

Keeping Scientific Eyes on Fluids

KOFLOC contributes to SDGs by our cutting edge technologies of
flow measurement and control for gas and liquid.



Fix our eyes on the new era of the mankind and the earth.

The surrounding environment of the Earth consists of gases and liquids.

The technologies for measuring, controlling and generating them are essential to the development of the society and industry, being the bases for supporting next-generation manufacturing.

With the motto, "Keeping Scientific Eyes on Fluids" KOFLOC has been seeking the measurement and control technologies for more than 70 years, centering around a micro flow rate of a fluid.

Accumulating the clients' trust in various fields, we now enjoy the top domestic share in many different fields today.

With new technologies to create the future for the humans and the Earth,

KOFLOC continues to make efforts to realize affluent living for people.





CONTENTS

Mass Flow Controller / Mass Flow Meter

Compared with mechanical flow meters and valves, mass flow controller/mass flow meter is less susceptible to the temperature and pressure because it is designed for mass flow rate measurement, and is capable of communicating a flow rate with an electric signal. It is used in every process and equipment which require accuracy, repeatability, responsiveness and cost effectiveness, such as semiconductors, optical fibers, analysis, fuel cells, FPD, biotechnology, food, environmental measurement, combustion gas control, factory equipment and experimental equipment. In addition to them, Karman vortex flow meters and ultrasonic flow meters are also lined up.

Variable Flow Meter

A variable flow meter contains a float in a conical tapered tube with its top end spread wider than the bottom end. The float moves up and down depending on the high/low flow rate, reading its balanced position to obtain the flow rate. We provide various products such as flow meters with valve capable of flow rate control as well as flow rate measurement, and flow meters with alarm function.

Flow Control Valve

Generally, a needle valve is used as a flow control valve, which adjusts the opening of a flow path, or a small orifice, with a bar-shaped needle to control a flow rate by resistance change of the flow path. We manufacture flow controllers combining a needle valve and a diaphragm, and proportional solenoid valves which control the flow rate electrically, in addition to various precision and simple needle valves.

Pressure Control Valve

The pressure control valves include reducing valves and back pressure valves. The reducing valve is a regulating valve designed to keep the constant secondary-side pressure against the fluctuating primary-side pressure. It is generally used in the first stage of the equipment. The back pressure valve is designed to release the pressure to keep the constant primary-side pressure when it exceeds a set value.

The Gas Generator / Engineering Device

MODEL EX-700R
SERIESMODEL FML-300
SERIES

Mass Flow Controller / Mass Flow Meter

MODEL RK1200
SERIESMODEL RK20T
SERIES

Variable Flow Meter



2412L

2412T

MODEL 2412
SERIESMODEL 2412D
SERIES

Flow Control Valve

MODEL 6600
SERIES

MODEL 6610



Pressure Control Valve

BRENDA
SERIESMini-CUBE
SERIES

The Gas Generator / Engineering Device

How to use the catalog

Product warranty and period

Thank you for choosing our products. When placing an order for the product, the following conditions apply unless noted otherwise in the quotation, contract, or specifications.

Description of the warranty

Warranty period

The warranty period is one year after shipment within the scope of our specifications.

Scope of warranty

In case our product has a defect due to reasons attributable to our responsibility during the warranty period, we will provide a replacement product or repair the defective product at our factory free of charge. Our scope of warranty does not include any damage caused by reasons not attributable to our responsibility, customer's loss of opportunity, loss of income, secondary disaster accident, damage on other than our product attributable to failure of our product, and other compensations.

Exclusions from the scope of warranty

The following cases are excluded from the scope of warranty even during the warranty period.

- a) Failure due to operational error, and unreasonable repair or modification.
(Including cases when the actual conditions differ from manufacture specifications)
- b) Damage and failure due to a dropping of the product after purchase.
- c) Failure due to natural disasters such as fire, earthquake, flood and lightning, or a riot.
- d) Failure due to a mixture of foreign substances through the piping.
- e) Failure due to a peculiar problem attributable to a combination with incorporated equipment.
- f) Other cases determined not attributable to our responsibility.

Our scope of warranty excludes the customer's or customer's client's loss of opportunity and damage on other than our product, and other damage attributable to failure of our product.

Response to directives and regulations

For responses to various directives and regulations, specify a product name and inquire our sales office.

Pressure standards

All pressure standards used in our catalog are indicated in "gauge pressure (G)", not the "absolute pressure (abs)."

Upon using the product

Read the instruction manual thoroughly and use in compliance with the specifications.

Product improvement and specifications change

In order to further improve performance, note that the specifications, appearance and accessories are subject to change without prior notice.

Product price

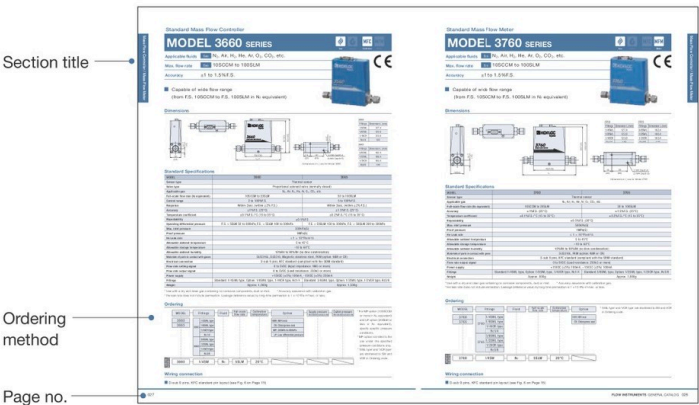
- For the product price, inquire our sales office each time.
- We make efforts to keep the product price unchanged as much as possible, but it may change without prior notice due to surging raw material prices, personnel expenses, and so on.
- Transportation expense, packaging expense, insurance cost and installation cost will be added separately.

Technical support

The technical documents on our products and FAQs are publicized and updated at our website.

Inquiry

If you have any question, opinion or request on our products, use an inquiry form available at our website or contact our sales office.



This catalog is accessible at our website as well. <https://www.kofloc.co.jp/en/>



Mass Flow Controller / Mass Flow Meter



FLOW INSTRUMENTS GENERAL CATALOG 008

List of Mass Flow Controller / Mass Flow Meter






Gas Liquid Controller Meter

Liquid Vortex Flow Meter with Temperature Correction **NEW**

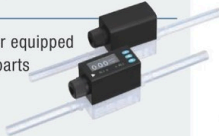
MODEL FML-300 SERIES

Max. flow rate: **Liquid** 2.5-250L/min

Accuracy: $\pm 2\%$ F.S.

Power supply: 12-24VDC

- Temperature sensor equipped
- PFA for all wetted parts (without O-ring)



P017






Gas Liquid Controller Meter *Optional needle valve

Digital Mass Flow Meter with Display

EXE-FLOW™
MODEL EX-700R SERIES

Max. flow rate: **Gas** 10SCCM-500SLM

Accuracy: $\pm 1\text{--}1.5\%$ F.S.

Power supply: 24VDC

- Built-in display
- Gas type switchable
- RS485 communication



P019






Gas Liquid Controller Meter

Compact Digital Mass Flow Controller / Mass Flow Meter

MODEL EX-250S SERIES

Max. flow rate: **Gas** 5SCCM-10SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC / 24VDC

- High-speed response
- Gas type switchable
- RS485 communication



P021






Gas Liquid Controller Meter

Metal-sealed Digital Mass Flow Controller / Mass Flow Meter

MODEL EX-550 SERIES

Max. flow rate: **Gas** 10SCCM-5SLM

Accuracy: $\pm 1\%$ S.P. (25-100%F.S.)
 $\pm 0.25\%$ F.S. (-25%F.S.)

Power supply: ± 15 VDC / 24VDC

- High-speed response
- Gas type switchable
- RS485 communication



P023






Gas Liquid Controller Meter

Mass Flow Controller / Mass Flow Meter with Display **NEW**

MODEL 8700 SERIES

Max. flow rate: **Gas** 10SCCM-100SLM

Accuracy: $\pm 1\text{--}1.5\%$ F.S.

Power supply: 24VDC

- Built-in display
- RS485 communication



P025






Gas Liquid Controller Meter

Standard Mass Flow Controller

MODEL 3660 SERIES

Max. flow rate: **Gas** 10SCCM-100SLM

Accuracy: $\pm 1\text{--}1.5\%$ F.S.

Power supply: ± 15 VDC



P027






Gas Liquid Controller Meter

Standard Mass Flow Meter

MODEL 3760 SERIES

Max. flow rate: **Gas** 10SCCM-100SLM

Accuracy: $\pm 1\text{--}1.5\%$ F.S.

Power supply: ± 15 VDC



P028






Gas Liquid Controller Meter

High-grade Mass Flow Controller

MODEL 3200 SERIES

Max. flow rate: **Gas** 1SCCM-20SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC

- Diaphragm valve



P029






Gas Liquid Controller Meter

High-grade Mass Flow Meter

MODEL 3100 SERIES

Max. flow rate: **Gas** 1SCCM-20SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC



P030

Gas Liquid MFC MFM

Controller Meter

Metal-sealed Mass Flow Controller

MODEL 5100 SERIES

Max. flow rate: Gas 1SCCM-20SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC

■ Diaphragm valve



P031

Gas Liquid MFC MFM

Controller Meter

Metal-sealed Mass Flow Meter

MODEL 5410 SERIES

Max. flow rate: Gas 10SCCM-20SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC



P032

Gas Liquid MFC MFM

Controller Meter *Optional needle valve

Low-cost Mass Flow Meter with Display

MODEL 3810DSII SERIES

Max. flow rate: Gas 10SCCM-100SLM

Accuracy: $\pm 2-3\%$ F.S.

Power supply: 24VDC

■ Built-in display



Precision needle valve

P033

Gas Liquid MFC MFM

Controller Meter

Low-cost Mass Flow Sensor

MODEL 3810S SERIES

Max. flow rate: Gas 10SCCM-50SLM

Accuracy: $\pm 3-5\%$ F.S.

Power supply: ± 15 VDC



P034

Gas Liquid MFC MFM

Controller Meter

Large flow rate Mass Flow Controller

MODEL HFC-303 SERIES

Max. flow rate: Gas 100-1000SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC



P035

Gas Liquid MFC MFM

Controller Meter

Large flow rate Mass Flow Meter

MODEL HFM-301 SERIES

Max. flow rate: Gas 100-1000SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: ± 15 VDC



P036

Gas Liquid MFC MFM

Controller Meter

Low pressure drop large flow rate Mass Flow Meter

MODEL HFM-200W / LS SERIES

Max. flow rate: Gas 1500-15000SLM

Accuracy: $\pm 3-5\%$ F.S.

Power supply: ± 15 VDC



P037

Gas Liquid MFC MFM

Controller Meter

Handy Mass Flow Control / Measuring Unit

FLOW COMPO™

Max. flow rate: Gas 1SCCM-20SLM

Accuracy: $\pm 1\%$ F.S.

Power supply: 100VAC

■ With handle



P038

Gas Liquid FC FM

Controller Meter

Small Karman Vortex Flow Meter for Liquid

MODEL FM01 SERIES

Max. flow rate: Liquid 4-150L/min

Accuracy: $\pm 3\%$ F.S.

Power supply: 12-24VDC



P039

List of Mass Flow Controller / Mass Flow Meter

Gas

Liquid

FC

FM

Small Karman Vortex Flow Meter for Liquid

MODEL FM31 SERIES

Max. flow rate: Liquid 4-100L/min

Accuracy: ±3%F.S.

Power supply: 12-24VDC

■ PFA for all wetted parts (without O-ring)



P040

Gas

Liquid

FC

FM

Ultrasonic Flow Meter for Liquid

MODEL FML-500

Max. flow rate: Liquid 5L/min

Accuracy: ±30mL/min-1.5%F.S.

Power supply: 24VDC



P041

Compact Readout Unit

MODEL CR-400B



P043

Power Supply for Mass Flow Controller / Mass Flow Meter

MODEL PSK-FB SERIES



P044

AC Adapter for Mass Flow Controller / Mass Flow Meter / Conversion plug

PSK-83CE / PSK-85CE / PSK-38DSII / TR-AD



P045

Table of compatibility Cables and accessories for mass flow controller / mass flow meter

P046


Gas


Liquid

Fluid


MFC


FC

Controller


MFM


FM

Flow meter

Mass Flow Controller / Mass Flow Meter

About Mass Flow Controller / Mass Flow Meter

Volume flow rate and mass flow rate

Roughly speaking, there are two types of gas flow meters; volume flow meters and mass flow meters. The volume flow meters include variable flow meters, positive displacement flow meters, differential pressure flow meters, etc., and the mass flow meters include Coriolis flow meters, vortex flow meters, thermal type flow meters, etc. **KOFLOC's** mechanical flow meters are classified into the variable flow meters among the volume flow meters, and the mass flow controllers (MFC) and mass flow meters (MFM) are classified into the thermal type flow meters among the mass flow meters.

The difference between the volume flow meter and the mass flow meter is explained by showing a simple example. As shown in **Fig. 1**, many volume flow meters are used in the state with each part opened to the atmosphere, that is, in the state free from internal pressure application. If the pressure is internally applied, the volume flow meter calibrated by opening to the atmosphere fails to indicate a correct flow rate, requiring a corrective calculation for a reading. Particularly

for soap-film flow meters, dry/wet gas meters, etc., the volume flow meter is opened to the atmosphere in use as a rule because even a slight resistance has a big effect. This is the same for **KOFLOC's** flow meters (variable flow meters). If the pressure fluctuates greatly or the gas temperature changes, causing the gas density to change, they fail to indicate accurate flow rate. Accordingly, it is necessary to predetermine constant pressure and temperature conditions or correct each factor for a reading.

On the other hand, the mass flow meter literally detects a flow rate in weight. Even if a fluid is compressed or a density changes, the same state can be defined. If a gas is detected in mass, an identical indication is obtained either in the previously mentioned flow or in the pressurized state as shown in **Fig. 2**. Accordingly, it can be actually installed anywhere in any flow sheet. It is very convenient and allows a system configuration with few errors in flow rate readings.

Fig. 1

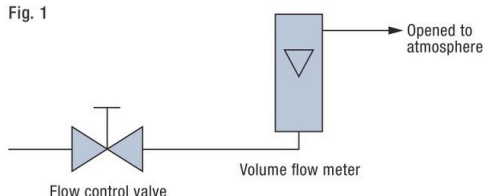
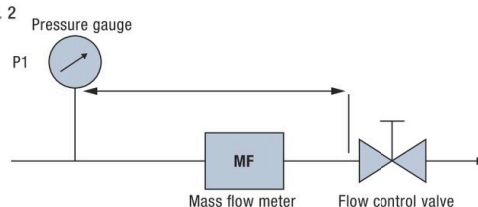


Fig. 2



Principle of mass flow controller / mass flow meter

A flow rate sensor used for **KOFLOC's** mass flow controller / mass flow meter is generally called thermal flow sensor. The following describes its detection principle.

A resistance element with high temperature coefficient of resistance is wound around the upstream side (Rus) and downstream side (Rds) of a capillary, a sensor part (**Fig. 3**), respectively. Two resistance elements are heated by running a current to this. If no fluid flows inside the capillary at this time, both the upstream and downstream sides are balanced at the same temperature. (Solid line in the graph in **Fig. 3**, Zero flow rate = Zero-point position, generally so called for the mass flow controller / mass flow meter).

If the fluid starts flowing in this state, a temperature distribution changes as shown by a broken line in the graph in **Fig. 3**. At this time, the upstream side is deprived of the heat by the fluid and the heat deprived from the upstream side is given to the downstream side. That is, there occurs a temperature difference (ΔT) between the upstream and downstream sides.

Focusing on that this temperature difference (ΔT) has a functional relationship with the mass flow rate of the fluid, it functions as a thermal type mass flow meter capable of measuring a mass flow rate under certain conditions by taking out changes of each resistance value as electric signals, and amplifying and correcting them. This is the mass flow meter (**Fig. 4**).

Furthermore, the mass flow controller (**Fig. 5**) is capable of stable mass flow rate control hardly affected by changes of various conditions such as temperature and pressure, by controlling the opening of a flow rate control valve by a solenoid actuator through comparison control with an external flow rate setting signal based on a flow rate signal output from the sensor part.

Fig. 3. Structure of sensor part

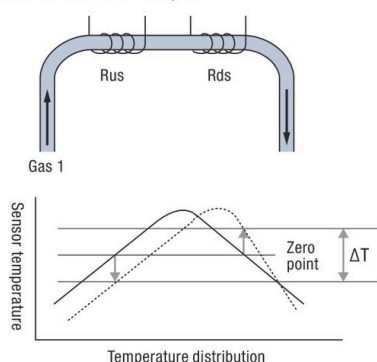


Fig. 4. Structure of mass flow meter

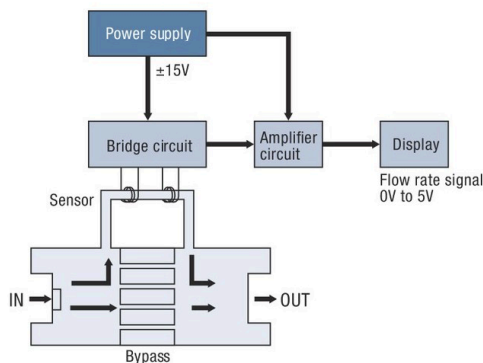
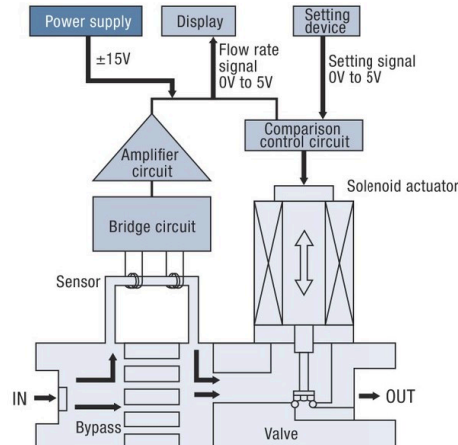


Fig. 5. Structure of mass flow controller



Unit of flow rate

As described above, the mass flow controller / mass flow meter measures a mass flow rate regardless of the pressure and temperature. If the flow rate is expressed in mass, unfamiliar units are used, different from those generally used for fluid measurement such as g/min and kg/min. Accordingly, it is generally expressed in terms of the volume flow rate under the conditions for the reference pressure and temperature. Currently, the units such as Pa·m³/s are used in compliance with the SI unit system. Generally, however, the units, SCCM and SLM, which have been used for the mass flow controller / mass flow meter for decades are still the mainstream.

Concerning the definition of units, **KOFLOC** has been adopting the definition by the SEMI standard as the standard units for the mass flow controller / mass flow meter since October 1998.

SCCM, an initial word of Standard Cubic Centimeter per Minute, expresses a value converted into cc/mm at 0°C and under the atmospheric pressure, and SLM, an initial word of Standard Liter per Minute, expresses a value converted into L/min under the same conditions.

In the non-semiconductor industries, the definition differs from one industry to another, such as SCCM and SLM at 20°C and under the atmospheric pressure, and NCCM and NLM at 0°C and under the atmospheric pressure. Accordingly, for the flow rate notation of our mass flow control / mass flow meter, specify the reference temperature and pressure, for example, SCCM (0°C, 1atm) or NLM (0°C, 1atm), when ordering our product.

Actual gas calibration and conversion factor method

As a rule, the thermal sensor can assure the accuracy only when it is calibrated with actual gas. Currently, we can calibrate with N₂, Air, O₂, H₂, He, CO₂ and Ar as actual gases. For other gases, calibration is performed with N₂ or Air, using a constant conversion factor (C.F.) to N₂.

For example, in case the N₂-specification mass flow controller / mass flow meter is used to run Ar, if the C.F. of Ar is 1.4, it is actually run by 1.4 times more than an indication value of the mass flow controller / mass flow meter. That is, the flow rate of Ar is 1.4 × the

indication value of the N₂-specification mass flow controller / mass flow meter. The C.F. is available for different gases due to data accumulation by calculation or actual gas measurement, but there may be a deviation even for one gas or exist multiple conversion factors depending on the actual state of gas (temperature, pressure) and a combination of the sensor system of the mass flow controller / mass flow meter and the bypass (laminar flow element). Please consider the C.F. only as a guide.

About Mass Flow Controller / Mass Flow Meter

■ Wiring connection -- KFC standard

In order to save wiring, **KOFLOC** has been standardizing various electrical wiring connections since 1999. Currently, low-flow rate mass flow controllers / mass flow meters of 20 SLM or less (except for special and compact models) are unified to the KFC standard, D-sub 9 pins (**Fig. 6**). The unified products are indicated "KFC standard" in the specification column of this catalog.

For the products of other connector standards, wiring connections are described on the pages of individual mass flow controllers / mass flow meters. For details, see the instruction manual for the product.

Fig. 6. KFC Standard

Main unit connector --- D-sub 9 pins, male (M2.6 short screw)
Cable side connector --- D-sub 9 pins, female (M2.6 short screw)

Pin no.	Signal name
1	Valve open / close signal
2	Flow rate output signal
3	Power: +15V
4	Power COM
5	Power: -15V

Pin no.	Signal name
6	Flow rate setting signal: Hi
7	Flow rate output signal COM
8	Flow rate setting signal: Lo
9	Valve voltage monitor

* For the mass flow meter, the pin nos. 1, 6, 8 and 9 are NC.
* The pin no. 9 differs depending on the model.

■ Notation of specifications

Notation of specifications for the mass flow controller / mass flow meter basically complies with the SEMI standard.
The following describes typical definitions of specifications.

[1] Accuracy

Indicated in the form of $\pm XX\%$ F.S. (full scale). This value refers to a percent value to a full-scale value of an error with calibration gas(N₂, etc.) against our reference flow meter. Accordingly, in the case of a full scale range of 50 SCCM and the accuracy is $\pm 1\%$, the accuracy is assured against our reference flow rate with "uncertainty" of $50 \times (1/100) = \pm 0.5$ SCCM.
It may be also indicated in the form of $\pm XX\%$ S.P. (set point). This is a percent value to the set flow rate value.

[2] Repeatability

Refers to the degree of approximation of repeated set values at the values set from both upper and lower directions over a specified period and under specified operating conditions.

[3] Response

Starts control from zero flow rate and indicates a time to stabilize the mass flow controller's output at 98% of full scale. Normally indicated like this because 100% is tough to analyze in the case of asymptote.

* Note that the items in the specifications list, such as flow rate, response, accuracy and operating differential pressure, are specific to N₂ or Air.

■ Repair

In case your product has any trouble or failure due to secular change, and so on, we will repair it at our site as a rule. This is because the mass flow controller / mass flow meter itself is a precision device composed of very fine parts. When you notice any trouble or failure, check with the instruction manual, and then, contact our office.

About Karman Vortex Flow Meter / Ultrasonic Flow Meter

■ Principle of the Karman vortex flow meter

Theodore Von Karman, a hydrodynamicist, revealed theoretically in 1911 that when an object was placed in a flow of fluid, a regular vortex was alternately generated on the downstream side. This vortex row is called a Karman vortex (row) in honor of his name. The Karman vortex flow meter is based on the measurement principle of the Karman vortex.

As shown in Fig. 1, if a vortex generator is placed in a flow, the Karman vortex row is generated on the downstream side. At this time, suppose the vortex row's frequency is f , its flow velocity is v , and the width of the vortex generator is d , there is a relationship of

$$f = St \cdot \frac{v}{d} \dots\dots\dots (1)$$

The Karman vortex row is detected as a vortex frequency by a piezoelectric element disposed behind the vortex generator. Since this vortex frequency is proportional to the flow velocity in a certain range of Reynolds number, the flow velocity and flow rate can be measured by measuring the vortex frequency. The Strouhal number St is a dimensionless number decided by the shape and dimensions of the vortex generator. By selecting the shape and dimensions appropriately, it becomes a constant value over a wide range of Reynolds number.

Fig. 1. Karman vortex row

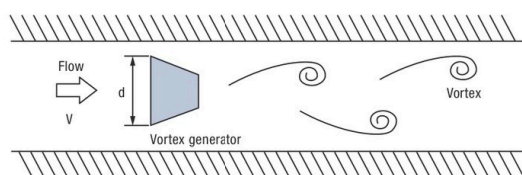
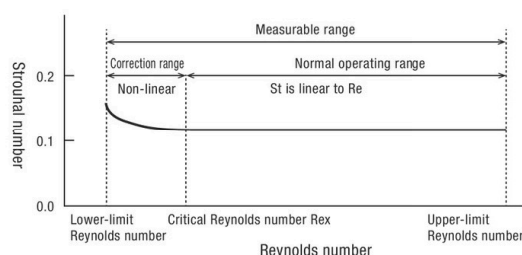


Fig. 2 shows the relations between the Reynolds number and the Strouhal number. If the Strouhal number is understood beforehand by Expression (1), the flow rate can be measured by measuring the vortex frequency. Some of KOFLOC's Karman vortex flow meters have a temperature sensor incorporated to correct the temperature (Reynolds correction) to the non-linear region of the Reynolds number and Strouhal number.

Fig. 2. Reynolds number vs. Strouhal number



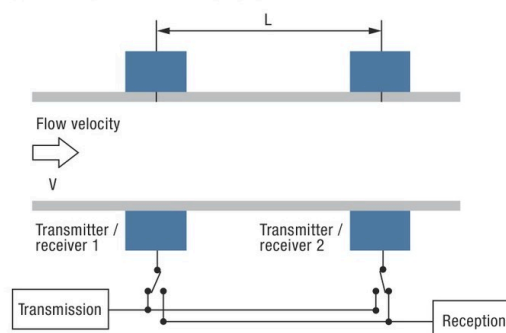
■ Principle of the ultrasonic flow meter

Ultrasonic waves are elastic vibration waves (sound waves) with high frequency unheardable to humans. They are generally defined as 20kHz or higher acoustic vibrations.

Since the ultrasonic waves are acoustic vibrations, a medium such as a gas or a liquid is required to convey them. The ultrasonic waves are suitable for the flow meters which do not require the signals to reach far away like communication devices, because their propagation velocity is slower and their wavelength is shorter than electric waves (electromagnetic waves) using similar media.

There are several measurement methods for ultrasonic flow meters such as ultrasonic propagation time difference method, ultrasonic reciprocal propagation time method (frequency difference method) and Doppler method. Our method, "ultrasonic propagation time difference method," has ultrasonic transmitters / receivers attached to the piping on the upstream and downstream sides as shown in Fig. 3, alternately transmitting and receiving ultrasonic waves from the transmitter / receiver 1 to transmitter / receiver 2 and vice versa. The flow velocity is calculated from the difference in the alternately received ultrasonic propagation time, and the flow rate can be obtained by multiplying the cross-sectional area of the flow path by a correction factor.

Fig. 3. Principle of ultrasonic propagation time difference method



Liquid Vortex Flow Meter with Temperature Correction

MODEL FML-300 SERIES **NEW**



Applicable fluids **Liquid** Water, pure water, chemical solution

Max. flow rate **Liquid** 2.5 to 250L/min

Accuracy ± 2 to 3%F.S.

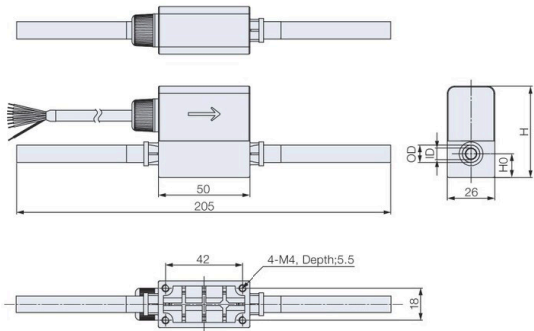


- Capable of measuring the fluid temperature by an on-board temperature sensor and correcting the flow rate to reduce the accuracy error caused by liquid temperature change
- New PFA for wetted parts (without O-ring)
- Compact design
- Available for wide range of flow rate (from 0.3 - 2.5L/min to 25 - 250L/min)
- Equivalent to IP65 protection rating



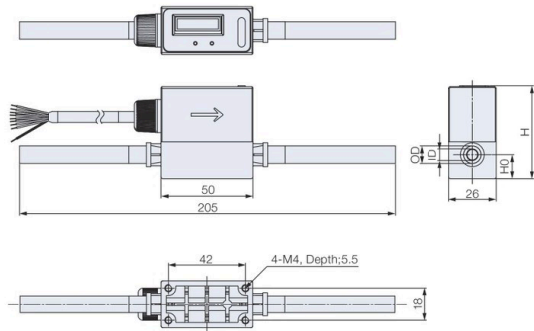
Dimensions

■ FML-301 to FML-305 without display



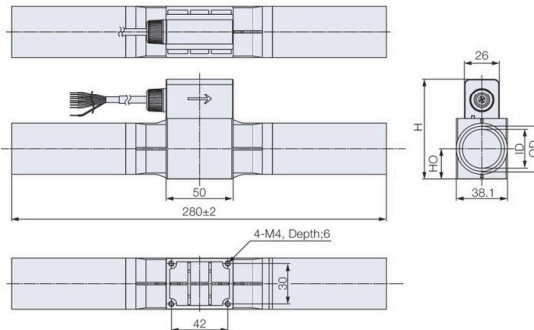
MODEL	Connection tube size	Dimensions (mm)			
		OD	ID	H	H0
FML-301-N	3/8 inch	9.52	6.35	50.0	13.0
FML-302-N	3/8 inch	9.52	6.35	50.0	13.0
FML-303-N	1/2 inch	12.70	9.52	50.0	13.0
FML-304-N	3/4 inch	19.05	15.87	52.0	12.0
FML-305-N	1 inch	25.40	20.20	60.7	15.7

■ FML-301 to FML-305 with display



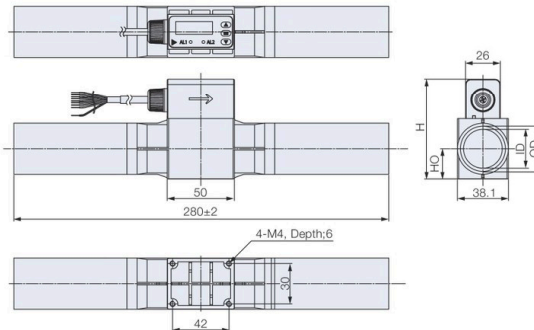
MODEL	Connection tube size	Dimensions (mm)			
		OD	ID	H	H0
FML-301-D	3/8 inch	9.52	6.35	50.5	13.0
FML-302-D	3/8 inch	9.52	6.35	50.5	13.0
FML-303-D	1/2 inch	12.70	9.52	50.5	13.0
FML-304-D	3/4 inch	19.05	15.87	52.5	12.0
FML-305-D	1 inch	25.40	20.20	61.2	15.7

■ FML-306 without display



MODEL	Connection tube size	Dimensions (mm)			
		OD	ID	H	H0
FML-306-N	1(1/2) inch	38.1	33.7	75.0	22.5

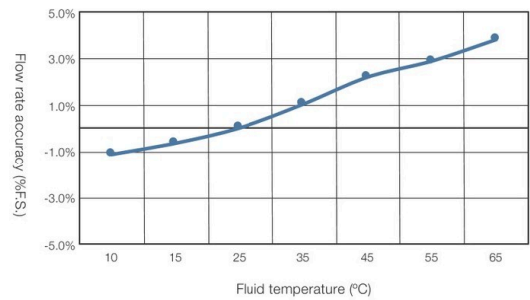
■ FML-306 with display



MODEL	Connection tube size	Dimensions (mm)			
		OD	ID	H	H0
FML-306-D	1(1/2) inch	38.1	33.7	75.5	22.5

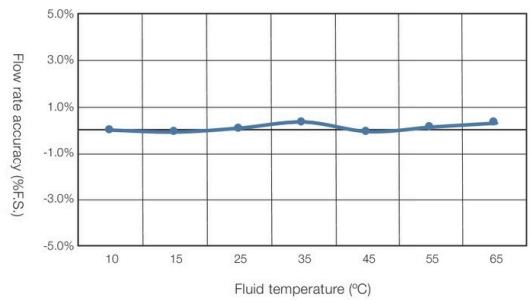
FML-300: Comparison of accuracy change between with and without temperature correction

Product used: FML-303, deviation from 25°C data (%F.S.)



Accuracy change by the fluid temperature at 16L/min. (without temperature correction)

Product used: FML-303, deviation from 25°C data (%F.S.)



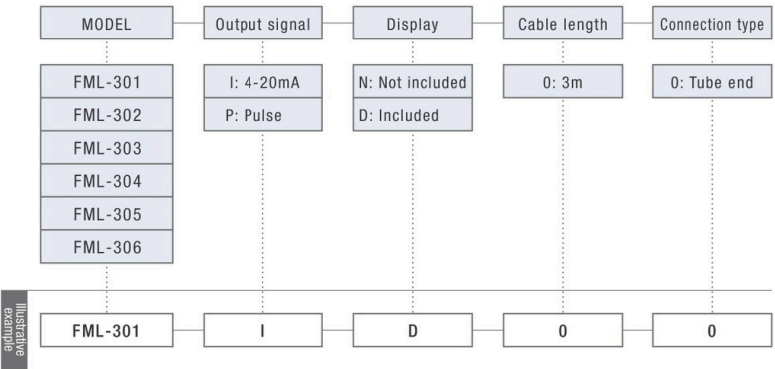
Accuracy change by the fluid temperature at 16L/min. (with temperature correction)

Mass Flow Controller / Mass Flow Meter

Standard Specifications

MODEL			FML-301	FML-302	FML-303	FML-304	FML-305	FML-306
Connection			3/8" tube end		1/2" tube end	3/4" tube end	1" tube end	1 (1/2)" tube end
Flow range			0.3 to 2.5L/min	0.4 to 4.0L/min	2.0 to 16L/min	5.0 to 50L/min	10 to 100L/min	25 to 250L/min
Fluid			Water, pure water, chemical solution					
Accuracy			±2%F.S. (25°C)				±3%F.S. (25°C)	
Temperature accuracy			±2°C ±0.15×ΔT°C (ΔT: Ambient temperature - Fluid temperature)					
Repeatability			±0.5%F.S.					
Fluid temperature			0°C to 90°C (no freezing and boiling)					
Accuracy guarantee temperature			Fluid temperature: 15°C to 60°C					
Max. working pressure			1MPa(G) @25°C			0.75MPa(G) @25°C	0.65MPa(G) @25°C	
Allowable ambient temperature			0°C to 50°C (no freezing)					
Allowable ambient humidity			95%RH or less (no dew condensation)					
Storage temperature			-10°C to 70°C (no freezing)					
Protective structure			Equivalent to IP65 (drip-proof, dust-proof)					
Materials of parts in contact with liquid			New PFA					
Output	Flow rate output	Without display	Current: 4 to 20mA, Allowable load resistance: 250Ω to 500Ω at 24VDC input, 250Ω or less at 12VDC input or pulse output (1kHz at F.S. Duty: 50%, NPN open collector output: Max. 30VDC / 80mA)					
		With display	Current: 4 to 20mA, Allowable load resistance: 250Ω to 500Ω at 24VDC input, 250Ω or less at 12VDC input or pulse output (1kHz at F.S. Duty: 50%, NPN open collector output: Max. 30VDC / 80mA)					
	Temperature output (only when water runs)	Without display	Integrated flow output: Pulse output					
		With display	1-5VDC (0°C to 100°C), External load resistance: 250kΩ or more					
	Alarm output			Current: 4 to 20mA (0°C to 100 °C), Allowable load resistance: 250Ω to 500Ω at 24VDC input, 250Ω or less at 12VDC input				
			Alarm contacts: 2points NPN open collector output, Max. 30VDC / 80mA (only with display)					
Digital communication			RS485 (MODBUS protocol, RTU mode) (only with display)					
Power supply			12 to 24VDC ±10%, Current consumption (80mA or less without display, 140mA or less with display)					
Cable length			3m terminated, preliminary soldering					
Weight		Without display	160g or less			175g or less	200g or less	360g or less
		With display	165g or less			180g or less	205g or less	365g or less

Ordering



Digital Mass Flow Meter with Display

EXE-FLOW™ MODEL EX-700R SERIES

 Gas

 Liquid

 MFC

 MFM

*Optional needle valve

Applicable fluids Gas N₂ (Air, H₂, He, Ar, O₂, CO₂, CH₄ / C.F. switchable)

Max. flow rate Gas 10SCCM to 500SLM

Accuracy ±1 to 1.5%F.S.

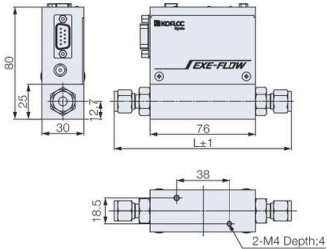


- Various functions are available with built-in display
Instantaneous / integrated flow rate display, gas type switching, C.F. setting, alarm setting, calibration temperature switching, etc
- RS485 communication function
4 to 20mA analog output (changeable to 0 to 5VDC and 1 to 5VDC)
Integrated flow pulse output
- Capable of controlling the flow rate with optional needle valve



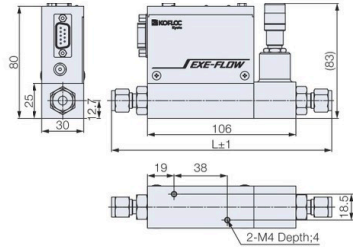
Dimensions

■ F.S.10SCCM to F.S.20SLM



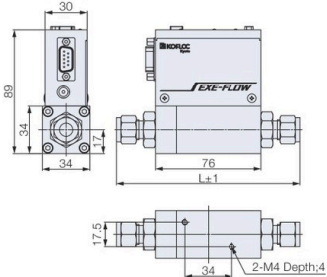
Fittings	Dimension L (mm)
1/4SWL	127.4
1/8SWL	122.8
1/4VCR	123.8
Rc1/4	102

■ F.S.10SCCM to F.S.20SLM (with precision needle valve)



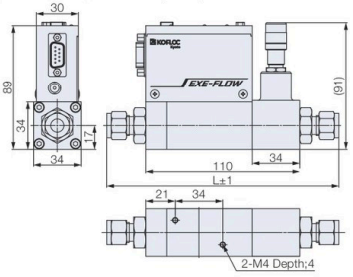
Fittings	Dimension L (mm)
1/4SWL	157.4
1/8SWL	152.8
1/4VCR	153.8
Rc1/4	132

■ F.S.50, 100, 200SLM



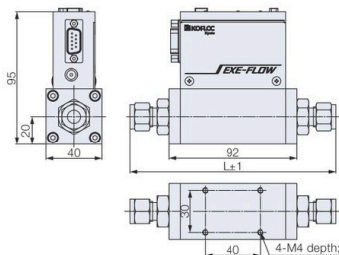
Fittings	Dimension L (mm)
3/8SWL	131.8
1/2VCR	131.4
Rc3/8	112

■ F.S.50, 100, 200SLM (with precision needle valve)



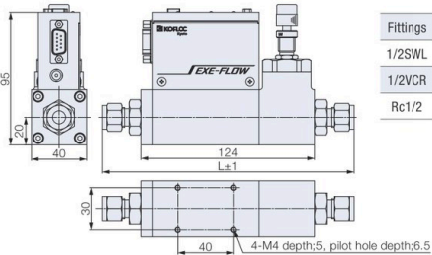
Fittings	Dimension L (mm)
3/8SWL	165.8
1/2VCR	165.4
Rc3/8	146

■ F.S.300, 400, 500SLM



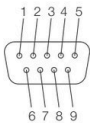
Fittings	Dimension L (mm)
1/2SWL	153.5
1/2VCR	147.4
Rc1/2	132

■ F.S.300, 400, 500SLM (with precision needle valve)



Fittings	Dimension L (mm)
1/2SWL	185.5
1/2VCR	179.4
Rc1/2	144

■ D-sub connector (male)



Pin no.	Signal name	Description
1	Power +24V	Power supply +24VDC
2	Power COM	Power COM
3	OUT1	Event output 1
4	OUT2	Event output 2
5	OUT COM	Event output COM
6	Analog flow rate output	Analog flow rate output
7	TR+	RS485 communication
8	TR-	RS485 communication
9	Analog flow rate output COM	Analog flow rate output COM
	TR COM	RS485 communication COM

■ DC jack



Pin no.	Signal name	Description
1	Power GND	Power GND
2	Power +24V	Power supply +24VDC

Standard Specifications

MODEL	EX-700R		
Sensor type	Thermal sensor		
Applicable gas	N ₂ (Air, H ₂ , He, Ar, O ₂ , CO ₂ , CH ₄ / C.F. switchable)	N ₂ (Air, Ar / C.F. switchable)	N ₂ (Air / C.F. switchable)
Full-scale flow rate (N ₂ equivalent)	10 / 50 / 100 / 500SCCM 1 / 5 / 10 / 20SLM	50 / 100 / 200SLM	300 / 400 / 500SLM
Accuracy	±1%F.S.		±1.5%F.S.
Repeatability	±0.2%F.S.		
Max. inlet pressure	500kPa(G)		
Proof pressure	1MPa(G)		
Allowable ambient temperature	5 to 50°C		
Accuracy guarantee temperature	15 to 35°C		
Allowable storage temperature	-10 to 60°C		
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)		
Materials of parts in contact with gases	SUS316L, SUS316, PTFE, FKM (Option: NBR or CR)		SUS316L, SUS316, PTFE, PCTFE, FKM (Option: NBR or CR)
Electrical connection	D-sub 9 pins		
Flow rate output signal	4 to 20mA (Load resistance: 500Ω or less) / 0 to 5VDC (Load resistance: 10kΩ or more) / 1 to 5VDC (Load resistance: 10kΩ or more)		
Event output	2 points NPN open collector (Max. rating: 30VDC, 50mA)		
Digital communication	RS485 (MODBUS protocol, RTU mode)		
Display	4-digit 7-segment LED		
Power supply	24VDC (±10%), 100mA or less		
Fittings	Standard: 1/4SWL type Option: 1/8SWL type, 1/4VCR type, Rc1/4	Standard: 3/8SWL type Option: 1/2VCR type, Rc3/8	Standard: 1/2SWL type Option: 1/2VCR type, Rc1/2
Weight	Approx. 600g (valve excluded)	Approx. 700g (valve excluded)	Approx. 1,000g (valve excluded)

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assured with N₂ gas.

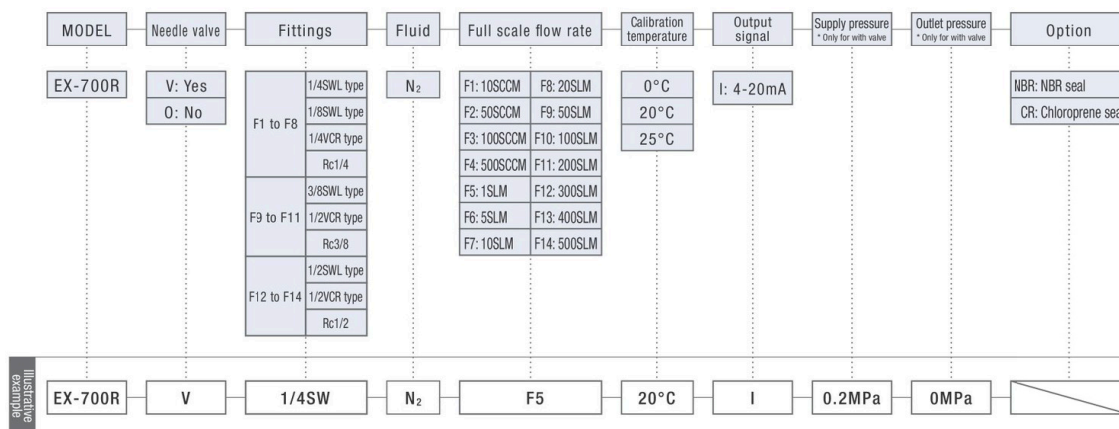
* The full scale of the selected gas is the same as the full scale of N₂.

This is gas type correction based on measurement data and does not assure the accuracy.

The customer can register other gas types than registered ones additionally, if their C.F. value is 0.50 to 1.50. For the C.F. value, inquire our office.

* The flow rate output signal can be changed with the display (4 to 20mA at factory default).

Ordering



* See Page 45 for the AC adaptor PSK-83CE.

The polarity of the AC adaptor differs between the EX-700R and the EX-700. The AC adaptors PSK-85 and PSK-85CE used for the EX-700 are not available for the EX-700R.

* See Page 46 for the external cable CP-EX-700-CF.

* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

Compact Digital Mass Flow Controller / Mass Flow Meter

MODEL EX-250S SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 5SCCM to 10SLM

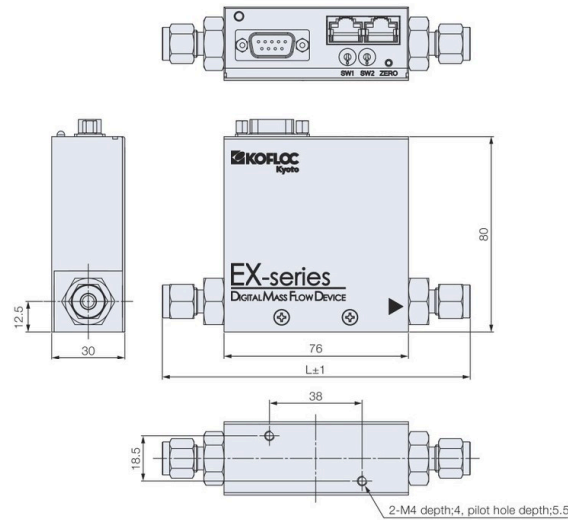
Accuracy ±1%F.S.



- Compact design
 - Within 1sec. response at the entire flow rate control range
 - Gas type switchable with rotary switch
 - RS485 communication function
- Analog input / output selectable from 0 to 5VDC or 4 to 20mA
Power supply selectable from ±15VDC or 24VDC

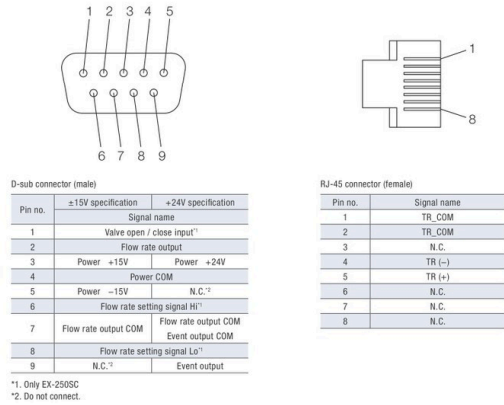


Dimensions



Fittings	Dimension L (mm)
Rc1/4	102.0
1/8SWL	122.8
1/4SWL	127.4
1/4VCR	123.8

Wiring connection



SW1 rotary switch position table

No.	Gas type
0 ^{*1*2}	User-specified gas
1	N ₂
2	Air
3	H ₂
4	He
5	Ar
6	O ₂
7	CO ₂
8	Unusable
9	User custom C.F. mode (changeable by user)

^{*1} The C.F. conversion value at ordering time is set.
^{*2} Factory default position.

Standard Specifications

MODEL	EX-250SC-RJ (MFC)	EX-250SM-RJ (MFM)
Sensor type	Thermal sensor	
Valve type	Proportional solenoid valve (normally closed)	—
Applicable gas	N ₂ , Ar, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	5SCCM to 10SLM	
Control range	2 to 100%F.S.	—
Response	Within 1sec. (within ±2% F.S.) (Within 2sec. for F.S. 5SCCM specification) (L: 50 to 149kPa H: 150 to 300kPa)	—
Accuracy	±1%F.S.	
Repeatability	±0.2%F.S.	
Operating differential pressure	F.S. < 10SLM 50 to 300kPa (Ar CO ₂ : 100 to 300kPa) F.S.10SLM 100 to 350kPa (Ar CO ₂ : 150 to 300kPa)	—
Max. inlet pressure	500kPa(G)	
Proof pressure	1MPa(G)	
He Leak rate	≤ 1 × 10 ⁻⁶ Pa·m ³ /s	
Allowable ambient temperature	5 to 50°C	
Accuracy guarantee temperature	15 to 35°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316L, SUS316, Magnetic stainless steel, PTFE, FKM (option: NBR or CR)	SUS316L, SUS316, PTFE, FKM (option: NBR or CR)
Electrical connection	D-sub 9 pins RJ45 connector, 2 pcs	
Flow rate setting signal	0 to 5VDC (Input impedance: Approx. 1MΩ) or 4 to 20mA (Input impedance: Approx. 250Ω)	—
Flow rate output signal	0 to 5VDC (Load resistance: 10kΩ or more) or 4 to 20mA (Load resistance: 500Ω or less)	
Event output	1 point NPN open collector (Max. rating: 30VDC, 50mA) (24VDC power specification only)	
Digital communication	RS485	
Power supply	+15VDC (±5%) 100mA or less -15VDC (±5%) 150mA or less or 24VDC (±10%) 300mA or less	+15VDC (±5%) 100mA or less -15VDC (±5%) 100mA or less or 24VDC (±10%) 100mA or less
Fittings	Standard: 1/4SWL type Option: 1/8SWL type, 1/4VCR type, Rc1/4	
Weight	Approx. 500g	Approx. 440g

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assurance with calibration gas.

* He leak rate does not include permeation.

Leakage (reference value) by long-time permeation is 1 × 10⁻⁶Pa·m³/sec. or less.

Ordering

MODEL	Power supply	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Setting signal * Controller only	Output signal	Working pressure * Controller only	Option
EX-250SC-RJ EX-250SM-RJ	15: ±15V 24: 24V	1/4SWL type 1/8SWL type 1/4VCR type Rc1/4			0°C 20°C 25°C	V: 0-5V I: 4-20mA	V: 0-5V I: 4-20mA	H: 150 to 300kPa L: 50 to 149kPa	NBR: NBR seal CR: Chloroprene seal
EX-250SC-RJ	24	1/4SW	N ₂	5SLM	20°C	V	V	H	

* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

Metal-sealed Digital Mass Flow Controller / Mass Flow Meter

MODEL EX-550 SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

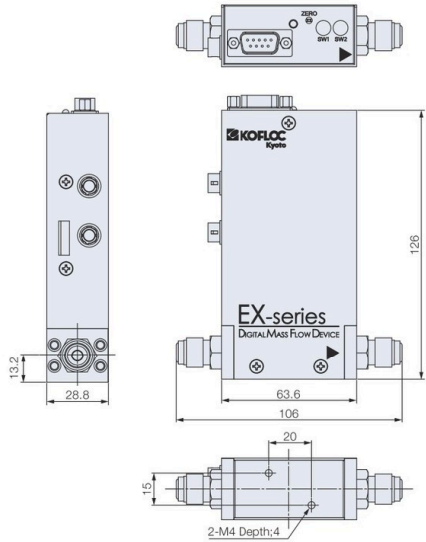
Max. flow rate Gas 10SCCM to 5SLM

Accuracy ±1%S.P. (25 to 100%F.S.)
±0.25%F.S. (under 25%F.S.)

- Metal sealing design
- Set-point High-accuracy
Response within 1 sec. at the entire flow rate control range
- Gas type switchable with rotary switch
- RS485 communication function
Analog input / output selectable from 0 to 5VDC or 4 to 20mA
Power supply selectable from ±15VDC or 24VDC



Dimensions



Wiring connection

(1) D-sub connector (male)

Pin no.	±15V specification	+24V specification
1	Signal name	
1	Valve open / close input ^{*1}	
2	Flow rate output	
3	Power +15V	Power +24V
4	Power COM	
5	Power -15V	N.C. ^{*2}
6	Flow rate setting signal Hi ^{*1}	
7	Flow rate output COM	
8	Flow rate setting signal Lo ^{*1}	
9	N.C. ^{*2}	

^{*1} Only EX-550C
^{*2} Do not connect.

(2) HR10A-7R-4S / HRS

Pin no.	Signal name
1	TR- (RS485)
2	TR+ (RS485)
3	TRCOM (RS485)
4	TRCOM (RS485)

SW1 rotary switch position table

No.	Gas type
0 ^{*1} 2	User-specified gas
1	N ₂
2	Air
3	H ₂
4	He
5	Ar
6	O ₂
7	CO ₂
8	Unusable
9	User custom C.F. mode (changeable by user)

^{*1} The C.F. conversion value at ordering time is set.
^{*2} Factory default position.

Standard Specifications

MODEL	EX-550C (MFC)	EX-550M (MFM)
Sensor type	Thermal sensor	
Valve type	Proportional solenoid valve (normally closed)	—
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	10SCCM to 5SLM	
Control range	2 to 100%F.S.	—
Response	Within 1 sec. (within $\pm 2\%$ F.S.) (L: 50 to 149kPa H: 150 to 300kPa)	—
Accuracy	$\pm 1\%$ S.P. (25 to 100%F.S.) $\pm 0.25\%$ F.S. (under 25%F.S.)	
Repeatability	$\pm 0.2\%$ F.S.	
Operating differential pressure	50 to 300kPa (Ar CO ₂ : 100 to 300kPa)	—
Max. inlet pressure	350kPa(G)	
Proof pressure	1MPa(G)	
He Leak rate	$\leq 1 \times 10^{-11}$ Pa·m ³ /s	
Allowable ambient temperature	5 to 50°C	
Accuracy guarantee temperature	15 to 35°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316L, Magnetic stainless steel, PTFE	SUS316L, PTFE
Electrical connection	D-sub 9 pins HR-10A $\times$ 2	
Flow rate setting signal	0 to 5VDC (Input impedance: Approx. 1M Ω) or 4 to 20mA (Input impedance: Approx. 250 Ω)	—
Flow rate output signal	0 to 5VDC (Load resistance: 10k Ω or more) or 4 to 20mA (Load resistance: 500 Ω or less)	
Digital communication	RS485	
Power supply	+15VDC ($\pm 5\%$) 100mA or less -15VDC ($\pm 5\%$) 150mA or less or 24VDC ($\pm 10\%$) 180mA or less	+15VDC ($\pm 5\%$) 100mA or less -15VDC ($\pm 5\%$) 100mA or less or 24VDC ($\pm 10\%$) 100mA or less
Fittings	1/4VCR type	
Weight	Approx. 800g	Approx. 550g

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assurance with calibration gas.

Ordering

MODEL	Power supply	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Setting signal * Controller only	Output signal	Working pressure * Controller only
EX-550C EX-550M	15: ± 15 V 24: 24V	1/4VCR type			0°C 20°C 25°C	V: 0-5V I: 4-20mA	V: 0-5V I: 4-20mA	H: 150 to 300kPa L: 50 to 149kPa
EX-550C	24	1/4VCR	N ₂	5SLM	20°C	V	V	

* 'VCR type' is shortened to VCR in Ordering code.

Mass Flow Controller / Mass Flow Meter with Display

MODEL 8700 SERIES NEW



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 10SCCM to 100SLM

Accuracy ±1 to 1.5%F.S.

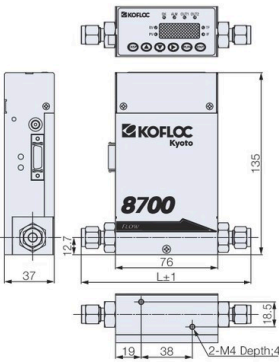


- Capable of wide flow range
(from F.S. 10SCCM to F.S. 100SLM in N₂ equivalent)
- Various functions are available with built-in display
Instantaneous / integrated flow rate display, alarm setting
- RS485 communication function
0 to 5VDC analog input / output (changeable to 4 to 20mA)

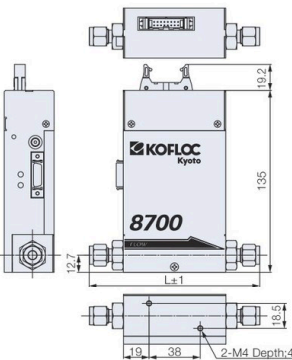


Dimensions

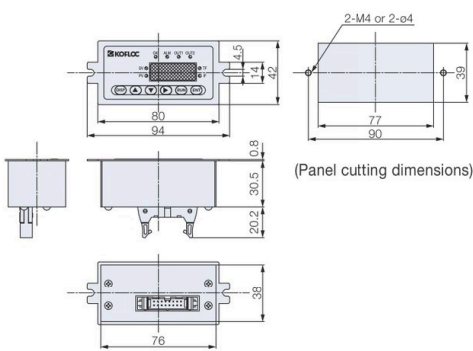
<<8700 built-in display type>>



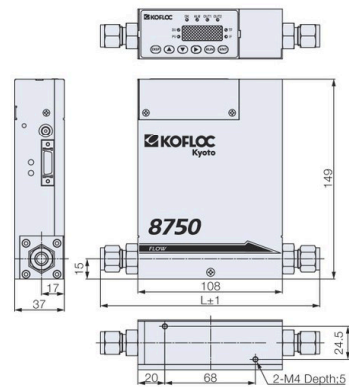
<<8700 separate type main unit>>



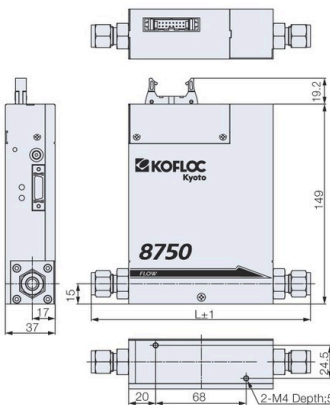
<<8700 / 8750 separate type display>>



<<8750 built-in display type>>



<<8750 separate type main unit>>



8700	
Fittings	Dimension L (mm)
Rc1/4	102
1/4SWL	127.4
1/8SWL	122.8
1/4VCR	123.8

8750	
Fittings	Dimension L (mm)
Rc3/8	144
3/8SWL	162.4
1/2SWL	166.4
1/2VCR	163.4

Standard Specifications

MODEL	8700MC / MM	8750MC / MM
Sensor type	Thermal sensor	
Valve type	Proportional solenoid valve (normally closed)	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	10SCCM to 20SLM	30 to 100SLM
Control range	2 to 100%F.S.	5 to 100%F.S.
Response	Within 2sec. (within $\pm 2\%$ F.S.)	Within 3sec. (within $\pm 2\%$ F.S.)
Accuracy	$\pm 1\%$ F.S. (25°C)	$\pm 1.5\%$ F.S. (25°C)
Temperature coefficient	$\pm 0.1\%$ F.S./°C (15 to 35°C)	$\pm 0.2\%$ F.S./°C (15 to 35°C)
Repeatability	$\pm 0.5\%$ F.S.	
Operating differential pressure	F.S. $\leq$ 5SLM 50 to 300kPa F.S. $>$ 5SLM 100 to 300kPa	F.S. $\leq$ 50SLM 150 to 300kPa F.S. $>$ 50SLM 200 to 300kPa
Max. inlet pressure	500kPa(G)	
Proof pressure	1MPa(G)	
He Leak rate	$\leq 1 \times 10^{-6}$ Pa·m ³ /s	
Allowable ambient temperature	5 to 45°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316, SUS316L, Magnetic stainless steel (MFC only), FKM (option: NBR or CR)	
Electrical connection	D-sub half pitch 20 pins, Hirose DX10M-20S	
Flow rate setting signal	0 to 5VDC (Input impedance: 100k Ω or more) / 4 to 20mA (Input impedance: Approx. 250 Ω)	
Flow rate output signal	0 to 5VDC (Load resistance: 250k Ω or more) / 4 to 20mA (Load resistance: 300 Ω or less)	
Digital communication	RS485	
Display	4-digit 7-segment LED	
Power supply	24VDC ($\pm 10\%$), 300mA or less	
Fittings	Standard: Rc1/4 Option: 1/4SWL type, 1/8SWL type, 1/4VCR type	Standard: Rc3/8 Option: 3/8SWL type, 1/2SWL type, 1/2VCR type
Weight	Approx. 1,200g	Approx. 1,500g

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assurance with calibration gas.

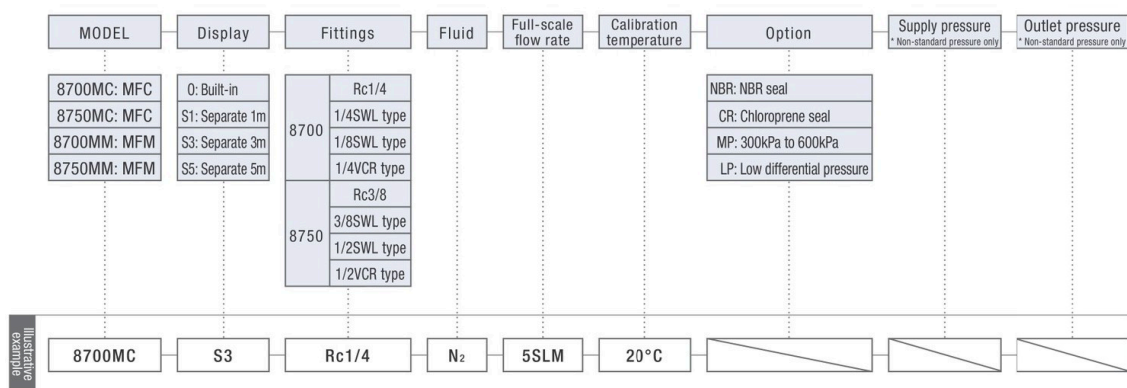
* He leak rate does not include permeation.

Leakage (reference value) by long-time permeation is 1×10^{-6} Pa·m³/sec. or less.

* Analog input/output are changeable with the display (0 to 5VDC at factory default).

* The valve type, control range, response, operating differential pressure and flow rate setting signal are only for the mass flow controller.

Ordering



* For MP option (100SCCM or more in N₂ equivalent) and LP option (20SLM or less in N₂ equivalent), specify specific pressure conditions.

* MP option is limited to the use under the specified pressure conditions only.

* See Page 45 for the power adaptor PSK-85CE.

See Page 46 for the external cable CP-STD6.

* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

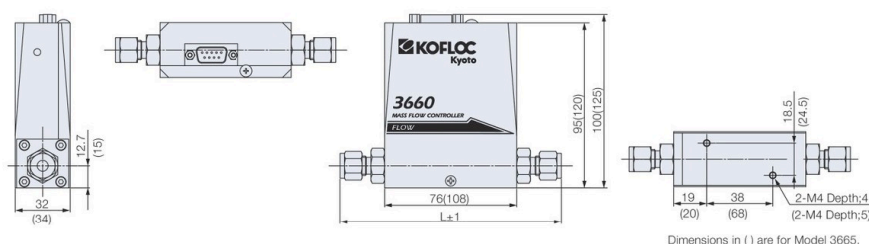
Standard Mass Flow Controller

MODEL 3660 SERIES
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 10SCCM to 100SLM

Accuracy ±1 to 1.5%F.S.

- Capable of wide flow range
(from F.S. 10SCCM to F.S. 100SLM in N₂ equivalent)

**Dimensions**

3660	
Fittings	Dimension L (mm)
1/4SWL	127.4
1/8SWL	122.8
1/4VCR	123.8
Rc1/4	102

3665	
Fittings	Dimension L (mm)
3/8SWL	162.4
1/2SWL	166.4
1/2VCR	163.4
Rc3/8	144

Dimensions in () are for Model 3665.

Standard Specifications

MODEL	3660	3665
Sensor type	Thermal sensor	
Valve type	Proportional solenoid valve (normally closed)	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	10SCCM to 20SLM	30 to 100SLM
Control range	2 to 100%F.S.	5 to 100%F.S.
Response	Within 2sec. (within ±2% F.S.)	Within 3sec. (within ±2% F.S.)
Accuracy	±1%F.S. (25°C)	±1.5%F.S. (25°C)
Temperature coefficient	±0.1%F.S./°C (15 to 35°C)	±0.2%F.S./°C (15 to 35°C)
Repeatability	±0.5%F.S.	
Operating differential pressure	F.S. ≤ 5SLM 50 to 300kPa, F.S. > 5SLM 100 to 300kPa	F.S. ≤ 50SLM 150 to 300kPa, F.S. > 50SLM 200 to 300kPa
Max. inlet pressure	500kPa(G)	
Proof pressure	1MPa(G)	
He Leak rate	≤ 1 × 10 ⁻⁶ Pa·m ³ /s	
Allowable ambient temperature	5 to 45°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316L, SUS316, Magnetic stainless steel, FKM (option: NBR or CR)	
Electrical connection	D-sub 9 pins, KFC standard (compliant with the SEMI standard)	
Flow rate setting signal	0 to 5VDC (Input impedance: 1MΩ or more)	
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)	
Power supply	+15VDC (±5%) 100mA, -15VDC (±5%) 250mA	
Fittings	Standard: 1/4SWL type, Option: 1/8SWL type, 1/4VCR type, Rc1/4	Standard: 3/8SWL type, Option: 1/2SWL type, 1/2VCR type, Rc3/8
Weight	Approx. 1,000g	Approx. 1,500g

* Use with a dry and clean gas containing no corrosive components, dust or mist. * Accuracy assurance with calibration gas.

* He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁶Pa·m³/sec. or less.**Ordering**

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Option	Supply pressure	Outlet pressure
3660	3660 1/4SWL type 1/8SWL type 1/4VCR type Rc1/4	N ₂	5SLM	20°C	NBR: NBR seal CR: Chloroprene seal MP: 300kPa to 600kPa LP: Low differential pressure	Non-standard pressure only	Non-standard pressure only
3665							
3660	3665 3/8SWL type 1/2SWL type 1/2VCR type Rc3/8						

* For MP option (100SCCM or more in N₂ equivalent) and LP option (20SLM or less in N₂ equivalent), specify specific pressure conditions.

* MP option is limited to the use under the specified pressure conditions only.

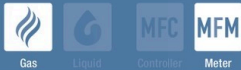
* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

Wiring connection

- D-sub 9 pins, KFC standard pin layout (see Fig. 6 on Page 15)

Standard Mass Flow Meter

MODEL 3760 SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 10SCCM to 100SLM

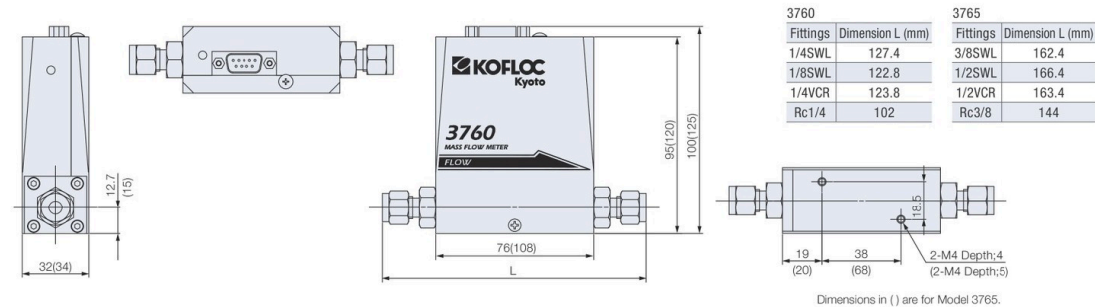
Accuracy ±1 to 1.5%F.S.

- Capable of wide flow range
(from F.S. 10SCCM to F.S. 100SLM in N₂ equivalent)



Mass Flow Controller / Mass Flow Meter

Dimensions

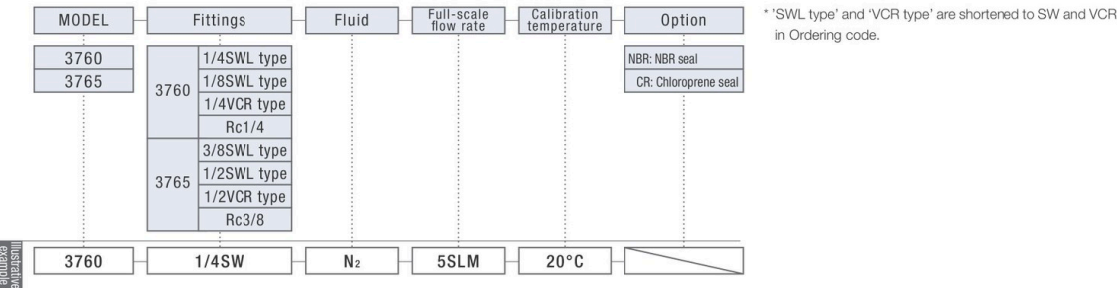


Standard Specifications

MODEL	3760	3765
Sensor type	Thermal sensor	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	10SCCM to 20SLM	30 to 100SLM
Accuracy	±1%F.S. (25°C)	±1.5%F.S. (25°C)
Temperature coefficient	±0.1%F.S./°C (15 to 35°C)	±0.2%F.S./°C (15 to 35°C)
Repeatability	±0.5%F.S. (20°C)	
Max. inlet pressure	500kPa(G)	
Proof pressure	1MPa(G)	
He Leak rate	≤ 1 × 10 ⁻⁶ Pa·m ³ /s	
Allowable ambient temperature	5 to 45°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316L, FKM (option: NBR or CR)	
Electrical connection	D-sub 9 pins, KFC standard (compliant with the SEMI standard)	
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)	
Power supply	+15VDC (±5%) 100mA, -15VDC (±5%) 100mA	
Fittings	Standard: 1/4SWL type, Option: 1/8SWL type, 1/4VCR type, Rc1/4	Standard: 3/8SWL type, Option: 1/2SWL type, 1/2VCR type, Rc3/8
Weight	Approx. 800g	Approx. 1,000g

* Use with a dry and clean gas containing no corrosive components, dust or mist. * Accuracy assurance with calibration gas.
* He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁶Pa·m³/sec. or less.

Ordering



Wiring connection

- D-sub 9 pins, KFC standard pin layout (see Fig. 6 on Page 15)

High-grade Mass Flow Controller

MODEL 3200 SERIES
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

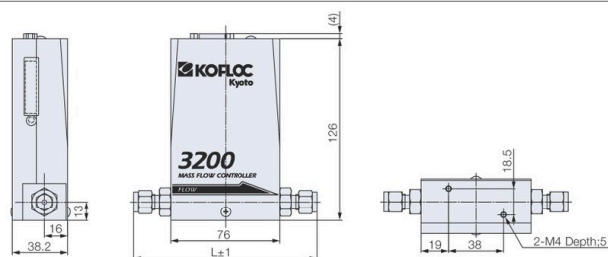
Max. flow rate Gas 1SCCM to 20SLM

Accuracy ±1%F.S.

- Minute flow range available (from F.S. 1SCCM in N₂ equivalent)
- Reduced dead volume thanks to the diaphragm seat valve



Dimensions



Fittings	Dimension L (mm)
1/4SWL	127.4
1/8SWL	122.8
1/4VCR	123.8
Rc1/4	102

Standard Specifications

MODEL	3200
Sensor type	Thermal sensor
Valve type	Proportional solenoid valve (normally closed)
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Full-scale flow rate (N ₂ equivalent)	1SCCM to 20SLM
Control range	2 to 100%F.S.
Response	Within 1sec. (within ±2% F.S.)
Accuracy	±1%F.S.
Repeatability	±0.2%F.S.
Operating differential pressure	F.S. ≤ 5SLM 50 to 300kPa, F.S. > 5SLM 100 to 300kPa
Max. inlet pressure	300kPa(G)
Proof pressure	1MPa(G)
He Leak rate	≤ 1 × 10 ⁻⁹ Pa·m ³ /s
Allowable ambient temperature	0 to 50°C
Accuracy guarantee temperature	15 to 35°C
Allowable storage temperature	-10 to 60°C
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)
Materials of parts in contact with gases	SUS316L, Ni, PTFE, FKM (option: NBR or CR)
Electrical connection	D-sub 9 pins, KFC standard (compliant with the SEMI standard)
Flow rate setting signal	0 to 5VDC (Input impedance: 1MΩ or more)
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)
Power supply	+15VDC (±5%) 100mA, -15VDC (±5%) 200mA
Fittings	Standard: 1/4SWL type, Option: 1/8SWL type, 1/4VCR type, Rc1/4
Weight	Approx. 1,000g

* Use with a dry and clean gas containing no corrosive components, dust or mist. * Accuracy assurance with calibration gas.

* He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁹Pa·m³/sec. or less.

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Option	Supply pressure * Non-standard pressure only	Outlet pressure * Non-standard pressure only
3200	1/4SWL type 1/8SWL type 1/4VCR type Rc1/4				NBR: NBR seal CR: Chloroprene seal MP: 300kPa to 600kPa LP: Low differential pressure SR: 1 to 5SCCM		
3200	1/4SW	N ₂	5SLM	20°C			

* For MP option (100SCCM or more in N₂ equivalent) and LP option (20SLM or less in N₂ equivalent), specify specific pressure conditions.

* MP option is limited to the use under the specified pressure conditions only.

* For SR option, only operation check is conducted as to measurement points except for 100% F.S. in the case of the gas type of 3SCCM or less in calibration gas equivalent.

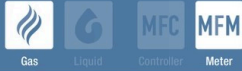
* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

Wiring connection

- D-sub 9 pins, KFC standard pin layout (see Fig. 6 on Page 15)

High-grade Mass Flow Meter

MODEL 3100 SERIES



Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate **Gas** 1SCCM to 20SLM

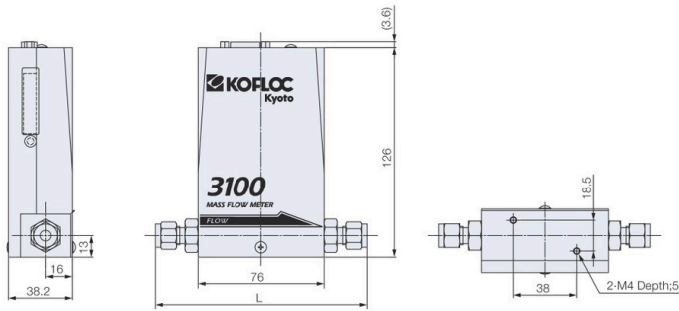
Accuracy ±1%F.S.

■ Minute flow range available (from F.S. 1SCCM in N₂ equivalent)



Mass Flow Controller / Mass Flow Meter

Dimensions



Fittings	Dimension L (mm)
1/4SWL	127.4
1/8SWL	122.8
1/4VCR	123.8
Rc1/4	102

Standard Specifications

MODEL	3100
Sensor type	Thermal sensor
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Full-scale flow rate (N ₂ equivalent)	1SCCM to 20SLM
Accuracy	±1%F.S.
Repeatability	±0.2%F.S.
Max. inlet pressure	500kPa(G)
Proof pressure	1MPa(G)
He Leak rate	≤ 1 × 10 ⁻⁹ Pa·m ³ /s
Allowable ambient temperature	0 to 50°C
Accuracy guarantee temperature	15 to 35°C
Allowable storage temperature	-10 to 60°C
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)
Materials of parts in contact with gases	SUS316L, Ni, PTFE, FKM (option: NBR or CR)
Electrical connection	D-sub 9 pins, KFC standard (compliant with the SEMI standard)
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)
Power supply	+15VDC (±5%) 100mA, -15VDC (±5%) 100mA
Fittings	Standard: 1/4SWL type, Option: 1/8SWL type, 1/4VCR type, Rc1/4
Weight	Approx. 800g

* Use with a dry and clean gas containing no corrosive components, dust or mist. * Accuracy assurance with calibration gas.

* He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁹Pa·m³/sec. or less.

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Option
3100	1/4SWL type 1/8SWL type 1/4VCR type Rc1/4				NBR: NBR seal CR: Chloroprene seal SR: 1 to 5SCCM
3100	1/4SW	N ₂	5SLM	20°C	

* For SR option, only operation check is conducted as to measurement points except for 100% F.S. in the case of the gas type of 3SCCM or less in calibration gas equivalent.

* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

Wiring connection

■ D-sub 9 pins, KFC standard pin layout (see Fig. 6 on Page 15)

Metal-sealed Mass Flow Controller

MODEL 5100 SERIES
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

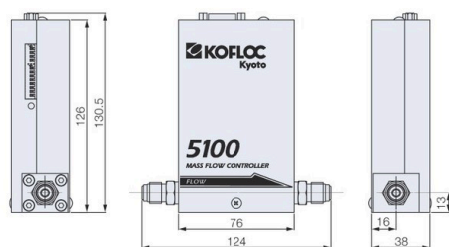
Max. flow rate Gas 1SCCM to 20SLM

Accuracy ±1%F.S.

- Metal sealing design
- Minute flow range available (from F.S. 1SCCM in N₂ equivalent)
- Reduced dead volume thanks to the diaphragm seat valve



Dimensions



Standard Specifications

MODEL	5100
Sensor type	Thermal sensor
Valve type	Proportional solenoid valve (normally closed)
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Full-scale flow rate (N ₂ equivalent)	1SCCM to 20SLM
Control range	2 to 100%F.S.
Response	Within 1sec. (within ±2% F.S.)
Accuracy	±1%F.S.
Repeatability	±0.2%F.S.
Operating differential pressure	F.S. ≤5SLM 50 to 300kPa, F.S. >5SLM 100 to 300kPa
Max. inlet pressure	300kPa(G)
Proof pressure	1MPa(G)
He Leak rate	≤1 × 10 ⁻¹¹ Pa·m ³ /s
Allowable ambient temperature	0 to 50°C
Accuracy guarantee temperature	15 to 35°C
Allowable storage temperature	-10 to 60°C
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)
Materials of parts in contact with gases	SUS316L, Ni, PTFE, Au
Electrical connection	D-sub 9 pins, KFC standard (compliant with the SEMI standard)
Flow rate setting signal	0 to 5VDC (input impedance: 1MΩ or more)
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)
Power supply	+15VDC (±5%) 100mA, -15VDC (±5%) 200mA
Fittings	1/4VCR type
Weight	Approx. 1,000g

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assurance with calibration gas.

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Option	Supply pressure	Outlet pressure
5100	1/4VCR type				MP: 300kPa to 600kPa LP: Low differential pressure SR: 1 to 5SCCM	* Non-standard pressure only	* Non-standard pressure only
5100	1/4VCR	N ₂	5SLM	20°C			

* For MP option (100SCCM or more in N₂ equivalent) and LP option (20SLM or less in N₂ equivalent), specify specific pressure conditions.

* MP option is limited to the use under the specified pressure conditions only.

* For SR option, only operation check is conducted as to measurement points except for 100% F.S. in the case of the gas type of 3SCCM or less in calibration gas equivalent.

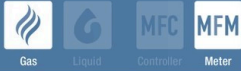
* 'VCR type' is shortened to VCR in Ordering code.

Wiring connection

- D-sub 9 pins, KFC standard pin layout (see Fig. 6 on Page 15)

Metal-sealed Mass Flow Meter

MODEL 5410 SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 10SCCM to 20SLM

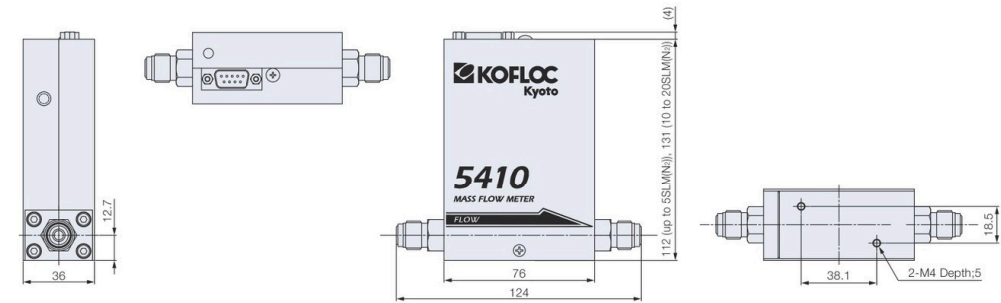
Accuracy ±1%F.S.

■ Metal sealing design



Mass Flow Controller / Mass Flow Meter

Dimensions

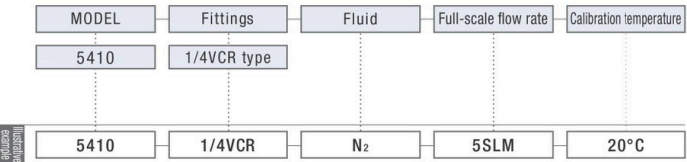


Standard Specifications

MODEL	5410
Sensor type	Thermal sensor
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Full-scale flow rate (N ₂ equivalent)	10SCCM to 20SLM
Accuracy	±1%F.S.
Repeatability	±0.2%F.S.
Max. inlet pressure	500kPa(G)
Proof pressure	1MPa(G)
He Leak rate	≤1 × 10 ⁻¹¹ Pa·m ³ /s
Allowable ambient temperature	0 to 50°C
Accuracy guarantee temperature	15 to 35°C
Allowable storage temperature	-10 to 60°C
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)
Materials of parts in contact with gases	SUS316L, Ni, PTFE
Electrical connection	D-sub 9 pins, KFC standard (compliant with the SEMI standard)
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)
Power supply	+15VDC (±5%) 100mA, -15VDC (±5%) 100mA
Fittings	1/4VCR type
Weight	Approx. 800g

* Use with a dry and clean gas containing no corrosive components, dust or mist.
* Accuracy assurance with calibration gas.

Ordering



* 'VCR type' is shortened to VCR in Ordering code.

Wiring connection

■ D-sub 9 pins, KFC standard pin layout (see Fig. 6 on Page 15)

Low-cost Mass Flow Meter with Display

MODEL 3810DSII SERIES

Gas

Liquid

Controller

Meter

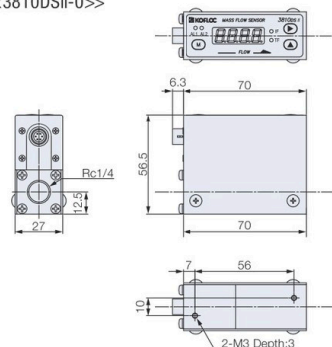
*Optional needle valve

Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc.Max. flow rate **Gas** 10SCCM to 100SLMAccuracy ± 2 to 3%F.S.

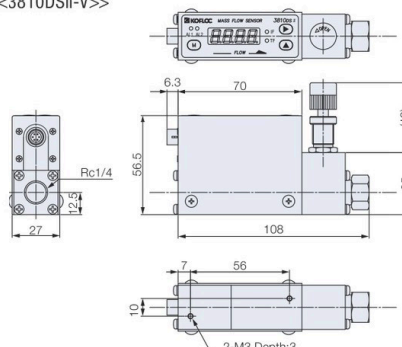
- Various functions are available with built-in display
Instantaneous / integrated flow rate display, alarm setting
- Analog output selectable from 4 to 20mA or 1 to 5VDC
Integrated flow pulse output
- Capable of controlling the flow rate with optional needle valve

**Dimensions**

<<3810DSII-0>>



<<3810DSII-V>>

**Standard Specifications**

MODEL	3810DSII	
Sensor type	Thermal sensor	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	10SCCM to 20SLM	21 to 100SLM
Accuracy	$\pm 2\%$ F.S. (25°C)	$\pm 3\%$ F.S. (25°C)
Temperature coefficient	$\pm 0.2\%$ F.S./°C (15 to 35°C)	
Max. inlet pressure	500kPa(G)	
Proof pressure	1MPa(G)	
Allowable ambient temperature	0 to 50°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	30%RH to 80%RH (no dew condensation)	
Materials of parts in contact with gases	SUS303, PTFE, FKM (option: NBR or CR)	
Electrical connection	Hirose HR10A-7R-6P (HR10A-7P-6S on cable side)	
Flow rate output signal	1 to 5VDC or 4 to 20mA	
Event output	2 points NPN open collector (Max. rating: 30VDC, 50mA)	
Display	4-digit 7-segment LED	
Power supply	24VDC ($\pm 5\%$) 100mA	
Fittings	Rc1/4	
Weight	Approx. 400g (valve excluded)	

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assurance with calibration gas.

Ordering

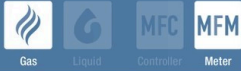
MODEL	Needle valve	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Output signal	Supply pressure * Only for with valve	Outlet pressure * Only for with valve	Option
3810DSII	V: Yes O: No	Rc1/4				I: 4 - 20mA V: 1 - 5V			NBR: NBR seal CR: Chloroprene seal
3810DSII	V	Rc1/4	N ₂	5SLM	20°C	V	0.2MPa	0MPa	

* See Page 45 for the power adaptor PSK-38DSII.

* See Page 46 for the external cable CP-3810DSII-CF.

Low-cost Mass Flow Sensor

MODEL 3810S SERIES



Mass Flow Controller / Mass Flow Meter

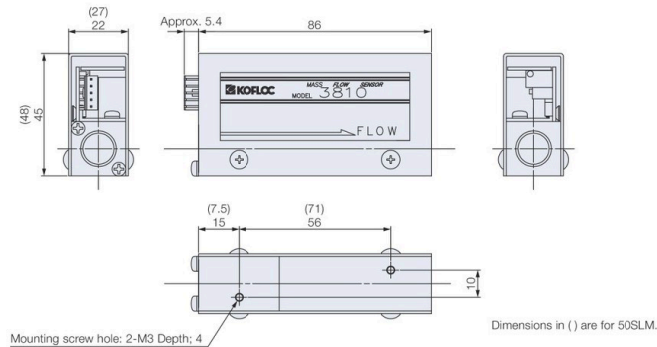
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 10SCCM to 50SLM

Accuracy ±3 to 5%F.S.



Dimensions



Standard Specifications

MODEL	3810S	
Sensor type	Thermal sensor	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	10SCCM to 2SLM	3 to 50SLM
Accuracy	±3%F.S. (25°C)	±5%F.S. (25°C)
Temperature coefficient	±0.15%F.S./°C (15 to 35°C)	±0.2%F.S./°C (15 to 35°C)
Repeatability	±0.5%F.S.	
Max. inlet pressure	500kPa(G)	
Proof pressure	1MPa(G)	
Allowable ambient temperature	5 to 45°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS303, PTFE, FKM (option: NBR or CR)	
Electrical connection	AMP 171826-5 (171822-5 on cable side)	
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)	
Power supply	+15VDC (±5%) 60mA, -15VDC (±5%) 60mA	
Fittings	Rc1/4	
Weight	Approx. 250g	Approx. 350g

* Use with a dry and clean gas containing no corrosive components, dust or mist.

* Accuracy assurance with calibration gas.

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Option
3810S	Rc1/4				NBR: NBR seal CR: Chloroprene seal
3810S	Rc1/4	N ₂	5SLM	20°C	

Cable connection

No.1	Power supply: +15VDC
No.2	Power COM
No.3	Power supply: -15VDC
No.4	Flow rate output: 0 to 5VDC
No.5	Flow rate output COM

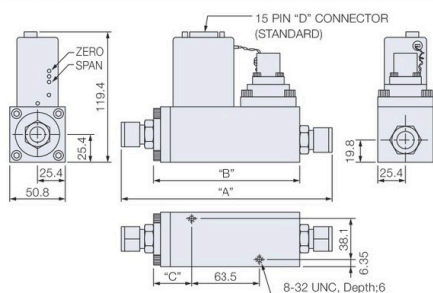
Large flow rate Mass Flow Controller

MODEL HFC-303 SERIES
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 100 to 1000SLM

Accuracy ±1%F.S.

■ Available for large flow rates (F.S. 1,000SLM in N₂ equivalent)

**Dimensions**

≤300SLM 1/2SWL type

HFC-303 1/2" FITTING

FITTING TYPE	SWAG. 1/2" W NUT
DIM "A"	7.56 (197.6)
DIM "B"	5.36 (136.1)
DIM "C"	1.36 (34.5)

>300SLM 3/4SWL type

HFC-303 3/4" FITTING

FITTING TYPE	SWAG. 3/4" W NUT
DIM "A"	8.44 (214.4)
DIM "B"	5.76 (146.3)
DIM "C"	1.56 (39.6)

Standard Specifications

MODEL	HFC-303	
Sensor type	Thermal sensor	
Valve type	Proportional solenoid + pneumatic 2-stage valve (normally closed)	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	100 to 300SLM	301 to 1000SLM
Control range	2 to 100%F.S.	5 to 100%F.S.
Accuracy	±1%F.S. (25°C)	
Temperature coefficient	±0.1%F.S./°C (15 to 35°C)	±0.2%F.S./°C (15 to 35°C)
Repeatability	±0.25%F.S.	
Operating differential pressure	Individually processed	
Proof pressure	3.4MPa(G) (HP option: 6.8MPa(G))	
He Leak rate	≤1 × 10 ⁻⁷ Pa·m ³ /s	
Allowable ambient temperature	5 to 45°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316, Ni, SUS302, FKM	
Electrical connection	D-sub 15 pins	
Flow rate setting signal	0 to 5VDC (Input impedance: 1MΩ or more)	
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)	
Power supply	+15VDC (±5%) 150mA, -15VDC (±5%) 300mA	
Fittings	1/2SWL type	3/4SWL type
Weight	Approx. 2,400g	

* Use with a dry and clean gas containing no corrosive components, dust or mist. * Accuracy assurance with calibration gas.

* He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁷Pa·m³/sec. or less.

* The material of the gas contact part is subject to change, depending on the specification.

* In order to measure the flow rate accurately, attach straight pipes to inlet and out of the unit, which has the same diameter as the piping diameter. Particularly, longer than 300mm straight pipe is recommended for the inlet side.

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Supply pressure	Outlet pressure	Option
HFC-303	1/2SWL type 3/4SWL type						HP: High pressure
HFC-303	1/2SW	N ₂	100SLM	20°C	0.1MPa	0MPa	

* 'SWL type' is shortened to SW in Ordering code.

Wiring connection (D-sub 15 pins)

Pin no.	Signal name	Pin no.	Signal name	Pin no.	Signal name
1	NC	6	Output signal: 0V to 5V	11	Power supply: +15VDC
2	NC	7	NC	12	Power COM
3	NC	8	Valve open / close	13	NC
4	NC	9	Power supply: -15VDC	14	Flow rate setting
5	Signal COM	10	NC	15	NC

Large flow rate Mass Flow Meter

MODEL HFM-301 SERIES


Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 100 to 1000SLM

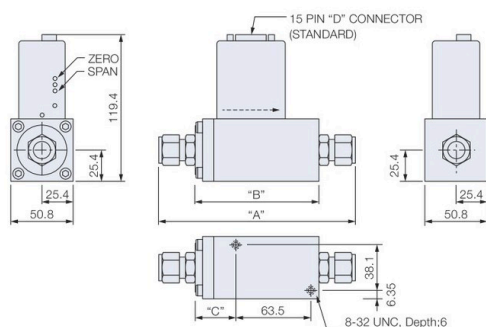
Accuracy ±1%F.S.

■ Available for large flow rates (F.S. 1,000SLM in N₂ equivalent)



Mass Flow Controller / Mass Flow Meter

Dimensions



≤300SLM 1/2SWL type

HFM-301 1/2FITTING

FITTING TYPE	SWAG. 1/2" W NUT
DIM "A"	6.31 (165.9)
DIM "B"	4.11 (104.4)
DIM "C"	1.36 (34.5)

>300SLM 3/4SWL type

HFM-301 3/4FITTING

FITTING TYPE	SWAG. 3/4" W NUT
DIM "A"	6.99 (177.5)
DIM "B"	4.31 (109.5)
DIM "C"	1.56 (39.6)

Standard Specifications

MODEL	HFM-301	
Sensor type	Thermal sensor	
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	
Full-scale flow rate (N ₂ equivalent)	100 to 300SLM	301 to 1000SLM
Accuracy	±1%F.S. (25°C)	
Temperature coefficient	±0.1%F.S./°C (15 to 35°C)	±0.2%F.S./°C (15 to 35°C)
Repeatability	±0.25%F.S.	
Proof pressure	3.4MPa(G) (HP option: 6.8MPa(G))	
He Leak rate	≤1 × 10 ⁻⁷ Pa·m ³ /s	
Allowable ambient temperature	5 to 45°C	
Allowable storage temperature	-10 to 60°C	
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)	
Materials of parts in contact with gases	SUS316, Ni, SUS302, FKM	
Electrical connection	D-sub 15 pins	
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)	
Power supply	+15VDC (±5%) 60mA, -15VDC (±5%) 60mA	
Fittings	1/2SWL type	3/4SWL type
Weight	Approx. 1,600g	

* Use with a dry and clean gas containing no corrosive components, dust or mist. * Accuracy assurance with calibration gas.

 * He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁷Pa·m³/sec. or less.

* The material of the gas contact part is subject to change, depending on the specification.

* In order to measure the flow rate accurately, attach straight pipes to inlet and out of the unit, which has the same diameter as the piping diameter. Particularly, longer than 300mm straight pipe is recommended for the inlet side.

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Working pressure	Option
HFM-301	1/2SWL type 3/4SWL type					HP: High pressure
HFM-301	1/2SW	N ₂	100SLM	20°C	0.1MPa	

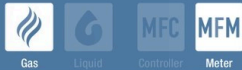
* 'SWL type' is shortened to SW in Ordering code.

Wiring connection (D-sub 15 pins)

Pin no.	Signal name	Pin no.	Signal name	Pin no.	Signal name
1	NC	6	Output signal: 0V to 5V	11	Power supply: +15VDC
2	NC	7	NC	12	Power COM
3	NC	8	NC	13	NC
4	NC	9	Power supply: -15VDC	14	NC
5	Signal COM	10	NC	15	NC

Low pressure drop large flow rate Mass Flow Meter

MODEL HFM-200W / LS SERIES

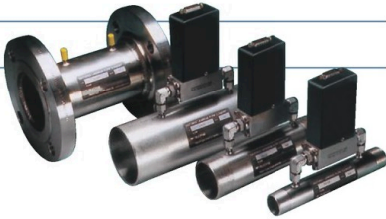


Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 1500 to 15000SLM

Accuracy ±3 to 5%F.S.

Available for large flow rates (F.S. 15,000SLM in N₂ equivalent)



Standard Specifications

MODEL	HFM-200W / LS			
Sensor type	Thermal sensor			
Applicable gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.			
Full-scale flow rate (N ₂ equivalent)	1500SLM	3000SLM	6000SLM	15000SLM
Accuracy	±3%F.S. (25°C)		±5%F.S. (25°C)	
Temperature coefficient	±0.1%F.S./°C (15 to 35°C)		±0.2%F.S./°C (15 to 35°C)	
Repeatability	±0.5%F.S.			
Proof pressure	980kPa(G) (Smooth end: 3.4 MPa(G))			
He Leak rate	<1 × 10 ⁻⁷ Pa·m ³ /s			
Allowable ambient temperature	5 to 45°C			
Allowable storage temperature	-10 to 60°C			
Allowable ambient humidity	10%RH to 90%RH (no dew condensation)			
Materials of parts in contact with gases	SUS316, Ni, FKM			
Electrical connection	D-sub 15 pins			
Flow rate output signal	0 to 5VDC (Load resistance: 250kΩ or more)			
Power supply	+15VDC (±5%) 50mA, -15VDC (±5%) 50mA			
Fittings	Standard: 3" NPT Option: 3" smooth end	Standard: 4" Ansi flange Option: 4" smooth end	Standard: 6" Ansi flange Option: 6" smooth end	Standard: 8" Ansi flange Option: 8" smooth end

- * Use with a dry and clean gas containing no corrosive components, dust or mist.
- * Accuracy assurance with calibration gas.
- * He leak rate does not include permeation. Leakage (reference value) by long-time permeation is 1 × 10⁻⁶Pa·m³/sec. or less.
- * The material of the gas contact part is subject to change, depending on the specification.
- * In order to measure the flow rate accurately, attach straight pipes to inlet and out of the unit, which is longer than 5 times of the laminar diameter.

Laminar flow element

Laminar type	Connection	Laminar type	Connection
3	3" NPT	6F	6" Ansi flange
3S	3" smooth end (option)	6S	6" smooth end (option)
4F	4" Ansi flange	8F	8" Ansi flange
4S	4" smooth end (option)	8S	8" smooth end (option)

Ordering

MODEL	Fittings	Fluid	Full-scale flow rate	Calibration temperature	Working pressure
HFM-200W / LS	Laminar type				
HFM-200W / LS	3	N ₂	1500SLM	20°C	0.1MPa

Wiring connection (D-sub 15 pins)

Pin no.	Signal name	Pin no.	Signal name	Pin no.	Signal name
1	NC	6	Output signal: 0V to 5V	11	Power supply: +15VDC
2	NC	7	GND	12	Power COM
3	NC	8	NC	13	NC
4	NC	9	Power supply: -15VDC	14	NC
5	Signal COM	10	NC	15	NC

Handy Mass Flow Control / Measuring Unit

FLOW COMPO™



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 1SCCM to 20SLM

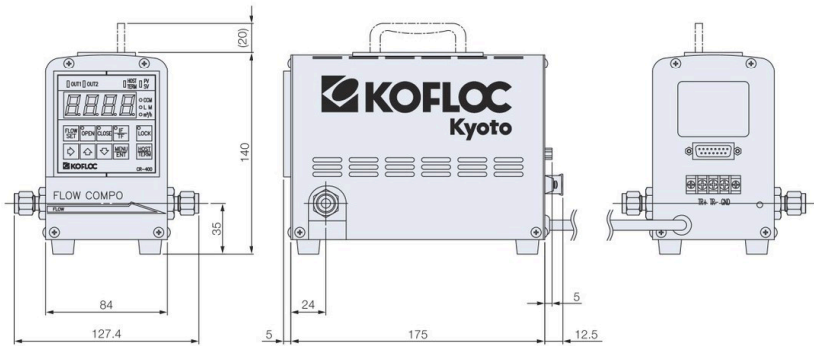
Accuracy ±1%F.S.

■ Handy mass flow control / measuring unit combining the readout unit CR-400B with the mass flow controller / mass flow meter



Mass Flow Controller / Mass Flow Meter

Dimensions



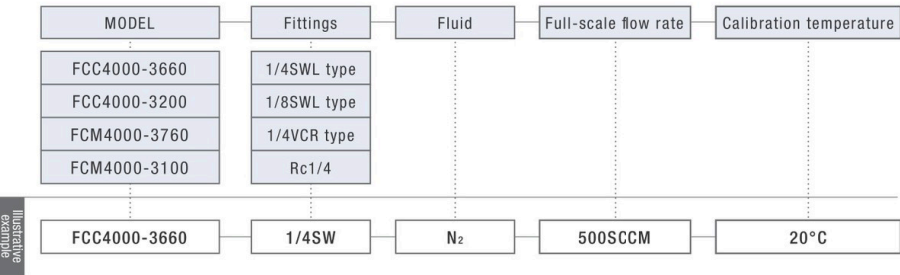
* For L, refer to the face-to-face dimension of each MFC / MFM.
* "FLOW COMPO™" is our registered trademark.

Standard Specifications

MODEL	FCC4000-3660	FCC4000-3200	FCM4000-3760	FCM4000-3100
Equipped MFC / MFM	3660 (MFC)	3200 (MFC)	3760 (MFM)	3100 (MFM)
Full-scale flow rate (N ₂ equivalent)	10SCCM to 20SLM	1SCCM to 20SLM	10SCCM to 20SLM	1SCCM to 20SLM
Accuracy	±1%F.S. (25°C)	±1%F.S. (15 to 35°C)	±1%F.S. (25°C)	±1%F.S. (15 to 35°C)

* For the detailed specifications, refer to equipped MFC / MFM. For CR-400B, inquire our sales office.

Ordering



* "SWL type" and "VCR type" are shortened to SW and VCR in Ordering code.

Small Karman Vortex Flow Meter for Liquid

MODEL FM31 SERIES

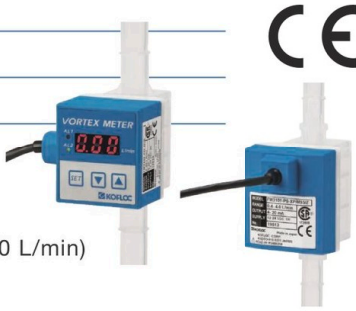


Applicable fluids **Liquid** Pure water, chemical solution

Max. flow rate **Liquid** 4 to 100L/min

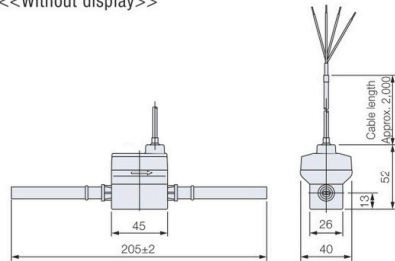
Accuracy $\pm 3\%$ F.S.

- PFA material for wetted parts (without O-ring)
- Small and light-weight
- Available for wide range of flow rate (from 0.4 - 4 L/min. to 10 - 100 L/min)

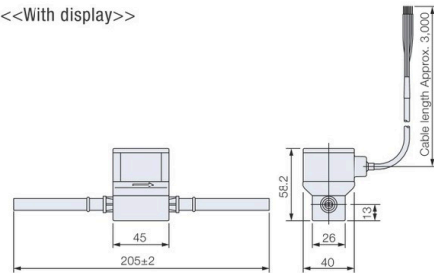


Dimensions

<<Without display>>



<<With display>>



Standard Specifications

MODEL			FM3101	FM3102	FM3103	FM3104
Connection			3/8" tube end	1/2" tube end	3/4" tube end	1" tube end
Flow rate range			0.4 to 4L/min	2 to 20L/min	5 to 50L/min	10 to 100L/min
Fluid			Pure water, chemical solution			
Accuracy			±3%F.S. (25°C)			
Repeatability			±0.5%F.S.			
Liquid temperature			0°C to 90°C (no freezing and boiling)			
Proof pressure			1MPa(G)			
Allowable ambient temperature			0 to 50°C			
Allowable ambient humidity			5%RH to 90%RH (no dew condensation)			
Protective structure			IP64 (JIS C0920 Splash-proof structure)			
Materials of parts in contact with liquid			New PFA, Super PFA			
Output	With display	D	Display: 3-digit LED Current output: 4 to 20mA (linear) Alarm output: Open collector (2 LEDs, 80mA, 30VDC at maximum)			
	Without display	S	Current output: 4 to 20mA (linear)			
Supply voltage			12 to 24VDC			
Cable length			Without display: 2m terminated, preliminary soldering With display: 3m terminated, preliminary soldering			
Weight			Without display: 60g (main body) With display: 100g (main body)			165g (main body) 205g (main body)

Ordering

MODEL	Output				
FM3101	S: 4-20mA				
FM3102	D: 4-20mA + display				
FM3103					
FM3104					
Illustration example	FM3101	P	D	X	P /K

Ultrasonic Flow Meter for Liquid

MODEL FML-500



Applicable fluids **Liquid** Water, pure water

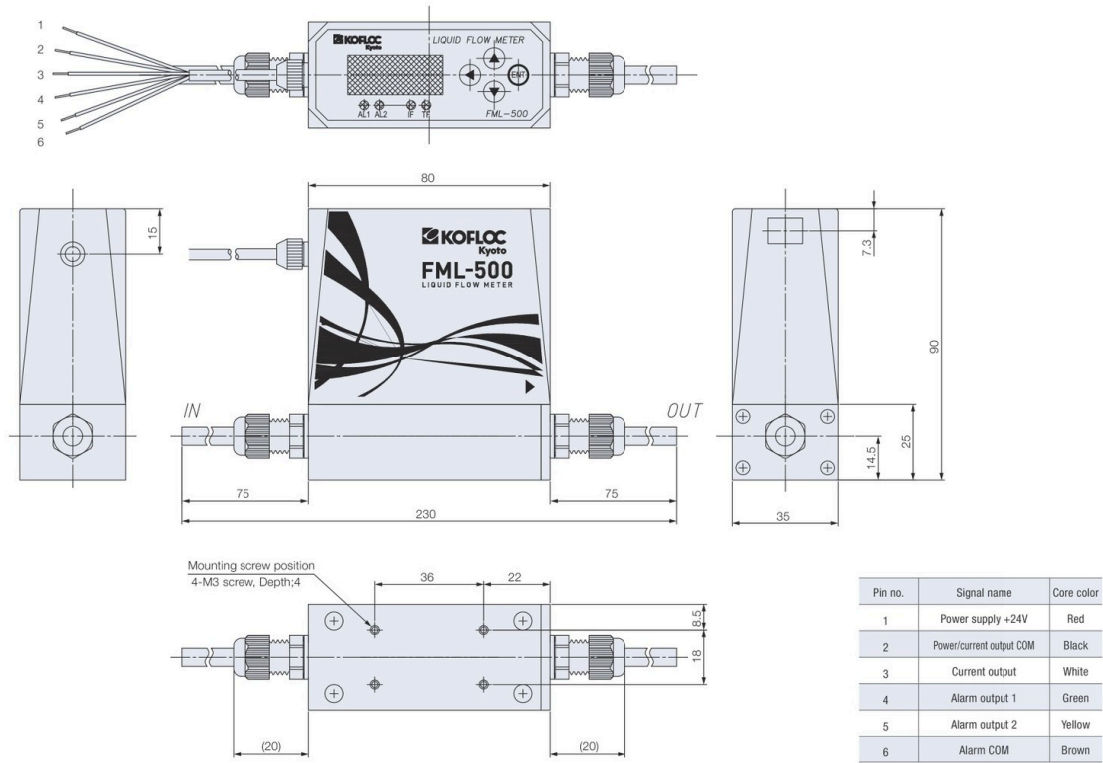
Max. flow rate **Liquid** 5L/min

Accuracy $\pm 30\text{mL/min}$ to $\pm 1.5\% \text{F.S.}$

- New PFA material for wetted parts
- Straight structure free from obstacles in the tube



Dimensions



Standard Specifications

MODEL	FML-500
Fluid	Water, pure water (no air bubbles) * For other liquids, please contact us.
Fluid sound velocity	1300 to 1600m/s
Fluid temperature range	15 to 50°C
Measurement range	0 to 5L/min
Accuracy	See Table 1.
Materials of parts in contact with liquid	New PFA
Proof pressure	0.5MPa (at 23°C)
Process connection	6mm tube end
Exclusive cable length	3m
Cable sheath	PVC
Structure	Equivalent to IP64
Allowable ambient temperature	5°C to 50°C (no dew condensation)
Allowable ambient humidity	10%RH to 85%RH (no dew condensation)
Mounting direction	Vertical, horizontal, oblique
Weight	200g (main body)

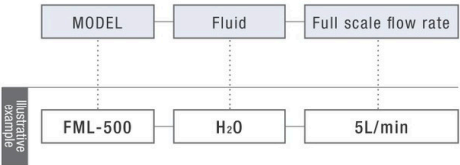
Table 1. Accuracy (Water, 23°C)

Measurement range	0 to 5L/min		
Flow rate range	0-0.20L/min to 0-5.00L/min		
Accuracy	Flow velocity	Less than 1m/s	±30mL/min (Less than 0.8L/min)
		1 to 2m/s	±2.5%F.S. (0.8 to 1.5L/min)
		2 to 3m/s	±2.0%F.S. (1.6 to 2.2L/min)
		3 to 6.6m/s	±1.5%F.S. (2.3 to 5L/min)

Electrical specifications

Measuring method		Ultrasonic propagation time difference calculation method
Output	1) Flow rate output	4 to 20mA (load resistance: 500Ω or less)
	2) Flow rate alarm output	2 points open collector output Load rating: 30VDC, 20mA, Operation: Comparison method
Display		4-digit 7-segment LED
Display data		Instantaneous flow rate, integrated flow rate
Alarm output monitor		2-point LED display (instantaneous flow rate alarm, integrated flow rate alarm)
Parameter setting		With 4 key switches on the panel
Power supply		24VDC±5%
Current consumption		150mA or less

Ordering



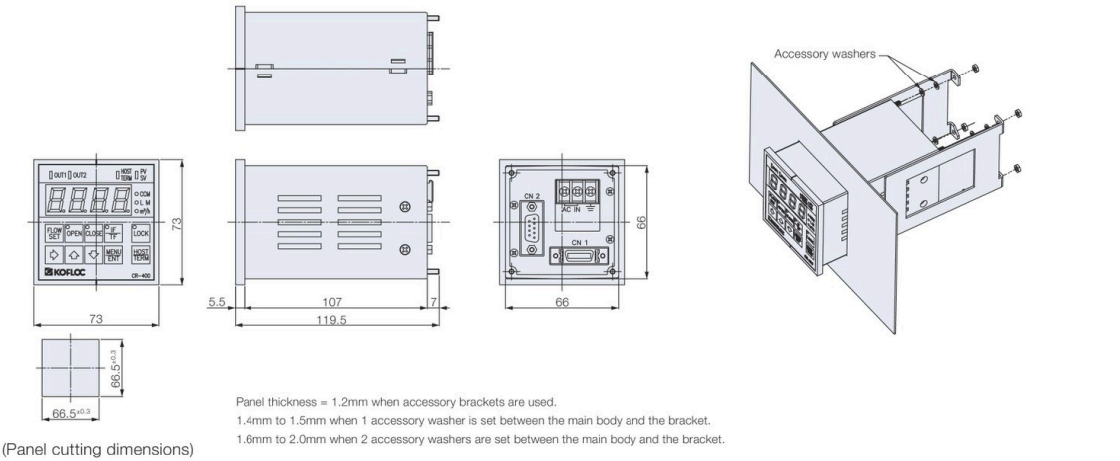
Compact Readout Unit

MODEL CR-400B

- Power supply combining flow rate setting and display for mass flow controller / mass flow meter
- Capable of using various functions by operating the display (Instantaneous / integrated flow rate display, alarm setting, valve open / close of mass flow controller, etc.)
- External operation allowed by RS485 communication function and analog input / output of 0 to 5VDC



Dimensions

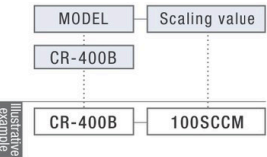


Standard Specifications

MODEL	CR-400B
Control function	Flow setting, forced valve open / close operation and zero cut
Flow rate input / output signal	0 to 5VDC
Power output	±15VDC (300mA)
Display	4-digit 7-segment LED (4 digits for instantaneous flow rate, 8 digits for integrated flow rate (upper and lower 4 digits shown alternately))
Display accuracy	Instantaneous flow rate: within ±0.1% F.S., ±1 digit
Electrical connection	D-sub 9 pins, female (on MF main body side) D-sub half pitch, 20 pins, female (external control)
Event output	2 stages (select from among upper-limit, lower-limit, upper and lower-limit instantaneous flow rates, and arrival of integrated flow rate) Open collector output (max. rating: 50V, 50mA)
Digital communication	RS485
Power consumption	Approx. 25W
Input voltage (frequency)	85 to 264VAC (48 to 440Hz)
Power cable	Approx. 3m
Weight	Approx. 400g

* The flow rate setting function is valid only for the mass flow controller.

Ordering



* See Page 46 for the mass flow controller / mass flow meter connection cables CP-STD1 and CP-STD5, and the external cable CP-STD6.
* The old models of mass flow controllers / mass flow meters may not operate properly, or their specific functions may fail.

Power Supply for Mass Flow Controller / Mass Flow Meter

MODEL PSK-FB SERIES

- Power supply for mass flow controller / mass flow meter
- Capable of supplying the power for 1 system with 1FB, for 3 systems with 3FB and for 6 systems with 6FB



PSK-1FB

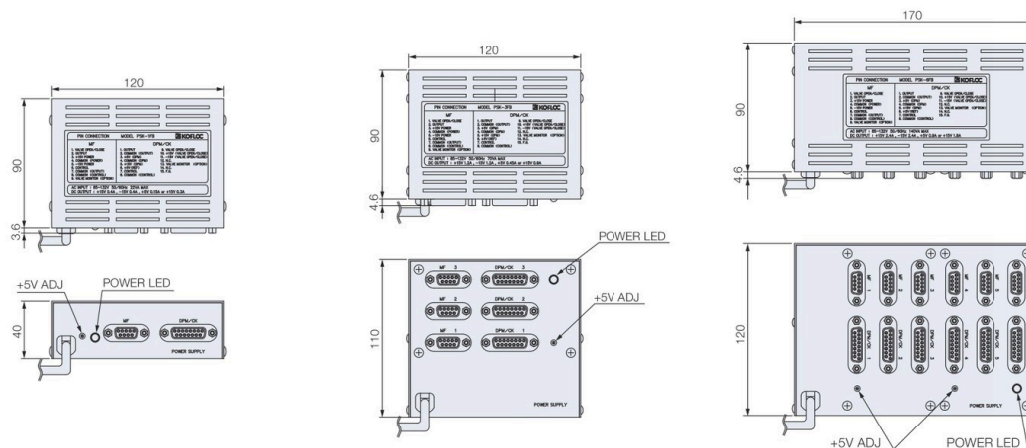


PSK-3FB



PSK-6FB

Dimensions



Standard Specifications

MODEL		PSK-1FB	PSK-3FB	PSK-6FB
Power supply for		1 unit	3 units	6 units
Electrical connection		D-sub 9 pins, female (on MF main body side) D-sub 15 pins, female (on display and setting device side)		
Input voltage (frequency)		85 to 132VAC (47 to 66Hz)		
Power consumption		Up to 22W	Up to 70W	Up to 140W
Fuse		125V-0.8A	125V-3.15A	125V-6.3A
Output	Power output	±15VDC (±5%)		
	For flow rate setting	+5VDC (±1%)		
	For external display	+5VDC (±5%), +15VDC (±5%)		
Flow rate input / output signal		0 to 5VDC, up to 15VDC		
Flow rate setting output signal		0 to 5VDC		
Working temperature		0 to 40°C		
Working environment		0%RH to 90%RH (no dew condensation)		
Weight		Approx. 800g	Approx. 1,300g	Approx. 1,700g

AC Adapter for Mass Flow Controller / Mass Flow Meter

PSK-83CE / PSK-85CE

- PSK-83CE available for Model EX-700R series
- PSK-85CE available for Model 8700 series



PSK-83CE / PSK-85CE



Ordering

- Power adaptor: PSK-83CE (cable length: approx. 1,500mm)
- Power adaptor: PSK-85CE (cable length: approx. 1,200mm)

AC Adapter for Mass Flow Meter

PSK-38DSII

- PSK-38DSII available for Model 3810DSII series



PSK-38DSII



Ordering

- Power adaptor: PSK-38DSII (cable length: approx. 1,900mm)

Conversion Plug

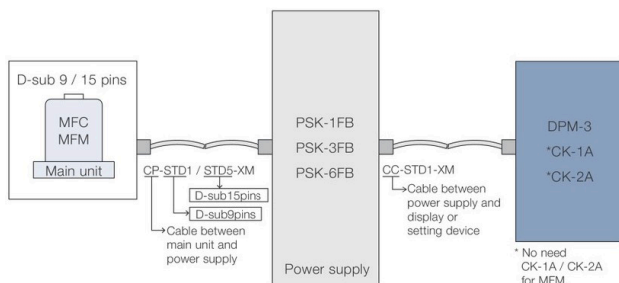
TR-AD

A	BF	SE	C	B3	O
A purple conversion plug with two prongs and a green 'A' label.	A purple conversion plug with two prongs and a blue 'BF' label.	A purple conversion plug with two prongs and a green 'SE' label.	A purple conversion plug with two prongs and a green 'C' label.	A purple conversion plug with two prongs and a blue 'B3' label.	A purple conversion plug with two prongs and a blue 'O' label.
TR-AD11	TR-AD12	TR-AD13	TR-AD14	TR-AD15	TR-AD16

Table of compatibility Cables and accessories for mass flow controller / mass flow meter

Examples of using the accessories

■ When using the power unit PSK-FB series



(Ordering method: Main unit to power supply)



STD1 : D-sub 9 pins (compliant with SEMI std.)
STD5 : D-sub 15 pins (HFC and HFM series)

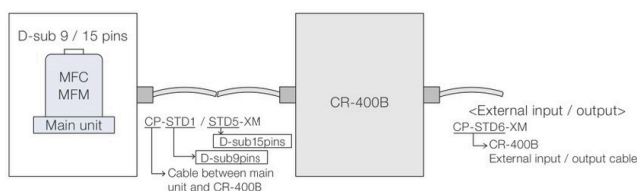
(Example) When ordering 1m length cable to connect 5100 and PSK-1FB: CP-STD1-1M

(Ordering method: Power supply to display or setting device)



(Example) When ordering 3m length cable to connect PSK-1FB and DPM3 / CK-1A: CC-STD-3M

■ When using the CR-400B



(Ordering method: Main unit to power supply)



STD1 : D-sub 9 pins (compliant with SEMI std.)
STD5 : D-sub 15 pins (HFC and HFM series)

(Example) When ordering 1m length cable to connect 3660 and CR-400B : CP-STD-1M

(Ordering method: CR-400B external input / output)

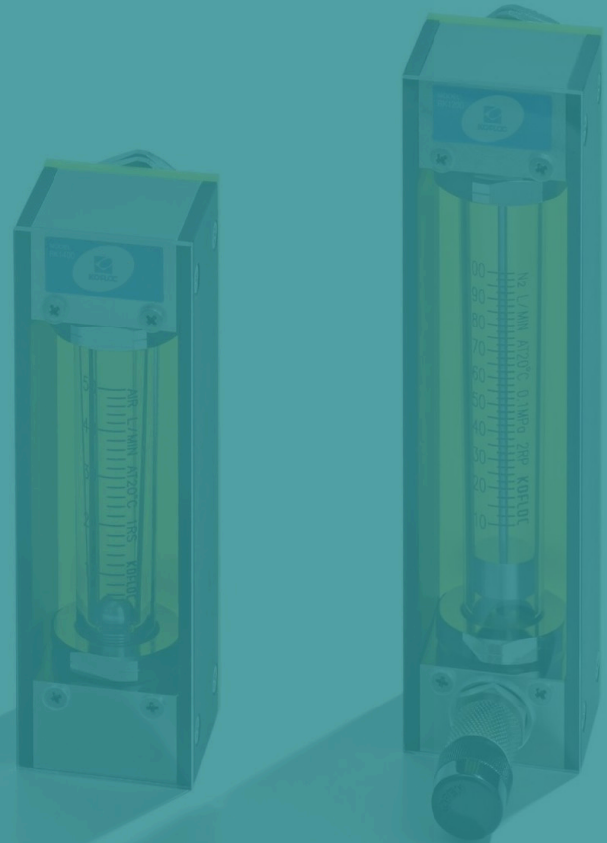
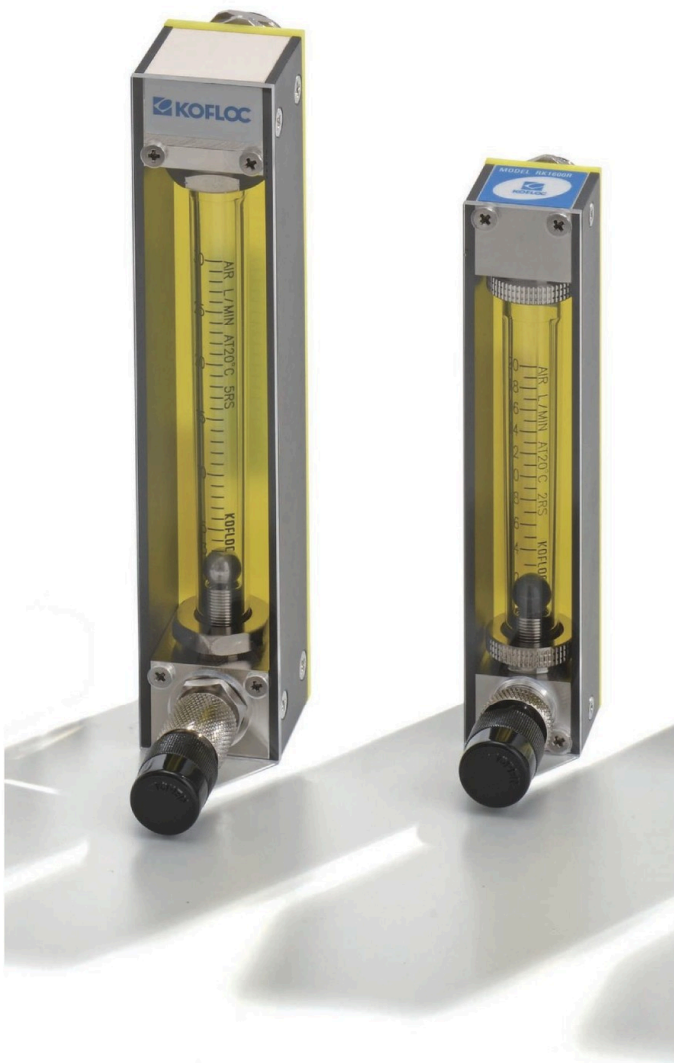


List of applicable cables

MODEL	Shape	Applicable model and usage
CP-STD1-1M	D-sub 9P on both ends, 1m	EX-250S, EX-550, 3660, 3200, 5410, 5100, 3100, 3760, to PSK-FB / CR-400B
CP-STD1-3M	D-sub 9P on both ends, 3m	
CP-STD1-5M	D-sub 9P on both ends, 5m	
CP-STD5-1M	D-sub 15P / 9P, 1m	HFC-303, HFM-301, HFM-200W / LS, to PSK-FB / CR-400B
CP-STD5-3M	D-sub 15P / 9P, 3m	
CP-STD5-5M	D-sub 15P / 9P, 5m	
CP-STD6-1M	D-sub 20P / loose end, 1m	8700 and CR-400B input / output cable
CP-STD6-3M	D-sub 20P / loose end, 3m	
CP-STD6-5M	D-sub 20P / loose end, 5m	
CC-STD1-1M	D-sub 15P / AM pins, 1m	Overall Mass Flow products (± 15 VDC) Between PSK-FB and display
CC-STD1-3M	D-sub 15P / AM pins, 3m	
CC-STD1-5M	D-sub 15P / AM pins, 5m	
CP-3810DSII-CF-1M	HRS 6P / loose end, 1m	3810DSII exclusive free cable Round connector (HR10A-7P-6S)
CP-3810DSII-CF-3M	HRS 6P / loose end, 3m	
CP-3810DSII-CF-5M	HRS 6P / loose end, 5m	
CP-EX-700-CF-1M	D-sub 9P / loose end, 1m	EX-250S, EX-550, EX-700R 24VDC conditions
CP-EX-700-CF-3M	D-sub 9P / loose end, 3m	
CP-EX-700-CF-5M	D-sub 9P / loose end, 5m	
CT-DF3-0.3M	HRS 4P on both ends, 0.3m	EX-550 Communication cable Round connector (HR10A-7P-4P)
CT-DF3-1M	HRS 4P on both ends, 1m	
CT-DF3-3M	HRS 4P on both ends, 3m	
CT-DF3-5M	HRS 4P on both ends, 5m	

* The RJ connector standard used for the EX series is "RJ45."

Variable Flow Meter



List of Variable Flow Meter



Flow Meter
with Precision Needle Valve

MODEL RK1200 SERIES

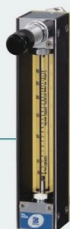
Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min

Accuracy: $\pm 2\%$ F.S.

■ General-purpose



P059



High-precision Flow Meter

MODEL RK1400 SERIES

Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min

Accuracy: $\pm 2\%$ F.S.

■ General-purpose



P061



Purge Flow Meter
with Needle Valve

MODEL RK1600R SERIES

Max. flow rate:

Gas 1-20L/min

Accuracy: $\pm 5\%$ F.S.

■ Compact



P063



Purge Flow Meter

MODEL RK1000 SERIES

Max. flow rate:

Gas 100mL/min-20L/min

Accuracy: $\pm 5\%$ F.S.

■ Compact



P064



Resin Flow Meter

MODEL RK20T SERIES

Max. flow rate:

Gas 0.5-100L/min

Liquid 25-2800mL/min

Accuracy: $\pm 6\%$ F.S.

■ Low cost
■ Quick delivery



P065



Resin Flow Meter
for Large flow rate

NEW

MODEL RK50T SERIES

Max. flow rate:

Gas 100-300L/min

Liquid 3-10L/min

Accuracy: $\pm 5\%$ F.S.

■ Low cost
■ Quick delivery



P066



Resin Flow Meter
with Reed Switch

NEW

MODEL RK20T-RSW SERIES

Max. flow rate:

Gas 10-100L/min

Liquid 250-2800mL/min

Accuracy: $\pm 6\%$ F.S.

■ Alarm function



P067



Flow Meter
for Cylinder Regulator

MODEL RK4400 SERIES

Max. flow rate:

Gas 10mL/min-20L/min

Accuracy: $\pm 2\%$ F.S.

■ Available for
cylinder regulator



P068



Flow Meter
with Reed Switch

MODEL RK1970 / RK1975 / RK1976 SERIES

Max. flow rate:

Gas 30-150L/min

Liquid 1-5L/min

Accuracy: $\pm 5\%$ F.S.

■ Alarm function



P069



Gas



Liquid

Fluids



With valve

With flow control valve



Without valve

Without flow control valve



Gas



Liquid



With valve



Without valve

Flow Meter
for Large flow rate

MODEL RK2000 / RK2005 / RK2006 SERIES

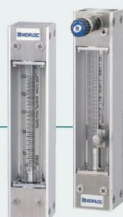
Max. flow rate:

Gas 100-1000L/min

Liquid 10-30L/min

Accuracy: $\pm 5\%$ F.S.

■ Alarm function



P071



Gas



Liquid



With valve



Without valve

Flow Meter
with Photosensor

MODEL RK1812 / RK1814 SERIES

Max. flow rate:

Gas 50mL/min-50L/min

Liquid 20mL/min-1L/min

Accuracy: $\pm 2\%$ F.S.

■ Alarm function



P073



Gas



Liquid



With valve



Without valve

Flow Meter
with Bellows Needle Valve

MODEL RK1500 SERIES

Max. flow rate:

Gas 5mL/min-30L/min

Liquid 5mL/min-1L/min

Accuracy: $\pm 2\%$ F.S.

■ Low leak



P075



Gas



Liquid



With valve



Without valve

Low pressure Flow Meter

MODEL RK130 / RK230 / RK260 SERIES

Max. flow rate:

Gas 10-1000L/min

Accuracy: $\pm 2-5\%$ F.S.

■ Available for
low pressure



P077



Gas



Liquid



With valve



Without valve

Flexible Flow Meter

MODEL RK1100 SERIES

Max. flow rate:

Gas 10mL/min-
20L/min

Accuracy: $\pm 2\%$ F.S.

■ Disassemble and
reassemble



P079



Gas



Liquid



With valve



Without valve

Flow Meter
with Stand

NEW

MODEL RK1310 SERIES

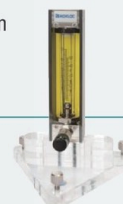
Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min

Accuracy: $\pm 2\%$ F.S.

■ Stand



P081



Gas



Liquid



With valve



Without valve

Multiple Flow Meter
with Needle Valve

MODEL RK120X SERIES

Max. flow rate:

Gas 5mL/min-20L/min

Accuracy: $\pm 2\%$ F.S.

■ Available for multiple lines
■ Stand



P082



Gas



Liquid



With valve



Without valve

Multiple Flow Meter

MODEL RK140X SERIES

Max. flow rate:

Gas 5mL/min-20L/min

Accuracy: $\pm 2\%$ F.S.

■ Available for multiple lines
■ Stand



P083



Gas



Liquid



With valve



Without valve

Multiple Flow Meter
for Gas Mixing

MODEL RK120XM SERIES

Max. flow rate:

Gas 50mL/min-10L/min

Accuracy: $\pm 2\%$ F.S.

■ Gas mixing
■ Stand



P084

Variable Flow Meter

List of Variable Flow Meter

Gas

Liquid

Fluids

With valve

With flow control valve

Without valve

Without flow control valve

Variable Flow Meter

Gas

Liquid

With valve

Without valve

Flow Meter
for Large flow rate

MODEL RK1950AP SERIES

Max. flow rate:

Gas 80L/min-25m³/min

Liquid 1.5-900L/min

Accuracy: ±2%F.S.

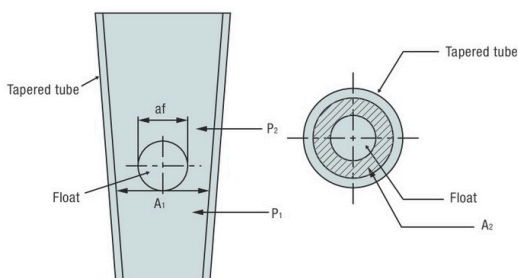


P085

About Variable Flow Meter

Principle of flow meter

As shown in the **figure below**, the variable flow meter contains a float in a conical cylinder (tapered tube) whose upper end spread wider than the lower end. The float moves up/down depending on a degree of flow rate, reading a balanced position to obtain the flow rate.



Now, the symbols and units are determined as follows.

Vf: Volume of the float [cm³]

ρf: Density of the float [g/cm³]

af: Max. cross-sectional area of the float [cm²]

P₁: Pressure right under the float [Pa]

P₂: Pressure right above the float [Pa]

ρ: Density of the fluid [g/cm³]

U₁: Flow velocity right under the float [cm/sec]

U₂: Flow velocity in the gap with the float [cm/sec]

A₁: Cross-sectional area right under the float [cm²]

A₂: Cross-sectional area of the gap with the float [cm²]

Q: Flow rate [cm³/sec]

g: Acceleration of gravity

A float push-up force is af(P₁ - P₂). By subtracting buoyancy, the gravity of the float is Vf(ρf - ρ)g.

The balance formula is;

$$af(P_1 - P_2) = Vf(\rho_f - \rho)g$$

$$P_1 - P_2 = \frac{Vf(\rho_f - \rho)g}{af} \quad (1)$$

Now, based on the flow rate Q = A₁U₁ = A₂U₂;

$$U_1 = \frac{Q}{A_1} \quad U_2 = \frac{Q}{A_2} \quad (2)$$

Now, based on Bernoulli's theorem;

$$\frac{U_1^2}{2} + \frac{P_1}{\rho} = \frac{U_2^2}{2} + \frac{P_2}{\rho}$$

Accordingly;

$$P_1 - P_2 = \frac{\rho}{2} (U_2^2 - U_1^2) \quad (3)$$

Substitute (2) for (3).

$$P_1 - P_2 = \frac{\rho}{2} \left[\left(\frac{Q}{A_2} \right)^2 - \left(\frac{Q}{A_1} \right)^2 \right]$$

Solve this formula.

$$Q = \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \sqrt{\frac{2(P_1 - P_2)}{\rho}} \quad (4)$$

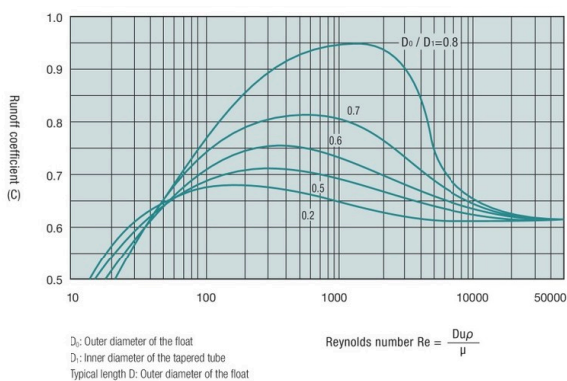
Substitute "P₁ - P₂" of (1) for this.

$$Q = \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \sqrt{\frac{2g(\rho_f - \rho)}{\rho}} \cdot \frac{Vf}{af}$$

Actually, there is a friction resistance and a general formula will be as follows.

$$Q = C \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \sqrt{2g \left(\frac{\rho_f - \rho}{\rho} \right) \cdot \frac{Vf}{af}} \quad (5)$$

A₁ and A₂ depend on the float position, and C is a function of Reynolds number using an equivalent diameter of a circular runway. (See the graph)



In Formula (5), A₁, A₂ and af depend on the float position. The summarized result is;

$$Q = C \sqrt{2g \left(\frac{\rho_f - \rho}{\rho} \right) Vf} \quad (6)$$

This is a basic formula for all conditions.

About Variable Flow Meter

[For the liquid]

Formula (6) is valid as it is. If the flow meter for water is used for kerosene with a different specific gravity, its indications change as follows.

$$Q_{H_2O} = C' \sqrt{2g \left(\frac{\rho_f - \rho_{H_2O}}{\rho_{H_2O}} \right) V_f} \dots\dots\dots A$$

$$Q_{oil} = C' \sqrt{2g \left(\frac{\rho_f - \rho_{oil}}{\rho_{oil}} \right) V_f} \dots\dots\dots B$$

By dividing A by B;

$$Q_{oil} = Q_{H_2O} \sqrt{\frac{(\rho_f - \rho_{oil}) \times \rho_{H_2O}}{\rho_{oil} \times (\rho_f - \rho_{H_2O})}}$$

Accordingly;

$$\text{Actual flow rate of kerosine} = \text{Flow rate scale for water when kerosine flows} \times \sqrt{\frac{\left(\frac{\text{Density of float}}{\text{Density of kerosine}} - \frac{\text{Density of kerosine}}{\text{Density of water}} \right) \times \text{Density of water}}{\left(\frac{\text{Density of float}}{\text{Density of kerosine}} - \frac{\text{Density of kerosine}}{\text{Density of water}} \right)}}$$

The actual flow rate is obtained by the above formula.

[For the gas]

For the gas, its density ρ is ignorably low to that of float ρ_f . The formula can be simplified as follows.

$$Q = C' \sqrt{2g \left(\frac{\rho_f}{\rho} \right) V_f}$$

Since the density of float ρ_f and the volume V_f are constant, the formula can be further simplified as follows.

$$Q = C'' \sqrt{\frac{1}{\rho}} \dots\dots\dots (7)$$

As mentioned above, if the Reynolds number is close, C'' is considered constant in the case of gas, determining the flow rate according to the density of gas ρ .

Since the Reynolds number is also a function $\frac{D \rho v}{\mu}$ of the density viscosity of gas, however, a considerably complicated analysis is required, if C'' changes and density viscosity conditions differ greatly. The density of gas changes depending on the pressure and temperature as well as the gas type. If the same flow meter is used to measure under different conditions, accordingly, the following flow rate relations are theoretically established.

First, the gas state equation;

$PV = nRT$ results in;

$$P \frac{1}{\rho} = nRT \quad \rho = \frac{P}{nRT}$$

The density is inversely proportional to the absolute temperature T and proportional to the absolute pressure P . Combining this with Formula (7), the following formula is established.

Density of gas	ρ_1
Pressure	Indicated value Q_1 (L/min at 20°C) by the flow meter for P_1
Temperature	T_1
Density of gas	ρ_2
Pressure	Actual flow rate Q_2 (L/min at 20°C) when measuring the conditions for P_2
Temperature	T_2

$$Q_2 = Q_1 \times \sqrt{\frac{\rho_1 \times P_2 \times (273 + T_1)}{\rho_2 \times P_1 \times (273 + T_2)}}$$

In the case of the P_1/P_2 gauge pressure;

$$Q_2 = Q_1 \times \sqrt{\frac{\rho_1(0.1 + P_2G)(273 + T_1)}{\rho_2(0.1 + P_1G)(273 + T_2)}}$$

<Absolute pressure = 0.10133 + Gauge pressure(MPa)>

The following shows examples of specific correction formulas.

(Example 1) When the gas type is different

When the flow meter for H_2 is used for He, P_1, P_2, T_1 and T_2 are the same. By substituting the above formula, the following formula results.

$$Q_{He} = Q_{H_2} \sqrt{\frac{\rho_{H_2}}{\rho_{He}}} = Q_{H_2} \sqrt{\frac{2}{4}} \approx 0.7 Q_{H_2}$$

The actual flow rate becomes lower than the indicated graduation.

(Example 2) When the pressure condition is different

When the flow meter with atmospheric scale ($P_1G = 0Pa$) for N_2 is used to conduct measurement of N_2 and 0.3MPa ($= P_2G$), ρ_1, ρ_2, T_1 and T_2 are the same, resulting in the following formula.

$$Q_3 = Q_0 \sqrt{\frac{0.1 + 0.3}{0.1 + 0}} \approx 2 Q_0$$

The actual flow rate becomes higher than the indicated graduation.

(Example 3) When the temperature condition is different

When the flow meter calibrated on the basis of 20°C is used at 25°C;

($T_1 = 20^\circ C$), ($T_2 = 25^\circ C$)

Since ρ_1, ρ_2, P_1 and P_2 are the same, the following formula results.

$$Q_{\text{Actual flow rate}} = Q_{\text{Indicated value}} \sqrt{\frac{273 + 20}{273 + 25}} \approx 0.99 Q_{\text{Indicated value}}$$

The actual flow rate becomes lower than the indicated graduation.

The above-mentioned corrections are based on approximation formulas. A flow rate value may be often inconsistent with a theoretical one under actual conditions. Keeping in mind that a theory may differ from the reality, use the correction formulas.

Unit of flow rate

Generally, the flow meters use the indication of 20°C and 1atm (std, stp, etc.) standard condition or 0°C and 1atm (normal, nor. ntp, etc.) normal condition in many cases. We have defined as follows. As a rule, the flow rate indication in the catalog of our flow meters refers to the standard condition.

Designation	Unit temperature of flow rate	Unit pressure of flow rate	Suffix	Example of indication
Standard condition	20°C	1atm (Atmospheric pressure)	(stp)	L/min(stp) mL/min(stp)
Normal condition	0°C	1atm (Atmospheric pressure)	(ntp)	L/min(ntp) mL/min(ntp)

Calibration fluid

Our flow meters have 7 types of applicable standard gases; Air, N₂, O₂, He, H₂, Ar and CO₂. These actual gases are used to calibrate the scale of the flow meters according to the condition. For other special gases, they are arranged by us or the customer to perform actual calibration or conversion scale calibration is performed with the Air, N₂, etc., using the correction formula in Example 1 on Page 53. In the case of the gas with similar mass and properties, the conversion scale calibration method has hardly problems. Compared with the actual gas scale calibration method, however, there may be bigger errors.

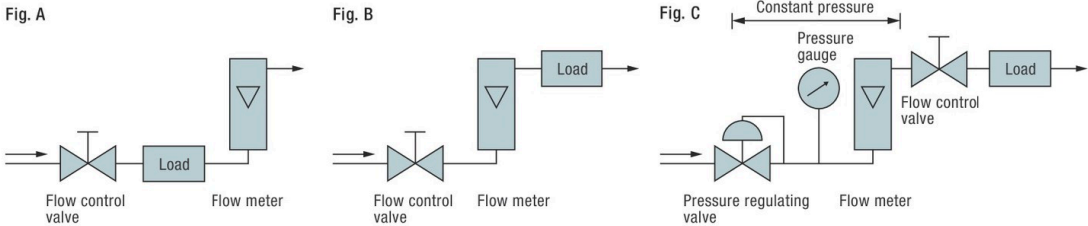
Also, in the cases of the special gases, special materials may be required to use, or crystals, etc. may adhere, disabling measurement. For other gases than standard ones, be sure to consult our sales office beforehand. The flow meters for liquid are, as a rule, calibrated with water (H₂O).

Calibration pressure (for the gases)

As shown in Fig. A, the flow meter is generally used with its outlet opened to the atmosphere or freed from load application (no pressure loss resistance). Such a flow meter is called an "atmospheric pressure scale."

In actual use, however, load pressure resistance is often applied as shown in Fig. B. If it is applied, an indication deviates from an actual flow rate as described in Example 2 on Page 53. There is a method to calculate by this formula to obtain a guide, but there is a gap between a theory and reality, causing an error. This is the case for both pressurization and vacuum pressure.

In such a case, if the pressure applied to the flow meter is known, the scale can be calibrated beforehand in this pressure state. As an example, attach a flow control valve to the outlet of the flow meter as shown in Fig. C and control the pressure applied to the flow meter with a pressure regulating valve to always keep constant pressure application. Then, calibrate the scale under this pressure condition. Such a flow meter scale is called a "load pressure scale."



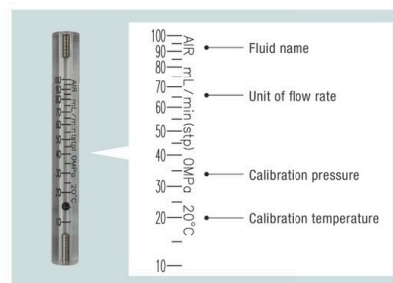
Calibration temperature (for the gases)

As described in Example 3 on Page 53, the density of gas changes depending on the temperature, causing an indication error against the flow meter's graduation. Our flow meters are, as a rule, manufactured at the calibration temperature of 20°C. When there may occur an indication error because of a difference between the calibration temperature and the actual working temperature, carry out a correction calculation as a guide with the correction formula shown in Example 3 on Page 53.

About Variable Flow Meter

■ Notation of the flow rate, calibration pressure and temperature unit on the tapered tube

	Manufacturing condition	Indication on tapered tube
Example of gas	Fluid Air Unit of flow rate Standard condition mL/min Calibration pressure 0MPa(G)(atm) Calibration temperature 20°C	AIR mL/min(stp) 0MPa 20°C
	Fluid N ₂ Unit of flow rate Normal condition L/min Calibration pressure 0.2MPa(G)(Load pressure) Calibration temperature 20°C	N ₂ L/min(ntp) 0.2MPa 20°C
Example of liquid	Fluid H ₂ O Unit of flow rate mL/min Calibration temperature 20°C	H ₂ O mL/min at 20°C



■ Accuracy

The accuracy of the flow meter is indicated with a percent value of an error against the full-scale flow rate (maximum flow rate measurable with that flow meter). In the case of the RK1400 with 100mL/min, for example, the error is ± 2 mL/min because the accuracy is $\pm 2\%$ of

the full scale. Calibration points are specified for each flow rate range. The accuracy is a value at these points. Other points than calibration points are equally distributed. They are also within the accuracy in most cases, but excluded from the warranty.

■ Scale notation on the tapered tube

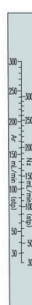
Total length	Flow rate range (example: mL/min)	Scale interval (mL/min)	Indicated numerals (example: mL/min)
L = 80	0.1 to 1 (10 to 100)	1/20 (5)	10, 50, 100
	0.2 to 2 (20 to 200)	1/20 (10)	20, 100, 200
	0.3 to 3 (30 to 300)	1/12 (25)	30, 50, 100, 150, 200, 250, 300
	0.5 to 5 (50 to 500)	1/20 (25)	50, 100, 200, 300, 400, 500
L = 100	0.1 to 1 (10 to 100)	1/20 (5)	10, 20, 30, 40, 50, 60, 70, 80, 90, 100
	0.2 to 2 (20 to 200)	1/20 (10)	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
	0.3 to 3 (30 to 300)	1/30 (10)	30, 50, 100, 150, 200, 250, 300
	0.5 to 5 (50 to 500)	1/25 (20)	50, 100, 200, 300, 400, 500
L = 120	0.1 to 1 (10 to 100)	1/20 (5)	10, 20, 30, 40, 50, 60, 70, 80, 90, 100
	0.2 to 2 (20 to 200)	1/20 (10)	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
	0.3 to 3 (30 to 300)	1/30 (10)	30, 50, 100, 150, 200, 250, 300
	0.5 to 5 (50 to 500)	1/25 (20)	50, 100, 200, 300, 400, 500
L = 150	0.1 to 1 (10 to 100)	1/40 (2.5)	10, 20, 30, 40, 50, 60, 70, 80, 90, 100
	0.2 to 2 (20 to 200)	1/40 (5)	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
	0.3 to 3 (30 to 300)	1/30 (10)	30, 50, 100, 150, 200, 250, 300
	0.5 to 5 (50 to 500)	1/50 (10)	50, 100, 150, 200, 250, 300, 350, 400, 450, 500
L = 200	0.1 to 1 (10 to 100)	1/50 (2)	10, 20, 30, 40, 50, 60, 70, 80, 90, 100
	0.2 to 2 (20 to 200)	1/80 (2.5)	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
	0.3 to 3 (30 to 300)	1/60 (5)	30, 50, 100, 150, 200, 250, 300
	0.5 to 5 (50 to 500)	1/50 (10)	50, 100, 150, 200, 250, 300, 350, 400, 450, 500
L = 250	0.1 to 1 (10 to 100)	1/100 (1)	10, 20, 30, 40, 50, 60, 70, 80, 90, 100
	0.2 to 2 (20 to 200)	1/100 (2)	20, 40, 60, 80, 100, 120, 140, 160, 180, 200
	0.3 to 3 (30 to 300)	1/60 (5)	30, 50, 100, 150, 200, 250, 300
	0.5 to 5 (50 to 500)	1/100 (5)	50, 100, 150, 200, 250, 300, 350, 400, 450, 500

■ Special scales



Millimeter scale

Equally spaced scale such as a ruler. It is used with a calibration curve (scale convection line). It is manufactured as a standard flow meter.



Dual scales

Two types of measurements are conducted with one tapered tube. Simultaneous scale is available depending on the gas type, pressure type, temperature type, etc.



1/20 scale

Normally, 10% of the maximum is the minimum measurable flow rate, but special specifications allow scales down to 5% (1/20).



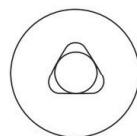
Specially specified scale

The figure shows a single-point specially specified scale. We are ready to respond to your request so please consult our sales office.

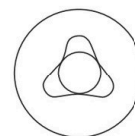
Shape of the tapered tube

The inside of our glass tapered tubes is not a simple cylinder, but features special molded shapes called the tri flat and rib guide types.

The tri flat type is used for a very low flow rate range below the maximum air flow rate of 5mL/min to 500mL/min, and the rib guide type is used for the maximum flow rate range of 1L/min to 50L/min, allowing stable flow rate measurement.



Tri flat type



Rib guide type

Flow meter with valve

KOFLOC is a general manufacturer of precision flow rate measurement and precision flow rate control. With a combination of these two technologies, we manufacture various flow meters with valve. Flow rate control is almost always accompanied by flow rate measurement. There is a merit of easy specification change in separately assembling the valve and the flow meter, and combining them, but the flow meter with valve has more merits such as saving time and labor for piping, securing the space and allowing general coordination.

In response to these needs, **KOFLOC** manufacture many flow meters with valve. Those with valve include different types such as the simple type, precision type, large flow rate type and bellows type, plus the inlet- and outlet-side installation types.

Upper and lower valves

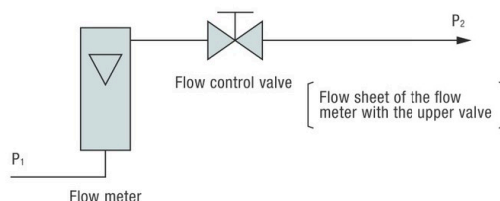
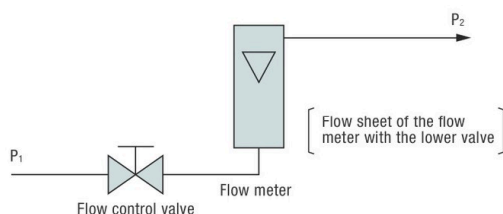
The upper side of the flow meter is outlet and the lower side is inlet. The following figure illustrates the flow sheet of the upper and lower valves. The pressure loss of the flow meter is quite small and not a big deal for the flow meter alone. When it comes to the flow meter with valve, however, what counts is the inlet and outlet pressures. By attaching the valve, pressure loss will result, causing a difference between the inlet and outlet pressures.

As described in Example 2 on Page 53, the flow meter indicates a different value, depending on the applied pressure. When the valve is attached, note particularly how the pressure applied to the flow meter is affected.

For the lower valve, the inlet pressure P_1 is throttled by a needle, resulting in P_2 at the outlet. This P_2 is the pressure applied to the flow meter. In case there is no significant load resistance on the outlet side (similar to being opened to the atmosphere), P_2 is assumed to be

0MPa(G). Accordingly, calibrate with the atmospheric scale, considering that the pressure applied to the flow meter is zero. Since the valve requires the working pressure condition, however, it is necessary to specify P_1 and P_2 at ordering time. When there is load resistance (P_2 pressure), of course, specify P_2 as well.

For the upper valve, the inlet pressure P_1 is applied to the flow meter. P_1 and P_2 are necessary to select the valve as mentioned above, and the scale of the flow meter needs to be the load pressure scale for P_1 . Accordingly, this flow meter is generally used with the pressure regulating valve so that P_1 will not fluctuate. Particularly, in case there is vacuum decompression from outlet side, an indication error may occur in most cases unless the upper valve type is selected.



Selection of the specifications for liquid flow meters

When the fluid is a liquid, note that air bubbles may adhere to the float, failing to obtain precise measurement accuracy. It is recommended to select the upper valve type, because the dissolved air comes out when releasing the pressure of outlet side of the valve.

Also, from the viewpoints of foreign substances and corrosion, when accurate flow rate measurement is required, it is recommended to select the stainless steel as the block material of the flow meter.

About Variable Flow Meter

■ Principle of the flow meters with reed switch

[About the reed switch]

As shown in the **right figure**, the reed switch has a pair of magnetic reeds enclosed in a glass tube with a certain contact gap together with an inactive gas.

By applying a magnetic field to the reed switch from the external, the reeds are magnetized and sucked to each other into contact, closing a circuit.

Once the magnetic field is gone, the circuit is opened by the elasticity of the reeds.

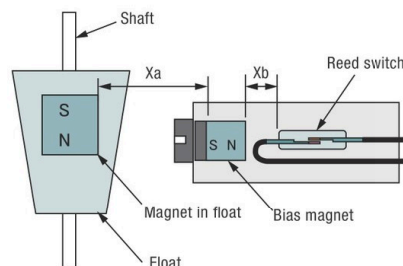
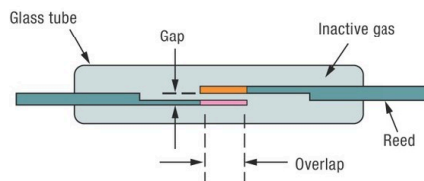
[Operation with our flow meters]

The **right figure** shows the polarity of a magnet in the float and that in the reed switch.

In case the upper side of the magnet incorporated in the float is set to Polarity S, if the float moves up, the magnetic field increases strength at Polarity N of the magnet in the float and Polarity S of the bias magnet incorporated in the reed switch, turning on the switch. If the float moves down to the contrary, Polarity S of the magnet in the float and that of the bias magnet repel each other, weakening the strength of the magnetic field of the reed switch and turning it off. Thus, the reed switch operates differently depending on the polarity of the magnet incorporated in the float.

The sensitivity (operating state) of the reed switch is greatly susceptible to the distance between the magnet in the float and the bias magnet (Xa), and that between the bias magnet and the reed switch (Xb).

Structure of the reed switch



* How to use

Fix the reed switch at the flow rate graduation desired to be detected. There are Contact A which is turned on if the float moves higher than a set point, and Contact B which is turned on if it moves lower than the set point. Once the contact is turned on, a signal continues to be held unless the float moves in the other direction (self-holding switch).

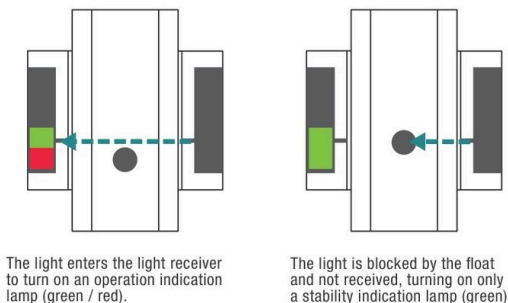
■ Principle of the flow meters with photosensor

[About the transmissive photosensor]

This photosensor has a pair of projector and light receiver facing each other so that the light emitted from the projector hits the light receiver.

It detects an object between the projector and the light receiver when the light from the projector is blocked by the detected object.

Light-on diagram



[Operation with our flow meters]

Light-on:

When the light emitted from the projector enters the light receiver, the operation indication lamp is turned on. (Our standard mode)

Dark-on:

When the light emitted from the projector does not enter the light receiver (blocked by an object), the operation indication lamp is turned on.

Operation indication lamp (green / red):

Turned on if the light enters the light receiver.

(The upper half of the indication lamp is lit up in green and the lower half in red.)

Stability indication lamp (green):

State that the light is blocked by the float and not received. When the lamp is turned on, there is no problem in use. When it is turned off, there may be a misaligned optical axis, contamination, etc. Or, the power is not connected.

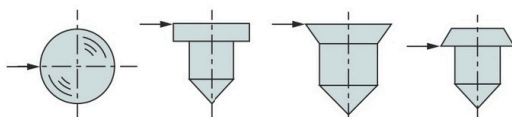
* How to use

Fix the photosensor body at the flow rate graduation desired to be detected. Run a fluid and confirm that the float detects at the sensor position. Adjust the sensitivity with a control knob as required. Different from the reed switch, the photosensor has only a fixed contact.

■ Precautions for handling the flow meter

- Select a low-humidity place and install the flow meter vertically.
- To pipe the flow meter, select an appropriate material and diameter, depending on the fluid, flow rate and pressure.
- Fully clean inside the piping.
- To read the float, see the figure below.

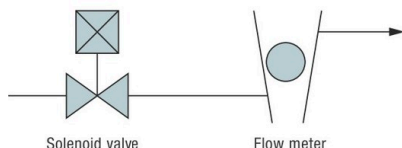
Float reading position



* This figure is intended for showing a scale reading position and does not stipulate the shape and structure of a moving part.

- When measuring a flow rate, **use at 70% or less of the proof pressure in order to prevent damage on the tapered tube.** For the temperature as well, use at 60°C or less in order to prevent damage on the tapered tube and other parts. The tapered tube may be broken due to an abrupt temperature change or a heat shock by the recurring cycles. Avoid applying such a load. Never use any harmful gas or liquid other than the fluids indicated on the tapered tube or at the temperature or pressure beyond the maximum limit. Otherwise, the human body may be hurt.
- If the pressure or flow rate changes abruptly, the float may jump up, breaking the tapered tube. If piped in series with a solenoid valve as illustrated, a considerable amount of fluid runs abruptly even at low pressure. **Take care not to directly apply a pressure change** by installing a regulator.

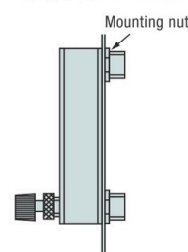
Bad example of use



- Our flow meters have quite a narrow gap between the tapered tube and the float for measuring a very low flow rate. If dust, moisture, etc. are allowed in the flow meter, gap is clogged or it becomes unstable. A filter may be attached to the end of the tapered tube, but use a clean and dry gas, allowing in no dust.
- A needle valve is intended to "control flow rate." It does not assure complete shutoff. When stopping a flow of fluid, you are requested to additionally install a stop valve. Note that if the needle valve is turned more than necessary, the product may be damaged.

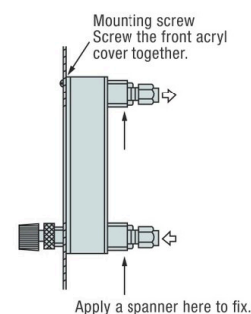
- When mounting the flow meter to the panel surface, use accessory nuts as illustrated. See the dimension drawing for the panel cutting dimensions.

Mounting to the panel surface
<Single-nut mounting>



- When embedding into the panel, use tapped holes in the front of the body as illustrated.

Embedding into the panel



- Tighten nuts and screws with a minimum required force.
- When mounting to the panel or connecting and disconnecting a joint, fix a flow meter joint with a spanner and do work in order to prevent loosening. After mounting, be sure to conduct leak test with soap water, etc.

Flow Meter with Precision Needle Valve

MODEL RK1200 SERIES

Gas

Liquid

With valve

Without valve

Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.**Liquid** H₂O**Max. flow rate** Gas 5mL/min to 100L/min**Liquid** 5mL/min to 2L/min**Accuracy** ±2% F.S.

- Available for a wide range of flow rate from minute flow
- High-accuracy measurement of ±2% F.S. or better
- Superior control performance by non-rotating precision needle valve
- Upper needle valve type available
- Wide variations suitable for various conditions of use



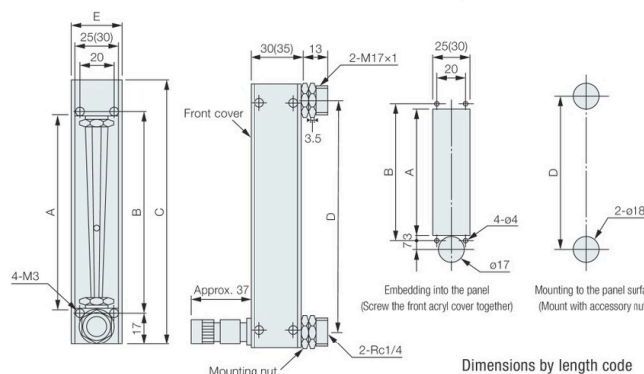
RK1200 (valve at top)

Dimensions

<<Other than right dimension drawing>>

(Cutting dimensions)

<<Air 60 to 100L/min>>

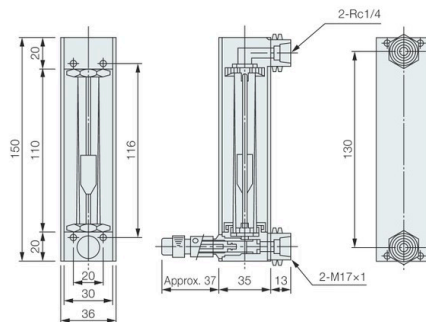


* The figure is for the lower valve. The dimensions are upside down for the upper valve.

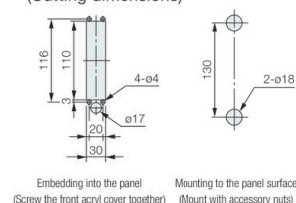
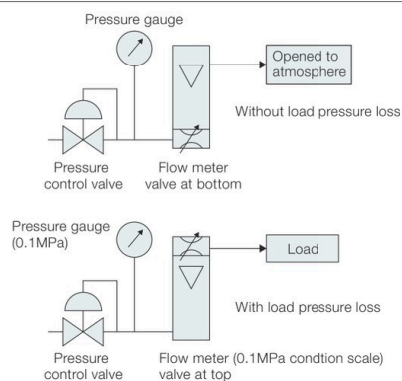
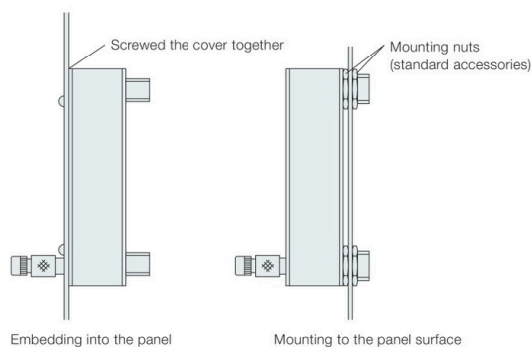
* Dimensions in () are for Air-50L/min and H₂O-2L/min.

Dimensions by length code

Part	Code	12	15	20	25
A		80	110	160	210
B		86	116	166	216
C		120	150	200	250
D		100	130	180	230
E		29(36)	29(36)	31(36)	31(36)



(Cutting dimensions)

**Example of use**

Standard Specifications

MODEL	RK1200	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
Max. flow rate (Air atm condition for gas)	5mL/min to 100L/min (See the Capacity Table below)	5mL/min to 2L/min (See the Capacity Table below)
Effective scale	10:1	
Accuracy	±2%F.S.	
Proof pressure	100mL/min or less: 1MPa(G) 5L/min or less: 0.7MPa(G) 10L/min or more: 0.5MPa(G)	5mL/min or less: 1MPa(G) 150mL/min or less: 0.7MPa(G) 200mL/min or more: 0.5MPa(G)
Max. working temperature	60°C	
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, PCTFE, (PTFE) B: Brass, Hard glass, NBR, POM, SUS316, (PTFE)	
Connection	Rc1/4	
Weight	Approx. 450g	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Capacity Table

Air (atmospheric pressure)

Max. flow rate	5	10	20	30	50	100	150	200	300	500	1	2	3	5	10	15	20	30	50	100
Total length	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	L/min	L/min	L/min	L/min	L/min	L/min	L/min	L/min	L/min	L/min
120mm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—
150mm	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200mm	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—
250mm	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—

H₂O

Max. flow rate	5	10	20	30	50	100	150	200	300	500	1	2
Total length	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	L/min	L/min
120mm	○	○	○	○	○	○	○	○	○	○	○	—
150mm	○	○	○	○	○	○	○	○	○	○	○	○
200mm	○	○	○	○	○	○	○	○	○	○	○	—
250mm	○	○	○	○	○	○	○	○	○	○	○	—

Ordering

MODEL	Total length	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure	Needle valve	Other options
RK1200	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4					D: at bottom U: at top	Accuracy ±1% F.S. * Gases only Dual scales * Gases only 1/20 scale FFKM O-ring
RK1200	12	SS	1/4	Air	2L/min	0.2MPa	0MPa	D	

* Possible to manufacture with a scale of 0.5mL/min to 3mL/min (air at atmospheric pressure) only for total length of 120mm.
* No shutting O-ring for FFKM option.

High-precision Flow Meter

MODEL RK1400 SERIES

Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc. **Liquid** H₂O

Max. flow rate **Gas** 5mL/min to 100L/min **Liquid** 5mL/min to 2L/min

Accuracy ±2% F.S.

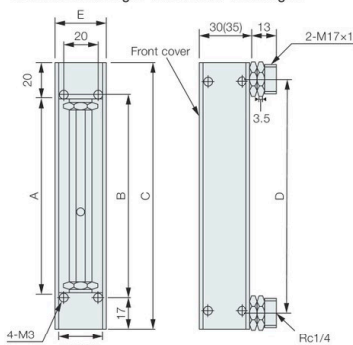
- Available for a wide range of flow rate from minute flow
- High-accuracy measurement of ±2% F.S. or better
- Wide variations suitable for various conditions of use



Variable Flow Meter

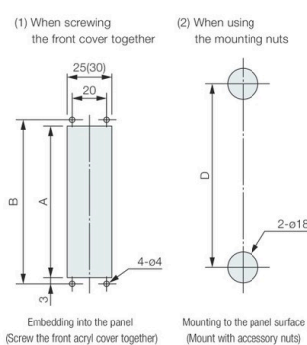
Dimensions

<<Other than right dimension drawing>>

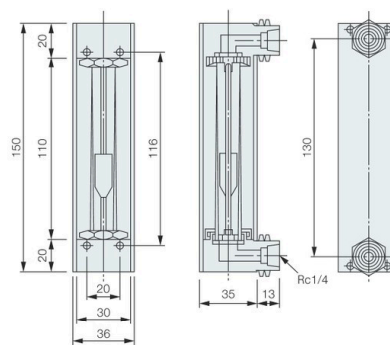


* Dimensions in () are for Air-50L/min.

(Cutting dimensions)



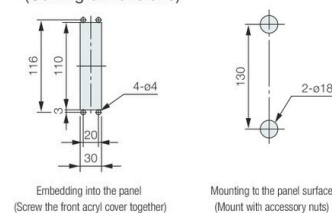
<<Air 60 to 100L/min>>



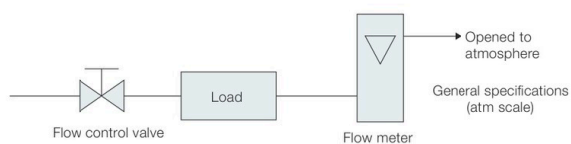
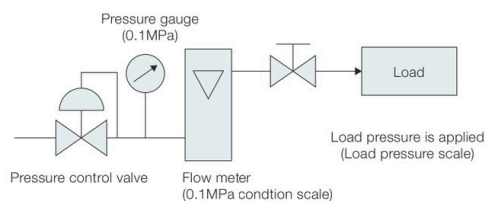
Dimensions by length code

Part	Code	12	15	20	25
A		80	110	160	210
B		86	116	166	216
C		120	150	200	250
D		100	130	180	230
E		29(36)	29(36)	31(36)	31(36)

(Cutting dimensions)



Example of use



Standard Specifications

MODEL	RK1400	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
Max. flow rate (Air atm condition for gas)	5mL/min to 100L/min (See the Capacity Table below)	5mL/min to 2L/min (See the Capacity Table below)
Effective scale	10:1	
Accuracy	±2%F.S.	
Proof pressure	100mL/min or less: 1MPa(G) 5L/min or less: 0.7MPa(G) 10L/min or more: 0.5MPa(G)	5mL/min or less: 1MPa(G) 150mL/min or less: 0.7MPa(G) 200mL/min or more: 0.5MPa(G)
Max. working temperature	60°C	
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, (PTFE, PCTFE) B: Brass, Hard glass, NBR, SUS316, (PTFE, POM)	
Connection	Rc1/4	
Weight	Approx. 400g	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Capacity Table

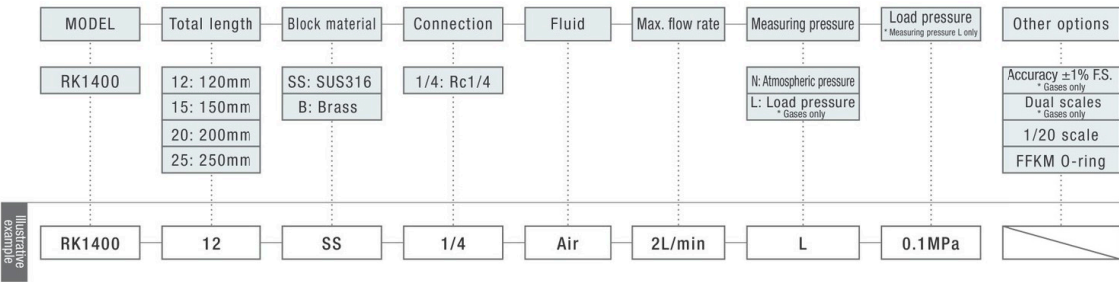
Air (atmospheric pressure)

Max. flow rate Total length	5 mL/min	10 mL/min	20 mL/min	30 mL/min	50 mL/min	100 mL/min	150 mL/min	200 mL/min	300 mL/min	500 mL/min	1 L/min	2 L/min	3 L/min	5 L/min	10 L/min	15 L/min	20 L/min	30 L/min	50 L/min	100 L/min
120mm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—
150mm	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200mm	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—
250mm	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—

H₂O

Max. flow rate Total length	5 mL/min	10 mL/min	20 mL/min	30 mL/min	50 mL/min	100 mL/min	150 mL/min	200 mL/min	300 mL/min	500 mL/min	1 L/min	2 L/min
120mm	○	○	○	○	○	○	○	○	○	○	○	—
150mm	○	○	○	○	○	○	○	○	○	○	○	○
200mm	○	○	○	○	○	○	○	○	○	○	○	—
250mm	○	○	○	○	○	○	○	○	○	○	○	—

Ordering



* Possible to manufacture with a scale of 0.5mL/min to 3mL/min (air at atmospheric pressure) only for total length of 120mm.

Purge Flow Meter with Needle Valve

MODEL RK1600R SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

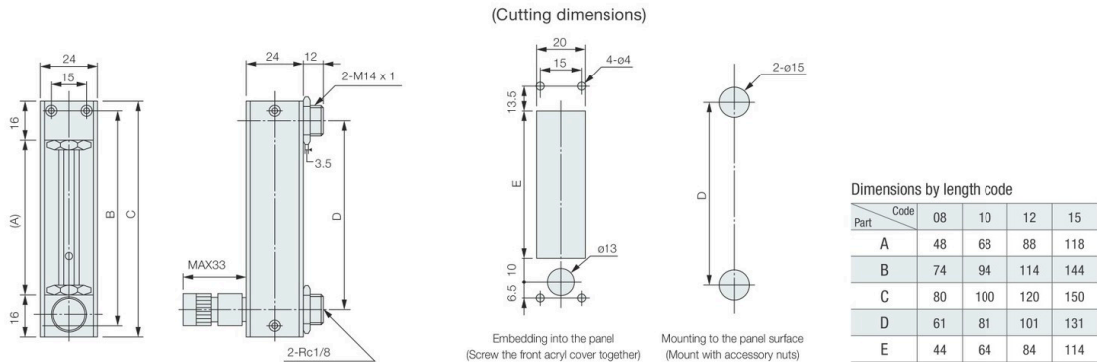
Max. flow rate Gas 1 to 20L/min

Accuracy ±5%F.S.

■ Compact design



Dimensions

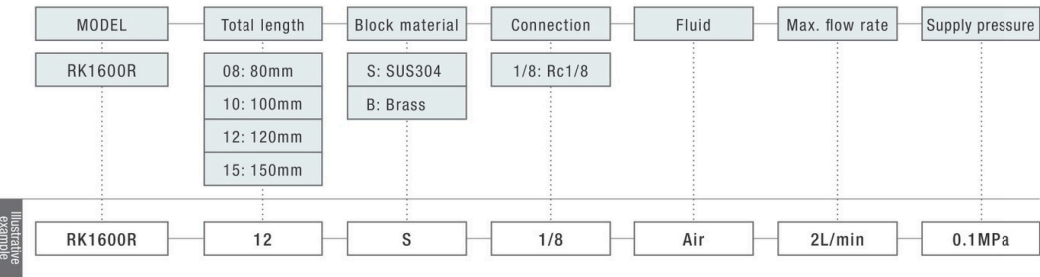


Standard Specifications

MODEL	RK1600R		
Applicable fluids	N ₂ , Ar, H ₂ , He, Ar, O ₂ , CO ₂ , etc.		
Max. flow rate (Air atm condition)	1, 2, 3, 5, 10, 15, 20L/min		
Effective scale	10:1		
Accuracy	±5%F.S.		
Proof pressure	5L/min or less: 0.7MPa(G) 10L/min or more: 0.5MPa(G)		
Max. working temperature	60°C		
Materials of parts in contact with fluid	S: SUS304, Hard glass, FKM, PCTFE, SUS316, SUS303, (PTFE) B: Brass, Hard glass, NBR, POM, SUS316, SUS303, (PTFE)		
Connection	Rc1/8		
Weight	Approx. 250g		

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering



* The needle valve is for flow control, so in order to stop the flow, install a stop valve additionally. If the needle valve is turned more than necessary, the product may be damaged.
* In the case of 2L/min or less, flow rate control may become unstable depending on the pressure condition.

Purge Flow Meter

MODEL RK1000 SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 100mL/min to 20L/min

Accuracy ±5%F.S.

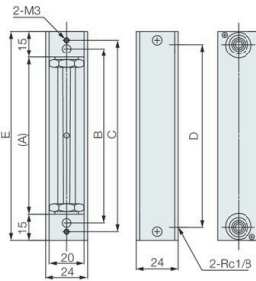
■ Compact design



Variable Flow Meter

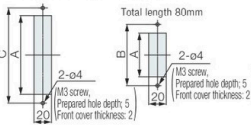
Dimensions

<<Standard>>



(Cutting dimensions)

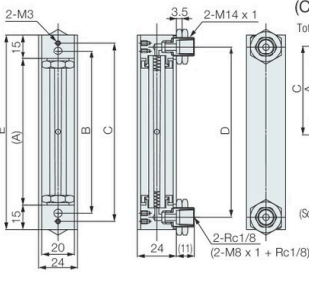
Total length 100mm, 120mm, 150mm



Embedding into the panel
(Screw the front acrylic cover together)

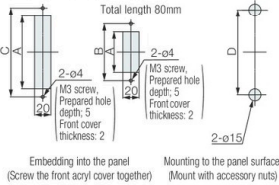
Dimensions by length code		Code			
Part	Code	08	10	12	15
A		50	70	90	120
B		60	80	100	130
C		70	90	110	140
D		65	85	105	135
E		80	100	120	150

<<With mounting nuts>>



(Cutting dimensions)

Total length 100mm, 120mm, 150mm



Embedding into the panel
(Screw the front acrylic cover together)

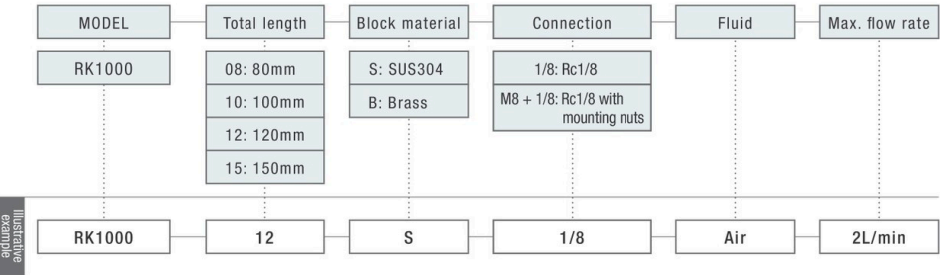
Mounting to the panel surface
(Mount with accessory nuts)

Standard Specifications

MODEL	RK1000
Applicable fluids	N ₂ , Ar, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Max. flow rate (Air atm condition)	100, 150, 200, 300, 500mL/min 1, 2, 3, 5, 10, 15, 20L/min
Effective scale	10:1
Accuracy	±5%F.S.
Proof pressure	5L/min or less: 0.7MPa(G) 10L/min or more: 0.5MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	S: SUS304, Hard glass, FKM, SUS316, (PTFE) B: Brass, Hard glass, NBR, SUS316, (PTFE)
Connection	Standard: Rc1/8 Option: Rc1/8 with mounting nuts
Weight	Approx. 200g

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering



Resin Flow Meter

MODEL RK20T SERIES

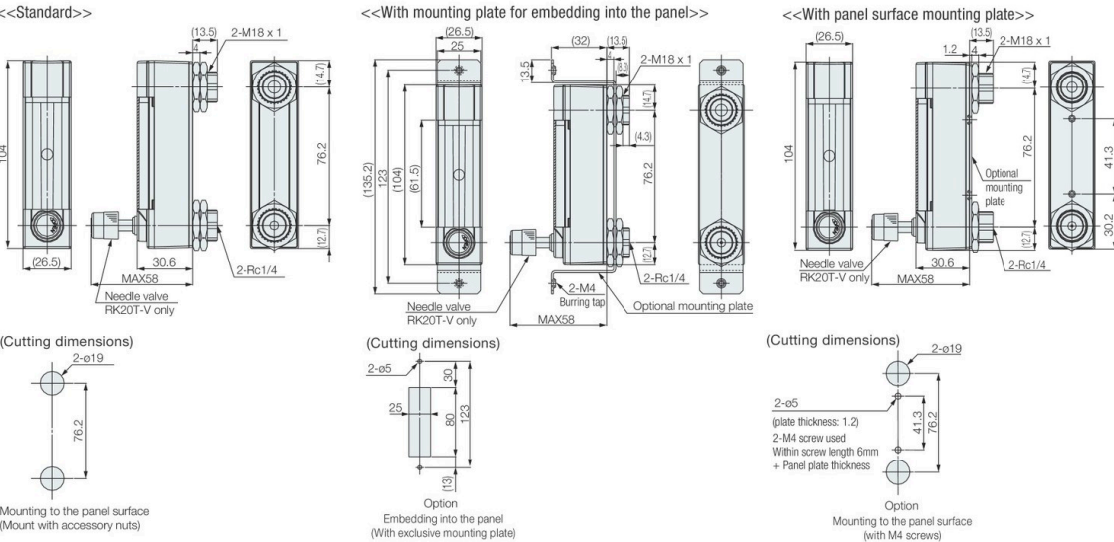


Applicable fluids	Gas Air / N ₂	Liquid WATER
Max. flow rate	Gas 0.5 to 100L/min	Liquid 25 to 2800mL/min
Accuracy	±6%F.S.	

- Low cost
- Quick delivery



Dimensions



Standard Specifications

MODEL	RK20T	
Applicable fluids	Air / N ₂	WATER
Flow rate range (atm condition for gas)	0.05 to 0.5L/min, 0.15 to 1L/min, 0.5 to 5L/min, 1 to 10L/min, 2.5 to 25L/min, 5 to 50L/min, 20 to 100L/min	2.5 to 25mL/min, 30 to 300mL/min, 100 to 800mL/min, 200 to 1600mL/min, 500 to 2800mL/min
Accuracy	±6%F.S.	
Proof pressure	0.7MPa(G)	
Max. working temperature	65°C	
Materials of parts in contact with fluid	ABS, Acryl, SUS303, FKM, POM, (Hard glass, SUS316, SUS304)	
Connection	Rc1/4	
Weight	Approx. 150g	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

MODEL	Needle valve	Connection	Fluid	Max. flow rate	Other options
RK20T	V: Yes 0: No	1/4: Rc1/4	Air / N ₂ WATER		Panel surface mounting plate Mounting plate for embedding into the panel
RK20T	V	1/4	Air / N ₂	1L/min	

* This product is excluded from our scope of repair.

Resin Flow Meter for Large flow rate

MODEL RK50T SERIES NEW

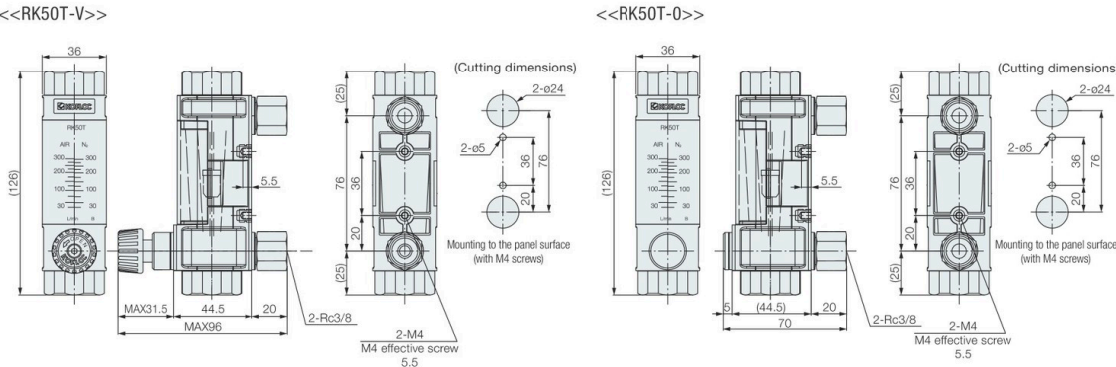


Applicable fluids	Gas Air / N ₂	Liquid WATER
Max. flow rate	Gas 100 to 300L/min	Liquid 3 to 10L/min
Accuracy	±5%F.S.	

- Low cost
- Quick delivery



Dimensions

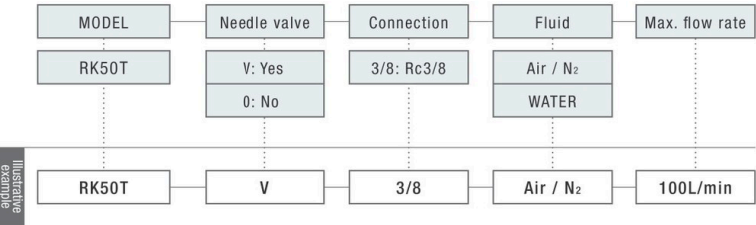


Standard Specifications

MODEL	RK50T	
Applicable fluids	Air / N ₂	WATER
Flow rate range (atm condition for gas)	10 to 100L/min, 20 to 200L/min, 30 to 300L/min	0.3 to 3L/min, 0.5 to 5L/min, 1 to 10L/min
Accuracy	±5%F.S.	
Proof pressure	1MPa(G)	3MPa(G)
Max. working temperature	55°C	
Materials of parts in contact with fluid	Acryl, FKM, SUS303, SUS304, SUS316, (Glass fiber contained nylon)	
Connection	Rc3/8	
Weight	Approx. 350g	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering



* This product is excluded from our scope of repair.

Variable Flow Meter

Resin Flow Meter with Reed Switch

MODEL RK20T-RSW SERIES NEW

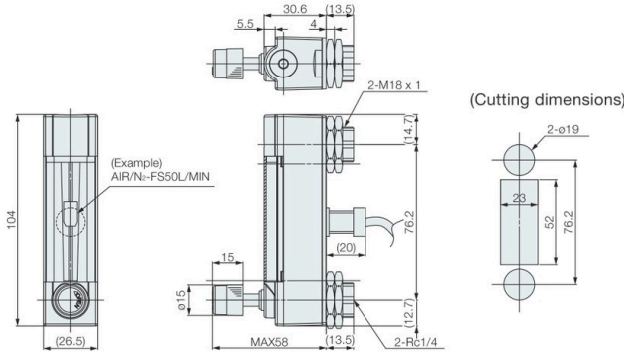


Applicable fluids	Gas	Air / N ₂	Liquid	WATER
Max. flow rate	Gas	10 to 100L/min	Liquid	250 to 2800mL/min
Accuracy	±6%F.S.			

- Alarm function by reed switch



Dimensions

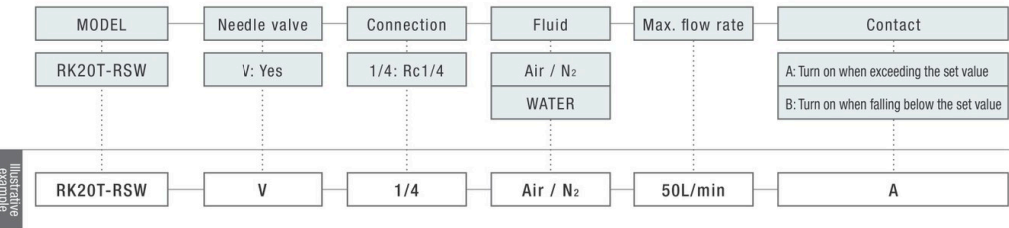


Standard Specifications

MODEL	RK20T-RSW					
Applicable fluids	Air / N ₂			WATER		
Flow rate range (atm condition for gas)	Flow rate range	Alarm setting range		Flow rate range	Alarm setting range	
		Contact A	Contact B		Contact A	Contact B
	4 to 10L/min	6 to 9.5L/min	4.5 to 8.5L/min	—	—	—
	2.5 to 25L/min	8 to 20L/min	5 to 16L/min	20 to 250mL/min	50 to 250mL/min	30 to 230mL/min
	5 to 50L/min	16 to 46L/min	10 to 36L/min	100 to 1500mL/min	300 to 1500mL/min	150 to 1400mL/min
	20 to 100L/min	45 to 100L/min	35 to 90L/min	600 to 2800mL/min	900 to 2800mL/min	700 to 2800mL/min
Accuracy	±6%F.S.					
Proof pressure	0.7MPa(G)					
Working ambient temperature	10°C to 35°C (no dew condensation)					
Materials of parts in contact with fluid	ABS, Acryl, SUS303, FKM, POM, SUS316, (Ferrite magnet, epoxy-coated magnet)					
Connection	Rc1/4					
Contact capacity	DC30V DC10W DC0.5A					
Cable length	65cm					
Weight	Approx. 200g					

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering



* This product is excluded from our scope of repair.

Flow Meter for Cylinder Regulator

MODEL RK4400 SERIES



Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

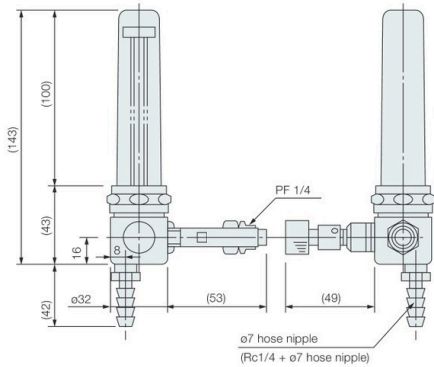
Max. flow rate **Gas** 10mL/min to 20L/min

Accuracy ±2%F.S.

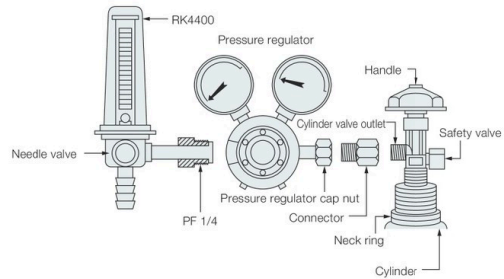
- Capable of attaching a cylinder regulator
- Superior control performance by non-rotating precision needle valve



Dimensions



Example of use

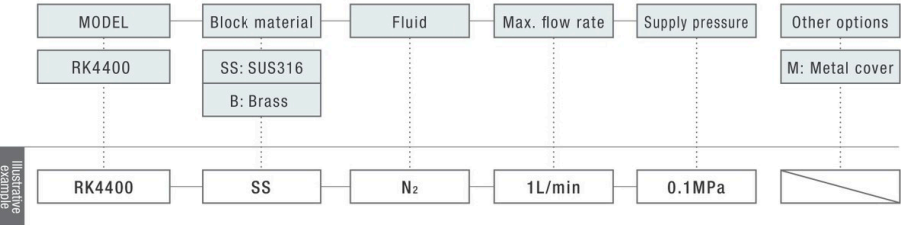


Standard Specifications

MODEL	RK4400
Applicable fluids	N ₂ , Ar, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Max. flow rate (Air atm condition)	10, 50, 100, 500mL/min 1, 5, 10, 15, 20L/min
Effective scale	10:1
Accuracy	±2%F.S.
Proof pressure	0.3MPa(G)
Max. working temperature	40°C
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, PCTFE, (PTFE) B: Brass, Hard glass, NBR, POM, PCTFE, SUS316, (PTFE)
Connection	Inlet: PF1/4 Outlet: Rc1/4 + ø7 hose nipple
Weight	Approx. 370g

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering



Variable Flow Meter

Flow Meter with Reed Switch

MODEL RK1970 / RK1975 / RK1976 SERIES



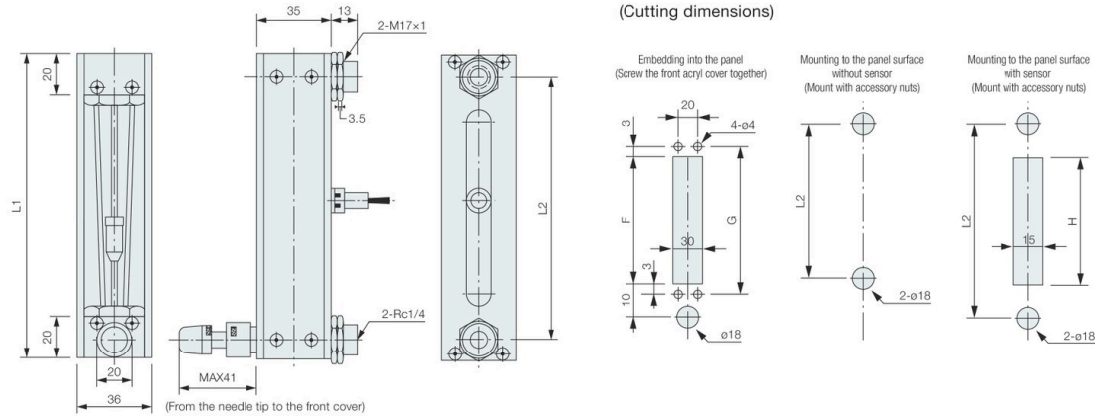
Applicable fluids	Gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	Liquid	H ₂ O
Max. flow rate	Gas	30 to 150L/min	Liquid	1 to 5L/min
Accuracy	±5%F.S.			

- Alarm function by reed switch
- Upper needle valve type available



RK1975-VD

Dimensions



Dimensions by length code

Part \ Code	15	20
A	36	36
B	35	35
L1	150	200
L2	130	180
F	110	160
G	116	166
H	100	150

* H exists when the reed switch is included.

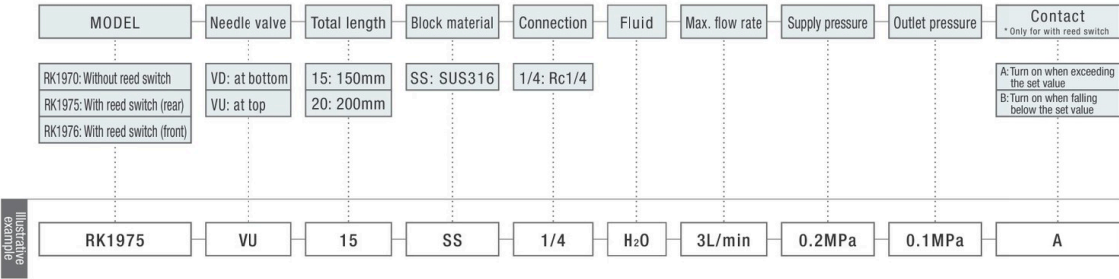
Standard Specifications

MODEL	RK1970, RK1975, RK1976	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc. (RK1975 and RK1976 not available for H ₂)	H ₂ O
Max. flow rate (Air atm condition for gas)	Total length 150mm: 30, 100, 150L/min Total length 200mm: 100, 150L/min	Total length 150mm: 1, 3, 5L/min Total length 200mm: 3, 5L/min
Effective scale	10:1	
Accuracy	±5%F.S.	
Proof pressure	0.5MPa(G)	
Working ambient temperature	10°C to 35°C (no dew condensation)	
Materials of parts in contact with fluid	SUS316, Hard glass, FKM, POM, (PTFE, nylon)	
Connection	Rc1/4	
Alarm setting range	RK1975, RK1976: 20 to 90%F.S.	
Contact capacity	RK1975, RK1976: 100VAC / 100VDC, AC10VA / DC10W	
Cable length	RK1975, RK1976: 65cm	
Weight	Approx. 600g	

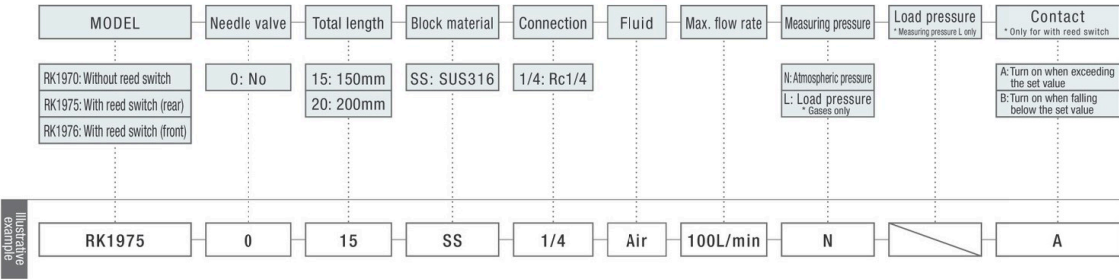
* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

<with needle valve type>



<without needle valve type>



Flow Meter for Large flow rate

MODEL RK2000 / RK2005 / RK2006 SERIES

Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc. **Liquid** H₂O

Max. flow rate **Gas** 100 to 1000L/min **Liquid** 10 to 30L/min

Accuracy ±5% F.S.

- Available for large flow rate
- Upper needle valve type available
- Alarm function by reed switch



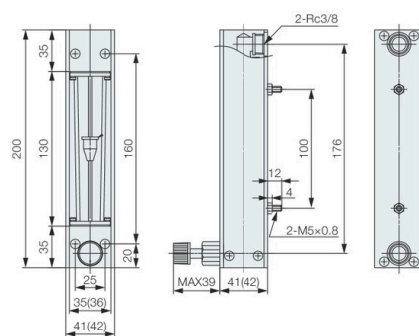
RK2000-0



RK2006-VU

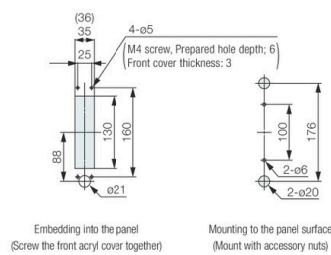
Dimensions

<<100 to 300L/min>>



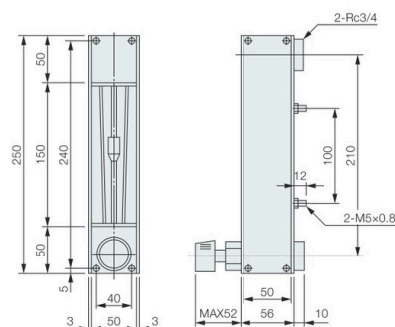
* Dimensions in () are for SUS material.

(Cutting dimensions)

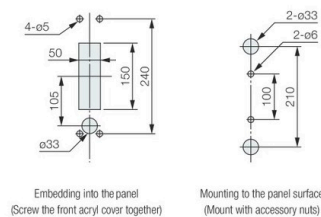


* The RK2005 and RK2006 can only be embedded into the panel.

<<400 to 1000L/min>>



(Cutting dimensions)



* The RK2005 and RK2006 can only be embedded into the panel.

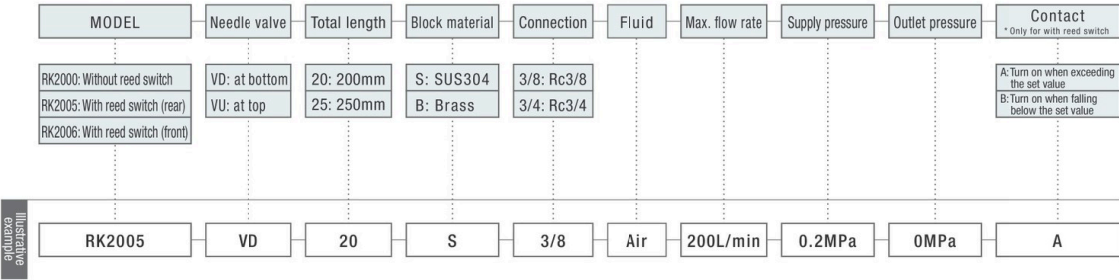
Standard Specifications

MODEL	RK2000, RK2005, RK2006	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc. (RK2005 and RK2006 not available for H ₂)	H ₂ O
Max. flow rate (Air atm condition for gas)	Total length 200mm: 100, 200, 250, 300L/min Total length 250mm: 400, 500, 700, 1000L/min	Total length 200mm: 10L/min Total length 250mm: 20, 30L/min
Effective scale	10:1	
Accuracy	±5%F.S.	
Proof pressure	0.7MPa(G)	
Max. working temperature	RK2000: 60°C	
Working ambient temperature	RK2005, RK2006: 10°C to 35°C (no dew condensation)	
Materials of parts in contact with fluid	S: SUS304, Hard glass, FKM, (SUS316, PCTFE, PTFE) B: Brass, Hard glass, SUS304, NBR, (SUS316, POM, PTFE)	
Connection	Total length 200mm: Rc3/8 Total length 250mm: Rc3/4	
Alarm setting range	RK2005, RK2006: 20 to 90%F.S.	
Contact capacity	RK2005, RK2006: AC100V / DC100V, AC10VA / DC10W	
Cable length	RK2005, RK2006: 65cm	
Weight	Approx. 1,000g	

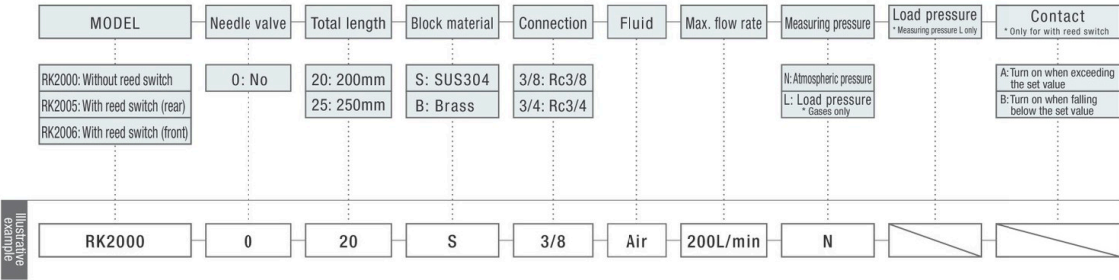
* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

<with needle valve type>



<without needle valve type>



* Even in case the maximum gas flow rate exceeds 400L/min, total length could be 200mm depending on the condition.

Flow Meter with Photosensor

MODEL RK1812 / RK1814 SERIES



Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc. **Liquid** H₂O

Max. flow rate **Gas** 50mL/min to 50L/min **Liquid** 20mL/min to 1L/min

Accuracy ±2% F.S.

- Alarm function by photosensor
- High-accuracy measurement of ±2% F.S. or better
- Superior control performance by non-rotating precision needle valve
- Upper needle valve type available

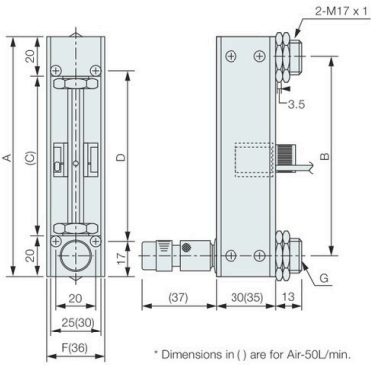


RK1812 (valve at bottom)

RK1814

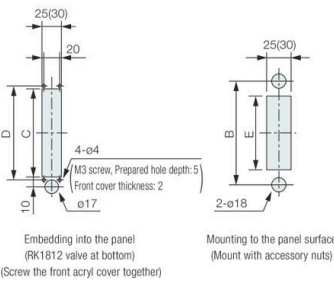
Dimensions

<<RK1812>>



* Dimensions in () are for Air-50L/min.

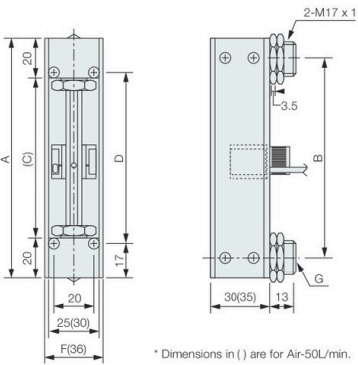
(Cutting dimensions)



Dimensions by length code

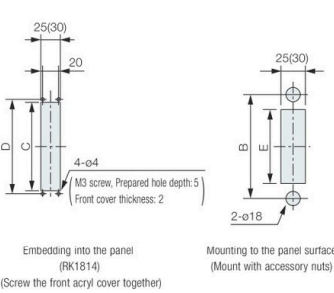
Part	Code	12	15	20	25
A		120	150	200	250
B		100	130	180	230
C		80	110	160	210
D		86	116	166	216
E		70	100	150	200
F		29	29	31	31
G		Rc1/4			

<<RK1814>>



* Dimensions in () are for Air-50L/min.

(Cutting dimensions)



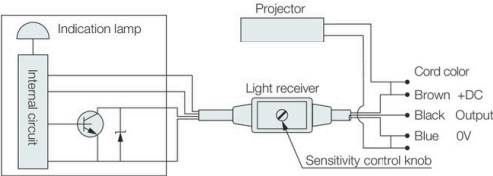
Standard Specifications

MODEL	RK1812, RK1814	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc	H ₂ O
Max. flow rate (Air atm condition for gas)	50mL/min to 50L/min (See the Capacity Table of RK1200 and RK1400)	20mL/min to 1L/min (See the Capacity Table of RK1200 and RK1400)
Effective scale	10:1	
Accuracy	±2%F.S.	
Proof pressure	100mL/min or less: 1MPa(G) 5L/min or less: 0.7MPa(G) 10L/min or more: 0.5MPa(G)	20mL/min or less: 1MPa(G) 150mL/min or less: 0.7MPa(G) 200mL/min or more: 0.5MPa(G)
Working ambient temperature	5 to 55°C	
Materials of parts in contact with fluid	RK1812	SS: SUS316, Hard glass, FKM, PCTFE, (PTFE) B: Brass, Hard glass, NBR, POM, SUS316, (PTFE)
	RK1814	SS: SUS316, Hard glass, FKM, (PTFE) B: Brass, Hard glass, NBR, SUS316, (PTFE)
Connection	Rc1/4	
Alarm setting range	10 to 90%F.S.	
Weight	Approx. 450g	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Photosensor Specifications

Operating power	24VDC±10%
Power consumption	Projector: 15mA or less Light receiver: 22mA or less
Output mode	NPN open collector, Sink current: Max. 80mA (30VDC)
Operation mode	Light-on
Response time	0.5msec or less
Cord	Projector: 0.15mm ² x 2 cores (2m) Light receiver: 0.15mm ² x 3 cores (2m)
Protective structure	IP64
Manufacturer	Takenaka Electronic Industrial Co., Ltd.
Model	Photoelectric switch incorporating UM-T15TV (24VDC) Provided with relay control knob (on light receiver side)



* When adjusting the photosensor, loosen the sensor fixing knob first. The transmissive projector is omitted here because it has only power input (brown: 24VDC, blue: OV). See the photosensor instruction manual enclosed before use.

Ordering

<RK1812: with needle valve type>

MODEL	Total length	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure	Number of sensors	Needle valve	Other options
RK1812	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4						D: at bottom U: at top	Accuracy ±1% F.S. * Gases only Dual scales * Gases only 1/20 scale FFKM O-ring
RK1812	12	SS	1/4	Air	2L/min	0.2MPa	0MPa	1	D	

<RK1814: without needle valve type>

MODEL	Total length	Block material	Connection	Fluid	Max. flow rate	Measuring pressure	Load pressure * Measuring pressure L only	Number of sensors	Other options
RK1814	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4			N: Atmospheric pressure L: Load pressure * Gases only			Accuracy ±1% F.S. * Gases only Dual scales * Gases only 1/20 scale FFKM O-ring
RK1814	12	SS	1/4	Air	2L/min	L	0.1MPa	1	

* If you want multiple sensors to be installed, consult our sales office.

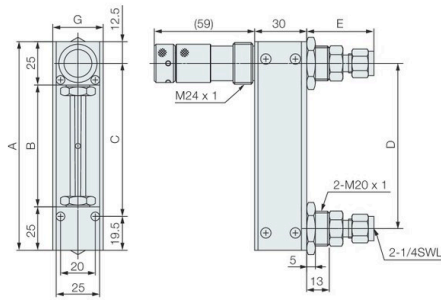
MODEL RK1500 SERIES



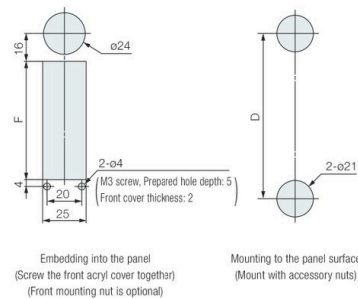
Accuracy $\pm 2\%$ F.S.

-
- RK1500
(valve at bottom)

(Cutting dimensions)



* When connecting the piping, fix the hexagonal part of fittings so that the SWL type fittings will not be loosened. (It may be loosened because of O-ring sealing.)



Dimensions by length code

Part	Code	12	15	20	25
A		120	150	200	250
B		70	100	150	200
C		88	118	168	218
D		95	125	175	225
E	1/4 SWL	39	39	39	39
	1/8 SWL	37	37	37	37
	1/4 VCR	37	37	37	37
F		68	98	148	198
G		29	29	31	31

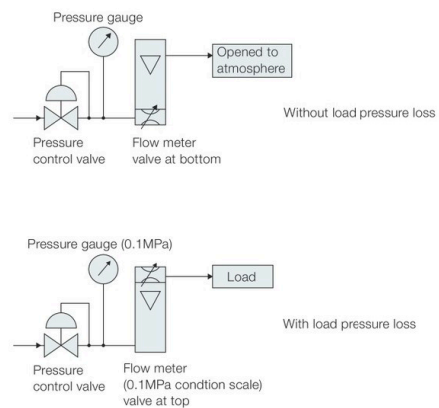
Panel mounting nut

M3 screw x 2

Embedding into the panel
(Front mounting nut is optional)

Mounting nut

Mounting to the panel surface
(Mount with accessory nuts)



Standard Specifications

MODEL	RK1500	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
Max. flow rate (Air atm condition for gas)	5mL/min to 30L/min (See the Capacity Table below)	5mL/min to 1L/min (See the Capacity Table below)
Effective scale	10:1	
Accuracy	±2%F.S.	
Proof pressure	100mL/min or less: 1MPa(G)	5mL/min or less: 1MPa(G)
	5L/min or less: 0.7MPa(G)	150mL/min or less: 0.7MPa(G)
	10L/min or more: 0.5MPa(G)	200mL/min or more: 0.5MPa(G)
Max. working temperature	60°C	
Materials of parts in contact with fluid	SUS316, Hard glass, FKM, PCTFE, (PTFE)	
Connection	Standard: 1/4SWL type	
	Option: 1/8SWL type, 1/4VCR type	
Weight	Approx. 800g	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Capacity Table

Air (atmospheric pressure)

Max. flow rate Total length	5 mL/min	10 mL/min	20 mL/min	30 mL/min	50 mL/min	100 mL/min	150 mL/min	200 mL/min	300 mL/min	500 mL/min	1 L/min	2 L/min	3 L/min	5 L/min	10 L/min	15 L/min	20 L/min	30 L/min
120mm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150mm	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200mm	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○
250mm	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○

H₂O

Max. flow rate Total length	5 mL/min	10 mL/min	20 mL/min	30 mL/min	50 mL/min	100 mL/min	150 mL/min	200 mL/min	300 mL/min	500 mL/min	1 L/min
120mm	○	○	○	○	○	○	○	○	○	○	○
150mm	○	○	○	○	○	○	○	○	○	○	○
200mm	○	○	○	○	○	○	○	○	○	○	○
250mm	○	○	○	○	○	○	○	○	○	○	○

Ordering

MODEL	Total length	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure	Needle valve	Other options
RK1500	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316	1/4SW: 1/4SWL type 1/8SW: 1/8SWL type 1/4VCR: 1/4VCR type					D: at bottom U: at top	Accuracy ±1% F.S. * Gases only Dual scales * Gases only 1/20 scale FFKM O-ring
RK1500	12	SS	1/4SW	Air	2L/min	0.2MPa	0MPa	D	

* Possible to manufacture with a scale of 0.5mL/min to 3mL/min (air at atmospheric pressure) only for total length of 120mm.

* No shutting O-ring for FFKM option.

* If you need the front panel mounting nut, let us know at ordering time.

* 'SWL type' and 'VCR type' are shortened to SW and VCR in Ordering code.

Low pressure Flow Meter

MODEL RK130 / RK230 / RK260 SERIES

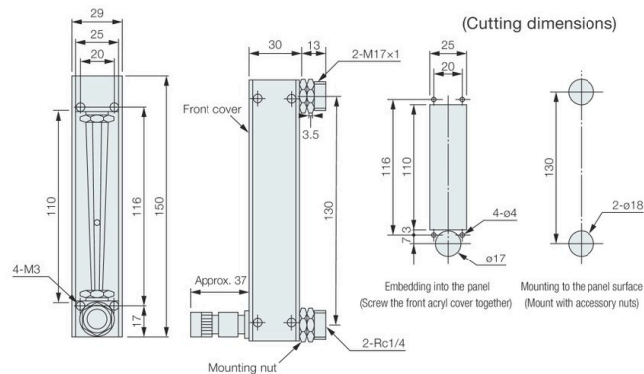
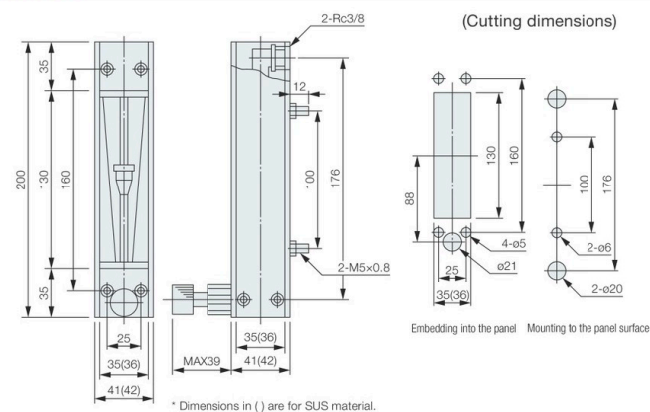
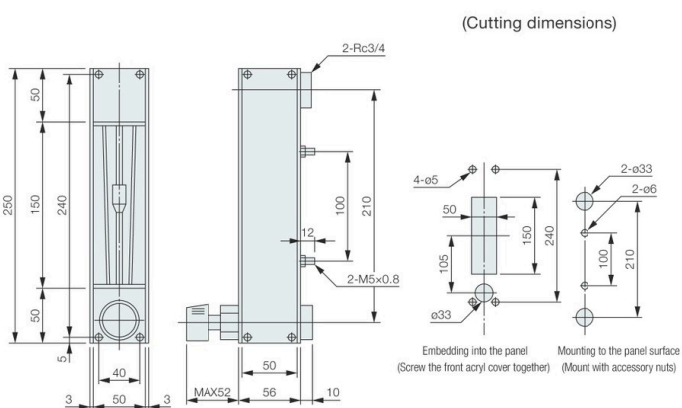
Applicable fluids Gas Air, O₂, LNG, C₃H₈

Max. flow rate Gas 10 to 1000L/min

Accuracy RK130: $\pm 2\%$ F.S. RK230, RK260: $\pm 5\%$ F.S.

- Available for use at low pressure
- Available for large flow rate

Variable Flow Meter

RK130**Dimensions****RK230****Dimensions****RK260****Dimensions**

Standard Specifications

MODEL	RK130
Accuracy	±2%F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	50°C
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, PCTFE B: Brass, Hard glass, NBR, SUS316, PCTFE
Connection	Rc1/4

Differential pressure range (Air atmospheric pressure)

10L/min	1.6 to 4kPa
20L/min	2.5 to 5kPa
30L/min	5 to 10kPa

* When the pressure is relatively high, the RK1200 is recommended from a viewpoint of flow rate control.

Flow rate range (atmospheric pressure)

Flow rate range (L/min)				Pressure loss (kPa)	Float material
Air	O ₂	LNG	C ₂ H ₄		
1 to 10	1 to 10	1 to 10	0.8 to 8	0.6	Hard glass
2 to 20	2 to 20	2 to 20	1.5 to 15	1.4	
3 to 30	3 to 30	3 to 30	2.5 to 25	3.5	SUS316

* The pressure loss is the result of measurement with no load applied to the fittings and piping.

Ordering

MODEL	Block material	Connection	Fluid	Max. flow rate	Supply pressure * Pressure loss + 1kPa at least	Outlet pressure	Needle valve
RK130	SS: SUS316 B: Brass	1/4: Rc1/4				0kPa	D: at bottom
RK130	SS	1/4	Air	10L/min	1.6kPa	0kPa	D

Standard Specifications

MODEL	RK230
Accuracy	±5%F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	50°C
Materials of parts in contact with fluid	S: SUS304, Hard glass, SUS316, FKM, PCTFE, PTFE, POM B: Brass, Hard glass, SUS316, NBR, PTFE, SUS304, POM
Connection	Rc3/8

Differential pressure range (Air atmospheric pressure)

30L/min	1.5 to 3kPa
50L/min	2 to 5kPa
100L/min	2.5 to 15kPa

* When the pressure is relatively high for 100L/min, the RK2000 is recommended from a viewpoint of flow rate control.

Flow rate range (atmospheric pressure)

Flow rate range (L/min)				Pressure loss (kPa)	Float material
Air	O ₂	LNG	C ₂ H ₄		
3 to 30	3 to 30	4 to 40	2.5 to 25	0.5	POM (polyacetal, white)
5 to 50	5 to 50	8 to 60	4 to 40	0.7	
10 to 100	10 to 90	20 to 120	10 to 80	1.5	

* The pressure loss is the result of measurement with no load applied to the fittings and piping.

Ordering

MODEL	Block material	Connection	Fluid	Max. flow rate	Supply pressure * Pressure loss + 1kPa at least	Outlet pressure	Needle valve
RK230	S: SUS304 B: Brass	3/8: Rc3/8				0kPa	D: at bottom
RK230	S	3/8	Air	100L/min	2.5kPa	0kPa	D

Standard Specifications

MODEL	RK260
Accuracy	±5%F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	50°C
Materials of parts in contact with fluid	S: SUS304, Hard glass, FKM, PTFE, (POM) B: Brass, Hard glass, NBR, PTFE, SUS304, (POM)
Connection	Rc3/4

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Differential pressure range (Air atmospheric pressure)

100L/min	1.6 to 3.5kPa	500L/min	7 to 40kPa
200L/min	2.2 to 10kPa	800L/min	18 to 50kPa
300L/min	3.6 to 20kPa	1000L/min	30 to 50kPa

* When the pressure is relatively high for 500L/min, the RK2000 is recommended from a viewpoint of flow rate control.

Flow rate range (atmospheric pressure)

Flow rate range (L/min)				Pressure loss (kPa)	Float material
Air	O ₂	LNG	C ₂ H ₄		
10 to 100	10 to 100	20 to 130	10 to 80	0.6	POM (polyacetal, white)
20 to 200	20 to 190	25 to 250	20 to 150	1.2	
50 to 300	50 to 300	70 to 400	50 to 250	2.6	
100 to 500	100 to 450	150 to 600	80 to 400	5.5	
80 to 800	80 to 750	—	80 to 600	15	SUS304
100 to 1000	100 to 1000	100 to 1000	80 to 800	23	

* The pressure loss is the result of measurement with no load applied to the fittings and piping.

Ordering

MODEL	Block material	Connection	Fluid	Max. flow rate	Supply pressure * Pressure loss + 1kPa at least	Outlet pressure	Needle valve
RK260	S: SUS304 B: Brass	3/4: Rc3/4				0kPa	D: at bottom
RK260	S	3/4	Air	1000L/min	30kPa	0kPa	D

Flexible Flow Meter

MODEL RK1100 SERIES



Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

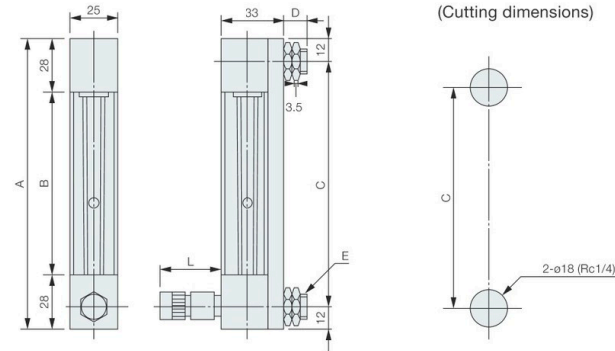
Max. flow rate **Gas** 10mL/min to 20L/min

Accuracy $\pm 2\%$ F.S.

- Possible to disassemble and reassemble
- Capable of selecting a non-rotating precision needle valve
- Upper needle valve type available



Dimensions

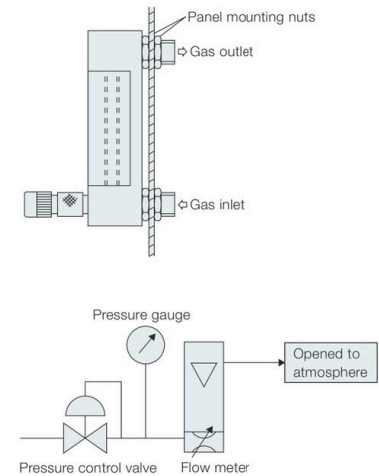


Dimensions by length code

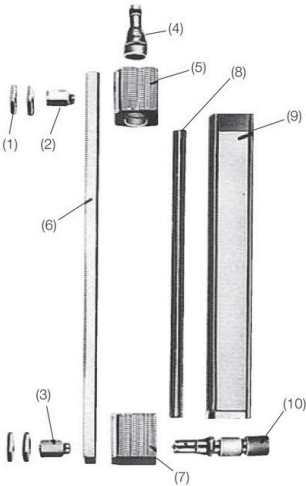
Part	Code	12	15	20	25
A		120	150	200	250
B		64	94	144	194
C		96	126	176	226
D	Rc1/4	14	14	14	14
E	Rc1/4	M17×1	M17×1	M17×1	M17×1

MODEL	L
RK1100-0	0
RK1100-V	33MAX
RK1100-PV	40

Example of use



Disassembled parts



(1)	Panel mounting nuts
(2)	Gas outlet joint
(3)	Gas inlet joint
(4)	Glass tube retainer
(5)	Upper block
(6)	Backplate base
(7)	Lower block
(8)	Glass tapered tube
(9)	Acryl cover
(10)	Needle valve

Standard Specifications

MODEL	RK1100
Applicable fluids	N ₂ , Ar, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Max. flow rate (Air atm condition)	0, P/V: 10mL/min to 20L/min V: 1 to 20L/min (See the Capacity Table below)
Effective scale	10:1
Accuracy	±2%F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	S: SUS304, Hard glass, SUS316, FKM, (SUS303, PCTFE, PTFE, nylon) A: Al, Brass, Hard glass, SUS316, NBR, (SUS303, POM, PTFE, nylon)
Connection	Rc1/4
Weight	Approx. 400g

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Capacity Table

Air (atmospheric pressure)

Max. flow rate	10	20	30	50	100	150	200	300	500	1	2	3	5	10	15	20
Total length	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	mL/min	L/min	L/min	L/min	L/min	L/min	L/min	L/min
120mm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
150mm	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
200mm	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○
250mm	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○

Ordering

<with needle valve type>

MODEL	Needle valve	Total length	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure	Other options
RK1100	VD: at bottom VU: at top PVD: Precision, at bottom PVU: Precision, at top	12: 120mm 15: 150mm 20: 200mm 25: 250mm	S: SUS304 A: Al	1/4: Rc1/4					Accuracy ±1% F.S. 1/20 scale
RK1100	PVD	12	S	1/4	Air	2L/min	0.1MPa	0MPa	

<without needle valve type>

MODEL	Needle valve	Total length	Block material	Connection	Fluid	Max. flow rate	Measuring pressure	Load pressure	Other options
RK1100	0: No	12: 120mm 15: 150mm 20: 200mm 25: 250mm	S: SUS304 A: Al	1/4: Rc1/4			N: Atmospheric pressure L: Load pressure	* Measuring pressure L only	Accuracy ±1% F.S. 1/20 scale
RK1100	0	12	S	1/4	Air	2L/min	L	0.1MPa	

Flow Meter with Stand

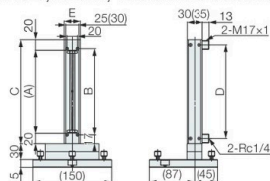
MODEL RK1310 SERIES **NEW**Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc.**Liquid** H₂OMax. flow rate **Gas** 5mL/min to 100L/min**Liquid** 5mL/min to 2L/minAccuracy $\pm 2\%$ F.S.

- With stand
- Available for minute flow rate as well
- High-accuracy measurement of $\pm 2\%$ F.S. or better
- Superior control performance by non-rotating precision needle valve
- Upper needle valve type available

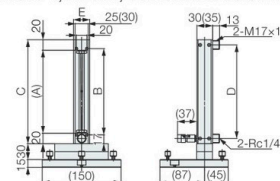


Dimensions

<<RK1310-0, Air atm, 10mL/min to 50L/min>>



<<RK1310-V, Air atm, 10mL/min to 50L/min>>

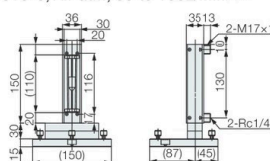


Dimensions by length code

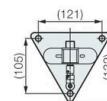
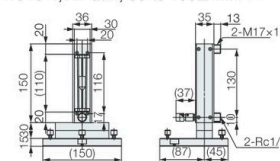
Part	Code	12	15	20	25
A		80	110	160	210
B		86	116	166	216
C		120	150	200	250
D		100	130	180	230
E		29(36)	29(36)	31(36)	31(36)

* Dimensions in () are for Air-50L/min and H₂O-2L/min.

<<RK1310-0, Air atm, 60 to 100L/min>>



<<RK1310-V, Air atm, 60 to 100L/min>>



* Dimensions of the stand are common.

Standard Specifications

MODEL	RK1310	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
Max. flow rate (Air atm condition for gas)	5mL/min to 100L/min (See the Capacity Table of RK1200 and RK1400)	5mL/min to 2L/min (See the Capacity Table of RK1200 and RK1400)
Effective scale	10:1	
Accuracy	$\pm 2\%$ F.S.	
Proof pressure	100mL/min or less: 1MPa(G) 5L/min or less: 0.7MPa(G) 10L/min or more: 0.5MPa(G)	5mL/min or less: 1MPa(G) 150mL/min or less: 0.7MPa(G) 200mL/min or more: 0.5MPa(G)
Max. working temperature	60°C	
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, PCTFE, (PTFE) B: Brass, Hard glass, NBR, POM, SUS316, (PTFE)	
Connection	Rc1/4	

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

<with needle valve type>

MODEL	Needle valve	Total length * Stand not included	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure
RK1310	VD: at bottom VU: at top	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4				
RK1310	VD	20	SS	1/4	N ₂	10L/min	0.1MPa	0MPa

<without needle valve type>

MODEL	Needle valve	Total length * Stand not included	Block material	Connection	Fluid	Max. flow rate	Measuring pressure	Load pressure
RK1310	0: No	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4			N: Atmospheric pressure L: Load pressure	
RK1310	0	20	SS	1/4	N ₂	10L/min	L	0.1MPa

Multiple Flow Meter with Needle Valve

MODEL RK120X SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 5mL/min to 20L/min

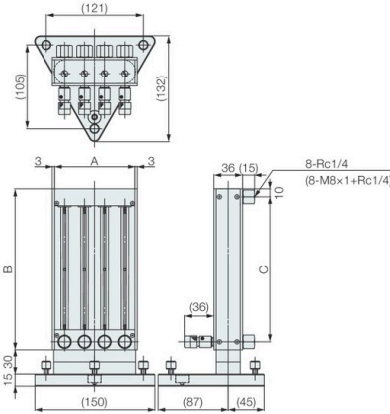
Accuracy ±2% F.S.

- Capable of gas measurement and control up to 4 lines with one unit
- Stand installable
- Available for minute flow rate as well
- High-accuracy measurement of ±2% F.S. or better
- Superior control performance by non-rotating precision needle valve
- Upper needle valve type available



RK1202
(Valve at bottom, with stand)

Dimensions



Dimensions of each part

MODEL	A	B			
RK1202	50	120	150	200	250
RK1203	75	120	150	200	250
RK1204	100	120	150	200	250

	C
B=120	100
B=150	130
B=200	180
B=250	230

Standard Specifications

MODEL	RK1202, RK1203, RK1204
Applicable fluids	N ₂ , Ar, H ₂ , He, Ar, O ₂ , CO ₂ , etc.
Max. flow rate (Air atm condition)	5mL/min to 20L/min (See the Capacity Table of RK1200)
Effective scale	10:1
Accuracy	±2% F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, PCTFE, (PTFE, nylon) B: Brass, Hard glass, SUS316, NBR, POM, (PTFE, nylon)
Connection	Rc1/4

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

MODEL	Total length * Stand not included	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure	Needle valve	Stand	Other options	
RK1202: 2 glass tubes RK1203: 3 glass tubes RK1204: 4 glass tubes	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4					D: at bottom U: at top	O: No S: Yes	Accuracy ±1%F.S. 1/20 scale	
Illustrative example	RK1204	12	SS	1/4	Air	1L/min	0.2MPa	0.1MPa	U	S	
					Air	2L/min	0.2MPa	0.1MPa			
					N ₂	10L/min	0.2MPa	0.1MPa			
					N ₂	20L/min	0.2MPa	0.1MPa			

* For the fluid, Max. flow rate, supply pressure and outlet pressure, specify them in order of ascending flow rate from the left as you face for the number of glass tubes.

Variable Flow Meter

Multiple Flow Meter

MODEL RK140X SERIES


Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

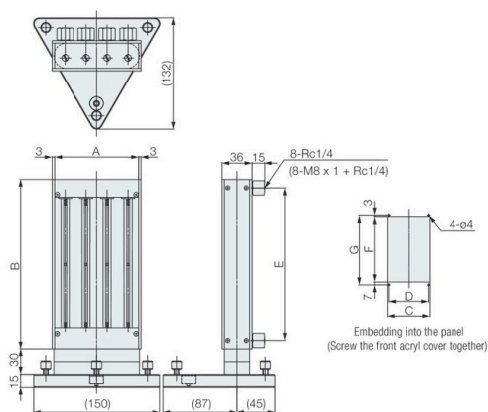
Max. flow rate Gas 5mL/min to 20L/min

Accuracy ±2% F.S.

- Capable of gas measurement up to 4 lines with one unit
- Stand installable
- Available for minute flow rate as well
- High-accuracy measurement of ±2% F.S. or better

RK1402
(with stand)

Dimensions



Dimensions of each part

MODEL	A	B	C	D
RK1402	50	120	150	200
RK1403	75	120	150	200
RK1404	100	120	150	200

	E	F	G
B = 120	100	74	84
B = 150	130	104	114
B = 200	180	154	164
B = 250	230	204	214

Standard Specifications

MODEL	RK1402, RK1403, RK1404
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc
Max. flow rate (Air atm condition)	5mL/min to 20L/min (See the Capacity Table of RK1400)
Effective scale	10:1
Accuracy	±2% F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, (PTFE, nylon) B: Brass, Hard glass, NBR, SUS316, (PTFE, nylon)
Connection	Rc1/4

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

MODEL	Total length * Stand not included	Block material	Connection	Fluid	Max. flow rate	Measuring pressure	Load pressure * Measuring pressure L only	Stand	Other options
RK1402: 2 glass tubes RK1403: 3 glass tubes RK1404: 4 glass tubes	12: 120mm 15: 150mm 20: 200mm 25: 250mm	SS: SUS316 B: Brass	1/4: Rc1/4			N: Atmospheric pressure L: Load pressure		0: No S: Yes	Accuracy ±1% F.S. 1/20 scale
illustrative example RK1404	12	SS	1/4	Air Air N ₂ N ₂	1L/min 2L/min 10L/min 20L/min	L	0.1MPa 0.1MPa 0.1MPa 0.1MPa	S	

* For the fluid, maximum flow rate and pressure condition, specify them in order of ascending flow rate from the left as you face for the number of glass tubes.

Multiple Flow Meter for Gas Mixing

MODEL RK120XM SERIES



Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Max. flow rate Gas 50mL/min to 10L/min (Max. 10L/min for 1 line, Max. 20L/min in total)

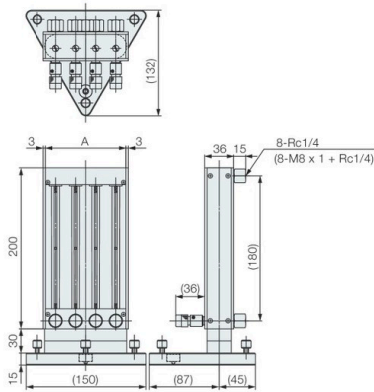
Accuracy ±2% F.S.

- Capable of simple gas mixing up to 4 lines
- Stand installable
- High-accuracy measurement of ±2% F.S. or better
- Superior control performance by non-rotating precision needle valve



RK1202M
(with stand)

Dimensions



Dimensions of each part

MODEL	A
1202M	50
1203M	75
1204M	100

Standard Specifications

MODEL	RK1202M, RK1203M, RK1204M
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc
Max. flow rate (Air atm condition)	50mL/min to 10L/min (Max. 10L/min for 1 line, Max. 20L/min in total) (See the Capacity Table of RK1200)
Effective scale	10:1
Accuracy	±2% F.S.
Proof pressure	0.5MPa(G)
Max. working temperature	60°C
Materials of parts in contact with fluid	SS: SUS316, Hard glass, FKM, PCTFE, (PTFE, nylon) B: Brass, Hard glass, NBR, POM, SUS316, (PTFE, nylon)
Connection	Rc1/4

* Of the materials of parts in contact with fluid, what is in () depends on the manufacturing specification condition.

Ordering

MODEL	Total length * Stand not included	Block material	Connection	Fluid	Max. flow rate	Supply pressure	Outlet pressure	Needle valve	Stand	Other options
RK1202M: 2 glass tubes RK1203M: 3 glass tubes RK1204M: 4 glass tubes	20: 200mm	SS: SUS316 B: Brass	1/4: Rc1/4					D: at bottom	0: No S: Yes	Accuracy ±1% F.S. 1/20 scale
illustration example RK1203M	20	SS	1/4	Air Air N ₂	1L/min 2L/min 10L/min	0.2MPa 0.2MPa 0.2MPa	0.1MPa 0.1MPa 0.1MPa	D	S	

* For the fluid, maximum flow rate, supply pressure and outlet pressure, specify them in order of ascending flow rate from the left as you face for the number of glass tubes.

Flow Meter for Large flow rate

MODEL RK1950AP SERIES



Applicable fluids Gas Air

Liquid H₂O

Max. flow rate Gas 80L/min to 25m³/min

Liquid 1.5 to 900L/min

Accuracy ±2%F.S.

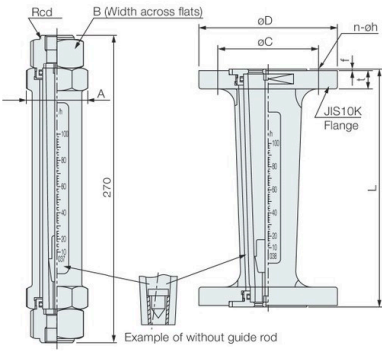
Available for large flow rate



Threaded type

Flange type

Dimensions



Dimensions of each part

Bore	d	A	B
10A	3/8	52	41
15A	1/2	52	41
20A	3/4	62	46
25A	1	73	41*

* Width across flats

Dimensions of each part

Bore	L	øD	øC	f	t	n-øh
10A		90	65	1	14	4-15
15A		95	70	1	16	4-15
20A		100	75	1	18	4-15
25A		125	90	1	18	4-19
32A	220	135	100	2	20	4-19
40A		140	105	2	20	4-19
50A		155	120	2	20	4-19
65A		175	140	2	22	4-19
80A		185	150	2	22	8-19
100A	250	210	175	2	24	8-19

Standard Specifications

MODEL	RK1950AP			
Applicable fluids	Air		H ₂ O	
Max. flow rate (Air atm condition for gas)	10A: 80 to 350L/min 20A: 80 to 1000L/min 32A: 2 to 5m ³ /min 50A: 2.5 to 9m ³ /min 80A: 8 to 15m ³ /min	15A: 80 to 500L/min 25A: 0.4 to 3m ³ /min 40A: 2.5 to 6m ³ /min 65A: 8 to 15m ³ /min 100A: 12 to 25m ³ /min	10A: 1.5 to 10L/min 20A: 1.5 to 30L/min 32A: 60 to 150L/min 50A: 80 to 300L/min 80A: 250 to 500L/min	15A: 1.5 to 15L/min 25A: 9 to 100L/min 40A: 90 to 200L/min 65A: 250 to 500L/min 100A: 400 to 900L/min
Accuracy	±2%F.S.			
Max. working pressure	40A or less: 1MPa(G) 50A or more: 0.8MPa(G)			
Max. working temperature	120°C			
Materials of parts in contact with fluid	SUS304, Polysulphone resin (amber, transparent), NBR			
Connection	25A or less: JIS10K RF flange or thread 32A or more: JIS10K RF flange			

Ordering

MODEL	Material	Fluid	Max. flow rate	Connection	Supply pressure	Calibration temperature (working temperature)	Measuring pressure
RK1950AP	S: SUS304						N: Atmospheric pressure L: Load pressure * Gases only
RK1950AP	S	H ₂ O	150L/min	32A Flange	0.2MPa	20°C	N

* Specifying pressure condition is necessary to check whether the required pressure is satisfied for the desired specifications, prevent hunting, and for calibration.



Flow Control Valve

List of Flow Control Valve



Precision Needle Valve

MODEL 2412 SERIES

Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min



P095



Precision Needle Valve with Multidial

MODEL 2412M SERIES

Max. flow rate:

Gas 5mL/min-100L/min

Liquid 5mL/min-2L/min



P098



Bellows Needle Valve

MODEL 2450 SERIES

Max. flow rate:

Gas 5mL/min-50L/min

Liquid 5mL/min-1L/min



Low leak

P099



Grease-less Needle Valve

MODEL 2420 SERIES

Max. flow rate:

Gas 20-180L/min

Liquid 500mL/min-4L/min



P101



Simplified Needle Valve

MODEL 2400 / 2400A SERIES

Max. flow rate:

Gas 5-50L/min

Liquid 200mL/min-1L/min



P103



Precision Needle Valve for Large flow rate

MODEL 2412D SERIES

Max. flow rate:

Gas 150-350L/min

Liquid 6-15L/min



P104



Flow Controller for Fluctuating outlet pressure

MODEL 2203 SERIES

Max. flow rate:

Gas 10mL/min-20L/min

Available for pressure fluctuations



P105



Flow Controller for Fluctuating supply pressure

MODEL 2204 SERIES

Max. flow rate:

Gas 10mL/min-10L/min

Available for pressure fluctuations



P106



Liquid Flow Controller

MODEL 2600-S SERIES

Max. flow rate:

Liquid 10mL/min-1L/min

Available for pressure fluctuations



P107





Liquid Flow Controller

MODEL 2600-PPS SERIES

Max. flow rate:
Liquid 10mL/min-1L/min

■ Available for pressure fluctuations



P108



Small Proportional Solenoid Valve

MODEL 3000 SERIES



P109

About Flow Control Valve

Types of flow control valves

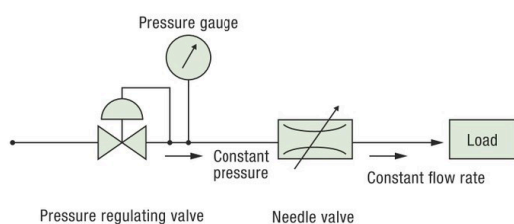
[1] Needle valves

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.

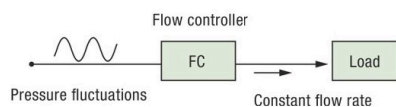
Fig. A. Flow rate control by needle valve



[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**)

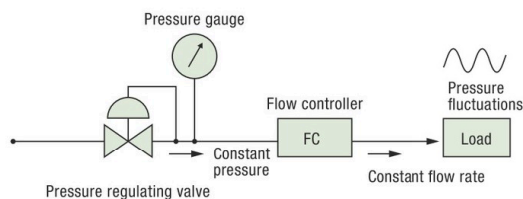
Fig. B. Flow rate control by Flow controller for fluctuating supply pressure



[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.

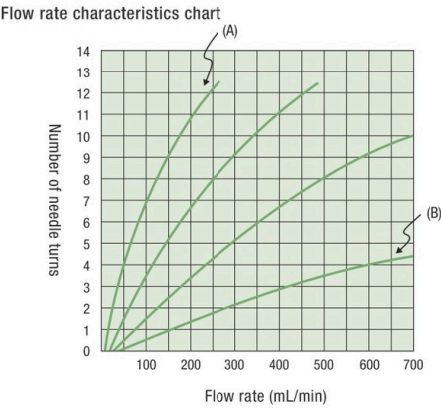
[5] Proportional solenoid valve

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 available 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.



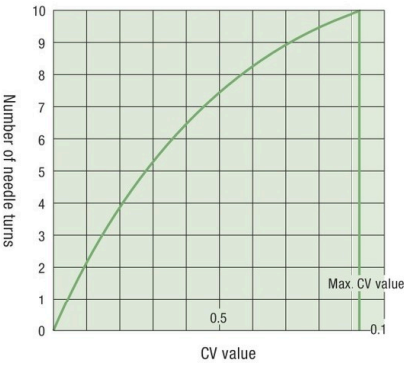
The following describes the CV value used as a flow rate characteristics for the needle valves. The CV value, a kind of flow coefficient, is a guide to indicate approximate flow rate under a certain pressure condition.

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.

$P_1 = 0.2MPa(abs) \quad P_2 = 0.1MPa(abs)$
 $P_2 \leq \frac{P_1}{2}$
 $0.075 = \frac{Q}{2090 \times 0.2} \sqrt{1 \times (273 + 20)}$
* $Q \approx 1.8[m^3/h] = 30[L/min]$

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.

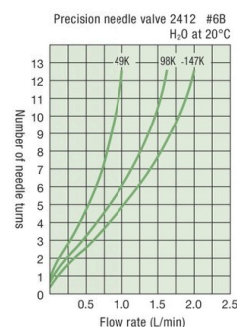
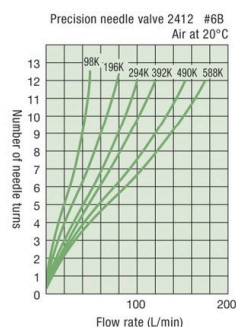
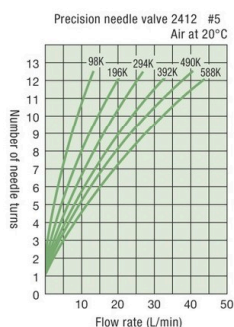
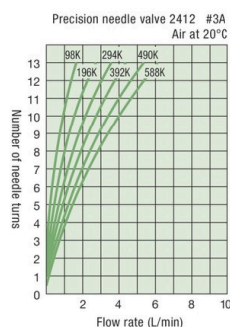
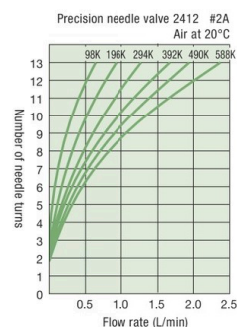
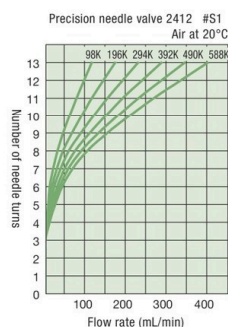
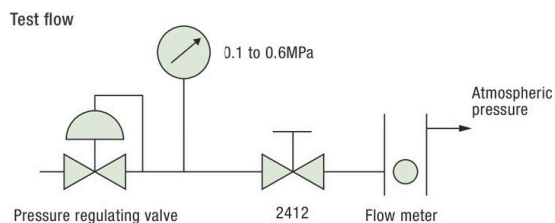
$$(\text{Example}) \text{ He flow rate} = \text{Air flow rate} \times \sqrt{\frac{28.8}{4}}$$

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

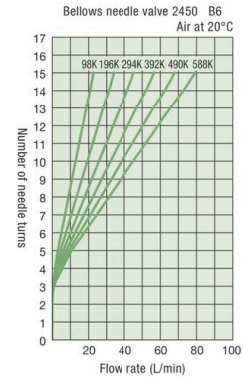
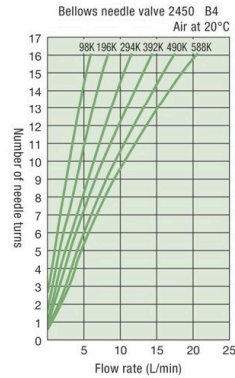
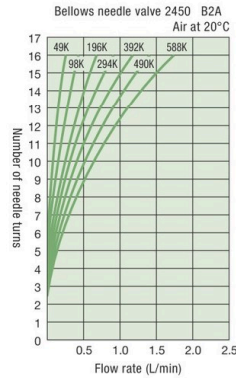
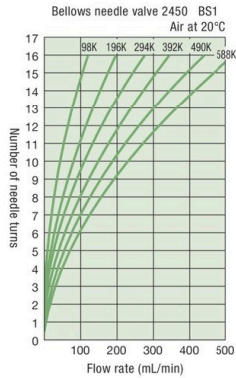
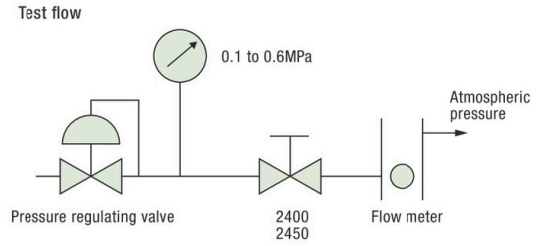
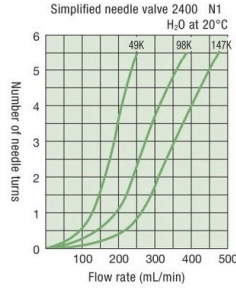
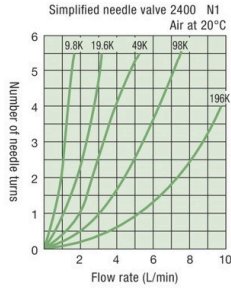
$$\sqrt{\frac{\text{Specific gravity of water}}{\text{Specific gravity of liquid}}}$$

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

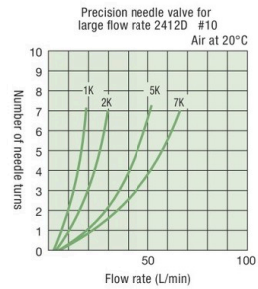
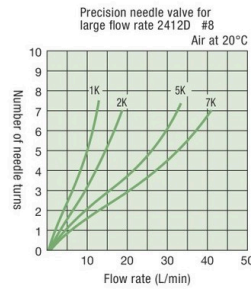
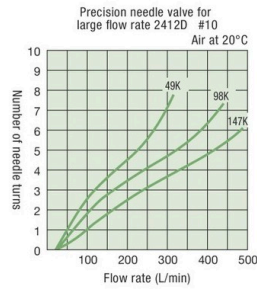
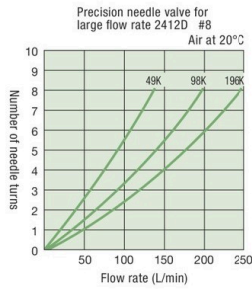
2412 Examples of flow rate control characteristics (Unit: K = kPa)



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



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



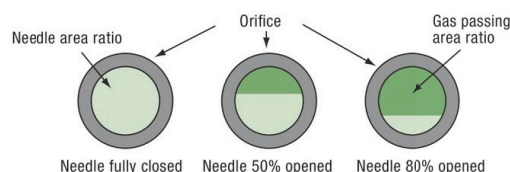
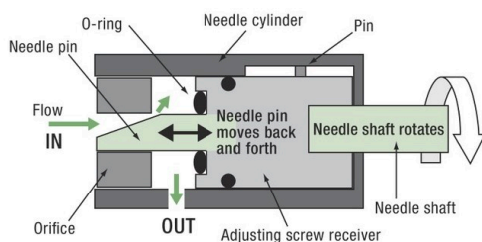
About Flow Control Valve

■ Principle of the Precision needle valve (2412)

When a needle shaft is rotated, 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.

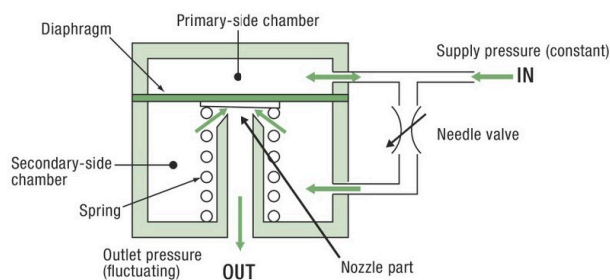
Model 2412 has very high adjustability among general needle valves. Capable of selecting 15 types of ranges, it is used not only for the flow controllers 2203 and 2204, but also our flow meters with needle valve. It is a must for strict flow rate adjustment.



■ 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

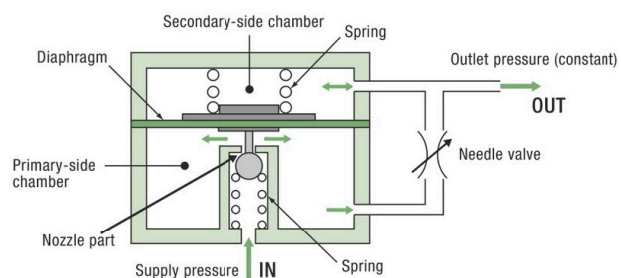
primary-side chamber. The nozzle part adjusts a gas outflow so that the pressure in the secondary-side chamber is kept balanced, and the differential pressure before and after the needle valve is always kept constant. As this indicates that a gas flow rate is only associated with the opening of the needle 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

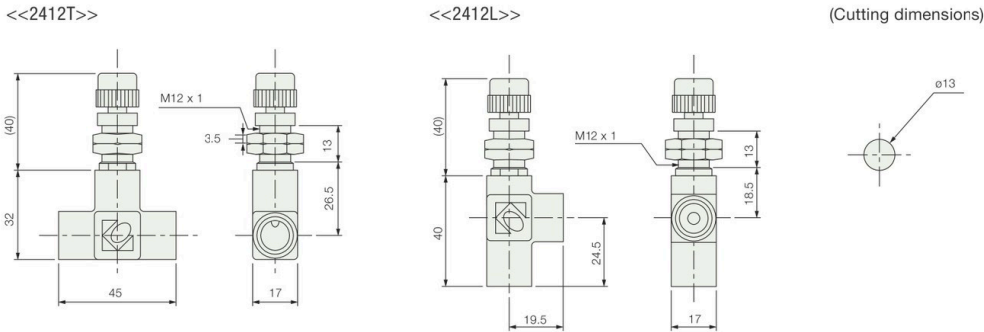


Applicable fluids	Gas N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	Liquid H ₂ O
Max. flow rate	Gas 5mL/min to 100L/min (Air at 20°C, 0.1MPa differential pressure)	Liquid 5mL/min to 2L/min (H ₂ O at 20°C, 0.1MPa differential pressure)
* Up to the working conditions. For details, see the reference data.		

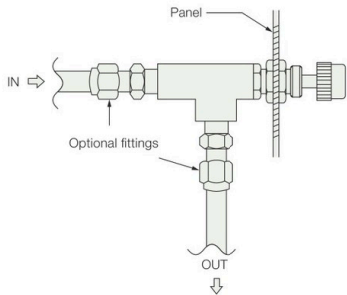
- Stable control of minute flow rate
- Superior control performance by a non-rotating structure
- Capable of selecting optimum controllability according to the working conditions with wide variety of needles



Dimensions



Example of use



Standard Specifications

MODEL	2412	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
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 ratings table (reference)

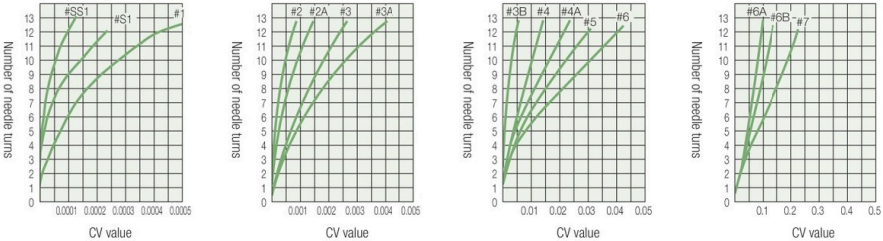
Flow rate when the valve is fully opened to atmosphere. Unit of flow rate: L/min

Needle No.	Supply pressure (MPa(G)) (Air at 20°C)							Supply pressure (MPa(G)) (H ₂ O 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.

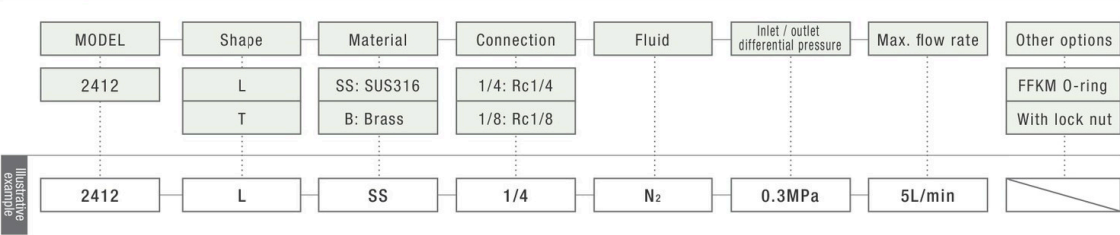
CV value (reference)

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



Flow Control Valve

Ordering



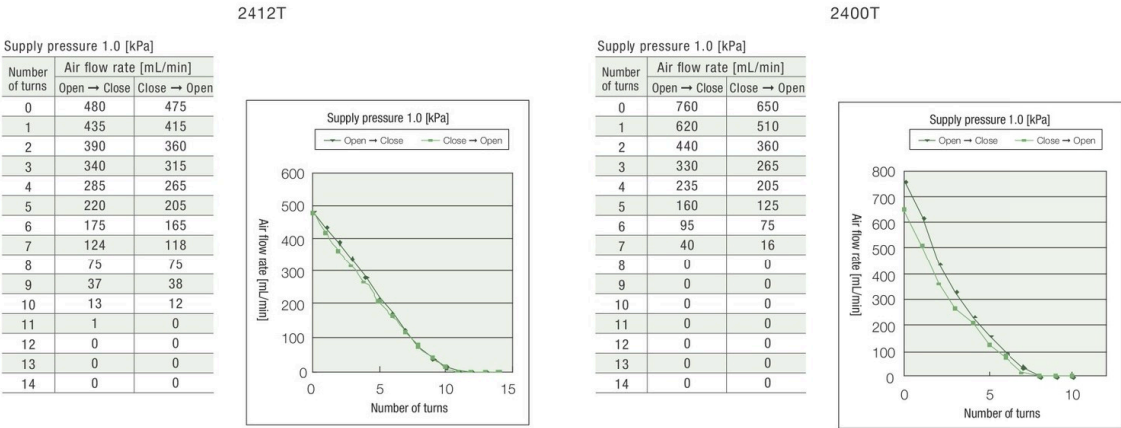
* We will select an optimum needle number based on the conditions such as the pressure, fluid and flow rate. Use the ratings table only as reference.
* No shutting O-ring for FFKM option.

Performance comparison data of 2412 and 2400 (reference)

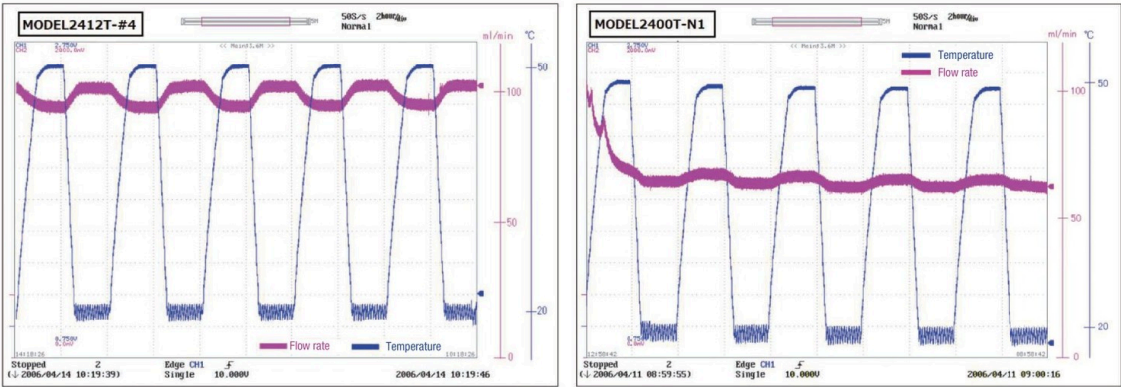
Followings are the comparison survey at low pressure conditions.
See them as the performance comparison reference data of the precision needle valve 2412 and the simplified needle valve 2400.
They are typical values, not guaranteed ones.

[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



[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



Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc. **Liquid** H₂O

Max. flow rate **Gas** 5mL/min to 100L/min (Air at 20°C, 0.1MPa differential pressure) **Liquid** 5mL/min to 2L/min (H₂O at 20°C, 0.1MPa differential pressure)

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

- 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



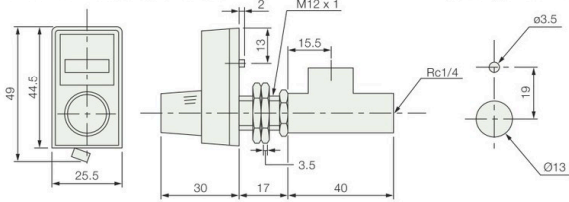
2412MAT



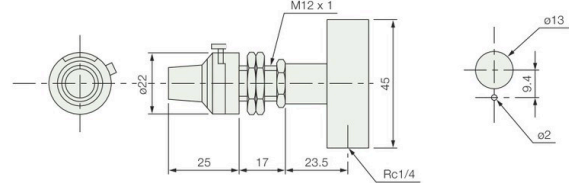
2412MBL

Dimensions

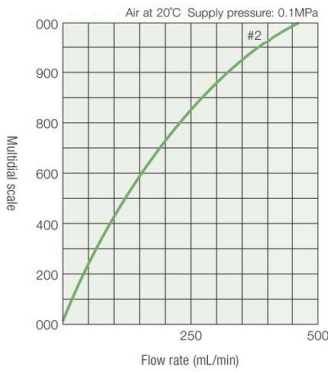
«2412MAL» A...Standard multidial (Cutting dimensions)



«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 ₂ O
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			
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.

Bellows Needle Valve

MODEL 2450 SERIES

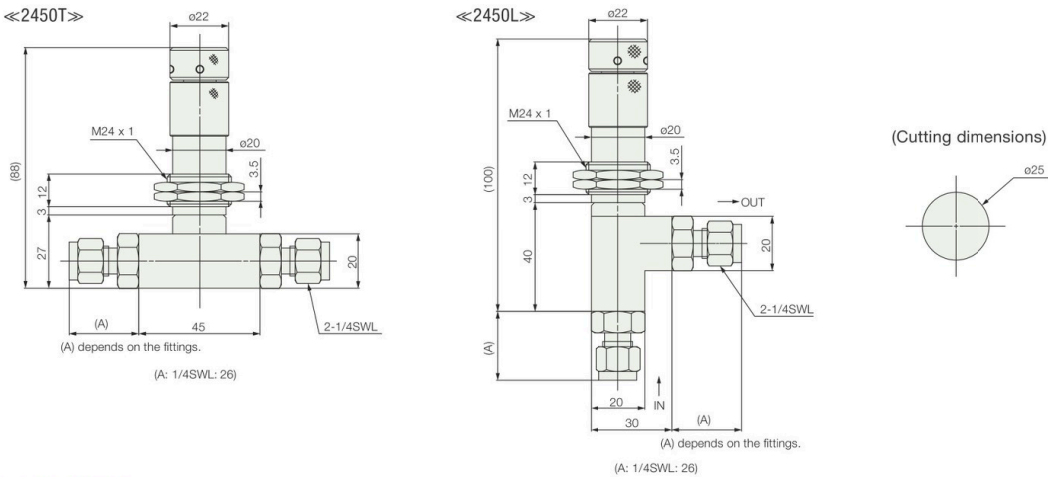


Applicable fluids	Gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	Liquid	H ₂ O
Max. flow rate	Gas	5mL/min to 50L/min (Air at 20°C, 0.1MPa differential pressure)	Liquid	5mL/min to 1L/min (H ₂ O at 20°C, 0.1MPa differential pressure)
* Up to the working conditions. For details, see the reference data.				

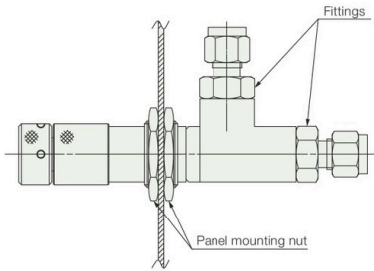
- Low leak thanks to bellows seal
- Stable control of minute flow rate
- Superior control performance by a non-rotating structure
- Capable of selecting optimum controllability according to the working conditions with wide variety of needles



Dimensions



Example of use



Standard Specifications

MODEL	2450	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
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	

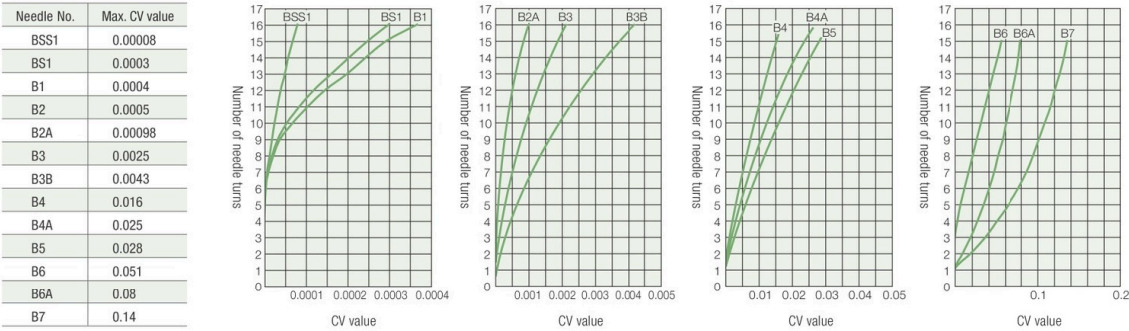
Flow ratings table (reference)

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

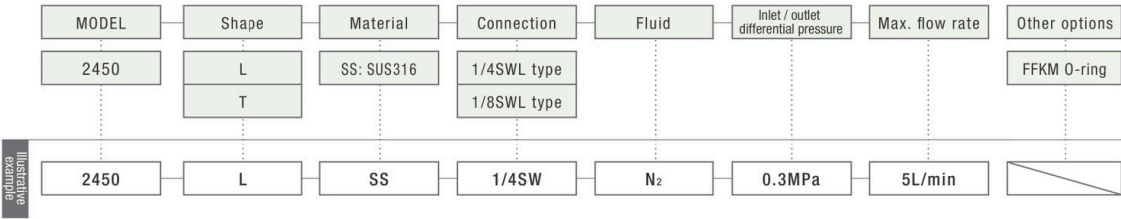
Needle No.	Supply pressure (MPa(G)) (Air at 20°C)							Supply pressure (MPa(G)) (H ₂ O at 20°C)		
	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.05	0.1	0.15
BSS1	0.016	0.032	0.058	0.086	0.115	0.14	0.18	—	—	—
BS1	0.074	0.12	0.20	0.28	0.34	0.44	0.52	—	—	—
B1	0.10	0.16	0.24	0.34	0.42	0.53	0.60	—	—	—
B2	0.12	0.19	0.29	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)



Ordering



* 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 Ordering code.

Grease-less Needle Valve

MODEL 2420 SERIES

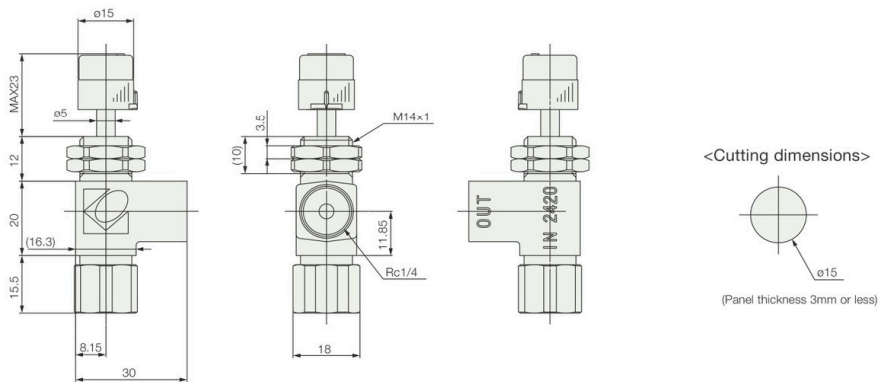


Applicable fluids	Gas N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	Liquid H ₂ O
Max. flow rate	Gas 20 to 180L/min (Air at 20°C, 0.1MPa differential pressure)	Liquid 500mL/min to 4L/min (H ₂ O at 20°C, 0.1MPa differential pressure)
* Up to the working conditions. For details, see the reference data.		

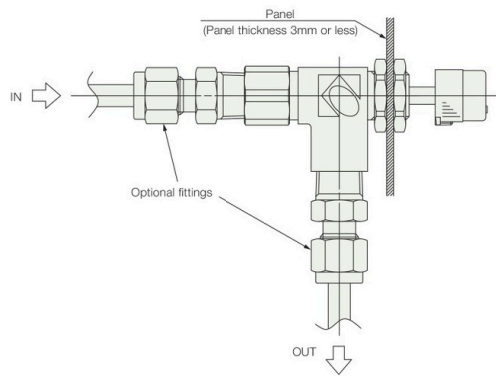
Grease-less design



Dimensions



Example of use



Standard Specifications

MODEL	2420	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
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)

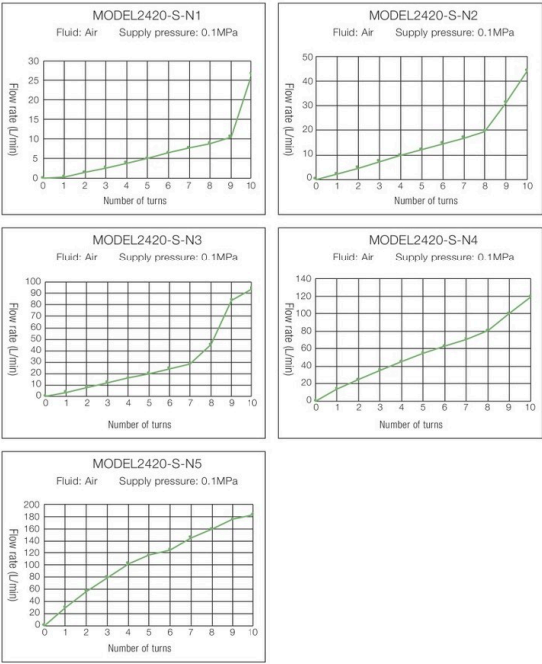
Flow rate when the valve is fully opened to atmosphere.

Unit of flow rate: L/min

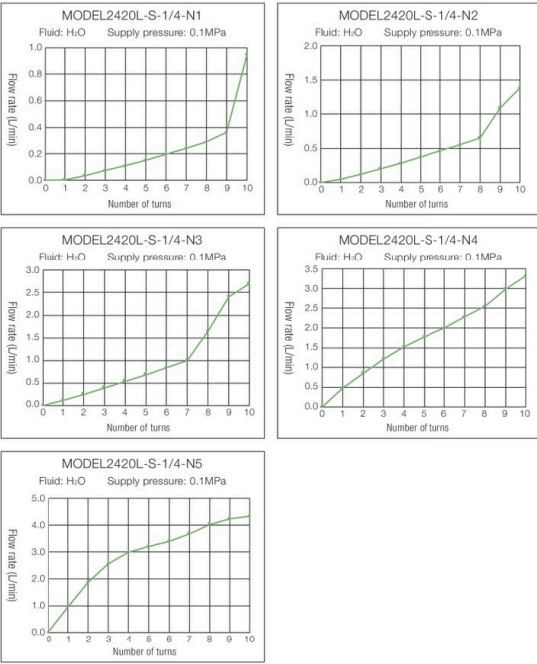
Needle No.	Supply pressure (MPa(G)) (Air at 20°C)						Supply pressure (MPa(G)) (H ₂ O at 20°C)		
	0.05	0.1	0.2	0.3	0.4	0.5	0.05	0.1	0.15
N1	18	26	38	50	62	76	0.60	0.87	1.06
N2	28	40	62	82	102	124	0.98	1.38	1.69
N3	62	92	140	186	234	280	1.91	2.70	3.30
N4	76	112	178	240	298	360	2.31	3.28	4.05
N5	122	182	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), 20°C)



Example of flow rate characteristics (H₂O, 0.1MPa(G), 20°C)



Flow Control Valve

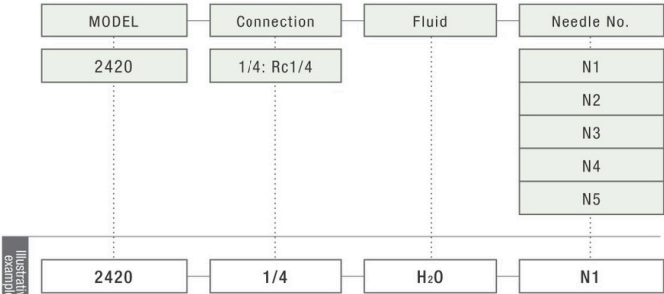
CV value (reference)

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 ₂ O (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



* This product is excluded from our scope of repair.

Simplified Needle Valve

MODEL 2400 / 2400A SERIES



Applicable fluids **Gas** N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

Liquid H₂O

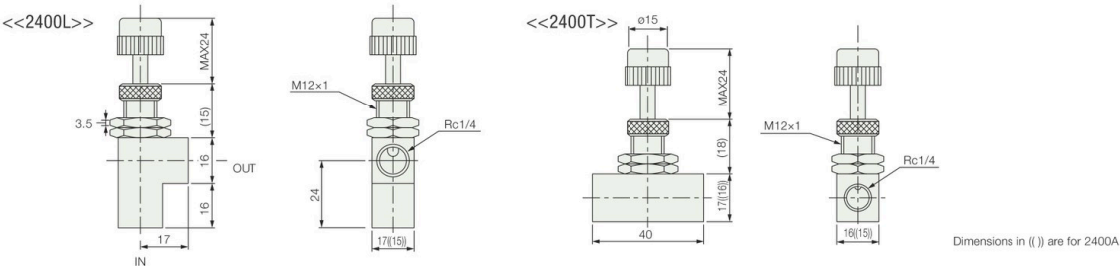
Max. flow rate **Gas** 5 to 50L/min
(Air at 20°C, 0.1MPa differential pressure)

Liquid 200mL/min to 1L/min
(H₂O at 20°C, 0.1MPa differential pressure)

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



Dimensions



Standard Specifications

MODEL	2400, 2400A	
Applicable fluids	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	H ₂ O
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)

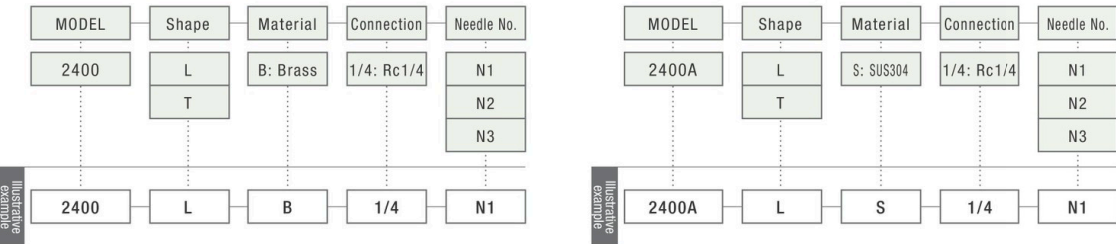
Flow rate when the valve is fully opened to atmosphere.

Unit of flow rate: L/min

Needle No.	Max. CV value	Supply pressure (MPa(G)) (Air at 20°C)					Supply pressure (MPa(G)) (H ₂ O 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



Precision Needle Valve for Large flow rate

MODEL 2412D SERIES

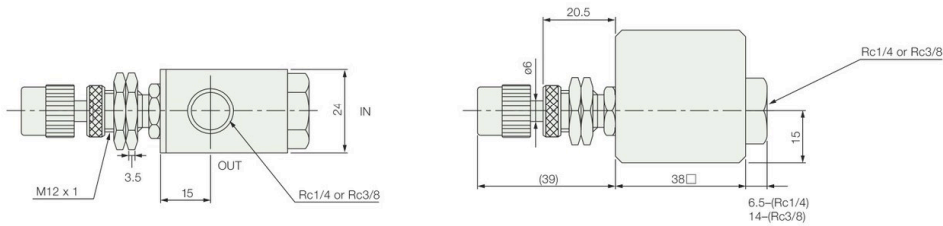


Applicable fluids	Gas	N ₂ , Air, H ₂ , He, Ar, O ₂ , CO ₂ , etc.	Liquid	H ₂ O
Max. flow rate	Gas	150 to 350L/min (Air at 20°C, 0.1MPa differential pressure)	Liquid	6 to 15L/min (H ₂ O at 20°C, 0.1MPa differential pressure)
* Up to the working conditions. For details, see the reference data.				

- 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 ₂ O
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	

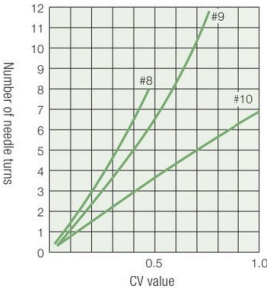
Flow ratings table (reference)

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 ₂ O 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			
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 Controller for Fluctuating outlet pressure

MODEL 2203 SERIES



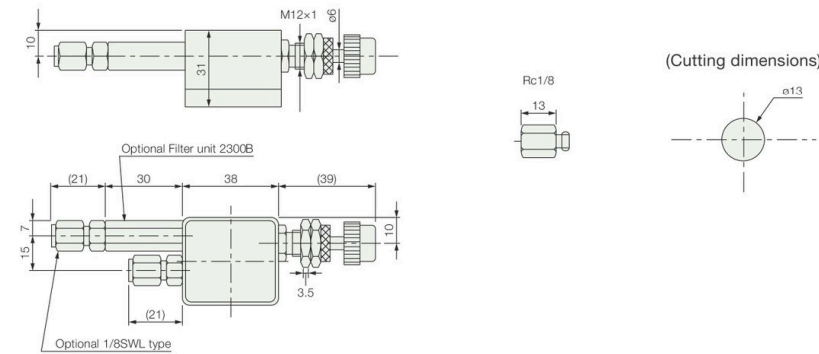
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

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 , Ar, 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
2203	SS	1/8	He	0.6MPa	100mL/min	0

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

Flow Controller for Fluctuating supply pressure

MODEL 2204 SERIES



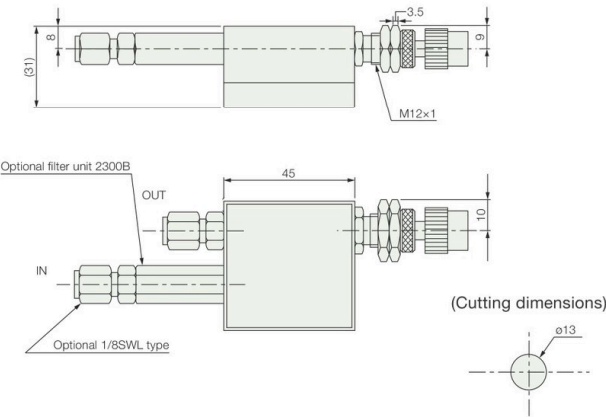
Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

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

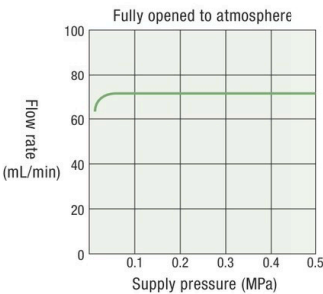
- Capable of holding a constant flow rate against pressure fluctuations on the inlet (primary) side
- Superior control performance by a non-rotating structure



Dimensions



Example of control characteristics



Standard Specifications

MODEL	2204
Applicable fluids	N ₂ , Ar, 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
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



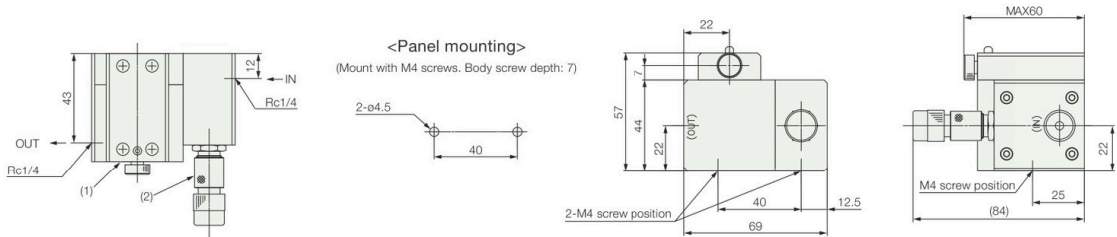
Applicable fluids Liquid H₂O

Max. flow rate Liquid 10mL/min to 1L/min (H₂O at 20°C)

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

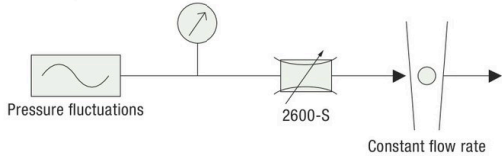


Dimensions



Example of use

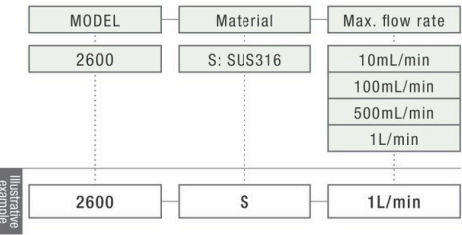
In case the supply pressure fluctuates



Standard Specifications

MODEL	2600-S
Applicable fluids	H ₂ O
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



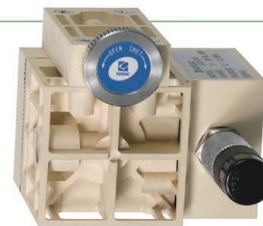
MODEL 2600-PPS SERIES



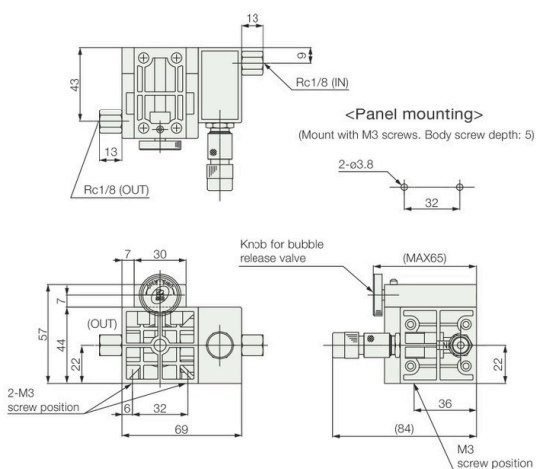
Liquid H_2O

Liquid 10mL/min to 1L/min (H₂O at 20°C)

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



Example of use



Pressure fluctuations

2600-PPS

Constant flow rate

Figure 10 is a line graph titled "2600-PPS-100mL/min". The y-axis is labeled "Flow rate (mL/min)" and ranges from 0 to 125 in increments of 25. The x-axis is labeled "Supply pressure (MPa)" and ranges from 0 to 0.6 in increments of 0.1. There are two data series plotted. The first series, represented by green circles, starts at a flow rate of approximately 100 mL/min at 0.05 MPa and slightly decreases to about 98 mL/min at 0.5 MPa. The second series, represented by green triangles, starts at a flow rate of approximately 50 mL/min at 0.05 MPa and slightly decreases to about 48 mL/min at 0.5 MPa. Both series show a very slight downward trend as supply pressure increases.

Supply pressure (MPa)	Flow rate (mL/min) - Circles	Flow rate (mL/min) - Triangles
0.05	100	50
0.1	100	50
0.3	98	48
0.5	98	48

MODEL	2600-PPS
Applicable fluids	H ₂ O
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)

The diagram illustrates the concept of a 'representative' value for a categorical variable. It shows a flow from a categorical variable 'Material' with values 'PPS' and 'PPS' to a numerical value '2600'. This numerical value is then used as a representative value for the 'Material' variable in a subsequent step.

```
graph LR; subgraph Top; direction LR; M1[MODEL] --- M2[Material] --- M3[Max. flow rate]; end; subgraph Middle; direction LR; M1 --- M2 --- M3; end; subgraph Bottom; direction LR; M1 --- M2 --- M3; end; M1 --- M2; M2 --- M3; M1 --- M2; M2 --- M3; M1 --- M2; M2 --- M3;
```

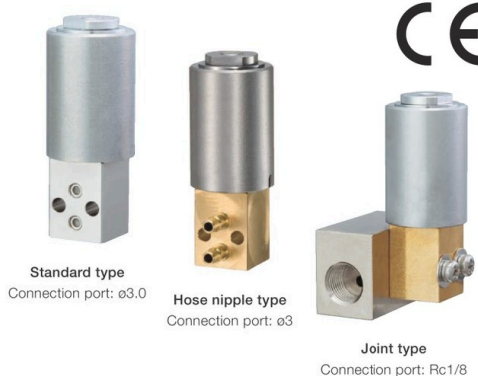
The diagram shows a flow from a categorical variable 'Material' with values 'PPS' and 'PPS' to a numerical value '2600'. This numerical value is then used as a representative value for the 'Material' variable in a subsequent step.

Small Proportional Solenoid Valve

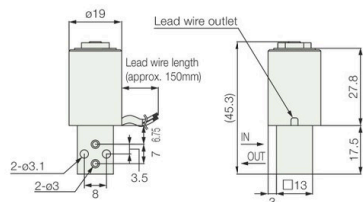
MODEL 3000 SERIES

Applicable fluids Gas N₂, Air, H₂, He, Ar, O₂, CO₂, etc.

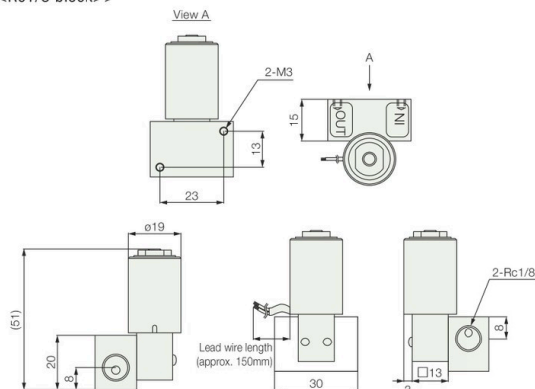
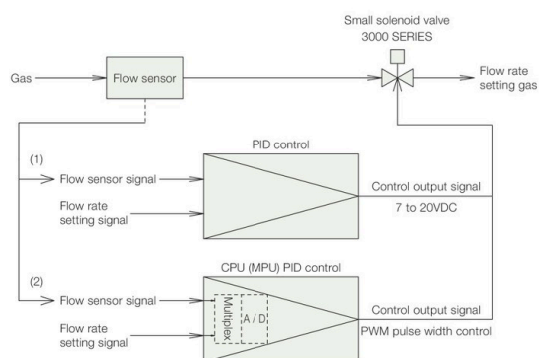
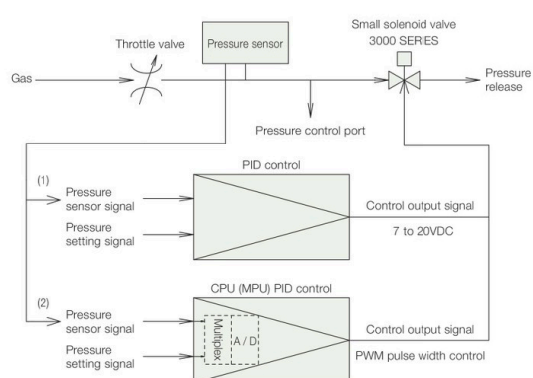
- Small, light-weight, single power supply
- Low power consumption (Max. 2W)
- Hysteresis within 15%

**Dimensions**

<<ø3 0-ring manifold>>



<<Rc1/8 block>>

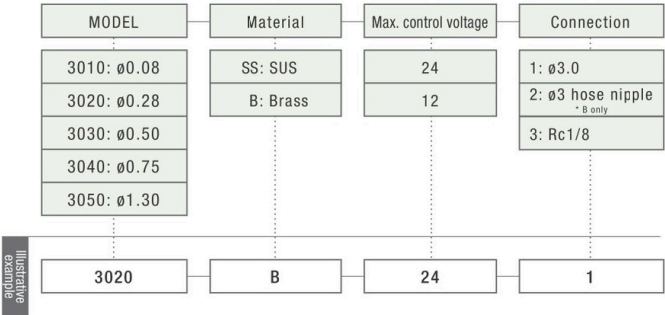
**Example of use****1. Gas flow rate control****2. Gas pressure control**

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				
	Hysteresis	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 $R_t = R_0^{\circ}\text{C} (1 + 0.004 \times 1^{\circ}\text{C})$. 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.

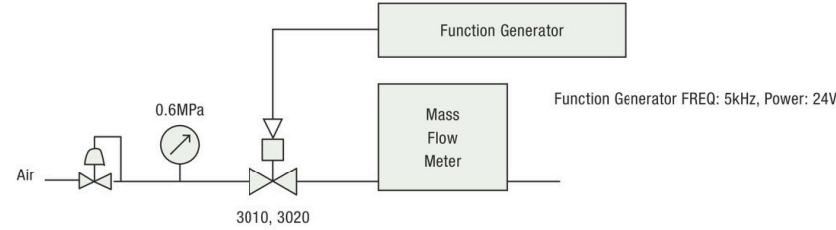
Ordering



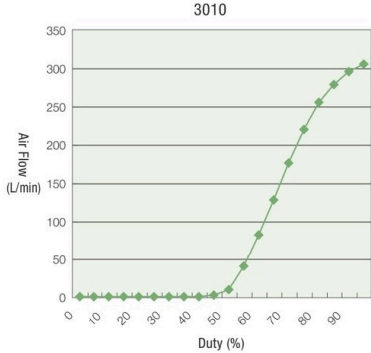
* Let us know the fluid name, supply pressure, outlet pressure and maximum flow rate at ordering time.

Example of PWM controlled flow rate characteristics

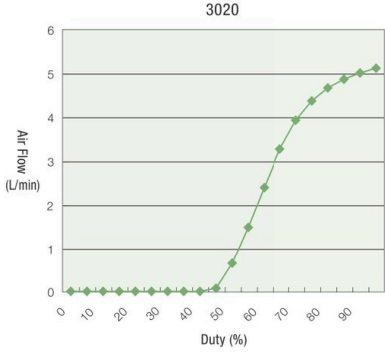
<<Measurement flow>>



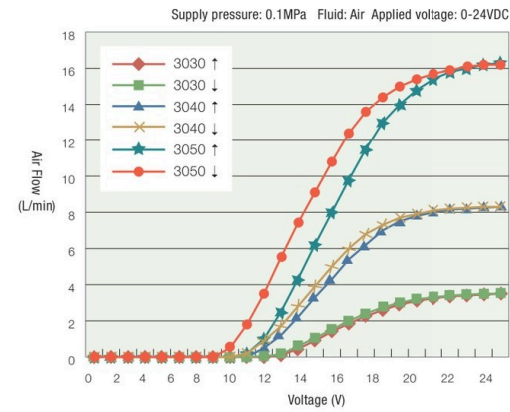
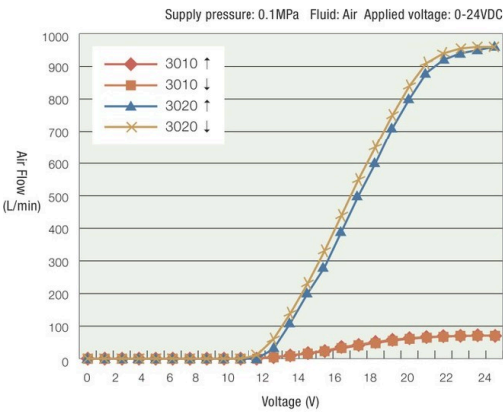
Duty (%)	Flow (mL/min)
0	0
45	2
50	9.1
55	40.4
60	82
65	127.8
70	176.2
75	220
80	255.4
85	278.7
90	295.5
95	305.4



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



Pressure Control Valve



113

List of Pressure Control Valve

Gas

Liquid

Fluids

Gas

Liquid

Precision Pressure Regulator

MODEL 6600 SERIES

Setting pressure:
Secondary side
0.01-0.6MPa(G)

Max. flow rate:
Gas 10L/min, 20L/min



P117

Gas

Liquid

Pressure Regulator
for Large flow rate

MODEL 6700 SERIES

Setting pressure:
Secondary side
0.01-0.6MPa(G)

Max. flow rate:
Gas 50L/min



P119

Gas

Liquid

Precision Pressure Regulator
for Low pressure

MODEL 6610

Setting pressure:
Secondary side
0.01-0.15MPa(G)

Max. flow rate:
Gas 5L/min



P120

Gas

Liquid

Backpressure Regulator

MODEL 6800 SERIES

Setting pressure:
Primary side
0.01-0.6MPa(G)

Max. flow rate:
Gas 0.8L/min, 1L/min, 10L/min



P121

Gas

Liquid

Cylinder Regulator
with Precision Flow Meter

MODEL 7700 SERIES

Setting pressure:
Secondary side
0.01-0.15MPa(G)

Max. flow rate:
Gas 20L/min



P122

Pressure Control Valve

About Pressure Control Valve

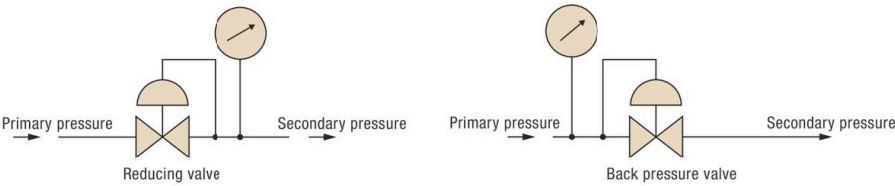
Types of Pressure Control Valves

The pressure control valve controls the pressure constant or reduces the pressure during flow rate control. The pressure control valves generally include reducing valves (pressure regulators) and back pressure valves (back pressure regulators). They are represented by the symbols illustrated below, respectively.

The reducing valve is a regulating valve designed to keep the outlet-side pressure constant against the fluctuating pressure on the supply side. It is normally used in the first stage of the system in many cases.

On the other hand, the back pressure valve is designed to release the primary-side pressure (gas) through the valve to keep it constant when it exceeds the set value.

Since the reducing valve controls the outlet-side pressure, it is used with a pressure gauge attached to the outlet side. Model 6600 comes with a gauge port. In such a case, connect the pressure gauge to this port. The pressure of this port is virtually equivalent to the outlet.



Flow rate characteristics chart

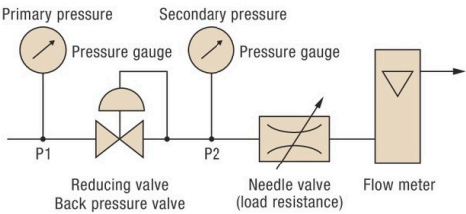
The flow rate characteristics graph of the reducing valve shown in the catalog is measured by the illustrated flow sheet below.

In the example of flow rate characteristics graph, the primary pressure (supply pressure) is 686kPa(G). With the needle valve closed (zero flow rate), the secondary pressure is set by the reducing valve as load resistance in its latter stage. This value becomes zero flow rate in the graph, that is, a left-end value. Next, open the needle valve to run a gas and plot the changing state of the pressure (secondary pressure) set according to a flow rate. The most desired state is that the set pressure does not change depending on the flow rate (change

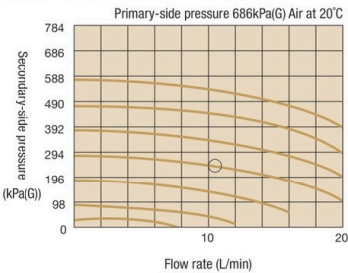
of load resistance). Depending on the characteristics of the reducing valve, however, there is a slight effect up to a certain flow rate, and once reaching a limit, the pressure changes. The range with the least change is the working range of the reducing valve. In the example of flow rate characteristics graph, if the setting pressure is 294kPa(G) when the primary-side pressure is 686kPa(G), the characteristics are favorable at the flow rate below a circle mark (○) in the graph. If the flow rate exceeds 11L/min, however, the pressure characteristics deteriorate. Use at 11L/min or less.

Pressure Control Valve

Flow rate characteristics test flow sheet



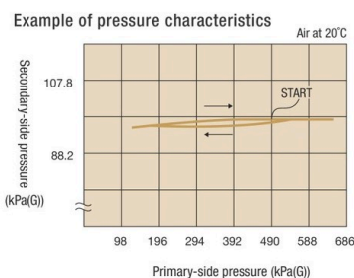
Example of flow rate characteristics



Pressure characteristics chart

In the case of the reducing valve, the figure shows secondary-side pressure fluctuations when the primary-side pressure in the aforementioned flow sheet is changed.

Control characteristics differ slightly between primary pressure increase and decrease. The change status is indicated by arrows.



Principle of the pressure regulator (6600)

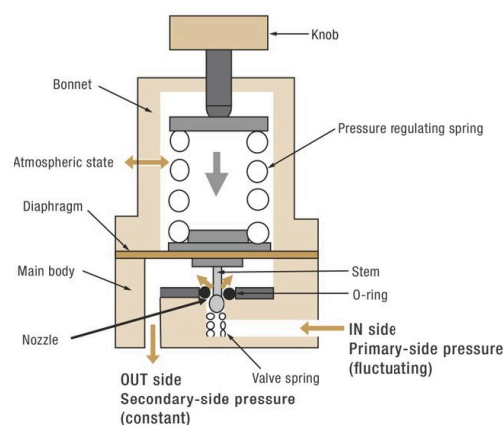
If a knob is turned counterclockwise, a pressure regulating spring is loosened, allowing only the atmospheric pressure to be applied to the diaphragm surface.

When this is done, a stem is pushed up by the gas supplied from the IN side, bringing a ball into contact with an O-ring to seal the nozzle part, thereby blocking a gas flow to the OUT side.

If the knob is turned clockwise, the pressure regulating spring is held down, applying the atmospheric pressure plus the pressure of the pressure regulating spring to the diaphragm surface.

The diaphragm held down by the pressure regulating spring pushes down the stem, opening a path in the nozzle part.

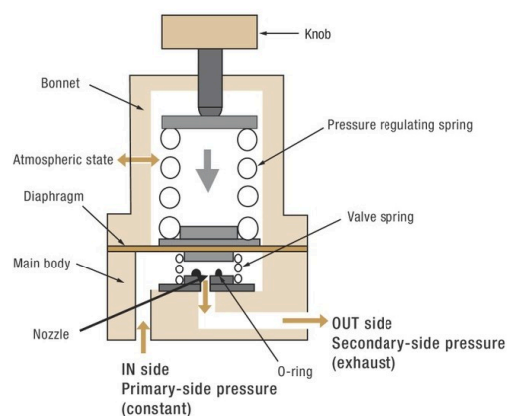
Since the pressure applied to the diaphragm surface is always kept constant by the atmospheric pressure plus the pressure regulating spring inside the bonnet, the secondary-side pressure is kept constant by the stem, even if the primary-side pressure fluctuates.



Principle of the backpressure regulator (6800)

Operation is opposite to the 6600.

The pressure applied to the diaphragm surface is always kept constant by the atmospheric pressure plus the pressure regulating spring inside the bonnet. The pressure is regulated by a valve spring inside the main body so that the primary-side pressure will be kept constant, and the fluctuated pressure is exhausted to the OUT side through the nozzle part to adjust.



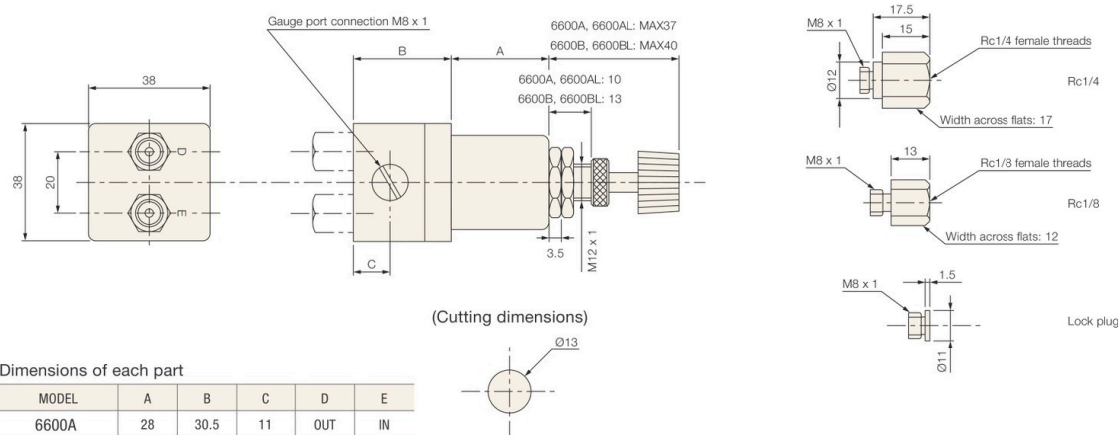
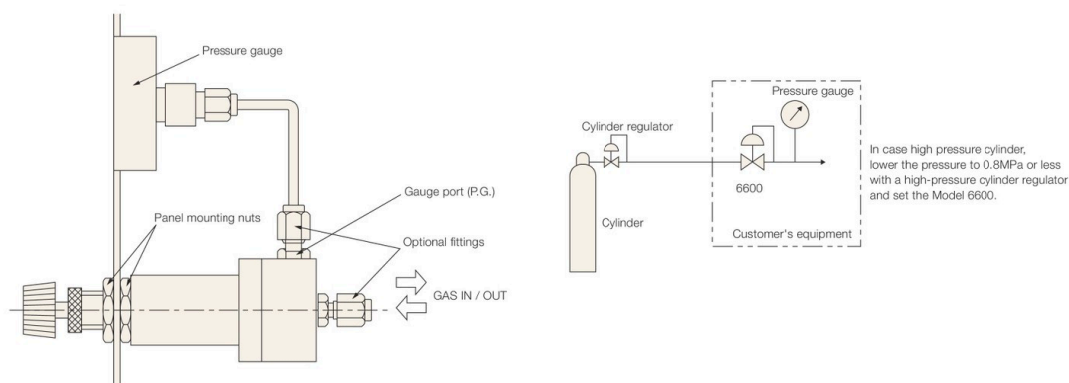
Precision Pressure Regulator

MODEL 6600 SERIES

Setting pressure Gas Secondary side: 0.01 to 0.6MPa(G)

Max. flow rate Gas 10L/min, 20L/min

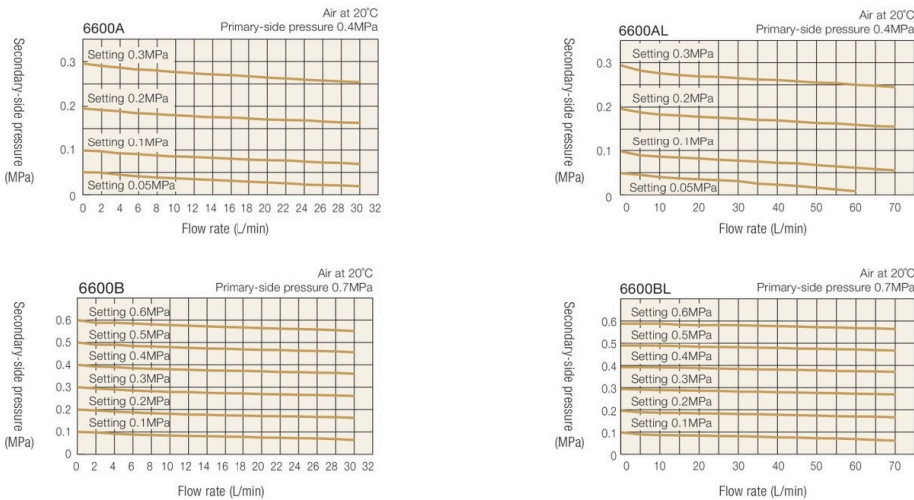
- High controllability of $\pm 1\%$ repeatability against primary- and secondary-side pressure fluctuations
- Optimum inlet and outlet arrangement for mounting to the panel
- Non-bleed design

**Dimensions****Example of use**

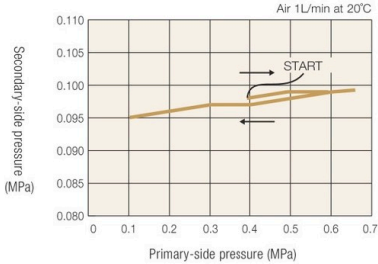
Standard Specifications

MODEL	6600A	6600B	6600AL	6600BL
Primary-side maximum pressure	0.8MPa(G)			
Secondary-side setting pressure	0.01 to 0.3MPa(G)	0.03 to 0.6MPa(G)	0.01 to 0.3MPa(G)	0.03 to 0.6MPa(G)
Max. flow rate	10L/min		20L/min	
Repeatability	Within ±1% of the rated pressure			
Temperature characteristics	Within ±1% / 10°C of the rated pressure			
Minimum operating differential pressure	0.05MPa			
Proof pressure	0.8MPa(G)			
Ambient temperature	5 to 60°C			
Materials of parts in contact with fluid	SS: SUS316, FKM, PCTFE, SUS303, (Hard glass) A: Al, Brass, NBR, POM, SUS316, (Hard glass)			
Connection	Standard: Rc1/4 Option: Rc1/8			
Weight	Approx. 200g			

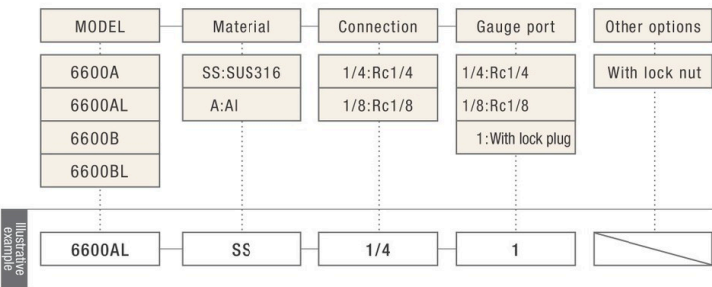
Example of flow rate characteristics



Example of pressure characteristics



Ordering



Pressure Control Valve

Pressure Regulator for Large flow rate

MODEL 6700 SERIES



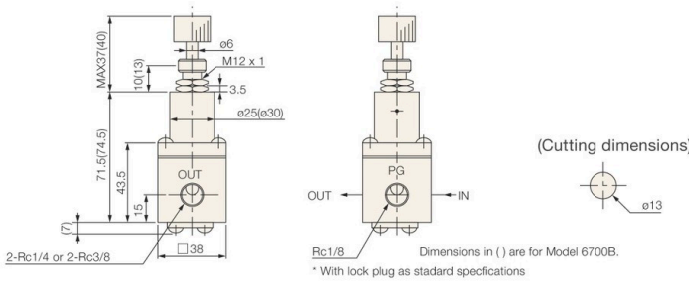
Setting pressure Gas Secondary side: 0.01 to 0.6MPa(G)

Max. flow rate Gas 50L/min

- High controllability of $\pm 1\%$ repeatability against primary- and secondary-side pressure fluctuations
- Non-bleed design



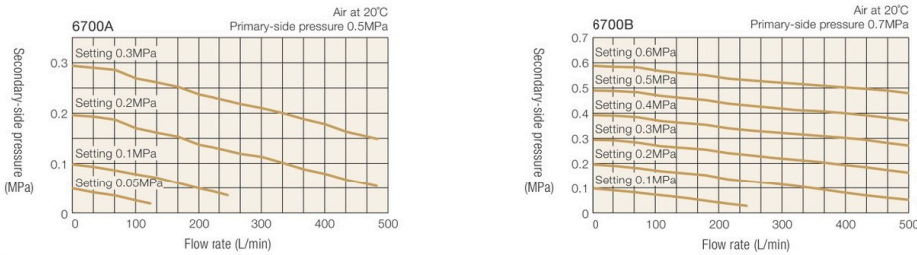
Dimensions



Standard Specifications

MODEL	6700A	6700B
Primary-side maximum pressure	0.9MPa(G)	
Secondary-side setting pressure	0.01 to 0.3MPa(G)	0.05 to 0.6MPa(G)
Max. flow rate	50L/min	
Repeatability	Within $\pm 1\%$ of the rated pressure	
Minimum operating differential pressure	0.05MPa	
Proof pressure	1MPa(G)	
Ambient temperature	5 to 60°C	
Materials of parts in contact with fluid	SS: SUS316, FKM, PCTFE, (SUS304) A: Al, Brass, NBR, POM, SUS316, FKM, (SUS304)	
Connection	Standard: Rc3/8, Option: Rc1/4	
Weight	Approx. 250g	

Example of flow rate characteristics



Ordering

MODEL	Material	Connection
6700A	SS: SUS316	3/8: Rc3/8
6700B	A: Al	1/4: Rc1/4
6700A	SS	3/8

Precision Pressure Regulator for Low pressure

MODEL 6610



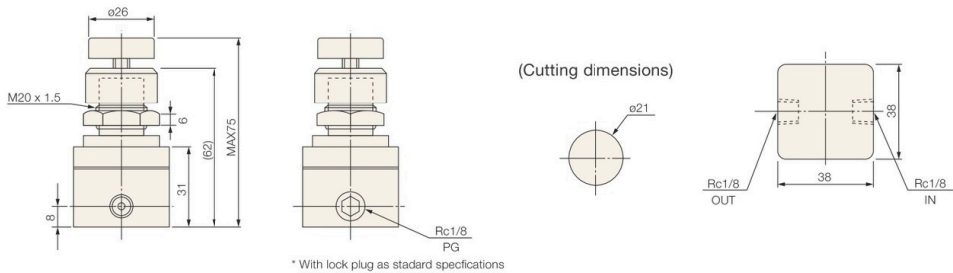
Setting pressure Gas Secondary side: 0.01 to 0.15MPa(G)

Max. flow rate Gas 5L/min

- High controllability of $\pm 1\%$ repeatability against primary- and secondary-side pressure fluctuations
- Grease-less gas contact part
- Non-bleed design
- Structured with lock nut



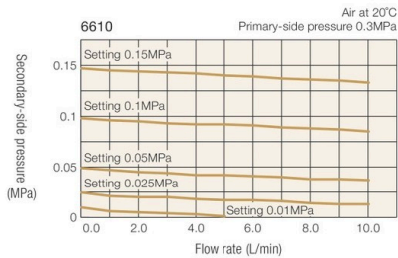
Dimensions



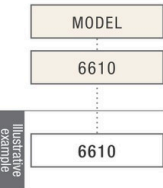
Standard Specifications

MODEL	6610
Primary-side maximum pressure	0.4MPa(G)
Secondary-side setting pressure	0.01 to 0.15MPa(G)
Max. flow rate	5L/min
Repeatability	Within $\pm 1\%$ of the rated pressure
Minimum operating differential pressure	0.1MPa
Proof pressure	0.8MPa(G)
Ambient temperature	5 to 60°C
Materials of parts in contact with fluid	SUS316, FKM, Hard glass, PTFE, PCTFE, SUS304, SUS303
Connection	Rc1/8
Weight	Approx. 350g

Example of flow rate characteristics



Ordering



Pressure Control Valve

Backpressure Regulator

MODEL 6800 SERIES



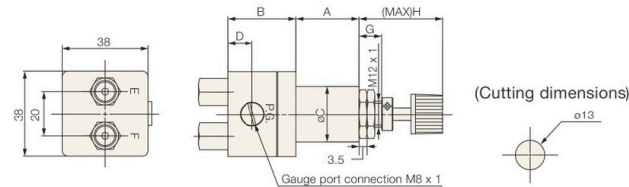
Setting pressure Gas Primary side: 0.01 to 0.6MPa(G)

Max. flow rate Gas 0.8L/min, 1L/min, 10L/min

- Constant primary-side pressure
- Optimum inlet and outlet arrangement for mounting to the panel



Dimensions



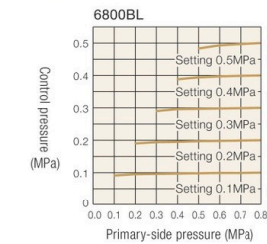
Dimensions of each part

MODEL	A	B	C	D	E	F	G	H
6800A	28	30.5	25	11	IN	OUT	10	37
6800B	31	30.5	30	11	IN	OUT	13	40
6800AL	28	34.5	25	14	OUT	IN	10	37
6800BL	31	34.5	30	14	OUT	IN	13	40

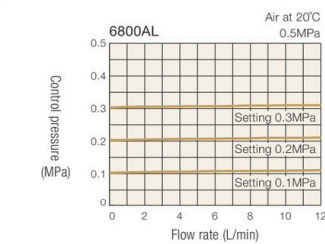
Standard Specifications

MODEL	6800A	6800B	6800AL	6800BL
Primary-side setting pressure	0.01 to 0.3MPa(G)	0.01 to 0.6MPa(G)	0.01 to 0.3MPa(G)	0.01 to 0.6MPa(G)
Maximum exhaust flow	1L/min	0.8L/min	10L/min	
Proof pressure	0.8MPa(G)			
Ambient temperature	5 to 60°C			
Materials of parts in contact with fluid	SS: SUS316, FKM, SUS303 A: Al, Brass, NBR, SUS316			
Connection	Standard: Rc1/4, Option: Rc1/8			
Weight	Approx. 400g			

Example of pressure characteristics



Example of flow rate characteristics



Ordering

MODEL	Material	Connection	Gauge port
6800A	SS: SUS316	1/4: Rc1/4	1/4: Rc1/4
6800AL	A: Al	1/8: Rc1/8	1/8: Rc1/8
6800B			
6800BL			1: With lock plug

6800A	SS	1/4	1
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Cylinder Regulator with Precision Flow Meter

MODEL 7700 SERIES



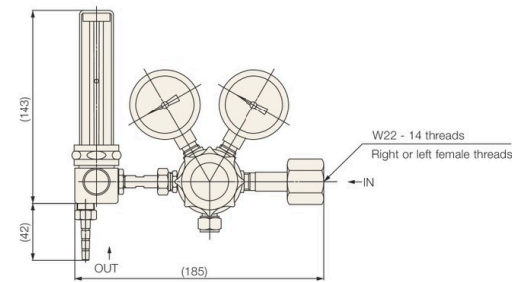
Setting pressure **Gas** Secondary side: 0.01 to 0.15MPa(G)

Max. flow rate **Gas** 20L/min

■ Cylinder regulator provided with Model 4400 series



Dimensions

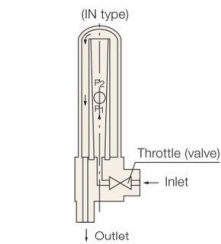


Standard Specifications

Setting pressure range	Max. flow rate	Pressure gauge		Material
		Primary side	Secondary side	
0.02 to 0.15MPa	20L/min	0 to 25MPa(G)	0 to 0.25MPa(G)	Brass
0.01 to 0.06MPa	20L/min	0 to 25MPa(G)	0 to 0.1MPa(G)	SUS316

* The Model 7700 has an exclusive flow meter (Model 4400) attached to a cylinder regulator. Other combinations are also available. Inquire our sales office.
* Depending on the gas type, pressure reducing operation lowers the gas temperature extremely due to the Joule-Thomson effect and deteriorates the regulator's function, disturbing a gas flow.

Flow meter specifications



As illustrated on the left, the flow meter's valve is attached to the inlet side. The scale is manufactured on the premise of a fluid flow in the atmospheric state. If a tank, etc. subjected to resistance or back pressure are located on the downstream side, the following flow rate correction is required.

Actual flow rate = Indicated flow rate value on taper tube $\times \sqrt{\frac{0.1 + \text{secondary side pressure}}{0.1}}$

In case the secondary-side pressure gauge indicates

0.3MPa and the indicated flow rate value is 3L/min, 6L/min = $3\text{L} \times \sqrt{\frac{0.1 + 0.3}{0.1}}$

is established, and the actual flow rate becomes greater than the indicated flow rate.

Ordering

MODEL	Material	Inlet connection	Outlet connection	Fluid	Working pressure	Max. flow rate
7700	SS: SUS316 B: Brass	R ₂ : W22 - 14 right L ₂ : W22 - 14 left	1/4: Rc1/4 5/16: 5/16 hose nipple			
7700	B	R ₂	1/4	N ₂	0.1MPa	1L/min

Illustrative example

Pressure Control Valve

The Gas Generator / Engineering Device



List of Gas Generator / Engineering Device

Compact Gas Generator

Mini-CUBE® SERIES
N₂ O₂ O₃ CDA



P125

Multifunction Intelligent Gas Mixer

BRENDA® SERIES



P127

Flow Meter Type Gas Mixer

GM SERIES



P128

Compact Gas Generator

Mini-CUBE® SERIES N₂ O₂ O₃ CDA

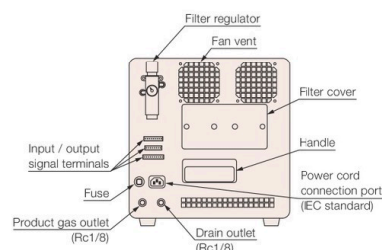
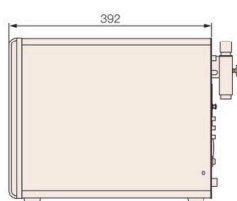
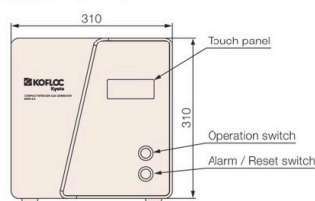
The Mini-CUBE series is an ultra-small gas generator installable on the desk. It is capable of easily supplying high-quality gases such as nitrogen, oxygen, ozone and clean dry air (CDA). Also, it lines up a tank unit as an auxiliary.

- Reduced noise and conserving energy by up to 40% thanks to DC inverter-controlled compressor.
- Double sound-proof structure. Noise value: 55 dB¹
- Push one switch to start gas supply. Freeing you from cylinder management.
- 100VAC to 240VAC, 50/60Hz free power voltage.
- Compact design: 310(W) × 392(D) × 310(H)mm (For NCP, 310(W) × 270(D) × 310(H)mm)
- 25kg light-weight design allows transportation by home delivery service, and also allows to return for maintenance.
- Air supply type (no compressor) lined up for N₂, O₂ and CDA. (Type indication: NCP)

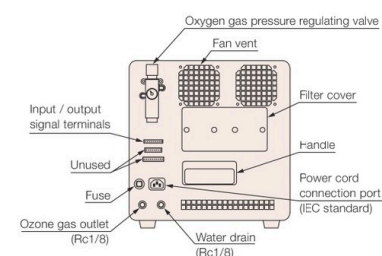
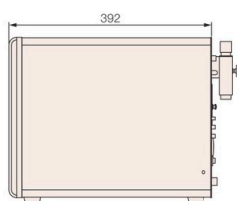
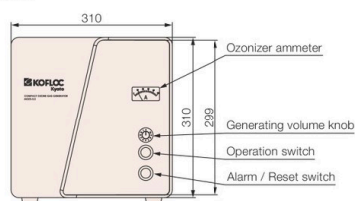


Dimensions

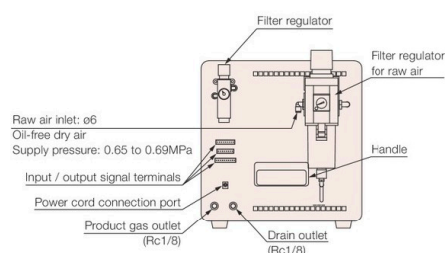
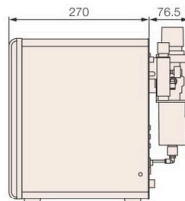
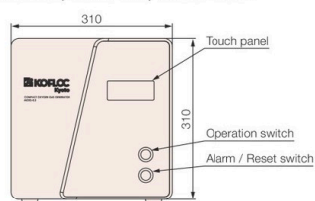
«MNTS, MOXS, MAIRS»



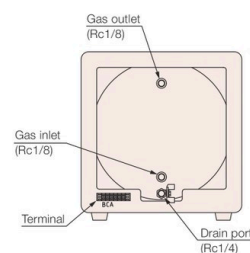
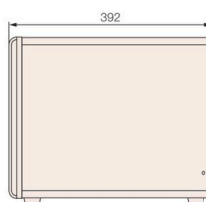
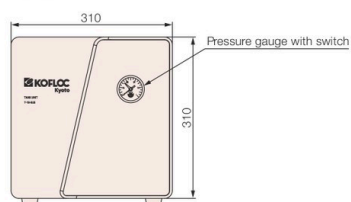
«MOZS»



«MNTS-NCP, MOXS-NCP, MAIRS-NCP»



«Tank unit»



Nitrogen Gas Generators Standard Specifications

<Usage>

- Supply to various analyzers (GC / FT-IR / DSC)
- CO₂ incubator
- Non-oxidation storeroom
- Supply to incubator and bioreactor
- Non-oxidation pumping of solvent and powder
- Electronic part soldering atmospheric gas
- Purge gas to various reaction container
- Gas flush packaging of small foodstuff

■ Nitrogen gas generator MNTS

MNTS is a nitrogen gas generator capable of selecting purity of 95% to 99.999%. Its maximum discharge pressure is 0.5MPa.

MODEL	M1NTS-0.3-95	M1NTS-0.3-96	M1NTS-0.3-97	M1NTS-0.3-98	M2NTS-0.3	M3NTS-0.3	M4NTS-0.3	M5NTS-0.3
Purity* ²	95%	96%	97%	98%	99%	99.9%	99.99%	99.999%
Generating volume* ³	8NL/min	7NL/min	6NL/min	5NL/min	4NL/min	2.4NL/min	1.2NL/min	0.5NL/min
Pressure	0.3MPa					0.4MPa	0.5MPa	
Dew point	-55°C or less							
Power consumption	0.06 to 0.3kW							

* As described in the specification sheet, the display of an incorporated oxygen densitometer is a guide for 99.999% model.

To seek the accuracy, optional separate oxygen densitometer is required.

■ Nitrogen gas generator MNTS-NCP

MNTS-NCP is the air supply type (no compressor) of the MNTS type. The numbers in () are specification of the W type.

MODEL	M1NTS-NCP(W)-95	M1NTS-NCP(W)-96	M1NTS-NCP(W)-97	M1NTS-NCP(W)-98	M2NTS-NCP(W)	M3NTS-NCP(W)	M4NTS-NCP(W)	M5NTS-NCP(W)
Purity*2	95%	96%	97%	98%	99%	99.9%	99.99%	99.999%
Generating volume*3	8(14.5)NL/min	7(13)NL/min	6(11.5)NL/min	5(10)NL/min	4(8)NL/min	2.4(4.8)NL/min	1.2(2.4)NL/min	0.5(1)NL/min
Pressure	0.3(0.2)MPa		0.3MPa			0.4MPa	0.5MPa	
Dew point	-55°C or less							
Power consumption	0.1(0.035)kW							

* As described in the specification sheet, the display of an incorporated oxygen densitometer is a guide for 99.999% model.

To seek the accuracy, optional separate oxygen densitometer is required.

Oxygen Gas Generators Standard Specifications

<Usage>

- Supply to incubator and bioreactor
- Oxygen enrichment for fishery
- Oxygen-enriched combustion
- As raw material for ozone
- CO₂ elimination

■ Oxygen gas generators MOXS and MOXS-NCP

MOX is an oxygen gas generator capable of supplying oxygen gases with purity of 90% or more. The numbers in () are specification of the W type.

MODEL	MOXS-0.3	MOXS-NCP(W)
Purity	90% or more	
Generating volume* ³	0.2 to 2NL/min	0.2 to 2(3)NL/min
Pressure	0.1MPa	
Dew point	-55°C or less	
Power consumption	0.06 to 0.3kW	0.1(0.035)kW

Ozone Gas Generators Standard Specifications

<Usage>

- Chemical (oxidation process)
- Cleaning and cotton-filling
- Drainage treatment, deodorization
- (deodorization, bleaching, sterilization)
- (decolorization, decomposition)
- Oxidation corrosion durability test
- Fishery (sterilization, purification)
- Resin processing (lamination)

■ Ozone gas generator MOZS

MOZS is an ozone gas generator. It generates ozone, using oxygen generated by an incorporated oxygen generator as a raw material.

MODEL	MOZLS-0.3	MOZHS-0.3
Generating volume	0 to 2.0g/h	0 to 1.5g/h
Ozone concentration	0 to 25g/Nm ³	0 to 50g/Nm ³
Gas flow rate	1.5NL/min	0.5NL/min
Ozone gas pressure	up to 0.05MPa(G)	
Cooling method	Air-cooled	
Power consumption	0.06 to 0.3kW	

* Because of the air-cooled cylindrical silent discharge method, the ozone concentration (ozone generating amount) changes depending on the installation ambient temperature. As the temperature rises, the concentration is lowered and the device life is shortened.

Clean Dry Air Generators Standard Specifications

<Usage>

- Supply to various analyzers
- Frost prevention of freezers
- Humidity control

■ Clean dry air generators MAIRS and MAIRS-NCP

MAIRS is a clean dry air generator capable of supplying the air with the atmospheric dew point of -70°C. It supplies the air compliant with the air cleanliness class, ISO8573-1:2010 (JIS B 8392-1:2012 [0:2:0]).

The numbers in () are specification of the W type.

MODEL	MAIRS-0.3	MAIRS-NCP(W)
Generating volume* ³	10NL/min	10(16)NL/min
Pressure	Reference: 0.2MPa (variable between 0.05MPa and 0.3MPa)	
Compressed air cleanliness class	JIS B 8392-1:2012 (ISO8573-1:2010)	
Item	Class	Description
Maximum particle content	0	Maximum number of particles per 1m ³ in response to the particle diameter d (μm).
		0.1 < d ≤ 0.5
		0.5 < d ≤ 1.0
	10 pcs.	4 pcs.
Provided with 0.01μm filter element.		
Pressure dew point (0.2 MPa)	2	-60°C or less (atmospheric dew point: -70°C or less)
Total oil concentration	0	Liquid oil, oil mist, oil vapor <0.005mg/m ³ >
Power consumption	0.06 to 0.3kW	

Tank Units Standard Specifications

■ Tank unit SUS

The tank unit is a gas folder for the Mini-CUBE series. Capable of automatically starting / stopping the Mini-CUBE series depending on the storage pressure, it not only has an energy conservation effect, but also is an effective option for intermittently using a gas.

Since it has the same size as various Mini-CUBE generators, it can be placed on top of them. It is not necessary to secure additional tank installation space.

MODEL	T-10-SUS
Volume	12.8L
Pressure gauge	0 to 1.0MPa
Pressure switch setting range	0.1 to 0.8MPa
Tank material	SUS304

*1. Actual measured value at 1m in front of the device and at the height of 1m in an anechoic room.

*2. Value of N₂ + Ar

*3. Value converted into the 0°C atmospheric pressure in an environment where the ambient temperature is 20°C and the humidity is 60%RH. Generating volume and a dew point are lowered as the temperature and humidity rise.

Multifunction Intelligent Gas Mixer

BRENDA® SERIES



Applicable fluids Gas Air, N₂, O₂, He, Ar, CO₂, H₂, etc.

Max. flow rate Gas 10SCCM to 50SLM for 1 line, 100SLM in total

Accuracy Within $\pm 1\%$ F.S.

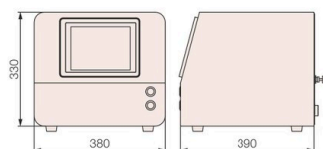


BRENDA series can produce a mixed gas at accurate gas mixture rate by a high-performance digital mass flow controller. Also, use of an 8-inch touch panel has simplified the concentration and flow rate settings of the gas mixing. With fulfilled functions, the BRENDA series is provided with a VNC server function, allowing remote control through a network and at a mobile device via wireless access point.

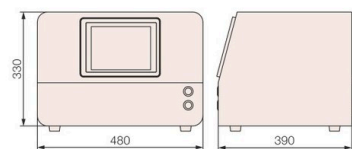
- High-performance digital mass flow controller equipped.
- Ratio setting mode
Automatically controlled gas flow rate of each line by only setting a gas mixing ratio and a mixed gas flow rate. Ratio setting is down to the first decimal place (unit: %).
- Step mode
Allows programmed operation based on preset conditions. Possible to preset up to 9 steps of gas flow rate and time.
- VNC server function
Allows remote control through a network and mobile device via wireless access point.
- Data logging
Capable of setting a sampling cycle to log the operational status. Recorded data are retrievable from the USB port on the back of the device.
- Various additional functions
Safety function: An emergency shutoff valve is installed at the mixed gas outlet, allowing shutoff by a manual switch and automatic shutoff against an alarm setting value.
Setting authority: Capable of setting a password for each setting item.
Upper- and lower-limit setting: Capable of setting the upper and lower limits of the flow rate and pressure of each line.
Flow rate integrating function: Capable of displaying integrated flow amount of each line. Convenient for monitoring the remaining capacity of the cylinder.

Dimensions

<<2-line>>



<<3 / 4-line>>



Sample touch panel



Standard Specifications

Type	2-line	3-line	4-line
MODEL	BR-2C	BR-3C	BR-4C
Control system	Thermal mass flow controller control*1		
MFC accuracy	Within $\pm 1\%$ F.S.		
MFC response	Within 1sec		
Applicable gas	Air, N ₂ , O ₂ , He, Ar, CO ₂ , H ₂ * Capable of dealing with other corrosive gases and combustion gases*2.		
Max. flow rate (N ₂ equivalent)	10SCCM to 50SLM for 1 line (10SCCM to 30SLM for CO ₂ , mixed gas flow rate up to 100SLM)		
Proof pressure	800kPa(G)		
Connection	Gas IN: Rc1/4 Gas OUT: Rc1/4		
Major gas contact part	SUS316, SUS316L, Magnetic stainless steel, Ni, PTFE, PCTFE, FKM, SUS304		
Ambient temperature / humidity	5 to 50°C (Accuracy assurance: 15°C to 35°C) / 10 to 80%RH		
Device dimensions	W380×D390×H330mm	W480×D390×H330mm	
Weight	30kg	37kg	40kg
Power consumption	0.1kW		
Supply voltage	AC100 to 240V 1ø 50/60Hz		

*1. A gas mixing ratio is based on the mixing method by volumetric flow ratio. *2. For the details of the gas type, flow rate and pressure range, feel free to inquire us.

* For overseas specifications and options not specified above, feel free to inquire us.

* The specifications are subject to change without prior notice due to product improvement.

Selection method

MODEL															
Gas line	Model	1st line			2nd line			3rd line			4th line			Outlet pressure	Calibration temperature
		Gas name	Max. flow rate	Supply pressure	Gas name	Max. flow rate	Supply pressure	Gas name	Max. flow rate	Supply pressure	Gas name	Max. flow rate	Supply pressure		
4 lines	BR-4C	Gas name (1)	Flow rate (1)	Supply pressure (1)	Gas name (2)	Flow rate (2)	Supply pressure (2)	Gas name (3)	Max. flow rate (3)	Supply pressure (3)	Gas name (4)	Flow rate (4)	Supply pressure (4)	Outlet pressure	Calibration temperature
3 lines	BR-3C	Gas name (1)	Flow rate (1)	Supply pressure (1)	Gas name (2)	Flow rate (2)	Supply pressure (2)	Gas name (3)	Flow rate (3)	Supply pressure (3)	—	—	—		
2 lines	BR-2C	Gas name (1)	Flow rate (1)	Supply pressure (1)	Gas name (2)	Flow rate (2)	Supply pressure (2)	—	—	—	—	—	—		
Example	BR-4C	N ₂	10SLM	0.2MPa(G)	O ₂	10SLM	0.2MPa(G)	H ₂	5SLM	0.2MPa(G)	Ar	10SLM	0.2MPa(G)	0.1MPa(G)	20°C

Example	BR-4C	N ₂	10SLM	0.2MPa(G)	O ₂	10SLM	0.2MPa(G)	H ₂	5SLM	0.2MPa(G)	Ar	10SLM	0.2MPa(G)	0.1MPa(G)	20°C
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Flow Meter Type Gas Mixer

GM SERIES



Applicable fluids Gas Air, N₂, O₂, He, H₂, Ar, CO₂, etc.

Max. flow rate Gas 10mL/min to 20L/min for 1 line, 40L/min in total

Accuracy ±2%F.S.

GM series is gas mixer consisting of **KOFLOC**'s mechanical precision flow control valve and flow meter. The device has incorporated constant flow rate unit capable of precision gas flow rate control from minute flow rate range.

Flow rate setting is easy and reliable without mutual interference, allowing constant supply of a stable mixed gas, even if there are fluctuations in the load pressure connected to the device. Having excellent stability and repeatability, GM series is highly evaluated in extensive fields.

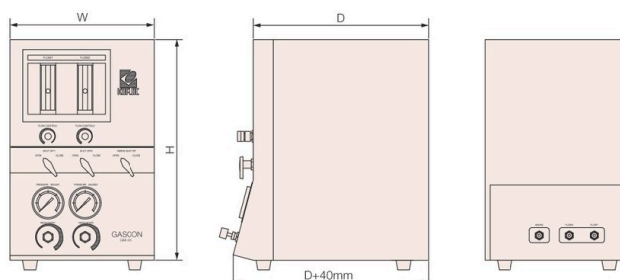
- Superior stability and repeatability
- Excellent air-tightness
- Excellent temperature characteristic
- Cleanliness
- Available as a constant flow rate unit
- Capable of minute gas flow rate control
- Available for mixing 4 or more types of gases by optional specifications



GM-2B

Dimensions

<<GM-2B>>



Standard Specifications

MODEL	GM-2B	GM-3B	GM-4B
Mixing method	Flow ratio mixing system		
Max. flow rate (Air atm condition)	10mL/min to 20L/min * Each line		
Applicable gas	Air, N ₂ , O ₂ , He, H ₂ , Ar, CO ₂ * Other gases are also available.		
Accuracy	±2%F.S. * Each line		
Major gas contact part	BS specification: BS, NBR, POM SUS specification: SUS316, FKM, PCTFE, PTFE		
Working temperature range	5 to 40°C		
Working pressure range	49 to 588kPa(G)		
Proof pressure	784kPa(G)		
Connection	Rc1/4 * IN, OUT		
Dimensions	W290×D350×H440mm	W360×D350×H440mm	W430×D350×H440mm

Selection method

Selection method											
Gas line	MODEL										
	Model	Material	1st line		2nd line		3rd line		4th line		Working pressure
			Gas name	Max. flow rate	Gas name	Max. flow rate	Gas name	Max. flow rate	Gas name	Max. flow rate	
4 lines	GM-4B	B(Brass) or SS(SUS)	Gas name (1)	Flow rate (1)	Gas name (2)	Flow rate (2)	Gas name (3)	Flow rate (3)	Gas name (4)	Flow rate (4)	Working pressure
3 lines	GM-3B	B(Brass) or SS(SUS)	Gas name (1)	Flow rate (1)	Gas name (2)	Flow rate (2)	Gas name (3)	Flow rate (3)	—	—	Working pressure
2 lines	GM-2B	B(Brass) or SS(SUS)	Gas name (1)	Flow rate (1)	Gas name (2)	Flow rate (2)	—	—	—	—	Working pressure
Example	GM-4B	B	N ₂	20L/min	O ₂	10L/min	He	5L/min	Ar	5L/min	0.1MPa

Example	GM-4B	B	N ₂	20L/min	O ₂	10L/min	He	5L/min	Ar	5L/min	0.1MPa
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* The working pressure is pressure value to be set with the reducing valve in the device.

* The supply pressure of each gas to the device should be [operating pressure + 0.05MPa] at least.

* If load pressure is applied to the device outlet, [operating pressure - device outlet pressure] should be at least 0.05MPa.

* If you have any request other than the above specifications, consult our sales office.

Custom-made design

Many of KOFLOC's products are produced to client's order according to their desired conditions specified in terms of our product type.

We will respond to your custom order about the product and specifications other than the standard specifications in the catalog.

We will consider in view of the price and quantity, ranging from the mass flow controllers/mass flow meters, flow meters and valves to the devices composed of their combinations. Consult our sales office.



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