YAMATAKE

No.CP-PC-1422E

Panel Mount Mass Flow Controller

MPC Series

World's First !!

Advanced Flow Control Possible with the Panel Mounting Type Controller

●World's minimum size and weight mass flow controller

Compact (front panel: 48x48mm, depth: 73.7mm) and light (300g) panel mounting body contains a built-in miniature proportioning valve, enabling full-automatized flow control.

●Easy operation and easy mounting

Easy operation and easy mounting even for the purgemeter users.
Once you set the flowrate set point, all the operations are automatically done by the MPC. External set point change (from PLC or host systems) is easy, using optional analog setting input function or communication function (RS-485).

●24Vdc drive

The 24Vdc drive for the mass flow controller is already common.

●Yamatake's original μF (Micro Flow) sensor

High speed (1s), high accuracy (2%FS) flow control unaffected by pressure and temperature fluctuations.

●Variety of functions available as a standard

Variety of functions responding user demands offers total equipment cost reduction.

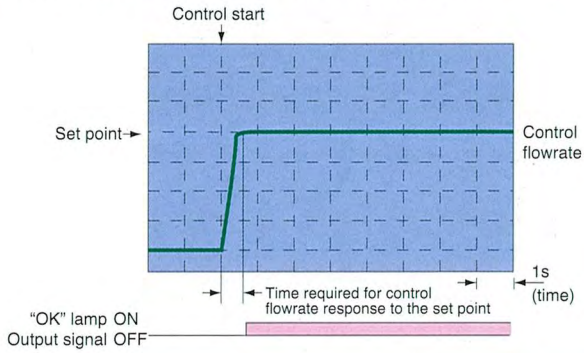
The MPC meets such user demands as follows:

- Numerical flowrate control is required.
- The purgemeter problem, "the measurement error caused by conditional difference between equipment design and field",is required to be solved.
- Flowrate control is required, but high cost, complicated instrumentation or difficult operation is unacceptable.
- Purgemeters are required to be replaced with mass flow controllers, but drastic design change such as mounting locations or piping layout is impossible.

Solution for purgemeter problems:
Pressure and temperature compensation is inevitable for the purgemeters. Moreover, the scale reading requires being converted using the formula when conditions in use are different from conditions under design, in gas specific gravity or secondary back pressure. The MPC controls mass flowrate, releasing from such onerous process.

Superior performance with its high-speed control

The MPC offers high-speed control similar to that of the favorable CMQ Series.
High-speed control during a control start (from zero point onwards) and a set point change. Also, disturbance such as pressure fluctuation is minimized with its high-speed control.



Easy pipe connections and electrical wiring

Pipe connections and electrical wiring terminals are arranged on the rear of the body, enabling easy mounting. Wiring is easy by connector type terminal.

Variety of functions offering equipment cost reduction

1. Multi set point function
- Up to 4 set points can be switched by a key operation or an external switching input.

2. Gas type switching
- Air, N_2, Argon and CO_2 standard compatible gases.
- Any gas type conversion factor can be set to accommodate the mixed gases.

3. Operation mode switching
- Three modes of control / fully-closed / fully open.

4. Slow start function
- The settling time can be changed in 8 steps within the range from about 1 to 6 seconds.
- Sudden fluctuations in the control flowrate can be suppressed when control is started or when the flowrate set point is changed.

5. Flowrate integration function
- Integration up to 8 digits (99,999,999 count). Integration reset by a key operation. Integration start/stop/reset by an external switching input.
- Control start and integration reset can be carried out simultaneously in a single action. Using the automatic shut-off function, the valve shut-off is possible at repeated count-up to constant integration count. Constant amount sampling or constant amount injection is easily possible without a PLC.

6. Alarm indication/output/automatic shut-off
- Flowrate alarm can be set to upper and lower deviation between the flowrate set point and control flowrate.
- The alarm ON delay time can also be set.
- When a flowrate alarm occurs or when an alarm occurs during the controller self-diagnostics, the event output can be triggered ON or the valve can be forcibly fully closed or fully open.

7. Event indication/output
- Two of the event types described below (*) can be assigned. The output ON delay time can also be set (Delay cannot be set to integration pulse output). The output logic can also be inverted (Normal: ON, Event occurrence: OFF) (The event output is OFF when the power is OFF).
(*Alarm output, Control flowrate upper/lower output, Integration count up output, "OK" output, and Operating mode output)
- Easy and low cost equipment operation monitoring without analog signal monitoring using a PLC or host systems.

8. "OK" indication/output
- The "OK" lamp can indicate when the control flowrate is within the "setting value ± allowable range".
- The "OK" output can also be used as an interlock signal for subsequent processes.

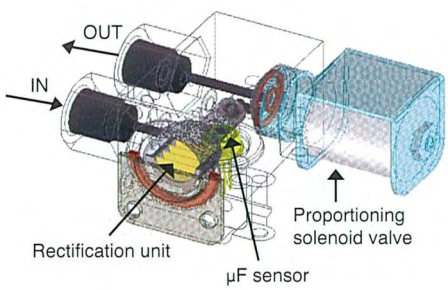
9. Automatic shut-off function
- The valve can be shut off automatically when the integration count is up or when the alarm occurs.

10. Valve drive output monitor
- Proportioning valve drive status indication.
- Equipment self-diagnosis is possible by detecting the supply gas pressure rise/drop or block in the pipe.

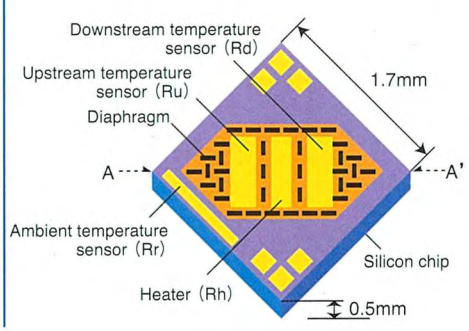
11. Standard support of the loader communication
- Uploading and downloading various settings such as flowrate set point or function parameters are freely possible via one-to-one communications to PC.

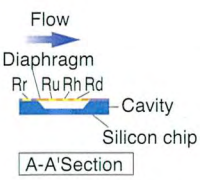
Channel structure and measurement principle of the μF sensor

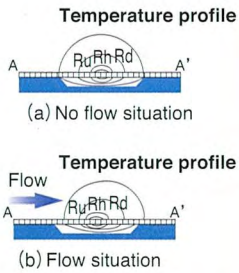
Channel structure



Measurement principle of the μF sensor







When gas flow does not exist, the temperature distribution around the heater is symmetric. When the gas starts to flow from Ru to Rd, the temperature at Ru upstream begins to decrease, while the temperature at Rd downstream increases, thus causing a distortion of the symmetry in temperature distribution. This temperature difference between Ru and Rd is used to calculate the mass velocity (velocity x density).

■ Product Specification List

Model No.			MPC9500	MPC0002	MPC0005	MPC0020
Valve type			Proportional solenoid valve			
Valve operation			Normally closed when de-energized (N.C.)			
Standard full-scale flowrate (Nitrogen conversion value) (Note 1)			0.500 L/min(standard)	2.00 L/min(standard)	5.00 L/min(standard)	20.0 L/min(standard)
Standard compatible gas types			Nitrogen/air, argon, carbon dioxide (CO_2) Note, however, that gas must be a dry gas not containing corrosive components (chlorine, sulfur, acid). The gas must also be a clean gas not containing dust or oil mist.			
Control	Control range (See Table in Note 1.)		4 to 100%FS		2 to 100%FS	
	Response		Within 1.0s at setting ±2%FS (typical)			
	Accuracy		Within ±2%FS (at standard temperature and differential pressure)			
	Repeatability		Within ±1%FS			
	Temperature influence		Within 0.1%FS/℃			
	Pressure influence (Q: Flowrate per 0.1MPa)	40%FS≦Q	0.7%FS max.	0.4%FS max.	0.2%FS max.	0.2%FS max.
		10%FS≦Q <40%FS	1.2%FS max.	0.7%FS max.	0.3%FS max.	
		Q<10%FS	2%FS max.	1.2%FS max.	0.5%FS max.	
Pressure	Standard differential pressure (Note 2)		0.2MPa (Inlet pressure: 0.2MPa(gauge), outlet pressure: 0.0MPa(gauge))			
	Required differential pressure (Note 3)		0.05MPa	0.05MPa	0.1MPa	0.15MPa
	Operating differential pressure (Note 4)		0.3MPa max.			0.05 to 0.3MPa
	Pressure resistance		0.5MPa(gauge)			
Temperature	Standard operating temperature (Note 2)		25℃			
	Allowable operating temperature		-10 to +50℃ (0 to +50℃ when RS-485 communication function is selected)			
	Allowable storage temperature		-10 to +60℃			
Humidity	Allowable operating humidity		10 to 90%RH (non-condensing)			
Flowrate setup	Setup method		1: Key operation, 2: External setup voltage input (only the model with analog input/output function), 3: Communication (only the model with RS-485 communication function)			
	Setup resolution		(See Table in Note 1.)			
	Setup input voltage		0 to 5Vdc/1 to 5Vdc (selectable) (only the model with analog input/output function)			
Flowrate indication	Display method		7-segment LED 8 digits (Instantaneous flowrate display: 4 digits, Set point flowrate display: 4 digits)			
	Display resolution		(See Table in Note 1.)			
	Indication accuracy		±2%FS±1 digit			
Integration function	Display range		0.00 to 999,999.99L	0.0 to 9,999,999.9L	0.0 to 9,999,999.9L	0 to 99,999,999L
	Display resolution		0.01L	0.1L	0.1L	1L
	Integration backup timing		At each 5L count	At each 20L count	At each 50L count	At each 200L count
			At each hour (time) from the previous backup			
Flowrate output	Output scale		0 to full-scale flowrate (scale changeable) (only the model with analog input/output function)			
	Standard output voltage		0 to 5Vdc/1 to 5Vdc (selectable)			
	Max. output voltage		7Vdc Max. (Max. output when flowrate exceeds range)			
	Accuracy		±0.5%FS (The input impedance of the connected device must be at least 100kΩ.). Overall output accuracy: Indication accuracy±0.5%FS			
Event output	Number of outputs		2			
	Output rating		30Vdc, 15mA Max. (open collector non-insulated output)			
	Integration pulse output width		100mS±10% (when integration pulse output is selected)			
	Integration pulse output rate		0.01L/pulse	0.1L/pulse	0.1L/pulse	1L/pulse
External contact input	Number of inputs		2			
	Other party circuit type		Potential free contact, or open collector			
	Contact OFF terminal voltage		2.0±0.5V			
	Contact ON terminal current		Approx. 0.5mA (current flowing to contact)			
	Allowable ON contact resistance		Max. 250Ω			
	Allowable OFF contact resistance		Min. 100kΩ			
	Allowable ON residual voltage		Max. 1.0V (open collector at other party)			
	Allowable OFF leakage current		Max. 50μA (open collector at other party)			
Communication	System		1. Loader communication (A dedicated cable is required.) 2. RS-485 communication (3-wire system) (only the model with RS-485 communication function)			
	Transmission speed		2400, 4800, 9600, 19200, 38400bps (19200bps only for loader communication)			
Power	Rating		24Vdc, current consumption 300mA Max.			
	Allowable power voltage		22.8 to 25.2V (ripple 5% Max.)			
Material of gas-contacting parts			Brass (Ni-plated), stainless steel, Teflon, Viton			
Connection method			Rc1/8			
Mounting orientation			Display surface must face to front (inlet port down, outlet port up)			
Mass (weight)			Approx. 300g			
Applicable standard			EN61326 : 1997, Ambient A1 : 1998/A2 : 2001			
Accessory parts			Mounting bracket (81446917-001), connector			

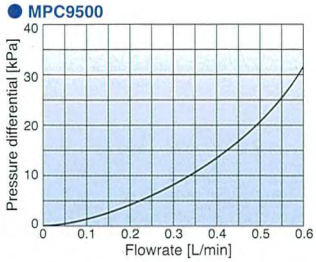
Note 1. L/min(standard) indicates the volume flowrate (L/min) per minute converted to 20℃, 1 atmosphere. The reference temperature can also be changed to 0℃ and 25℃. The controllable flowrate range varies according to the gas type. See Table.
Note 2. Temperature and pressure during calibration.
Note 3. Differential pressure required for obtaining full-scale flowrate.
Note 4. Operation is possible even under required differential pressure. (However, the controllable flowrate range becomes narrower.)

■ Control flowrate range table

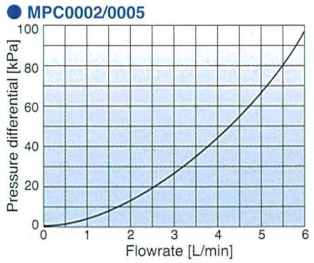
	MPC9500		MPC0002		MPC0005		MPC0020	
	Control flowrate range	Setup/display resolution	Control flowrate range	Setup/display resolution	Control flowrate range	Setup/display resolution	Control flowrate range	Setup/display resolution
Nitrogen/air	0.020 to 0.500	0.002	0.08 to 2.00	0.01	0.10 to 5.00	0.02	0.4 to 20.0	0.1
Argon	0.020 to 0.500	0.002	0.08 to 2.00	0.01	0.10 to 5.00	0.02	0.4 to 20.0	0.1
Carbon dioxide	0.012 to 0.300	0.001	0.040 to 1.200	0.005	0.06 to 3.00	0.01	0.3 to 16.0	0.1

■ Relationship between flowrate when valve is fully open and differential pressure (in case of air)

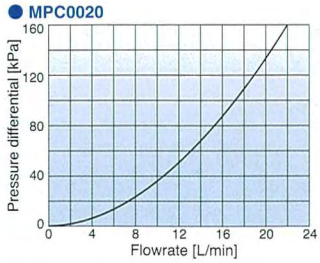
● MPC9500



● MPC0002/0005



● MPC0020



Note.
Calculate the differential pressure from the following formula when a gas other than air/nitrogen is used:
Differential pressure = differential pressure in air x specific gravity of gas to be controlled

Example: The differential pressure when argon gas flows at 10L/min(standard) (MPC0020) is
35kPa x 1.38 = 48kPa
Specific gravity of standard compatible gas (air/nitrogen is taken as 1.0)
Argon = 1.38 Carbon dioxide = 1.53

Model selection guide

I II III IV V VI VII VIII IX X XI XII

Example: MPC0020BBRN010000

Table	Selection		Description
I	Basic model No.	MPC	Panel mount mass flow controller
II	Range	9500	0.020 to 0.500L/min(standard) (Note 1)
		0002	0.08 to 2.00L/min(standard) (Note 1)
		0005	0.10 to 5.00L/min(standard) (Note 1)
		0020	0.4 to 20.0L/min(standard) (Note 1)
III	Model	B	Model with integrated display
IV	Material of gas-contacting parts	B	Brass (Ni-plated)
V	Connection method	R	Rc1/8
VI	Gas type	N	Air/nitrogen, argon, carbon dioxide (Note 2)
VII	No use	0	—
VIII	Optional function (1)	0	With event output
		1	With analog input/output and event output
		2	With RS-485 communication (CPL) function and event output (Note 3)
IX	Optional function (2)	0	None
X	Optional function (3)	0	None
XI	Optional function (4)	0	None
		D	With test data
		Y	Complying with traceability certification
XII	Code	0	Product version

Note 1: L/min(standard) indicates the volume flowrate (L/min) per minute converted at 20℃, 1 atmosphere (1 atm). The reference temperature can also be changed to 0℃, 25℃ and 35℃.

Note 2: The air/nitrogen is set as a factory setting. This controller can also be used for argon and carbon dioxide (CO_2) gases by changing the setting of the gas type selection in the function setup.

Note 3: Analog input/output function is not applied.

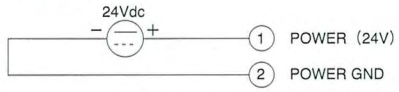
Terminal connection

Connector specifications

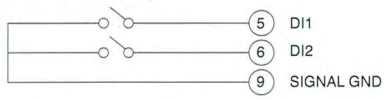
Part No.: MCVM1.5/9-STF-3.5 (Phoenix Contact Mfg.)
Wire type: Either of solid wire or stranded wire applicable
Compatible cable: 0.08 to 1.5mm² (AWG#28 to #16)
Appropriate length of stripped wire: 7mm
Compatible screwdriver: Tip size 2.5 x 0.4mm (flat-head)

Wiring

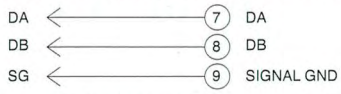
Power supply



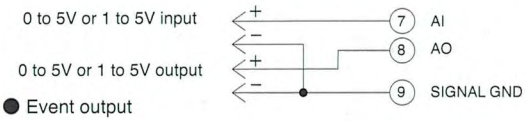
External switch input



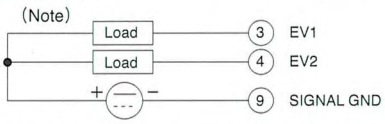
RS-485 communication (model with RS-485 communication function)



Analog input/output (model with analog input/output function)



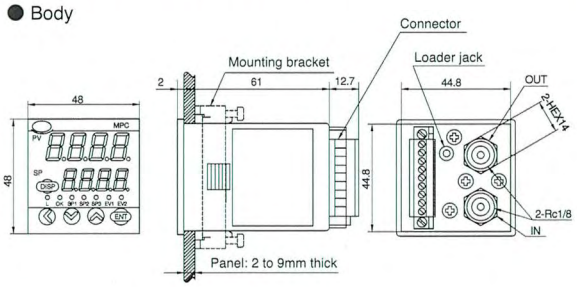
Event output



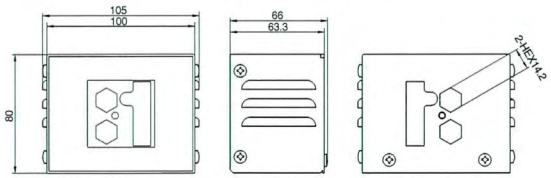
Note: Be sure that the event output does not exceed the specified output rating of this controller. When driving a relay, use the relay with a built-in diode for coil surge absorption. Doing so might cause faulty operation.

External dimensions (Unit:mm)

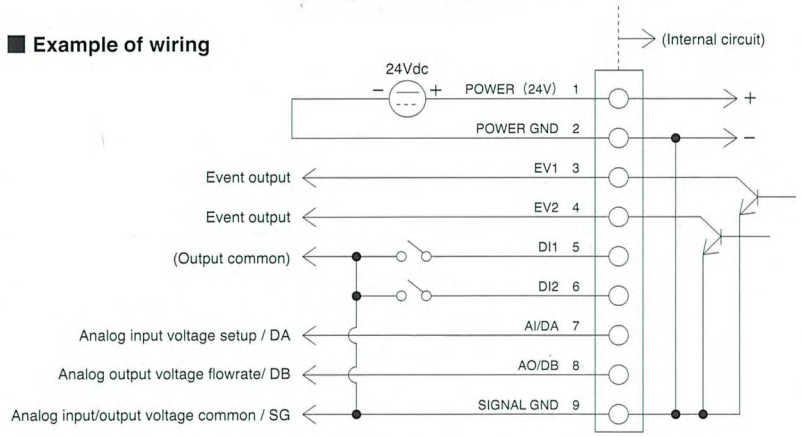
Body



MPC dedicated case set (Part No.81446927-001)



Example of wiring



⚠ RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment. Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- **Safety devices for plant worker protection**
- **Start/stop control devices for transportation and material handling machines**
- **Aeronautical/aerospace machines**
- **Control devices for nuclear reactors**

Never use this product in applications where human safety may be put at risk.

YAMATAKE

Specifications are subject to change without notice.

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