Proposal for a new generation

SAM™
Speedy Accuracy Maintainability

1480G
2480G series

G series = Next Gen
From the release of the first of our SFC480 series, SAM brand high-performance mass flow controllers continue in the tradition of perfection. High corrosion resistance and stable control performance are possible thanks to a waveform diaphragm made of a Ni-Co alloy (YET*101), developed by Hitachi Metals. This technology demonstrates that Hitachi is a manufacturer of high grade metallic materials. Hitachi includes features like “dual-range” mass flow controller and a “hybrid” mass flow controller, thanks to the latest digital control technology developed for the SFC1480F series. Hitachi products that are equipped with these technologies enjoy a well deserved reputation from globally recognized customers. Real SAM-brand products are highly valued as premium performance designs.

In an ever changing and demanding market for even more advanced mass flow controllers, Hitachi Metals is proud to introduce the G series. This design is positioned to play a major role in the next generation of controllers. This G series is an all-in-one mass flow controller that meets or exceeds the next generation of requirements, a step ahead of the competition. These advances are in response to our customers’ needs for functions such as guaranteed control accuracy with actual gas, MG/MR, PI, valve shut off, and flow rate verification.

With SAM’s advanced technologies, such as its reliable diaphragm valve structure, digital control, etc., the G series offers innovative features that can be used for a variety of new functions. Hitachi Metals is developing a product lineup that best meets user’s needs, such as an all-in-one mass flow controller that includes all the functions along with models that include only desired functions.

The search for excellent technologies with unlimited investment is a bygone era. Today we seek appropriate technologies with appropriate levels of investment. We believe our new mass flow controller must apply the technologies which are desired to receive good marks from customers. Customers can get the most desirable functions in performance from one of our many G series models, at a cost to match the expectation of performance. If users have a mass flow controller problems, Hitachi Metals strongly recommends that close review of the G series will satisfy the demands for next generation semiconductor production.
The G series controllers are all-in-one mass flow controllers ready for the next generation of requirements for guaranteed accuracy with the actual gas, MG/MR, PI, valve shut off, and flow rate verification.

New functions in the G series

**Multi-gas / multi-range (MG/MR) function**

The G4 has new functions which allow one mass flow controller to handle two or more gas types and ranges. When mass flow controllers are equipped with this function the need for dedicated devices is reduced to only a few models which reduces the capital investment and inventory liability.

Also, the G series MFCs provide a flow rate accuracy guarantee for the actual gas type, so that the performance (precision and response) of the MFC before changing the flow rate can be maintained after a change.

**Pressure Insensitive (PI) function**

While a mass flow controller is controlling the flow rate and another gas line is connected to the same gas source, the upstream gas supply pressure changes instantly which can cause the flow rate control to fluctuate by this change in pressure. This symptom comes from the fact that the mass flow controller tries to maintain control of the flow rate as it detects the change in pressure at the flow rate sensor.

To reduce or eliminate this problem, a line regulators for each gas line is installed to augment pressure fluctuation. The PI function reduces this influence by sensing pressure changes with a pressure sensor incorporated in the device. This interrupts the feedback from the flow rate sensor to the control valve, and keeps the control valve opening at the optimum level.

**Valve shut off function**

The flow rate control valve on a mass flow controller stabilizes the flow rate, but it cannot shut off the flow like an ordinary pneumatic valve. That is why a minute leak may still occur if a mass flow controller tries to shut off the gas flow completely. Therefore, normally a mass flow controller is installed with pneumatic control valves upstream and downstream the MFC. Sometimes, leaking gas may be left in the space between the mass flow controller valve and the downstream pneumatic valve. This can cause an unexpected gas surge when gas is re-introduced which may negatively impact the process. Hitachi Metals has incorporated a positive valve shut off function which makes it possible to isolate the gas completely by integrating an ultra-small pneumatic valve linked to the control valve.
The G series controllers are all-in-one mass flow controllers ready for the next generation of requirements for guaranteed accuracy with the actual gas, MG/MR, PI, valve shut off, and flow rate verification.

New functions in the G series

In-line flow rate verification and self calibration functions

The requirements for flow rate accuracy and repeat performance from a mass flow controller are constantly growing. In manufacturing semi-conductor devices, where process margins are tight, and stopping operation of the devices is not allowed, it must be possible to evaluate the performance of the mass flow controller without removing it from the gas circuit.

The in-line flow rate verification function measures the current flow rate using an integrated flow rate verification system, while the mass flow controller remains installed in the gas circuit. The report identifies deviation in flow rate after comparing the measured data with previously recorded data in memory. And, this function allows you to re-calibrate the stored data in memory whenever you like.

Using this function, you can identify risks that might otherwise cause significant damage to your products, and it prolongs the life of the mass flow controller by using the calibration function until it is time to be replaced. It also contributes to maintaining planned maintenance cycles.

Table of models and functions

<table>
<thead>
<tr>
<th>Model name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
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<tr>
<td></td>
<td>MG/MR function (Guaranteed accuracy with the actual gas)</td>
</tr>
<tr>
<td>1480FX</td>
<td>*</td>
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<tr>
<td>2480FX</td>
<td></td>
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<td>1480G1</td>
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<td>2480G2</td>
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<tr>
<td>1480G3</td>
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<td>2480G3</td>
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<tr>
<td>1480G4</td>
<td>*</td>
</tr>
<tr>
<td>2480G4</td>
<td></td>
</tr>
</tbody>
</table>
1480G1 / 2480G1 series

For both the 1.5" and 1.125" IGS

PI Mass Flow Controllers

**Dimensions**

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**Basic specifications**

<table>
<thead>
<tr>
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<th>Specifications</th>
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</thead>
<tbody>
<tr>
<td>Model name</td>
<td>1480G1, 2480G1</td>
</tr>
<tr>
<td>Standard full scale flow rate (N2 equivalent)</td>
<td>55SCCM, ~5,500SCCM</td>
</tr>
<tr>
<td>Operation pressure *2</td>
<td>2~100% F.S.</td>
</tr>
<tr>
<td>Inlet pressure</td>
<td>0.05~0.3 MPa (G)</td>
</tr>
<tr>
<td>Outlet pressure</td>
<td>7.3~43.5 PSI (G)</td>
</tr>
<tr>
<td>Proof pressure</td>
<td>1.0 MPa(G) 145 PSI(G)</td>
</tr>
<tr>
<td>Temperature</td>
<td>5~60 °C</td>
</tr>
<tr>
<td>Operation</td>
<td>5~60 °C</td>
</tr>
<tr>
<td>Heating temperature when not powered</td>
<td>65 °C max</td>
</tr>
<tr>
<td>Humidity</td>
<td>35~80%RH (non-condensing)</td>
</tr>
<tr>
<td>Installation position</td>
<td>Horizontal, Vertical</td>
</tr>
<tr>
<td>Flow rate setting signal</td>
<td>0.1 ~ 5 VDC (absolute rating: Max. ±15 VDC)</td>
</tr>
<tr>
<td>Flow rate output signal</td>
<td>0 ~ 5 VDC (maximum output: ±15 VDC)</td>
</tr>
<tr>
<td>Required power</td>
<td>+15 VDC ±4%, 140 max max</td>
</tr>
<tr>
<td>Material of gas wetted surface</td>
<td>SUS316L</td>
</tr>
<tr>
<td>Housing, flange, valve seat</td>
<td>SUS316L</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>YET101 (Ni-Co alloy)</td>
</tr>
<tr>
<td>Flow sensor</td>
<td>SUS316L</td>
</tr>
<tr>
<td>Seal *3</td>
<td>SUS316L</td>
</tr>
<tr>
<td>Pressure sensor</td>
<td>SUS316L</td>
</tr>
<tr>
<td>LCD display</td>
<td>4 digit display (6 x 4 mm), LED backlight</td>
</tr>
<tr>
<td>External leakage standard</td>
<td>Max. 1x10^-11 Pa m³/s (He)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± (0.5% S.P. + 0.15% F.S.)</td>
</tr>
<tr>
<td>Linearity</td>
<td>± (1.5% S.P. + 0.35% F.S.)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± (0.5% F.S.)</td>
</tr>
<tr>
<td>Flow rate sensor guaranteed zero point deviation range</td>
<td>± (0.5% F.S., year, max.)</td>
</tr>
<tr>
<td>Zero point</td>
<td>±0.01% F.S. / °C (15~35 °C)</td>
</tr>
<tr>
<td>Temperature dependence</td>
<td>±0.01% S.P. / °C (15~35 °C)</td>
</tr>
<tr>
<td>Response Time</td>
<td>Max. 1.0 sec. to reach ±2% S.P. of the set value.</td>
</tr>
<tr>
<td>Flow rate change time when the pressure changes</td>
<td>Max. 1.5 sec. to reach ±0.4% S.P. of the set value.</td>
</tr>
</tbody>
</table>

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**Flow rate control function**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>-99.9~999.9 kPa (G) <del>14.5</del>145 PSI (G)</td>
</tr>
<tr>
<td>Pressure sensor</td>
<td>±0.5% F.S.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1.0% S.P.</td>
</tr>
<tr>
<td>Temperature dependence</td>
<td>0.05% / °C</td>
</tr>
<tr>
<td>Pressure output</td>
<td>LCD display and digital communication (no analog output)</td>
</tr>
<tr>
<td>Temperature measuring range</td>
<td>273.2~323.2 K (<del>0</del>50°C)</td>
</tr>
</tbody>
</table>

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*1: The specifications above are guaranteed values when the MFC was measured by itself in standard conditions. The MFC may not meet the specifications above, depending on the measurement conditions.

*2: The 147G1 / 247G1 series are also available for use with minute pressure differences. Please inquire separately for the specifications of our minute pressure difference models.

*3: A model using a rubber seal is also available. Please inquire separately about the rubber seal specifications.

*4: An HIG seal is only available on the SFC14™/G1 series

*5: The PI function may not perform as specified in certain plumbing conditions. Please consult us in advance.
**What is a G1?**

The G1 series is a line of mass flow controllers that are equipped with MG/MR, an PI (Pressure Insensitive) functions.

The PI function is resistant to fluctuation in the actual flow rate caused by fluctuation in the inlet pressure of the mass flow controller (MFC).

An ordinary gas supply unit uses a regulator to absorb pressure fluctuation in the gas supply inlet, and to stabilize the actual flow rate. Therefore, any current mass flow controller, without this regulator, is directly influenced by fluctuation in the gas supply inlet pressure, and the actual flow rate will change instantly by a large amount.

**Principle of the PI control**

At a normal stable pressure, a mass flow controller controls the flow rate using feedback control, in order to match the signal from the flow rate sensor with the setting.

The PI control stops this feedback when the integrated pressure sensor detects an inlet pressure fluctuation. The pressure sensing circuit controls valve voltage directly using this pressure signal, thereby reducing fluctuation in the flow rate. It controls the opening of the flow rate control valve directly.

In other words, a PI equipped mass flow controller uses two control methods: PI control when a pressure fluctuation occurs, and feedback control while the pressure is stable.
**1480G2 / 2480G2 series**

Applied to 1.5" and 1.125" IGS

**Valve shut off Mass Flow Controllers**

### Basic specifications

- **Model name**: 1480G2, 2480G2
- **Standard full scale flow rate (N₂ equivalent)**: 5SCCM ~ 5,500SCCM
- **Function**: 1) Multi-gas/multi-range, 2) Valve shut off function
- **Valve operation**: Normally closed / normally open
- **Operation temperature**: 5~50°C
- **Operation accuracy guaranteed**: ±2% S.P.
- **Heating temperature when not powered**: 65°C max
- **Humidity**: 35~80%RH (non condensing)
- **Installation position**: Horizontal, vertical
- **Flow rate setting signal**: 0.1 - 5 VDC (absolute rating: Max. ±15 VDC)
- **Flow rate output signal**: 0 - 5 VDC (maximum output: ±15 VDC)
- **Required power**:
  - +15 VDC ±4%, 200 mA max
  - -15 VDC ±4%, 150 mA max
- **Material of gas wetted surface**:
  - Housing, flange, valve seat: SUS316L
  - Diaphragm: YET101 (Ni-Co alloy)
  - Flow sensor: SUS316L
  - Seal: SUS316L
  - Shut off valve: SUS316L, YET101, PCTFE
  - Pressure sensor: SUS316L
- **Surface finish of components that contact the gas**: Specially electro-polished (standard)
- **External leakage standard**:
  - W-seal, C-seal, H1G seal
  - Max. 1×10⁻¹¹ Pa·m³/s (He)
- **Accuracy**:
  - N₂ gas:
    - 10~100%: ±(0.3% S.P. + 0.15% F.S.)
    - 2~10%: ±0.2% F.S.
  - Actual gas:
    - 10~100%: ±(1.5% S.P. + 0.35% F.S.)
    - 2~10%: ±0.5% F.S.
- **Linearity**:
  - N₂ gas: ±0.3% F.S.
  - Actual gas: ±1.0% F.S.
- **Repeatability**:
  - 10~100%: ±(0.1% S.P. + 0.05% F.S.)
  - 2~10%: ±0.06% F.S.
- **Flow rate sensor guaranteed zero point deviation range**: ±0.5% F.S. / year, max.
- **Temperature dependence**:
  - Zero point: ±0.01% F.S. / °C (15~35 °C)
  - Span: ±0.01% S.P. / °C (15~35 °C)
- **Response Time**:
  - 0%~100%: Max. 1.5 sec to reach ±0.4% S.P. of the set value.
  - 0%~2% (2~20%): Max. 1.5 sec to reach ±0.4% S.P. of the set value.
- **Valve operation pneumatic pressure**: 0.4~0.7 MPa (G) 58.0~101.5 PSI (G)
- **Valve seat leakage amount**: Max. 1×10⁻⁸ Pa · m³/s (He)
- **Number of durability**:
  - 2 million times
- **Operation of integrated metal diaphragm valve**: Normally open

### Dimensions

**W-seal**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model name</td>
<td>1480G2, 2480G2</td>
</tr>
<tr>
<td>Standard full scale flow rate (N₂ equivalent)</td>
<td>5SCCM ~ 5,500SCCM</td>
</tr>
<tr>
<td>Function</td>
<td>1) Multi-gas/multi-range, 2) Valve shut off function</td>
</tr>
<tr>
<td>Valve operation</td>
<td>Normally closed / normally open</td>
</tr>
<tr>
<td>Operation temperature</td>
<td>5~50°C</td>
</tr>
<tr>
<td>Operation accuracy guaranteed</td>
<td>±2% S.P.</td>
</tr>
<tr>
<td>Heating temperature when not powered</td>
<td>65°C max</td>
</tr>
<tr>
<td>Humidity</td>
<td>35~80%RH (non condensing)</td>
</tr>
<tr>
<td>Installation position</td>
<td>Horizontal, vertical</td>
</tr>
<tr>
<td>Flow rate setting signal</td>
<td>0.1 - 5 VDC (absolute rating: Max. ±15 VDC)</td>
</tr>
<tr>
<td>Flow rate output signal</td>
<td>0 - 5 VDC (maximum output: ±15 VDC)</td>
</tr>
</tbody>
</table>
| Required power | +15 VDC ±4%, 200 mA max
  - -15 VDC ±4%, 150 mA max |
| Material of gas wetted surface | Housing, flange, valve seat: SUS316L
  - Diaphragm: YET101 (Ni-Co alloy)
  - Flow sensor: SUS316L
  - Seal: SUS316L
  - Shut off valve: SUS316L, YET101, PCTFE
  - Pressure sensor: SUS316L |
| Surface finish of components that contact the gas | Specially electro-polished (standard) |
| External leakage standard | Max. 1×10⁻¹¹ Pa·m³/s (He) |
| Accuracy | N₂ gas:
  - 10~100%: ±(0.3% S.P. + 0.15% F.S.)
  - 2~10%: ±0.2% F.S.
- Actual gas:
  - 10~100%: ±(1.5% S.P. + 0.35% F.S.)
  - 2~10%: ±0.5% F.S. |
| Linearity | N₂ gas: ±0.3% F.S.
  - Actual gas: ±1.0% F.S. |
| Repeatability | 10~100%: ±(0.1% S.P. + 0.05% F.S.)
  - 2~10%: ±0.06% F.S. |
| Flow rate sensor guaranteed zero point deviation range | ±0.5% F.S. / year, max. |
| Temperature dependence | Zero point: ±0.01% F.S. / °C (15~35 °C)
  - Span: ±0.01% S.P. / °C (15~35 °C) |
| Response Time | 0%~100%: Max. 1.5 sec to reach ±0.4% S.P. of the set value.
  - 0%~2%: Max. 1.5 sec to reach ±0.4% S.P. of the set value. |
| Valve operation pneumatic pressure | 0.4~0.7 MPa (G) 58.0~101.5 PSI (G) |
| Valve seat leakage amount | Max. 1×10⁻⁸ Pa · m³/s (He) |
| Number of durability | 2 million times |
| Operation of integrated metal diaphragm valve | Normally open |

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*1: The specifications above are guaranteed values when the MFC was measured by itself in standard conditions. The MFC may not meet the specifications above, depending on the measurement conditions.

*2: The 147°G2 / 247°G2 series are also available for use with minute pressure differences. Please inquire separately for the specifications of our minute pressure difference models.

*3: A model using a rubber seal is also available. Please inquire separately about the rubber seal specifications.

*4: An H1G seal is only available on the SFC14*G2 series.
What is a G2?

The G2 series is a line of mass flow controllers that are equipped with MG/MR and valve shut off functions. The major purpose of the valve shut off function is to reduce the gas purge time that is required to vent residual gas in the space between the downstream pneumatic valve and the mass flow controller valve. The ordinary flow rate control valve installed in a mass flow controller cannot shut off the gas completely. In order to overcome this problem, a minute, solenoid driven pneumatic valve is integrated near the downstream flow rate control valve, to enable the valve shut off function. The integrated minute pneumatic valve is a normally open type and is normally fully open. It absolutely shuts off all gas with a setting of 0 % or when a close fully signal is received. Also, this miniature pneumatic valve is always installed together with a flow rate control valve, so that the volume of gas leaking (that could cause a gas surge) will be approximately 1/10 that in a combination of an ordinary mass flow controller and pneumatic valve, as shown in the figure.

Description of the G2 series construction

**Construction**
Integrates a miniature, solenoid driven pneumatic valve. Normally open type.

**Operation**
Shuts off the gas inlet completely when set to 0% or when connected to a close fully input signal

Dead volume: 0.25 cc
(Approximately 1/10 that of ordinary MFCs)

Using the configuration above, the G2 series MFCs reduce the gas that can surge into a chamber due to residual gas in the pipe, as shown in the figure, and it shorten the gas purge time needed to achieve a stable flow rate. Finally, it provides productivity improvements and reduces the amount of wasted expensive gas.

Reduction of gas purge time

Conventional model

G series

MFC output

Process gas

MFC output

Valve

Gas panel

MFC output

Process chamber

Valve

Actual flow rate right after the MFC

Valve

Actual flow rate just before the chamber

MFC output

Influence from the dead volume

Reduced gas purge time

Actual flow rate

Time

MFC output

Time

Actual flow rate

Time
## 1480G4 / 2480G4 series

**Applied to 1.5” and 1.125” IGS**

**All-in-one Mass Flow Controllers**

### 1480G4

![Image of 1480G4]

### 2480G4

![Image of 2480G4]

### Specifications

#### Model name
- 1480G4
- 2480G4

#### Standard full scale flow rate (N2 equivalent)
- 55CCM ~ 5,500SCCM

#### Function
1. Multi-gas/multi-range
2. PI function
3. Valve shut off function
4. Flow rate confirmation function
5. LCD display

#### Valve operation
- Normally closed / normally open

#### Flow rate control range
- 2 ~ 100% F.S.

#### Operation pressure
- 0.05 ~ 0.3 MPa (G) 7.3 ~ 43.5 PSI (G)

#### Outlet pressure
- Vacuum to ambient pressure

#### Proof pressure
- 1.0 MPa (G) 145 PSI (G)

#### Temperature
- Operation: 5 ~ 50 °C
- Accuracy guaranteed: 15 ~ 35 °C
- Repeatability temperature when not powered: 65 °C max

#### Humidity
- 35 ~ 80% RH (non-condensing)

#### Installation position
- Horizontal, vertical

#### Flow rate setting signal
- 0.1 Hz VDC (absolute rating: Max. ±15 VDC)

#### Flow rate output signal
- ±15 VDC ±4%, 200 mA max
- -15 VDC ±4%, 150 mA max

#### Required power
- 0 to 5 VDC (maximum output: ±15 VDC)

#### Material of gas wetted surface
- SUS316L
- Seal: SUS316L
- Shut off valve: SUS316L, YET101, PCTFE
- Pressure sensor: SUS316L

#### Surface finish of components that contact the gas
- Specially electro-polished (standard)

#### Fitting
- 4 digit display (6 x 4 mm), LED backlight

#### External leakage standard
- Max. 1x10^-12 Pa · m3/s (He)

#### Accuracy
- N2 gas: ± (0.5% S.P. + 0.15% F.S.)
- Actual gas: ± (1.5% S.P. + 0.5% F.S.)
- Linearity
  - ±0.3% F.S.
  - ±0.2% F.S.

#### Response time
- 0% ~ 10%: Max. 10 sec, to match ±0.5% F.S. of the set value
- 20 ~ 100%: Max. 1.0 sec, to match ±0.5% F.S. of the set value

#### Temperature dependence
- ±0.01% F.S. / °C (15 ~ 35 °C)

#### Alarm LED
- Operation of integral metal diaphragm valve
- Pressure sensor
- Pressure at measuring reference data
- Flow rate sensor

**Three types of verification operations are available as follows.**

1. **Self calibration**
   - The results of the verification can be checked on a personal computer display or on the LCD on the main housing. If needed, the self calibration function can be used. Follow the instructions below to perform the verification using the zero reset switch.

2. **Valve shut off**
   - The zero reset switch on top of the main housing is used to perform the verification. This switch is used to lock the valve in a position where the internal tank pressure is confirmed.

3. **Verification using commands from a system**
   - The verification results can be confirmed by checking the internal tank pressure and output on the vertical axis. After closing the bypass line, the verification results are compared to the reference data for normal operation.

#### Pressure sensor
- ±0.5% F.S.

#### Temperature dependence
- ±0.01% F.S. / °C
- Temperature range: 0.0% ~ 100% (15 ~ 35 °C)

#### Pressure range
- 0.006% / °C
- Pressure output: LCD display and digital communication (not analog output)

#### Temperature measuring range
- 273.2 ~ 323.2 K (0 ~ 50 °C)

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*1: The specifications above are guaranteed values when the MFC was measured by itself in standard conditions. The MFC may not meet the specifications above, depending on the measurement conditions.
*2: The 147G4 / 247G4 series are also available for use with low inlet pressure. Please inquire separately for the specifications for low inlet pressure models.
*3: A model using a rubber seal is also available. Please inquire separately about the rubber seal specifications.
*4: An H1G seal is available only on the SFC14**G4 series
*5: The PI function may not perform its specifications depending on each plumbing condition. Please consult us in advance.
*6: For details about the confirmation pressure for the minute pressure difference model, please contact Hitachi Metals.
What is a G4?

The G4 series MFCs are full specification G series models. They are equipped with the MG/MR, PI (Pressure Insensitive), valve shut off, inline flow rate verification, and self calibration functions. Flow rate verification is a method for verifying changes in the flow rate over time. It compares reference data for normal operation when starting to the current flow rate verification results at certain intervals.

A tank with an integrated pressure sensor and a side inlet valve are the main items used for verification.

At the beginning of the verification the MFC temporarily stops the normal flow rate control and locks the opening position of the flow rate control valve. Next, the side inlet valve closes. The chart below shows the relationship between the internal tank pressure \( P \) and the flow rate sensor output \( RO \), with time on the horizontal axis and pressure and output on the vertical axis. After closing the side inlet valve, \( P \) and \( RO \) change as shown below. The amount of flow rate deviation (the verification value), can be obtained from the ratio between flow rate when starting to use the MFC, and the results of the verification calculation after a certain period has elapsed.

The results of the verification can be checked on a personal computer display or on the LCD on the main housing. If needed, the mass flow controller can be re-calibrated to normalize the data using the self calibration function.

There are three types of verification operations

Three types of verification operations are available as follows.

One is operation uses a special program on a personal computer. Another is a stand alone operation using the mass flow controller by itself.

With this method, the zero reset switch on top of the main housing is used for the verification and the verification results are shown on the LCD. This method does not need a personal computer.

The last method controls the operation with commands from a system.

In any of these methods, the basic operation procedures are the same, as shown below. You can easily calibrate a periodically verified flow rate.

1) Operation using a special program on a personal computer

Follow the instructions on the screen.

2) Stand alone operation

Perform the verification using the zero reset switch on the top of the MFC housing.

3) Verification using commands from a system

Basic operating procedures

1. Obtain the initial data or select the flow rate verification (Up to 5 sets of initial data can be stored.)
2. Start obtaining the initial data.
3. Set the verification flow rate, and start the verification.
4. The measured results are displayed.
5. Verify the flow rate periodically

\[ \Rightarrow \text{The user can calibrate the MFC using the verification results.} \]

* For details about the operation method, see the instruction manual.
### 1480G1-D / 2480G1-D series

**DeviceNet™ communication type For both the 1.5” and 1.125”IGS**

**PI Mass Flow Controllers**

#### Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications *1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model name</td>
<td>1480G1-D0 / 2480G1-D0</td>
</tr>
<tr>
<td>Standard full scale flow rate (N2 equivalent)</td>
<td>55SCCM / 11SLM</td>
</tr>
<tr>
<td>Function</td>
<td>Multi-gas/multi-range, PI function, LCD display (flow rate output, flow rate setting, pressure, and temperature)</td>
</tr>
<tr>
<td>Valve operation</td>
<td>Normally closed / normally open</td>
</tr>
</tbody>
</table>

#### Operation pressure

| Inlet pressure | 0.05~0.3 MPa (G) | 0.1~0.3 MPa (G) | 0.2~0.3 MPa (G) |
| Outlet pressure | 7.3~43.5 PSI (G) | 14.5~43.5 PSI (G) | 29.0~43.5 PSI (G) |

#### Temperature

- **Operation** | 5~50 °C |
- **Accuracy guaranteed** | 15~35 °C |
- **Heating temperature when not powered** | 65 °C max |
- **Humidity** | 35~80%RH (non condensing) |

#### Installation position

| Horizontal | Vertical (option) |

#### Flow rate setting signal

| Flow rate output signal | DeviceNet™ communication *3 |

#### Material of gas wetted surface

- **Housing, flange, valve seat** | SUS316L |
- **Diaphragm** | YET101 (Ni-Co alloy) |
- **Flow sensor** | SUS316L |
- **Seal *4** | Ni |
- **Pressure sensor** | SUS316L |
- **Surface finish of components that contact the gas** | Specially electro-polished (standard) |

#### Fitting *5

- **W seal, C seal, H1G seal, 1/4” HMJ (UJR) male** |
- **Male Micro Connector** |
- **Service connector (RJ-12)** |
- **(RS-232C) DeviceNet™ Connector** |

#### Flow rate control

- **External leakage standard** | 5x10⁻¹¹ Pa.m³/year (He) |
- **Liquid gas** | ± (0.5 S.P + 0.15% F.S.) |
- **Accuracy** | ± (0.2% F.S.) |
- **Linearity** | ± (1.5 S.P + 0.35% F.S.) |
- **Repeatability** | ± (0.1% S.P + 0.05% F.S.) |
- **Flow rate sensor guaranteed zero point deviation range** | ± 0.5% F.S. |
- **Temperature dependence** | ± 0.01% F.S. / °C (15~35 °C) |
- **Response Time** | Max. 1.0 sec to reach ±2% S.P of the set value. |

#### Flow rate fluctuation with pressure variations

- **Pressure gradient: <0.5Pa/0.12sec** | ± (1.5% S.P + 1.0% F.S.) |
- **Pressure gradient: >0.5Pa/0.12sec** | ± (3.0% S.P + 1.0% F.S.) |
- **Flow rate sensor accuracy** | ±0.3% F.S. |
- **Pressure output** | ±0.01% F.S. |
- **Temperature dependence** | 0.05% / °C |
- **Temperature measuring range** | 273.2~323.2 K (0~50°C) |

---

1: The specifications above are guaranteed values when the MFC was measured by itself in standard conditions. The MFC may not meet the specifications above, depending on the measurement conditions.

2: The 147”G1-D / 247”G1-D series are also available for use with minute pressure differences. Please inquire separately for the specifications of our minute pressure difference models.

3: For details about DeviceNet™ communication, see page 14.

4: A model using a rubber seal is also available. Please inquire separately about the rubber seal specifications.

5: An H1G seal is available only on the SFC14”G1 series.

6: The PI function may not perform its specifications depending on each plumbing condition. Please consult us in advance.

---

*55SCCM* 1480G1-D / 1481G1-D / 2480G1-D / 2481G1-D

*11SLM* 2470G1-D / 2480G1-D / 2481G1-D / 2482G1-D

*305SLM* 1470G1-D / 1480G1-D / 2471G1-D / 2481G1-D / 2482G1-D

*505SLM* 1472G1-D / 1482G1-D / 2473G1-D / 2483G1-D / 2484G1-D
**MG/MR (multi-gas/multi-range) function**

This is the core technology that is included in all the G series models is the MG/MR (multi-gas / multi-range) function. In conventional mass flow controllers, one controller would only handle one type of gas and one full scale flow rate range. This means that customers needed to have a dedicated mass flow controller for each system, and for each process recipe. With the FX series flow rate controller equipped with the MG/MR function, you can have up to 14 user recipes (full scale ranges of 2 SCCM to 50 SLM) to match the intended flow range, and you can change the gas type and flow rate to match the actual gas you want to handle. When connected to a personal computer, the metering conditions can be changed instantly (See page 14).

Hitachi Metals actual gas flow rate accuracy warranty system backs up this MG/MR function. A conventional mass flow controller only guarantees the flow rate accuracy with N2 gas. To get the flow rate conditions for your actual gas using a conventional MFC, a conversion factor must be used as a coefficient to convert the flow rate.

The reference values for these coefficients have been based of a variety of values, including calculated values, actually measured values, and empirical values. And, these were merely guidelines or reference values with some gas types. Although the MG/MR function is included, if the gas data deviates from the characteristics of the actual gas, the mass flow controller cannot perform as its designed level.

With the G series mass flow controller, in addition to the flow rate reference for N2 gas (that ensures conformance with the national standard using the conventional gravimetric method), we installed full scale actual gas metering and exhaust gas processing facilities at our factory. Using these facilities, measurement is made for each type of gas at each full-scale range, and record the data. This is then used as actual gas data.

### Conceptual diagram of the MG/MR (multi-gas/multi-range) mass flow controller

![Diagram](image)

### Abbreviation | Standard full-scale flow rate range (N2 equivalent)
---|---
MG/MR | Flow range
FR-01 | 2~5 SCCM
FR-02 | 6~14 SCCM
FR-03 | 15~27 SCCM
FR-04 | 28~38 SCCM
FR-05 | 39~71 SCCM
FR-06 | 72~103 SCCM
FR-07 | 104~192 SCCM
FR-08 | 193~279 SCCM
FR-09 | 280~754 SCCM
FR-10 | 755~2037 SCCM
FR-11 | 2038~5500 SCCM
FR-12 | 5501~11000 SCCM
FR-13 | 11001~30000 SCCM
FR-14 | 30001~50000 SCCM

**Abbreviation**
- MG/MR: MG/MR function
- FR-01 to FR-14: Specific flow rate ranges

**Standard full-scale flow rate range**
- (N2 equivalent)
- Flow rate ranges from 2 to 5 SCCM, 6 to 14 SCCM, 15 to 27 SCCM, up to 30001 to 50000 SCCM (N2 equivalent)

**Legend**
- MFC: Mass Flow Controller
- Ar, O2, H2, C2H4, SF6, SiH4, CF4, PH3, C2F6, NF3, SiF4, CO: Specific gases

**Notes**
- N2 gas reference flow rate
- Actual gas flow rate measurement facility
How to use the MG/MR conversion program

Gas type and flow rate can be converting using an MG/MR conversion program. Connect the mass flow controller to a personal computer using a digital communication cable, and use our proprietary program. One can convert the data easily with a simple GUI interface program. Following the program instructions, first select the gas type, and then flow rate units. A flow rate range will appear, and it can be changed. Enter a flow rate value and the setting is complete.

Users can change the gas type and flow rate.

<MG/MR conversion program> Select the correction amount data according to the gas type and flow rate you want to control.

Simple operation to set the gas type and flow rate.

- Select a gas type
- Enter a flow rate
- The flow rate range is displayed (user settable).
- A screen that shows the program is converting.

Models compatible with the DeviceNet™ communication system

About DeviceNet™

This is a field network recognized world wide, and it is approved as a standard sensor bus by the SEMI. Field devices can be connected using serial communication in place of an I/O connection, allowing transfer of a large volume of data effectively.

The DeviceNet™ specifications are administrated by the ODVA (Open DeviceNet Vendor Association, Inc.) a non-profit body established to promote the spread of this system world-wide.

What are the advantages of employing DeviceNet™

1) By using serial communication from an I/O connection, one does not need an AD / DA / O board which can decrease configuration and set up costs.
2) Only network cables are needed and this reduces cabling costs, which decreases required man-hours, shortening engineering periods, and avoids problems from incorrect wiring.
3) DeviceNet™ employs a CAN (Controller Area Network) as a communication controller, and you can use a variety of CAN error detection functions.
4) The DeviceNet™ specifications are administrated by the ODVA, and have been normalized as international standards by IEC and SEMI. With this normalization, they are completely open, and lots of control devices are available from multiple vendors. You can choose the optimum device for your application.
5) The power for DeviceNet™ is only +24 VDC. You do not need to supply ±15 VDC for the mass flow controller.
Analog interface connector (D-Sub 9-pin)
Connector used: D-Subminiature, 9-pin connector (M3 screw)
Compatible plug: 17JE-13090-02 (D8B) (made by DDK) or equivalent

1) Connector model: L type

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve open/close input (+15 VDC = Fully open; -15 VDC = Fully closed)</td>
</tr>
<tr>
<td>2</td>
<td>Output (0 to 5 VDC)</td>
</tr>
<tr>
<td>3</td>
<td>+15 VDC</td>
</tr>
<tr>
<td>4</td>
<td>COM (+15 VDC)</td>
</tr>
<tr>
<td>5</td>
<td>-15 VDC</td>
</tr>
<tr>
<td>6</td>
<td>Input (0.1 to 5 VDC)</td>
</tr>
<tr>
<td>7</td>
<td>COM (output)</td>
</tr>
<tr>
<td>8</td>
<td>COM (Input)</td>
</tr>
<tr>
<td>9</td>
<td>Valve voltage (0 to 5VDC)</td>
</tr>
</tbody>
</table>

2) Connector model: Q type

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve Full open (operate by connecting to COM)</td>
</tr>
<tr>
<td>2</td>
<td>Out put (0 to 5 VDC)</td>
</tr>
<tr>
<td>3</td>
<td>+15 VDC</td>
</tr>
<tr>
<td>4</td>
<td>COM (+15 VDC)</td>
</tr>
<tr>
<td>5</td>
<td>-15 VDC</td>
</tr>
<tr>
<td>6</td>
<td>Input (0.1 to 5 VDC)</td>
</tr>
<tr>
<td>7</td>
<td>COM (output)</td>
</tr>
<tr>
<td>8</td>
<td>COM (Input)</td>
</tr>
<tr>
<td>9</td>
<td>Valve Full-close (operate by connecting to COM)</td>
</tr>
</tbody>
</table>

Digital interface connector
Connector used: 43814-6621 (made by Molex) (RJ-12 x 2 connectors)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COM (Siginal)</td>
</tr>
<tr>
<td>2</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>Rxd</td>
</tr>
<tr>
<td>4</td>
<td>Txd</td>
</tr>
<tr>
<td>5</td>
<td>N.C.</td>
</tr>
<tr>
<td>6</td>
<td>N.C.</td>
</tr>
</tbody>
</table>

Note 1: Rxd, Txd: RS232C Input and output
Note 2: RS-, RS+: RS485 Input and output

DeviceNet™ connector
Connector used: DeviceNet™ Male Micro Connector (CM02-8DR5P(D5) made by DDK, or equivalent)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drain</td>
</tr>
<tr>
<td>2</td>
<td>V+</td>
</tr>
<tr>
<td>3</td>
<td>V-</td>
</tr>
<tr>
<td>4</td>
<td>CAN_H</td>
</tr>
<tr>
<td>5</td>
<td>CAN_L</td>
</tr>
</tbody>
</table>

Additional functions

<table>
<thead>
<tr>
<th>Function name</th>
<th>Description</th>
<th>Setting and reading methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm function</td>
<td>See the item for the alarm function</td>
<td>By command</td>
</tr>
<tr>
<td>Flow sensor zero reset function</td>
<td>Reset the flow sensor zero</td>
<td>By command or when the switch on the top is pressed</td>
</tr>
<tr>
<td>Pressure sensor zero reset function</td>
<td>Reset the pressure sensor zero</td>
<td>By command</td>
</tr>
<tr>
<td>Pressure sensor span correction function</td>
<td>Correct the pressure sensor span</td>
<td>By command</td>
</tr>
<tr>
<td>Lamp response function</td>
<td>Control the flow rate using a specified time for the step flow rate setting</td>
<td>By command</td>
</tr>
<tr>
<td>Flow control valve voltage monitor output function</td>
<td>Set the flow control valve opening (0 to 5 VDC)</td>
<td>By command or analog voltage output (only Q type)</td>
</tr>
<tr>
<td>Flow control valve fully open / close function</td>
<td>Open and close the flow control valve completely</td>
<td>By command, ±15 VDC, or contact point connection</td>
</tr>
</tbody>
</table>

Alarm function

<table>
<thead>
<tr>
<th>Alarm cause</th>
<th>Alarm LED display</th>
<th>Alarm output condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal operation</td>
<td>Green LED blinks at 1 Hz</td>
<td>No alarm</td>
</tr>
<tr>
<td>Flow rate setting does not the match flow rate output</td>
<td>Red LED lights</td>
<td>The mis-match between the flow rate setting and the flow rate output is 10% or more of the full scale and has continued for 10 seconds or longer</td>
</tr>
<tr>
<td>Abnormal ±15 VDC power supply</td>
<td>Turns off</td>
<td>The ±15 VDC power supply is outside the range of ±12 VDC to ±17 VDC, and has been for 0.5 seconds or longer</td>
</tr>
<tr>
<td>EEPROM access error</td>
<td>Red LED lights</td>
<td>Abnormal value in the EEPROM data</td>
</tr>
<tr>
<td>Digital communication error</td>
<td>Red LED lights</td>
<td>Did not receive a normal digital command</td>
</tr>
<tr>
<td>Change in flow rate control status (Change from the preset status)</td>
<td>Red LED blinks at 2 Hz</td>
<td>The change in the preset value was 10% or more of the full scale and continued for 10 seconds or longer. Or, the cumulative value of the zero point correction amount for the flow sensor is more than ±20% of full scale</td>
</tr>
</tbody>
</table>
### 1480G, 2480G series ordering information

<table>
<thead>
<tr>
<th>Size</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Flow range</th>
<th>Series</th>
<th>Seal</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>G1</td>
<td>M</td>
<td>C</td>
</tr>
<tr>
<td>1.5&quot; size</td>
<td>Normal temperature type</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.125&quot; size</td>
<td>Normal pressure type</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low inlet pressure type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>5<del>5,500 SCCM (FR-01</del>11)</td>
<td></td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11 SLM (FR-12)</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>30 SLM (FR-13)</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50 SLM (FR-14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G1</td>
<td>Multi gas, multi range, Pressure insensitive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G2 *</td>
<td>Multi gas, multi range, valve shut off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G3 *</td>
<td>Multi gas, multi range, Pressure insensitive, valve shut off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G4 *</td>
<td>Multi gas, multi range, Pressure insensitive, valve shut off, flow rate calibration verification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Optional code**

<table>
<thead>
<tr>
<th>Fitting</th>
<th>Connector</th>
<th>Flow sensor material</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>UG</td>
<td>L</td>
<td>Blank</td>
<td>N</td>
</tr>
<tr>
<td>4V **</td>
<td>1/4&quot; HMJ (UJR) male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UG</td>
<td>L</td>
<td>Blank</td>
<td>N</td>
</tr>
<tr>
<td>AG</td>
<td>L</td>
<td>Blank</td>
<td>N</td>
</tr>
<tr>
<td>HG ***</td>
<td>1.5&quot; H1G seal (Hitachi GS seal)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- G2, G3, and G4 series can only control flow rates up to 5,500 SCCM.
- ** Only the G1 series can be used with a 4V fitting.
- ** Only the G1 series can be used with a 4V fitting.
- ** Only the G1 series can be used with a 4V fitting.
- ** Only the G1 series can be used with a 4V fitting.

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**For details, please contact us.**

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