Flow Control Valve

List of Flow Control Valve

Gas Liquid

Precision Needle Valve

MODEL 2412 SERIES

Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min

P095

Gas Liquid

Precision Needle Valve with Multidial

MODEL 2412M SERIES

Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min

P098

Gas Liquid

Bellows Needle Valve

MODEL 2450 SERIES

Max. flow rate:

Gas 5mL/min-50L/min

Liquid 5mL/min-1L/min

■ Low leak

P099

Gas Liquid

Grease-less Needle Valve

MODEL 2420 SERIES

Max. flow rate:

Gas 20-180L/min

Liquid 500mL/min-4L/min

P101

Gas Liquid

Simplified Needle Valve

MODEL 2400 / 2400A SERIES

Max. flow rate:

Gas 5-50L/min

Liquid 200mL/min-1L/min

P103

Gas Liquid

Precision Needle Valve for Large flow rate

MODEL 2412D SERIES

Max. flow rate:

Gas 150-350L/min

Liquid 6-15L/min

P104

Gas Liquid

Flow Controller for Fluctuating outlet pressure

MODEL 2203 SERIES

Max. flow rate:

Gas 10mL/min-20L/min

■ Available for pressure fluctuations

P105

Gas Liquid

Flow Controller for Fluctuating supply pressure

MODEL 2204 SERIES

Max. flow rate:

Gas 10mL/min-10L/min

■ Available for pressure fluctuations

P106

Gas Liquid

Liquid Flow Controller

MODEL 2600-S SERIES

Max. flow rate:

Liquid 10mL/min-1L/min

■ Available for pressure fluctuations

P107

Fluid

Gas Liquid

Liquid

Liquid Flow Controller

MODEL 2600-PPS SERIES

Max. flow rate:

Liquid 10mL/min-1L/min

■ Available for pressure fluctuations

P108

Gas

Small Proportional Solenoid Valve

MODEL 3000 SERIES

P109

About Flow Control Valve

Types of flow control valves

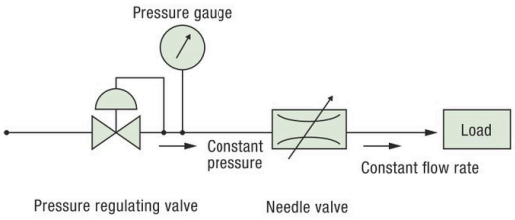
[1] Needle valves

The needle valve is designed to adjust the opening of a small orifice in the flow path with an acicular or bar-shaped needle to control a flow rate by a resistance change of the flow path, serving as a resistor in a way. Accordingly, the flow rate changes as the pressure applied to the valve changes. To cope with this, a pressure regulator is installed in the front stage as shown in **Fig. A** to ensure that the constant pressure is applied to the valve, thereby obtaining a constant flow rate.

This method is inexpensive and effective when there is no change in the pressure loss on the valve outlet side (secondary side), and is frequently used.

The needle valves are largely classified into the simple and precision types. The simple type has a needle part integrated with a knob part. When adjusting a flow rate, the needle part moves rotationally to control the flow rate. For the precision type, on the other hand, the needle part is not integrated with the knob part, and the needle part moves irrotationally. The precision type is superior in both easy setting of the flow rate and stability.

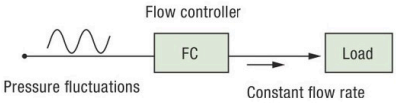
Fig. A. Flow rate control by needle valve



[2] Flow controller for fluctuating supply pressure

It is a flow controller that combines the functions of the needle valve in **[1]** and the pressure regulator. Even if the supply-side pressure changes, the flow rate can be always maintained constantly. (**Fig. B**)

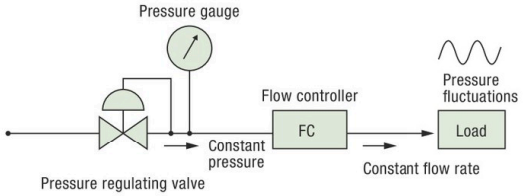
Fig. B. Flow rate control by Flow controller for fluctuating supply pressure



[3] Flow controller for fluctuating outlet pressure

If the pressure loss of outlet side changes, flow rate may also change for the methods of **[1]** and **[2]**. In such a case, Flow controller for fluctuating outlet pressure condition is used to control the flow rate in the flow sheet illustrated in **Fig. C**. With the supply-side pressure controlled by the regulator, the flow controller unsusceptible to outlet-side pressure fluctuations allows flow rate control affected by neither the supply nor outlet pressure.

Fig. C. Flow rate control by Flow controller for fluctuating outlet pressure



[4] Liquid flow controller

As with the flow controller for gas, the flow rate is kept constantly against one-sided pressure fluctuations by a combination of a needle valve and a diaphragm.

[5] Proportional solenoid valve

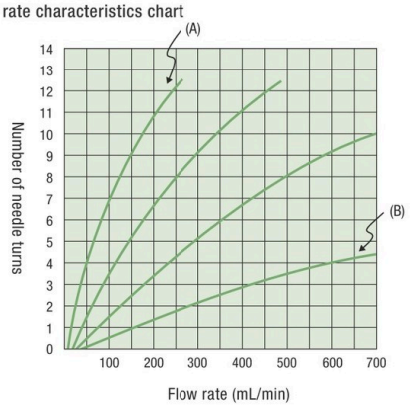
This valve adjusts the opening by the applied voltage or current, not by manual control like the needle valve, to control the flow rate or pressure. Feedback control is avaliable with flow rate sensor or pressure sensor circuit.

Flow rate characteristics chart and CV value

The flow rate control characteristics of the needle valve are shown by the below-mentioned flow rate characteristics chart. In the example below, (B) denotes a use method which changes the flow rate greatly by slightly turning the valve, making setting difficult and losing stability. Accordingly, it is necessary to select conditions as close to the state of (A) as possible.

KOFLOC manufactures each valve suitable to different working conditions. By specifying a needle number or a fluid name, the supply pressure (primary pressure), outlet pressure (load pressure or secondary pressure) and maximum working flow rate, we manufacture and provide the valve with the best control characteristics.

Flow rate characteristics chart



The following describes the CV value used as a flow rate characteristics for the needle valves. The CV value, a kind of flow coefficient, is a guide to indicate approximate flow rate under a certain pressure condition.

The general formulas are as shown in the table.

P_1: Supply-side absolute pressure [MPa (abs)]

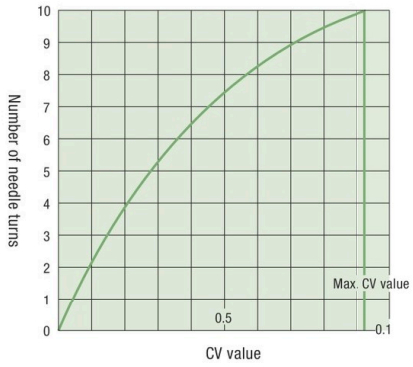
P_2: Outlet-side absolute pressure [MPa (abs)]

Q: Flow rate [m^3/h]

ρ: Specific gravity (Gas: Air = 1, Liquid: Water = 1)

	$P_2 > \frac{P_1}{2}$	$P_2 \leq \frac{P_1}{2}$
Non-viscous liquid	$CV = 0.366Q\sqrt{\frac{\rho}{P_1 - P_2}}$	
Gas (at 20°C)	$CV = \frac{Q}{4170}\sqrt{\frac{\rho\,(273+t)}{(P_1 - P_2)\,P_2}}$	$CV = \frac{Q}{2090P_1}\sqrt{\rho\,(273 + t)}$

With the needle valve, the CV value changes as shown in the figure below, depending on the valve opening. In actual selection of the valve, the Max. CV value in the figure below is important to secure the maximum flow rate.



If this Max. CV value is substituted for the aforementioned formula to obtain Q, the maximum flow rate is derived under the working pressure and temperature conditions. This method, however, becomes less applicable as the flow rate gets more precise, take it only as a guide.

As an example, obtain the flow rate with the valve fully opened when controlling the 20°C air at the supply pressure of 0.1MPa(G) and outlet pressure of 0MPa(G), using the valve of Max. CV 0.075. Assuming the gauge pressure (G) to be the absolute pressure, 0.1MPa(abs) should be added, resulting in the following formula.

$P_1 = 0.2\text{MPa(abs)} \quad P_2 = 0.1\text{MPa(abs)}$

$P_2 \leq \frac{P_1}{2}$

$0.075 = \frac{Q}{2090 \times 0.2}\sqrt{1 \times (273 + 20)}$

* $Q \approx 1.8[m^3/h] = 30[L/min]$

Under the above conditions, accordingly, the flow rate of 30L/min will be limited by switching from fully closed to fully opened.

About Flow Control Valve

Examples of flow rate characteristics of needle valves

KOFLOC's needle valves have various needle numbers according to the flow rate.

Precision type needle numbers

{ SS1, S1, 1, 2, 2A, 3, 3A, 3B, 4, 4A, 5, 6, 6A,
6B, 7 ..... (2412, 2412M)
8, 9, 10 ..... (2412D)

Simple type needle numbers

{ N1, N2, N3 ..... (2400)

Bellows type needle numbers

{ BSS1, BS1, B1, B2, B2A, B3, B3B, B4, B4A,
B5, B6, B6A, B7 ..... (2450)

The following graphs summarize the characteristics of typical needle valves for each Model. Use them only as guides because if they are actually used, they may occur certain discrepancies due to inclusion of errors in the working conditions and instrumental errors, and characteristics arrangement at the differential pressure.

For the gases, arrangement is made with the air as the typical one. For other gases, multiply a flow rate value by

$$\sqrt{\frac{\text{Air molecular weight } 28.8}{\text{Gas molecular weight}}}$$

and use a resultant value as a guide.

(Example) He flow rate = Air flow rate $\times \sqrt{\frac{28.8}{4}}$

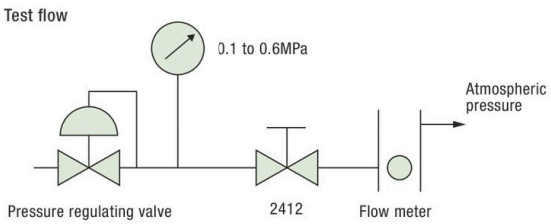
For the liquids, water is assumed to be the typical one. For other liquids, multiply a flow rate value by

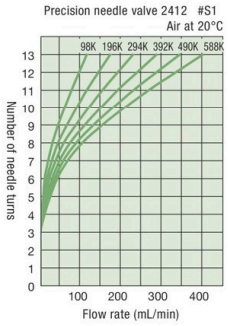
$$\sqrt{\frac{\text{Specific gravity of water}}{\text{Specific gravity of liquid}}}$$

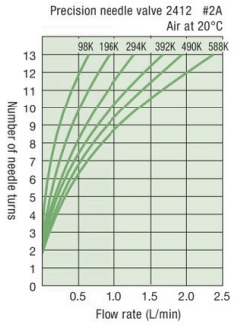
In the case of high viscosity, however, inquire our sales because there is a viscosity coefficient.

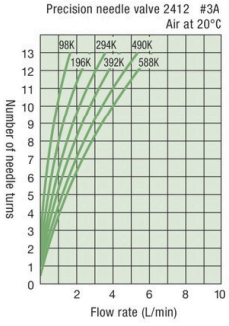
Flow Control Valve

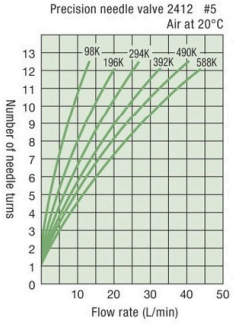
2412 Examples of flow rate control characteristics (Unit: K = kPa)

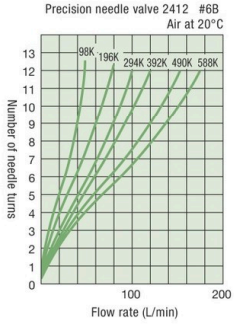


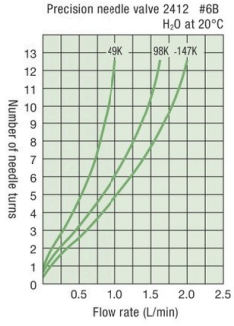




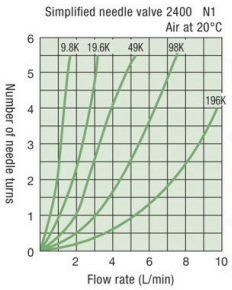


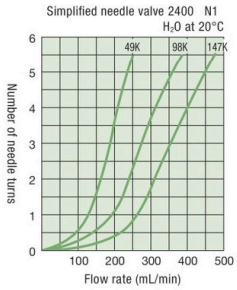


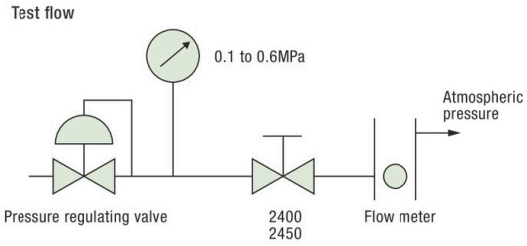


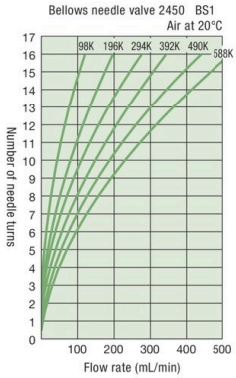


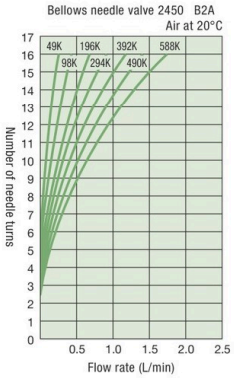
2400/2450 Examples of flow rate control characteristics (Unit: K = kPa)

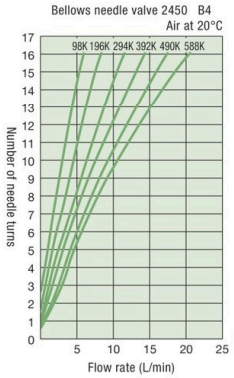


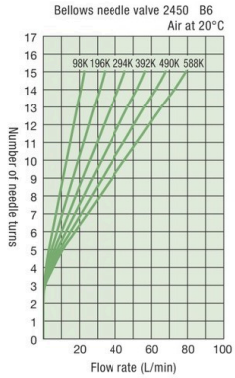




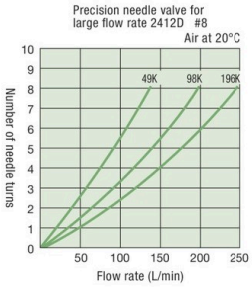


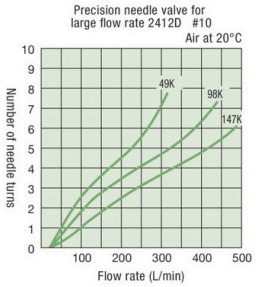


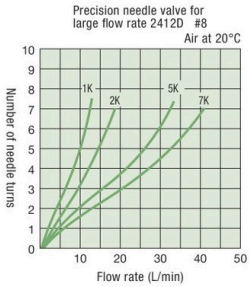


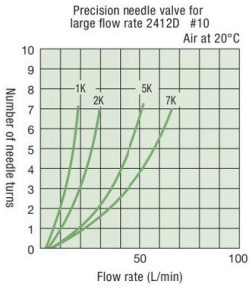


2412D Examples of flow rate control characteristics (Unit: K = kPa)









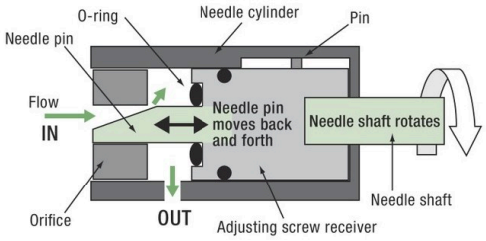
Flow Control Valve

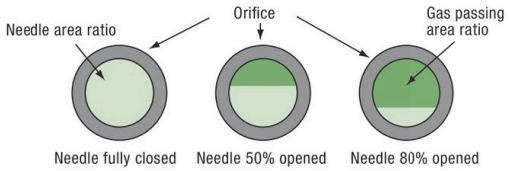
About Flow Control Valve

Principle of the Precision needle valve (2412)

When a needle shaft is roated, its movement is conveyed to an adjusting screw receiver. The adjusting screw receiver takes a rotational force, but blocks a rotary motion by a pin attached to it. Energy by the rotational force moves the adjusting screw receiver back and forth along a pin groove. This moves a needle pin attached to the end of the adjusting screw receiver back and forth. The needle pin moves back and forth through an orifice with a constant hole to adjust the opening of the orifice, narrowing down a flow rate coming in from the IN side.

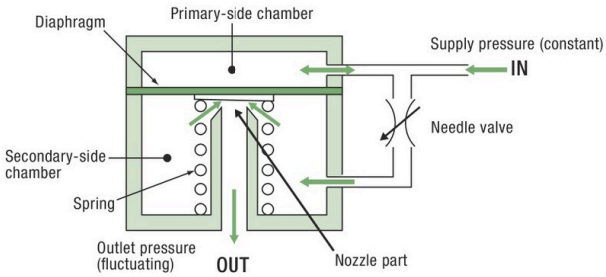
Model 2412 has very high adjustability among general needle valves. Capable of selecting 15 types of ranges, it is used not only for the flow controllers 2203 and 2204, but also our flow meters with needle valve. It is a must for strict flow rate adjustment.





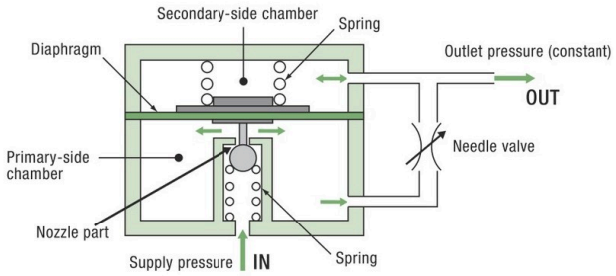
Principle of the Flow controller for fluctuating outlet pressure (2203)

When the gas is supplied from the IN side by the constantly kept pressure, the primary-side chamber is filled with the supply pressure and the gas enters the secondary-side chamber through the needle valve. The primary-side and secondary-side chambers are partitioned by a diaphragm. A spring force is applied to the pressure in the secondary-side chamber balanced with the constant pressure in the primary-side chamber. The nozzle part adjusts a gas outflow so that the pressure in the secondary-side chamber is kept balanced, and the differential pressure before and after the needle valve is always kept constant. As this indicates that a gas flow rate is only associated with the opening of the needle valve, it is not affected by the outlet pressure.



Principle of the Flow controller for fluctuating supply pressure (2204)

The fluctuating pressure gas supplied from the IN side enters the primary-side chamber through the nozzle part. Passing through the needle valve, it is discharged to the OUT side, and part of it enters the secondary-side chamber. The primary-side and secondary-side chambers are partitioned by a diaphragm. The secondary-side chamber is exposed to a constant pressure and a spring force. In order to keep a balance with this, the pressure of the gas entering the primary-side chamber is adjusted by the nozzle part. Striking a pressure balance between the secondary-side and primary-side chambers, the differential pressure before and after the needle valve is always kept constant. As this indicates that a gas flow rate is only associated with the opening of the needle valve, it is not affected by the supply pressure.



Precautions for handling the flow control valves

- The needle valve cannot assure a constant flow rate continuously. Opening/closing of other valves, temperature change, impact, etc. may be the factors to change the flow rate. Set a period to monitor and readjust it.
- The needle valve is designed to “control a fluid.” It does not assure complete shutoff. To stop a flow of the fluid, install a stop valve additionally. Note that if the needle valve is turned more than necessary, the product may be damaged.

Precision Needle Valve

MODEL 2412 SERIES

Gas Liquid

Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc. Liquid H_2O

Max. flow rate Gas 5mL/min to 100L/min (Air at 20°C, 0.1MPa differential pressure) Liquid 5mL/min to 2L/min (H_2O at 20°C, 0.1MPa differential pressure)

* Up to the working conditions. For details, see the reference data.

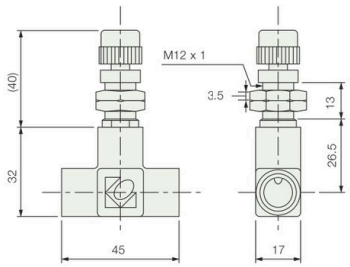
- Stable control of minute flow rate
- Superior control performance by a non-rotating structure
- Capable of selecting optimum controllability according to the working conditions with wide variety of needles

2412L

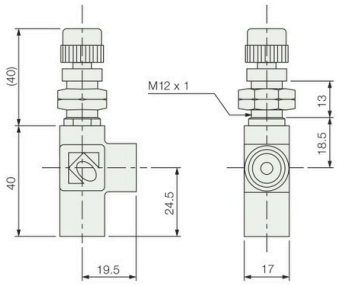
2412T

Dimensions

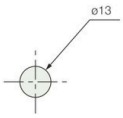
<<2412T>>



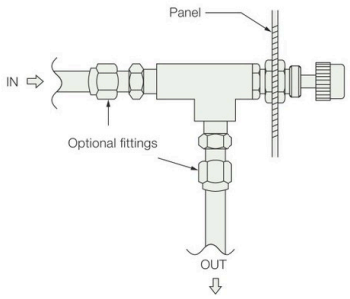
<<2412L>>



(Cutting dimensions)



Example of use



Standard Specifications

MODEL	2412	
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.	H_2O
Number of turns of regulating screw	Approx. 12 turns	
Max. working pressure	1MPa(G)	
Max. working temperature	SS: 120°C B: 70°C	
Materials of parts in contact with fluid	SS: SUS316, PCTFE, FKM B: Brass, POM, NBR, SUS316	
Connection	Rc1/4	
Weight	Approx. 150g	

Flow Control Valve

Flow ratings table (reference)

Flow rate when the valve is fully opened to atmosphere.

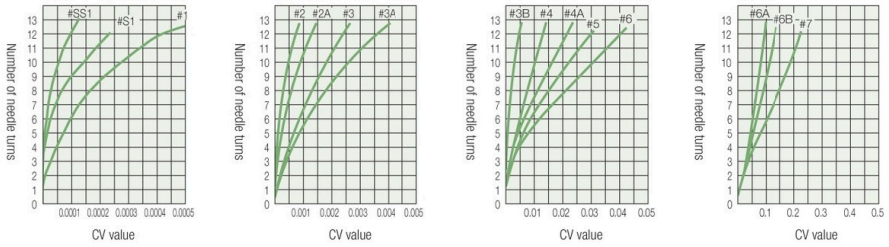
Unit of flow rate: L/min

Needle No.	Supply pressure (MPa(G)) (Air at 20˚C)							Supply pressure (MPa(G)) (H_2O at 20˚C)		
	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.05	0.1	0.15
#SS1	0.023	0.047	0.078	0.11	0.15	0.19	0.22	–	–	–
#S1	0.068	0.11	0.20	0.27	0.34	0.40	0.47	–	–	–
#1	0.15	0.23	0.36	0.51	0.65	0.79	0.93	0.00145	0.0026	0.0036
#2	0.34	0.46	0.71	1.0	1.2	1.5	1.75	0.0076	0.012	0.0153
#2A	0.45	0.65	1.0	1.3	1.65	2.0	2.3	0.0132	0.0195	0.0245
#3	0.9	1.3	2.0	2.6	3.25	3.9	4.6	0.0260	0.0390	0.0510
#3A	1.25	1.9	2.75	3.65	4.5	5.3	6.4	0.0365	0.0546	0.0740
#3B	1.85	2.5	3.7	5.0	6.0	7.2	8.3	0.053	0.0760	0.0980
#4	4.3	6.2	9.0	12.0	15.0	18.3	22.0	0.124	0.188	0.234
#4A	8.0	11.0	15.0	21.0	26.0	31.0	36.0	0.228	0.336	0.417
#5	10.0	14.0	21.0	27.0	33.0	40.0	46.0	0.294	0.435	0.576
#6	22.0	31.0	45.0	60.0	75.0	92.0	105.0	0.564	0.834	1.100
#6A	30.0	41.0	60.0	80.0	100	118	138	0.774	1.190	–
#6B	38.0	53.0	82.0	106	135	160	185	1.280	1.950	–
#7	80.0	110	160	215	260	285	310	1.840	2.890	–

* An actual flow rate may deviate from the values in the table within a range of 80% to 130% depending on the working conditions and instrumental errors. Use them as reference values.
* The above table shows a data example of the 2412L. Due to a structural difference, if a flow rate increases, 2412L shows better flow characteristics than the 2412T. So 2412L is recommended for over 5L/min flow rate condition.

CV value (reference)

Needle No.	MAX CV value
#SS1	0.00012
#S1	0.00022
#1	0.00058
#2	0.0012
#2A	0.0016
#3	0.0033
#3A	0.0048
#3B	0.0063
#4	0.016
#4A	0.028
#5	0.035
#6	0.078
#6A	0.10
#6B	0.13
#7	0.28



Ordering

MODEL	Shape	Material	Connection	Fluid	Inlet / outlet differential pressure	Max. flow rate	Other options
2412	L	SS: SUS316	1/4: Rc1/4				FFKM O-ring
	T	B: Brass	1/8: Rc1/8				With lock nut
Illustrative example: 2412	L	SS	1/4	N_2	0.3MPa	5L/min	

* We will select an optimum needle number based on the conditions such as the pressure, fluid and flow rate. Use the ratings table only as reference.
* No shutting O-ring for FFKM option.

Performance comparison data of 2412 and 2400 (reference)

Followings are the comparison survey at low pressure conditions.
See them as the performance comparison reference data of the precision needle valve 2412 and the simplified needle valve 2400.
They are typical values, not guaranteed ones.

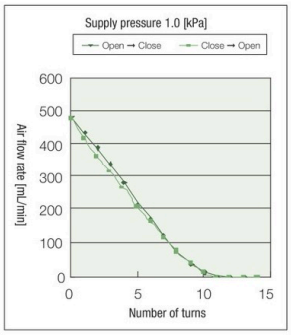
[Items] 2412T-SS-1/4-Air-#4
2400T-S-1/4-N1

[Hysteresis characteristics]
(Fluid) Air (Supply pressure) 1kPa (Hysteresis check) Needle open → Close → Open

2412T

Supply pressure 1.0 [kPa]

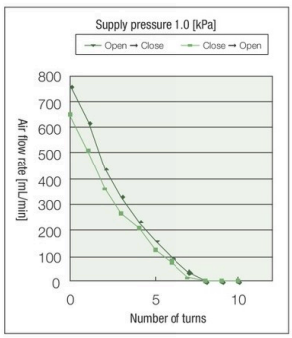
Number of turns	Air flow rate [mL/min]	
	Open → Close	Close → Open
0	480	475
1	435	415
2	390	360
3	340	315
4	285	265
5	220	205
6	175	165
7	124	118
8	75	75
9	37	38
10	13	12
11	1	0
12	0	0
13	0	0
14	0	0



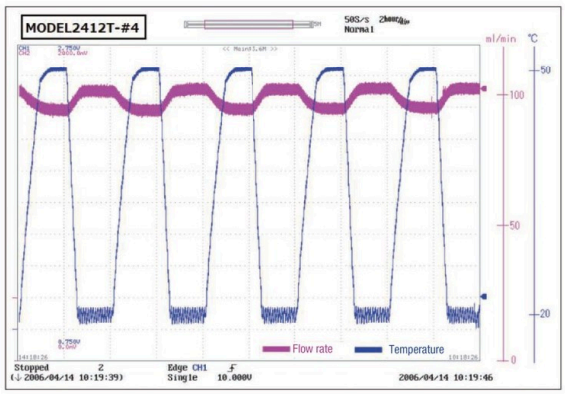
2400T

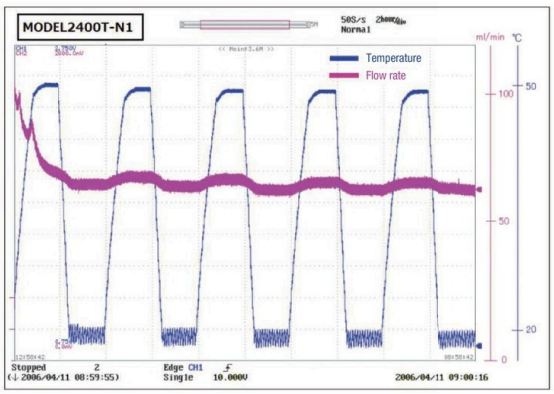
Supply pressure 1.0 [kPa]

Number of turns	Air flow rate [mL/min]	
	Open → Close	Close → Open
0	760	650
1	620	510
2	440	360
3	330	265
4	235	205
5	160	125
6	95	75
7	40	16
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0



[Temperature condition flow rate stability test]
(Ambient temperature setting) Starting from 20°C, repeat 5 cycles of 20°C → 50°C, 3 hours → 20°C, 3 hours.





(Supplementary explanation)
In the above data, Model 2412 is superior in both the restorability of hysteresis and the flow rate stability under temperature change condition. This is because the precision needle 2412 has an adjusting shaft and a needle separated, converts a rotating direction into a translatory motion and its conversion threads are provided with a backlash-free mechanism, allowing very stable adjustment and setting, whereas the simplified needle 2400 is a single-axis rotary needle where a knob adjusting shaft itself is a needle shaft. (See Page 93 for the detailed principle) The valve part of the 2412 is used for the precision flow meters such as RK1200 and the flow controllers of the valves 2203, 2204 and 2600. The 2400 is used for simple flow meters such as RK1600R. Select the models conforming to your specifications (performance, cost, etc.). It is recommended to test at harsh working conditions with an actual machine.

Precision Needle Valve with Multidial

MODEL 2412M SERIES

Gas Liquid

Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc. Liquid H_2O

Max. flow rate Gas 5mL/min to 100L/min (Air at 20°C, 0.1MPa differential pressure) Liquid 5mL/min to 2L/min (H_2O at 20°C, 0.1MPa differential pressure)

* Up to the working conditions. For details, see the reference data.

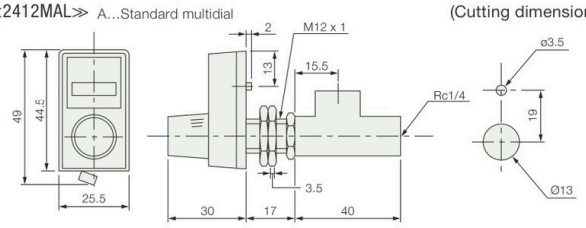
2412MAT

2412MBL

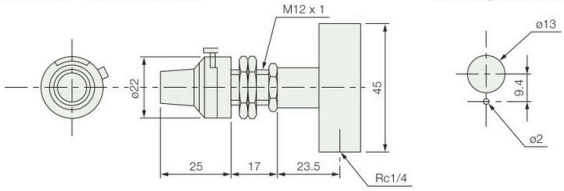
- Capable of setting flow rate at the scale of multidial
- Stable control of minute flow rate
- Superior control performance by a non-rotating structure
- Capable of selecting optimum controllability according to the working conditions with wide variety of needles

Dimensions

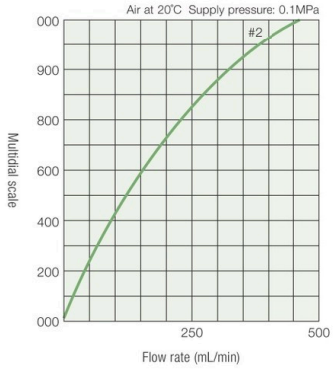
≪2412MAL≫ A...Standard multidial (Cutting dimensions)



≪2412MBT≫ B...Round multidial (Cutting dimensions)



Example of flow rate characteristics



Standard Specifications

MODEL	2412M	
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.	H_2O
Number of turns of regulating screw	Approx. 12 turns	
Max. working pressure	1MPa(G)	
Max. working temperature	SS: 120°C B: 70°C	
Materials of parts in contact with fluid	SS: SUS316, PCTFE, FKM B: Brass, POM, NBR, SUS316	
Connection	Rc1/4	
Weight	Approx. 170g	

* Dial scale range: 000 to 999 (no scale calibration)
* The 2412M and 2412 have opposite screw turning directions to each other.

Ordering

MODEL	Multidial	Shape	Material	Connection	Fluid	Inlet / outlet differential pressure	Max. flow rate
2412M	A: Standard B: Round type	L T	SS: SUS316 B: Brass	1/4: Rc1/4 1/8: Rc1/8			
Illustrative example: 2412M	A	L	SS	1/4	N_2	0.3MPa	5L/min

* We will select an optimum needle number based on the conditions such as the pressure, fluid and flow rate. Use the ratings table only as reference.
* See the 2412 for the flow rating.

Flow Control Valve

Bellows Needle Valve

MODEL 2450 SERIES

Gas Liquid

Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc. Liquid H_2O

Max. flow rate Gas 5mL/min to 50L/min (Air at 20°C, 0.1MPa differential pressure) Liquid 5mL/min to 1L/min (H_2O at 20°C, 0.1MPa differential pressure)

* Up to the working conditions. For details, see the reference data.

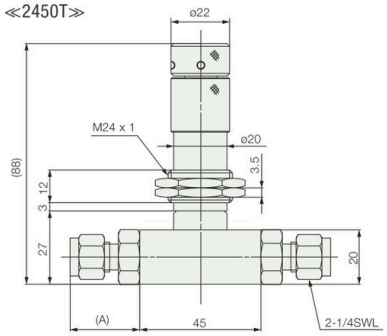
- Low leak thanks to bellows seal
- Stable control of minute flow rate
- Superior control performance by a non-rotating structure
- Capable of selecting optimum controllability according to the working conditions with wide variety of needles

2450L

2450T

Dimensions

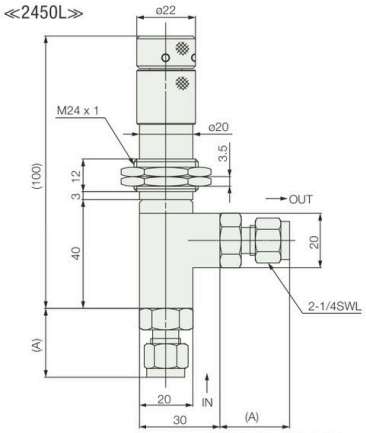
≪2450T≫



(A) depends on the fittings.

(A: 1/4SWL: 26)

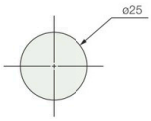
≪2450L≫



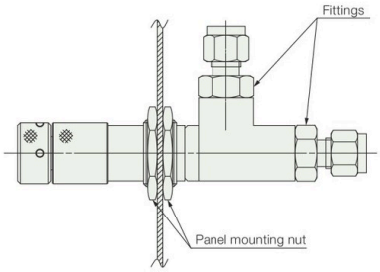
(A) depends on the fittings.

(A: 1/4SWL: 26)

(Cutting dimensions)



Example of use



Standard Specifications

MODEL	2450	
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.	H_2O
Number of turns of regulating screw	Approx. 13 to 16 turns (effective turns: 5 to 16)	
Max. working pressure	1MPa(G)	
Max. working temperature	120°C	
Materials of parts in contact with fluid	SUS316, PCTFE, FKM	
Connection	Standard: 1/4SWL type Option: 1/8SWL type	
Weight	Approx. 270g	

Flow Control Valve

Flow ratings table (reference)

Flow rate when the valve is fully opened to atmosphere.

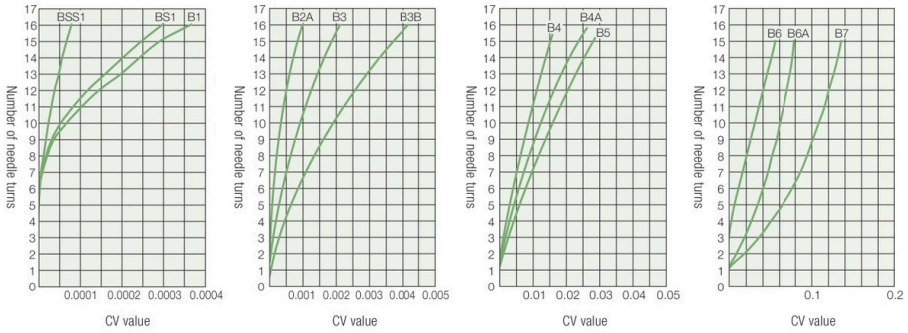
Unit of flow rate: L/min

Needle No.	Supply pressure (MPa(G)) (Air at 20˚C)							Supply pressure (MPa(G)) (H_2O at 20˚C)		
	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.05	0.1	0.15
BSS1	0.016	0.032	0.058	0.086	0.115	0.14	0.18	–	–	–
BS1	0.074	0.12	0.20	0.28	0.34	0.44	0.52	–	–	–
B1	0.10	0.16	0.24	0.34	0.42	0.53	0.60	–	–	–
B2	0.12	0.19	0.29	0.41	0.50	0.63	0.72	0.0010	0.0017	0.0024
B2A	0.25	0.39	0.60	0.82	1.05	1.30	1.50	0.010	0.015	0.018
B3	0.67	0.98	1.55	2.10	2.65	3.20	3.70	0.019	0.029	0.037
B3B	1.10	1.7	2.5	3.4	4.3	5.1	5.9	0.034	0.05	0.067
B4	4.4	6.3	9.4	12.0	16.0	19.2	22.0	0.15	0.21	0.27
B4A	6.7	9.8	13.9	19.0	24.0	27.9	31.6	0.23	0.32	0.40
B5	7.8	11.3	16.5	20.0	28.0	33.0	38.0	0.26	0.35	0.46
B6	15.3	20.5	32.0	44.0	55.0	68.0	80.0	0.46	0.66	0.79
B6A	21.0	32.0	51.0	70.0	90.0	110	128	0.72	1.0	1.15
B7	40.0	55.0	100	130	170	195	230	1.18	1.7	1.95

* An actual flow rate may deviate from the values in the table within a range of 80% to 130% depending on the working conditions and instrumental errors. Use them as reference values.
* The above table shows a data example of the 2450L. Due to a structural difference, if a flow rate increases, 2450L shows better flow characteristics than the 2450T. So 2450L is recommended for over 5L/min flow rate condition.

CV value (reference)

Needle No.	Max. CV value
BSS1	0.00008
BS1	0.0003
B1	0.0004
B2	0.0005
B2A	0.00098
B3	0.0025
B3B	0.0043
B4	0.016
B4A	0.025
B5	0.028
B6	0.051
B6A	0.08
B7	0.14



Ordering

MODEL	Shape	Material	Connection	Fluid	Inlet / outlet differential pressure	Max. flow rate	Other options
2450	L	SS: SUS316	1/4SWL type				FFKM O-ring
	T		1/8SWL type				
Illustrative example: 2450	L	SS	1/4SW	N_2	0.3MPa	5L/min	

* We will select an optimum needle number based on the conditions such as the pressure, fluid and flow rate. Use the ratings table only as reference.
* No shutting O-ring for FFKM option.
* 'SWL type' is shortened to SW in Orcering code.

Grease-less Needle Valve

MODEL 2420 SERIES

Gas Liquid

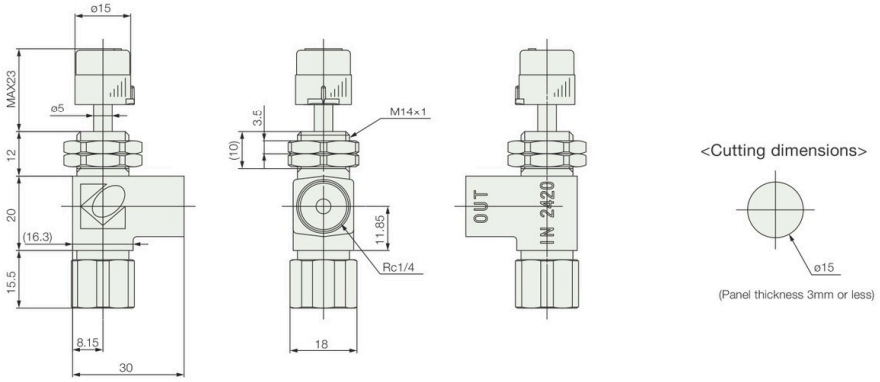
Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc. Liquid H_2O

Max. flow rate Gas 20 to 180L/min (Air at 20°C, 0.1MPa differential pressure) Liquid 500mL/min to 4L/min (H_2O at 20°C, 0.1MPa differential pressure)

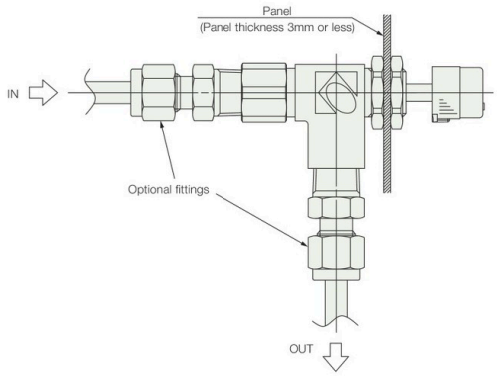
* Up to the working conditions. For details, see the reference data.

■ Grease-less design

Dimensions



Example of use



Standard Specifications

MODEL	2420	
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.	H_2O
Number of turns of regulating screw	Approx. 10 turns	
Max. working pressure	0.6MPa(G)	
Max. working temperature	80°C	
Materials of parts in contact with fluid	SUS304, PP, FKM (Partly coated with PTFE)	
Connection	Rc1/4	
Weight	Approx. 100g	

Flow ratings table (reference)

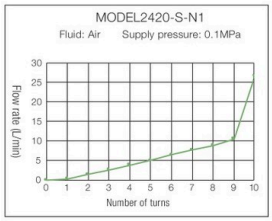
Flow rate when the valve is fully opened to atmosphere.

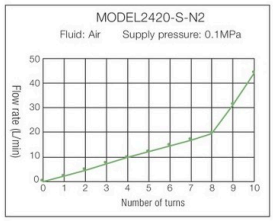
Unit of flow rate: L/min

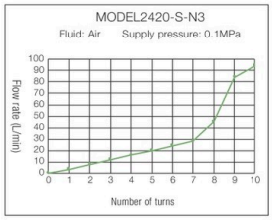
Needle No.	Supply pressure (MPa(G)) (Air at 20˚C)						Supply pressure (MPa(G)) (H_2O at 20˚C)		
	0.05	0.1	0.2	0.3	0.4	0.5	0.05	0.1	0.15
N1	18	26	38	50	62	76	0.60	0.87	1.06
N2	28	40	62	82	102	124	0.98	1.38	1.69
N3	62	92	140	186	234	280	1.91	2.70	3.30
N4	76	112	178	240	298	360	2.31	3.28	4.05
N5	122	182	274	366	462	558	2.95	4.22	5.23

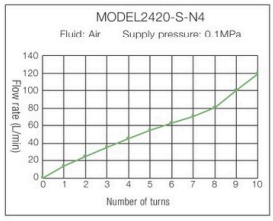
* An actual flow rate may deviate from the values in the table depending on the working conditions and instrumental errors. Use them as reference values.

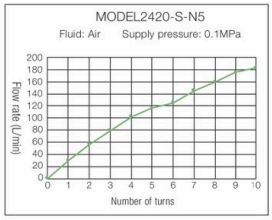
Example of flow rate characteristics (Air, 0.1MPa(G), 20ºC)



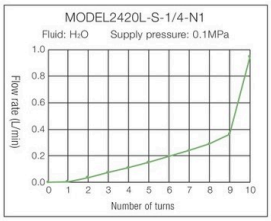


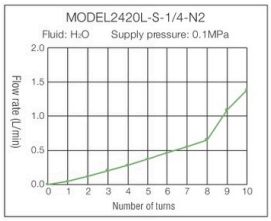


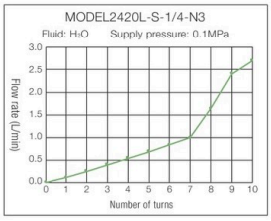


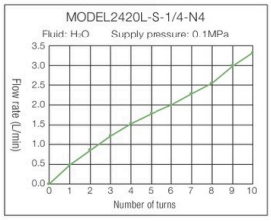


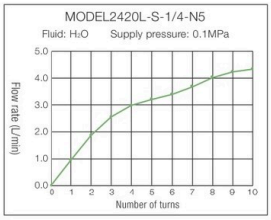
Example of flow rate characteristics (H_2O, 0.1MPa(G), 20ºC)











CV value (reference)

Needle No.	MAX CV value
N1	0.059
N2	0.097
N3	0.188
N4	0.228
N5	0.290

Working flow rate (reference)

Needle No.	Air (0.1MPa(G) at 20˚C)	H_2O (0.1MPa(G) at 20˚C)
N1	from 200mL/min	from 10mL/min
N2	from 1L/min	from 30mL/min
N3	from 1.5L/min	from 50mL/min
N4	from 5L/min	from 150mL/min
N5	from 5L/min	from 150mL/min

Ordering

MODEL	Connection	Fluid	Needle No.
2420	1/4: Rc1/4		N1
			N2
			N3
			N4
			N5

Illustrative example

2420	1/4	H_2O	N1

* This product is excluded from our scope of repair.

Flow Control Valve

Simplified Needle Valve

MODEL 2400 / 2400A SERIES

Gas Liquid

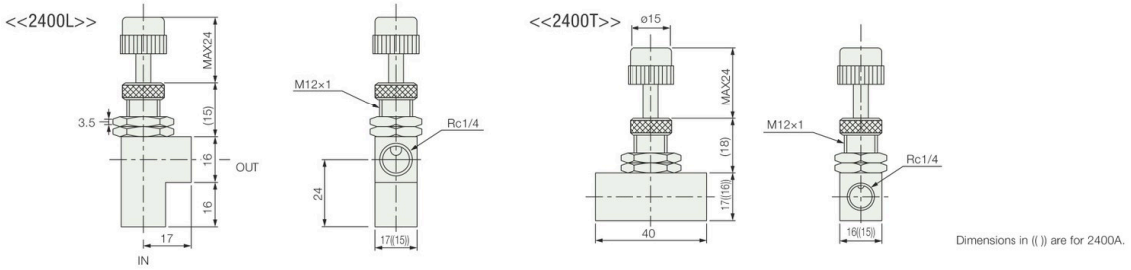
Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc. Liquid H_2O

Max. flow rate Gas 5 to 50L/min (Air at 20°C, 0.1MPa differential pressure) Liquid 200mL/min to 1L/min (H_2O at 20°C, 0.1MPa differential pressure)

* Up to the working conditions. For details, see the reference data.

2400AL-S 2400T-B

Dimensions



Dimensions in (( )) are for 2400A.

Standard Specifications

MODEL	2400, 2400A	
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.	H_2O
Number of turns of regulating screw	Approx. 12 turns (effective turns: 5 to 12)	
Max. working pressure	0.6MPa(G)	
Max. working temperature	S: 60°C B: 60°C	
Materials of parts in contact with fluid	2400A: SUS304, FKM, SUS303, PCTFE 2400: Brass, NBR, SUS303, POM	
Connection	Rc1/4	
Weight	Approx. 100g	

Flow ratings table (reference)

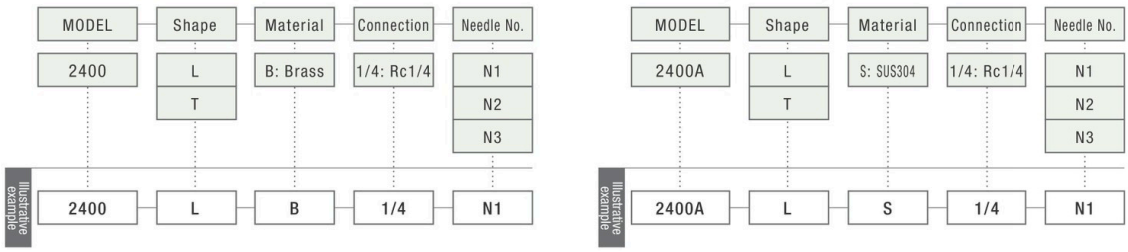
Flow rate when the valve is fully opened to atmosphere.

Unit of flow rate: L/min

Needle No.	Max. CV value	Supply pressure (MPa(G)) (Air at 20°C)					Supply pressure (MPa(G)) (H_2O at 20°C)		
		0.01	0.05	0.1	0.2	0.3	0.05	0.1	0.15
N1	0.018	1.6	5.0	7.5	12.0	15.0	0.16	0.24	0.31
N2	0.03	3.8	9.0	13.0	21.0	27.0	0.26	0.42	0.86
N3	0.13	12.0	31.0	55.0	90	120	1.2	1.8	2.5

* An actual flow rate may deviate from the values in the table depending on the working conditions and instrumental errors. Use them as reference values.

Ordering



Flow Control Valve

Precision Needle Valve for Large flow rate

MODEL 2412D SERIES

Gas Liquid

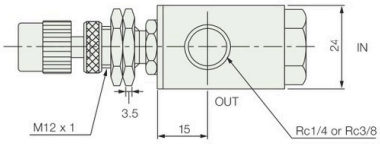
Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc. Liquid H_2O

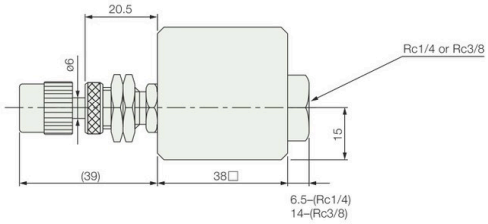
Max. flow rate Gas 150 to 350L/min (Air at 20°C, 0.1MPa differential pressure) Liquid 6 to 15L/min (H_2O at 20°C, 0.1MPa differential pressure)

* Up to the working conditions. For details, see the reference data.

- Stable control of large flow rate
- Superior control performance by a non-rotating structure

Dimensions





Standard Specifications

MODEL	2412D	
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.	H_2O
Number of turns of regulating screw	Approx. 8 to 12 turns	
Max. working pressure	1MPa(G)	
Max. working temperature	SS: 120°C A: 70°C	
Materials of parts in contact with fluid	SS: SUS316, FKM, PCTFE A: Al, Brass, SUS316, NBR, POM	
Connection	Standard: Rc3/8, Option: Rc1/4	

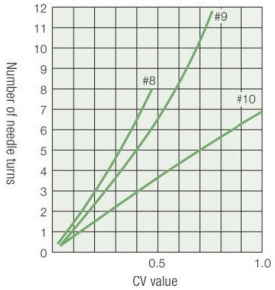
Flow ratings table (reference)

Flow rate when the valve is fully opened to atmosphere. Unit of flow rate: L/min

Needle No.	Max. CV value	Supply pressure (MPa(G)) (Air at 20°C)					Supply pressure (MPa(G)) (H_2O at 20°C)		
		0.01	0.05	0.1	0.2	0.3	0.01	0.05	0.1
#8	0.48	50	135	200	280	370	2.2	4.9	6.9
#9	0.63	72	180	270	423	-	2.9	6.4	9.1
#10	1.06	80	300	440	-	-	4.8	10.8	15.3

* An actual flow rate may deviate from the values in the table depending on the working conditions and instrumental errors. Use them as reference values.

CV value (reference)



Ordering

MODEL	Material	Connection	Fluid	Inlet / outlet differential pressure	Max. flow rate
2412D	SS: SUS316 A: Al	3/8: Rc3/8 1/4: Rc1/4			
Illustrative example: 2412D	SS	3/8	N_2	0.3MPa	100L/min

* We will select an optimum needle number based on the conditions such as the pressure, fluid and flow rate. Use the ratings table only as reference.

Flow Control Valve

Flow Controller for Fluctuating outlet pressure

MODEL 2203 SERIES

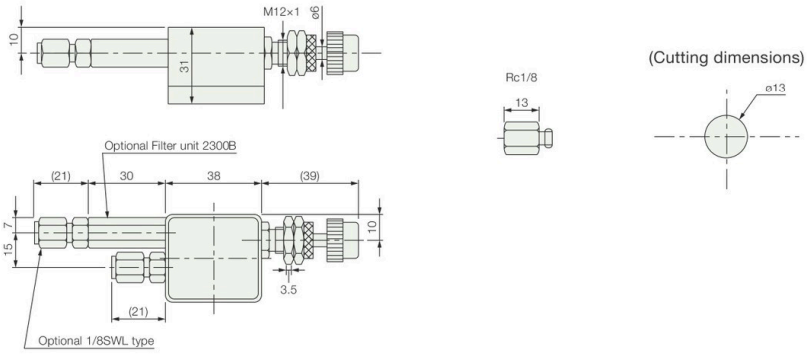
Gas Liquid

Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc.

Max. flow rate Gas 10mL/min to 20L/min (Air at 20°C)

- Capable of holding a constant flow rate against pressure fluctuations on the outlet (secondary) side
- Superior control performance by a non-rotating structure

Dimensions



Standard Specifications

MODEL	2203
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.
Max. flow rate (air at 20°C)	10mL/min to 20L/min
Control accuracy	Within 1% of indication value against load pressure fluctuations (inlet / outlet differential pressure: 0.05MPa or more)
Number of turns of regulating screw	Approx. 12 turns
Max. working pressure	0.8MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	SS: SUS316, PCTFE, FKM A: Al, Brass, SUS316, POM, NBR
Connection	Rc1/8 (M8 + Rc1/8)
Weight	Approx. 160g

Ordering

MODEL	Material	Connection	Fluid	Supply pressure	Max. flow rate	Filter
2203	SS: SUS316 A: Al	1/8: Rc1/8				0: Not included 1: Included
Illustrative example: 2203	SS	1/8	He	0.6MPa	100mL/min	0

* Inlet / outlet differential pressure needs to be 0.05MPa or more.

Flow Control Valve

Flow Controller for Fluctuating supply pressure

MODEL 2204 SERIES

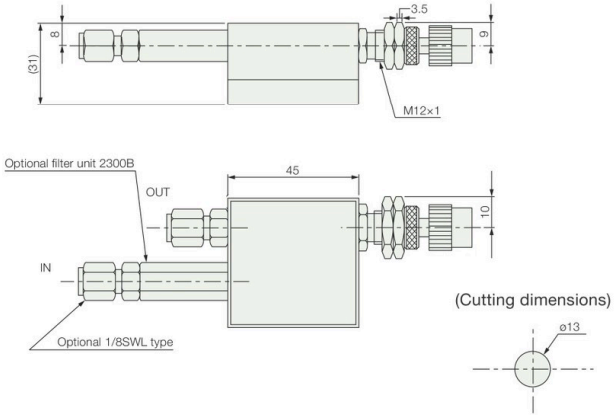
Gas Liquid

Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc.

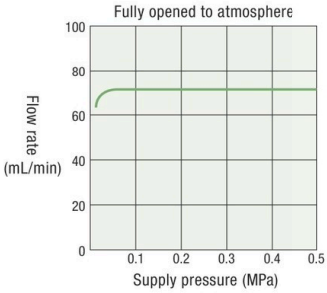
Max. flow rate Gas 10mL/min to 10L/min (Air at 20°C)

- Capable of holding a constant flow rate against pressure fluctuations on the inlet (primary) side
- Superior control performance by a non-rotating structure

Dimensions



Example of control characteristics



Standard Specifications

MODEL	2204
Applicable fluids	N_2, Air, H_2, He, Ar, O_2, CO_2, etc.
Max. flow rate (air at 20°C)	10mL/min to 10L/min
Control accuracy	Within ±2% of indication value at 0.3MPa change between the inlet pressure of 0.07MPa and 0.8MPa
Number of turns of regulating screw	Approx. 12 turns
Max. working pressure	0.8MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	SS: SUS316, PCTFE, FKM, Hard glass A: Al, Brass, SUS316, POM, NBR, Hard glass
Connection	Rc1/8 (M8 + Rc1/8)
Weight	Approx. 210g

Ordering

MODEL	Material	Connection	Fluid	Supply pressure	Outlet pressure	Max. flow rate	Filter
2204	SS: SUS316 A: Al	1/8: Rc1/8					0: Not included 1: Included
Illustrative example: 2204	SS	1/8	Air	0.6MPa	0.1MPa	5L/min	0

* Inlet / outlet differential pressure needs to be 0.07MPa or more.

Flow Control Valve

Liquid Flow Controller

MODEL 2600-S SERIES

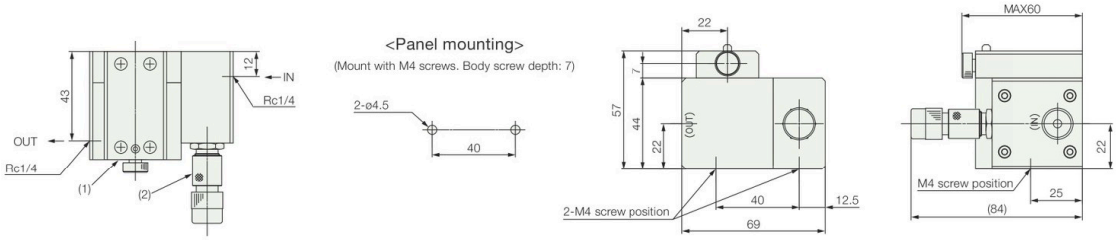
Gas Liquid

Applicable fluids Liquid H_2O

Max. flow rate Liquid 10mL/min to 1L/min (H_2O at 20°C)

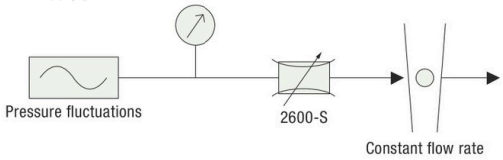
- Capable of holding a constant flow rate against pressure fluctuations
- Capable of controlling from minute flow rate

Dimensions



Example of use

In case the supply pressure fluctuates



Standard Specifications

MODEL	2600-S
Applicable fluids	H_2O
Flow rating	1 to 10mL/min, 10 to 100mL/min, 50 to 500mL/min, 0.1 to 1L/min
Control accuracy	Within ±3%F.S. (liquid temperature should be constant)
Operating differential pressure	0.1MPa or more
Working pressure	0.1 to 0.5MPa(G)
Proof pressure	0.7MPa(G)
Working temperature	15 to 35°C
Materials of parts in contact with fluid	S: SUS316, FKM, FFKM, PTFE
Connection	Rc1/4

Ordering

MODEL	Material	Max. flow rate
2600	S: SUS316	10mL/min
		100mL/min
		500mL/min
		1L/min

Illustrative example: 2600 — S — 1L/min

Flow Control Valve

Liquid Flow Controller

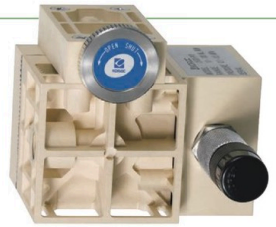
MODEL 2600-PPS SERIES

Gas Liquid

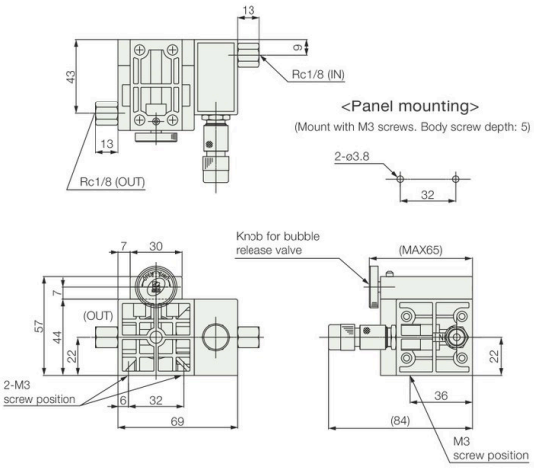
Applicable fluids Liquid H_2O

Max. flow rate Liquid 10mL/min to 1L/min (H_2O at 20°C)

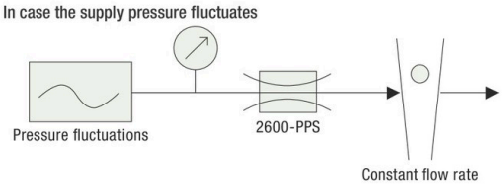
- Capable of holding a constant flow rate against pressure fluctuations
- Capable of controlling from minute flow rate



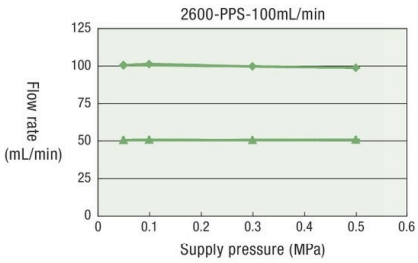
Dimensions



Example of use



Example of control characteristics



Standard Specifications

MODEL	2600-PPS
Applicable fluids	H_2O
Flow rating	1 to 10mL/min, 10 to 100mL/min, 50 to 500mL/min, 0.1 to 1L/min
Control accuracy	Within ±3%F.S. (liquid temperature should be constant)
Operating differential pressure	0.1MPa or more
Working pressure	0.1 to 0.5MPa(G)
Proof pressure	0.7MPa(G)
Working temperature	15 to 50°C
Materials of parts in contact with fluid	PPS (30% glass contained), SUS316, FKM, FFKM, PTFE
Connection	Rc1/8 (M8 + Rc1/8)

Ordering

MODEL	Material	Max. flow rate
2600	PPS: PPS	10mL/min
		100mL/min
		500mL/min
		1L/min
Illustrative example: 2600	PPS	1L/min

Flow Control Valve

Small Proportional Solenoid Valve

MODEL 3000 SERIES

Gas Liquid

Applicable fluids Gas N_2, Air, H_2, He, Ar, O_2, CO_2, etc.

- Small, light-weight, single power supply
- Low power consumption (Max. 2W)
- Hysteresis within 15%

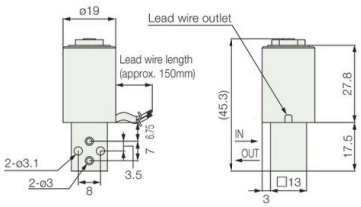
Standard type
Connection port: ø3.0

Hose nipple type
Connection port: ø3

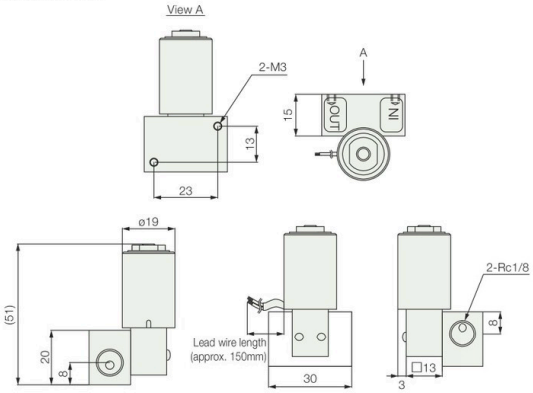
Joint type
Connection port: Rc1/8

Dimensions

<<ø3 O-ring manifold>>

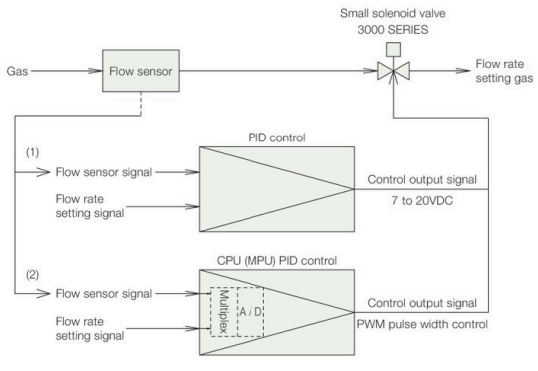


<<Rc1/8 block>>

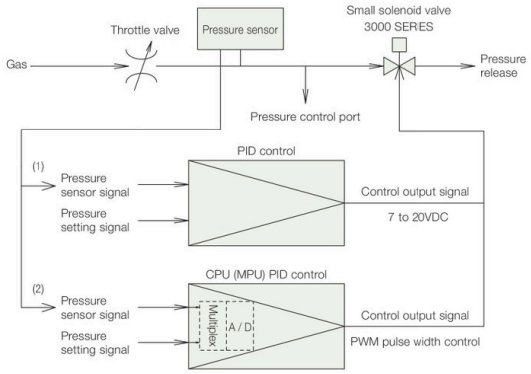


Example of use

1. Gas flow rate control



2. Gas pressure control



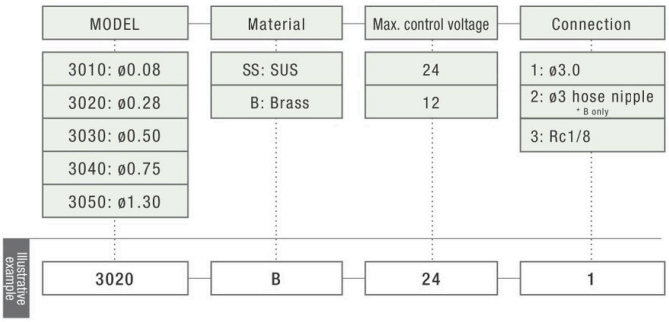
Flow Control Valve

Standard Specifications

MODEL		3010	3020	3030	3040	3050
Orifice diameter (ø mm)		0.08	0.28	0.5	0.75	1.3
Maximum CV value		0.00022	0.0021	0.0086	0.02	0.042
Pressure	Proof pressure	0.98MPa(G)*1				
	Operating differential pressure	up to 0.98MPa		up to 0.6MPa		up to 0.4MPa
Control	Maximum control voltage	12/24V				
	Power consumption	Max.1W/2W				
	Hystesresis	Within 15%, full-scale current				
Filter		20μ (IN, OUT)			Without filter	
Internal leak		0.1mL/min or less within proof pressure of applicable gas			0.2mL/min or less	
Working temperature		0°C to 50°C*2				
Storage temperature		-5°C to 70°C				
Materials of parts in contact with fluid	BS	C3604, SUS430F, FKM, SUS316, SUS304				
	SUS	SUS430F, FKM, SUS316, SUS304				
Dimensions (mm)		□13 × 17.5 + ø19 × 31				
Lead wire		UL3266 XLPE #28				
Insulation class		Class A				
Connection		ø3.0 manifold (standard), ø3 hose nipple, Rc1/8				
Weight		Approx. 60g (140g for Rc1/8)				

*1. Proof pressure is a value of the valve body. In the case of the hose nipple type, refer to the proof pressure of the hose.
*2. A coil copper wire resistance value has a temperature coefficient of Rt = Ro°C (1 + 0.004 × t°C). When using voltage control, make sure that the ambient temperature does not vary widely.
In case the ambient temperature changes greatly, current control is recommended. Consult our sales office.

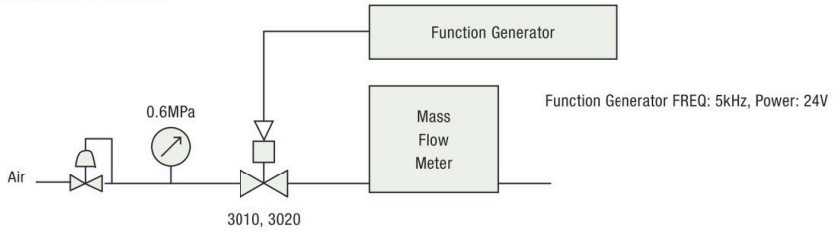
Ordering



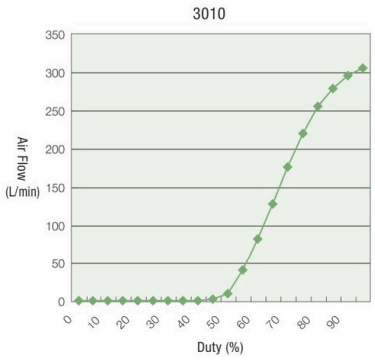
* Let us know the fluid name, supply pressure, outlet pressure and maximum flow rate at ordering time.

Example of PWM controlled flow rate characteristics

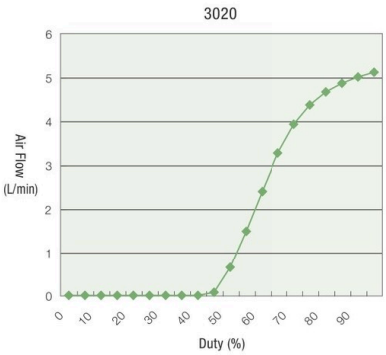
<<Measurement flow>>



Duty (%)	Flow (mL/min)
0	0
45	2
50	9.1
55	40.4
60	82
65	127.8
70	176.2
75	220
80	255.4
85	278.7
90	295.5
95	305.4



Duty (%)	Flow (L/min)
0	0
45	0.072
50	0.652
55	1.484
60	2.391
65	3.272
70	3.931
75	4.37
80	4.67
85	4.864
90	5.007
95	5.116



Example of flow rate characteristics