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CKD

SM-385853-A

INSTRUCTION MANUAL

SMALL SIZE FLOW SENSOR RAPIFLOW®

FSM2 Series

- Integrated indicator type (FSM2-N/P series)
- Separated indicator type (FSM2-A series)
- Integrated indicator type（Integrated needle valve type）

- 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 Corporation

Safety precautions

Always read before starting use.

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

Warning

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 of specifications.

Contact CKD when using the product outside the unique specifications range, when using it outdoors, and when using it under the conditions and environment below.
Do not attempt to modify or additionally machine the product.

(1) Use for special applications requiring safety including nuclear energy, railroad, aviation, ship, vehicle, medical equipment, or applications coming into contact with beverage or food, amusement equipment, emergency shutoff circuits, press machine, brake circuits, or for safeguard.
(2) Use for applications where life or assets could be adversely affected, and special safety measures are required.

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

ISO 4414, JIS B 8370 (pneumatic system rules)
JPAS 005 (policy for pneumatic cylinder use and selection)
High Pressure Gas Maintenance Laws Occupational Safety and Sanitation Laws, and other safety rules, association standards and regulations.

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

(1) Inspect and service the machine and devices after confirming safety of the entire system 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 Safety cautions 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: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

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.
In any case, important information that must be observed is explained.

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

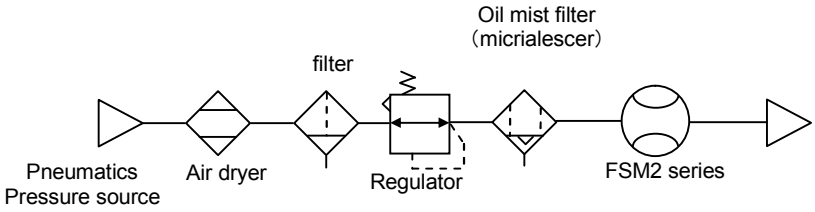
●This product cannot be used as a business meter.

This product does not comply with Measurement Laws, and cannot be used for commercial business. Use this as an industrial sensor.

●Do not use fluids other than the applicable fluid because accuracy cannot be guaranteed.

●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 Circuit>



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

●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.

Working environment

●Corrosive environment

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

●Ambient temperature/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.

●Max. working pressure specified 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.

●Drip-proof environment

The degree of protection of this product is equivalent to IP40. Do not

⚠ WARNING: install this product where water, salt, dust, or swarf is present or in a pressurized or depressurized environment. This product cannot be used where the temperature changes greatly or where high humidity environment could cause damage through dew condensation.

⚠ 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., but this is the display when the mass flow rate is converted to volumetric flow rate at 20°C 1 barometric pressure (101 kPa) , and relative humidity 65%.

Proof pressure

●Please note the difference when you select the series.

Overflow

●With each series, no problem will occur in the sensor, even if an overflow double the measurement range. If dynamic pressure is applied near the max. working pressure (when a pressure difference exceeding the max. working pressure is applied between primary and secondary sides), a problem could occur with the sensor. If dynamic pressure is applied, such as when a workpiece is filled for leakage inspection, provide a bypass circuit or restrictor so that dynamic pressure is not applied to the sensor.

Use for suction confirmation, etc.

●When this product is used to confirm suction, etc., select the flow rate range based on the operating vacuum pressure and suction nozzle. Refer to Page 65 on the attached sheet for “5.Technical data [5.1How to select flow sensor]”

●When this product is used to confirm suction, etc., provide an air filter upstream from suction to prevent the entry of foreign matter.

●When this product is used to confirm vacuum, etc., consider the atmospheric dew point and this product’s ambient temperature, and use the product under conditions in which dew does not condense in pipes.

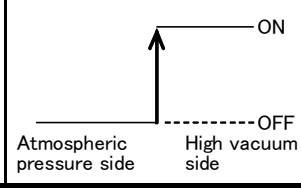
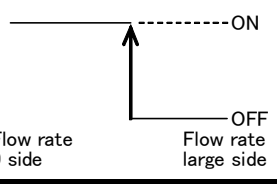
●When this product is used to confirm suction, etc., response time may be delayed by the capacity of the pipe between the suction nozzle and this product. In this case, take countermeasures to reduce piping capacity.

●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.

Using for leakage inspections

●The working pressure range of this product is -0.09 to 1.00 MPa. If it is energized in a vacuum state of -0.09 MPa or less, the sensor’s heat dissipation performance will drop and could degrade the sensor.

●When the suction confirmation sensor is switched from a pressure sensor (switch) to a flow rate sensor (switch), sensor output (switch output) logic will be reversed. Refer to the drawing below.
Note that the PLC sequence program must be changed or revised.

	Pressure sensor (switch)	Flow sensor (switch)
Adsorption verification	Setpoint and over ON	Setpoint or less ON
		

CAUTION: 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.

INSTALLATION & ADJUSTMENT

CAUTION:

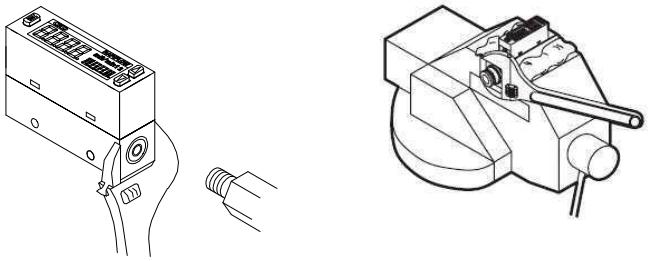
Piping

- Always attach the pipes before starting wiring.
- Align the fluid flow direction to the direction indicated on the pipe when connecting the pipes.
- When installing the sensor on piping, refer to the torque below so that excessive screw-in torque or load torque is not applied to the connection port.

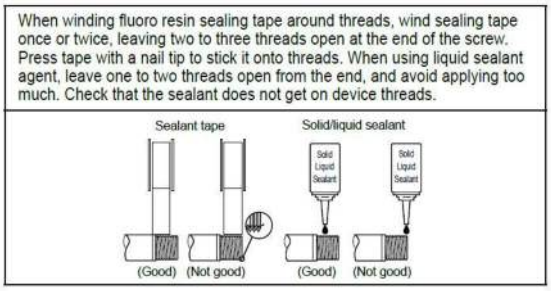
[Reference value]

Set screw	Tightening torque N·m
M5	1.0 to 1.5
Rc1/8	3 to 5
Rc1/4	6 to 8
Rc1/2	16 to 18

- Before 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 an entry of a large amount of foreign matter, cutting chips, etc., occurs.
- Attach a wrench to metal sections when tightening pipes so that pressure is not applied to the resin section.



- 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.



- Connect a fitting even when using the metal body type with the OUT side opened. The port filter could come off.
- When using a push-in fitting, accurately insert tube and confirm that it is not dislocated even when pulled. Cut tube at a right angle with a dedicated cutter before use.
- Make sure that the leakage detection solution does not enter the case when inspecting the pipe for leaks.
- Do not install the regulator/solenoid valve, etc immediately before to this product. Incorrect flow could cause errors. Provide a straight piping section if required.

CAUTION:

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

CAUTION:

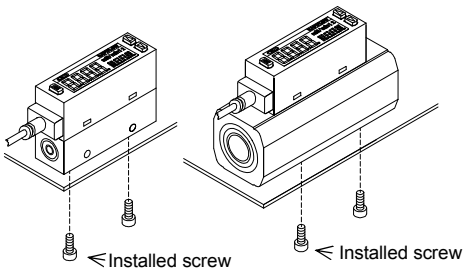
About Mounting

●The display integrated type's flow rate meter uses a liquid crystal display, which may be difficult to read depending on the angle.

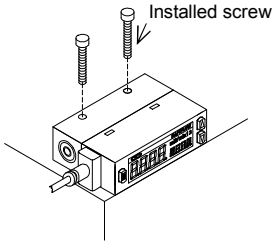
●Do not install the product in a manner that the bodies contact each other. The evolution of heat from each other could cause the generation body's temperature rise and enhance the change in characteristics or the deterioration of the resin materials. When using the products in a row, set intervals of distance of 10 mm and over.

●This product can be installed in any direction; top, bottom, left, or right.

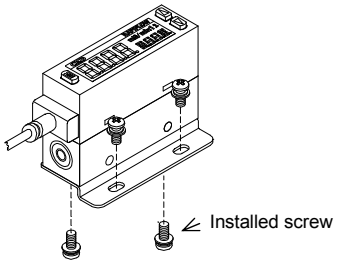
Vertical mount (with bottom thread)



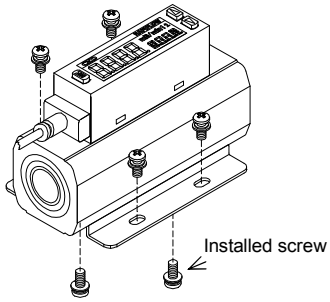
Horizontal mount (with through hole)



Bracket mount (with bracket)



Bracket (separate sales)
Model no. : FSM2-LB1
Port size: Push-in joint φ4、6、8、10
Rc1/8、Rc1/4、M5



Bracket (separate sales)
Model no. : FSM2-LB2
Port size: Rc1/2

Note of Integrated needle valve type

●This valve cannot be used as a stop valve that has no leakage. Slight leakage is allowed in product specifications.

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

●Do not turn the dial 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 vary if turning the dial of the needle valve forcibly when fully closing. Take care not to turn the dial forcibly when setting a very small flow rate.

●When you install the panel, please install this product after piping etc.

●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.

DANGER:

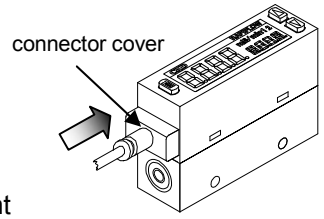
About Wiring

- 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. Failure to observe this could result in output damage or fire.

WARNING:

About Wiring

- Check line color when wiring. Incorrect wiring could result in sensor damage and malfunctions, so check wire color against the instruction manual before wiring.
- Check wiring insulation.
  Check that wires do not contact other circuits and that there are no ground faults or insulation faults across terminals. Overcurrent could flow in and damage the sensor.
- Use a stabilized DC power supply within the specified rating that has been insulated from the AC power supply. A noninsulated 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.
- Always attach the connector bar after connecting the connector.
- Check that stress (7 N and over) is not directly applied to cable lead outs or connectors.



- Stop the control device and equipment and turn power off before wiring. Starting operation suddenly could cause unpredictable operation and hazards. 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 or tools before and during work. Connect and wire bending resistant material, such as robot wire material for movable sections.
- Do not use this product at levels exceeding the power supply voltage range. If voltage exceeding this range is applied or if AC power is applied, the controller could rupture or burn.
- Install this product and wiring far 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. The product could break or burn.
- The power supply for the metal body (stainless steel body, aluminum body) type is a DC stabilized power supply completely isolated from the AC primary side. Connect either the + side or - side of the power to F.G. A varistor (limit voltage approx. 40 V) is connected between the metal body internal power circuit and metal body 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 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 device/frame, or short-circuit accidents, etc., could cause welding current, excessive high voltage caused by welding, or surge voltage, etc., to run through wiring, ground wire, or fluid path line connected between such devices, damaging lines or devices. Conduct any work such as electrical welding after removing this device and disconnecting all electric wires connected to F.G.

WARNING:

●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.)

CAUTION:

During adjustment

●If switches are operated when flow rate is not stable, such as pulsating, 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.

DURING USE & MAINTENANCE

WARNING:

●Output accuracy is affected by temperature characteristics and self-heat generated when energized. Provide standby time (5 minutes and over) after energizing.
●Immediately after power is turned on, this product does not start flow rate detection switch operation for approx. 4 seconds to complete self-diagnosis. Provide a control circuit/program that ignores signals for 4 seconds after energizing.
●This product cannot be used as a stop valve with zero leakage. Slight leakage is allowed in product specifications.
●Dust generation inside the paths of the needle valve is not zero. Install a final clean filter in circuits where dust generation causes problems.

CAUTION:

●This product uses a micro-sensor chip, and must be installed where it will not be subject to dropping, impact or vibration. Handle this product as a precision component during installation and transportation.
●If a problem occurs during operation, immediately turn power off, stop use, and contact your dealer.
●Keep this product's flow rate within the rated flow range.
●Use this product within the working pressure range.
●If the output setting value is changed, control system devices could operate unintentionally. Stop devices before changing settings.
●A periodic inspection should be done at least once a year, then make sure that the product be operated properly.
●Do not disassemble or modify this product. Doing so could result in faults.
●The case is made of resin. Do not use solvent, alcohol or detergent in cleaning, or resin could absorb it. Wipe off dirt with a rag soaked in a diluted neutral detergent solution and wrung out well.
●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.

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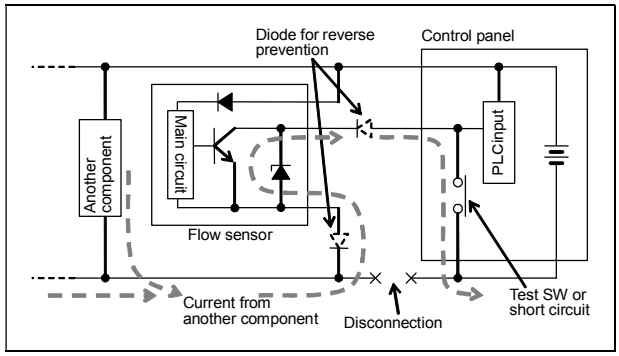
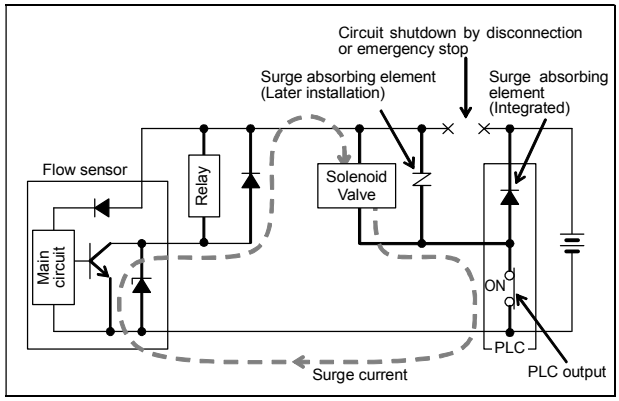
⚠ CAUTION:



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

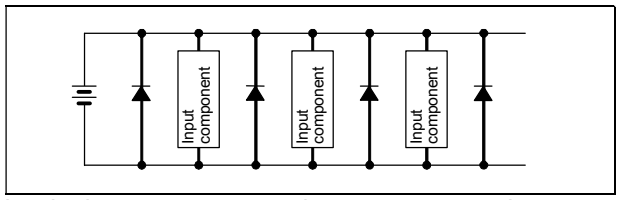
(1) Avoid centralizing current at the power cable, especially the minus side power cable, and use as thick a cable as possible.
(2) Limit the number of devices connected to the same power source as the flow rate sensor.
(3) Insert a diode parallel to the flow rate sensor's output line to prevent the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

(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 separate power supplies cannot be used, directly install a surge absorbing element for all inductive loads. Remember that the surge absorbing element connected to the PLC, etc., protects only that device.
(3) Connect a surge absorbing 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 power off before connecting or disconnecting the connector.

⚠ CAUTION:

- ●Analog output continues even if the flow rate range is exceeded. With the display integrated type, "Hi" or "Lo" will be displayed. With the display separate type, the bar display will flicker. Note that this is outside guaranteed precision.
- ●When using the display integrated type, do not press down on the display section. It could break.
- ●The accuracy may vary from the initial status depending on the working environment or working conditions at the customer site. It is recommended to check the operation of the product periodically.
- ●The sensor chip will degrade when used for a long time and cause the detected flow rate to vary. Periodically inspect the sensor chip.
- ●Use conditions for CE compliance
  This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:
  [Conditions]
  - The evaluation of this product is performed by using a cable pairing a power supply line and a signal line, evaluating this cable as a signal line.
  - This product has no resistance against surge immunity. Implement surge protection measures on the system side.
- ●Do not turn the dial 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.

Note of Integrated needle valve type

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

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SMALL SIZE FLOW SENSOR RAPIFLOW FSM2 Series

Manual No. SM-385853-A

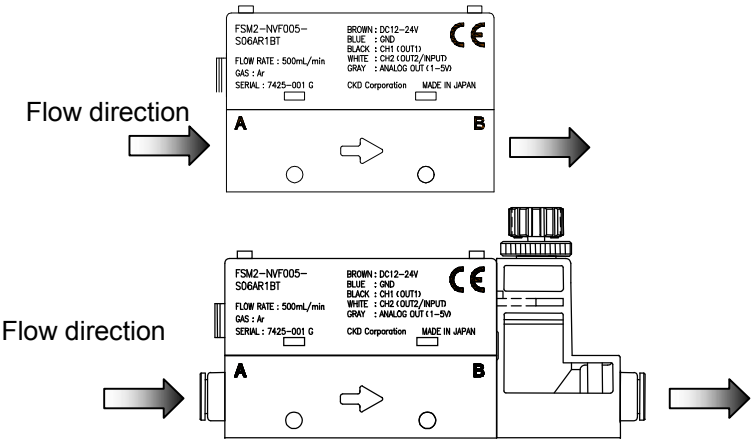
Please see the instruction manual(D2-180166) about the separated indicator type.

1. INSTALLATION

1. 1 Piping

＜Caution＞

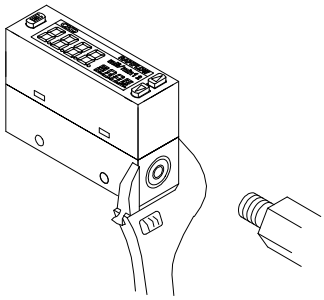
Arrange piping so that the flow direction agrees with the direction of the arrow indicated on the sensor body.

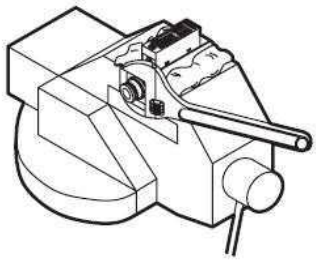


●Flash the pipe to remove foreign substances and swarf, etc., in inside of pipe before piping.
●When piping a sensor, do not apply excessive screw-in and load torques to the port.
When piping, apply a spanner on the metal section not to apply forces onto the resin section.

[Reference value]

Set screw	Tightening torque N·m
M5	1.0 to 1.5
Rc1/8	3 to 5
Rc1/4	6 to 8
Rc1/2	16 to 18





●When piping, care must be taken that sealing tape and adhesive must not enter into the inside.
●If a push-in joint is used, the tube must be inserted certainly. Pulls the tube to check that the tube not be come out

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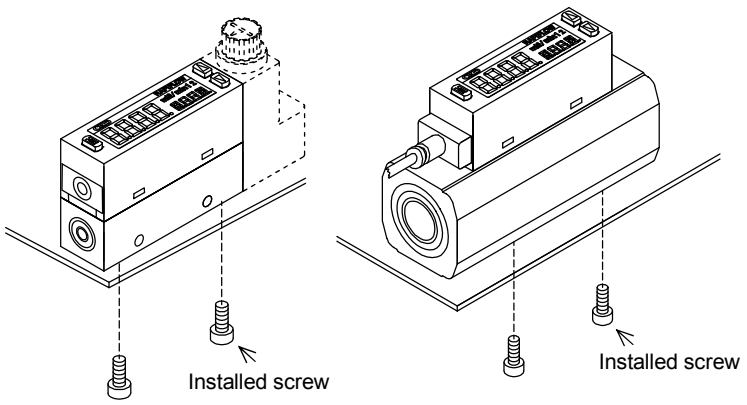
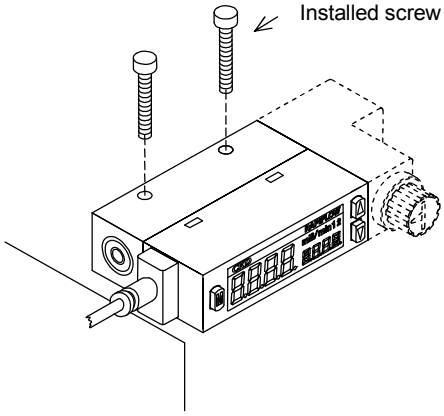
1．2 Installation

・The display part uses the LCD. The display becomes difficult to see for the view angle.
・This product can be installed with any attitude; vertical, horizontal, right or left. The tightening torque for screws should be 0.5N･m.

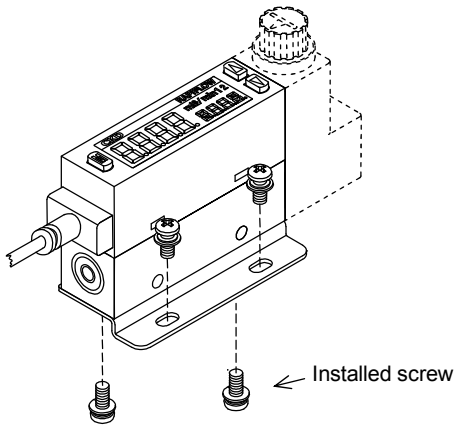
Vertical mount(with bottom thread)



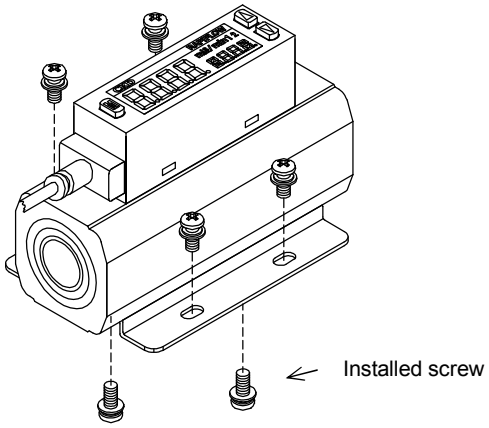
Horizontal mount
(with through hole)



Bracket mount (with bracket)

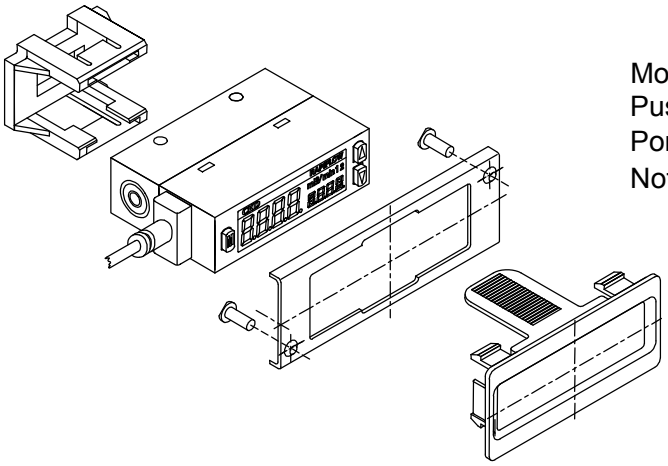


Bracket (separate sales)
Model no. : FSM2-LB1
Port size: Push-in joint φ4、6、8、10
Rc1/8、Rc1/4、M5

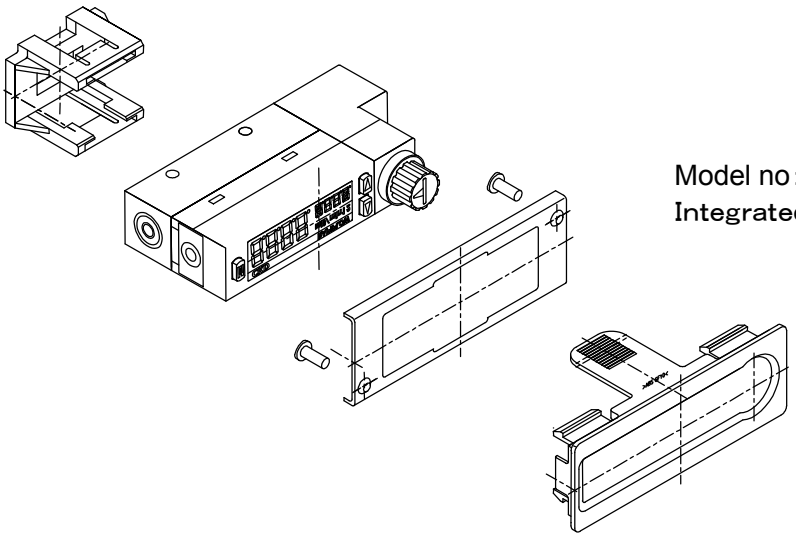


Bracket (separate sales)
Model no. : FSM2-LB2
Port size: Rc1/2

Panel mount



Model no：FSM2-KHS
Push in joint type
Port size：Rc1/8、Rc1/4、M5type
Note：It is not possible to use it for「A15」 of port size

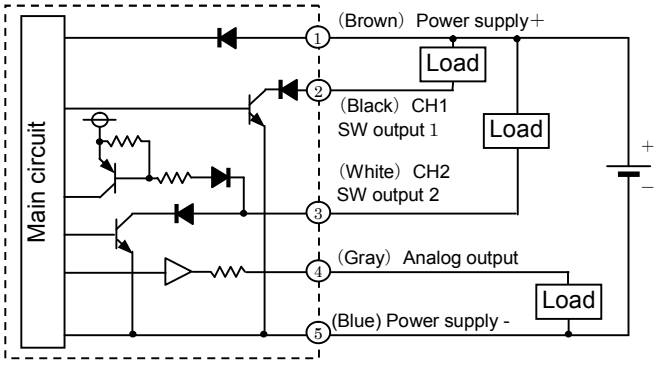


Model no：FSM2-KHS-N
Integrated needle valve type

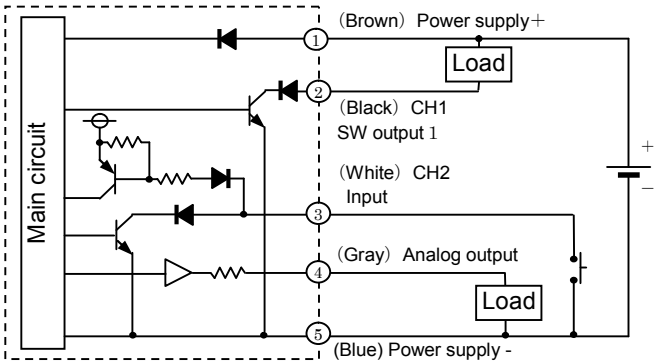
1．3 Wiring

1．3．1 FSM2-N series（Integrated indicator type, NPN output type）

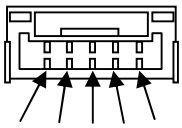
CH2 function selected switch output



CH2 function selected external input



connector



(FSM2 side)

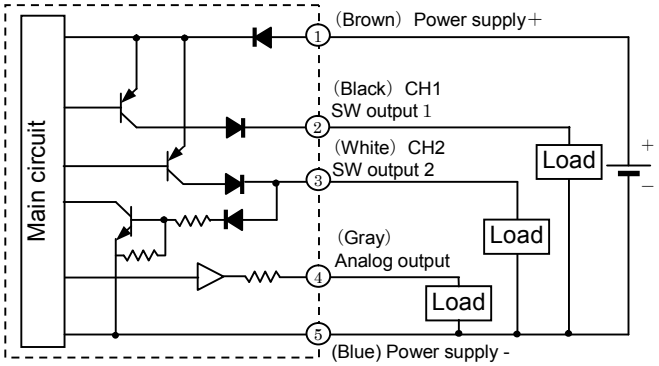
[1] [2] [3] [4] [5]

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

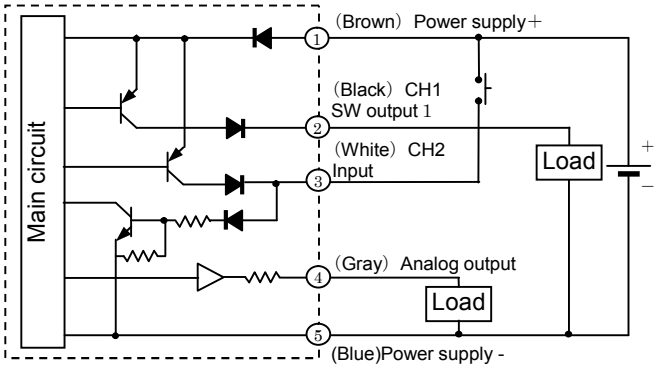
Pin No.	Line color	Content
[1]	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
[2]	Black	CH1(Switch output 1: max50mA)
[3]	White	CH2(Switch output 2: max50mA　or　External input)
[4]	Gray	Analog output Voltage output: 1 to 5 V load impedance 50 kΩ and over Current output: 4 to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

1．3．2 FSM2-P series（Integrated indicator type, PNP output type）

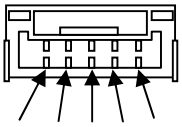
CH2 function selected switch output



CH2 function selected external input



connector

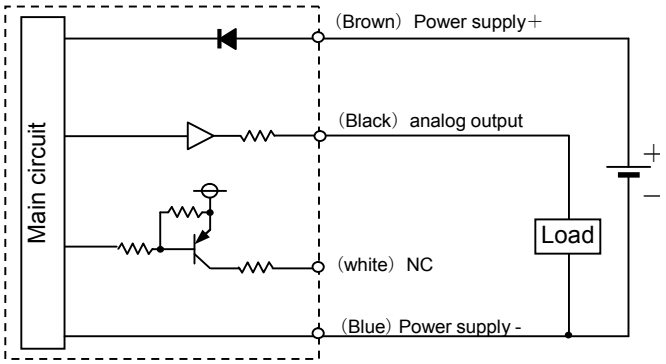


(FSM2 side)

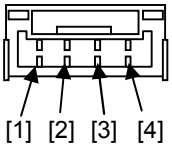
※ Analog voltage output R : approx.1kΩ
Analog current output R : approx.100Ω

Pin No.	Line color	Content
[1]	Brown	Power supply (+) (voltage output: 12 to 24 V, current output: 24 V)
[2]	Black	CH1(Switch output 1: max50mA)
[3]	White	CH2(Switch output 2: max50mA or External input)
[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 FSM2-A series（Separated indicator type）



connector



(FSM2 side)

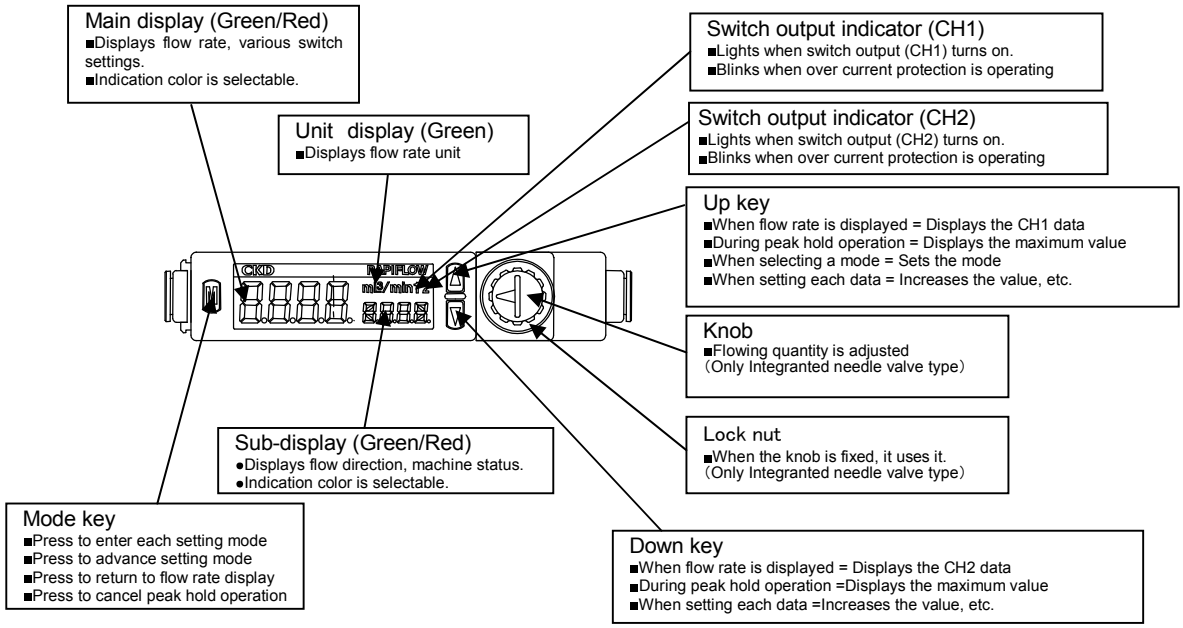
※ Analog voltage output R : approx.1kΩ
Analog current output R : approx.100Ω

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. (model identification signal; do not connect when using as single part)
[4]	Blue	Power supply- (GND)

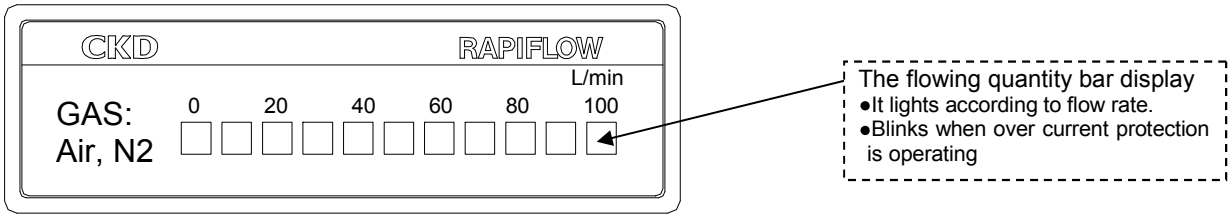
2. OPERATION

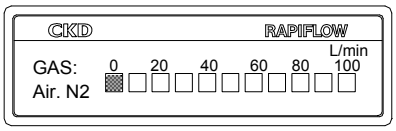
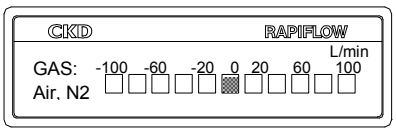
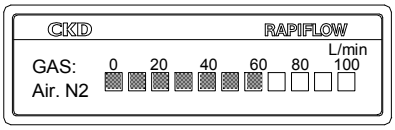
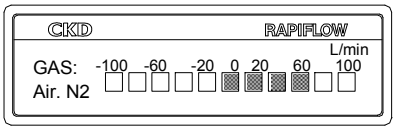
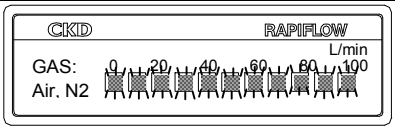
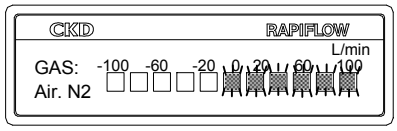
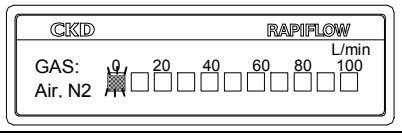
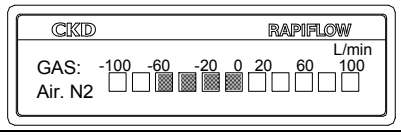
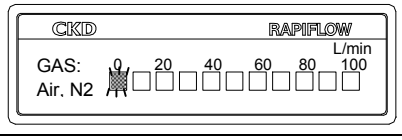
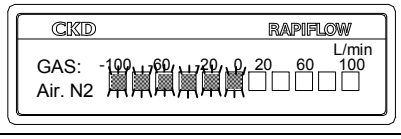
2. 1 Names and functions of display and operation section

2. 1. 1 Integrated indicator type (FSM2-N/P series)



2. 1. 2 Separated indicator type (FSM2-A series)



Flow rate	One-direction type	Bi-directional type
0%F.S.		
+60%F.S. (Forward)		
+120%F.S. (Forward) Blinks		
-60%F.S. (Reverse)		
-120%F.S. (Reverse) Blinks		

2. 2 Function（FSM2-N/P series）

●Normal mode （Refer to Page 20 for the operation.）

Item	Description	Setting at shipping out of factory
Instantaneous flow display	Instantaneous flow is displayed.	Instantaneous flow display
Integrated flow display	An integrated flow is able to be displayed. The switch output function includes one to turn the switch ON and OFF when the specified count value is exceeded, and an integrated pulse function that outputs a pulse after a set count value.	
Peak hold function	Maximum and minimum flow rate values during the specified period can be read.	Peak hold : OFF
Key lock	Setting changes are disabled to prevent incorrect operations.	Key unlock
Error display function	The error state is displayed.	—

●Standard setting mode （Refer to Page 22 for the operation.）

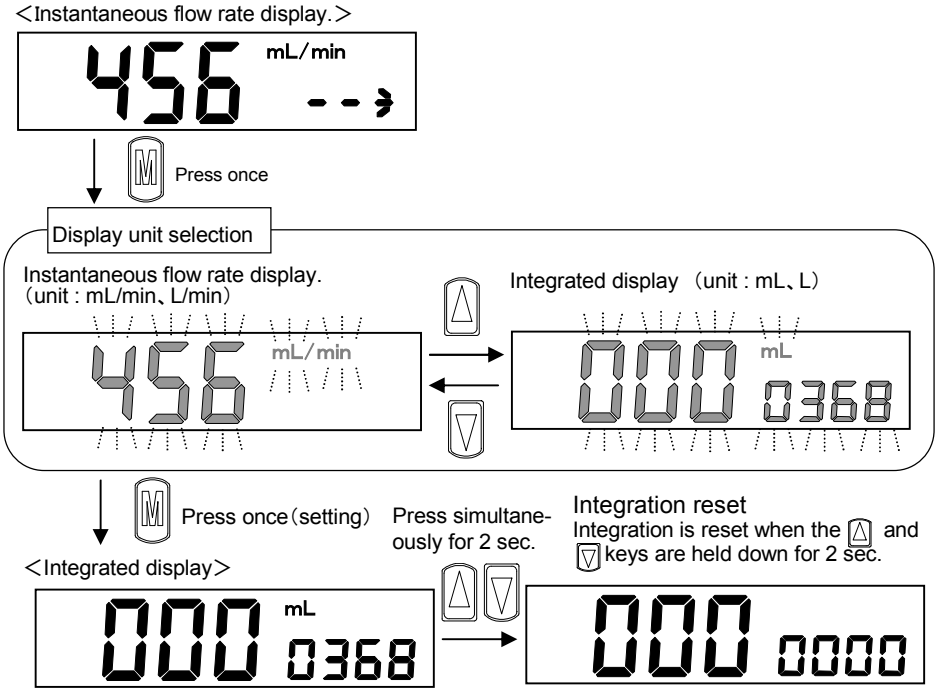
Item	Description	Setting at shipping out of factory
Switch output	Having 2 pieces of switch output, 7 operation patterns and stop of operation can be set.	OFF
Forcible output	Switch output is turned on forcibly to check wiring connection and initial operation of input unit.	—
0 point adjustment	Deviation of the display from 0 is corrected	Zero

●Detailed setting mode （Refer to Page 26 for the operation.）

Item	Description	Setting at shipping out of factory
Flow direction selection	Only bi-directional type, flow direction can be switched.	Bi-direction
CH2 function selection	Sets the CH2 function. Selects “Switch output”, ”External input of auto reference”, or ”External input of integrated reset”.	Switch output
Auto reference function	When CH2 function selected external input of auto reference, setting value of switch output can be taken by external input or key operation.	Auto reference Function : OFF
Response time setting	Sets the response time. The response time can be selected from 20ms to 1280ms.	Response time :50msec
Display speed selection	Change the speed of the displayed.	Display speed :250msec
Sub-display selection	Change the indication of the sub-display. Selects “Flow direction”, ”Flow rate unit”, or “Working fluid”.	Sub-display
Displayed color selection	Displayed color can be changed.	Red when ON Green when OFF
Hysteresis fixed value selection	Sets hysteresis of the window operation mode and the auto reference mode. (8 steps)	Hysteresis：1%FS
Unit selection	Flow rate unit can be changed. 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)	Flow rate unit : ANR
Eco mode setting	Current consumption can be lowered. When the product is left for 1 min. without any operation, it’s shift to eco mode.	Eco mode : OFF
Reset setting	Return to default settings (factory settings)	—

2. 3 Normal mode (Integrated indicator type)

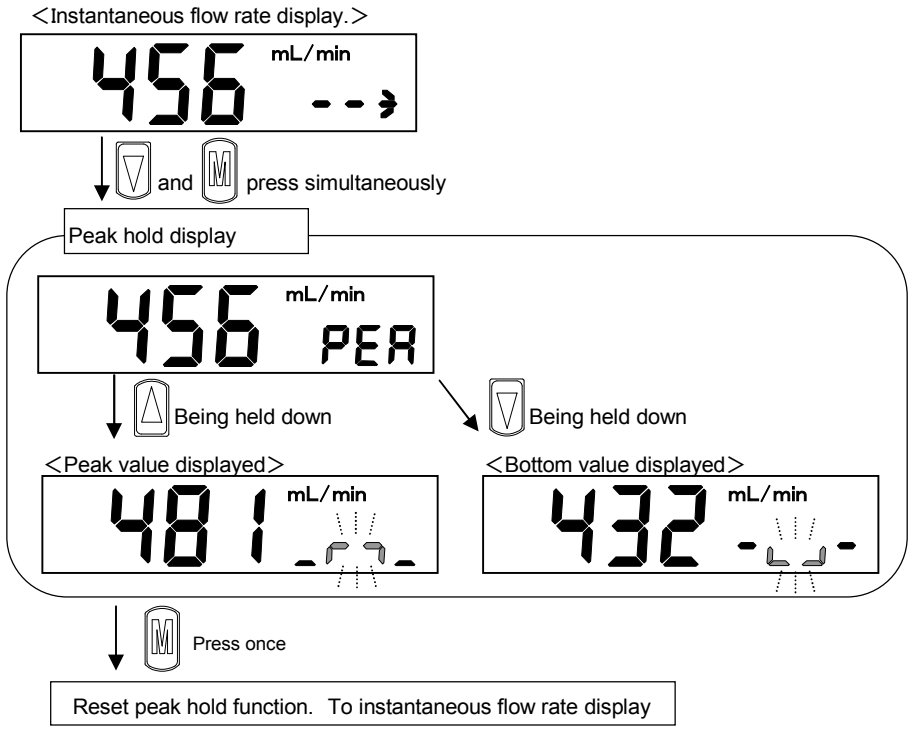
2. 3. 1 Displaying the integrated flow



Note: Integration is reset with the external input. See auto reference function.

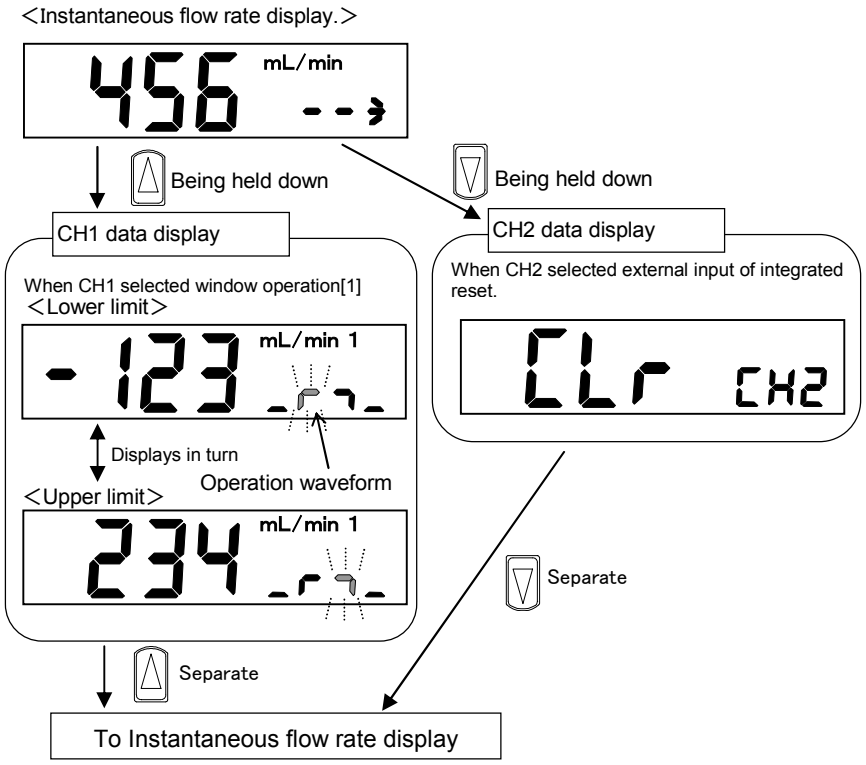
Note: Integration is also reset, Moreover Integrating function display setting is keeping when power is turned OFF.

2. 3. 2 Peak hold function



Note: The screen color at switch ON doesn't change while holding the peak.

2. 3. 3 Set-point verification method

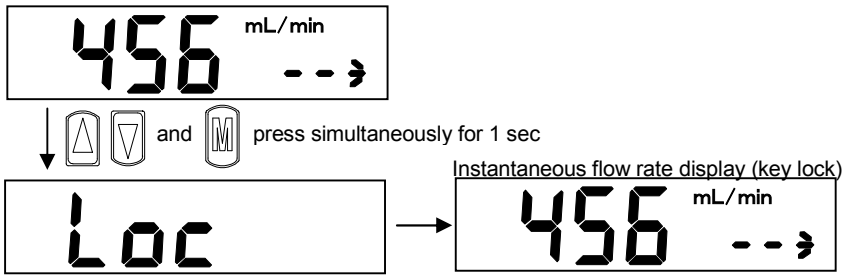


Note: When an external input uses the auto reference function, it doesn't operate.

2. 3. 4 Key lock / Key unlock function

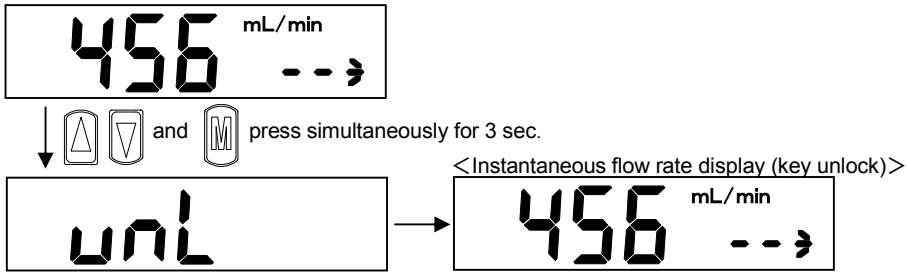
● Key lock

<Instantaneous flow rate display.(key unlock)>



● Key unlock

<Instantaneous flow rate display. (key lock)>

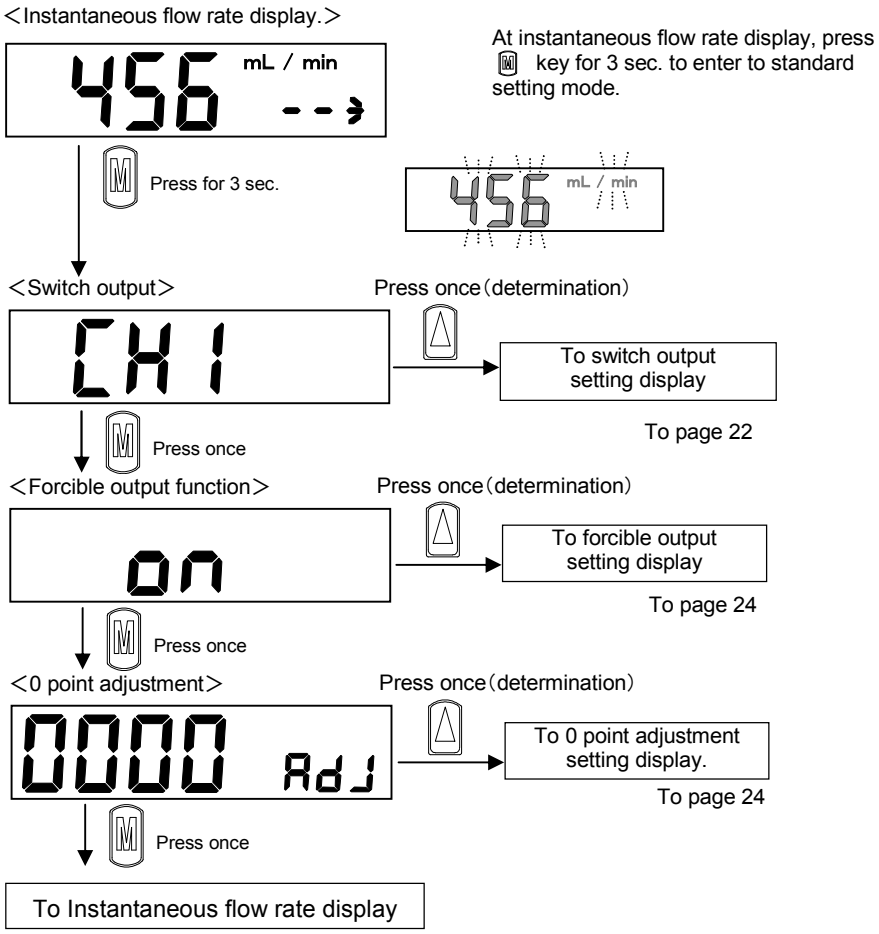


Note: Keys are unlocked when the controller is shipped. Lock keys if necessary.
The key lock/unlock state is held even if power is turned OFF.

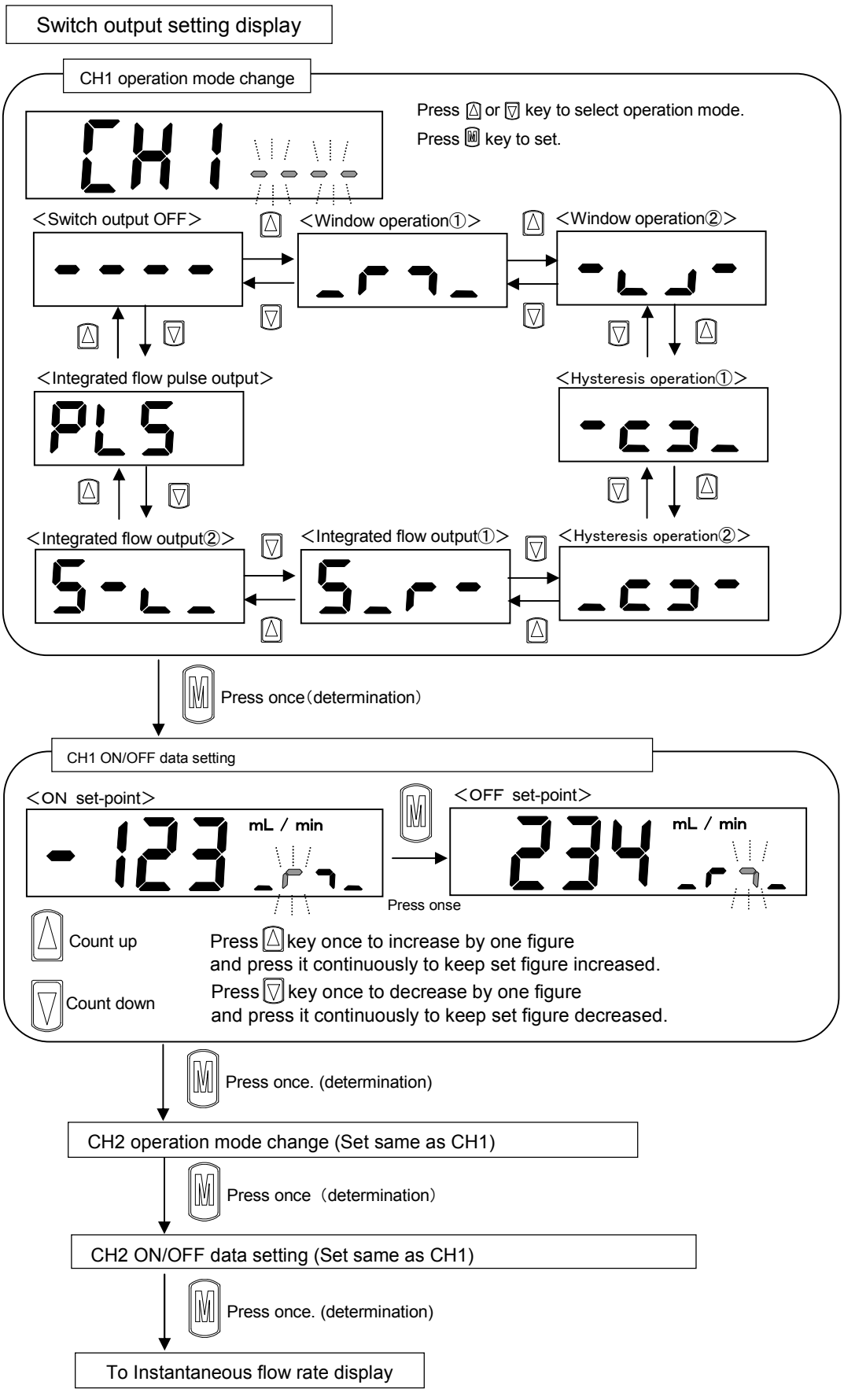
Note: All the operations are not accepted excluding the key lock release constancy while locking the key. Moreover, when other operations are done, "Loc" is displayed while locking the key.

2. 4 Standard setting mode

2. 4. 1 How to enter to standard setting mode

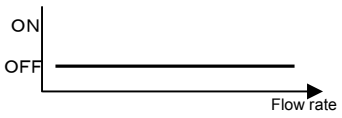
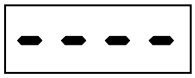
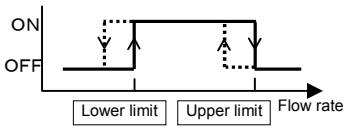
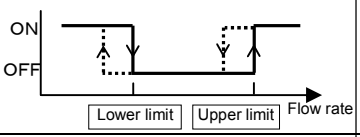
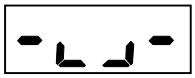
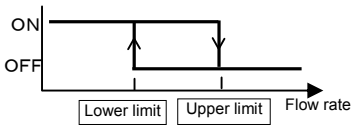
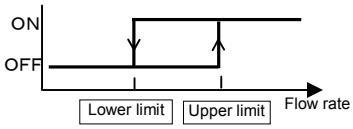
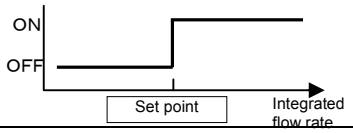
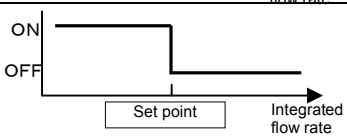
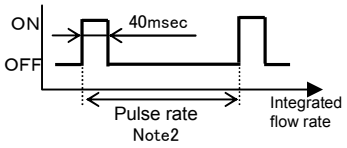
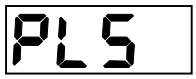


2. 4. 2 Setting of switch output function



●Switch output

Having 2 pieces of switch output, 7 operation patterns and stop of operation can be set.

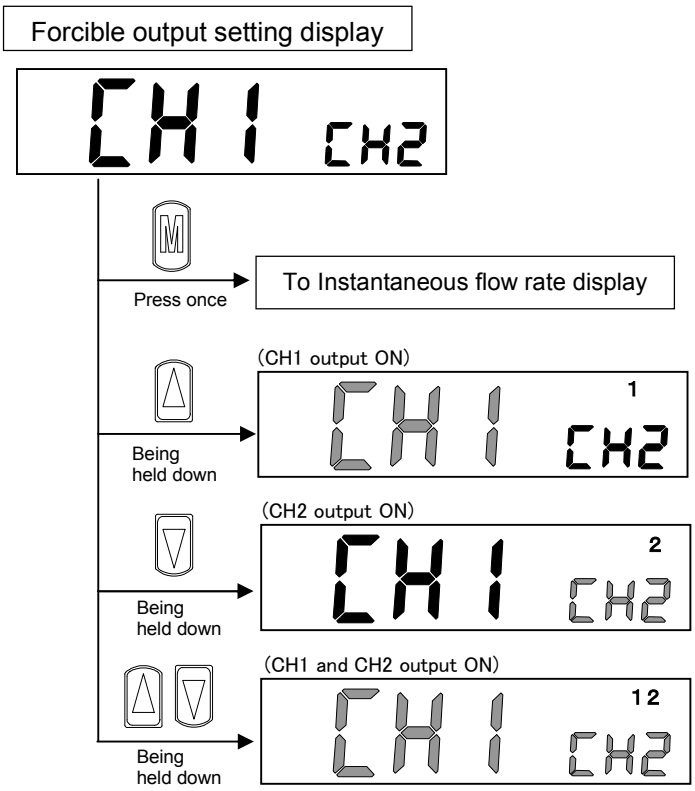
No.	Operation pattern	Description	Operation waveform	LCD display
1	Switch output OFF	Switch output OFF		
2	Window operation[1] (Range inside ON) Note1	The switch turns ON when the level is within the designated flow rate range.		
3	Window operation[2] (Range out ON) Note1	The switch turns ON when the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

Note1: Hysteresis is provided on upper and lower limit of window operation automatically.
The hysteresis can be fixed in 8 steps. Refer to <2.5.8.Hysteresis fixed value selection> in <Detailed setting mode>.

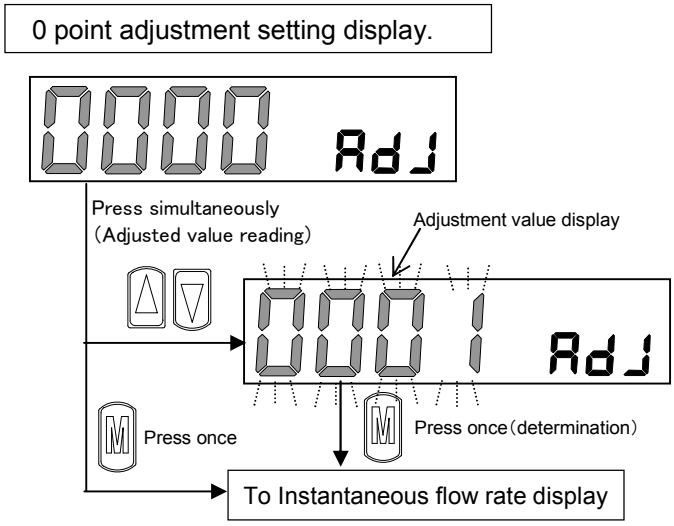
Note2:Refer to <Pulse output rate> in <4.1. Specifications>.

Note3: Output (OUT1,2) display blinks when the multiplication pulse output is set.

2. 4. 3 Switch output forcible ON mode



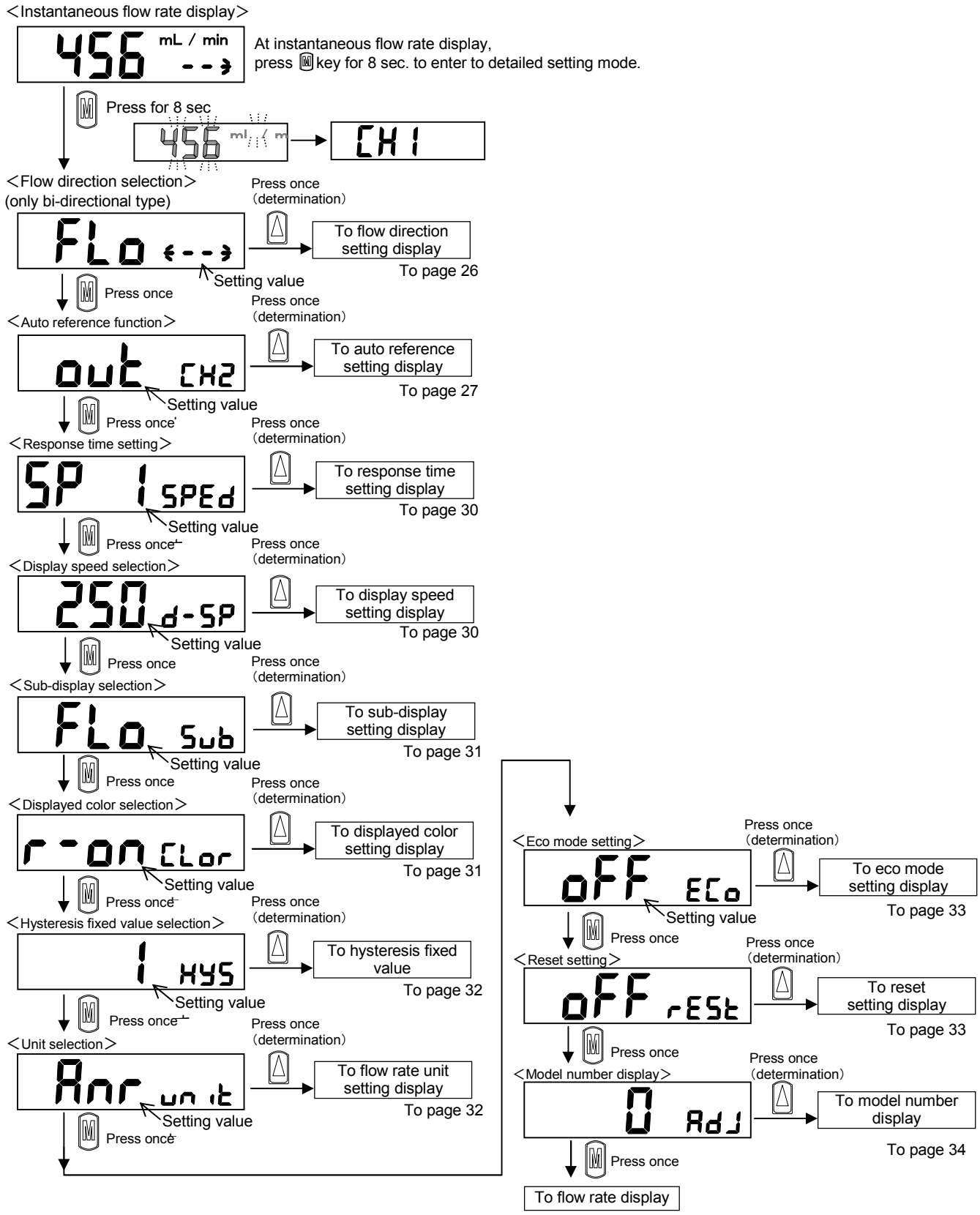
2. 4. 4 Zero point adjustment



Note: Always adjust 0 point without flow.
Note: If fluid flows during zero adjustment setting, “E 02” is indicated.
Note: The offset value is different to display it by the operation processing value from an actual flowing quantity value.

2. 5 Detailed setting mode

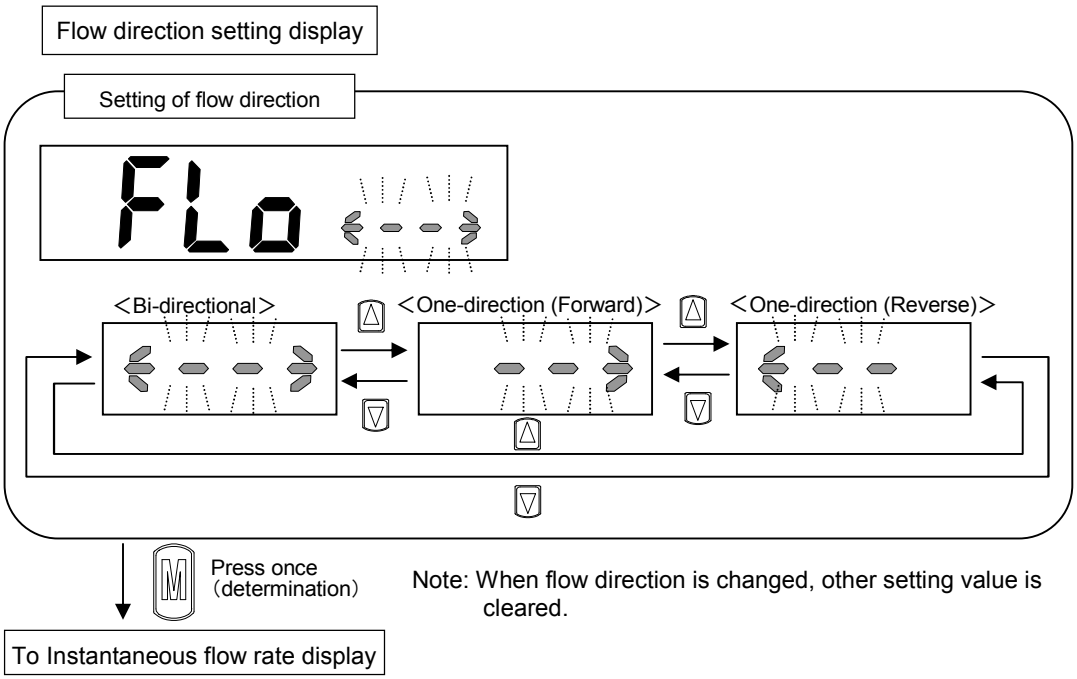
2. 5. 1 How to enter to detailed setting mode



2. 5. 2 Setting of flow direction（Integrated indicator type, Bi-directional type only）

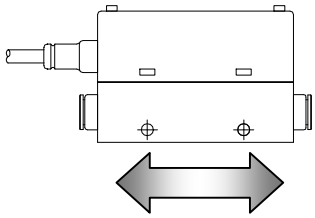
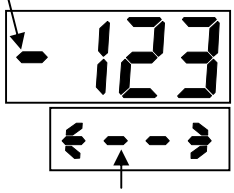
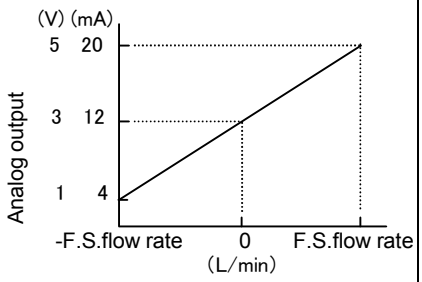
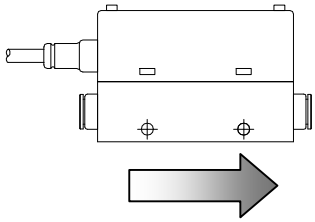
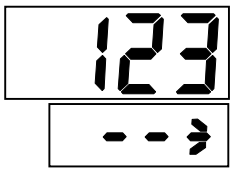
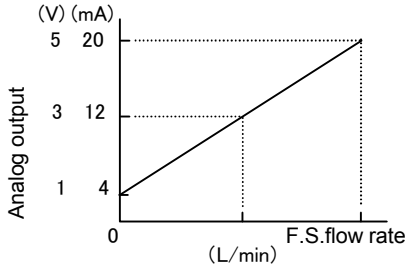
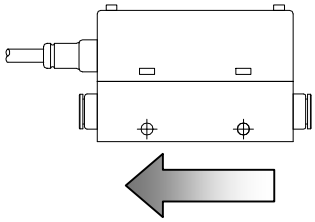
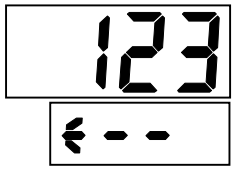
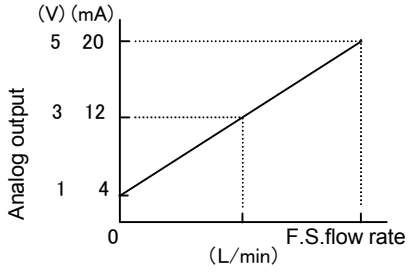
Flow direction can be switched.

Press △ or ▽ key to select flow direction. Press Ⓜ key to set.



Note: When flow direction is changed, other setting value is cleared.

●Flow direction

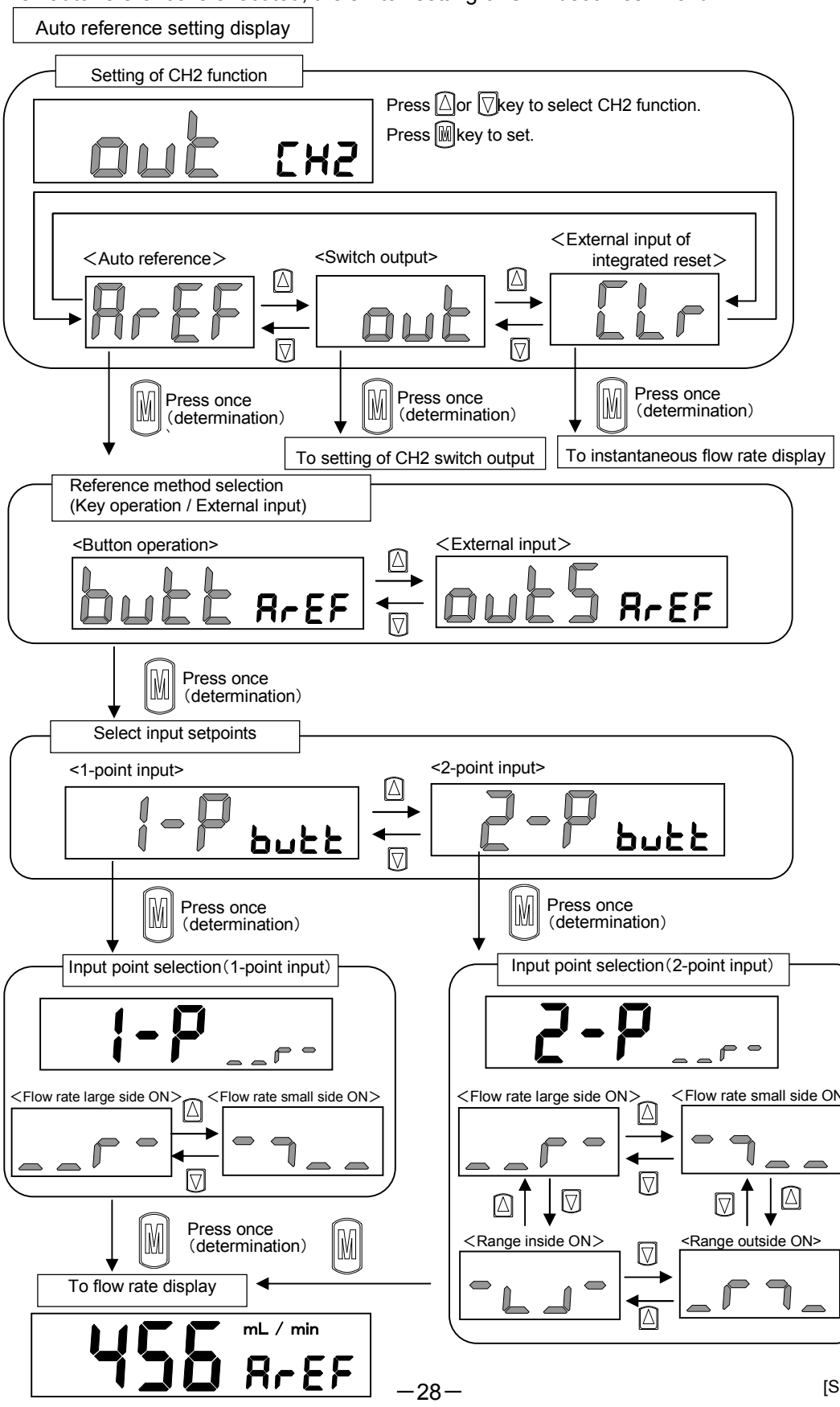
Flow direction	LCD display	Analog output characteristics
<Bi-directional> 	When reverse flow, "-"is indicated  The arrow changes according to flow direction	
<One-direction (Forward)> 		
<One-direction (Reverse)> 		

2. 5. 3 Setting of auto reference

When CH2 function selected external input of auto reference, setting value of switch output can be taken by external input or key operation.

The set point takes the flow rate when external input is turned on (or key operation).

When auto reference is executed, the switch setting of CH2 becomes invalid.



●How to take set point by key operation

・1-point input : The set point takes the flow rate when press ▽ key for 2 sec.
・2-point input : The upper limit takes the flow rate when press △ key for 2 sec.
The lower limit takes the flow rate when press ▽ key for 2 sec.
・After taking, the set point is displayed.

●How to take set point by external input

・1 point input : The set point takes the flow rate when external input is turned on (keep approx. 40msec.).
・2 points input : The set point takes the flow rate when external input is turned on (keep approx. 40msec.).
The big and small relations between latest two points are compared, upper limit and lower limit are distinguished automatically.

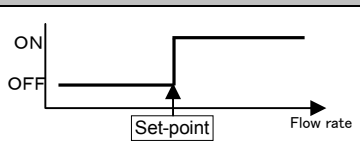
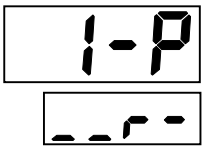
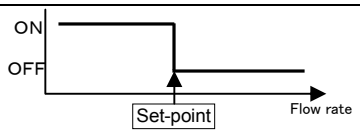
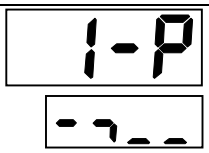
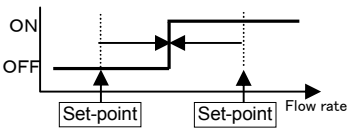
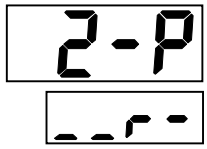
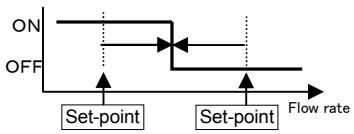
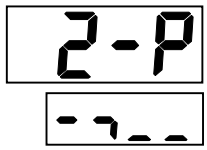
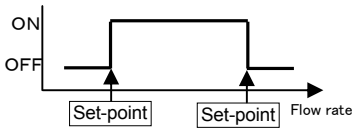
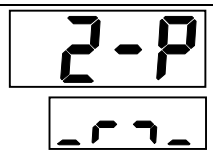
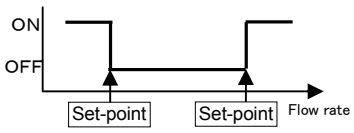
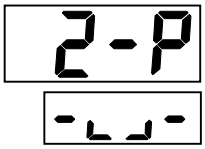
（Example）

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	45	345
5th	456	345	456

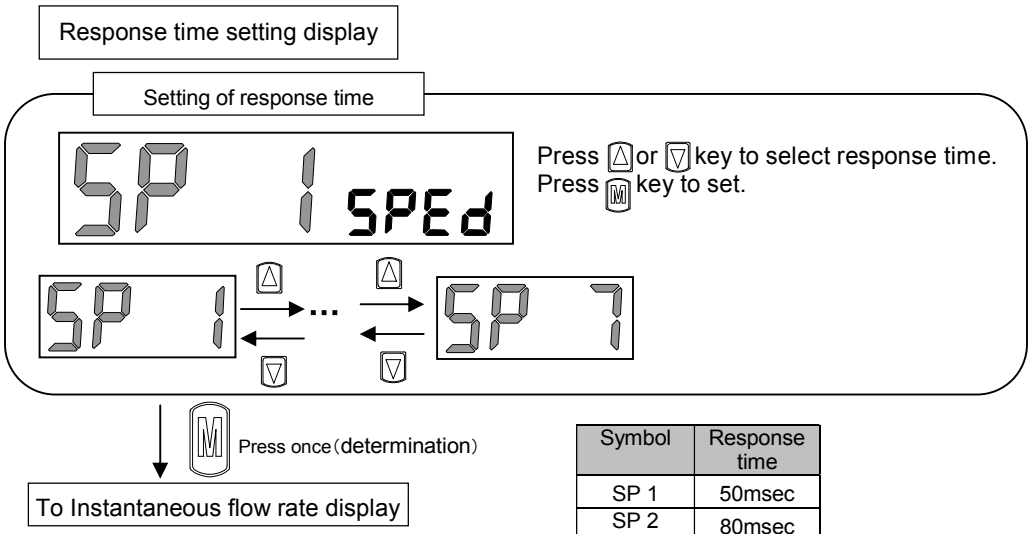
An initial value is zero in both bound

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

●Auto reference

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: $\frac{(Input1+Input2)}{2}$)		
	2-point input[2] (Flow rate small side ON)	OFF when higher than centre value of two input points (Set-point: $\frac{(Input1+Input2)}{2}$)		
	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 outsid (Range outside ON)	OFF when flow rate level is (Set-point1 : input point1) (Set-point2 : input point2)		

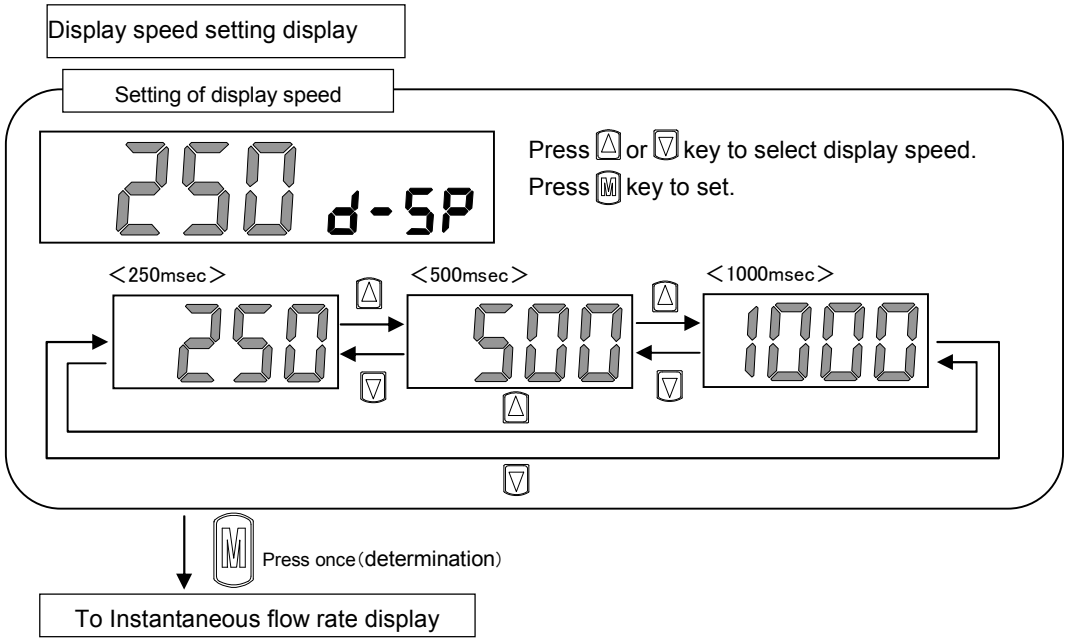
2. 5. 4 Setting of response time



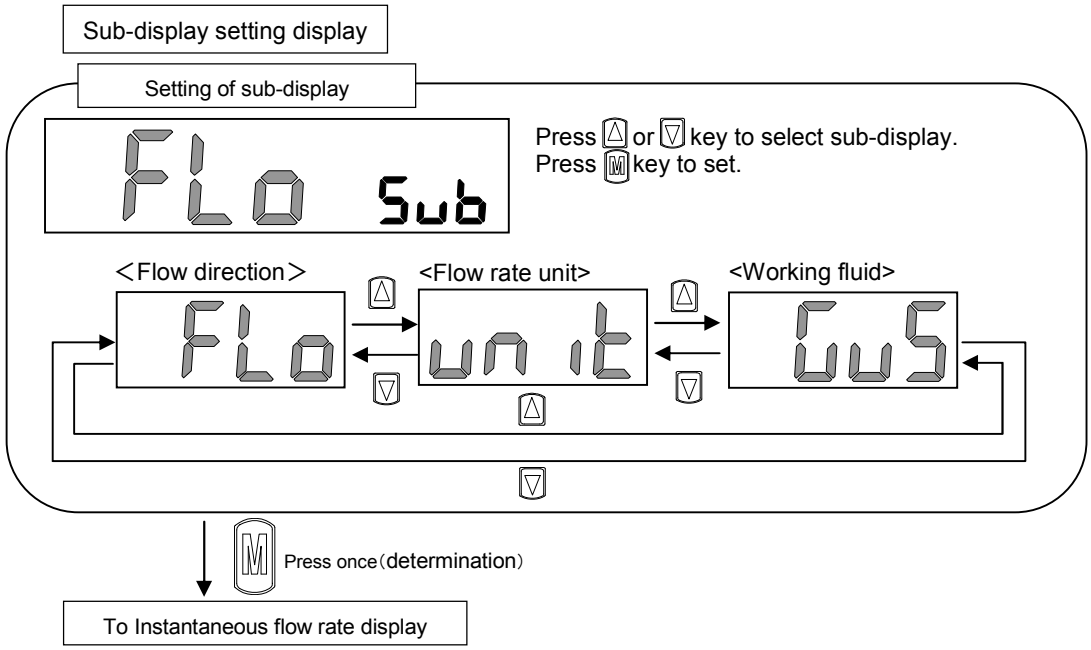
Symbol	Response time
SP 1	50msec
SP 2	80msec
SP 3	120msec
SP 4	200msec
SP 5	400msec
SP 6	800msec
SP 7	1500msec

Note) Response time is time of the standard. An actual response speed changes by piping.

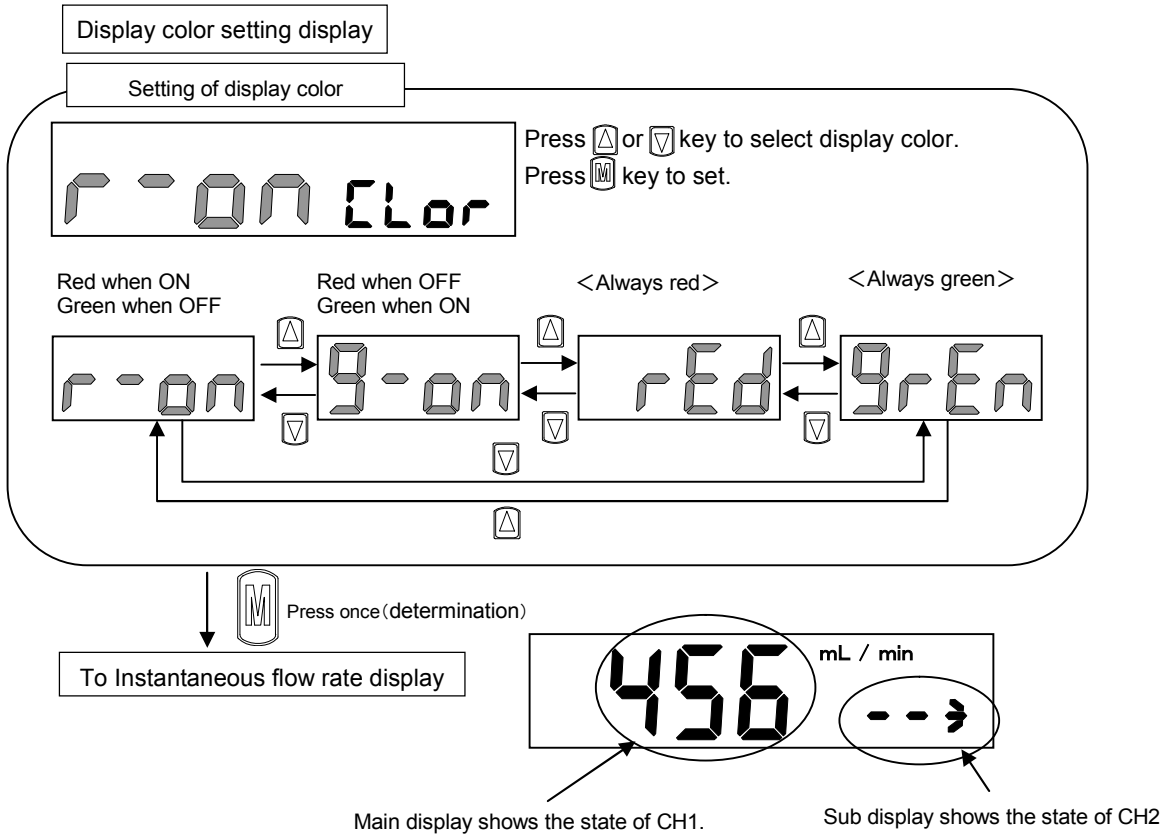
2. 5. 5 Setting of display speed



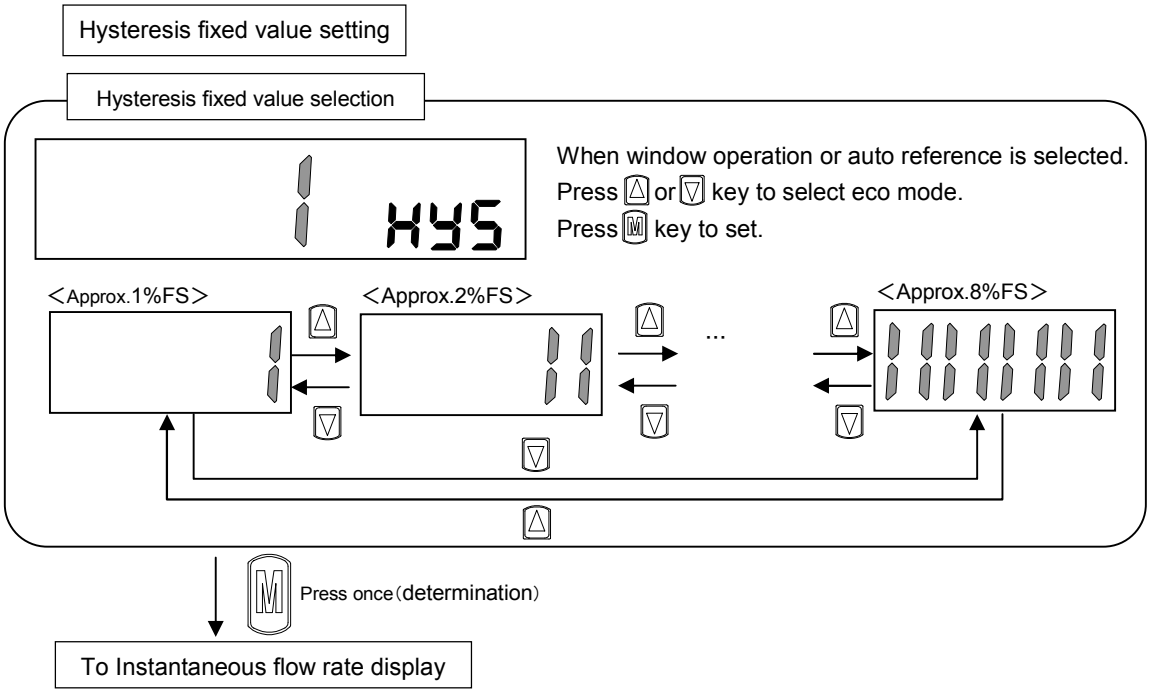
2. 5. 6 Setting of sub-display



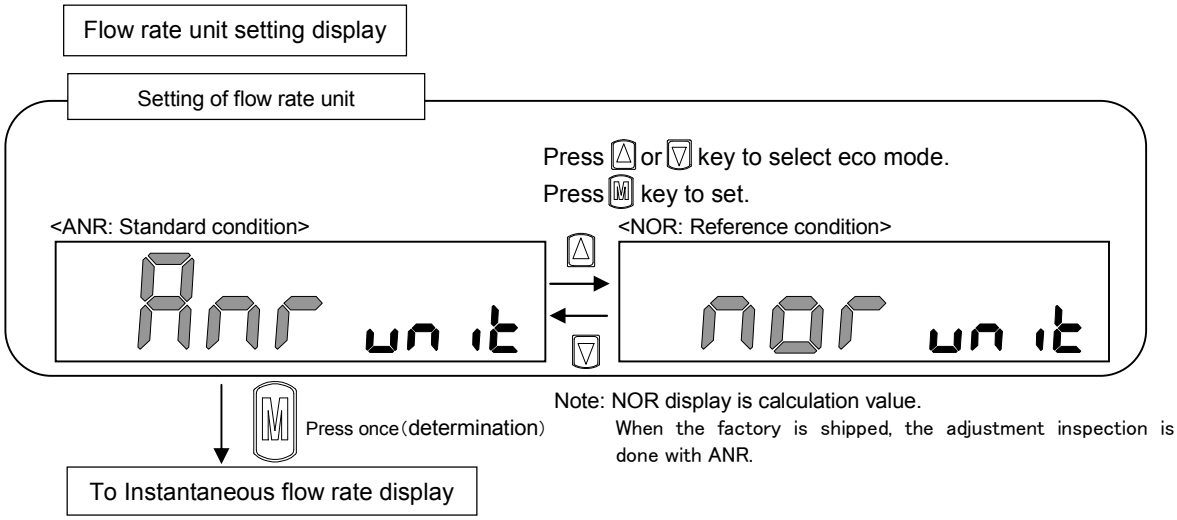
2. 5. 7 Setting of display color



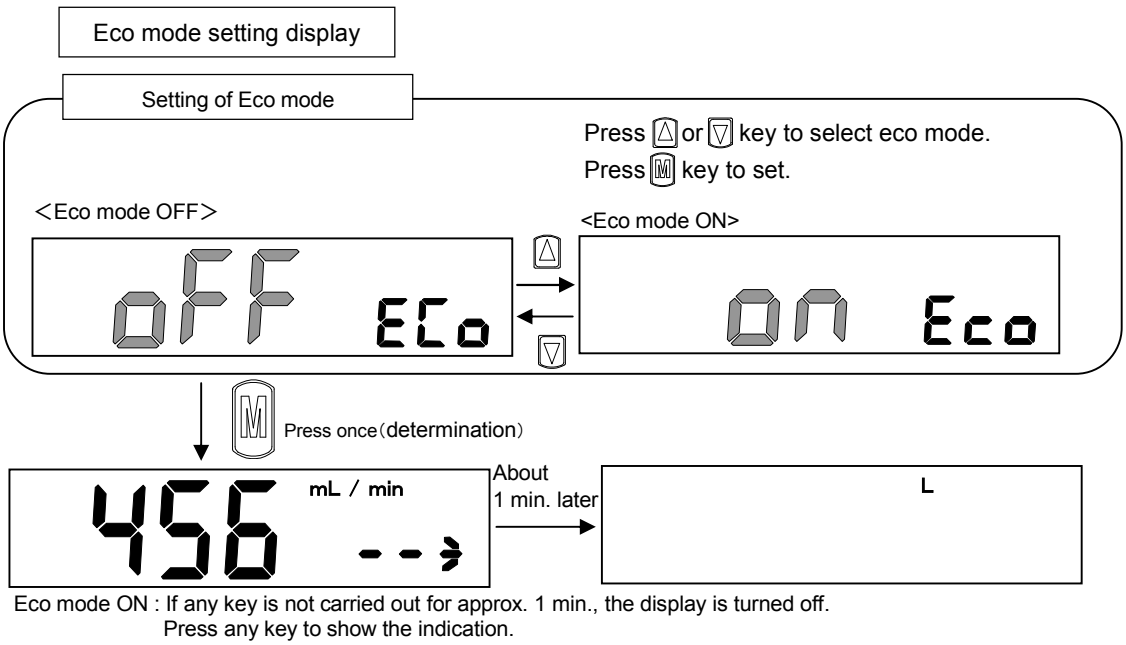
2. 5. 8 Hysteresis fixed value selection



2. 5. 9 Setting of flow rate unit

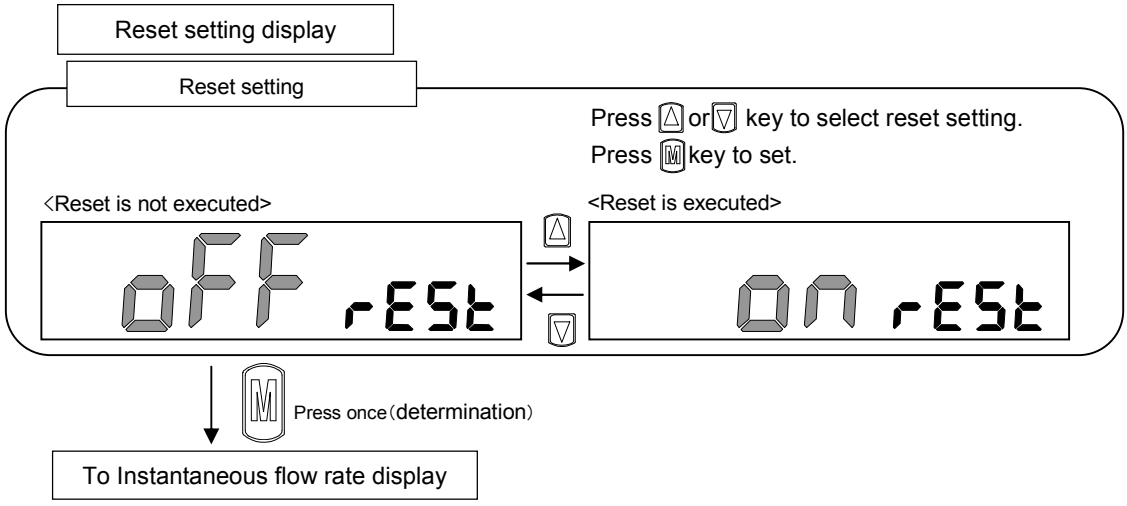


2. 5. 10 Setting of Eco mode



Eco mode ON : If any key is not carried out for approx. 1 min., the display is turned off.
Press any key to show the indication.

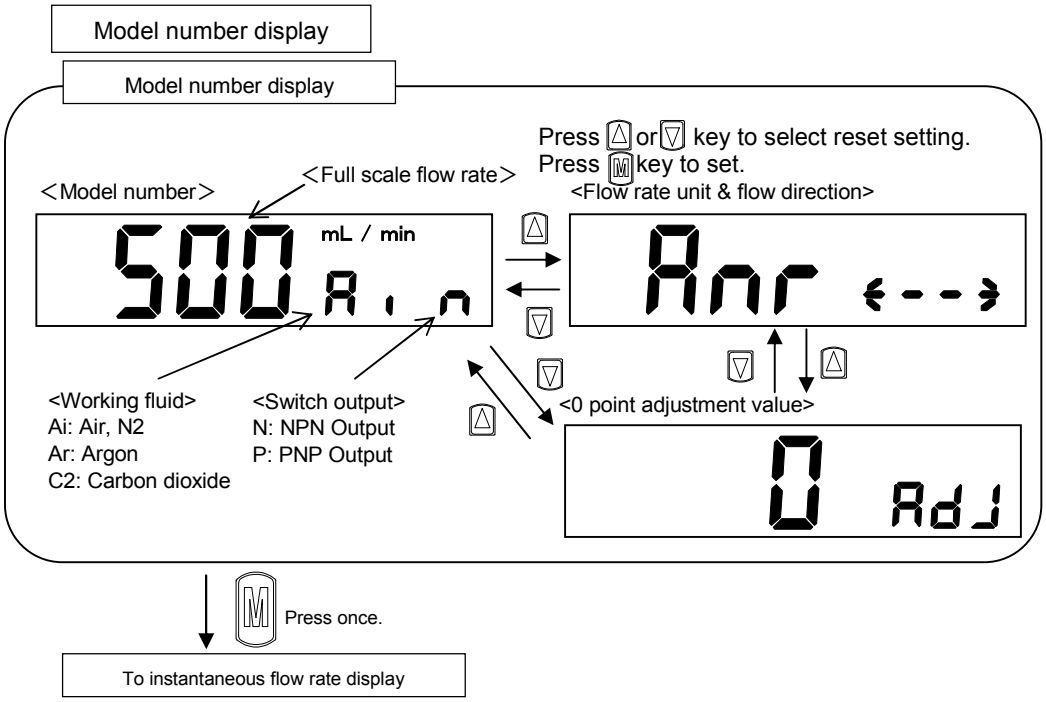
2. 5. 11 Reset to the initial setting



●Setting at shipping out of factory

Item	Setting at shipping out of factory
Switch out put	OFF
Zero adjustment value	Zero
Integrating flow rate value	Zero
Flow direction (bi-directional type only)	Bi-direction
Auto reference (CH2 setting)	Switch output
Response time	SP1(50msec)
Display speed	250msec
Sub-display	Flow direction display
Displayed color	ON: Red (OFF: Green)
Hysteresis	1%FS
Flow rate unit	ANR(20℃ 1 atmosphere conversion)
Eco mode	OFF

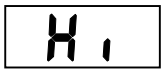
2. 5. 12 Model number display



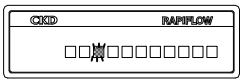
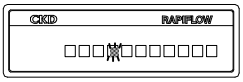
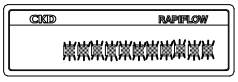
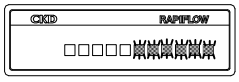
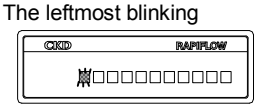
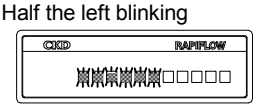
3. MAINTENANCE

3. 1 Error displays and corrective action

●Integrated indicator type

Error indication	Cause	Corrective action
	If fluid flows during zero adjustment setting, “E 02” is indicated.	Please check that fluid doesn’t flow at the time of zero adjustment setting.
	An error occurred during EEPROM reading or writing.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
	An error occurred during memory reading or writing.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
	Reading exceeds the upper limit of detection range.	Reduce the flow.
	Sensor chip is broken.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
	Reading exceeds the lower limit of detection range.	Reduce the flow.
	Sensor chip is broken.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
Switch output indicator is blinking	Switch output over current protection circuit is activated.	Check whether load current exceeds the rating, correctly connect the controller, and turn power ON again.

●Separated indicator type

Error indication	Cause	Corrective action
The third from the left blinks. 	An error occurred during EEPROM reading or writing.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
The fourth from the left blinks. 	An error occurred during memory reading or writing.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
<One-direction> Blinking of all  <Bi-directional> Half the left blinking 	Reading exceeds the upper limit of detection range.	Reduce the flow. Contact your nearest CKD Sales Office or dealer.
	Sensor chip is broken.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.
<One-direction> The leftmost blinking  <Bi-directional> Half the left blinking 	Reading exceeds the lower limit of detection range.	Reduce the flow.
	Sensor chip is broken.	Replace FSM2. Contact your nearest CKD Sales Office or dealer.

3. 2 Troubleshooting

Trouble	Cause	Corrective action
No flow display (No analog output)	Breakage of wire.	Replace FSM2. Recheck/repair external wiring.
	Wrong connection of power source.	Connect the rated power source correctly.
	Malfunction caused by noise.	Keep FSM2 main body and cable away from noise source.
	Output circuit is broken.	Replace FSM2.
	FSM2 is broken.	Replace FSM2.
Flow display remains 0. (Analog output remains 1V or 3V)	Flow path clogged by foreign matter.	Remove foreign matter and install filter at primary side of FSM2.
Flow display does not reach 0. (Analog output does not make 1V or 3V)	Leakage	Check and correct piping.
	Foreign matter sticking to sensor chip.	Replace FSM2.
	Malfunction caused by noise.	Keep FSM2 main body and cable away from the noise source.
Poor precision	Sensor chip is broken.	Replace FSM2.
	Foreign matter sticking to sensor chip.	Replace FSM2.
	Malfunction caused by noise.	Keep FSM2 main body and cable away from the noise source.
Flow display is not stable. (Analog output is not stable. Output is chattering.)	Pulsation of air. Fault in power source (not enough voltage/capacity) Pulsation of air.	Reduce pulsation by installing tank, etc.
		Change the response time.
		Change the display speed.
		Change the hysteresis.
	Fault in power source (not enough voltage/capacity)	Supply rated voltage. Provide power source with enough capacity.
	Malfunction caused by noise.	Keep FSM2 main body and cable away from noise source.
It doesn't move at power supply on by abnormal display.	It turned on power with the button had been pushed.	The power supply is put again without pushing the button.

4. PRODUCTS

4. 1 Specifications

4. 1. 1 Integrated indicator type(FSM2-N/P series)

● Integrated indicator type(Resin / Aluminum body)

Descriptions \ Model no.				Display integrated type (Resin / Aluminum body) FSM2-[*1][*2][*3][*4]-[*5][ ]-[*6]										
			Full scale flow rate	005	010	020	050	100	200	500	101	201	501	102
Flow rate range Note 1	*4	005	500mL/min	●										
		010	1L/min		●									
		020	2L/min			●								
		050	5L/min				●							
		100	10L/min					●						
		200	20 L/min						●					
		500	50 L/min							●				
		101	100 L/min								●			
		201	200 L/min									●		
		501	500 L/min										●	
		102	1000 L/min											●
Poet size/ Body material	*5	H04	φ4 push-in / resin	●	●	●	●	●	●					
		H06	φ6 push-in / resin	●	●	●	●	●	●	●				
		H08	φ8 push-in / resin							●	●	●		
		H10	φ10 push-in/ resin								●	●		
		A15	Rc1/2 / aluminum										●	●
Flow rate display Note 1,2	Type of display			4 digit + 4 digit 2 color LCD										
	Display range	*3	F	0 to 500 mL/min	0 to 1000 mL/min	0 to 2.00 L/min	0 to 5.00 L/min	0 to 10.00 L/min	0 to 20.0 L/min	0 to 50.0 L/min	0 to 100.0 L/min	0 to 200 L/min	0 to 500 L/min	0 to 1000 L/min
			R	-500 to 500 mL/min	-1000 to 1000 mL/min	-2.00 to 2.00 L/min	-5.00 to 5.00 L/min	-10.00 to 10.00 L/min	-20.0 to 20.0 L/min	-50.0 to 50.0 L/min	-100.0 to 100.0 L/min	-200 to 200 L/min	-500 to 500 L/min	-1000 to 1000 L/min
	Display resolution			1mL/min		0.01L/min			0.1L/min			1L/min		
Integrating functions Note 3	Display range			9999999mL		99999.99L			999999.9L			9999999L		
	Display resolution			1mL		0.01L			0.1L			1L		
	Integrating pulse output rate			5mL	10mL	0.02L	0.05L	0.1L	0.2L	0.5L	1L	2L	5L	10L
Working conditions	Working fluid Note 4			Clean air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 5:6:2]), compressed air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 1:6:2]), nitrogen gas										
	Maximum working pressure			0.7MPa										
	Minimum working pressure			-0.09MPa										
	Proof pressure			1MPa										
	Operating ambient temperature/humidity			0 to 50°C , 90%RH or less										
	Fluid temperature			0 to 50°C (no dew condensation)										
Accuracy Note 5	Specified range			Uni-direction type: 3 to 100% F.S., bi-direction type: -100 to -3% F.S., 3 to 100% F.S.										
	Linearity (display / analog output)			Within ±3% F.S. (Secondary side released to atmosphere)										
	Pressure characteristics			Within ±5% F.S. (-0.09 to 0.7 MPa, secondary side released to atmosphere reference)										
	Temperature characteristics			Within ±0.2% F.S./°C (15 to 35°C, 25°C reference)										
	Repeatability			Within ±1% F.S.										
Response time Note 6				50ms or less										
Output	Switch output	*1	N	Output 2 points (NPN open collector output, 50 mA or less, voltage drop 2.4 V or less)										
			P	Output 2 points (PNP open collector output, 50 mA or less, voltage drop 2.4 V or less)										
	Analog output	*2	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ and over) Note 7										
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)										
Power supply voltage Note 8		*2	V	12 to 24 VDC (10.8 to 26.4 V)										
			A	24 VDC (21.6 to 26.4 V)										
Current consumption Note 9				50mA or less										
Lead wire				φ3.7, AWG26 or equivalent × 5-conductors (connector connection), insulator O. D. φ1.0										
Holding function				Flow rate display, flow rate display peak hold, switch output, analog output, etc.										
Mounting orientation				Unrestricted in vertical/horizontal direction										
Straight piping section				Not required										
Degree of protection				IEC standards IP40 or equivalent										
Protection circuit Note 10				Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection										
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8										
Weight (main body only)		*5	H04	Approx. 50g										
			H06	Approx. 50g										
			H08	Approx. 70g										
			H10	Approx. 75g										
			A15	Approx. 155g										
Clean room specifications		*6	Blank	Absence										
			P70	Dust generation preventing Note 11										
			P80	Oil free Note 12										

Note 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%)
Note 2 : The flow rate display is rounded off at approx. ±1% F.S. or less (forced zero).
Note 3 : The integrated flow rate is a calculated (reference value). It will be reset when the power is turned OFF.
Note 4 : Use dry air which does not contain corrosive elements such as chlorine, sulphur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies to JIS B 8392-1:2012 (ISO 8573-1:2010) Class [1:1:1 to 1:6:2] Compressed air from the compressor contains drainage-water, oiloxide, foreign substances, etc. To maintain the function of this product, so 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 (upper stream side) of this product.
Note 5 : Calibration of this product is performed within specified range. Accuracy conditions: Temperature 25±3°C, power supply voltage 24±0.01 VDC. F.S. stands for full scale flow rate.
Note 6 : Response time can be set in seven steps from 50 ms. or less to approx. 1.5 s.
Note 7 : 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.
Note 8 : The power supply voltage specifications differ for the voltage output type and current output type.
Note 9 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.
Note 10 : This product's protection circuit is effective only for specific mis-connections and a load short-circuit. It does not provide protection against various mis-connections.
Note 11 : <P70> Dust generation preventing (product surface is decreased and cleaned before packaging. Heat sealed into anti-static bag in clean bench (Class 1000 and over).)
Note 12 : <P80> Oil free (In addition to P70 specifications, gas contact sections are degreased and washed. Refer to the "Internal structure drawing and parts list" for details on the wetted section members.)

●Integrated indicator type (Stainless steel body)

Descriptions \ Model no.				Display integrated type (stainless steel body) FSM2-[*1][*2][*3][*4]-[*5][*6][ ]-[*7]								
			Full scale flow rate	005	010	020	050	100	200	500	101	201
Flow rate range Note 1	*4	005	500mL/min	●								
		010	1L/min		●							
		020	2L/min			●						
		050	5L/min				●					
		100	10L/min					●				
		200	20 L/min						●			
		500	50 L/min							●		
		101	100 L/min								●	
		201	200 L/min									●
Poet size/ Body material	*5	S06	Rc1/8 stainless steel	●	●	●	●	●	●	● (Not for carbon dioxide)		
		S08	Rc1/4 stainless steel							●	●	● Only air and nitrogen gas
		SM5	M5 stainless steel (custom order product)	●	●	●	●	●	● (Not for carbon dioxide)			
Flow rate display Note 1,2			Type of display	4 digit + 4 digit 2 color LCD								
	Display range	*3	F	0 to 500 mL/min	0 to 1000 mL/min	0 to 2.00 L/min	0 to 5.00 L/min	0 to 10.00 L/min	0 to 20.0 L/min	0 to 50.0 L/min	0 to 100.0 L/min	0 to 200 L/min
			R	-500 to 500 mL/min	-1000 to 1000 mL/min	-2.00 to 2.00 L/min	-5.00 to 5.00 L/min	-10.00 to 10.00 L/min	-20.0 to 20.0 L/min	-50.0 to 50.0 L/min	-100.0 to 100.0 L/min	-200 to 200 L/min
	Display resolution			1mL/min		0.01L/min			0.1L/min			1mL/min
Integrating functions Note 3	Display range			9999999mL		99999.99L			999999.9L			9999999mL
	Display resolution			1mL		0.01L			0.1L			1mL
	Integrating pulse output rate			5mL	10mL	0.02L	5mL	10mL	0.02L	5mL	10mL	2L
Working conditions	Working fluid Note 4	*6	Blank	Clean air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 5:6:2]), compressed air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 1:6:2]), nitrogen gas								
			AR	Argon								
			C2	Carbon dioxide								
	Maximum working pressure			1.0MPa								
	Minimum working pressure			-0.09MPa								
	Proof pressure			1.5MPa								
	Operating ambient temperature/humidity			0 to 50°C , 90%RH or less								
	Fluid temperature			0 to 50°C (no dew condensation)								
Accuracy Note 5	Specified range			Uni-direction type: 3 to 100%F.S., bi-direction type: -100 to -3%F.S., 3 to 100%F.S.								
	Linearity (display / analog output)			Within ±3%F.S. (Secondary side released to atmosphere)								
	Pressure characteristics			Within ±5%F.S. (-0.09 to 0.7 MPa, secondary side released to atmosphere reference)								
	Temperature characteristics			Within ±0.2%F.S./°C (15 to 35°C, 25°C reference)								
	Repeatability			Within ±1% F.S.								
Response time Note 6				50 ms or less								
Output	Switch output	*1	N	Output 2 points (NPN open collector output, 50 mA or less, voltage drop 2.4 V or less)								
			P	Output 2 points (PNP open collector output, 50 mA or less, voltage drop 2.4 V or less)								
	Analog output	*2	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ and over) Note 7								
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)								
Power supply voltage Note 8		*2	V	12 to 24 VDC (10.8 to 26.4 V)								
			A	24 VDC (21.6 to 26.4 V)								
Current consumption Note 9				50mA or less								
Lead wire				φ3.7, AWG26 or equivalent × 5-conductors (connector connection), insulator O. D. φ1.0								
Holding function				Flow rate display, flow rate display peak hold, switch output, analog output, etc.								
Mounting orientation				Unrestricted in vertical/horizontal direction								
Straight piping section				Not required								
Degree of protection				IEC standards IP40 or equivalent								
Protection circuit Note 10				Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection								
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8								
Weight (main body only)		*5	S06	Approx. 95g								
			S08	Approx. 115g								
			SM5	Approx. 140g								
Clean room specifications		*7	Blank	Absence								
			P70	Dust generation preventing Note 11								
			P80	Oil free Note 12								

Note 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%)
Note 2 : The flow rate display is rounded off at approx. ±1% F.S. or less (forced zero).
Note 3 : The integrated flow rate is a calculated (reference value). It will be reset when the power is turned OFF.
Note 4 : Use dry air which does not contain corrosive elements such as chlorine, sulphur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies to JIS B 8392-1:2012 (ISO 8573-1:2010) Class [1:1:1 to 1:6:2] Compressed air from the compressor contains drainage-water, oiloxide, foreign substances, etc. To maintain the function of this product, so 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 (upper stream side) of this product.
Note 5 : Calibration of this product is performed within specified range. Accuracy conditions: Temperature 25±3˚C, power supply voltage 24±0.01 VDC. F.S. stands for full scale flow rate.
Note 6 : Response time can be set in seven steps from 50 ms. or less to approx. 1.5 s.
Note 7 : 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.
Note 8 : The power supply voltage specifications differ for the voltage output type and current output type.
Note 9 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.
Note 10 : This product's protection circuit is effective only for specific mis-connections and a load short-circuit. It does not provide protection against various mis-connections.
Note 11 : <P70> Dust generation preventing (product surface is decreased and cleaned before packaging. Heat sealed into anti-static bag in clean bench (Class 1000 and over).)
Note 12 : <P80> Oil free (In addition to P70 specifications, gas contact sections are degreased and washed. Refer to the "Internal structure drawing and parts list" for details on the wetted section members.)

4．1．2 Separated indicator type(FSM2-A series)

●Separated indicator type (Resin / Aluminum body)

Descriptions \ Model no.				Display separate type (resin/aluminum body) FSM2-A[*1][*2][*3]-[*4][ ]-[*5]											
			Full scale flow rate	005	010	020	050	100	200	500	101	201	501	102
Flow rate range Note 1	*3	005	500mL/min	●										
		010	1L/min		●									
		020	2L/min			●								
		050	5L/min				●							
		100	10L/min					●						
		200	20 L/min						●					
		500	50 L/min							●				
		101	100 L/min								●			
		201	200 L/min									●		
		501	500 L/min										●	
		102	1000 L/min											●
Poet size/ Body material	*4	H04	φ4 push-in / resin	●	●	●	●	●	●					
		H06	φ6 push-in / resin	●	●	●	●	●	●	●				
		H08	φ8 push-in / resin							●	●	●		
		H10	φ10 push-in/ resin								●	●		
		A15	Rc1/2 / aluminum										●	●
Flow direction	*2	F	Uni-direction											
		R	Bi-direction											
Working conditions	Working fluid Note 2		Clean air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 5:6:2]), compressed air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 1:6:2]), nitrogen gas											
	Maximum working pressure		0.7MPa											
	Minimum working pressure		-0.09MPa											
	Proof pressure		1MPa											
	Operating ambient temperature/humidity		0 to 50°C , 90%RH or less											
	Fluid temperature		0 to 50°C (no dew condensation)											
Accuracy Note 3	Specified range		Uni-direction type: 3 to 100% F.S., bi-direction type: -100 to -3% F.S., 3 to 100% F.S.											
	Linearity (analog output)		Within ±3% F.S. (Secondary side released to atmosphere)											
	Pressure characteristics		Within ±5% F.S. (-0.09 to 0.7 MPa, secondary side released to atmosphere reference											
	Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, 25°C reference)											
	Repeatability		Within ±1% F.S.											
Response time			50 ms or less											
Type of display			Flow bar display											
Output	Analog output	*1	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ and over) Note 4										
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)										
Power supply voltage note 5		*1	V	12 to 24 VDC (10.8 to 26.4 V)										
			A	24 VDC (21.6 to 26.4 V)										
Current consumption Note 6			50mA or less											
Lead wire			φ3.7, AWG26 or equivalent × 4-conductors (connector connection), insulator O. D. φ1.0											
Holding function			Analog output, flow bar display, error display											
Mounting orientation			Unrestricted in vertical/horizontal direction											
Straight piping section			Not required											
Degree of protection			IEC standards IP40 or equivalent											
Protection circuit Note 7			Power supply reverse connection protection											
EMC Directive			EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8											
Weight (main body only)		*4	H04	Approx. 40g										
			H06	Approx. 40g										
			H08	Approx. 60g										
			H10	Approx. 65g										
			A15	Approx. 145g										
Clean room specifications		*5	Blank	Absence										
			P70	Dust generation preventing Note 8										
			P80	Oil free Note 9										

Note 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%)

Note 2 : Use dry gas which does not contain corrosive elements such as chlorine, sulphur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies to JIS B 8392-1:2012 (ISO 8573-1:2010) Class [1:1:1 to 1:6:2] Compressed air from the compressor contains drainage-water, oil oxide, foreign matters, etc. To maintain the function of this product, so install a filter, air dryer (min. pressure dew point 10°C or less), and oil mist filter (max. oil concentration 0.1 mg/m^3) on the primary side (upper stream side) of this product.

Note 3 : Calibration of this product is performed within specified range. Accuracy conditions: Temperature 25±3°C, power supply voltage 24±0.01 VDC. F.S. stands for full scale flow rate.

Note 4 : 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.

Note 5 : The power supply voltage specifications differ for the voltage output type and current output type.

Note 6 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.

Note 7 : This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.

Note 8 : <P70> Dust generation preventing (product surface is degreased and cleaned before packing. Heat sealed into anti-static bag in clean bench (Class 1000 and over).)

Note 9 : <P80> Oil free (In addition to P70 specifications, gas contact sections are degreased and cleaned. Refer to the “Internal structure drawing and parts list” for details on the wetted section members.)

Discontinue

● Separated indicator type (Stainless steel body)

Descriptions \ Model no.				Display separate type (stainless steel body) FSM2-A[*1][*2][*3]-[*4][*5][ ]-[*6]								
		Full scale flow rate	005	010	020	050	100	200	500	101	201
Flow rate range Note 1	*3	005	500mL/min	●								
		010	1L/min		●							
		020	2L/min			●						
		050	5L/min				●					
		100	10L/min					●				
		200	20 L/min						●			
		500	50 L/min							●		
		101	100 L/min								●	
		201	200 L/min									●
Poet size/ Body material	*4	S06	Rc1/8 stainless steel	●	●	●	●	●	●	● (Not for carbon dioxide)		
		S08	Rc1/4 stainless steel							●	●	● Only air and nitrogen gas
		SM5	M5 stainless steel (custom order product)	●	●	●	●	●	● (Not for carbon dioxide)			

Flow direction		*2	F	Uni-direction
			R	Bi-direction
Working conditions	Working fluid Note 2	*5	Blank	Clean air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 5:6:2]), compressed air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 1:6:2]), nitrogen gas
			AR	Argon
			C2	Carbon dioxide
	Maximum working pressure			1.0MPa
	Minimum working pressure			-0.09MPa
	Proof pressure			1.5MPa
	Operating ambient temperature/humidity			0 to 50°C , 90%RH or less
	Fluid temperature			0 to 50°C (no dew condensation)
Accuracy Note 3	Specified range			Uni-direction type: 3 to 100% F.S., bi-direction type: -100 to -3% F.S., 3 to 100% F.S.
	Linearity (analog output)			Within ±3% F.S. (Secondary side released to atmosphere)
	Pressure characteristics			Within ±5% F.S. (-0.09 to 0.7 MPa, secondary side released to atmosphere reference)
	Temperature characteristics			Within ±0.2% F.S./°C (15 to 35°C, 25°C reference)
	Repeatability			Within ±1% F.S.
Response time				50ms or less
Type of display				Flow bar display
Output	Analog output	*1	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ and over) Note 4
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)
Power supply voltage note 5		*1	V	12 to 24 VDC (10.8 to 26.4 V)
			A	24 VDC (21.6 to 26.4 V)
Current consumption Note 6				50mA or less
Lead wire				φ3.7, AWG26 or equivalent × 4-conductors (connector connection), insulator O. D. φ 1.0
Holding function				Analog output, flow bar display, error display
Mounting orientation				Unrestricted in vertical/horizontal direction
Straight piping section				Not required
Degree of protection				IEC standards IP40 or equivalent
Protection circuit Note 7				Power supply reverse connection protection
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8
Weight (main body only)		*4	S06	Approx. 85g
			S08	Approx.105g
			SM5	Approx.130g
Clean room specifications		*6	Blank	Absence
			P70	Dust generation preventing Note 8
			P80	Oil free Note 9

Note 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%)

Note 2 : Use dry gas which does not contain corrosive elements such as chlorine, sulphur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies to JIS B 8392-1:2012 (ISO 8573-1:2010) Class [1:1:1 to 1:6:2] Compressed air from the compressor contains drainage-water, oil oxide, foreign matters, etc. To maintain the function of this product, so install a filter, air dryer (min. pressure dew point 10˚C or less), and oil mist filter (max. oil concentration 0.1 mg/m^3) on the primary side (upper stream side) of this product.

Note 3 : Calibration of this product is performed within specified range. Accuracy conditions: Temperature 25±3˚C, power supply voltage 24±0.01 VDC. F.S. stands for full scale flow rate.

Note 4 : 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.

Note 5 : The power supply voltage specifications differ for the voltage output type and current output type.

Note 6 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.

Note 7 : This product's protection circuit is effective only for specific misconnections and load short-circuits. It does not provide protection for all misconnections.

Note 8 : <P70> Dust generation preventing (product surface is degreased and cleaned before packing. Heat sealed into anti-static bag in clean bench (Class 1000 and over).)

Note 9 : <P80> Oil free (In addition to P70 specifications, gas contact sections are degreased and cleaned. Refer to the “Internal structure drawing and parts list” for details on the wetted section members.)

4. 1. 3 Integrated indicator type（Integrated needle valve type）

●Integrated needle valve type (Resin body)

Descriptions \ Model no.				Needle valve integrated type (Resin body) FSM2-[*1][*2][*3][*4]-[*5][ ]N-[*6]								
		Full scale flow rate	005	010	020	050	100	200	500	101	201
Flow rate range Note 1	*4	005	500mL/min	●								
		010	1L/min		●							
		020	2L/min			●						
		050	5L/min				●					
		100	10L/min					●				
		200	20 L/min						●			
		500	50 L/min							●		
		101	100 L/min								●	
		201	200 L/min									●
Poet size/ Body material	*5	H04	φ4 push-in / resin	●	●	●	●	●	●			
		H06	φ6 push-in / resin	●	●	●	●	●	●	●		
		H08	φ8 push-in / resin							●	●	●
		H10	φ10 push-in/ resin								●	●
Flow rate display Note 1,2		Type of display		4 digit + 4 digit 2 color LCD								
		Display range	*3 F	0 to 500 mL/min	0 to 1000 mL/min	0 to 2.00 L/min	0 to 5.00 L/min	0 to 10.00 L/min	0 to 20.0 L/min	0 to 50.0 L/min	0 to 100.0 L/min	0 to 200 L/min
		Display resolution		1mL/min		0.01L/min			0.1L/min			1L/min
Integrating functions Note 3		Display range		9999999mL		99999.99L			999999.9L			9999999L
		Display resolution		1mL		0.01L			0.1L			1L
		Integrating pulse output rate		5mL	10mL	0.02L	0.05L	0.1L	0.2L	0.5L	1L	2L
Working conditions		Working fluid Note 4		Clean air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 5:6:2]), compressed air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 1:6:2]), nitrogen gas								
		Maximum working pressure		0.7MPa								
		Minimum working pressure		-0.09MPa								
		Proof pressure		1.0MPa								
		Operating ambient temperature/humidity		0 to 50°C , 90%RH or less								
		Fluid temperature		0 to 50°C (no dew condensation)								
Accuracy Note 5		Specified range		Uni-direction type: 3 to 100% F.S., 3 to 100% F.S.								
		Linearity (display / analog output)		Within ±3% F.S. (Secondary side released to atmosphere)								
		Pressure characteristics		Within ±5% F.S. (-0.09 to 0.7 MPa, secondary side released to atmosphere reference)								
		Temperature characteristics		Within ±0.2% F.S./°C (15 to 35°C, 25°C reference)								
		Repeatability		Within ±1% F.S.								
Response time Note 6				50ms or less								
Output	Switch output	*1	N	Output 2 points (NPN open collector output, 50 mA or less, voltage drop 2.4 V or less)								
			P	Output 2 points (PNP open collector output, 50 mA or less, voltage drop 2.4 V or less)								
	Analog output	*2	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ and over) Note 7								
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)								
Power supply voltage Note 8		*2	V	12 to 24 VDC (10.8 to 26.4 V)								
			A	24 VDC (21.6 to 26.4 V)								
Current consumption Note 9				50 mA or less								
Lead wire				φ 3.7, AWG26 or equivalent × 5-conductors (connector connection), insulator O. D. φ1.0								
Holding function				Flow rate display, flow rate display peak hold, switch output, analog output, etc.								
Mounting orientation				Unrestricted in vertical/horizontal direction								
Straight piping section				Not required								
Degree of protection				IEC standards IP40 or equivalent								
Protection circuit Note 10				Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection								
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8								
Weight (main body only)		*5	H04	Approx. 80g								
			H06	Approx. 80g								
			H08	Approx. 110g								
			H10	Approx. 115g								
Clean room specifications		*6	Blank	Absence								
			P70	Dust generation preventing Note 11								
			P80	Oil free Note 12								

Note 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%)
Note 2 : The flow rate display is rounded off at approx. ±1% F.S. or less (forced zero).
Note 3 : The integrated flow rate is a calculated (reference value). It will be reset when the power is turned OFF.
Note 4 : Use dry air which does not contain corrosive elements such as chlorine, sulphur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies to JIS B 8392-1:2012 (ISO 8573-1:2010) Class [1:1:1 to 1:6:2] Compressed air from the compressor contains drainage-water, oiloxide, foreign substances, etc. To maintain the function of this product, so 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 (upper stream side) of this product.
Note 5 : Calibration of this product is performed within specified range. Accuracy conditions: Temperature 25±3˚C, power supply voltage 24±0.01 VDC. F.S. stands for full scale flow rate.
Note 6 : Response time can be set in seven steps from 50 ms. or less to approx. 1.5 s.
Note 7 : 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.
Note 8 : The power supply voltage specifications differ for the voltage output type and current output type.
Note 9 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.
Note 10 : This product's protection circuit is effective only for specific mis-connections and a load short-circuit. It does not provide protection against various mis-connections.
Note 11 : <P70> Dust generation preventing (product surface is decreased and cleaned before packaging. Heat sealed into anti-static bag in clean bench (Class 1000 and over).)
Note 12 : <P80> Oil free (In addition to P70 specifications, gas contact sections are degreased and washed. Refer to the "Internal structure drawing and parts list" for details on the wetted section members.)

Discontinue

4 PRODUCTS

● Integrated needle valve type (Stainless steel body)

Descriptions		Model no.	Needle valve integrated type (Stainless steel body) FSM2-[*1][*2][*3][*4]-[*5][*6][ ]N-[*7]								
		Full scale flow rate	005	010	020	050	100	200	500	101	201
Flow rate range Note 1	*4	005	500mL/min	●								
		010	1L/min		●							
		020	2L/min			●						
		050	5L/min				●					
		100	10L/min					●				
		200	20 L/min						●			
		500	50 L/min							●		
		101	100 L/min								●	
		201	200 L/min									●
Poet size/ Body material	*5	S06	Rc1/8 / Stainless	●	●	●	●	●	●	● (Not for carbon dioxide)		
		S08	Rc1/4 / Stainless							●	●	● Only air and nitrogen gas
Flow rate display Note 1,2		Type of display		4 digit + 4 digit 2 color LCD								
		Flow rate range *3 F		0 to 500 mL/min	0 to 1000 mL/min	0 to 2.00 L/min	0 to 5.00 L/min	0 to 10.00 L/min	0 to 20.0 L/min	0 to 50.0 L/min	0 to 100.0 L/min	0 to 200 L/min
		Display resolution		1mL/min		0.01L/min			0.1L/min			1L/min
Integrating functions Note 3		Flow rate range		9999999mL		99999.99L			999999.9L			9999999L
		Display resolution		1mL		0.01L			0.1L			1L
		Integrating pulse output rate		5mL	10mL	0.02L	5mL	10mL	0.02L	5mL	10mL	2L
Working conditions	Working fluid Note 4	*6	Blank	Clean air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 5:6:2]), compressed air (JIS B 8392-1:2012(ISO 8573-1:2010)[1:1:1 to 1:6:2]), nitrogen gas								
			AR	Argon								
			C2	Carbon dioxide								
	Maximum working pressure			1.0MPa								
	Minimum working pressure			-0.09MPa								
	Proof pressure			1.5MPa								
	Operating ambient temperature/humidity			0 to 50°C , 90%RH or less								
	Fluid temperature			0 to 50°C (no dew condensation)								
Accuracy Note 5	Specified range			Uni-direction type: 3 to 100%F.S., 3 to 100%F.S.								
	Linearity (display / analog output)			Within ±3%F.S. (Secondary side released to atmosphere)								
	Pressure characteristics			Within ±5%F.S. (-0.09 to 0.7 MPa, secondary side released to atmosphere reference)								
	Temperature characteristics			Within ±0.2%F.S./°C (15 to 35°C, 25°C reference)								
	Repeatability			Within ±1% F.S.								
Response time Note 6				50ms or less								
Output	Switch output	*1	N	Output 2 points (NPN open collector output, 50 mA or less, voltage drop 2.4 V or less)								
			P	Output 2 points (PNP open collector output, 50 mA or less, voltage drop 2.4 V or less)								
	Analog output	*2	V	1 to 5 V voltage output 1 point (connecting load impedance 50 kΩ and over) Note 7								
			A	4 to 20 mA current output 1 point (connecting load impedance 0 to 300 Ω)								
Power supply voltage Note 8		*2	V	12 to 24 VDC (10.8 to 26.4 V)								
			A	24 VDC (21.6 to 26.4 V)								
Current consumption Note 9				50mA or less								
Lead wire				φ3.7, AWG26 or equivalent × 5-conductors (connector connection), insulator O. D. φ1.0								
Holding function				Flow rate display, flow rate display peak hold, switch output, analog output, etc.								
Mounting orientation				Unrestricted in vertical/horizontal direction								
Straight piping section				Not required								
Degree of protection				IEC standards IP40 or equivalent								
Protection circuit Note 10				Power reverse connection protection, switch output reverse connection protection, switch output load short-circuit protection								
EMC Directive				EN55011, EN61000-6-2, EN61000-4-2/3/4/6/8								
Weight (main body only)		*5	S06	Approx. 160g								
			S08	Approx. 200g								
Clean room specifications		*7	Blank	Absence								
			P70	Dust generation preventing Note 11								
			P80	Oil free Note 12								

Note 1 : The value converted to volumetric flow rate at standard condition (20°C 1 barometric pressure (101 kPa) relative humidity 65%)
Note 2 : The flow rate display is rounded off at approx. ±1% F.S. or less (forced zero).
Note 3 : The integrated flow rate is a calculated (reference value). It will be reset when the power is turned OFF.
Note 4 : Use dry air which does not contain corrosive elements such as chlorine, sulphur or acids, and which is clean and does not contain dust or oil mist. When using compressed air, use clean air that complies to JIS B 8392-1:2012 (ISO 8573-1:2010) Class [1:1:1 to 1:6:2] Compressed air from the compressor contains drainage-water, oiloxide, foreign substances, etc. To maintain the function of this product, so 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 (upper stream side) of this product.
Note 5 : Calibration of this product is performed within specified range. Accuracy conditions: Temperature 25±3°C, power supply voltage 24±0.01 VDC. F.S. stands for full scale flow rate.
Note 6 : Response time can be set in seven steps from 50 ms. or less to approx. 1.5 s.
Note 7 : 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.
Note 8 : The power supply voltage specifications differ for the voltage output type and current output type.
Note 9 : Current for when 24 VDC is connected, and no load is connected. The current consumption will vary depending on how the load is connected.
Note 10 : This product's protection circuit is effective only for specific mis-connections and a load short-circuit. It does not provide protection against various mis-connections.
Note 11 : <P70> Dust generation preventing (product surface is decreased and cleaned before packaging. Heat sealed into anti-static bag in clean bench (Class 1000 and over).)
Note 12 : <P80> Oil free (In addition to P70 specifications, gas contact sections are degreased and washed. Refer to the "Internal structure drawing and parts list" for details on the wetted section members.)

Discontinue

4. 2 How to order

FSM2	–	N	V	F	005	–	S06	AR	1	B	K	N	–	P80
		[1]	[2]	[3]	[4]		[5]	[6]	[7]	[8]	[9]	[10]		[11]

[1]Output type		[2]Analog output type		[3]Flow direction		[4]Flow rate range (full scale flow rate)	
A	Display separate type Analog output 1 point only Note1	V	Voltage output (1-5V)	F	Uni-direction	005	500 mL/min
		A	Current output (4-20mA)	R	Bi-direction Note1	010	1 L/min
N	Display Integrated type Switch output(NPN): 2points Analog output: 1point					020	2 L/min
						050	5 L/min
						100	10 L/min
						200	20 L/min
						500	50 L/min
						101	100 L/min
						201	200 L/min
						501	500 L/min Note1
P	Display Integrated type Switch output(PNP): 2points Analog output: 1point					102	1000 L/min Note1

※Please see the nether table about combination of flow rate range[4], port size[5], and working fluid[6].

[5]Port size(body material)		[6]Working fluid		[7]Cable		[8]Bracket		[9] Traceability	
H04	φ4 push-in (resin)	Blank	Air, Nitrogen gas	Blank	None	Blank	None	Blank	None
H06	φ6 push-in (resin)	AR	Argon	1	1m	B	With bracket	T	With Traceability certificate, system diagram and inspection results
H08	φ8 push-in (resin)	C2	Carbon dioxide	3	3m				
H10	φ10 push-in (resin)					P	Panel mounting kit		
S06	Rc1/8 (stainless)							K	With company certification
S08	Rc1/4 (stainless)								
A15	Rc1/2 (aluminum)								
SM5	M5 (stainless) (Production on orders) Note1								

Note1) Integrated needle valve type is not select it

[10]With needle valve		[11]Clean room specifications	
Blank	None	Blank	None
N	Needle valve integrated type	P70	Dust generation preventing
		P80	Oil free

●Combination of flow rate range, port size, and working fluid

[4]Flow rate range	[5]Port size(body material)							
	H04	H06	H08	H10	S06	S08	A15	SM5
005	●◆	●◆			●○△◆			●○△
010	●◆	●◆			●○△◆			●○△
020	●◆	●◆			●○△◆			●○△
050	●◆	●◆			●○△◆			●○△
100	●◆	●◆			●○△◆			●○△
200	●◆	●◆			●○△◆			●○
500		●◆	●◆		●○◆	●○△◆		
101			●◆	●◆		●○△◆		
201			●◆	●◆		●◆		
501							●	
102							●	

[6]Working fluid
●: Air, Nitrogen gas
○: Argon
△: Carbon dioxide
■: Not available

[10]With needle valve
◆: Needle valve integrated type

●Combination of Clean room specifications and port size

[11] Clean	[5] Port size(body material)							
	H04	H06	H08	H10	S06	S08	A15	SM5
P70	●	●	●	●	●	●	●	●
P80	●	●			●	●	●	●

[11]Clean room specifications
●: Available
■: not available

[SM-385853-A]

Discontinue

Discrete option model

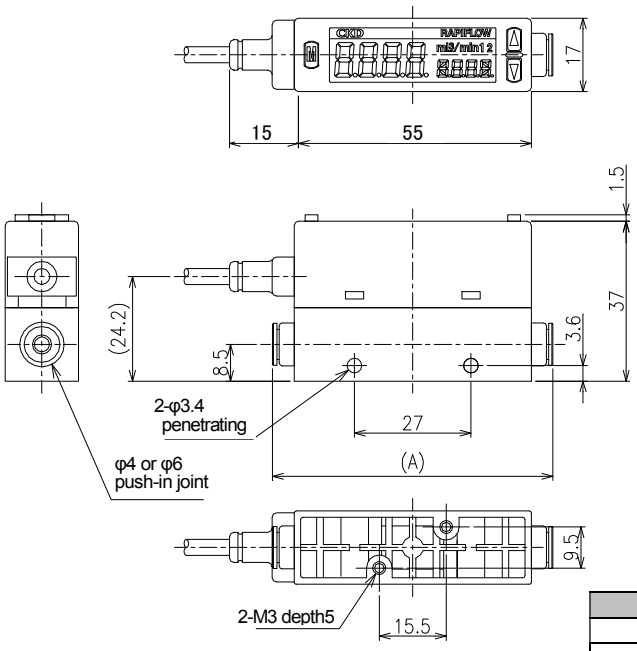
FSM2 – LB1 – P70
[12] [13]

[12]Option		[13] Clean specification	
LB1	Bracket (for Φ4,6,8,10, Rc1/8, Rc1/4, M5)	Blank	None
LB2	Bracket (for Rc1/2)	P70	Dust generation preventing
C51	5-conductor cable 1 m (for display integrated type)		
C53	5-conductor cable 3 m (for display integrated type)		
C41	4-conductor cable 1 m (for display separate type)		
C43	4-conductor cable 3 m (for display separate type)		
KHS	Panel mounting kit (for display integrated type) (The panel mounting kit cannot be mounted on the FSM2-*-A15* type.)		
KHS-N	Panel mounting kit (for needle valve integrated type)		

4. 3 Dimensions

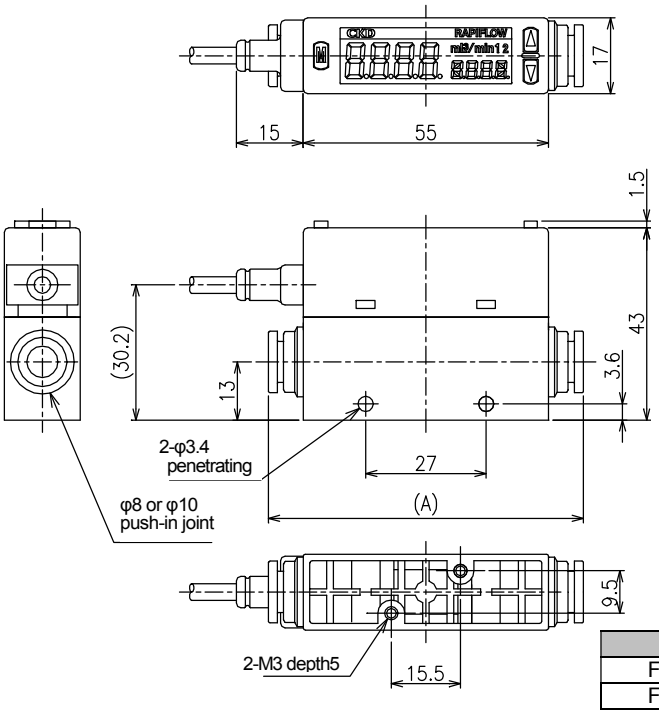
4. 3. 1 Integrated indicator type (FSM2-N/P series)

●FSM2-N/P[ ]-H04/H06[ ](Flow range：005／010／020／050／100／200／500)



Model No.	Port size	Dimension (A)
FSM2-[ ]-H04[ ]	φ4 push-in	64.9
FSM2-[ ]-H06[ ]	φ6 push-in	67.2

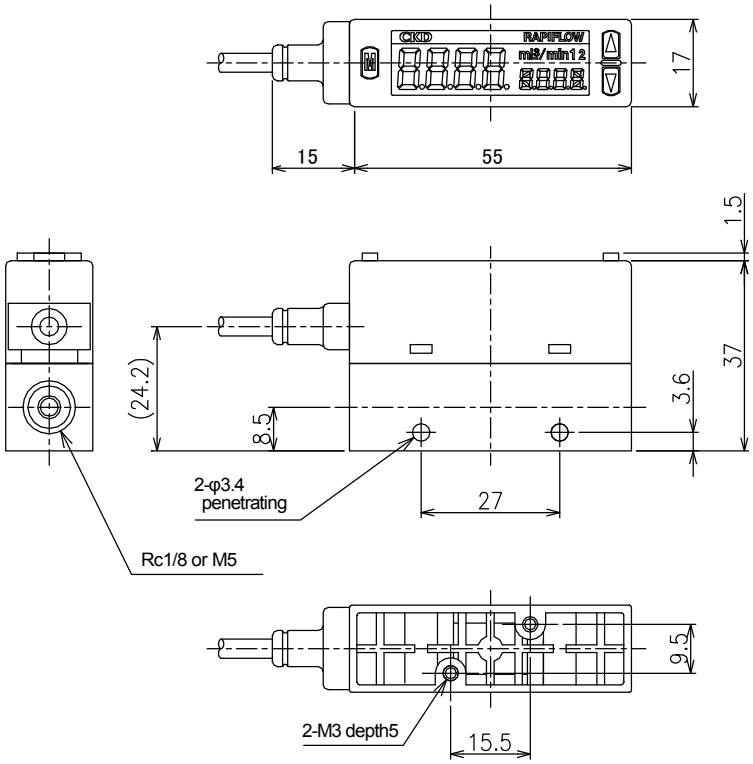
●FSM2-N/P[ ]-H08/H10[ ](Flow range：500／101／201)



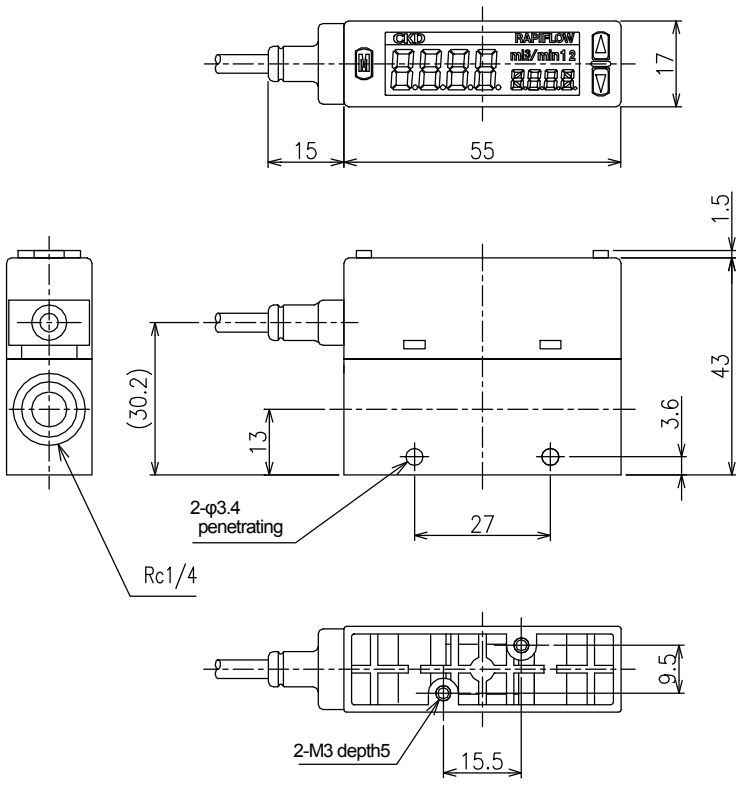
Model No.	Port size	Dimension (A)
FSM2-[ ]-H08[ ]	φ8 push-in	70.6
FSM2-[ ]-H10[ ]	φ10 push-in	82.2

[SM-385853-A]

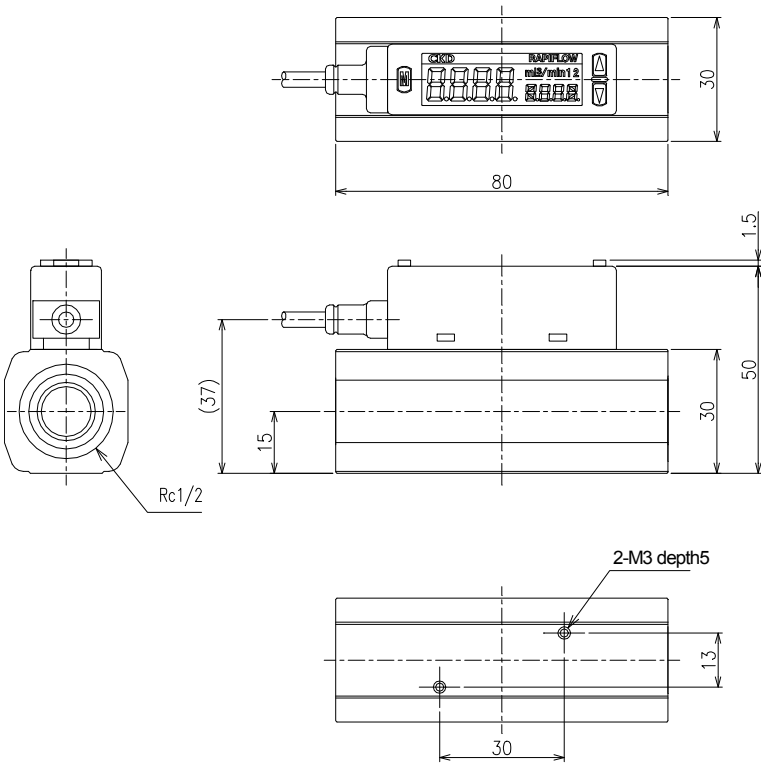
●FSM2-N/P[ ]-S06/SM5[ ](Flow range：005／010／020／050／100／200／500)



●FSM2-N/P[ ]-S08[ ](Flow range：500／101／201)

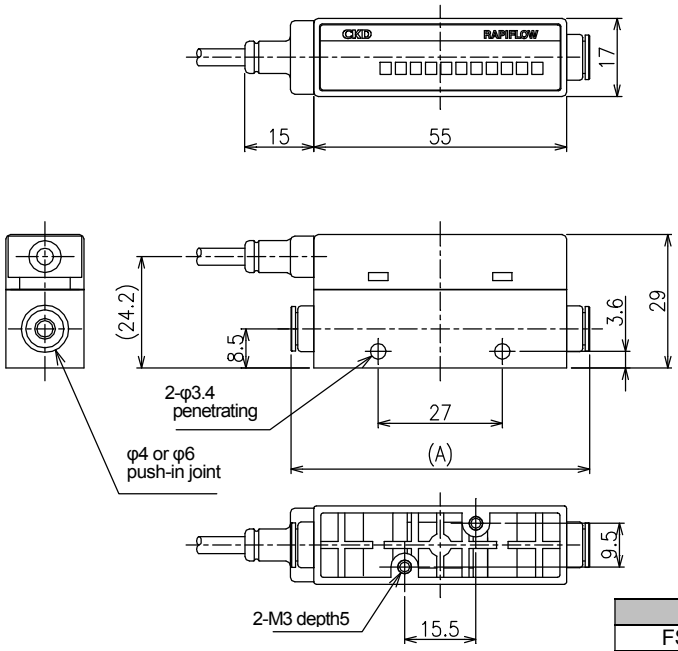


●FSM2-N/P[ ]-A15(Flow range：501／102)



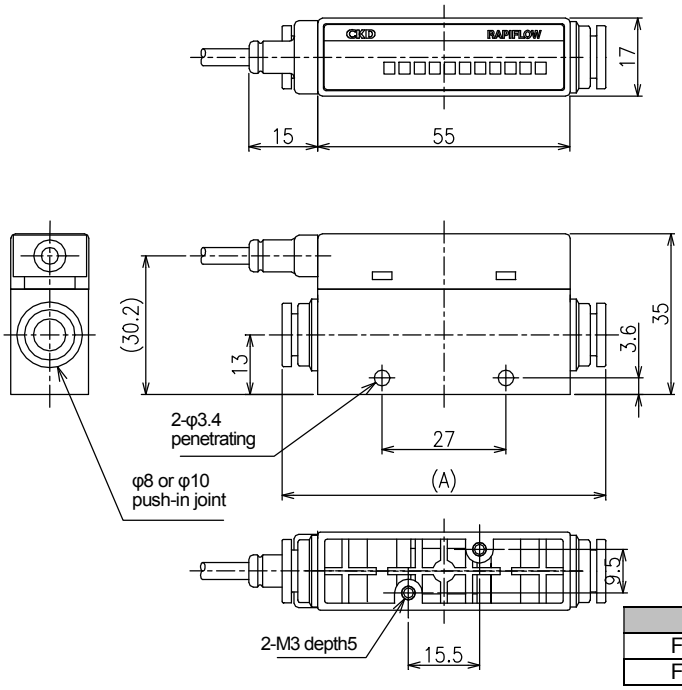
4．3．2 Separated indicator type (FSM2-A series)

●FSM2-A[ ]-H04/H06[ ](Flow range：005／010／020／050／100／200／500)



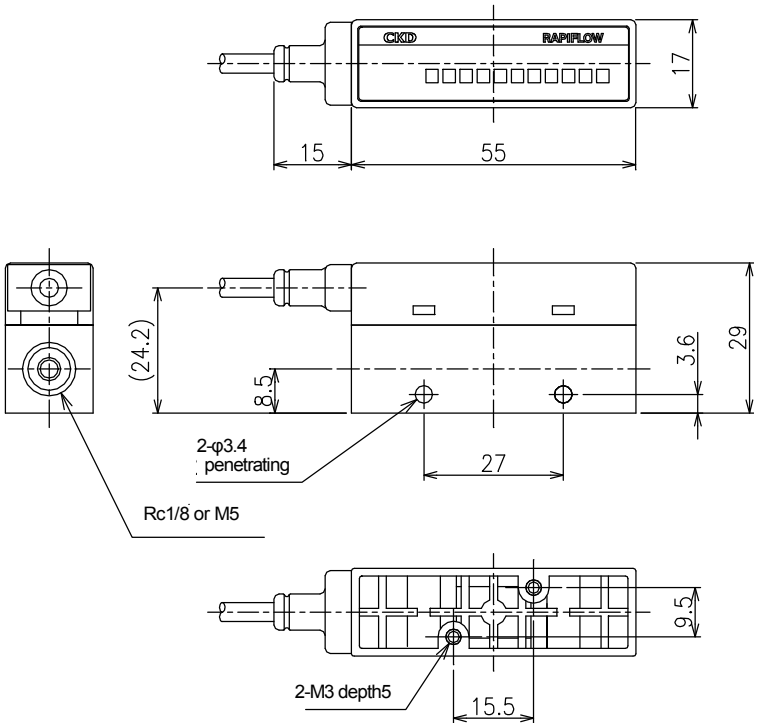
Model No.	Port size	Dimension (A)
FSM2-[ ]-H04[ ]	φ4 push-in	64.9
FSM2-[ ]-H06[ ]	φ6 push-in	67.2

●FSM2-A[ ]-H08/H10[ ](Flow range：500／101／201)

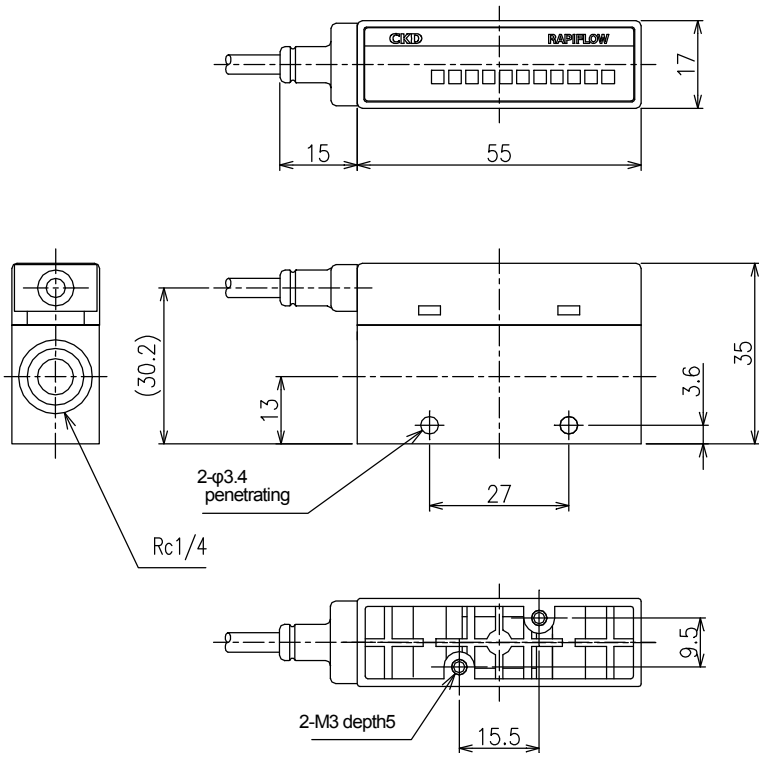


Model No.	Port size	Dimension (A)
FSM2-[ ]-H08[ ]	φ8 push-in	70.6
FSM2-[ ]-H10[ ]	φ10 push-in	82.2

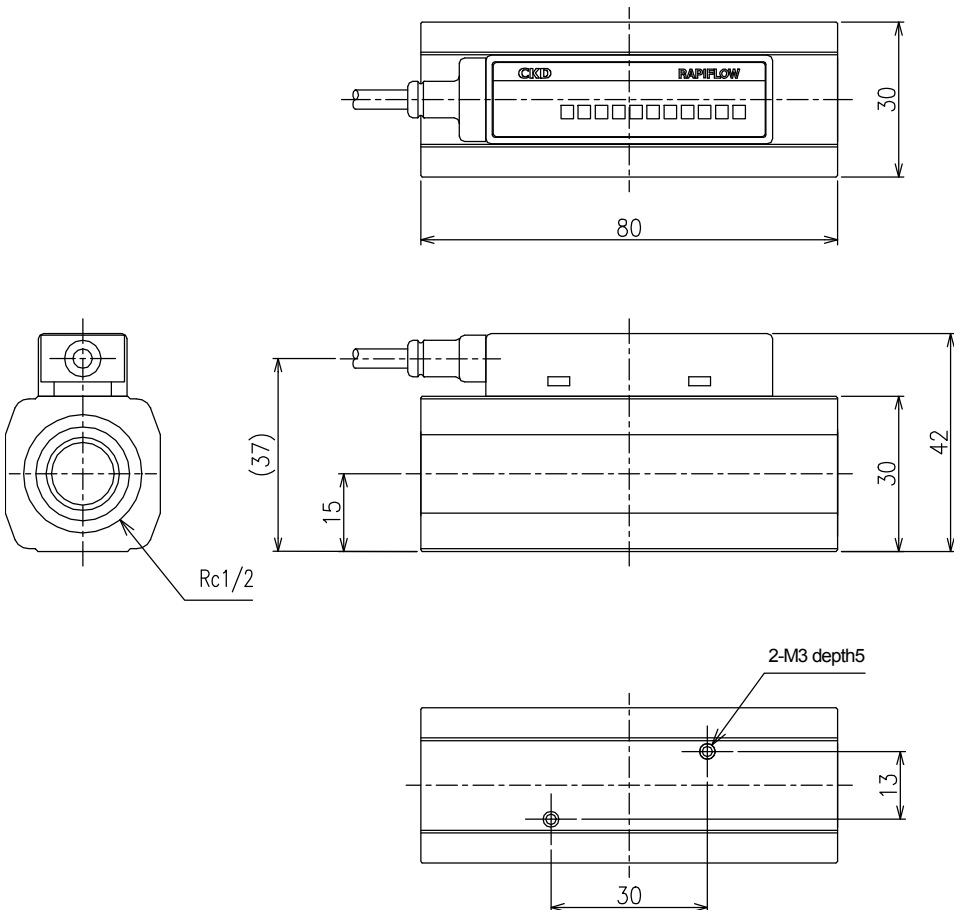
●FSM2-A[ ]-S06/SM5[ ](Flow range：005／010／020／050／100／200／500)



●FSM2-A[ ]-S08[ ](Flow range：500／101／201)

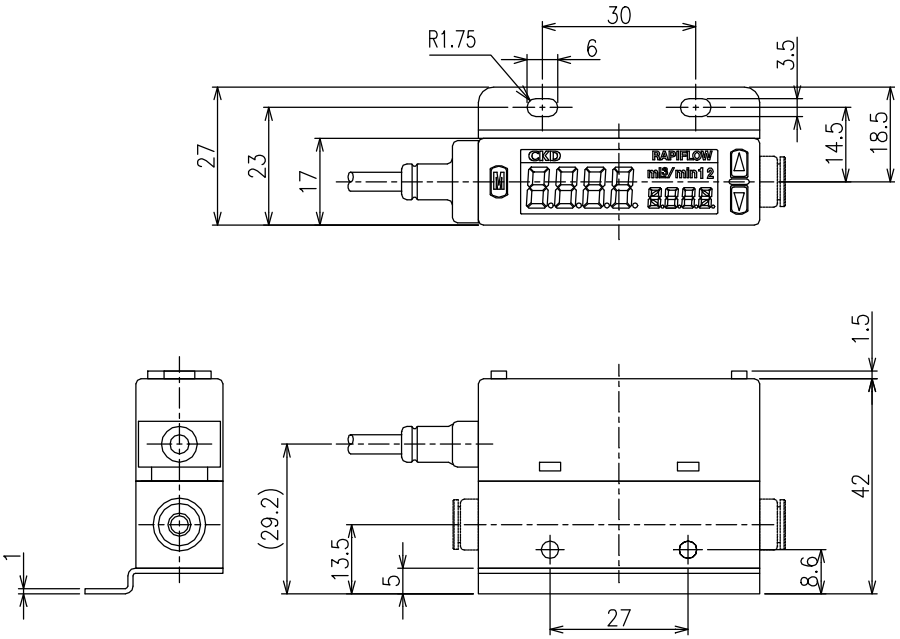


●FSM2-A[ ]-A15(Flow range：501／102)

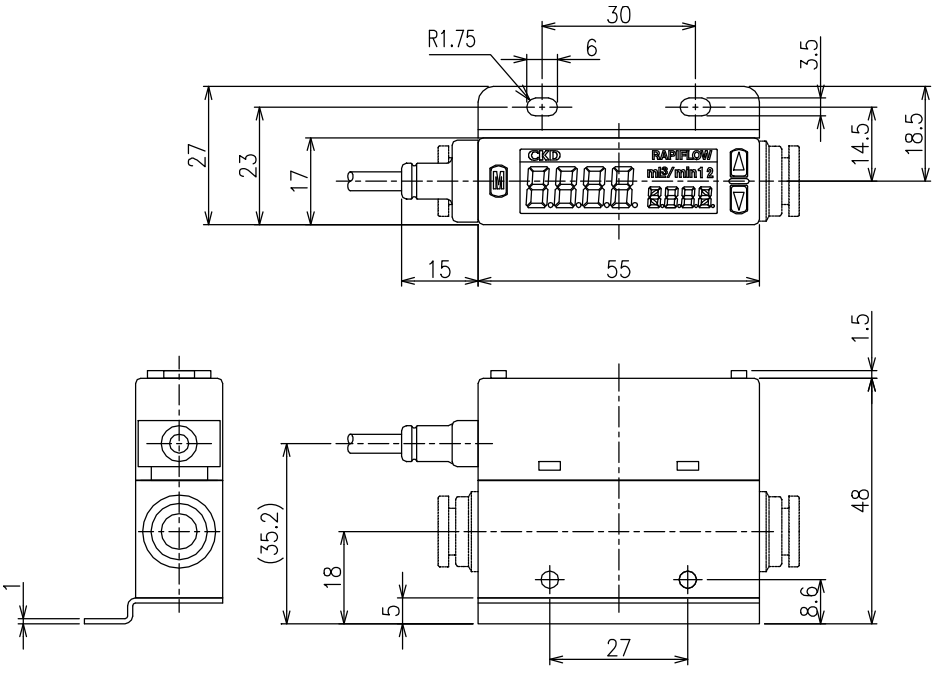


4．3．3 Integrated indicator type (with bracket)

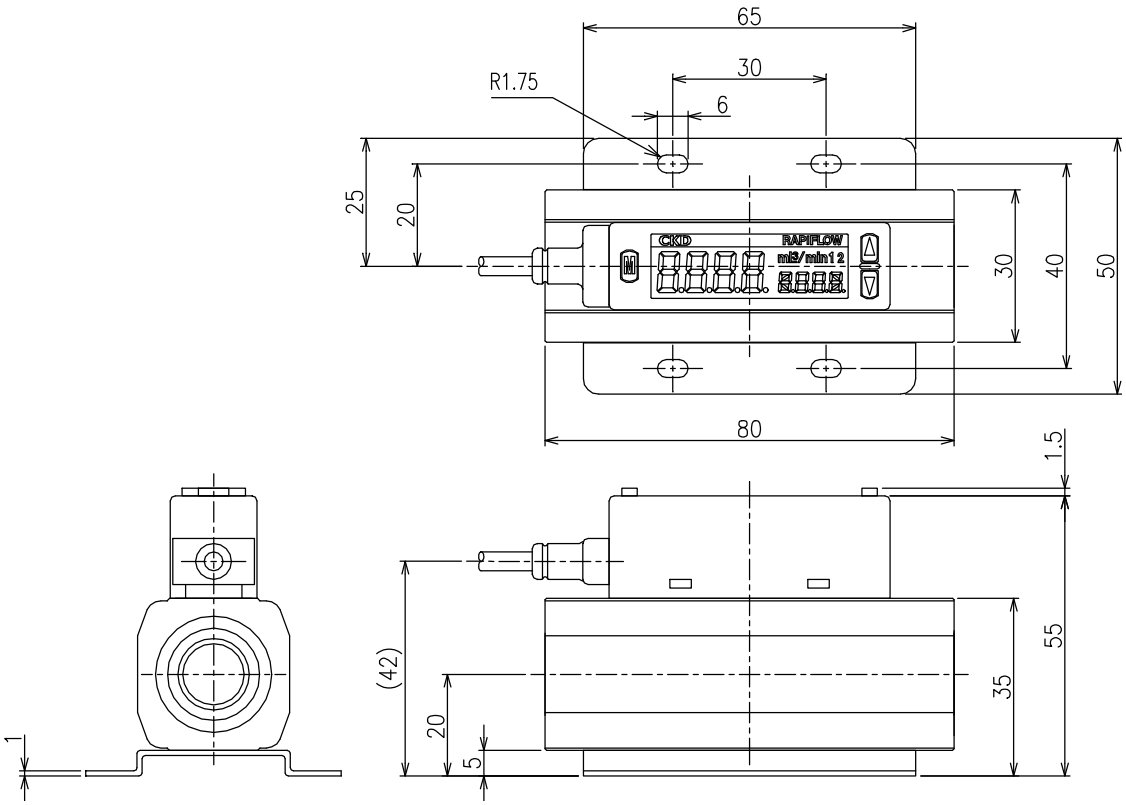
●FSM2-N/P[ ]-H04/H06/S06/SM5[ ]B
(Flow range：005／010／020／050／100／200／500)



●FSM2-N/P[ ]-H08/H10/S08[ ]B(Flow range：500／101／201)

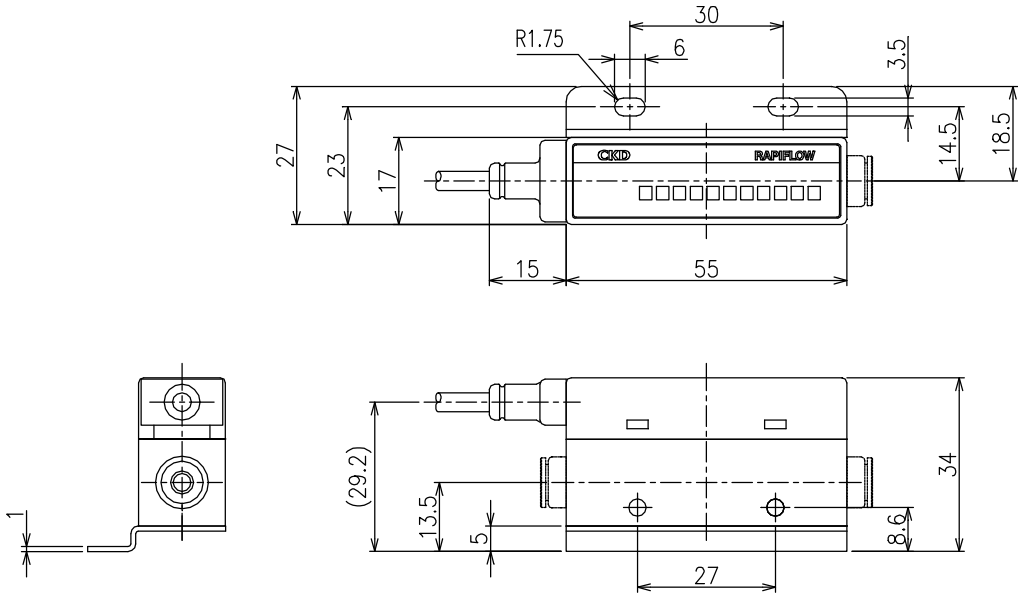


●FSM2-N/P[ ]-A15[ ]B(Flow range：501／102)

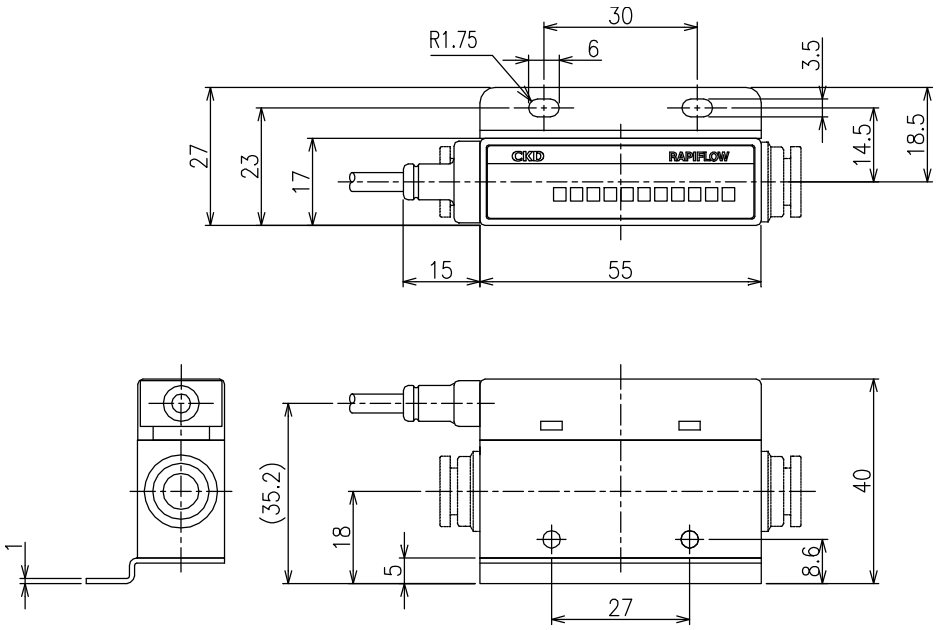


4．3．4 Separated indicator type (with bracket)

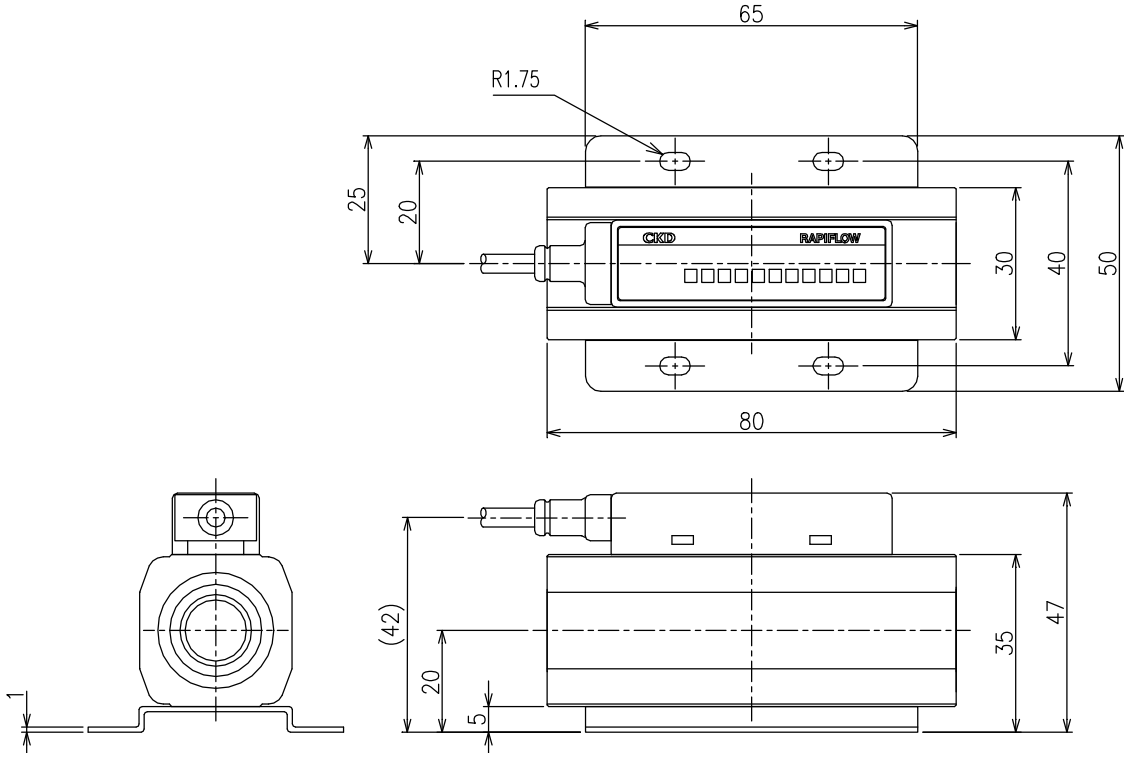
●FSM2-A[ ]-H04/H06/S06/SM5[ ]B
(Flow range：005／010／020／050／100／200／500)



●FSM2-A[ ]-H08/H10/S08[ ]B(Flow range：500／101／201)

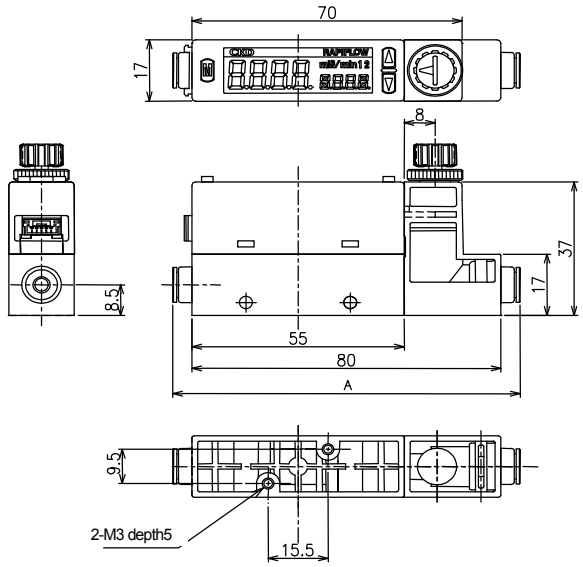


●FSM2-A[ ]-A15[ ]B(Flow range：501／102)



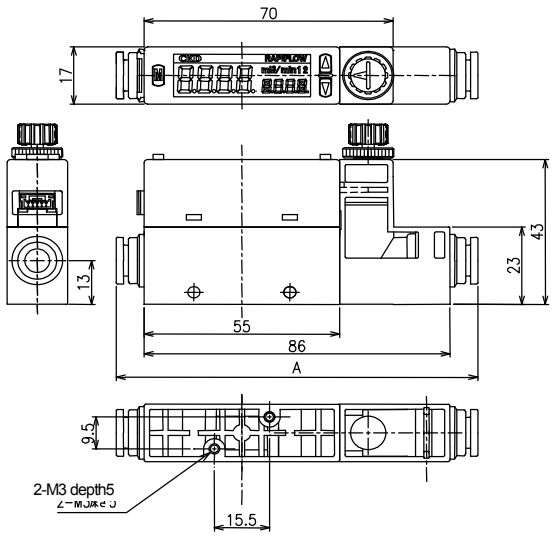
4．3．5 Integrated indicator type (Integrated needle valve type)

●FSM2-N/P[ ]-H04/H06[ ]N(Flow range：005／010／020／050／100／200／500)



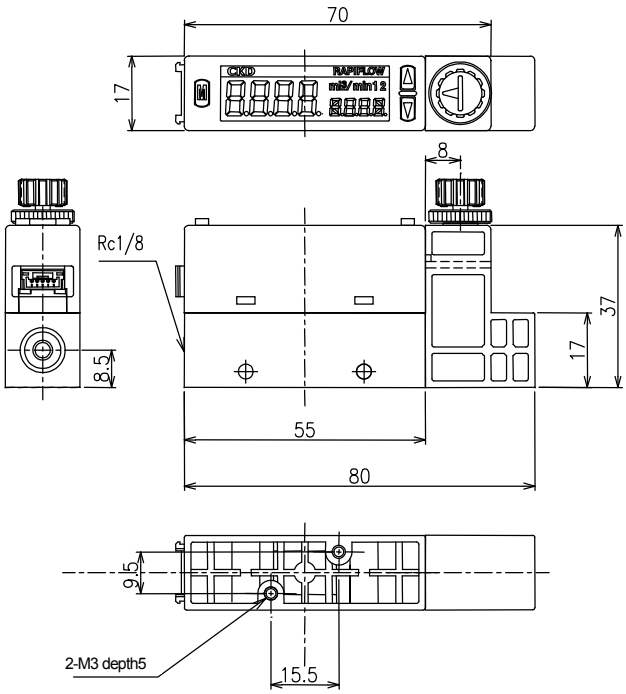
Model No	Port size	Dimension(A)
FSM2-[ ]-H04[ ]N	φ4 push-in	89.9
FSM2-[ ]-H06[ ]N	φ6 push-in	92.2

●FSM2-N/P[ ]-H08/H10[ ]N(Flow range：500／101／201)

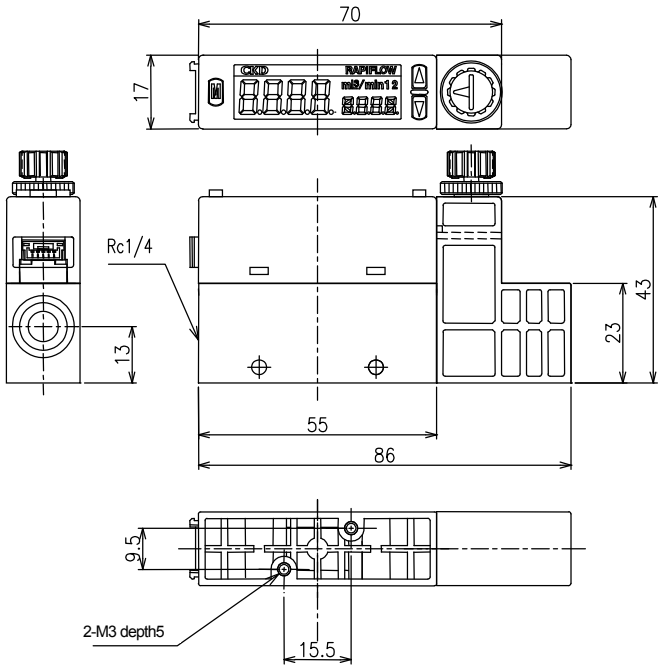


Model No	Port size	Dimension(A)
FSM2-[ ]-H08[ ]N	φ8 push-in	101.6
FSM2-[ ]-H10[ ]N	φ10 push-in	113.2

●FSM2-N/P[ ]-S06[ ]N(Flow range：005／010／020／050／100／200／500)

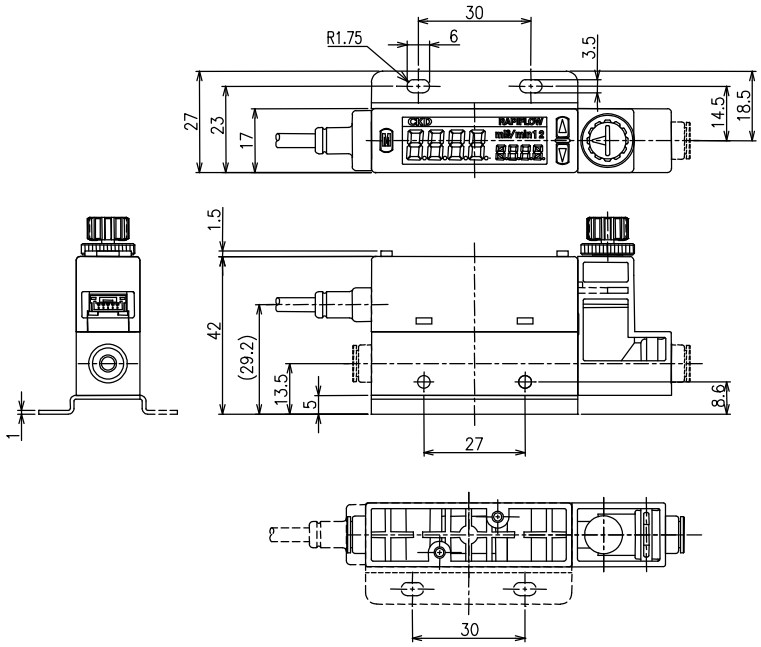


●FSM2-N/P[ ]-S08[ ]N(Flow range：500／101／201)

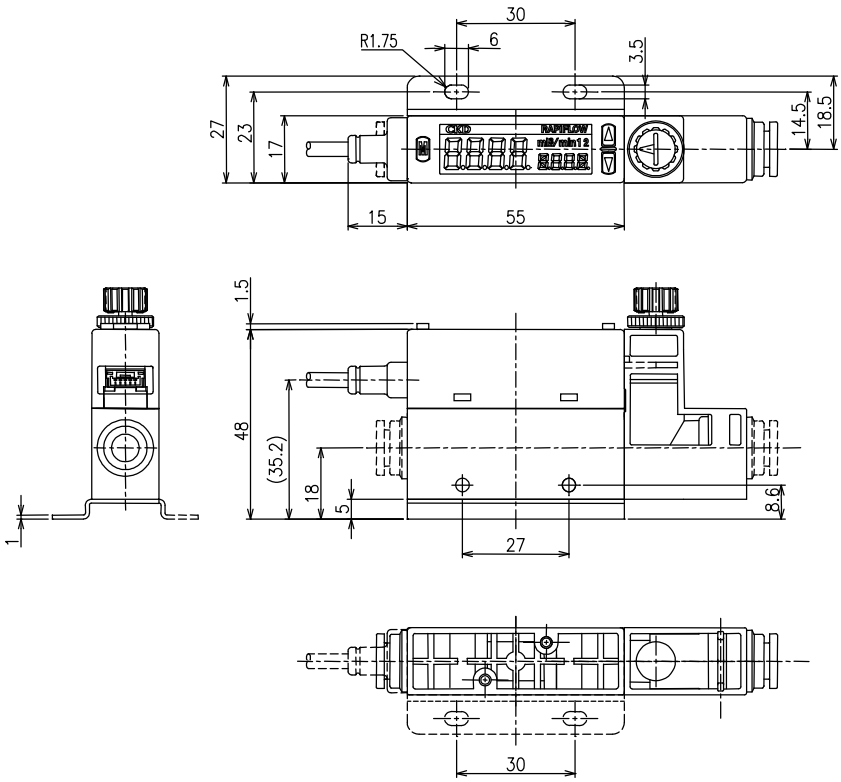


4．3．6 Integrated indicator type (Integrated needle valve type) (with bracket)

●FSM2-N/P[ ]-H04/H06/S06[ ]BN
(Flow range：005／010／020／050／100／200／500)

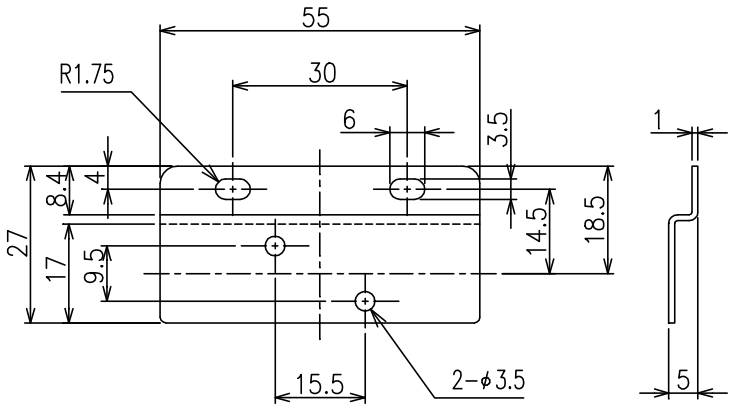


●FSM2-N/P[ ]-H08/H10/S08[ ]BN(Flow range：500／101／201)

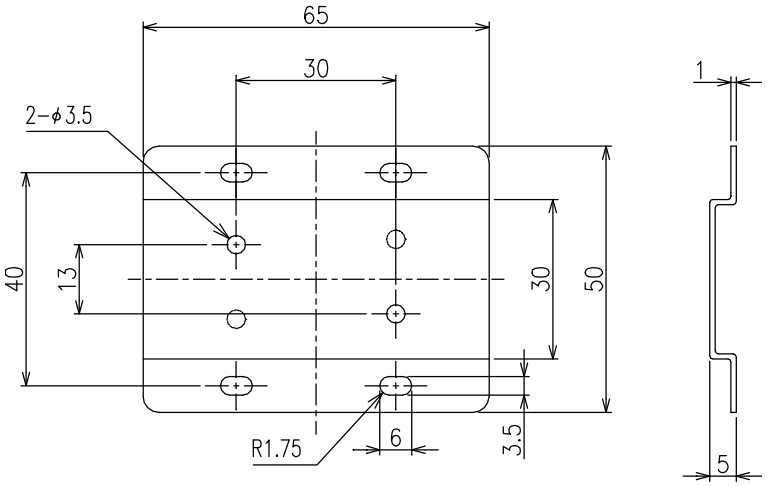


4. 3. 7 Bracket

●FSM2-LB1(FSM2-[ ]005／010／020／050／100／200／500／101／201)

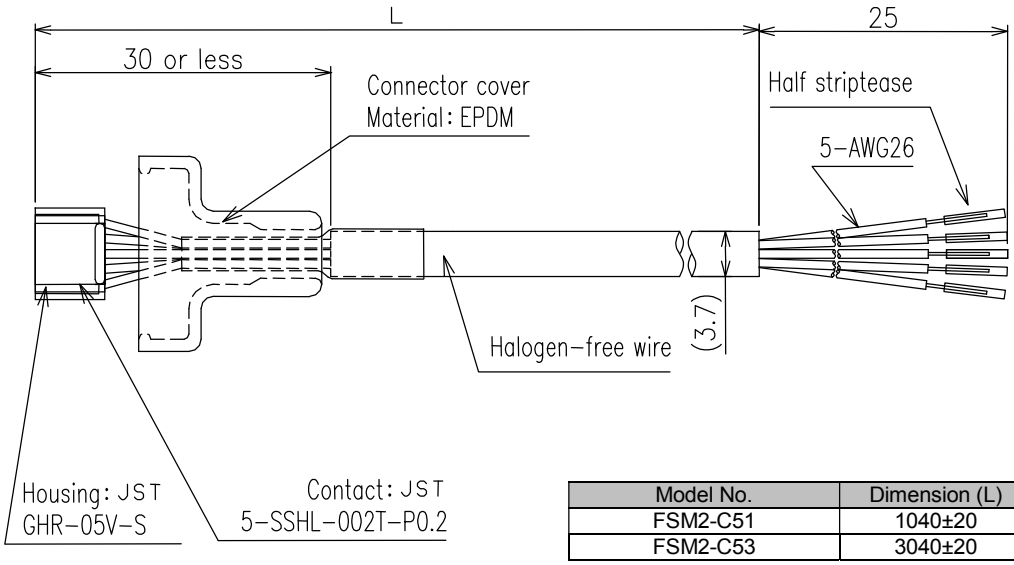


●FSM2-LB2(FSM2-[ ]501／102)



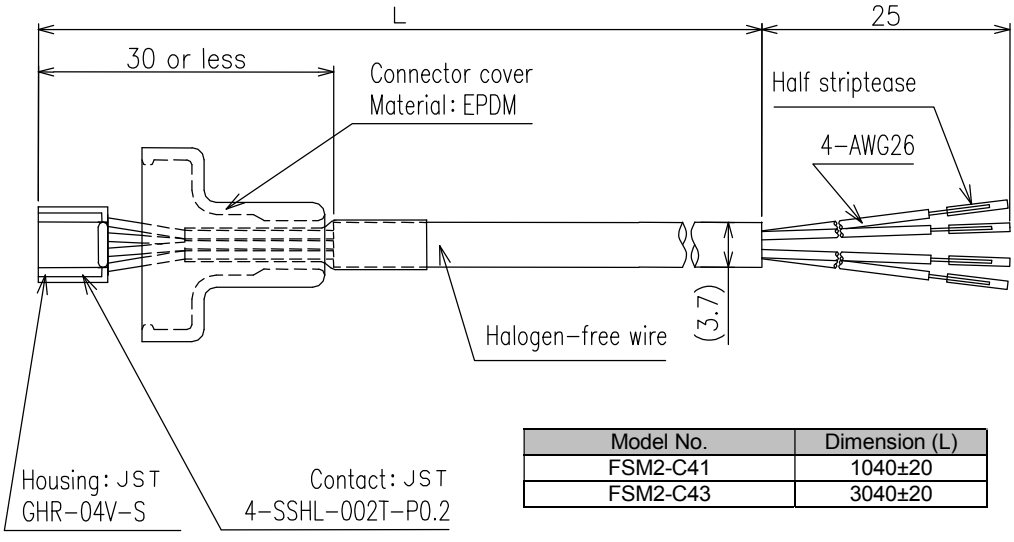
4. 3. 8 Cable option

●FSM2-C51/C53 (Integrated indicator type)



Model No.	Dimension (L)
FSM2-C51	1040±20
FSM2-C53	3040±20

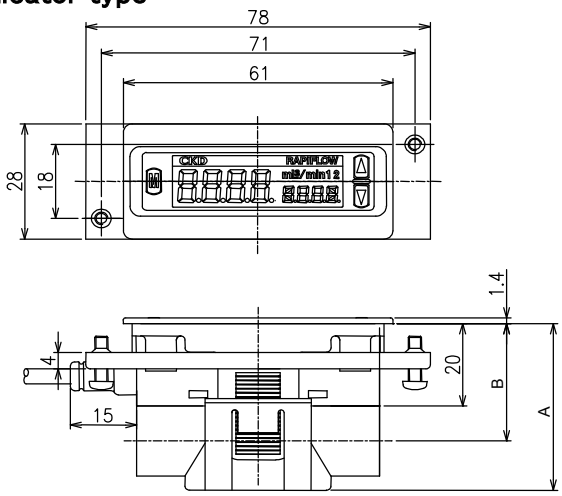
●FSM2-C41/C43 (Separated indicator type)



Model No.	Dimension (L)
FSM2-C41	1040±20
FSM2-C43	3040±20

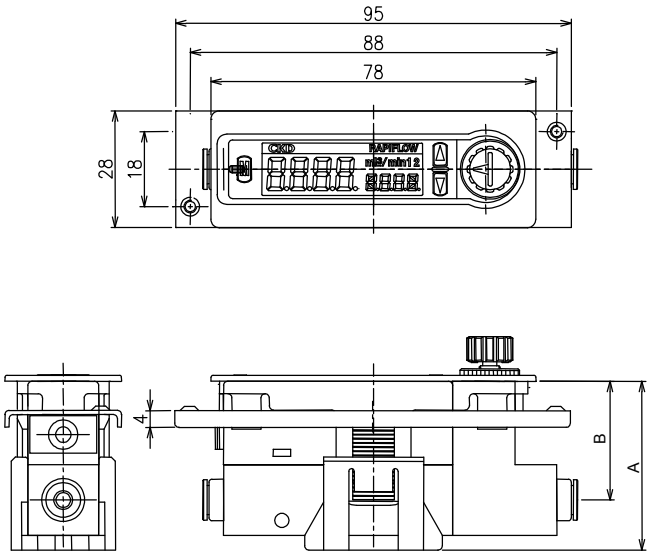
4. 3. 9 How to Panel mount

●Integrated indicator type



Model No.	Dimension (A)	Dimension(B)
FSM2-[ ]-H04/H06/S06/SM5	40.5	28.5
FSM2-[ ]-H08/H10/S08	46.5	30.0

●Integrated needle valve type

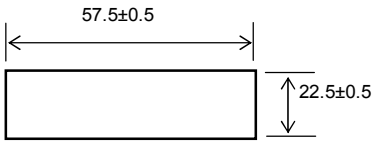


Model No.	Dimension (A)	Dimension(B)
FSM2-[ ]-H04/H06/S06[ ]N	40.5	28.5
FSM2-[ ]-H08/H10/S08[ ]N	46.5	30.0

Panel hold matching Fig （Plate thickness t 0.8 to 6）

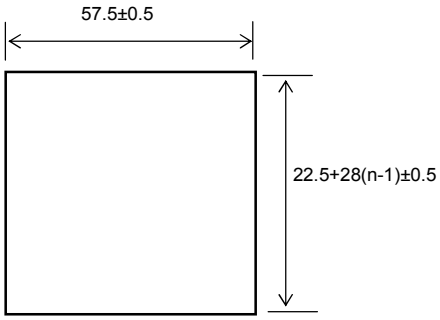
●Integrated indicator type

＜Single mount＞



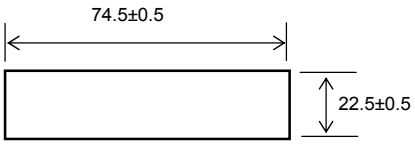
＜Sticking mount＞

n：Number of sticking installations



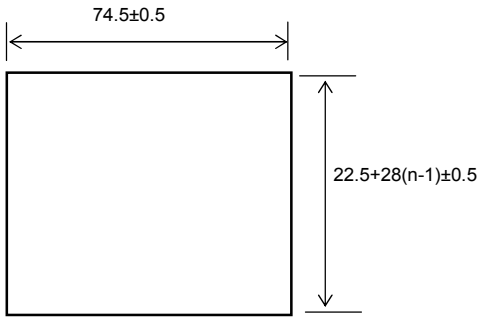
●Integrated needle valve type

＜Single mount＞



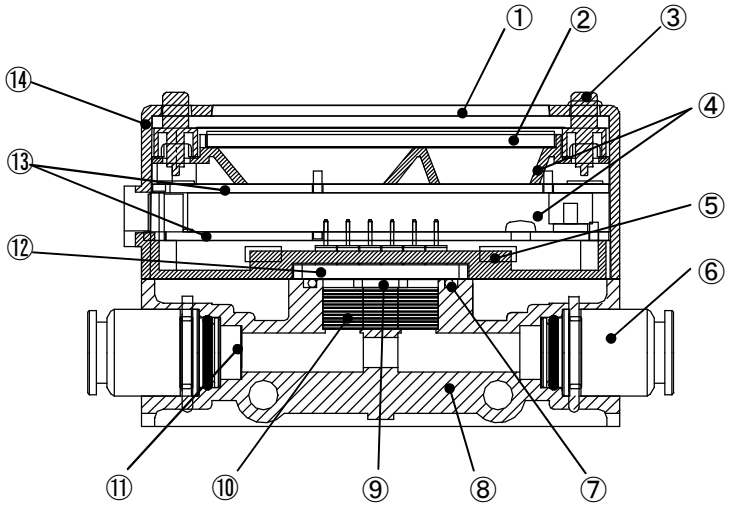
＜Sticking mount＞

n：Number of sticking installations



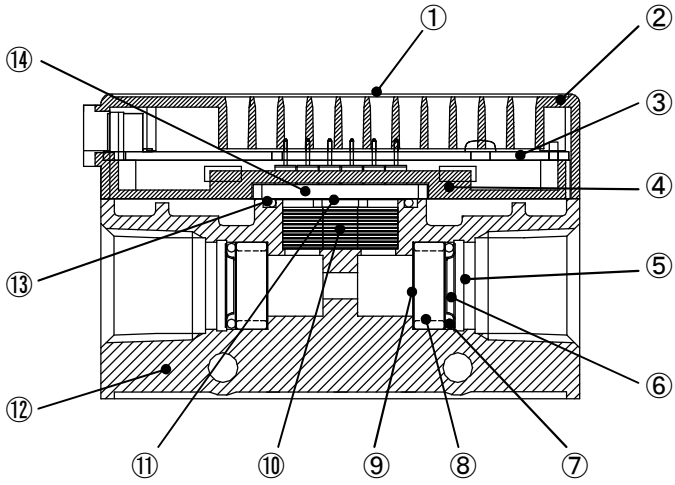
4. 4 Internal structure

4. 4. 1 Resin body (Integrated indicator type) Port size: φ6 push-in



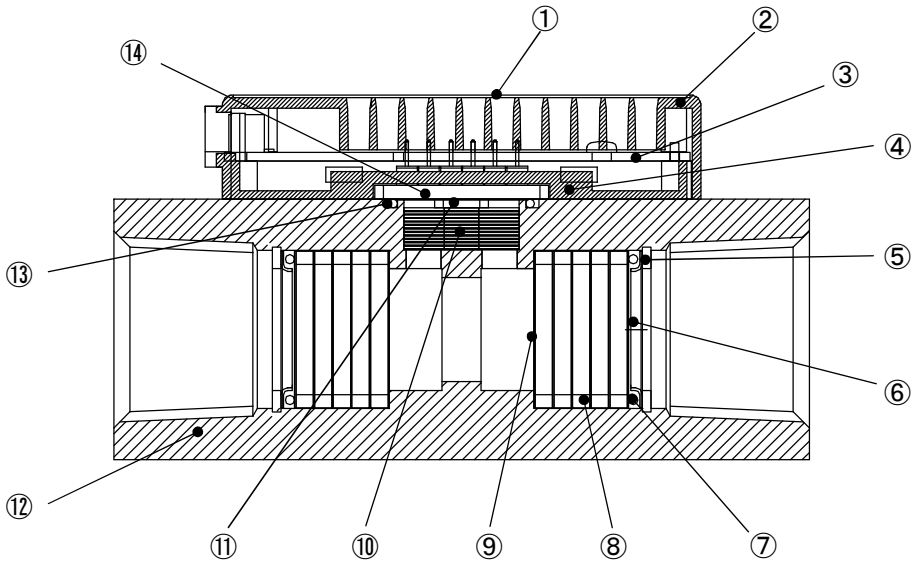
No.	Parts name	Material	No.	Parts name	Material
①	Liquid crystal cover	Acryl resin	⑧	Resin body	Polyamide resin
②	Liquid crystal	-	⑨	Sensor chip	Semiconductor chips
③	Switch	Ethylene propylene rubber	⑩	Rectification plate	Stainless steel
④	Base spacer	Polycarbonate resin	⑪	Port filter	Stainless steel
⑤	Module holder	PPS resin	⑫	Sensor base	Alumina
⑥	Push-in fitting	-	⑬	Electron circuit board	-
⑦	Sensor gasket	Fluoro rubber	⑭	Case	ABS resin

4. 4. 2 Stainless body（Separated indicator type） Port size:Rc1/4



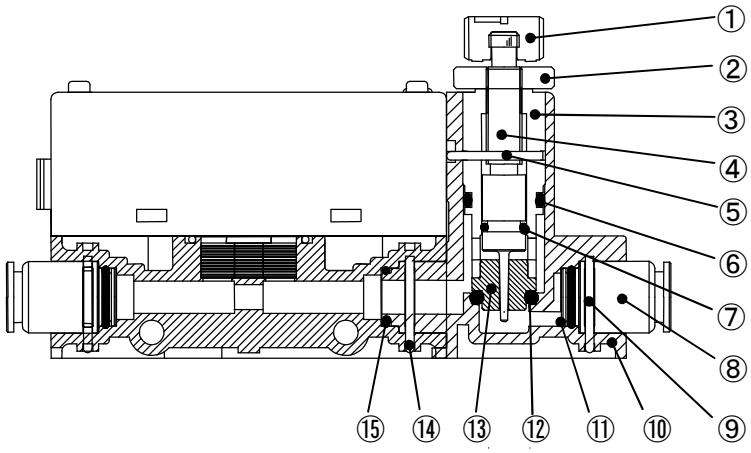
No.	Parts name	Material	No.	Parts name	Material
①	Front sheet	Polyethylene film	⑧	Spacer	Stainless steel
②	Case	ABS resin	⑨	Port filter	Stainless steel
③	Electron circuit board	-	⑩	Rectification plate	Stainless steel
④	Module holder	PPS resin	⑪	Sensor chip	Semiconductor chips
⑤	C ring	Stainless steel	⑫	Stainless steel body	Stainless steel
⑥	O-ring holder	Stainless steel	⑬	Sensor gasket	Fluoro rubber
⑦	O-ring	Fluoro rubber	⑭	Sensor base	Alumina

4．4．3 Aluminum body(Separated indicator type) Port size:Rc1/2



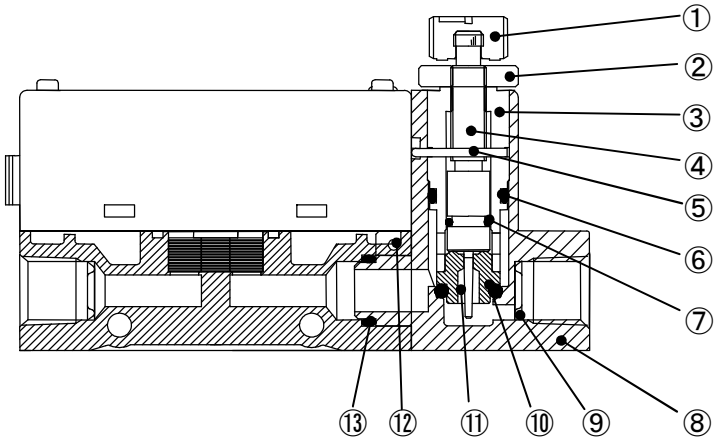
No.	Parts name	Material	No.	Parts name	Material
①	Front sheet	Polyester film	⑧	Spacer	Aluminum alloy
②	Case	ABS resin	⑨	Port filter	Stainless steel
③	Electron circuit board	-	⑩	Rectification plate	Stainless steel
④	Module holder	PPS resin	⑪	Sensor chip	Semiconductor chips
⑤	C-ring	Stainless steel	⑫	Aluminum body	Aluminum
⑥	O-ring holder	Stainless steel	⑬	Sensor gasket	Fluoro rubber
⑦	O-ring	Fluoro rubber	⑭	Sensor base	Alumina

4. 4. 4 With needle valve(Resin body)



No.	Parts name	Material	No	Parts Name	Material
①	Knob	PBT	⑨	Fitting fixing pin	SUS304
②	Lock nut	Brass/nickeling	⑩	Needle valve body	Polyamide resin
③	Needle guide	Brass/nickeling	⑪	Port filter	Stainless steel
④	Needle	Brass/nickeling	⑫	O-ring	Fluoro rubber
⑤	Fixing pin	Stainless steel	⑬	Orifice	Brass/nickeling
⑥	O-ring	Fluoro rubber	⑭	Fitting fixing pin	Stainless steel
⑦	O-ring	Fluoro rubber	⑮	O-ring	Fluoro rubber
⑧	Cartridge fitting	-			

4. 4. 5 With needle valve(Stainless body)

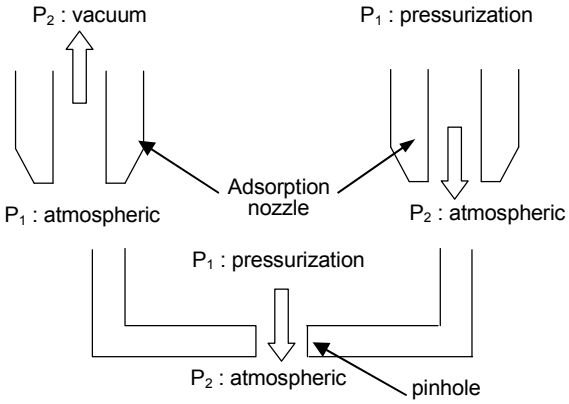


No.	Parts Name	Material	No.	Parts Name	Material
①	Knob	PBT	⑧	Needle valve body	Stainless steel
②	Lock nut	Brass/nickeling	⑨	Port filter	Stainless steel
③	Needle guide	Stainless steel	⑩	O-ring	Fluoro rubber
④	Needle	Stainless steel	⑪	Orifice	PTFE
⑤	Fixing pin	Stainless steel	⑫	Spring pin	Stainless steel
⑥	O-ring	Fluoro rubber	⑬	O-ring	Fluoro rubber
⑦	O-ring	Fluoro rubber			

5. Technical data

5. 1 How to select flow sensor

This is a guide of flow range when using a flow sensor as the adsorption/separation verification with adsorption cossle and leakage inspection, etc. The flow rate can be calculated according to effective sectional area of a nozzle(pinhole) and differential pressure between 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 : Ef.sec. area mm^2 of Nozzle(pinhole)

- Example of calculation

  When diameter of a nozzle is between 0.1 to 2 and P_2 is variable, the calculated flow rate values are shown as followings.

	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)

·If piping has a leakage, the actual flow will be larger than the calculated value. Please consider the leakage then selecting flow rate.

·If there is a narrower section then adsorption nozzle diameter in the midway of piping, flow rate will be restricted, so the value will be smaller than the calculated value.

Also, adsorption, etc., could not be done.

·The effective sectional area is just reference. If the nozzle is elongated, the effective sectional area will be smaller than opening area of the nozzle.

·Response time is decided by capacity of pipe from adsorption nozzle(pinhole) to flow sensor. When detecting with high speed, reduce capacity in pipe as placing a flow sensor near the adsorption nozzle.