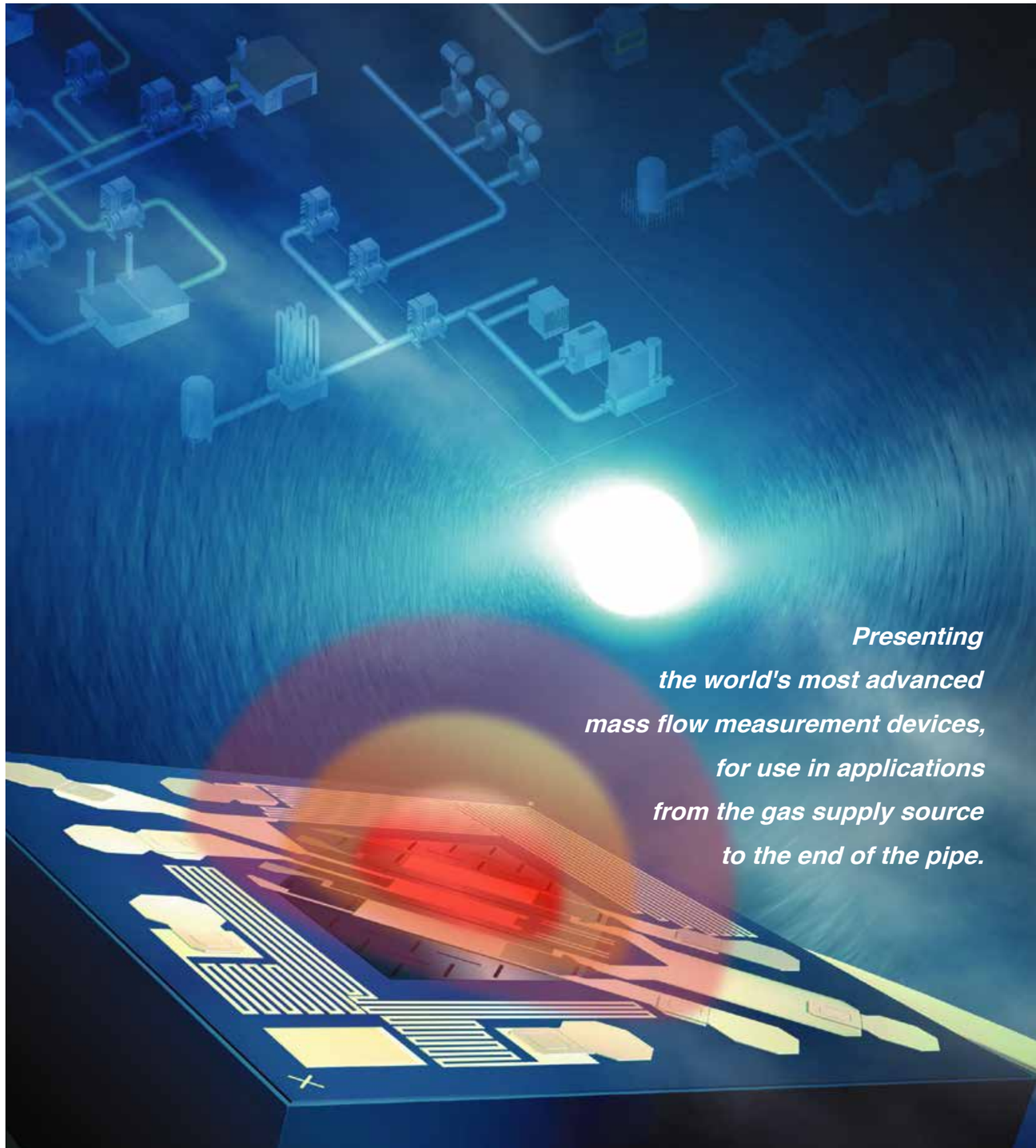
azbil

Gas Mass Flowmeters

Micro Flow(μF)

Selection Guide



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Advanced Automation Company

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URL: https://www.azbil.com

12th Edition: Issued in June 2019-SK/AZ

CP-PC-1333E

INTRODUCING MASS FLOWMETERS

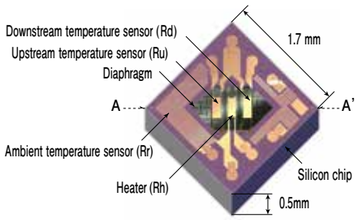
Thermal gas mass flow measurement using a MEMS (micro electromechanical systems) flow sensor helps users improve quality and save energy.

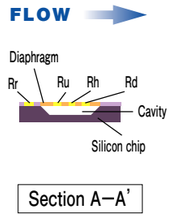
Features of the Micro Flow sensor

- **2ms** — High speed 2ms response
- **High repeata-bility** — Very low age deterioration High repeatability
- **Symmetric** — Symmetric structure measures reverse flow as well.
- **300:1** — Wide 300:1 range
- **No compensation required** — Mass flow measurement withoutthe need to compensate forchanges in temperature and pressure
- **3,500,000 units installed** — Proven reliability in 3,500,000 actual applications

Note: Features of the μF sensor are described below. Functions differ by model.

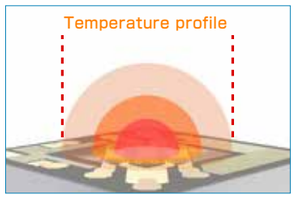
Sensor structure



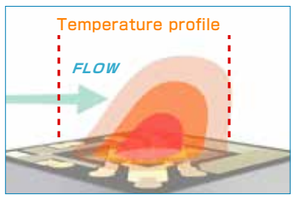


- Ultra-miniature structure (1.7 mm square x 0.5 mm thick)
- High resolution (1 mm/s)
- High speed response, unaffected by changes in pressure and temperature

Measurement principle



No gas flow

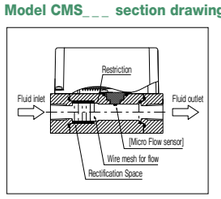


When gas is flowing

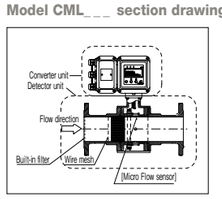
When there is no gas flow, the temperature distribution around the heater is symmetric. When gas starts to flow, the temperature upstream of the heater begins to decrease, while the temperature downstream increases, causing a distortion of the symmetric temperature distribution. This temperature difference 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

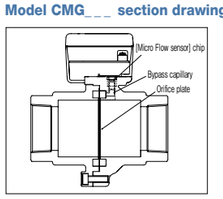
Model CMS___ section drawing



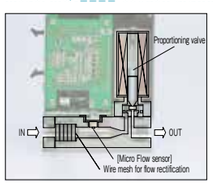
Model CML___ section drawing



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	Laughing gas
Model CMS___		Industrial gas management by department; experimentation and research	1/4 1/2	0.5 L/min to 2000 L/min	■	■	■	■	■	■	■	■	■	■	■	
Model MCF___		Energy-saving management for compressed air and nitrogen gas	1/4 1/2 1 1-1/2 2	200 L/min to 12000 L/min	■	■										
Model CMG___		Unit consumption management for burner air-fuel ratio	1/2 1 1-1/2 2	4 m³/h to 150 m³/h	■					■	■	■	■			
Model MVF___		Energy conservation management	2 3 4 6	2302 m³/h to 16839 m³/h	■	■	■	■	■	■	■	■	■			
Model MCS___		Chip pickup detection	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	1/4	50m L/min to 20 L/min	■	■	■	■	■						■	■
Model MQV____		Tooling burner air-fuel ratio control, and fuel battery evaluation equipment	1/4 1/2	5m L/min to 500 L/min	■	■	■	■	■	■	■	■	■	■	■	
Model MPC____		Replacement of float type flowmeter (purgemeter) Auxiliary devices	1/8	0.5 L/min to 20 L/min	■	■		■	■							

Gas mass flowmeter

Model CMS_ _ _

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

CE

SUS /SUS316 model

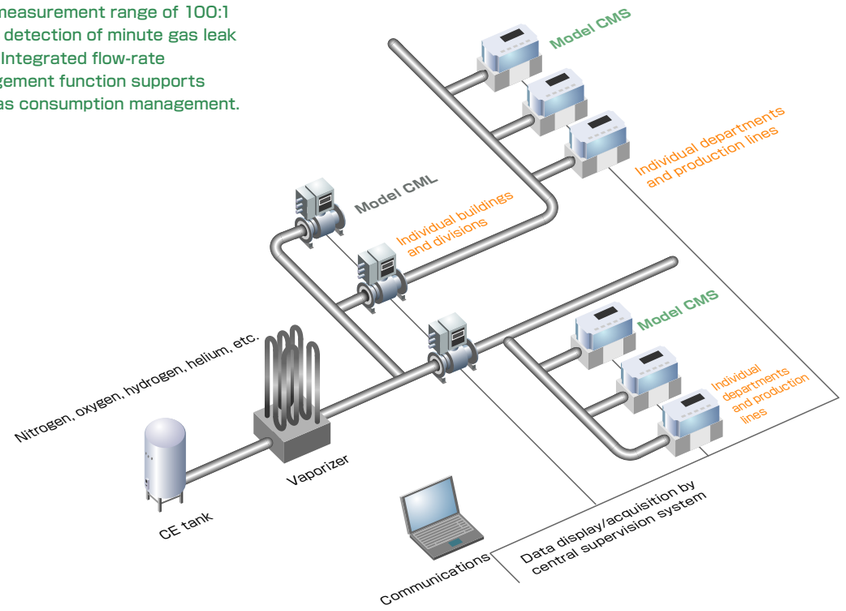
Hydrogen/helium model

Model	SUS/SUS316 model		Hydrogen/helium model	
Model No.	CMS _ _ _ _ _ _ _ N		CMS _ _ _ _ _ _ _ N	
Applicable gas	Air/nitrogen, oxygen, argon, carbon dioxide, city gas 13A (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 ℃			
Output	0–5V / 1–5V / 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 24V dc			
Pipe size / connection standard	Rc1/4,Swl,VCR	Rc1/2,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

Industrial gas flow rate management and consumption cost allocation by department

Wide measurement range of 100:1 allows detection of minute gas leak flows. Integrated flow-rate management function supports unit gas consumption management.



Air flowmeter

Model MCF_ _ _

A superb way to save energy when using compressed air or nitrogen.

CE

Model No.	MCF008	MCF015	MCF025	MCF040	MCF050
Gas types	Air/nitrogen. (Note that gas must be dry, without corrosive components such as chlorine, sulfur and acid. It must also be clean, without dust or oil mist.)				
Flow rate range [L/min (normal)] *1	0 to 200	0 to 500 / 0 to 1000	0 to 3000	0 to 6000	0 to 12000
Measurement accuracy	± 3% FS				
Measurement range	50:1				
Minimum flow rate	100:1				
Temperature	−10 to +60 ℃ (without condensation)				
Pipe size	8A (1/4B)Rc,G	15A (1/2B)Rc,G	-25A (1B)Rc,G	40A (1 1/2B)Rc,G	50A (2B)Rc,G
Body material	Aluminum alloy				
Case material	Denatured PPO				
Operating pressure range	−0.07 to +1.0 MPa				
Power supply	24V dc, 120 mA max.				
Output signal (instantaneous flow rate)	4 to 20 mA, allowable load resistance 300 Ω max.				
Communications	RS-485 (Modbus, option)				
Event output	One open collector output (rating 30V dc, 50 mA), with output type selectable from event function.				
Event function	Selectable from pulse output for integration, instantaneous flow rate high/low limit alarm, integration count up/down, or alarm output.				
Protective structure	IP65. (Rating is based on JIS C 0920 and IEC60529. For purposes of installation indoors, device is waterproof and dustproof.)				
Mass	400 g	400 g	500 g	700 g	1100 g

Notes: *1. The unit L/min (normal) refers to the volumetric flow rate adjusted for 0℃, 101.325 kPa.

Application example

Detecting air leakage

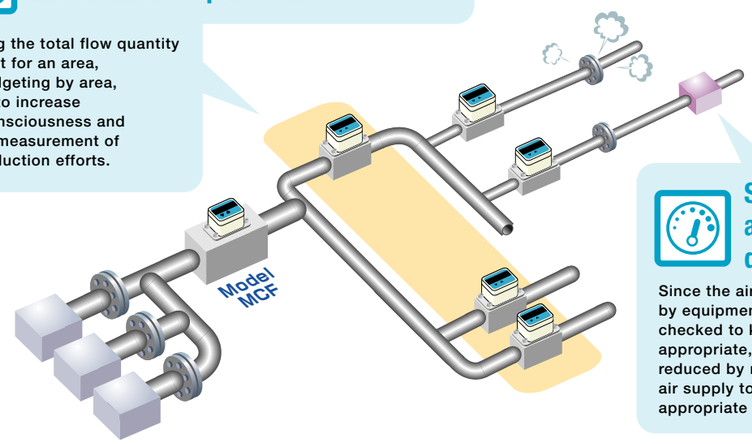
Substantial reduction of air leakage by determining the leakage quantity — generally said to be around 30% — and repairing the leaks.

Leakage check method

1. Read the instantaneous flow rate from the flowmeter.
2. Plot the instantaneous flow rate using a PC.

Cost management for production line or whole department

Knowing the total flow quantity and cost for an area, and budgeting by area, is sure to increase cost consciousness and enable measurement of cost reduction efforts.



Supply of appropriate quantities

Since the air quantity used by equipment can be checked to know if it is appropriate, waste can be reduced by restricting the air supply to an appropriate quantity.

Model CMG_ _ _

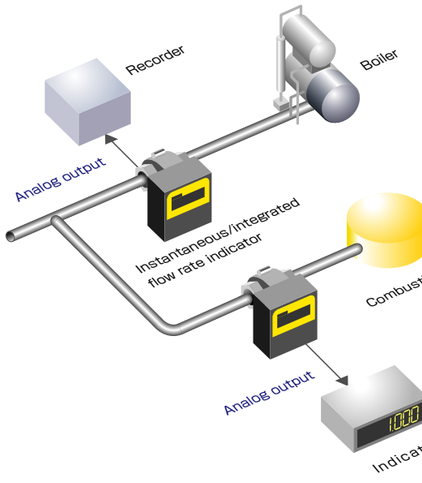
Flowmeters that provide optimal control of burner air/fuel ratio or unit consumption management

CE (DC type only)

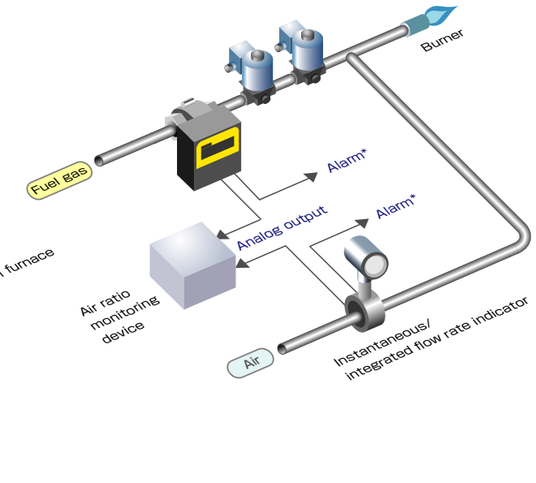
Model	Air model	City gas model		Propane model	Butane model
Model	CMG _ _ _ A	CMG _ _ _ G		CMG _ _ _ P	CMG _ _ _ B
Applicable gas	Air	City gas 13A		Propane	Butane
Flow rate range : m^3/h(normal)	4/10/30/80/150	4/10/30/80/150	80/150	2/4/10/25/50	1/3/8/20/40
Accuracy	±4% RD			±6% RD	
Measurement range	10 : 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 ℃				
Output	1–5V/4–20mA, selectable by model number				
Power supply	24V dc / 100V ac / 200V ac, selectable by model number				
Pipe size	15A/25A/40A/50A		40A/50A	15A/25A/40A/50A	
Connection type	Rc thread		JIS10k RF	Rc thread	
Straight pipe length	15A and 25A: not required. 40A, 50A: 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

Energy management



Flow rate monitoring for burner



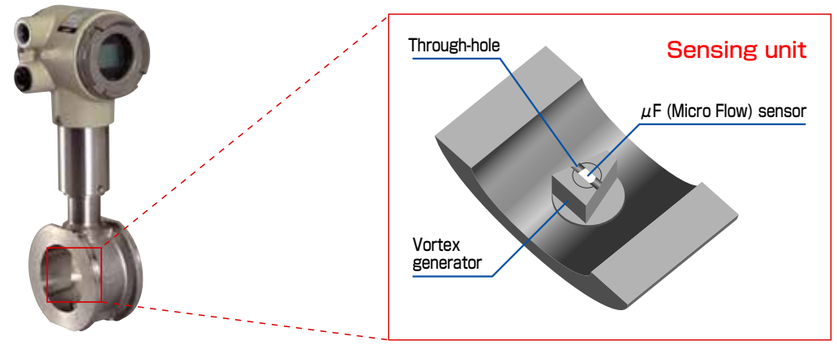
*Alarm warns of high/low flow rate.

Model MVF_ _ _

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

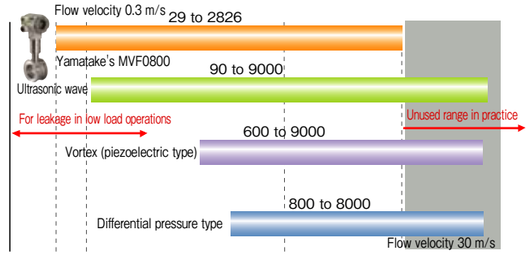
Model No.	MVF050	MVF080	MVF100	MVF150
Applicable gas	Air/nitrogen, oxygen, argon, carbon dioxide, city gas 13A (45/46MJ), propane, butane, other inert gases.			
Flow rate range: m^3/h (normal) at pressure of 0.5 MPa	1280	2826	4352	9364
Accuracy	Volumetric flow rate: ±2% RD. After temperature and pressure compensation: ±3.5% RD			
Measurement range	100 : 1			
Minimum flow rate (at a pressure of 0.5 MPa)	2.3 m^3/h (normal)	5.2 m^3/h (normal)	7.9 m^3/h (normal)	17.1 m^3/h (normal)
Operating pressure	0 to 1.0 MPa			
Operating temperature	−15 to +60 ℃			
Output	4–20 mA and integrated pulse output			
Communications	RS-485			
Power supply	24V dc			
Pipe size	2B (50A)	3B (80A)	4B (100A)	6B (150A)
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 μF (Micro 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 80A pipe size, 0.5MPa)



Sample applications

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

Chip pickup detection mass-flow sensor

Model MCS_ _ _

5ms ultra high-speed response.
At only 9g, 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	5ms max. (95% response to a step state flow rate change)				
Operating pressure	−100 to +200 kPa				
Operating temperature	0 to +50 ℃				
Output	1–5V output (non-linear)				
Power supply	12 to 24V 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 (DC24V) to Model MCS_ _ _

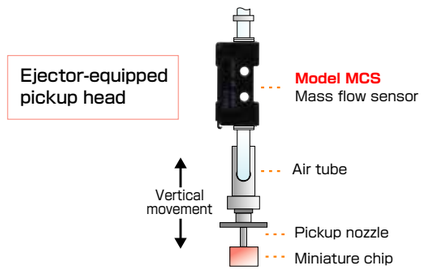
Separate flow rate range can be set for each channel, with display and event output.

MCW100 1ch type

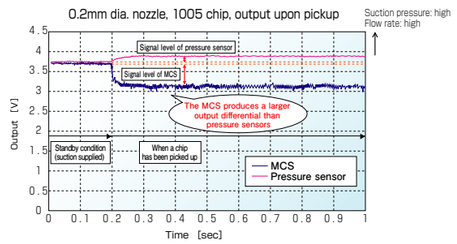
MCW400 4ch type

Application example

Installation example for miniature chip pickup detection



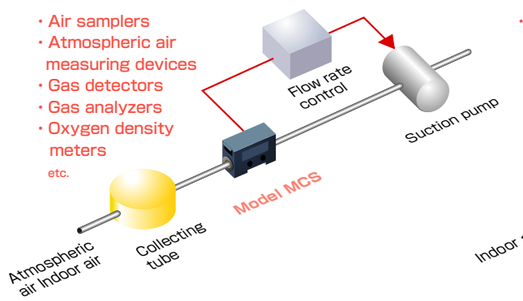
For detecting chip pickup, the MCS produces a larger output differential between chip and no-chip conditions than a standard pressure sensor.



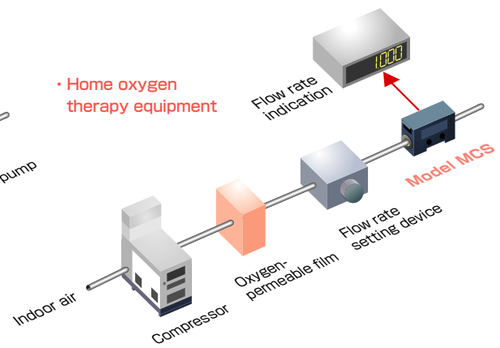
Sample applications for physical, chemical, and medical devices

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

etc.



- Home oxygen therapy equipment



Compact Digital Mass Flow Controller

Model F4H_ _ _ _

Saving Space, Saving wiring, Saving cost

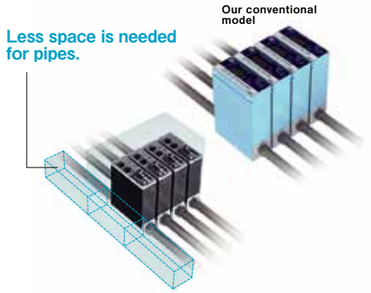
fluororubber seal model only

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	**Repeatability**	± 0.2 % FS ± 1 digit					
	Accuracy	①±2%SP (50%FS＜Q≦100%FS) ②±1%FS (0%FS≦Q≦50%FS)	①±1%SP (50%FS＜Q≦100%FS) ②±0.5%FS (0%FS≦Q≦50%FS)				
	Offset of PV from SP	± 0.1 % FS ± 1 digit max.					
Presure	**Operating differential pressure range** Ambient temperature: -10 ≤ t ≤ 40 ℃	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 ≤ 50 ℃	20 to 200 kPa	100 to 30 0kPa	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 ℃					− 10 to + 40 ℃
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

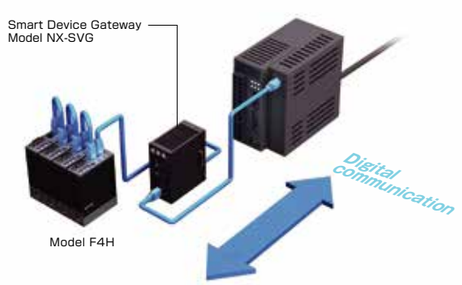
Compact Design Saves Space

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



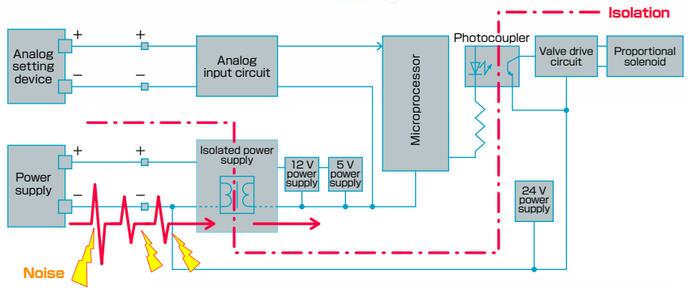
All Models Have Communication Functions

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

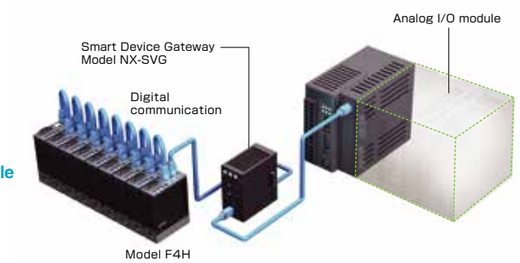
Isolation of the power supply from the signal circuit
By isolating the valve drive circuit from other circuits, power supply circuit and analog circuit isolation (patent No. 5132617) is achieved, even with a small-capacity isolated power supply. Thanks to this feature, noise from power wiring has no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



Reduction in Overall Cost

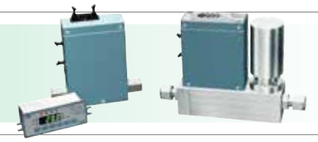
By switching from an analog to a digital connection with the PLC, the analog I/O module can be eliminated.

The analog I/O module can be eliminated!



Model MQV_ _ _ _

The world's fastest high-speed control (300ms) also offers exceptionally high accuracy



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	0.5s for SP ±2% FS (typ.)	0.3s for SP ±2% FS (typ.)		0.7s for SP ±2% FS (typ.)
	Accurcy	±1% FS	±1%FS (50%FS<Q≦100%FS) ±0.5%FS (0%FS≦Q≦50%FS)	±2% FS (80%FS<Q≦100%FS) ±1% FS (0%FS≦Q≦80%FS)	±1.5%FS (80%FS<Q≦100%FS) ±1%FS (40%FS<Q≦80%FS) ±0.5%FS (0%FS≦Q≦40%FS)
Input/Output		0-5V dc / 1-5V 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		24V dc			
Standard compliance		EN61326-1, EN61326-2-3			
Weght		Approx. 1.1 kg	Approx. 1.2 kg		Approx. 3.5 kg

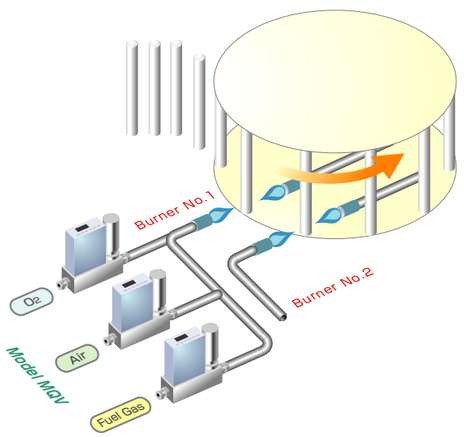
Hydrogen / Helium gas model

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	0.5s for SP ±2% FS (typ.)		0.3s for SP ±2% FS (typ.)
	Accurcy	±1%FS (50%FS<Q≦100%FS) ±0.5%FS (0%FS≦Q≦50%FS)	±1% FS	±2%FS (80%FS<Q≦100%FS) ±1%FS (40%FS<Q≦80%FS) ±0.5%FS (0%FS≦Q≦40%FS)
Input/Output		0-5V dc / 1-5V 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		24V dc		
Standard compliance		EN61326-1, EN61326-2-3		
Weght		Approx. 1.1 kg		Approx. 1.2 kg

Application example

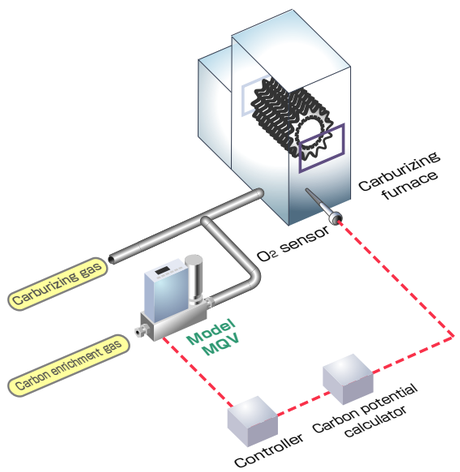
Air/fuel ratio control of burner

- Lamps
- Brazing



Control of furnace internal atmosphere

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



Model MPC_ _ _ _

World's smallest (48 mm square × 73.7 mm deep) and lightest (300 g) mass flow controller

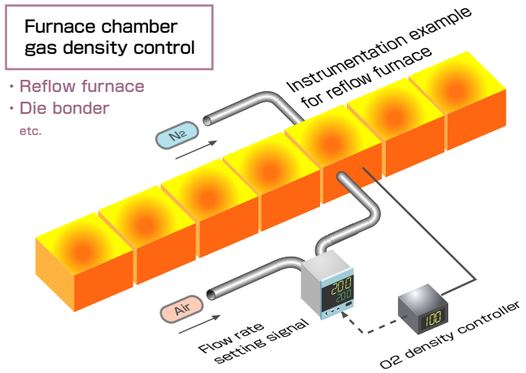
Model	Standard gas model			
Applicable gas	Air/nitrogen, argon, carbon dioxide			
Flow rate range: L/min (standard)	0.500 (air)	2.00 (air)	5.00 (air)	20.0 (air)
Accuracy	±2% FS			
Flow rate control range	4 to 100% FS		2 to 100% FS	
Response	1s max. (setting ±2%)			
Operating differential pressure range	300 kPa max.			50 to 300 kPa
Pressure resistance	500 kPa			
Operating temperature	−10 to +50 ℃			
Input	0–5V dc / 1–5V dc (only models with analog input/output function), external contact input (2 points)			
Output	0–5Vdc / 1–5Vdc (only models with analog input/output function), event output (2 points)			
Communications	Smart Loader connection (standard), RS-485 communications (option)			
Power supply	24V dc			
Pipe size / connection standard	1/8 Rc			
Straight pipe length	Not required			
Material	Gas-contacting parts: brass (Ni-plated), stainless steel, Teflon, and fluororubber			
Weight	300 g			

Application example

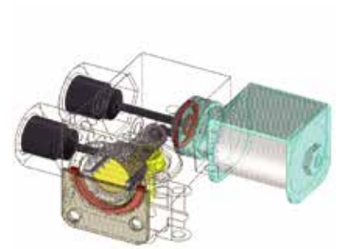
Furnace chamber gas density control

- Reflow furnace
- Die bonder

etc.



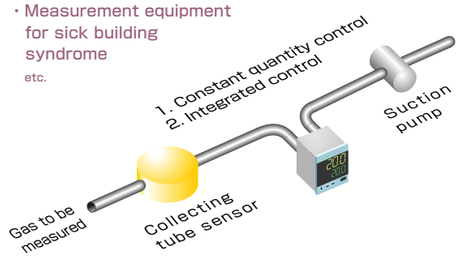
Structure drawing



Suction flow rate control

- Gas sensor
- Gas analyzer
- Oxygen density meter
- Measurement equipment for sick building syndrome

etc.



Gas mixing control

- Welding machine
- Incubator
- Use for various experiments

etc.