPT1/2

[F] Piping direction	
1	Straight
2	Elbow *6

[G] Output specifications *2	
J	Analog voltage output x 1
K	Analog current output x 1

[H] Unit specifications	
1	SI units only

[I] Valve option *3	
N	None
E	EXA connecting fitting (EXA sold separately) *7, *8, *9

[J] Lead wire	
Blank	None
C	4-conductor 1 m
D	4-conductor 3 m

[K] Mounting attachments *10, *11	
Blank	None
H	Bracket 1 (for models 200 L or less)
J	Bracket 2 (for 500 or 1000 L models)
M	DIN rail mounting (for models 200 L or less)

[L] Attached documents	
Blank	None
R	Inspection certification
S	Inspection certification + Traceability certification

[M] Clean-room specifications		
Blank	None	
P70	Anti-dust generation	*12
P80	Oil- prohibited processing	*13

■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 the separate display device (FSM2-D), select "J: Analog voltage output x 1".
*3: The [I] Valve option of the model with the flow direction "B: Bi-direction" is "N: None" only. Note that "E: EXA connection fitting" cannot be selected.
*4: The G screw connection shape complies with ISO 16030.
*5: Check the G screw connection shape with "1.4 Dimensions" when selecting.
(The G screw connection shape complies with JIS B 2351-1 O type)
*6: Note that the elbow fitting interferes with the case when installed upward and with the DIN rail installation when installed downward.
*7: Connection to solenoid valve (EXA series) is possible with the dedicated fitting.
Refer to "1.4 Dimensions".
*8: Be sure to set EXA to the OUT side of the product.
Use a lead wire for the EXA coil option.
The DIN terminal box cannot be mounted because it will cause interference.
After making sure it is connected firmly, confirm that there is no mis-connection and external leakage.
*9: [M] Clean-room specifications "P.70" and "P.80" cannot be selected.
*10: The option of "Panel mounting" cannot be selected.
Note that the bracket mounting position may interference with the elbow type fitting.
*11: Optional parts are provided with the product. They are not mounted to the product.
*12: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*13: In addition to P.70 specifications, the contact parts are degreased and cleaned.

Compatibility table of flow rate range and port size, and EXA connection fitting

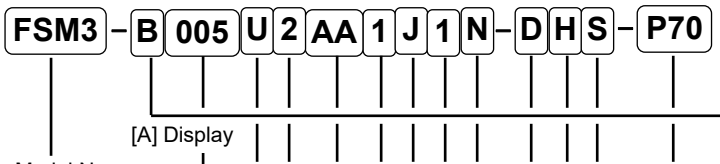
[B] Flow rate range	[E] Port size [F] Piping direction															
	BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
005	●	●			●		●	●			●		●			●
010	●	●			●		●	●			●		●			●
020	●	●			●		●	●			●		●			●
050	●	●			●		●	●			●		●			●
100	●	●			●		●	●			●		●			●
200	●	●			●		●	●			●		●		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

● :Port compatibility ★:EXA connection fitting compatibility

Compatibility table of port size and clean-room specifications

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

■ Stainless steel body type



<Example of model No.>
FSM3-B005U2AA1J1N-DHS-P70
Model: RAPIFLOW FSM3 Series
[A] Display : Bar display
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids : SUS/air
[E] Port size : Rc1/8
[F] Piping direction : Straight
[G] Output specifications : Analog voltage output x 1
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : 4-conductor 3 m
[K] Mounting attachments : Bracket 1
[L] Attached documents : Inspection certification + Traceability certification
[M] Clean-room specifications : Anti-dust generation

Code	Content
[A] Display	
B	Bar display

[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		

[C] Flow direction	
U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids		
	Body material	Applicable fluid
2	SUS	Air
3	SUS	Oxygen (Oil- prohibited specification) *3

[E] Port size	
AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
AF	G1/8 *4
BF	G1/4 *4
CF	G1/2 *4
AB	G1/8 *5
BB	G1/4 *5
CB	G1/2 *5
AC	NPT1/8
BC	NPT1/4
CC	NPT1/2
AD	1/4" double barbed fitting (50 L/min or less)
BD	1/4" double barbed fitting (50 to 200 L/min)
AE	1/4" JXR male fitting (50 L/min or less)
BE	1/4" JXR male fitting (50 to 200 L/min)

[F] Piping direction	
1	Straight

[G] Output specifications *2	
J	Analog voltage output x 1
K	Analog current output x 1

[H] Unit specifications	
1	SI units only

[I] Valve option	
N	None

[J] Lead wire	
Blank	None
C	4-conductor 1 m
D	4-conductor 3 m

[K] Mounting attachments *6	
Blank	None
H	Bracket 1 (for models 200 L or less)
J	Bracket 2 (for 500 or 1000 L models)
M	DIN rail mounting (for models 200 L or less)

[L] Attached documents	
Blank	None
R	Inspection certification
S	Inspection certification + Traceability certification

[M] Clean-room specifications *9		
Blank	None	
P70	Anti-dust generation	*7
P80	Oil- prohibited processing	*8

■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 the separate display device (FSM2-D), select "J: Analog voltage output x 1".
*3: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*4: The G screw connection shape complies with ISO 16030.
*5: Check the G screw connection shape with "1.4 Dimensions" when selecting.
(The G screw connection shape complies with JIS B 2351-1 O type)
*6: Optional parts are provided with the product. They are not mounted to the product.
*7: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*8: In addition to P.70 specifications, the contact gas parts are degreased and cleaned.
*9: This cannot be selected on an oxygen type (blank only).

Flow rate range and port size

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

■ Environment-resistant specifications

FSM3 – B 005 U 4 AA 1 J 1 N – D J S – P70 – EX

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

<Example of model No.>
FSM3-B005U4AA1J1N-DJS-P70-EX
Model: RAPIFLOW FSM3 Series
[A] Display : Bar display
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids : SUS (Environment-resittantspecs) /air
[E] Port size : Rc1/8
[F] Piping direction : Straight
[G] Output specifications : Analog voltage output x 1
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : 4-conductor 3 m
[K] Mounting attachments : Bracket 2
[L] Attached documents : Inspection certification + Traceability certification
[M] Clean-room specifications : Anti-dust generation
[#] Option (ATEX Compliant) : ATEX Compliant

Code	Content		
[A] Display			
B	Bar display		
[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		
[C] Flow direction			
U	Uni-direction		
B	Bi-direction		
[D] Body material/applicable fluids			
	Body material	Applicable fluids	
4	SUS (Environment-resistant specs)	Air (Gas type can be switched)	
5	SUS (Environment-resistant specs)	Oxygen (Oil-prohibited specification) *3	
[E] Port size			
AA	Rc1/8		
BA	Rc1/4		
CA	Rc1/2		
AF	G1/8		*4
BF	G1/4		*4
CF	G1/2		*4
AC	NPT1/8		
BC	NPT1/4		
CC	NPT1/2		
[F] Piping direction			
1	Straight		
[G] Output specifications			*2
J	Analog voltage output x 1		
K	Analog current output x 1		
[H] Unit specifications			
1	SI units only		
[I] Valve option			
N	None		
[J] Lead wire			
Blank	None		
C	4-conductor 1 m		
D	4-conductor 3 m		
[K] Mounting attachments			*5
Blank	None		
J	Bracket 2		
[L] Attached documents			
Blank	None		
R	Inspection certification		
S	Inspection certification + Traceability certification		
[M] Clean-room specifications			*8
Blank	None		
P70	Anti-dust generation		*6
P80	Oil-prohibited processing		*7
[#] Option (ATEX Compliant)			
Blank	None		
EX	ATEX Compliant		*9

■Precautions for model No. selection

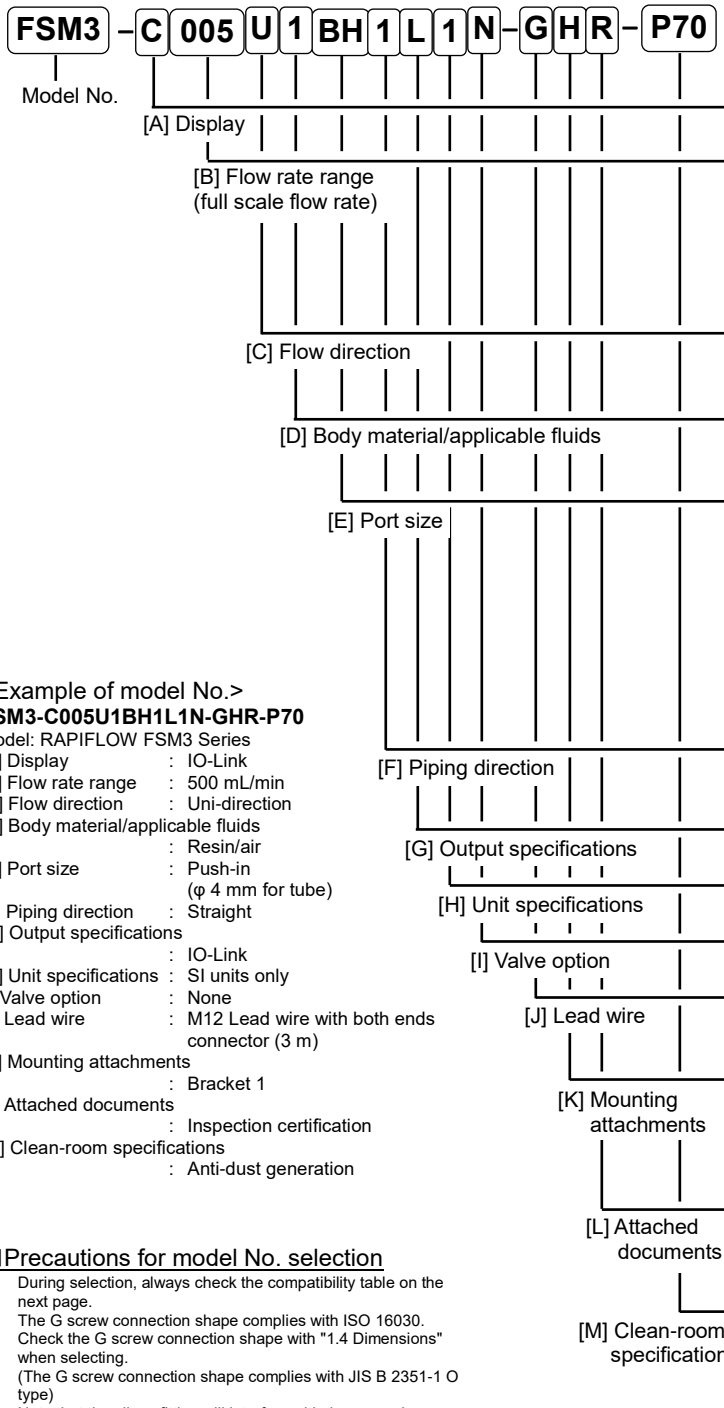
*1: Refer to the correspondence table on the following page when selecting the model.
*2: When using in combination with a separated display (FSM2-D), select “J”.
*3: “3: Oxygen” cannot be selected with 500 L/min and 1000 L/min models.
*4: The G screw connection shape complies with ISO 16030.
*5: Optional parts are provided with the product. They are not mounted to the product.
*6: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*7: In addition to P.70 specifications, the contact gas parts are degreased and cleaned.
*8: This cannot be selected on an oxygen type (blank only).
*9: Refer to “Option (ATEX Compliant)” on page 61 for specifications.

Flow rate range and port size

		Ⓔ Port size								
		AA	BA	CA	AF	BF	CF	AC	BC	CC
		Rc1/8	Rc1/4	Rc1/2	G1/8	G1/4	G1/2	NPT1/8	NPT1/4	NPT1/2
Ⓑ Flow rate range	005	●			●			●		
	010	●			●			●		
	020	●			●			●		
	050	●			●			●		
	100	●			●			●		
	200	●			●			●		
	500		●			●			●	
	101		●			●			●	
	201		●			●			●	
	501			●			●			●
	102			●			●			●

1.1.3 IO-Link (FSM3-C Series)

■ Resin body type



<Example of model No.>
FSM3-C005U1BH1L1N-GHR-P70
Model: RAPIFLOW FSM3 Series
[A] Display : IO-Link
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids : Resin/air
[E] Port size : Push-in (φ 4 mm for tube)
[F] Piping direction : Straight
[G] Output specifications : IO-Link
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : M12 Lead wire with both ends connector (3 m)
[K] Mounting attachments : Bracket 1
[L] Attached documents : Inspection certification
[M] Clean-room specifications : Anti-dust generation

Code	Content
[A] Display	
C	IO-Link

[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		

[C] Flow direction	
U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids		
	Body material	Applicable fluid
1	Resin	Air (Gas type can be switched)

[E] Port size			
BH	Push-in (for φ 4 mm tube)	**AF**	G1/8 *2
CH	Push-in (for φ 6 mm tube)	**BF**	G1/4 *2
DH	Push-in (for φ 8 mm tube)	**CF**	G1/2 *2
EH	Push-in (for φ 10 mm tube)	**AB**	G1/8 *3
HH	Push-in (for φ 1/4" tube)	**BB**	G1/4 *3
JH	Push-in (for φ 3/8" tube)	**CB**	G1/2 *3
AA	Rc1/8	**AC**	NPT1/8
BA	Rc1/4	**BC**	NPT1/4
CA	Rc1/2	**CC**	NPT1/2

[F] Piping direction	
1	Straight
2	Elbow *4

[G] Output specifications	
L	IO-Link communication

[H] Unit specifications	
1	SI units only

[I] Valve option	
N	None

[J] Lead wire	
Blank	None
G	M12 Lead wire with both ends connector (3 m)

[K] Mounting attachments *5, *6	
Blank	None
H	Bracket 1 (for models 200 L or less)
J	Bracket 2 (for models 500 or 1000 L)
M	DIN rail mounting (for models 200 L or less)

[L] Attached documents	
Blank	None
R	Inspection certification
S	Inspection certification + traceability certificate

[M] Clean-room specifications		
Blank	None	
P70	Anti-dust generation	*7
P80	Oil- prohibited processing	*8

■Precautions for model No. selection

*1: During selection, always check the compatibility table on the next page.
*2: The G screw connection shape complies with ISO 16030.
*3: Check the G screw connection shape with "1.4 Dimensions" when selecting.
(The G screw connection shape complies with JIS B 2351-1 O type)
*4: Note that the elbow fitting will interfere with the case when installed upward and with the DIN rail installation when installed downward.
*5: Note that the bracket mounting position may interference with the elbow type fitting.
*6: Optional parts will come with the product. They are not preassembled.
*7: Product surface is degreased before packaging and heat-sealed into an antistatic bag on the clean bench (Class 1000 and over).
*8: The contact gas parts are degreased and washed in addition to the specifications on P.70.

Flow rate range and port size

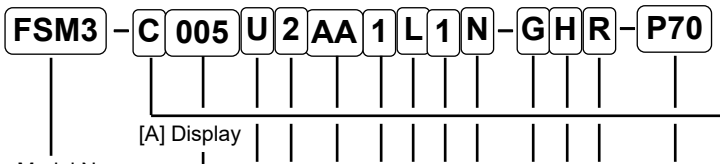
[B] Flow rate range	[E] Port size [F] Piping direction															
	BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1	CA1	AA2
005	●	●			●		●	●			●		●			●
010	●	●			●		●	●			●		●			●
020	●	●			●		●	●			●		●			●
050	●	●			●		●	●			●		●			●
100	●	●			●		●	●			●		●			●
200	●	●			●		●	●			●		●		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

● :Port size compatibility

Compatibility table of port size and clean-room specifications

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

■ Stainless steel body type



<Example of model No.>
FSM3-C005U2AA1L1N-GHR-P70
Model: RAPIFLOW FSM3 Series
[A] Display : IO-Link
[B] Flow rate range : 500 mL/min
[C] Flow direction : Uni-direction
[D] Body material/applicable fluids : SUS/air
[E] Port size : Rc1/8
[F] Piping direction : Straight
[G] Output specifications : IO-Link
[H] Unit specifications : SI units only
[I] Valve option : None
[J] Lead wire : M12 Lead wire with both ends connector (3 m)
[K] Mounting attachments : Bracket 1
[L] Attached documents : Inspection certification
[M] Clean-room specifications : Anti-dust generation

Code	Content
[A] Display	
C	IO-Link

[B] Flow rate range (full scale flow rate)			
005	500 mL/min	**500**	50 L/min
010	1000 mL/min	**101**	100 L/min
020	2 L/min	**201**	200 L/min
050	5 L/min	**501**	500 L/min
100	10 L/min	**102**	1000 L/min
200	20 L/min		

[C] Flow direction	
U	Uni-direction
B	Bi-direction

[D] Body material/applicable fluids		
	Body material	Applicable fluids
2	SUS	Air (Gas type can be switched)
3	SUS	Oxygen (Oil-prohibited specifications)*2

[E] Port size	
AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
AF	G1/8 *3
BF	G1/4 *3
CF	G1/2 *3
AB	G1/8 *4
BB	G1/4 *4
CB	G1/2 *4
AC	NPT1/8
BC	NPT1/4
CC	NPT1/2
AD	1/4" double barbed fitting (50 L/min or less)
BD	1/4" double barbed fitting (50 to 200 L/min)
AE	1/4" JXR male fitting (50 L/min or less)
BE	1/4" JXR male fitting (50 to 200 L/min)

[F] Piping direction	
1	Straight

[G] Output specifications	
L	IO-Link

[H] Unit specifications	
1	SI units only

[I] Valve option	
N	None

[J] Lead wire	
Blank	None
G	M12 Lead wire with both ends connector (3 m)

[K] Mounting attachments *5	
Blank	None
H	Bracket 1 (for models 200 L or less)
J	Bracket 2 (for 500 or 1000 L models)
M	DIN rail mounting (for models 200 L or less)

[L] Attached documents	
Blank	None
R	Inspection certification
S	Inspection certification + Traceability certification

[M] Clean-room specifications *8		
Blank	None	
P70	Anti-dust generation	*6
P80	Oil- prohibited processing	*7

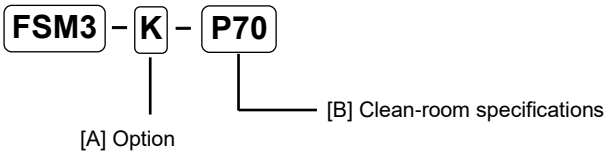
■Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*3: The G screw connection shape complies with ISO16030.
*4: Check the G screw connection shape with "1.4 Dimensions" when selecting.
(The G screw connection shape complies with JIS B2351-1 O type)
*5: Optional parts are provided with the product. They are not mounted to the product.
*6: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*7: In addition to P.70 specifications, the contact gas parts are degreased and cleaned.
*8: The oxygen type cannot be selected (blank only).

Flow rate range and port size

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

1.1.4 Option



Code	Content
[A] 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 ends connector cable (3 m) (for IO-Link)
H	Bracket 1 (for models with a flow rate range below 200 L/min)
J	Bracket 2 (for models with a flow rate range of 500 L/min or 1000 L/min)
K	Panel mounting kit 1 (for sensor unit models with a flow rate range below 200 L/min)
L	Panel mounting kit 2 (for needle valves integrated models with a flow rate range below 200 L/min)
M	DIN rail mounting kit (for models with a flow rate range below 200 L/min)

[B] Clean-room specifications	
Blank	None
P70	Anti-dust generation

1.2 Specifications

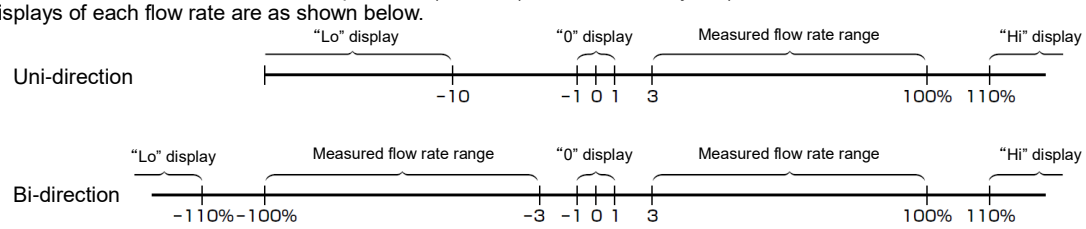
1.2.1 LCD display type

■ Resin body type

Item			FSM3-[A][B][C][D][E][F][G][H][I] - [ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured flow rate range (□/min) *1	[B]	U	15 to 500 mL	30 to 1000 mL	0.06 to 2.00 L	0.15 to 5.00 L	0.30 to 10.00 L	0.6 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15 15 to 500 L	-1000 to -30 30 to 1000 L
Display type			4-digit + 4-digit 2-color LCD										
Flow rate display range (□/min) *2	[B]	U	-49 to 549 mL	-99 to 1099 mL	-0.19 to 2.19 L	-0.49 to 5.49 L	-0.99 to 10.99 L	-1.9 to 21.9 L	-4.9 to 54.9 L	-9.9 to 109.9 L	-19 to 219 L	-49 to 549 L	-99 to 1099 L
		B	-549 to 549 mL	-1099 to 1099 mL	-2.19 to 2.19 L	-5.49 to 5.49 L	-10.99 to 10.99 L	-21.9 to 21.9 L	-54.9 to 54.9 L	-109.9 to 109.9 L	-219 to 219 L	-549 to 549 L	-1099 to 1099 L
Integration display *3		Display range	0 to ±9999999 mL		0.00 to ±99999.99 L			0.0 to ±999999.9 L			0 to ±9999999 L		
		Pulse output rate	5 mL	10 mL	0.02 L	0.05 L	0.1 L	0.2 L	0.5 L	1 L	2 L	5 L	10 L
Working conditions		Applicable 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										
			Argon, carbon dioxide, gas mixture (argon + carbon dioxide)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 0.75 MPa										
		Withstanding pressure	1 MPa										
Operating ambient temperature/humidity			0 to 50°C, 90%RH or less										
Storage temperature			-10 to 60°C										
Accuracy *5 (Fluid: in dry air)		Accuracy *6	Within ±3% F.S. (Secondary side atmosphere releasing) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *7	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Secondary side atmosphere releasing standard)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time		*8	50 msec or below (Response time set to 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 (connection load impedance 50 kΩ and over)										
		E, F, G, H	4 to 20 mA current output (connection 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 x 5-conductor (connector connection), insulator outer diameter φ 1.0										
Holding functions		*12	(1) Gas type switching, (2) setting copy function, (3) flow rate integration, (4) peak hold, etc.										
Protection structure			IP40-equivalent (IEC standards)										
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/s^2, XYZ direction, for 2 hours respectively										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *14	Unrestricted in vertical/horizontal direction										
		Straight piping installation 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%). (For gas other than air, 20°C 1 barometric pressure (101 kPa), relative humidity 0%)

*2: The displays of each flow rate are as shown below.



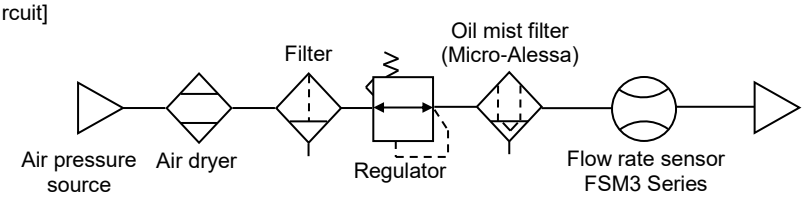
*3: The integrating flow is a calculated (reference) value. When using the integrated value saving function, be careful that the number of times saved does not exceed the number of access times of the storage element (the limit is 1 million times). (Changes of various settings are counted in number of accesses.)

$$\text{Times saved} = \frac{\text{Usage time}}{5 \text{ minutes}} < 1 \text{ million times}$$

When instantaneous flow rate is below 1%, it is not counted as integrated flow rate.

*4: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and clean gas which 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 drain (water, oil oxide, foreign substances, 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 concentration 0.1 mg/m^3) on the primary side (upstream side) of this product.

[Recommended circuit]



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

*6: The accuracy is based on CKD's basic flow rate mater. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*7: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*8: Actual response time may differ depending on piping conditions. Setting response time can be selected between 50 msec and 1.5 sec.

*9: The output impedance of the analog output section is approx. 1 kΩ. If the impedance of the connecting load is small, the output value and error increase. Check the 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 when 24 VDC is connected and no load is applied. The current consumption will vary depending on how the load is connected.

*12: Gas can be switched to argon, carbon dioxide, argon 80% + carbon dioxide 20% with the gas switching function (Note the gas switching function is not available on 500 L/min and 1000 L/min models).
The full-scale flow rate becomes half of the flow rate range after switching to carbon dioxide gas. Also, an output type can be selected for analog output.

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

Gas type	Flow direction	Analog output			
		Output type A		Output type B	
		Voltage	Current	Voltage	Current
• Carbon dioxide	Uni-direction	1 to 3 V	4 to 12 mA	1 to 5 V	4 to 20 mA
	Bi-direction	2 to 4 V	8 to 16 mA	1 to 5 V	4 to 20 mA

The "Copy function" setting is selected at "[G] Output specifications".
Note that the "External input" function is not available on models in which the "Setting copy function" is available.

*13: The protection circuit of this product is effective only for specific error connections and load short-circuit. It is not designed to protect from any error connections.

*14: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence heat distribution or cause the zero point to deviate.

*15: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping inner diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

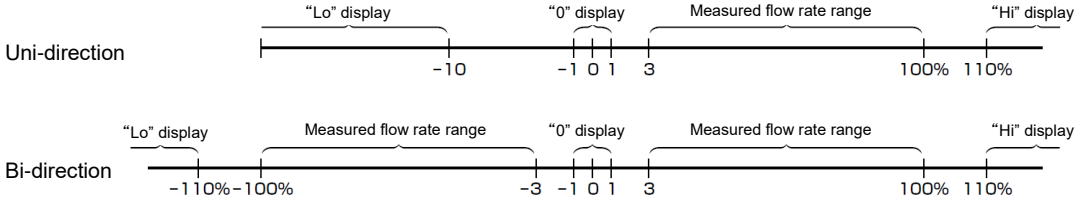
*16: For the mass, refer to "1.4.5 Products weight".

■ Stainless steel body type

Item			FSM3-[A][B][C][D][E][F][G][H][I]－[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display type			4-digit + 4-digit 2-color LCD										
Flow rate display range (□/min) *2	[B]	U	-49 to 549 mL	-99 to 1099 mL	-0.19 to 2.19 L	-0.49 to 5.49 L	-0.99 to 10.99 L	-1.9 to 21.9 L	-4.9 to 54.9 L	-9.9 to 109.9 L	-19 to 219 L	-49 to 549 L	-99 to 1099 L
		B	-549 to 549 mL	-1099 to 1099 mL	-2.19 to 2.19 L	-5.49 to 5.49 L	-10.99 to 10.99 L	-21.9 to 21.9 L	-54.9 to 54.9 L	-109.9 to 109.9 L	-219 to 219 L	-549 to 549 L	-1099 to 1099 L
Integration display *3		Display range	0 to ±9999999 mL		0.00 to ±99999.99 L			0.0 to ±999999.9 L			0 to ±9999999 L		
		Pulse output rate	5 mL	10 mL	0.02 L	0.05 L	0.1 L	0.2 L	0.5 L	1 L	2 L	5 L	10 L
Working conditions		Applicable 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										
			Argon, carbon dioxide, gas mixture (argon + carbon dioxide)									-	
			Oxygen gas (When oxygen specifications are selected, the clean-room specifications of [M] cannot be selected. Specifications automatically become oil-prohibited specifications.)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 1.00 MPa									-0.09 to 0.75 MPa	
		Withstanding 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 atmosphere releasing) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *7	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing standard)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time *8			50 msec or below (Response time set to 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 (connection load impedance 50 kΩ and over)										
		E, F, G, H	4 to 20 mA current output (connection 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 x 5-conductor (connector connection), insulator outer diameter φ 1.0										
Holding function *12			(1) Gas type switching, (2) setting copy function, (3) flow rate integration, (4) peak hold, etc.										
Protection structure			IP40-equivalent (IEC standards)										
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/s^2, XYZ direction, for 2 hours respectively										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *14	Unrestricted in vertical/horizontal direction										
		Straight piping installation 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%). (For gas other than air, 20°C 1 barometric pressure (101 kPa), relative humidity 0%)

*2: The displays of each flow rate are as shown below.



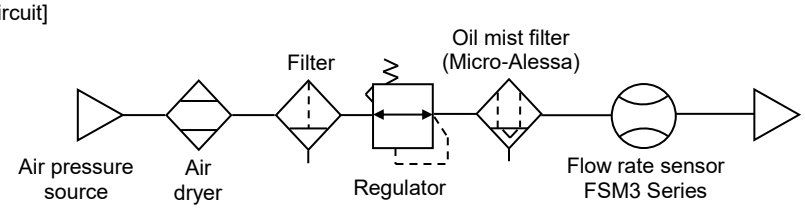
*3: The integrating flow rate is a calculated (reference) value. When using the integration saving function, be careful that the number of saving times does not exceed the number of access times of the storage element (the limit is 1 million times). (Changes of various settings are counted in number of accesses.)

$$\text{Times saved} = \frac{\text{Usage time}}{5 \text{ minutes}} < 1 \text{ million times}$$

When instantaneous flow rate is below 1%, it is not counted as integrating flow rate.

*4: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and clean which 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 drain (water, oil oxide, foreign substances, 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.

[Recommended circuit]



The sensor for oxygen gas is custom model. To prevent ignition accident, 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 of this product. Accuracy for gas types other than air is a guideline.

*6: The accuracy is based on CKD's basic flow rate meter. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for the accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*7: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*8: Actual response time may differ depending on piping conditions. Setting response time can be selected between 50 msec and 1.5 sec.

*9: The output impedance of the analog output section is approx. 1 kΩ. If the impedance of the connecting load is small, the output values and error increase. Check the 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 when 24 VDC is connected and no load is connected. The current consumption will vary depending on how the load is connected.

*12: Gas can be changed to argon, carbon dioxide, argon 80% + carbon dioxide 20% with the gas change function. (Note the gas switching function is not available on 500 L/min and 1000 L/min models).
The full-scale flow rate becomes half of the flow rate range after switching to carbon dioxide gas. Also, an output type can be selected for analog output.

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

Gas type	Flow direction	Analog output			
		Output type A		Output type B	
		Voltage	Current	Voltage	Current
• Carbon dioxide	Uni-direction	1 to 3 V	4 to 12 mA	1 to 5 V	4 to 20 mA
	Bi-direction	2 to 4 V	8 to 16 mA	1 to 5 V	4 to 20 mA

The "Setting copy function" is selected with "[G] Output specifications".
Note that the "External input" function is not available on models in which the "Setting copy function" is available.

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

*14: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution and cause the zero point to deviate.

*15: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping internal diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

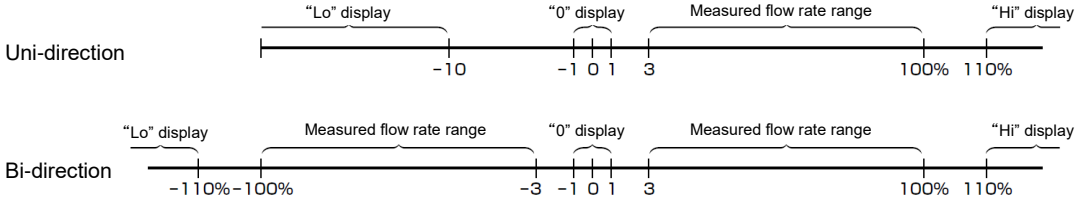
*16: For mass, refer to "1.4.5 Products weight".

■ Environment-resistant specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]－[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display type			4-digit + 4-digit 2-color LCD										
Flow rate display range (□/min) *2	[B]	U	-49 to 549 mL	-99 to 1099 mL	-0.19 to 2.19 L	-0.49 to 5.49 L	-0.99 to 10.99 L	-1.9 to 21.9 L	-4.9 to 54.9 L	-9.9 to 109.9 L	-19 to 219 L	-49 to 549 L	-99 to 1099 L
		B	-549 to 549 mL	-1099 to 1099 mL	-2.19 to 2.19 L	-5.49 to 5.49 L	-10.99 to 10.99 L	-21.9 to 21.9 L	-54.9 to 54.9 L	-109.9 to 109.9 L	-219 to 219 L	-549 to 549 L	-1099 to 1099 L
Integration display *3		Display range	0 to ±9999999 mL		0.00 to ±99999.99 L			0.0 to ±999999.9 L			0 to ±9999999 L		
		Pulse output rate	5 mL	10 mL	0.02 L	0.05 L	0.1 L	0.2 L	0.5 L	1 L	2 L	5 L	10 L
Working conditions		Applicable 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										
			Argon, carbon dioxide, gas mixture (argon + carbon dioxide)									-	
			Oxygen gas (When oxygen specifications are selected, the clean-room specifications of [M] cannot be selected. Specifications automatically become oil-prohibited specifications.)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 1.00 MPa									-0.09 to 0.75 MPa	
		Withstanding 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 atmosphere releasing) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *7	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing standard)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time *8			50 msec or below (Response time set to 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 (connection load impedance 50 kΩ and over)										
		E, F, G, H	4 to 20 mA current output (connection 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 x 5-conductor (connector connection), insulator outer diameter φ 1.0										
Holding function *12			(1) Gas type switching, (2) setting copy function, (3) flow rate integration, (4) peak hold, etc.										
Protection structure *13			IP65-equivalent (IEC standards)										
Protection circuit *14			Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *15	Unrestricted in vertical/horizontal direction										
		Straight piping installation section *16	Not required										

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

*2: The displays of each flow rate are as shown below.



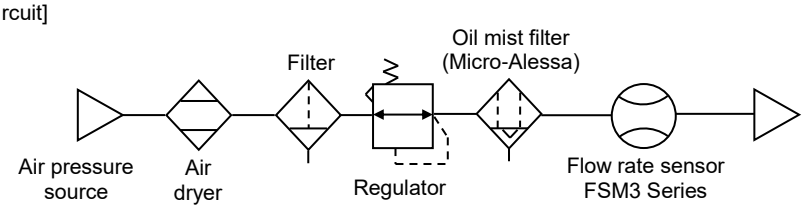
*3: The integrating flow rate is a calculated (reference) value. When using the integration saving function, be careful that the number of saving times does not exceed the number of access times of the storage element (the limit is 1 million times). (Changes of various settings are counted in number of accesses.)

$$\text{Times saved} = \frac{\text{Usage time}}{5 \text{ minutes}} < 1 \text{ million times}$$

When instantaneous flow rate is below 1%, it is not counted as integrating flow rate.

*4: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and clean which 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 drain (water, oil oxide, foreign substances, 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.

[Recommended circuit]



The sensor for oxygen gas is custom model. To prevent ignition accident, 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 of this product. Accuracy for gas types other than air is a guideline.

*6: The accuracy is based on CKD's basic flow rate meter. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for the accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*7: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*8: Actual response time may differ depending on piping conditions. Setting response time can be selected between 50 msec and 1.5 sec.

*9: The output impedance of the analog output section is approx. 1 kΩ. If the impedance of the connecting load is small, the output values and error increase. Check the 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 when 24 VDC is connected and no load is connected. The current consumption will vary depending on how the load is connected.

*12: Gas can be changed to argon, carbon dioxide, argon 80% + carbon dioxide 20% with the gas change function. (Note the gas switching function is not available on 500 L/min and 1000 L/min models).
The full-scale flow rate becomes half of the flow rate range after switching to carbon dioxide gas. Also, an output type can be selected for analog output.

Gas	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 20mA
	Bi-direction	-100 to 100%		
・Carbon dioxide (Type A setting)	Uni-direction	0 to 50%	1 to 3 V	4 to 12mA
	Bi-direction	-50 to 50%	2 to 4 V	8 to 16mA
・Carbon dioxide (Type B setting)	Uni-direction	0 to 50%	1 to 5 V	4 to 20mA
	Bi-direction	-50 to 50%		

The "Setting copy function" is selected with "[G] Output specifications".
Note that the "External input" function is not available on models in which the "Setting copy function" is available.

*13: Be sure to read the precautions in "Option (ATEX Compliant)" on page 61, "Installation Environment" on page 62 and "USAGE" on page 76.
It is IP64 in ATEX evaluation.

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

*15: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution and cause the zero point to deviate.

*16: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping internal diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

*17: For mass, refer to "1.4.5 Products weight".

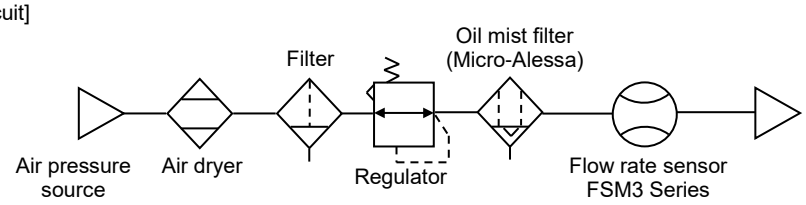
1.2.2 Bar display type

■ Resin body type

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15 15 to 500 L	-1000 to -30 30 to 1000 L
Display type			LED bar display										
Used fluid		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										
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 0.75 MPa										
		Withstanding pressure	1 MPa										
Operating ambient temperature/humidity			0 to 50°C, 90%RH or less										
Storage temperature			-10 to 60°C										
Accuracy		Accuracy *3	Within ±3%F.S. (Secondary side atmosphere releasing) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *4	Within ±1%F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing standard)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time		*5	50 msec or below										
Analog output *6	[G]	J	1 to 5 V voltage output (connection load impedance 50 kΩ and over)										
		K	4 to 20 mA current output (connection 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 x 4-conductor (connector), insulator outer diameter φ1.0										
Protection structure			IP40-equivalent (IEC standards)										
Protection circuit		*9	Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, max. 100 m/s^2, XYZ direction, for 2 hours respectively										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *10	Unrestricted in vertical/horizontal direction										
		Straight piping installation 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%). (For gas other than air, 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 clean which 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 drain (water, oil oxide, foreign substances, 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.
[Recommended circuit]



*3: The accuracy is based on CKD's basic flow rate mater. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for the accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*4: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*5: Actual response time may differ depending on piping conditions.

*6: The output impedance of the analog output section is approx. 1 kΩ. If the impedance of the connecting load is small, the output values and error increase. Check the 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 will vary depending on how the load is connected.

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

*10: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution or cause the zero point to deviate.

*11: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping internal diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

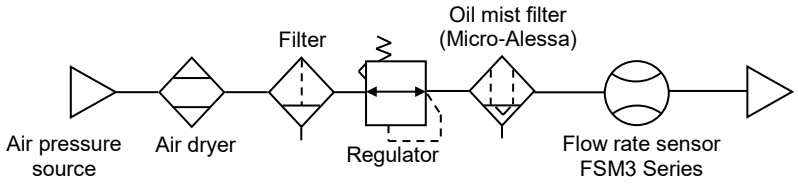
*12: For mass, refer to "1.4.5 Products weight".

■ Stainless steel body type

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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 10.00 L	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display type			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 gas (When oxygen specifications are selected, the clean-room specifications of [M] cannot be selected. Specifications automatically become oil-prohibited specifications.)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 1.00 MPa									-0.09 to 0.75 MPa	
		Withstanding 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) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *4	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time *5			50 msec or below										
Analog output *6	[G]	J	1 to 5 V voltage output (connection load impedance 50 kΩ and over)										
		K	4 to 20 mA current output (connection 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 x 4-conductor (connector), insulator outer diameter φ1.0										
Protection structure			IP40-equivalent (IEC standards)										
Protection circuit *9			Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, max. 100 m/s^2, XYZ direction, for 2 hours respectively										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *10	Unrestricted in vertical/horizontal direction										
		Straight piping installation 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%). (For gas other than air, 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 clean gas which 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 drain (water, oil oxide, foreign substances, 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.
[Recommended circuit]



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

*3: The accuracy is based on CKD's basic flow rate mater. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for the accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*4: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*5: Actual response time may differ depending on piping conditions. Setting response time can be selected between 50 msec and 1.5 sec.

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

*7: The power supply voltage specifications differ for the voltage output type and current output type.

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

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

*10: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution or cause the zero point to deviate.

*11: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping inner diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

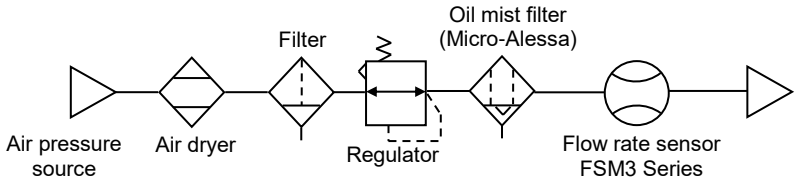
*12: For mass, refer to "1.4.5 Products weight".

■ Environment-resistant specifications

Item			FSM3-[A][B][C][D][E][F][G][H][I]-[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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 10.00 L	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000 L
Display type			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 gas (When oxygen specifications are selected, the clean-room specifications of [M] cannot be selected. Specifications automatically become oil-prohibited specifications.)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 1.00 MPa									-0.09 to 0.75 MPa	
		Withstanding 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) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *4	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time *5			50 msec or below										
Analog output *6	[G]	J	1 to 5 V voltage output (connection load impedance 50 kΩ and over)										
		K	4 to 20 mA current output (connection 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 x 4-conductor (connector), insulator outer diameter φ1.0										
Protection structure *9			IP65-equivalent (IEC standards)										
Protection circuit *10			Power supply reverse connection protection										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *11	Unrestricted in vertical/horizontal direction										
		Straight piping installation section *12	Not required										

*1: The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%). (For gas other than air, 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 clean gas which 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 drain (water, oil oxide, foreign substances, 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.
[Recommended circuit]



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

*3: The accuracy is based on CKD's basic flow rate mater. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for the accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*4: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*5: Actual response time may differ depending on piping conditions. Setting response time can be selected between 50 msec and 1.5 sec.

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

*7: The power supply voltage specifications differ for the voltage output type and current output type.

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

*9: Be sure to read the precautions in "Option (ATEX Compliant)" on page 61, "Installation Environment" on page 62 and "USAGE" on page 76.
It is IP64 in ATEX evaluation.

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

*11: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution or cause the zero point to deviate.

*12: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping inner diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

*13: For mass, refer to "1.4.5 Products weight".

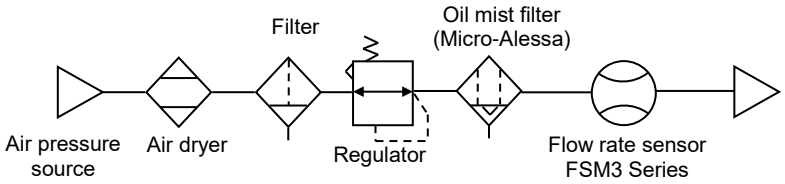
1.2.3 IO-Link type

■ Resin body type

Item			FSM3-[A][B][C][D][E][F][G][H][I]－[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15 15 to 500 L	-1000 to -30 30 to 1000 L
Display type			LED display (power lamp and status lamp)										
Used fluids		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										
			Argon, carbon dioxide, gas mixture (argon + carbon dioxide)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 0.75 MPa										
		Withstanding pressure	1 MPa										
Operating ambient temperature/humidity			0 to 50°C, 90%RH or less										
Storage temperature			-10 to 60°C										
Accuracy *3 (Fluid: In dry air)		Accuracy *4	Within ±3% F.S. (Secondary side atmosphere releasing) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *5	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing)								Within ±5% F.S. (Base pressure 0.35 MPa)		
Response time		*6	50 msec or below										
Power supply voltage			18 to 30 VDC ripple rate 1% or less										
Current consumption		*7	45 mA or less										
Lead wire		*8	M12 both ends connector cable (3 m) AWG#23 or equivalent x 4-conductor										
Saving function		*9	(1) Gas type switching, (2) flow rate integration, (3) peak hold, etc.										
Protection structure			IP40-equivalent (IEC standards)										
Protection circuit		*10	Power supply reverse connection protection										
Vibration resistance		*11	10 to 150 Hz, max. 100 m/s^2, XYZ direction, for 2 hours respectively										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting	Mounting orientation	*12	Unrestricted in vertical/horizontal direction										
	Straight piping installation section	*13	Not required										

*1: The value converted to volumetric flow rate at standard condition (20 °C 1 barometric pressure (101 kPa) relative humidity 65%). (For gas other than air, 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 clean gas which 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 drain (water, oil oxide, foreign substances, 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.
[Recommended circuit]



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

*4: The accuracy is based on CKD's basic flow rate mater. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for the accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*5: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*6: Actual response time may differ depending on piping conditions. Setting response time can be selected from between 50 msec to 1.5 sec.

*7: Current 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 side is straight and the female side is angle (refer to "1.4.4 Option").
Tighten the M12 connector with 0.5 N･m or less torque.
Note if tightened with excessive force, it may break.

*9: Gas can be changed to argon, carbon dioxide, argon 80% + carbon dioxide 20% with the gas change function. Full scale flow rate and analog output after changing gas is as follows.
(Note that the gas type switching function is not available for the 500 L/min model and 1000 L/min model)

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

The integrating flow is a calculated (reference) value.
When using the integration saving function, be careful that the number of saving times does not exceed the number of access times of the storage element (the limit is 1 million times). (Changes to the settings are counted in number of accesses.)

$$\text{Times saved} = \frac{\text{Usage time}}{5 \text{ minutes}} < 1 \text{ million times}$$

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

*11: Communication errors may be generated due to vibration conditions. Install in places where there is no vibration.

*12: This product measures the changes in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution or cause the zero point to deviate.

*13: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping inner diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

*14: For mass, refer to "1.4.5 Products weight".

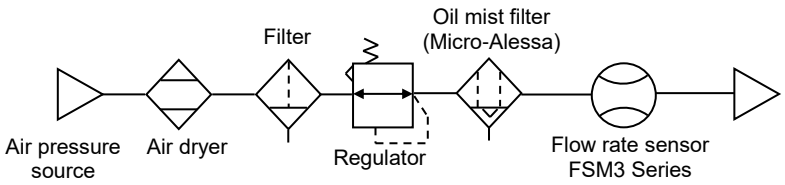
■ Stainless steel body type

Item			FSM3-[A][B][C][D][E][F][G][H][I]－[ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured 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	0.60 to 20.0 L	1.5 to 50.0 L	3.0 to 100.0 L	6 to 200 L	15 to 500 L	30 to 1000 L
		B	-500 to -15 15 to 500 mL	-1000 to -30 30 to 1000 mL	-2.00 to -0.06 0.06 to 2.00 L	-5.00 to -0.15 0.15 to 5.00 L	-10.00 to -0.30 0.30 to 10.00 L	-20.0 to -0.6 0.6 to 20.0 L	-50.0 to -1.5 1.5 to 50.0 L	-100.0 to -3.0 3.0 to 100.0 L	-200 to -6 6 to 200 L	-500 to -15, 15 to 500 L	-1000 to -30, 30 to 1000L
Display type			LED bar display (power lamp and status lamp)										
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										
			Argon, carbon dioxide, gas mixture (argon + carbon dioxide)									-	
			Oxygen gas (When oxygen specifications are selected, the clean-room specifications of [M] cannot be selected. Specifications automatically become oil-prohibited specifications.)									-	
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.09 to 1.00 MPa									-0.09 to 0.75 MPa	
		Withstanding 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 atmosphere releasing) (Scope of warranty depends on the "Measured flow rate range")										
		Repeatability *5	Within ±1% F.S. (Secondary side atmosphere releasing)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (Where secondary side atmosphere releasing standard)									Within ±5% F.S. (Base pressure 0.35MPa)	
Response time		*6	50 msec or below										
Power supply voltage			18 to 30 VDC ripple rate 1% or less										
Current consumption		*7	45 mA or less										
Lead wire		*8	M12 lead wire with both ends connector (3 m) AWG#23 or equivalent x 4-conductor										
Saving function		*9 *10	(1) Gas type switching, (2) flow rate integration, (3) peak hold, etc.										
Protection structure			IP40-equivalent (IEC standards)										
Protection circuit		*11	Power supply reverse connection protection										
Vibration resistance		*12	10 to 150 Hz, max. 100 m/s^2, XYZ direction, for 2 hours respectively										
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Mounting		Mounting orientation *12	Unrestricted in vertical/horizontal direction										
		Straight piping installation section *13	Not required										

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

*2: Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and clean gas which 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 drain (water, oil oxide, foreign substances, 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.

[Recommended circuit]



The sensor for oxygen gas is custom model. To prevent ignition accident, 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 of this product. Accuracy for gas types other than air is a guideline.

*4: The accuracy is based on CKD's basic flow rate mater. It does not show absolute accuracy.
Repeatability, temperature characteristics, and pressure characteristics are not included for an accuracy ±3% F.S.
Consider separately according to the working environment and working conditions.

*5: Repeatability over a short period of time. Changes over time are not included. (Refer to the product specifications sheet for details.)

*6: Actual response time may differ depending on piping conditions. Setting response time can be selected between 50 msec and 1.5 sec.

*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 side is straight and the female side is angle (refer to "1.4.4 Option").
Tighten the M12 connector with 0.5 N・m or less torque.
Note if tightened with excessive force, it may break.

*9: Gas can be changed to argon, carbon dioxide, argon 80% + carbon dioxide 20% with the gas change function. The full-scale flow rate and analog output are as follows. Note that the gas switching function is not available for the 500 L/min mode and 1000 L/min model)

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

The integrating flow is a calculated (reference) value.
When using the integration saving function, be careful that the number of saving times does not exceed the number of access times of the storage element (the limit is 1 million times).
(Changes to the settings are counted in number of accesses.)

$$\text{Times saved} = \frac{\text{Usage time}}{5\ \text{minutes}} < 1\ \text{million times}$$

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

*11: Communication errors may be generated due to vibration conditions. Install in places where there is no vibration.

*12: This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence the heat distribution or cause the zero point to deviate.

*13: Accuracy may be affected by the piping conditions. For more accurate measurement, install a straight pipe with a piping inner diameter ten times longer.
With the 500 L/min and 1000 L/min models, use piping with an internal diameter of 9 mm or more. If it is less than 9 mm, accuracy may be negatively affected.

*14: For mass, refer to "1.4.5 Products weight".

1.3 Communication specification

1.3.1 General

Item	Details
Communication protocol	IO-Link
Communication protocol revision	V1.1
Transmission speed	COM2 (38.4 kbps)
Port type	Class A
Process Data length (input)	4 bytes
Process Data length (output)	0 bytes

Item	Details
Min. Cycle Times	5 ms
Data Storage	1 kbyte
SIO Mode support	Non
Device ID	Refer to the table below.

■ Device ID

Device ID is different per flow rate range and flow direction.

Flow rate range	Flow rate range	Product ID	Device ID (Decimal)	Device ID (Hex)
500 mL/min	Uni-direction	FSM3-C005U	2170881	0x212001
	Bi-direction	FSM3-C005B	2170882	0x212002
1000 mL/min	Uni-direction	FSM3-C010U	2170883	0x212003
	Bi-direction	FSM3-C010B	2170884	0x212004
2 L/min	Uni-direction	FSM3-C020U	2170885	0x212005
	Bi-direction	FSM3-C020B	2170886	0x212006
5 L/min	Uni-direction	FSM3-C050U	2170887	0x212007
	Bi-direction	FSM3-C050B	2170888	0x212008
10 L/min	Uni-direction	FSM3-C100U	2170889	0x212009
	Bi-direction	FSM3-C100B	2170890	0x21200A
20 L/min	Uni-direction	FSM3-C200U	2170891	0x21200B
	Bi-direction	FSM3-C200B	2170892	0x21200C
50 L/min	Uni-direction	FSM3-C500U	2170893	0x21200D
	Bi-direction	FSM3-C500B	2170894	0x21200E
100 L/min	Uni-direction	FSM3-C101U	2170895	0x21200F
	Bi-direction	FSM3-C101B	2170896	0x212010
200 L/min	Uni-direction	FSM3-C201U	2170897	0x212011
	Bi-direction	FSM3-C201B	2170898	0x212012
500 L/min	Uni-direction	FSM3-C501U	2170899	0x212013
	Bi-direction	FSM3-C501B	2170900	0x212014
1000 L/min	Uni-direction	FSM3-C102U	2170901	0x212015
	Bi-direction	FSM3-C102B	2170902	0x212016
500 mL/min O_2type	Uni-direction	FSM3-C005U3	2170903	0x212017
	Bi-direction	FSM3-C005B3	2170904	0x212018
1000 mL/min O_2type	Uni-direction	FSM3-C010U3	2170905	0x212019
	Bi-direction	FSM3-C010B3	2170906	0x21201A
2 L/min O_2type	Uni-direction	FSM3-C020U3	2170907	0x21201B
	Bi-direction	FSM3-C020B3	2170908	0x21201C
5 L/min O_2type	Uni-direction	FSM3-C050U3	2170909	0x21201D
	Bi-direction	FSM3-C050B3	2170910	0x21201E
10 L/min O_2type	Uni-direction	FSM3-C100U3	2170911	0x21201F
	Bi-direction	FSM3-C100B3	2170912	0x212020
20 L/min O_2type	Uni-direction	FSM3-C200U3	2170913	0x212021
	Bi-direction	FSM3-C200B3	2170914	0x212022
50 L/min O_2type	Uni-direction	FSM3-C500U3	2170915	0x212023
	Bi-direction	FSM3-C500B3	2170916	0x212024
100 L/min O_2type	Uni-direction	FSM3-C101U3	2170917	0x212025
	Bi-direction	FSM3-C101B3	2170918	0x212026
200 L/min O_2type	Uni-direction	FSM3-C201U3	2170919	0x212027
	Bi-direction	FSM3-C201B3	2170920	0x212028

*Download the IO-Link setting file (IODD) from our company's home page (https://www.ckd.co.jp/)).

1.3.2 On demand data

■ Identification

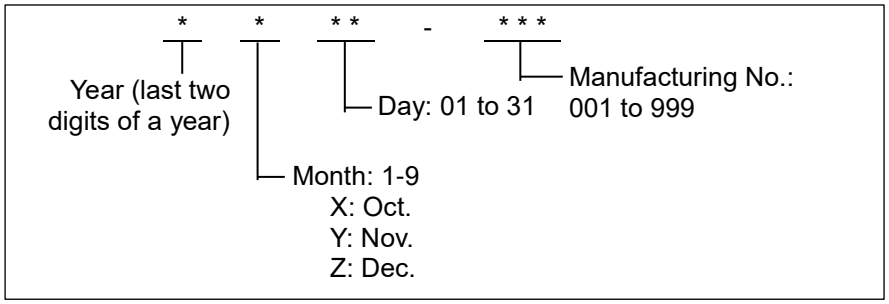
Vendor ID: 855 (Decimal number) / 357 (Hexadecimal number)

Index	Sub Index	Item	Value	Access	Data length	Format
0x0010	0	Vendor Name	CKD Corporation	R	64 bytes	String
0x0011	0	Vendor Text	https://www.ckd.co.jp/	R	64 bytes	String
0x0012	0	Product Name	FSM3-C020U1BH1L1 *1	R	40 bytes	String
0x0013	0	Product ID	FSM3-C020U *1	R	64 bytes	String
0x0014	0	Product Text	Small Size Flow Sensor RapiFlow, 2L/min *1	R	64 bytes	String
0x0015	0	Serial- Number	****-*** *2	R	16 bytes	String
0x0016	0	Hardware Revision	100.100	R	64 bytes	String
0x0017	0	Firmware Revision	100.100	R	64 bytes	String
0x0018	0	Application Specific Tag	Application Specific Tag	R/W	32 bytes	String

R: Read out
R/W: Read out / Writing

*1 A reference example: 2L/min and uni-direction type are used as the main description.

*2 Serial number



■ Flow rate range for each model

Model No.	Instantaneous flow rate			Integration flow rate		
	Display range	Output value	Decimal point position	Integration display range	Output value	Decimal point position
FSM3-C005U	-50 to 550 mL/min	-50 to 550	None	0 to 9999999 mL	0 to 9999999	None
FSM3-C010U	-100 to 1100 mL/min	-100 to 1100				
FSM3-C005B	-550 to 550 mL/min	-550 to 550		-9999999 to 9999999 mL	-9999999 to 9999999	
FSM3-C010B	-1100 to 1100 mL/min	-1100 to 1100				
FSM3-C020U	-0.20 to 2.20 L/min	-20 to 220	Second digit	0 to 99999.99 L	0 to 9999999	Second digit
FSM3-C050U	-0.50 to 5.50 L/min	-50 to 550				
FSM3-C100U	-1.00 to 11.00 L/min	-100 to 1100				
FSM3-C020B	-2.20 to 2.20 L/min	-220 to 220		-99999.99 to 99999.99 L	-9999999 to 9999999	
FSM3-C050B	-5.50 to 5.50 L/min	-550 to 550				
FSM3-C100B	-11.00 to 11.00 L/min	-1100 to 1100				
FSM3-C200U	-2.0 to 22.0 L/min	-20 to 220	First digit	0 to 999999.9 L	0 to 9999999	First digit
FSM3-C500U	-5.0 to 55.0 L/min	-50 to 550				
FSM3-C101U	-10.0 to 110.0 L/min	-100 to 1100				
FSM3-C200B	-22.0 to 22.0 L/min	-220 to 220		-999999.9 to 999999.9 L	-9999999 to 9999999	
FSM3-C500B	-55.0 to 55.0 L/min	-550 to 550				
FSM3-C101B	-110.0 to 110.0 L/min	-1100 to 1100				
FSM3-C201U	-20 to 220 L/min	-20 to 220	None	0 to 9999999 L	0 to 9999999	None
FSM3-C501U	-50 to 550 L/min	-50 to 550				
FSM3-C102U	-100 to -1100 L/min	-100 to 1100				
FSM3-C201B	-220 to 220 L/min	-220 to 220		-9999999 to 9999999 L	-9999999 to 9999999	
FSM3-C501B	-550 to 550 L/min	-550 to 550				
FSM3-C102B	-1100 to 1100 L/min	-1100 to 1100				

・When IODD is not used, a flow rate value is input/output with a numerical value without decimal points.
Conduct conversion noting the number of digits.
・When IODD is used, a flow rate value is input/output with a numerical value with decimal points.
・In case of the uni-direction type, when the instantaneous flow rate value is negative, no addition and no deduction are performed on the integrated flow rate value.

1.3.3 Parameter and commands

■ Common specification

Index	Sub Index	Item	Value	Access	Data length	Format
0x0002	0	System Command	Refer to “Table 1” shown below.	W	1 byte	UInteger8
0x000C	0	Device Access Locks	0x0000: No lock 0x0001: parameter lock 0x0002: Date storage lock	R/W	2 bytes	Record
0x0020	0	Error Count	0	R	2 bytes	UInteger16
0x0024	0	Device Status	0	R	1 byte	UInteger8
0x0025	0	Detailed Devices Status	Refer to “Diagnosis”	R	33 bytes	Array of 3 Octetstring

R: Read out
W: Write
R/W: Read out / Write

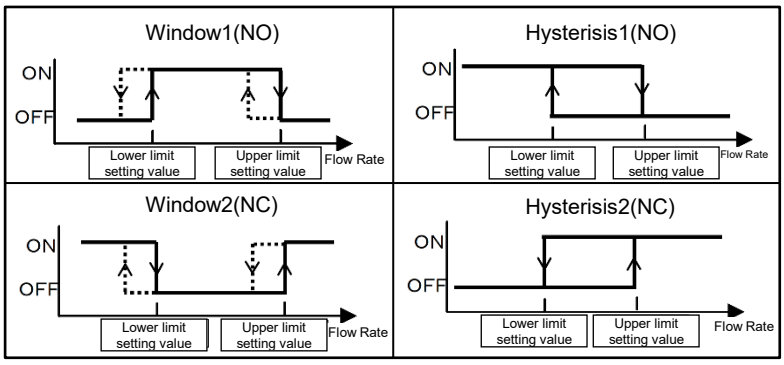
Table 1 System commands

Value	Command	Contents
0x82	Restore Factory Settings	Set the setting value to the factory state.
0xA0	Peak Hold Q Reset	Reset peak value of instantaneous flow rate. (Max. value/Min. value)
0xA3	Peak Hold Q Start	Start logging of instantaneous flow rate. (Max. value/Min. value)
0xA4	Peak Hold Q Stop	Stop logging of instantaneous flow rate. (Max. value/Min. value)
0xA5	Integration Flow Start	Start measurement of integrated flow rate.
0xA6	Integration Flow Stop	Stop measurement of integrated flow rate.
0xA2	Integration Flow Reset	Reset the integrated flow rate.
0xA7	Zero Adjust Start	Adjust current value as zero point.
0xA8	Zero Adjust Reset	Return the zero point adjustment value to the initial value.

■ Individual specification

Index	Sub Index	Item	Value	DS	Access	Data length	Format
0x0100	0	Gas type	1: AIR / 2: AR / 3: CO_2 / 7: MAG(8:2) / 10: O_2 *1	○	R/W	2 bytes	Integer16
0x0101	0	Flow direction	0: Uni-direction / 2: Bi-direction	—	R	2 bytes	Integer16
0x0102	0	Moving average (Response time)	8: 50 ms / 16: 80 ms / 32: 120 ms / 64: 200 ms / 128: 400 ms / 256: 800 ms / 512: 1500 ms	○	R/W	2 bytes	Integer16
0x0103	0	Flow rate standard	0: ANR / 1: NOR	○	R/W	2 bytes	Integer16
0x0104	0	Switch output CH1 Operation mode setting *2, *3	0: None 1: Window1 (NO) 2: Window2 (NC) 3: Hysterisis1 (NO) 4: Hysterisis2 (NC)	○	R/W	2 bytes	Integer16
0x0105	0	Switch output CH1 Lower limit value	Depend on flow rate range 0 L/min *Refer to “1.3.2 On demand data”.	○	R/W	2 bytes	Integer16
0x0106	0	Switch output CH1 Upper limit value	Depend on flow rate range (2%F.S.) L/min *Refer to “1.3.2 On demand data”.	○	R/W	2 bytes	Integer16
0x0107	0	Switch output CH2 Operation mode setting *2, *3	0: None 1: Window1 (NO) 2: Window2 (NC) 3: Hysterisis1 (NO) 4: Hysterisis2 (NC)	○	R/W	2 bytes	Integer16
0x0108	0	Switch output CH2 Lower limit value	Depend on flow rate range 0 L/min *Refer to “1.3.2 On demand data”.	○	R/W	2 bytes	Integer16
0x0109	0	Switch output CH2 Upper limit value	Depend on flow rate range (2%F.S.) L/min *Refer to “1.3.2 On demand data”.	○	R/W	2 bytes	Integer16
0x010A	0	Switch output CH1/ CH2 Hysteresis	1: 1% F.S. / 2: 2% F.S. / 3: 3% F.S. / 4: 4% F.S. / 5: 5% F.S. / 6: 6% F.S. / 7: 7% F.S. / 8: 8% F.S.	○	R/W	2 bytes	Integer16

* R: Read out, W: Write, R/W: Read out / Write, DS: Data storage
* : Default value (The flow direction value is a fixed value. Depending on a selected type, the value is determined)
*1: “10: O2” can be used with the oxygen type.
Also, in case of the oxygen type, the default value is “10: O_2”, and changing to other gas types is not possible.
*2: Make sure to avoid the lower limit value ≥ upper limit value. Also, when in the Window mode, set the setting value by avoiding a hysteresis value ≥ (upper limit - lower limit).
Since the settings of switch output cannot be performed, when five seconds have passed in the state, it becomes Warning. For detail, refer to “1.3.6 Diagnosis”.
*3: Refer to below for the operation waveform of each mode.



1.3.4 Process data IN

PD	PD0								PD1							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	MSB															LSB
Date name	Instantaneous flow rate <Flow Rate>															
Data range	Refer to the instantaneous flow rate output value in “1.3.2 On demand data”.															
Format	Integer16															

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Error	Warn -ing	—	—	—	—	Switch output		—	—	—	—	—	—	—	—
Date name							2	1	Unused							
Data range	True/False															
Format	Boolean															

1.3.5 Observation

Index	Sub Index	Item	Value	Access	Data length	Format
0x0400	0	Peak Hold Q Max	Refer to the instantaneous flow rate output value in “1.3.2 On demand data”.	R	2 bytes	Integer16
0x0401	0	Peak Hold Q Min				
0x0404	0	Integration Flow	Refer to the integrated flow rate output value in “1.3.2 On demand data”.	R	4 bytes	Integer32
0x0405	0	Operating Time	0 to 9,999,999 h 【0 to 9,999,999】	R	4 bytes	Integer32
0x0406	0	Integration Flow Status	0: Integrated flow rate not measured 1: Measuring the integrated flow rate	R	2 bytes	Integer16
0x0407	0	Peak Hold Status	0: Data not collected 1: Collecting data	R	2 bytes	Integer16
0x0408	0	Zero Adjust Status	0: No processing 1: Processing	R	2 bytes	Integer16

*R: Read out
*1: Able to count the launching time for 10 years or more.
Calculation: 9,999,999h÷7,488h≒1335.5 Year
24 h/Day x 26 Day/Month x 12 months = 7,488 h/Year

1.3.6 Diagnosis

Event code	Type	Device status	Contents	Measures
0x4210	Warning	Out of specification	Temperature of IO-Link driver is high	Check the connection.
0x5111	Warning	Out of specification	Supply voltage drop (Approx. 18V or less)	Check the power supply voltage.
0x8000	Error	Failure	ROM / RAM error	Turn the power supply ON again.
0x8320	Error	Failure	Memory read out / writing error	Turn the power supply ON again.
0x8C10	Warning	Out of specification	Exceeding the measured flow rate range Uni-direction: Exceeding 110% F.S. Less than -10% F.S. Bi-direction: Exceeding 110% F.S. Less than -10% F.S.	Set the flow rate within the measurement range.
			Sensor broken	・Turn the power supply ON again. ・Replace the main body.
0x8D02	Error	Failure	Sensor broken	・Turn the power supply ON again. ・Replace the main body.
0x8D03	Warning	Function Check	Exceeding the zero adjust possible range (Flow rate ≥ |10%F.S.|)	Operate after setting the flow rate to zero.
0x8D04	Warning	Out of specification	Error of threshold setting in switch output 1 ・Five seconds or more at Lower limit ≥ upper limit ・Five seconds or more at Hysteresis ≥ (Upper limit – lower limit) (Window mode only)	Reset the threshold value.
0x8D05	Warning	Out of specification	Error of threshold setting in switch output 2 ・Five seconds or more at Lower limit ≥ upper limit ・Five seconds or more at Hysteresis ≥ (Upper limit – lower limit) (Window mode only)	Reset the threshold value.

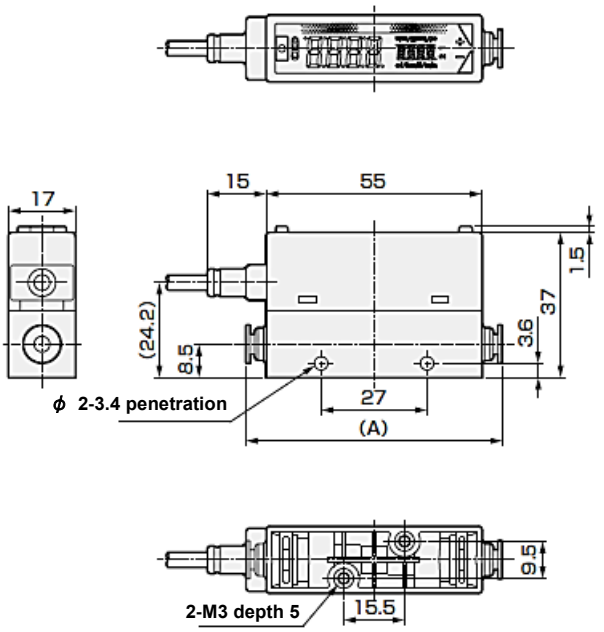
1.4 Dimensions

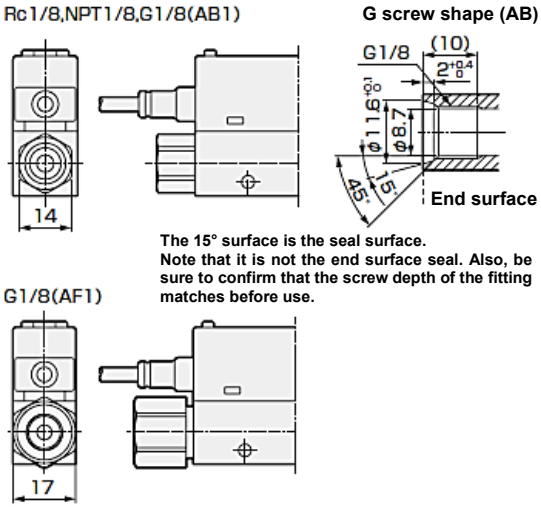
1.4.1 LDC display type

■ Resin body type

Port size: Straight type φ 4 mm, φ 6 mm, φ1/4”, Rc1/8, G1/8, NPT1/8

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



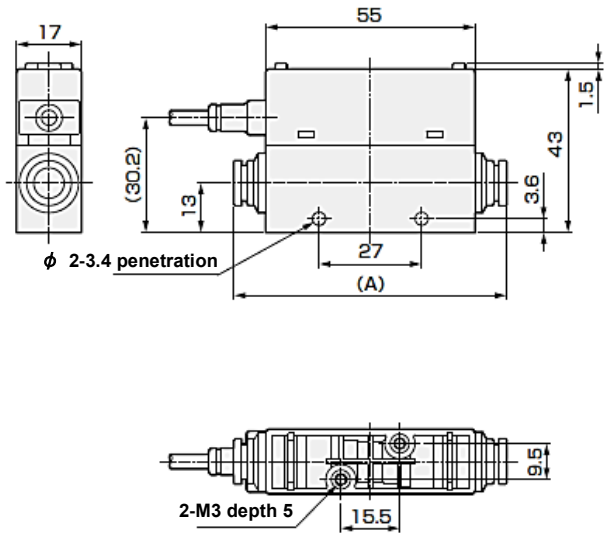


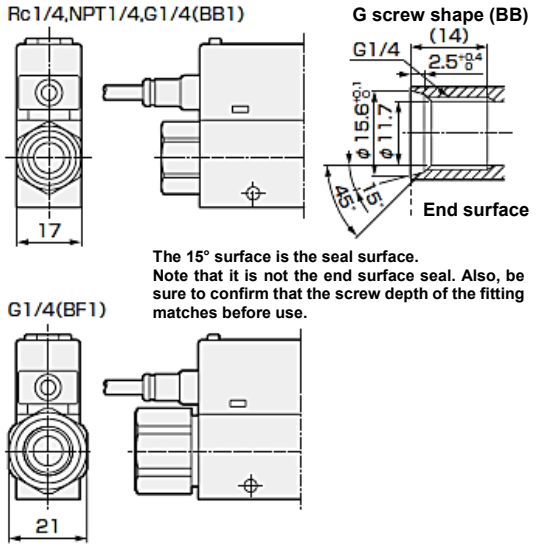
Model No.	Fitting	Dimensions (A)
FSM3-L□□1BH1	Push-in φ 4 mm	(65)
FSM3-L□□1CH1	Push-in φ 6 mm	(67.2)
FSM3-L□□1HH1	Push-in 1/4”	(70.4)
FSM3-L□□1AA1	Rc1/8	(75)
FSM3-L□□1AF1	G1/8	(87)
FSM3-L□□1AB1	G1/8	(87)
FSM3-L□□1AC1	NPT1/8	(75)

Port size: Straight φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

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

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

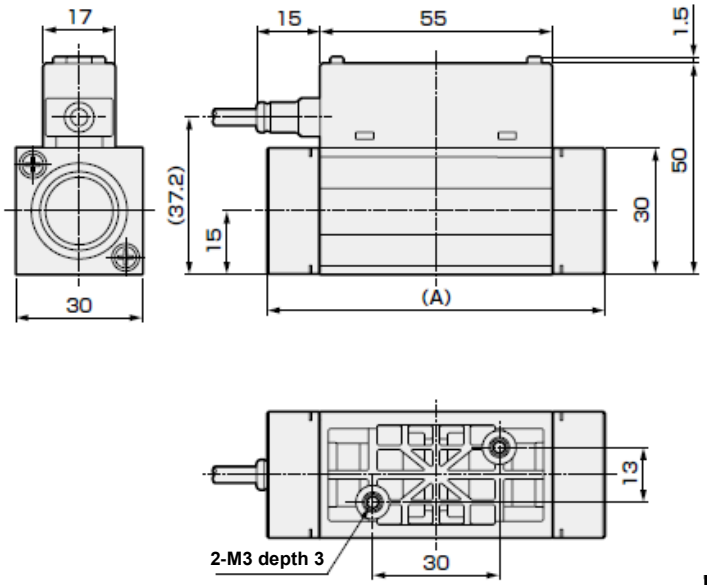




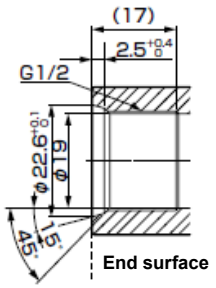
Model No.	Fitting	Dimensions (A)
FSM3-L□□1DH1	Push-in φ 8 mm	(70.6)
FSM3-L□□1EH1	Push-in φ 10 mm	(82.1)
FSM3-L□□1JH1	Push-in 3/8”	(83.4)
FSM3-L□□1BA1	Rc1/4	(75)
FSM3-L□□1BF1	G1/4	(89)
FSM3-L□□1BB1	G1/4	(89)
FSM3-L□□1BC1	NPT1/4	(75)

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

●FSM3 − L[B][C]1/CA1/CF1/CB1/CC1 (Full scale flow rate: 500, 1000 L/min)

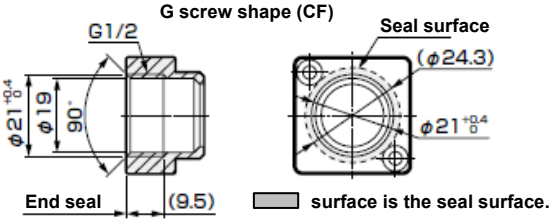


G screw shape (CB)



The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

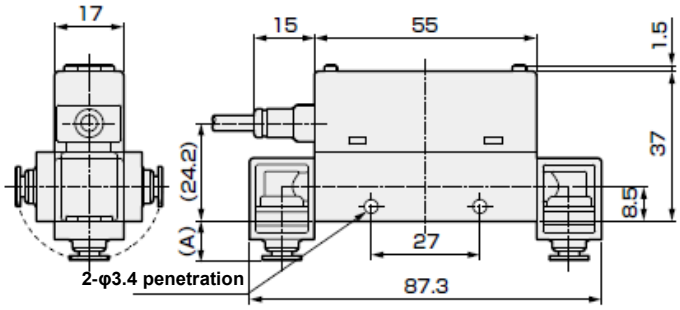
G screw shape (CF)



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

Connection diameter: Elbow type φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

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



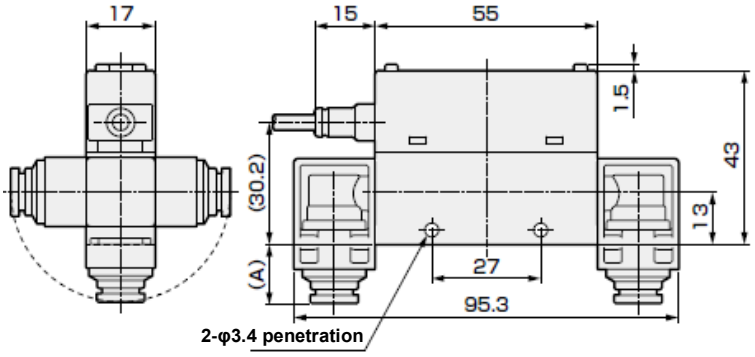
***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

Model No.	Fitting	Dimensions (A)
FSM3-L□□1BH2	Push-in φ 4 mm	(9.5)
FSM3-L□□1CH2	Push-in φ 6 mm	(10.6)
FSM3-L□□1HH2	Push-in 1/4”	(12.2)
FSM3-L□□1AA2	Rc1/8	(14.5)
FSM3-L□□1AF2	G1/8 *	(20.5)
FSM3-L□□1AB2	G1/8* *	(20.5)
FSM3-L□□1AC2	NPT1/8	(14.5)

***For the G shape, refer to the straight type.**

Connection diameter: Elbow type φ 8 mm, φ 10 mm, φ 3/8”, RC1/4, G1/4, NPT1/4

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



***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

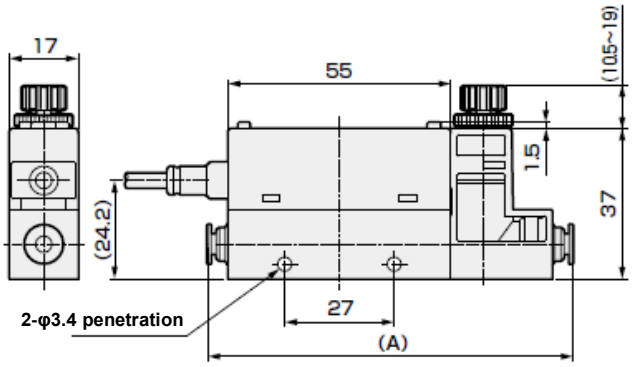
Model No.	Fitting	Dimensions (A)
FSM3-L□□1DH2	Push-in φ 8 mm	(13.6)
FSM3-L□□1EH2	Push-in φ 10 mm	(19.3)
FSM3-L□□1JH2	Push-in 3/8”	(20.0)
FSM3-L□□1BA2	Rc1/4	(15.8)
FSM3-L□□1BF2	G1/4 *	(22.8)
FSM3-L□□1BB2	G1/4 *	(22.8)
FSM3-L□□1BC2	NPT1/4	(15.8)

***For the G shape, refer to the straight type.**

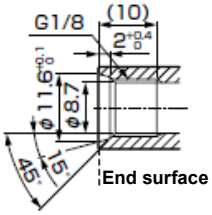
Dimensions with needle valve

Connection diameter: φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

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



G screw shape (AB)



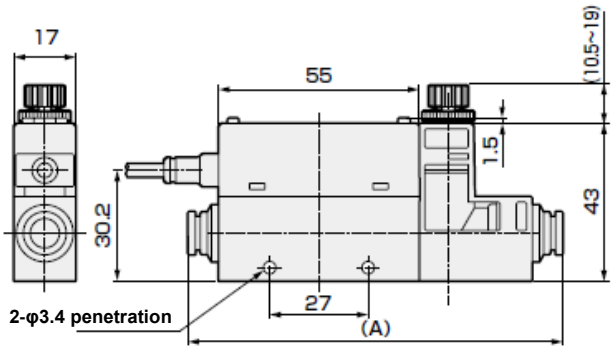
**The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.**

***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

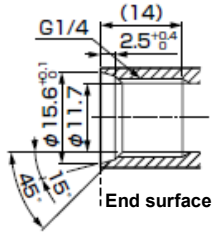
Model No.	Fitting	Dimensions (A)
FSM3-L□□1BH1	Push-in φ 4 mm	(90)
FSM3-L□□1CH1	Push-in φ 6 mm	(92.2)
FSM3-L□□1HH1	Push-in 1/4”	(95.4)
FSM3-L□□1AA1	Rc1/8	(100)
FSM3-L□□1AF1	G1/8	(112)
FSM3-L□□1AB1	G1/8	(112)
FSM3-L□□1AC1	NPT1/8	(100)

Connection diameter: φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

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



G screw shape (BB)



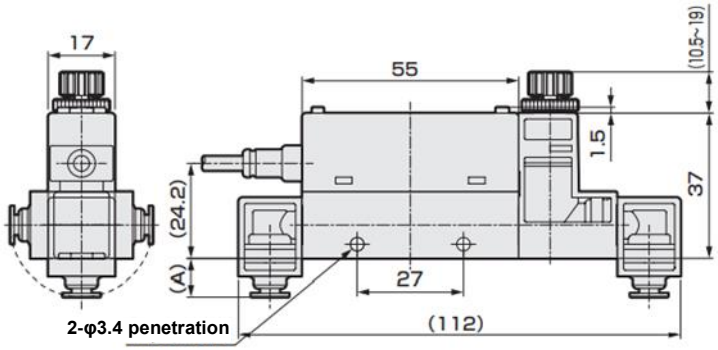
**The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.**

***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

Model No.	Fitting	Dimensions (A)
FSM3-L□□1DH1	Push-in φ 8 mm	(101.6)
FSM3-L□□1EH1	Push-in φ 10 mm	(113.1)
FSM3-L□□1JH1	Push-in 3/8”	(114.4)
FSM3-L□□1BA1	Rc1/4	(106)
FSM3-L□□1BF1	G1/4	(120)
FSM3-L□□1BB1	G1/4	(120)
FSM3-L□□1BC1	NPT1/4	(106)

Connection diameter: Elbow type φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

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



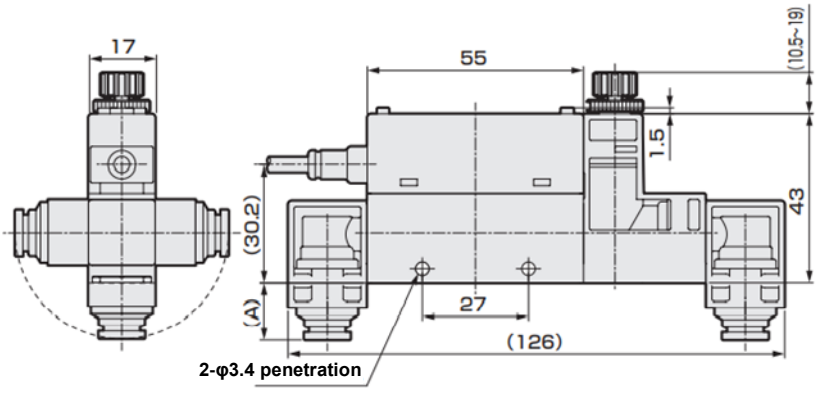
***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

Model No.	Fitting	Dimensions (A)
FSM3-L□□1BH2	Push-in φ 4 mm	(9.5)
FSM3-L□□1CH2	Push-in φ 6 mm	(10.6)
FSM3-L□□1HH2	Push-in 1/4”	(12.2)
FSM3-L□□1AA2	Rc1/8	(14.5)
FSM3-L□□1AF2	G1/8 *	(20.5)
FSM3-L□□1AB2	G1/8 *	(20.5)
FSM3-L□□1AC2	NPT1/8	(14.5)

***For the G shape, refer to the straight type.**

Connection diameter: Elbow type φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

●FSM3－L[B][C]1/DH2/EH2/JH2/BA2/BF2/BB2/BC2/[G][H]T (Full scale flow rate: 50,100,200 L/min)



***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

Model No.	Fitting	Dimensions (A)
FSM3-L□□1DH2	Push-in φ 8 mm	(13.6)
FSM3-L□□1EH2	Push-in φ 10 mm	(19.3)
FSM3-L□□1JH2	Push-in 3/8”	(20.0)
FSM3-L□□1BA2	Rc1/4	(15.8)
FSM3-L□□1BF2	G1/4	(22.8)
FSM3-L□□1BB2	G1/4	(22.8)
FSM3-L□□1BC2	NPT1/4	(15.8)

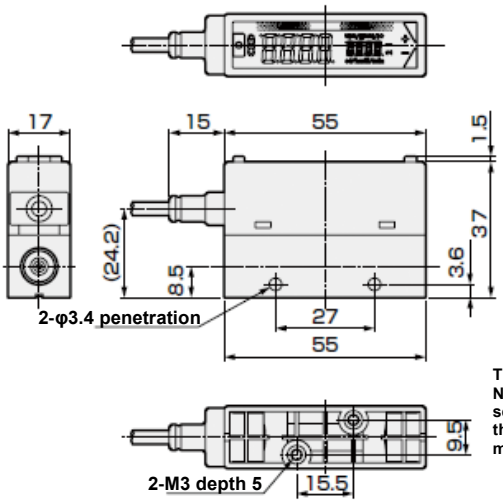
***For the G shape, refer to the straight type.**

■ Stainless steel body type

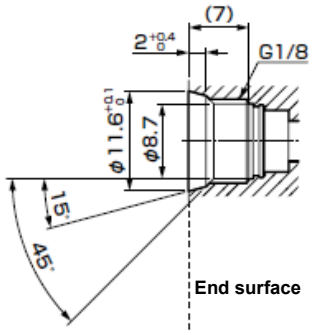
Connection diameter: Straight type Rc1/8, G1/8, NPT1/8

●FSM3 – L[B][C]$^{2}_{3}$/AA1/AB1/AC1

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



G screw shape (AB)

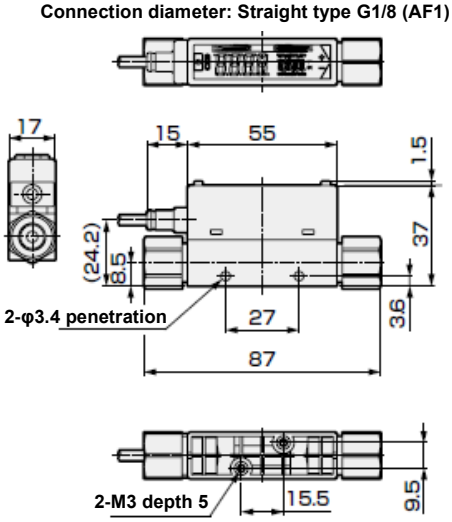


The 15° surface is the seal surface. Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Connection diameter: Straight type G1/8 (AF1)

●FSM3 – L[B][C]$^{2}_{3}$/AF1

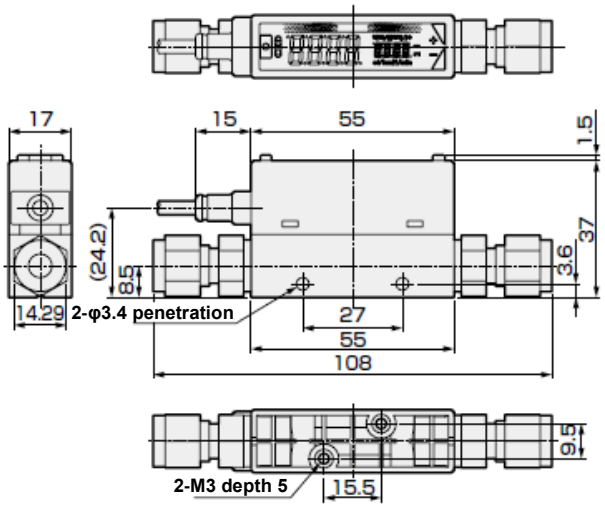
(Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Connection diameter: Straight 1/4” double barbed fitting

●FSM3 – L[B][C]$^{2}_{3}$/AD1

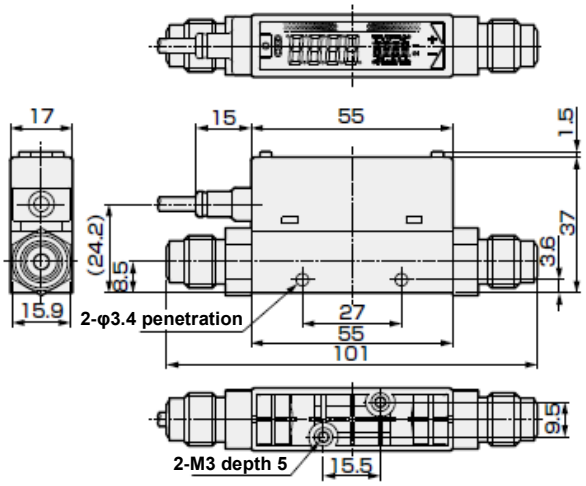
(Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Connection diameter: Straight 1/4” JXR male fitting

●FSM3 – L[B][C]$^{2}_{3}$/AE1

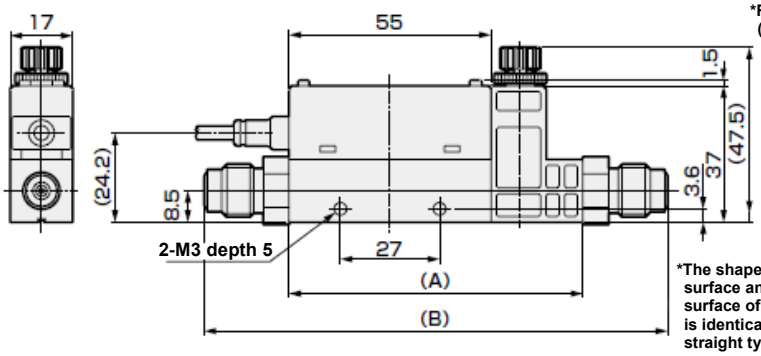
(Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Dimensions with needle valve

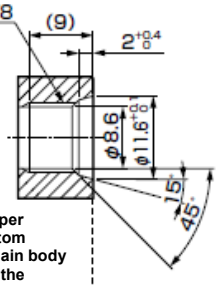
Connection diameter: Rc1/8, G1/8, NPT1/8, 1/4” double barbed fitting, 1/4” JXR male fitting

●FSM3 – L[B][C]$^{2}_{3}$/A AA1/AF1/AB1/AC1/AD/AE[G][H] (Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



G screw shape (AB*needle valve side)

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



*The shape of upper surface and bottom surface of the main body is identical with the straight type.

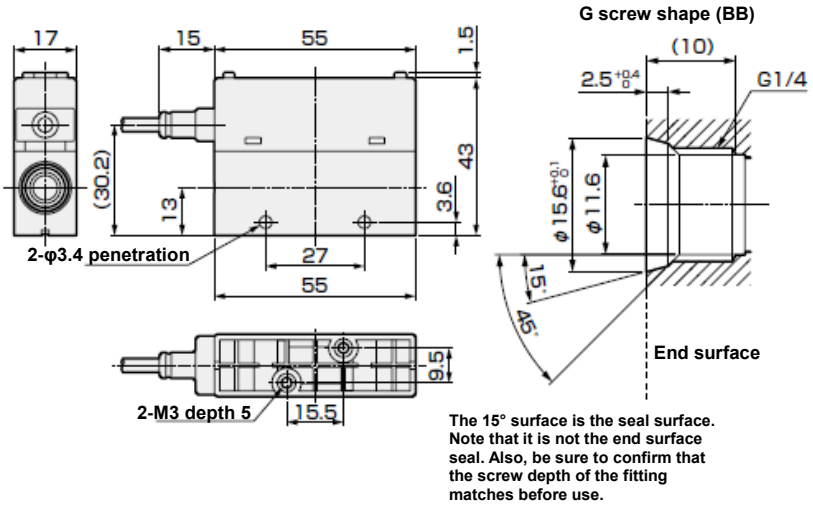
The 15° surface is the seal surface. Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Connection diameter:	Dimension (A)	Dimension (B)
Rc1/8	80	–
G1/8 (AF1)	80	112
G1/8 (AB1)	80	–
NPT1/8	80	–
1/4” Double barbed fitting	80	133
1/4” JXR male fitting	80	126

Connection diameter: Straight Rc 1/4, G1/4, NPT1/4

●FSM3 – L[B][C]$^{2}_{3}$/ BA1/BB1/BC1

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

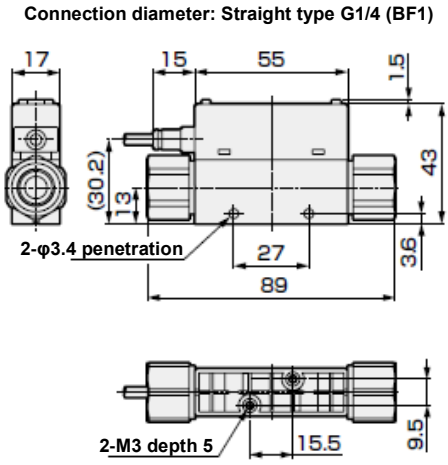


The 15° surface is the seal surface. Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Connection diameter: Straight G1/4 (BF1)

●FSM3 – L[B][C]$^{2}_{3}$/ BF1

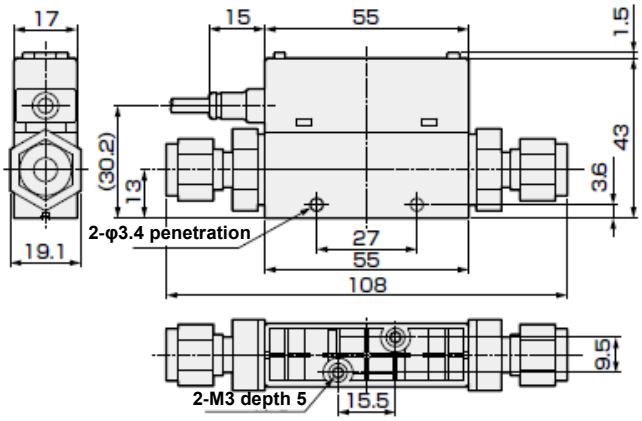
(Full scale flow rate: 50,100,200 L/min)



Connection diameter:
Straight type 1/4” double barbed fitting

●FSM3 – L[B][C]$^{2}_{3}$/ BD1

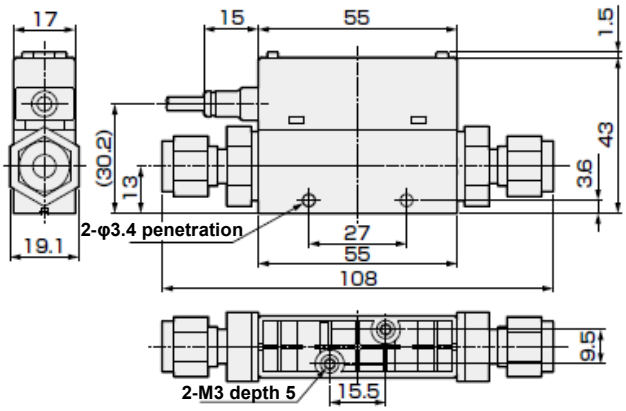
(Full scale flow rate: 50,100,200 L/min)



Connection diameter:
Straight type 1/4” JXR male fitting

●FSM3 – L[B][C]$^{2}_{3}$/ BE1

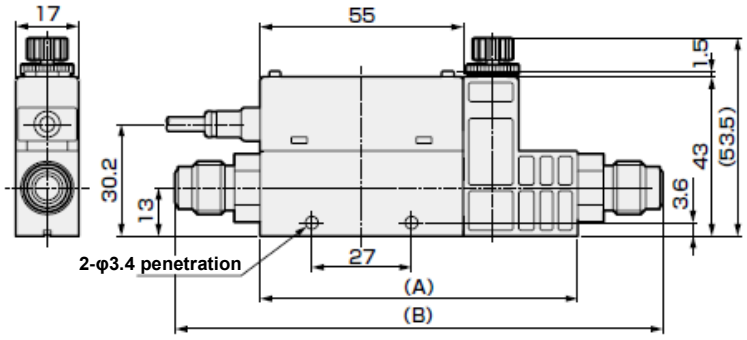
(Full scale flow rate: 50,100,200 L/min)



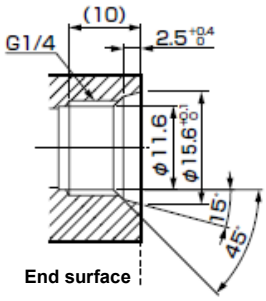
Dimensions with needle valve

Connection diameter: Rc1/4, G1/4, NPT1/4, 1/4” double barbed fitting, 1/4” JXR male fitting

●FSM3 – L[B][C]$^{2}_{3}$/ BA1/BF1/BB1/BC1/BD/BE [G][H] (Full scale flow rate: 50,100,200 L/min)



G screw shape (BB*needle valve side)
*Refer to the figure above for the G screw (BB) shape on the sensor side.



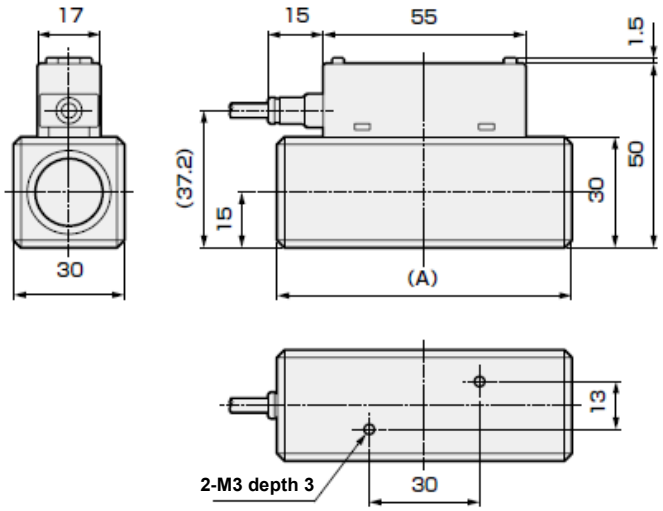
The 15° surface is the seal surface. Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Connection diameter:	Dimension (A)	Dimension (B)
Rc1/4	86	–
G1/4 (BF1)	86	120
G1/4 (BB1)	86	–
NPT1/4	86	–
1/4” Double barbed fitting	86	139
1/4” JXR male fitting	86	132

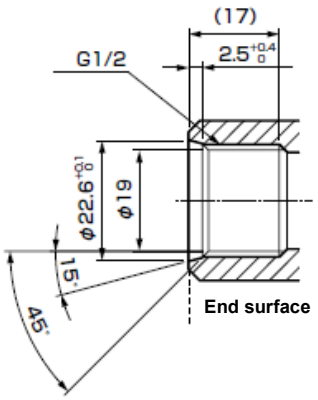
*The shape of upper surface and bottom surface of the main body is identical with the straight type.

Connection diameter: Straight type Rc1/2, G1/2, NPT1/2

●FSM3 – L[B][C]2/CA1/CF1/CB1/CC1
(Full scale flow rate: 500,1000 L/min)



G screw shape (CB)



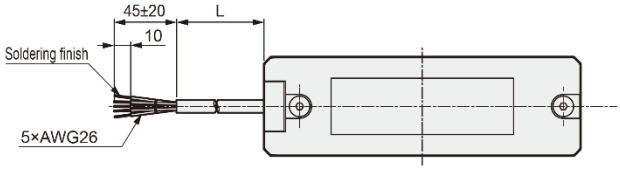
The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

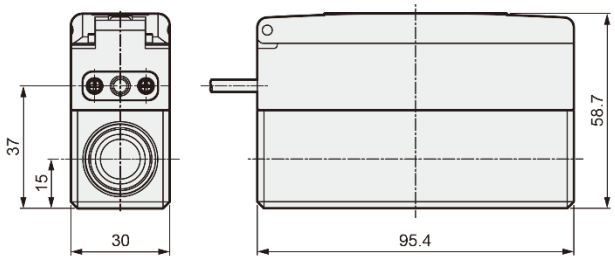
Model No.	Fitting	Dimensions (A)
FSM3-L□□2CA1	Rc1/2	(80)
FSM3-L□□2CF1	G1/2	(80)
FSM3-L□□2CB1	G1/2	(95.4)
FSM3-L□□2CC1	NPT1/2	(80)

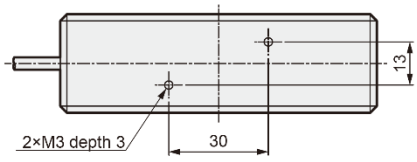
■ Environment-resistant specifications

[Lead wire length]

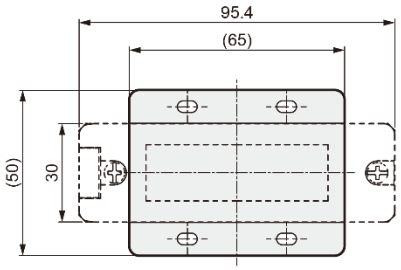
Lead wire code	L dimensions
A	1000±20
B	3000±20

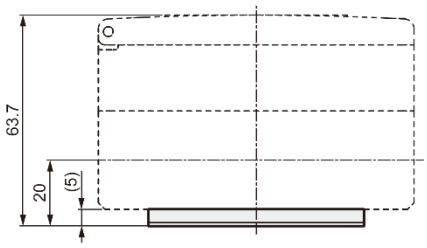


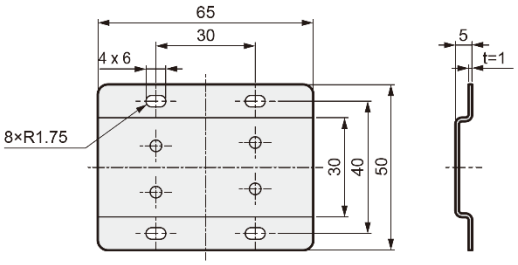




●FSM3-J
Bracket 2





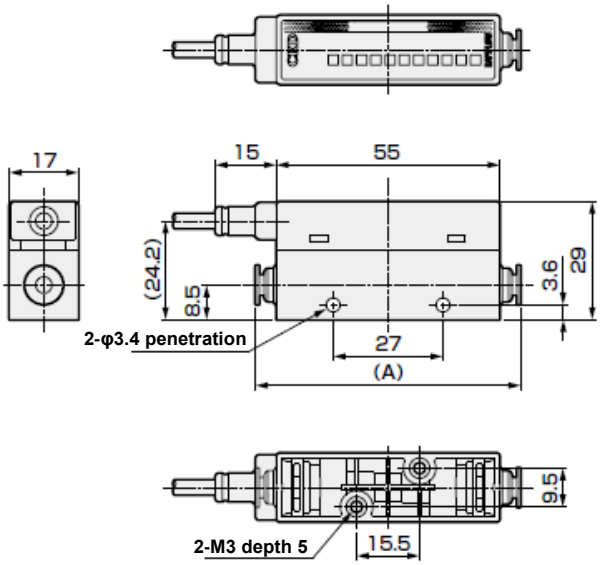


1.4.2 Bar display type

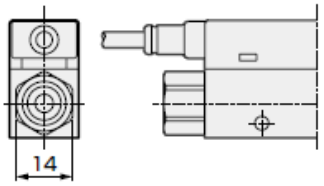
■ Resin body type

Connection diameter: Straight type φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

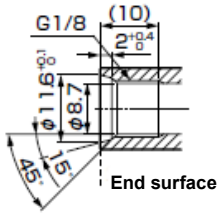
●FSM3 － B[B][C]1/BH1/CH1/HH1/AA1/AF1/AB1/AC1 (Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Rc 1/8,NPT1/8,G1/8(AB1)

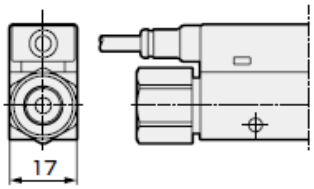


G screw shape (AB)



The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

G1/8(AF1)

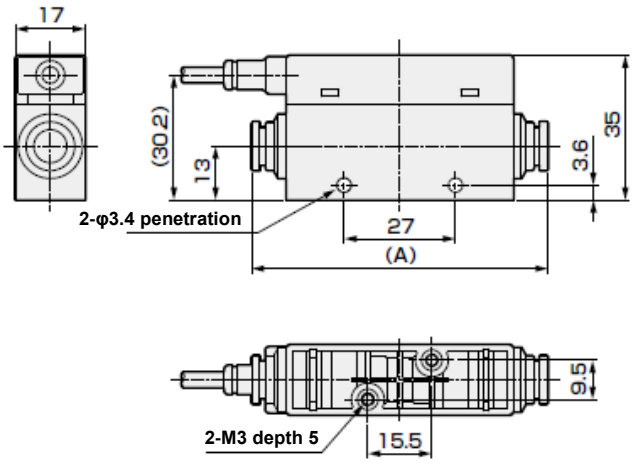


Model No.	Fitting	Dimensions (A)
FSM3-B□□1BH1	Push-in φ 4 mm	(65)
FSM3-B□□1CH1	Push-in φ 6 mm	(67.2)
FSM3-B□□1HH1	Push-in 1/4”	(70.4)
FSM3-B□□1AA1	Rc1/8	(75)
FSM3-B□□1AF1	G1/8	(87)
FSM3-B□□1AB1	G1/8	(87)
FSM3-B□□1AC1	NPT1/8	(75)

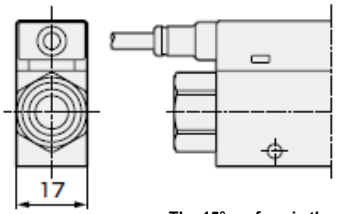
Connection diameter: Straight type φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

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

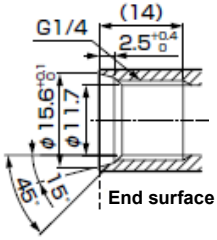
*The dedicated adapter for the EXA connection type is the secondary side (the right in the figure below).



Rc 1/4,NPT1/4,G1/4(AB1)

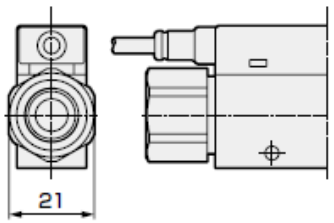


G screw shape (BB)



The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

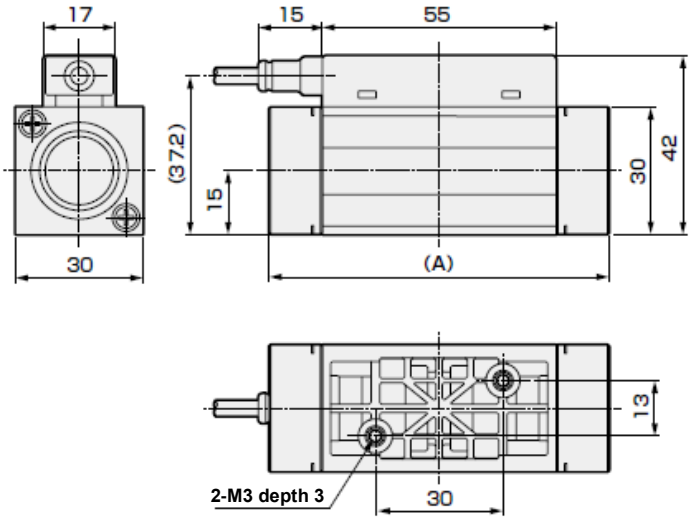
G1/4(BF1)



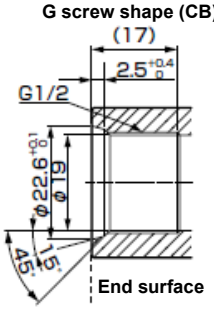
Model No.	Fitting	Dimensions (A)
FSM3-B□□1DH1	Push-in φ 8 mm	(70.6)
FSM3-B□□1EH1	Push-in φ 10 mm	(82.1)
FSM3-B□□1JH1	Push-in 3/8”	(83.4)
FSM3-B□□1BA1	Rc1/4	(75)
FSM3-B□□1BF1	G1/4	(89)
FSM3-B□□1BB1	G1/4	(89)
FSM3-B□□1BC1	NPT1/4	(75)

Connection diameter: Straight type Rc1/2, G1/2, NPT1/2

●FSM3 − B[B][C]1/CA1/CF1/CB1/CC1 (Full scale flow rate: 500,1000 L/min)

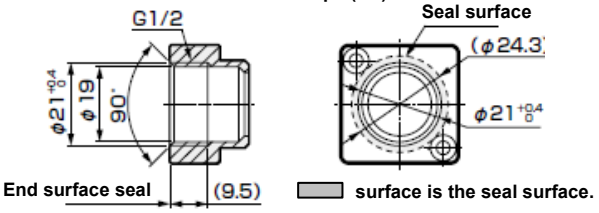


G screw shape (CB)



The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

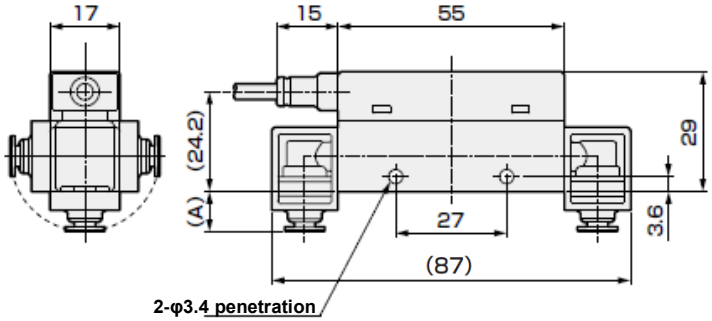
G screw shape (CF)



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

Connection diameter: Elbow type φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

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



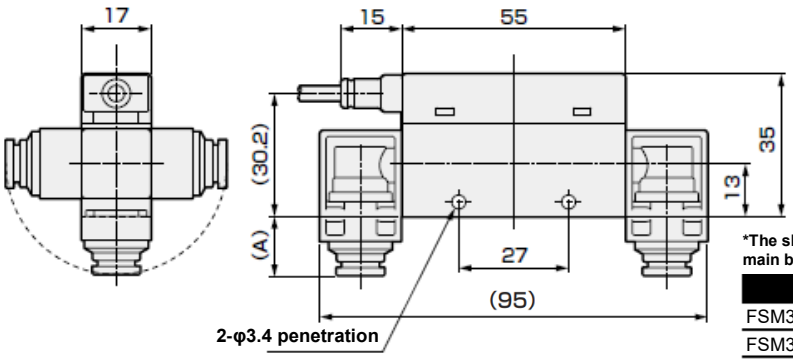
***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

Model No.	Fitting	Dimensions (A)
FSM3-B□□1BH2	Push-in φ 4 mm	(9.5)
FSM3-B□□1CH2	Push-in φ 6 mm	(10.6)
FSM3-B□□1HH2	Push-in 1/4”	(12.2)
FSM3-B□□1AA2	Rc1/8	(14.5)
FSM3-B□□1AF2	G1/8 *	(20.5)
FSM3-B□□1AB2	G1/8 *	(20.5)
FSM3-B□□1AC2	NPT1/8	(14.5)

***For the G screw type, refer to the straight type.**

Connection diameter: Elbow type φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

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



***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

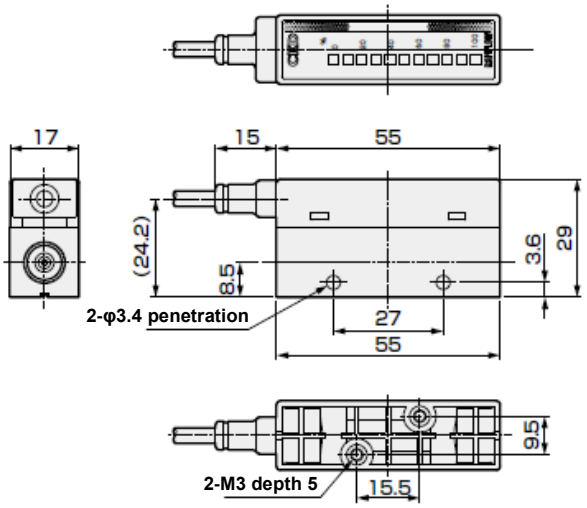
Model No.	Fitting	Dimensions (A)
FSM3-B□□1DH2	Push-in φ 8 mm	(13.6)
FSM3-B□□1EH2	Push-in φ 10 mm	(19.3)
FSM3-B□□1JH2	Push-in 3/8”	(20.0)
FSM3-B□□1BA2	Rc1/4	(15.8)
FSM3-B□□1BF2	G1/4 *	(22.8)
FSM3-B□□1BB2	G1/4 *	(22.8)
FSM3-B□□1BC2	NPT1/4	(15.8)

***For the G screw type, refer to the straight type.**

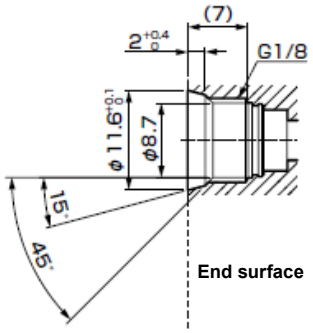
■ Stainless steel body type

Connection diameter: Straight type Rc1/8, G1/8, NPT1/8

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



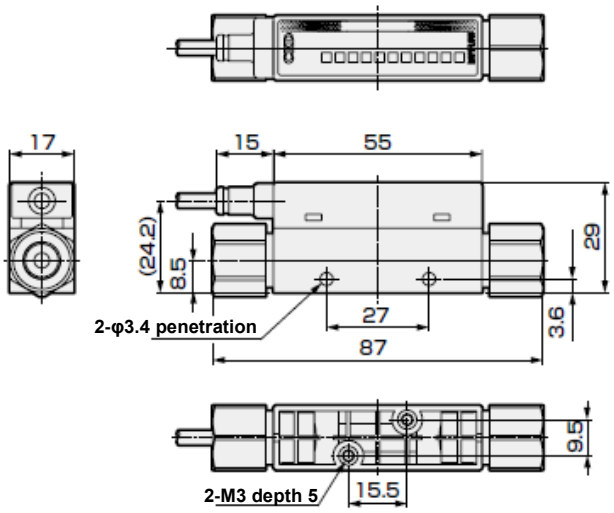
G screw shape (AB)



**The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.**

Connection diameter: Straight type G1/8

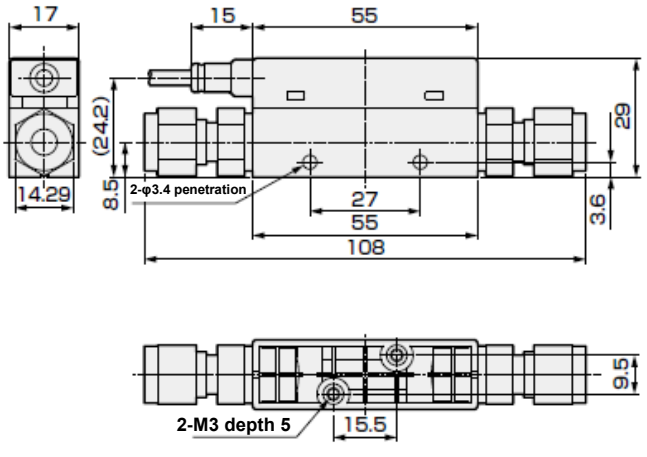
●FSM3 − B[B][C]$^{2}_{3}$/ AF1 (Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Connection diameter: Straight type 1/4” double barbed fitting

●FSM3 − B[B][C]$^{2}_{3}$/ AD1

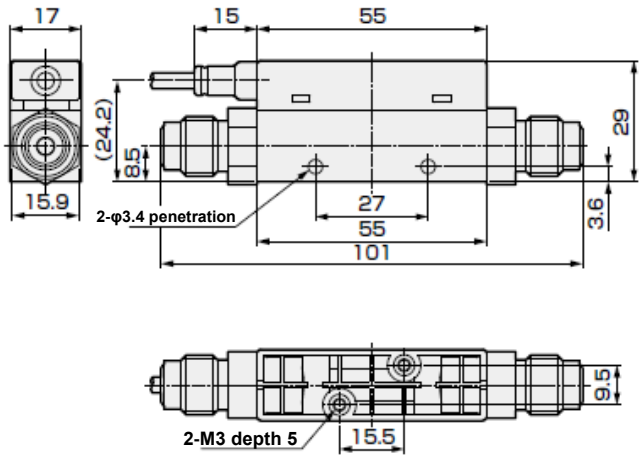
(Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Connection diameter: Straight type 1/4” JXR male fitting

●FSM3 − B[B][C]$^{2}_{3}$/ AE1

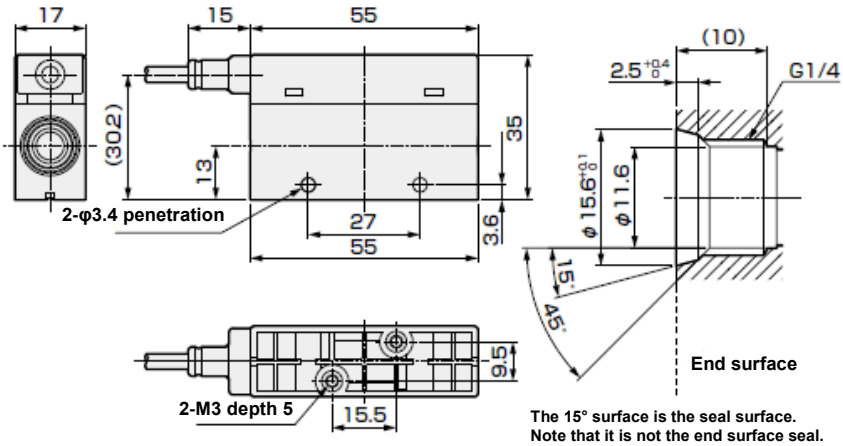
(Full scale flow rate: 500 mL/min,1,2,5,10,20,50 L/min)



Connection diameter: Straight type Rc1/4, G1/4, NPT1/4

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

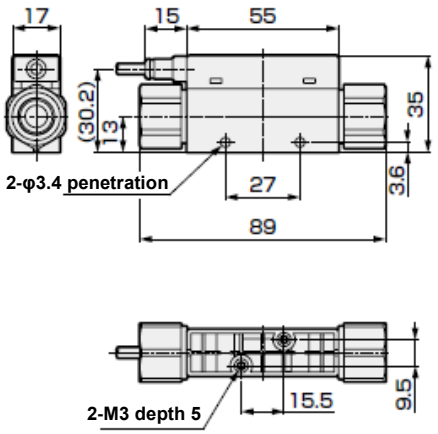
G screw shape (BB)



The 15° surface is the seal surface.
Note that it is not the end surface seal.
Also, be sure to confirm that the screw depth of the fitting matches before use.

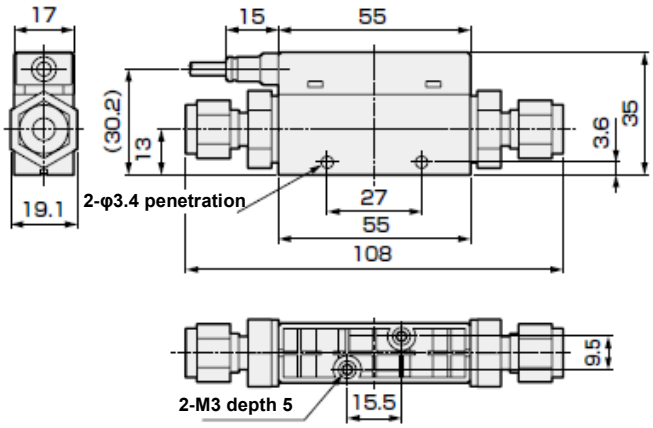
Connection diameter: Straight G1/4

●FSM3 - B[B][C]$^{2}_{3}$/ BF1
(Full scale flow rate: 50,100,200 L/min)



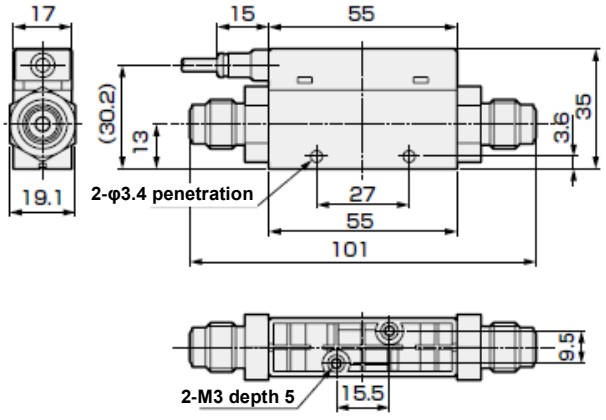
Connection diameter: Straight type 1/4" double barbed fitting

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



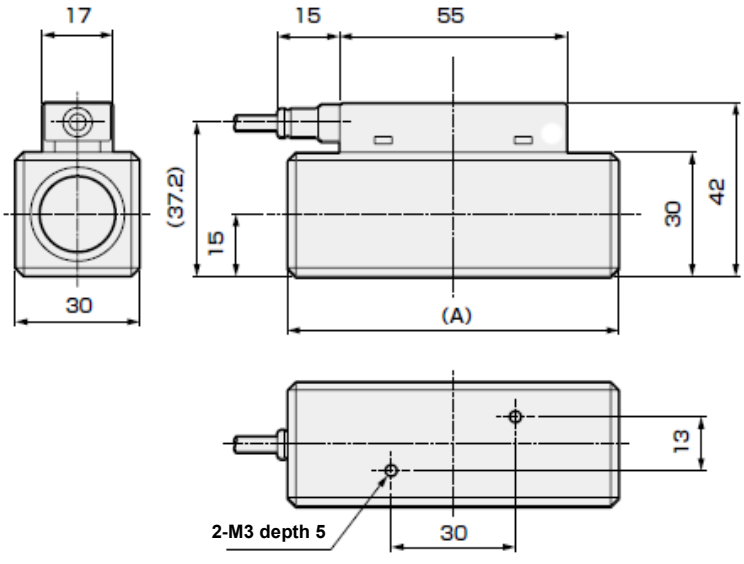
Port size: Straight 1/4" JXR male fitting

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

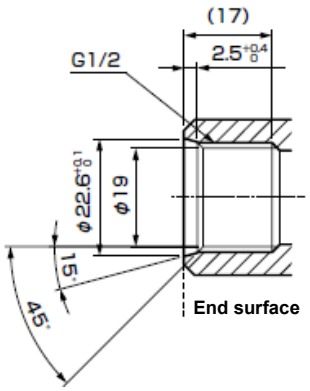


Connection diameter: Straight type Rc1/2, G1/2, NPT1/2

●FSM3 - B[B][C]$^{2}_{3}$/ A1/CB1/CC1 (Full scale flow rate: 500,1000 L/min)



G screw shape (CB)



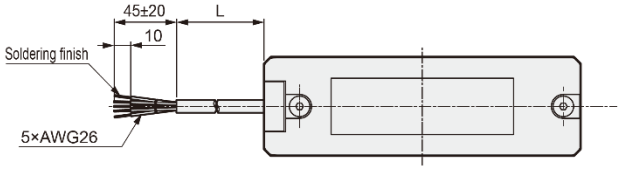
The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

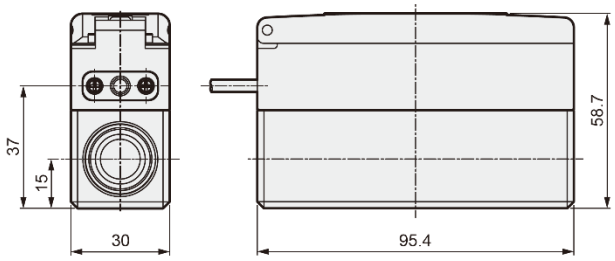
Model No.	Fitting	Dimensions (A)
FSM3-B□□2CA1	Rc1/2	(80)
FSM3-B□□2CF1	G1/2	(80)
FSM3-B□□2CB1	G1/2	(95.4)
FSM3-B□□2CC1	NPT1/2	(80)

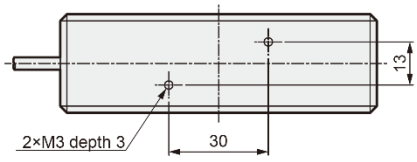
■ Environment-resistant specifications

[Lead wire length]

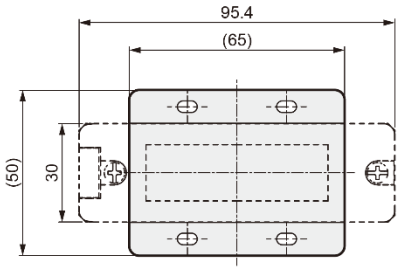
Lead wire code	L dimensions
A	1000±20
B	3000±20

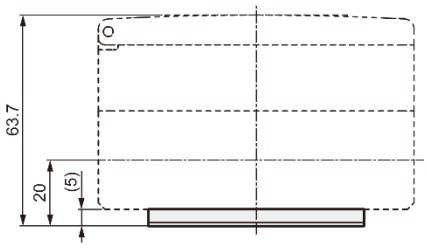


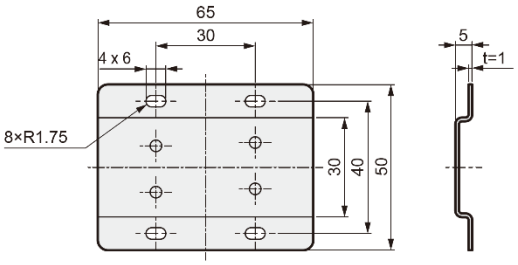




●FSM3-J
Bracket 2





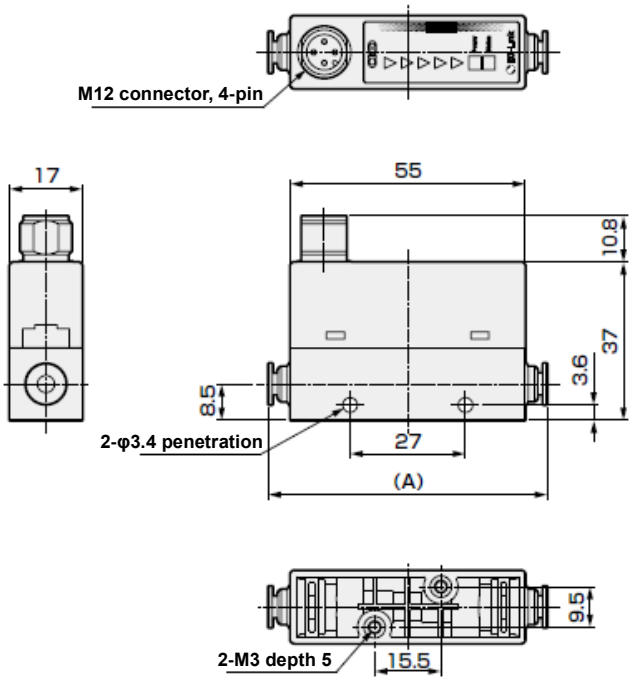


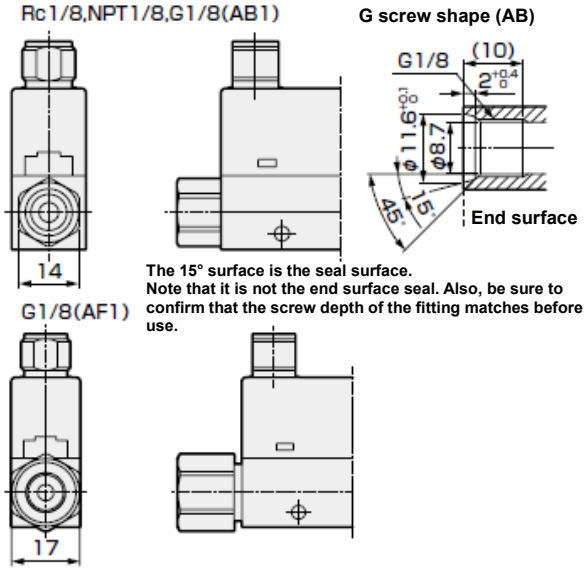
1.4.3 IO-Link type

■ Resin body type

Connection diameter: Straight type φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

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

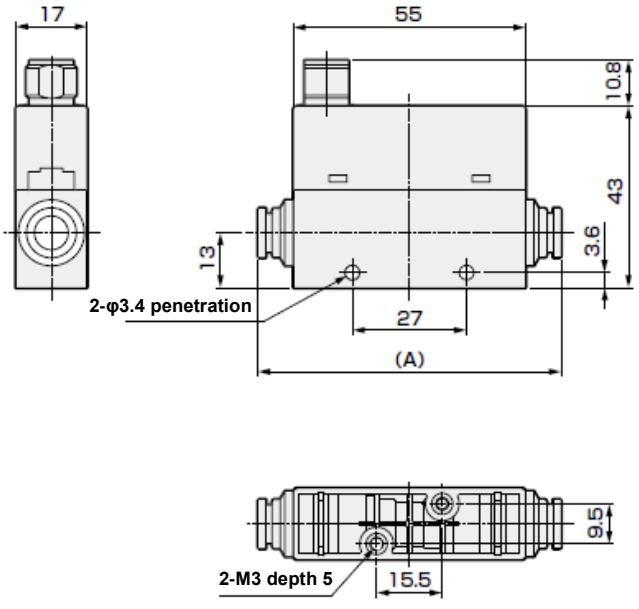


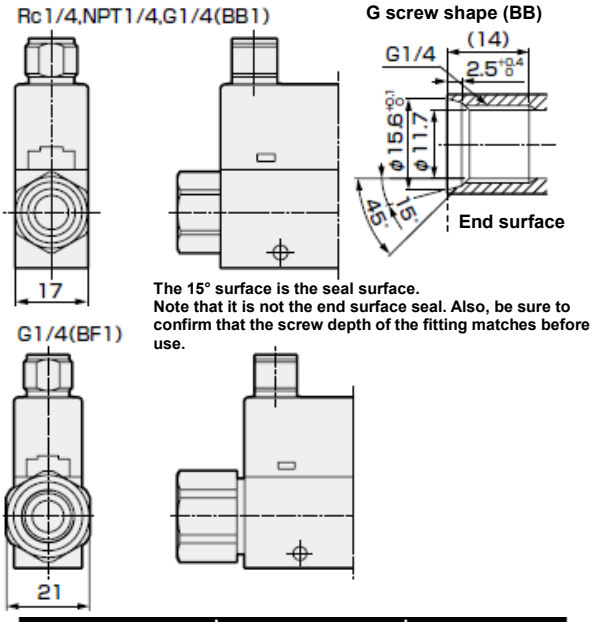


Model No.	Fitting	Dimensions (A)
FSM3-C□□1BH1	Push-in φ 4 mm	(65)
FSM3-C□□1CH1	Push-in φ 6 mm	(67.2)
FSM3-C□□1HH1	Push-in 1/4”	(70.4)
FSM3-C□□1AA1	Rc1/8	(75)
FSM3-C□□1AF1	G1/8	(87)
FSM3-C□□1AB1	G1/8	(87)
FSM3-C□□1AC1	NPT1/8	(75)

Connection diameter: Straight type φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

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

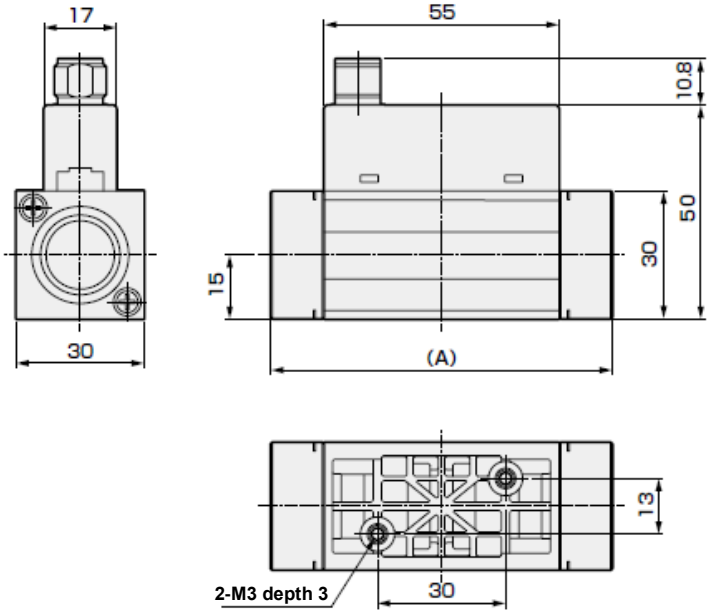




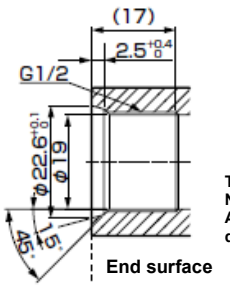
Model No.	Fitting	Dimensions (A)
FSM3-C□□1DH1	Push-in φ 8 mm	(70.6)
FSM3-C□□1EH1	Push-in φ 10 mm	(82.1)
FSM3-C□□1JH1	Push-in 3/8”	(83.4)
FSM3-C□□1BA1	Rc1/4	(75)
FSM3-C□□1BF1	G1/4	(89)
FSM3-C□□1BB1	G1/4	(89)
FSM3-C□□1BC1	NPT1/4	(75)

Connection diameter: Straight type Rc1/2, G1/2, NPT1/2

●FSM3 – C[B][C]1/CA1/CF1/CB1/CC1 (Full scale flow rate: 500,1000 L/min)

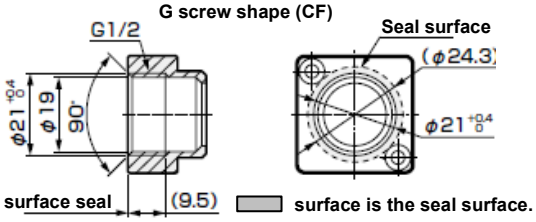


G screw shape (CB)



The 15° surface is the seal surface. Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

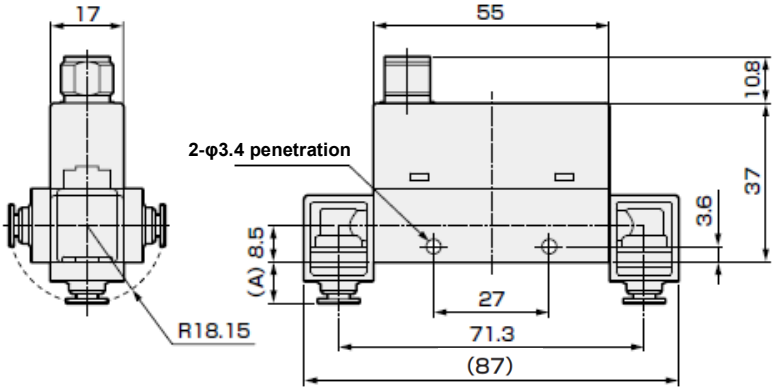
G screw shape (CF)



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

Connection diameter: Elbow type φ 4 mm, φ 6 mm, φ 1/4”, Rc1/8, G1/8, NPT1/8

●FSM3 – C[B][C]1/BH2/CH2/HH2/AA2/AF2/AB2/AC (Full scale flow rate: 500 L/min,1,2,5,10,20,50 L/min)



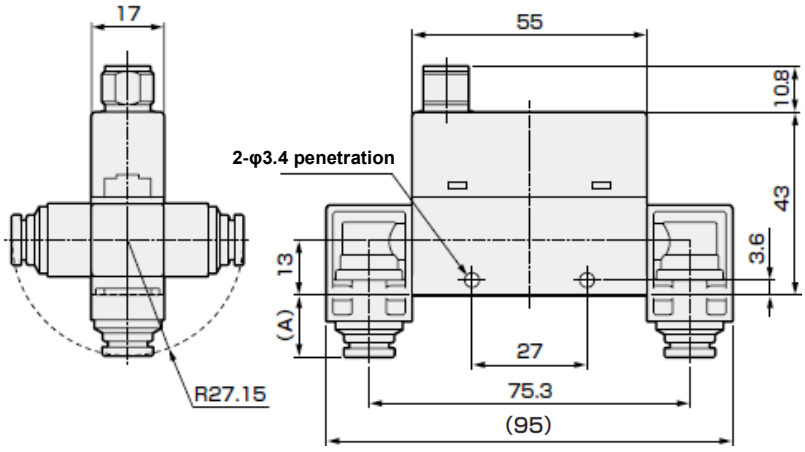
***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

Model No.	Fitting	Dimensions (A)
FSM3-L□□1BH2	Push-in φ 4 mm	(9.5)
FSM3-L□□1CH2	Push-in φ 6 mm	(10.6)
FSM3-L□□1HH2	Push-in 1/4”	(12.2)
FSM3-L□□1AA2	Rc1/8	(14.5)
FSM3-L□□1AF2	G1/8	(20.5)
FSM3-L□□1AB2	G1/8	(20.5)
FSM3-L□□1AC2	NPT1/8	(14.5)

***For the G screw type, refer to the straight type.**

Connection diameter: Elbow type φ 8 mm, φ 10 mm, φ 3/8”, Rc1/4, G1/4, NPT1/4

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



***The shape of upper surface and bottom surface of the main body is identical with the straight type.**

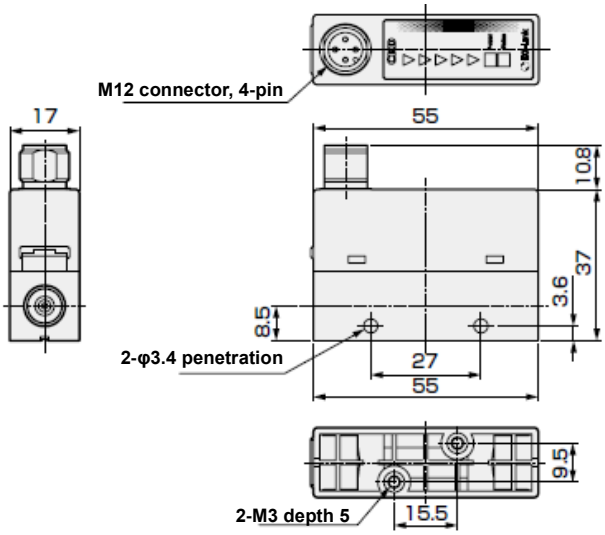
Model No.	Fitting	Dimensions (A)
FSM3-C□□1DH2	Push-in φ 8 mm	(13.6)
FSM3-C□□1EH2	Push-in φ 10 mm	(19.3)
FSM3-C□□1JH2	Push-in 3/8”	(20.0)
FSM3-C□□1BA2	Rc1/4	(15.8)
FSM3-C□□1BF2	G1/4	(22.8)
FSM3-C□□1BB2	G1/4	(22.8)
FSM3-C□□1BC2	NPT1/4	(15.8)

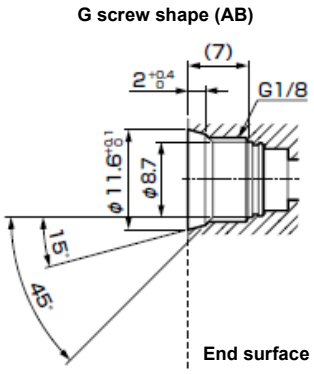
***For the G screw type, refer to the straight type.**

■ Stainless steel body type

Connection diameter: Straight type Rc1/8, G1/8, NPT1/8

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

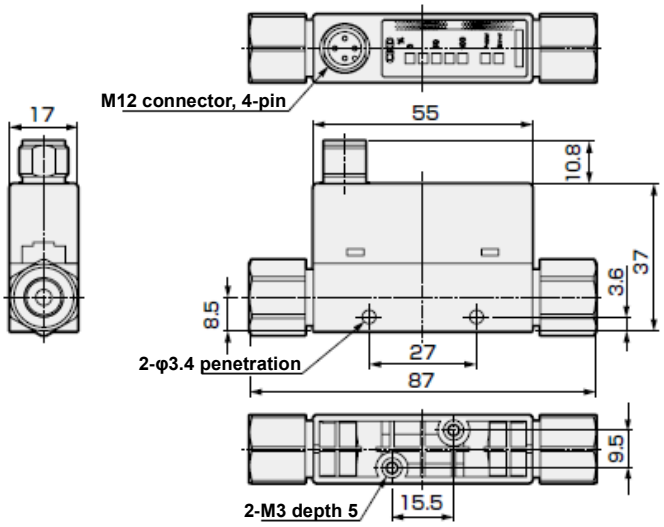




The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Connection diameter: Straight type G1/8

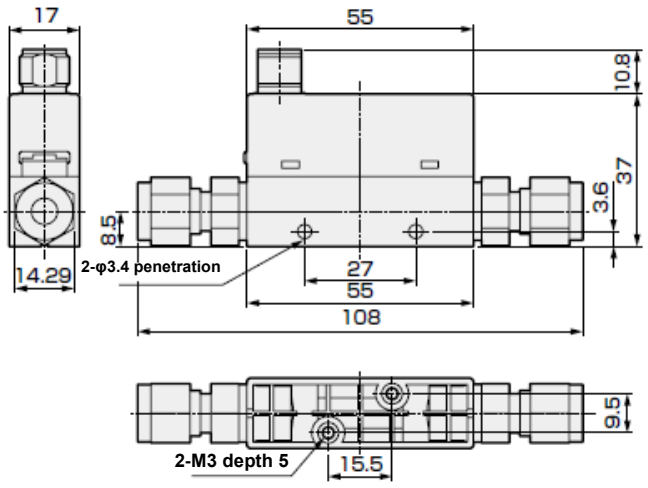
●FSM3 − C[B][C]$^{2}_{3}$/AF1 (Full scale flow rate: 500 L/min, 1,2,5,10,20,50 L/min)



Connection diameter: Straight type 1/4” Double barbed fitting

●FSM3 − C[B][C]$^{2}_{3}$/AD1

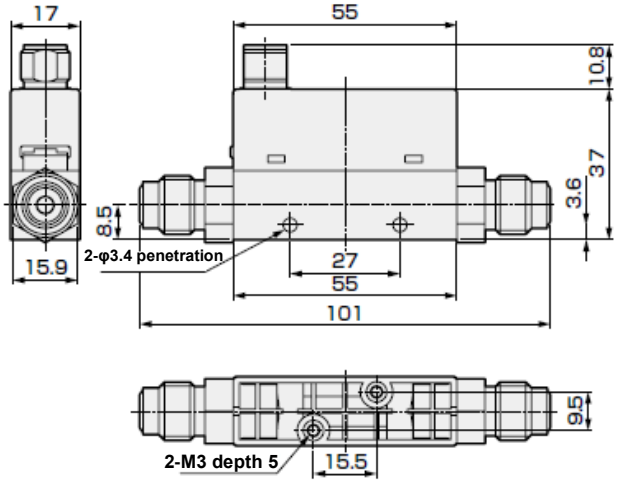
(Full scale flow rate: 500 L/min, 1,2,5,10,20,50 L/min)



Connection diameter: Straight type 1/4” JXR male fitting

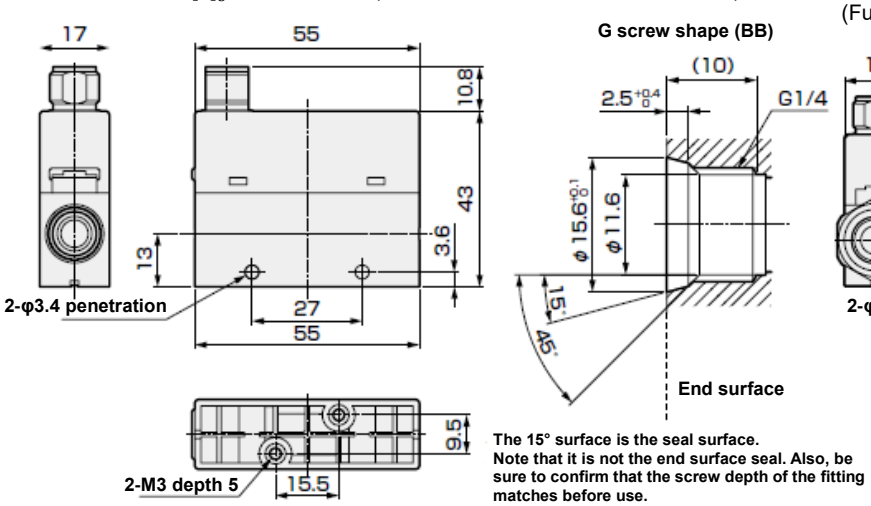
●FSM3 − C[B][C]$^{2}_{3}$/AE1

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



Connection diameter: Straight type Rc1/4, G1/4, NPT1/4

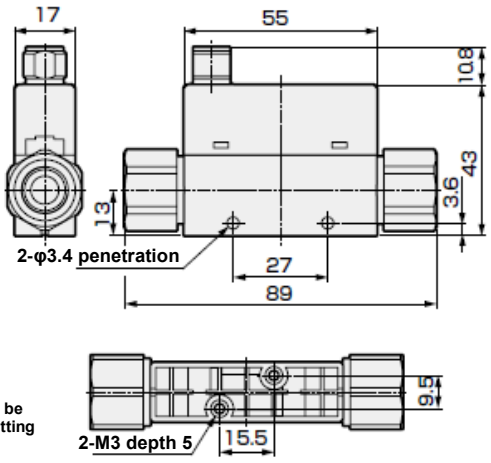
●FSM3 – C[B][C]$^{2}_{3}$/BA1/BB1/BC1 (Full scale flow rate: 50,100,200 L/min)



The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

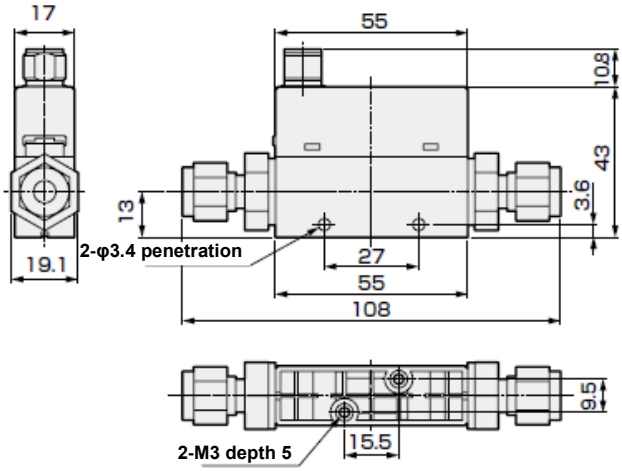
Connection diameter: Straight type G1/4

●FSM3 – C[B][C]$^{2}_{3}$/CF1
(Full scale flow rate: 50,100,200 L/min)



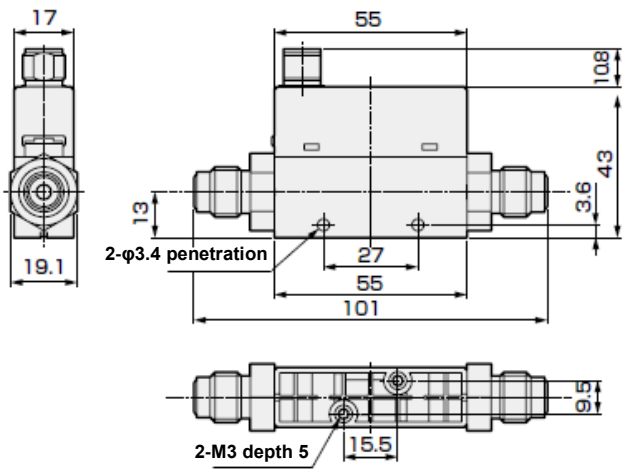
Connection diameter: Straight type 1/4" double barbed fitting

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



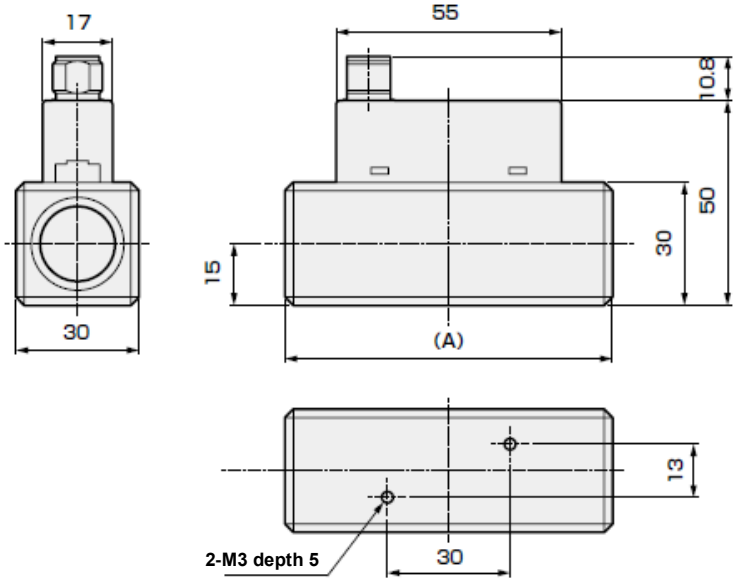
Connection diameter: Straight type 1/4" JXR male fitting

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

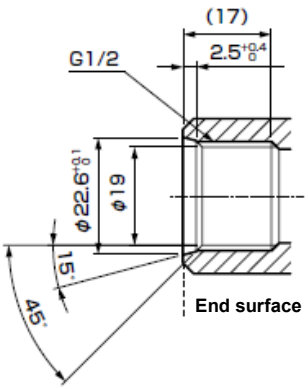


Connection diameter: Straight type Rc1/2, G1/2, NPT1/2

●FSM3 – B[B][C]$^{2}_{3}$/CA1/CB1/CC1 (Full scale flow rate: 500,1000 L/min)



G screw shape (CB)



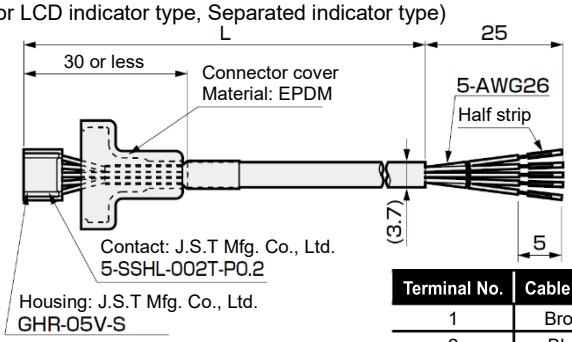
The 15° surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Model No.	Fitting	Dimensions (A)
FSM3-C□□2BA1	Rc1/2	(80)
FSM3-C□□2BF1	G1/2	(80)
FSM3-C□□2BB1	G1/2	(95.4)
FSM3-C□□2BC1	NPT1/2	(80)

1.4.4 Option

●FSM3-A,B

5-conductor lead wire
(For LCD indicator type, Separated indicator type)

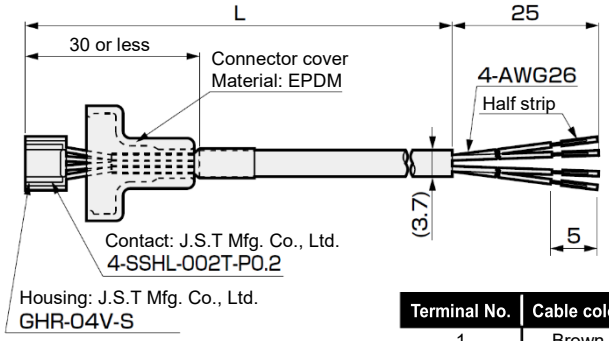


Model No.	L dimensions	Weight g
FSM3-A	1040 ± 20	21
FSM3-B	3040 ± 20	57

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

●FSM3-C,D

4-conductor lead wire (For Bar indicator type)

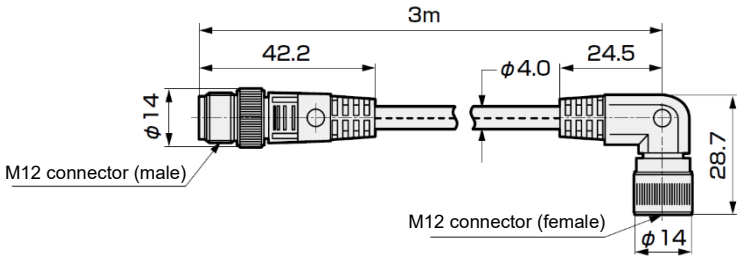


Model No.	L dimensions	Weight g
FSM3-C	1040 ± 20	19
FSM3-D	3040 ± 20	52

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

●FSM3-G

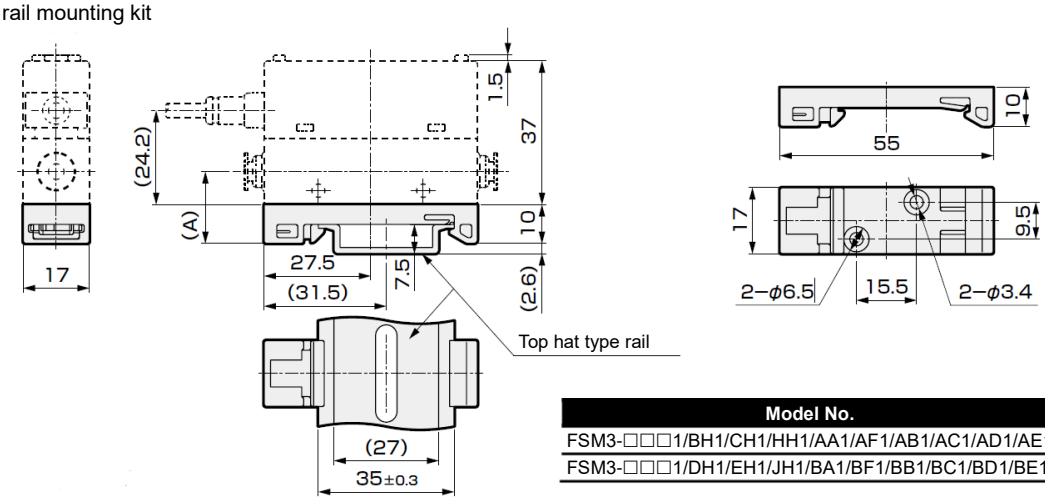
(M12 Lead wire with both side connector)



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

●FSM3-M

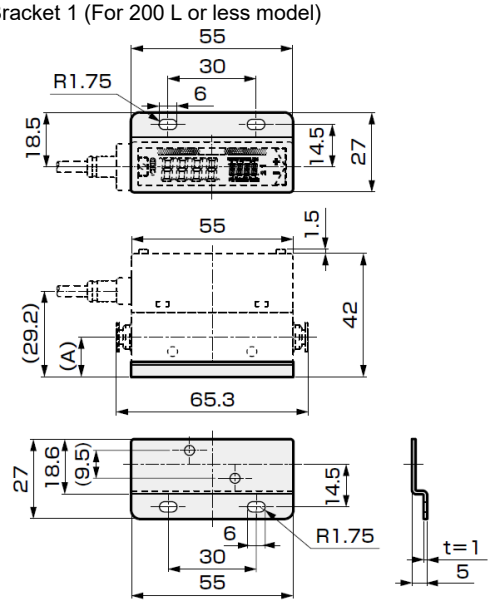
DIN rail mounting kit



Model No.	Dimensions (A)
FSM3-□□□1/BH1/CH1/HH1/AA1/AF1/AB1/AC1/AD1/AE1	18.5
FSM3-□□□1/DH1/EH1/JH1/BA1/BF1/BB1/BC1/BD1/BE1	23.0

●FSM3-H

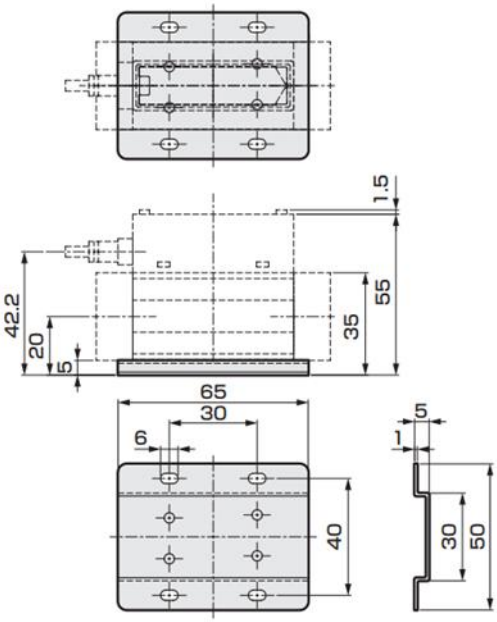
Bracket 1 (For 200 L or less model)



Model No.	Dimensions (A)
FSM3-□□□1/BH1/CH1/HH1/AA1/AF1/AB1/AC1/AD1/AE1	13.5
FSM3-□□□1/DH1/EH1/JH1/BA1/BF1/BB1/BC1/BD1/BE1	18.0

●FSM3-J

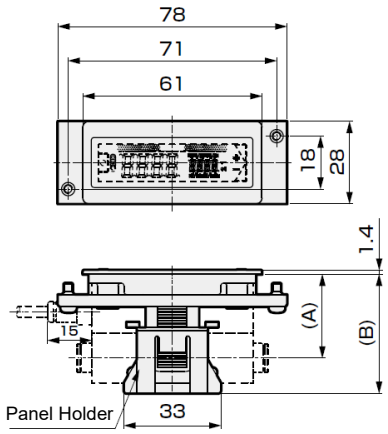
Bracket 2 (For 500 L and 1000 L models)



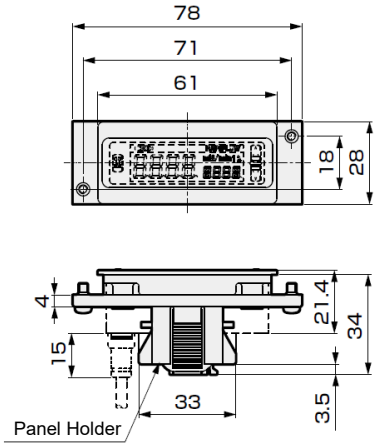
●FSM3-K

Panel mounting kit 1 (For LCD indicator type, Separated indicator type)

- LCD indicator

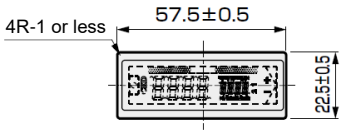


- Separated indicator

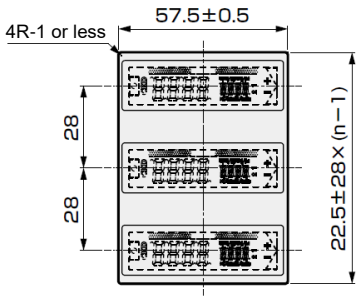


[Panel cut dimensions]

Single mount



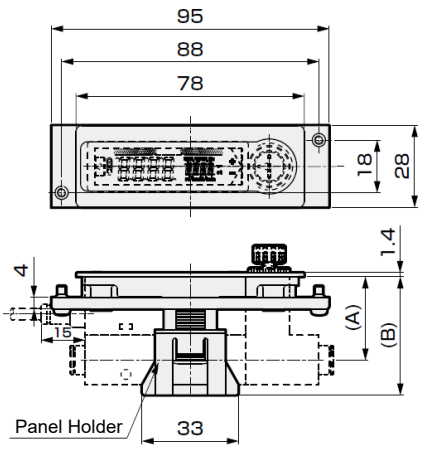
Adhered mount



●FSM3-L

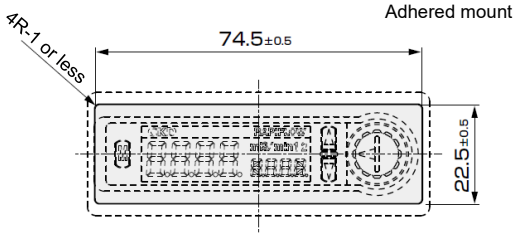
Panel mounting kit 2 (For Needle valve integrated type)

- Needle valve integrated type



[Panel cut dimensions]

Adhered mount



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

1.4.5 Products weight

■ Resin body type

[Unit: g]

Fitting		LCD indicator type		Bar display type	IO-Link type
Model	Content	No needle valve	With needle valve		
BH1	Push-in (φ 4 mm straight)	60	90	50	50
CH1	Push-in (φ 6 mm straight)	50	80	40	50
DH1	Push-in (φ 8 mm straight)	80	120	70	80
EH1	Push-in (φ 10 mm straight)	80	120	70	80
HH1	Push-in (φ 1/4 inch straight)	60	90	50	50
JH1	Push-in (φ 3/8 inch straight)	80	120	70	80
AA1	Rc1/8 Straight	60	90	50	50
BA1	Rc1/4 Straight	60	100	50	60
CA1	Rc1/2 Straight	120	-	110	120
AF1	G1/8 Straight	70	100	60	70
BF1	G1/4 Straight	85	125	75	85
CF1	G1/2 Straight	120	-	110	120
AB1	G1/8 Straight	60	90	50	60
BB1	G1/4 Straight	70	110	60	70
CB1	G1/2 Straight	140	-	130	140
AC1	NPT1/8 Straight	50	80	50	50
BC1	NPT1/4 Straight	60	100	50	60
CC1	NPT1/2 Straight	120	-	110	120
BH2	Push-in (φ 4 mm elbow)	70	100	60	60
CH2	Push-in (φ 6 mm elbow)	60	90	50	60
DH2	Push-in (φ 8mm elbow)	100	140	90	90
EH2	Push-in (φ 10 mm elbow)	100	140	90	100
HH2	Push-in (φ 1/4 inch elbow)	70	100	60	60
JH2	Push-in (φ 3/8 inch elbow)	100	140	90	100
AA2	Rc1/8 elbow	70	100	60	60
BA2	Rc1/4 elbow	80	120	70	80
AF2	G1/8 elbow	80	110	70	80
BF2	G1/4 elbow	105	145	95	105
AB2	G1/8 elbow	70	100	60	70
BB2	G1/4 elbow	90	130	80	90
AC2	NPT1/8 elbow	70	100	60	60
BC2	NPT1/4 elbow	80	120	70	80

■ SUS body type

[Unit: g]

Fitting		LCD indicator type		Bar display type	IO-Link type
Model	Content	No needle valve	With needle valve		
AA1	Rc1/8 Straight	100	165	90	95
BA1	Rc1/4 Straight	115	200	105	110
CA1	Rc1/2 Straight	420	-	410	420
AF1	G1/8 Straight	155	220	145	150
BF1	G1/4 Straight	190	275	180	185
CF1	G1/2 Straight	420	-	410	420
AB1	G1/8 Straight	100	165	90	95
BB1	G1/4 Straight	110	195	100	105
CB1	G1/2 Straight	440	-	430	440
AC1	NPT1/8 Straight	100	165	90	95
BC1	NPT1/4 Straight	115	200	105	110
CC1	NPT1/2 Straight	420	-	410	420
AD1	1/4 inch double barbed joint (500 mL/min to 50 L/min)	155	220	145	150
BD1	1/4 inch double barbed joint (50 mL/min to 200 L/min)	190	275	180	190
AE1	1/4 inch JXR male joint (500 mL/min to 50 L/min)	155	220	145	150
BE1	1/4 inch JXR male joint (50 mL/min to 200 L/min)	190	275	180	190

■ Environment-resistant specifications

[Unit: g]

Fitting		LCD display	Bar display
Model No.	Description		
AA1	Rc1/8 Straight	750	740
BA1	Rc1/4 Straight	690	680
CA1	Rc1/2 Straight	590	580
AF1	G1/8 Straight	750	740
BF1	G1/4 Straight	690	680
CF1	G1/2 Straight	590	580
1 VAC	NPT 1/8 Straight	750	740
BC1	NPT 1/4 Straight	690	680
CC1	NPT 1/2 Straight	590	580

1.5 Option (ATEX Compliant)

⚠ WARNING

Attach the product to grounded metal. Wipe it with a damp cloth.
There is a possibility that the electrostatic charge could be drained.

In an explosive atmosphere, never unplug and plug back in this product while it is being energized.

In an explosive atmosphere, never loosen the cover bolts and never open the protective cover while it is being energized.

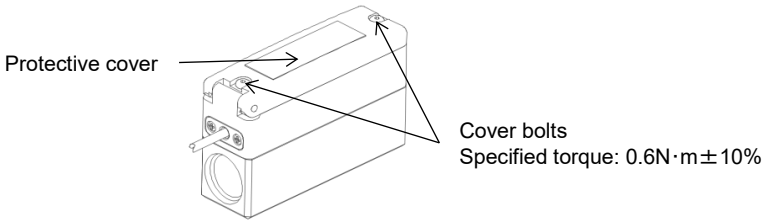
Do not disassemble and modify this product.
It may cause failure.

■ The following should be observed.

Ⅱ 3G Ex ec ⅡC T6 Gc 0°C≦Ta≦50°C

■ Working conditions

1) There is a possibility that the electrostatic charge could be drained. Attach the product to grounded metal. Wipe it with a damp cloth.
2) The cable fastening parts of this product do not have enough fastening function. The user shall provide additional clamping of the cable to ensure that pulling is not transmitted to the terminations.
3) The protective cover of this product can be opened and closed, but it has an explosion protection structure only when the protective cover is closed and the cover bolts are tightened to the specified torque.



■ Temperature rating of measurement fluid

From a point of view of explosion protection, the upper limit temperature of measurement fluid is 50°C.

■ ATEX Directive 2014/34/EU

EN standards for explosive atmospheres
EN IEC 60079-0:2018
EN IEC 60079-7:2015/A1:2018

■ Self-declaration No.

EX-307

2. INSTALLATION

2.1 Installation Environment

⚠ WARNING

Do not use in a corrosive gas atmosphere such as sulfurous acid gas.

This product shall be used in the ambient temperature 0 to 50°C.

Even within the temperature range, do not use in places where temperature changes suddenly causing dew condensation.

Do not install this product where moisture, salt, dust, and chip powder, and in a pressurized and depressurized environment. (Excluding environmental-resistant specifications)

The degree of protection of this product is equivalent to IP40. Also, the product cannot be used where temperature change is rapid and the humidity is high as failure may be generated by dew inside the main body.

The degree of protection of environmental-resistant specifications is equivalent to IP65. Note that this product cannot be used in environments where it will be constantly exposed to water, or in water or where water or oil may radiate violently.

⚠ CAUTION

Always conduct piping and installation before wiring.

Before installing piping, clean out the pipes using air blower to remove all foreign objects and cutting chips from the pipes.

The rectifier or platinum sensor may be damaged if foreign objects, cutting chips, etc., enter in piping.

Also, connect fitting when the stainless steel body type is used to release on the OUT side.

The port filter may disengage.

When using a pushed-in fitting, insert the tube firmly, and then check the tube does not get removed when pulled.

Cut the tube in right angle with the dedicated cutter.

Be cautious when using on steel pipe connection.

The core in the IN side steel pipe and OUT side steel pipe may deviates resulting in excessive load applied to the body, and cause external leakage and product damage. The screw-in fitting of the resin body type is especially used for the pushed-in fitting for pneumatic pressure. Do not use this product on pneumatic pressure circuit of steel pipe connection.

Be cautious of interference when the elbow fitting is mounted downward.

If the elbow fitting is mounted downward, it may interfere with the DIN rail mount and bracket.

Verify there is no gas leakage after piping is done.

When using this product with oxygen gas, be cautious of the following points.

- Piping work should be conducted by those who have special knowledge and skills on oxygen gas handling.
- Use only piping that treated with oil-prohibited processing.
- Before installing this product, remove dust, burr, etc. on the piping.
- Install a filter on the primary side of this product.

Do not install a regulator/solenoid valve, etc., immediately before this product.

Drifting may be generated causing an error. When necessary, install a straight pipe section.

Make sure that the leakage detection fluid does not get into the case.

When a leakage inspection is conducted on the piping, make sure the leakage detection fluid does not get into the case.

⚠ CAUTION

Do not turn the elbow fitting or screw-in fitting more than necessary.
Elbow fitting or screw-in fitting of resin body type can be rotated about 10 times, but do not rotated the fitting except when changing the orientation during installation. If it is rotated more than necessary the seal parts may get caught or worn, causing external leakage.

Be cautious of flow rate changes caused by installation posture of the main body.
Though this product can be used for both “vertically and horizontally”, the flow rate may fluctuate due to installation posture difference and piping condition.

Do not install the main bodies close to each other.
Self-heat generation of each product can cause the temperature of product main body to rise, promoting characteristic changes and resin material changes. When placing side by side, secure a space for 10 mm or more.

Be cautious how the LCD type flow rate display part is looked.
Since liquid crystal is used on the flow rate display part, it may be hard to read in certain angles.

Do not apply excessive force to the knob on the needle valve.
When closing/opening the knob to the end, do not turn the knob with excessive force (0.05 N・m or less). Also, do not pick the lock nut when adjusting the needle. It may cause needle snagging and damage.

Do not overly tighten the knob of the needle valve.
If it is tightened too tightly when fully-opened, the setting flow rate may fluctuate. Be cautious of tightening the knob too tightly.

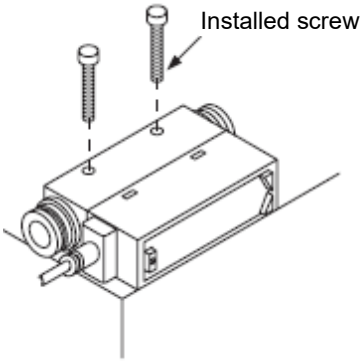
Verify the lock nut of the needle valve is not loosened.
If the lock nut is loosened, the speed control of the actuator may not be possible.

Do not turn the needle too much.
The needle valve comes with the retaining mechanism; however, if the needle is turned too much, it may cause damage.

2.2 Mounting Method

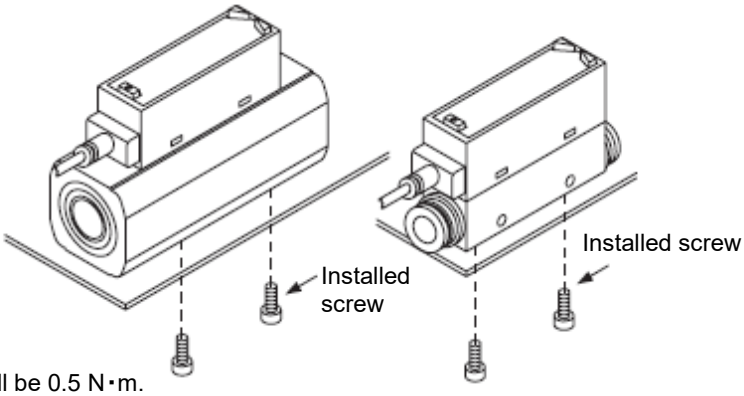
・It may be difficult to view the LCD, depending on the angle.
・This product can be installed with any direction; vertical, horizonal, left, and right orientation.
・The tightening torque for screws should be 0.5 N・m.

Lateral mounting
(use of through hole)

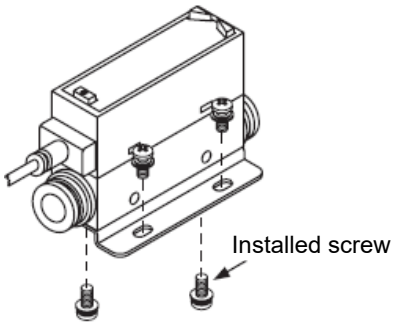


The mounting tightening torque shall be 0.5 N・m.

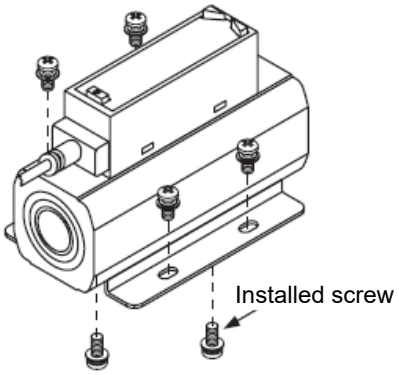
Vertical mounting
(use of female thread on bottom surface)



Bracket mounting
(use of dedicated bracket)

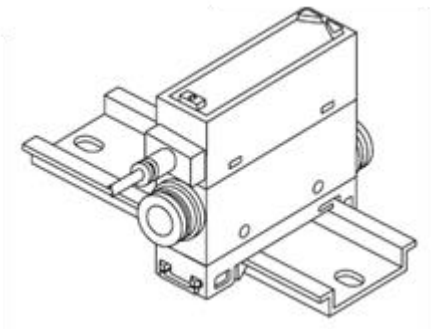


FSM3 - *005 to 201
Single item model No.: FSM3-H



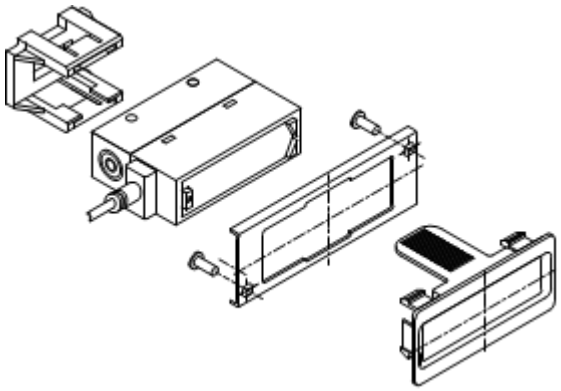
FSM3 - *501 to 102/
Environment-resistant specifications
Single item model No.: FSM3-J

DIN rail mount



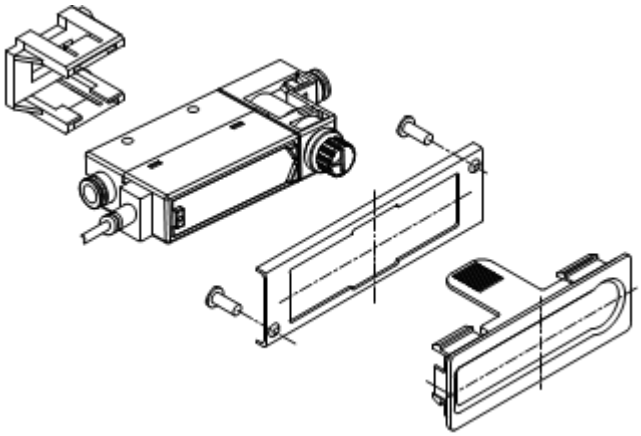
FSM3 - *005 to 201
Single item model No.: FSM3-M

Panel mounting (non-needle valve)

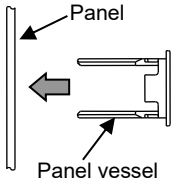
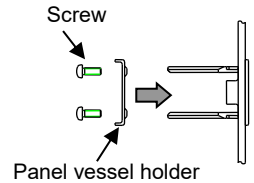
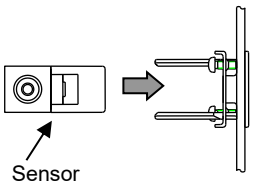
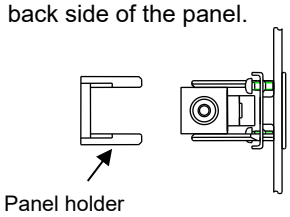
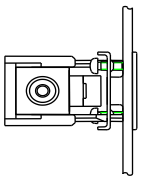


FSM3 - *005 to 201 (non-needle valve)
Single item model No.: FSM3-K

Panel mounting (with needle valve)



FSM3 - *005 to 201 (with needle valve)
Single item model No.: FSM3-L

[1]	[2]	[3]
The panel vessel is inserted from the front side of the panel. For panel cut dimension, refer to the appearance dimensions figure. 	The panel vessel is inserted from the back side of the panel (hang it on the panel vessel notch), and fix with the screw. 	Insert the sensor from the back side of the panel. 
[4]	**[5]**	
The panel holder is inserted from the back side of the panel. 	Push the panel holder until the sensor is firmly fixed, and attach the connector. 	

- Please fix the panel vessel using a tightening torque of 0.06 N・m.
- Please do the piping work before panel mounting. Do not add excessive stress to parts of the panel mount. It may damage the parts.
- When mounting the panel, please ensure that vibration is not applied to the product.
- For panel cutout dimensions, refer to “1.4.4 Option”.

2.3 Piping Method

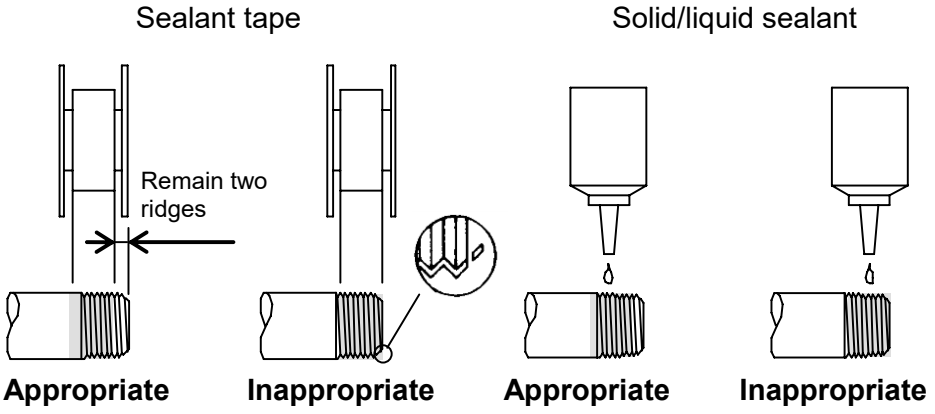
2.3.1 Cleaning the pipes

Before installing piping, clean out the pipes using air blower to remove all foreign objects and cutting chips from the pipes. The rectifier or platinum sensor could be damaged if foreign objects, cutting chips, etc., enter the pipes.

2.3.2 Sealant

Apply seal tape or sealant about two ridges or more inside from the tip of a screw. If it protrudes the top of the screw part of piping, the pieces of seal tape and remaining parts of sealant may enter inside piping and devices due to screwing-in causing failure.

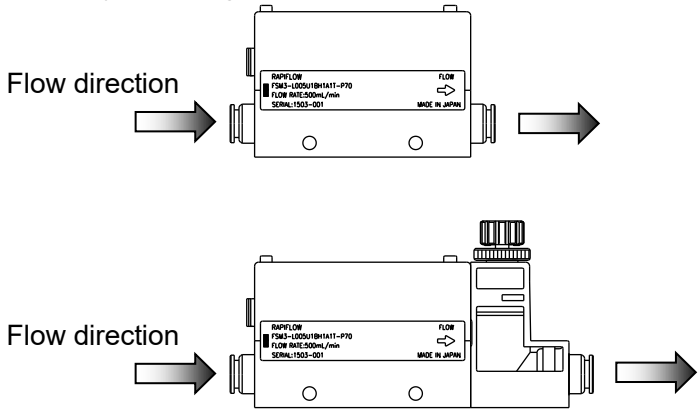
When using a seal tape, put it around the reverse direction of the screw's direction, push it with your finger, and adhere it to the screw.
When using a liquid sealant, be cautious that it does not attach to the resin part. The resin part may break causing failure and malfunctions. Also, do not apply a sealant on a female screw side.



- As a part of sealant may remain on the screw part once the piping is removed once, remove when re-piping is done.
- When using the clean-room specification, be cautious of seal materials against the used system.

2.3.3 Piping direction

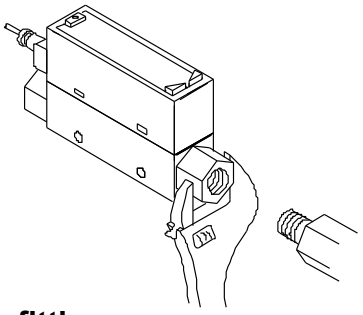
Piping should be conducted by matching the fluid's direction and the direction indicated on the body.



2.3.4 Tightening

- When mounting on piping, do not apply excessive screwing, torque and load torque on the connection board. Also, use a wrench on the metallic part of the body at piping to avoid force on the resin part.
- When tightening the fitting, use a wrench catcher to the metal board.
- The tightening torque of the fitting is as follows.

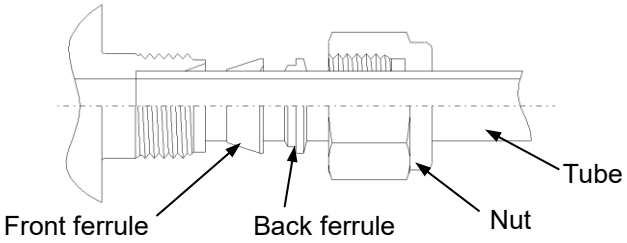
Connection diameter	Tightening torque N·m
Rc1/8, G1/8, NPT1/8	3 to 5
Rc1/4, G1/4, NPT1/4	6 to 8
Rc1/2, G1/2, NPT1/2	16 to 18



■ Tightening of 1/4” double barbed fitting, 1/4” JWR male fitting

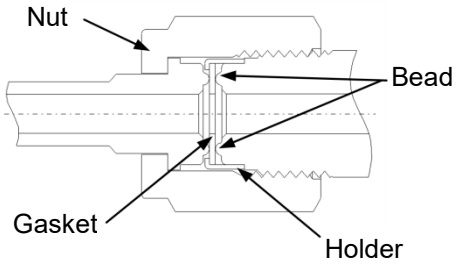
<1/4” double barbed fitting>

4) Check the front ferrule, back ferrule and nut are attached correctly.
5) Insert the tube to the end of the main body, and tighten the nut with your finger as much as possible. (This position is called the finger tight position.)
6) Tighten 1 and 1/4 rotations from the finger tight position using the tool.



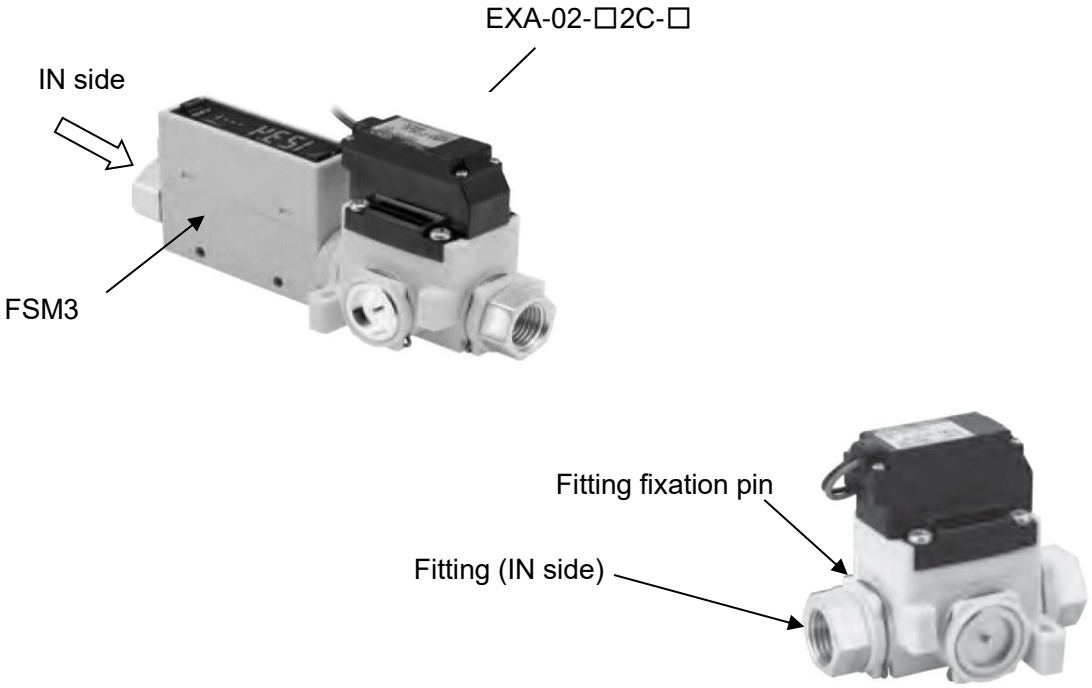
<1/4” JXR male fitting>

1) Insert the gasket with holder to the gland.
   The gasket gets on and maintained on the bead correctly.
   (In case of the gasket without holder, insert into the female nut)
2) Assemble each part and tighten the nut with your finger as much as possible
   (this position is called the finger tight position)
3) Hold the main body firmly, and tighten the female nut 1/8 rotations from the finger tight position (when gasket material is nickel and SUS316).
   In case of other materials, contact your nearest sales dealer and agency.



2.3.5 EXA connection method

To connect the EXA-02-☐2C-☐ (sold separately) and the EXA connection fitting type of FSM3, remove the fitting fixation pin on IN side of EXA, and after inserting the dedicated connection fitting of OUT side of FSM3 to the end, fix with the fitting fixation pin firmly again.



- To avoid influence of grease and oil flowing, always attach EXA on the OUT side of FSM3.
- Use the lead wire type (without lamp/surge compressor) for the coil option of EXA.
  As interference occurs in the terminal box, the DIN terminal box type cannot be attached.
- Before using this product, always check for disconnection and external leakage.

2.4 Wiring method

⚠ DANGER

Do not use by exceeding the power supply voltage range.
If voltage exceeding the power supply voltage range indicated in the specification is applied, it may cause malfunction, damage of this product, electric shock and fire.

Do not connect the load exceeding the output ratings.
It may cause damage and fire of output circuit.

⚠ WARNING

Check the wire colors when wiring.
Mis-wiring leads to damage, failure and malfunction of this product. Always check the colors of wires in the operation manual and conduct wiring.

Check insulation of wiring.
Avoid contacting with other circuit, ground faults and insulation failure between terminals. Overcurrent may flow in this product causing damage.

This product uses the DC regulated power supply within rating insulated from the AC power supply.
If the power supply is not insulated, it may cause electric shock.
The peak value may exceed the rating in the unregulated power source. It may cause damage this product and accuracy may be worsened.

Perform wiring after stopping control device and the machinery device, and turning the power supply OFF.
Sudden operation is dangerous as it may cause unexpected movement.
First, conduct an electrification test while the control device and machinery device are OFF, and perform necessary data settings.
Before working and during working, discharge the static electricity electrified on human body, tools and devices. On the moving parts, connect and conduct wiring with flexible wires such as wires for a robot.

Install this product and wiring away from the noise sources as much as possible such as strong electric lines.
Take separate measures for the surge on the power line.

Do not use this product by exceeding the power supply voltage range.
If voltage over the specification range is applied or 100 V AC is applied, the product may cause damage, electric shock, and fire.

Do not short circuit the load.
It may cause damage and fire.

For the power source for the stainless steel body type (including environment-resistant specifications), use a DC regulated power source completely insulated from the AC primary side, and use one of + side and – side as the F.G. connection.
Between the internal power source circuit of stainless steel body type and stainless steel body, a varistor (approx. 40 V DC in regulated voltage) is connected for insulation damage prevention of this product. Do not conduct a withstand voltage test and insulation resistance test between the internal power supply circuit of the stainless steel body type and stainless steel body. If these tests are required, perform after removing the wiring. Excessive potential difference between the power supply and stainless steel body result in burning of internal parts. If electric welding of devices and frames are performed for installation of stainless steel body type, connection, and after wiring, and a short circuit accident occurs, excessive high voltage and surge voltage at welding current and welding flows to the wiring, earth lines and fluid route connected between above devices causing electric line and device damage. Works such as electric welding shall be performed after removing all F.G. connections of the product and electric wiring.

Do not mis-wire power source polarity.
It may cause damage and burn out.

⚠ WARNING

Use the impedance of connection load after verification.

The output impedance of the analog output voltage output type is approx. 1 kΩ. If the impedance of the connecting load is low, the output error increases. Check for an error with the impedance of the connecting load before using.

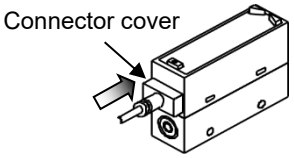
(The analog output current output type is excluded.)

[Example of calculation]

$$\text{FSM3 (Voltage output) impedance: } R_o = 1k\Omega$$
$$\text{Load internal impedance} \quad : R_x = 1M\Omega$$
$$\text{Output value} = \left(1 - \frac{R_o}{R_o + R_x}\right) \times 100\%$$
$$= \left(1 - \frac{1k\Omega}{1k\Omega + 1M\Omega}\right) \times 100\% \Rightarrow \text{Output error approx. } 0.1\%$$

Check that stress (7 N and over) is not applied to cable pulling out section or connectors.

It may cause malfunction.



Always attach the connector cover after connecting the connector.

After connecting the 4-core/5-core cable, attach the connector cover.

Turn the power source OFF before inserting/removing the cable.

Make sure to turn the power OFF before inserting/removing the cable.

Do not rotate the M12 connector.

The M12 lead wire with both-end connector does not rotate. Do not try to rotate it.

When matching the M12 connector, match the position of the convex part of the connector terminal on the main body side and the concave part of the cable connector terminal.

After inserting firmly, hold the knurled part not to damage the threads, and tighten by turning clockwise.

Do not tighten the M12 connector too tightly.

If it is screwed in excessively, it may damage the connector on the main body side.

Recommended torque: 0.4 to 0.49 N・m

The length of the M12 connector cable shall be 20 m or less.

When extending the cable, the cable length between the master and device (this product) should be 20 m or less.

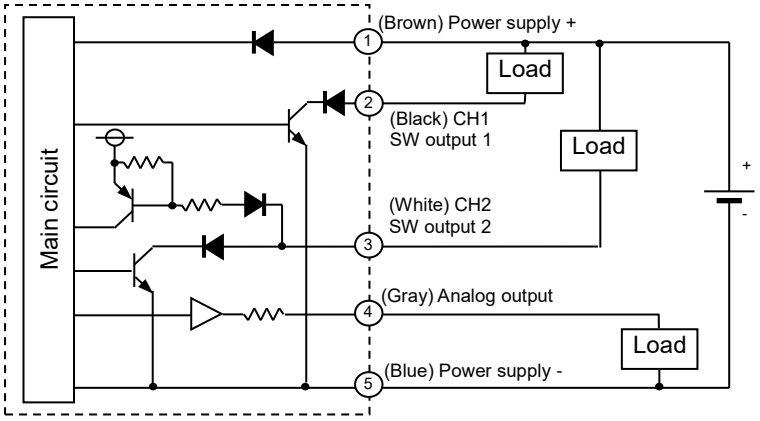
Insulate unused wires so that they do not contact with other wires.

If an unused wire contacts the gland by error, the product may be damaged and malfunctioned.

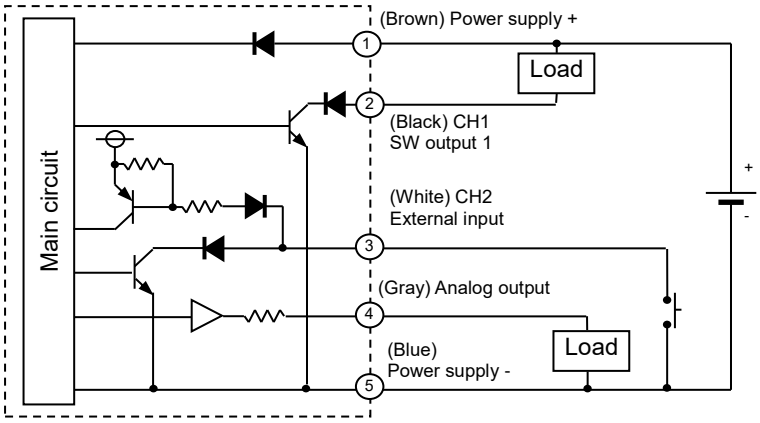
2.4.1 LDC display (NPN output)

■ FSM3-L*****B/F (One analog, 2 switches)

Using CH2 as **switch output**



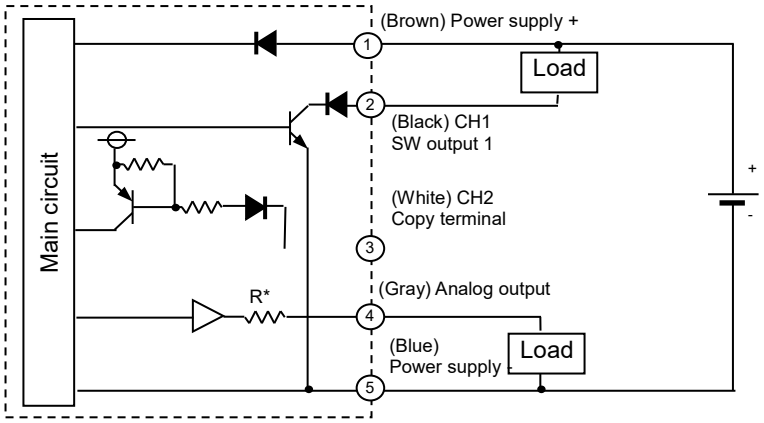
Using CH2 as **external input**



■ FSM3-L*****A/E (One analog, One switch, With copy function)

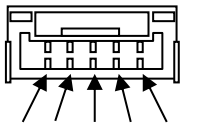
Model with the copy function

* When using the copy function, please refer to “2.4.3 Copying setting values”.



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

Main body connector



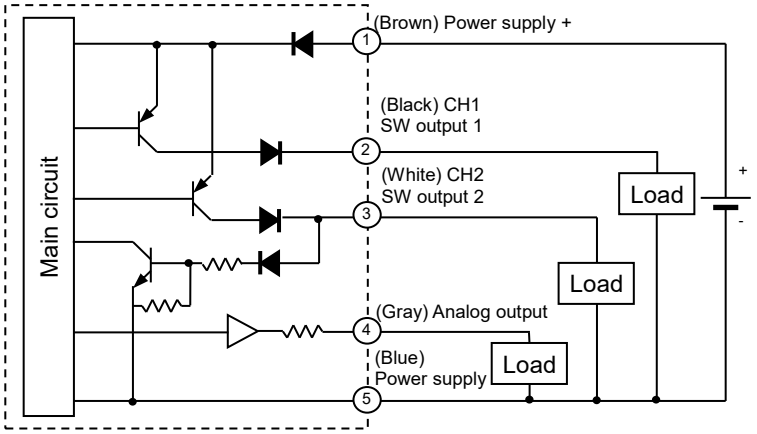
(FSM3 side)

Pin No.	Option cable color	Name
[1]	Brown	Power supply (+) (Voltage output: 12 to 24 V, current output:24 V)
[2]	Black	CH1 (NPN transistor output 1: max50 mA)
[3]	White	CH2 (NPN transistor output: max50 mA or External input or Copy terminal)
[4]	Gray	Analog output: Voltage output: 1 to 5 V load impedance 50 kΩ or over Current output: 4 to 20 mA load impedance 300 Ω or less
[5]	Blue	Power supply – (GND)

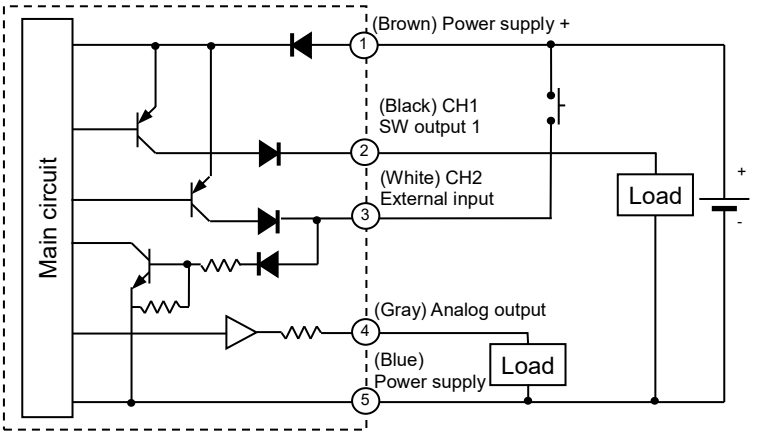
2.4.2 LDC display type (PNP output)

■ FSM3－FSM3-L*****D/H (One analog, 2 switches)

Using CH2 as **switch output**



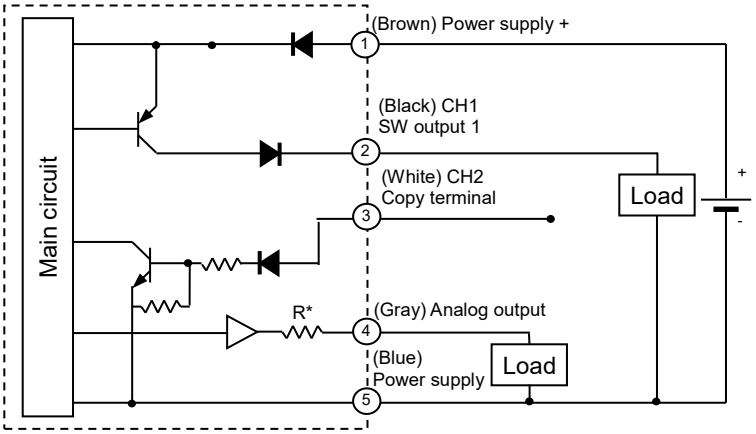
Using CH2 as **external input**



■ FSM3-L*****C/G (One analog, One switch, Copy function)

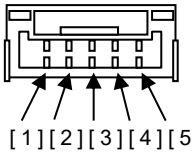
Model with the copy function

* When using the copy function, please refer to “2.4.3 Copying setting values”



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

Main body connector

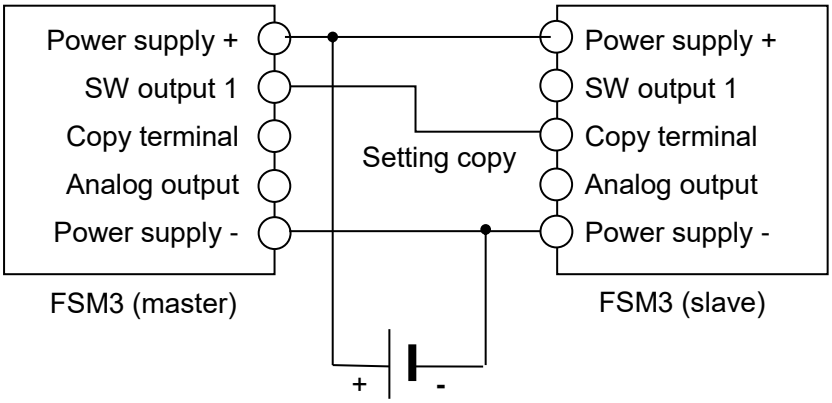


(FSM3 side)

Pin No.	Option cable color	Name	
[1]	Brown	Power supply (+) (Voltage output: 12 to 24 V, current output:24 V)	
[2]	Black	CH1 (NPN transistor output 1: max50 mA)	
[3]	White	CH2 (NPN transistor output: max50 mA or External input or Copy terminal)	
[4]	Gray	Analog output	Voltage output: 1 to 5 V load impedance 50 kΩ or over Current output: 4 to 20 mA load impedance 300 Ω or less
[5]	Blue	Power supply – (GND)	

2.4.3 Copying setting values

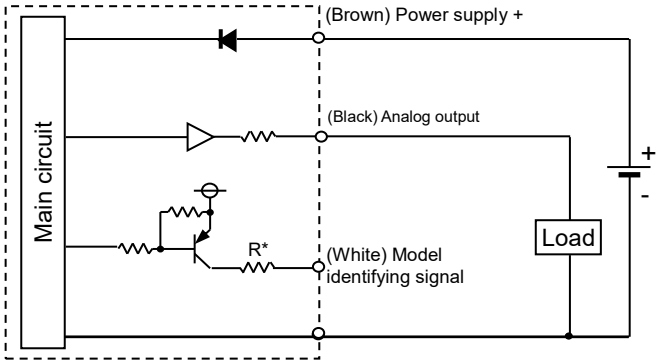
■ FSM3-L*****A/C/E/G/** (LCD indicator type, with copy function)



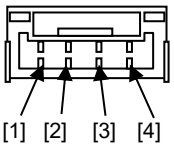
・Connect CH1 (SW output 1) on the master side and CH2 (copy terminal) of the slave side, turn the power of the sensor ON, and use the copy setting function (F.93). This connection shall be used on when using the copy setting function is used.
・If copying is performed while load is connected on CH1 or the switch is operated while CH1 and CH2 are connected, the device side may perform unexpected operation, and device and FSM3 may be damaged. Do not use while connecting to the copy terminal.
・For details of the copy setting function, refer to "F.93: Copy function".

2.4.4 Bar display type

■ FSM3-B*****J/K (Bar display)



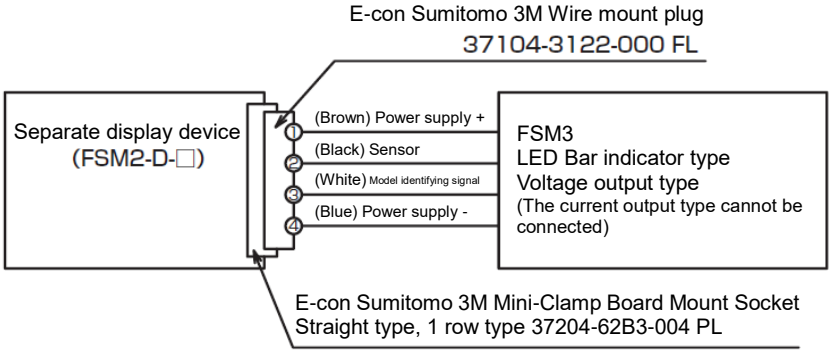
Main body connector



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

Pin 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 or over Current output: 4 to 20 mA load impedance 300 Ω or less
[3]	White	N.C. when using the single unit of the model identifying signal.	
[4]	Blue	Power supply – (GND)	

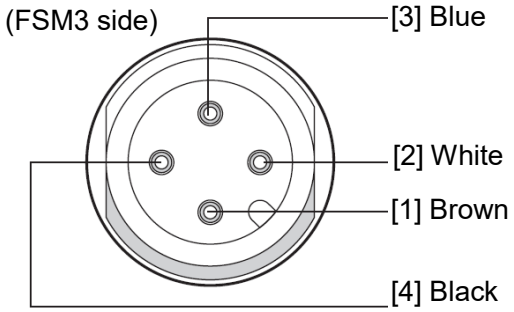
2.4.5 Connection between Bar display type and separate display device



- When the FSM3 bar display type and FSM2 separate display device are connected, the flow rate range, flow direction, and gas type are automatically identified (in factory setting).
- "Gas type setting" function in the FSM2 separate display device is different from the "Gas type switching" function in which the sensor is switched according to a gas type.
  When the “Gas type switching” function is necessary, use the LCD display type.
- When connecting the FSM3 bar display type oxygen, the gas type display is “Ai” (Air, N_2); however, it can be used without trouble.
- For operation of the FSM2 separate display device, refer to Separate Display Device Operation Manual D2-180166.

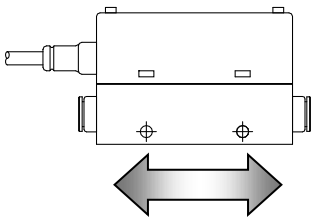
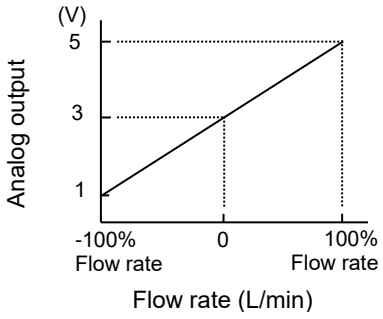
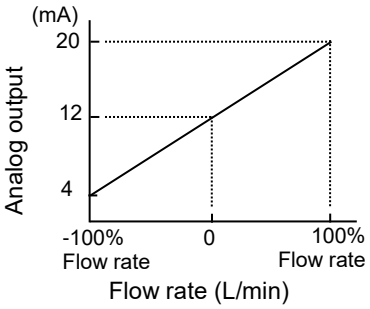
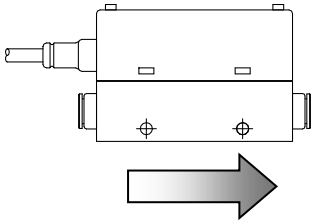
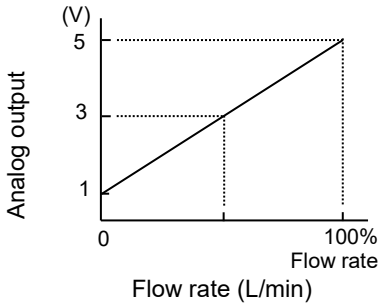
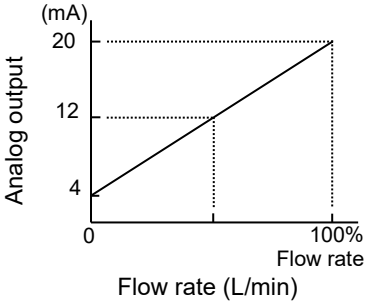
2.4.6 IO-link type

■ FSM3-C*****L** (IO-link type)



No.	Option cable color	Name
[1]	Brown	Power supply (+) (18 to 30V DC)
[2]	White	N.C.
[3]	Blue	Power supply – (GND)
[4]	Black	C/Q (IO-Link)

2.5 Analog output characteristics

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

- 0 to 100% for the uni-direction type and -100 to 100% for the bi-direction type are the full scale.
  The bi-direction type of LCD display type can be switched to uni-direction output with the button setting (forward and reverse directions)
  The value after switching is a reference value.
- In the LCD display type, the output type of the analog output when switched to carbon dioxide gas is selected from type A or type B.
  Type A: Voltage output; 1-3 V (uni-direction type), 2-4 V (bi-direction type)
  Current output; 4-12 mA (uni-direction type), 8-16 mA (bi-direction type)
  Type B: Voltage output; 1-5 V, current output; 4-20 mA
- Analog output is also output outside the range of measured flow rate. It will be outside the accuracy guarantee.
  Output possible range: the lower limit is approx. 0.6 V and upper limit is approx. 5.4 V for the voltage type, and the lower limit is approx. 2.4 mA and upper limit is approx. 21.6 mA for the current type.

3. USAGE

⚠ WARNING

When using, perform warming-up (five minutes or more after electrification).
Output accuracy is influenced by self-heating with electrification in addition to temperature characteristics.

When changing the setting values, change after stopping the equipment.
The control device may conduct unexpected operations.

Do not disassemble and modify this product.
It may cause failure.

Observe the use conditions for CE conformity.
This product is a CE compliant product that complies with EMC directives. The followings are required as the compliance conditions to the conformity standard EN 61000-6-2 regarding immunity applied to this product.

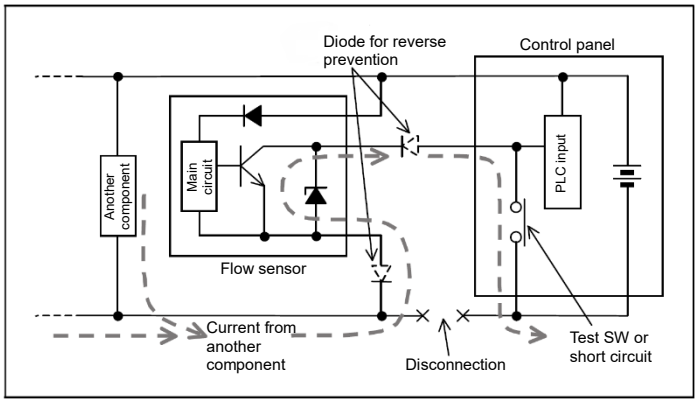
- Use a cable that a pair of power source line and signal line, and it is evaluated as the signal line.
- Surge immunity measures are implemented on the device side.

⚠ CAUTION

Even when exceeding the measured flow rate range, analog input is performed.
In case of LCD display type for the display, it is displayed “Hi” or “Lo”. In case of bar display type, the bar display blinks. However, please note that it will be out of accuracy guarantee. For details on display, refer to the section on display and error code.

Avoid switch settings in areas where flow rate is unstable such as fluid pulsation.
If the switch is operated when the flow rate is unstable, the operation becomes unstable. In the case, there should be enough interval between two setting values or avoid switch settings in unstable areas, and then check the switch operation is stable before using.

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 sensor as the flow rate sensor, and the switch output wire and power cable minus (-) side are short-circuited to check the operation of the control panel's input unit, or if the power cable's minus (-) 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 a thick cable as much 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.

⚠ CAUTION

When using the LCD display, do not press down on the display section.

This may lead to failure.

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.

If an abnormality is generated during operation, stop using this product promptly, turn the power OFF, and contact the sales dealer.

For approx. five seconds immediately after electrification, use the control circuit and program to ignore signals.

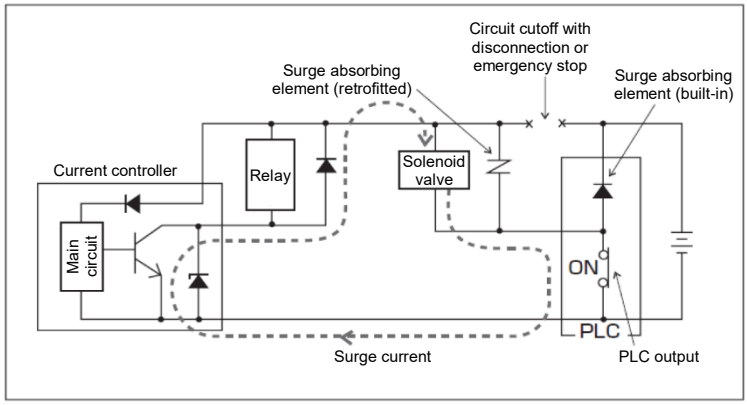
Immediately after electrification, as this product performs self-diagnosis, it does not perform any flow rate control operation for approx. five seconds.

The flow rate of this product should be used within the range of rated flow rate.

This product should be used within the range of operating pressure.

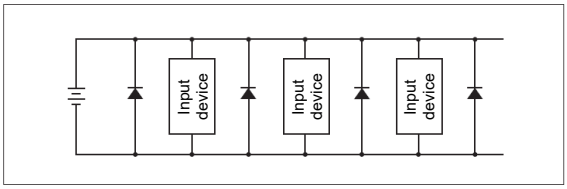
If this product shares the power source with an inductive load that surge current is generated, implement measures for surge current wraparound.

When this product shares the power source with an inductive load that surge current such as solenoid valve and relay is generated, if the circuit is shut in the operating state of inductive load, the surge current wraparounds the output circuit depending on the installation position of surge absorption element causing failure.



Implement countermeasures as followings to prevent damages caused by surge current wraparound.

- Separate the power source between the output system that becomes inductive load such as solenoid valve and relay and input system such as flow rate controller.
- When the power source cannot be separated, install an element for surge absorption directly for all inductive loads. The surge absorption element connected to PLC is to protect the device only.
- As shown in the figure below, connect a surge absorption element on each of power source wires to prepare for disconnection in an unspecified location.



When devices are connected to the connector, turn the power OFF when removing and attaching the connector. If the connector is removed during electrification, surge current wraparounds causing damages on the output circuit.

When it has a needle valve, the needle may rotate due to vibration causing the flow rate to fluctuate.

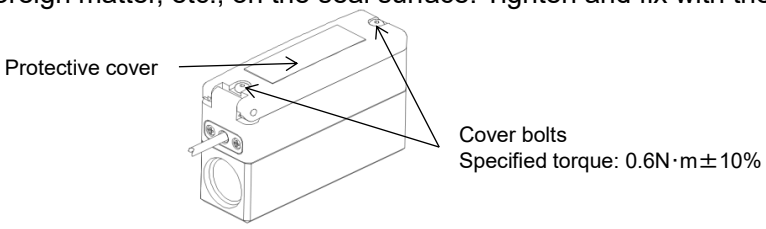
⚠ CAUTION

Do not turn the fitting while applying fluid pressure on this product.

It may cause external leakage. Also, do not turn the fitting while using this product.

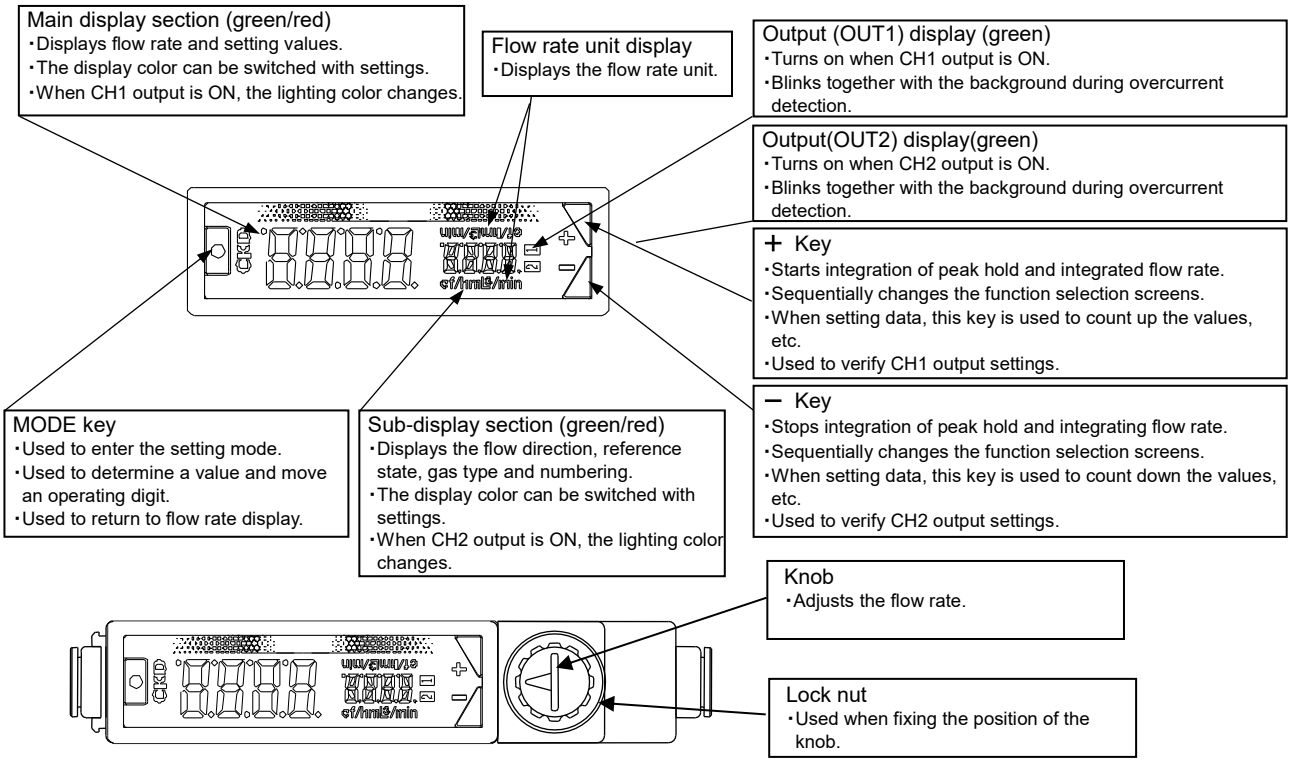
Install the protective cover correctly.

The explosion-proof and protective structures function with the protective cover (transparent cover) correctly attached. Regularly confirm that the cover bolt (M3) for fixing the protective cover is tightened to the following torque. Also, when opening and closing the protective cover, make sure that there is no floating or displacement of the protective cover and that there is no adhered foreign matter, etc., on the seal surface. Tighten and fix with the following torque.



3.1 How to use the LCD display (FSM3-L series)

3.1.1 Names and functions of display/operation section



・The integrated flow rate value is displayed on the main screen and sub-screen.
・When the display is reversed with “F.07: Display reverse setting”, the main display and sub-display are reversed respectively. Please note that + key and - key operations are not reversed even when the display is reversed.
・When “ON Red/OFF Green” and “ON Green/OFF Red” are set with “F.05: Display color setting”, the screen color changes when the switch output is ON.
When CH1 is ON, the lighting color of the main screen changes, and when CH2 is ON, the lighting color of the sub-screen changes.

3.1.2 Explanation of functions

For functions and various settings, there are cases to conduct during normal flow rate display and after entering the setting mode.
The setting mode is divided to the SET mode and maintenance mode according to the use frequency.
When verifying the setting contents, the setting monitor mode is used.

■ Normal operation (RUN mode)

Item	Description	Factory setting
Instantaneous flow rate display	The instantaneous flow rate is displayed.	Display (Measurement)
Peak hold function	Max. and min. values for the flow rate within a set interval are displayed. There are measurement/stop states, and during the measurement state, values are acquired. When the power is turned ON: Stop	Non-display (Stop)
CO_2 discharge rate display	By setting the power, discharge pressure, flow rate of the compressor, as well as the power <=> CO_2 conversion coefficient, you can learn how much CO_2 is discharged. (Calculated reference value) Can be used only when the gas type is set to “Air”.	Non-display (Stop)
Integrated flow rate display	Displays the integrated flow rate. There are the measurement state/stop state, and calculation on the integrated flow rate is conducted during the measurement state. When the power is turned ON, it is in the measurement state. As the switch output functions, the switch can be turned ON/OFF on the set integrated value or more, and there is the integration pulse function that outputs pulse per specified integration value.	Non-display (Measurement)

■ SET mode

No.	Item	Description	Factory setting
F.01	Selection of CH1 operation	Select the function of CH1. You can set switch output operation and set the integrated pulse.	No switch output
F.02	Selection of CH2 operation	Select the function of CH2. Select if CH2 is used as switch output or external input (integrated value reset / auto reference).	No switch output
F.03	Integrated functions setting	You can choose to acquire integrated flow rate values consecutively or at set times. You can also decide whether or not to save that data. (Note1)	Consecutive acquisition Data holding: OFF
F.04	Sub-screen display setting	Set the sub-display section's display method. Can be switched to "flow direction", "reference state", "gas type", or "number" display.	Flow direction
F.05	Display color setting	Set the display color. (Red, Green) The display color when the switch output is ON can be set during normal display.	At normal display: Green At switch ON: Red
F.06	Flow rate direction setting (Bi-direction type only)	Set the flow direction. Setting is possible for bi-direction, one-side forward direction and one-side reverse direction.	Bi-direction
F.07	Display reverse function	The LCD display can be vertically reversed.	Standard display
F.08	Reference state setting	Select the standard state or reference state. Standard state (ANR): Flow rate converted to volume of 20°C, 1 atm and 65%RH. (For a gas type except for air is 20°C, 1 atm and 0%RH) Reference state (NOR): Flow rate converted to volume of 0°C, 1 atm and 0%RH.	ANR
F.09	Unit setting (For overseas only)	A unit can be set. Select from "L/min" or "cf/h (cf/min)". (cf/min for 1000L/min type only)	For domestic: L/min For overseas: 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 flicks, it may be improved by setting a longer display refresh cycle.	0.5sec
F.11	Analog output setting response time	Sets the response time. Response can be set in seven stages from 0.05 s to approx. 1.5 s. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	0.05sec
F.12	Numbering setting	You can set the numbering.	0000
F.13	Gas type switching	The measured gas can be changed. (0.5 to 200 L/min type only. Oxygen type has no gas type switching)	Air
F.14	ECO mode setting	ECO mode can be selected. 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 rate calculation setting	CO_2 emission can be calculated. Set your compressor power, discharge pressure, discharge flow rate, and CO_2 conversion coefficient.	・Power: 0.20 kW ・Pressure: 0.10 MPa ・Flow rate: 100 L/min ・Conversion coefficient: 0.000 kg (CO_2)/kWh
F.16	Lock setting	Key lock method and PIN number method can be set. Select according to the use purpose.	OFF
F.17	Peak hold setting	You can choose to acquire peak bottom values consecutively or at set times. You can also decide whether or not to save the data (Note 1).	Consecutive acquisition Hold data: OFF

Note1: Data is saved every 5 minutes. Please be careful that the number of saving times does not exceed the number of access times of the storage element (the limit is 1 million times). (Changes to various settings are also counted in the number of accesses.)

Saved times = Usage time / 5min (< 1 million times)

■ Maintenance mode

No.	Item	Description	Factory setting
F.91	Forced output function	Use this function to forcibly turn the switch output ON and confirm the wiring connection and initial operation of the input device.	—
F.92	Zero adjustment function	The zero point deviation is corrected (Range: Within ±10%F.S.)	Adjusted value: 0 L/min
F.93	Copy function	Operations and set values can be easily copied between two FSM3. (Copying is only possible between products with the same model No.)	—
F.99	Reset function	Return the settings to the factory settings.	—

■ Setting monitor mode

Item	Description	Factory setting
Setting monitor function	The contents set in the SET mode can be checked. (The contents cannot be edited)	—
Model display function	Able to verify the zero adjusted value, flow rate range, gas type, flow rate reference, flow direction, switch output type, and number of switch output points. (Current setting values instead of factory setting are displayed)	—

■ Effects of setting values

When settings are done to change a flow rate value (Table 1), the setting of function to refer to the flow rate value (Table 2) is cleared.
When conducting settings, perform the settings that change a flow rate value first, and then the setting of function that the flow rate refers.
Also, it is cleared when confirmed without changing the settings.
When verifying the setting value, use the setting monitor mode.

Table 1 Settings that change a flow rate value

No.	Item
F.06	Flow rate direction setting
F.08	Reference state setting
F.09	Unit setting
F.13	Gas type switching

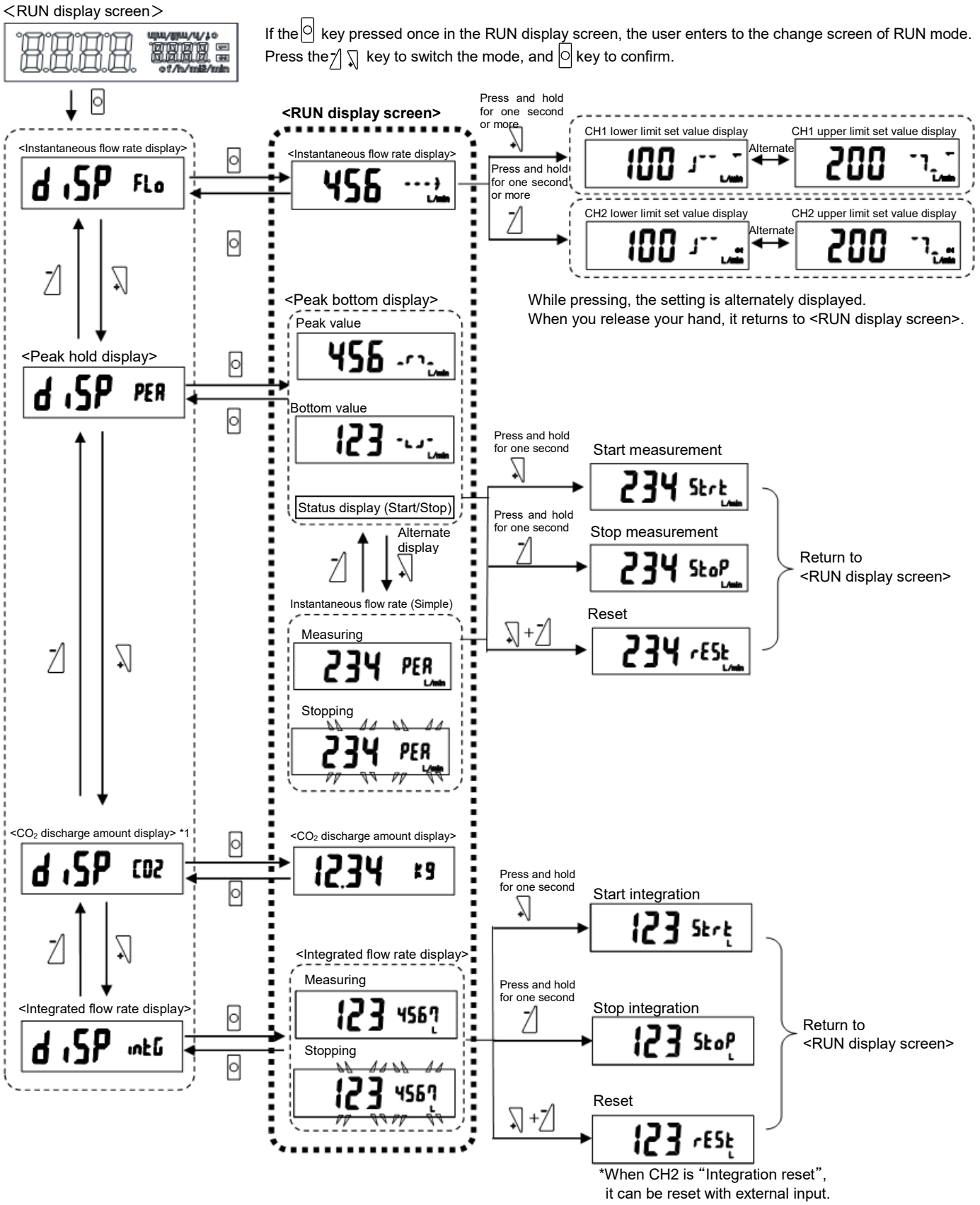
Table 2 Function that refers a flow rate value

No.	Item	Setting after clearing
F.01	Selection of CH1 operation	No switch output
F.02	Selection of CH2 operation	No switch output
—	Peak hold function	Peak value bottom value: Reset Measurement state: Stop
—	Integrated flow rate function	Integrated flow rate value: Reset Measurement state: Stop

3.1.3 How to operate

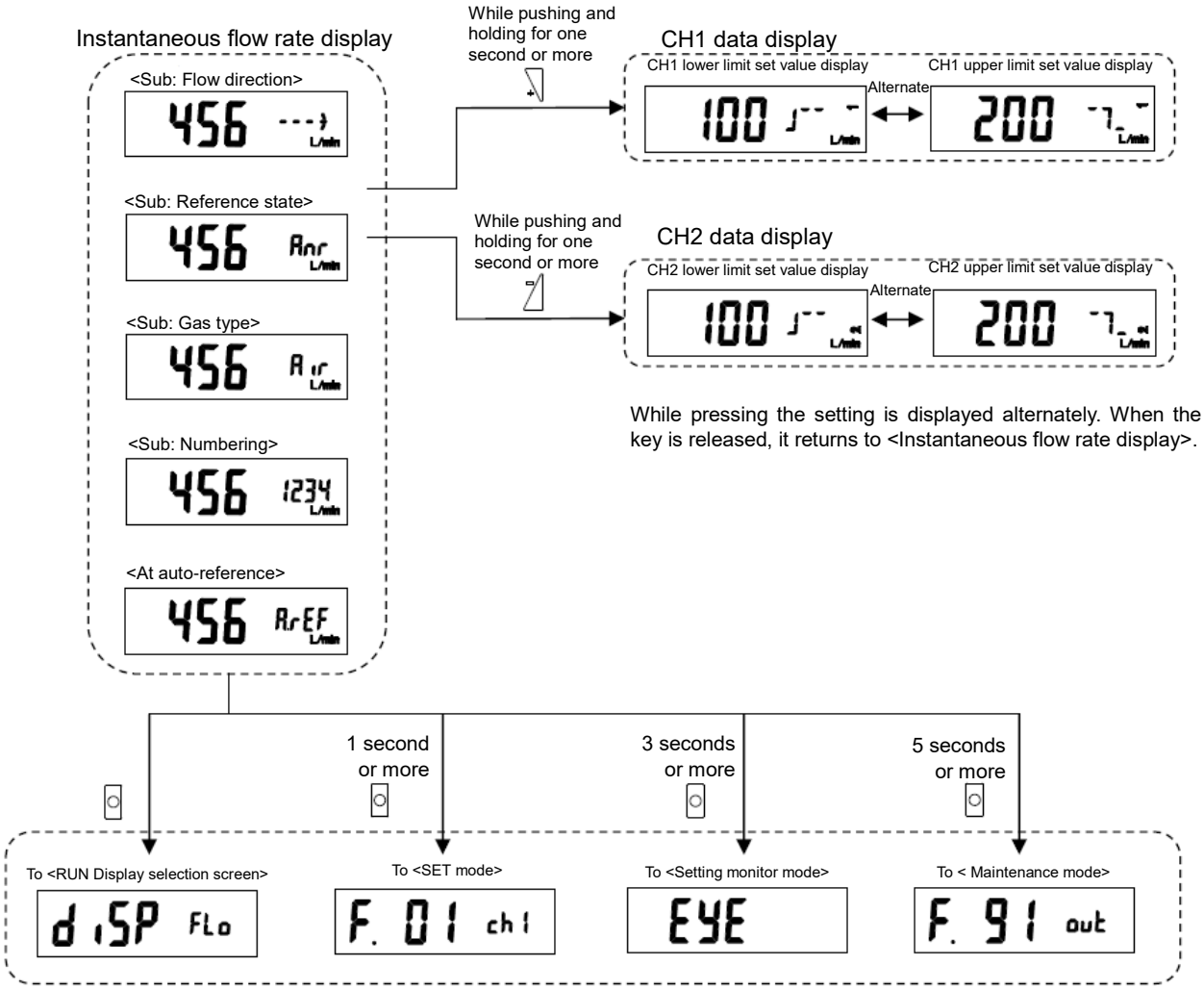
■ Normal operation (RUN mode)

* When no instruction is provided on how to press a key, it means to press the key once.



*1 When the gas type is besides “Air”, it does not change to CO_2 discharge amount display.

● Instantaneous flow rate display

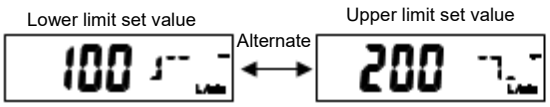


While pressing the setting is displayed alternately. When the key is released, it returns to <Instantaneous flow rate display>.

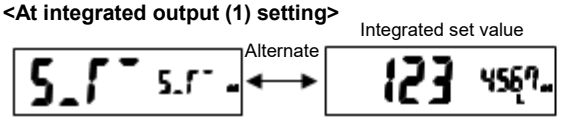
・The display update cycle of instantaneous flow rate value can be changed with "F.10: Display cycle setting".

CH1 and CH2 data display

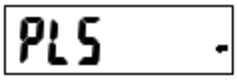
<At Window operation (1) setting>



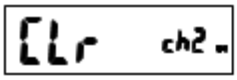
<At integrated output (1) setting>



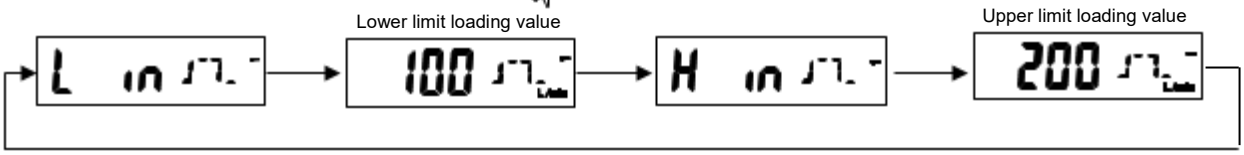
<At integrated pulse setting>



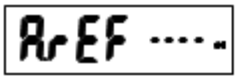
<At integrated clear setting> (CH2 only)



<At auto-reference external input setting> (when key is pushed)



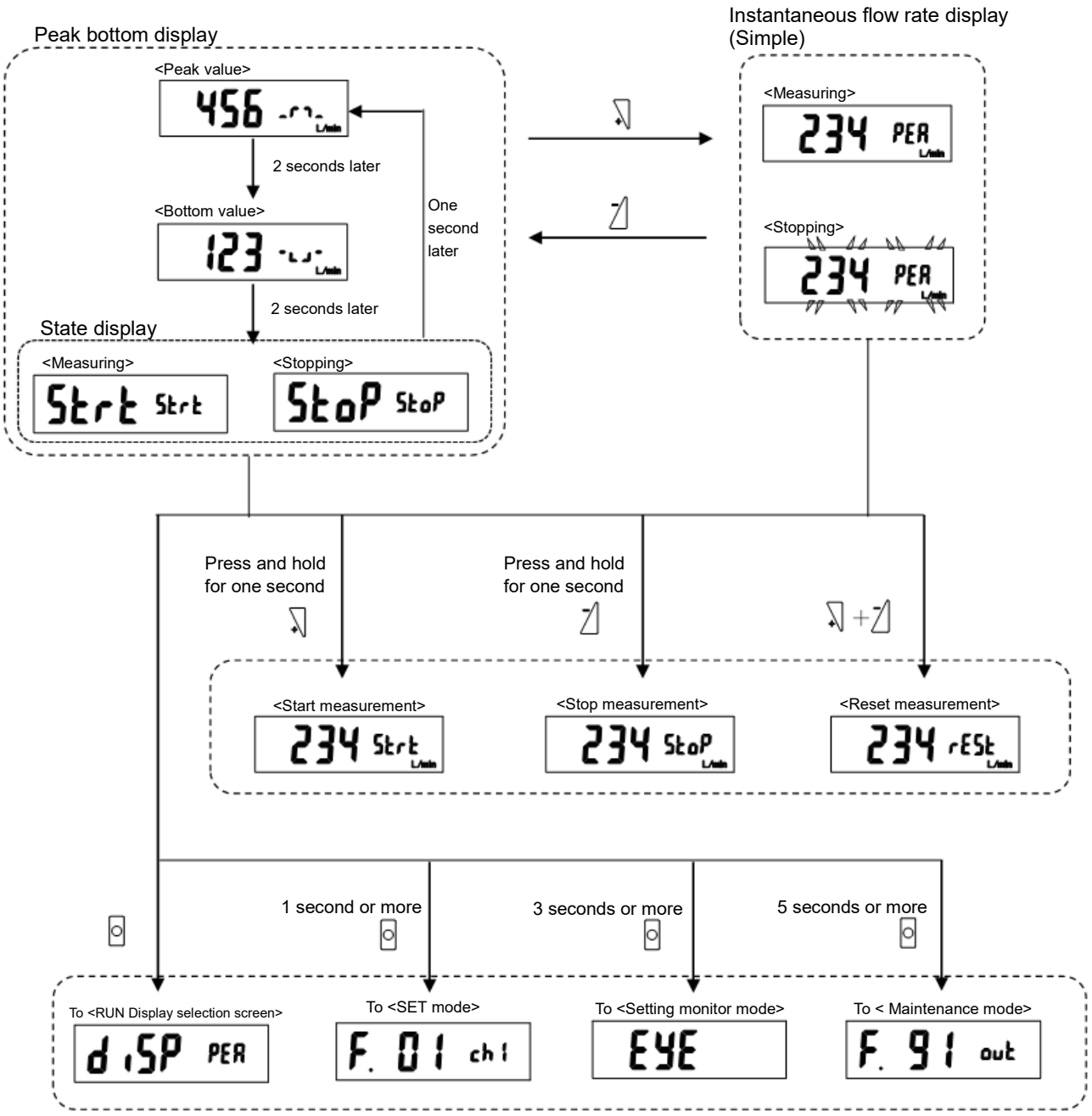
<At auto-reference external input setting> (when key is pushed)



- CH1 settings are displayed with the key, and CH2 settings are displayed with the key.
- When the CH1 settings are displayed, “1” output display turns ON, and for the CH2 settings, “2” output display turns ON.

● Peak hold function

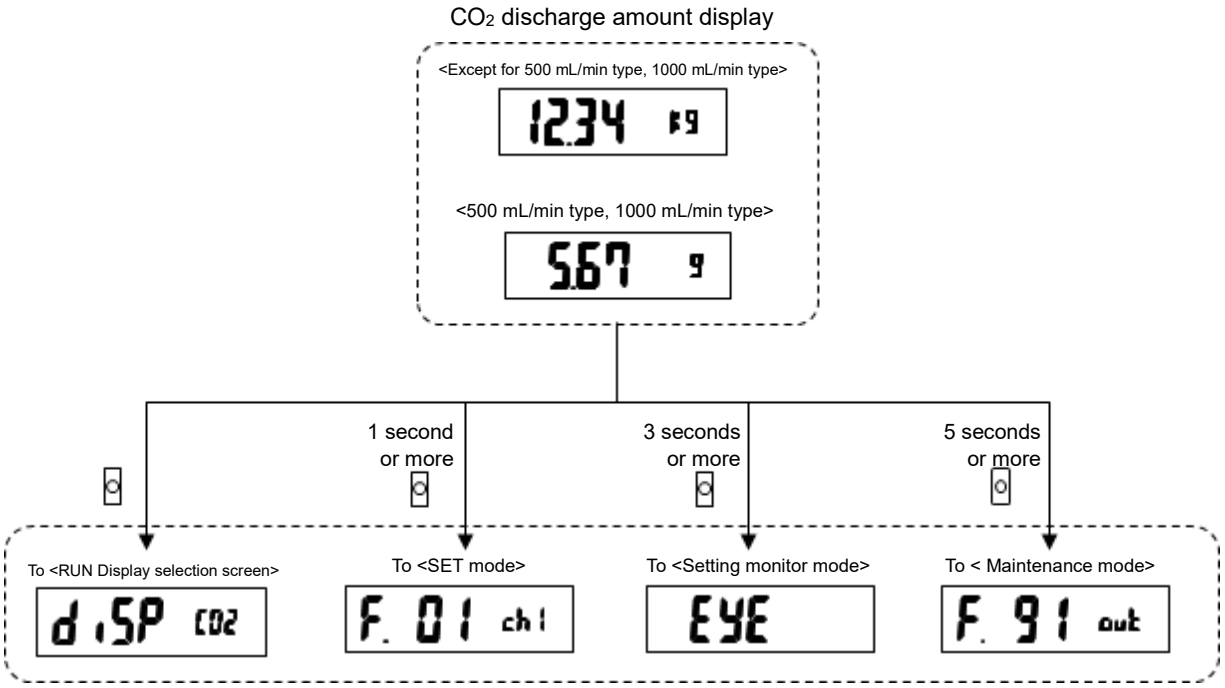
Able to know the maximum value and minimum value indicated by the flow rate value.
There are the measurement/stop states, and values are acquired at the measurement state.
Also, press the 1 button to switch to the instantaneous flow rate display.



- The peak value, bottom value and state display are switched automatically.
- Immediately after power is turned ON, it is “Stop measurement”. To start measurement, perform “Start measurement”.
- The display update cycle of the peak value and bottom value is one second.
- The display update cycle of instantaneous flow rate display (Simple) can be changed with "F.10: Display cycle setting".
- The instantaneous flow rate display (Simple) blinks while measurement is stopped.
- When settings are done with "F.06: Flow direction setting", "F.08: Reference state setting", "F.09: Unit setting" and "F.13: Gas type switch function", the peak value and bottom value are reset, and it becomes “Stop measurement”. When conducting measurement, perform above settings first.

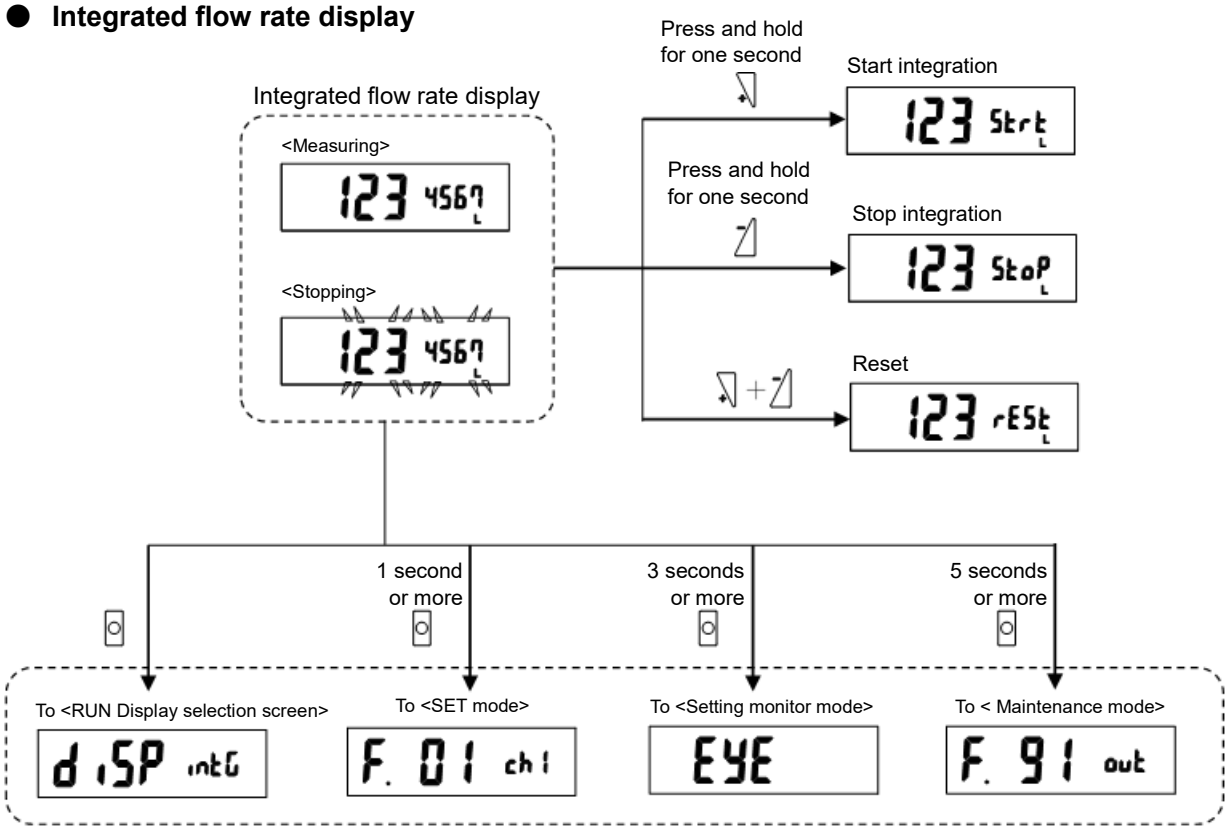
● CO_2 discharge amount display

The compressor's power consumption is calculated from the integrated flow rate value, and calculate CO_2 discharge amount by multiplying the discharge coefficient of electricity.
By setting the compressor capacity (power, discharge pressure and discharge flow rate) and CO_2 conversion coefficient with "F.15: CO_2 discharge amount calculation setting" to make the integrated flow rate in the measurement state, display the CO_2 discharge amount.
This setting cannot be used for other gas types than "Air".



- Calculation of CO_2 discharge amount is conducted only when the gas type is "Air".
- If a flow direction changes during calculation, a correct calculation cannot be performed.
- CO_2 discharge amount is automatically calculated from the integrated flow rate value. Please note that calculation of CO_2 discharge amount is also stopped/reset if the integrated flow rate is stopped/reset.
- Depending on the flow rate range, the unit of CO_2 discharge amount display differs.
  In case of 500 mL/min and 1000 mL/min range: "g"
  For other ranges: "kg"
- The maximum value of CO_2 discharge amount display is "99.99" (kg or g) regardless of a flow rate range.

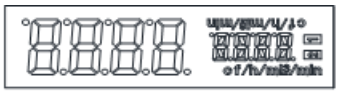
● Integrated flow rate display



- Immediately after the power is turned ON, it is “Measurement” state.
- The integrated flow rate value blinks during “Stop measurement”.
- The display update cycle of integrated flow rate value can be changed with "F.10: Display cycle setting".
- When CH2 is set to “Integration Reset”, the integrated flow rate value is reset at external input ON (40 msec Save). In case of integration reset through external input, it becomes in the “measurement” state after reset, and then measurement of integrated flow rate starts.
- In case of integration reset by manual operation, if it is “Stop measurement”, it remains as “Stop measurement”, and if it is “Measuring”, it remains as “Measuring”.
- When settings are done with "F.06: Flow direction setting", "F.08: Reference state setting", "F.09: Unit setting" and "F.13: Gas type switch function", the integrated flow rate value is reset, and it becomes “Stop measurement”. When conducting measurement, perform above settings first.

■ SET mode

< RUN display screen >



Press and hold for 2 seconds

When pressing and holding the ○ key for 2 seconds (keep pressing) in the RUN display state, the user enters to the SET mode.

Press the key to switch the mode, and press the ○ key to confirm.

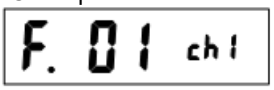
In each setting screen, press the ○ + key to return to the SET mode selection screen.

By pressing the ○ + key in the SET mode selection screen, the user returns to the RUN display.

If no key operation is performed for approx. one minute in the SET mode, it returns to the RUN display.

<SET mode selection screen>

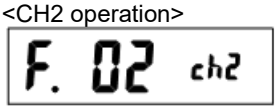
<CH1 operation>



F.01: CH1 Operation setting screen

To Page 89

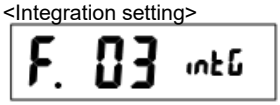
<CH2 operation>



F.02: CH2 Operation setting screen

To Page 90

<Integration setting>



F.03: Integration setting screen

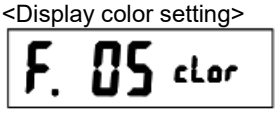
To Page 94

<Sub-screen display setting>

F.04: Sub-screen setting screen

To Page 94

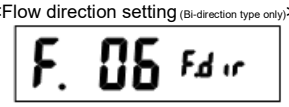
<Display color setting>



F.05: Display color setting screen

To Page 94

<Flow direction setting (Bi-direction type only)>



F.06: Flow rate direction selection setting screen

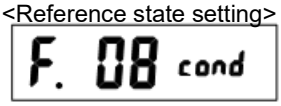
To Page 95

＜Display reverse setting＞

F.07: Display reverse setting screen

To Page 96

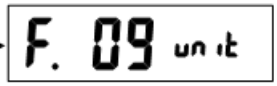
<Reference state setting>



F.08: Unit 1 setting screen

To Page 96

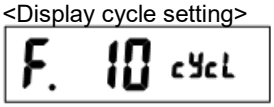
<Unit setting (Overseas model only)>



F.09: Unit 2 setting screen

To Page 97

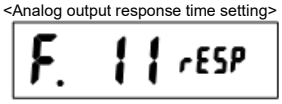
<Display cycle setting>



F.10: Display cycle setting screen

To Page 98

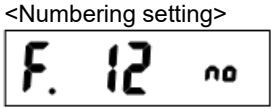
<Analog output response time setting>



F.11: Analog output response time setting screen

To Page 98

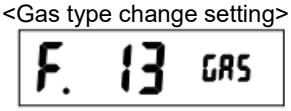
<Numbering setting>



F.12: Numbering setting screen

To Page 98

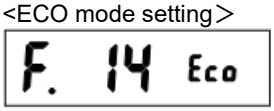
<Gas type change setting>



F.13: Gas type change selection screen

To Page 99

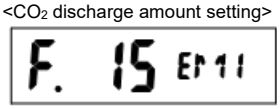
<ECO mode setting＞



F.14: Eco-mode setting screen

To Page 99

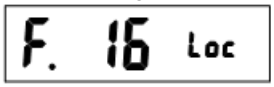
<CO_2 discharge amount setting>



F.15: CO_2 discharge amount setting screen

To Page 100

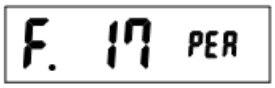
<Lock setting>



F.16: Lock setting screen

To Page 101

<Peak hold setting>



F.17: Peak hold setting screen

To Page 102

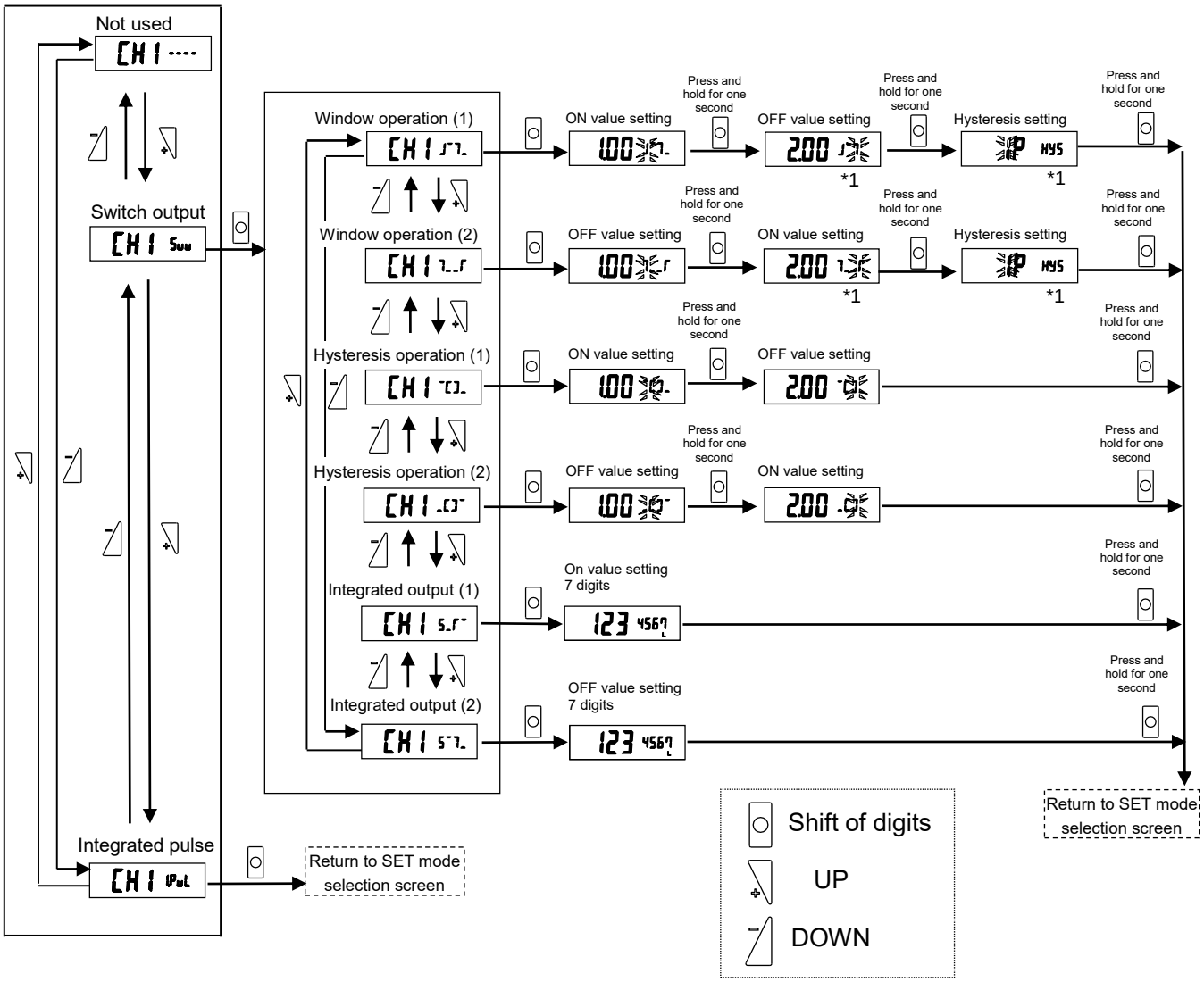
<CH1 operation>Return to setting

● F.01: CH1 Operation setting

Select a function of CH1.

Able to set the switch output operation and integrated pulse.

<Setting selection screen>



* Return with ○ + − or move to the RUN mode with no operation for approx. 1 minute.

* When settings are done with "F.06: Flow direction setting", "F.08: Reference state setting", "F.09: Unit setting" and "F.13: Gas type switch function", the switch setting is reset. When conducting switch setting, perform above settings first.

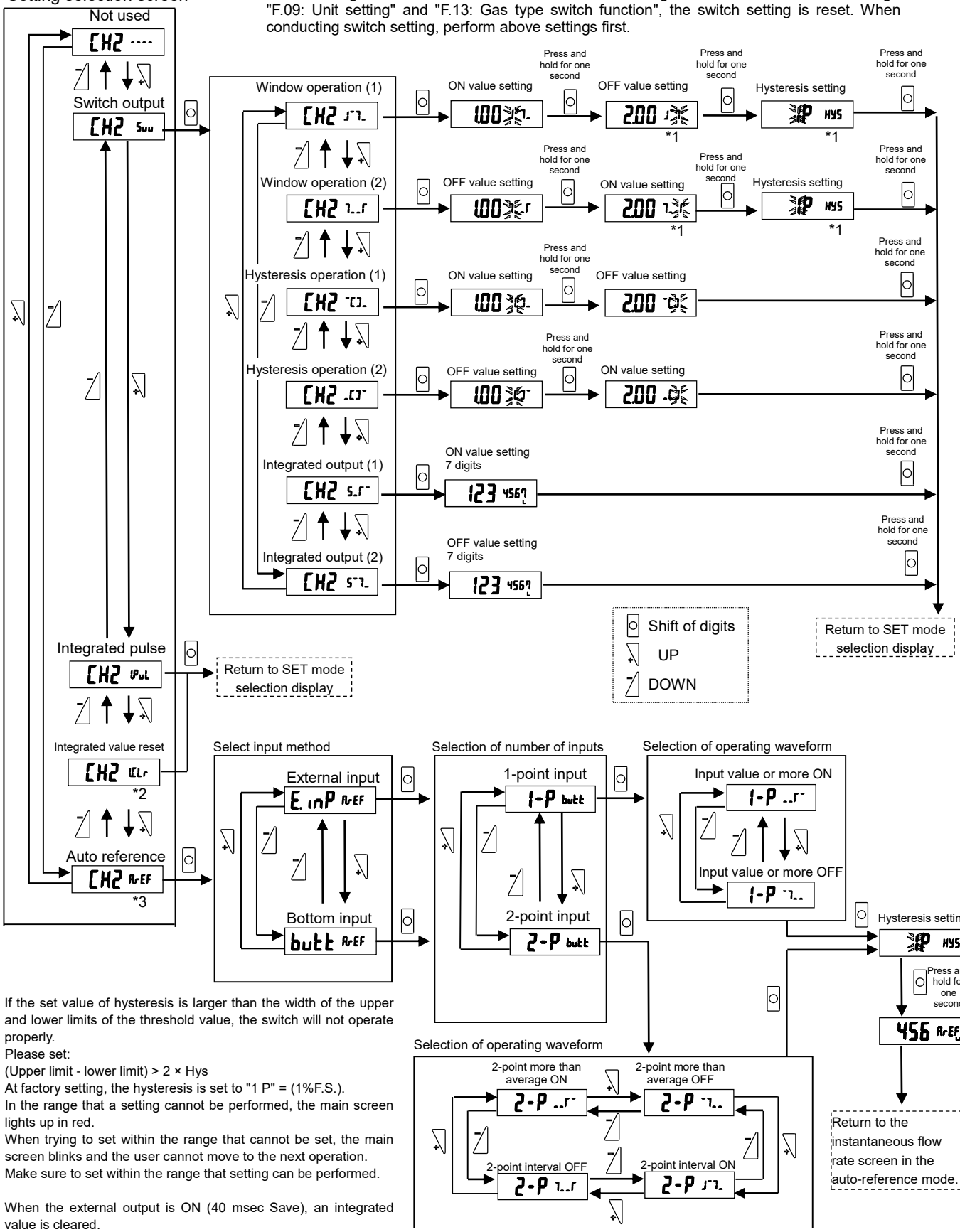
*1 When a hysteresis setting value is larger than the upper and lower limit value width of the threshold, the switch does not operate correctly.
Make sure to set it as:
(Upper limit – lower limit) > 2 x Hys.
In factory setting, the hysteresis is set to "1 P" = "1%".
In the range that a setting cannot be performed, the main screen lights up in red.
When trying to set within the range that cannot be set, the main screen blinks and the user cannot move to the next operation.
Make sure to set within the range that setting can be performed.

● F.02: CH2 operation setting

Selects a function of CH2. Select/set if CH2 is used as the switch output or external input (integrated value reset and auto-reference).

<Setting selection screen>

* When settings are done with "F.06: Flow direction setting", "F.08: Reference state setting", "F.09: Unit setting" and "F.13: Gas type switch function", the switch setting is reset. When conducting switch setting, perform above settings first.



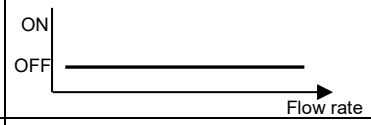
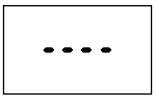
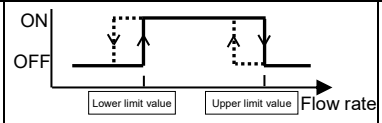
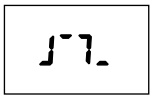
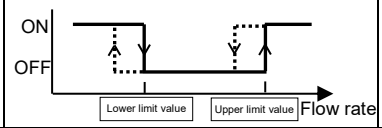
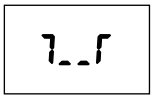
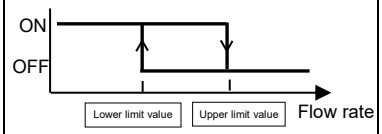
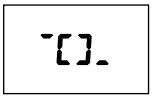
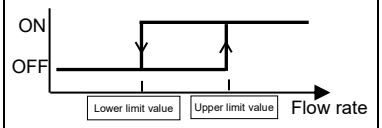
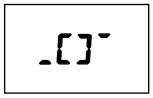
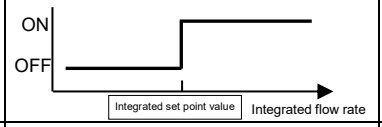
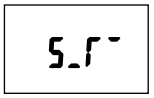
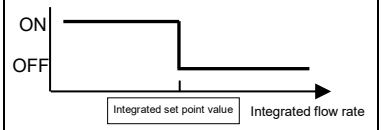
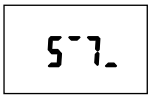
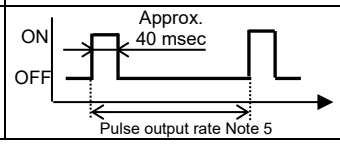
*1: If the set value of hysteresis is larger than the width of the upper and lower limits of the threshold value, the switch will not operate properly.
Please set:
(Upper limit - lower limit) > 2 × Hys
At factory setting, the hysteresis is set to "1 P" = (1%F.S.).
In the range that a setting cannot be performed, the main screen lights up in red.
When trying to set within the range that cannot be set, the main screen blinks and the user cannot move to the next operation.
Make sure to set within the range that setting can be performed.

*2 When the external output is ON (40 msec Save), an integrated value is cleared.
Also, it becomes “Integration START” after clearing.

*3 For details on auto-reference function, refer to “Supplement (2): Auto-reference function”.

Supplement [1]: Switch output function

Depending on the application, you can choose from 8 types of switch operation.

No.	Operation pattern name	Description	Operation waveform	LCD display (Sub-display)
1	Switch operation OFF	Switch operation is the OFF state.		
2	Window operation (1) (Inside range ON) Note1, 2, 3	The switch output turns ON within the specified range.		
3	Window operation (2) (Outside range ON) Note1, 2, 3	The switch output turns ON outside the specified range.		
4	Hysteresis operation (1) (Flow rate small side ON) Note1, 3	Set the hysteresis, and the switch output turns OFF at the specified flow rate or more.		
5	Hysteresis operation (2) (Flow rate large side ON) Note1, 3	Set the hysteresis, and the switch output turns ON at the specified flow rate or more.		
6	Integrated output (1) (Setting value or more ON) Note4	The switch turns ON at the set integrated flow or more.		
7	Integrated output (2) (Setting value or more OFF) Note4	The switch turns OFF at the set integrated flow or more.		
8	Integrated pulse output Note5, 6	The integrated pulse is output.		

Note1: The range of 0 to 100% of the full scale flow rate is the settable range.

Note2: Hysteresis can be set for the upper and lower limits of window operation (1) or (2). Hysteresis can be set from 1 to 8% F.S.

Note3: When setting is done to be Lower setting value > Upper limit setting value, it is set by replacing the upper limit and lower limit value automatically.

Note4: The displayable range of integrated flow rate is the settable range.

Note5: For pulse output rate, refer to “Pulse output rate” under "1.2 Specifications".

Note6: At integrated pulse output, the output display (OUT1, 2) also flashes according to the pulse output.

Supplement (2): Auto-reference function

The auto-reference function loads the measuring flow rate and make it a threshold value of the switch output.
Loading is done with a button operation or the external input of CH2, and it is outputs from CH1.
When a workpiece changes and the threshold value of the switch changes, a threshold value can be changed automatically.

Loading method with the button

・1-point input: Press and hold the key for 2 seconds and load the instantaneous flow rate at the time.

・2-point input: Press and hold the key for 2 seconds and load the instantaneous flow rate at the time as the upper limit value.
Press and hold the key for 2 seconds to load the instantaneous flow rate at the time as the lower limit value.

Loading method with the external input

・1-point input: When the external output is ON (40 msec Save), load the instantaneous flow rate at the time.

・2-point input: When the external output is ON (40 msec Save), load the instantaneous flow rate at the time. The size relationship of the latest two points is compared, and the upper limit value and lower limit value are automatically judged.

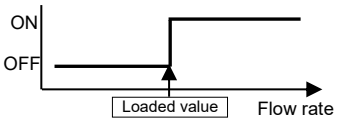
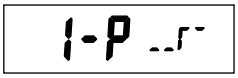
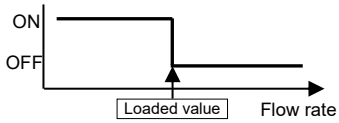
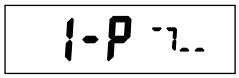
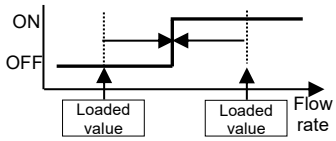
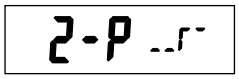
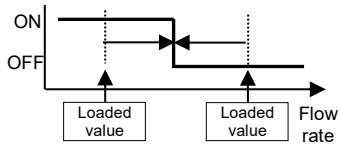
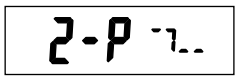
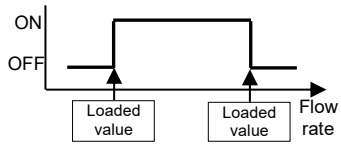
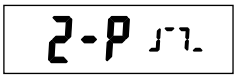
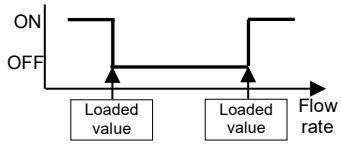
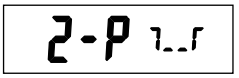
(Example)

Loading value (mL/min)		Lower limit value (mL/min)	Upper limit value (mL/min)
Initial value		0	0
1st	123	0	123
2nd	234	123	234
3rd	45	45	234
4th	345	45	345
5th	456	345	456
6th	-50	-50	456
7th	-211	-211	-50
8th	-100	-211	-100
9th	-300	-300	-100
10th	0	-300	0

The initial value is zero both in the upper and lower limits.

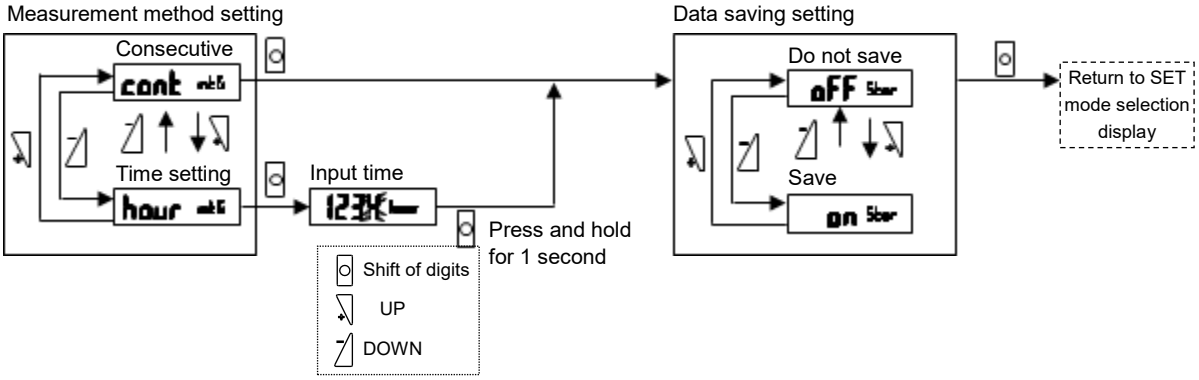
・While setting "F.02: CH2 operation setting" to auto-reference, "F.01: CH1 Operation setting" becomes invalid and cannot be operated.
When setting "F.01: CH1 Operation setting", set "F.02: CH2 operation setting" to other than auto-reference.
・Loading with the button is possible only during instantaneous flow rate display. Loading with the external input is possible during RUN display.
・The values loaded with auto-reference are cleared when the power is turned OFF. Perform setting again.
・After loading, loaded values are displayed.
・The values loaded with auto-reference can be checked also with the setting monitor mode.
・In case of external input, ON/OFF pulse is output from CH1 as the loading verification at the time of loading.
・While pressing and holding the key for one second, the loaded values can be displayed (at the loading time with the external input only).

Auto-reference function

No. of input points	Operation pattern name	Description	Operation waveform	LCD display
1 point (1-P)	Loaded value or above ON	Turn the loaded value or above ON. (Threshold: Loaded value)		
	Input value or above OFF	Turn the loaded value or above OFF. (Threshold: Loaded value)		
2 points (2-P)	Central value or above of 2 points ON	Turn the central value of 2 points or above ON. (Threshold: (loaded 1 + loaded 2)/2)		
	Central value or above of 2 points OFF	Turn the central value of 2 points or above OFF. (Threshold: (loaded 1 + loaded 2)/2)		
	Between 2 points ON	Turn between the 2 points ON. (Threshold 1: Loaded value 1) (Threshold 2: Loaded value 2)		
	Between 2 points OFF	Turn between the 2 points OFF. (Threshold 1: Loaded value 1) (Threshold 2: Loaded value 2)		

● F.03: Integration setting

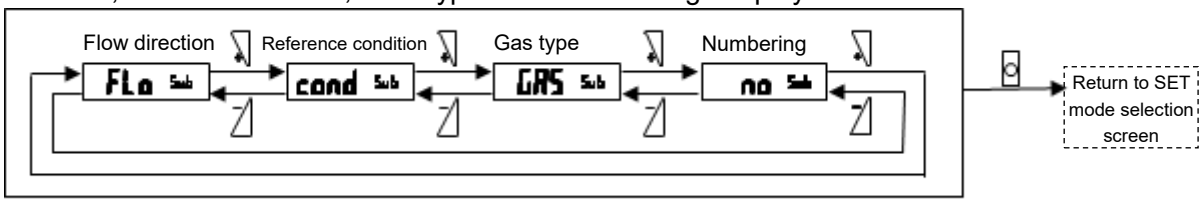
The user can select whether to acquire an integrated flow rate value consecutively or perform time setting. Also, the user can select to save an integrated flow rate value.



- Time setting is a function that the state automatically becomes “Integration STOP” when “Integration START” state continues for a set time.
  The passing time is reset once switched from “Integration START” -> “Integration STOP”, and the power is turned ON again. From the moment it becomes “Integration START” again, the setting time and integrated flow rate value are acquired (Immediately after launched when the power is turned ON again).
- For saving of the integrated flow rate value, the moment the setting is confirmed while data saving is turned ON is regarded as the first saving time, and data are saved every 5 minutes afterwards. When the power is turned ON again, the time is reset, and launched time is regarded as the first time and data are saved every 5 minutes afterwards.
- When integration reset is performed, saving data are also reset.
- Saving of the integrated flow rate value is performed even in the “Integration STOP” state.

● F.04: Sub-screen display setting

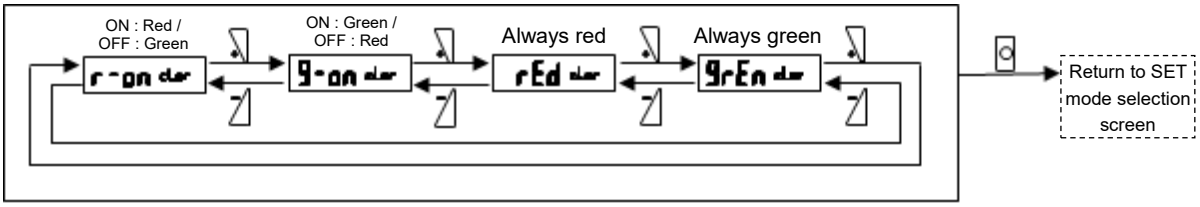
Set the display contents of the sub-screen.
"Flow direction", "Reference state", "Gas type" and "Numbering" display can be switched.



- The sub-screen setting is applied only at instantaneous flow rate display.
- When "F.02: CH2 operation setting" is set to “Auto-reference setting”, the sub-screen is displayed as “A.rEF” regardless the setting of "F.04: Sub-screen display setting".

● F.05: Display color setting

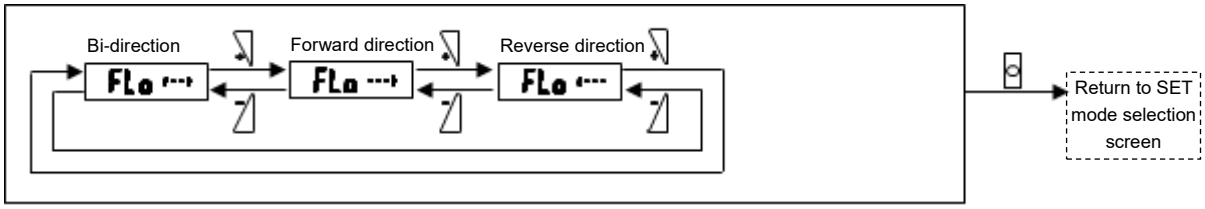
Set the display color. (Red/ Green)
During the normal display, the display color when the switch output is ON can be set.



- The display color setting can be applied only during the RUN mode. It is always green during the SET mode, setting monitor mode, and maintenance mode.
- When set to “ON Red / OFF Green” and “ON Green / OFF Red”, the screen color changes when the switch output is ON.
  The main screen color changes when CH1 is ON, and the sub-screen color changes when CH2 is ON.

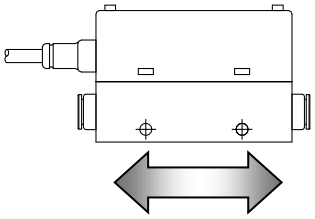
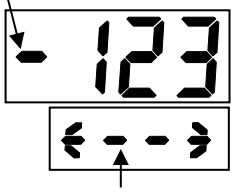
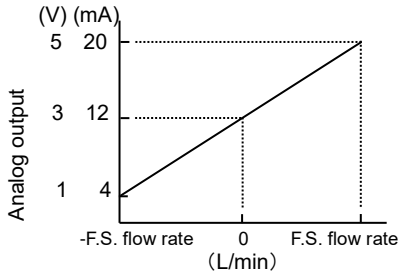
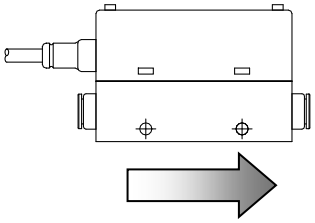
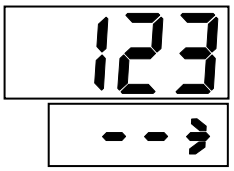
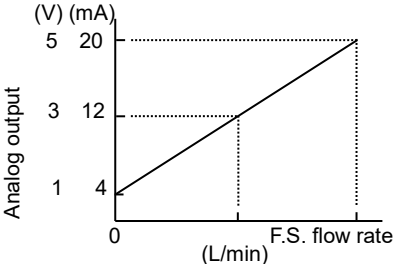
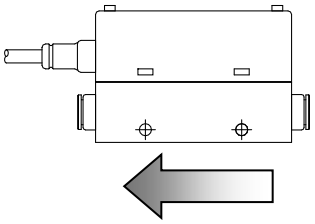
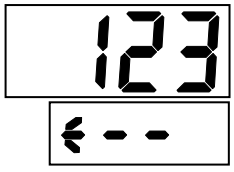
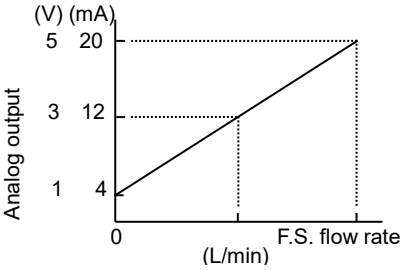
● F.06: Flow direction setting

(Bi-direction type only. Uni-direction type is not displayed.)
Select the flow direction. Bi-direction, uni-direction, and uni-reverse direction can be selected.



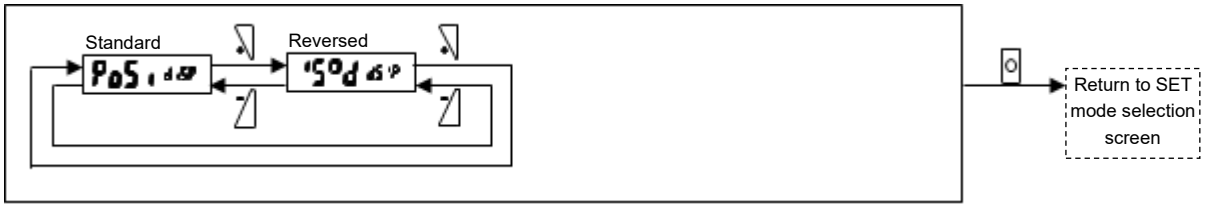
・When a flow direction is set, the setting values below are cleared. Always set a flow direction first.
・Switch setting
・Peak bottom value
・Integrated flow rate value
For detail, refer to "3.1.2 Explanation of functions".

List of flow direction

Flow direction	LCD display	Analog output characteristics
<Bi-direction> 	Minus (-) is shown for the reverse direction.  According to the flow direction, the arrow switches.	
<Uni-direction (forward direction)> 		
<Uni-direction (reverse direction)> 		

● F.07: Display reverse setting

The top and bottom of LCD display can be reversed.



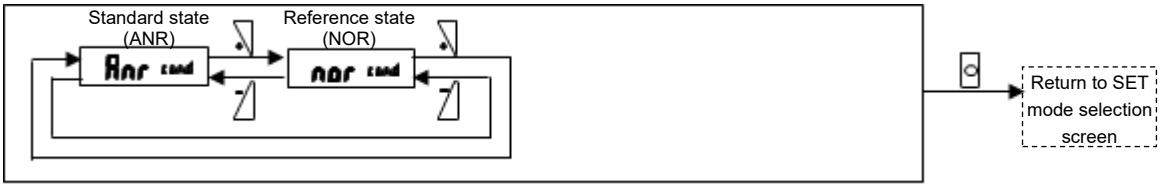
・Even when the display is reversed, the key operation remains the same. If operation is performed with the key in the standard display, it is also performed with the key in the reverse display. Please note that key operations do not get reversed.

● F.08: Reference state setting

Flow rate unit (standard state ANR /reference state NOR) is switched.

・Standard state ANR: 20°C, 1 atm and humidity 65%RH
(Gas type except for air: 0°C, 1 atm and humidity 0%RH)

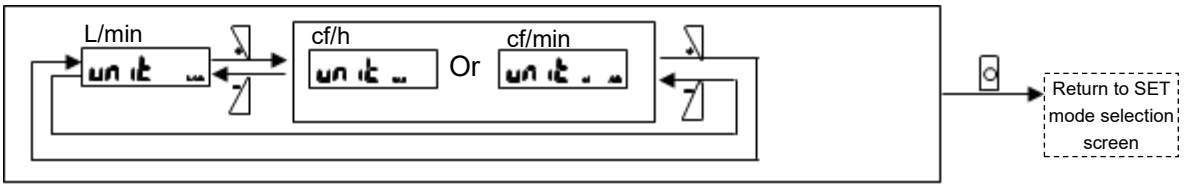
・Reference state NOR: 0°C, 1 atm and humidity 0%RH



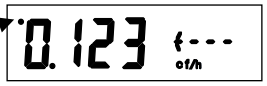
・When a flow rate unit is set, the setting values below are cleared. Always set a flow rate unit first.
・Switch setting
・Peak bottom value
・Integrated flow rate value
For detail, refer to "3.1.2 Explanation of functions".

● F.09: Unit setting

(For overseas model only – Unit specification “2”)
The unit can be set from “L/min” and “cf/h”.
(For 1000 L/min type, “cf/min” can be set instead of “cf/h”)



・When a unit is set, the setting values below are cleared. Always set a unit first.
・Switch setting
・Peak bottom value
・Integrated flow rate value
For detail, refer to "3.1.2 Explanation of functions".
・When it is changed to “cf/h” in the 500 mL/min type, for the display purpose, the minus “-“ display is not used and “a dot on the upper left” is used instead.

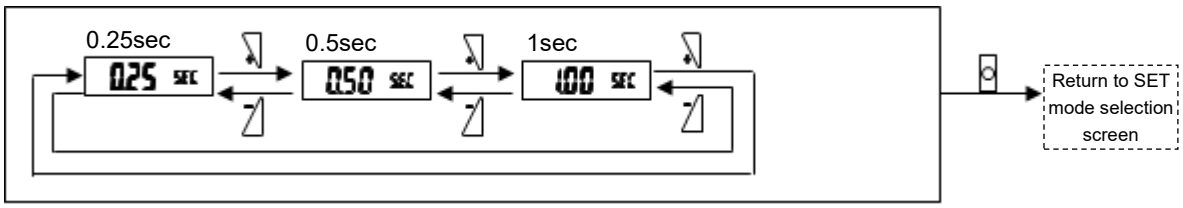
Minus display 

Full scale flow rate after changing the unit

Model No.	Full scale flow rate	
[B]	L/min (mL/min)	cf/h (cf/min)
005	500 mL/min	1.059 cf/h
010	1000 mL/min	2.12 cf/h
020	2.00 L/min	4.24 cf/h
050	5.00 L/min	10.59 cf/h
100	10.00 L/min	21.2 cf/h
200	20.0 L/min	42.4 cf/h
500	50.0 L/min	105.9 cf/h
101	100.0 L/min	212 cf/h
201	200 L/min	424 cf/h
501	500 L/min	1059 cf/h
102	1000 L/min	3.53 cf/min

● F.10: Display cycle setting

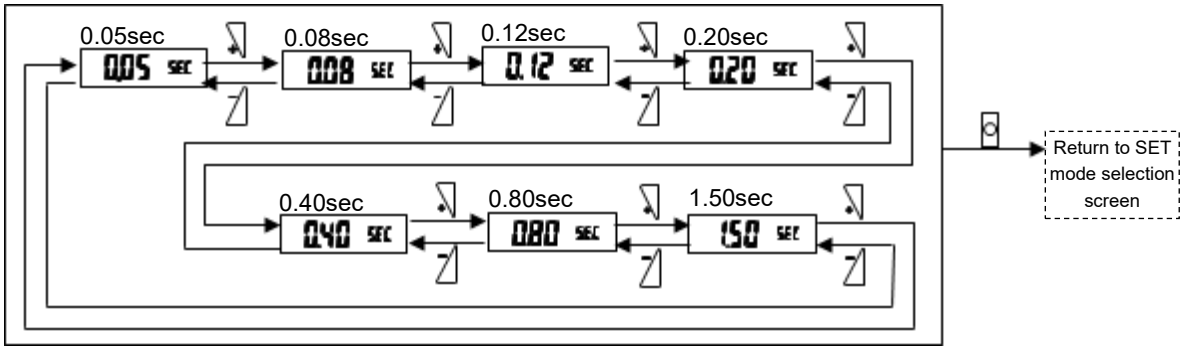
The display cycle of the digital display can be changed in 3 levels from 0.25 s to 1 s. If the display flicks, it can be improved by setting the long display update cycle.



・The applicable range of display cycle setting is the instantaneous flow rate display, integrated flow rate display, and the instantaneous flow rate display during the peak hold function.
Please note that the setting is not applied to other displays.

● F.11: Analog output response time setting

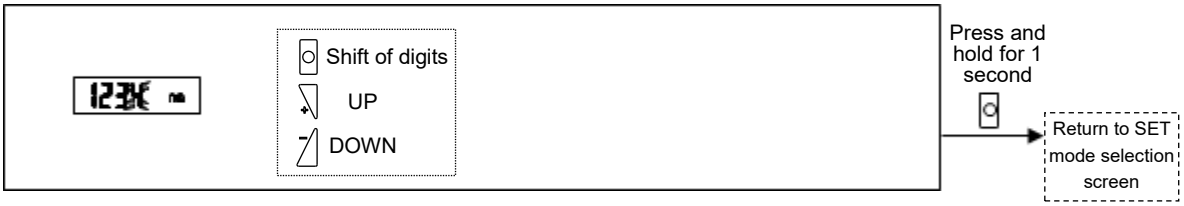
Set the response time. It can be changed in 7 levels from 0.05 sec to 1.50 sec.
It prevents chattering and error operation due to sudden flow rate change and noise.



・In addition to analog output, the setting is applied also on the display and switch output.
・The response time is an estimate time. The actual response speed changes due to piping.

● F.12: Numbering setting

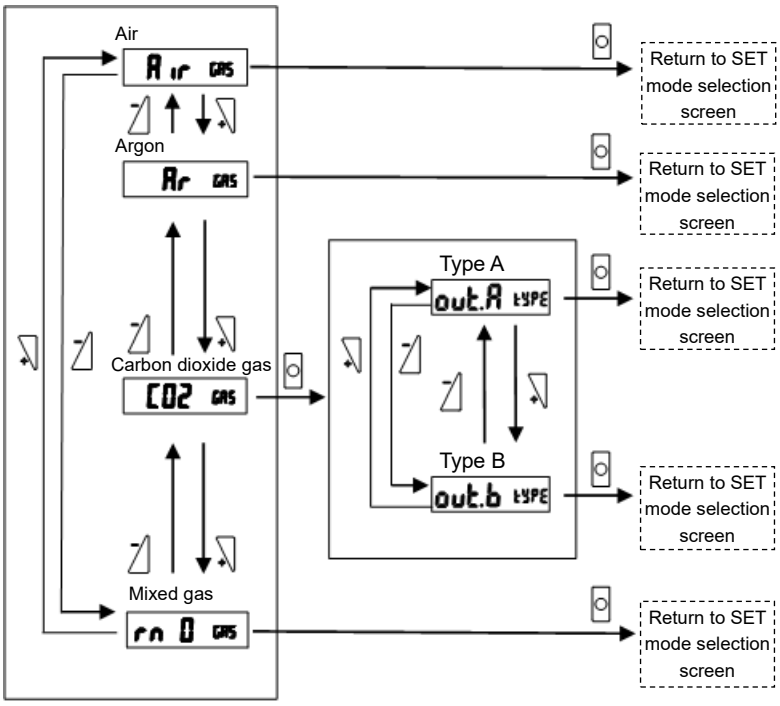
Able to assign any unique number to each product.



・Can be set between 0 to 9999.
・The numbering setting is not copied with the setting copy function.

● F.13: Gas type switch function

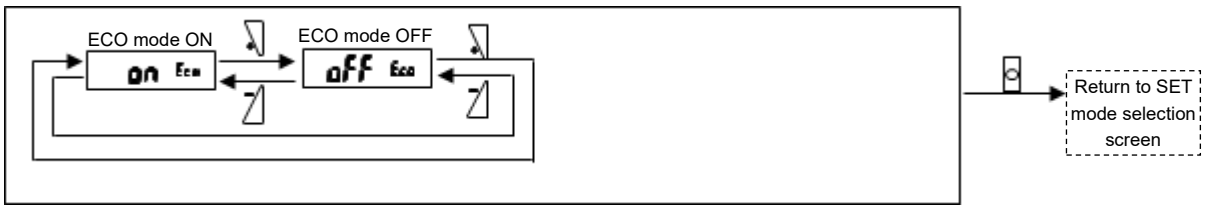
Able to switch a gas type to measure.
This function can be used with the flow rate range: 500 mL/min to 200 L/min type.
Oxygen type has no gas type switching.



・Gas ratio of the mixed gas is Ar 80% + CO_2 20%.
・When CO_2 is selected, select the output type from type A or type B.
Type A: Voltage output 1-3 V (Uni-direction type) 2-4 V (Bi-direction type)
Current output 4-12 mA (Uni-direction type) 8-16 mA (Bi-direction type)
Type B: Voltage output 1-5 V, current output 4-20 mA

● F.14: ECO mode setting

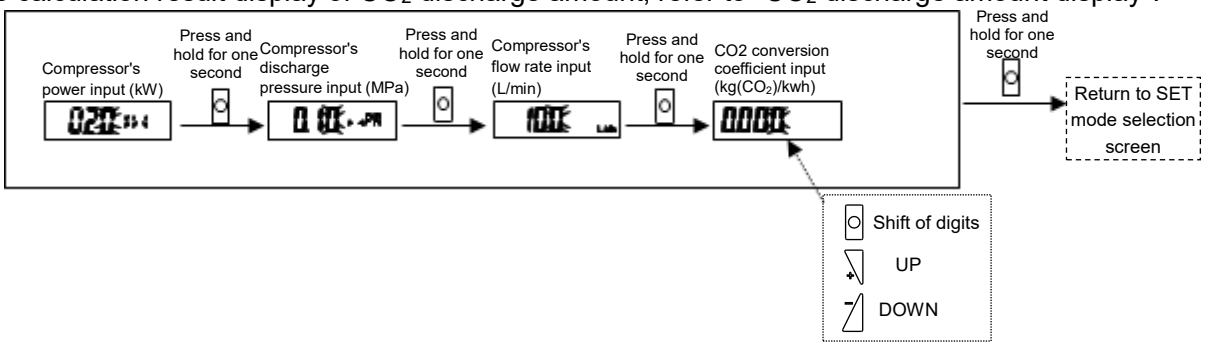
Can select the ECO mode.
When the ECO mode is ON, the mode switches to the ECO mode if there was no key operation approx. 1 minute, the backlight on the display turns OFF, and only the unit display “L” is lit. The power current consumption can be reduced.
Press any key to turn them ON again.



・The restoration operation responds when a key is pressed within one second. Please note it does not respond with pressing and holding.

● F.15: CO_2 discharge amount calculation setting

Perform settings to calculate the CO_2 discharge amount.
The input values are the compressor's power, discharge pressure, discharge flow rate, and conversion coefficient (kg (CO_2)/kWh).
Set the compressor's power, discharge pressure, discharge flow rate, and CO_2 conversion coefficient of the compressor being used.
This setting cannot be used for other gas types than "Air".
For the calculation result display of CO_2 discharge amount, refer to "CO_2 discharge amount display".



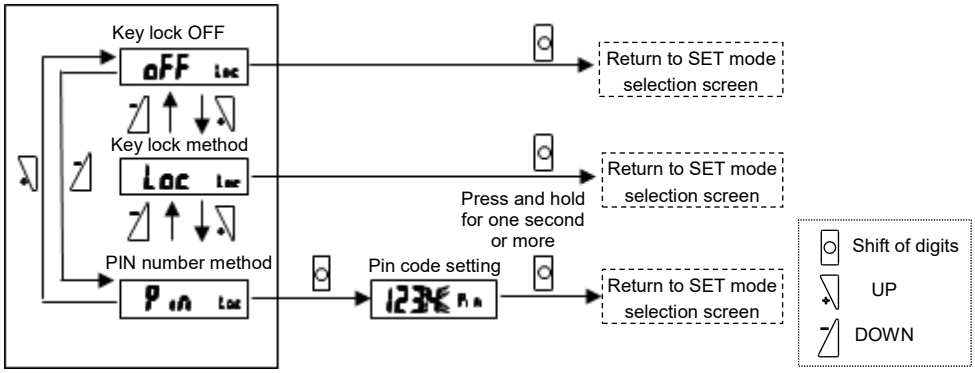
$$\frac{\text{Integrated flow rate (L)}}{\text{Compressor flow rate } \left(\frac{\text{L}}{\text{min}}\right) \times \frac{(\text{Discharge pressure(MPa)} + 0.1013)}{0.1013}} \times \text{Compressor's power (kW)}$$
$$\div 60 \times CO_2 \text{ conversion coefficient } (\text{kg}(CO_2)/\text{kWh})$$

Reference: Coefficient of Chubu Electric Power is 0.457kg (CO_2)/kWh (2018FY)

- Calculation of CO_2 discharge amount is performed only when the gas type is "Air".
- If the flow direction changes during calculation, correct calculation cannot be performed.
- CO_2 conversion coefficient differs depending on electric power companies.
- When the unit is "cf/h (cf/min)", the compressor flow rate is set with the unit "cf/min". In addition, the integrated flow rate value is calculated with "cf".
- CO_2 discharge amount is calculated automatically from the integrated flow rate value. Please note if the integrated flow rate is stopped/reset, the CO_2 discharge amount calculation also stops/resets.

● F.16: Lock setting

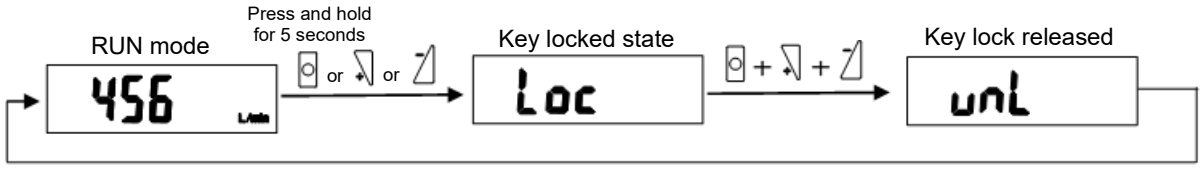
This setting is for the lock. Error operation can be prevented by making key operation invalid.
There are two types of lock method to select: Key lock method and PIN number method, and each has different releasing method.
In case of the PIN number method, a PIN code is set at lock setting.



- PIN code can be set between 0 to 9999.
- After releasing the lock, it is locked again if no key operation is performed for approx. 10 seconds. To release the lock completely, set to “Key lock OFF”.
- While locked, it does not switch to the SET mode and maintenance mode, and the user can use only the RUN mode and setting monitor mode.
  Also, it is possible to verify the display in the RUN mode, and the integration start/stop/reset cannot be conducted (Display change from instantaneous flow rate display -> integrated flow rate display is possible).

Lock releasing method (Key lock method)

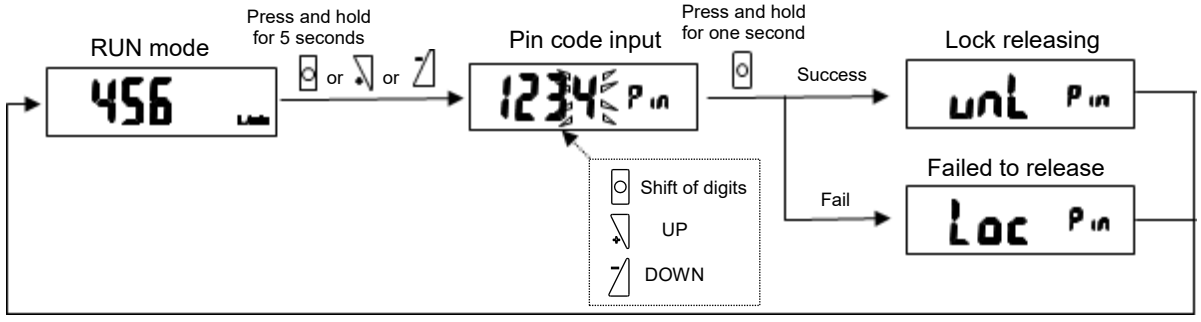
“Loc” is displayed when key operation is performed and operation cannot be conducted.
While “Loc” is displayed, press all keys to release the key lock.
After releasing the key lock, it is locked again if no operation is performed for approx. 10 seconds.



- Key lock releasing operation is accepted only while “Loc” is displayed.
- The display time of “Loc” and “unL” is approx. one second.
- Set to “Key lock OFF” to completely release the lock including the re-locking.

Lock releasing method (PIN number method)

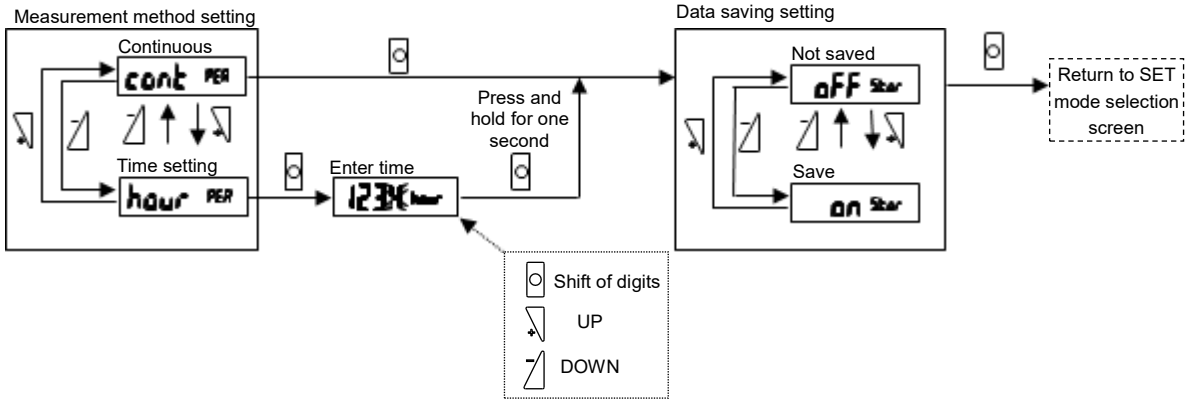
When any key is pressed, the PIN code input screen is displayed.
Enter the PIN code determined during setting to release the lock.
After the lock is released, it is locked again if no operation is performed for approx. 10 seconds.



- Set to “Key lock OFF” to release the lock completely including the re-locking.
- If you forgot your PIN code, contact the sales dealer.
- The PIN code is not copied with the setting copy function.

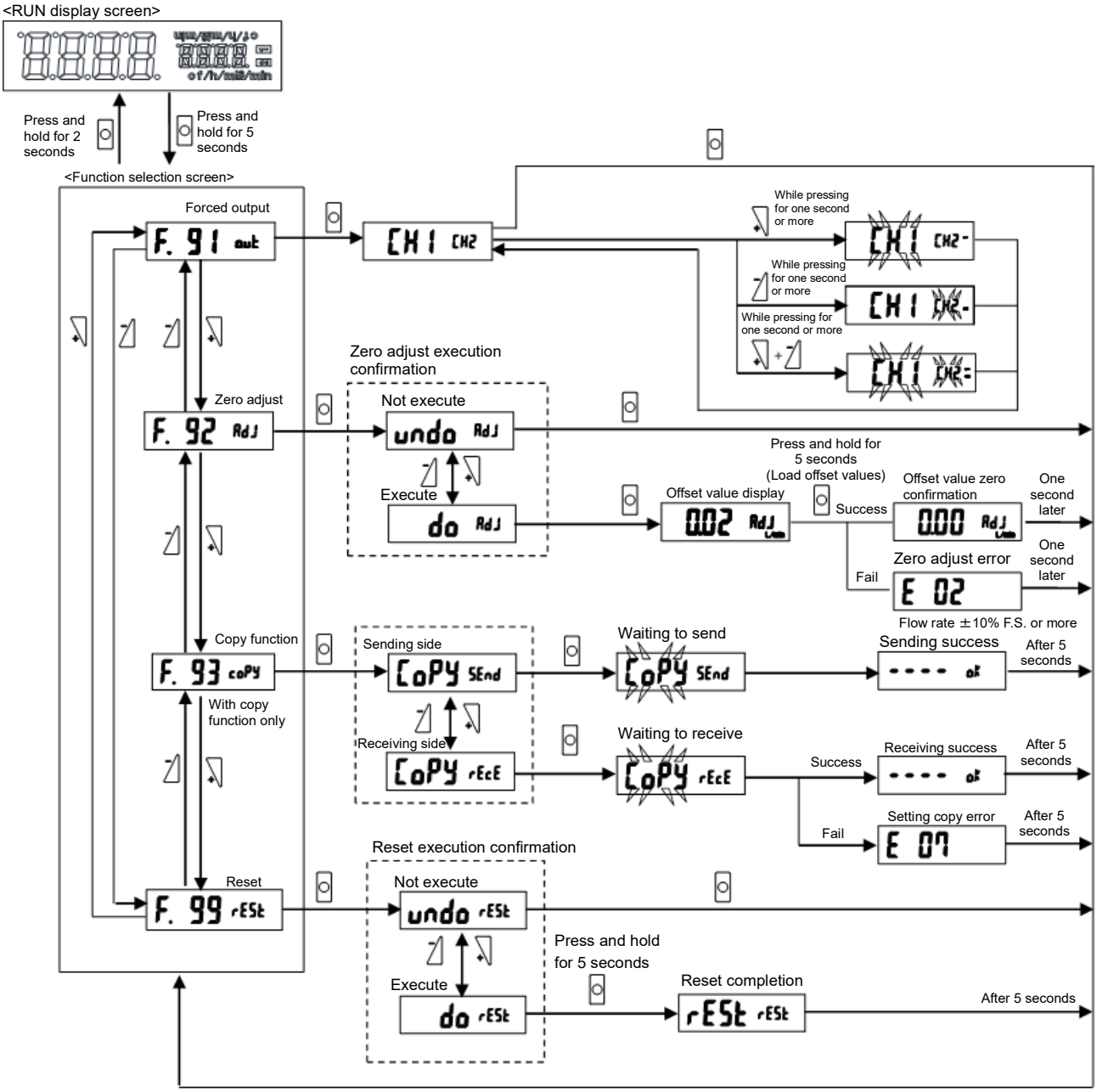
● F.17: Peak hold setting

Able to select to acquire peak hold values consecutively or specify time. Also, it can be selected if the peak hold value should be saved.



- Time setting is a function that it automatically becomes “Peak hold STOP” from the “Peak hold START” state after a set time duration.
  If it switches from “Peak Hold START” -> “Peak hold STOP” and the power is re-applied, the time duration is reset. From the time it becomes “Peak hold START” again, the set time and peak bottom values are acquired. (In case of power re-application, from immediately after it was launched)
- For saving the peak bottom value, when the setting is confirmed while data saving is ON, the first saving is performed, and then data are saved in 5 minutes interval afterwards. When the power is re-applied, the time is reset, and the first time is when it is launched, and then data are saved in 5 minutes interval.
- When a peak hold reset is conducted, the saved data are also reset.
- Saving of the peak bottom values is also conducted during the “Peak hold STOP” state.

■ Maintenance mode



*1 Pressing ○ + ↙ on all screens except <Function selection screen> returns to <Function selection screen>. (However, this operation is not accepted during copying)

*2 Pressing ○ + ↙ on all screens of <Function selection screen> returns to <RUN display screen>.

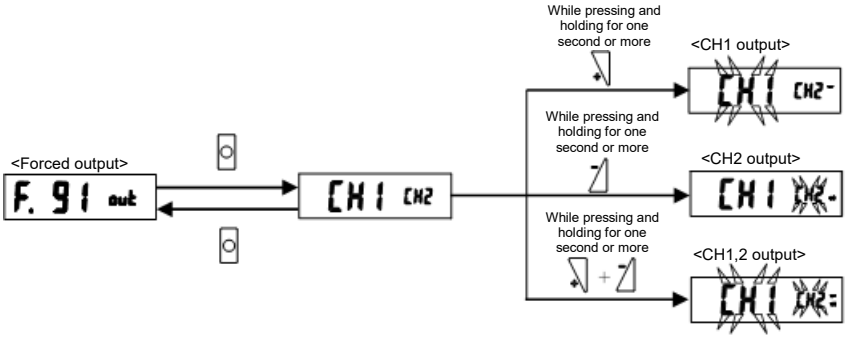
*3 Resetting will restore the factory default settings.

*4 When approx. one minute passes without operation, the screen returns to <RUN display screen>.

*5 In case of model number without copy function, selection screen of F.93 (copy function) is not displayed.

● F.91: Forced output function

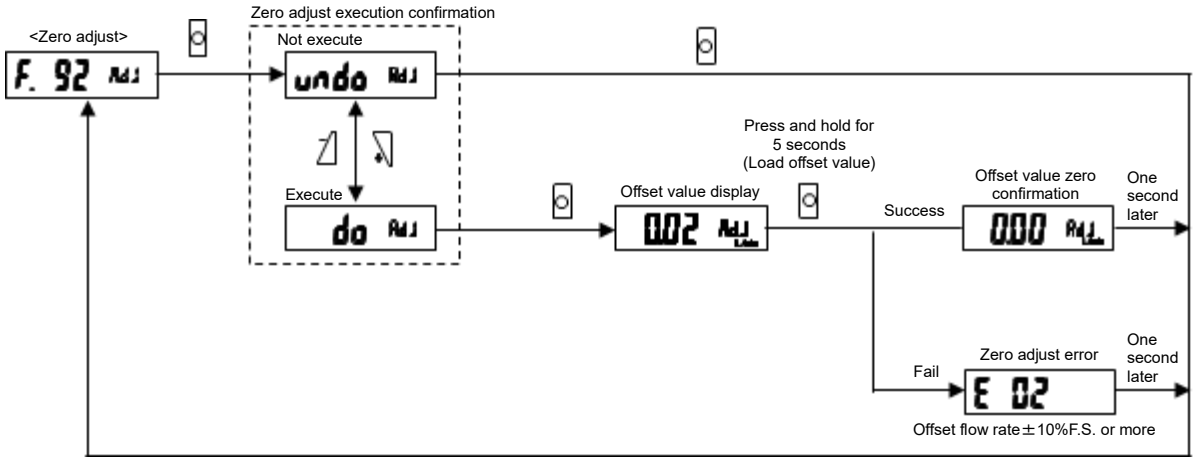
The switch output is forced to turn ON, and used for wiring connections and initial operation verification of input devices.



- The main screen flashes during CH1 output, and sub-screen flashes during CH2 output.
- In case of the model number with the copy function (Ⓖ Output specification “A,C,E,G”) or CH2 setting is “Integration reset” and “Auto-reference”, “CH2” in the sub-screen is not displayed and output cannot be conducted.
- The display color follows "F.05: Display color setting".
- To prevent error operation, output is made by pressing and holding for one second or more.

● F.92: Zero adjust function

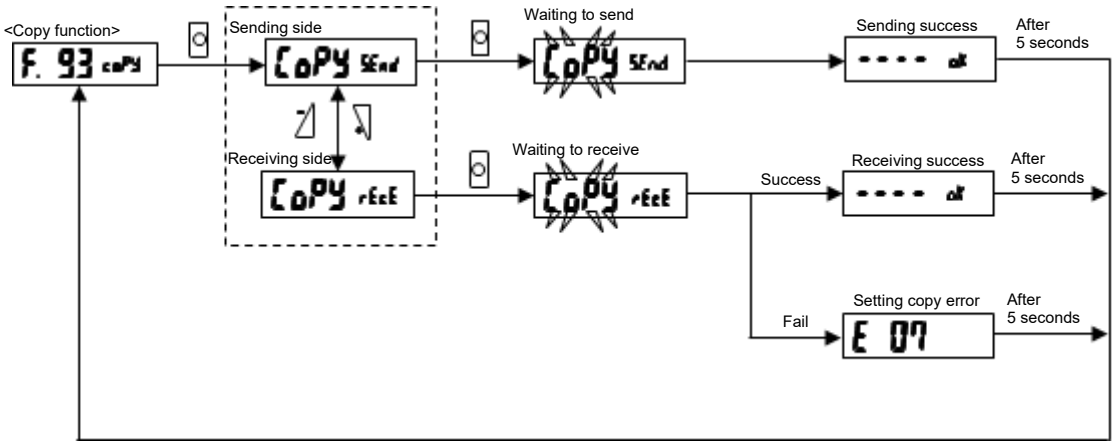
Correct the deviation of zero point (Range: Within ±10%F.S.)



- Make sure to set the flow rate to zero, and then load the offset value.
- When zero adjust is successful, after the screen is displayed that the offset value is zero, it returns to “F.92” display.
- When the offset flow rate is ±10%F.S. or more, “E02” is displayed and the zero adjust fails.
- The loaded offset value can be verified with "Model display" of the setting monitor mode.

● F.93: Copy function

Between two FSM3s, operations and setting values can be easily copied.
(Copying is possible between the products of the identical model number)



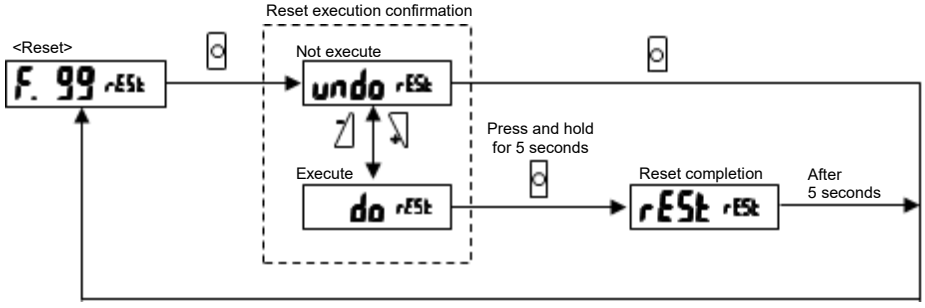
Copy procedure

(1) Prepare a copy source FSM3 (master) and copy destination FSM3 (slave).
(2) Referring to "2.4.3 Copying setting values", perform wiring.
(3) Enter “F.93”, and match the master side [CoPy SEnd] and slave side [CoPy rEcE] to the display by operating the key and key.
(4) Press the slave side ○ first, and then press the master side ○. It becomes the waiting to receive/send state.
(5) When copying succeeds on the slave side, [- - - - ok] is displayed and it fails, [E 07] is displayed.
[- - - - ok] is displayed on the master side regardless of success/failure.

- The model numbers the copy function can be used are Ⓖ output specification “A,C,E,G”.
- The copy function copy the settings of F.01 to F.17 of the SET mode.
  However, "F.12: Numbering setting" and "F.16: Lock setting" are not copied.
- In step (4), make sure to operate from the slave side first. If operation is done from the master side, the copy signal cannot be received causing failure.
- Conditions for copy failure are the following two reasons.
  - The model number between the master and slave is different.
  - The slave side does not receive the copy signal in waiting to receive state, and it passes 10 seconds.

● F.99: Reset function

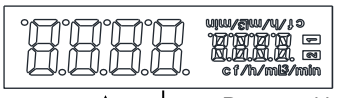
Returns to the factory setting state.



- For the factory setting values, refer to "3.1.2 Explanation of functions".

■ Setting monitor mode

< RUN display screen >



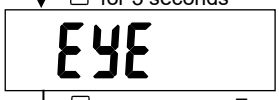
In the instantaneous flow rate display state, if you press and hold ○ key for 3 seconds (keep pressing), it enters into the setting monitor mode.

Press the ○ key to enter the selection screen, switch to the function you want to check with the ▽ △ key, press the ○ key and check the contents.

It returns to the RUN display screen after 30 seconds have elapsed without operation.

Press and hold for 2 seconds ○

Press and hold for 3 seconds ○

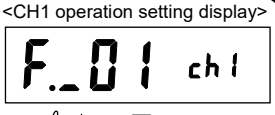


○

<Setting monitor mode selection screen>

Every time the ○ key is pressed, the setting contents are displayed sequentially.

<CH1 operation setting display>



▽ △ ▽ △

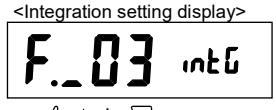
○ F.01: CH1 operation setting confirmation

<CH2 operation setting display (no copying function only)>

▽ △ ▽ △

○ F.02: CH2 operation setting confirmation

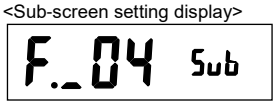
<Integration setting display>



▽ △ ▽ △

○ F.03: Integration setting confirmation

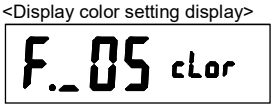
<Sub-screen setting display>



▽ △ ▽ △

○ F.04: Sub-screen setting confirmation

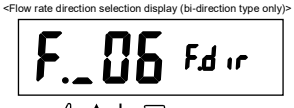
<Display color setting display>



▽ △ ▽ △

○ F.05: Display color confirmation

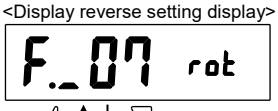
<Flow rate direction selection display (bi-direction type only)>



▽ △ ▽ △

○ F.06: Flow rate direction selection setting confirmation

<Display reverse setting display>



▽ △ ▽ △

○ F.07: Display reverse setting confirmation

<Display reverse setting display>

▽ △ ▽ △

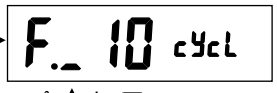
○ F.08: Unit 1 setting confirmation

<Unit setting display>

▽ △ ▽ △

○ F.09: Unit 2 setting confirmation

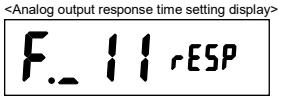
<Display cycle setting>



▽ △ ▽ △

○ F10: Display cycle setting confirmation

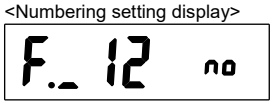
<Analog output response time setting display>



▽ △ ▽ △

○ F11: Analog output Response time setting confirmation

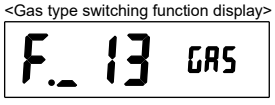
<Numbering setting display>



▽ △ ▽ △

○ F12: Numbering setting confirmation

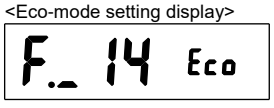
<Gas type switching function display>



▽ △ ▽ △

○ F13: Gas type changing setting confirmation

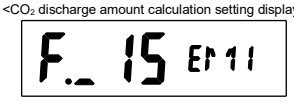
<Eco-mode setting display>



▽ △ ▽ △

○ F14: Eco-mode setting confirmation

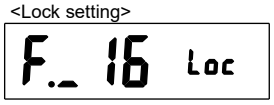
<CO_2 discharge amount calculation setting display>



▽ △ ▽ △

○ F15: CO_2 discharge amount setting confirmation

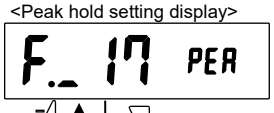
<Lock setting>



▽ △ ▽ △

○ F16: Lock setting confirmation

<Peak hold setting display>



▽ △ ▽ △

○ F17: Peak hold setting confirmation

<Model display>

▽ △ ▽ △

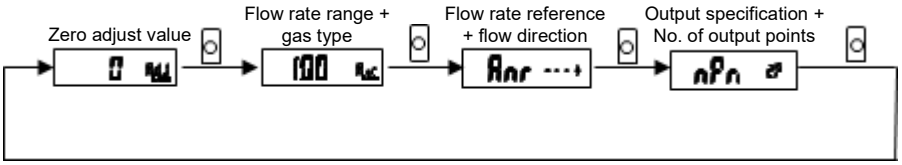
○ Model setting confirmation

Return to <CH1 operation setting display>

● **Model display**

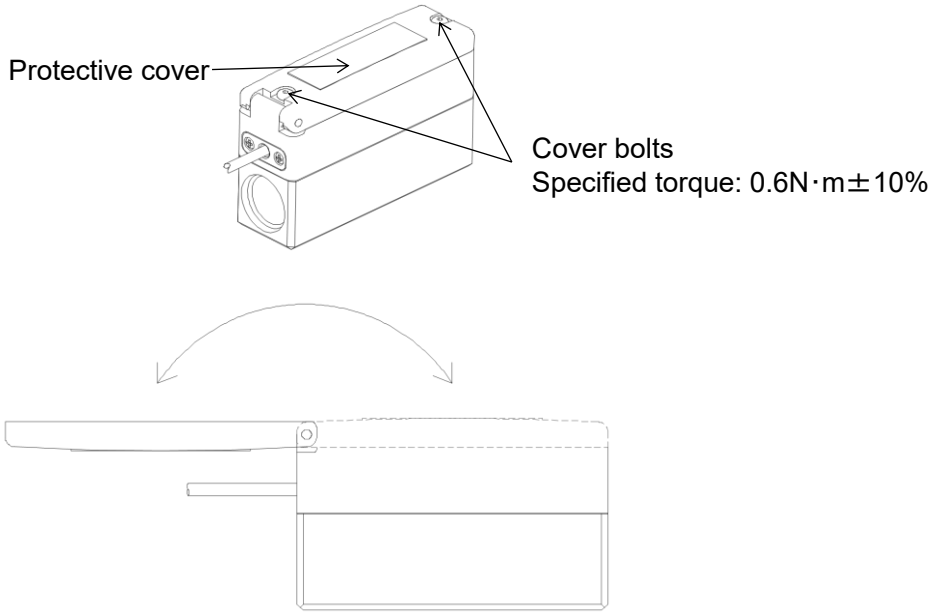
A model (the current setting state) can be confirmed.

It shows in the order of “Zero adjust value”, “Flow rate amount range + gas type”, “Flow rate reference + flow direction” and “Output specification + No. of output points”.



3.1.4 How to key operate environment-resistant specifications

Environment-resistant specifications can be key operated by opening the protective cover.
Loosen the two cover bolts and open the protective cover as shown in the figure below.

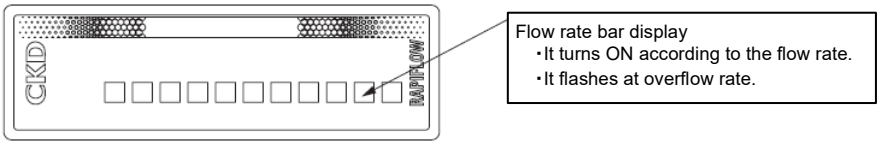


Excluding key operating, use this product with the protective cover is closed and the cover bolts are tighten and fixed with the specified torque.
When opening and closing the protective cover, make sure that there is no floating or displacement of the protective cover and that there is no adhered foreign matter, etc., on the seal surface. Tighten and fix with the specified torque.

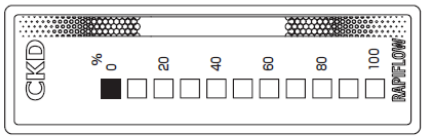
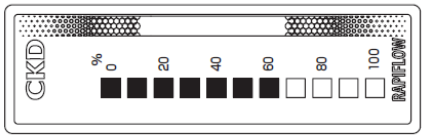
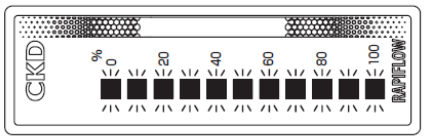
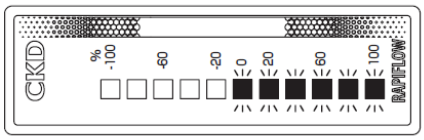
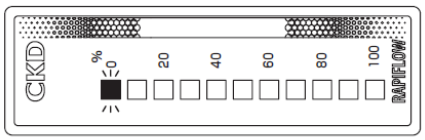
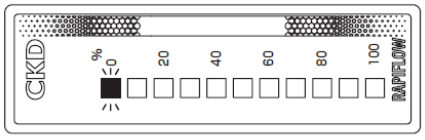
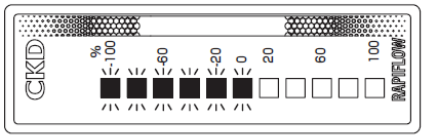
・The protective cover may come off from the main unit, but this is not a malfunction. Please reattach and use.

3.2 Use method of bar display type (FSM3-B series)

3.2.1 Names of display section

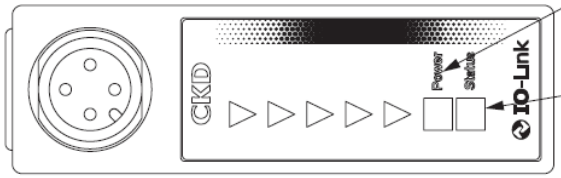


<Display example> The display is in case of FSM3-B101□□□□□□□.

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

3.3 How to use the IO-Link type (FSM3-C series)

3.3.1 Names of display section



Power lamp (green)
・Lights when power supply is ON.
・Blinks during IO-Link communication.

Status lamp (Green, Orange, Red)
・OFF… Turns OFF when the flow rate is within ±3%.
・Green… Turns ON within the measurement flow rate range.
・Orange… Overflow rate from 100%F.S. or more to less than 110%F.S.
・Red… Overflow rate with 110%F.S. or more.

3.3.2 Explanation of functions (IO-Link type)

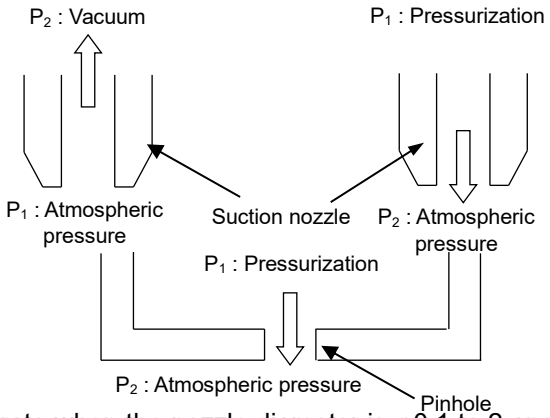
Item	Description	Factory setting
Instantaneous flow rate display	Displays the instantaneous flow rate.	-
Integrated flow rate display	Displays the integration flow counted after indication to start logging.	Stop
Instantaneous flow rate peak value display (Peak hold function)	Displays the maximum and minimum instantaneous flow rate values by providing instruction to start/stop of logging.	Stop
Error display	Displays the error details.	-
Warning display (warning)	Displays the warning details.	-
Power ON time display	Displays the total power ON time from the start. This time is not reset even if the power turns off. (Also not reset when using the reset setting)	-
Switch output function	The switch output operation function can be set. This function can be used to monitor whether the flow rate is within the set range or monitor whether it exceeds the set flow rate.	Not set
Setting of flow rate reference	Select the flow rate reference. Standard state (ANR): Converted into volumetric flow rate at 20°C, 1 atmospheric pressure, relative humidity 65%. (For gases other than air, it is 20°C, 1 atmospheric pressure, 0%RH). Reference state (NOR): Converted into volumetric flow rate at 0°C, 1 atmospheric pressure, relative humidity 0%.	ANR
Gas type switching	The measured gas can be changed. (The oxygen type does not have the gas type switching function)	Air
Changing travel average (Response time setting)	The travel average when measuring can be set. The average can be set in seven steps from 50 msec to 1500 msec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	50 msec
Lock setting	Parameter Lock can be set, which disables changing the parameters of the unit. Data Storage Lock can be set, which prohibits uploading and downloading set values to the master. (Parameter Lock and Data Storage Lock and be set simultaneously)	Not set
Zero adjust function	The zero point deviation is corrected. (Within ± 10%)	Not set
Data storage function	Uploading set values to the master and downloading set values from the master are possible. (Can be copied by the same model No.)	-
Reset function	Return to the factory settings. (Cannot reset while parameter lock is enabled)	-
Unit identification function	The model No., serial No., and other information can be checked over the network.	-

For details and communication specifications, refer to "1.3 Communication specification"

3.4 Flow rate logic calculation method

Use for flow rate range selection estimate when using a flow rate sensor for attaching/detaching of suction nozzle. A flow rate can be calculated from the pressure difference and inside/outside of the effective sectional area of nozzle (pinhole).

- Calculating flow rate from the effective sectional area
  - For $P_1 \geq 1.89P_2$ (sound velocity)
    $Q = 113.2 \times S \times P_1$
  - For $P_1 < 1.89P2$ (subsonic velocity)
    $Q = 226.4 \times S \times \sqrt{P_2 (P_1 - P_2)}$
    - Q : Flow rate L/min
    - P_1 : Primary side absolute pressure MPa
    - P_2 : Secondary side absolute pressure MPa
    - S : Effective sectional area of nozzle (pinhole) mm^2



- Calculation example

  The figure below shows the calculated value of flow rate when the nozzle diameter is φ0.1 to 2 and P_1 or P_2 is varied.

	P_1 (MPa) Absolute pressure	P_1 (MPa) Gauge pressure	P_2 (MPa) Absolute pressure	P_2 (MPa) Gauge pressure	Sound velocity/ Subsonic velocity	Flow rate calculation value (□/min)								
						φ0.1	φ0.2	φ0.3	φ0.4	φ0.5	φ0.7	φ1	φ1.5	φ2
Suction	0.1013	0	0.0313	-0.07	Sound 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	Sound 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	Sound 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 test)	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	25.455	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	Sound 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	Sound 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	Sound 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	Sound 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	Sound 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 piping, the flow rate that actually flows is larger than the calculated value. When selecting a flow rate, consider the leakage amount in piping.
- ·When there is a part narrower than the suction nozzle diameter in the middle of piping, the flow rate is squeezed causing it to be lower than the calculated value.
- ·The effective sectional area is an estimate. When the nozzle is narrow, the effective sectional area becomes smaller than the opening area of the nozzle.
- ·The response speed is determined by internal volume of piping from the flow rate sensor to the suction nozzle (pinhole). When performing a high speed detection, place the flow rate sensor near the suction nozzle so that the inner volume of piping can be reduced as much as possible.

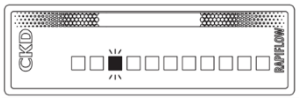
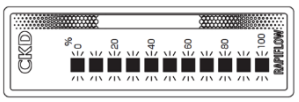
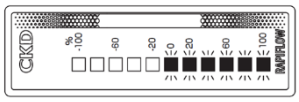
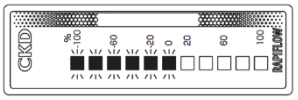
4. TROUBLESHOOTING

4.1 Error code (LCD display type)

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 chip is damaged.	Check that the flow rate is within the flow range and turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
	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 chip is damaged.	Check that the flow rate is within the flow range and turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
	An error occurred during CPU processing.	Turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
	The range at which zero adjustment is possible is exceeded.	Make sure to set the flow rate to zero, and then perform the zero adjustment.
	An error occurred during EEPROM reading or writing.	Turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
	An error occurred during memory reading or writing.	Turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
	Sensor failure has occurred.	Turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
	Setting copy failed.	Check the connection and try again.

Error code	Cause	Countermeasures
	Button operations are locked.	Release the lock before operation.
	A pin number is set.	Enter the set PIN number. * Be careful not to forget your PIN number. If you have forgotten your PIN code, please contact your nearest CKD sales office.
Blinking of 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.

4.2 Error code (Bar display type)

Error code	Cause	Countermeasures
The third from left blinks 	An error occurred during memory reading or writing.	Turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
[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- direction] The right half blinks 	Sensor failure	Check that the flow rate is within the flow range and turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.
[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- direction] The left half blinks 	Sensor failure	Check that the flow rate is within the flow range and turn the power supply ON again. If it still does not return to normal, the product may be faulty. Please replace the product. Also, if you feel any abnormality in the product, please stop using it and contact the nearest CKD sales office.

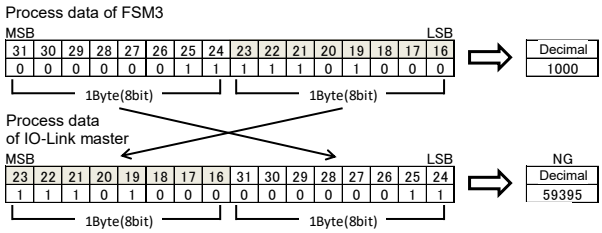
4.3 Error code (IO-Link type)

Refer to “1.3.6 Diagnosis”.

4.4 Troubleshooting

Trouble	Cause	Corrective action
No flow display (LCD display type)	Wrong connection of power source.	Connect the rated power supply correctly.
	It is in eco-mode.	Please press either the MODE key or the + key or - key to confirm that it will light again. (Do not push the button for a long time.) During the Eco-mode, the backlight of the display turns OFF unless the button is operated for about 1 minute.
	It may be difficult to see depending on the angle.	Change the mounting direction and change the viewing angle.
	Malfunction caused by noise.	Keep the FSM3 main unit and cable away from noise source.
	The external wiring is disconnected.	Please reconfirm / repair the external wiring.
	Output circuit is broken (damage on the main body)	Replace FSM3.
No flow display (IO-Link type)	Wrong connection of power source.	Connect the rated power supply correctly.
	Malfunction caused by noise.	Keep the FSM3 main unit and cable away from noise source.
	The external wiring is disconnected.	Please reconfirm / repair the external wiring.
	Output circuit is broken (damage on the main body)	Replace FSM3.
	IODD file is not imported to IO-link master. Or the IODD file is incorrect.	Download the latest IODD file from the CKD homepage, and then import that into the IO-Link master.
	The flow rate is out of the display range.	The flow rate may be out of the display range. Check for any errors or warnings. The status is also able to check with the status lamp on the FSM3. Lights green when the flow rate is within the measurement range, lights orange when the flow rate is 100% to less than 110%, and lights red when the flow rate is 110% or more.
	No communication.	When communication is in progress, the power lamp on the FSM3 is blinking green. If it is lit green, communication is not progress, so check if FSM3 is connected to the IO-Link master. Also, check that the settings required for communication have been completed.
No analog output (LCD display type and bar display type)	Wrong connection of power source.	Connect the rated power supply correctly.
	Wrong connecting line.	Please reconfirm the external wiring and rewire.
	Analog GND line is not connected.	Check the wiring of the connected device. [Example] The connected device and the analog output of FSM3 are connected, but GND is not connected. Or the connected device and analog output of FSM3 GND were not in common GND.
	Malfunction caused by noise.	Keep the FSM3 main unit and cable away from noise source.
	The external wiring is disconnected.	Please reconfirm / repair the external wiring.
	Output circuit is broken (damage on the main body)	Replace FSM3.
No switch output (LCD display type)	Wrong connection of power source.	Connect the rated power supply correctly.
	Wrong connecting line.	Please use the "F.91: Forced output function" and check the I/O with the connected device. As a result of the I/O check, if there is no conduction, check the cable color and correctly re-wire.
	Output specification does not match. (NPN and PNP)	Make sure that it matches the specification of the connected device. (For example, it does not operate normally if FSM3 is NPN specification and the input unit of PLC on the connection destination is PNP specification.)
	Malfunction caused by noise.	Keep the main unit and cable away from noise source.
	The external wiring is disconnected.	Please use the "F.91: Forced output function" and check the I/O with the connected device. As a result of the I/O check, if there is no conduction, replace the rewiring or wiring.
	Output circuit is broken (damage on the main body)	Please use the "F.91: Forced output function" and check the I/O with the connected device. As a result of the I/O check, if there is no problem with wiring and there is no conduction, replace FSM3.

Trouble	Cause	Corrective action
Flow display does not reach 0. The zero point is shifted. (Common to all types)	Fluid leakage	Check piping for leakage.
	Foreign objects are mixed inside the main body. (Foreign objects sticking to sensor chip.)	Foreign objects are in the main body and correct flow rate cannot be viewed correctly. Replace FSM3. When installing the main body, make sure that there is no foreign object in the piping or the port of the main unit, and use a filter so that foreign objects do not get mixed in the main body.
	Malfunction caused by noise.	Keep the FSM3 main unit and cable away from noise source.
	Sensor chip inside the main body is broken.	Replace FSM3.
	Fluid outside the specification is flowing.	Please use with the fluid that this product supports. It cannot be used correctly with fluids outside specifications.
	Incorrect the gas type setting.	Make sure that the fluid and gas type setting are correct. If the gas type setting is incorrect, measurement cannot be performed correctly.
	The zero point is shifted.	Please adjust the zero point and correct the zero point. (Bar display type has no zero adjustment function.)
	FSM3 lack of electrification (insufficient warming up).	Please use it after energizing (= warm up) for more than 5 minutes when using. If there is no energization (= warming up) for more than 5 minutes, the zero point may be shifted.
The flow rate indication does not change from 0. (All types)	Foreign objects are mixed inside the main body and they are clogged.	Foreign objects are mixed inside the main body and it is not possible to measure the correct flow rate. Please replace FSM3. When installing the main body, make sure that there is no foreign object in the piping or the port of the main body, and use a filter so that foreign object does not get mixed in the main body.
The measured flow rate is not stable. *1: Excluding bar type. *2: LCD type only.	The fluid is pulsating.	Reduce pulsation by providing a tank etc..
		Change the response time. (*1)
		Change the display cycle. (*2)
		Increase the hysteresis setting. (*1)
	The power supply voltage is abnormal. (Insufficient voltage, insufficient current capacity)	Supply rated voltage.
		Secure the current capacity of the power supply.
	Malfunction caused by noise.	Keep the FSM3 main unit and cable away from noise source.
	The flow rate is at the boundary of display resolution.	Change the response time. (*1)
		Change the display cycle. (*2)

Trouble	Cause	Corrective action
Flow indicator is wrong, Feel it is inaccurate. (All types)	Foreign objects are mixed inside the main body. (Foreign objects sticking to sensor chip.)	Foreign objects are mixed inside the main body and it is not possible to measure the correct flow rate. Please replace FSM3. When installing the main body, make sure that there is no foreign object in the piping or the port of the main body, and use a filter so that foreign object does not get mixed in the main body.
	Malfunction caused by noise.	Keep the main unit and cable away from noise source.
	Sensor chip inside the main body is broken.	Replace FSM3.
	The flow rate range type being used is large.	This product accuracy is ±3% of flow rate range (full scale flow rate). Measuring small flows with high flow rate range type will result in poor accuracy. Please reselect to the flow range type corresponding to the measured flow rate and replace it.
	The flow is disturbed, the uneven flow is occurring.	It is considered that the equipment causing the uneven flow is installed on the primary side of this product. If there is the uneven flow, it may cause errors, so please provide a straight pipe part between this product and the primary side equipment. [Examples of instrument that causing the uneven flow] Regulator, solenoid valve, flow rate control valve, controller.
	Difference between ANR and NOR	Flow rate standard of FSM3 remains at ANR setting, and there is a difference in measurement when flow rate is set with flow meter based on NOR. Change the flow standard of FSM3 to NOR.
	Insufficient FSM3 warm-up (insufficient warming up)	Please use it after energizing (= warming up) for more than 5 minutes when using. If there is no energization (= warming up) for more than 5 minutes, the zero point may be shifted.
	Fluid outside the specification is flowing	Please use with the fluid that this product supports. It cannot be used correctly with fluids outside specifications,
	Incorrect gas type setting	Please check whether the fluid to be used and gas type setting are correct. If cannot be used correctly if the gas type setting is incorrect.
Flow indicator is wrong, Feel it is inaccurate. (IO-Link types)	Process data is not imported correctly on the IO-link master.	Process data is input to the IO- Link master in an array of 1Byte (8bit). Depending on the IO-Link master, the flow rate cannot be displayed correctly unless the array of 1Byte (8bit) is inverted. See the example below.  If the array is not inverted, the wrong flow rate is displayed. Check your IO-Link master.

5. WARRANTY PROVISIONS

5.1 Warranty conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

5.2 Warranty period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer