CKD

SM-662466-A

INSTRUCTION MANUAL

SMALL SIZE FLOW SENSOR RAPIFLOW®

FSM3 Series

·LCD display (FSM3-L Series)
·Bar display (FSM3-B Series)
·IO-Link (FSM3-C Series)

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

2nd EDITION

CKD株式会社

Safety precautions

Always read this section before use.

When designing and manufacturing a device using CKD products, the manufacturer is obligated to check that device safety mechanism, pneumatic control circuit, or water control circuit and the system operated by electrical control that controls the devices are secured.
It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured, and manufacture a safe device.

Warning

①This product is designed and manufactured as a general industrial machine part. It must be handled by an operator having sufficient knowledge and experience in handling.

②Use this product in accordance with specifications.

This product must be used within its stated specifications. In addition, never modify or additionally machine this product. This product is intended for use in general industrial machinery equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments. (Note that this product can be used when CKD is consulted prior to its usage and the customer consents to CKD product specifications. The customer should provide safety measures to avoid danger in the event of problems.)

(1) Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, device or applications in contract with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications.
(2) Use for applications where life or assets could be significantly affected, and special safety measures are required.

③Observe organization standards and regulations, etc. related to the safety of device design and control, etc.

ISO 4414, JIS B 8370 (General rules for pneumatic systems)
JFPS2008 (Principles for pneumatic cylinder selection and use)
Including High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, body standards and regulations, etc.

④Do not handle, pipe, or remove devices before confirming safety.

(1) Inspect and service the machine and devices after confirming safety of all systems related to this product.
(2) Note that there may be hot or charged sections even after operation is stopped.
(3) When inspecting or servicing the device, turn OFF the energy source (air supply or water supply), and turn OFF power to the facility. Discharge any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.
(4) When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety, such as pop-out prevention measures, is secured.

⑤Observe warnings and cautions on the pages below to prevent accidents.

■The precautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

DANGER:	When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.
WARNING:	If handled incorrectly, a dangerous situation may occur, resulting in death or serious injury.
CAUTION:	When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

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

[SM-662466-A]

DESIGN AND SELECTION

DANGER:

Working fluid

●Do not use this product for flammable fluids.

Working environment

●Explosion-proof environment

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

WARNING:

Working fluid

●This product cannot be used as a business meter.
Do not use this product for commercial transactions as it is not compliant with the Measurement Act. Intended applications include industrial sensors.

●For fluids other than the applicable fluid, the accuracy is a reference value.

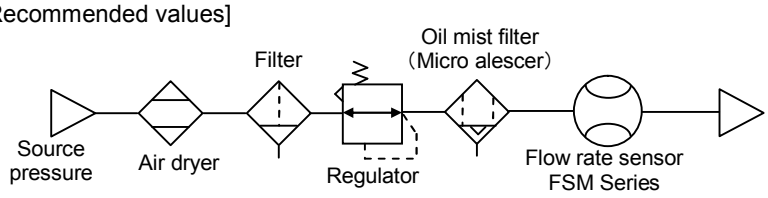
●When using the valve with liquified gases such as carbon dioxide, always vaporize the gas. Faults could result if the liquified gas enters this product.

●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

●When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1:1:1 to 1:6:2. Compressed air from the compressor contains drainage (water, oil oxide, foreign matters, etc.). So install a filter, air dryer, and oil mist filter (micro alescer) on the primary side (upper stream side) of the sensor. The sensor's meshing rectifies flow in the pipe. It does not filter out foreign matters, so provide a filter.

[Recommended values]



●Working pressure/Flow rate range
Applications exceeding the max. working pressure and specified flow rate range may result in faults. Use this product only within the specified range. If energized in a vacuum state of -0.07 MPa or less, the sensor's heat dissipation will suffer, leading to degradation of the sensor.

●When using a valve on the primary side of the sensor, use only valves with oil-prohibited specifications. This sensor could malfunction or fail if exposed to splattering grease, oil, etc. As friction powder may be generated depending on the valve, mount a filter to prevent the powder from entering the sensor.

●Do not allow oxygen gas to flow through products that are not oil prohibited. There is a danger of ignition accidents. In addition, even if it is an oil prohibited treated product, please do not use it for oxygen when used to flow gas other than oxygen even once.

Working environment

DANGER:

●Explosion-proof environments

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

WARNING:

●Corrosive environment

Do not use this product in an atmosphere containing corrosive gases such as sulfur dioxide.

⚠ WARNING:

●Ambient/fluid temperature
Use ambient temperature/fluid temperature from 0 to 50°C within specified range. Even if the temperature is within the specified range, do not use this product if the ambient temperature and fluid temperature could suddenly change and cause dew to condense.

●Drip-proof environment
The degree of protection of this product is equivalent to IP40. Do not install this product where water, salt, dust, or swarf is present or in a pressurized or depressurized environment. The product cannot be used with large temperature variations or high temperature/humidity since condensation may occur inside the body.

⚠ CAUTION:

Flow rate unit

●This product's flow rate is measured at a mass flow rate unaffected by temperature or pressure. The unit is ℓ/min, the display used when the mass flow rate is converted to volumetric flow rate at 20℃, 1 barometric pressure (101kPa), relative humidity 65%. (For gases other than air, 20℃, 1 barometric pressure(101kPa),relative humidity 0%).

Overflow

●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.

Note of Integrated Throttle valve type

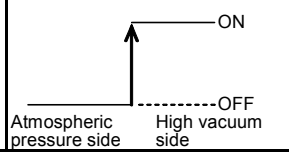
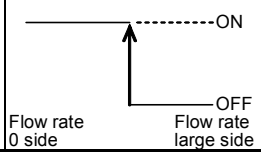
●This valve cannot be used as a stop valve that requires no leakage. Slight leakage is allowed for in product's specifications.

Use for suction confirmation, etc.

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

●Consider the atmospheric dew point and the product's ambient temperature, and use the product under conditions in which dew does not condense in pipes.

●When 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 sensor (switch)
Adsorption verification	ON at setting value or more	ON at setting value or less
		

●When this product is used for vacuum applications such as air suction, do not bend the tube near the push-in fitting. If stress is applied to the tube near the push-in fitting, insert an insert ring into the tube, and connect the tube to the push-in fitting.

●Select the flow rate range based on the operating vacuum pressure and suction nozzle. Refer to Page 84 on the attached sheet for "7. Technical data [7.1How to select flow sensor]"

CAUTION:

●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.

Other

●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.

INSTALLATION & ADJUSTMENT

CAUTION:

Piping

●Always attach the pipes before starting wiring.

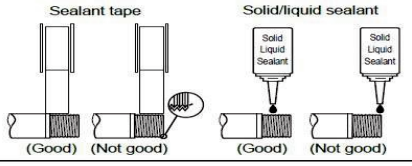
●Align the fluid flow direction to the direction indicated on the FSM3 when connecting the pipes.

●Do not install the regulator/solenoid valve, etc., immediately before this product. Generated drift may cause errors. Provide a straight piping section if required.

●Before installing piping, clean out the pipes using air blower to remove all foreign matter and cutting chips from the pipes. The rectifier or sensor chip could be damaged if a large amount of foreign matter, cutting chips, etc., enters.

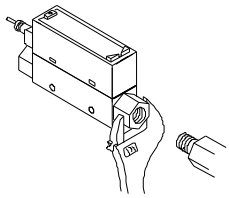
●Check that sealant tape or sealant material does not get inside during piping. * When using for clean room specifications, make sure that the sealant material matches the system.

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



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

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



●Refer to the torque below so as not to apply excessive screw-in torque or load torque to the connection port.

[Reference value]

Port thread	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

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

●Connect a fitting even when using the metal body type with the OUT side opened. The port filter could come off.

●Make sure that the leakage detection solution does not enter the product when inspecting the pipe for leaks.

⚠ CAUTION:

●Do not turn the fitting while the product fluid pressure is on, since it may cause external leakage. Also avoid use that may cause the fitting to rotate during operation.

Mounting

●The LCD display type flow rate display meter uses a liquid crystal display. This may be difficult to read depending on the angle.

●Do not install the multiple product bodies in close contact. The generation of heat on each part could cause the product's temperature to rise, hastening changes in characteristics or deterioration of the resin material. When using the product in a row set intervals of distance of 10mm and over.

●Although the mounting is "unrestricted in vertical/horizontal direction", the characteristics may vary depending on difference in the mounting orientations or piping conditions.

●Please be careful as it may interfere with DIN rail mounting if the elbow fitting is mounted downward.

●Please note that the bracket may interfere with the elbow fitting depending on the mounting position.

⚠ DANGER:

Wiring

●Use power supply voltage and output within the specified voltage. If voltage exceeding the specified voltage is applied, the sensor could malfunction or be damaged, or electrical shock or fire could occur. Do not use any load that exceeds the rated output. Otherwise, output damage or fire may result.

●Stop the control device and equipment and turn power OFF before wiring. Starting operation suddenly could cause unpredictable and dangerous operation. Conduct an energized test with controls and machine devices stopped, and set target switch data. Be sure to discharge any accumulated electrostatic charge among personnel, tools, or equipment before and during work. Connect and wire bending resistant material, such as robot wire material for movable sections.

⚠ WARNING:

Wiring

●Install the product and wiring away from sources of noise, such as power distribution wires. Provide separate countermeasures for surge applied to the power cable. The display or output could fluctuate.

●Do not short-circuit the load. Failure to observe this could result in rupture or burning.

●Check wiring insulation.
Check that wires do not come into contact with other circuits, that no ground faults occur, and that the insulator between terminals is not defective. Overcurrent could flow in and damage the sensor.

●Check line color when wiring. Incorrect wiring could result in sensor damage and malfunctions, check wire color against the instruction manual before wiring.

●Connecting load
The output impedance of the analog output section is approx. 1 kΩ. If the impedance of the connecting load is small, output error increases. Check error with the impedance of the connecting load before using. (The analog output current output type is excluded.)

[Example of calculation]

FSM3（Voltage output） impedance: Ro=1kΩ
Load internal impedance : Rx=1MΩ

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

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

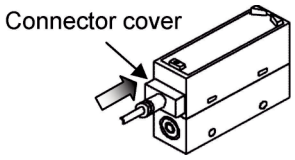
⚠ WARNING:

●Use a stabilized DC power supply within the specified rating that has been insulated from the AC power supply. A non-insulated power supply could result in electrical shock. If power is not stabilized, the peak value could be exceeded. This could damage the product or impair accuracy.

●Do not use at levels exceeding the power supply voltage range. If voltage exceeding this range is applied or if AC power is applied, the product could rupture or burn.

●Check that stress (7 N and over) is not applied to cable leadouts or connectors.

●Always attach the connector cover after connecting the connector.



●The power supply for the metal body (stainless steel body, aluminum body) is a DC stabilized power supply completely isolated from the AC primary side. Connect either the + side or - side of the power to the F.G. Between the metal body internal power circuit and metal body, a varistor (limit voltage approx. 40 V) is connected to prevent dielectric breakdown of the sensor. Do not conduct a withstand voltage test or insulation resistance test between the internal power circuit and metal body. Disconnect wiring first if this testing is required. An excessive potential difference between power and metal body will burn internal parts. After installing, connecting and wiring the metal body, electrical welding of the equipment/frame or short-circuit accidents, etc., could cause welding current, excessive high voltage caused by welding, or surge voltage, etc., to run through the wiring, ground wire, or fluid path connected between such devices, damaging wires or devices. Conduct any work such as electrical welding after removing this device and disconnecting all electric wires connected to the F.G.

⚠ CAUTION:

During adjustment

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

Needle valve integrated

●Do not turn the knob forcibly when fully closing or opening it (0.05 N·m or less). Do not use the lock nut to adjust the needle. Otherwise this could cause needle galling or damage.

●The set flow rate may unstable if turning the knob of the throttle valve forcibly when fully closing. No not overly tighten the dial.

●Check that lock nuts are not loose. Actuator speed cannot be controlled if the lock nut is loose.

●A stopper mechanism is provided, but damage could result if the needle is turned too far.

●Fix the position of the knob by lock nut. Slack of the lock nut result in instability of the flow rate.

DURING USE & MAINTENANCE

⚠ WARNING:

●Working conditions for CE compliance
This product is CE-marked, indicating conformity with the EMC Directives. EN61000-6-2; regulation matched to immunity applies to this product. Conditions below are necessary to comply with these standards.
[Conditions]
- The assessment of this product is performed by using a cable pairing a power supply line and a signal line, treating this cable as a signal line.
- This product is not equipped with surge immunity.
  Implement surge protection measures on the system side.

●Do not disassemble or modify this product. Doing so could result in faults.

●Output accuracy is affected by temperature characteristics and heat generated when energized. Provide a standby time (5 minutes and more) after turning the power ON for use.

●Immediately after power is turned ON, this product does not start flow rate detection switch operation for approx. 5 seconds to complete self-diagnosis. Provide a control circuit/program that ignores signals for at least 5 seconds after power is turned ON.

⚠ CAUTION:

●If a problem occurs during operation, immediately turn power off, stop use, and contact your dealer.

●This product uses a micro-sensor chip, and must be installed where it will not be subject to dropping, impact or vibration. Handle this product as a precision component during installation and transportation.

●Keep this product's flow rate within the rated flow range.

●Use this product within the working pressure range.

●Do not turn the product’s fitting while the fluid pressure is on, since it may cause external leakage. Also avoid use that may cause the fitting to rotate during operation.

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

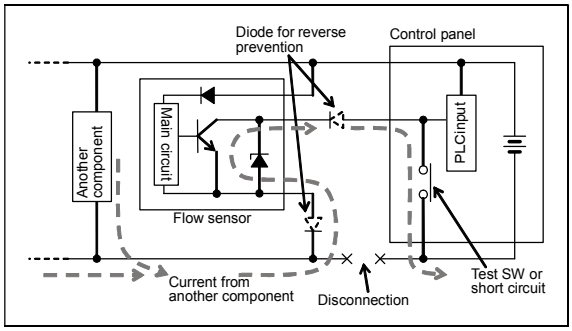
●Even if it exceeds the measurement flow range, analog output is done. However, we will not guarantee accuracy, so please be forewarned. For details on the display, refer to the section on display and the section on error code.

●The accuracy may vary from the initial status depending on the working environment or working conditions. It is recommended to check the operation of the product periodically.

●The sensor chip will degrade when used for a long time and cause the detected flow rate to vary. Periodically inspect the accuracy of the product.

●Replace the working gas in the flow path before changing the gas type.

●Pay attention to the reverse current caused by disconnected wires/wiring resistance. If other devices, including a flow rate sensor, are connected to the same power 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.

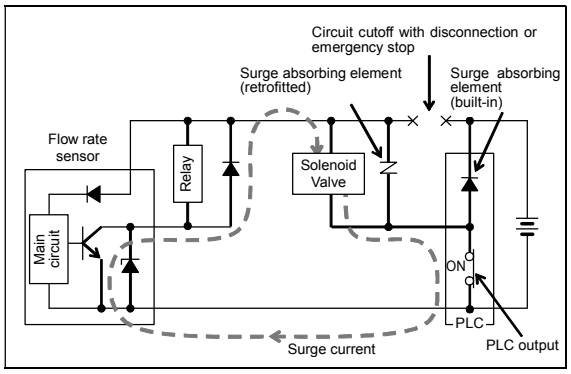


⚠ CAUTION:

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

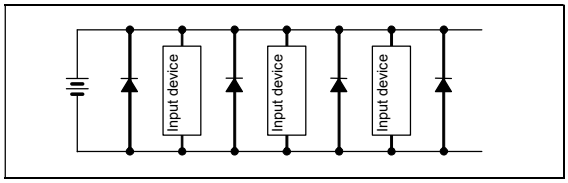
(1) Avoid centralizing current at the power cable, especially the minus side power cable, and use as thick a cable as possible.
(2) Limit the number of devices connected to the same power supply as the flow rate sensor.
(3) Insert a diode parallel to the flow rate sensor's output line to prevent the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

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



Take countermeasures as followings to prevent damage caused by reverse current.

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



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

●When using the LCD display, do not press down on the display section. This may be lead to failure.

●The case is made of resin. Do not use solvent, alcohol or detergent in cleaning, since the resin could absorb it. Wipe off dirt with a rag soaked in a diluted neutral detergent solution and wrung out well.

Needle valve integrated

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

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SMALL SIZE FLOW SENSOR RAPIFLOW FSM3 Series

Manual No. SM-662466-A

Please see the instruction manual (D2-180166) about the separated indicator type.

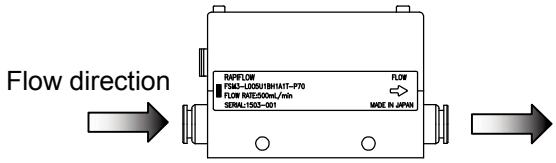
edit Oct.24.2018

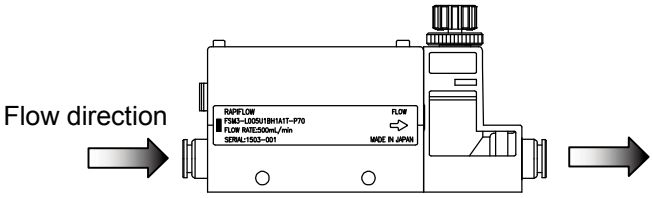
1 INSTALLATION

1.1 Piping

[Caution]

Pipe so that the flow direction conforms to the direction of the arrow indicated on the sensor body.



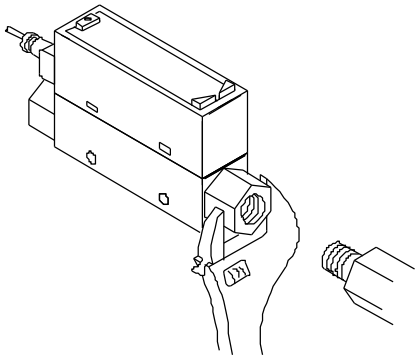


●Before piping, flash the pipe to remove foreign matter, swarf, etc., from the inside.

●When piping the sensor, do not apply excessive screw-in and load torques to the port. Attach a wrench to metal sections when tightening pipes so that stress is not applied to the resin section.

●When piping, apply a spanner on the metal section so as not to apply stress onto the resin section.

Set screw	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



●When piping, care must be taken that sealing tape and adhesive must not enter the inside.

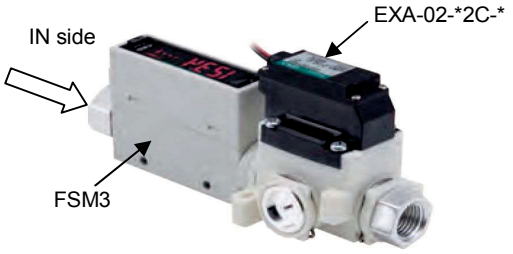
●If a push-in fitting is used, the tube must be inserted completely. Pulls the tube to confirm that it cannot be removed.

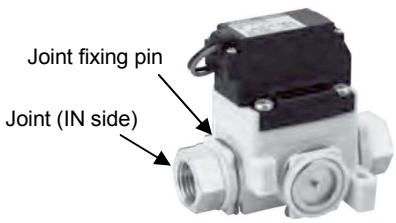
●When connecting the optional EXA-02-□2C-□ with the EXA connection fitting of FSM3, remove the IN side joint fixing pin and joint of the EXA. Next, completely insert the special connection joint on the OUT side of the FSM3. Finally, fix it with the fitting pin again.

· In order to eliminate the influence of grease and oil inflow, be sure to attach the EXA to the OUT side of the FSM3.

· Please use a lead wire (without lamp / surge suppressor) coil option for EXA. The DIN terminal box cannot be installed due to interference of from the terminal box.

· Before using, always check the assembly is correct and there is no external leakage.

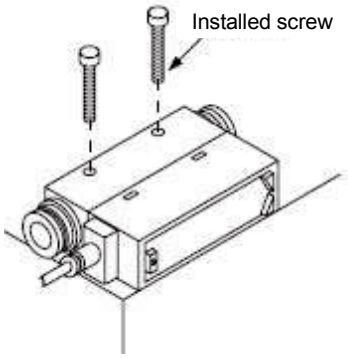




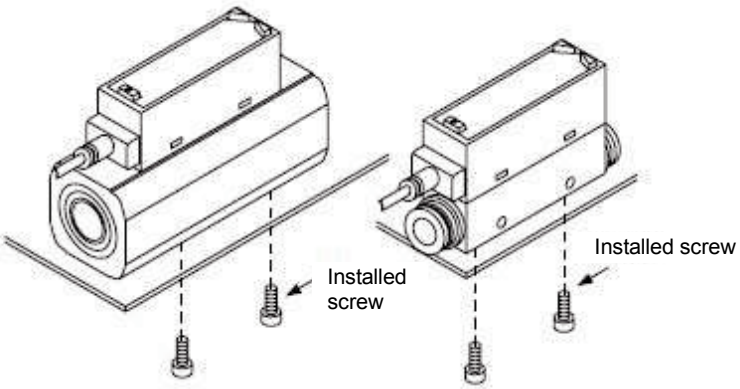
1.2 Installation

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

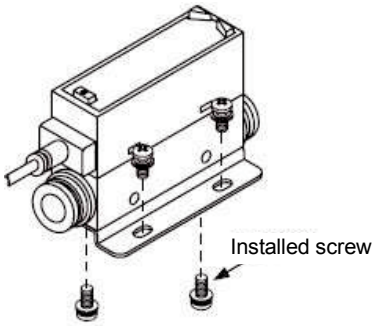
Lateral mounting (use of through hole)



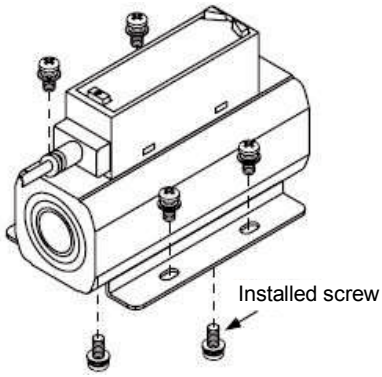
Vertical mounting (use of female thread on bottom surface)



Bracket mounting (use of dedicated bracket)

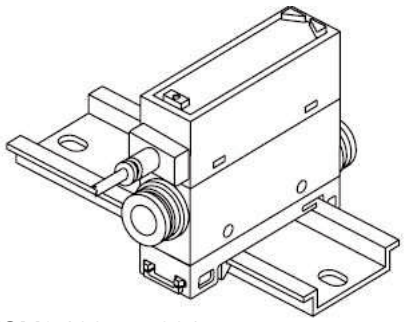


FSM3-*005 to 201
Single item model No.: FSM3-H



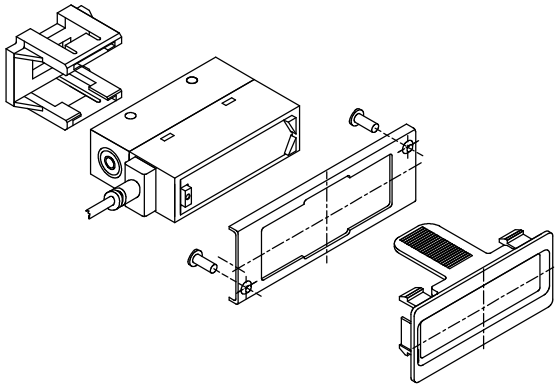
FSM3-*501 / 102
Single item model No.: FSM3-J

DIN rail mount (use of dedicated Kit)



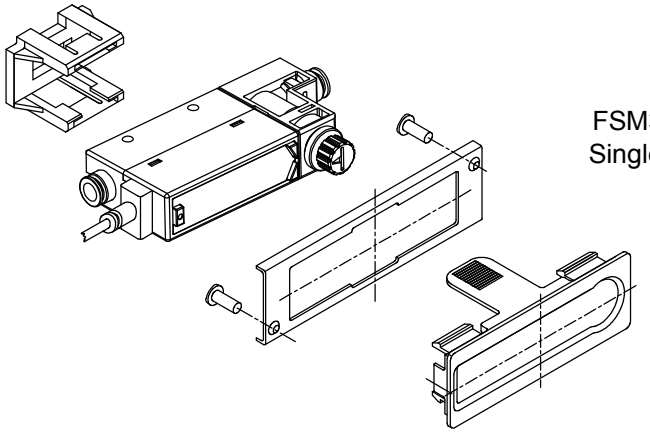
FSM3-*005 to 201
Single item model No.: FSM3-M

Panel mounting (use of dedicated Kit)

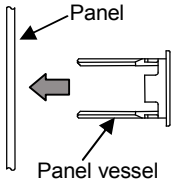
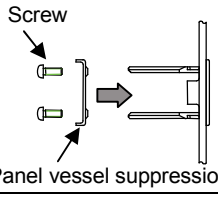
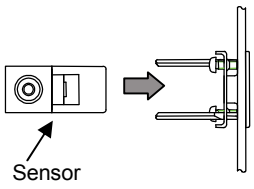
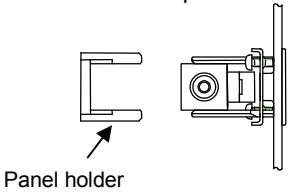
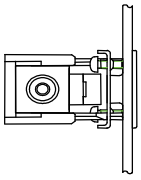


FSM3-*005 to 201 (non needle valve)
Single item model No.: FSM3-K

Panel mounting (use of dedicated Kit)



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. 	The panel vessel is inserted from the back side of the panel, and holding with the screw. 	The separated indicator is inserted from the back side of the panel. 
[4]	[5]	
The panel holder is inserted from the back side of the panel. 	The panel holder is pushed until the sensor is firmly fixed, and connector is attached. 	

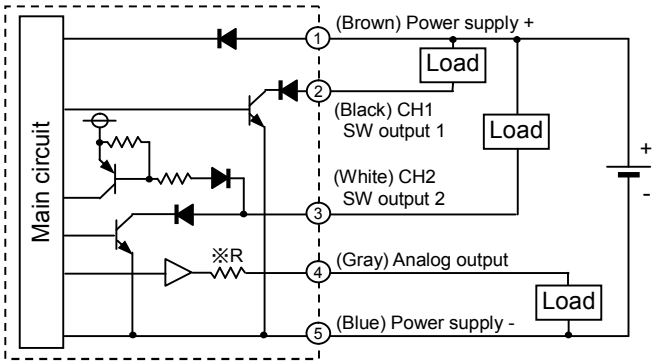
・Please fix the panel vessel using a torque of 0.06 N·m.
・Please do the piping work before panel mounting, and please do not add stress to parts of the panel mount.
・When mounting the panel, please ensure that vibration is not applied to the product.
・For panel cutout dimensions, refer to "6.3.4 Option" (page 80).

1.3 Wiring

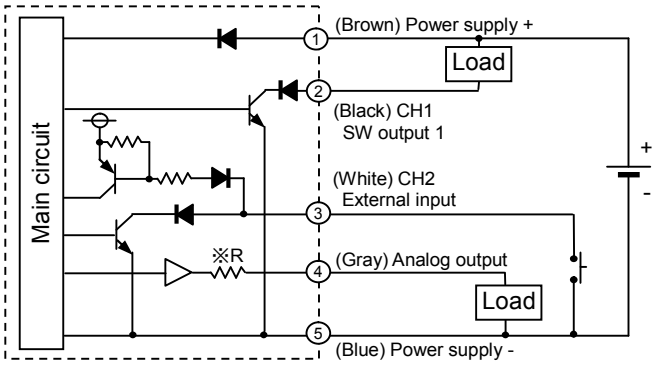
1.3.1 LCD display (NPN output)

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

Selected function of CH2 is switch output



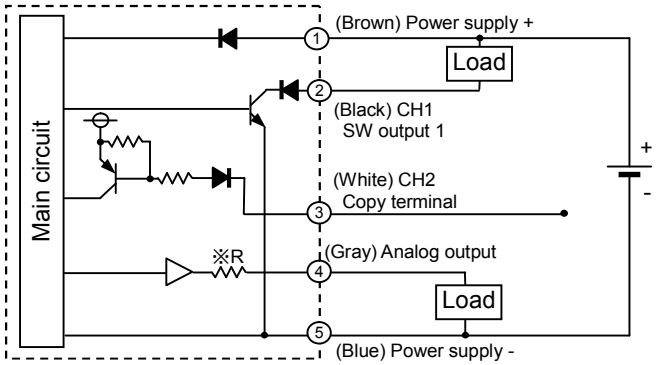
Selected function of CH2 is external input



●FSM3-L*****A/E（One analog, One switch, Copy function）

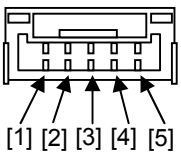
Model with the copy function

※ When using the copy function please refer to "1.3.3 When copying setting values"



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

connector



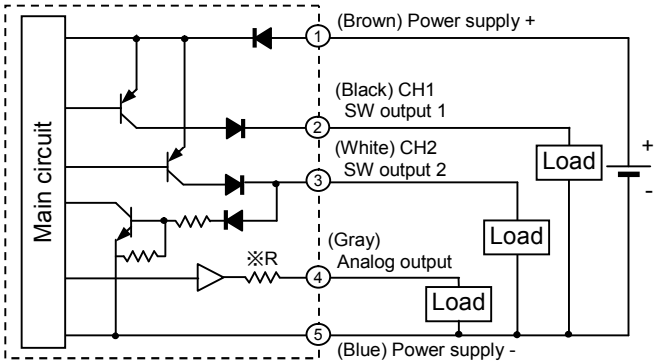
(FSM3 side)

Pin No.	Line color	Content
[1]	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
[2]	Black	CH1(Switch output 1: max50mA)
[3]	White	CH2(Switch output 2: max50mA or External input or Copy terminal)
[4]	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ and over Current output: 4 to 20 mA load impedance 300 Ω or less
[5]	Blue	Power supply- (GND)

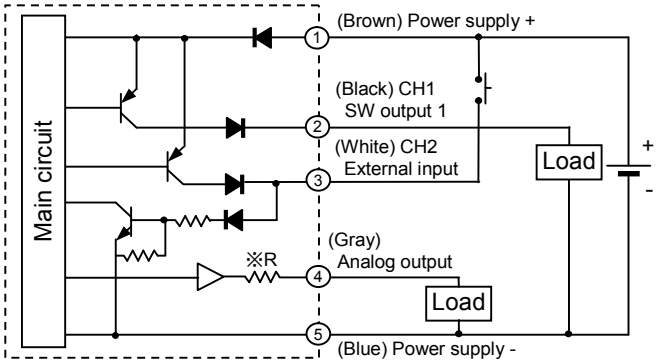
1.3.2 LCD display (PNP output)

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

Selected function of CH2 is switch output



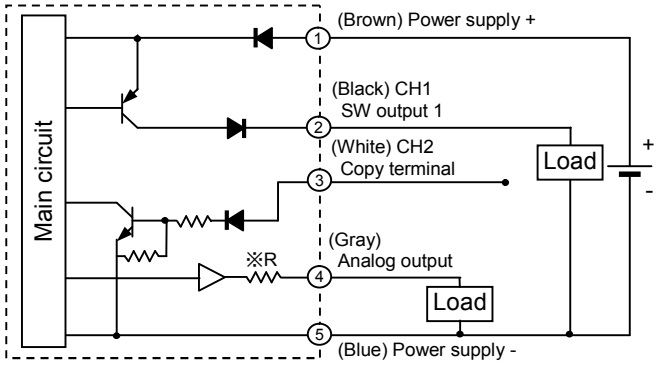
Selected function of CH2 is external input



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

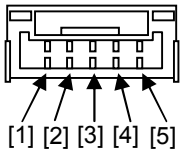
Model with the copy function

※ When using the copy function, please refer to "1.3.3 When copying setting values"



※ Analog voltage output R = approx.1kΩ
Analog current output R = approx.100Ω

connector

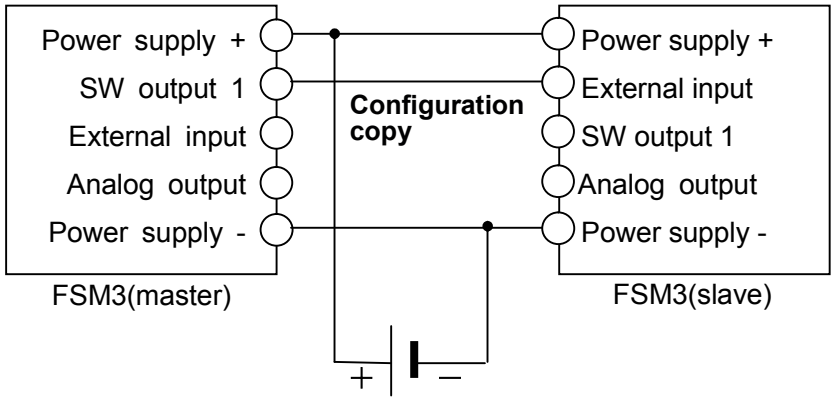


(FSM3 side)

Pin No.	Line color	Content
[1]	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
[2]	Black	CH1(Switch output 1: max50mA)
[3]	White	CH2(Switch output 2: max50mA or External input or Copy terminal)
[4]	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ and over Current output: 4 to 20 mA load impedance 300 Ω or less
[5]	Blue	Power supply- (GND)

1.3.3 When copying setting values

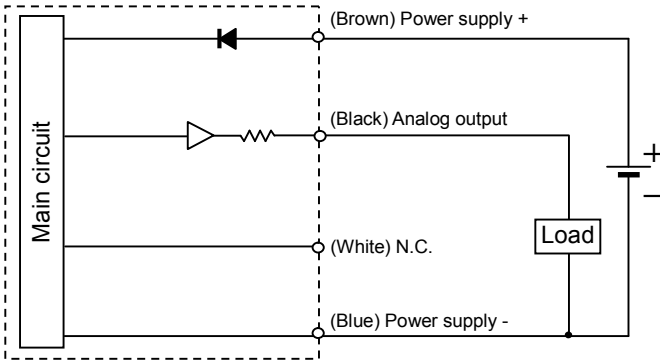
●FSM3-L*****A/C/E/G/**（LCD indicator, with copy function）



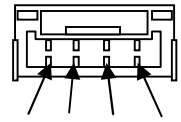
Connect CH1(SW output) of the origin of copy (master) and CH2 (copy terminal) of the copy destination (Slave).

1.3.4 Bar display

●FSM3-B



connector

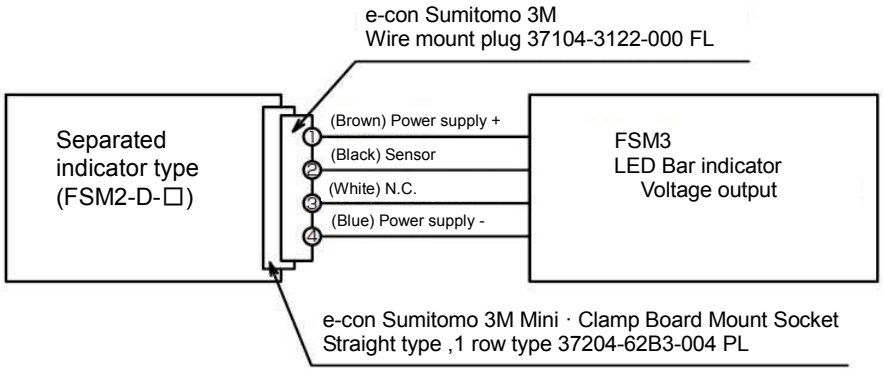


(FSM3 side)

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

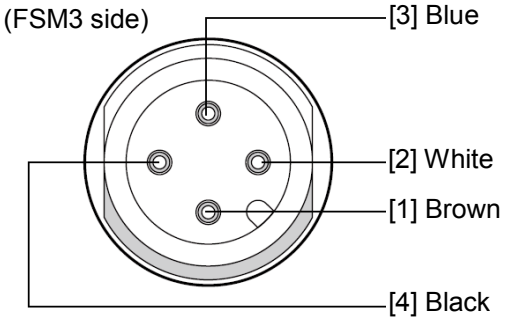
Pin No.	Line color	Content
[1]	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
[2]	Black	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ and over Current output: 4 to 20 mA load impedance 300 Ω or less
[3]	White	N.C.
[4]	Blue	Power supply- (GND)

1.3.5 Connection between Bar display and separate display



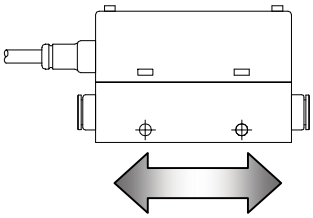
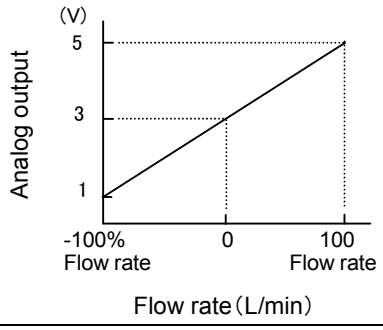
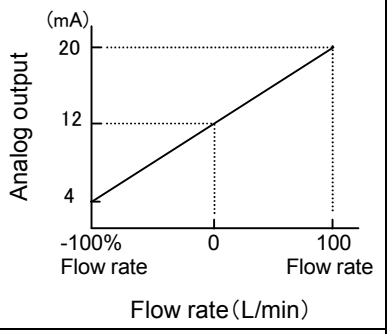
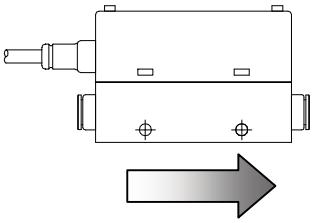
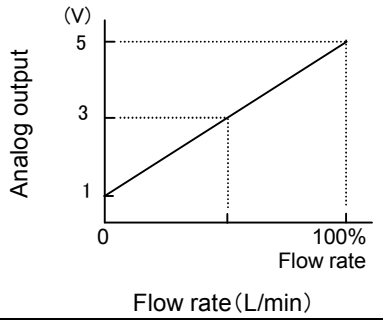
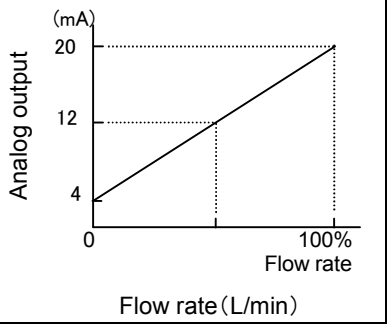
1.3.6 IO-Link

●FSM3-C



Pin No.	Line color	Content
[1]	Brown	Power supply(+)(DC18 to 30V)
[2]	White	N.C.
[3]	Blue	0V(GND)
[4]	Black	C/Q(IO-Link)

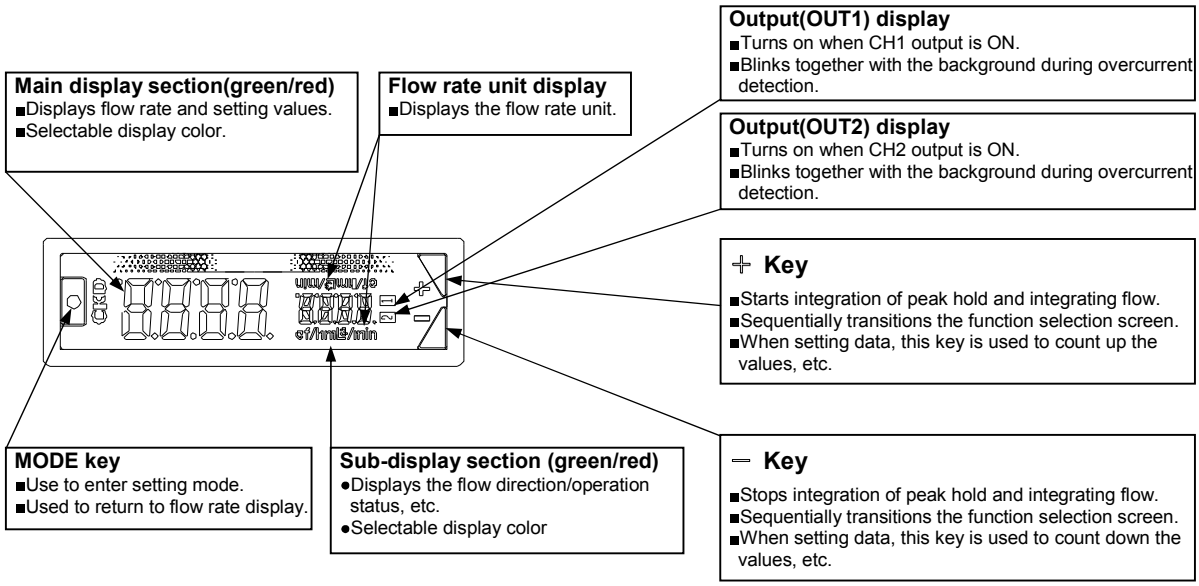
1.4 Analog output characteristics

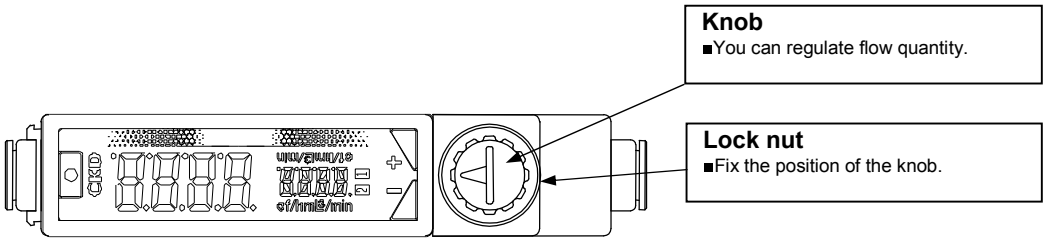
Flow direction	Voltage output	Current output
[Bi-directional] 		
[Uni-directional] 		

Notes

2. How to use the LCD display (FSM3-L)

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





2.2 Function (LCD display)

●Normal operation (RUN mode) (Refer to Page 21 for the operation.)

Item	Description	Setting at shipping out of factory
Instantaneous flow rate display	The instantaneous flow rate is displayed.	Instantaneous flow rate display
Peak hold function	Max. and min. values for the flow rate within a set interval are displayed.	
CO_2 discharge rate display	By setting the power, discharge pressure, flow rate of the compressor, as well as the conversion coefficient, you can learn how much CO_2 is being discharged. (Calculated reference value) Can only be used when the gas type is set to “air”.	
Integrating flow display	An integrated flow is displayed. The switch output function includes a function to turn the switch ON/OFF at a level higher than the recommended cumulative value, and an integrated pulse function to output the pulse at a set cumulative value.	

SET mode (Refer to Page 22 for the operation.)

No.	Description	Explanation	Default setting
F.01	Selection of CH1 operation	Select the function of CH1. You can set switch output operation and set the integrated flow pulse.	No switch output
F.02	Selection of CH2 operation	Select the function of CH2. Select whether to use CH2 as switch output, or external input (integrated value reset / auto reference).	No switch output
F.03	Integrating functions setting	You can choose to acquire integrating flow values consecutively or at set times. You can also decide whether or not to hold that data.	Consecutive acquisition: hold data 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 color for normal display and for switch output ON can be set.	At normal: Green At switch output ON: Red
F.06	Flow rate direction setting (Bi-directional only)	Setting the flow direction. Setting available for bi-directional, one-side forward direction or one-side reverse direction.	Bi-direction
F.07	Display inversion Function	The LCD display can be vertically inverted.	Standard display
F.08	Reference state setting	Select from the standard state or reference state. Standard state (ANR): Converted into volumetric flow rate at 20℃, 1 barometric pressure, relative humidity 65%. (For gases other than air, 20, 1 barometric pressure, 0%RH). Reference state (NOR): Converted into volumetric flow rate at 0℃, 1 barometric pressure, relative humidity 0%.	ANR
F.09	Unit setting (For overseas only)	You can set the unit. Select from "L/min" or "cf/h (cf/min)".	For Japan: 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 flickers, it may be improved by setting a longer display refresh cycle.	0.25 sec
F.11	Analog output setting response time	Set the response time. 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.	0.05 sec
F.12	Numbering setting	You can set the numbering.	0000
F.13	Change gas type	The measured gas can be changed. (Model with full scale flow rate of 200 L/min or below. Oxygen type has no change gas type.)	Air
F.14	Setting ECO mode	ECO mode can be set. If the buttons are not operated for approx. one minute, the ECO mode will activate and turn OFF the display's backlight. Current consumption can be reduced with this mode.	OFF
F.15	CO_2 discharge rate calculation setting	CO_2 emission can be calculation can be set. Set you compressor power, discharge pressure, 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. Change use according to the working environment. If you have forgotten your PIN code, please contact your nearest CKD branch.	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 hold that data.	Consecutive acquisition: hold data OFF

Note1: Data is saved every 5 minutes. Please be careful that the number of times maintained 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.)

Times maintained = Usage time / 5min (＜1 million)

●Maintenance mode (Refer to Page 31 for the operation.)

No.	Description	Explanation	Default setting
F.91	Forced output function	Use this function to forcibly turn the switch output ON and confirm the wiring connection or initial operation of the input device.	—
F.92	Zero adjustment	The zero point deviation is corrected.	Adjust value：0
F.93	Copy function	For eligible model nos., 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	Returns the settings to the default settings.	—

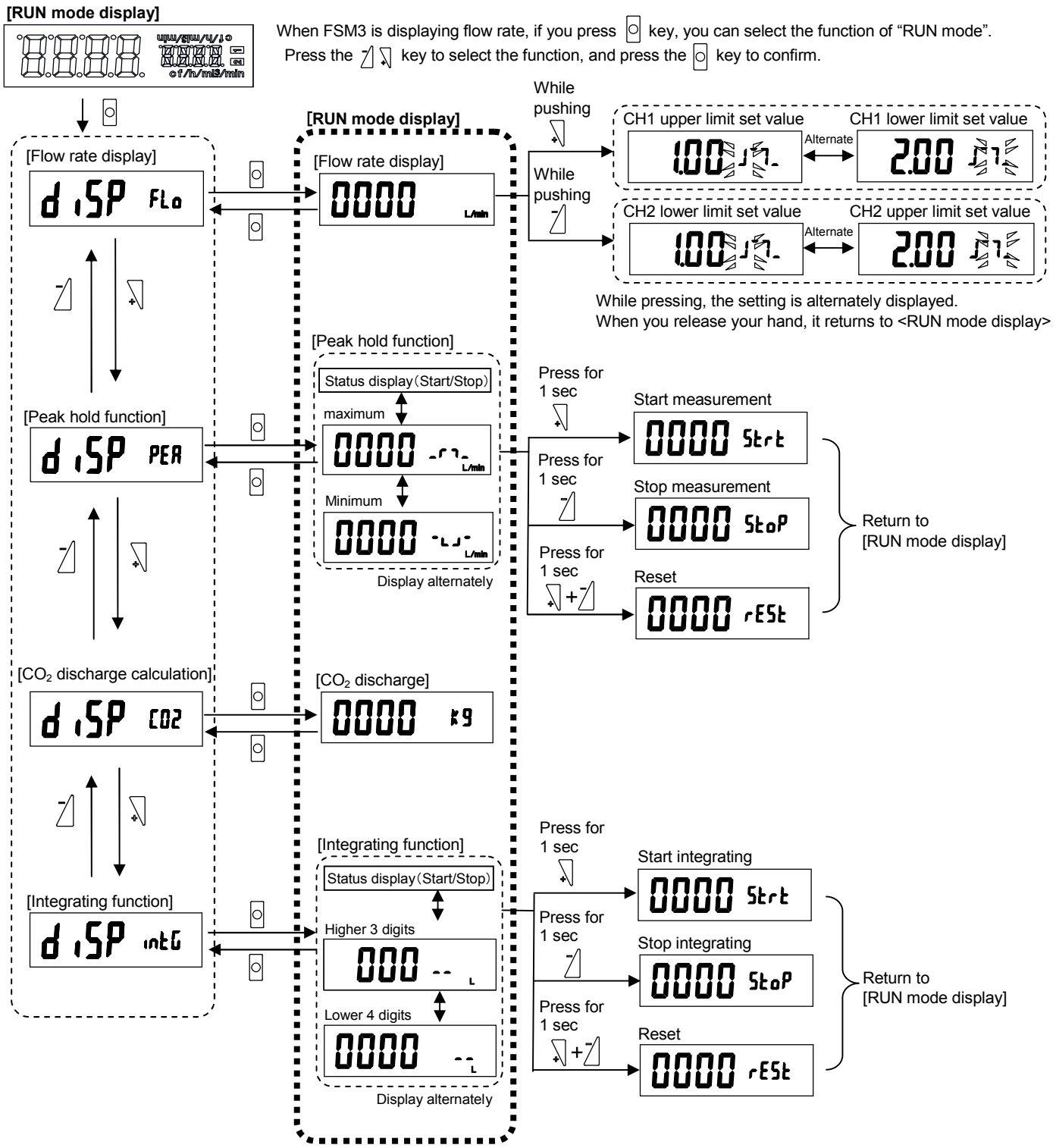
●Setting monitor mode (Refer to Page 32 for the operation.)

Description	Explanation	Default setting
Setting monitor function	SET mode setting details can be checked. (Set details cannot be edited.)	—

2.3 How to operate (LCD display)

2.3.1 RUN mode

※The figure of the key without comments means “Press one time”.

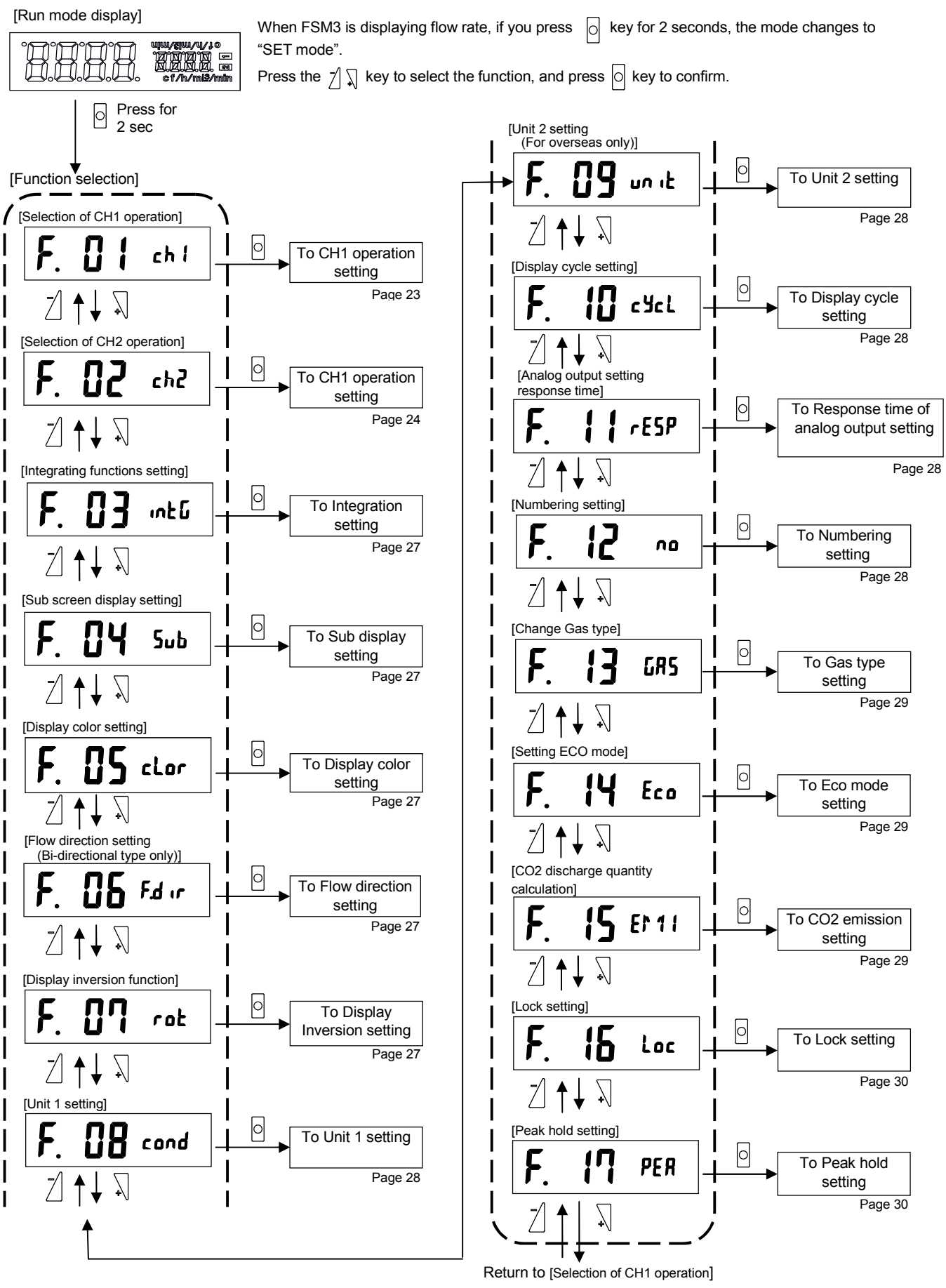


2.3.2 SET mode

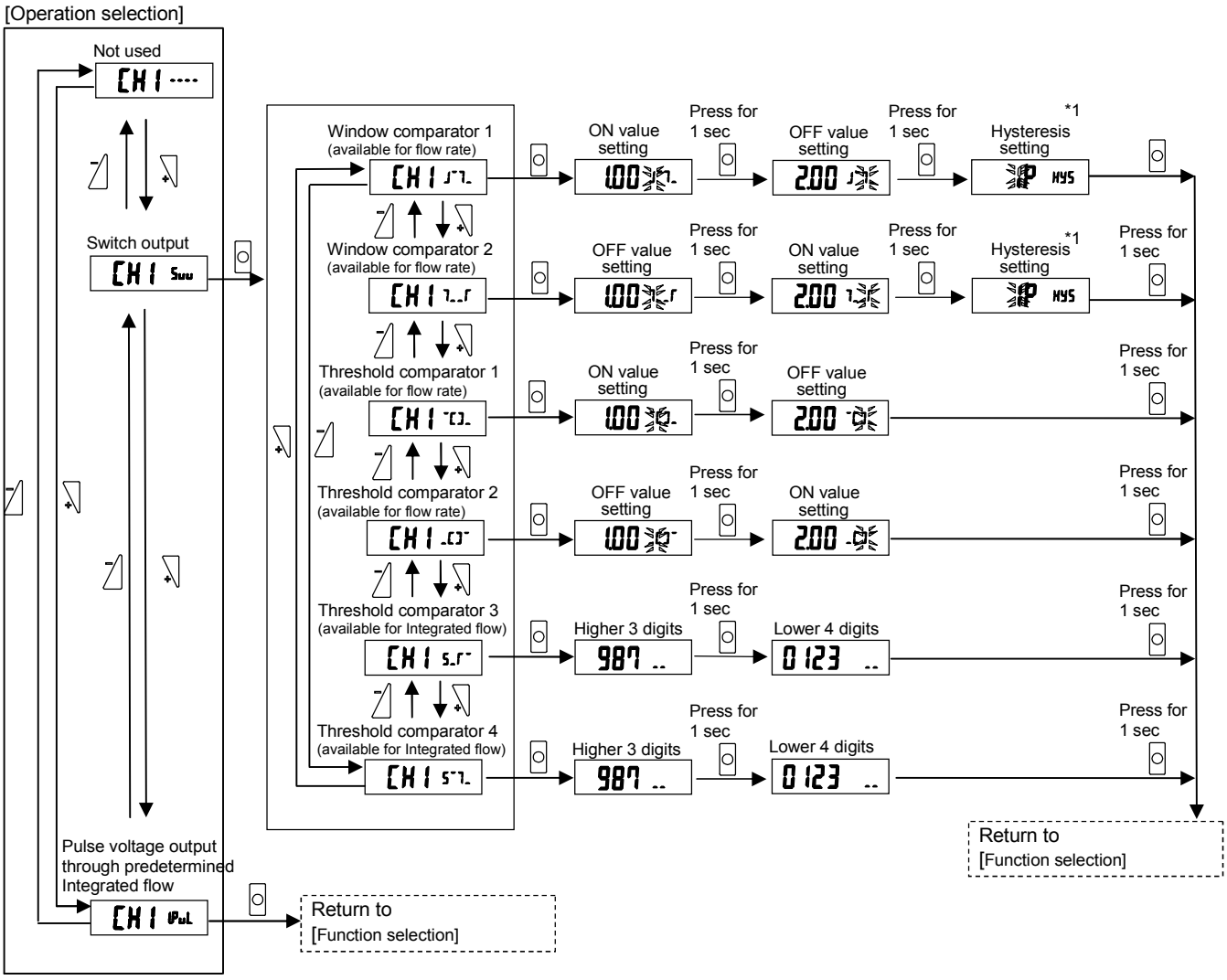
※The figure of the key without comments means “Press one time”.

When FSM3 is displaying flow rate, if you press ○ key for 2 seconds, the mode changes to “SET mode”.

Press the ▽△ key to select the function, and press ○ key to confirm.



●F.01_Selection of CH1 operation



*1
Set the hysteresis value satisfies the relationship below, so as to work correctly.

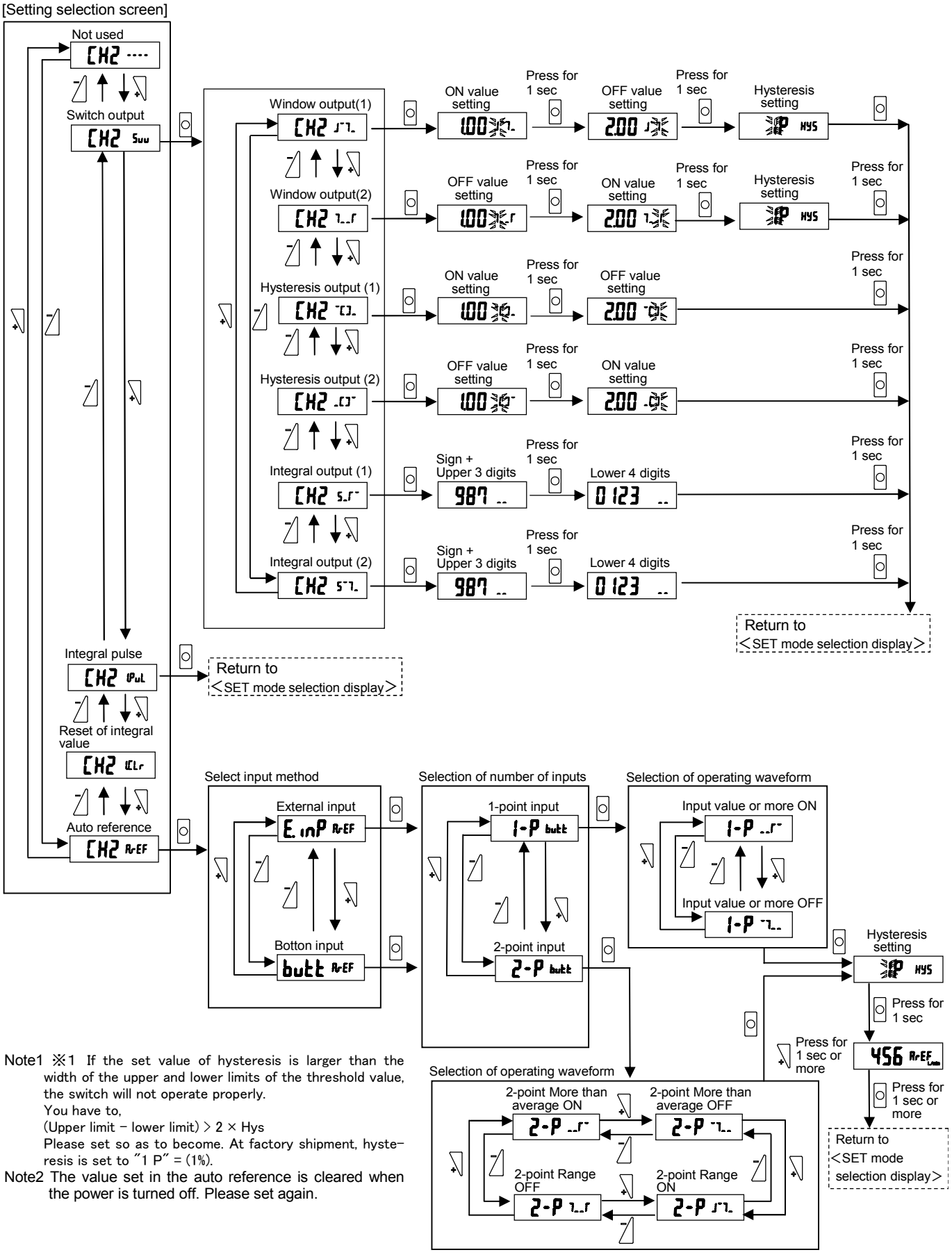
(Higher value - lower value) > 2 × Hysteresis

The default setting of hysteresis is "1 P" = (1%).

[Note]

Press + , or in 30 seconds without operation, so FSM3 returns “RUN mode”.

●F.02_Selection of CH2 operation

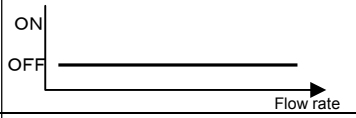
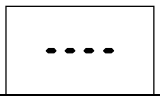
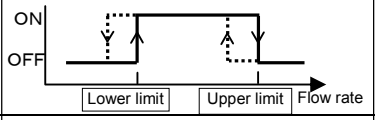
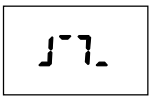
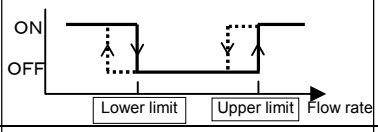
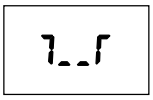
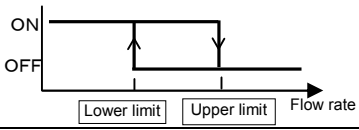
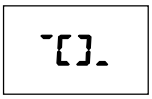
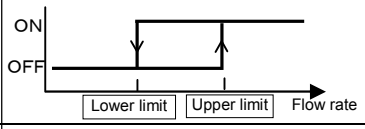
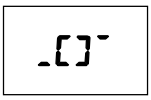
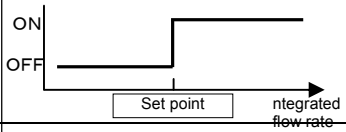
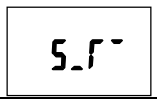
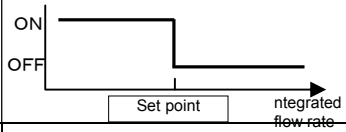
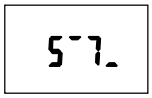
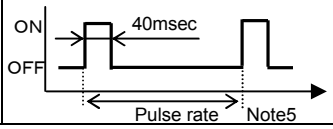


Note1 ※1 If the set value of hysteresis is larger than the width of the upper and lower limits of the threshold value, the switch will not operate properly.
You have to,
(Upper limit − lower limit) > 2 × Hys
Please set so as to become. At factory shipment, hysteresis is set to "1 P" = (1%).

Note2 The value set in the auto reference is cleared when the power is turned off. Please set again.

Supplement [1] : Switch output function

Depending on the application, you can choose from 8 types of switch operation. Can be applied to CH1, CH2 respectively.

No.	Operation pattern	Description	Operation waveform	LCD display (Sub display)
1	Switch output OFF	Switch output OFF		
2	Window operation[1] (Range inside ON) Note1, 2	The switch turns ON when the level is within the designated flow rate range.		
3	Window operation[2] (Range out ON) Note1, 2	The switch turns ON when the level is not within the designated flow rate range.		
4	Hysteresis operation[1] (Flow rate small side ON) Note1, 3	ON when lower than set point. Hysteresis can be arbitrarily set.		
5	Hysteresis operation[2] (Flow rate large side ON) Note1, 3	ON when higher than set point. Hysteresis can be arbitrarily set.		
6	Integrated output[1] (On when higher than set integration) Note4	The switch turns ON at the set integrated flow.		
7	Integrated output[2] (Off when higher than set integration) Note4	The switch turns OFF at the set integrated flow.		
8	Integrated pulse Note5,6	The integrated pulse is output during integration. See specifications for details on the pulse output rate.		

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% FS.

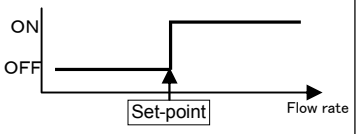
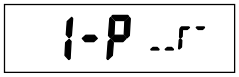
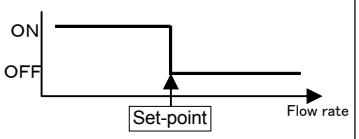
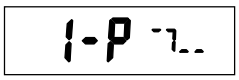
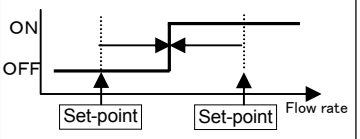
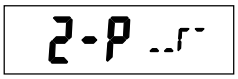
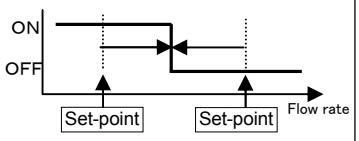
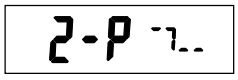
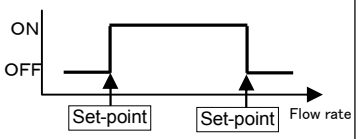
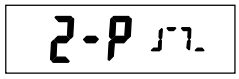
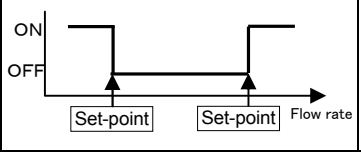
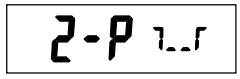
Note3: Switch output is kept ON even if it exceeds measurement flow range when switch output is ON. (ON also when Hi or Lo is displayed)

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

Note5: Refer to [Pulse output rate] in <6.1. Specifications>.

Note6: When the integrated pulse output is set, the output (OUT 1, 2) display also flashes.

Supplement [2] : Auto reference function

Points of input	Operation pattern name	Description	Operation waveform	LCD display
1 point (1-P)	1-point input[1] (Flow rate large side ON)	ON when higher than input point. Set-point=input point		
	1-point input[2] (Flow rate small side ON)	OFF when higher than input point. Set-point=input point		
2 points (2-P)	2-point input[1] (Flow rate large side ON)	ON when higher than centre value of two input points (Set-point:$\frac{(入力①+入力②)}{2}$)		
	2-point input[2] (Flow rate small side ON)	OFF when higher than centre value of two input points (Set-point:$\frac{(入力①+入力②)}{2}$)		
	2-point inside (Range inside ON)	ON when flow rate level is within two input points. (Set-point1 : input point1) (Set-point2 : input point2)		
	2-point outside (Range outside ON)	OFF when flow rate level is (Set-point1 : input point1) (Set-point2 : input point2)		

Supplement [2] : How to take set point by external input

The upper and lower limit values are automatically discriminated by comparing magnitude relation of past two points.

(Example)

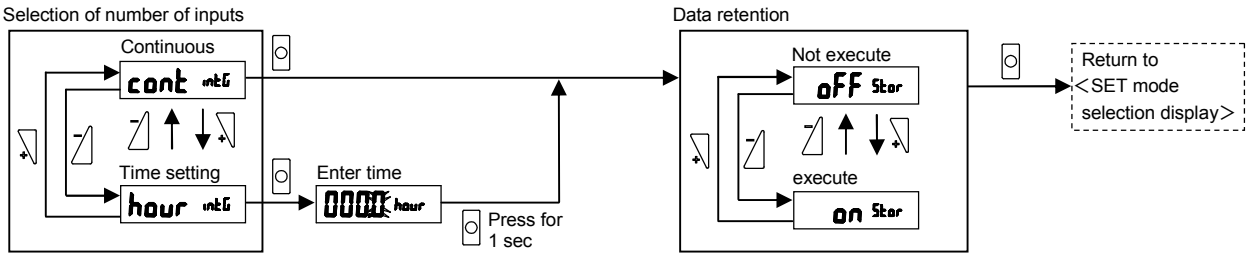
Input point (mL/min)		Upper limit (mL/min)	Lower limit (mL/min)
Initial value		0	0
1st	123	0	123
2nd	234	123	234
3rd	45	45	234
4th	345	234	345
5th	456	345	456
6th	-50	-50	456
7th	-211	-211	-50
8th	-100	-100	-50
9th	-300	-300	-100
10th	0	-100	0

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

・After taking, the pulse is output from CH1 for the taking confirmation.
・The set point value is cleared if power is turned OFF.

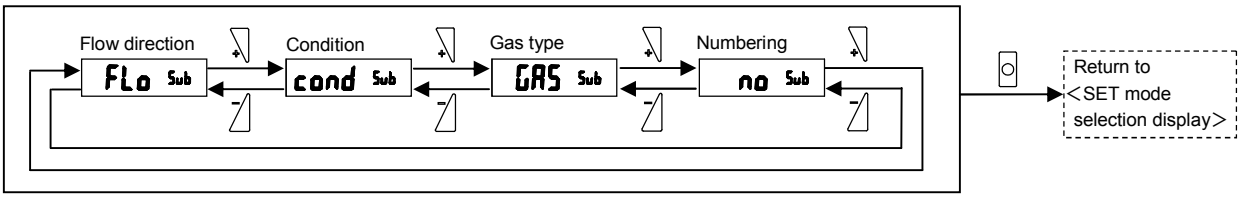
●F.03_Integrating functions setting

Set the Integrated flow rate continuously or fixed time.
Also, set whether or not to retention Integrated value in internal memory.



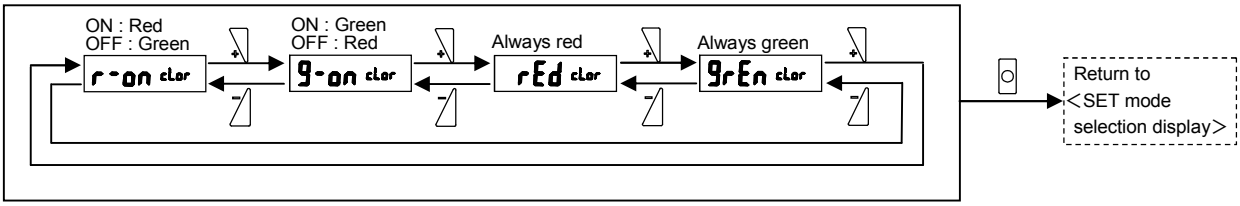
●F.04_Sub screen display setting

Set the display contents of the sub screen.



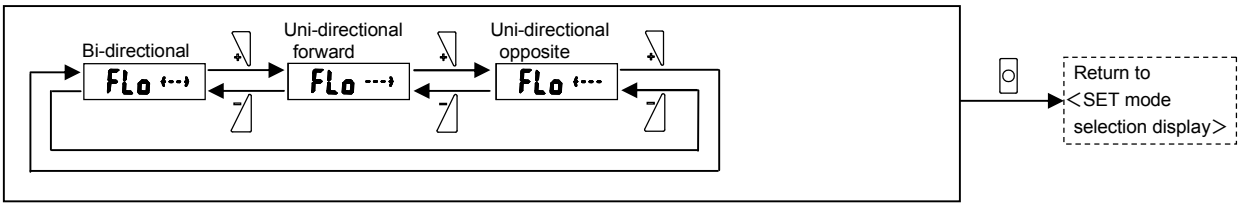
●F.05_Display color setting

Set display color.
You can switch to "flow direction", "reference state", "gas type", "numbering" display.



●F.06_Flow direction setting **(Bi-direction type only. Uni-direction type is not displayed.)**

Bi-directional detection or set flow detection direction in Uni-direction.



●F.07_Display inversion function

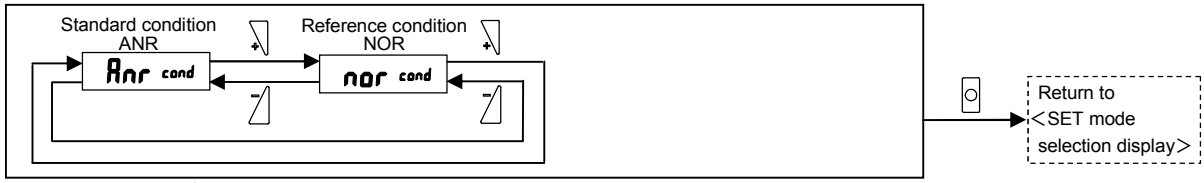
Invert the display up and down.

●F.08_Unit 1 setting

Switching of flow rate unit. (Standard condition ANR／Reference condition NOR)

Standard condition (ANR): Converted to volumetric flow at 20°C and 1 atmospheric pressure (101kPa)

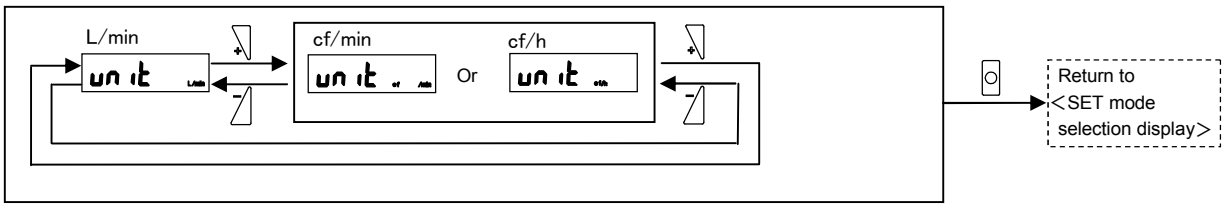
Reference condition (NOR): Converted to volumetric flow at 0°C and 1 atmospheric pressure (101kPa). (calculation value)



※空気以外のガス種では 20℃、1 気圧、相対湿度 0%RH

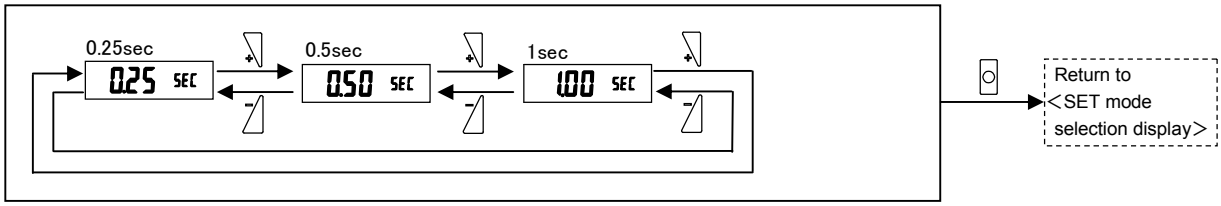
●F.09_Unit 2 setting

Switching of flow rate unit. (L/min／cf/min (or cf/h))



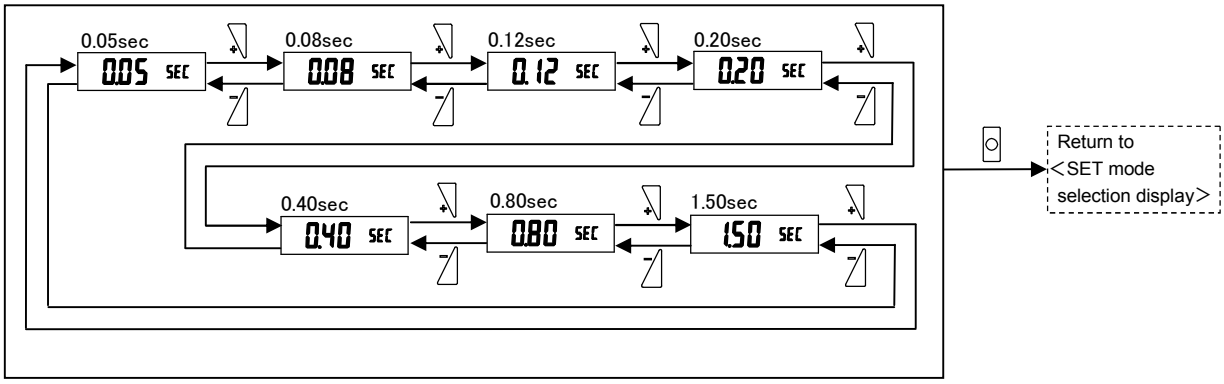
●F.10_Display cycle setting

Change the display update cycle.



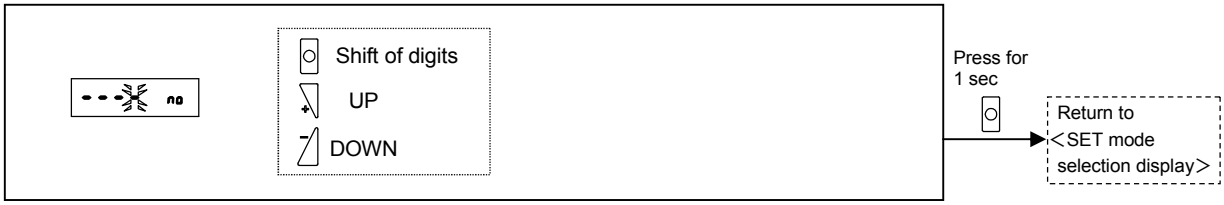
●F.11_Analog output setting response time

Change the analog output response time by changing the internal moving average number.



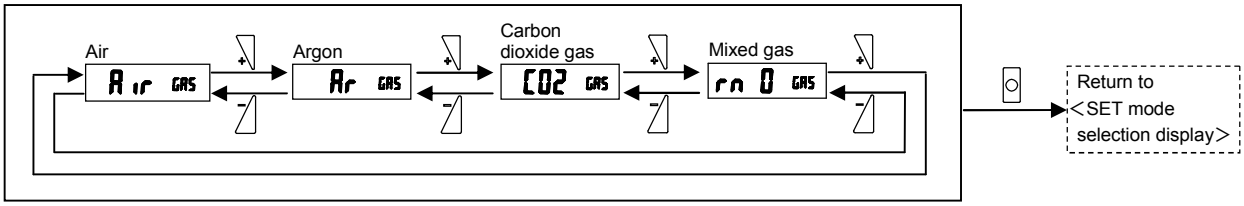
●F.12_Numbering setting

Assign any unique number to each product.



●F.13_Change gas type

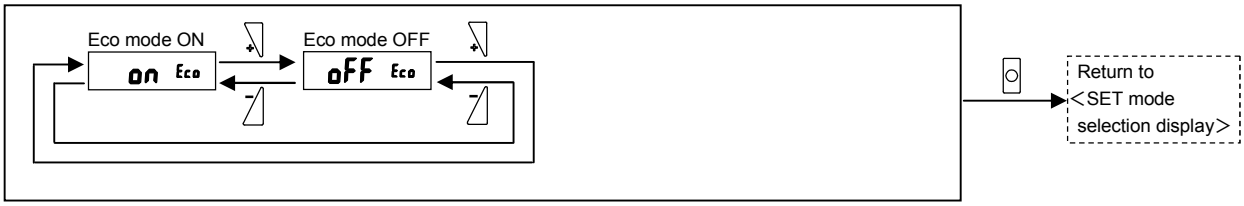
The displayed value can be changed according to the type of gas to be measured.
This function can be used only in the flow rate range 0.5 L/min to 200 L/min type.
Oxygen type has no change gas type.



※Mixed gas ： Ar 80% , CO_2 20%

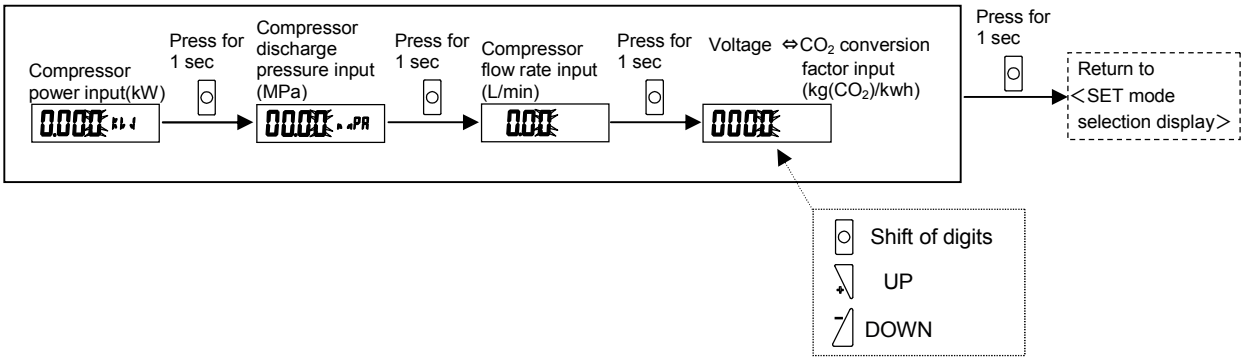
●F.14_Setting ECO mode

Eco mode can be turned on.
When the ECO mode is turned ON, it goes out after 1 minute. However, only "L" in unit display is displayed.
Also, it is available only when the gas type is "Air".



●F.15_CO_2 discharge quantity calculation setting

Set the calculation of CO2 emissions.
The input values are the compressor power, discharge pressure, flow rate, conversion factor (kg (CO_2) / kWh).
Please set the power, discharge pressure, flow rate, CO_2 conversion factor of your compressor.

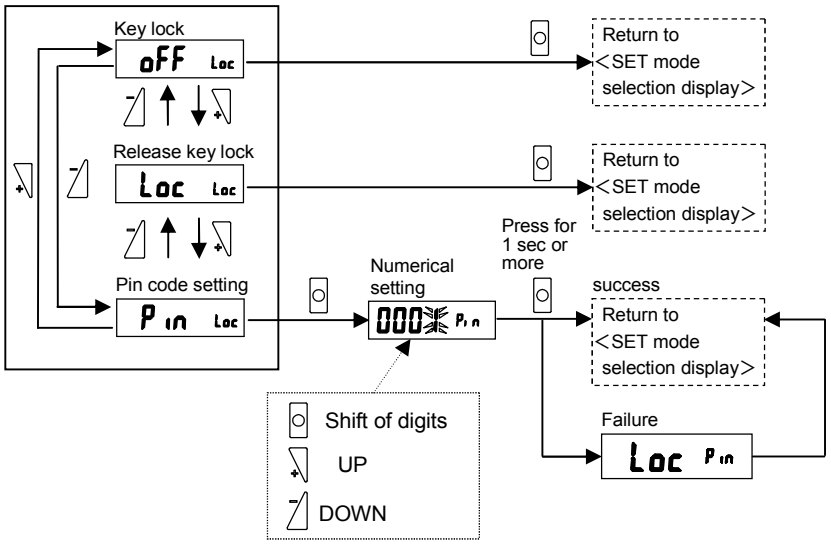


$$\frac{\text{Integrated flow (L)}}{\text{Compressor flow rate(L/min)} \times \dfrac{(\text{Discharge pressure(MPa)} \times 0.1013)}{0.1013}} \times \text{Compressor power (kW)} \div 60(\text{min}) \times CO_2 \text{ conversion factor (kg}(CO_2)\text{/kWh)}$$

Reference ： Coefficient 0.516kg(CO_2)/kWh (CHUBU Electric Power Co.,Inc)
※CO2 emission calculation setting is done only when the gas type is "Air".
※If the flow direction changes during calculation, the inspection will not be performed correctly.

●F.16_Lock setting

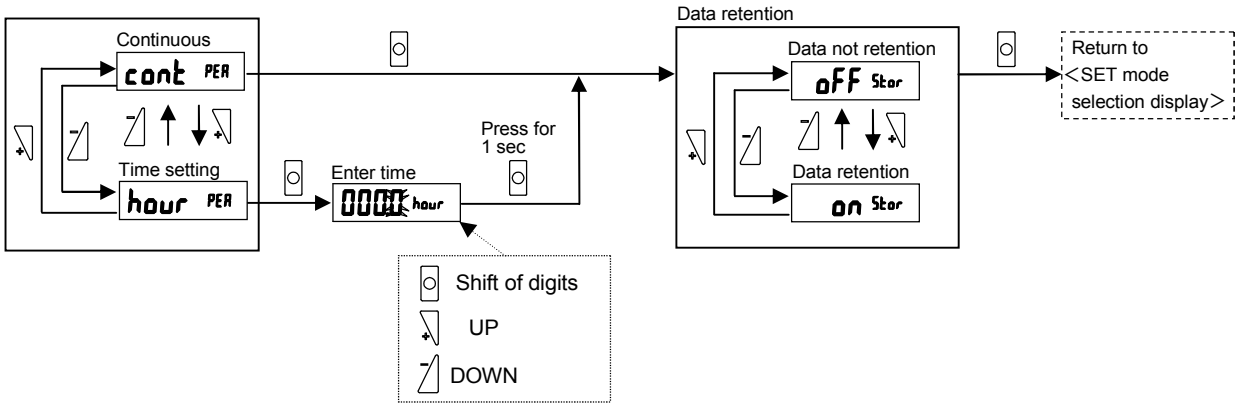
Set key locking method.
Set whether to enable key lock (to prevent operation) or reset by pin code.
In the case of secret code setting, the lock function works and it becomes the pin code input screen.



* If you have forgotten your PIN code, please contact our sales office.

●F.17_Peak hold setting

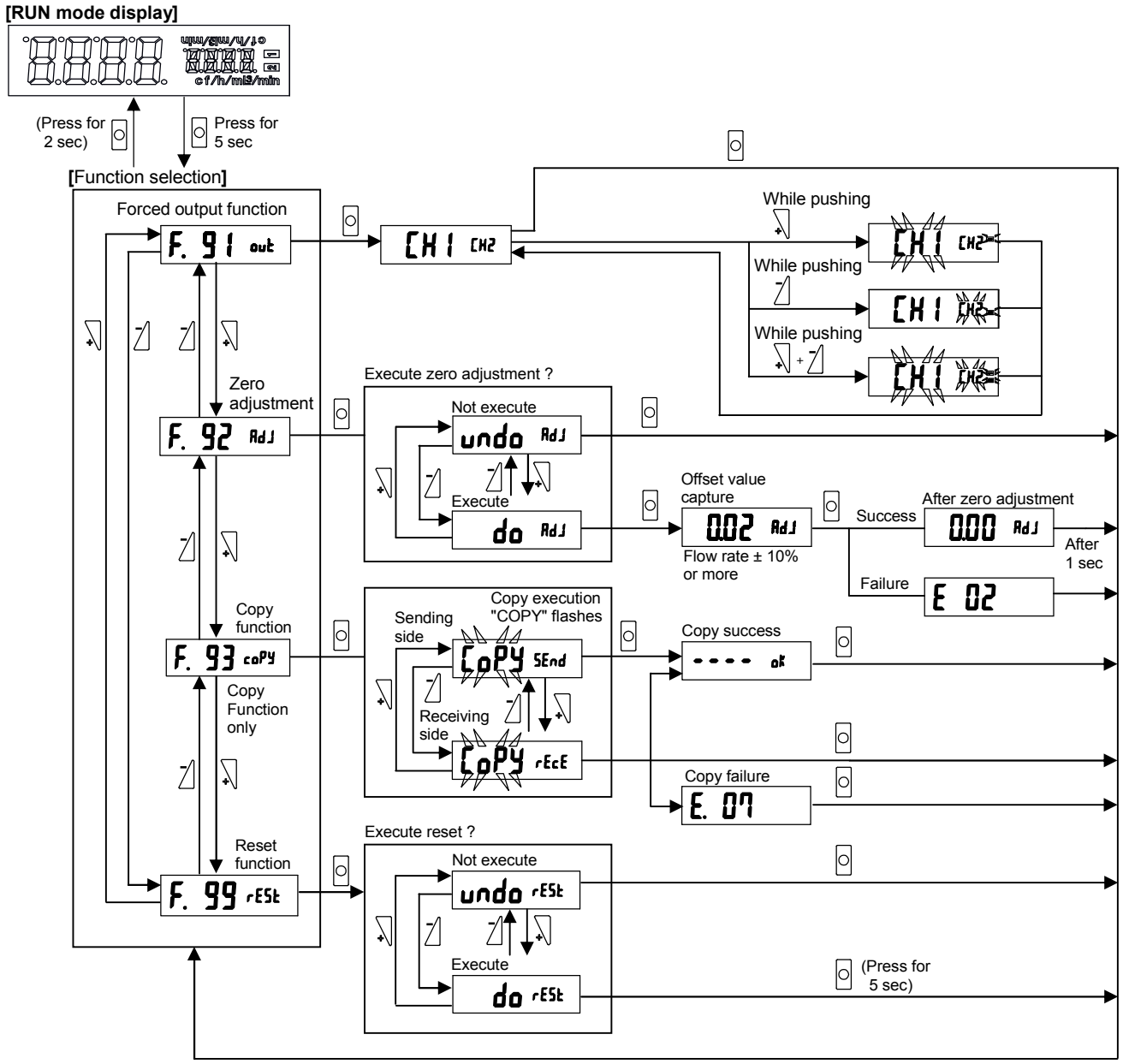
Set the peak hold recording method.
Data retention is saved periodically (every 5 minutes) in EEPROM.



*If you perform "F.06" (Setting flow direction), "F.08" (unit 1 setting), "F.09" (unit 2 setting), "F.13" (Change of gas type setting), F .01 (Operation setting, F.02operation setting), Integrated flow value, peak hold value are reset.

2.3.3 Maintenance mode

※The figure of the key without comments means “Press one time”.



※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 the full screen of <Function selection screen> returns to <RUN mode display>.

※3 Copy function copies F.01 to F.18 setting in SET mode.
However, F.12(Numbering function) · F.16(Pin code) is not copied.

※4 Resetting will restore the factory default settings.

※5 When one second has elapsed by pressing the ⊕ or ⊖ in the <function selection screen> screen, you can accelerate the count up or count down.

※6 It returns to <RUN display screen> after 30 seconds have elapsed without operation.

※7 In forced output function, switch output of CH 2 cannot be turned ON in case of model number with copy function or when using auto reference function. (Also do not display)

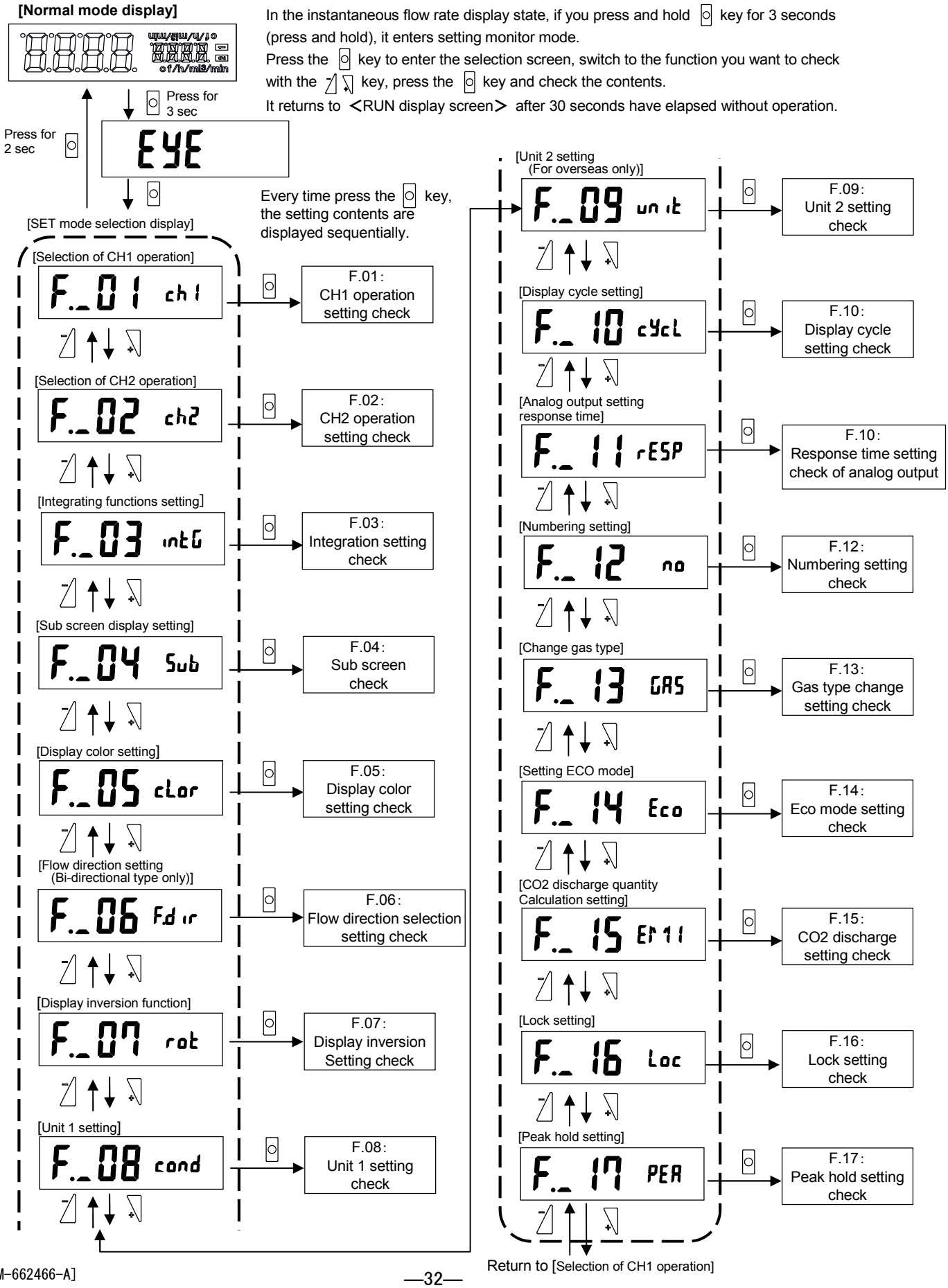
※8 In case of model number without copy function, selection screen of F.93 (copy function) is not displayed.

※9 In the integrated output setting [1], [2], when setting a negative value, the negative display is " -123 " instead of " -123 ".

※10 For overseas model with 500 mL/min type, the negative display is " -123 " instead of " -123 ".

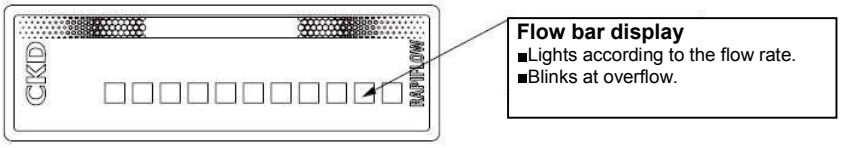
2.3.4 Setting confirmation mode

※ The place without instruction is pressed once.

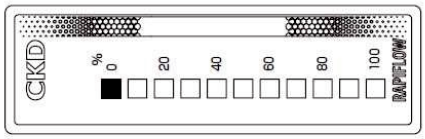
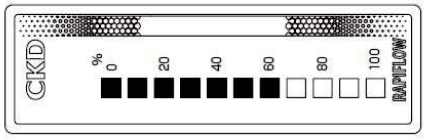
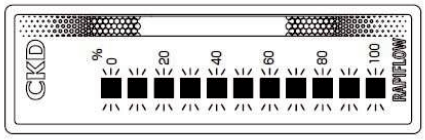
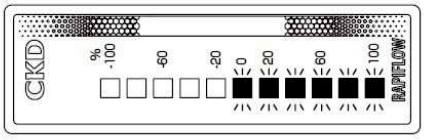
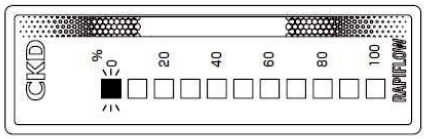
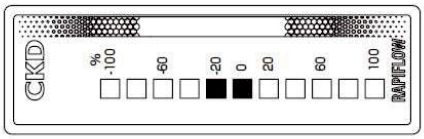
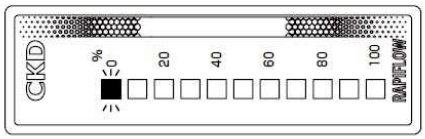
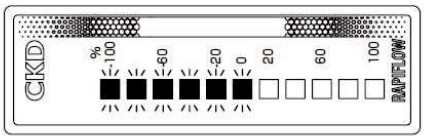


3. How to use the Bar display (FSM3-B)

3.1 Display section name



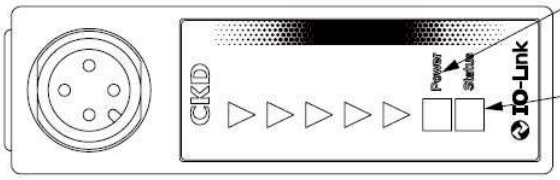
[example] FSM3-B101*******

Flow rate	Uni-direction type	Bi-direction type
0%		
+60% (Forward direction)		
+110% (Forward direction) Blinks at overflow. Blinks at +110% F.S. and over.		
-10% (Reverse direction)		
-110% (Reverse direction)		

Notes

4. How to use the IO-Link (FSM3-C)

4.1 Display section name



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

Status lamp (Green, Orange, Red)
■Green・・・・Lights when within specified flow rate range.
■Orange・・・Lights when flow rate exceeds specified range by less than 10%.
Lights during a warning.
■Red・・・・・ Lights when flow rate exceeds specified range by 10% or more.
Lights during an error.
■Lamp turns OFF when the flow rate is 3%(±3%)

4.2 Function (IO-Link)

Item	Description	Setting at shipping out of factory
Instantaneous flow rate display	Displays the instantaneous flow rate.	-
Integrating flow Display	Displays the Integrating flow counted after indicating to start logging.	Stop
Instantaneous flow rate peak value display (Peak hold function)	Displays the maximum and minimum instantaneous flow rate values during the period between indicating to start logging and stop logging.	Stop
Error display	Displays the error details.	-
Warning display	Displays the warning details.	-
Power ON time display	Displays the total power ON time from the start use. This time is not reset even if the power turns off. (Also not reset when using the re-set 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
Reference state setting	Select from the standard state or reference state. Standard state (ANR): Converted into volumetric flow rate at 20℃, 1 barometric pressure, relative humidity 65%. (For gases other than air, 20, 1 barometric pressure, 0%RH). Reference state (NOR): Converted into volumetric flow rate at 0℃, 1 barometric pressure, relative humidity 0%.	ANR
Change gas type	The measured gas can be changed. (Model with full scale flow rate of 200 L/min or below. Oxygen type has no change gas type.)	Air
Change travel average (Setting response time)	The travel average when measuring can be set. The average can be set in seven steps from 50 msec to 1500 msec. Chattering and mis-operation caused by sudden flow rate changes or noise are prevented.	50msec
Lock setting	Parameter Lock can be set, which disables changing the parameters of the unit. Data Storage Lock can be set, which prohibits uploading and downloading set values to the master. (Parameter Lock and Data Storage Lock and be set simultaneously)	Not set
Zero adjustment	The zero point deviation is corrected. (Within ± 10%)	Adjust value:0
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 the settings 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, please check on the following pages.

4.3 Communication specification

4.3.1 General

Item	Details
Communication protocol	IO-Link
Communication protocol revision	V1.1
Transmission rate	COM2（38.4kbps）
Port	Class A
Process Data (Input)	4byte
Process Data (Output)	0byte

Item	Details
Min Cycle Times	5ms
Data Storage ※1	1kbyte
SIO Mode support	Non
Device ID	Refer 4.3.2.6

※1. Set by parameter specification.

4.3.2 On demand data

4.3.2.1 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	64byte	String
0x0011	0	Vendor Text	http://www.ckd.co.jp/	R	64byte	String
0x0012	0	Product Name	FSM3-C020U1BH1L1(※1)	R	40byte	String
0x0013	0	Product ID	FSM3-2L_5L_10L (※1)	R	64byte	String
0x0014	0	Product Text	Small Size Flow sensor RapiFlow, 2L/min (※1)	R	64byte	String
0x0015	0	Serial- Number	8101-001 (※2)	R	16byte	String
0x0016	0	Hardware Revision	100.100	R	64byte	String
0x0017	0	Firmware Revision	100.100	R	64byte	String
0x0018	0	Application Specific Tag	Application Specific Tag	R/W	32byte	String

※R：Read out , W：Writing, R/W：Read out / Writing

※1･･･A reference example: Uni-direction, 2 L/min type.

※2･･･Reference example Serial is different individually

●Flow range for each model

Code	Flow rate display range		Integration display	
	Display range	Display value	Display range	Display value
FSM3-C005U	-50 to 550mL/min	-50 to 550	0 to 9999999mL	0 to 9999999
FSM3-C010U	-100 to 1100mL/min	-100 to 1100		
FSM3-C005B	-550 to 550mL/min	-550 to 550	-9999999 to 9999999mL	-9999999 to 9999999
FSM3-C010B	-1100 to 1100mL/min	-1100 to 1100		
FSM3-C020U	-0.20 to 2.2L/min	-0.20 to 2.2L	0 to 99999.99L	0 to 99999.99
FSM3-C050U	-0.50 to 5.50L/min	-0.50 to 5.50		
FSM3-C100U	-1.00 to 11.00L/min	-1.00 to 11.00		
FSM3-C020B	-2.20 to 2.20L/min	-2.20 to 2.20	-99999.99 to 99999.99L	-99999.99 to 99999.99
FSM3-C050B	-5.50 to 5.50L/min	-5.50 to 5.50		
FSM3-C100B	-11.00 to 11.00L/min	-11.00 to 11.00		
FSM3-C200U	-2.0 to 22.0L/min	-2.0 to 22.0	0 to 999999.9L	0 to 999999.9
FSM3-C500U	-5.0 to 55.0L/min	-5.0 to 55.0		
FSM3-C101U	-10.0 to 110.0L/min	-10.0 to 110.0		
FSM3-C200B	-22.0 to 22.0L/min	-22.0 to 22.0	-999999.9 to 999999.9L	-999999.9 to 999999.9
FSM3-C500B	-55.0 to 55.0L/min	-55.0 to 55.0		
FSM3-C101B	-110.0 to 110.0L/min	-110.0 to 110.0		
FSM3-C201U	-20 to 220L/min	-20 to 220L	0 to 9999999L	0 to 9999999
FSM3-C501U	-50 to 550L/min	-50 to 550L		
FSM3-C102U	-100 to 1100L/min	-100 to 1100		
FSM3-C201B	-220 to 220L/min	-220 to 220n	-9999999 to 9999999L	-9999999 to 9999999
FSM3-C501B	-550 to 550L/min	-550 to 550		
FSM3-C102B	-1100 to 1100L/min	-1100 to 1100		

4.3.2.2 Parameter and commands

●Common specification

Index	Sub index	Item	Value	Access	Data length	Format
0x0002	0	System Command	Refer to the next section	W	2byte	Integer16
0x000C	0	Device Access Locks	0x0000：No lock 0x0001：Parameter lock 0x0002：Data storage lock	R/W	2byte	Record
0x0020	0	Error Count	0	R	2byte	Integer16
0x0024	0	Device Status	0	R	1byte	Integer8
0x0025	0	Detailed Devices Status	Refer to 4.3.2.5	R	24byte	Record

※ R：Read out 、W：Writing 、R/W：Read out / Writing

●System command

Value	Command	Contents
0x82	Restore Factory Settings	Set the setting value to the shipping 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	Access	Data length	Format
0x0100	0	Gas type	1:AIR / 2:AR / 3:CO2 / 7:MAG(8:2)	R/W	2byte	Integer16
0x0101	0	Flow direction	0:Uni-direction / 2:Bi-direction	R	2byte	Integer16
0x0102	0	moving average	8:50ms / 16:80ms / 32:120ms / 64:200ms / 128:400ms / 256:800ms / 512:1500ms	R/W	2byte	Integer16
0x0103	0	Flow standard	0:ANR / 1:NOR	R/W	2byte	Integer16
0x0104	0	Switch output CH1 Mode setting	0:None 1:Window1 (NO) 2:Window 2 (NC) 3:Hysteresis1 (NO) 4:Hysteresis2 (NC)	R/W	2byte	Integer16
0x0105	0	Switch output CH1 Lower limit value	Depends on flow range 0	R/W	2byte	Integer16
0x0106	0	Switch output CH1 Upper limit value	Depends on flow range 0	R/W	2byte	Integer16
0x0107	0	Switch output CH2 Mode setting	0:None 1:Window1 (NO) 2:Window 2 (NC) 3:Hysteresis1 (NO) 4:Hysteresis2 (NC)	R/W	2byte	Integer16
0x0108	0	Switch output CH2 Lower limit value	Depends on flow range 0	R/W	2byte	Integer16
0x0109	0	Switch output CH2 Upper limit value	Depends on flow range 0	R/W	2byte	Integer16
0x010A	0	Switch output CH1 / CH2 Hysteresis	1:1% / 2:2% / 3:3% / 4:4% / 5:5% / 6:6% / 7:7% / 8:8%	R/W	2byte	Integer16

※ R：Read out 、W：Writing 、R/W：Read out / Writing

※ ：Default value

4.3.2.3 Process data IN

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	MSB															LSB
Data name	Instantaneous flow rate ＜Flow Rate＞															
Data range	Refer to 4.3.2.1[Flow range for each model]															
Format	Integer16															

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

4.3.2.4 Observation

Index	Sub index	Item	Value	Access	Data length	Format
0x0400	0	Peak Hold Q Max	Refer to the instantaneous flow rate display value in 4.3.2.1 "Flow range for each model"	R	2byte	Integer16
0x0401	0	Peak Hold Q Min				
0x0404	0	Integration Flow	Refer to the instantaneous flow rate display value in 4.3.2.1 "Flow range for each model"	R	4byte	Integer32
0x0405	0	Operating Time ※2	0 to 9,999,999h 【0 to 9,999,999】	R	4byte	Integer32
0x0406	0	Integrated flow rate flag	0：Not measurement of the integrated flow rate 1：During the measurement of the integrated flow rate	R	2byte	Integer16
0x0407	0	Peak hold flow rate flag	0：Not Collect data 1：Collecting data	R	2byte	Integer16
0x0408	0	Zero adjust flag	0：Untreated 1：Processing	R	2byte	Integer16

※1. R: Read out . R/W: Read out / Writing

※2. Be able to count more than 10 years of energization time.

(Calculation) 9,999,999h ÷ 7,488h≒1335.5 Year

※ 24h / Day × 26 Day / Month × 12 months ＝ 7,488h / Year

4.3.2.5 Diagnosis

Error code	Type	Name	Contents
0x4000	Warning	High temperature warning	Product temperature warning
0x4210	Error	High temperature error	Product temperature error
0x5000	Error	Hardware error	Product broken (hard)
0x5111	Warning	Supply voltage drop	Supply voltage drop (18 V or less)
0x6000	Error	CPU error	ROM / RAM error
0x6320	Error	Memory error	Memory read out / writing error
0x7710	Error	Overflow error	C / Q Terminal overflow error
0x8C10	Warning	Flow rate error	Flow rate value Out of specification range Uni-direction：110%F.S. Excess -10%F.S. Less than Bi-direction ：110%F.S. Excess -110%F.S. Less than
0x8D02	Error	Sensor error	Sensor broken
0x8D03	Warning	Zero adjust warning	Flow rate warning at zero adjustment (±10%F.S.以上)
0x8D04	Warning	SW1 setting warning	SW output 1 setting warning (Lower limit ≥ upper limit 5 more seconds)
0x8D05	Warning	SW1 setting warning	SW output 2 setting warning (Lower limit ≥ upper limit 5 more seconds)

4.3.2.6 IODD File list

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

※ Please download the IODD file from the CKD homepage.(http://www.ckd.co.jp/)

5. MAINTENANCE

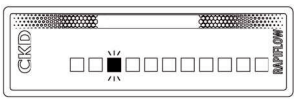
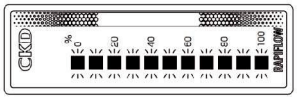
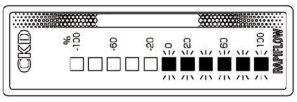
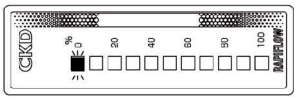
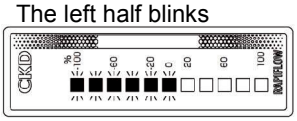
5.1.1 Error code and countermeasures (LCD display)

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.

5.1.2 Error code and countermeasures (LCD display)

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 output display (Switch output is not output)	The switch output's over current protection circuit has operated.	Check whether load current exceeds the rating. Correctly connect, then turn the power ON again.

5.2 Error code and countermeasures (Bar display)

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.

5.3 Error code and countermeasures (IO-Link)

Refer to [4.3.2.5 Diagnosis]

Notes

5.4 Trouble shooting[1]

Trouble	Cause	Corrective action
No flow display ・LCD display type, ・Separate 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 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 FSM3 main unit and cable away from noise source.
	The external wiring is disconnected	Please reconfirm / repair the external wiring.
	Output circuit is broken.	Replace FSM3.
No analog output ・LCD display type ・Bar display type ・Separate display type	Wrong connection of power source.	Connect the rated power supply correctly.
	Mistake the 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 are connected, but GND is not connected. Or, the connected device and analog output GND were not in common GND.
	Malfunction caused by noise.	Keep FSM3 main unit and cable away from noise source.
	The external wiring is disconnected	Please reconfirm / repair the external wiring.
	Output circuit is broken.	Replace FSM3.
No switch output ・LCD display type ・Separate display type	Wrong connection of power source.	Connect the rated power supply correctly.
	Mistake the connecting line.	Please use the forcible output function of F.91 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-wiring.
	Output specification does not match. (NPN or PNP)	Make sure that it matches the specifications of the connected device. (As an example, it does not operate normally if FSM3 is NPN specification and the input unit of PLC to be connected is PNP specification.)
	Malfunction caused by noise.	Keep FSM3 main unit and cable away from noise source.
	The external wiring is disconnected.	Please use the forcible output function of F.91 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.	Please use the forcible output function of F.91 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.
Flow display does not reach 0. (Analog output does not make 1V or 3V) ・All type	leakage	Check and correct piping.
	Foreign matter is mixed inside the main body. (Foreign matter sticking to sensor chip.)	Replace FSM3. When installing the main body, make sure that there is no foreign matter in the piping or the port of the main unit, and use a filter so that foreign matter does not get mixed in the main body.
	Malfunction caused by noise.	Keep FSM3 main unit and cable away from noise source.
	Sensor chip 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.
	Mistake 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 warm-up shortage.	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.

5.4 Trouble shooting[2]

Trouble	Cause	Corrective action
The flow rate indication does not change from 0. ・All type	Foreign matter is mixed inside the main body and it is clogged.	Foreign matter is mixed inside the main body and it is not possible to measure the correct flow rate. Please replace the main unit. When installing the main body, make sure that there is no foreign matter in the piping or the port of the main body, and use a filter so that foreign matter does not get mixed in the main body.
Flow indicator is wrong, Feel bad in accuracy. ・All type	Foreign matter is mixed inside the main body. (Foreign matter sticking to sensor chip.)	Foreign matter is mixed inside the main body and it is not possible to measure the correct flow rate. Please replace the main unit. When installing the main body, make sure that there is no foreign matter in the piping or the port of the main body, and use a filter so that foreign matter does not get mixed in the main body.
	Malfunction caused by noise.	Keep FSM3 main unit and cable away from noise source.
	Sensor chip 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 instruments that causing the uneven flow] Regulator, solenoid valve, flow control valve, etc.
	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 FSM to NOR.
	FSM3 warm-up shortage	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.
	Fluid outside the specification is flowing	Please use with the fluid that this product supports. It cannot be used correctly with fluids outside specifications.
	Mistake the gas type setting	Please check whether the fluid to be used and the gas type setting are available. It cannot be used correctly if the gas type setting is incorrect.

6. PRODUCTS

6.1 Specifications

6.1.1 LCD display

■Resin body type

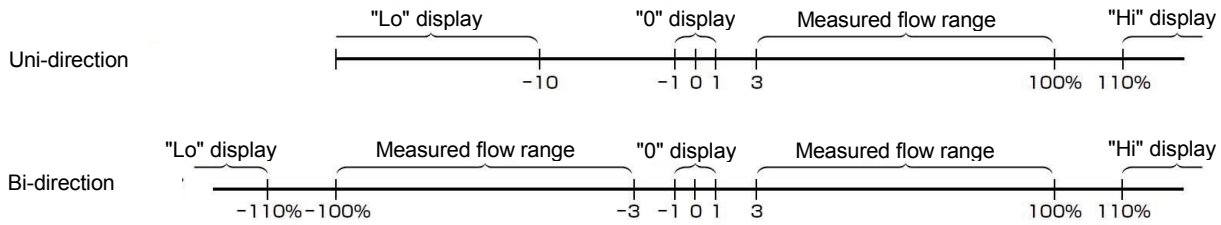
Descriptions			FSM3-L[B][C][D][E][F][G][H][I] - [ ]										
			[B]										
			005	010	020	050	100	200	500	101	201	501	102
Flow direction	[C]	U	Uni-direction										
		B	Bi-direction										
Measured flow rate range (/min) *1	[C]	U	15 to 500mL	30 to 1000mL	0.06 to 2.00L	0.15 to 5.00L	0.30 to 10.00L	0.60 to 20.0L	1.5 to 50.0L	3.0 to 100.0L	6 to 200L	15 to 500L	30 to 1000L
		B	-500 to -15 15 to 500mL	-1000 to -30 30 to 1000mL	-2.00 to -0.06 0.06 to 2.00L	-5.00 to -0.15 0.15 to 5.00L	-10.00 to -0.30 0.30 to 10.00L	-20.0 to -0.6 0.6 to 20.0L	-50.0 to -1.5 1.5 to 50.0L	-100.0 to -3.0 3.0 to 100.0L	-200 to -6 6 to 200L	-500 to -15 15 to 500L	-1000 to -30 30 to 1000L
Display			4-digit + 4-digit 2-color LCD										
Flow rate display range (/min) *2	[C]	U	-49 to 549mL	-99 to 1099mL	-0.19 to 2.19L	-0.49 to 5.49L	-0.99 to 10.99L	-1.9 to 21.9L	-4.9 to 54.9L	-9.9 to 109.9L	-19 to 219L	-49 to 549L	-99 to 1099L
		B	-549 to 549mL	-1099 to 1099mL	-2.19 to 2.19L	-5.49 to 5.49L	-10.99 to 10.99L	-21.9 to 21.9L	-54.9 to 54.9L	-109.9 to 109.9L	-219 to 219L	-549 to 549L	-1099 to 1099L
Integration display *3	Display range		0 to ±9999999mL		0.00 to ±99999.99L			0.0 to ±999999.9L			0 to ±9999999L		
	Pulse output rate		5mL	10mL	0.02L	0.05L	0.1L	0.2L	0.5L	1L	2L	5L	10L
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		-0.07 to 0.75MPa								0 to 0.75MPa		
	Proof pressure		1.0MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60℃										
Accuracy (Fluid: in dry air) *5	Accuracy *6		Within ±3% F.S. (Secondary side released to atmosphere) (Scope of warranty depends on the "Measured flow rate range")										
	Repeatability *7		Within ±1% F.S. (Secondary side released to atmosphere)										
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
	Pressure characteristics		Within ±5% F.S. (–0.07 to 0.75 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 0.75 MPa, 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 (connecting load impedance 50 kΩ and over)										
		E,F,G,H	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)										
Power supply voltage *10		A,B,C,D	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less										
		E,F,G,H	24 VDC (21.6 to 26.4 V) ripple rate 1% or less										
Current consumption *11			45 mA or less										
Lead wire			φ3.7, AWG26 or equivalent × 5-conductor (connector), insulator outer diameter φ1.0										
Functions *12			1 Gas change, 2 setting detail copy, 3 flow rate adjustment, 4 peak hold, etc.										
Degree of protection			IIP40-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/s2, X, Y, Z direction, every 2 hours										
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										

6.1.1 LCD display

■Stainless steel body type

Descriptions			FSM3-L[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	[C]	U	15 to 500mL	30 to 1000mL	0.06 to 2.00L	0.15 to 5.00L	0.30 to 10.00L	0.60 to 20.0L	1.5 to 50.0L	3.0 to 100.0L	6 to 200L	15 to 500L	30 to 1000L
		B	-500 to -15 15 to 500mL	-1000 to -30 30 to 1000mL	-2.00 to -0.06 0.06 to 2.00L	-5.00 to -0.15 0.15 to 5.00L	-10.00 to -0.30 0.30 to 10.00L	-20.0 to -0.6 0.6 to 20.0L	-50.0 to -1.5 1.5 to 50.0L	-100.0 to -3.0 3.0 to 100.0L	-200 to -6 6 to 200L	-500 to -15, 15 to 500L	-1000 to -30, 30 to 1000L
Display			4-digit + 4-digit 2-color LCD										
Flow rate display range (/min) *2	[C]	U	-49 to 549mL	-99 to 1099mL	-0.19 to 2.19L	-0.49 to 5.49L	-0.99 to 10.99L	-1.9 to 21.9L	-4.9 to 54.9L	-9.9 to 109.9L	-19 to 219L	-49 to 549L	-99 to 1099L
		B	-549 to 549mL	-1099 to 1099mL	-2.19 to 2.19L	-5.49 to 5.49L	-10.99 to 10.99L	-21.9 to 21.9L	-54.9 to 54.9L	-109.9 to 109.9L	-219 to 219L	-549 to 549L	-1099 to 1099L
Integration display *3	Display range		0 to ±9999999mL		0.00 to ±99999.99L			0.0 to ±999999.9L			0 to ±9999999L		
	Pulse output rate		5mL	10mL	0.02L	0.05L	0.1L	0.2L	0.5L	1L	2L	5L	10L
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		-0.07 to 1.0MPa								0 to 1.0MPa	0 to 0.75MPa	
	Proof pressure		1.5MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60℃										
Accuracy (Fluid: in dry air) *5	Accuracy *6		Within ±3% F.S. (Secondary side released to atmosphere) (Scope of warranty depends on the "Measured flow rate range")										
	Repeatability *7		Within ±1% F.S. (Secondary side released to atmosphere)										
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
	Pressure characteristics		Within ±5% F.S. (−0.07 to 0.75 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 1.00 MPa, base pressure 0.35 MPa)	Within ±5% F.S. (0 to 0.75 MPa, 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 (connecting load impedance 50 kΩ and over)										
		E,F,G,H	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)										
Power supply voltage *10		A,B,C,D	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less										
		E,F,G,H	24 VDC (21.6 to 26.4 V) ripple rate 1% or less										
Current consumption *11			45 mA or less										
Lead wire			φ3.7, AWG26 or equivalent × 5-conductor (connector), insulator outer diameter φ1.0										
Functions *12			1 Gas change, 2 setting detail copy, 3 flow rate adjustment, 4 peak hold, etc.										
Degree of protection			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, X, Y, Z direction, every 2 hours										
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 various flow rates are as shown below.



* 3 : The integrating flow is a calculated (reference) value. When using the integration maintaining function, be careful that the number of times maintained 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.)

$$\text{Times maintained} = \frac{\text{Usage time}}{\text{Maintenance intervals}} < 1 \text{ million times}$$

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

* 4 : Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains 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. (Refer to the recommended values on page 2.)
The sensor for oxygen gas is a custom model. To prevent ignition accidents, do not allow oxygen to flow again when a fluid other than oxygen has flown even once.
* 5 : Compressed air is used for adjusting and inspecting 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 an accuracy of ±3%F.S.
Consider separately according to the working environment and working conditions.
* 7 : Repeatability over a short period of time. Change over time is 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 from between 50 msec to 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, output and error increase. Check error with the impedance of the connecting load before using.
* 10 : The power supply voltage specifications differ for the voltage output and current output.
* 11 : Current for when 24 VDC is connected and no load is applied. The current consumption will vary depending on how the load is connected.
* 12 : Gas can be changed to argon, carbon dioxide, and 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 gas exchange function cannot be set with a full scale flow rate of 500 or 1000 L/min or an oxygen type.)

Gas type	Flow direction	Full-scale flow fate	Analog output	
			Voltage	Current
●Air/Nitrogen ●Argon ●Mixed gas (Argon80%+ Carbon dioxide20%)	One-direction	0 to 100%	1 to 5V	4 to 20mA
	Bi-direction	-100 to 100%		
●Carbon dioxide	One-direction	0 to 50%	1 to 3V	4 to 12mA
	Bi-direction	-50 to 50%	2 to 4V	8 to 16mA

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

* 13 : This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.
* 14 : This product measures the change in heat distribution caused by flow.
When this product is mounted in vertical orientation, convection flow can influence or cause the zero point to deviate.
* 15 : Accuracy may be affected by the piping conditions. For more accurate measurements, install a straight pipe with a piping I.D. ten times larger.
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.

Notes

6.1.2 Bar display

■Resin body type

Descriptions			FSM3-B[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	[C]	U	15 to 500mL	30 to 1000mL	0.06 to 2.00L	0.15 to 5.00L	0.30 to 10.00L	0.60 to 20.0L	1.5 to 50.0L	3.0 to 100.0L	6 to 200L	15 to 500L	30 to 1000L
		B	-500 to -15 15 to 500mL	-1000 to -30 30 to 1000mL	-2.00 to -0.06 0.06 to 2.00L	-5.00 to -0.15 0.15 to 5.00L	-10.00 to -0.30 0.30 to 10.00L	-20.0 to -0.6 0.6 to 20.0L	-50.0 to -1.5 1.5 to 50.0L	-100.0 to -3.0 3.0 to 100.0L	-200 to -6 6 to 200L	-500 to -15 15 to 500L	-1000 to -30 30 to 1000L
Display			LED bar display										
Working conditions		Applicable fluids *2	Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2), nitrogen gas										
		Temperature range	0 to 50°C (no condensation)										
		Pressure range	-0.07 to 0.75MPa								0 to 0.75MPa		
		Proof pressure	1.0MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy (Fluid: in dry air)		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 released to atmosphere)										
		Temperature characteristics	Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
		Pressure characteristics	Within ±5% F.S. (−0.07 to 0.75 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 0.75 MPa, base pressure 0.35 MPa)		
Response time *5			50 msec or less										
Analog output *6	[G]	J	1 to 5 V voltage output (connecting load impedance 50 kΩ and over)										
		K	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)										
Power supply voltage *7		J	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less										
		K	24 VDC (21.6 to 26.4 V) ripple rate 1% or less										
Current consumption *8			45 mA or less										
Lead wire			φ3.7, AWG26 or equivalent × 4-conductor (connector), insulator outer diameter φ1.0										
Degree of protection			IP40-equivalent (IEC standards)										
Protection circuit *9			Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, max. 100 m/s2, X, Y, Z direction, every 2 hours										
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										

6.1.2 Bar display

■Stainless steel body type

Descriptions			FSM3-B[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	[C]	U	15 to 500mL	30 to 1000mL	0.06 to 2.00L	0.15 to 5.00L	0.30 10.00L	0.60 to 20.0L	1.5 to 50.0L	3.0 to 100.0L	6 to 200L	15 to 500L	30 to 1000L
		B	-500 to -15 15 to 500mL	-1000 to -30 30 to 1000mL	-2.00 to -0.06 0.06 to 2.00L	-5.00 to -0.15 0.15 to 5.00L	-10.00 to -0.30 0.30 to 10.00L	-20.0 to -0.6 0.6 to 20.0L	-50.0 to -1.5 1.5 to 50.0L	-100.0 to -3.0 3.0 to 100.0L	-200 to -6 6 to 200L	-500 to -15, 15 to 500L	-1000 to -30, 30 to 1000L
Display			LED bar display										
Working conditions	Applicable fluids *2		Clean air (JIS B 8392-1:2012 1.1.1 to 5.6.2), compressed air (JIS B 8392-1:2012 1.1.1 to 1.6.2), nitrogen gas										
			Oxygen 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		-0.07 to 1.0MPa								0 to 1.0MPa	0 to 0.75MPa	
	Proof pressure		1.5MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy (Fluid: in dry air)	Accuracy *3		Within ±3% F.S. (Secondary side released to atmosphere) (Scope of warranty depends on the "Measured flow rate range")										
	Repeatability		Within ±1% F.S. (Secondary side released to atmosphere)										
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
	Pressure characteristics		Within ±5% F.S. (−0.07 to 0.75 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 1.00 MPa, base pressure 0.35 MPa)	Within ±5% F.S. (0 to 0.75 MPa, base pressure 0.35 MPa)	
Response time *5			50 msec or below (Response time set to OFF)										
Analog output *6	[G]	J	1 to 5 V voltage output (connecting load impedance 50 kΩ and over)										
		K	4 to 20 mA current output (connecting load impedance 0 to 300 Ω)										
Power supply voltage *7	[G]	J	12 to 24 VDC (10.8 to 26.4 V) ripple rate 1% or less										
		K	24 VDC (21.6 to 26.4 V) ripple rate 1% or less										
Current consumption *8			45 mA or less										
Lead wire			φ3.7, AWG26 or equivalent × 4-conductor (connector), insulator outer diameter φ1.0										
Degree of protection			IP40-equivalent (IEC standards)										
Protection circuit *9			Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, max. 100 m/s^2, X, Y, Z direction, every 2 hours										
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%).
* 2 : Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains 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. (Refer to the recommended values on page 2.)
  The sensor for oxygen gas is a custom model. To prevent ignition accidents, do not allow oxygen to flow again when a fluid other than oxygen has flown even once.
* 3 : 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 an accuracy of ±3%F.S.
  Consider separately according to the working environment and working conditions.
* 4 : Repeatability calculated during a short time. Change over time is not included.
  (Refer to the product specifications sheet for details.)
* 5 : The 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, output and error increase. Check error with the impedance of the connecting load before using.
* 7 : The power supply voltage specifications differ for the voltage output and current output..
* 8 : Current for when 24 VDC is connected and no load is applied.
  The current consumption will vary depending on how the load is connected.
* 9 : This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.
* 10 : This product measures the change in heat distribution caused by flow.
  When this product is mounted in vertical orientation, convection flow can influence or cause the zero point to deviate.
* 11 : Accuracy may be affected by the piping conditions. For more accurate measurements, install a straight pipe with a piping I.D. ten times larger.
  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.

Notes

6.1.3 IO-Link

■Resin body type

Descriptions			FSM3-C[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	[C]	U	15 to 500mL	30 to 1000mL	0.06 to 2.00L	0.15 to 5.00L	0.30 to 10.00L	0.60 to 20.0L	1.5 to 50.0L	3.0 to 100.0L	6 to 200L	15 to 500L	30 to 1000L
		B	-500 to -15 15 to 500mL	-1000 to -30 30 to 1000mL	-2.00 to -0.06 0.06 to 2.00L	-5.00 to -0.15 0.15 to 5.00L	-10.00 to -0.30 0.30 to 10.00L	-20.0 to -0.6 0.6 to 20.0L	-50.0 to -1.5 1.5 to 50.0L	-100.0 to -3.0 3.0 to 100.0L	-200 to -6 6 to 200L	-500 to -15 15 to 500L	-1000 to -30 30 to 1000L
Display			LED display (power lamp, 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)									-	
	Temperature range		0 to 50°C (no condensation)										
	Pressure range		-0.07 to 0.75MPa								0 to 0.75MPa		
	Proof pressure		1.0MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy (Fluid: in dry air) *3	Accuracy *4		Within ±3% F.S. (Secondary side released to atmosphere) (Scope of warranty depends on the "Measured flow rate range")										
	Repeatability *5		Within ±1% F.S. (Secondary side released to atmosphere)										
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
	Pressure characteristics		Within ±5% F.S. (−0.07 to 0.75 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 0.75 MPa, base pressure 0.35 MPa)		
Response time *6			50 msec or below (Response time set to OFF)										
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 4 conductor										
Functions *9 *10			1 Various exchanges, 2 flow rate adjustment, 3 peak hold, etc.										
Degree of protection			IP40-equivalent (IEC standards)										
Protection circuit *11			Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, max. 100 m/s^2, X, Y, Z direction, every 2 hours										
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										

* Refer to page 35 for communication specifications.

6.1.3 IO-Link

■Stainless steel body type

Descriptions			FSM3-C[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	[C]	U	15 to 500mL	30 to 1000mL	0.06 to 2.00L	0.15 to 5.00L	0.30 to 10.00L	0.60 to 20.0L	1.5 to 50.0L	3.0 to 100.0L	6 to 200L	15 to 500L	30 to 1000L
		B	-500 to -15 15 to 500mL	-1000 to -30 30 to 1000mL	-2.00 to -0.06 0.06 to 2.00L	-5.00 to -0.15 0.15 to 5.00L	-10.00 to -0.30 0.30 to 10.00L	-20.0 to -0.6 0.6 to 20.0L	-50.0 to -1.5 1.5 to 50.0L	-100.0 to -3.0 3.0 to 100.0L	-200 to -6 6 to 200L	-500 to -15, 15 to 500L	-1000 to -30, 30 to 1000L
Display			LED display (power lamp, 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		-0.07 to 1.0MPa								0 to 1.0MPa	0 to 0.75MPa	
	Proof pressure		1.5MPa										
Operating ambient temperature/humidity			0 to 50°C, 90% RH or less										
Storage temperature			-10 to 60°C										
Accuracy (Fluid: in dry air) *3	Accuracy *4		Within ±3% F.S. (Secondary side released to atmosphere) (Scope of warranty depends on the "Measured flow rate range")										
	Repeatability *5		Within ±1% F.S. (Secondary side released to atmosphere)										
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, base temperature 25°C)										
	Pressure characteristics		Within ±5% F.S. (−0.07 to 0.75 MPa, where secondary side is released to atmosphere)								Within ±5% F.S. (0 to 1.00 MPa, base pressure 0.35 MPa)	Within ±5% F.S. (0 to 0.75 MPa, base pressure 0.35 MPa)	
Response time *6			50 msec or below (Response time set to OFF)										
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 4 conductor										
Functions *9 *10			1 Various exchanges, 2 flow rate adjustment, 3 peak hold, etc.										
Degree of protection			IP40-equivalent (IEC standards)										
Protection circuit *11			Power supply reverse connection protection										
Vibration resistance			10 to 150 Hz, max. 100 m/s2, X, Y, Z direction, every 2 hours										
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										

* Refer to page 35 for communication specifications.

* 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%). (With gas types other than air, this is 20°C 1 barometric pressure (101 kPa) relative humidity 0%)
* 2 : Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies with JIS B 8392-1:2012 Class 1.1.1 to 1.6.2. Compressed air from the compressor contains 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. (Refer to the recommended values on page 2.)
The sensor for oxygen gas is a custom model. To prevent ignition accidents, do not allow oxygen to flow again when a fluid other than oxygen has flown even once.
* 3 : Compressed air is used for adjustment and inspection of this product. For other gases than air, it is a reference value.
* 4 : 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 an accuracy of ±3%F.S.
Consider separately according to the working environment and working conditions.
* 5 : Repeatability over a short period of time. Change over time is not included.
* 6 : Actual response time depends on piping conditions. The response time can be set within the range of 50 msec to 1.5 sec.
* 7 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.
* 8 : The male side is straight, and the female side is angle. (Refre to page 79)
Tighten the M12 connector with a torque of 0.5 N·m or less.
Tightening it using excessive force may lead to damages.
* 9 : Gas can be changed to argon, carbon dioxide, and 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 gas exchange function cannot be set with a full scale flow rate of 500 or 1000 L/min or an oxygen type.)

Gas type	Flow direction	Full-scale flow fate
●Air/Nitrogen ●Argon ●Mixed gas (Argon80%+ Carbon dioxide20%)	One-direction	0 to 100%
	Bi-direction	-100 to 100%
●Carbon dioxide	One-direction	0 to 50%
	Bi-direction	-50 to 50%

*10: The integrating flow is a calculated (reference) value. When using the integration maintaining function, be careful that the number of times maintained 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.)

$$\text{Times maintained} = \frac{\text{Usage time}}{\text{5 min}} < \text{1 million times}$$

When instantaneous flow rate is below 1% it is not counted as integrating flow.
* 11 : This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not Provide protection for all misconnections.
* 12 : This product measures changes in heat distribution due to flow.
If installed vertically, the heat distribution may change due to convection, and the zero point may shift.
* 13 : Depending on piping conditions, accuracy may be affected. For more accurate measurement, please provide 10 times straight pipe section on the pipe inner diameter.
For 500 L / min, 1000 L / min model, please use pipe with inner diameter of 9 mm or more. If it is less than 9 mm, accuracy may deteriorate.

Notes

6.2 How to order

6.2.1 LCD display

■Resin body type

[Example of model No.]
FSM3-L005U1BH1A1N-BMR-P80

Model: RAPIFLOW FSM3 Series

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

Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: For "B: bi-directional" models, Ⓘ the only valve option is "N: none". Note that "T: with needle valve" and "E: EXA connecting fitting" cannot be selected.
*3: Check using the connection shape and dimensions (page 73) of of the G screw when selecting.
*4: Note that if you mount the elbow fitting in an upward position, it will interfere with the connector, and if you mount the elbow fitting in a downward position, it will interfere with the DIN rail mounting.
*5: Models with the unit switching function are not sold in Japan.
*6: Connection to solenoid valves (EXA Series) is possible with the dedicated fitting. Refer to page 11.
*7: Be sure to set EXA to the OUT side of the product. Use a lead wire for the EXA coil option. The DIN terminal box cannot be mounted because it will cause interference. After making sure it is connected firmly, confirm that there is no external leakage.
*8: Ⓜ Clean-room specifications "P70" and "P80" cannot be selected.
*9: Note that the bracket mounting position may interfere with the elbow fitting.
*10: Optional parts are provided with the product. They are not attached to the product.
*11: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*12: In addition to P70 specifications, wetted section materials are degreased and cleaned.

Code	Content
Ⓐ Display	
L	Liquid crystal display

Ⓑ 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		

Ⓒ Flow direction *2

U	Uni-direction
B	Bi-direction

Ⓓ Body material/applicable fluids

	Body material	Applicable fluids
1	Resin	Air (gas switchable)

Ⓔ Port size

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

Ⓕ Piping direction

1	Straight
2	Elbow *4

Ⓖ Output specifications

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

Ⓗ Unit specifications

1	SI units only
2	With unit switching function (overseas models only) *5

Ⓘ Valve option *2

N	None
T	With needle valve (only for models 200 L or less)
E	EXA connecting fitting (EXA sold separately) *6, *7, *8

Ⓙ Lead wire

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

Ⓚ Mounting attachments *9, *10

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)

Ⓛ Attached documents

Blank	None
R	Company certification
S	Company certification + Traceability certification

Ⓜ Clean-room specifications

Blank	None	
P70	Anti-dust generation	*11
P80	Oil free	*12

6.2.1 LCD display

■Resin body type

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

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

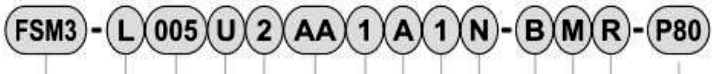
●: Port compatibility ○: Needle valve option compatibility ★: EXA connection fitting compatibility

Compatibility table of port size and clean-room specifications

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

6.2.1 LCD display

■Stainless steel body type



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

[Example of model No.]

FSM3-L005U2AA1A1N-BMR-P80

Model: RAPIFLOW FSM3 Series

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

Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: For "B: bi-directional" models, Ⓘ the only valve option is "N: none". Note that "T: with needle valve" cannot be selected.
*3: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*4: Check using the connection shape and dimensions (page 75) of the G screw when selecting.
*5: Models with the unit switching function are not sold in Japan.
*6: Optional parts are provided with the product. They are not attached 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 P70 specifications, wetted section materials are degreased and cleaned.
*9: This cannot be selected on an oxygen type (blank only).

Code	Content
Ⓐ Display	
L	Liquid crystal display

Ⓑ 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		

Ⓒ Flow direction *2

U	Uni-direction
B	Bi-direction

Ⓓ Body material/applicable fluids

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

Ⓔ Port size

AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
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)

Ⓕ Piping direction

1	Straight

Ⓖ Output specifications

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

Ⓗ Unit specifications

1	SI units only
2	With unit switching function (overseas models only) *5

Ⓘ Valve option *2

N	None
T	With needle valve (only for models 200 L or less)

Ⓙ Lead wire

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

Ⓚ Mounting attachment *6

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)

Ⓛ Attached documents

Blank	None
R	Company certification
S	Company certification + Traceability certification

Ⓜ Clean-room specifications *9

Blank	None
P70	Anti-dust generation *7
P80	Oil free *8

6.2.1 LCD display

■Stainless steel body type

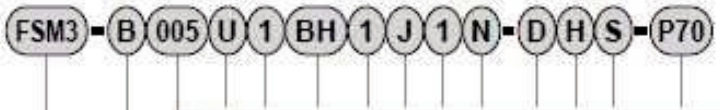
Flow rate range and port size

Ⓑ Flow rate	Ⓔ Port size												
	AA	BA	CA	AB	BB	CB	AC	BC	CC	AD	BD	AE	BE
	Rc1/8	Rc1/4	Rc1/2	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			●			●			●				

●: Port size compatibility ○: Needle valve option compatibility

6.2.2 Bar display

■Resin body type



Model No.

Ⓐ Display

Ⓑ Flow rate range (full scale flow rate)

Ⓒ Flow direction

Ⓓ Body material/applicable fluids

Ⓔ Port size

Ⓕ Piping direction

Ⓖ Output specifications

Ⓗ Unit specifications

Ⓘ Valve option

Ⓙ Lead wire

Ⓚ Mounting attachment

Ⓛ Attached documents

Ⓜ Clean-room specifications

[Example of model No.]

FSM3-B005U1BH1J1N-DHS-P70

Model: RAPIFLOW FSM3 Series

Ⓐ Display	B	: Bar display
Ⓑ Flow rate	005	: 500 mL/min
Ⓒ Flow direction	U	: Uni-direction
Ⓓ Body material/applicable fluids	1	: Resin/air
Ⓔ Port size	BH	: Push-in (ø4 mm for tube)
Ⓕ Piping direction	1	: Straight
Ⓖ Output specifications	J	: Analog voltage output x1
Ⓗ Unit specifications	1	: SI units only
Ⓘ Valve option	N	: None
Ⓙ Lead wire	D	: 4-conductor 3 m
Ⓚ Mounting attachment	H	: Bracket
Ⓛ Attached documents	S	: Company certification + Traceability certification
Ⓜ Clean-room specifications	P70	: Anti-dust generation

⚠ Precautions for model No. selection

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

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

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

*4: Check using the connection shape and dimensions (page 79) of the G screw when selecting.

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

*6: Connection to solenoid valves (EXA Series) is possible with the dedicated fitting. Refer to page 11.

*7: Be sure to set EXA to the OUT side of the product. Use a lead wire for the EXA coil option. The DIN terminal box cannot be mounted because it will cause interference. After making sure it is connected firmly, confirm that there is no external leakage.

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

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

*10: Optional parts are provided with the product. They are not attached to the product.

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

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

Code	Content
Ⓐ Display	
B	Bar display

Ⓑ 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		

Ⓒ Flow direction *3

U	Uni-direction
B	Bi-direction

Ⓓ Body material/applicable fluids

	Body material	Applicable fluids
1	Resin	Air

Ⓔ Port size

BH	Push-in (for ø4 mm tube)	AB	G1/8 *4
CH	Push-in (for ø6 mm tube)	BB	G1/4 *4
DH	Push-in (for ø8 mm tube)	CB	G1/2 *4
EH	Push-in (for ø10 mm tube)	AC	NPT1/8
HH	Push-in (for ø1/4" tube)	BC	NPT1/4
JH	Push-in (for ø3/8" tube)	CC	NPT1/2
AA	Rc1/8		
BA	Rc1/4		
CA	Rc1/2		

Ⓕ Piping direction

1	Straight
2	Elbow *5

Ⓖ Output specifications *2

J	Analog voltage output x 1 point
K	Analog current output x 1 point

Ⓗ Unit specifications

1	SI units only

Ⓘ Valve option *3

N	None
E	EXA connecting fitting (EXA sold separately) *6, *7, *8

Ⓙ Lead wire

Blank	None
C	4-conductor 1 m
D	4-conductor 3 m

Ⓚ Mounting attachments *9, *10

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)

Ⓛ Attached documents

Blank	None
R	Company certification
S	Company certification + Traceability certification

Ⓜ Clean-room specifications

Blank	None	
P70	Anti-dust generation	*11
P80	Oil free	*12

6.2.2 Bar display

■Resin body type

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

Ⓑ Flow rate	Ⓔ Port size Ⓕ Piping direction													
	BH1	CH1	DH1	EH1	HH1	JH1	BH2	CH2	DH2	EH2	HH2	JH2	AA1	BA1
005	●	●			●		●	●			●		●	
010	●	●			●		●	●			●		●	
020	●	●			●		●	●			●		●	
050	●	●			●		●	●			●		●	
100	●	●			●		●	●			●		●	
200	●	●			●		●	●			●		●	
500		●	●		●			●	●		●		●	●★
101			●	●		●			●	●		●		●★
201			●	●		●			●	●		●		●★
501														
102														
	CA1	AA2	BA2	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

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

6.2.2 Bar display

■Stainless steel body type

Code	Content
Ⓐ Display	
B	Bar display

Ⓑ 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		

Ⓒ Flow direction	
U	Uni-direction
B	Bi-direction

Ⓓ Body material/applicable fluids		
	Body material	Applicable fluids
2	SUS	Air
3	SUS	Oxygen (oil-prohibited specifications) *3

Ⓔ Port size	
AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
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)

Ⓕ Piping direction	
1	Straight

Ⓖ Output specifications *2	
J	Analog voltage output × 1 point
K	Analog current output × 1 point

Ⓗ Unit specifications	
1	SI units only

Ⓘ Valve option	
N	None

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

Ⓚ Mounting attachment *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)

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

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

[Example of model No.]

FSM3-B005U2AA1J1N-DHS-P70

Model: RAPIFLOW FSM3 Series

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

Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: When using in combination with a separated display (FSM2-D), select "J".
*3: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*4: Check using the connection shape and dimensions (page 81) of the G screw when selecting.
*5: Optional parts are provided with the product. They are not attached 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 P70 specifications, wetted section materials are degreased and cleaned.
*8: This cannot be selected on an oxygen type (blank only).

6.2.2 Bar display

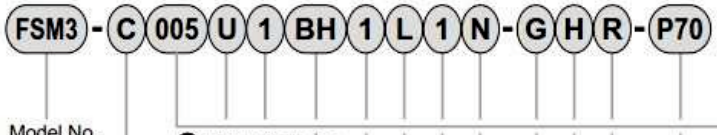
■Stainless steel body type

Flow rate range and port size

Ⓑ Flow rate	Ⓔ Port size												
	AA	BA	CA	AB	BB	CB	AC	BC	CC	AD	BD	AE	BE
	Rc1/8	Rc1/4	Rc1/2	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			●			●			●				

6.2.3 IO-Link

■Resin body type



[Example of model No.]

FSM3-C005U1BH1L1N-GHR-P70

Model: RAPIFLOW FSM3 Series

Ⓐ Display	C	: IO-Link
Ⓑ Flow rate range	005	: 500 mL/min
Ⓒ Flow direction	U	: Uni-direction
Ⓓ Body material/compatible fluids	1	: Resin/air
Ⓔ Port size	BH	: Push-in (φ4 mm for tube)
Ⓕ Piping direction	1	: Straight
Ⓖ Output specifications	L	: IO-Link
Ⓗ Unit specifications	1	: SI units only
Ⓘ Valve option	N	: None
Ⓙ Cable	G	: M12 both ends connector cable (3 m)
Ⓚ Mounting attachments	H	: Bracket
Ⓛ Attachments	R	: Company certification
Ⓜ Clean-room specifications	P70	: Anti-dust generation

Precautions for model No. selection

*1: During selection, always check the compatibility table on the next page.
*2: Check using the connection shape and dimensions (page 83) of the G screw when selecting.
*3: Note that if you mount the elbow fitting in a downward position, it will interfere with the DIN rail mounting.
*4: Note that the bracket mounting position may interfere with the elbow fitting.
*5: Optional parts will come with the product. They are not pre-assembled.
*6: Product surface is degreased before packaging and heat sealed into an antistatic bag on the clean bench (Class 1000 and over).
*7: The wetted section is degreased in addition to the specifications on P70.

Code	Content
Ⓐ Display	
C	IO-Link

Ⓑ Flow rate range (full scale flow rate)

005	500 mL/min	**500**	50 L/min
010	1 L/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		

Ⓒ Flow direction

U	Uni-direction
B	Bi-direction

Ⓓ Body material/compatible fluids

	Body material	Compatible fluids
1	Resin	Air (Gas can be changed)

Ⓔ Port size

BH	Push-in (for φ4 mm tube)	**AB**	G1/8 *2
CH	Push-in (for φ6 mm tube)	**BB**	G1/4 *2
DH	Push-in (for φ8 mm tube)	**CB**	G1/2 *2
EH	Push-in (for φ10 mm tube)	**AC**	NPT1/8
HH	Push-in (for φ1/4" tube)	**BC**	NPT1/4 *2
JH	Push-in (for φ3/8" tube)	**CC**	NPT1/2
AA	Rc1/8		
BA	Rc1/4		
CA	Rc1/2		

Ⓕ Piping direction

1	Straight
2	Elbow *3

Ⓖ Output specifications

L	IO-Link communication

Ⓗ Unit specifications

1	SI units only

Ⓘ Valve option

N	None

Ⓙ Cable

Blank	None
G	M12 both ends connector cable (3 m)

Ⓚ Mounting attachments *4, *5

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)

Ⓛ Attachments

Blank	None
R	Company certification
S	Company certification + traceability certificate

Ⓜ Clean-room specifications

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

6.2.3 IO-Link

■Resin body type

Flow rate range and port size

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

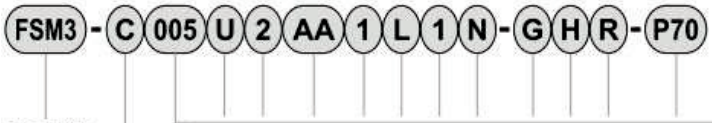
●: Port size compatibility

Compatibility table of port size and clean-room specifications

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

6.2.3 IO-Link

■Stainless steel body type



[Example of model No.]

FSM3-C005U2AA1L1N-GHR-P70

Model: RAPIFLOW FSM3 Series

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

⚠ Precautions for model No. selection

*1: Refer to the correspondence table on the following page when selecting the model.
*2: "3: Oxygen" cannot be selected with 500 L/min and 1000 L/min models.
*3: Check using the connection shape and dimensions (page 85) of the G screw when selecting.
*4: Optional parts are provided with the product. They are not attached to the product.
*5: The product surface is degreased and cleaned before packaging, and heat-sealed into an antistatic bag on a clean bench (Class 1000 or more).
*6: In addition to P70 specifications, wetted section materials are degreased and cleaned.
*7: This cannot be selected on an oxygen type (blank only).

Code	Content
Ⓐ Display	
C	IO-Link

Ⓑ 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		

Ⓒ Flow direction

U	Uni-direction
B	Bi-direction

Ⓓ Body material/applicable fluids

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

Ⓔ Port size

AA	Rc1/8
BA	Rc1/4
CA	Rc1/2
AB	G1/8 *3
BB	G1/4 *3
CB	G1/2 *3
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)

Ⓕ Piping direction

1	Straight

Ⓖ Output specifications

L	IO-Link communication

Ⓗ Unit specifications

1	SI units only

Ⓘ Valve option

N	None

Ⓙ Lead wire

Blank	None
G	M12 both-end lead wire with connector (3 m)

Ⓚ Mounting attachment *4

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)

Ⓛ Attached documents

Blank	None
R	Company certification
S	Company certification + Traceability certification

Ⓜ Clean-room specifications *7

Blank	None	
P70	Anti-dust generation	*5
P80	Oil free	*6

6.2.3 IO-Link

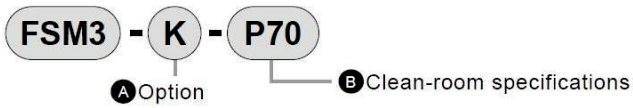
■Stainless steel body type

Flow rate range and port size

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

6.2.4 Option

Discrete option model No. method



Code	Content
Ⓐ Option	
A	5 conductor cable 1 m (for LCD display)
B	5 conductor cable 3 m (for LCD display)
C	4 conductor cable 1 m (for bar display)
D	4 conductor cable 3 m (for bar display)
G	M12 both 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 valve 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)

Ⓑ Clean-room specifications	
Blank	None
P70	Anti-dust generation (FSM3-G-P70 cannot be selected.)

6.2.5 Products weight

■Resin body type

【Unit:g】

Fitting		LCD indicator type	Bar indicator type	IO-Link type	LCD indicator type (Needle valve integrated type)
Model	Contents				
BH1	Push-in(Φ4mm Straight)	60	50	50	90
CH1	Push-in(Φ6mm Straight)	50	40	50	80
DH1	Push-in(Φ8mm Straight)	80	70	80	120
EH1	Push-in(Φ10mm Straight)	80	70	80	120
HH1	Push-in(Φ1/4 inch Straight)	60	50	50	90
JH1	Push-in(Φ3/8 inch Straight)	80	70	80	120
AA1	Rc1/8 Straight	60	50	50	90
BA1	Rc1/4 Straight	60	50	60	100
CA1	Rc1/2 Straight	120	110	120	—
AB1	G1/8 Straight	60	50	60	90
BB1	G1/4 Straight	70	60	70	110
CB1	G1/2 Straight	140	130	140	—
AC1	NPT1/8 Straight	50	50	50	80
BC1	NPT1/4 Straight	60	50	60	100
CC1	NPT1/2 Straight	120	110	120	—
BH2	Push-in(Φ4mm Elbow)	70	60	60	100
CH2	Push-in(Φ6mm Elbow)	60	50	60	90
DH2	Push-in(Φ8mm Elbow)	100	90	90	140
EH2	Push-in(Φ10mm Elbow)	100	90	100	140
HH2	Push-in(Φ1/4 inch Elbow)	70	60	60	100
JH2	Push-in(Φ3/8 inch Elbow)	100	90	100	140
AA2	Rc1/8 Elbow	70	60	60	100
BA2	Rc1/4 Elbow	80	70	80	120
AB2	G1/8 Elbow	70	60	70	100
BB2	G1/4 Elbow	90	80	90	130
AC2	NPT1/8 Elbow	70	60	60	100
BC2	NPT1/4 Elbow	80	70	80	120

■Stainless steel body type

【Unit:g】

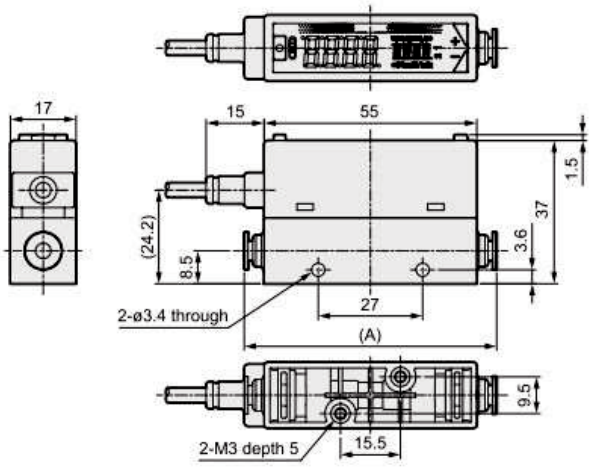
Fitting		LCD indicator type	Bar indicator type	IO-Link type	LCD indicator type (Needle valve integrated type)
Model	Contents				
AA1	Rc1/8 Straight	100	90	95	165
BA1	Rc1/4 Straight	115	105	110	200
CA1	Rc1/2 Straight	420	410	420	-
AB1	G1/8 Straight	100	90	95	165
BB1	G1/4 Straight	110	100	105	195
CB1	G1/2 Straight	440	430	440	-
AC1	NPT1/8 Straight	100	90	95	165
BC1	NPT1/4 Straight	115	105	110	200
CC1	NPT1/2 Straight	420	410	420	-
AD1	1/4inch double barbed joint (500mL/min to 50L/min)	155	145	150	220
BD1	1/4 inch double barbed joint (50 to 200L/min)	190	180	190	275
AE1	1/4 inch JXR male joint (500mL/min to 50L/min)	155	145	150	220
BE1	1/4 inch JXR (50 to 200L/min)	190	180	190	275

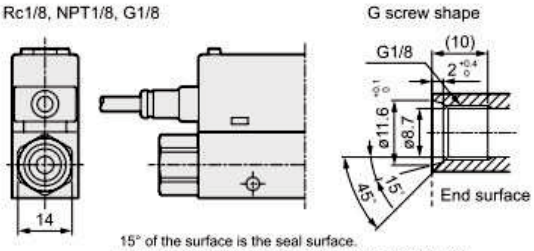
6.3 Dimensions

6.3.1 LCD display (Resin body type)

Port size: Straight ø4 mm, ø6 mm, ø1/4", Rc1/8, G1/8, NPT1/8

● FSM3−L□□1/BH1/CH1/HH1/AA1/AB1/AC1 (Full scale flow rate: 500 mL/min,1, 2, 5,10, 20, 50 L/min)





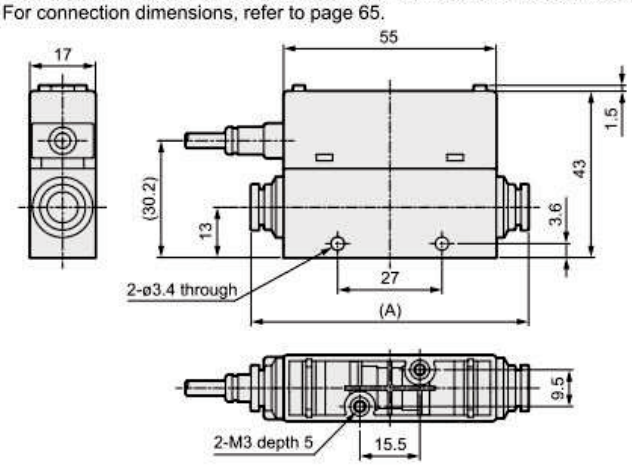
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

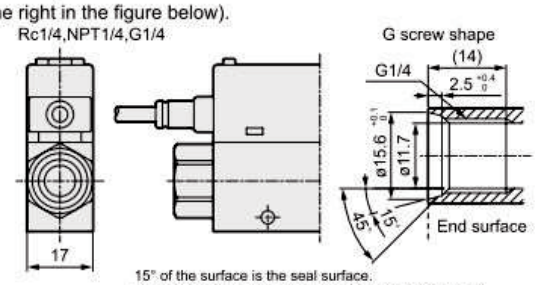
Model No.	Fitting	Dimension (A)
FSM3-L□□1BH1	Push-in ø4 mm	(65)
FSM3-L□□1CH1	Push-in ø6 mm	(67.2)
FSM3-L□□1HH1	Push-in 1/4"	(70.4)
FSM3-L□□1AA1	Rc1/8	(75)
FSM3-L□□1AB1	G1/8	(87)
FSM3-L□□1AC1	NPT1/8	(75)

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

● FSM3−L□□1/DH1/EH1/JH1/BA1/BB1/BC1 (Full scale flow rate: 50, 100, 200 L/min)

* The dedicated adaptor for the EXA connection type is the secondary side (to the right in the figure below).
For connection dimensions, refer to page 65.



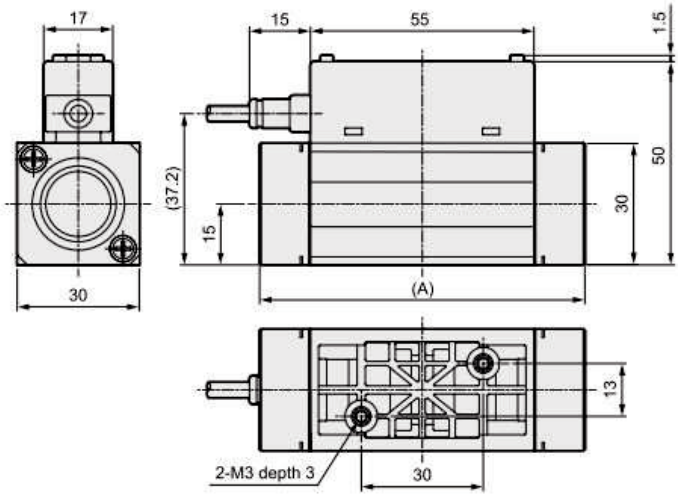


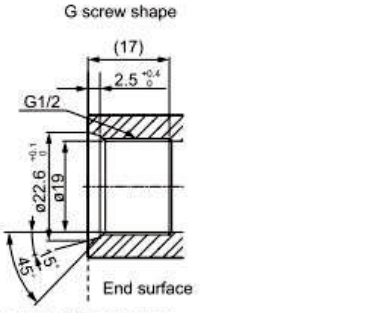
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Model No.	Fitting	Dimension (A)
FSM3-L□□1DH1	Push-in ø8 mm	(70.6)
FSM3-L□□1EH1	Push-in ø10 mm	(82.1)
FSM3-L□□1JH1	Push-in 3/8"	(83.4)
FSM3-L□□1BA1	Rc1/4	(75)
FSM3-L□□1BB1	G1/4	(89)
FSM3-L□□1BC1	NPT1/4	(75)

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

● FSM3−L□□1/CA1/CB1/CC1 (Full scale flow rate: 500, 1000 L/min)





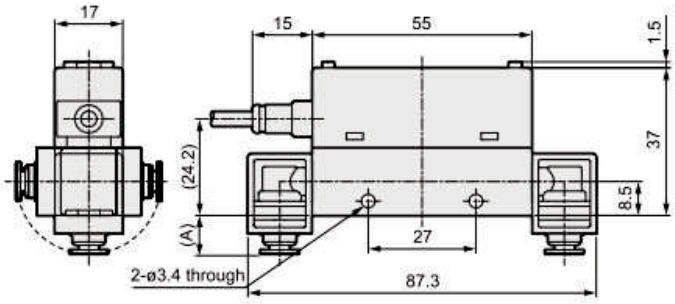
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

6.3.1 LCD display (Resin body type)

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

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

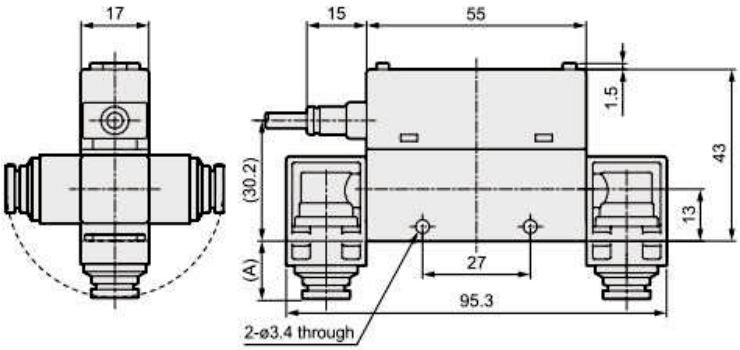


Note: Because it causes external leakage, please do not turn the joint while adding fluid pressure to this product. Also, please do not use in a way to rotate the fitting during use.

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

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

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



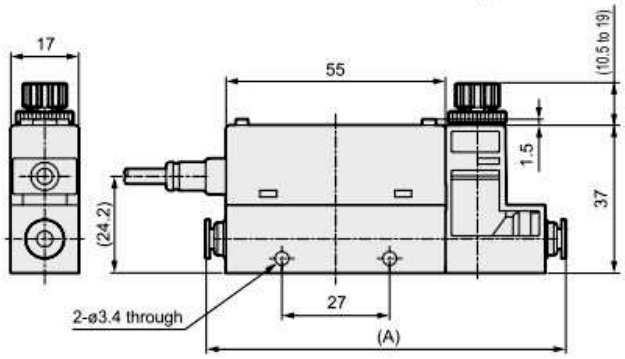
Note: Because it causes external leakage, please do not turn the joint while adding fluid pressure to this product. Also, please do not use in a way to rotate the fitting during use.

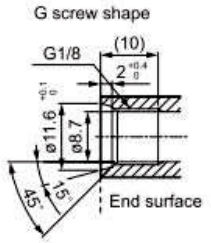
Model No.	Fitting	Dimension (A)
FSM3-L□□1DH2	Push-in ø8 mm	(13.6)
FSM3-L□□1EH2	Push-in ø10 mm	(19.3)
FSM3-L□□1JH2	Push-in 3/8"	(20.0)
FSM3-L□□1BA2	Rc1/4	(15.8)
FSM3-L□□1BB2	G1/4	(22.8)
FSM3-L□□1BC2	NPT1/4	(15.8)

Solenoid valve with needle dimensions

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

● FSM3−L□□1/BH1/CH1/HH1/AA1/AB1/AC1/□□T (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



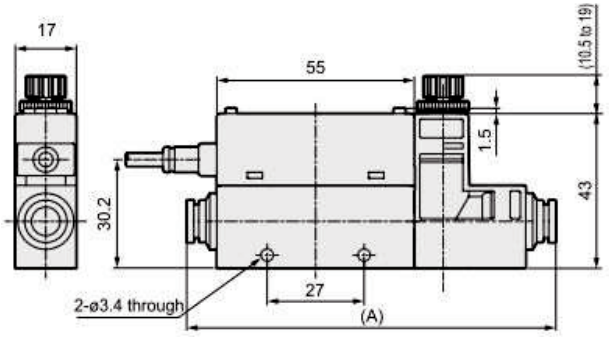


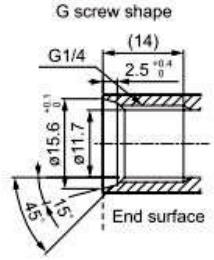
15° of the surface is the seal surface. Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

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

● FSM3−L□□1/DH1/EH1/JH1/BA1/BB1/BC1/□□T (Full scale flow rate: 50, 100, 200 L/min)





15° of the 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.

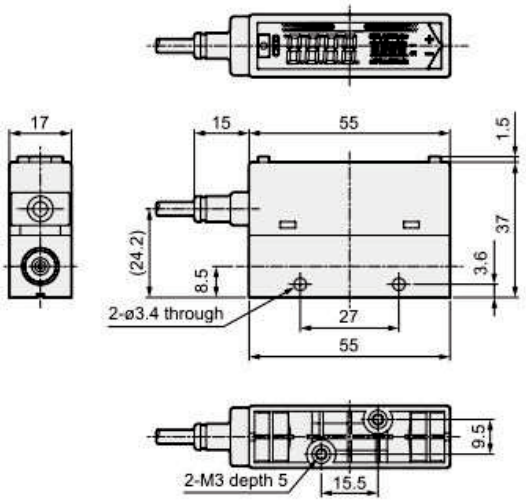
Model No.	Fitting	Dimension (A)
FSM3-L□□1DH1	Push-in ø8 mm	(101.6)
FSM3-L□□1EH1	Push-in ø10 mm	(113.1)
FSM3-L□□1JH1	Push-in 3/8"	(114.4)
FSM3-L□□1BA1	Rc1/4	(106)
FSM3-L□□1BB1	G1/4	(120)
FSM3-L□□1BC1	NPT1/4	(106)

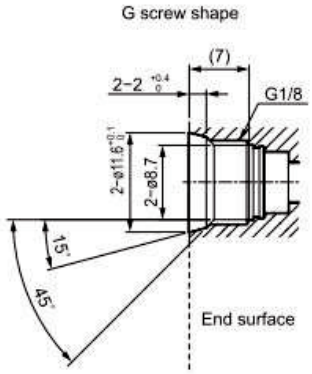
6.3.1 LCD display (Stainless steel body, 500mL/min to 50L/min)

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

● FSM3-L[B][C]$\frac{2}{3}$/AA1/AB1/AC1

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



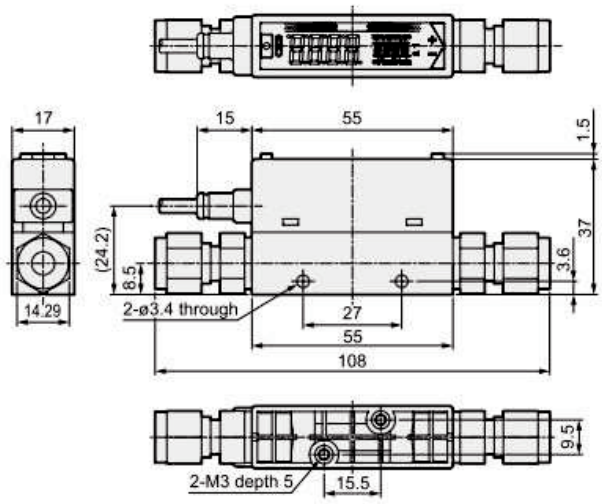


15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Port size: Straight 1/4" double barbed fitting

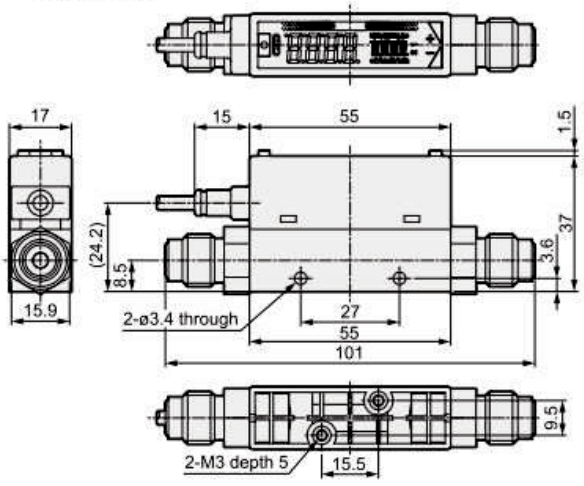
● FSM3-L[B][C]$\frac{2}{3}$/AD1

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



Port size: Straight 1/4" JXR male fitting

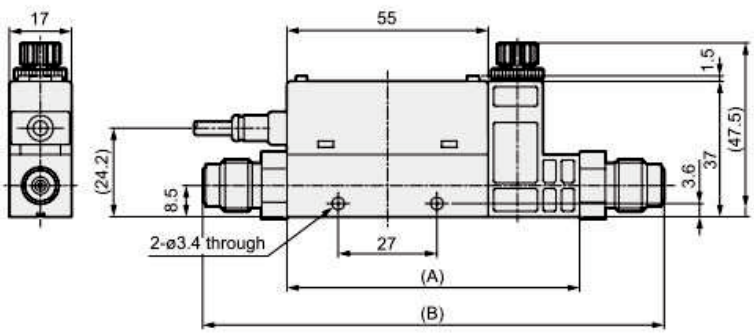
● FSM3-L[B][C]$\frac{2}{3}$/AE1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Solenoid valve with needle dimensions

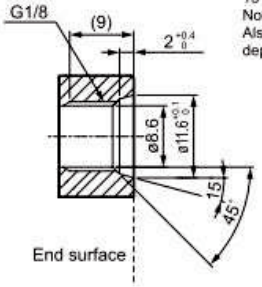
Port size: Rc1/8, G1/8, NPT1/8, 1/4" double barbed fitting, 1/4" JXR male fitting

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



G screw shape (needle valve side)

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



15° of the 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.

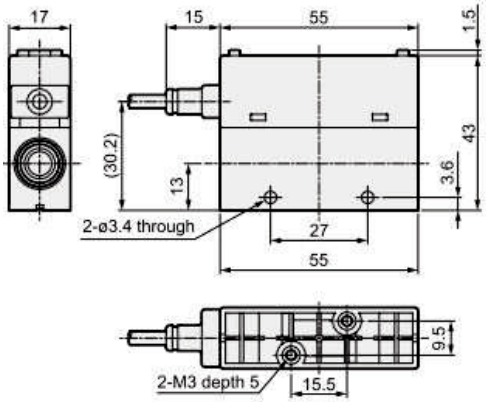
Port size	Dimension (A)	Dimension (B)
Rc 1/8	80	–
G 1/8	80	–
NPT 1/8	80	–
1/4" Double barbed fitting	80	133
1/4" JXR male fitting	80	126

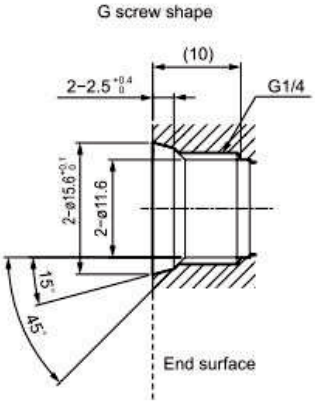
6.3.1 LCD display (Stainless steel body, 50 to 200L/min)

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

● FSM3-L[B][C]$\frac{2}{3}$/BA1/BB1/BC1

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



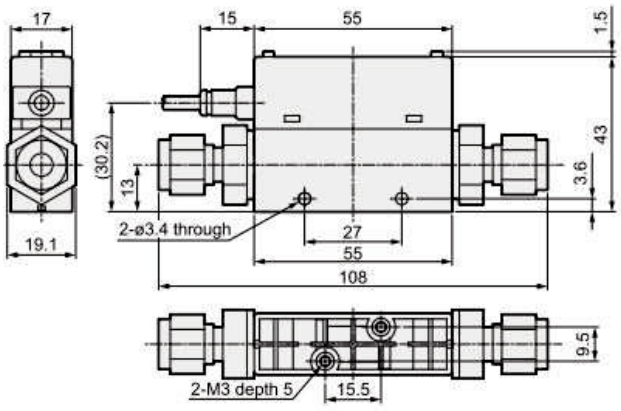


15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Port size: Straight 1/4" double barbed fitting

● FSM3-L[B][C]$\frac{2}{3}$/BD1

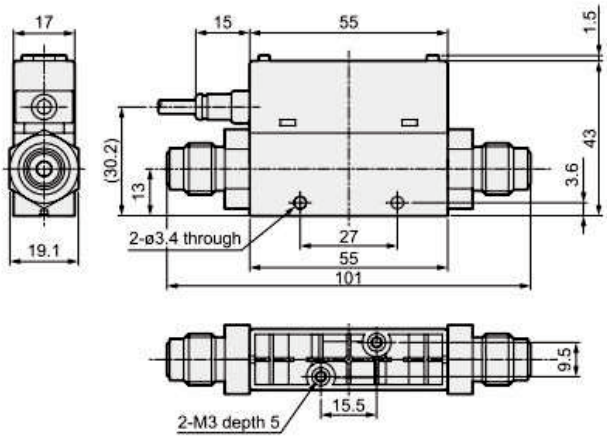
(Full scale flow rate: 50, 100, 200 L/min)



Port size: Straight 1/4" JXR male fitting

● FSM3-L[B][C]$\frac{2}{3}$/BE1

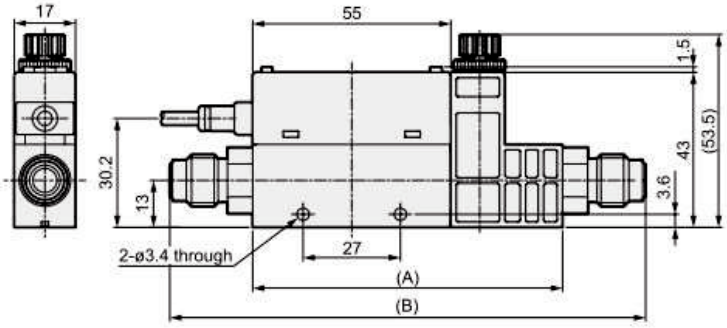
(Full scale flow rate: 50, 100, 200 L/min)



Solenoid valve with needle dimensions

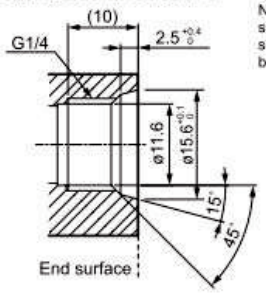
Port size: Rc1/4, G1/4, NPT1/4, 1/4" double barbed fitting, 1/4" JXR male fitting

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



G screw shape (needle valve side)

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



15° of the 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.

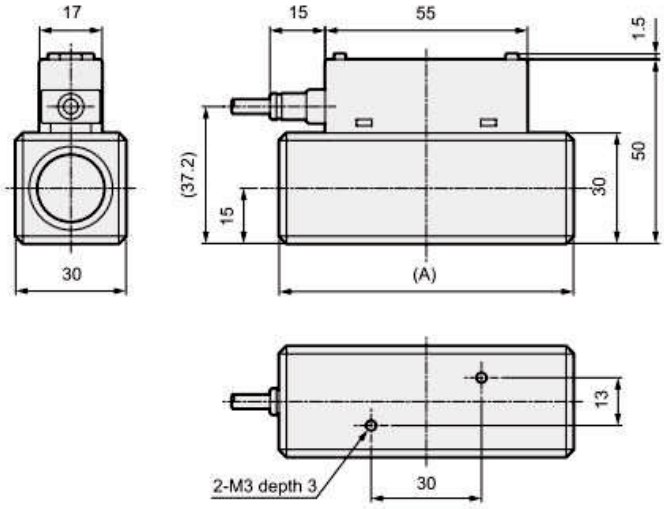
Port size	Dimension (A)	Dimension (B)
Rc 1/4	86	–
G 1/4	86	–
NPT 1/4	86	–
1/4" Double barbed fitting	86	139
1/4" JXR male fitting	86	132

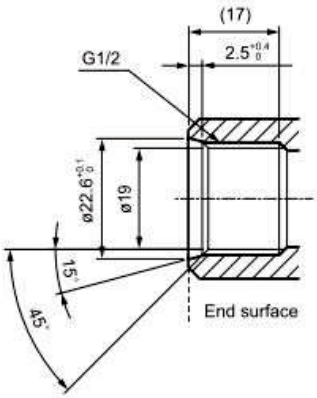
6.3.1 LCD display (Stainless steel body, 500 to 1000L/min)

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

● FSM3-L B C 2/CA1/CB1/CC1

(Full scale flow rate: 500,1000L/min)





15° of the 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.

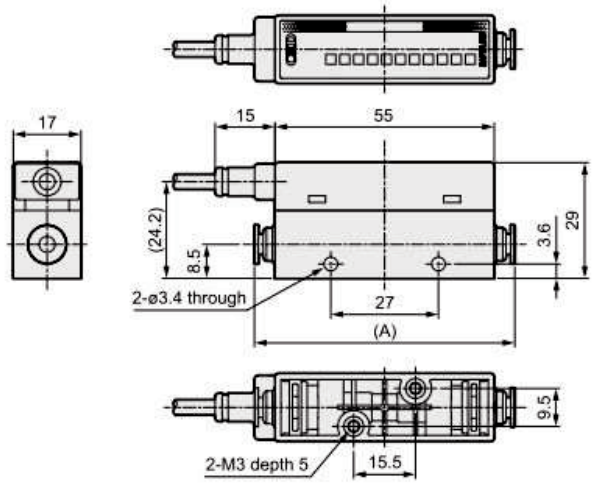
Model No.	Port size	Dimension (A)
FSM3-L□□2CA1	Rc1/2	(80)
FSM3-L□□2CB1	G1/2	(95.4)
FSM3-L□□2CC1	NPT1/2	(80)

Notes

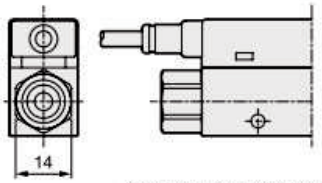
6.3.2 Bar display (Resin body type)

Port size: Straight ø4 mm, ø6 mm, ø1/4", Rc1/8, G1/8, NPT1/8

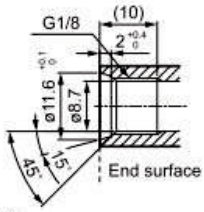
● FSM3−B□□1/BH1/CH1/HH1/AA1/AB1/AC1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Rc1/8, NPT1/8, G1/8



G screw shape



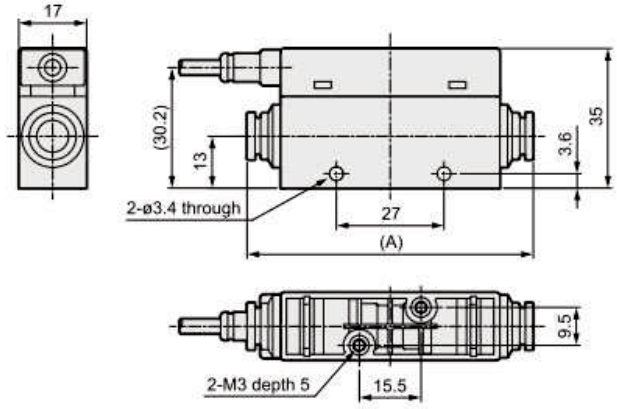
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

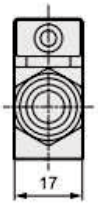
Port size: Straight ø8 mm, ø10 mm, ø3/8", Rc1/4, G1/4, NPT1/4

● FSM3−B□□1/DH1/EH1/JH1/BA1/BB1/BC1 (Full scale flow rate: 50, 100, 200 L/min)

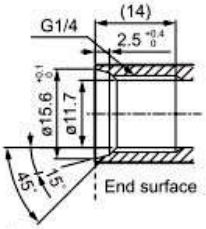
* The dedicated adaptor for the EXA connection type is the secondary side (to the right in the figure below).
For connection dimensions, refer to page 65.



Rc1/4, NPT1/4, G1/4



G screw shape

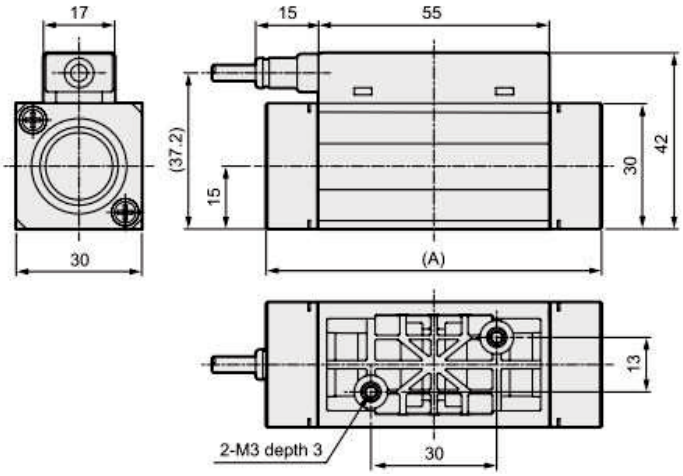


15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

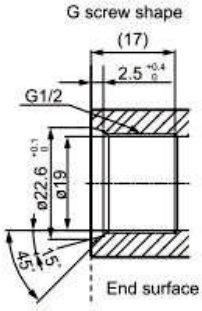
Model No.	Fitting	Dimension (A)
FSM3-B□□1DH1	Push-in ø8 mm	(70.6)
FSM3-B□□1EH1	Push-in ø10 mm	(82.1)
FSM3-B□□1JH1	Push-in 3/8"	(83.4)
FSM3-B□□1BA1	Rc1/4	(75)
FSM3-B□□1BB1	G1/4	(89)
FSM3-B□□1BC1	NPT1/4	(75)

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

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



G screw shape



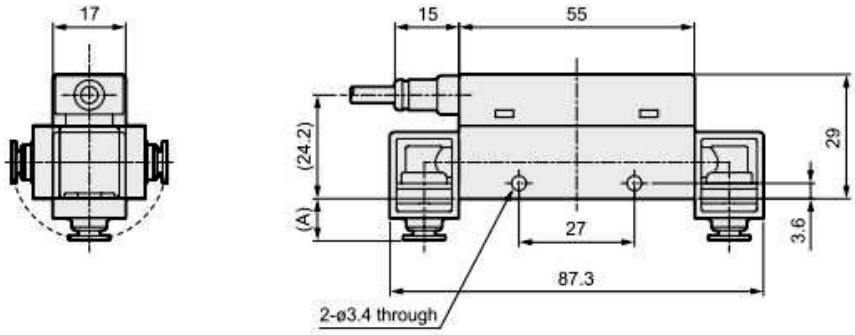
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

6.3.2 Bar display (Resin body type)

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

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

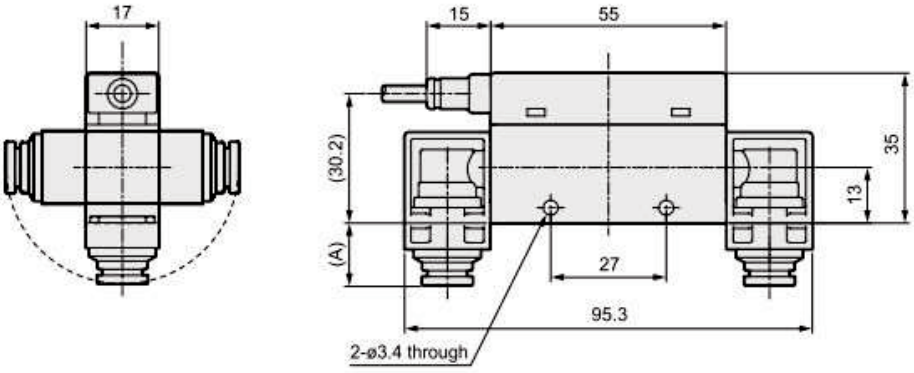


Model No.	Fitting	Dimension (A)
FSM3-B□□1BH2	Push-in ø4 mm	(9.5)
FSM3-B□□1CH2	Push-in ø6 mm	(10.6)
FSM3-B□□1HH2	Push-in 1/4"	(12.2)
FSM3-B□□1AA2	Rc1/8	(14.5)
FSM3-B□□1AB2	G1/8	(20.5)
FSM3-B□□1AC2	NPT1/8	(14.5)

Note: Because it causes external leakage, please do not turn the joint while adding fluid pressure to this product. Also, please do not use in a way to rotate the fitting during use.

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

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



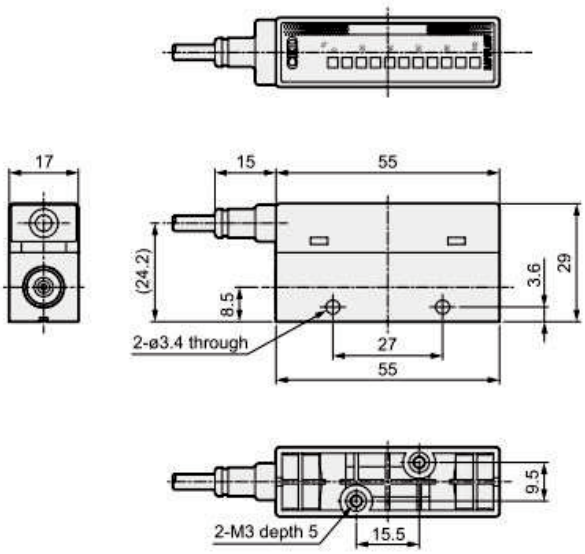
Model No.	Fitting	Dimension (A)
FSM3-B□□1DH2	Push-in ø8 mm	(13.6)
FSM3-B□□1EH2	Push-in ø10 mm	(19.3)
FSM3-B□□1JH2	Push-in 3/8"	(20.0)
FSM3-B□□1BA2	Rc1/4	(15.8)
FSM3-B□□1BB2	G1/4	(22.8)
FSM3-B□□1BC2	NPT1/4	(15.8)

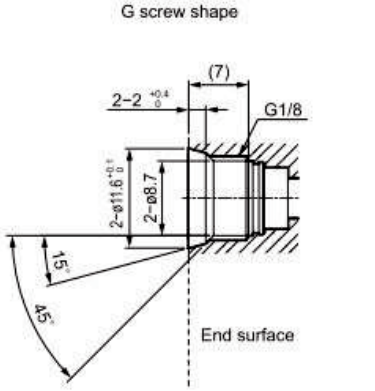
Note: Because it causes external leakage, please do not turn the joint while adding fluid pressure to this product. Also, please do not use in a way to rotate the fitting during use.

6.3.2 Bar display (Stainless steel body, 500mL/min to 50L/min)

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

● FSM3-B□□2/3/AA1/AB1/AC1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)

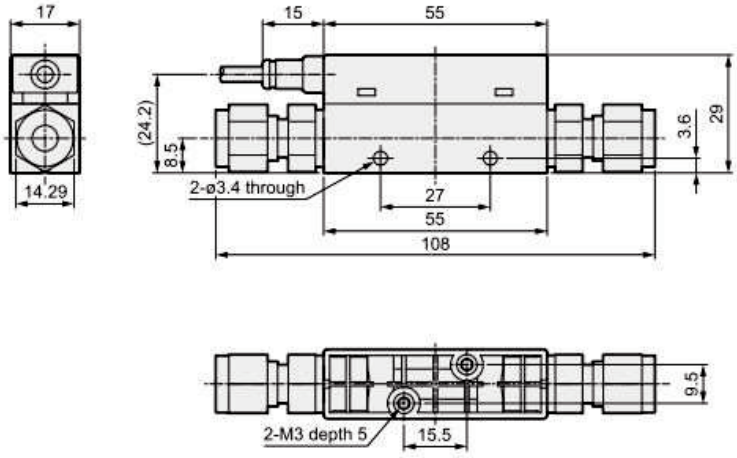




15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

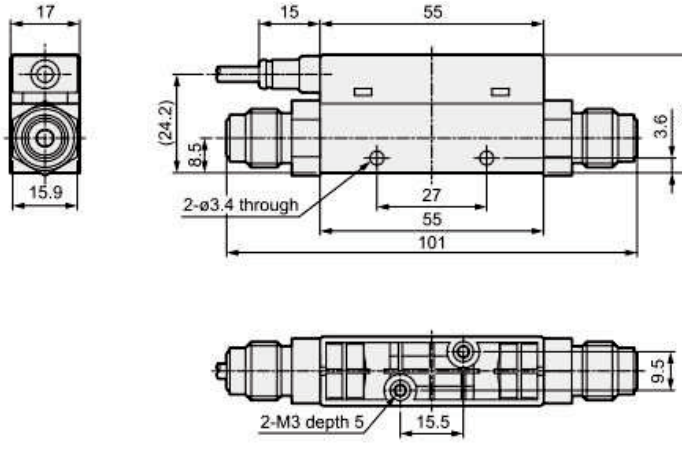
Port size: Straight 1/4" double barbed fitting

● FSM3-B□□2/3/AD1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)



Port size: Straight 1/4" JXR male fitting

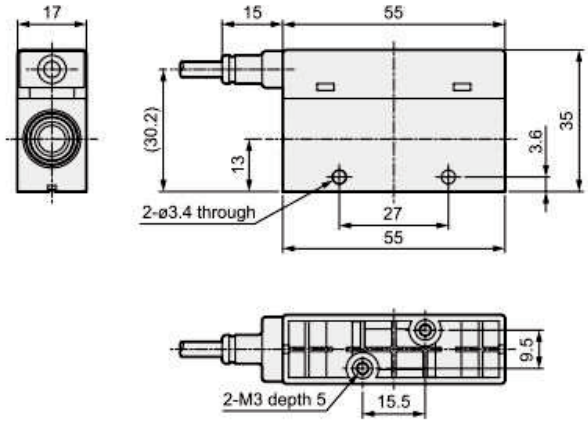
● FSM3-B□□2/3/AE1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)

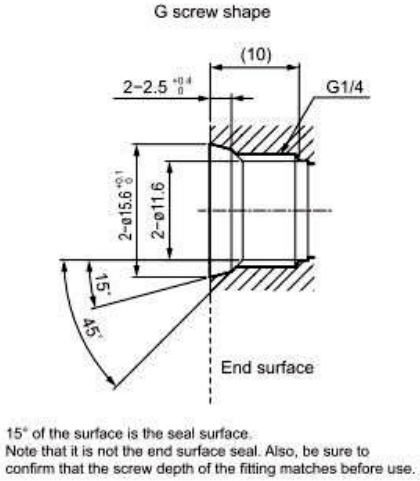


6.3.2 Bar display (Stainless steel body, 50 to 200L/min)

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

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

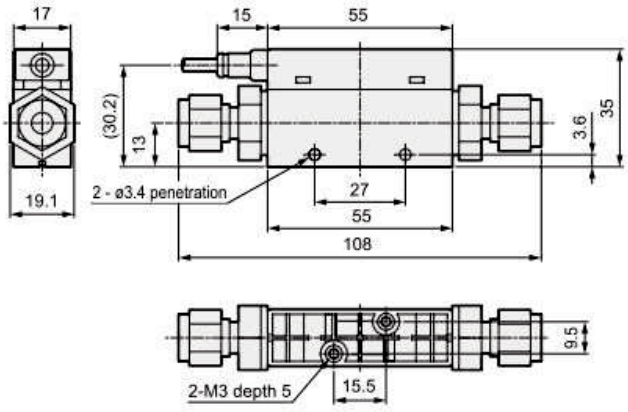




15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

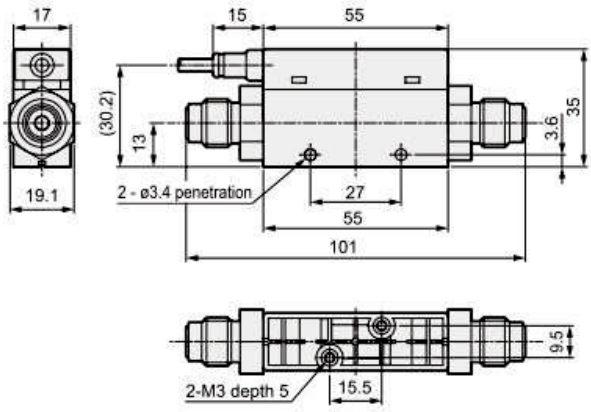
Port size: Straight 1/4" double barbed fitting

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



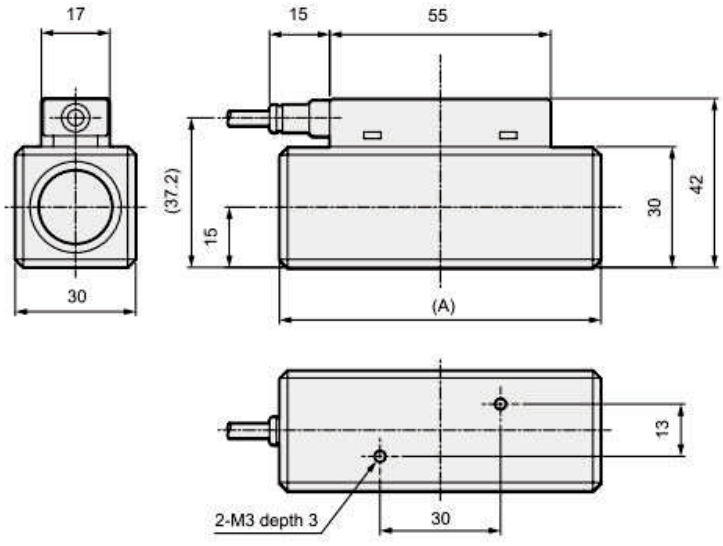
Port size: Straight 1/4" JXR male fitting

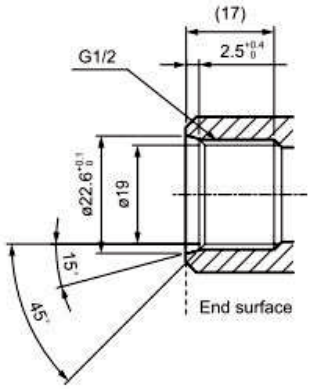
● FSM3-B□□2/3/BE1 (Full scale flow rate: 50, 100, 200 L/min)



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

● FSM3-B□□2/CA1/CB1/CC1 (Full scale flow rate: 500,1000L/min)





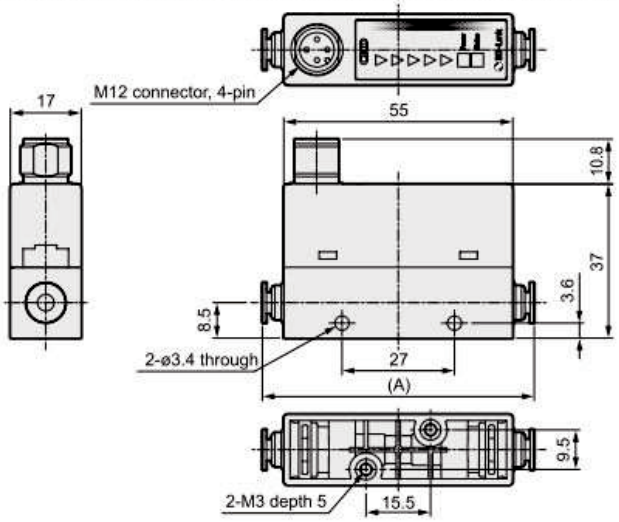
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

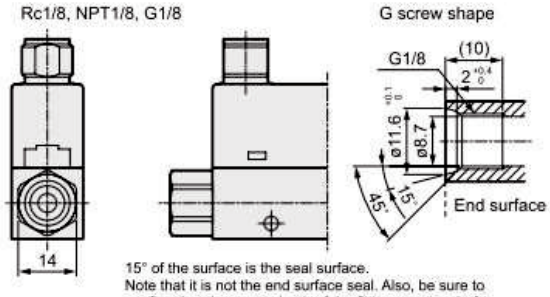
Model No.	Port size	Dimension (A)
FSM3-B□□2CA1	Rc1/2	(80)
FSM3-B□□2CB1	G1/2	(95.4)
FSM3-B□□2CC1	NPT1/2	(80)

6.3.3 IO-Link (Resin body type)

Port size: Straight ø4 mm, ø6 mm, ø1/4", Rc1/8, G1/8, NPT1/8

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



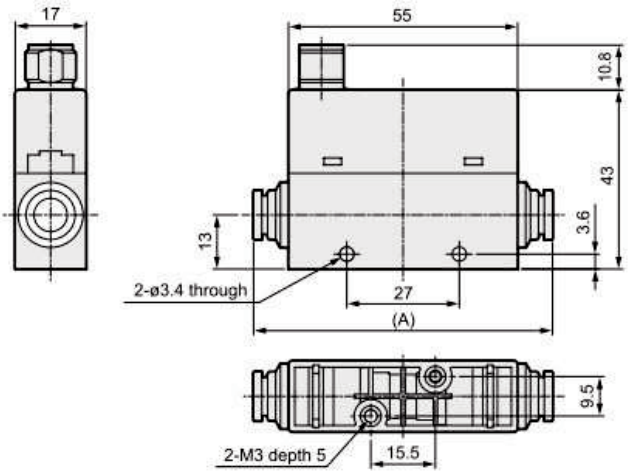


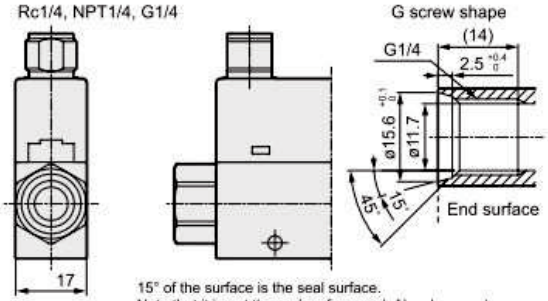
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

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

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



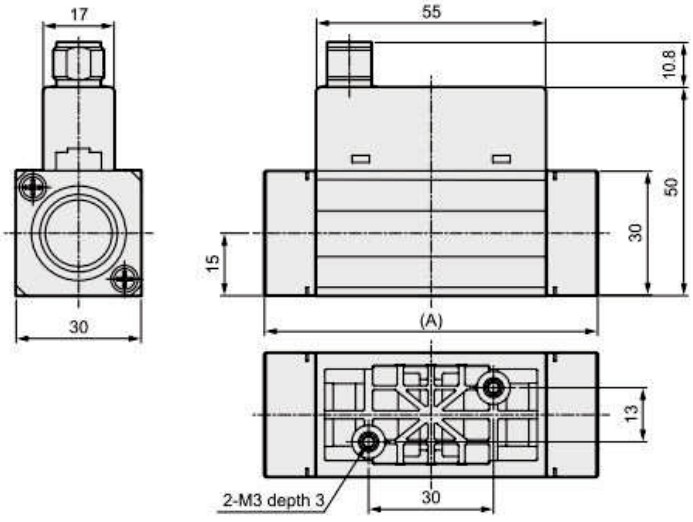


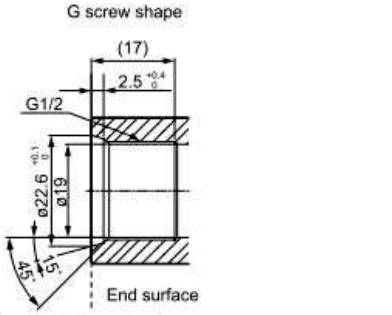
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

Model No.	Fitting	Dimension (A)
FSM3-C□□1DH1	Push-in ø8 mm	(70.6)
FSM3-C□□1EH1	Push-in ø10 mm	(82.1)
FSM3-C□□1JH1	Push-in 3/8"	(83.4)
FSM3-C□□1BA1	Rc1/4	(75)
FSM3-C□□1BB1	G1/4	(89)
FSM3-C□□1BC1	NPT1/4	(75)

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

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





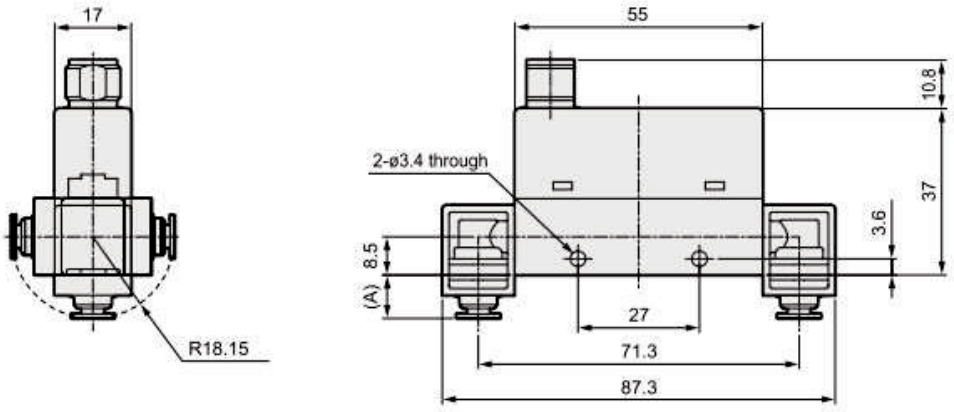
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

6.3.3 IO-Link (Resin body type)

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

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

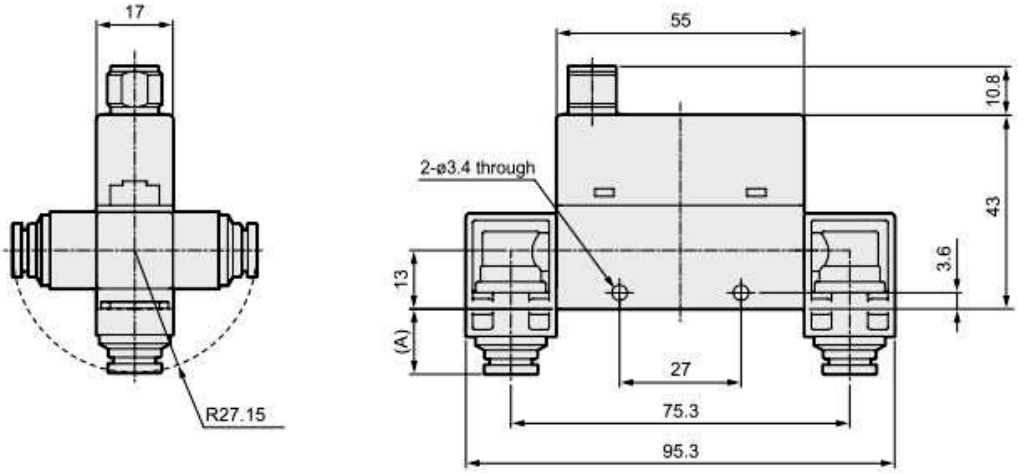


Model No.	Fitting	Dimension (A)
FSM3-C□□1BH2	Push-in ø4 mm	(9.5)
FSM3-C□□1CH2	Push-in ø6 mm	(10.6)
FSM3-C□□1HH2	Push-in 1/4"	(12.2)
FSM3-C□□1AA2	Rc1/8	(14.5)
FSM3-C□□1AB2	G1/8	(20.5)
FSM3-C□□1AC2	NPT1/8	(14.5)

Note: Because it causes external leakage, please do not turn the joint while adding fluid pressure to this product. Also, please do not use in a way to rotate the fitting during use.

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

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



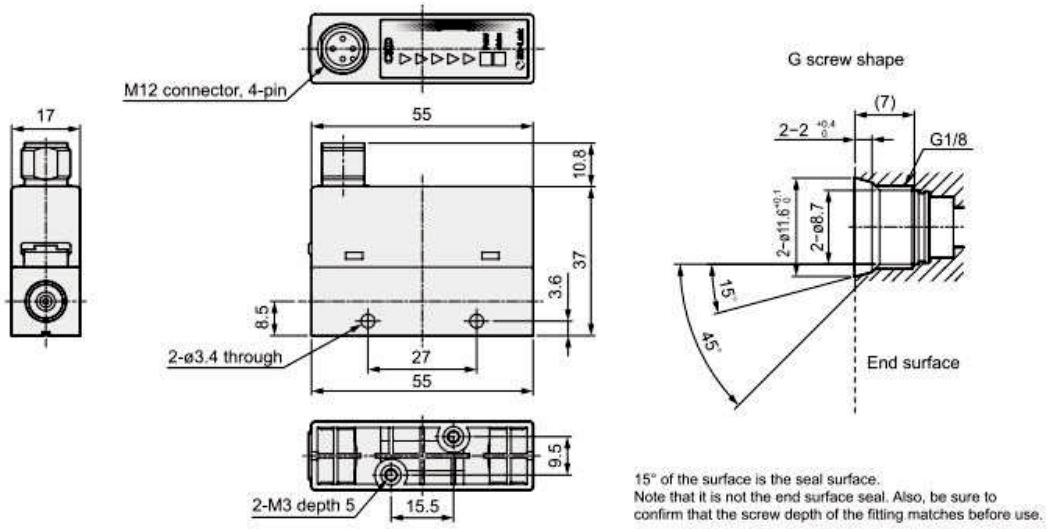
Model No.	Fitting	Dimension (A)
FSM3-C□□1DH2	Push-in ø8 mm	(13.6)
FSM3-C□□1EH2	Push-in ø10 mm	(19.3)
FSM3-C□□1JH2	Push-in 3/8"	(20.0)
FSM3-C□□1BA2	Rc1/4	(15.8)
FSM3-C□□1BB2	G1/4	(22.8)
FSM3-C□□1BC2	NPT1/4	(15.8)

Note: Because it causes external leakage, please do not turn the joint while adding fluid pressure to this product. Also, please do not use in a way to rotate the fitting during use.

6.3.3 IO-Link(Stainless steel body type)

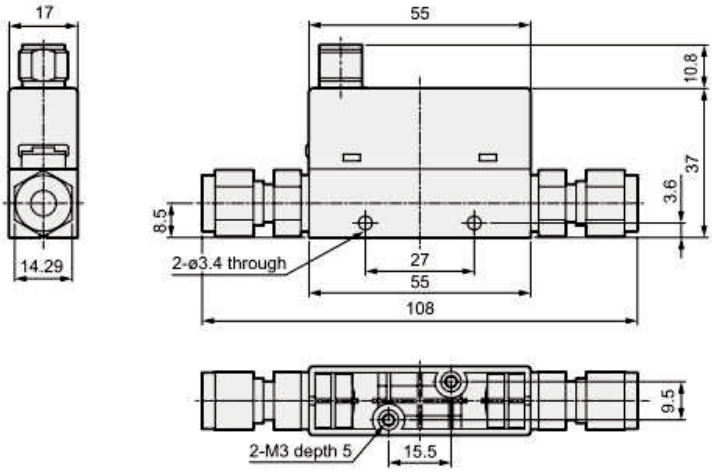
Port size: Straight Rc1/8, G1/8, NPT1/8

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



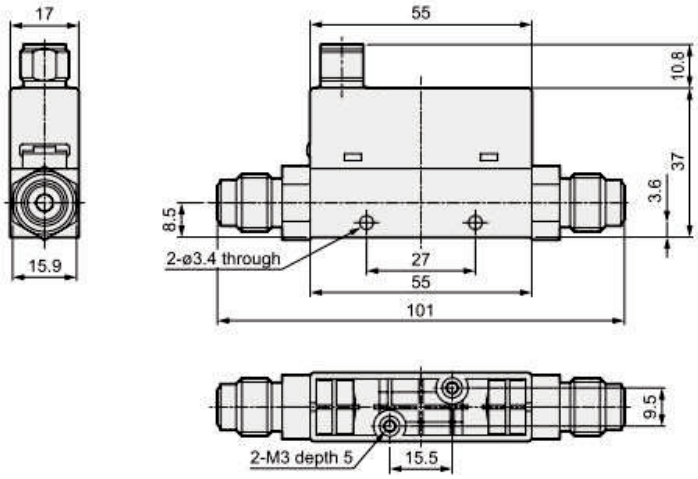
Port size: Straight 1/4" double barbed fitting

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



Port size: Straight 1/4" JXR male fitting

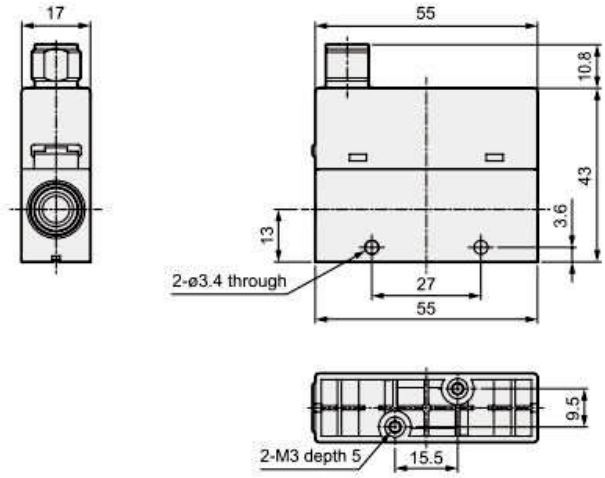
● FSM3-C[B][C]$^{2}_{3}$/AE1 (Full scale flow rate: 500 mL/min, 1, 2, 5, 10, 20, 50 L/min)

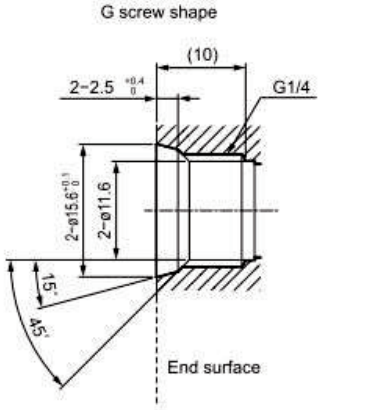


6.3.3 IO-Link(Stainless steel body, 50～200L/min)

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

● FSM3-C□□2/3/BA1/BB1/BC1 (Full scale flow rate: 50, 100, 200 L/min)

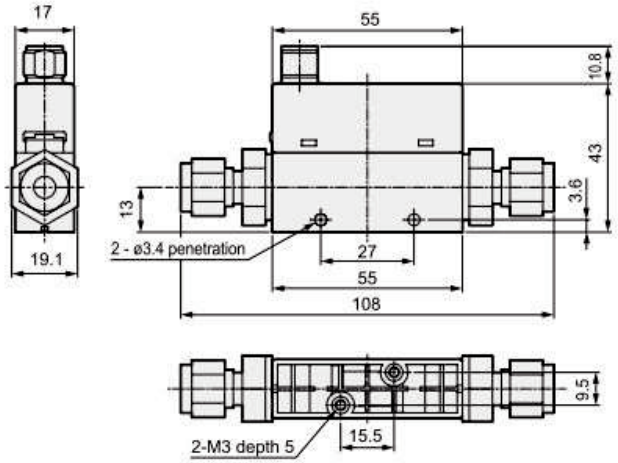




15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

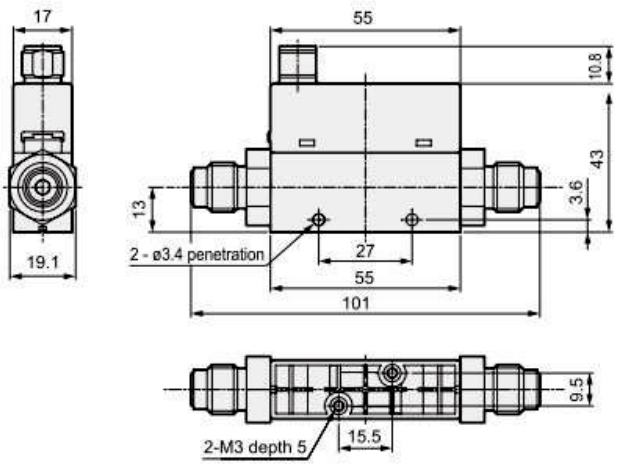
Port size: Straight 1/4" double barbed fitting

● FSM3-C□□2/3/BD1 (Full scale flow rate: 50, 100, 200 L/min)



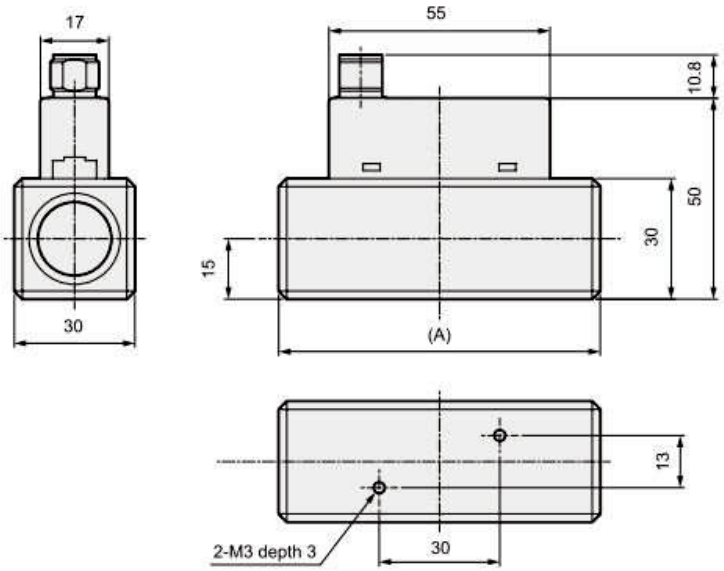
Port size: Straight 1/4" JXR male fitting

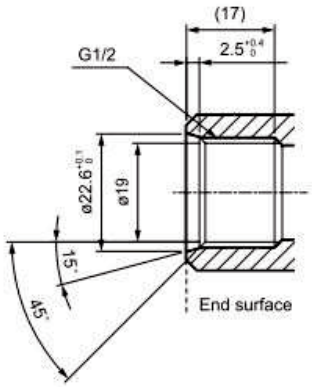
● FSM3-C□□2/3/BE1 (Full scale flow rate: 50, 100, 200 L/min)



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

● FSM3-C□□2/CA1/CB1/CC1 (Full scale flow rate: 500,1000L/min)





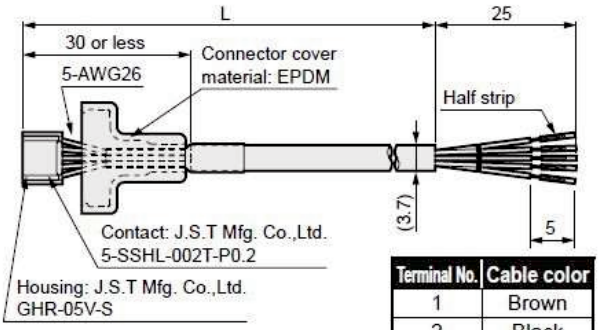
15° of the surface is the seal surface.
Note that it is not the end surface seal. Also, be sure to confirm that the screw depth of the fitting matches before use.

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

6.3.4 Option

●FSM3−A, B

5-conductor cable
（For LCD indicator type, Separated indicator type)

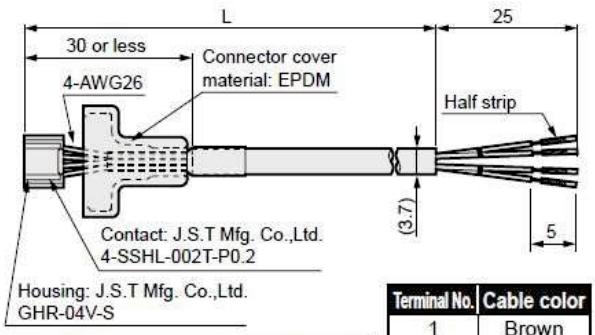


Model No.	L dimensions	Weight g
FSM3-A	1040 ±20	21
FSM3-B	3040 ±20	57

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

●FSM3−C, D

4-conductor cable
（For Bar indicator type)

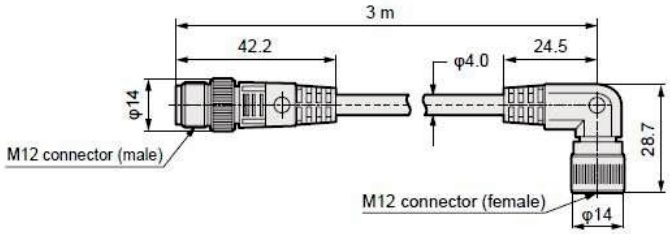


Model No.	L dimensions	Weight g
FSM3-C	1040 ±20	19
FSM3-D	3040 ±20	52

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

●FSM3−G

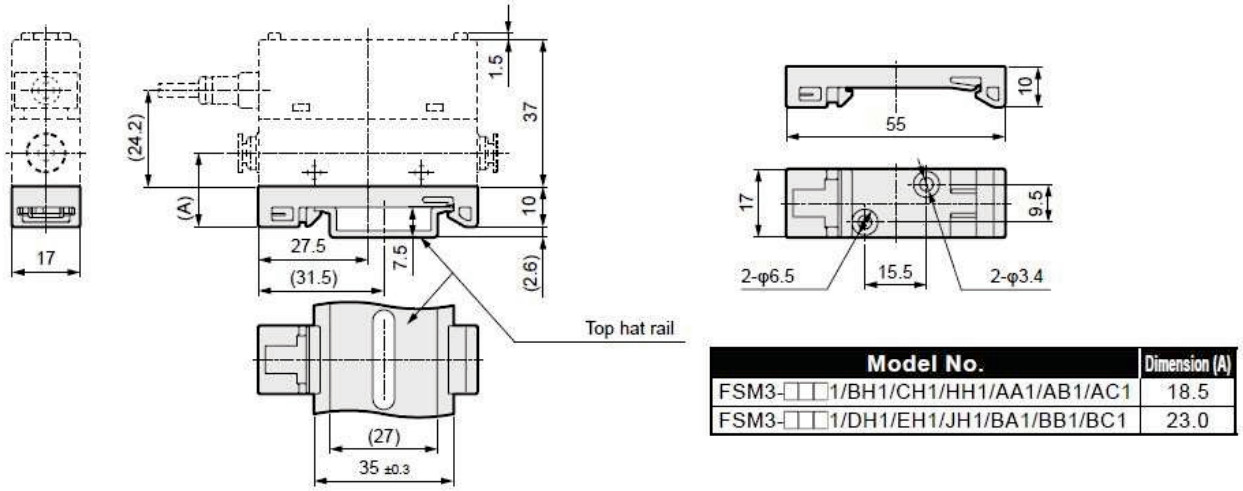
M12 Both side connector cable



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

●FSM3-M

DIN rail mounting kit

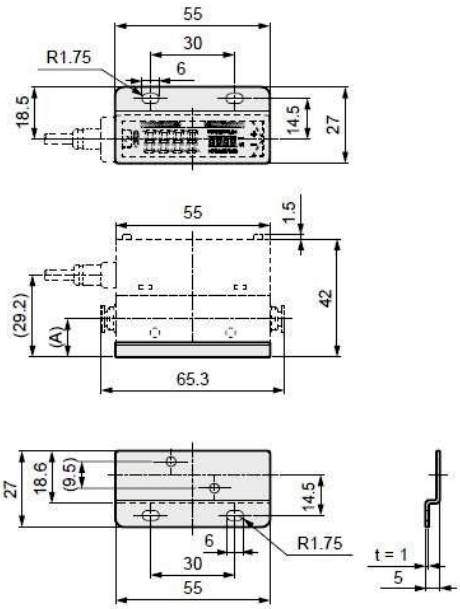


Model No.	Dimension (A)
FSM3-□□□1/BH1/CH1/HH1/AA1/AB1/AC1	18.5
FSM3-□□□1/DH1/EH1/JH1/BA1/BB1/BC1	23.0

6.3.4 Option (Continuation)

●FSM3-H

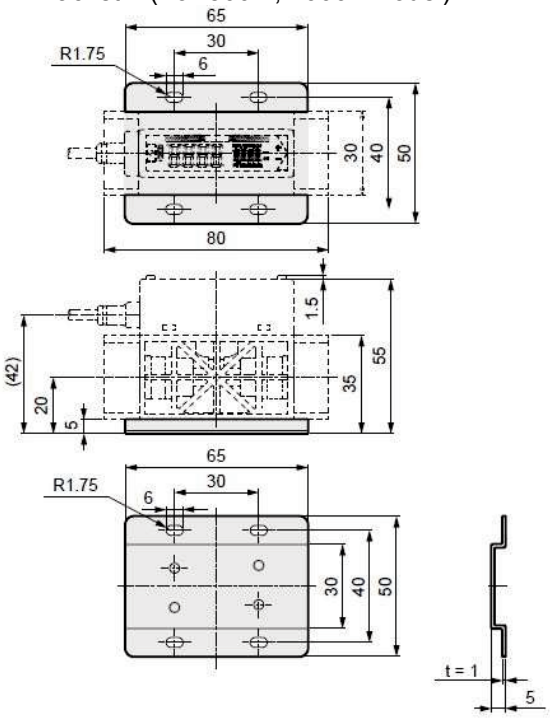
Bracket 1 (For 200 L or less model)



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

●FSM3-J

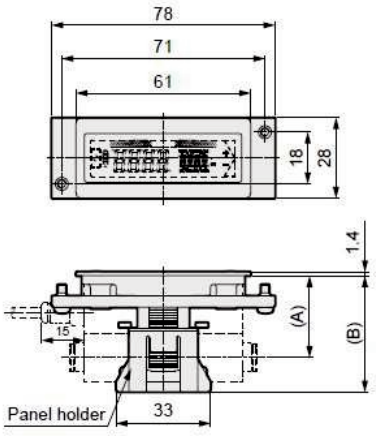
Bracket 2 (For 500 L, 1000L model)



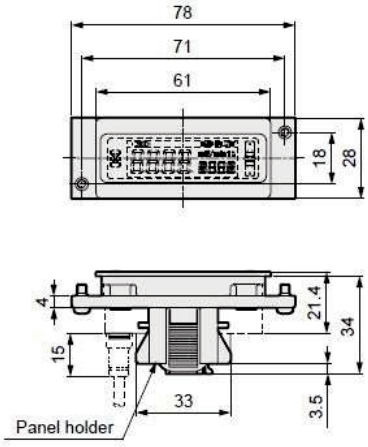
●FSM3-K

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

・LCD indicator type



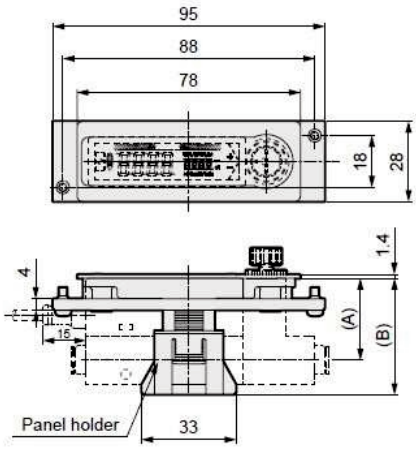
・Separated indicator type



●FSM3-L

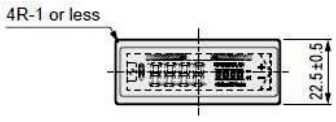
Panel mounting kit 2
(For Needle valve integrated type)

・Needle valve integrated type

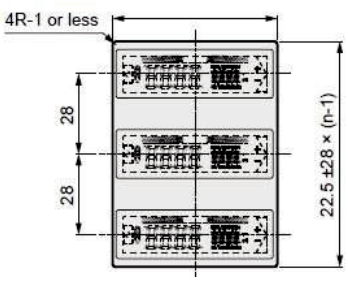


[Panel hold matching Fig]

Single mount



Sticking mount

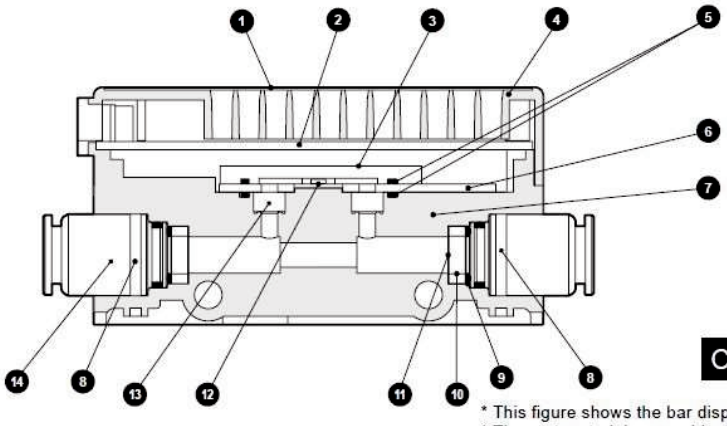


Model No.	Dimension (A)	Dimension (B)
FSM3-□□□1/BH2/CH2/HH2/AA2/AB2/AC2/□□□/N/T	28.5	40.5
FSM3-□□□1/DH2/EH2/JH2/BA2/BB2/BC2/□□□/N/T	30	46.5

6.4 Internal structure

6.4.1 FSM3-B005 to 500 (Bar display)

■Resin body

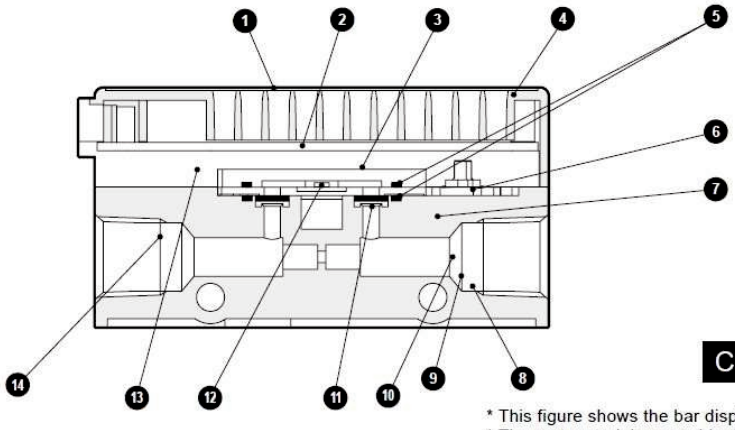


Cannot be disassembled

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

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

■Stainless steel body



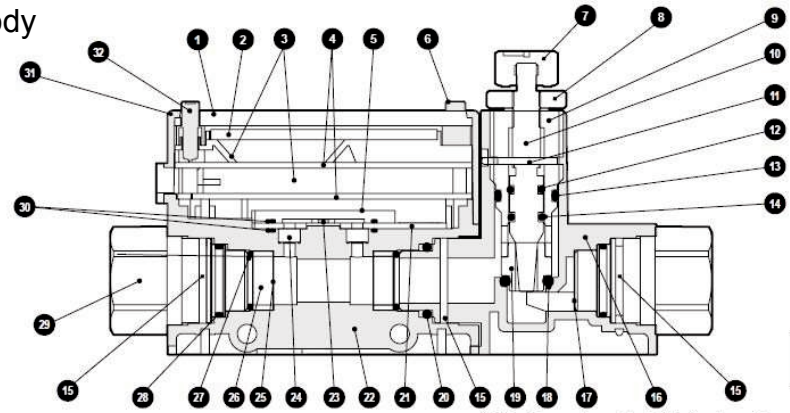
Cannot be disassembled

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

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

6.4.2 FSM3-L500 to 201 (LCD display, with needle valve)

■Resin body

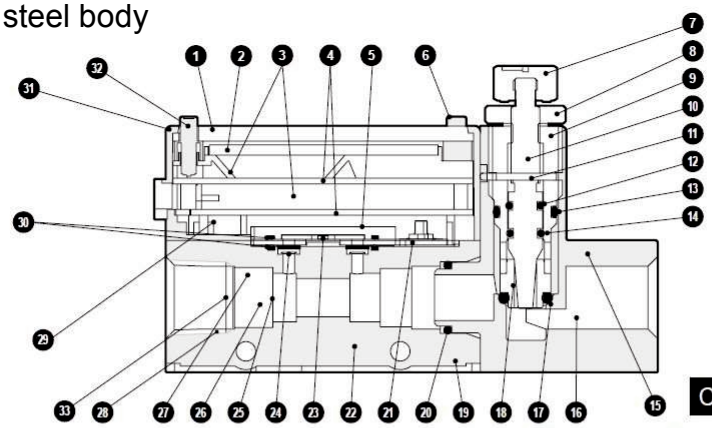


Cannot be disassembled

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

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

■Stainless steel body



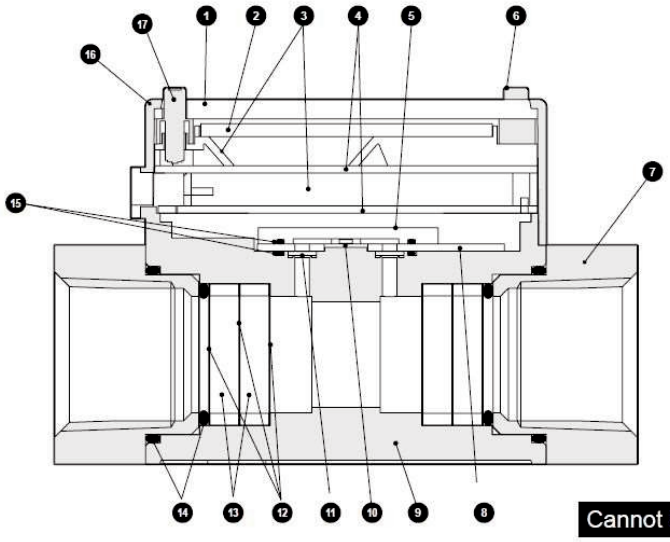
Cannot be disassembled

* This figure shows the bar display w/ needle valve.
* The part materials are subject to change without notice.

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

6.4.3 FSM3-L501/102 (LCD display, Large body)

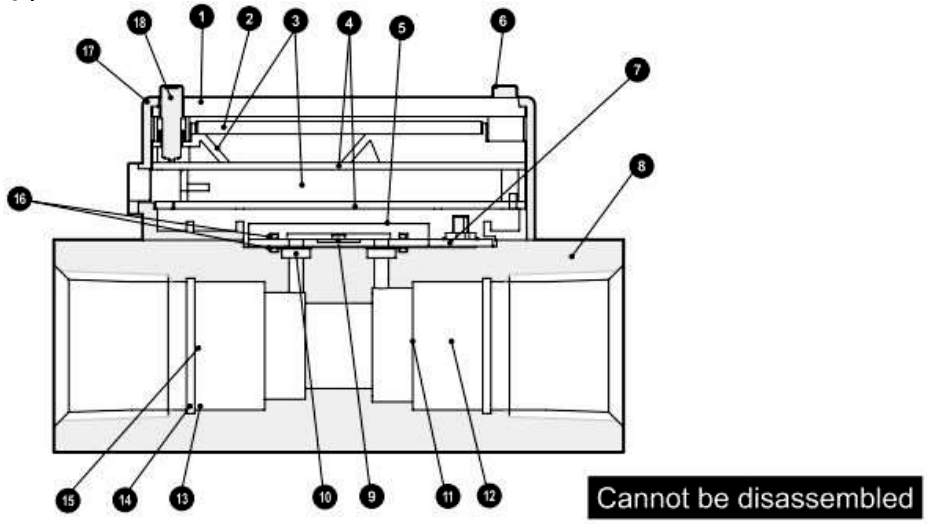
■Resin body



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

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

■Stainless steel bodv



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

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

7. Technical data

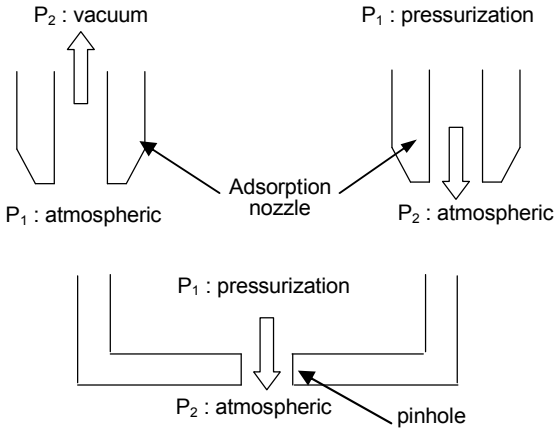
7.1 How to select flow sensor

Use as a guide for selection of the flow rate range when using the flow rate sensor for suction/unload confirmation or leakage inspection, etc., with the suction nozzle.
The flow rate can be calculated using the effective cross-sectional area of nozzle (pinhole) and the pressure difference inside and outside of nozzle.

- For $P_1 \geqq 1.89P_2$ (acoustic velocity)
  $Q = 113.2 \times S \times P_1$

- For $P_1 < 1.89P_2$ (subsonic)
  $Q = 226.4 \times S \times \sqrt{P_2 (P_1 - P_2)}$

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



- Example of calculation

The figure below shows the calculated value of flow rate when the nozzle diameter is φ0.1 to φ2 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	Acoustic/ subsonic velocity	Calculated flow rete value (L/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	Acoustic	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007
	0.1013	0	0.0413	−0.06	Acoustic	0.090	0.360	0.810	1.440	2.250	4.411	9.002	20.254	36.007
	0.1013	0	0.0513	−0.05	Acoustic	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	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	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	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	Velocity	0.054	0.215	0.483	0.859	1.343	2.631	5.370	12.083	21.480
Blow(Leakage inspection)	0.1113	0.01	0.1013	0	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	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	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	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	Velocity	0.160	0.640	1.440	2.560	4.000	7.840	15.999	35.998	63.996
	0.2013	0.1	0.1013	0	Acoustic	0.179	0.716	1.610	2.862	4.472	8.765	17.888	40.248	71.552
	0.3013	0.2	0.1013	0	Acoustic	0.268	1.071	2.410	4.284	6.694	13.119	26.774	60.242	107.096
	0.4013	0.3	0.1013	0	Acoustic	0.357	1.426	3.209	5.706	8.915	17.474	35.660	80.236	142.641
	0.5013	0.4	0.1013	0	Acoustic	0.445	1.782	4.009	7.127	11.137	21.828	44.547	100.230	178.186
	0.6013	0.5	0.1013	0	Acoustic	0.534	2.137	4.809	8.549	13.358	26.182	53.433	120.224	213.731

(Caution)

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