

# CKD



## Product training of electronic component products

< Sensor and Electro pneumatic regulator >

CKD Corporation

07.11.15


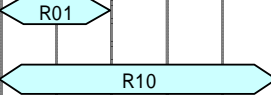

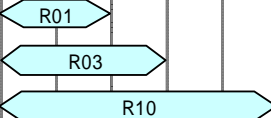

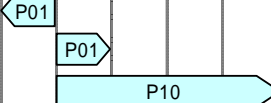

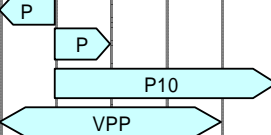

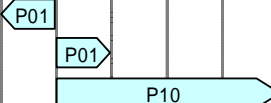

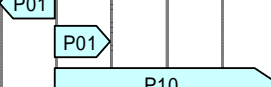
1. Pressure sensor
2. Flow sensor for air
3. Flow sensor for water
4. Electro pneumatic regulator
5. Flow controller

# CKD

## Pressure sensor



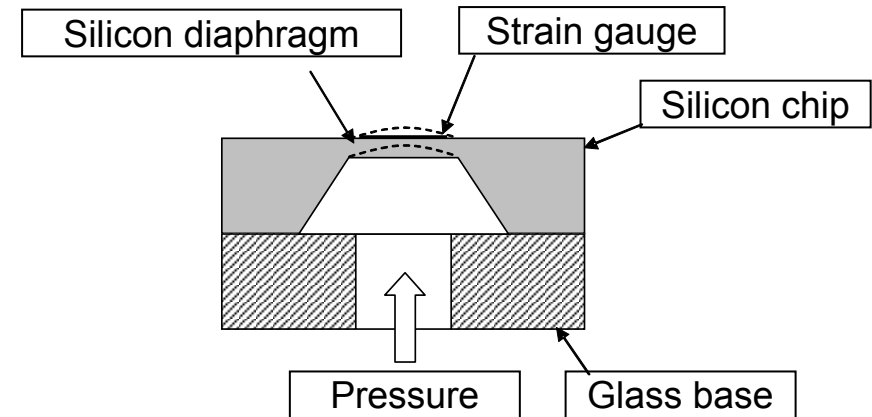
## Series variation

Model		Features	Pressure range(kPa)						Output	Port size	Panel mount	Protective structure
			-100	0	100	300	500	980				
Display integrated type	 PPX	New easy-to-use high-function digital pressure sensor PPX series with dual display to check (current value) and (set value) of pressure at the same time, 3-color display, copy function of setting details, etc.							NPN : 2points	R1/8, M5		IP40
									PNP : 2points	NPT1/8, M5		
									NPN:1point, 1-5V:1point			
									PNP:1point, 1-5V:1point	G1/8, M5		
	 PPD3	Due to various port options, adsorption confirmation / seating confirmation, etc. can be flexibly operated.							NPN : 2points	Rc1/8 (2-direction port)		IP65
									PNP : 2points	Rc1/8 (through port)		
									NPN:1point, 1-5V:1point	Push in joint 6mm (bottom)		
									PNP:1point, 1-5V:1point	Push in joint 6mm (inline)		
	 PPD	28mm square miniature switch with digital pressure display for pneumatic / vacuum circuit.							Switch output : 1point NPN	Rc1/8 (rear side)		IP40
										Rc1/8 (bottom)		
										Direct mount		
										Push in joint 6mm		
	 PPS2	4 point switch output allows wide application.							Switch output : 4points Non-polar transistor (and) Analog output : 1point 0-5V	Rc1/8		IP40
 PPE	Usage is flexible due to small and 3 types of connecting ports.							Switch output : 1point NPN	R1/8	-	IP65	
								Analog output : 1point 1-5V	6mm plug dia.			
	 PSW	Using multi rotation trimmer and operational indicator light, setting is easily done.							Switch output : 1point NPN (and) Analog output : 1point 1-5V	M5	-	IP40

## Measurement principle 1

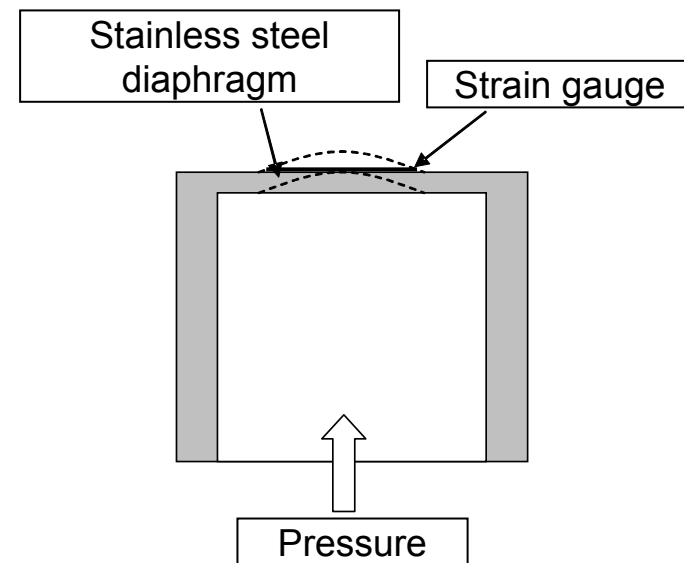
### Diffusion type pressure sensor (silicon diaphragm)

The diffusion type pressure sensor detects the pressure directly with a silicon chip where a silicon diaphragm is formed. Because the silicon makes direct contact with the fluid, this type is not used for corrosive gases. Its application is limited to the air and non-corrosive gases.



### Single-layer stainless steel diaphragm sensor

The single-layer stainless steel diaphragm sensor detects the pressure with a metallic diaphragm made of stainless steel, etc. so that it can be used for compressed air including moisture, drain or the like without corroding itself. Because a diffusion resistor is formed directly on the metallic diaphragm, it is called single-layer diaphragm pressure sensor.

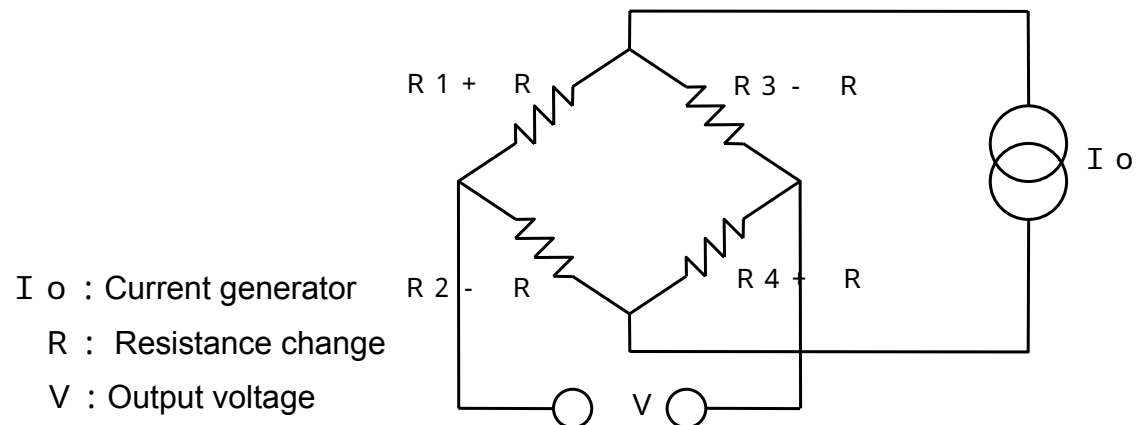
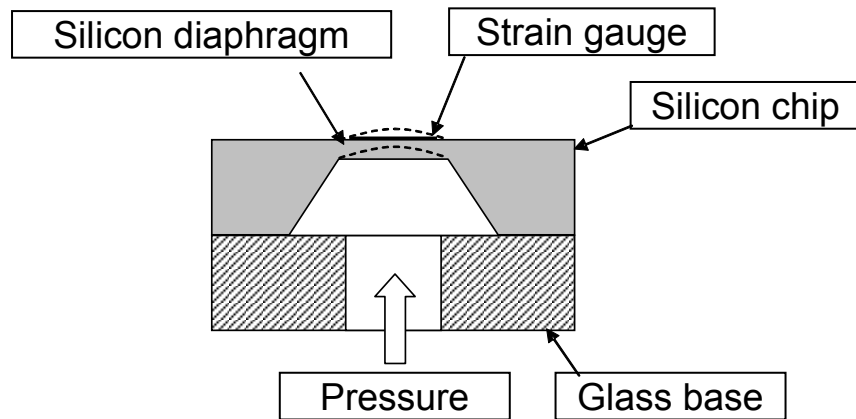


## Measurement principle 2

The sensor chip of the diffusion type semiconductor pressure sensor (pressure sensitive element) is a semiconductor strain gauge configured with a single silicon crystal.

The sensor chip is of a diaphragm structure and it deforms according to the added pressure. The extent of deformation is measured in resistance variation of the strain gauge. Therefore the resistance change is detected to know the added pressure.

Actually, four strain resistors formed on the diaphragm are connected in a Wheatstone bridge, to which a constant current (or a constant voltage) is supplied. The resistance change caused by the added pressure is detected as an output voltage change.



## Features New Product 1 PPX series

### 3-color display (red/green/orange)

The main display section is changed to green/red in accordance with output ON/OFF, and orange during setting. The sensor state is easily read.



### Customized sub-display section

Alphabet and number other than the setting can be displayed in the sub-display section. Troubles of putting labels such as normal pressure range and equipment No. are saved.



### Easy to operate

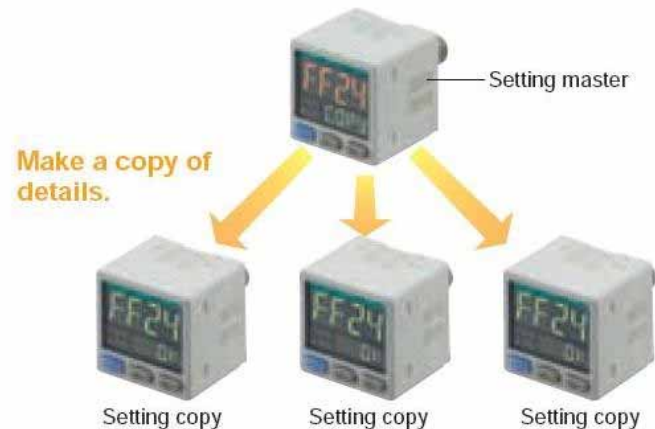
#### Easy-to-read alpha-numeric display

Alpha-numeric with 12-segment is provided. Alphabet and number are easily read.



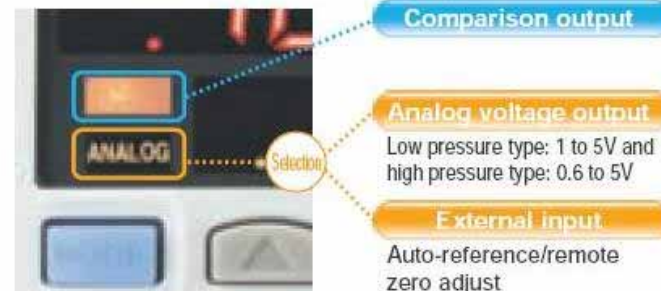
### Copy function to reduce man-hours and to prevent mistake

The copy of sensor setting details can be quickly made to other sensors with data communication. Problems caused by incorrect installation is prevented if the same setting is applied to several units.

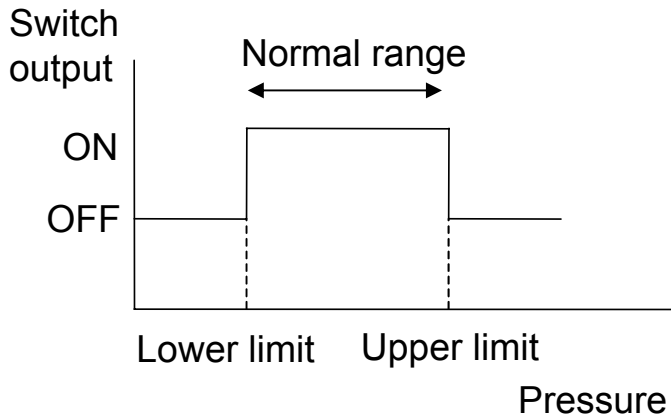
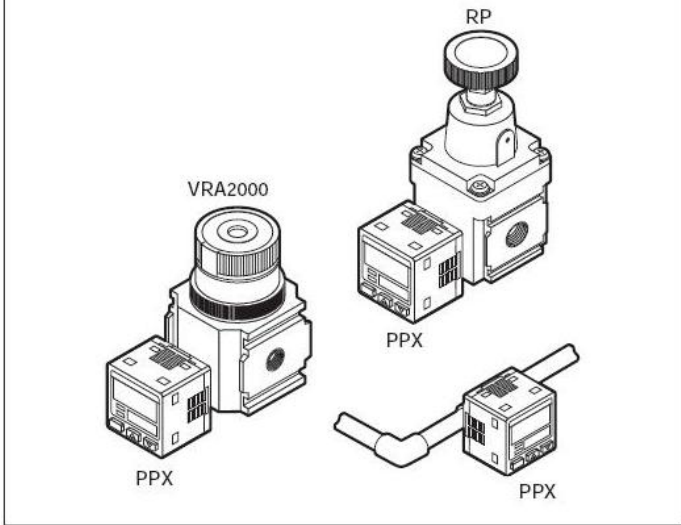


### High-function type meeting different applications

High-function type to select analog voltage output or external input instead of comparison output in the other side is available to meet different applications.



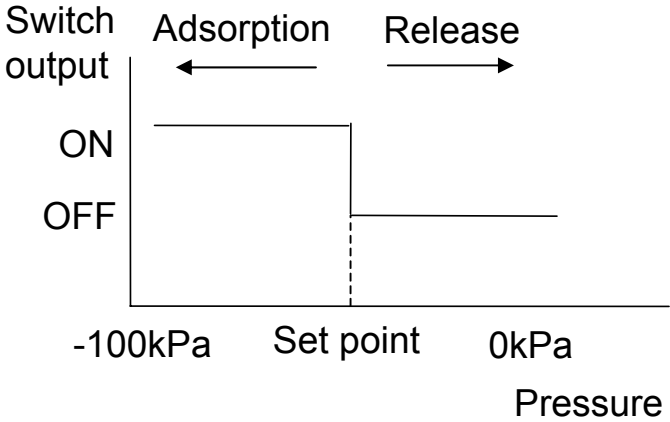
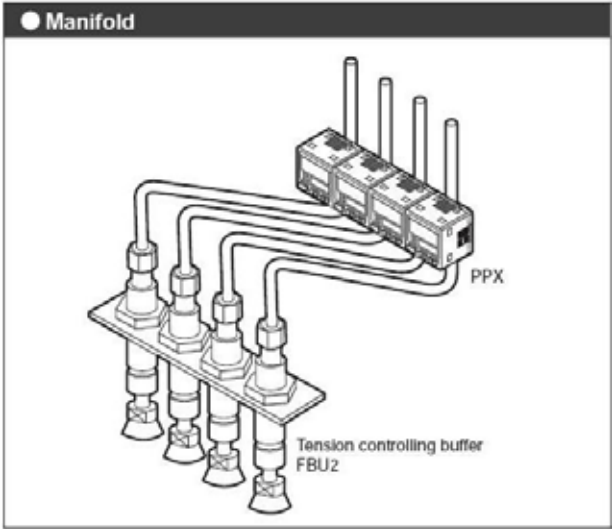
## Application 1

Example of switch setting	Image
 <p>The graph illustrates the switch output behavior. The vertical axis is labeled 'Switch output' with 'ON' and 'OFF' states. The horizontal axis is labeled 'Pressure'. A 'Normal range' is indicated by a double-headed arrow between two vertical dashed lines labeled 'Lower limit' and 'Upper limit'. The output is 'OFF' for pressures below the lower limit and above the upper limit, and 'ON' within the normal range.</p>	<p>● Positive pressure and vacuum confirmation or interlock</p>  <p>The image shows three different CKD pressure sensor models: VRA2000 (a large industrial unit with a top-mounted knob), RP (a smaller unit with a top-mounted knob), and PPX (a compact unit with a cable connector). The VRA2000 and RP units are shown with their respective PPX connectors.</p>

The pressure range of the supply pressure can be checked with switch outputs. Low and high pressure error detection limits can be specified individually.

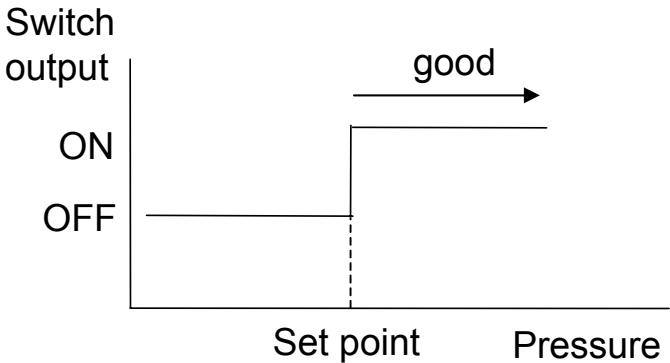
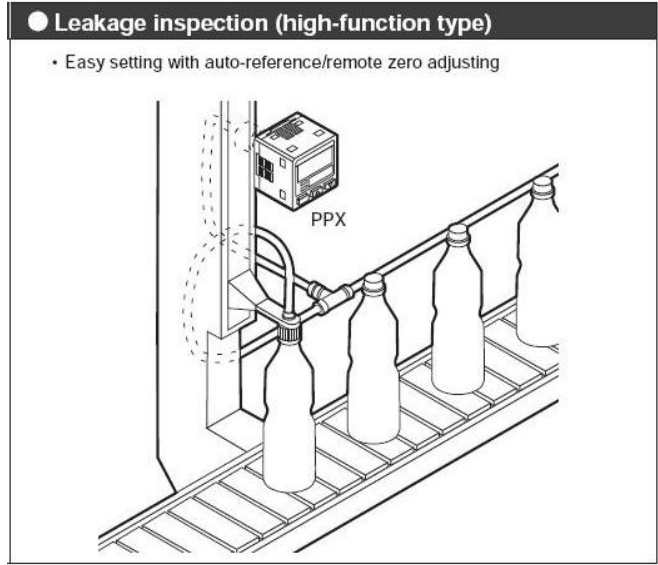


## Application 2

Example of switch setting	Image
 <p>The graph illustrates the switch output behavior during adsorption and release phases. The y-axis represents the switch output, with 'ON' and 'OFF' states. The x-axis represents pressure, ranging from -100kPa to 0kPa, with a 'Set point' marked. During the 'Adsorption' phase (indicated by a left-pointing arrow), the output is 'ON' for pressures below the set point and transitions to 'OFF' at the set point. During the 'Release' phase (indicated by a right-pointing arrow), the output remains 'OFF' for pressures above the set point and transitions back to 'ON' at the set point.</p>	 <p>The diagram shows a manifold assembly. A manifold block is connected to four vertical tubes. Below the manifold, there are four pressure sensors or actuators. One of these is labeled 'Tension controlling buffer FBU2'. The manifold is also connected to a 'PPX' component, which is a pressure transmitter or sensor.</p>

Part suction check using a vacuum pressure of a vacuum pump or vacuum generator can be checked with switch outputs.

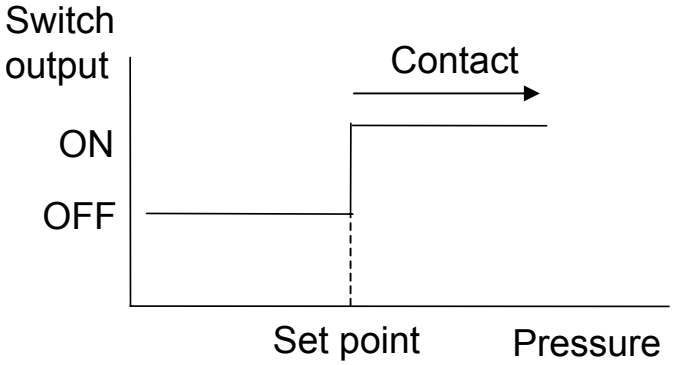
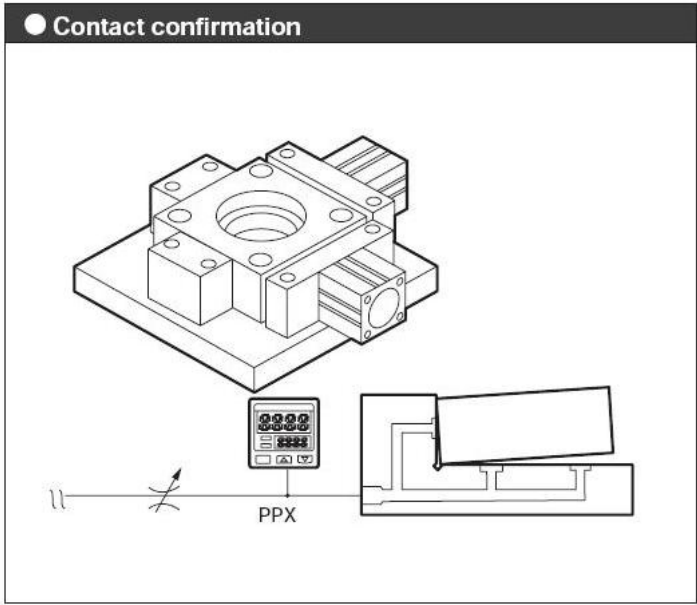
## Application 3

Example of switch setting	Image
 <p>The graph illustrates the switch output behavior. The vertical axis is labeled 'Switch output' with 'ON' and 'OFF' states. The horizontal axis is labeled 'Pressure' with a 'Set point' marked by a dashed vertical line. The output is 'OFF' for pressures below the set point and 'ON' for pressures above it. An arrow labeled 'good' points to the 'ON' region, indicating a successful leak test result.</p>	 <p>The diagram shows a PPX sensor unit connected to a vessel for leakage inspection. The unit is labeled 'PPX' and is connected to a vessel. The text 'Leakage inspection (high-function type)' is displayed, along with the note '• Easy setting with auto-reference/remote zero adjusting'.</p>

The pin hole check of the vessel can be made with a leak test of the pressurized vessel. In particular, fill the vessel at a certain pressure and, after a certain time has elapsed, check the extent of pressure drop to judge leakage.

If there is fluctuation in the filling pressure, the PPX Series advanced function type that cancels source pressure fluctuation can be used.

## Application 4

Example of switch setting	Image
 <p>The graph illustrates the switch output behavior. The vertical axis is labeled 'Switch output' with 'ON' and 'OFF' states. The horizontal axis is labeled 'Pressure'. A horizontal line at the 'OFF' level extends to a vertical dashed line labeled 'Set point'. At this point, the output switches to the 'ON' level and continues as a solid line. An arrow labeled 'Contact' points to the right, indicating the direction of increasing pressure.</p>	 <p>The image drawing, titled 'Contact confirmation', shows a mechanical assembly with a pressure switch (PPX) connected to a pressure sensor. The sensor is depicted as a small rectangular unit with a digital display showing '0.00'. The PPX is connected to the sensor via a line. The sensor is also connected to a control unit, which is shown as a rectangular box with a display and buttons. The control unit is connected to a power source, indicated by a symbol with two parallel lines and a diagonal line through them.</p>

A contact confirmation of the part can be made with a pressure switch. In particular, the usage is shown in the above image drawing. If the pressure does not reach the added pressure, “part absence” is judged, while if the added pressure is reached, “part presence” is judged.

**CKD**






# Flow sensor for air





<Flow sensor for air>

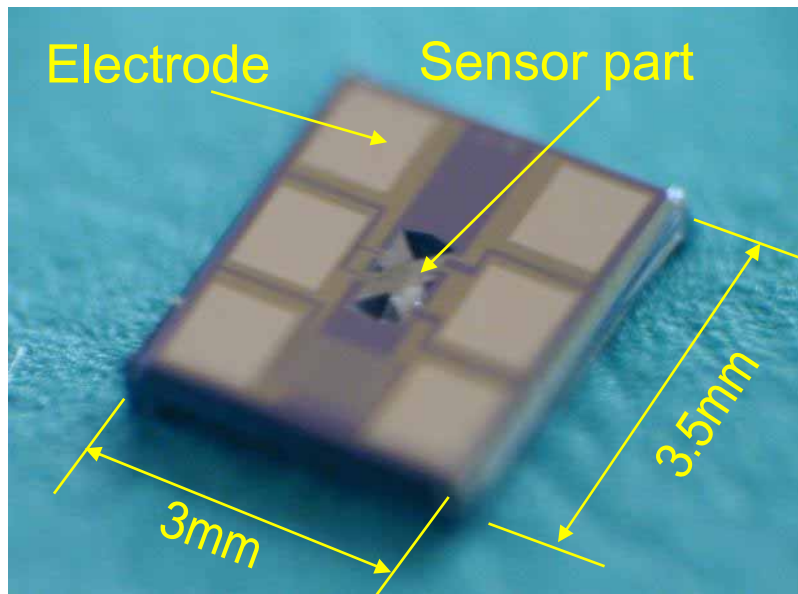
## Series variation

Model	Features	Flow rate range						Flow direction	Body material	Output	Response time	Linearity		
		mL/min			L/min								m <sup>3</sup> /min	
		1	10	100	1	10	100						1	10
	Enlarged flow range Large flow yet compact Measure fluids bidirectionally Twin indicator / bicolor indicator Auto-reference				11 ranges				Unidirectional	Resin/ Aluminum	Switch output :2points NPN or PNP (and) Analog output : 1point 1-5V or 4-20mA	50msec or less	±3%FS or less	
								Bidirectional	Stainless steel					
	Detects extremely small flow rates of 1mL/min or less at high speed. Perfect for leakage and pinhole inspections.	4 ranges							Unidirectional	Stainless steel	Switch output :2points NPN or PNP (and) Analog output : 1point 1-5V	50msec or less	±3%FS or less	
	Dramatic downsizing and a 5ms high-speed response have realized a novel design.			6 ranges					Bidirectional	Resin	Switch output :2points NPN or PNP	5msec or less	±5%FS or less	
								Analog output : 1point 1-5V						
	Display integrated type Ideal for controlling and checking the flow of compressed air at plants and equipment lines, etc.						6 ranges		Unidirectional	Aluminum	Switch output :1point NPN (and) Analog output : 1point 0-5V,1-5V,0-10V,4-20mA	2.5sec or less	±1.5%FS or less	
	Display separated type Ideal for controlling and checking the flow of compressed air at plants and equipment lines, etc.						6 ranges		Bidirectional	Aluminum	Switch output :2points NPN or PNP (and) Analog output : 1point 0-5V,1-5V,0-10V,4-20mA	2.5sec or less	±3%FS or less	

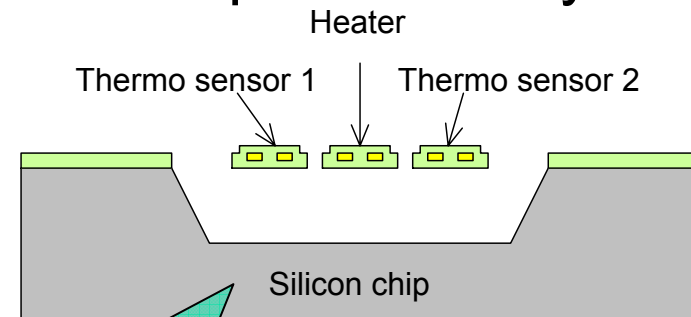
## Measurement principle 1 FSM2 series

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

### <Sensor chip>



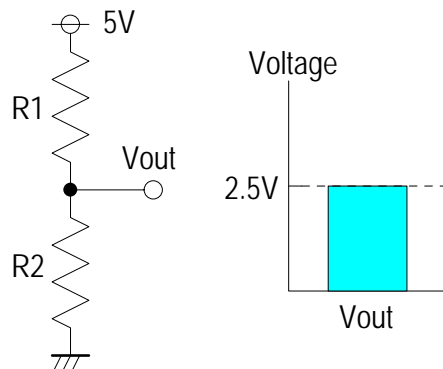
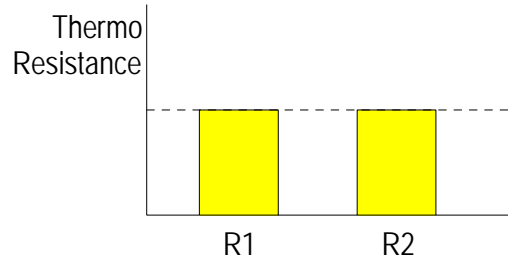
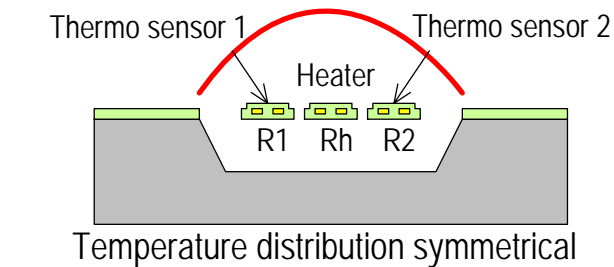
### <Sensor part cutaway view>



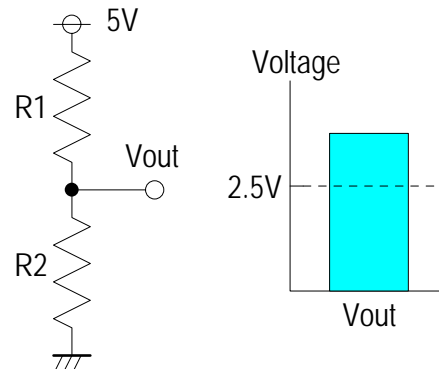
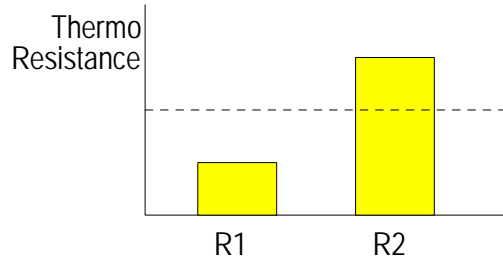
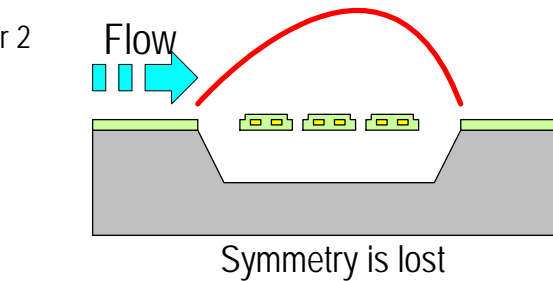
Ultra small heat capacity of sensor part realizes fast response, high sensitivity

## Measurement principle 2 FSM2 series

<No flow>



<Flow>



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 upstream side of heater will be lower, that of 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 depends on flow rate. The flow measured by this method is mass flow (flow speed x mass), which is not influenced by temperature nor pressure.

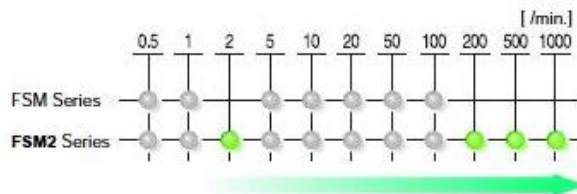


# CKD < Flow sensor for air >

## Features New Product FSM2 series

### Enlarged flow range

2, 200, 500, and 1000 /min. types have been added to conventional flow ranges -- 0.5, 1, 5, 10, 20, 50, and 100 /min.



### Large flow yet compact

The volume of the 500 and 1000 /min. types is 1/3 compared to the conventional type, realizing the industry's top class compact size. Equipment is downsized and lightened with this new series.



### Measure fluids bidirectionally

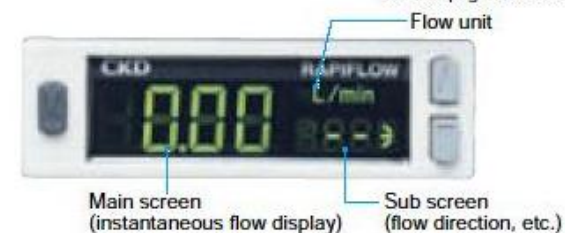
With the integrated bidirectional display, the flow direction is set in either direction and measured. This increases the freedom of piping installation and detects backflows.



### Twin indicator/bicolor indicator

With the integrated display, main and subscreens improve operability. The bicolor display makes it easy to spot problems quickly.

Refer to page 25 for details.



<Bicolor display>



### Bar display

With the separated display, the reference flow is easily grasped with a flow bar display.





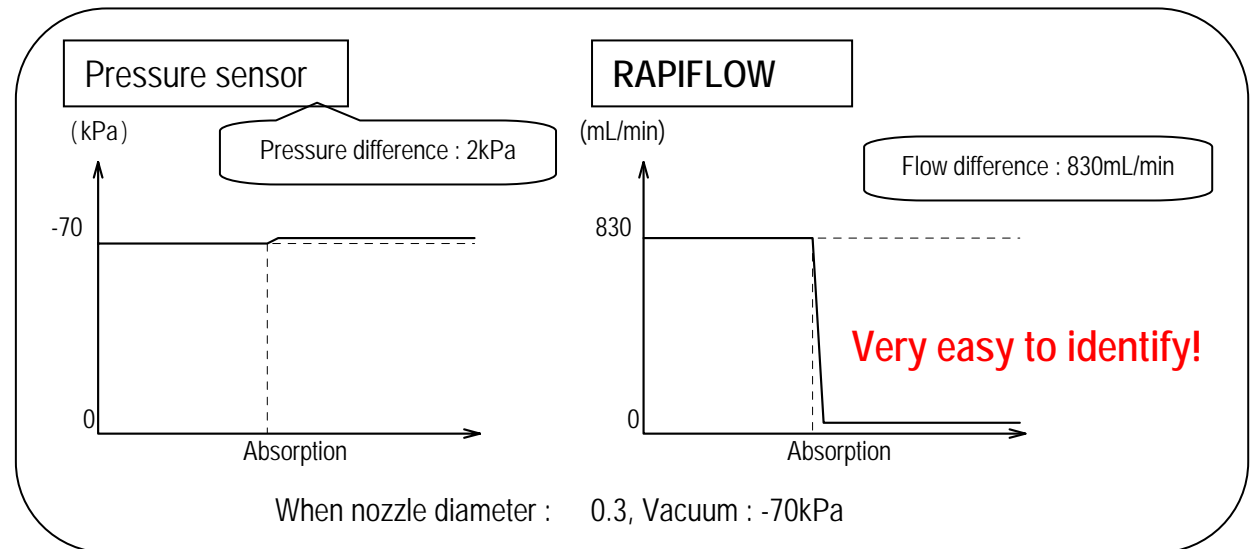
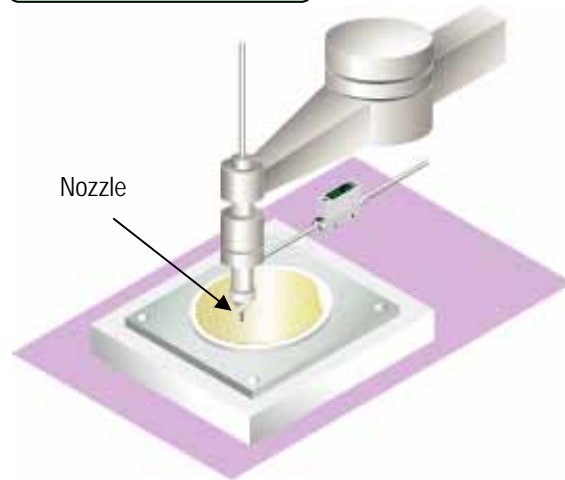
# CKD < Flow sensor for air >

## Application 1 Absorption check

### Application/Purpose

- Absorption check of ultra small electronic parts (nozzle diameter is 0.3 or smaller)
- Before pressure sensor was used for absorption check, but following further downsizing of electronic parts, enough differential pressure is not available and a lot of customers have common problems of wrong detection.

### Details



### Key points for success

- Fast response as pressure sensor (response time depends on internal volume of the piping and pressure etc.)
- Free from readjustment and wrong detection caused by pressure change.
- Can detect clogging of nozzle and/or filter.
- Can detect incomplete absorption like detection.

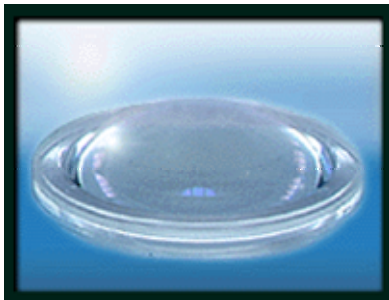
**No more pressure sensor but RAPIFLOW for absorption check of ultra small parts!**

## Application 2 Absorption check

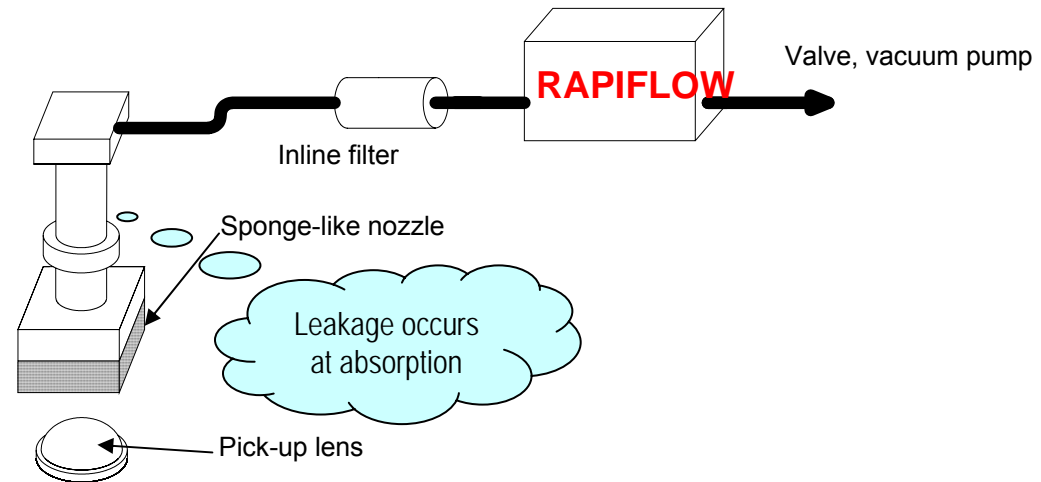
### Application/Purpose

- Absorption check for pick-up lens for DVD, CD.
- A sponge-like absorption nozzle is used as the work is easy to be damaged. For this reason, the customer had to expect leakage at absorption and pressure sensor could not detect the absorption.

### Details



Pick-up lens



### Key points for success

Adopted model : FSM-N-100-H4

RAPIFLOW could easily detect the absorption check which was not possible with pressure sensor.

Other than absorption check of small works done by small diameter nozzle, RAPIFLOW can work properly for absorption check with leakage at absorption, such as sponge-like absorption nozzle.

**RAPIFLOW is better for absorption check application when with leakage!!!**



< Flow sensor for air >

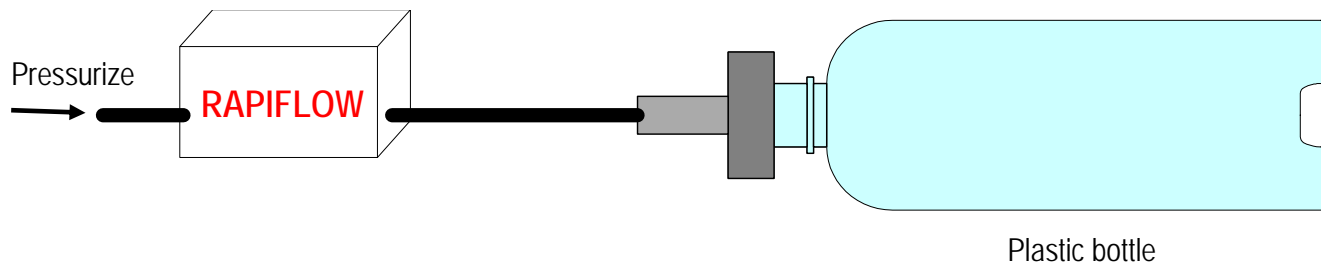
## Application 3 Leak test

### Application/Purpose

Use RAPIFLOW for leak test of plastic bottles.

When tested with pressure, the judgement is done with the pressure drop after filling gas into the bottle, so it takes time. Also to prevent the burst of the bottle, the filling pressure should be very low and there is limit of detecting pressure difference.

### Details



### Key points for success

Adopted model : FSM-N-005-H4, FSM-V-AH3-R0010-H4

RAPIFLOW can reduce the test time, because of its fast response time, the measurement is done soon after the bottle is filled.

Even with fine pressure, RAPIFLOW can detect it because of proportional output to pin hole diameter is available.

**RAPIFLOW for leak test! You can save the measuring time!**

## Application 4

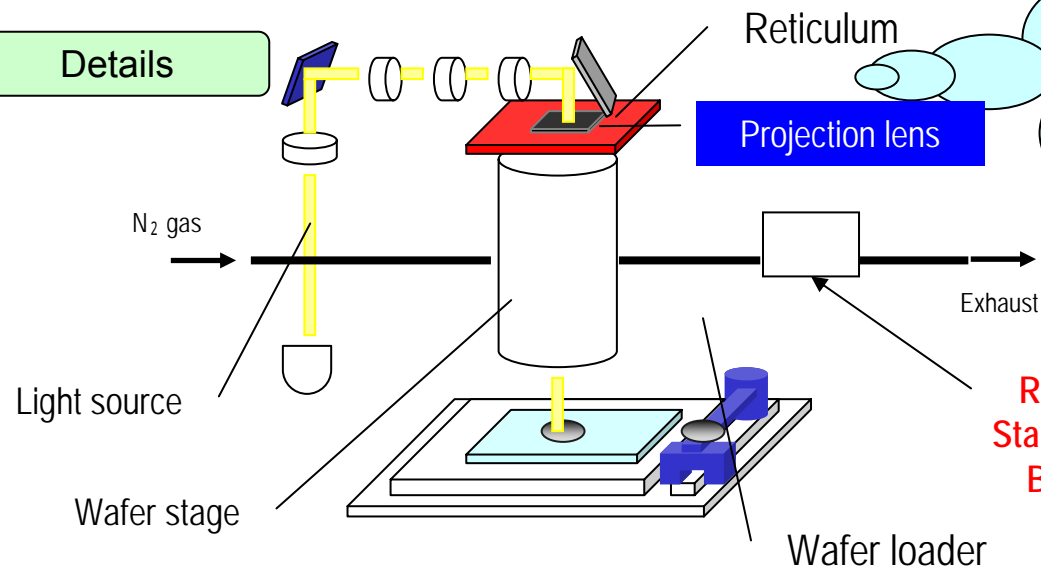
Flow control of N2 gas in stepper exhaust side

### Application/Purpose

Flow control of N2 gas used for defogging of projection lens of stepper (exposure machine used in semiconductor industry).

The customer used expensive (more than @ Yen 100,000.-) and big sensor.

### Details



A special version of RAPIFLOW, with precision cleaned materials for gas contacting materials, assembled in clean room, is available to prevent dust and gas radiation from RAPIFLOW.

### Key points for success

Adopted model : FSM-N-050-6A

RAPIFLOW has realized cost down and space saving at the same time.

A "clean" spec. type, with precision cleaned materials for gas contacting area, assembled in clean room.

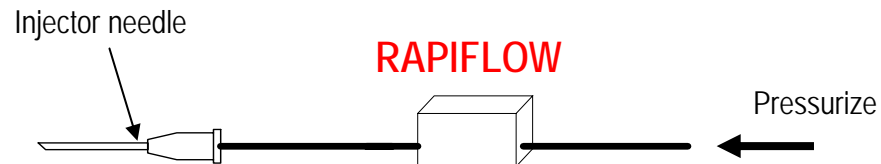
**RAPIFLOW is ready for clean room application!!!**

Application/Purpose

For inspection of injector needle

Details

Flow rate judges OK or NG.



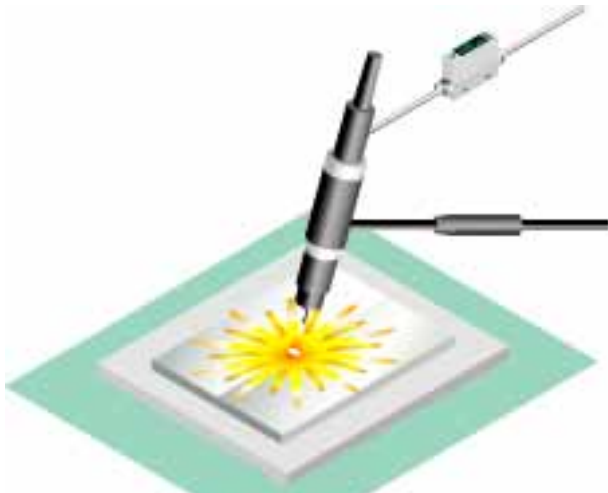
Key points for success

The flow rate depends on the hole diameter and with RAPIFLOW the judgement is easy.

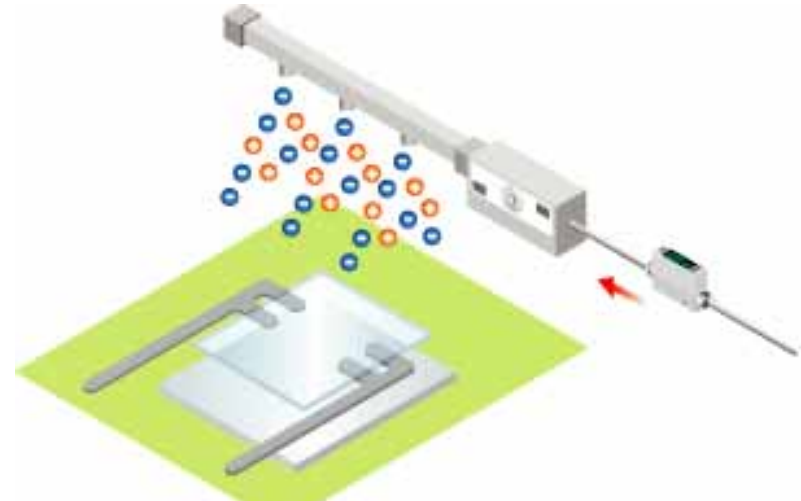
The fast response of RAPIFLOW enables fast inspection.

**RAPIFLOW also for pin hole inspection!!!**

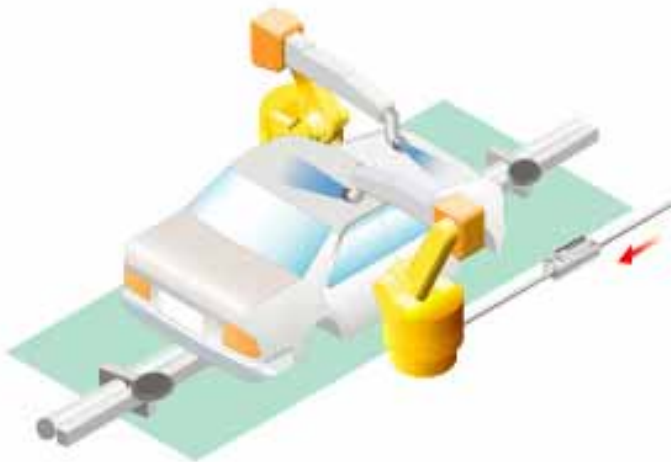
## Application 6



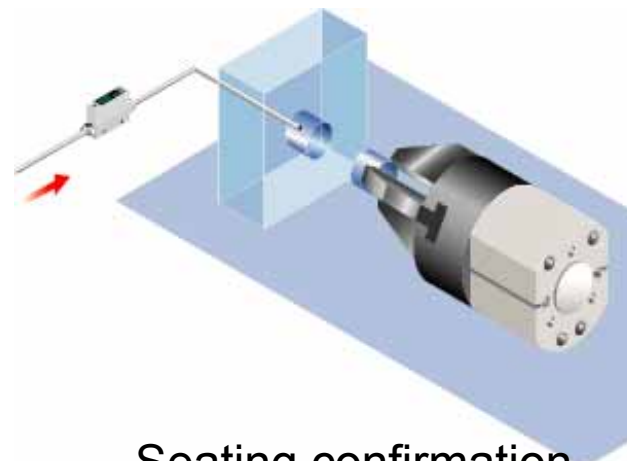
Welding argon gas flow control



Ionizer flow control









Painting air flow control



Seating confirmation

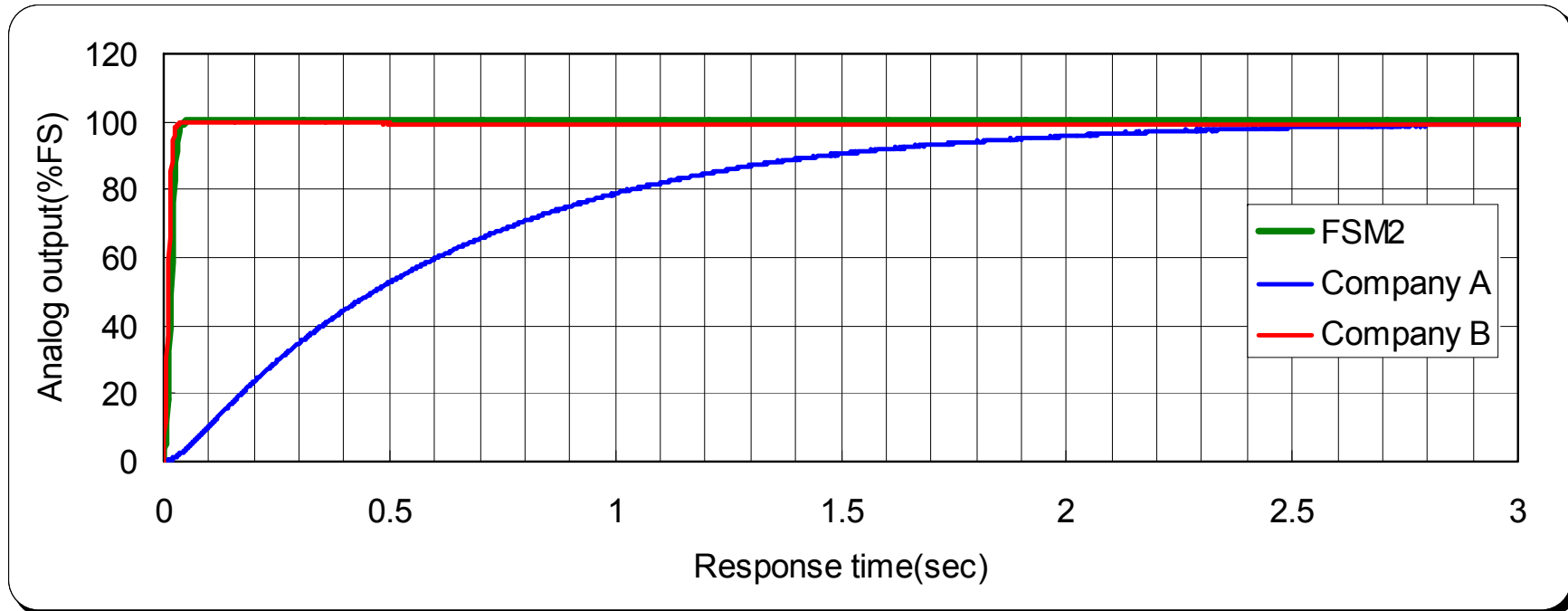
## Comparison with competitors' products

Company		CKD	CKD	Company A	Company A	Company B	Company B
Model		FSM2	FSM	PFM	PF2A	FD-V40	CMS
View							
Full scale flow range		0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000(L/min)	0.5, 1, 5, 10, 20, 50, 100(L/min)	10, 25, 50, 100(L/min)	10, 50, 100, 200, 500 (L/min)	1, 10, 50, 100, 250, 600(L/min)	0.5, 2, 5, 20, 50, 200, 500 (L/min)
Working fluid		Air, N2, Ar, CO2	Air, N2, Ar, CO2	Air, N2, Ar, CO2	Air, N2	Air, N2, Ar	Air, N2, Ar, CO2, City gas, Propane
Accuracy		±3%FS	±5%FS	±5%FS	±5%FS	-	±3%RD
Body material		Resin, Aluminum, SUS316	Resin, Aluminum, SUS303	Resin	Resin	Aluminum	Resin, SUS303
Analog output		1-5VDC or 4-20mA	1-5VDC	1-5VDC or 4-20mA	non	4-20mADC	0-5VDC
Switch output		2points	2points	2points	2points	2points	2points
Indicator		dual display 2-color display	single display 1-color display	single display 2-color display	single display 1-color display	dual display (by separate indicator)	single display 1-color display
Size	10L/min	35cm3	35cm3	37cm3	157cm3	34cm3	232cm3
	200L/min	40cm3	-	-	180cm3	77cm3	335cm3
	500L/min	74cm3	-	-	180cm3	77cm3	468cm3

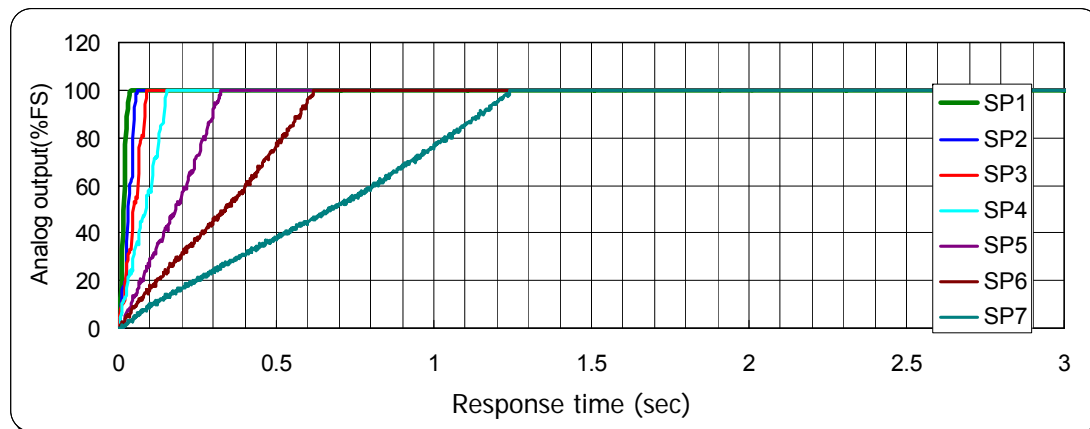


<Flow sensor for air>

## FSM2 series Response time comparison



FSM2 : Response time can be selected







<Flow sensor for air>





## Dimensions comparison

	Full scale flow rate (L/min)										
	0.5	1	2	5	10	20	50	100	200	500	1000
CKD FSM / PF-F	FSM						FSM			PF-F	
CKD FSM2	FSM2					FSM2				FSM2	
Company A PFM / PFA2					PFM				PF2A		
Company B FD-V40		FD-V40							FD-V40		
Company C CMS	CMS							CMS			



<Flow sensor for air>

## FSM2 series Display and Function comparison







	Display	Functions
CKD FSM2	Dual and 2-color display  The image shows the CKD FSM2 display. It has a green LED display with two main sections. The left section shows '0.0.0.0' and the right section shows '0.0.0.0'. Above the right section, it says 'RAPIFLOW mL³/min 1 2'. There are two arrows pointing to the display: one to the '0.0.0.0' on the left labeled 'Flow rate indicator' and one to the '0.0.0.0' on the right labeled 'Sub indicator'. Flow rate indicator Sub indicator	Interactive detection Switch output Auto calibration (setting value) Accumulated flow Peak / bottom hold
Company A PFM	2-color display  The image shows two versions of the Company A PFM display. The left one shows '0.25' in green and the right one shows '0.24' in red.	Switch output Accumulated flow Operating fluid selection Display unit selection ( ANR/NOR ) Peak / bottom hold
Company B FD-V40	Dual display (by separate indicator)  The image shows the Company B FD-V40 display. It has a red LED display showing '32.5' and a green LED display showing '200'. There are two arrows pointing to the displays: one to the '32.5' labeled 'Flow rate indicator' and one to the '200' labeled 'Setting value indicator'. Flow rate indicator Setting value indicator	Switch output Auto calibration (setting value) Accumulated flow Peak / bottom hold
Company C CMS	Single display  The image shows the Company C CMS display. It has a green LED display showing '8888'.	Switch output Accumulated flow Operating fluid selection Display unit selection ( ANR/NOR )

**CKD**

# Flow sensor for water



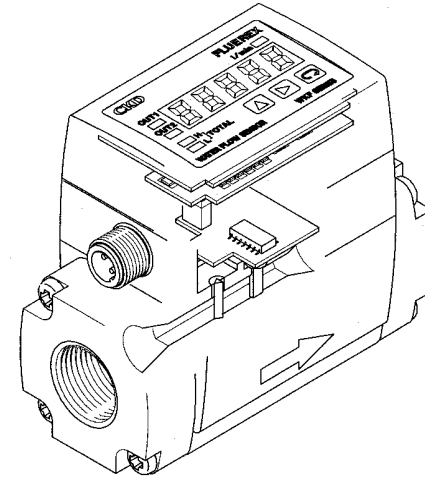
## Series variation

	Model	Features	Flow rate range (L/min)			Pressure loss	Output	Response time	Accuracy
			1	10	100				
Karman's vortex type	WFK3000 	Small, device-integrated custom	0.5 ~ 4.0	1.5 ~ 12	4 ~ 32	0.06MPa	Switch output : 2points NPN or PNP Analog output : 1point 0-5V, 1-5V, 0-10V, 4-20mA	1sec	±2.5%FS
	WFK5/6000 	Standard for a variety of applications	1.0 ~ 8.0	3.0 ~ 27		0.045MPa	Switch output : 1point NPN or PNP (and) Analog output : 1point 0-5V, 1-5V, 0-10V, 4-20mA	1sec	±2.5%FS
	WFK7000 	Large flow with stainless steel body		10 ~ 50	20 ~ 100 40 ~ 200	0.045MPa	Switch output : 1point NPN or PNP (and) Analog output : 1point 0-5V, 1-5V, 0-10V, 4-20mA	1sec	±2.5%FS
Turbine type	WF3000 	Small, device-integrated custom	1.0 ~ 10	2.5 ~ 20		0.015MPa	Analog output : 1point 0-5V or 0-10V	2sec	±2.5%FS
	WF5/6000 	Standard for a variety of applications	1.0 ~ 10	2.5 ~ 25		0.015MPa	Switch output : 1point NPN (and) Analog output : 1point 0-5V or 0-10V	2sec	±2.5%FS
	WF7000 	Large flow with stainless steel body		5 ~ 50	10 ~ 100 20 ~ 200	0.015MPa	Switch output : 1point NPN (and) Analog output : 1point 0-5V or 0-10V	2sec	±2.5%FS

## Features

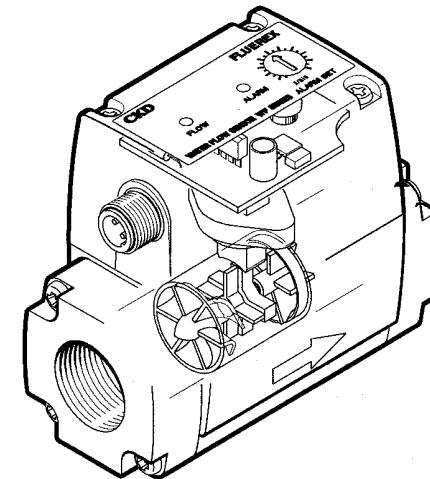
### WFK series : Karman's vortex type

The vortex flow meter in principle needs no moving part and therefore is subject to almost no age-based variation. Easy maintenance procedures are another major advantage.



### WF series : Turbine type

The turbine type flow meter is also called impeller type flow meter. This type has been used for the tap water meter since early times. It is distributed in the market, too, as a low-cost simple industrial flow sensor.

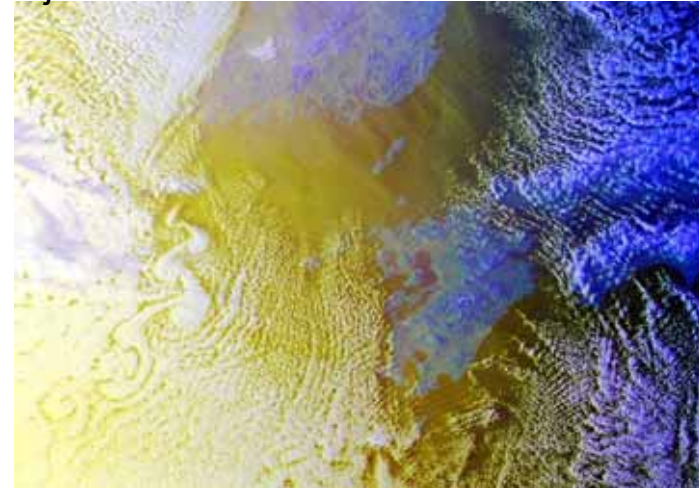


## Measurement principle WFK series

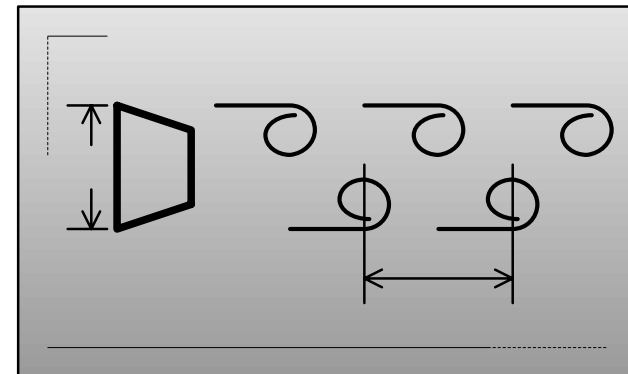
An obstacle placed in a flow generates vortexes. The vortexes are called Karman's vortexes and the phenomenon is observed in daily scenes such as a "flag fluttering in a wind."

Karman's vortexes generate alternately and regularly after an obstacle placed in the flow, and the interval of vortexes does not change even if the flow velocity changes. For this reason, a stronger flow generates more vortexes after a point, while a weaker flow generates fewer vortexes. That is, the number of vortexes is in proportion to the flow velocity.

Kalman vortexes that occurs because of Jeju island



Pattern diagrams of Karman's vortexes







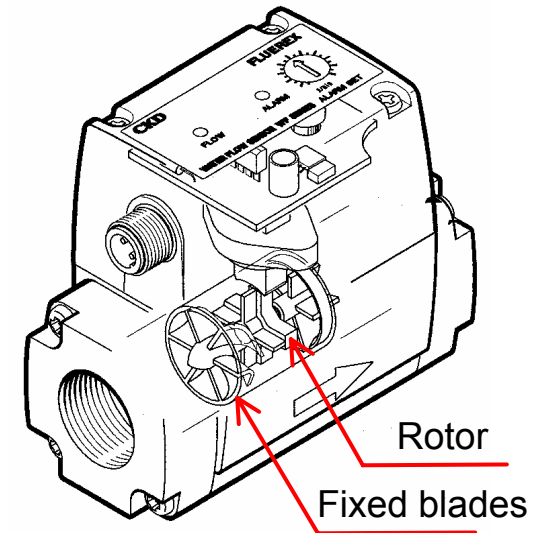
<Flow sensor for water>

## Measurement principle WF series

An impeller installed in a flow rotates in proportion to the flow velocity, so that the flow velocity (flow rate) can be obtained according to the rotation speed. Imagine a wind mill rotating by a wind force.

CKD's WF Series has a structure where the flow forced by fixed blades turns a rotor (turbine/impeller), and it belongs to the axial flow turbine type flow meter.

The rotor is made of plastic magnet, and a magnetic sensor detects the rotation speed to detect the flow rate.





< Flow sensor for water >

## Application

## Sales analysis



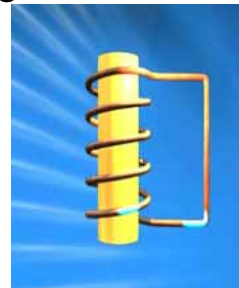
Semiconduct  
or Cleaning  
Equipment  
3%

Spot welding  
4%

Grinder /  
Dicing  
11%



High  
frequency  
induction  
hardening  
12%



Other  
19%

Dry vacuum  
pump  
36%



Laser  
transmitter  
15%







< Flow sensor for water >

## Application

## Sales analysis

Water (hot water) is used in various production fields in the world.

(1) Water cools heat sources such as the laser oscillator, welding machine and metallic mold.

(2) Water is used to regulate the atmosphere of a reactor or the like.

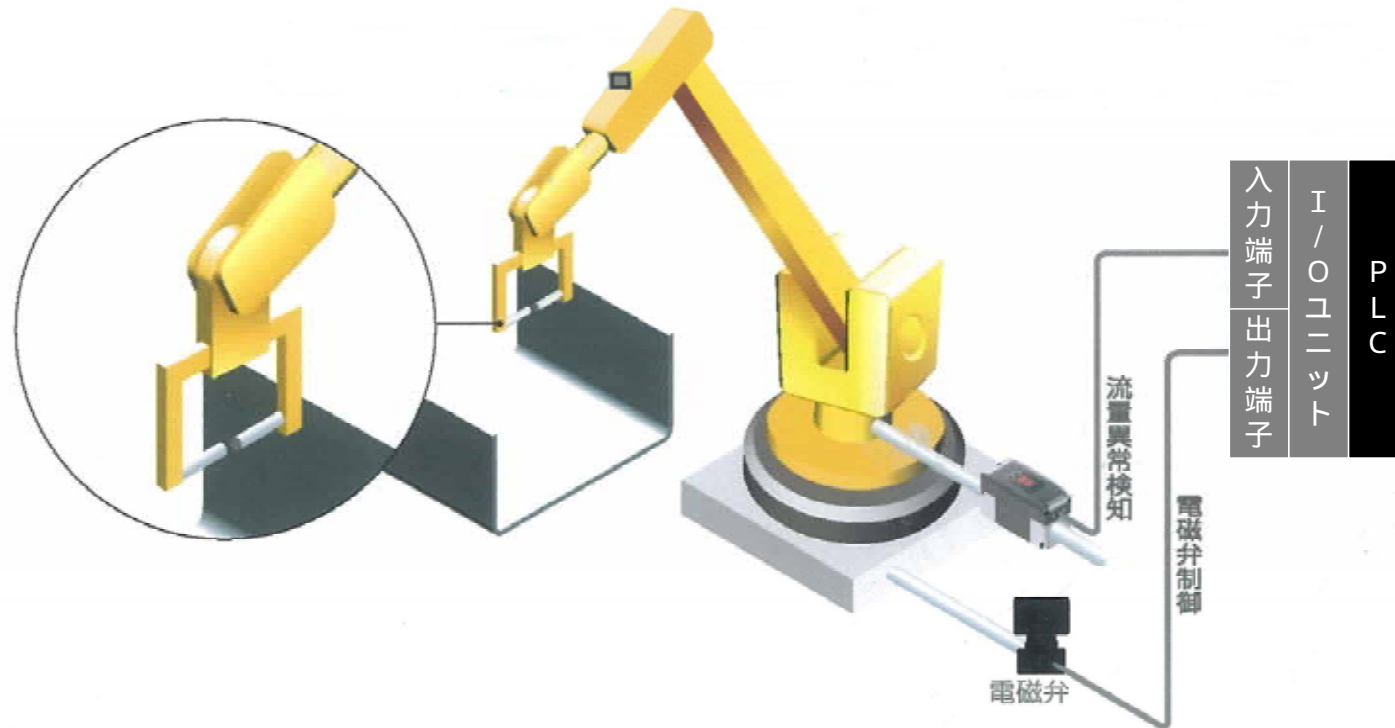
(3) A certain flow rate of water washes the workpiece.

Water (hot water) must flow regularly so that cooling, temperature regulation or washing is conducted correctly. The water flow sensor monitors the flow.

Application	Purpose	Flow rate (L/min)
Dry vacuum pump	Flow control of colling water	1 to 20
Laser transmitter	Flow control of colling water	1 to 27
High frequency induction hardening	Flow control of colling water	50 to 200
Grinder/Dicing	Flow control of colling water	1 to 25
Spot welding	Measure absence of chips	0.5 to 20
Semiconductor Cleaning Equipment	Flow control of cleaning water	0.5 to 20
Ion implantation	Flow control of colling water	1 to 27

## Application 1

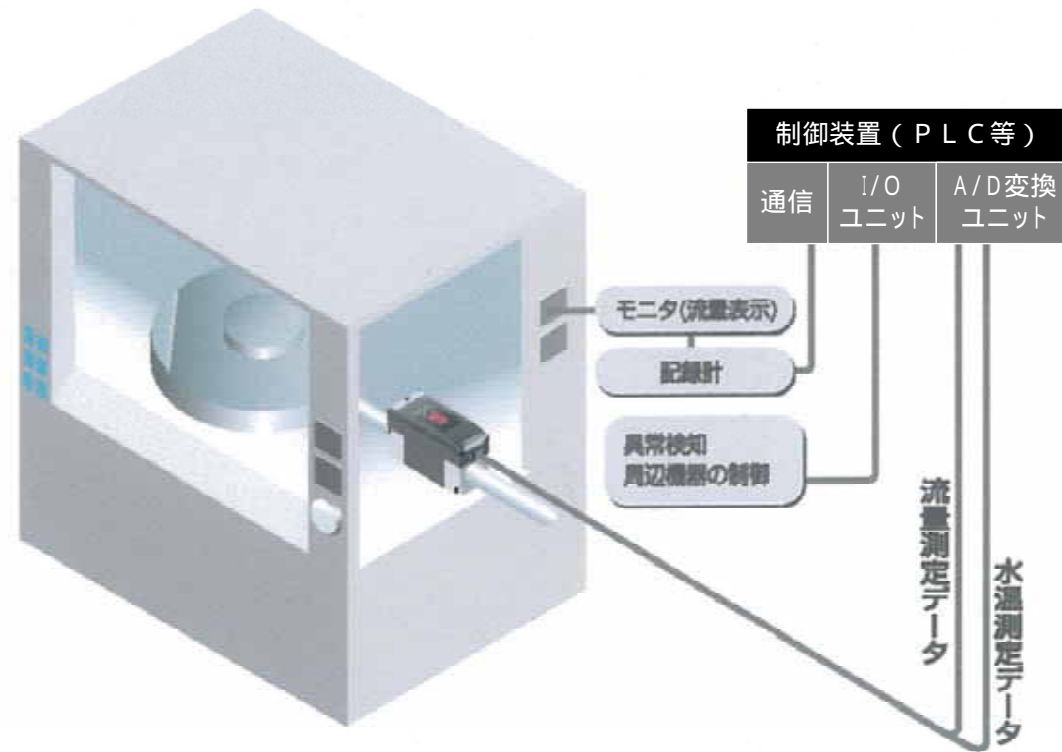
## Spot welding



- (1) A flow sensor measures absence of chips of the spot welding machine.
- (2) An alarm signal (switch output) is supplied to the PLC.
- (3) The PLC controls a solenoid valve to avoid leaks of cooling water.

## Application 2

## Semiconductor process equipment





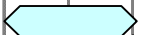


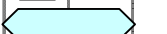


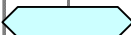


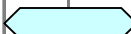



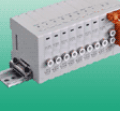

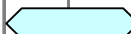
- (1) A flow sensor measures the state of the cooling water, temperature regulating water or washing water.
- (2) A flow rate signal (analog output) is supplied to the PLC.
- (3) The PLC controls in the event of alarms and records data.

**CKD**

# Electro pneumatic regulator



## Series variation

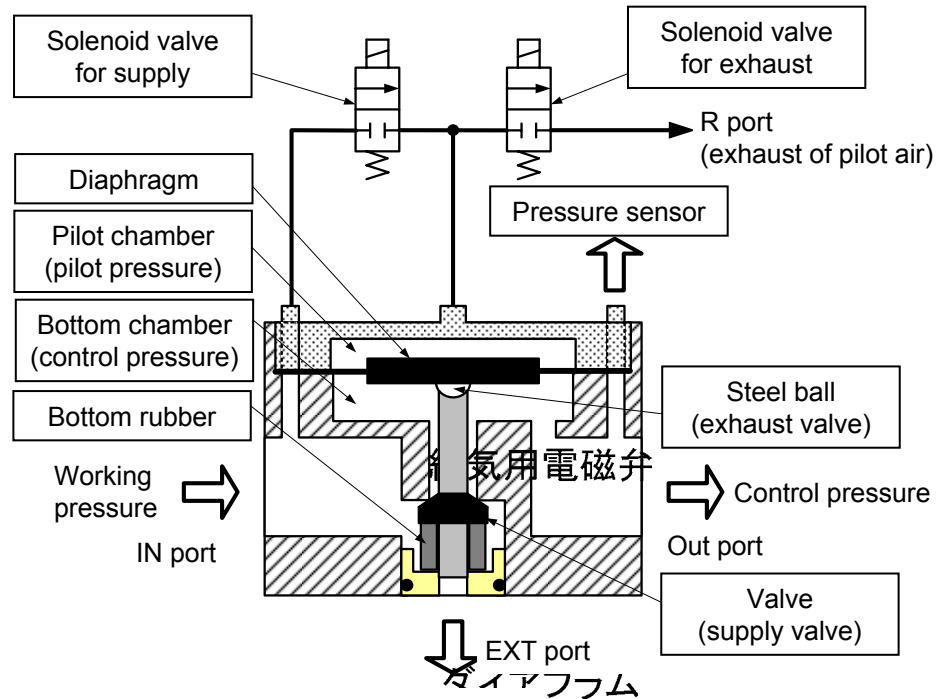
Model	Features	Control pressure range (kPa)					Max. flow rate (L/min)	Input signal	Port size	Step response	Linearity	Hysteresis
		-100	0	100	500	900						
 EVD-1000	The easy-to-use highly functional compact EVD series digital electropneumatic regulator features a variety of new functions including pressure display, error display, and direct memory.						400	0-10V	Rc1/4	0.2sec or less	±0.3%FS or less	0.5%FS or less
								0-5V				
								4-20mA				
								10bit(parallel)				
 EVD-3000	The easy-to-use highly functional compact EVD series digital electropneumatic regulator features a variety of new functions including pressure display, error display, and direct memory.						1500	0-10V	Rc1/4	0.2sec or less	±0.3%FS or less	0.5%FS or less
								0-5V	Rc3/8			
								4-20mA				
								10bit(parallel)				
 EV2000	Feedback control with semiconductor pressure sensor and electronic control circuit is used. This electro pneumatic regulator allows continuous and precise controlling air pressure by electric signals.						800	0-10V	Rc1/4	0.6sec or less	±0.5%FS or less	1.0%FS or less
								0-5V				
								4-20mA				
								variable resistance				
 EV0000	Feedback control with semiconductor pressure sensor and electronic control circuit is used. This pneumatic proportional pilot valve allows continuous and precise controlling air pressure by electric signals.						6	0-10V	M5	0.6sec or less	±0.5%FS or less	1.0%FS or less
								0-5V				
								4-20mA				
								variable resistance				
 EVS	Smaller than conventional models. Body extending cable is used for this pneumatic proportional pilot valve to achieve ultimate convenience and space saving.						6	0-10V	M5	0.6sec or less	±0.5%FS or less	1.0%FS or less
								0-5V				
								4-20mA				
 MEVT	Reduced wiring and thin shape. Ultimate space saving due to manifold. Thin type electro pneumatic regulator with higher accuracy and performance than conventional mechanism.						6	0-10V	push in joint 4 dia.	0.1sec or less	±0.5%FS or less	0.4%FS or less
								0-5V	push in joint 6 dia.			
								4-20mA				



<Electro pneumatic regulator>

## Principle of operation

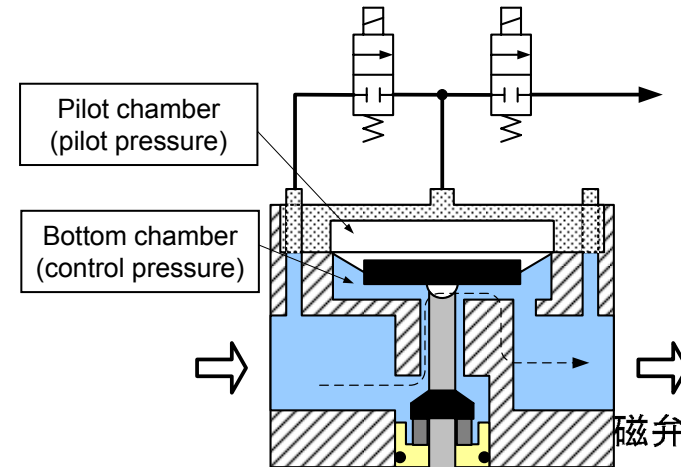
EVD-1000



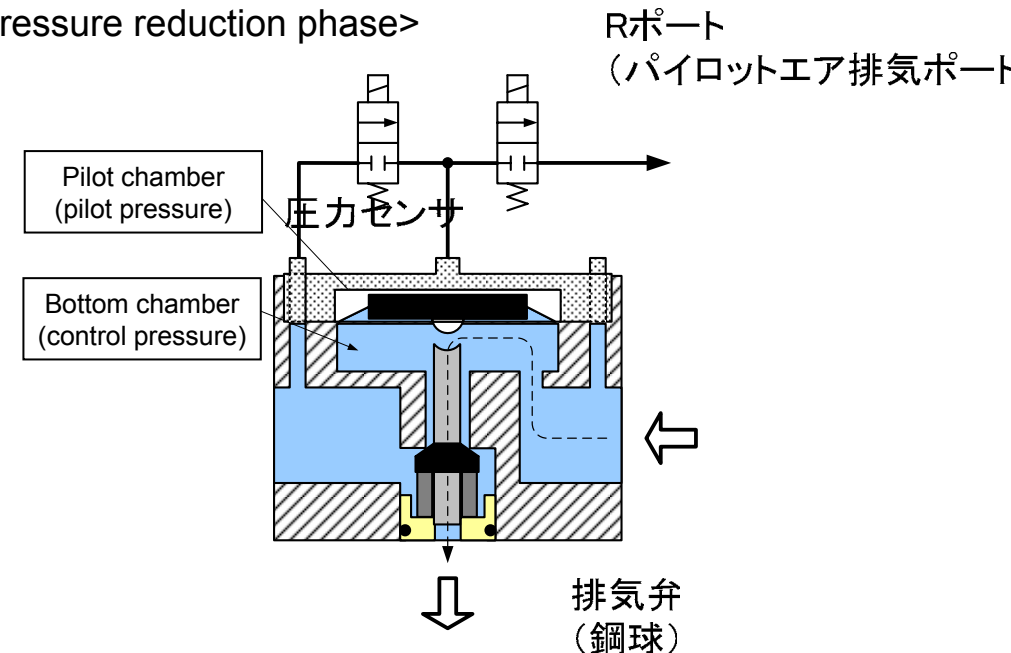
The supply and exhaust solenoid valves are driven with electric signals to control the pilot pressure, thereby actuating a diaphragm, so that the supply valve is pushed down in the pressure rising phase and the exhaust valve is opened in the pressure reduction phase.

ボトムゴム

### <Pressure rising phase>



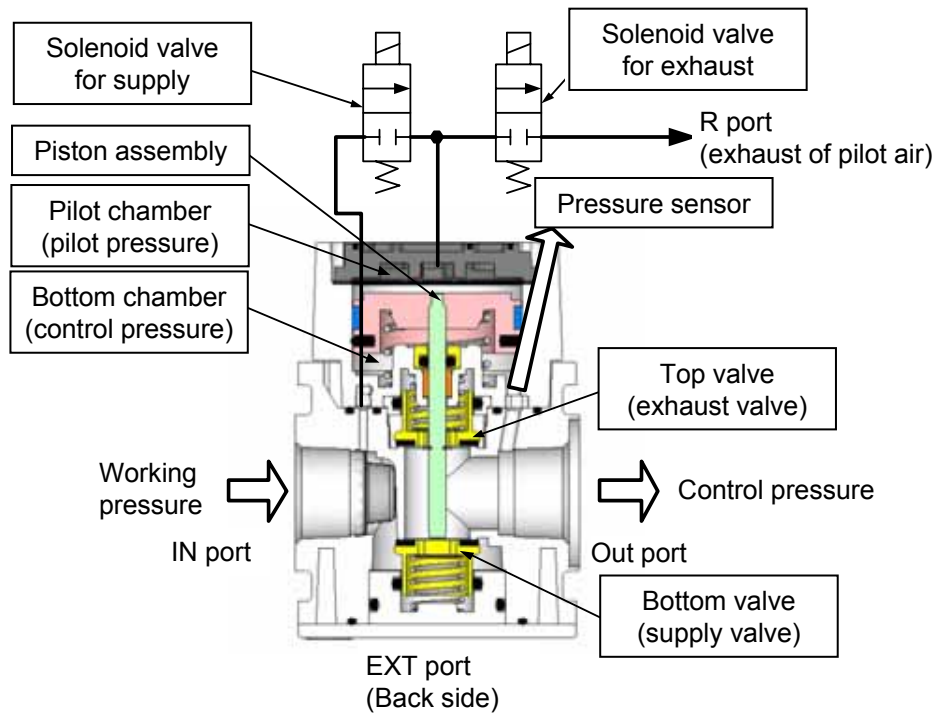
### <Pressure reduction phase>





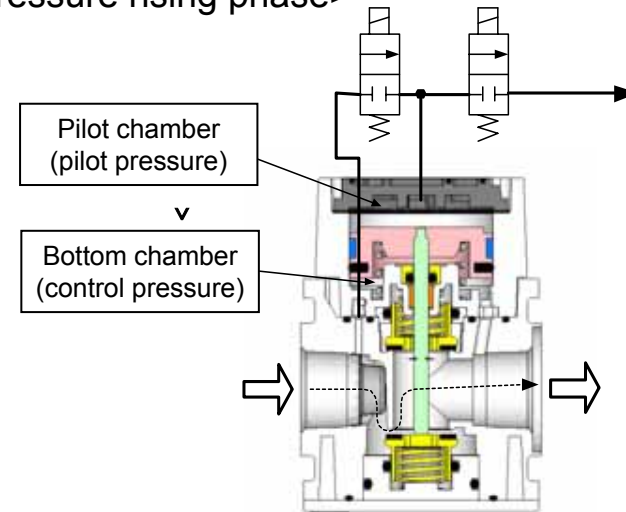
<Electro pneumatic regulator>

# Principle of operation EVD-3000

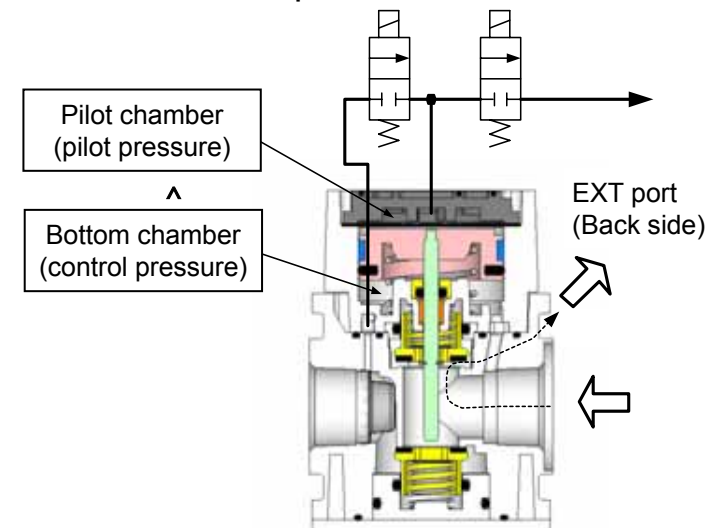


The supply and exhaust solenoid valves are driven with electric signals to control the pilot pressure and move the piston assembly, so that the supply valve is pushed down in the pressure rising phase and the exhaust valve is opened in the pressure reduction phase.

## <Pressure rising phase>



## <Pressure reduction phase>





# CKD < Electro pneumatic regulator > Features New Product

## EVD series

### User-friendly, outstanding installation performance

**The digital display shows control status at a glance.**

3-digit output pressure display  
Output status (switch output ON-OFF) is displayed in addition to error display.

Output display 3-digit numerical LED display



**Parallel input available as standard**

Direct control is possible from the PLC.

**Compact design is 25% smaller (CKD comparison)**



**The highly universal D-sub connector enables bidirectional connection.**

The connection is rotated 90 degrees from top to side, enabling top or side connection to be selected based on use.



### Realizing high-level functions with microcomputer

**Error display function**

Errors are displayed and reported with electric signals.

**Zero/span adjustment function**

Zero and span can be adjusted according to the usage methods

**Direct memory function**

External input signals are not required.

Secondary pressure is adjusted as desired with operation keys.

**Switch output function**

Switch outputs (built-in overcurrent protection) is possible by setting the upper/lower limit pressure

### Highly precise high-response pressure control

**Linearity  $\pm 0.3\%$**

**Hysteresis 0.5%**

**Response time 0.2sec**



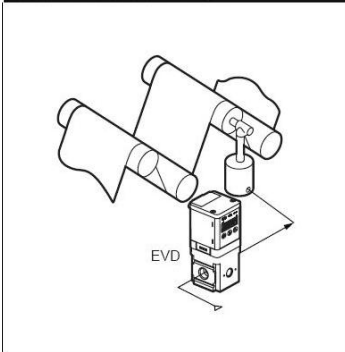


<Electro pneumatic regulator>

# Application

# Sales analysis

● Balancer tension control



Balancer  
tension  
control  
4%

Fluid  
pressure  
control  
10%

Assembly  
of chip  
16%

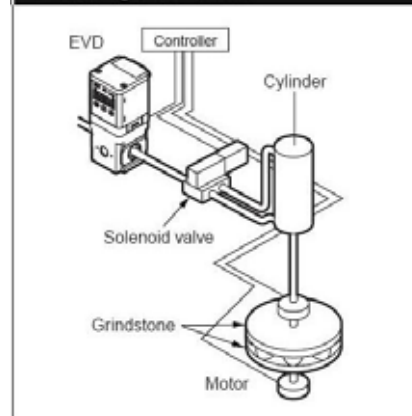
● Assembly of chips



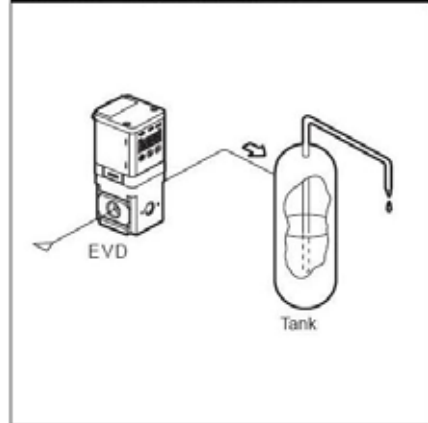
Other  
13%

Grinding  
force  
control  
18%

● Grinding force control

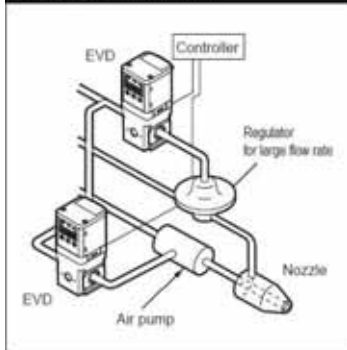


● Fluid discharge rate control

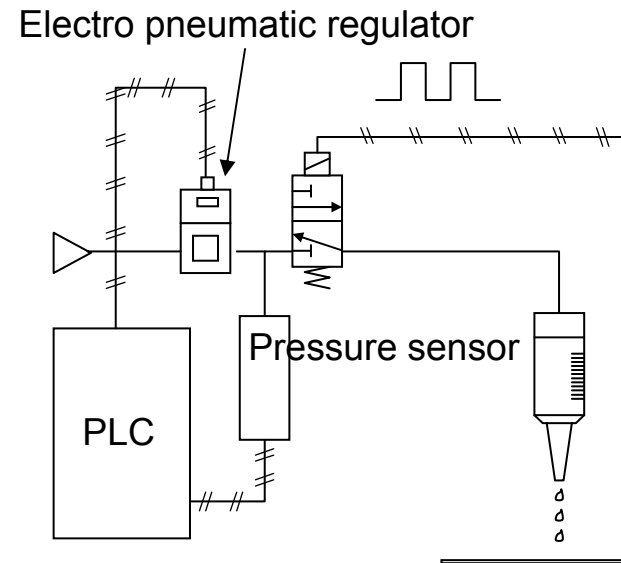
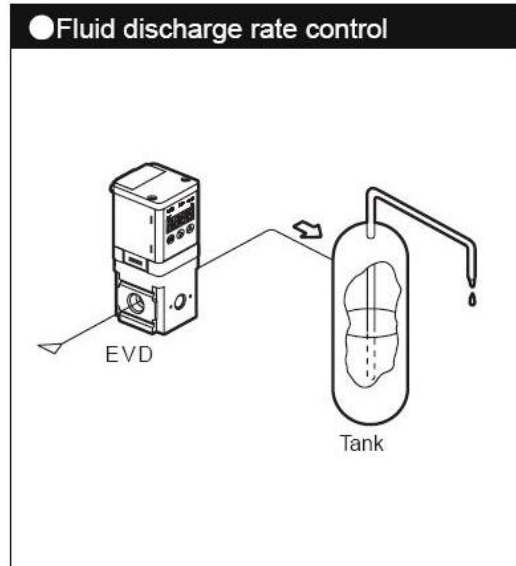


Fluid  
discharge  
rate control  
39%

● Fluid pressure control



# Application 1 Fluid discharge rate control



### <Equipment type>

Fluid constant discharge unit (dispenser)

### <Application>

Correction of discharge amount that reduces due to the liquid level dropping in the material container.

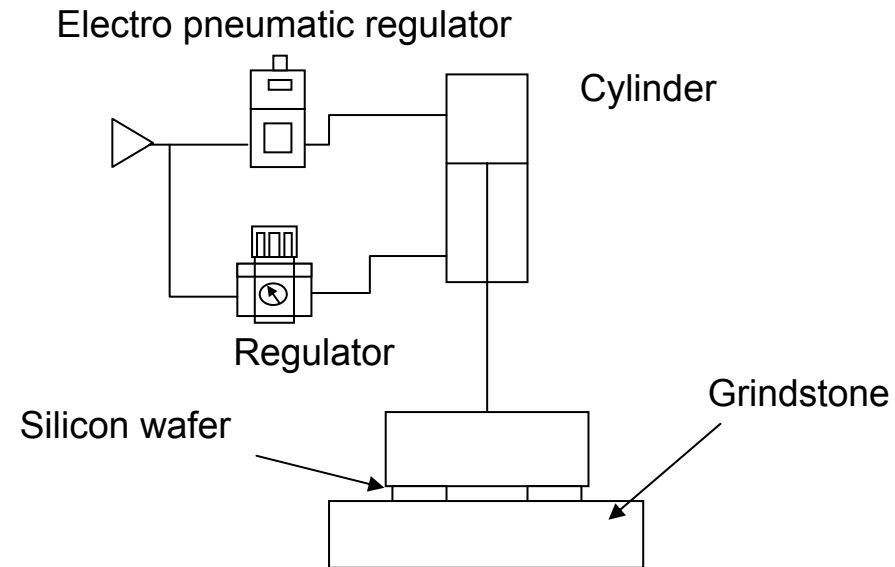
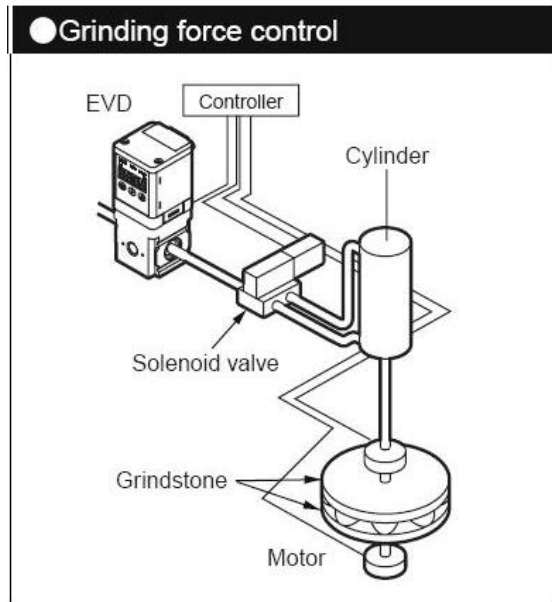
### <Application method>

The pressure for dispensing the fluid material such as adhesive, grease and conductive paste is controlled so that the metered amount is discharged.

### <Effects>

- (1) Stable discharge amount is obtained through continuous correction of the discharge pressure even at low liquid level inside the material container.
- (2) Because the discharge pressure is corrected instead of the discharge time, no effect is given on the production takt time.
- (3) Reduction of equipment size

### Applications 2 Grinding force control



#### <Equipment type>

Grinding machine/Caulking machine for silicon wafer, etc.

#### <Application>

Cylinder pressure control

#### <Application method>

The cylinder pressure for pressing the workpiece such as the silicon wafer on the grinding wheel is controlled to grind the workpiece.

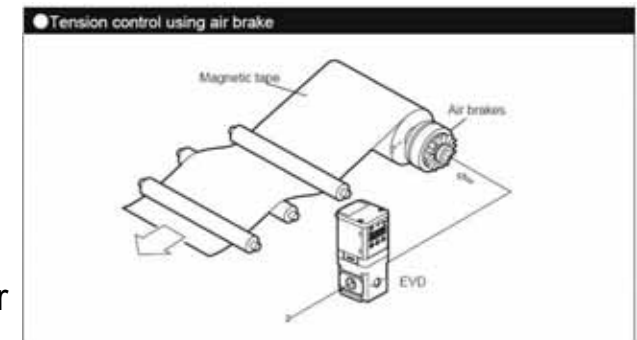
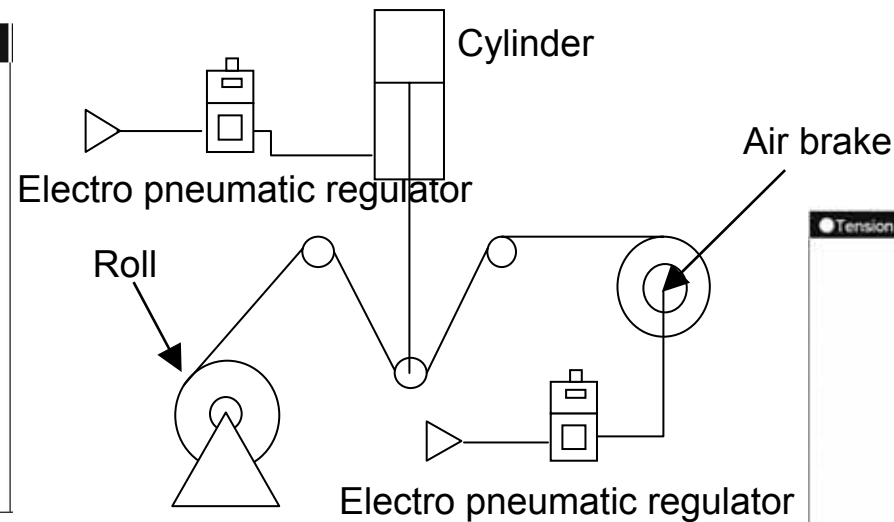
#### <Effect>

The equipment is applicable to various workpieces (materials, shapes, etc.) through continuous pressure control with an electro pneumatic regulator. Precision grinding of the silicon wafer, etc. is also possible.



<Electro pneumatic regulator>

## Applications 3 Balancer tension control



<Equipment type>

Film sheet, paper roll winding machine, newspaper press, etc.

<Application>

Torque control of cylinder or air brake

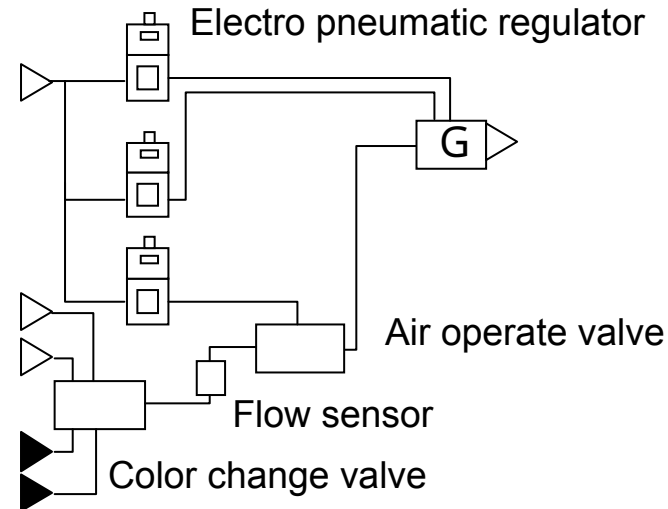
<Application method>

Tension control for keeping the cut or printed sheet tight

<Effect>

The precision electro pneumatic regulator controls the pressure continuously to obtain stable tension control.

More precise control is enabled through external feedback with a tension sensor, etc.



<Equipment type>

Painting equipment

<Application>

- (1) Paint discharge amount control (pilot air control)
- (2) Paint atomization control (turbine air control)
- (3) Paint application shape control (shaping air control)

<Application method>

The discharge amount, atomization state and application shape of the paint discharged from the gun are controlled.







<Effect>

The equipment is applicable to desired paint color, part shape, and type variation through continuous pressure control.



<Electro pneumatic regulator>

## Comparison with competitors' products

Descriptions		CKD			Company A		
		<div>EVD-1000</div> 	<div>EVD-3000</div> 	<div>EV2500</div> 	<div>ITV1000</div> 	<div>ITV2000</div> 	<div>ITV3000</div> 
Control pressure range		0 to 100kPa 0 to 500kPa 0 to 900kPa		0 to 0.49MPa	0.005 to 0.1MPa 0.005 to 0.5MPa 0.005 to 0.9MPa		
Input signal		0 to 10VDC + Preset input 0 to 5VDC + Preset input 4 to 20mADC + Preset input Parallel input		0 to 10VDC 0 to 5VDC 4 to 20mADC 10kΩ varia. resis.	0 to 5VDC / 0 to 10VDC 4 to 20mADC / 0 to 20mADC Preset input 4points (custom) Parallel input 16points (custom)		
Output	Analog output	1 to 5VDC		1 to 5VDC	1 to 5VDC, 4 to 20mA		
	Switch output	NPN / PNP		-	NPN / PNP		
Accuracy	Hysteresis	0.5%F.S. or less		1%F.S. or less	0.5%F.S. or less		
	Linearity	±0.3%F.S. or less		±0.5%F.S. or less	±1%F.S. or less		
	Resolution	0.2%F.S. or less		0.5%F.S. or less	0.2%F.S. or less		
	Repeatability	0.3%F.S. or less		0.5%F.S. or less	±0.5%F.S. or less		
Display	Type of display	3 digits LED display		-	3 digits LED display		
	Accuracy	±2%F.S.			±3%F.S.		
Max. flow rate		400L/min (Working pressure : 0.7MPa, Control pressure : 0.5MPa)	1,500L/min (Working pressure : 0.7MPa, Control pressure : 0.5MPa)	800L (Working pressure : 0.7MPa, Control pressure : 0.5MPa)	200L/min (Working pressure : 1.0MPa, Control pressure : 0.9MPa)	1500L/min (Working pressure : 1.0MPa, Control pressure : 0.9MPa)	4000L/min (Working pressure : 1.0MPa, Control pressure : 0.9MPa)
Step response time (loadless)		0.2sec or less		0.6sec or less	-		
Protective structure		IP40		IP64	IP65		
Port size		Rc1/4	Rc1/4, Rc3/8	Rc1/4	Rc1/4, 3/8	1/4, 3/8(Rc/NPT/NPTF/G)	1/4, 3/8, 1/2(Rc/NPT/NPTF/G)
Dimension		42×100	50×135	50×94.5	50×85	50×93	66×114
Weight		250g	450g	300g	250g	350g	645g
Function	Zero/span adjustment	with operation keys		By trimmer	with operation keys		
	Direct memory	with operation keys		non	non		
	Preset input	8 point (standard)		non	16 points (custom)		
	Err display	Error code displayed		non	Error code displayed		
	Err output	NPN / PNP		non	non		
	Energy saving	Automatic power off		non	non		

# CKD

## Flow controller












<Flow controller >

## FCM Series Variation

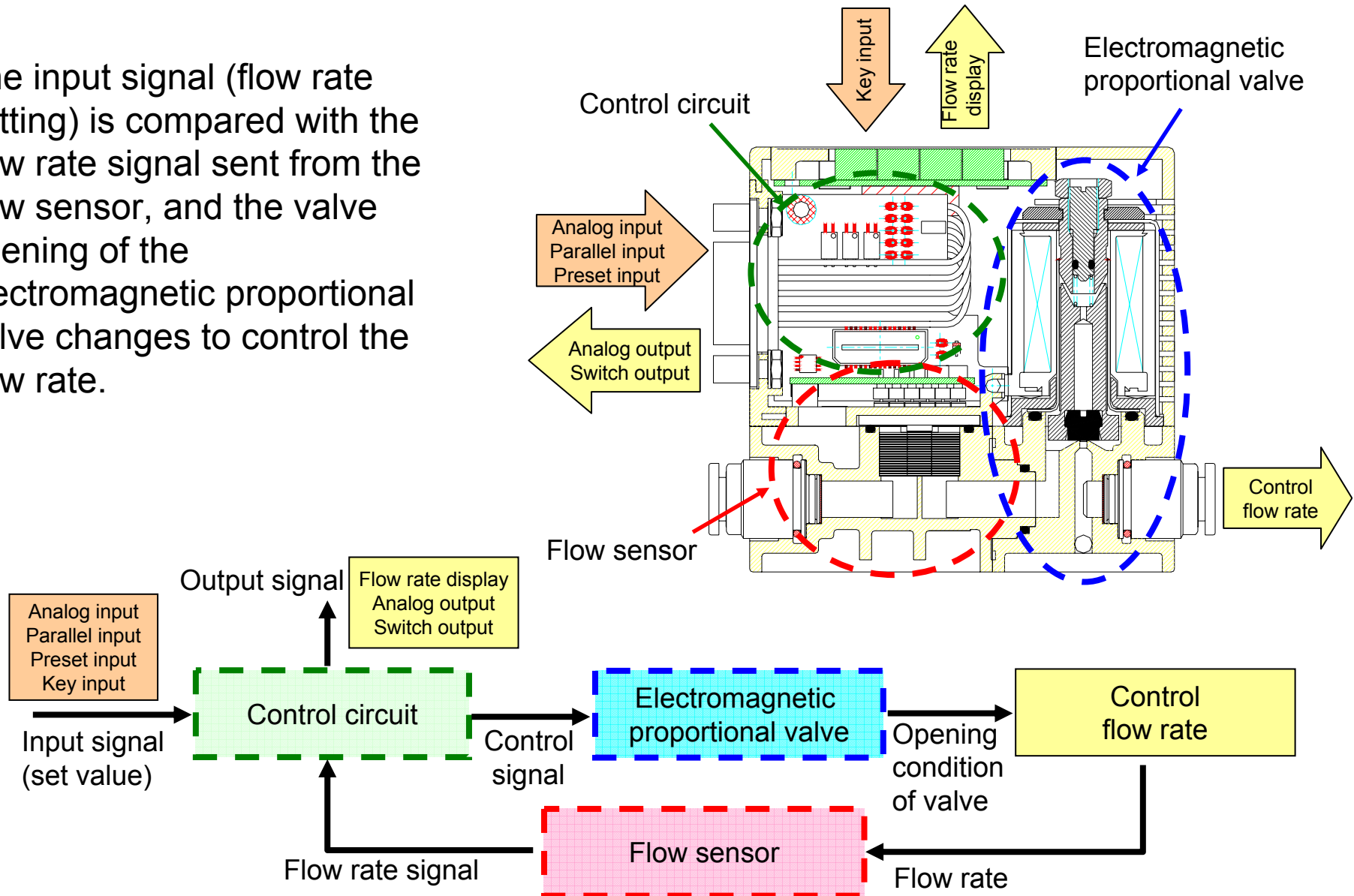
	Model No.	Applicable fluids	Flow rate control range (ℓ/min)					Body material	Port size	
			0.01	0.1	1	10	100			
Air type	FCM-9500 AI	<div>AIR</div> <div>Air</div> <div>N<sub>2</sub></div> <div>Nitrogen</div>						0.015 to 0.5	<div>Resin</div> 	<div>Resin</div> <div>ø6 push in</div> <div>ø8 push in</div>
	FCM-0001 AI							0.03 to 1		
	FCM-0002 AI							0.06 to 2	<div>SUS</div> 	<div>SUS</div> <div>Rc1/4</div> <div>9/16-18 UNF</div>
	FCM-0005 AI							0.15 to 5		
	FCM-0010 AI							0.3 to 10		
	FCM-0020 AI							0.6 to 20		
	FCM-0050 AI							1.5 to 50		
	FCM-0100 AI (only resin type)							3 to 100		
Gas type	FCM-9500 AR	<div>Ar</div> <div>Argon</div>						0.015 to 0.5	<div>SUS</div> 	<div>Rc1/4</div> <div>9/16-18 UNF</div>
	FCM-0001 AR							0.03 to 1		
	FCM-0002 AR							0.06 to 2		
	FCM-0005 AR							0.15 to 5		
	FCM-0010 AR							0.3 to 10		
	FCM-0020 AR							0.6 to 20		
	FCM-0050 AR							1.5 to 50		
	FCM-0100 AR							3 to 100		
Gas type	FCM-9500 O <sub>2</sub> /LN/C <sub>1</sub> /C <sub>3</sub>	<div>O<sub>2</sub></div> <div>Oxygen</div> <div>13A</div> <div>City gas</div> <div>CH<sub>4</sub></div> <div>Methane</div> <div>C<sub>3</sub>H<sub>8</sub></div> <div>Propane</div>						0.015 to 0.5	<div>SUS</div> 	<div>Rc1/4</div> <div>9/16-18 UNF</div>
	FCM-0001 O <sub>2</sub> /LN/C <sub>1</sub> /C <sub>3</sub>							0.03 to 1		
	FCM-0002 O <sub>2</sub> /LN/C <sub>1</sub> /C <sub>3</sub>							0.06 to 2		
	FCM-0005 O <sub>2</sub> /LN/C <sub>1</sub> /C <sub>3</sub>							0.15 to 5		
	FCM-0010 O <sub>2</sub> /LN/C <sub>1</sub> /C <sub>3</sub>							0.3 to 10		
	FCM-0020 O <sub>2</sub> /LN/C <sub>1</sub> /C <sub>3</sub>							0.6 to 20		
Gas type	FCM-0002 H <sub>2</sub> /HE	<div>H<sub>2</sub></div> <div>Hydrogen</div> <div>He</div> <div>Helium</div>						0.06~2	<div>SUS</div> 	<div>Rc1/4</div> <div>9/16-18 UNF</div>
	FCM-0005 H <sub>2</sub> /HE							0.15~5		
	FCM-0010 H <sub>2</sub> /HE							0.3~10		
	FCM-0020 H <sub>2</sub> /HE							0.6~20		



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## FCM Series

The input signal (flow rate setting) is compared with the flow rate signal sent from the flow sensor, and the valve opening of the electromagnetic proportional valve changes to control the flow rate.

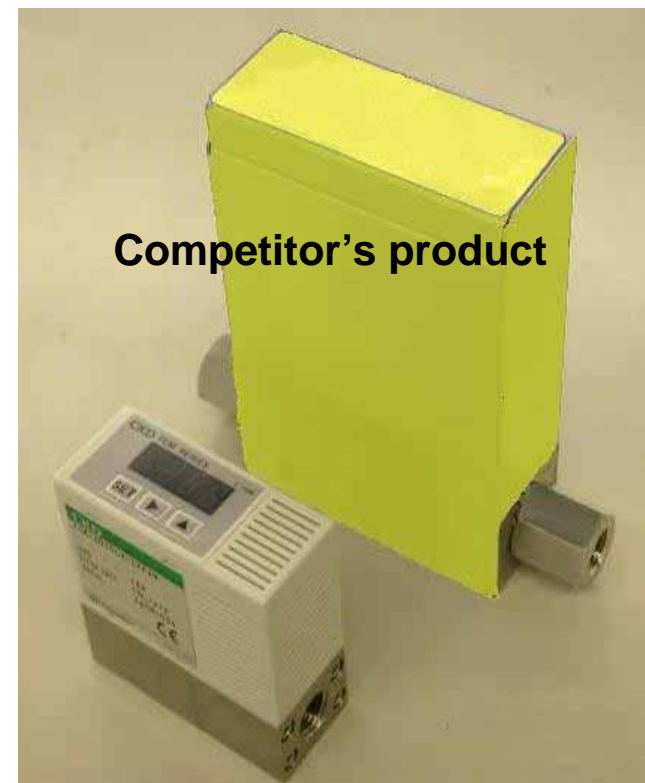
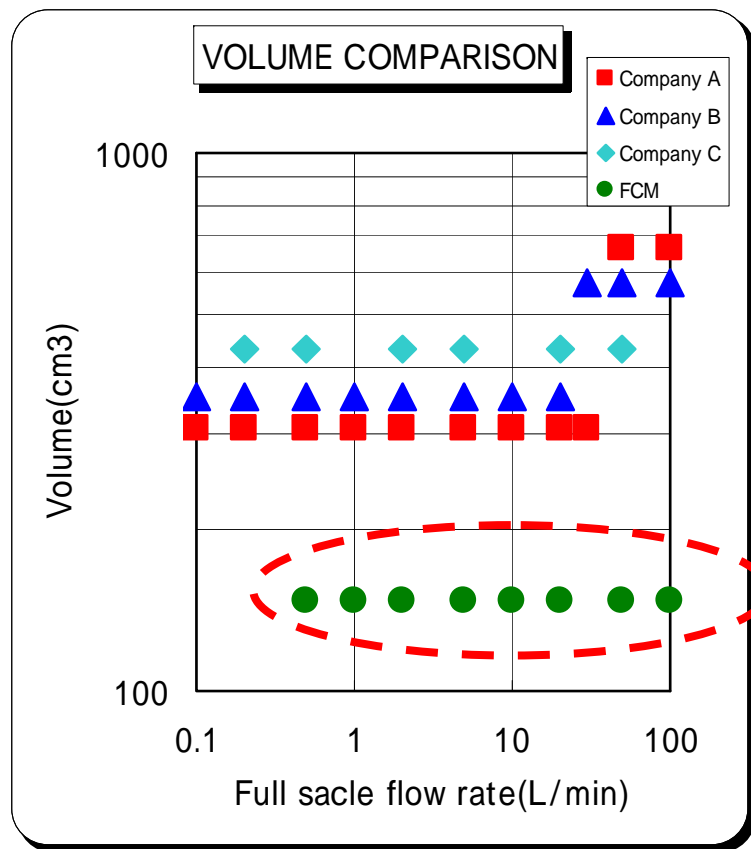




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## FCM series Volume comparison

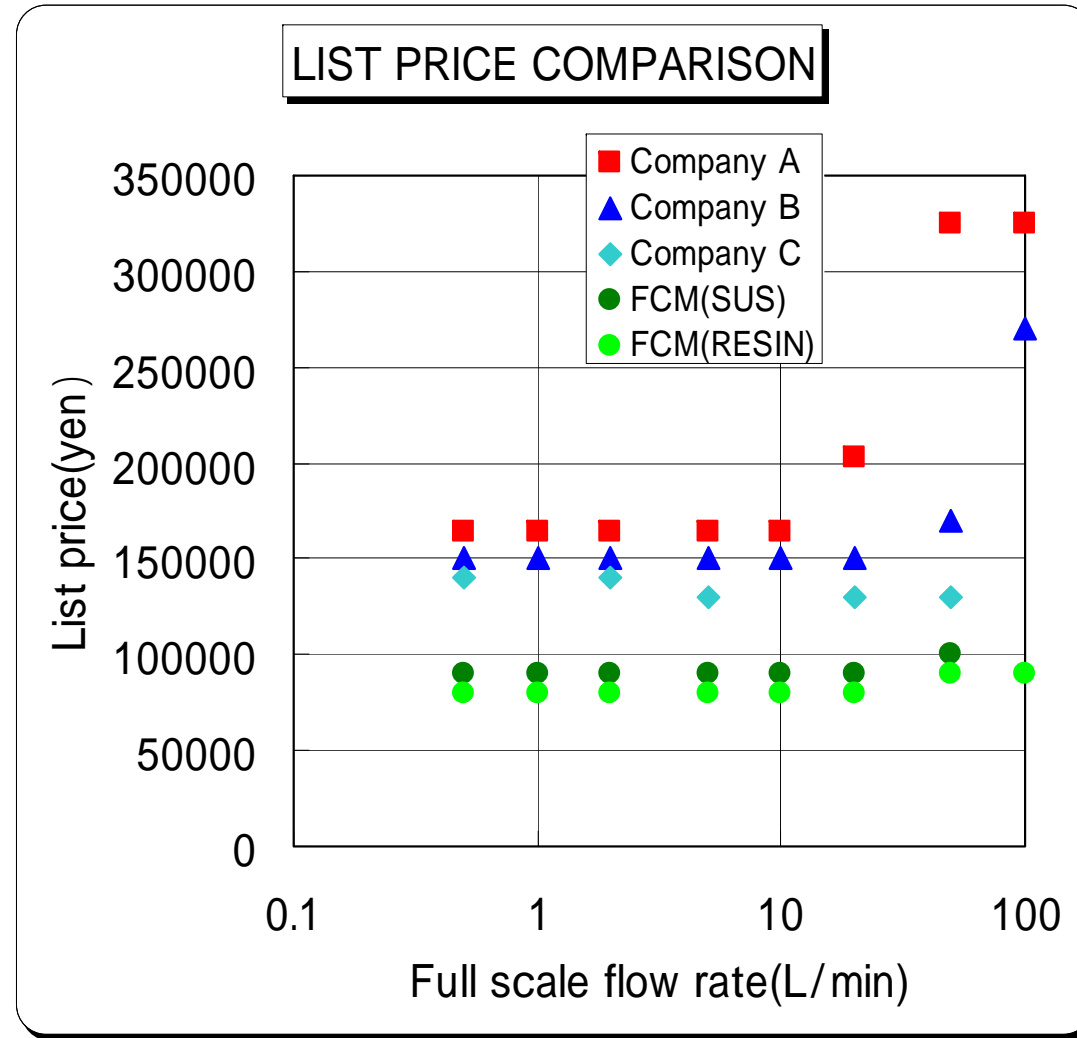
Only 1/3 volume compared with competitors' products, can be installed in narrower space.





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## FCM series List price comparison



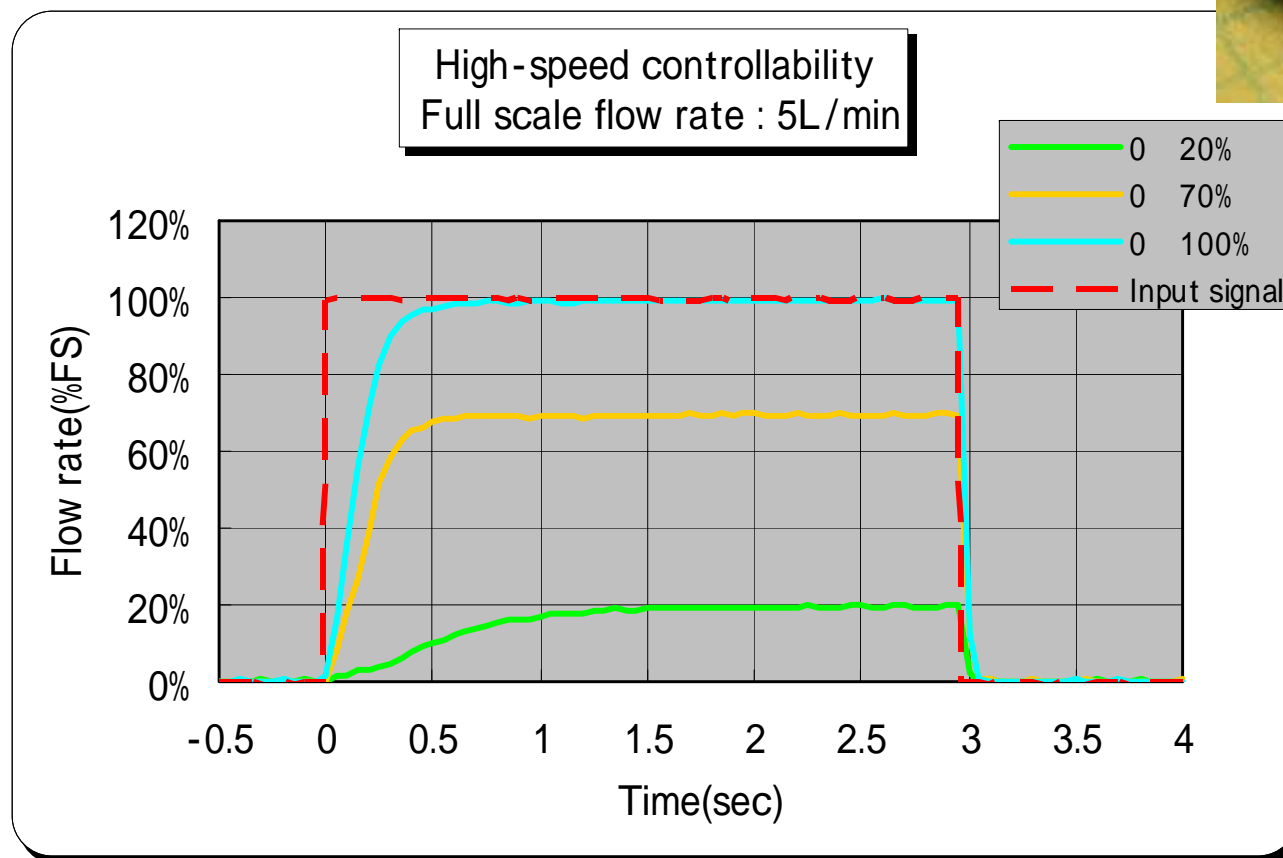
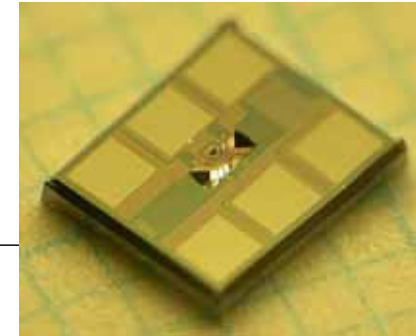


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## FCM series High-speed controllability 1

SENSOR CHIP

High-speed controllability has been realized by platinum sensor chip, applied silicone micro-machining.





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## FCM series High-speed controllability 2

If a pressure is fluctuated, flow rate is controlled rapidly.

