Warnings and Cautions for MQV series Flow Controllers
(For installation and use of this device, refer to the warnings and cautions in the user’s manual.)

- Never allow gases that are within explosive limits to pass through this device. Doing so might result in an explosion accident.
- Never use a device for oxygen gas if it is not a special oil-free oxygen gas model. Doing so could cause the gas to ignite. Even if gas-contacting sections have been treated to be oil-free, they cannot be used for oxygen if they have previously been used for some other gas.
- If the device is used for burner air-fuel ratio control, take the necessary countermeasures with the equipment to prevent the occurrence of backfire and to avoid any influence to the device even if backfire occurs. Pressure increase or fire in the pipes caused by the backfire of the burner could damage the controller.
- Prevent foreign matter from entering the device. If rust, water droplets, oil mist, or dust in the pipes enters the device, measurement or control error or damage may occur.
- If there is a possibility of foreign matter entering the device, provide a filter, strainer, or mist trap capable of eliminating foreign matter 0.3 μm or greater in diameter at the upstream. Be sure to inspect and replace the filter at regular intervals.
- Use the 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.
- Do not subject this device to pressure beyond its rated pressure resistance. Doing so might result in damage.
- Be sure to use within the flow rate range stated in the product specifications. To prevent excessive flow rate, design instrumentation that includes, as appropriate, supply pressure management, a throttle valve, etc. Exceeding the upper limit of the range may result in display and output values that are considerably lower than the actual flow rate. If a problem with this device could result in damage, include appropriate redundancy in the system design.
- The valve on this device cannot completely shut a flow off. If complete shutdown is required, provide a shutoff valve separately. When the external valve is closed, it is necessary also to fully close the valve of the device using either of the following methods:
  - Set the flow rate setpoint to zero.
  - Make the valve operation mode to fully closed.
- If this valve remains in normal control status when the external shutoff valve is closed (zero flow rate), there will be an excessively large flow as soon as the external shutoff valve is opened. For the MQVD050(J/K), MQVD200(J/K), and MQVD600(J/K), if the external shutoff valve is closed continuously for 5 minutes or more in control mode or with the valve forced fully open, the valve overheating limit (AL71) will be activated and the current to the valve will be forcibly limited.
- Before connecting pipes with Swagelok or VCR connections, check the precautions in the instruction provided by the connecting joint manufacturer. When separately purchasing a connecting joint, use the following made by Swagelok Co., Ltd:
  - 1/4" Swagelok: SS-400-1-ST (standard)
  - SS-400-1-8STSC1 (oil-inhibited)
  - 1/2" Swagelok: SS-610-1-ST (standard)
  - SS-610-1-8STSC1 (oil-inhibited)
  - 1/4" VCR: SS-A-VCR-1-D02DSC1
  - 3/8" VCR: SS-B-VCR-1-8STSC1 or equivalent
- Observe the following when using this device (oil-free model) for oxygen gas:
  - Piping should be carried out by a specialist skilled in handling oxygen gas.
  - Use oil-free pipes and parts.
  - Be sure to remove foreign matter, barns, etc. from the pipes before connecting the device.
  - Install a filter upstream of the device.
  - Mount securely in order to prevent vibration. Otherwise, equipment failure could result.
  - Mount the device horizontally. Do not mount it with the display facing down. Doing so might cause measurement error or equipment failure.
  - For the MQVD050(J/K)/MQVD200(J/K)/MQVD600(J/K)/1000D(J/K), to keep pressure loss in the piping as low as possible, use as large a diameter pipe as possible. If the pressure loss in the piping is high, the gas supply pressure to this device (operating differential pressure) may fluctuate greatly, resulting in unstable control.
  - When using a relay for external contact input and/or external 3-way switching input, always use a relay designed for micro-current use (with gold contacts). Failure to do so could cause faulty contact, resulting in malfunction.
  - If there is a risk of a power surge caused by lightning, use Azbil Corporation’s SurgeArrest to prevent possible fire or equipment failure.
  - Gas type switching by external contact input, flow rate switching, and analog input/output voltage range switching by external 3-way input switching should be done only after setting the operation mode to fully closed. Switching while controlling could cause large fluctuations.
  - Do not use a semi-standard gas model with gases other than those below. Doing so may degrade the O-ring seal.
  - Compatible gases: Nitrogen (N2), air, argon (Ar), carbon dioxide (CO2), ammonia (NH3), and acetylene (C2H2).
  - If a semi-standard gas model is used for a gas with an ammonia component, be sure the gas is dry, with a dew point of -20°C or less. Otherwise the sensor may be damaged.

Please read the "Terms and Conditions" from the following URL before ordering or use:
http://www.azbil.co.jp/products/bi/order.html

Other product names, model numbers and company names may be trademarks of the respective companies.

Azbil Corporation
Advanced Automation Company

Azbil Corporation Limited by Share is Azbil Corporation on April 1, 2002.

1-12-2 Kawan, Fujisawa
Kanagawa 251-8522 Japan
URL: http://www.azbil.com

1st Edition : Issued in Mar. 2006-ST
7th Edition : Issued in Nov. 2014-SK/AZ

(11)
The Ultra Fast \( \mu F \) Sensor, Combined with Advanced Actuator Control Technology

300ms \(^*\) high-speed control can be used for low differential pressure work. Selectable control range, power circuit isolation (an industry first), and emphasis on usability

\( (> 500 \text{ms for the MQV900S/9200/9050B and C, 700ms for the MQV0050/0200/0500/1000J and K} \) )

The MQV series features high performance digital gas mass flow controllers that incorporate the ultra small \( \mu F \) (Micro Flow\(^*\)) sensor developed by Azbil Corporation, a pioneer in MEMS (micro electromechanical systems) flow sensors. The MQV series uses \( \mu F \) sensor output and advanced PID control technology to drive a proportional actuator. Very low flow rate models of 5, 20, and 50 mL/min have been added to the lineup, expanding the available application ranges.

Structure and features of the \( \mu F \) sensor

Principle of measurement

- **When there is no gas flow:** The temperature distribution around the heater is symmetric. When the gas starts to flow from \( \text{F} \) to \( \text{R} \), the temperature at \( \text{R} \) decreases and the temperature at \( \text{F} \) increases, thus causing a distortion of the symmetry in temperature distribution. The temperature difference between \( \text{F} \) and \( \text{R} \) is used to calculate the mass flow rate (flow rate \( \times \) density).

- **Temperature profile:**
  - **Profile in steady state:**
    - **Flow rate 0:**
      - Temperature is symmetrical.
    - **Flow rate:**
      - Temperature at \( \text{R} \) is higher than that at \( \text{F} \).
  - **Profile in moving conditions:**
    - Temperature distribution is distorted due to flow rate change.

Advantages

1. **Advanced 300ms high-speed controllability**
   - Achieves 300ms high-speed control (700ms for the MQV0050/0200/0500/1000J and K). The MQV series offers exceptionally fast response from no flow to the stable setpoint flow rate, and after setpoint changes. This high-speed response to changes in primary gas pressure can maximize the effects on secondary flow.

2. **Reliable control**
   - Standard model
     - Accuracy: \( \pm 0.5\% \text{ FS} \)
     - Repeatability: \( \pm 0.25\% \text{ FS} \)
   - High accuracy model (standard gas model only)
     - Accuracy: \( \pm 1.0\% \text{ SP} \)
     - Repeatability: \( \pm 0.5\% \text{ SP} \)

3. **Broad lineup of models**
   - The lineup includes models with or without integrated display, and models for standard gas, for hydrogen/helium, and for special gases. Select the optimum model for your application needs.

4. **Operation at low differential pressure is a standard feature**
   - The MQV series does not use capillaries that have large pressure loss. So, the MQV series can control in the low pressure difference.

5. **Wide range of standard functions**
   - The MQV series comes with a multitude of standard functions such as flow rate indication and totalizing. Without the need to process software like a PLC, the MQV series handles a wide range of applications with ease.

6. **PC loader communications functions**
   - A convenient personal computer loader function has been integrated as a standard feature. The MLP loader software, which is sold separately, allows not only configuration of various settings, but also monitoring of flow rate trends and other operating status information on the PC screen. Acquired data can also be saved as a CSV file.

![Flow performance graph]

[Flow performance graph showing the relationship between flow rate and differential pressure]

**Start of control**

**Optimum for low pressure gas control application**

- Ex.: Braising, production of fluorescent lamps, etc.

**Structure of conventional mass flow products**

**Structure of Micro Flow products**

**Six easy-to-operate buttons, superior indication function, and SP change even in control run mode.**

![Control and display unit]

**Easy connection using a dedicated USB (PC side) communications cable**

(> With the MFP100, included with the MFP100)
A variety of available input and output signals

Voltage signal (0–5Vdc and 1–5Vdc) (selectable setting)
Current signal (4–20mA and 0–20mA)
Switch between 3 inputs and between 2 event outputs RS-485 communications (optional)
Dedicated port for connection to a PC

Can be connected to a regular 24Vdc power supply

The internal power supply circuit of this device is isolated from its analog circuits. When multiple MQVs are controlled by PLC analog input/output, even if the analog module of the PLC is not isolated between channels, a common power supply can be used. Even without individual power supplies, there is no negative effect from surrounding circuits. An AC adapter (100 to 240Vac) is also available by separate purchase.

Engineered for flexible installation

On models with an integrated display, the display direction can be changed 180 degrees.

Wide temperature range

As a product developed for general industrial markets, the MQV series can be used from -10 to +60°C (ambient temperature and gas temperature).

-10°C to +60°C

CE marking

The MQV series is CE-compliant.

JCSS traceability

The MQV series offers Japan Calibration Service System (JCSS) traceability, based on Japanese National Standards and Japanese measurement law, and in conjunction with Advanced Industrial Science and Technology (AIST).

- Japanese National Standards
- Accredited calibration laboratories
- Australia measurement standards
- Inspection equipment
- Product

Sample applications

- Air/fuel ratio control for burner
  - Manufacturing of backlights
  - Halogen lamps
  - Glass-forming
  - Brazing

- Gas flow rate control for vacuum
  - Sputtering
  - Plasma cleaning

- Various test equipment
  - Evaluation equipment
  - Gas analyzers
  - Incubators

- Control of furnace internal atmosphere
  - Baking furnaces for electronics parts
  - Gas carburizing furnaces
  - Baking and annealing furnaces
### Specifications

#### Standard gas model / Small-Flow Type

<table>
<thead>
<tr>
<th>Model No.</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00 (LJ)</th>
<th>MVGD00</th>
<th>MVGD10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve operation</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
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<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
</tr>
<tr>
<td>Standard medium flow rate (flow rate (Note 1))</td>
<td>0.25m³/min (standard)</td>
<td>0.25m³/min (standard)</td>
<td>0.25m³/min (standard)</td>
<td>0.25m³/min (standard)</td>
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<td>0.25m³/min (standard)</td>
<td>0.25m³/min (standard)</td>
<td>0.25m³/min (standard)</td>
</tr>
<tr>
<td>Gas types</td>
<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
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<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
</tr>
<tr>
<td>Control</td>
<td>Maximum static differential pressure (when control is started from fully closed condition and when the stopcock is changed while control is performed)</td>
<td>Maximum static differential pressure (when control is started from fully closed condition and when the stopcock is changed while control is performed)</td>
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</tr>
</tbody>
</table>

#### Semi-Standar-D Gas Model

<table>
<thead>
<tr>
<th>Model No.</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00 (L)</th>
<th>MVGD00</th>
<th>MVGD10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve operation</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
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</tr>
<tr>
<td>Standard medium flow rate (flow rate (Note 1))</td>
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<td>0.25m³/min (standard)</td>
</tr>
<tr>
<td>Gas types</td>
<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
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<td>Ammonia (N2), oxygen (O2), argon (Ar), carbon dioxide (CO2), city gas</td>
</tr>
<tr>
<td>Control</td>
<td>Maximum static differential pressure (when control is started from fully closed condition and when the stopcock is changed while control is performed)</td>
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<td>Maximum static differential pressure (when control is started from fully closed condition and when the stopcock is changed while control is performed)</td>
</tr>
</tbody>
</table>

#### Hydrogen / Helium gas model

<table>
<thead>
<tr>
<th>Model No.</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
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<th>MVGD00</th>
<th>MVGD00</th>
<th>MVGD00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve operation</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
<td>Normally closed when de-energized (N.C.)</td>
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<td>Normally closed when de-energized (N.C.)</td>
</tr>
<tr>
<td>Standard medium flow rate (flow rate (Note 1))</td>
<td>0.25m³/min (standard)</td>
<td>0.25m³/min (standard)</td>
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</tr>
<tr>
<td>Control</td>
<td>Maximum static differential pressure (when control is started from fully closed condition and when the stopcock is changed while control is performed)</td>
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<td>Maximum static differential pressure (when control is started from fully closed condition and when the stopcock is changed while control is performed)</td>
</tr>
</tbody>
</table>

**Notes:**
1. *Note 1:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
2. *Note 2:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
3. *Note 3:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
4. *Note 4:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
5. *Note 5:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
6. *Note 6:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
7. *Note 7:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
8. *Note 8:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
9. *Note 9:* Indicates the value of the control valve opening when the control valve is fully closed and the stopcock is changed while control is performed.
10. *Note 10:* Applies only to models with the optional RS-485 communications function.
### Specifications

#### Table 1. Standard gas model Control flow rate range and setting/display resolutions (factory settings)

<table>
<thead>
<tr>
<th>MAVICODS</th>
<th>MAVICODE</th>
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<th>MAVICODE</th>
<th>MAVICODE</th>
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</thead>
<tbody>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
</tr>
</tbody>
</table>

#### Table 2. Semi-Standard Model Control flow rate range and setting/display resolutions (factory settings)

<table>
<thead>
<tr>
<th>MAVICODS</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
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</tbody>
</table>

#### Table 3. Hydrogen gas model Control flow rate range and setting/display resolutions (factory settings)

<table>
<thead>
<tr>
<th>MAVICODS</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
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</thead>
<tbody>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
</tr>
</tbody>
</table>

### Selection guide

#### Standard gas model

<table>
<thead>
<tr>
<th>Low flow rate</th>
<th>Ex. M092000BR00000000</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
</tr>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
</tr>
</tbody>
</table>

#### Low flow rate high accuracy model

<table>
<thead>
<tr>
<th>MAVICODS</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
</tr>
</tbody>
</table>

#### Medium flow rate high accuracy model

<table>
<thead>
<tr>
<th>MAVICODS</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
<th>MAVICODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAVICODS</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
<td>MAVICODE</td>
</tr>
</tbody>
</table>

### Compatible gases for each model

- **Standard gas model**: Hydrogen, Methane, Ethane, Propane, Butane, Pentane, Hexane, Heptane, Octane, Nonane, Decane, Dodecane, and higher alkanes.

### Notes

1. **Priority gas** is in parentheses: Usage priority is methane, followed by hydrogen, then ethane.
2. **Medium flow rate** is recommended for medium flow rate.
3. **High flow rate** is recommended for high flow rate.
4. **Medium flow rate high accuracy model** is recommended for medium flow rate high accuracy.
5. **High flow rate high accuracy model** is recommended for high flow rate high accuracy.

#### Contact

For use with gases other than the above, contact Azbil Corporation.
## Selection guide

### Semi-standard gas model

#### Low flow rate

<table>
<thead>
<tr>
<th>Model</th>
<th>Model Code</th>
<th>Display</th>
<th>Material</th>
<th>Correction type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLD1</td>
<td>MQV0020SSE0000100</td>
<td>Standard</td>
<td>Steel</td>
<td>1</td>
<td>No expansion joint standard (1)</td>
</tr>
<tr>
<td>SLD2</td>
<td>MQV0020SSE0000200</td>
<td>Standard</td>
<td>Steel</td>
<td>1</td>
<td>No expansion joint standard (1)</td>
</tr>
</tbody>
</table>

#### Medium flow rate

<table>
<thead>
<tr>
<th>Model</th>
<th>Model Code</th>
<th>Display</th>
<th>Material</th>
<th>Correction type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMD1</td>
<td>MQV0020SSE0000100</td>
<td>Standard</td>
<td>Steel</td>
<td>1</td>
<td>No expansion joint standard (1)</td>
</tr>
<tr>
<td>SMD2</td>
<td>MQV0020SSE0000200</td>
<td>Standard</td>
<td>Steel</td>
<td>1</td>
<td>No expansion joint standard (1)</td>
</tr>
</tbody>
</table>

### Hydrogen/helium gas model

#### Low flow rate

<table>
<thead>
<tr>
<th>Model</th>
<th>Model Code</th>
<th>Display</th>
<th>Material</th>
<th>Correction type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLD1</td>
<td>MQV0020SSE0000100</td>
<td>Standard</td>
<td>Steel</td>
<td>1</td>
<td>No expansion joint standard (1)</td>
</tr>
<tr>
<td>SLD2</td>
<td>MQV0020SSE0000200</td>
<td>Standard</td>
<td>Steel</td>
<td>1</td>
<td>No expansion joint standard (1)</td>
</tr>
</tbody>
</table>

### External Dimensions (unit: mm)

#### Standard gas model/semi-standard gas model: MQV9005/9020/9200/9500/9505/9002/0005/0020/0050B.C

![Diagram](image)

#### Hydrogen/helium gas model: MQV9020/9050/9500/0005/0010/0050/0200B.C

![Diagram](image)

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**Notes:**

1. All dimensions are based on the factory's standard size, and the customer's requirement may vary.
2. For more information, please refer to the manufacturer's specifications.
3. The diagrams above are for reference only and may not be to scale.
4. The "h" dimensions for the above diagrams are shown in the table below.

### Table 3. Optional parts (sold separately)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front plate for separate display</td>
<td>For mounting the display separately</td>
</tr>
<tr>
<td>Rear plate for separate display</td>
<td>For mounting the rear panel separately</td>
</tr>
<tr>
<td>Expansion joint for separate display</td>
<td>For connecting two separate displays</td>
</tr>
<tr>
<td>Expansion joint for separate display</td>
<td>For connecting two separate displays</td>
</tr>
</tbody>
</table>

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