

Ultra-miniature flow sensor “RAPIFLOW” FSM-V Series



Common sense breaking downsizing and ultra fast response time of 5msec enable your given-up design.

Features

1) Ultra-miniature, light weight (Sensor body : L33XW10XH17, 8g)

To install in very narrow space, in addition to the features of free installation posture, no need for straight piping part, FSM-V is available with wide variation like 2 piping direction and 2 cable direction etc.

2) Ultra fast response (Sensor only : 5ms or faster)

To satisfy ultra fast response, FSM-V is available with "air fiber" (very thin tube) fitting.

3) Available with analog output type and switch output type

Can be selected depending on the application. Both are with good repeatability and stable. Also FSM-V is available with separate display unit for flow control purpose.

4) Adopting flow proportional analog output (linearity +/- 5% F.S.)

Analog output has good linearity and the flow rate can be estimated with the output. Fine flow change can be easily identified and best suitable for control input.

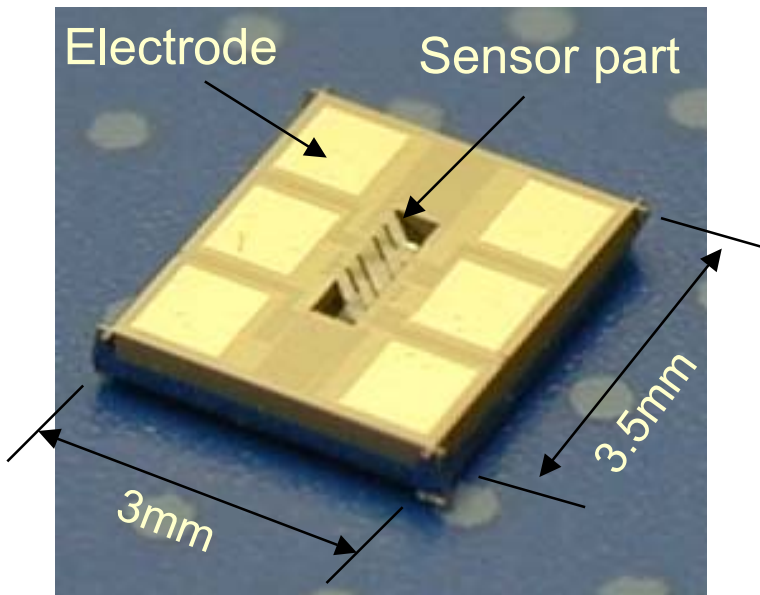
5) Wide variation

Available with 6 flow ranges, 4 piping options, 3 output types, 2 cable direction

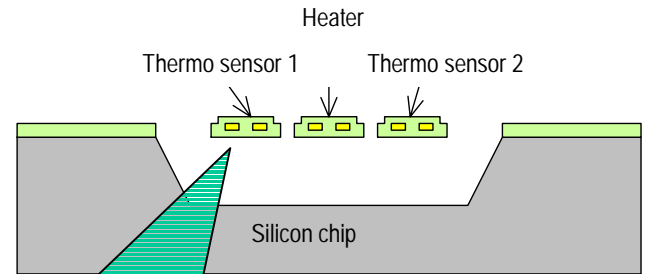
Sensor chip

Ultra fast response has been realized by platinum sensor chip, applied silicon micro-machining.

<Sensor chip>



<Sensor part cutaway view>



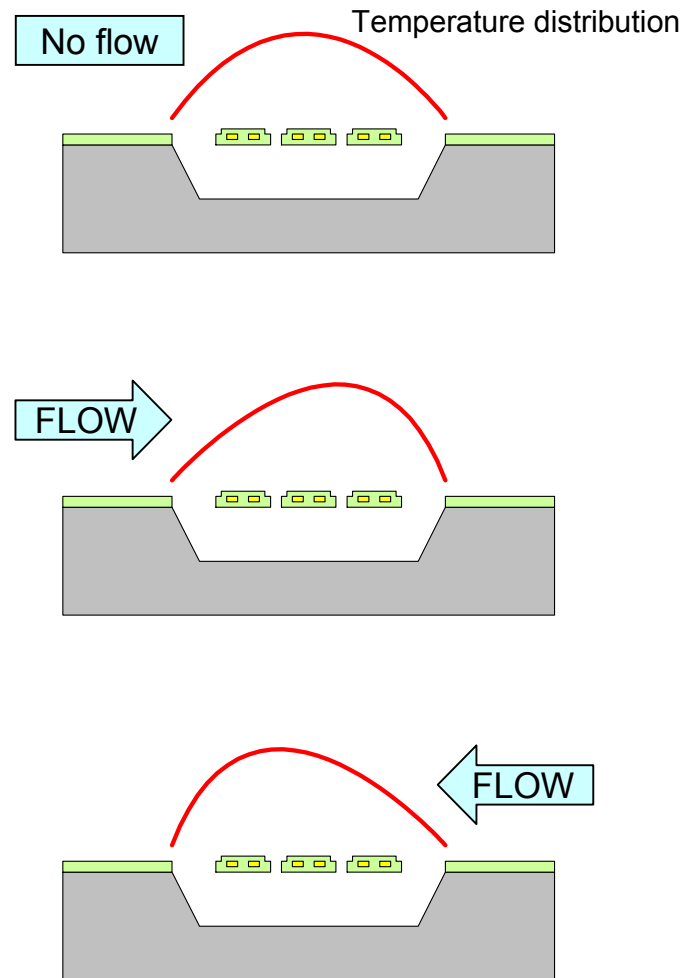
Ultra small heat capacity of sensor part realizes fast response, high sensitivity

Measurement principle

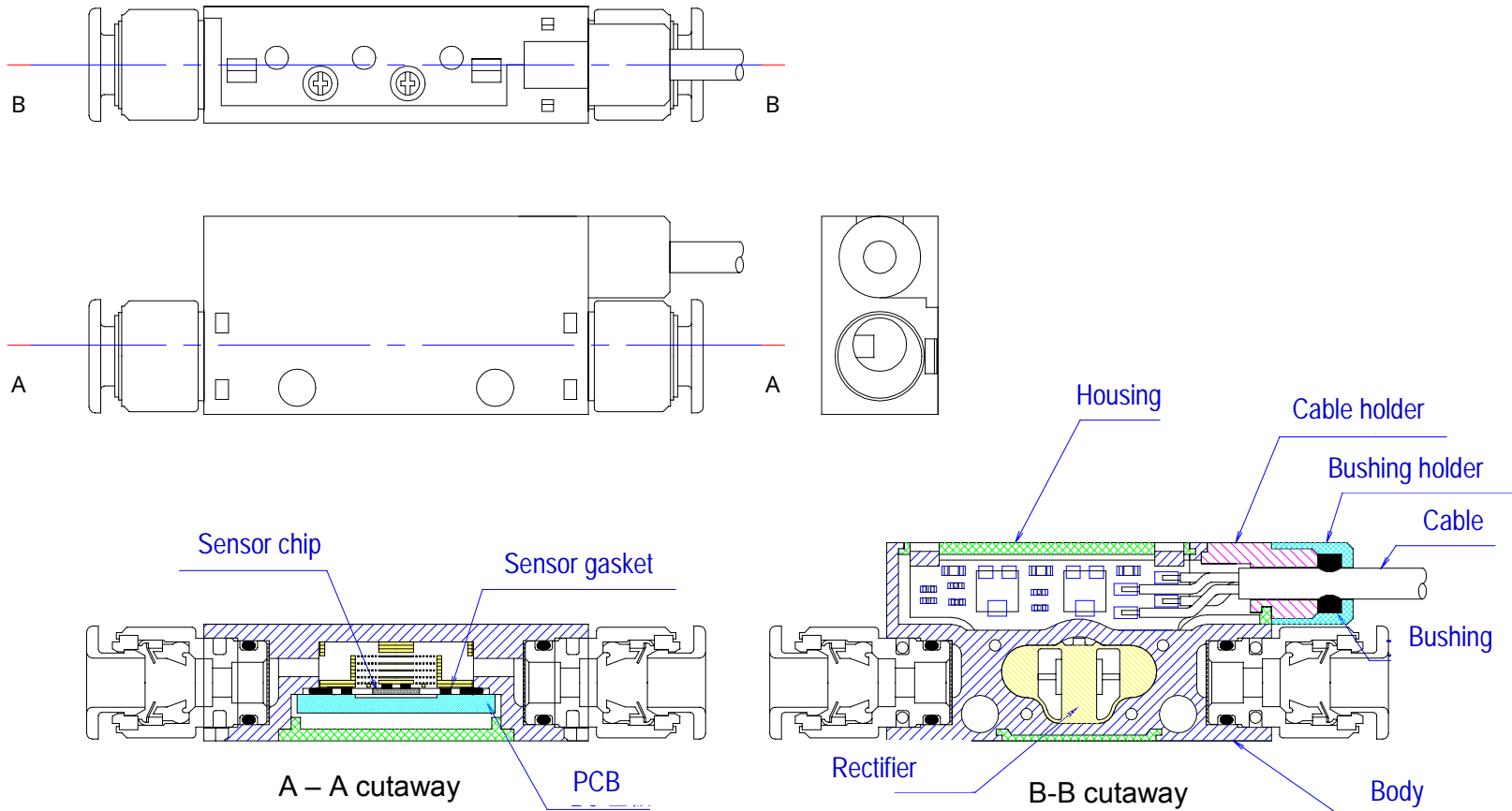
When heater is energized to be heated, while without air flow, temperature distribution is symmetrical with heater in the center.

With air flow, the temperature of the upstream side of heater will be lower, that of the downstream side will be higher, the symmetry will be lost. This temperature difference will be appeared as the difference of resistance of thermo sensor, and mass flow (flow speed X density) can be calculated.

With this method, bi-directional flow can be detected.



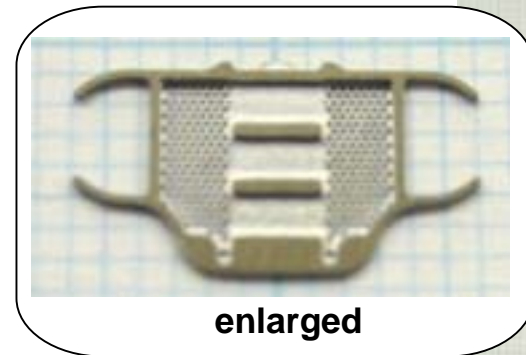
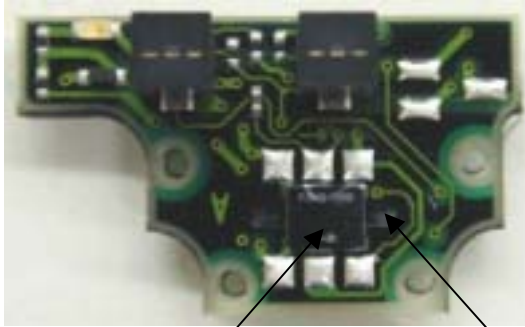
Internal structure



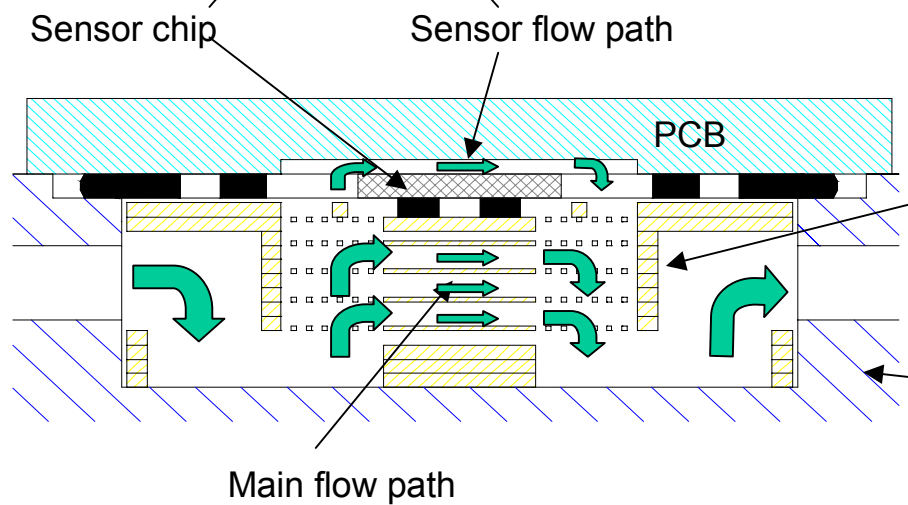
Flow path structure

Newly proposed rectifier mechanism (P.A.F.) has realized ultra-miniature body and ultra fast response.
No need for straight piping part before/after the sensor.

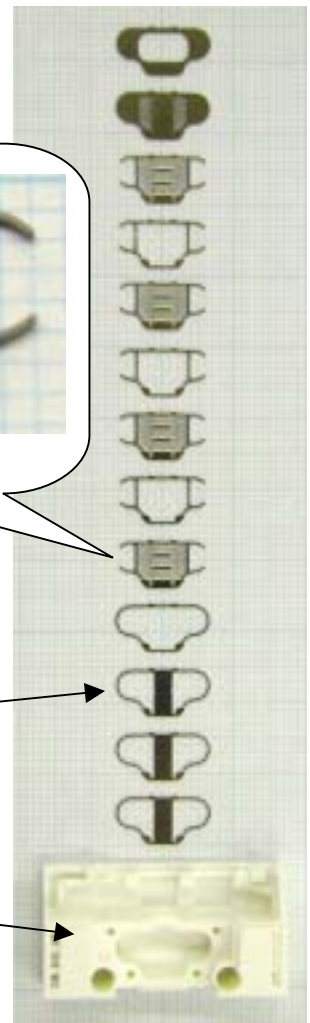
PCB



enlarged



13 rectifiers



Rectifier

Body

Comparison with FSM series

<Features of FSM series>

- *Display type available.
- *Available with stainless steel body type, which can be used for applications where emitting gas is prohibited.
- *Good repeatability (1% F.S.) with large flow type (5, 10 l/min).
- *Low pressure loss.



<Features of FSM-V series>

- *Ultra-miniature, light weighted.
- *Ultra fast response.
- *Bi-directional detection.
- *Available with low flow type (0.05, 0.1 l/min).

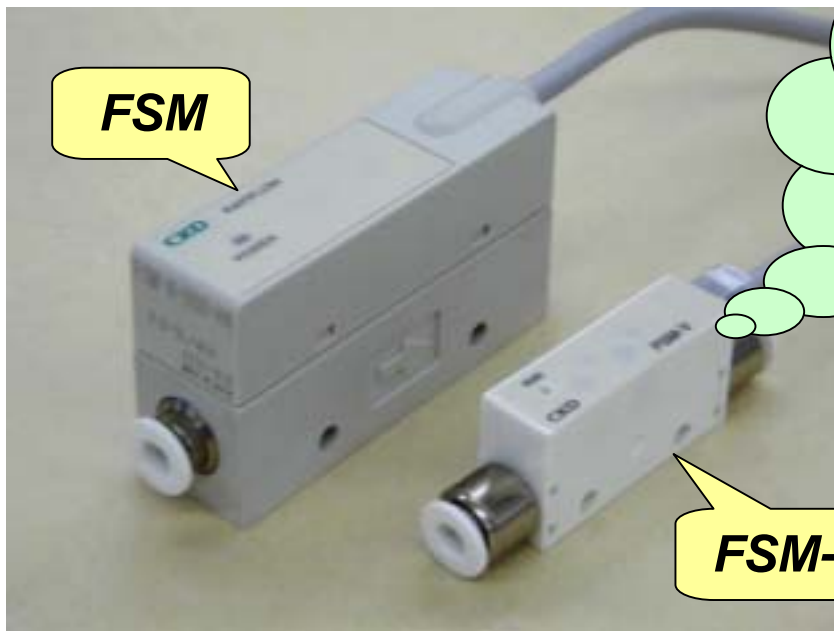


Ultra-miniature design

Dimensions : L33 X W10 X H17, Mass : 8g

The installation to movable part near to absorption nozzle is now possible and FSM-V contributes to improvement of response as total system.

<Compared with former type>

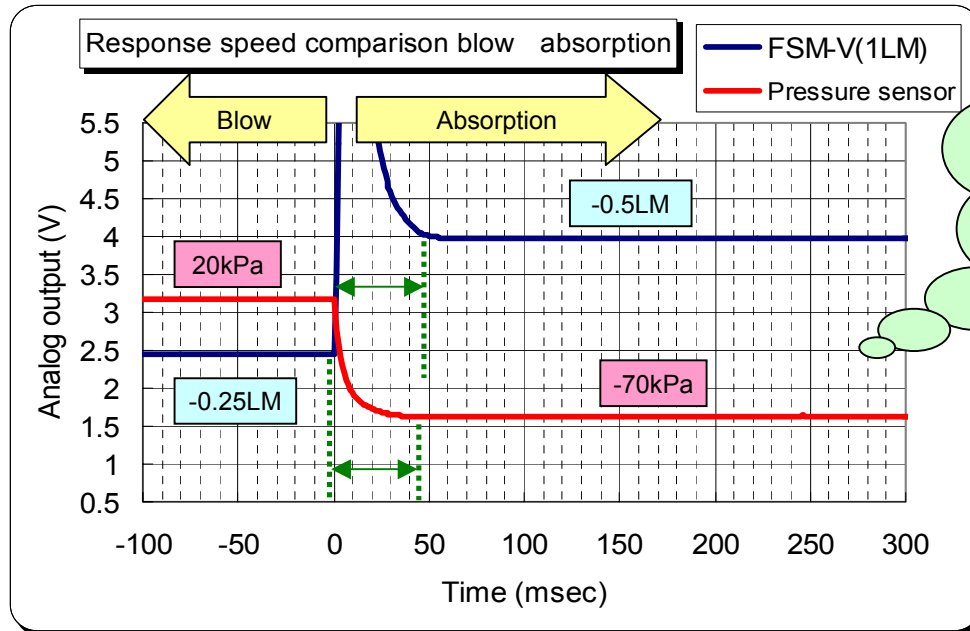


Volume 1/5
Ultra light
weight 8g

Ultra fast response

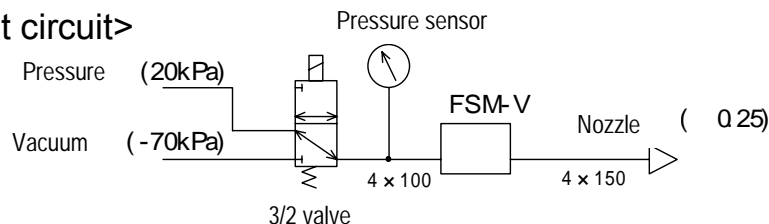
Sensor only : 5msec or faster

FSM-V has realized similar response speed as that of pressure sensor and can be used for high speed machines.



Similar response speed as pressure sensor has been realized

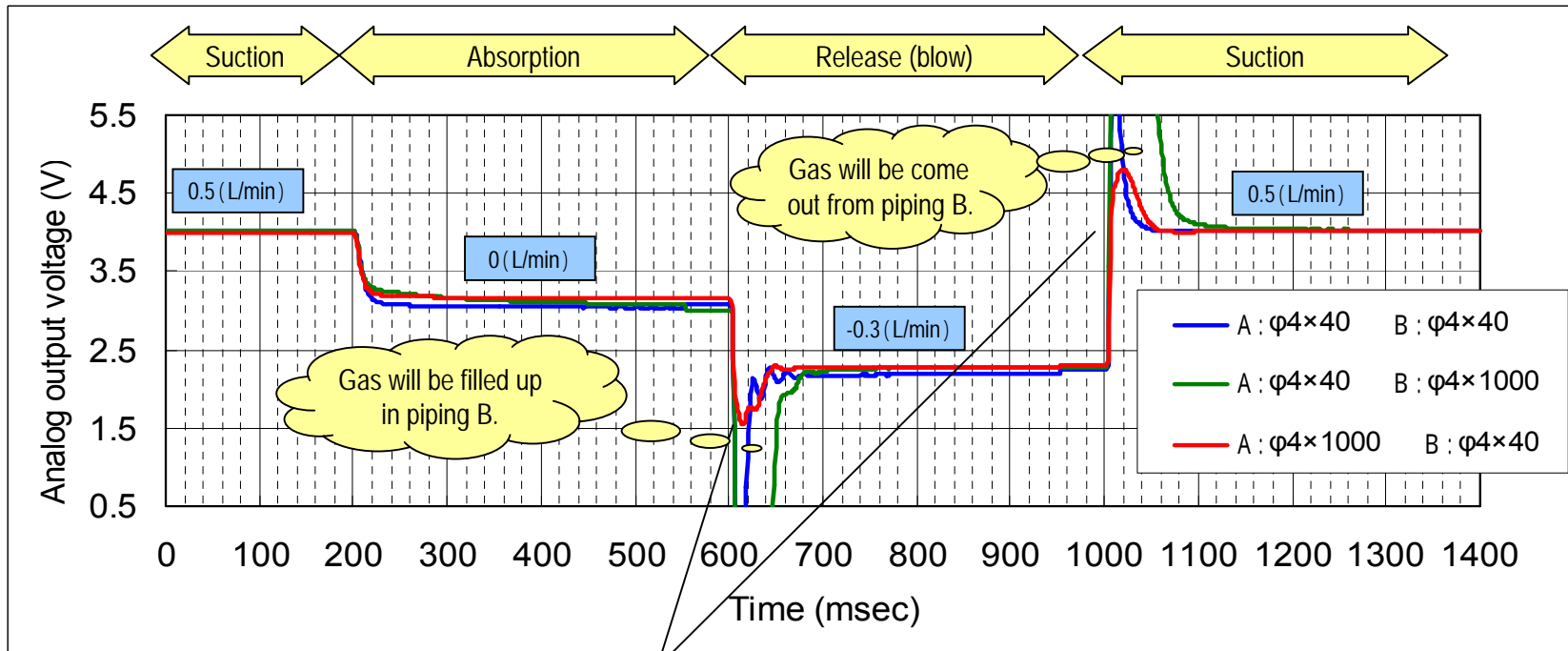
<Measurement circuit>



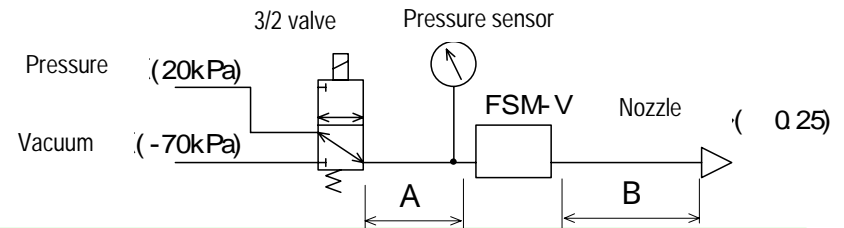
<Note>

Response speed is decided by piping and pressure.

Response speed depends on piping



The key point to have faster response speed is to install the sensor as near as possible to the nozzle.



Flow rate range

Available with 6 different flow rate range ($\pm 0.05 \sim \pm 10$ l/min), which correspond to different nozzles.

FSM-V can detect both absorption and desorption with bi-directional detection.

Flow rate range (l/min)	Applicable nozzle	Work
± 0.05	$\phi 0.1$ or smaller	Optical parts, quartz oscillator, solder ball
± 0.1	$\phi 0.1$	Optical parts, quartz oscillator, solder ball
± 0.5	$\phi 0.2$	Chip resistor, chip capacitor
± 1	$\phi 0.3$	Chip resistor, chip capacitor
± 5	Collet nozzle, etc.	Silicone wafer (Flip chip bonder), general parts
± 10	Collet nozzle, etc.	Silicone wafer (Flip chip bonder), general parts

Output type

<Analog output type>

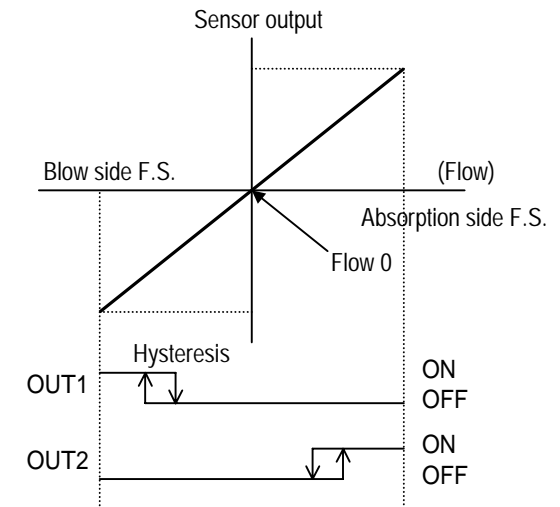
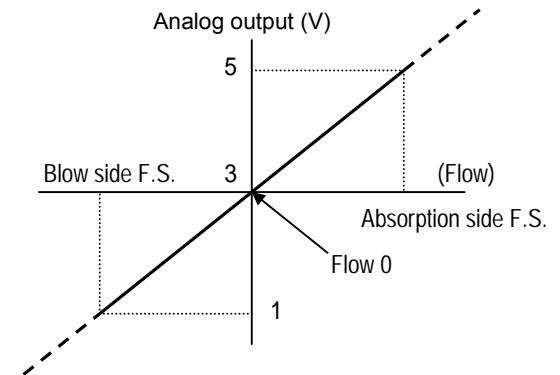
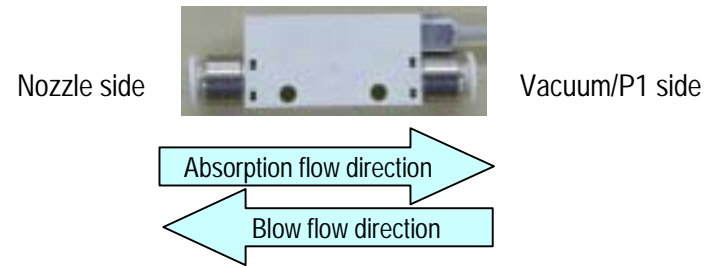
1~5V voltage output

- *When controlled by bigger controller
- *When separate display unit is used

<Switch output type>

2 X PNP or NPN open collector output

- *Economical solution for control
- *Can detect both absorption and desorption



Variation

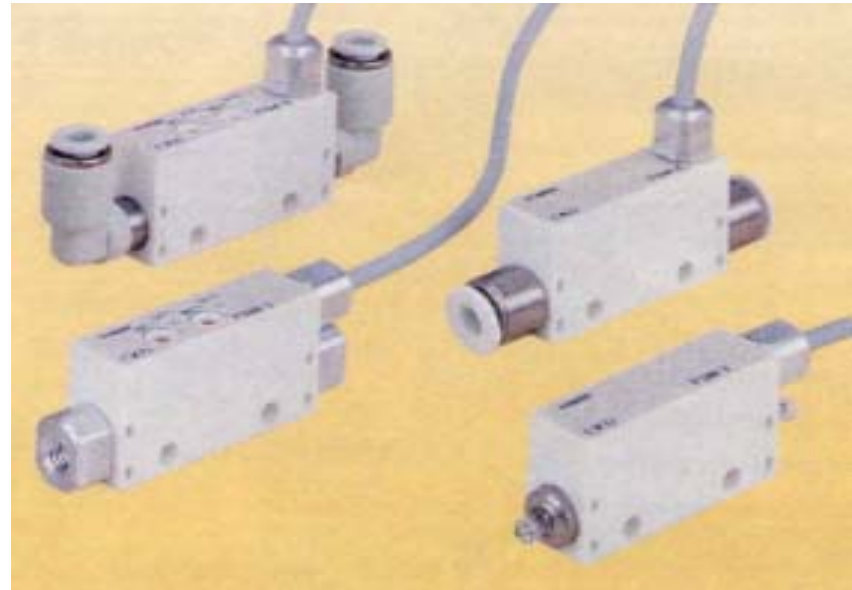
<Piping>

4, 4 elbow, Air fiber, M5

<Cable direction>

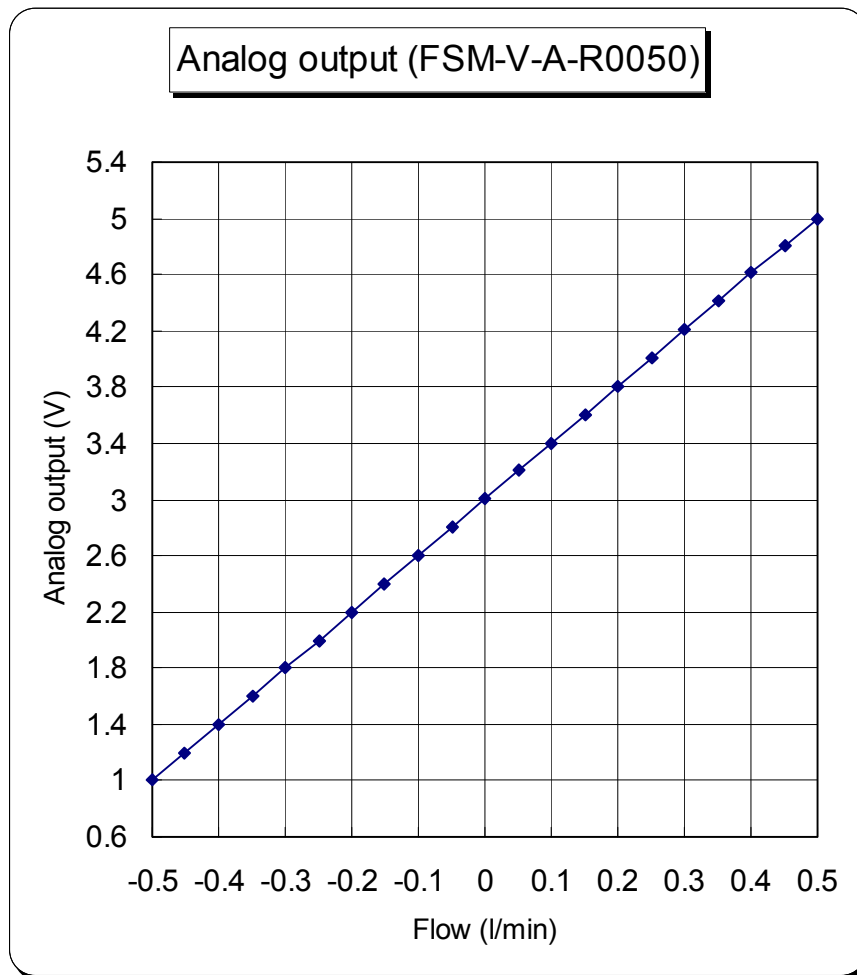
Axial, radial

Best suitable product can be selected from wide variation, depending on the application.



Analog output linearity

Linearity : +/- 5% F.S. or lower



*Analog output has good linearity and the flow rate can be estimated with the output.

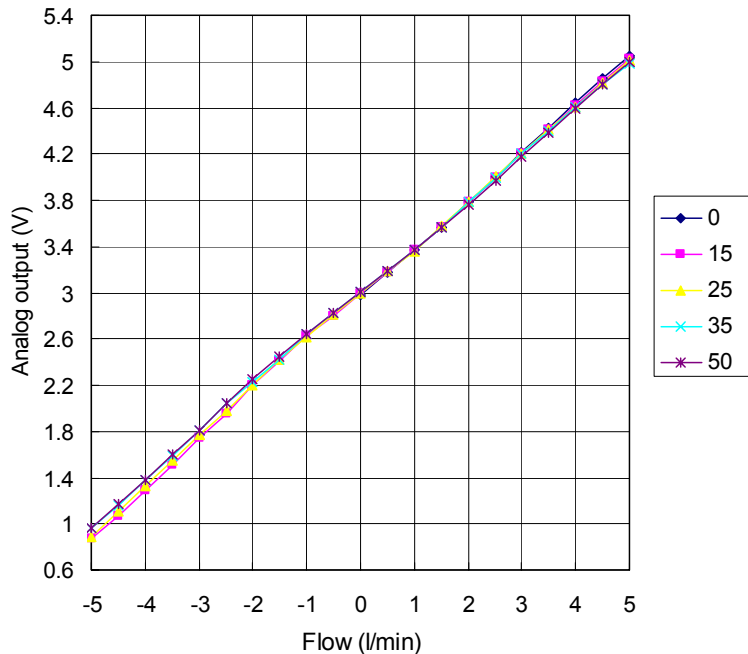
*Fine flow change can be easily identified and best suitable for control input.

Temperature/Pressure characteristics

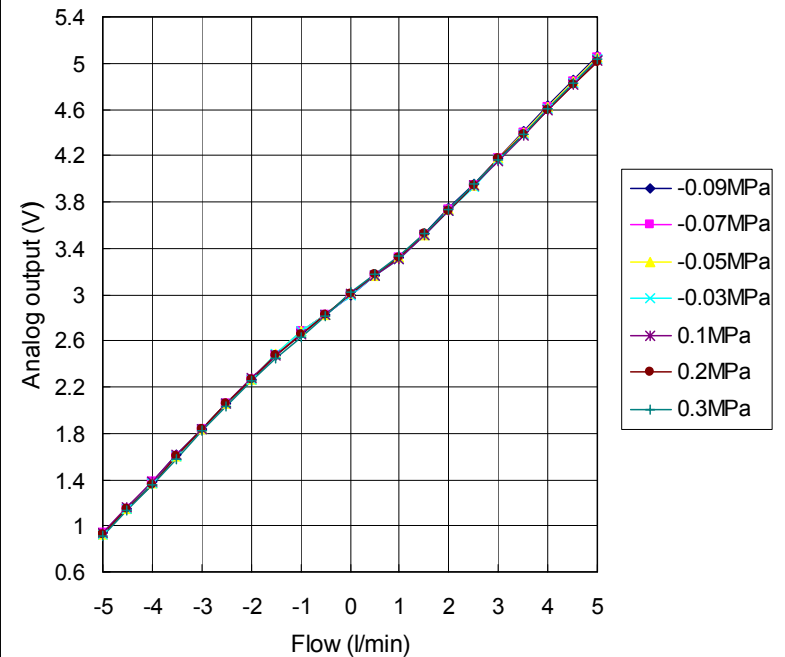
Temperature characteristics: $\pm 0.2\%$ F.S./ or smaller

Pressure characteristics: $\pm 5\%$ F.S. (-0.09~0.2MPa)

Temperature characteristics (FSM-V-A-R0500)



Pressure characteristics (FSM-V-A-R0500)



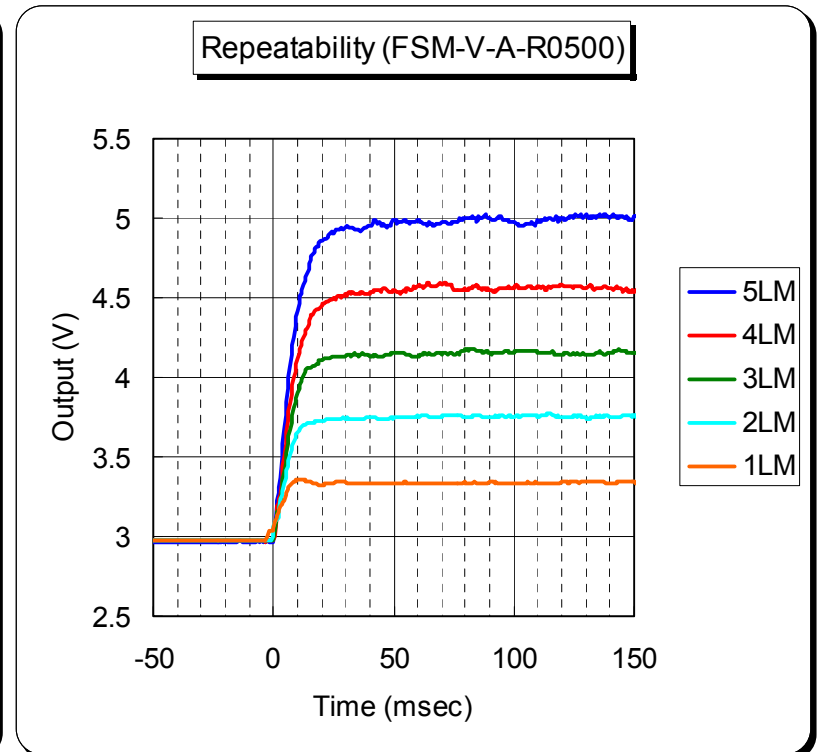
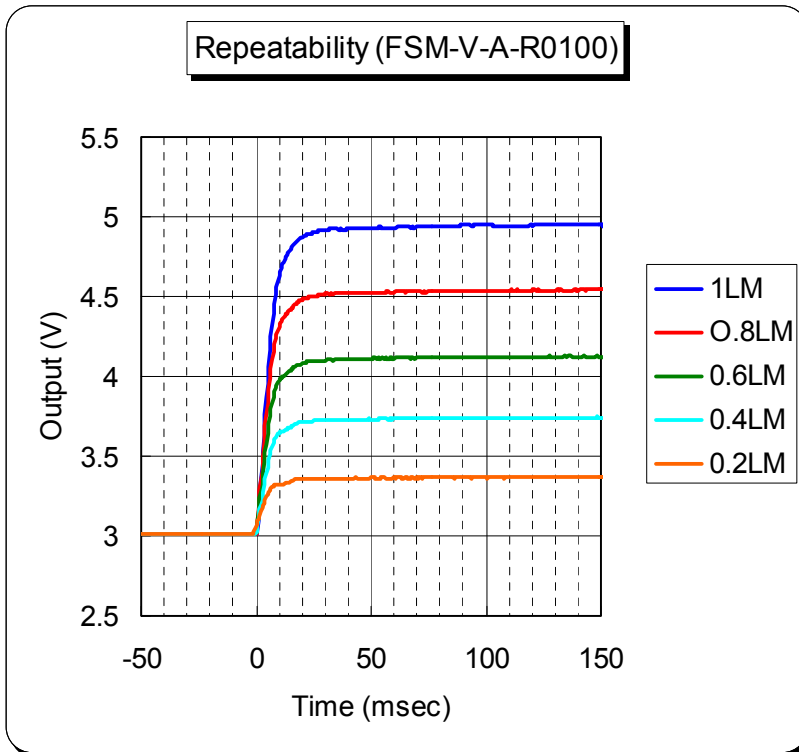
Highly reliable detection can be done, because the output is stable against the change of temperature and pressure.

Repeatability

Newly proposed rectifier mechanism (P.A.F.) stabilizes the output.

+/- 0.05~+/-1 (l/min) : +/-1% F.S. or smaller

+/-5~+/-10 (l/min) : +/-2% F.S. or smaller



Stabilized output makes the setting of threshold value easy.