



A

Mass Flow Meters and Controllers

■ What is a Mass Flow Instrument (Mass Flow Controller/Mass Flow Meter)?	12 – 14
■ Guide to Selection of Mass Flow Instruments	15
■ Mass Flow Controller/Mass Flow Meter with Indicator	16 – 18
MODEL D8500	
■ Model D8500 Series Power Cable	19
PSK-85/CP-85CF Series	
■ Standard Mass Flow Controller	20 – 21
MODEL 3660 Series	
■ High-grade Mass Flow Controller	22 – 23
MODEL 3200 Series	
■ Low-cost Metal Sealed Mass Flow Controller/Meter	24
MODEL 5400 Series	
■ High-grade Metal Seal Flow Controllers	25
MODEL 5100 Series	
■ Low-cost Mass Flow Meter with Display	26
MODEL 3810DS II Series	
■ High-grade Mass Flow Meter	27
MODEL 3100 Series	
■ Standard Mass Flow Meter	28
MODEL 3760 Series	
■ Low-cost Mass Flow Sensor	29
MODEL 3810S Series	
■ Low-cost Digital Mass Flow Meter	30
MODEL D3810 Series	
■ Small Karman Vortex Flow Meter for Liquids	31
FM0101/0102/0103/0105 Series	
■ Small Karman Vortex Flow Meter for Liquids	32
MODEL 31 (Teflon®/PFA) Series	
■ Mass Flow Meter Power Unit	33
MODEL DPM-3	
■ Flow Setting Device	34
MODEL CK Series	
■ Compact Readout Unit	35
MODEL CR-400	
■ Mass Flow Controller/Meter Power Units (for Integration into Customer's Equipment Panel)	36
MODEL PSK-FB Series	
■ Table of Compatibility Cables and Accessories for KOFLOC Mass Flow Meters/Controllers	37
■ Compact Handy Mass Flow Control/Measurement Unit	38
FLOW COMPO®	

A

Best Selection

Mass Flow Meters and Controllers



Mass Flow Controller/Mass Flow Meter with Indicator
MODEL D8500 SERIES



Standard Mass Flow Controller
MODEL 3660 SERIES

High-grade Mass Flow Controller
MODEL 3200 SERIES



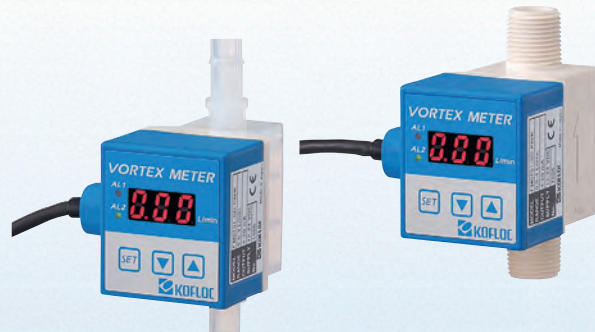
Low-cost Metal Sealed
Mass Flow Controller/Meter

MODEL 5400 SERIES



High-grade Metal Seal
Flow Controllers

MODEL 5100 SERIES



Small Karman Vortex Flow Meter for Liquids

FM0101/0102/0103/0105 SERIES

Small Karman Vortex Flow Meter for Liquids

MODEL 31 (Teflon/PFA) SERIES



Low-cost Mass Flow Meter with Display

MODEL 3810DS II SERIES

Compact Readout Unit

MODEL CR-400



Compact Handy Mass Flow Control/Measurement Unit
FLOW COMPO®



WHAT IS A MASS FLOW INSTRUMENT (MASS FLOW CONTROLLER/MASS FLOW METER)? (1)

KOFLOC is a general manufacturer of precision flow controllers and produces mechanical float type flow meters and valves, as well as electronic flow meters (mass flow controllers and mass flow meters). Our mass flow measuring/control technology based on mass flow meters and mass flow controllers has been used widely for the manufacture of semiconductors, liquid crystals, optical fibers, and other electronic devices; gas supply for fuel cells; combustion gas control for burners and the like; and for test, production, and inspection equipment in the food industry, biotechnology, and many other industries. In comparison with conventional mechanical products, mass flow measuring instruments offer more sophisticated flow measurement because they are not susceptible to temperature and pressure and they can pick up electric signals from the flow.

KOFLOC manufactures a variety of products related to electronic flow meters (mass flow controllers and mass flow meters), and quickly releases new products. Our products are highly valued by our customers.

1. Volume flow and mass flow

Gas flow meters can be roughly divided into volume flow meters and mass flow meters. Volume flow meters include area flow meters, positive displacement flow meters, and differential pressure flow meters, while mass flow meters include coriolis flow meters, vortex flow meters, and thermal flow meters. The float type flow meters produced by KOFLOC are classified as area flow meters in the category of volume flow meters, while the mass flow instruments produced by KOFLOC are classified as thermal flow meters in the category of mass flow meters. In terms of classification, the terms, "thermal mass flow controllers and thermal mass flow meters," are used according to the basic principle. In this catalog, however, the commonly used mass flow instruments mean mass flow controllers and mass flow meters in general.

The difference between volume flow meters and mass flow meters is explained below using some simple examples. Most of the volume flow meters are used when each section of a flow meter is exposed to the atmosphere as shown in Figure 1, namely, when no pressure is applied to the inside of the flow meter. When pressure is applied, the reading of the volume flow meter calibrated in the atmosphere will not be correct, and a calculation for correcting the reading is necessary. Soap film flow meters and dry/wet gas meters are especially susceptible to even a small resistance, and they are used in the atmosphere in principle. The same applies to float type flow meters; their reading cannot be correct when the gas density changes because of a substantial change in pressure or gas temperature. Therefore, the pressure and temperature conditions must be determined in advance, or calculation for correcting respective factors is necessary for the reading.

Meanwhile, as the name suggests, mass flow meters detect flow by means of weight, permitting the flow to be defined in the same state even if the density changes due to compression of fluid. When gas is detected by means of mass, the reading of the flow mentioned above will be the same even in a pressurized state as shown in Figure 2. Therefore, flow meters can be placed at any location on the flow chart, permitting a system to be configured without significant flow reading errors.

Fig. 1

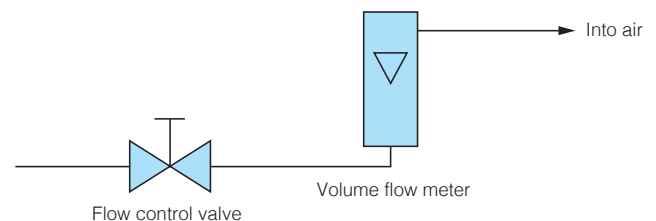
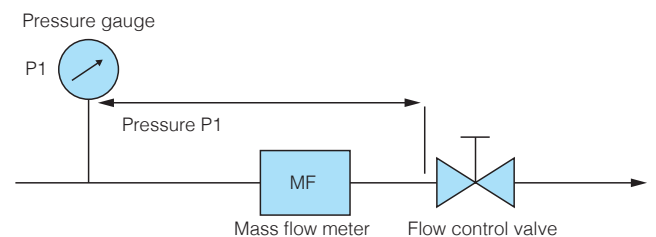


Fig. 2

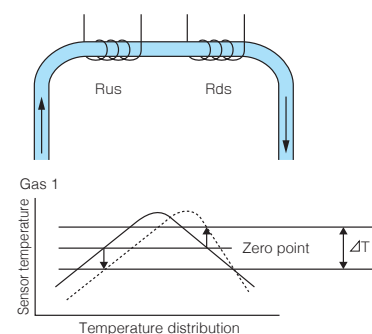


2. Principle of mass flow instruments

The flow sensor used in mass flow is called a thermal flow sensor in general. The principle of detection is as follows.

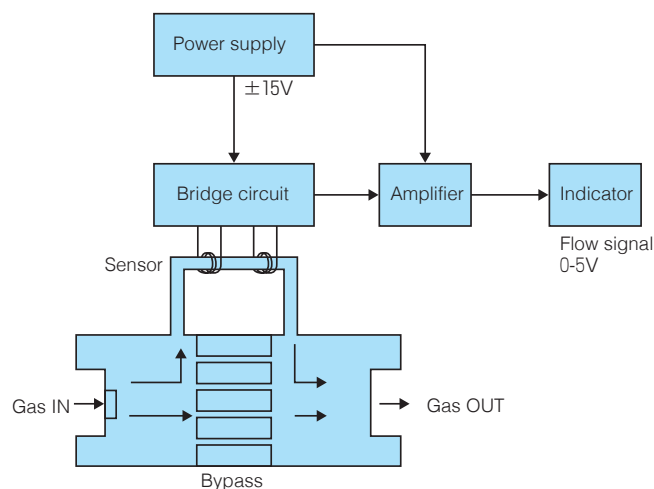
A resistive element with a large temperature coefficient of resistance is wound on the upstream side (R_{us}) and the downstream side (R_{ds}), respectively, around the capillary tube that is a sensor as shown in Figure 3. When electric current flows through these sections, the two resistive elements generate heat. When no fluid flows in the capillary tube at that time, the temperature of the upstream side is the same as that of the downstream side, matching each other. (The solid line in Figure 3: Zero flow = Position of the zero point used for mass flow instruments.) When the fluid begins to flow in this state, the temperature distribution changes as shown by the broken line in Figure 3. The heat of the upstream side is drawn at that time, and the heat is transferred by the flow to the downstream side conversely. In other words, a temperature difference (ΔT) arises between the upstream and downstream sides.

Fig. 3 Structure of sensor section



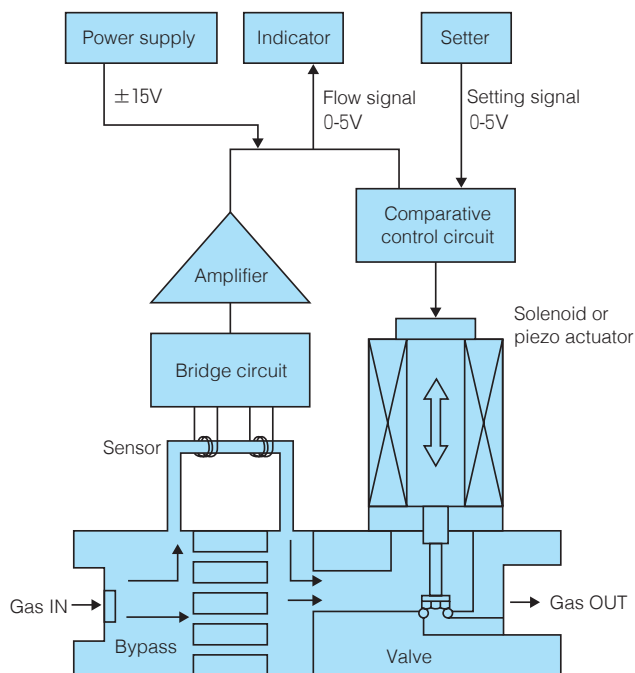
As the temperature difference (ΔT) has a functional relation to the mass flow of fluid, mass flow instruments pick up electric signals that represent the change in respective resistance values and amplify and correct the signal to permit the mass flow to be measured under a certain condition. This is the function of the mass flow meter shown in Figure 4.

Fig. 4 Structural chart of mass flow meter



In the mass flow controller shown in Figure 5, the opening of the flow control valve is controlled by a high-velocity, high-resolution piezo or solenoid actuator based on the comparison between the external flow setting signal and the flow signal output from the sensor. This system permits stable mass flow control, which will hardly be affected by changes of various conditions such as temperature and pressure.

Fig. 5 Structural chart of mass flow controller



3. Unit of flow

A mass flow meter measures the mass flow irrespective of pressure and temperature. When representing mass by the flow, it is necessary to use units such as g/min and kg/min which are different from the familiar units used for general fluid measurement. Therefore, it is common to use volume flow under predetermined standard conditions of pressure and temperature. At present, Pa·m³/s is used in conformance with the SI units, but SCCM and SLM which have long been used for mass flow instruments are still used as principal units.

With respect to the definition of the standard unit, KOFLOC adopted the definition based on the SEMI standard in October 1998. SCCM is an abbreviation of Standard Cubic Centimeter per Minute,

indicating cc/min at 0°C at 1 atmospheric pressure, while SLM is an abbreviation of Standard Liter per Minute, indicating L/min under the same conditions. Other units of flow, if they are recognized as units of measurement at present, can be used for calibration and manufacture of our products. In some industries other than the semiconductor industry, SCCM and SLM are defined as the units at 20°C at 1 atmospheric pressure and NCCM and NLM as the units at 0°C at 1 atmospheric pressure. Concerning the flow indication of our mass flow instruments, the standard temperature and pressure in units of SCCM (0°C, 1 atm) and NLM (0°C, 1 atm) are shown on our products and in test reports.

4. Calibration with actual gas and conversion factor method

KOFLOC mass flow instruments are calibrated with N₂ gas in principle before shipment. The accuracy of thermal sensors cannot be guaranteed unless they are calibrated with actual gas. The actual gases used for calibration at our company are N₂, O₂, H₂, He, CO₂, and Ar. Concerning other gases, certain conversion factors (CF) are used for correction after calibration with N₂ gas.

For example, when Ar is flowed through a mass flow instrument that was calibrated with N₂ gas, a 1.4 times larger quantity of Ar than the reading of the mass flow instrument will flow, because the CF of Ar is 1.4. In other words, the flow of Ar = 1.4 x Reading of N₂ mass flow instrument. The CF is calculated for various gases based on

calculation and the accumulation of data obtained through measurement with actual gases. However, the CF of one gas may not be exactly the same depending on the condition of the actual gas (temperature and pressure), the type of sensor of the mass flow instrument, and combination of the bypass (laminar flow element). The public standard CF should be used just as a standard value.

If you desire calibration with actual gas without using a CF, please provide us with the actual gas, and we will use it for calibration (this will incur a separate fee for gas calibration). However, we cannot accept some dangerous gases in view of the safety of products and facilities. Please contact us in advance for details.

WHAT IS A MASS FLOW INSTRUMENT (MASS FLOW CONTROLLER/MASS FLOW METER)? (2)

5. Harness layout - KFC standard

To reduce the wiring length, KOFLOC has been standardizing the harness layout. The Dsub 9-pin per KFC standard has been adopted for small capacity mass flow instruments of 20 SLM or less (excluding special and compact models). (See Figure 6.) This type will likely be adopted uniformly as the standard electric harness layout for mass flow instruments in the industry in the near future. To avoid confusion among users, "KFC standard" is written in the specification column of the catalog of products conforming to the above standard. Harness layouts are introduced on the page of each mass flow instrument with connectors made according to other standards. For details, refer to the operation manual of each product.

Fig. 6 KFC standard

Pin No.	Signal name	Pin No.	Signal name
1	Valve open/close signal	6	Flow setting signal: Hi
2	Flow output signal	7	Flow output signal COM
3	Power +15 V	8	Flow setting signal: Lo
4	Power COM	9	Valve voltage monitor
5	Power -15 V		

Note: Pin Nos. 1, 6, 8, and 9 are NC for mass flow meters.

6. Indication of specifications

The indication of mass flow instrument specifications in this catalog basically conforms to the SEMI standard. The definitions of representative specifications are explained below.

(1) Accuracy

The accuracy is indicated in the form of "Full scale \pm ○%." This is the % value with respect to the full-scale value of the error when the calibration standard gas (N₂, for example) is used for our standard flow meters. Therefore, when the accuracy is \pm 1% in the range of Full-scale 50 SCCM, the flow rate will be guaranteed with the "uncertainty" of $50 \times (1/100) = \pm 0.5$ SCCM with respect to our standard flow rate.

(2) Repeatability

The form of "Full scale \pm ○%" is the same as the accuracy. This value indicates the deviation of the value obtained by measuring the flow, which is set under the same environmental conditions, with our standard flow meters. This definition is different from the

reproducibility that shows the deviation of the value after the environmental condition is changed.

(3) Response

The response is indicated by the time taken for the output of mass flow instruments to stabilize at 98% of the full scale after starting control from zero flow. Such indication is adopted usually because it is difficult to analyze 100% in the case of an asymptotic line.

Note: The value used to indicate the flow range is the full-scale (100%) value only when N₂ (or air) is made to flow. Therefore, when the type of gas and pressure conditions are different, even if the flow is the same, we may not be able to manufacture products according to the desired specifications; please contact us in advance.

7. Product grade

(1) High-grade products

Mass flow instruments that are classified as high-grade products have a structure suitable for high-vacuum applications for semiconductor manufacturing equipment. They are manufactured in a clean room conforming to the ultra clean specifications required for semiconductor manufacturing. Particle counters and He leak detectors are used to check all products before shipment.

Depending on the difference in the sealing material, products are classified into mass flow controllers 5100 and 5400, as well as mass flow meters 5410, equipped with a metal seal and mass flow controllers 3200, as well as mass flow meters 3100, equipped with a rubber seal. Models that permit installation of an SR option for measurement and control of very small flow at full-scale 1 SCCM, as well as models that permit multi-point quick response defined finely throughout the entire flow range at the rate of not only 0–98% but also 0–50% and 0–10%, are high-function products.

(2) Standard low-cost products

Mass flow instruments classified as standard and low-cost products have a structure suitable for exposure to the atmosphere or medium pressure (high pressure partly). Equipped with a rubber seal, products are classified into mass flow controllers 3660 SERIES, mass flow meters 3760 SERIES, and low-cost mass flow meters 3810 SERIES. The HFC/HFM series is used for large flows exceeding the full-scale 100 SLM.

(3) Special usage

Mass flow instruments need to be made specially according to the usage when the temperature exceeds 100°C, the pressure exceeds 1 MPa, or liquid is to be measured and controlled. In order to meet diverse needs of customers, KOFLOC offers originally developed products, as well as products supplied from cooperative companies, for use in various fields. Do not hesitate to contact us for special products not covered by this catalog and products that include other piping or piping equipment.

8. Installation and piping

Refer to the dimensional drawing for installation on a panel or the like. Contact our factory if you are unsure about any aspect of installation.

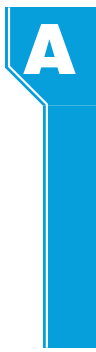
9. Repair

In the event that our product you are using fails due to aging or some other trouble, we will receive it for repair, because mass flow instruments are precision equipment composed of very delicate parts. To assist quick repairs, our products are packed with an operation

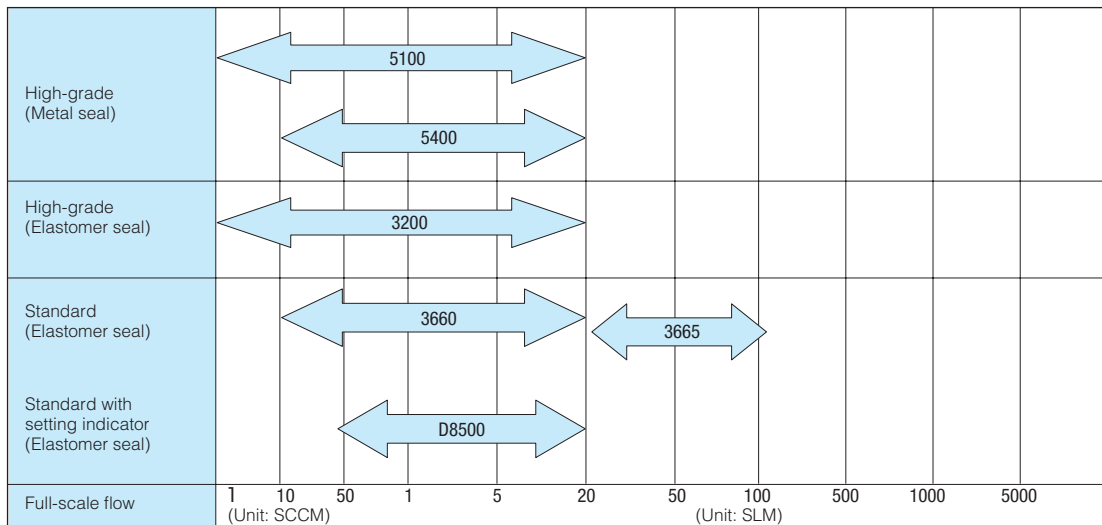
manual and check sheet. When a trouble or failure occurs, check the operation manual first, and then send the check sheet by fax to your nearest KOFLOC or phone us.



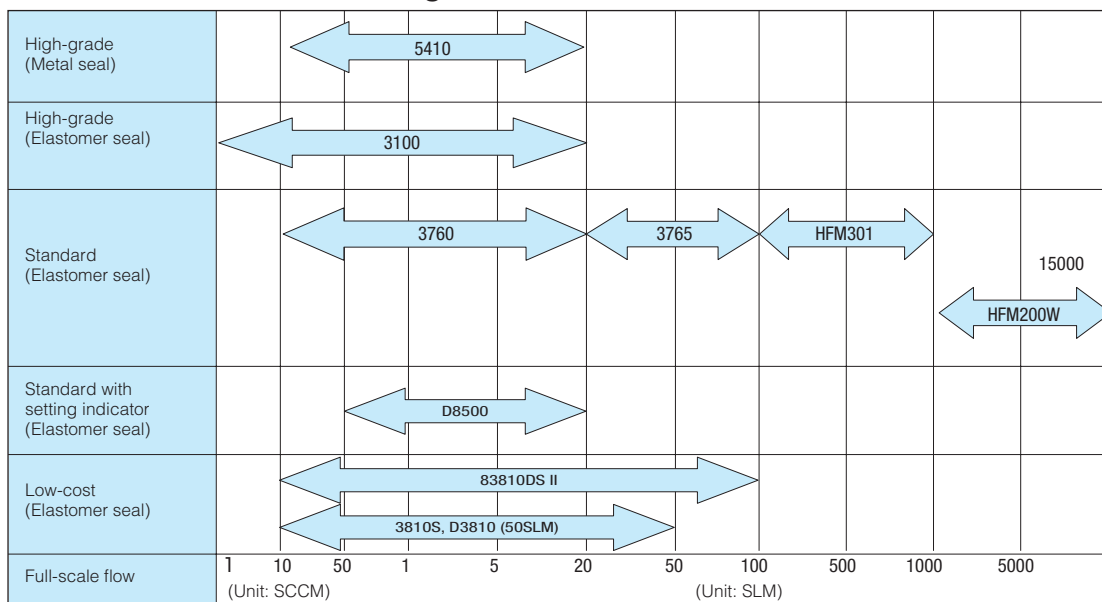
GUIDE TO SELECTION OF MASS FLOW INSTRUMENTS



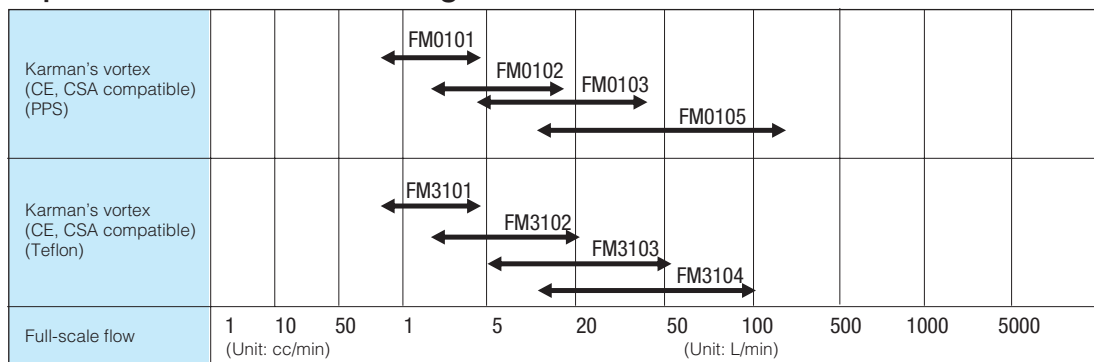
Mass flow controller Table of grades



Mass flow meter Table of grades



Liquid flow sensor Table of grades



Mass Flow Controller/Mass Flow Meter with Indicator MODEL D8500 SERIES



This mass flow controller/meter driven by a 24 VDC power supply has been developed as a successor to the MODEL 8300.

The view point change function of the display unit and the pattern setting function are unique to this model, and noise resistance has been improved dramatically. A sister model with a detachable display and setting unit is also available.

Features

- The high-lift actuator allows this compact model to control a large flow rate.
- Equipped with a display and setting unit, this model can be operated by a 24 VDC power supply.
- The RS232C/RS485 communication function and integration function are provided as standard equipment.
- The 14-bit converter permits display and operation in 4-1/2 digits.
- Control of the flow rate of inflammable gas is possible, because the heat generating part of the sensor is not exposed to gas.
- There are no limitations on the mounting position that may be employed.
- In addition to SV setting, five other patterns can be set.
- Auto zero and auto close functions are also standard.



Standard Specifications

Flow range (F.S.) (at N ₂ calibration conditions)	50 SCCM-5 SLM	Over 5 SLM-20 SLM
Applicable gases (dry gas)	N ₂ , air, O ₂ , CO ₂ , Ar, H ₂ , He, etc.	
Sensor	Thermal mass flow sensor	
Valve actuator	Normally-closed solenoid valve actuator*7	
Valve type	Poppet valve*7	
Control system	Control/measurement range	2-100% F.S.
	Response	0-100% F.S. or more within 2 sec.*1 0-below 10% F.S. within 4 sec.*1
Accuracy	Flow accuracy	±1.0%F.S.*2 ±1.5%F.S.*2
	Repeatability	±0.75%F.S.
Pressure	Proof pressure	1000 kPa (G)
	Allowable operating pressure	500 kPa (G) or less
	Operating differential pressure*7	50-300 kPa (G) 100-300 kPa (G)
Temperature	Allowable operating temperature	5-45°C
	Temperature characteristics	0.2% F.S./°C
Humidity	Allowable operating humidity 10-90% (No condensation allowed)	
Leak	He leak rate 1 × 10 ⁻⁶ Pa·m ³ /sec. or less*3	
Flow setting method	Digital	(1) Setting & display unit (2) Communications (3) Event input selection
	Analog*7	(1) 0-5 V (2) 4-20 mA (freely selectable)
Flow rate output	Analog (1) 0-5 V (2) 4-20 mA (interlocked with the above)	

Display	Display format	7-segment 4-digit LED
	Total flow	12 digits*4
	Mounting direction	Changeable
	Built-in/Separate	Built-in, separate 1 m, separate 3 m, separate 5 m
Other I/O functions	Status display LED	OK (within allowable range), ALM (alarm output interlock) OUT1 (event output 1 interlock), OUT2 (event output 2 interlock) SV (set flow), PV (instantaneous flow), TF (total flow) IF (mode setting)
	Event input	3 × contact input
	Alarm output	1 × open collector output, Max. 35 V, 50 mA
	Event output	2 × open collector output Max. 35 V, 50 mA
	Communications	RS-485, half-duplex, 9600 bps
	Power supply	Rating
Allowable supply voltage range		21.6-26.4 VDC (Ripple: 5% or less)
Mounting position	Not specified	
Applicable standards	RoHS and EN62326-1: 2006	
Materials of parts in contact with gases	SUS316, SUS316L, SUS430, FKM, PTFE, chloroprene rubber (option)	
Joint	1/4 SWL, RC1/4, 1/4 VCR	
Weight	Built-in: Approx. 1000 g Separate (excluding the cable): Approx. 1200 g (*6)	

(*1) Time required to reach the control flow ±2% F.S. from the fully closed state

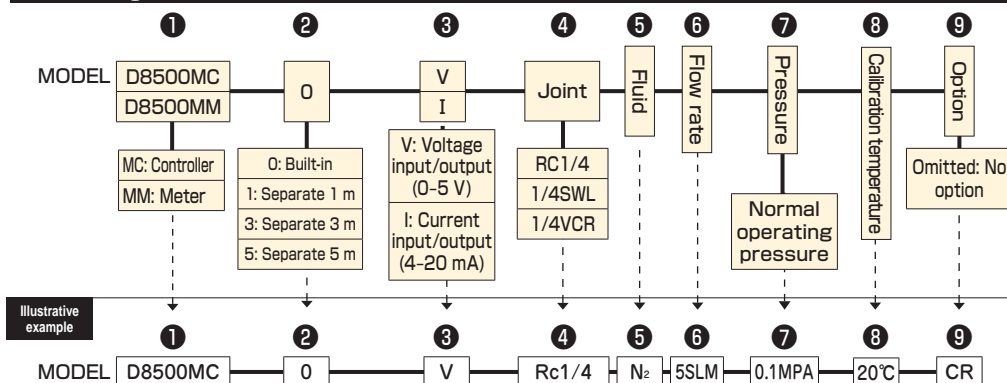
(*2) With the standard pressure of 200 kPa (G) and the standard temperature of 20°C

(*3) Permeation is not included. The leakage by prolonged permeation shall not exceed 1 × 10⁻⁶ Pa·m³/sec.

(*4) The units of measurement vary with the full scale flow. E.g.: With 1 SLM, the flows can be added up to 9999 9999 9.999 L.

(*5) For other joints, please contact us. (*6) The weight may slightly vary depending on the joint. (*7) These apply to the D8500MC mass flow controller.

Ordering

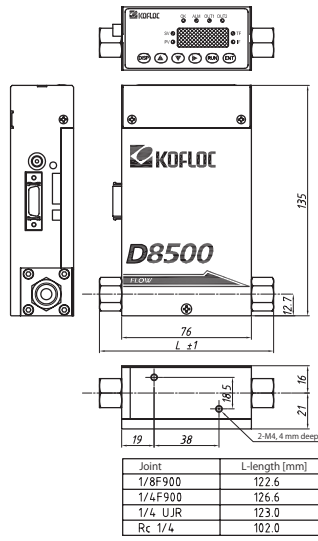


* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

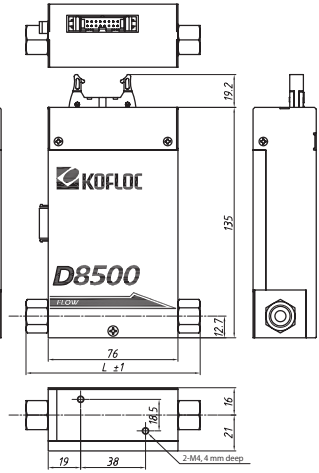
* Various joints other than our standard joints are also available (option).

MODEL D8500 SERIES

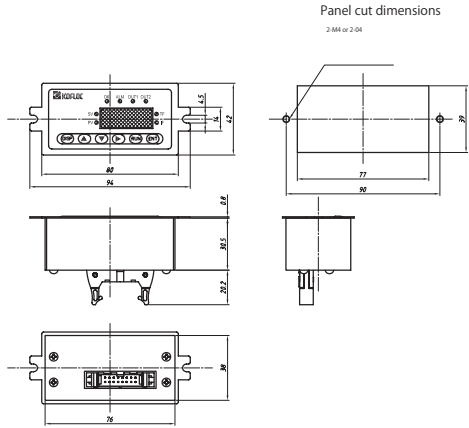
MODEL D8500
Built-in type



MODEL D8500
Separate type - Main unit -

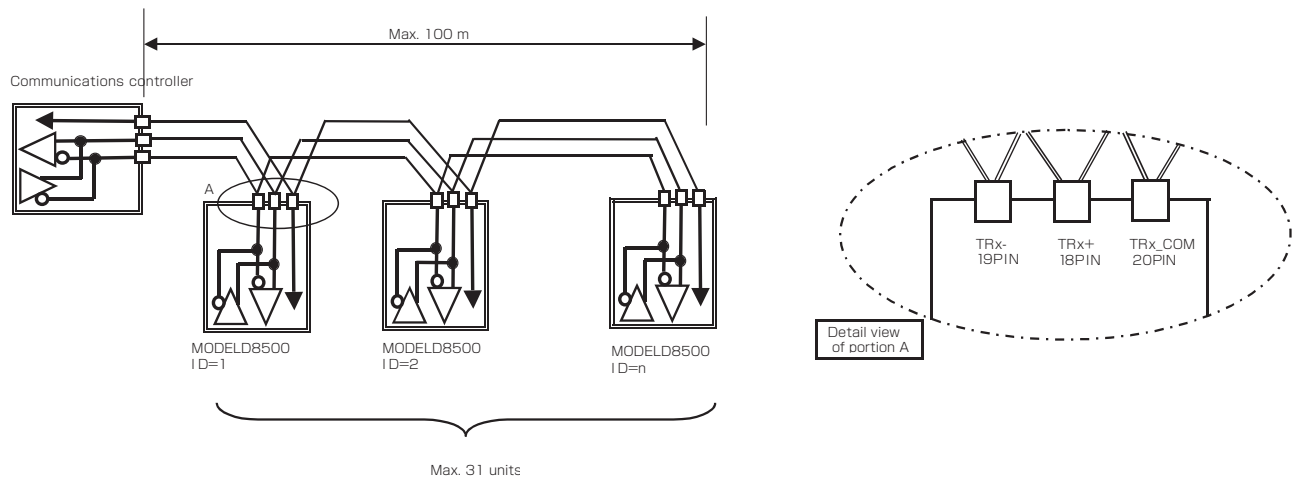


MODEL D8500
Separate type - Display -



Example of RS-485 Communications line configuration

Example of communications system configuration with Model D8500
On a single logging PC, logging and operation of up to 31 units are possible.
(A communications terminal resistor is provided, which can be turned on and off.)



Model D8500 Series Power Cable

PSK-85/CP-D85CF SERIES

The PSK-85 is an AC adapter type power supply that can operate the Model D8500 Series system. The CP-D85CF cable is used to drive the Model D8500 Series, acting as an interface for various event out puts for power flow signal (analog), digital communications (RS-485). (The cable end is loose).

Ordering

- Power supply adapter: PSK-85 (cable length: 1.5 m only)
- Cable: CP-D85CF

- 1M → 1m
- 3M → 3m
- 5M → 5m
- XM → Specified length (custom)



Loose end (* For details of the signal interface, refer to the instruction manual.)
D8500 main unit connector (DS20P half pitch connector)

Standard Mass Flow Controller

MODEL 3660 SERIES

Model 3660 Series Mass Flow Controller has been developed centering the focus on compactness and low cost and is being acclaimed by a wide range of users for diverse applications, including from laboratory research and development activities to the use as a standard mass flow control model for various types of analyzers and vacuum devices in the production line. Varieties of derived models and options are available.

Features

- Equipped with an advanced flow sensor of constant-current temperature difference detection type to ensure high-speed response
- Use of a normally closed valve to ensure safety
- High reliability ensured using a solenoid actuator
- Low differential pressure type control available for combustible gases (LP option)

Standard Specifications

Model	3660	3665
Flow range (N ₂ equivalent, 20°C/1 atm)	10 SCCM–20 SLM (freely selectable)	30 SLM–100 SLM (freely selectable)
Sensor	Thermal mass flow sensor	
Valve type	Proportional solenoid valve (closed when not energized)	
Control range	2–100% (F.S.)	5–100% (F.S.)
Response	2 sec. or less (0–100% within ±2% typical)	3 sec. or less (0–100% within ±2% typical)
Accuracy	±1.0% F.S. (25°C)	±1.5% F.S. (25°C)
Temperature coefficient	±0.1 F.S./°C (15–35°C)	±0.2 F.S./°C (15–35°C)
Repeatability	±0.5% F.S.	
Operating differential pressure	F.S. ≤ 5 SLM: 50–300 kPa (G)	F.S. ≤ 50 SLM: 150–300 kPa (G)
	F.S. > 100 SLM: 50–300 kPa (G)	F.S. > 50 SLM: 200–300 kPa (G)
	Option: Medium differential pressure (MP) and low differential pressure (LP) specifications are available.	
Allowable operating pressure	500 kPa (G) or less	
Proof pressure	980 kPa (G)	
Leak rate	1 × 10 ⁻⁸ Pa·m ³ /s or less (excluding permeation of He)	
Allowable ambient temperature	5–45°C	
Allowable ambient humidity	10–90% (No condensation allowed)	
Materials of parts in contact with gases	Body: SUS316	
	Valve seat: FKM (option: CR or NBR)	
	Sealing: FKM (option: CR or NBR)	
Electric connection	Dsub 9-pin connector as per KFC Standard (Compliant with SEMI Standard)	
Flow rate input signals	0–5 VDC (Input impedance: 1 MΩ or more)	
Flow rate output signals	0–5 VDC (External load resistance: 250 kΩ or more)	
Required power supply	+15 VDC (±5%) 100 mA, -15 VDC (±5%) 250 mA	
Joint (Main unit bore)	Standard: 1/4SWL	Standard: 3/8SWL
	Option: 1/8SWL 1/4VCR RC1/4, etc.	Option: 1/2SWL 3/8VCR RC3/8, etc.
Weight	Approx. 1000 g	Approx. 1500 g

Note
Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.

Harness Layout

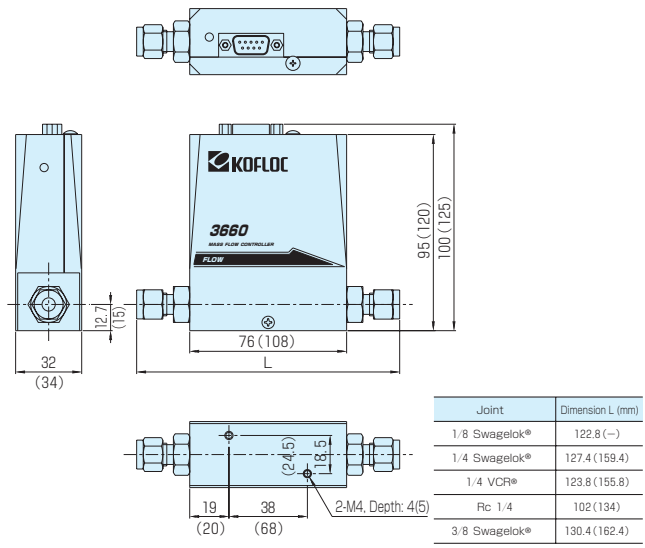
Pin Assignment of Dsub 9-pin Connector per KFC Standard

Pin No.	Signal	Pin No.	Signal
1	Input valve open/close operation	6	Flow input Hi
2	Flow output 0-5 V	7	Flow output COM
3	+15 VDC Power source	8	Flow input Lo
4	Power source COM	9	Output valve voltage
5	-15 VDC Power source		

* Because a differential input system is used for the product, pin 4 (Power source COM) and pin 7 (Flow output COM) are connected inside the mass flow controller while pin 8 (Flow input Lo) is isolated. In case of a single-ended connection, connect pin 8 to pin 4.

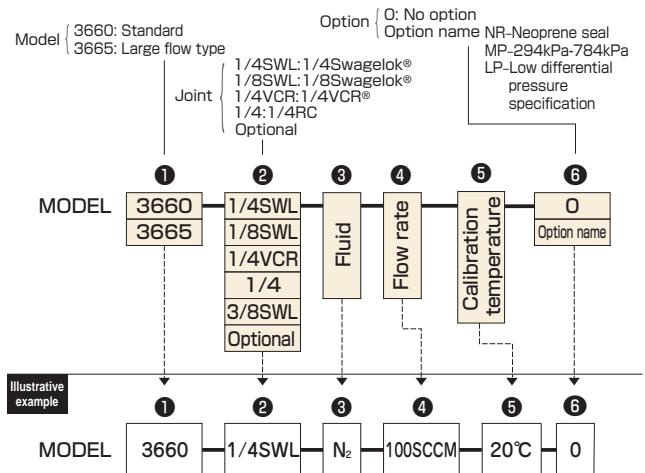


Dimensions



* Values indicated in () denote the dimensions for Model 3665.

Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.



High-grade Mass Flow Controller

MODEL 3200 SERIES

Model 3200 Series Mass Flow Controller is an advanced model designed as a successor of the 3910 Series that enjoys a wide use for diverse applications such as manufacture of semiconductors, LCDs, combustion equipment, analytical devices, and biotechnology fields. Its high performance is equal to a new standard of KOFLOC.

Features

- Equipped with a temperature follow-up type current difference detection flow sensor (patent applied for) to ensure high accuracy and high-speed response
- Use of a normally closed valve to ensure safety
- Reduced dead volume thanks to the diaphragm seat valve
- Control of small quantities of flows available up to 1 SCCM full scale (SR option)
- Low differential pressure type control available for combustible gases (LP option)

Standard Specifications

Flow range (N ₂ equivalent, 20°C/1 atm)	1 SCCM–20 SLM (The conditions are freely selectable)
Sensor	Thermal mass flow sensor
Valve type	Proportional solenoid valve (closed when not energized)
Control range	2–100% (F.S.)
Response	1 sec. or less (0–100% within ±2% typical)
Accuracy	±1% F.S. (Accuracy guaranteed at 15–35°C)
Repeatability	±0.2% F.S.
Operating differential pressure	F.S. ≤ 5 SLM: 50–300 kPa (G)
	F.S. > 5 SLM: 100–300 kPa (G)
	Option: Low differential pressure (LP) specification is available depending on conditions.
Allowable operating pressure	300 kPa (G) or less
Proof pressure	980 kPa (G)
Leak rate	1 × 10 ⁻⁸ Pa·m ³ /s or less (excluding permeation of He)
Allowable ambient temperature	0–50°C
Allowable ambient humidity	10–90% (No condensation allowed)
Materials of parts in contact with gases	Body: SUS316L
	Diaphragm: SUS316
	Valve seat: FKM (option: CR, NBR or perfluor)
	Sealing: FKM (option: CR, NBR or perfluor)
Electric connection	Dsub 9-pin connector as per KFC Standard (Compliant with SEMI Standard)
Flow rate input signals	0–5 VDC (Input impedance: 1 MΩ or more)
Flow rate output signals	0–5 VDC (External load resistance: 250 kΩ or more)
Required power supply	+15 VDC (±5%) 100 mA, –15 VDC (±5%) 200 mA
Joint (Main unit bore)	Standard: 1/4SWL Option: 1/8SWL 1/4VCR RC1/4, etc.
Weight	1000 g

Note
Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.

Harness Layout

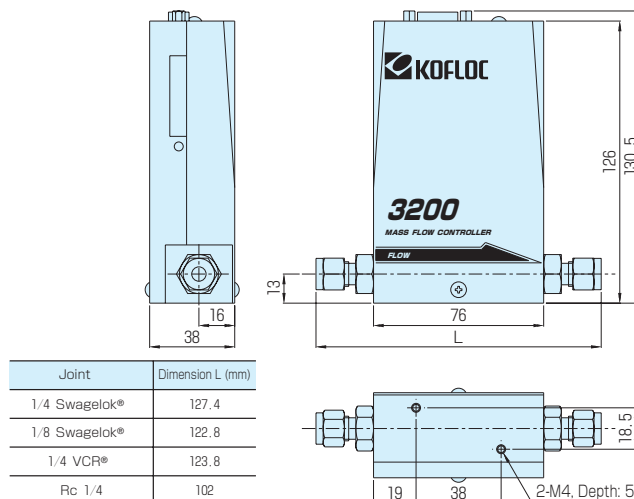
Pin Assignment of Dsub 9-pin Connector per KFC Standard

Pin No.	Signal	Pin No.	Signal
1	Input valve open/close operation	6	Flow input Hi
2	Flow output 0–5 V	7	Flow output COM
3	+15 VDC Power source	8	Flow input Lo
4	Power source COM	9	NC
5	–15 VDC Power source		

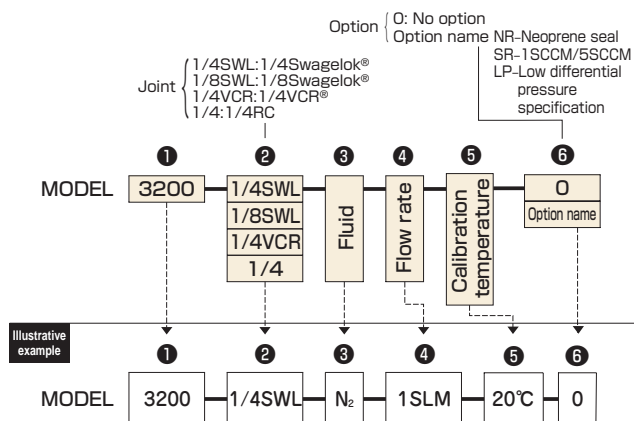
* Because a differential input system is used for the product, pin 4 (Power source COM) and pin 7 (Flow output COM) are connected inside the mass flow controller while pin 8 (Flow input Lo) is isolated. In case of a single-ended connection, connect pin 8 to pin 4.



Dimensions



Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

Low-cost Metal Sealed Mass Flow Controller/Meter

MODEL 5400 SERIES

The Model 5400 Series is a successor to the Model 3440, with enhanced basic capabilities. The appearance is similar to the conventional MFC. The sensor drive system is improved: the zero-drift is further reduced and the response in the lower range is improved. The Model 5410 Series is a mass flow meter with the same body design as that of the 5400 Series.

Features

- Control and response in each setting range are improved.
- The following capability to the set voltage is improved (supporting ramping specifications).
- As the valve is improved, the control resolution in each range is improved.

Standard Specifications

Model	5400	5410
Flow range (N ₂ equivalent, 20°C/1 atm)	10 SCCM-20 SLM (freely selectable)	10 SCCM-20 SLM (freely selectable)
Sensor	Thermal mass flow sensor	
Valve type	Proportional solenoid valve (closed when not energized)	-
Control range	2-100% (F.S.)	-
Response	1 sec. or less (0-100% within ±2% typical)	-
Accuracy	±1% F.S. (20°C)	
Repeatability	Within ±0.2% F.S. (20°C)	
Operating differential pressure	F.S. ≤ 5 SLM: 50-300 kPa	-
	F.S. > 5 SLM: 100-300 kPa	-
Allowable operating pressure	300 kPa (G) or less	
Proof pressure	980 kPa (G)	
Leak rate	1 × 10 ⁻¹¹ Pa·m ³ /s or less	
Allowable ambient temperature	0-50°C (Accuracy guaranteed at 15-35°C, ±0.1% F.S./°C)	
Allowable ambient humidity	10-90% (No condensation allowed)	
Materials of parts in contact with gases	Body: SUS316L	
	Diaphragm: Ni-Co	
	Valve seat: PTFE	
	Sealing: SUS316L, Ni	
Electric connection	Dsub 9-pin connector as per KFC Standard (Compliant with SEMI Standard)	
Flow rate input signals	0-5 VDC (Input impedance: 1 MΩ or more)	-
Flow rate output signals	0-5 VDC (Minimum load resistance: 250 kΩ or more)	
Required power supply	+15 VDC (±5%) 100 mA,	+15 VDC (±5%) 100 mA,
	-15VDC (±5%) 200mA	-15VDC (±5%) 100mA
Joint (Main unit bore)	Standard: 1/4 VCR equivalent Option: 1/4 SWL	
Weight	Approx. 1000 g	Approx. 800 g

Note

Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.

Harness Layout

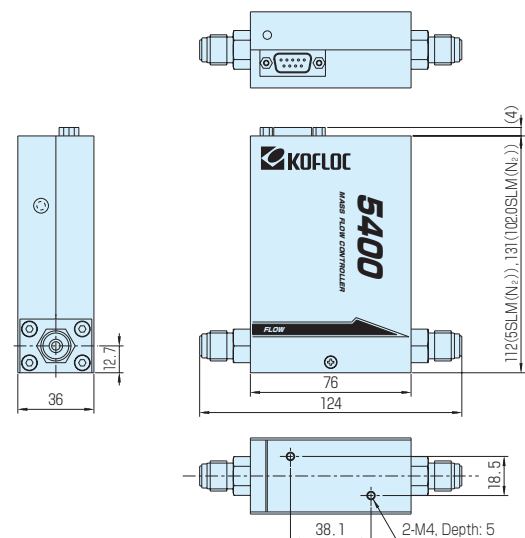
Pin Assignment of Dsub 9-pin Connector per KFC Standard

Pin No.	Signal	Pin No.	Signal
1	Input valve open/close operation	6	Flow input Hi
2	Flow output 0-5 V	7	Flow output COM
3	+15 VDC Power source	8	Flow input Lo
4	Power source COM	9	Output valve voltage
5	-15 VDC Power source		

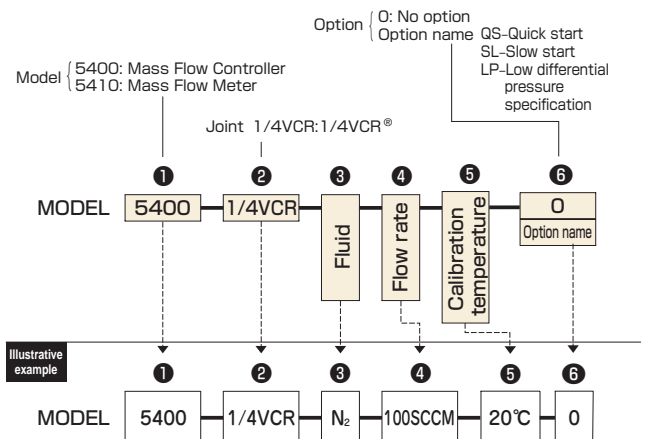
- * Because a differential input system is used for the product, pin 4 (Power source COM) and pin 7 (Flow output COM) are connected inside the mass flow controller while pin 8 (Flow input Lo) is isolated. In case of a single-ended connection, connect pin 8 to pin 4.
- * Pins 2, 3, 4, 5, 7 only for Mass Flow Meter



Dimensions



Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.



High Grade Metal Seal Flow Controllers

MODEL 5100 SERIES

Model 5100 Series Mass Flow Controller/Meter features weldless structure, metal seals, accuracy of $\pm 1\%$, response of $\leq \pm 1$ second and other basic performance conditions required for semiconductor process control, and additionally, has achieved a significant price reduction.

Features

- High accuracy and high response are achieved by the flow sensor with temperature-following current difference detection.
- A normally-closed solenoid valve is employed.
- A low leak rate is achieved by the weldless structure and metal seal.
- The dead volume is reduced thanks to the diaphragm seat valve.
- The face-to-face and body dimensions and the wiring tie-in points are designed to facilitate replacement of devices made by other companies.

Standard Specifications

Flow range (N ₂ equivalent, 20°C/1 atm)	1 SCCM–20 SLM (The conditions are freely selectable)
Sensor	Thermal mass flow sensor
Valve type	Proportional solenoid valve (closed when not energized)
Control range	2–100% (F.S.)
Response	1 sec. or less (0–100% within $\pm 2\%$ typical)
Accuracy	$\pm 1\%$ F.S. (Accuracy guaranteed at 15–35°C)
Repeatability	$\pm 0.2\%$ F.S.
Operating differential pressure	F.S. ≤ 5 SLM: 50–300 kPa
	F.S. > 5 SLM: 100–300 kPa
Option: Low differential pressure (LP) specification is available depending on conditions.	
Allowable operating pressure	300 kPa (G) or less
Proof pressure	980 kPa (G)
Leak rate	1×10^{-11} Pa·m ³ /s or less
Allowable ambient temperature	0–50°C
Allowable ambient humidity	10–90% (No condensation allowed)
Materials of parts in contact with gases	Body: SUS316L
	Diaphragm:
	Valve seat: PTFE
	Sealing: SUS316L, Ni, Au
Option: SUS seal (SU), inner surface polish (KP)	
Electric connection	Dsub 9-pin connector as per KFC Standard (Compliant with SEMI Standard)
Flow rate input signals	0–5 VDC (Input impedance: 1 M Ω or more)
Flow rate output signals	0–5 VDC (External load resistance: 250 k Ω or more)
Required power supply	+15 VDC ($\pm 5\%$) 100 mA, –15 VDC ($\pm 5\%$) 200 mA
Joint (Main unit bore)	Standard: 1/4 VCR equivalent Option: 1/4 SWL
Weight	Approx. 1000 g

Note
Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.

Harness Layout

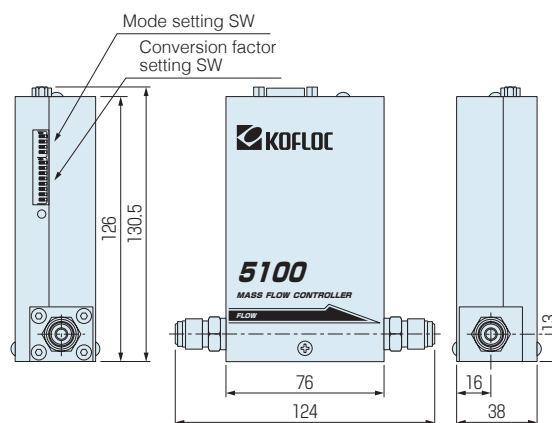
Pin Assignment of Dsub 9-pin Connector per KFC Standard

Pin No.	Signal	Pin No.	Signal
1	Input valve open/close operation	6	Flow input Hi
2	Flow output 0–5 V	7	Flow output COM
3	+15 VDC Power source	8	Flow input Lo
4	Power source COM	9	Output valve voltage
5	–15 VDC Power source		

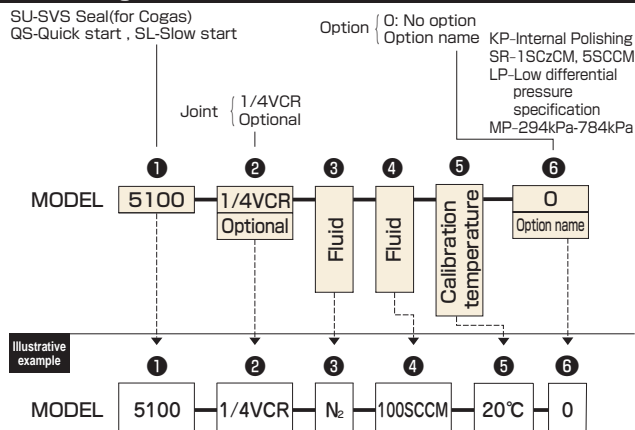
** Because a differential input system is used for the product, pin 4 (Power source COM) is connected inside the mass flow controller while pin 8 (Flow input Lo) is isolated. In case of a single-ended connection, connect pin 8 to pin 4.
* For baking applications on Model 5100B, working temperature is specified up to 80°C.



Dimensions



Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

Low-cost Mass Flow Meter with Display

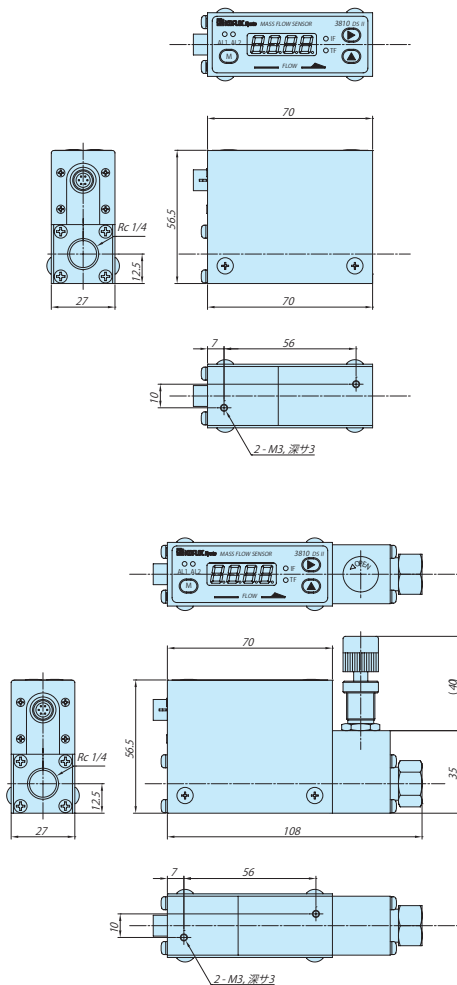
MODEL 3810DS II SERIES

The Model 3810DS II is a mass flow meter with a built-in display using a time-tested flow sensor. The 3810DS II displays total flow in addition to instantaneous flow, which is an improvement on the previous model 3810DS. Just like the 3810DS, the 3810DS II is also available with flow sensor and precision needle valve built into one piece.

Features

- Precision needle valve for controlling and monitoring very low flow rates
- Two alarm outputs for flow monitoring
- Analog output for instantaneous flow and pulse output for total flow
- Compact and lightweight
- The display is built in and the meter only requires connection to a 24-VDC power supply.
- The meter measures mass flow and directly reads the flow. There is no need for flow correction calculations based on temperature and pressure.

Dimensions



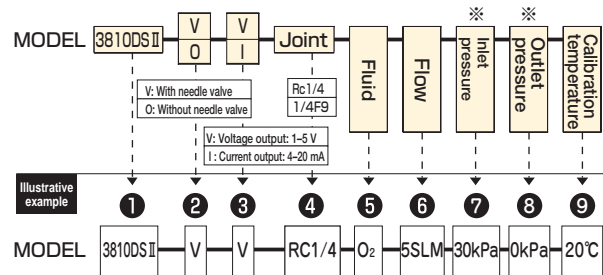
Standard Specifications

Sensor	Thermal sensor	
Flow range (N ₂ equivalent)	10 SCCM-20 SLM	21-100 SLM
Accuracy	Within ±2% F.S. at 25°C	Within ±3% F.S. at 25°C
Operating pressure	0.0-0.5 MPa (G)	
Proof pressure	1.0 MPa (G)	
Allowable ambient temperature	0-50°C	
Temperature coefficient	±0.2% F.S./°C (15-35°C)	
Materials of parts in contact with gases	Body: SUS303, PTFE	
	Sealing: FKM	
	Option: Neoprene	
Connection end	Standard: Rc 1/4 (Ask us for other sizes.)	
Power supply	24 VDC ±5%, 100 mA (option: AC adapter)	
Flow output signal	1-5 V, 4-20 mA (Select when ordering.)	
Event output	2 × NPN open collector output Maximum rating: 30 VDC, 50 mA	

- * Cable connection
Connector: 3810DS II end: HR10A-7R-6P (Hirose Electric)
Cable end: HR10A-7P-6S (Hirose Electric)
- * A conversion cable for the previous model 3810DS is available.

Note
Specifications relating to the flow range (e.g., flow range, accuracy and repeatability) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, ask us.

Ordering



- * Various joints other than our standard joints are also available (option).
- * (7) and (8) are needed only when a model with needle valve is selected.
- Power adapter: PSK-38DS II
- External cable: CP-38DS II CF — [XM] (Lengths: 1 m, 3 m and 5 m)
- * The power adapter and the external cable cannot be used together.



High-grade Mass Flow Meter

MODEL 3100 SERIES



The Model 3100 Series Mass Flow Meter is a new, advanced high-precision flowmeter developed based on the Model 3200 Series. The incorporated innovative capillary type flow sensor reduces pressure loss and ensures high response as well as ensuring stability.

Features

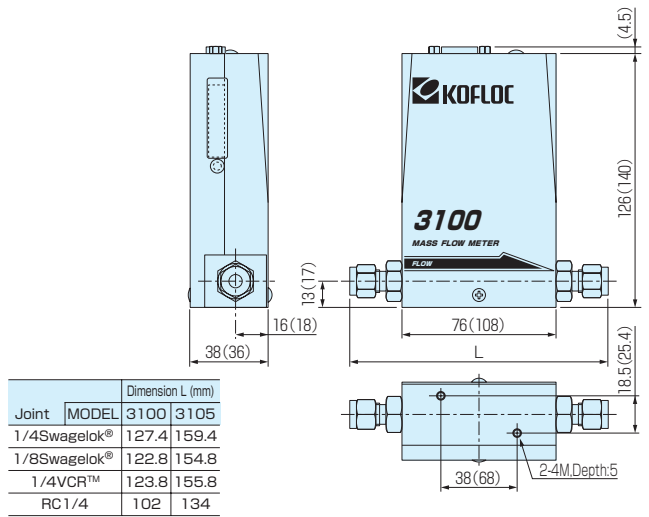
- Equipped with a temperature follow-up type current difference detection flow sensor to ensure high accuracy and quick response
- Measurements of minute flows available up to 1 SCCM full scale (SR option)

Standard Specifications

Flow range (at N ₂ calibration conditions)	10SCCM-20SLM
Response	1 sec. or less to within ±2% of full scale of final value typical for 0-100% response
Accuracy	Within ±1.0% F.S./3100
Linearity	Within ±0.5% F.S.
Repeatability	Within ±0.2% F.S.
Proof pressure	980kPa
Leak rate	1x10 ⁻⁸ Pa·m ³ /s or less (excluding transmission of He)
Working temperature range	0-50°C (Accuracy guarantee: 15-35°)
Materials of parts exposed to gases	Body: SUS 316L, SUS 316, PTFE Seals: Viton® (Optional: Neoprene®)
Joint	Standard: 1/4SWL® Optional: 1/8SWL® 1/4VCR® RC1/4®, etc.
Electrical connections	Dsub 9-pin male connector per KFC standard (SEMI standard)
Flow rate output signals	0-5VDC
Required power supply*	+15VDC (±5%) 100mA, -15VDC (±5%) 100mA



Dimensions

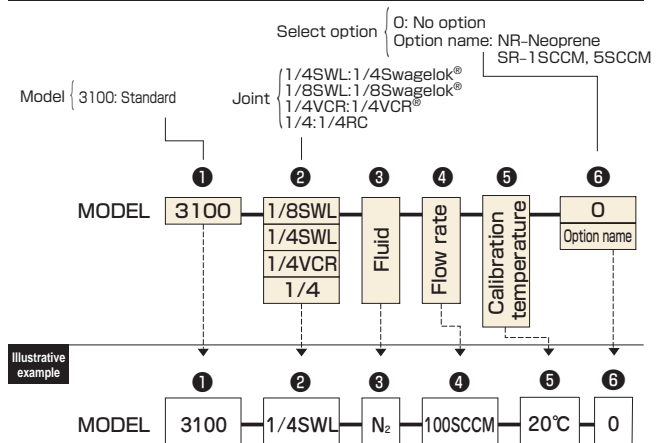


Harness Layout

Pin Assignment of Dsub 9-pin Connector per KFC Standard

Pin No.	Signal	Pin No.	Signal
1	NC	6	NC
2	Flow output 0-5 V	7	Flow output COM
3	+15 VDC Power source	8	NC
4	Power source COM	9	NC
5	-15 VDC Power source		

Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

Standard Mass Flow Meter MODEL 3760 SERIES

The Model 3760 Series is a compact, low-cost mass flow meter developed based on the Model 3660 Series. It has been developed as a standard model of various analyzers and vacuum equipment for research and development at universities and research institutes.

Features

- Improved constant-current temperature difference detection type flow sensor for quick response
- The compact body permits installation at any location.

Standard Specifications

Model	3760	3765
Flow range (N ₂ equivalent, 20°C/1 atm)	10 SCCM–20 SLM (freely selectable)	30 SLM–100 SLM (freely selectable)
Sensor	Thermal mass flow sensor	
Response	2 sec. or less	3 sec. or less
Accuracy	±1.0%F.S. (25°C)	±1.5%F.S. (25°C)
Temperature coefficient	±0.1 F.S./°C (15–35°C)	±0.2 F.S./°C (15–35°C)
Repeatability	±0.5%F.S. (20°C)	
Proof pressure	980kPa (G)	
Leak rate	1 × 10 ⁻⁸ Pa·m ³ /s or less (excluding permeation of He)	
Allowable ambient temperature	5–45°C	
Allowable ambient humidity	10–90% (No condensation allowed)	
Materials of parts in contact with gases	Body: SUS316 Sealing: FKM (option: CR or NBR)	
Electric connection	Dsub 9-pin connector as per KFC Standard (Compliant with SEMI Standard)	
Flow rate output signals	0–5 VDC (External load resistance: 250 kΩ or more)	
Required power supply	+15VDC (±5%) 100mA, –15VDC (±5%)100mA	
Joint (Main unit bore)	Standard: 1/4SWL Option: 1/8SWL 1/4VCR RC1/4, etc.	Standard: 3/8SWL Option: 1/2SWL 3/8VCR RC3/8, etc.
Weight	Approx. 800 g	Approx. 1000 g

Note
Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.

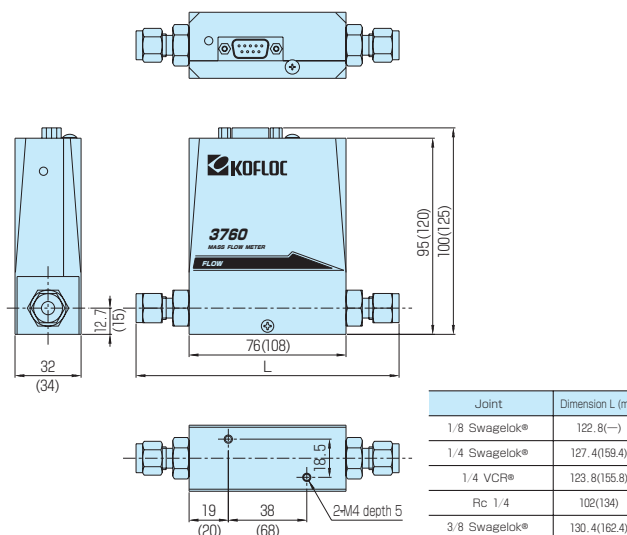
Harness Layout

Pin Assignment of Dsub 9-pin Connector per KFC standard

Pin No.	Signal	Pin No.	Signal
1	NC	6	NC
2	Flow output 0–5 V	7	Flow output COM
3	+15 VDC Power source	8	NC
4	Power source COM	9	NC
5	–15 VDC Power source		

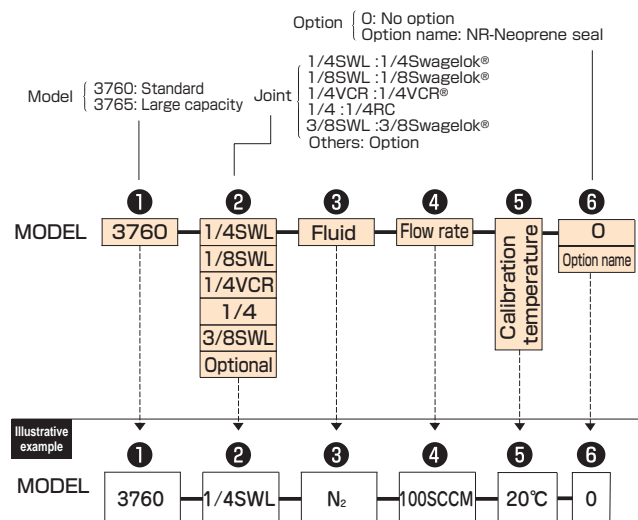


Dimensions



Dimensions indicated in () are for the 3765.

Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.



Low-cost Mass Flow Sensor

MODEL 3810S SERIES

Designed on the heritage base construction of the superior class bypass capillary type mass flow sensor, the Model 3810S Mass Flow Sensor centers the focus on economy through a thorough effort towards streamlining with the view to built-in applications. The series is one of the KOFLOC best sellers and is used by many assembly manufacturers as a substitute for the existing float type (tapered pipe type) flow meter.

Features

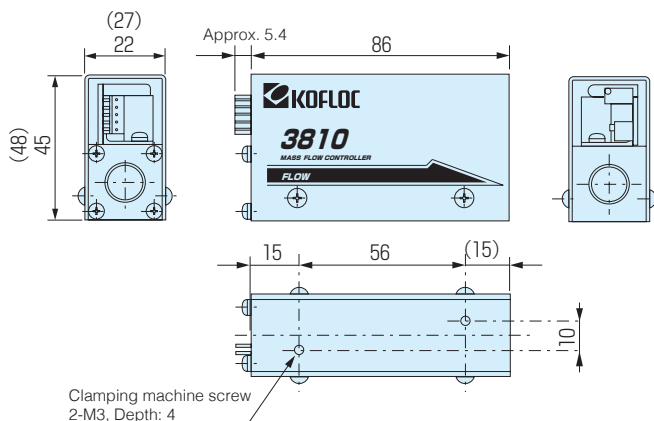
- A low-cost, still, full-fledged sensor based on a combination of the constant-current temperature difference detection type with the bypass capillary type
- A large cost reduction makes Model 3810S almost rival any existing float type flow meter in price.
- 0 to 5VDC analog flow outputs provide various applications such as measurements recording, control and alarm issuance.
- The sensor is mass flow type. The user needs no troublesome calculations for flow correction due to the effects of temperature and pressure.

Standard Specifications

Flow range (N ₂ equivalent, 20°C/1 atm)	10 SCCM-2 SLM (freely selectable)	3 SLM-50 SLM (freely selectable)
Sensor	Thermal mass flow sensor	
Accuracy	±2% F.S. (25°C)	±5% F.S. (25°C)
Temperature coefficient	±0.15 F.S./°C (15-35°C)	±0.2 F.S./°C (15-35°C)
Repeatability	±0.5% F.S.	
Proof pressure	980 kPa (G)	
Allowable ambient temperature	5-45°C	
Allowable ambient humidity	10-90% (No condensation allowed)	
Materials of parts in contact with gases	Body: SUS303, PTFE	
	Sealing: FKM (option: CR or NBR)	
Electric connection	171826-5 (made by AMP)	
Flow output signal	0-5 VDC (External load resistance: 250 kΩ or more)	
Power supply	±15 VDC ±5%, 60 mA	
Joint (Main unit bore)	Rc1/4	
Weight	Approx. 250 g	Approx. 350 g

Dimensions

Note
Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.



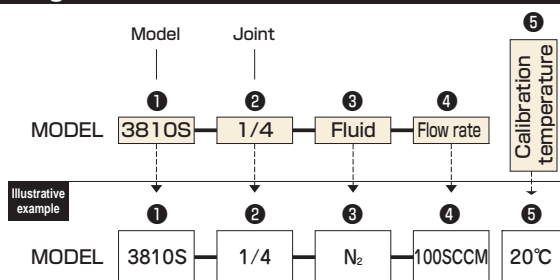
Cable Connections

No.1	Power source +15VDC
No.2	Power source COM
No.3	Power source -15VDC
No.4	Flow output 0-5VDC
No.5	Flow output COM

Note: The Series 3810 pin assignment has been modified from March 2000, and is not compatible with the old model. Please check the following:

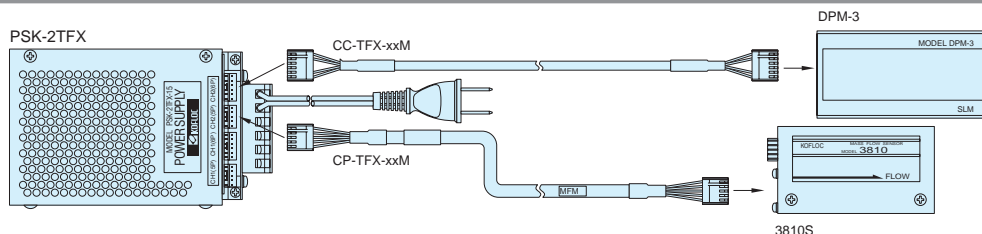
AMP171826-5 on the Connector 3810 side
AMP171822-5 on the cable side

Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

Example of Wiring



Low-cost Digital Mass Flow Meter

MODEL D3810 SERIES

The Model D3810 is a completely renovated digital mass flow meter designed on the basic structure of existing KOFLOC Model 3810. Incorporating a CPU inside and is equipped with an innovative sensor, a single unit of this new model covers a broad range of flows from very small to large.

Features

- An economical but high-precision sensor that uses the bypass capillary method
- Digital control allows the user to handle a broad range of flows (100 cc to 50 L).
- Compact design (overall size is one size smaller than the Model 3810)

Standard Specifications

Flow range (N ₂ equivalent, 20°C/1 atm)	50 SLM
Sensor	Thermal mass flow sensor
Response	7 sec. or less
Accuracy	≥25 SLM ±2% RD < 25 SLM ±3% F.S. (20°C)
Repeatability	±0.5% F.S.
Proof pressure	980 kPa (G)
Allowable ambient temperature	5–45°C
Allowable ambient humidity	10–90% (No condensation allowed)
Materials of parts in contact with gases	Body: SUS303, PTFE Sealing: FKM (option: CR or NBR)
Electric connection	171826-5 (made by AMP)
Flow rate output signals	0–5 VDC (Allowable external load resistance: 250 kΩ or more)
Required power supply	±15 VDC ±5%, 60 mA
Joint (Main unit bore)	Rc 1/4
Weight	Approx. 500 g

Note

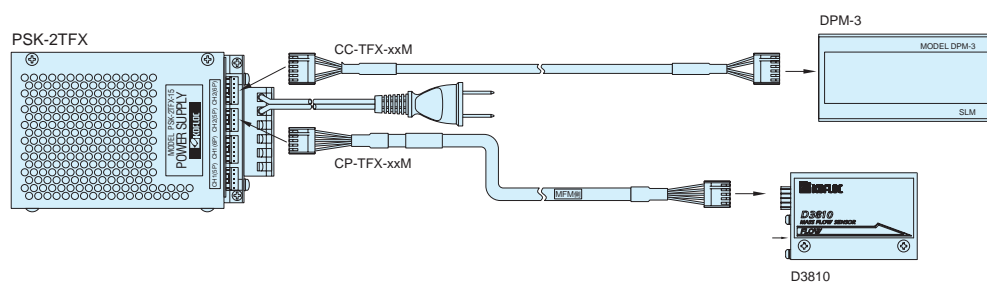
Specifications relating to the flow range (e.g., flow range, accuracy and response) are expressed in N₂ or air equivalent. The product will be built with the primary pressure of 300 kPa or less and the secondary side open to the atmosphere. For details on the pressure requirements, please contact us.

Cable Connections

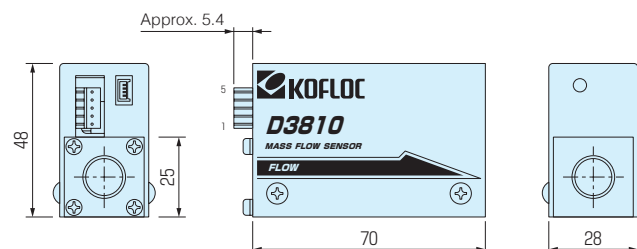
No.1	Power source +15VDC
No.2	Power source COM
No.3	Power source -15VDC
No.4	Flow output 0-5VDC
No.5	Flow output COM

AMP171826-5 on the Connector 3810 side
AMP171822-5 on the cable side

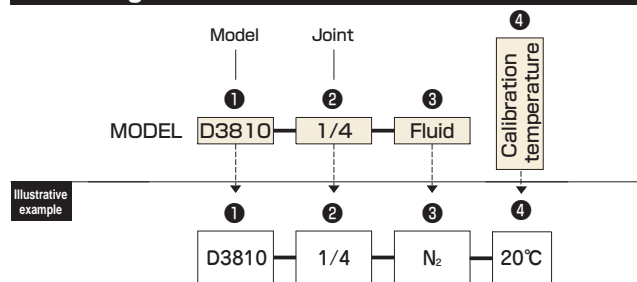
Example of Wiring



Dimensions



Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

Small Karman Vortex Flow Meter for Liquids

FM0101/0102/0103/0105 SERIES



KOFLOC's Karman Vortex Flow Meter FM Series provides an ideal tool for measuring and monitoring liquid flows, including cooling water and cleaning water. Since PPS resin is used for body material, all models of the series offer superior reliability and durability.

Features

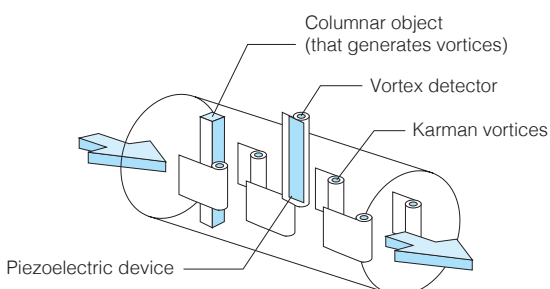
- Simple design that minimizes a dead space
- Measurements of very small flows available (up to 0.5 L/min)
- Use of PPS resin has achieved a small, lightweight and rigid.
- The sensor can be used for pure water or deionized water and chemicals (the sensor is acid-/alkali-resistant).
- These models are in the process of application for CE Marking.

Standard Specifications

Model	FM0101	FM0102	FM0103	FM0105
Dimension (a)	17.8	17.5	17.5	32.5
Dimension (L)	80.6	80.0	80.0	110.0
Connection (X)	R3/8	R1/2	R1/2	25A
Flow range	0.5-4 L/min	2-16 L/min	4-40 L/min	10-150 L/min
Fluids for measurement	Cooling water, cleaning water, etc.			
Measuring accuracy	Within $\pm 3.0\%$ FS			
Repeatability	Within $\pm 0.5\%$ FS			
Outputs	S Type: 4-20mA			
	P Type: Pulse (Open collector) (For w/o indicator only)			
	D Type: With indicator			
Supply voltage	12-24VDC			
Liquid temperature range	0-70°C			
Proof pressure	1MPa			
Amb. temperature range	0-50°C			
Amb. humidity range	5-90%RH			
Applicable cleanliness/ waterproofing standards	IP64 (Splashproof construction per JIS C 0920)			
Material for wetted part	PPS with 30% glass mixture		PPS w/o glass mixture	
Cable length	W/o indicator: 2 meters long; terminated/pretinned (presoldered)			
	With indicator: 3 meters long; terminated/pretinned (presoldered)			
Weight	W/o indicator: 85 g (Sensor unit)		165 g (Sensor unit)	
	With indicator: 100 g (Sensor unit)		205 g (Sensor unit)	

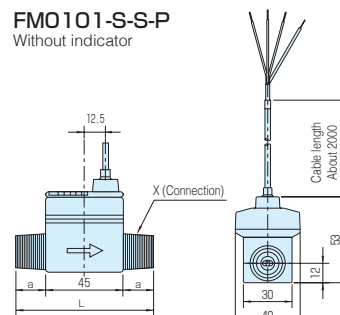
Principle of Measurement

When a columnar object (object that generates vortices) is placed in the flow path of a fluid, regular channels of vortices, called Karman vortex channels, are generated at the back of the object. Since the frequency of a vortex generated is linearly proportional to the flow velocity within a given range, the flow amount can be measured by counting the number of vortices. These series models make use of this principle. When the frequency of each vortex generated is detected by the incorporated vortex detector (piezoelectric device), the signal processing circuit outputs a signal which is linearly proportional to volume flow.

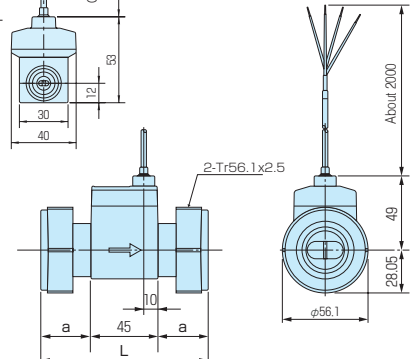


Dimensions

FM0101-S-S-P
Without indicator



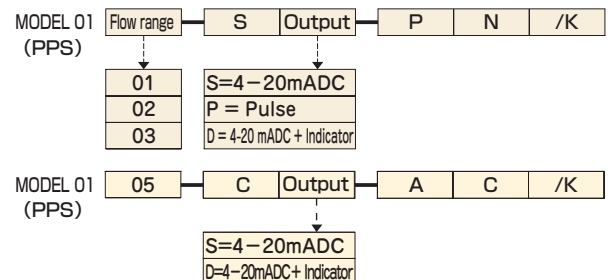
FM0105-S-S-P
Without indicator



CAUTION:
DO NOT load excessive clamping torque on the sensor unit and setscrews as they are made of plastics.

Note:
Tolerances for unspecified outside dimensions: ± 0.8
Tolerances for other unspecified dimensions: ± 0.4

Ordering



* Refer to "Ordering" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

Small Karman Vortex Flow Meter for Liquids MODEL31 (TEFLON®/PFA) SERIES

The Model31 Karman Vortex Flow Meter employs the following principle for measurement of flows:

When a columnar object (object that generates vortices) is placed in the flow path of a fluid, regular channels of vortices, called Karman vortex channels, are generated at the back of the object.

Since the frequency of a vortex generated is linearly proportional to the flow velocity within a given range, the flow amount can be measured by counting the number of vortices.

When the frequency of each vortex generated is detected by the incorporated vortex detector (piezoelectric device), the signal processing circuit outputs a signal which is linearly proportional to volume flow.

Features

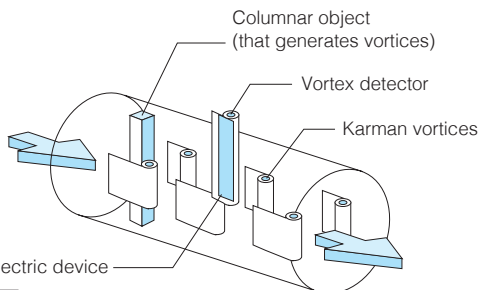
- Because of no moving part, the meter has superior reliability and durability and no error in mounting position is produced.
- Simple construction (its flow path of fluid contains a columnar object and a vortex detector only) ensures low pressure loss and low liquid leak. In addition, the detector does not get into contact with the fluid running through the path, therefore, it is ideal for process monitoring of various liquids.
- Two types of particle-free body materials (PPS and PFA) are available for choice according to your needs.
- Global specifications (Certification for CE Marking already acquired)
- Since Teflon is the material for the entire wetted part and no O-ring is in use, the Model31 Series Karman Vortex Flow Meter is optimum for monitoring liquid flows in the manufacturing process of semiconductors.

Standard Specifications

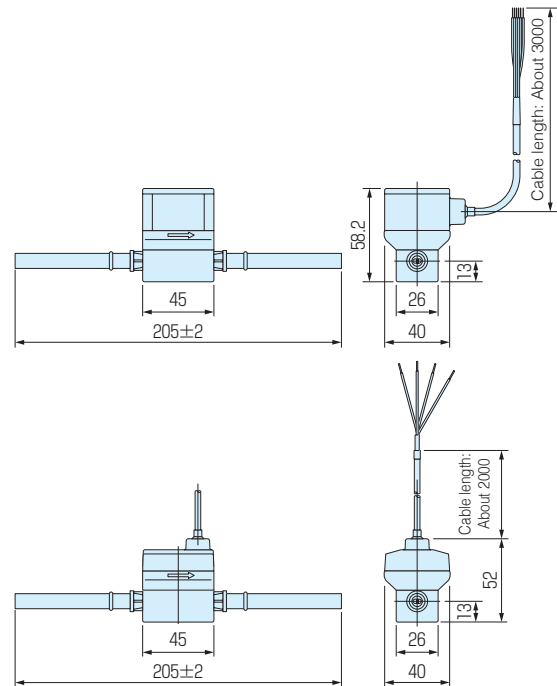
Item	FM3101	FM3102	FM3103	FM3104
Flow range (L/min)	0.4-4	2-20	5-50	10-100
Connection	3/8" Pipe end	1/2" Pipe end	3/4" Pipe end	1" Pipe end
Fluids for measurement	Ultrapure water, chemicals, and other liquids			
Measuring accuracy	±3.0%+ 1 digit			
Repeatability	Within ±0.5% F.S.			
Liquid temperature range	0-90°C (No bedewing, no boiling)			
Amb. temperature range	0-50°C			
Outputs	With indicator	LED display in 3 digits		
		Current output: 4-20 mA (linear)		
Outputs		Alarm output: Open collector (2 LEDs; 80 mA, 30 VDC max.)		
	W/o indicator	Current output: 4-20 mA (linear)		
Outputs		Pulse output: Open collector (10 mA, 30 VDC max.)		
Supply voltage	12-24VDC			
Materials	Body	All Teflon® (PFA), without O-rings		
	Cover	Polybutylene terephthalate (PBT) resin		
	Cable	2 meters long; Conductor: Tinned bare annealed copper wire; Sheath: Heat-/cold-resistant polyvinyl chloride (POC)		

Principle of Measurement

When a columnar object (object that generates vortices) is placed in the flow path of a fluid, regular channels of vortices, called Karman vortex channels, are generated at the back of the object. Since the frequency of a vortex generated is linearly proportional to the flow velocity within a given range, the flow amount can be measured by counting the number of vortices. The Model31 Series Karman Vortex Flow Meter makes use of this principle. When the frequency of each vortex generated is detected by the incorporated vortex detector (piezoelectric device), the signal processing circuit outputs a signal which is linearly proportional to volume flow.



Dimensions



Ordering

The ModelFM31 (PFA)	Flow range	P	Output	X	P	/K
	01	S=4-20mADC P = Pulse D = 4-20 mADC + Indicator				
	02					
	03					
	04					

* Refer to "Ordering" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

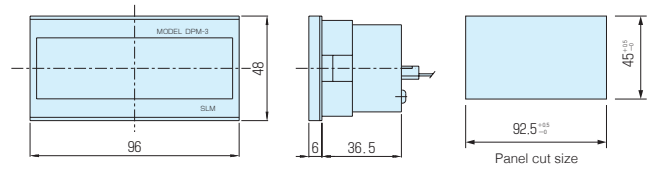
Flow Indicators

MODEL DPM-3

A dedicated flow indicator for mass flow controller/meter. Either 3-1/2-digit direct reading (standard spec.) or 1000 F.S. display is possible.



Dimensions



* DIN48x24 type indicator is also available on customer request.

Specifications

Display	3-1/2-digit 7-segment LED, direct reading
Power supply	+5 VDC
Mount type	Panel mount

Flow Setting Device

MODEL CK SERIES

These dial type devices generate 0 to 5-volt flow signals for mass flow controllers. Each dial scale has graduations from 000 to 999 to allow the user to set flow values in relation to the full scale. The series include two types, CK-1A and CK-2A according to the dial shape.

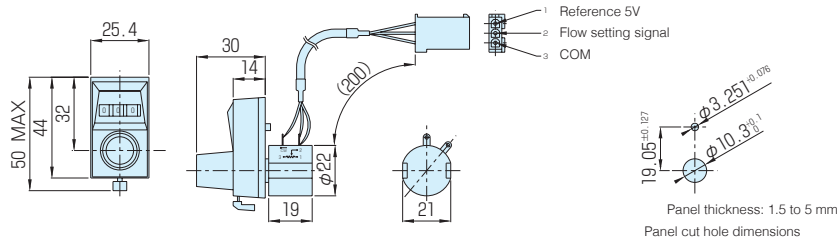


CK-1A

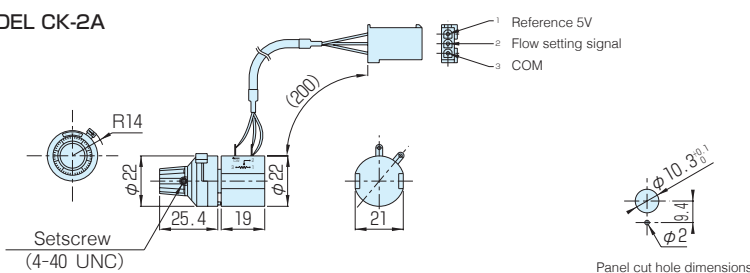
CK-2A

Dimensions

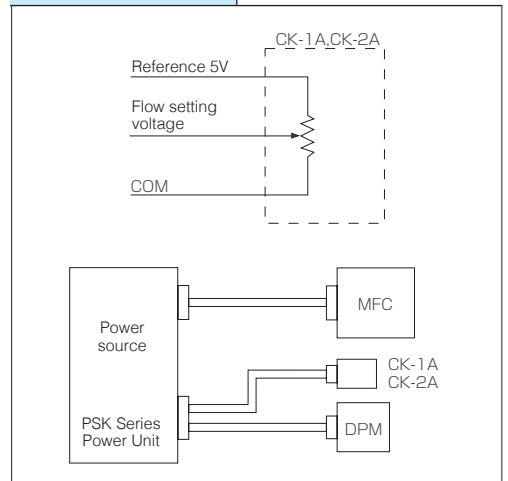
MODEL CK-1A



MODEL CK-2A



Input	5V
Output	5-volt full scale is divided
Resistance	10kΩ (Standard)
Setting accuracy	0.1% full scale
Applicable controller types	All mass flow controllers



Compact Readout Unit MODEL CR-400

The CR-400 readout unit, when connected to your mass flow controller or meter with a cable, provides the key mass flow functions, such as flow measurement and control as well as cumulative flow calculations and flow event outputs. This readout unit offers RS-485 communications capability, so multiple readout units can be controlled online by a host computer. * The CR-400 is fully compatible in size with the CR-300.

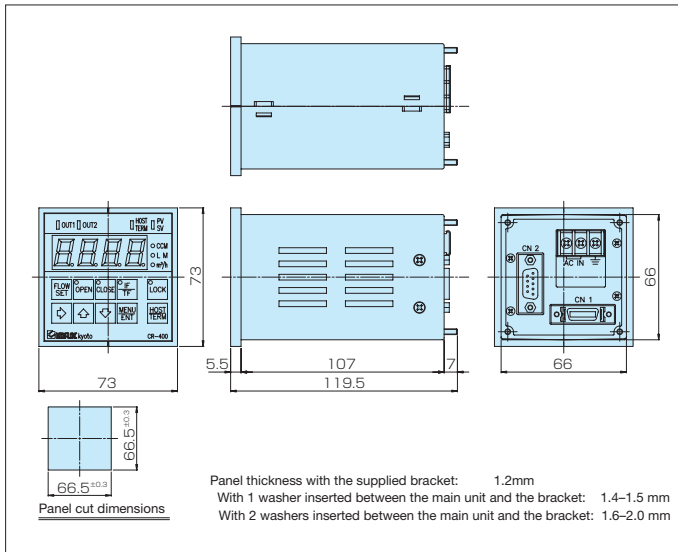


Features

- Total flow is displayed in 8 digits: The upper 4 digits and the lower 4 digits are shown alternately.
- Various event outputs are available.
- With a width of 73 mm and height of 73 mm, it takes up little space.
- Equipped with forced open/close operation of mass flow controller valve.
- External control terminals are provided on the rear for remote control.
- Mass flow control by RS-485 communications
- A lock key prevents accidental operation.
- Mass flow power: ± 15 VDC (300 mA)
- Driving power supply is 85–264 VAC and 48–440 Hz.



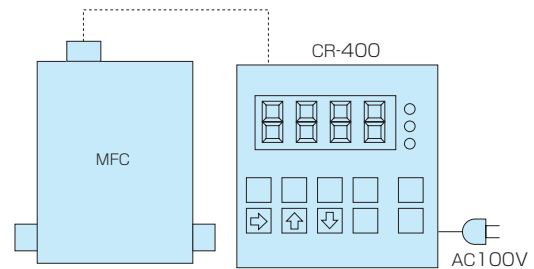
Dimensions



Standard Specifications

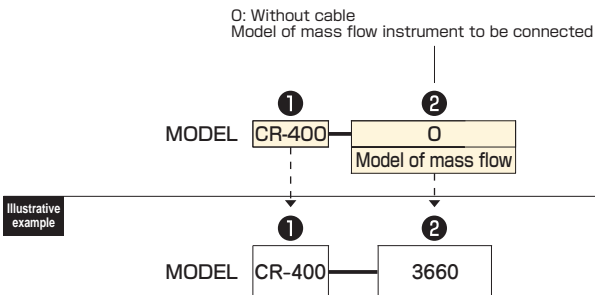
Mass flow control	Flow setting, forced valve open/close operation and zero cut
Mass flow input/output	0–5 VDC
Mass flow power	± 15 VDC (300 mA)
Number of display digits	Instantaneous flow: 4 digits, total flow: 8 digits (upper and lower 4 digits shown alternately)
Display accuracy	Instantaneous flow: Within $\pm 0.1\%$ F.S. ± 1 digit
External control	Rear input terminal: Analog signal and RS-485 (half-duplex)
Event output	2 outputs (selected from instantaneous upper limit, instantaneous lower limit, instantaneous upper/lower limits, and set total) Open collector output (max. rating: 50 V, 50 mA)
Power consumption	Approx. 25 W
AC power supply	85–264 VAC, 48–440 Hz
Weight and dimensions	Approx. 400 g, 73 W \times 73 H \times 119.5 D mm

Example of Use with Readout Unit CR-400



Ordering

Specify the model No. below when ordering the readout unit only.



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.

△Note

If the readout unit is connected to a previous model of mass flow instrument, the unit may not work properly or not provide particular functions. When using the readout unit with our mass flow instruments not shown in this catalog or those made by other companies, please contact us.

MODEL PSK-FB SERIES



PSK-1FB



PSK-3FB



PSK-6FB

These DC power units can be commonly used for mass flow controller and meters. The 1FB, 3FB and 6FB types can supply power to 1, 3 and 6 lines (units) of mass flow controllers/meters, respectively. A Dsub connector allows quick connection to the unit to which power is to be supplied without time-consuming wiring job, also making signal exchange easier.

Type	PSK-1FB	PSK-3FB	SK-6FB
Application (Power supply for)	1 unit	3 units	6 units
Input voltage (frequency)	85-132VAC (47-66Hz)		
Power consumption	22 W max.	70 W max.	140 W max.
Fuse	125V-0.8A	125V-3.15A	125V-6.3A
Power Output	Power source	±15VDC (±5%)	
	For setting flow values	+5VDC (±1%)	
	For external indicators	+5VDC (±5%), +15VDC (±5%)	
Flow I/O signals	0+5 VDC (15 VDC max.)		
Set point output signals	0+5VDC		
Working temperature range	0-40°C		
Working environment (humidity range)	0-90%RH (No condensation)		
AC Power supply	85-132VAC (47-66Hz)		
Weight	Approx. 0.8 kg	Approx. 1.3 kg	Approx. 1.7 kg

Dimensions

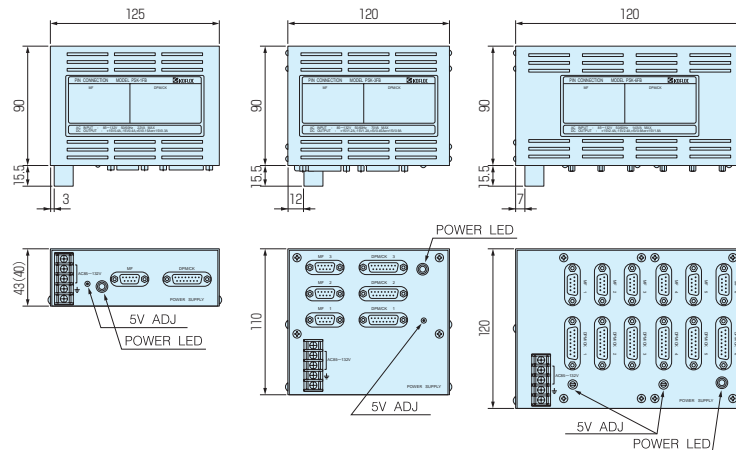
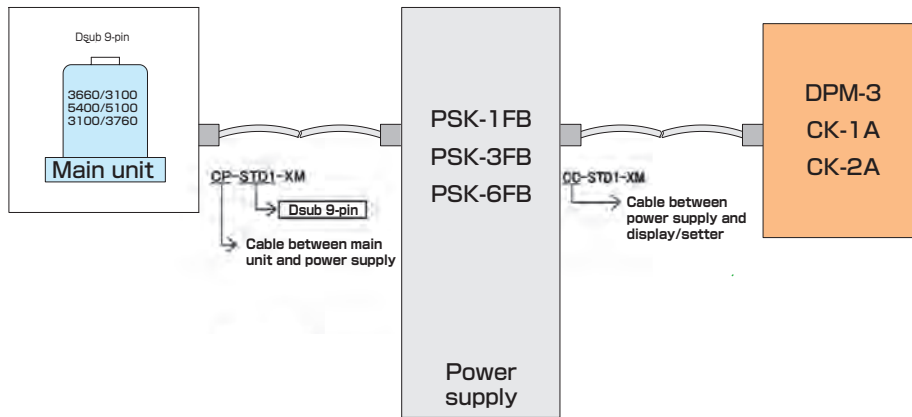


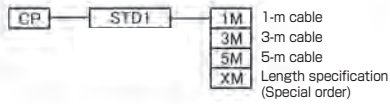
TABLE OF COMPATIBILITY - CABLES AND ACCESSORIES FOR KOFLOC MASS FLOW METERS/CONTROLLERS

Example of use of accessories

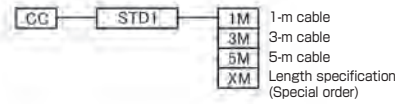
(1) When standard power supply is used



Ordering (Power supply-display/setter)



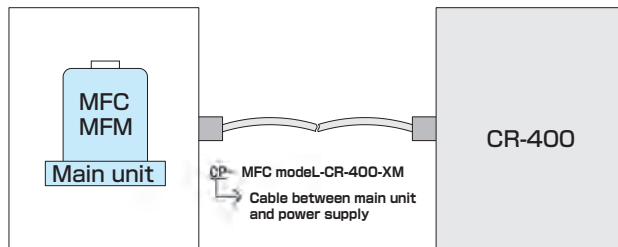
Ordering (Power supply-Indicator/Setter)



Example: When placing an order for the 5-m cable for connection between 5400 and PSK-1FB
CP-STD1-5M

Example: When placing an order for the 3-m cable for connection between PSK-1FB and DPM3/CK-1A
CC-STD1-3M

(2) When CR-400 is used



Ordering



Compact Handy Mass Flow Control/Measurement Unit

FLOW COMPO®

This is a compact handy flow control/measuring unit made by combining a compact DIN72 x72 power indicator [CR-300] and MFC/MFM.

Features

- Compact, lightweight integral unit
- The touch panel type permits easy FS scaling, flow setting, and valve opening/closing.
- Free selection of joints ranging from one-touch type to Swage-loc
- The MFC-equipped type (FCC Series) can be used as MFM by pressing the OPEN switch.
- Please contact us for the metal seal specifications for corrosive gas.

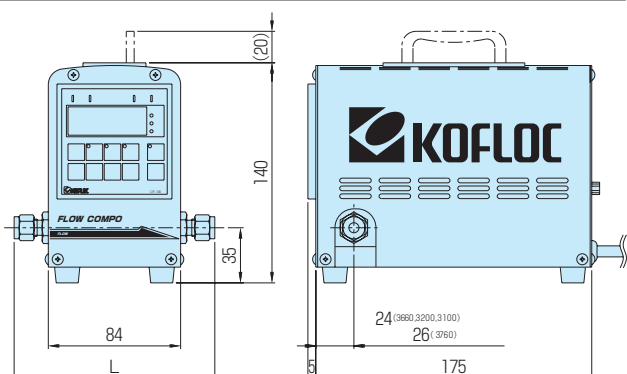


Standard Specifications

MODEL	FCC-3000-G1	FCC-3000-G2	FCM-3000-G1	FCM-3000-G2
Mounting MFC/MFM	3660 (MFC)	3200 (MFC)	3760 (MFM)	3100 (MFM)
Standard flow range (at N ₂ calibration condition)	10SCCM-20SLM	1SCCM-20SLM	10SCCM-20SLM	1SCCM-20SLM
Sealing material	FKM (option CR or NBR)			
Response	Within 2 sec. (F.S. ±2%)	Within 1 sec. (F.S. ±2%)	Within 2 sec.	Within 1 sec.
Joint	Various joints are applicable.			

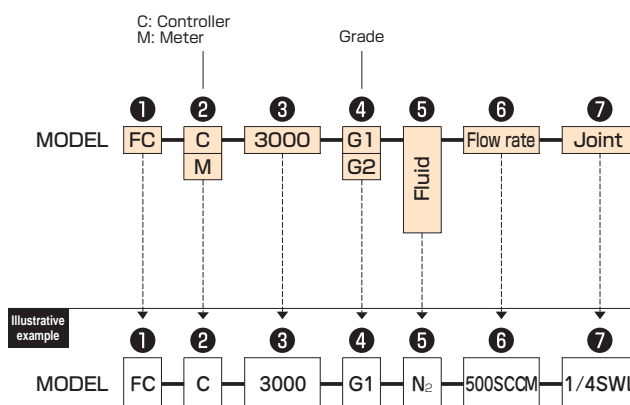
* For details of the specifications, refer to the mounting MFC/MFM and CR-400.

Dimensions



* For L, refer to the face-to-face distance of the joint of respective mounting MFC/MFM. Note: "FLOW COMPO" is a trademark of our company.

Ordering



* Refer to "Ordering" and "Illustrative example" when placing an order or requesting a quotation. Fill in the blanks in the "Order/Quotation Request Card" at the end of the catalog, and send the card by fax.