Materials Mag!c

HITACHI

Catalog

Aera

Aera® PI-980®

Series Pressure- Insensitive MFCs

Next-generation PI technology for tomorrow's manufacturing demands

Hitachi Metals, Ltd.

Benefits

- Improved gas delivery performance and production yields
- Easy integration on tool
- Substantial gas panel cost savings
- Reduced gas panel footprint
- Real-time communication and control
- World-class service and support

Features

- Pressure-insensitive operation
- High accuracy and repeatability Integrated gas panel components
- Live gas certified, multi-gas, multi-range configuration
- Field programmable
- DeviceNet, RS-485, and analog control
- All-metal seals and ultra-pure design

With industry-leading flow control technology, Aera PI-980 Series pressure- insensitive MFCs (mass flow controllers) anticipate the increasing demands of next-generation semiconductor manufacturing processes, including etch, CVD, PVD, and diffusion.

This innovative technology platform provides faster response, greater gas-flow stability, higher accuracy, and superior real-time process control when compared to previous technologies. High-flow stability delivers greater chamber-to-chamber process repeatability for improved production yields.

The PI-980 MFC's design integrates traditional thermal flow architecture with a pressure and temperature sensor, and NeuralStep control technology. This creates a single, compact delivery package, eliminating the need for a number of costly gas panel components traditionally utilized. Multi-gas, multi-range functionality dramatically reduces supporting inventory requirements, further enhancing cost efficiency. In addition to integrated diagnostics, this next-generation MFC technology has been combined with our field-proven D980 series product platform design to increase system uptime and make troubleshooting quick and easy.

Superior Performance and Production Yields

Tight performance, plus real-time control and integrated diagnostic capabilities, increase efficiency and throughput. Pressure insensitivity enables operation within extremely tight parameters, from one chamber to the next.

Faster Response and Outstanding Flow Stability

An integrated pressure transducer and NeuralStep control technology provide faster MFC response and minimize the effects of pressure disturbances in the gas supply. When a pressure perturbation occurs, the MFC responds instantaneously. Faster response delivered with excellent flow stability result in improved overall performance, including:

- Enabling technology for short process steps
- Stable chamber gas delivery performance
- High accuracy and high repeatability (see Specifications)
- Wide dynamic multi-gas control range (see Specifications)

Easy Integration

Obtain the next-generation performance and reliability advantages of PI-980 Series MFCs by replacing other, lower-performing conventional design MFC brands with no installation hassles. Most models feature standard electrical and mechanical dimensions to easily fit existing IGS and conventional gas systems.

Substantial Cost Savings

Integrated pressure and temperature sensors eliminate the need for costly gas panel components such as pressure sensors with displays and mounting blocks and seals used for these components.

Reduced Inventory Requirements

Multi-gas, multi-range technology, plus the outstanding Aera MFC performance you've come to rely on, further reduces costs by minimizing supporting inventory requirements. Just ten MFCs can replace hundreds of spares and part numbers. Single-gas MFCs require backup inventory for each process gas. Multi-gas, multi- range PI-980 MFCs dramatically reduce such requirements because they can replace other MFCs used in the process, regardless of gas type.

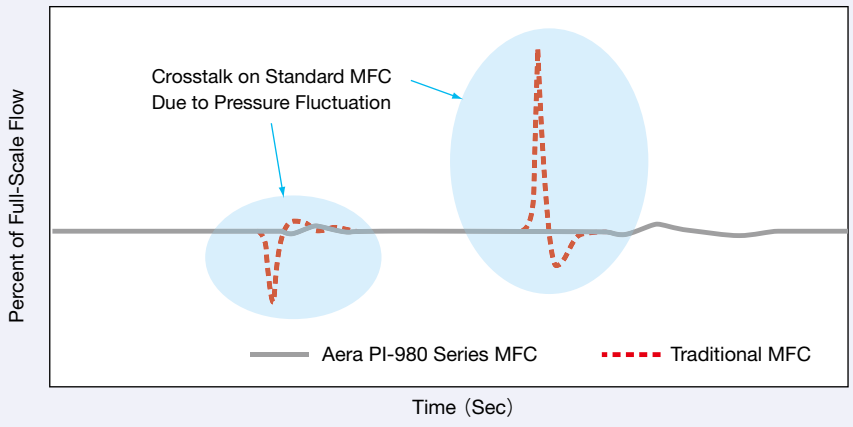
Real-Time Communication and Control

Real-time communication and control increases efficiency and productivity. Embedded software with on-board integrated diagnostics enables you to quickly and easily diagnose and solve problems, with little or no process interruption.

World-Class Service and Support

Hitachi Metals's record of highly reliable products reflects a superior standard of design and manufacturing quality. Our support and repair capabilities demonstrate these same, high-quality standards. No matter what your need or location, our international network of support sites and exceptional application expertise ensure superior service and fast turnaround.

Performance Comparison: Traditional MFCs vs. PI-980 Series MFCs



Traditional and Aera PI-980 Series MFC performance during a line pressure fluctuation. Notice the flow disturbance and instability with the traditional MFC versus highly stable flow control with the PI-980 MFC.

Specifications

Operational	PI-980® Series/PI-981 Series	PI-982 Series
Full-Scale Flow Range (N_2 equivalent)	5 to 1,000 sccm (PI-980)	51,001 to 100,000 sccm
	1,001 to 51,000 sccm (PI-981)	
Flow Accuracy※1	≤ ±1% of set point (25 to 100% of full scale)	≤ ±1.5% of full scale (5% to 100% of full scale)
	≤ ± 0.25% of full scale (2 to 25% of full scale)	
Settling Time	< 1 sec typical above 10% of full scale (per SEMI E17-91)	< 2 sec typical above 10% of full scale (per SEMI E17-91)
Linearity	< ± 0.5% of device full scale	
Repeatability	< ± 0.25% of device full scale	
Leak Across Valve	≤ 1% of device full scale (at 20 psiD N_2)	
Leak Integrity	$1x10^{-10}$ atm-cc/sec (He) max; $1x10^{-11}$ Pa-m^3 /sec (He) max	
Control Range	2 to 100% of full scale	
Differential Pressure	5 to 1,000 sccm: 7 to 50 psiD (49 to 345 kPaD)※2	—
	1,001 to 3,000 sccm: 10 to 50 psiD (69 to 345 kPaD)※2	—
	3,001 to 10,000 sccm: 15 to 50 psiD (103 to 345 kPaD)※2	—
	10,001 to 30,000 sccm: 25 to 50 psiD (172 to 345 kPaD)※2	—
	30,001 to 51,000 sccm: 40 to 65 psiD (276 to 448 kPaD)※2	—
	—	51,001 to 100,000 sccm: 40 to 70 psiD (276 to 483 kPaD)※2
Max Operating Pressure	100 psiA (690 kPaA)	
Proof Pressure	200 psiA (1,380 kPaA)	
Burst Pressure	2,000 psiA (13,800 kPaA)	
Pressure Sensing Accuracy	≤ ±1% full scale from 0 to 100 psiA (0 to 689 kPa)	
Pressure Transient Sensitivity (transient= ±< 2 psi over 0.1 sec)	≤ ±5% of set point for pressure transients < 1 sec (5 to 100% of full scale)	
Operating Temperature	5 to 60°C (41 to 140°F)※3	
Temperature Sensitivity	< ± 0.05% of full scale per °C	
Temperate Sensing Accuracy	≤ ±2°C (±3.6°F) from 5 to 60°C (41 to 140°F)	
Zero Drift	≤ ± 0.5% of device full scale per year	
Warm Up Time	≥ 30 min	
Alarm/Diagnostics	Flow, valve voltage, auto-zero adjustment, communications, and microprocessor errors	

※1: Based on factory conditions.
※2: For N_2 full-scale flow. Outlet pressure less than half the inlet pressure minus 2 psiA.
※3: Heated gas test conditions.
Note: For full model and suffix code information, see Model and Suffix Codes.

Model and Suffix Codes

Physical	PI-980® Series/PI-981 Series	PI-982 Series
Control Valve Type	Normally-closed piezoelectric or normally-open piezoelectric※1	Only normally-closed piezoelectric
Seals	Metal	
Materials	316SS, 316LSS, and PCTFE	
Standard Fittings	IGS (C-seal or W-seal) or VCR®	IGS (C-seal) or VCR®
Surface Finish	Electropolished and ultra-cleaned to 5 µin Ra	
Attitude Sensitivity	May be mounted and configured in any position	
Weight	1.0 kg (2.2 lb)	1.5 kg (3.3 lb)

※1: Normally-open applies to to Multi-08, 09, and 10 devices only.
Note: For full model and suffix code information, see Model and Suffix Codes.

Electrical	PI-980® Series/PI-981 Series	PI-982 Series
Connection Type	DeviceNet® or 9-pin D	
Input Power※1	DeviceNet®: + 11 VDC at 455 mA, +24 VDC at 208 mA	
	Analog: + 15 VDC at 333 mA, ±15 VDC at 167 mA	
Power Consumption	5.0 W max	
Available Input Signals	DeviceNet®: ODVA; 0 to 5 VDC; Ethernet: RS-485	
Available Output Indication	DeviceNet®: ODVA; 0 to 5 VDC; Ethernet: RS-485 (pressure and temperature also available)	
Available Service Communications	DeviceNet® or Ethernet	
EMC Certification	CE Compliant (EMC 89/336/EEC), (72/23/EEC) Low Voltage Directive	

※1: Voltages reflect steady-state conditions.

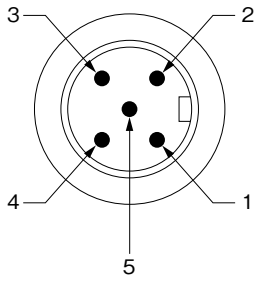
PI-980®/PI-981/PI-982 Series Model and Suffix Codes

Category	Description		Suffix Codes								
Product Description	Pressure-insensitive mass flow controller		FC-PI	···	···	···	···	···	···	···	···
Model	Model Number		···	980	···	···	···	···	···	···	···
			···	981	···	···	···	···	···	···	···
			···	982	···	···	···	···	···	···	···
Control Valve	Normally-closed		···	···	C	···	···	···	···	···	···
	Normally-open※1		···	···	O	···	···	···	···	···	···
Fittings	1/4" VCR® compatible		···	···	···	4VX	···	···	···	···	···
	1.5" c-seal		···	···	···	6BM※2	···	···	···	···	···
	1.125" c-seal		···	···	···	BAX	···	···	···	···	···
	1.125" w-seal		···	···	···	BWX	···	···	···	···	···
	1.5" w-seal		···	···	···	BFX	···	···	···	···	···
Electronics Connector	DeviceNet®		···	···	···	···	D	···	···	···	···
	9-pin sub-miniature D		···	···	···	···	9	···	···	···	···
Connector Location	Inlet side (DeviceNet® only)		···	···	···	···	···	I	···	···	···
	Top (9-pin sub D only)		···	···	···	···	···	T	···	···	···
	Outlet side (9-pin sub D only)		···	···	···	···	···	O	···	···	···
Customer Unique	AA = Null		···	···	···	···	···	···	AA	···	···
Full-Scale Flow Range (N_2 equivalent)	PI-980®	5 to 9 sccm	···	···	···	···	···	···	···	MULTI-02	···
		10 to 30 sccm	···	···	···	···	···	···	···	MULTI-03	···
		31 to 100 sccm	···	···	···	···	···	···	···	MULTI-04	···
		101 to 300 sccm	···	···	···	···	···	···	···	MULTI-05	···
		301 to 1,000 sccm	···	···	···	···	···	···	···	MULTI-06	···
	PI-981	1001 to 3,000 sccm	···	···	···	···	···	···	···	MULTI-07	···
		3001 to 10,000 sccm	···	···	···	···	···	···	···	MULTI-08※3	···
		10,001 to 30,000 sccm	···	···	···	···	···	···	···	MULTI-09※3	···
		30,001 to 51,000 sccm	···	···	···	···	···	···	···	MULTI-10※3	···
	PI-982	51,001 to 100,000 sccm	···	···	···	···	···	···	···	MULTI-11	···
Electronics	Analog, RS-485, Ethernet, DeviceNet®		···	···	···	···	···	···	···	···	Text ("Analog")
Example			FC-PI-	980	C	BAX	D	I	AA	Multi-05	DeviceNet®
Description	Pressure-insensitive mass flow controller, ultra-high purity design, all-metal seals, normally-closed piezoelectric valve, DeviceNet® electronics, 1.125" c-seal fittings, inlet side connector location, 101 to 300 sccm (N_2 equivalent) full-scale configurable flow range										

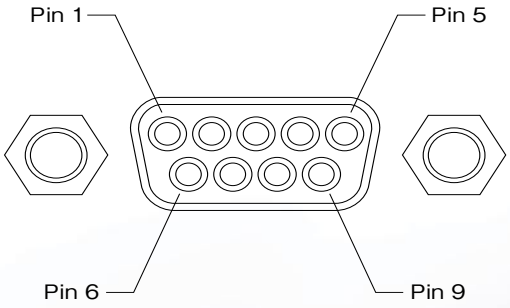
※1: Normally-open applies to bin 8, 9, and 10 devices only.
※2: Available for PI-982 model only.
※3: Normally-open versions are available in these bins only.

Electrical Connections

DeviceNet®	
1	DRAIN
2	V+
3	V-
4	CAN_H
5	CAN_L



9-Pin D	
1	VALVE OPEN /CLOSE
2	OUTPUT (0 TO 5 VDC)
3	INPUT POWER (+15 VDC)
4	POWER COMMON
5	INPUT POWER (-15 VDC)
6	SET POINT INPUT (0 to 5 VDC)
7	SIGNAL COMMON
8	SIGNAL COMMON (optional pressure or RS-485 output)
9	VALVE TEST POINT (optional temperature or RS-485 output)

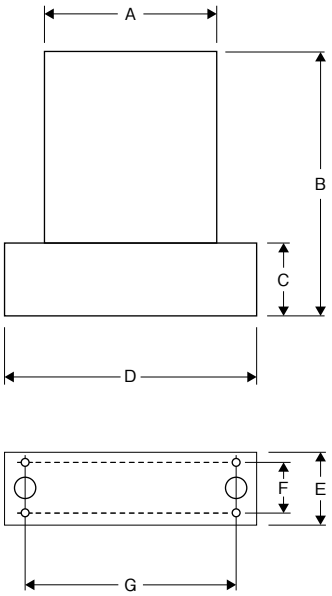


Dimensions

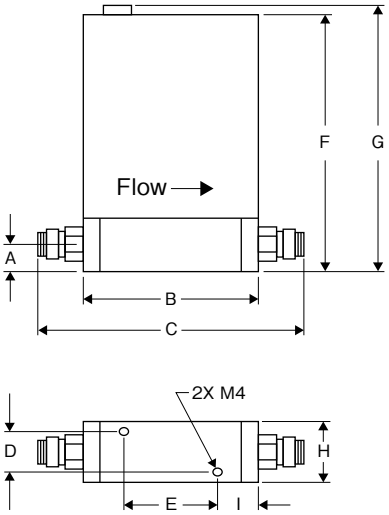
	5 to 51,000 sccm		51,001 to 100,000 sccm※1
	1.125" IGS-Compatible Fittings	1/4" VCR®-Compatible Fittings	1.5" IGS-Compatible Fittings
A	82.5 mm (3.2″)	12.8 mm (0.5″)	84.0 mm (3.3″)
B	127.0 mm (5.0″)	82.3 mm (3.2″)	145.0 mm (5.7″)
C	25.4 mm (1.0″)	124.0 mm (4.9″)	31.2 mm (1.2″)
D	105.0 mm (4.1″)	18.0 mm (0.7″)	106.0 mm (4.2″)
E	28.6 mm (1.1″)	69.0 mm (2.7″)	38.1 mm (1.5″)
F	21.8 mm (0.9″)	127.0 mm (5.0″)	30.2 mm (1.2″)
G	92.0 mm (3.6″)	132.0 mm (5.2″)	92.0 mm (3.6″)
H	...	28.6 mm (1.1″)	...
I	...	7.0 mm (0.3″)	...

※1: Consult factory for details and availability.

Models with IGS-Compatible Fittings



Models with VCR®-Compatible Fittings



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⚠ Safety Precaution

Before using any of the products introduced in this catalog, please read the respective user manuals thoroughly.

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The addresses and contact points listed in this catalog are as of January 2012.
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VEGETABLE OIL INK

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