

MPC 9500/0002/0005/0020 Panel-Mount Mass Flow Controller User's Manual

Thank you for purchasing this Azbil Corporation product. This manual contains information for ensuring the safe and correct use of the product. Also, this manual provides necessary information for installation, maintenance, and troubleshooting. It should be read by those who design or maintain control panels or other equipment that uses this product. Be sure to keep this manual nearby for handy reference.

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<http://www.azbil.com/products/factory/order.html>

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This manual gives instructions for installation, wiring, settings, and operation. It also contains handling precautions and the main specifications of the product. For details on handling, settings, etc., refer to the following.

MPC9500/0002/0005/0020 Panel Mount Mass Flow Controller User's Manual for Installation and configuration, CP-SP-1153E

MPC9500/0002/0005/0020 Panel Mount Mass Flow Controller User's Manual for Communications, CP-SP-1154E

UNPACKING

The following items should be included in your purchase.

- Mounting bracket 81446917-001 1
- Connector 1
- User's manual (this manual) CP-UM-5317E 1

CAUTIONS AND WARNINGS

Key to symbols

WARNING

Warnings are indicated when mishandling this product might result in death or serious injury to the user.

CAUTION

Cautions are indicated when mishandling this product might result in minor injury to the user, or physical damage to this product.

WARNING

Never allow combustible gases (especially gases that are within explosive limits) to pass through this device. Doing so might result in an explosion.

Do not use for gases other than the standard compatible gas types (air/nitrogen, argon, and carbon dioxide).

Do not use this device for medical instruments.

CAUTION

Prevent foreign matter from entering the flow path of this device. If rust, water droplets, oil mist, or dust from the pipes enters the device, measurement or control error may occur, or the device may be damaged.

If there is a possibility of foreign matter entering the device, install an upstream filter, strainer, or mist trap capable of eliminating foreign matter 0.1 μm or greater in diameter. Be sure to inspect and replace the filter at regular intervals.

Do not allow wire clippings, metal shavings, water, etc. to enter the device's case. Malfunction or device failure could result.

Use this device within the operating differential pressure range. Also, do not subject it to pressure beyond the rated pressure resistance range. Doing so might damage it.

CAUTION

Be sure to use this device within the specified flow rate range. To prevent excessive flow, use a suitable means to control the supply pressure or use a throttle valve or the like to control the flow rate. If the flow rate exceeds the upper limit, both the flow rate display and the output voltage/current may indicate lower values than the actual flow rate.

If damage could result from the abnormal functioning of this device, include appropriate redundancy in the system design.

The valve on this device cannot completely stop a flow. If complete shutoff is required, provide a separate shutoff valve. Also, if an external shutoff valve is closed, it is necessary also to fully close this device's valve using either of the following methods:

- Set the flow rate to zero.
- Set the operation mode to fully closed.

If this valve remains in control mode when the external shutoff valve is closed (zero flow rate), there will be an excessively large momentary flow when the external shutoff valve is opened. Also, in control mode or with the valve forced fully open, if the external shutoff valve is closed continuously, the MPC's over-heating prevention limit (AL71) will be activated and the electrical current driving the valve will be forcibly limited.

If this device is mounted on a panel, make sure, while connecting the pipes and afterwards, that the controller case is not stressed. If metal pipes are directly connected to the pipe connection ports, this controller cannot be mounted on a panel. Doing so can deform and damage the case.

There is no isolation between the power supply circuit of this device and the I/O circuit. Therefore, ensure that the power supply is isolated from the power supply of external devices. If this device and external devices share a common power supply, faulty operation or device failure might result.

For models with an analog I/O function, do not apply negative voltage or excessively large voltage (more than 5 V) to the analog setting input terminal. Doing so might cause malfunction or device failure.

If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector). Failure to do so might cause fire or device failure.

OVERVIEW

This device is a compact and lightweight mass flow controller for general industrial equipment. This panel-mount controller combines Azbil Corporation's own ultra high-speed response μF™ (Micro Flow™) flow speed sensor, an extremely compact proportional solenoid valve, an innovative flow path system, and advanced actuator control technology.

INSTALLATION

Installation location

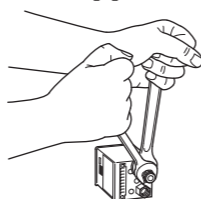
Avoid installing the device where it will be subject to conditions such as the following.

- High or low temperature or high or low humidity
- Sudden changes in temperature and condensation
- Corrosive gas or flammable gas atmosphere
- Large amounts of dust, salt, iron powder or other conductive substances, water droplets, oil mist, or organic solvents
- Direct vibration or shock
- Direct sunlight, wind, or rain
- Splashing by fluids (e.g. oil, chemicals)
- Sources of electrical noise
- Strong magnetic or electrical fields

Installation method

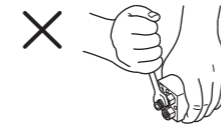
Installing the fittings

- When connecting a fittings, hold the MPC by putting a wrench on the hexagonal section of the pipe connection port.



Handling Precautions

- Do not hold the upper part of the flow controller when tightening the fitting. Doing so may cause deformation and damage.



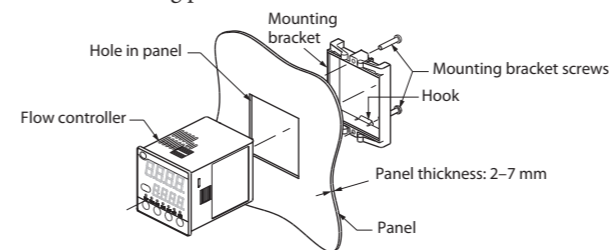
- Tighten the fitting to the torque specified by the fitting manufacturer. Excessive torque can damage the connection port.

- Coat the pipe threads, except the one nearest the tip, with an appropriate amount of sealant. Remove dirt or burrs from the inside of the fitting.



Mounting on a panel

- The mounting panel should be made of steel 2-7 mm thick.

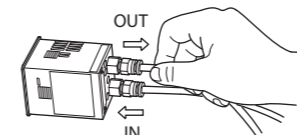


Handling Precautions

- Tighten the screws of the included mounting bracket until there is no more play between the bracket and screw and panel, and then turn one half revolution more only. Excessive tightening of the screws can deform the controller case.

Piping connection

- Make sure, while connecting the pipes and afterwards, that the controller case is not stressed.
- Connect the piping so that the gas flows as indicated on the device, from IN to OUT.
- After connecting the piping, check for gas leaks.



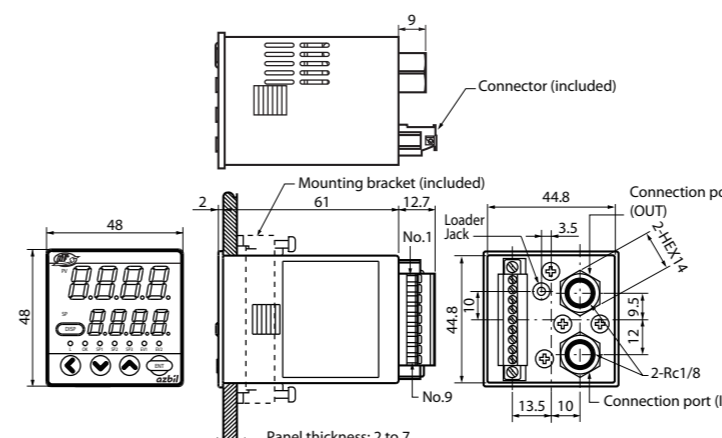
Handling Precautions

- If metal pipes are directly connected to the pipe connection ports, this controller cannot be mounted on a panel. Doing so can deform and damage the case.
- If leak check liquid is used to check for leaks, make sure to prevent it from coming into contact with the case, electrical wires, and connectors. There is a danger of malfunction or device failure.

External Dimensions

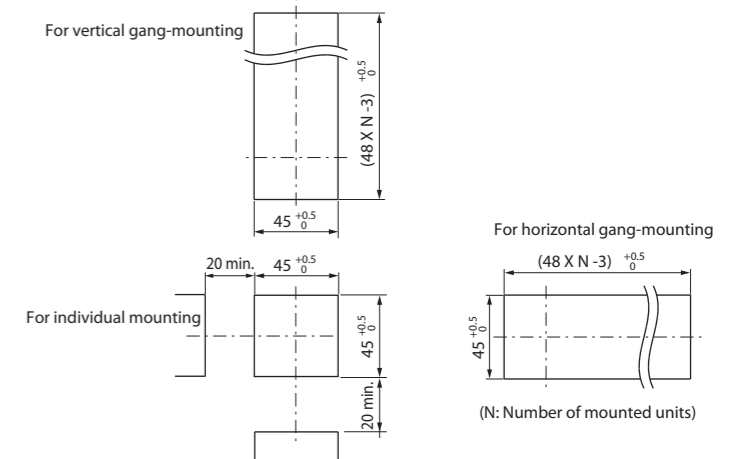
Body

Unit: mm



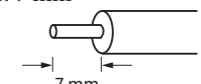
Panel cutout

Unit: mm



Connector specifications

- Part No.: MCVW1.5/9-STF-3.5 (Phoenix Contact)
- Wire type: Solid or stranded
- Wire size: 0.08 to 1.5 mm² (AWG 28 to 16)
- Exposed wire: 7 mm

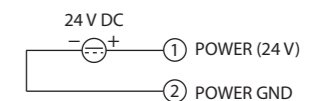


- Screwdriver: Tip size 2.5 x 0.4 mm (flat tip)

WIRING

Wiring

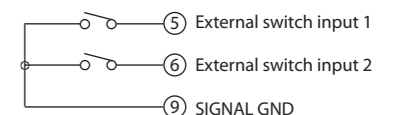
- Power source



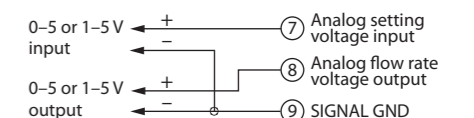
- Event output



- External switch input



- Analog input/output (for models so equipped)



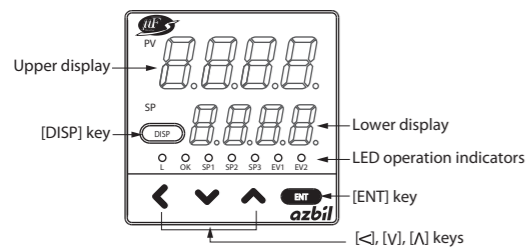
- RS-485 communication (for models so equipped)



Handling Precautions

- Before doing any wiring work, be sure to disconnect the power. Failure to do so might cause device failure.
- Check that the wiring is correct before turning the power on. Incorrect wiring could cause damage or faulty operation.
- Take care that the event output does not exceed the output rating of this device. Also, if driving a relay, use a relay with a built-in diode for coil surge absorption. Failure to do so might cause device failure.

NAMES AND FUNCTIONS OF PARTS



Definition of terms

- SP (setpoint): The value set for the flow rate.
- PV (process variable): The instantaneous flow rate (controlled flow rate)
- Operation modes: Valve fully closed mode, control mode, valve fully open mode

Upper display:

Shows the instantaneous flow rate (7-segment LED display). It also displays the totalized flow rate (first 4 digits), parameter setup items, function settings, and alarm codes.

Lower display:

Shows the preset flow rate (7-segment LED display). It also displays the operation modes, totalized flow rate (last 4 digits), output current to the valve, and parameter and function settings.

LED operation indicators

- L: Lit while the totalized flow is indicated. Flashes when a totalized flow event occurs.
 - OK: Lit when the control flow rate is within the allowable range. Flashes when the operating mode is "valve fully open."
 - SP1 to SP3: Lit to indicate which SP is currently used, if multiple set-points are configured.
 - EV1, EV2: Lit when the corresponding event output is turned ON.
- [DISP] key: Used to switch to a different display.
- <[, [V], [A] keys: Increase or decrease a value, or move the cursor to the desired digit.
- [ENT] key: Used to enter settings and to save them. It is also used to reset the totalized flow and alarms.

SETTING THE GAS TYPE

The flow controller is set at the factory for air/nitrogen use. If it is used for argon, carbon dioxide, or a mixture of these gases, change the gas type following the procedure below.

- After the power is turned on, press the [DISP] key twice to display the totalized flow.
 - >> The L indicator will be lit.
- Press and hold the <[key for 3 seconds.
 - >> "0.000" will be shown on the upper display (this is parameter setup mode).
- Press and hold the <[key for 3 seconds again.
 - >> Function "C-0" will be shown on the upper display (this is function setup mode).
- Press the [A] or [V] key.
 - >> Function "C-0" (gas type) will be shown.
- Press the [ENT] key.
 - >> The current setting (1: Air/nitrogen = default) will be blinking on the lower display.
- Press the [A] or [V] key to select one of the gas types listed below, and then press the [ENT] key.
 - >> The new gas type setting will be saved.
 - 0: Mixed gas (conversion factor [C.F.] is set by the user)
 - 1: Air/nitrogen
 - 3: Argon
 - 4: Carbon dioxide (CO₂)
- Press the [DISP] key.
 - >> The display seen when the power is turned ON will be shown.

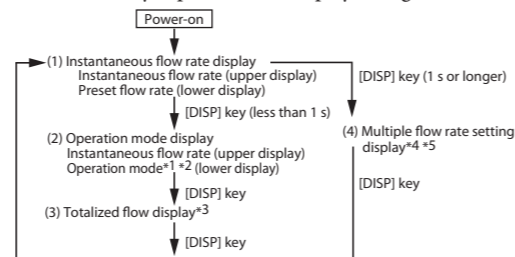
Note

- In the case of a gas mixture, the conversion factor (C.F.) must be set in parameter setup mode.
- Chapter 5, "ADVANCED OPERATION," in CP-SP-1153E

BASIC OPERATION

Switching Displays

When the [DISP] key is pressed, the display changes as shown below.



- If "0: Disabled" is selected for function C-02 (operation mode selection by key operation), the operation mode will not be displayed.
- While the operation mode is being displayed, if there is no key operation for about 10 seconds, the display will automatically return to (1), the instantaneous flow rate display.
- While the totalized flow is being displayed, if the [ENT] key is pressed for about 3 seconds, the totalized flow will be reset.
- This display is shown only if multiple flow rate SPs (settings 1 to 3) are configured for function C-04 (selection of the number of preset flow rates).
- While the multiple flow rate SPs display is shown, if the SP is not changed for about 10 seconds, the display will automatically return to (1), the instantaneous flow rate display.

Note

- Chapter 5, "ADVANCED OPERATION" in CP-SP-1153E

Setting the flow rate

Follow the procedure below to change the SP (preset flow rate).

- Press the [DISP] key.
 - >> The instantaneous flow rate and SP (preset flow rate) are displayed (when the power is turned on).
- Press the [A] or [V] key to change the SP.
 - >> The digit whose value is being changed starts blinking.
 - Also, when the <[key is pressed, the cursor moves to the next digit.
- When the desired value appears, press the [ENT] key.
 - >> The SP value is finalized and saved.

Handling Precautions

- In step 3, if the [DISP] key is pressed before the [ENT] key is pressed, the newly entered SP will not be saved and the SP will revert to the previous value.

Note

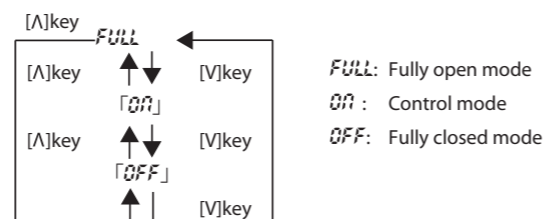
- By changing settings in the function setup, multiple preset flow rates (up to 4 SPs) or analog voltage settings (on models with an analog I/O function only) can be configured.
- Section 4-2, "Setting the flowrate" in CP-SP-1153E

Changing the operation mode (fully-closed/control/fully-open)

While the instantaneous flow rate is being displayed (the same display that is seen when the power is turned on), press the [DISP] key for less than 1 second. The upper display will continue to show the instantaneous flow rate but the lower one will show the operation mode. In this state, the mode can be changed.

Follow the procedure below to change the operation mode.

- Press the [DISP] key to display the operation mode.
- Press the [A] or [V] key.
 - >> The display changes as shown below.



- Select the desired operation mode.
 - >> The display starts blinking.
- Press the [ENT] key to finalize selection of the operation mode.
 - >> The operation mode changes.

Handling Precautions

- While the operation mode is being displayed, if there is no key operation for about 10 seconds, the display will automatically return to the instantaneous flow rate display.

Note

- By changing the settings in the function setup menu, external switch input can be used to switch between operation modes.
- Section 4-3, "Selecting the Operation Mode" in CP-SP-1153E

TROUBLESHOOTING

Alarm codes

Alarm code	Description	Cause	Countermeasures
RL01	Flow rate deviation low limit alarm	Insufficient alarm delay time, insufficient power source voltage, insufficient inlet pressure, excessive operating temperature, etc.	If none of the listed causes apply, call for repair.
RL02	Flow rate deviation high limit alarm	Insufficient alarm delay time, valve failure, sensor failure, etc.	If there is no problem with the delay time, call for repair.
RL11	Limited valve operation to prevent overheating	During control or with the valve fully open, the gas supply was cut off externally.	When the gas is continuously shut off by an external device, set the flow rate SP to zero or put the valve in fully closed mode.
RL81	Sensor error	Sensor malfunction, foreign matter attached to the sensor, or inflow of hydrogen or helium gas.	If the sensor does not recover after shutting the power off for a moment and then back on, call for repair.
RL91	I/O correction data error	Data corruption due to electrical noise, etc.	Call for repair.
RL92	Sensor calibration data error	Data corruption due to electrical noise, etc.	Call for repair.
RL93	User setting error	Power loss while setting was being saved.	Enter the setting again.

Handling Precautions

- If RL81 (sensor error) occurs, the controlled flow rate will be unstable.
- Reset the alarm to turn it off.

Alarm reset

Press and hold the [ENT] key while the instantaneous flow rate is being displayed. The alarm will be reset after 3 seconds.

Other problems

Problem	Possible Causes	Countermeasures
The indicated flow rate is not zero despite zero flow rate. (The display does not show zero even if the valve is fully closed.)	<ul style="list-style-type: none"> Pressure has caused the zero point to move. Incorrect gas type setting Condensation on the sensor Foreign matter on the sensor 	<ul style="list-style-type: none"> Set the inlet pressure (function C-22) to the actual inlet pressure, or use the PV forced zero function (function C-29). Set the gas type (function C-18) to the actual gas type used. Install a mist trap upstream. Call for repair.
The flow rate is not stable.	<ul style="list-style-type: none"> Flow exceeds the operating differential pressure range. The inlet pressure fluctuates greatly. Regulator interferes with the flow. A large pressure loss in the pipes (operating differential pressure fluctuates greatly with the flow rate) 	<ul style="list-style-type: none"> Reduce the inlet pressure. Install a regulator upstream. Change the regulator's pressure setting or apply the PV filter (function C-23) Use a larger pipe.
Poor accuracy	<ul style="list-style-type: none"> The temperature standard is not the same as that of the reference flowmeter. Regulator is making minute vibrations. Foreign matter on the sensor 	<ul style="list-style-type: none"> Use the same standard temperature (in function C-19). Change the regulator's pressure setting. Call for repair.

MODEL SELECTION TABLE

Basic model No.	Flow rate range	Model	Gas-contacting material	Connection method	Gas type	Reserved	Option 1	Option 2	Option 3	Option 4	Suffix	Specifications
MPC												Panel-mount mass flow controller
		9500										0.020-0.500 L/min (standard)*1
		0002										0.08-2.00 L/min (standard)*1
		0005										0.10-5.00 L/min (standard)*1
		0020										0.4-20.0 L/min (standard)*1
		B										With an integrated display
		B										Brass
			R									Rc 1/8
				N								Air/nitrogen *2
												—
							0					No optional functions
							1					With analog input/output function (without RS-485 communications function)
							2					With RS-485 communications function (without analog input/output function)
								0				No optional functions
									0			No optional functions
										0		With inspection report
											Y	With traceability certificate
											0	Product version

*1 L/min (standard) indicates the volumetric flow rate per minute (L/min) converted to conditions of 20 °C and 101.325 kPa (1 atm). The standard temperature can be changed to 0, 25, or 35 °C.

*2 This controller is set initially at the factory for air/nitrogen use. It can also be used for argon and carbon dioxide gases by changing the settings.

基于SJ/T11364-2014「电子电气产品有害物质限制使用标识要求」的表示式样

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电路板	×	○	○	○	○	○
流路部件 (流路与气体接触的部件)	×	○	○	○	○	○

本表格依据SJ/T 11364的规定编制。
 ○: 表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。
 ×: 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。

MAIN SPECIFICATIONS

Model No.	MPC9500	MPC0002	MPC0005	MPC0020	
Valve type	Proportional solenoid valve				
Valve operation	Normally closed (N.C.) when no power is supplied				
Standard full scale (FS) flow rate (nitrogen equivalent)*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	Air/nitrogen, argon, carbon dioxide (CO ₂)				
Control	Control range*1: 4-100 % FS, 2-100 % FS				
Responsiveness	Within 1.0 s (typ.) to the setpoint ± 2 % FS				
Accuracy	Within ±2 % FS (at standard temperature and standard differential pressure)				
Repeatability	Within ±1% FS				
Temperature characteristics	A maximum of 0.1 % FS per °C				
Pressure	Pressure characteristics	Q ≥ 40 % FS	0.7 % 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.	
	Standard differential pressure	0.2 MPa (inlet pressure: 0.2 MPa [gauge]; outlet pressure: 0.0 MPa [gauge])			
Minimum differential pressure*2	0.05 MPa			0.15 MPa	
	0.05 MPa			0.1 MPa	
	0.3 MPa max.			0.05 to 0.3 MPa	
Operating differential pressure range*3				0.05 to 0.3 MPa	
Pressure resistance	0.5 MPa (gauge)				
Temperature	Standard temperature: +25 °C				
Operating temperature range	-10 to +50 °C (but 0 to 50 °C when the RS-485 communication function is used)				
	Storage temperature: -10 to +60 °C				
Humidity	Operating humidity range: 10-90 % RH (without condensation)				
Totalizing function	Display range	0.00 to 9,999,999.99 L	0.0 to 9,999,999.9 L	0.0 to 9,999,999.9 L	0 to 99,999,999 L
	Display resolution	0.01 L	0.1 L	0.1 L	1 L
	Backup cycle	(1) Every 5 L	(1) Every 20 L	(1) Every 50 L	(1) Every 200 L
Flow output*4	Output scale	0 to full-scale flow rate (can be changed)			
	Rated output voltage range	0-5 or 1-5 V DC (selectable by function settings)			
Event output	Outputs	2			
	Output rating	30 V DC, 15 mA max. (open collector non-isolated output)			
	Analyzer pulse output width	100 ms ± 10 % (when the analyzer pulse output is selected)			
	Analyzer pulse output rate	0.01 L/pulse	0.1 L/pulse	0.1 L/pulse	1 L/pulse
External switch input	Inputs: 2				
Circuit type	Non-voltage contacts or open collector				
	Rated current	24 V DC, current consumption: 300 mA max.			
Power source	Allowable supply voltage range: 22.8-25.4 V DC (ripple: 5 % max.)				
	Gas-contacting material: Brass (Ni plated), stainless steel, Teflon, fluoroelastomer				
Connection method	Rc 1/8				
Mounting orientation	Display vertical, outlet above inlet				
Mass	Approx. 300 g				
Accessories	Mounting bracket (81446917-001), connector				
Standards compliance	EN61326-2-3:2013, EN61326-1:2013 (to be used in an industrial electromagnetic environment) During EMC testing, the reading or output may fluctuate by ±20 % FS.				

*1. L/min (standard) indicates the volumetric flow rate per minute (L/min) converted to conditions of 20 °C and 101.325 kPa (1 atm). The standard temperature can be changed to 0, 25, or 35 °C. The controllable flow rate range varies depending on the gas type. See the table below.

	MPC9500		MPC0002	
	Controlled flow rate range L/min (standard)	Setting and display resolution L/min (standard)	Controlled flow rate range L/min (standard)	Setting and display resolution L/min (standard)
Air/nitrogen	0.020 to 0.500	0.002	0.08 to 2.00	0.01
Argon	0.020 to 0.500	0.002	0.08 to 2.00	0.01
Carbon dioxide (CO ₂)	0.012 to 0.300	0.001	0.040 to 1.200	0.005

	MPC0005		MPC0020	
	Controlled flow rate range L/min (standard)	Setting and display resolution L/min (standard)	Controlled flow rate range L/min (standard)	Setting and display resolution L/min (standard)
Air/nitrogen	0.10 to 5.00	0.02	0.4 to 20.0	0.1
Argon	0.10 to 5.00	0.02	0.4 to 20.0	0.1
Carbon dioxide (CO ₂)	0.06 to 3.00	0.01	0.3 to 16.0	0.1.

*2. Minimum necessary differential pressure for obtaining full-scale flow rate (outlet pressure = 0.0 MPa [gauge])

*3. Operation is possible at less than the minimum necessary differential pressure. (However, the flow rate range narrows.) Chapter 5, "ADVANCED OPERATION" in CP-SP-1153E

*4. This function is available only on models with an analog input/output function.

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