




Mass Flow Meters / Mass Flow Controllers

Selection Guide

*Presenting
the world's most advanced
mass flow measurement devices,
for use in applications
from the gas supply source
to the end of the pipe.*

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INTRODUCING MASS FLOWMETERS

Thermal gas mass flow measurement using a MEMS (micro electromechanical systems) flow sensor helps users improve quality and save energy.

Features of the sensor



High speed 2 ms response



Very low age deterioration
High repeatability



Wide 300 : 1 range



Mass flow measurement without the need to compensate for changes in temperature and pressure

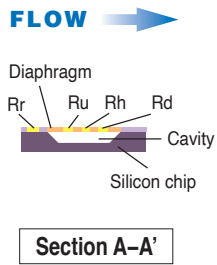
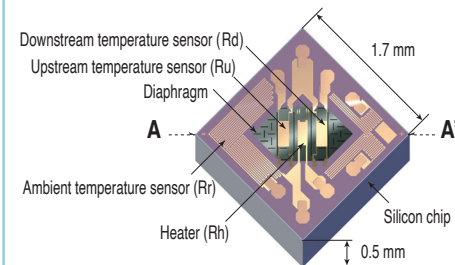


Symmetric structure measures reverse flow as well.



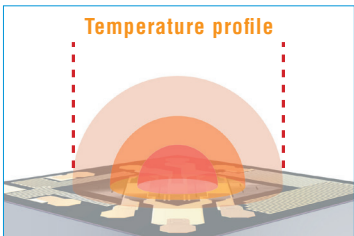
Proven reliability in 4.5 Million actual applications

Sensor structure

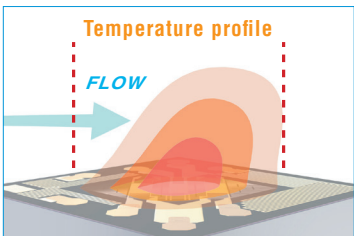


- Ultra-miniature structure (1.7 mm square x 0.5 mm thick)
- High resolution (1 mm/s)
- High speed response, unaffected by changes in pressure and temperature

Measurement principle



No gas flow

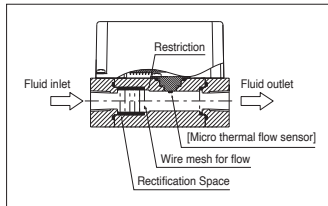


When gas is flowing

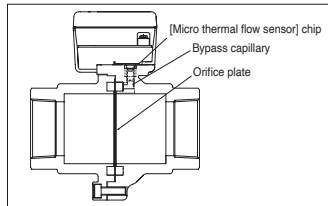
When there is no gas flow, the temperature distribution around the heater is symmetric. When gas starts to flow, the temperature upstream of the heater begins to decrease, while the temperature downstream increases, causing a distortion of the symmetric temperature distribution. This temperature difference causes a difference in resistance in a temperature sensor (a thin platinum film), and is used to calculate the mass flow rate (flow rate x density).

Examples of product structure

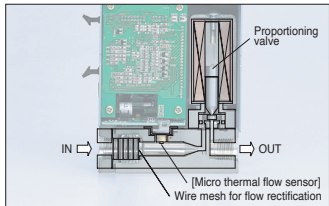
Model CMS___ section drawing



Model CMG___ section drawing



Model MQV___ section drawing



Advantages

- Sensor is located on the pipe wall.
- No need for a straight pipe section with low pressure loss (models with built-in flow rectifier)
- Wide measurement range

Points to keep in mind

- Corrosive gases cannot be measured
- Low tolerance for foreign matter deposition (filter installation required)

Mass flowmeter / Gas flowmeter

Model No.	Appearance	Major applications	Pipe size (B)	Flow rate range	Air	Nitrogen	Oxygen	Argon	Carbon dioxide	City gas	Methane	Propane	Butane	Hydrogen	Helium
Model CMS___		Industrial gas management by department; experimentation and research	$\frac{1}{4}$ $\frac{1}{2}$	0.5 L/min to 2000 L/min	■	■	■	■	■	■	■	■	■	■	■
Model CMG___		Unit consumption management for burner air-fuel ratio	$\frac{1}{2}$ 1 $1\frac{1}{2}$ 2	4 m³/h to 150 m³/h	■					■	■	■	■		
Model MVF___		Energy conservation management	$\frac{2}{3}$ $\frac{4}{6}$	2302 m³/h to 16839 m³/h	■	■	■	■	■	■	■	■	■		
Model MCS___		Chip pickup detection	$\frac{1}{8}$	-0.5 to + 0.5 L/min 0 to 0.5 L/min -3 to + 3 L/min 0 to 3 L/min	■	■									

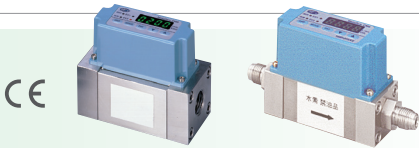
Mass flow controller / Gas flow rate control

Model F4H___		PVD, DLC, Plasma system, analyzer	$\frac{1}{4}$	50 mL/min to 20 L/min	■	■	■	■	■					■	■
Model MQV___		Tooling burner air-fuel ratio control, and fuel battery evaluation equipment	$\frac{1}{4}$ $\frac{1}{2}$	5 mL/min to 500 L/min	■	■	■	■	■	■	■	■	■	■	■
Model F4Q___		Burner air-fuel ratio control Atmosphere control in the furnace Culture apparatus	$\frac{1}{4}$ $\frac{1}{2}$	200 mL/min to 500 L/min	■	■	■	■	■	■	■	■	■	■	■

Gas mass flowmeter

Model CMS

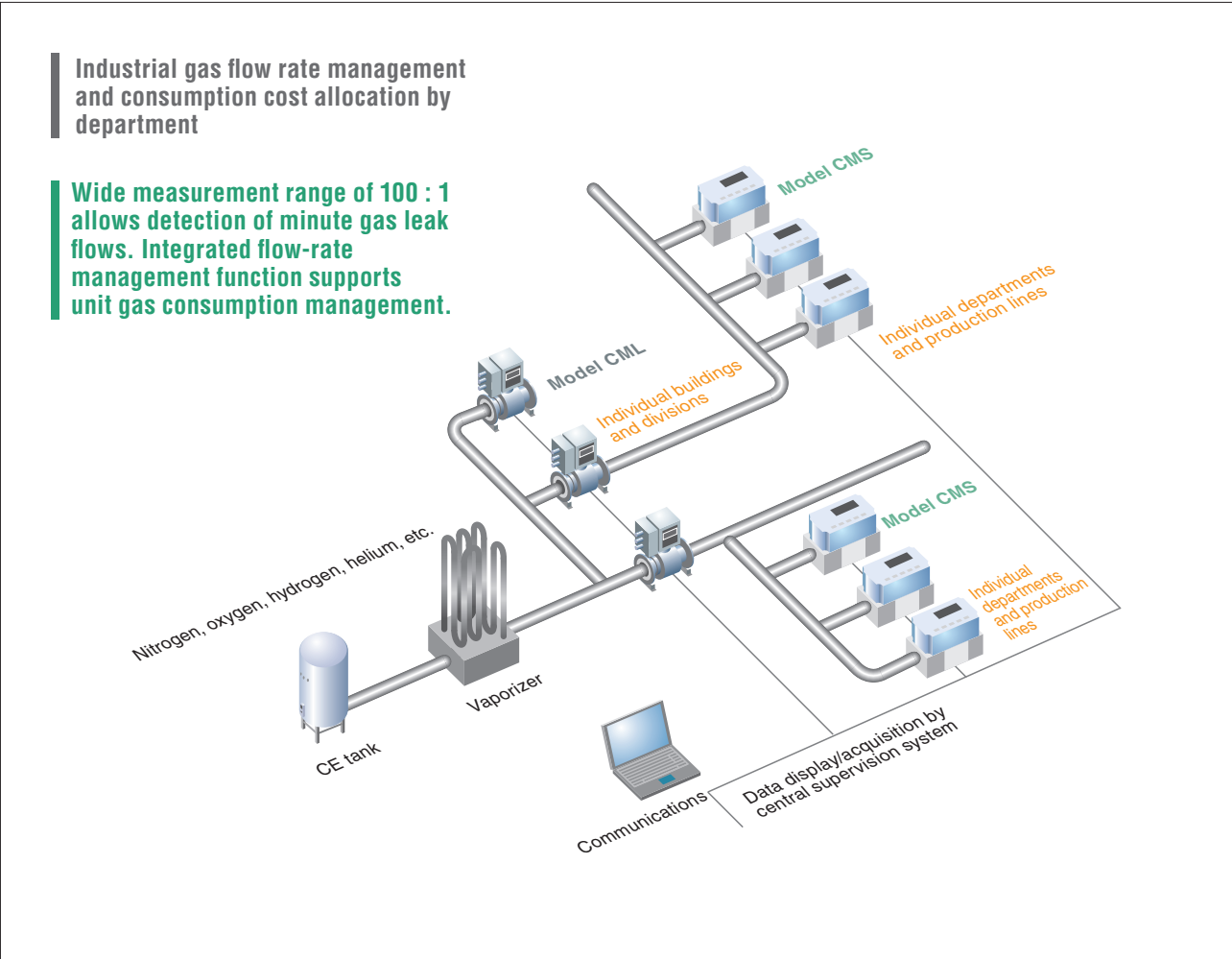
The ultimate compact mass flowmeter, with both high functionality and a 100 : 1 measurement range!



SUS / SUS316 model Hydrogen / helium model

Model	SUS / SUS316 model		Hydrogen / helium model	
Model No.	CMS _____ N		CMS _____ N	
Applicable gas	Air/nitrogen, oxygen, argon, carbon dioxide, city gas 13 A (45/46MJ), methane, propane, butane		Hydrogen, helium	
Flow rate range: L/min (standard)	0.5 / 2 / 5 / 20 / 50 (air)	200 / 500 (air)	10 / 50 / 200	500 / 1000 / 2000
Accuracy	± 3 % RD		± 5 % RD	
Measurement range	100 : 1			
Minimum flow rate	500 : 1			
Operating pressure	- 0.07 to + 1 MPa			
Operating temperature	- 10 to + 60 °C			
Output	0-5 V / 1-5 V / 4-20 mA output, selectable using keys on the CMS body			
Communications	RS-485 (optional for SUS316, hydrogen and helium models)			
Power supply	12 to 24 V dc			
Pipe size / connection standard	Rc 1/4, Swl, VCR	Rc 1/2, Swl, VCR	Rc 1/4, Swl, VCR	Rc 1/2, Swl, VCR
Straight pipe length	Not required if pipe size is uniform.			
Material	Gas-contacting parts: SUS304 or SUS316, fluororubber		Gas-contacting parts: SUS316L, fluororubber	
Weight	800 g	1400 g (2000 g for 500 L type)	800 g	1400 g (2000 g for 2000 L type)

Application example



Gas flow monitor

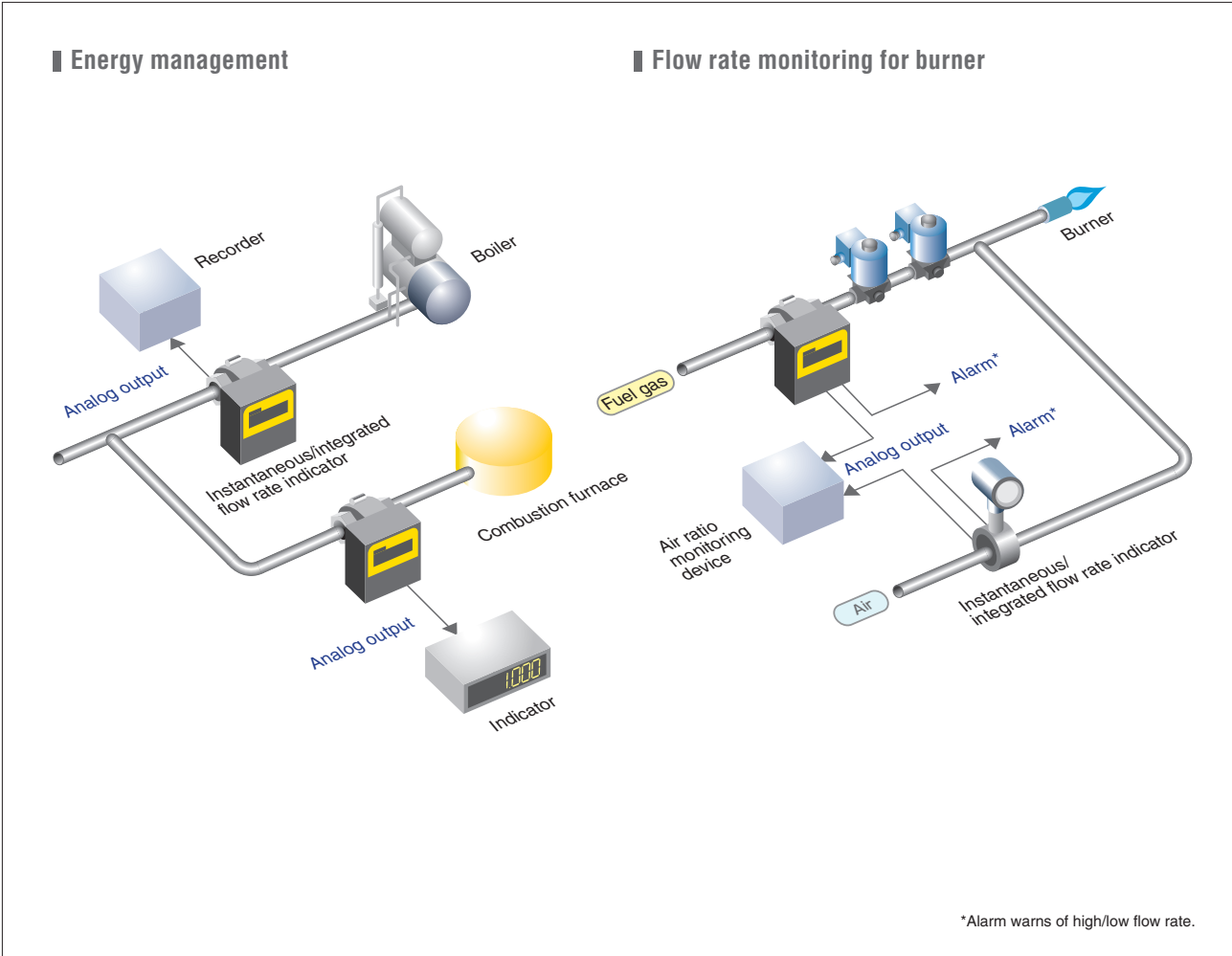
Model CMG

Flowmeters that provide optimal control of burner air/fuel ratio or unit consumption management



Model	Air model	City gas model		Propane model	Butane model
Model No.	CMG ___ A	CMG ___ G		CMG ___ P	CMG ___ B
Applicable gas	Air	City gas 13 A		Propane	Butane
Flow rate range : m ³ /h (normal)	4 / 10 / 30 / 80 / 150	4 / 10 / 30 / 80 / 150	80 / 150	2 / 4 / 10 / 25 / 50	1 / 3 / 8 / 20 / 40
Accuracy	± 4 % RD			± 6 % RD	
Measurement range	10 : 1				
Minimum flow rate	30 : 1				
Operating pressure	0 to 100 kPa	0 to 100 kPa	0 to 990 kPa	0 to 100 kPa	0 to 100 kPa
Operating temperature	- 10 to + 60 °C				
Output	1-5 V / 4-20 mA, selectable by model number				
Power supply	24 V dc / 100 V ac / 200 V ac / 220 V ac, selectable by model number				
Pipe size	15 A / 25 A / 40 A / 50 A		40 A / 50 A	15 A / 25 A / 40 A / 50 A	
Connection type	Rc thread		JIS 10 k RF	Rc thread	
Straight pipe length	15 A and 25 A: not required. 40 A, 50 A: 10 cm to 40 cm				
Material	1/4B and 1B: die cast aluminum (ADC12) 1 1/2B and 2B: cast aluminum alloy (AC4A)		SCS13	1/4B and 1B: die cast aluminum (ADC12) 1 1/2B and 2B: cast aluminum alloy (AC4A)	
Protective structure	IP54 (Rating is based on JIS C 0920 and IEC60529. For purposes of installation indoors, device is waterproof and dustproof.)				
Weight	850 to 2000 g	850 to 2000 g	9 to 10 kg	850 to 2000 g	850 to 2000 g

Application example



*Alarm warns of high/low flow rate.

Vortex flowmeter

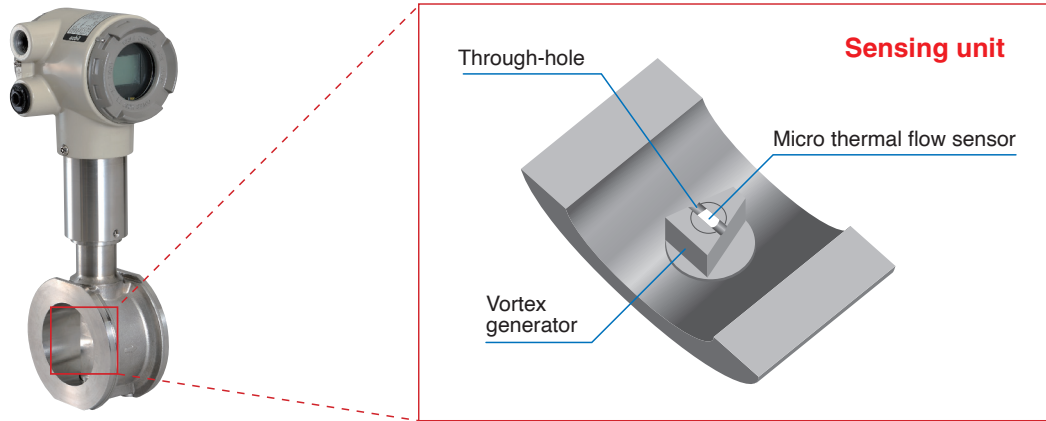
Model MVF

Wide 100:1 measurement range overturns common beliefs about vortex gas flowmeters. Temperature / pressure compensation functions are integrated.



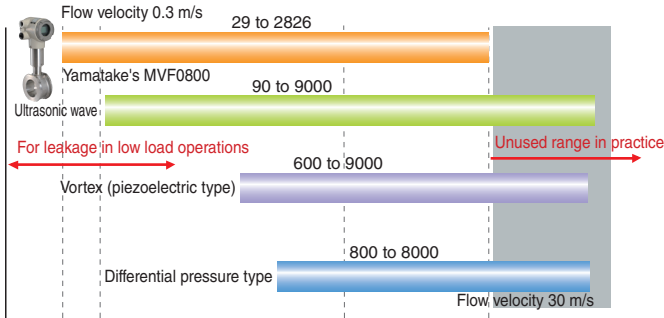
Model No.	MVF050	MVF080	MVF100	MVF150
Applicable gas	Air/nitrogen, oxygen, argon, carbon dioxide, city gas 13 A (45/46MJ), propane, butane, other inert gases.			
Flow rate range: m³/h (normal) at pressure of 0.5 MPa	1280	2826	4352	9364
Accuracy	Volumetric flow rate: ± 2 % RD. After temperature and pressure compensation: ± 3.5 % RD			
Measurement range	100 : 1			
Minimum flow rate (at a pressure of 0.5 MPa)	2.3 m³/h (normal)	5.2 m³/h (normal)	7.9 m³/h (normal)	17.1 m³/h (normal)
Operating pressure	0 to 1.0 MPa			
Operating temperature	- 15 to + 60 °C			
Output	4 – 20 mA and integrated pulse output			
Communications	RS-485			
Power supply	24 V dc			
Pipe size	2B (50 A)	3B (80 A)	4B (100 A)	6B (150 A)
Connection type	Wafer connection			
Straight pipe length	10D (at upstream elbow)			
Material	Gas contacting parts: SCS13A, SUS304 and fluororubber. Case: Aluminum alloy			
Protective structure	IP67 (Rating is based on JIS C 0920 and IEC60529. waterproof structure)			
Weight	6.3 kg	6.6 kg	9 kg	17 kg

Measurement principle



Downstream of a vortex generator situated in a gas flow, a vortex proportional to the flow velocity is generated. As shown in the figure, there is a hole in the vortex generator through which gas flows due to the action of the vortex. This flow is measured by a Micro thermal flow sensor capable of high-speed measurement of both direct and reverse flow. Consequently, vortex flowmeters can now achieve a 100:1 measurement range instead of the 15:1 range of the older piezoelectric vortex types. In addition, the integrated temperature and pressure sensors make the MVF indispensable for gas energy management. There is no need to install separate temperature/pressure compensation devices, contributing to total cost reduction.

Measurement ranges compared (for 80 A pipe size, 0.5 MPa)



Sample applications

Burner air-fuel ratio control, city gas and industrial gas energy management

Chip pickup detection mass flow sensor

Model MCS

5 ms ultra high-speed response. At only 9 g, compact and lightweight



Applicable gas	Air/nitrogen, oxygen				
Flow rate range: L/min (standard)	– 3 to + 3	0 to + 3	– 0.5 to + 0.5	0 to + 0.5	0 to + 10
Accuracy	± 5 % FS			± 6 % FS	±5 % FS
Response time	5 ms max. (95 % response to a step state flow rate change)				
Operating pressure	– 100 to + 200 kPa				
Operating temperature	0 to + 50 °C				
Output	1 – 5 V output (non-linear)				
Power supply	12 to 24 V dc				
Pipe size	M5 female (brass insertion)				
Straight pipe length	Not required				
Material	Gas contacting parts: PPS resin, ceramic and brass. Cover: PC (polycarbonate)				
Weight	9 g				

Multi-channel indicator for Model MCS

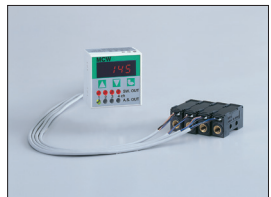
Model MCW

Supply power (DC 24 V) to Model MCS

Separate flow rate range can be set for each channel, with display and event output.



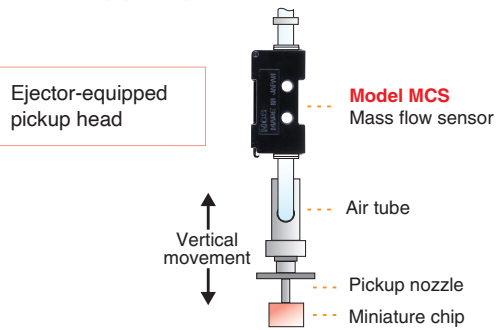
MCW100 1ch type



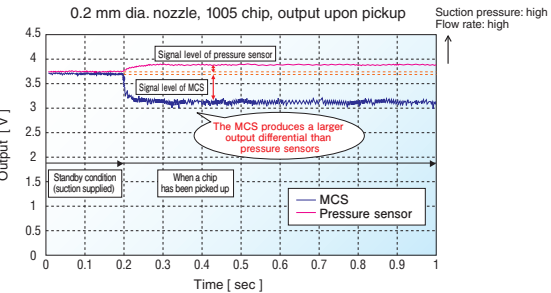
MCW400 4ch type

Application example

Installation example for miniature chip pickup detection

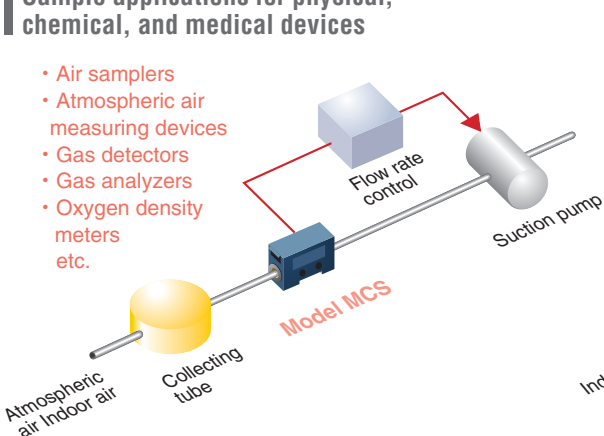


For detecting chip pickup, the MCS produces a larger output differential between chip and no-chip conditions than a standard pressure sensor.

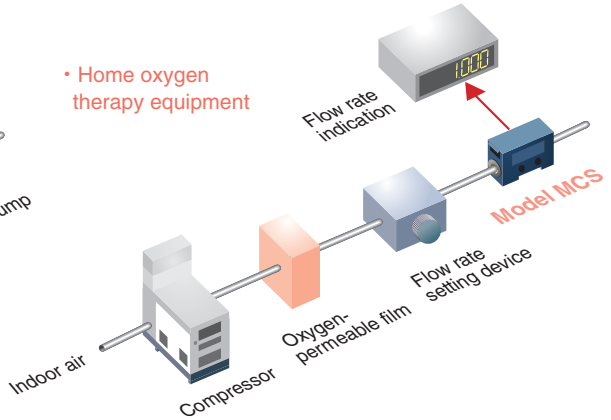


Sample applications for physical, chemical, and medical devices

- Air samplers
- Atmospheric air measuring devices
- Gas detectors
- Gas analyzers
- Oxygen density meters etc.



- Home oxygen therapy equipment



Model F4H

Saving space, Saving wiring, Saving cost



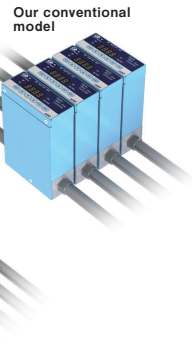
Model No.			F4H9050	F4H9200	F4H9500	F4H0002	F4H0005	F4H0020
Valve operation			Normally closed when de-energized (N.C.)					
Full-scale flow rate (air)			50.00 mL/min	200.0 mL/min	500.0 mL/min	2,000 L/min	5,000 L/min	20.00 L/min
Gas type			Air/nitrogen model: air/nitrogen, argon, carbon dioxide, hydrogen, and helium (switchable by setting) Oxygen model: oxygen, air/nitrogen, argon, carbon dioxide, hydrogen, and helium (switchable by setting)					
Control	Response (at standard differential pressure)		Time from zero flow rate setting until statically determinate $\pm 2\%$ FS: 0.3s (TYP.)					
	Accuracy		$\textcircled{1} \pm 2\%$ SP (50% FS < Q \leq 100% FS) $\textcircled{2} \pm 1\%$ FS (0% FS \leq Q \leq 50% FS)	$\textcircled{1} \pm 1\%$ SP (50% FS < Q \leq 100% FS) $\textcircled{2} \pm 0.5\%$ FS (0% FS \leq Q \leq 50% FS)				
Pressure	Operating differential pressure range	Ambient temperature: $-10 \leq t \leq 40^{\circ}\text{C}$	20 to 200 kPa	50 to 300 kPa	100 to 300 kPa	50 to 300 kPa	100 to 300 kPa	180 to 300 kPa
		Ambient temperature: $40 < t \leq 50^{\circ}\text{C}$	20 to 200 kPa	100 to 300 kPa	150 to 300 kPa	100 to 300 kPa	150 to 300 kPa	Usage prohibited
	Allowable inlet pressure		0.5 MPa (gauge) max.					
Temperature	Allowable operating temperature range		-10 to $+50^{\circ}\text{C}$					-10 to $+40^{\circ}\text{C}$
Analog input for flow rate setting			0 to 5 Vdc (factory setting), can be switched to 1 to 5 Vdc or 4 to 20 mAdc by host communication or PC loader					
Analog output for instantaneous flow rate			0 to 5 Vdc (factory setting), can be switched to 1 to 5 Vdc or 4 to 20 mAdc by host communication or PC loader					
Communications			CPL communication, Modbus RTU (select either by model number when ordering)					
Power			24 Vdc, current consumption: 300 mA max.					
Material of gas-contacting parts			Standard gas or oxygen model: SUS316, fluorocarbon resin, fluororubber					
Standards compliance			EN 61326-1:2013, EN61326-2-3:2013 S-Mark					
Weight			Approx. 700 g (excluding fitting)					

Advantages

Compact design saves space

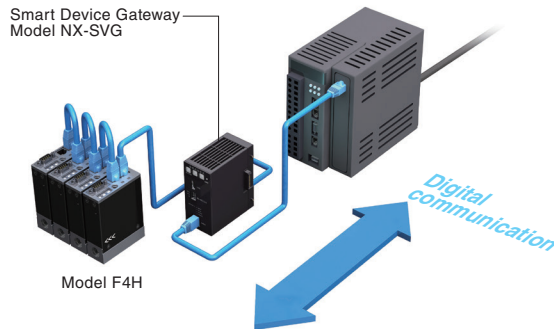
With a width of 28 mm, the products slim design allows closer spacing of pipes, saving more space.

Less space is needed for pipes.



All models have communication functions

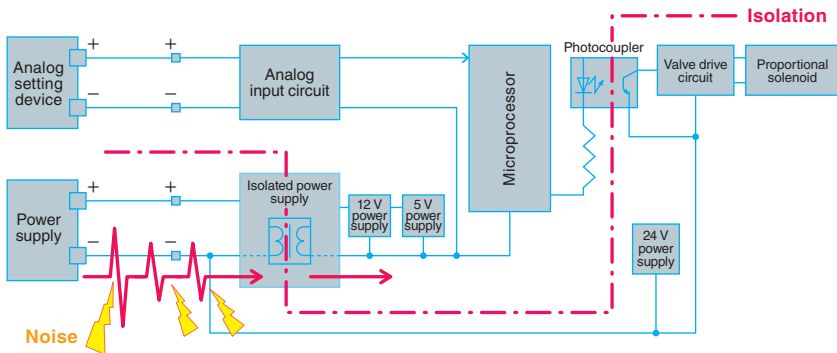
The large amount of data stored in the digital mass flow controller can be uploaded using the communication functions. This feature can be used not only to diagnose the mass flow controller, but also to diagnose the system that is using the mass flow controller.



High noise tolerance

Isolation of the power supply from the signal circuit

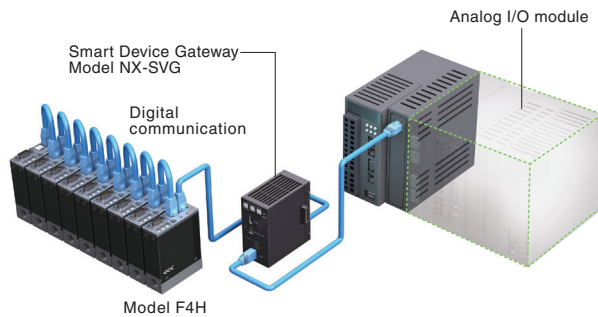
By isolating the valve drive circuit from other circuits, power supply circuit and analog circuit isolation (patent No. 5132617) is achieved, even with a small-capacity isolated power supply. Thanks to this feature, noise from power wiring has no effect on signals.



Reduction in overall cost

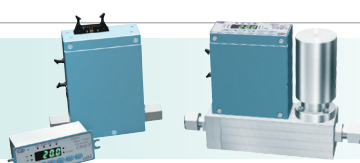
By switching from an analog to a digital connection with the PLC, the analog I/O module can be eliminated.

The analog I/O module can be eliminated!



Model MQV

Achieved high-speed response of 300 ms and low differential pressure control



Standard gas model

Model No.	MQV9005 / 9200	MQV9200 / 9500 / 0002 / 0005 / 0020 / 0050 (B,C)	MQV0100	MQV0050 (J,K) / 0200 / 0500
Full-scale flow rate (air)	5.00, 20.0 mL/min	200 mL/min 0.500, 2.00, 5.00, 20.0, 50.0 L/min	100.0 L/min	50.0, 200, 500 L/min
Control	Settling time 0.5 s for SP $\pm 2\%$ FS (typ.)			
	Accuracy $\pm 1\%$ FS			
Input / Output	0-5 V dc / 1-5 V dc / 0-20 mA dc / 4-20 mA dc (selectable)			
Communications	(1) Dedicated PC loader connection (2) RS-485 communications (3-wire system)			
Power supply	24 V dc			
Standard compliance	EN61326-1, EN61326-2-3			
Weight	Approx. 1.1 kg	Approx. 1.2 kg	Approx. 3.5 kg	

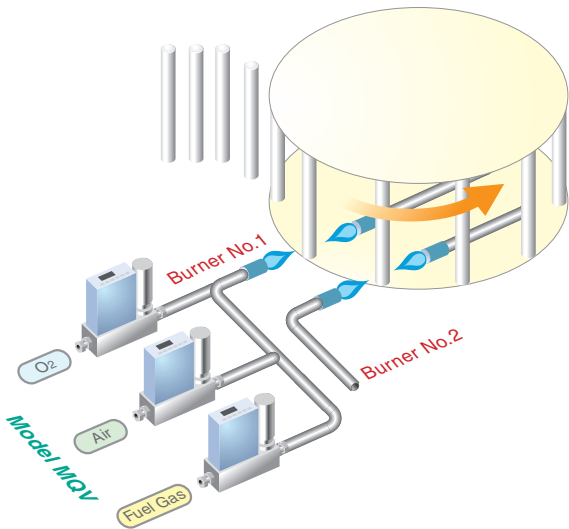
Hydrogen / Helium gas model

Model No.	MQV9020	MQV9050	MQV9500 / 0005 / 0010 / 0050 / 0200
Full-scale flow rate (air)	20.0 mL/min	50.0 mL/min	0.500, 5.00, 10.0, 50.0, 200 L/min
Control	Settling time 0.5 s for SP $\pm 2\%$ FS (typ.)		
	Accuracy $\pm 1\%$ FS (50 % FS < Q \leq 100 % FS) $\pm 0.5\%$ FS (0 % FS \leq Q \leq 50 % FS) $\pm 1\%$ FS		
Input / Output	0-5 V dc / 1-5 V dc / 0-20 mA dc / 4-20 mA dc (selectable)		
Communications	(1) Dedicated PC loader connection (2) RS-485 communications (3-wire system)		
Power supply	24 V dc		
Standard compliance	EN61326-1, EN61326-2-3		
Weight	Approx. 1.1 kg	Approx. 1.2 kg	

Application example

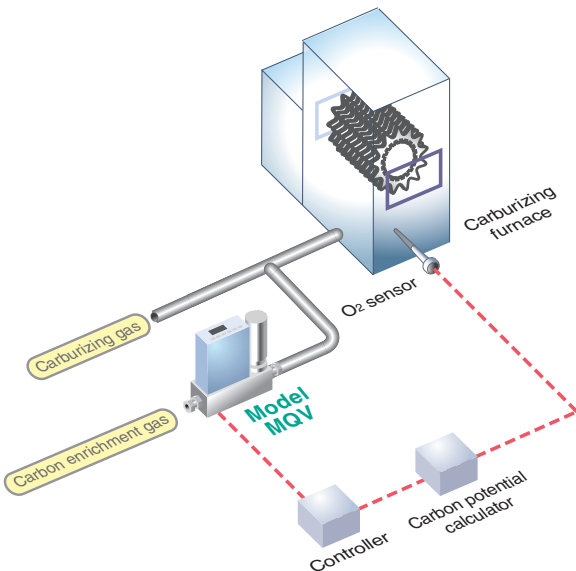
Air/fuel ratio control of burner

- Lamps
- Brazing



Control of furnace internal atmosphere

- Baking furnaces for electronics parts
- Gas carburizing furnaces
- Baking and annealing furnaces



Model F4Q

Advanced high-speed response, low pressure loss, and high-accuracy digital mass flow controllers

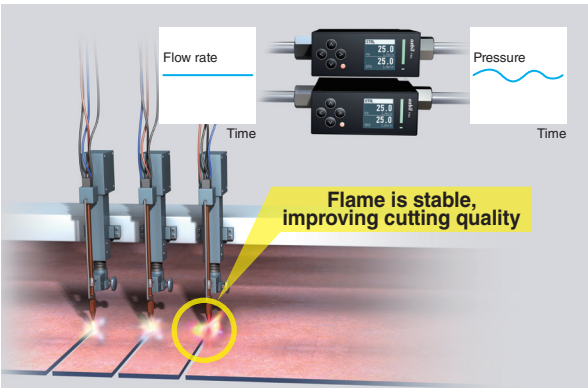


Model No.	F4Q9200	F4Q9500	F4Q0002	F4Q0005	F4Q0020	F4Q0050 (90 mm model)	F4Q0100	F4Q0050 (150 mm model)	F4Q0200	F4Q0500
Valve type	Proportional solenoid valve, normally closed when de-energized (N.C.)									
Standard full-scale flow rate (air, nitrogen)	200 mL/min	500 mL/min	2 L/min	5 L/min	20 L/min	50 L/min	100 L/min	50 L/min	200 L/min	500 L/min (Available soon)
Gas type	Fluororubber gasket : Air, nitrogen, oxygen, argon, carbon dioxide, city gas (45 MJ/m ³), methane (100 %), propane (100 %), butane (100 %) EPDM rubber gasket : Air, nitrogen, argon, carbon dioxide, acetylene, ammonia									
Response (at the standard differential pressure)	0.3 s for S.P. ± 2 % F.S. (typ.)							0.7 s for S.P. ± 2 % F.S. (typ.)		
Accuracy (under reference conditions) (Q = flow rate)	± 1 % SP (40 ≤ Q ≤ 100 %) ± 0.4 % FS (1 ≤ Q < 40 %)	± 1 % SP (15 ≤ Q ≤ 100 %) ± 0.15 % FS (1 ≤ Q < 15 %)					± 1.5 % SP (60 ≤ Q ≤ 100 %) ± 0.9 % FS (1 ≤ Q < 60 %)	± 1.5 % SP (30 ≤ Q ≤ 100 %) ± 0.45 % FS (1 ≤ Q < 30 %)	± 1 % SP (30 ≤ Q ≤ 100 %) ± 0.3 % FS (1 ≤ Q < 30 %)	± 1.5 % SP (20 ≤ Q ≤ 100 %) ± 0.3 % FS (1 ≤ Q < 20 %)
Operating differential pressure range	50 to 300kPa	5 to 300kPa	50 to 300kPa	5 to 300kPa	50 to 300kPa	100 to 300kPa	200 to 400kPa	10 to 100kPa	100 to 300kPa	150 to 300kPa
Allowable inlet pressure	0.5 MPa (gauge)									
Ambient operating temperature	- 10 to + 60 °C									
Analog inputs	DC 0 to 5 V / 1 to 5 V / 4 to 20 mA (selectable)									
Analog outputs	DC 0 to 5 V / 1 to 5 V / 4 to 20 mA (selectable)									
Communications	(1) USB 2.0, (2) RS-485 comm. (3-wire system, CPL or ModbusRTU (selectable by setting))									
Power	24 V DC, current consumption 300 mA max.							24 V DC, current consumption 400 mA max.		
Main material of gas-contacting parts	Fluororubber gasket : SUS316, Teflon, fluororubber EPDM rubber gasket : SUS316, Teflon, EPDM									
Standards compliance	EN61326-1, EN61326-2-3									
Mounting orientation	Horizontal (but top panel must not face downward) or vertical									
Weight	1.2 kg							3.1 kg		

Application example

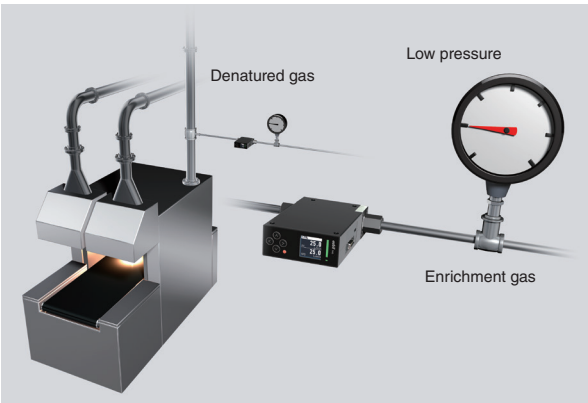
Gas cutting

Thanks to high-speed response, even when the source pressure changes, there is very little effect on the flow rate. The flame remains stable, which improves the cutting quality.



Gas carburizing furnace

Thanks to low pressure loss, model F4Q can control the flow rate of low-pressure enrichment gas, which is not possible with typical mass flow controllers. Better control of the atmosphere in the furnace can stabilize the quality of carburization.



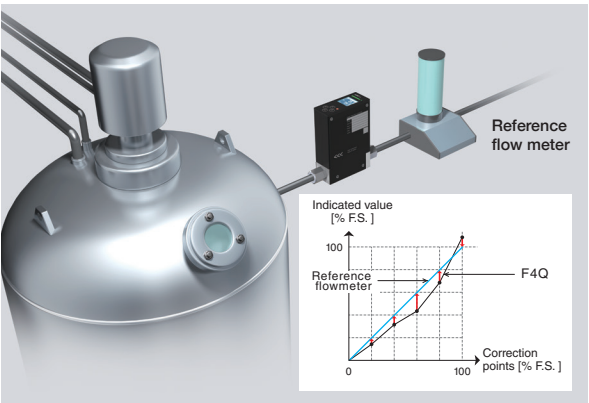
Baking furnace for MLCCs

The operating temperature range is a wide -10 to +60 °C and the effect of ambient temperature changes on flow rate control is small. A stable atmosphere in the furnace also helps to stabilize the quality of baking.



Culture apparatus

The multiple-point flow rate correction function makes matching to a reference flowmeter possible during onsite calibration. It is not necessary to send the controller to the manufacturer for calibration, so costs can be cut and delivery schedules can be shortened.



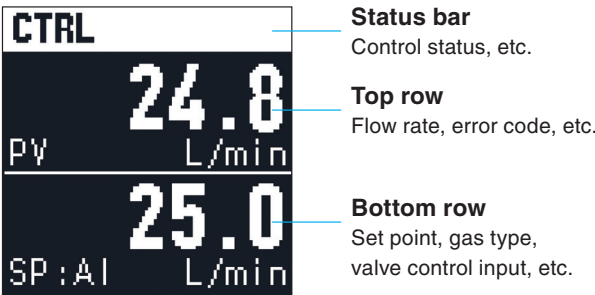
Advantages

Understand the status of control at a glance

The color and state (e.g., flashing) of the LED indicator show the control status.

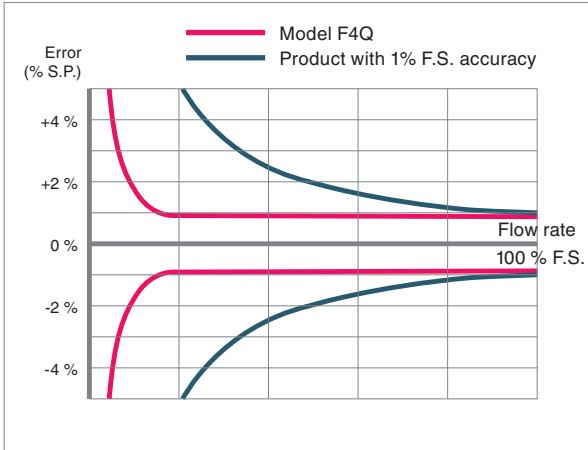


With the information-rich LCD, you understand the control status in detail.



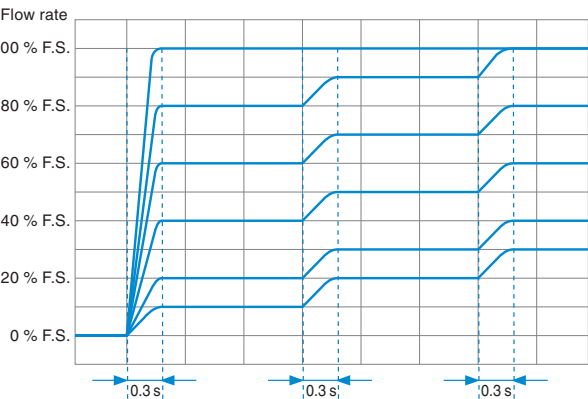
Accuracy of 1 % S.P. in a wide range of flow rates

High-accuracy control for high and low flow rates. Great for applications where the flow rate set point changes significantly.



High-speed response of 0.3 seconds over a wide range of flow rates

Response is fast whether starting control with a fully closed valve or changing the settings. Even when the flow rates of multiple gases are changed at the same time, their ratio can be retained.



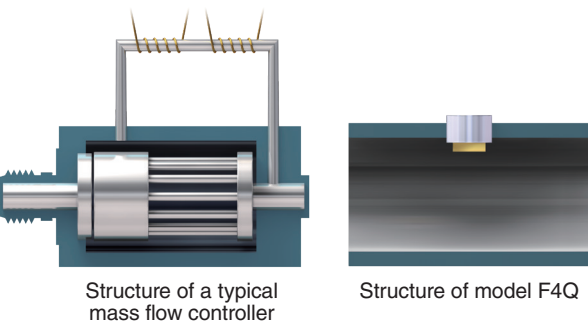
Usable in a wide temperature range, from -10 to +60 °C

The controller can be used in a cold room in winter or near a hot industrial furnace. Even when the temperature changes greatly, its effect on the measured values is minimal.



Low-differential pressure structure allows control of low-pressure gas

The pressure loss on a straight flow path is low, so this controller can control low-pressure gas (e.g., fuel gas).



Even without external power, settings can be changed from the PC loader

Power for the controller can be supplied through the USB cable of the PC loader, so settings of the controller can be changed even when it is not otherwise powered.



*Flow control is not possible when power is supplied from a USB cable.