ADVANCED ENERGY®

Aera® Transformer™ Digital Mass Flow Products

Transform your process with greater flexibility and lower cost of ownership

- Single-gas MFCs
- Multi-gas, multi-range MFCs
- Mass flow meters

Benefits

Superior results

Outstanding accuracy, repeatability, and stability

Unsurpassed reliability

Comprehensive communication and control

Easy integration

Maximum ease and versatility

Substantial cost savings

World-class service and support

Features

Multi-gas, multi-range selection

Fast response

All-metal seals and ultra-pure design

Field programmable[1]

Wide range of gas selection without recalibration[1]

DeviceNet®, RS-485, or analog control

Multiple alarm and diagnostic capabilities

Worldwide, the Aera® name is synonymous with high-quality, high-performing designs that are backed by exceptionally responsive customer service. With shipments of over 100,000 digital models, our reputation for digital MFC reliability and performance is unsurpassed.

Suitable for a variety of applications, including CVD, PVD, diffusion, and etch, Aera Transformer™ digital mass flow controllers (MFCs) and mass flow meters (MFMs) will transform your process, providing optimal flexibility and efficiency for improved yield, higher productivity, and lower cost of ownership. Advanced sensor and valve technology, field-proven platform components, and high-speed, digital circuitry deliver the most precise gas flow control available. With unsurpassed reliability and outstanding response, accuracy, and repeatability, this versatile product line offers both single-gas and multi-gas, multi-range MFCs to suit your priorities for value and functionality.

Superior Performance Results

Transformer MFCs produce film deposition and etch characteristics that are not only extremely uniform, but also highly repeatable. Superior response, accuracy, and repeatability enhance tool productivity and production yields.

Unsurpassed Reliability

Designed with field-proven Aera platform components and high-speed digital circuitry, Transformer MFCs have achieved unsurpassed reliability performance, with < 0.5% zero drift over one year. They provide the consistent results you expect from Aera products, increasing process efficiency, maximizing performance, and improving yields.

Outstanding Accuracy, Repeatability, and Stability

Aera Transformer MFCs enhance tool productivity and production yields by combining digital technology with algorithms unique to Aera products. These features, in addition to advanced sensor technology, provide the fastest available response between the sensor and control valve. The result is exceptional performance:

- *High accuracy (see Specifications)*
- *High repeatability (0.2% of full scale)*
- *Fast response (< 1 sec)*
- *Long-term stability (< 0.5% zero drift over one year)*

[1] Available in multi-gas, multi-range Transformer MFCs

Just eight multi-gas, multi-range Transformer™ MFCs can replace *hundreds* of spares and part numbers.

Comprehensive Communication and Control

Transformer MFCs and MFMs accommodate 0 to 5 VDC analog, RS-485, or DeviceNet® digital control.

Digital communication features include:

- *Flow, valve, and CPU alarms*
- *Gas-flow totalizing and ramping control*
- *External inputs and outputs for peripherals*
- *System override capabilities*
- *In-situ gas and range customization*

Easy Integration

Obtain the performance and reliability advantages of Aera Transformer products by replacing other brands—with no installation hassles. Certain models feature standard electrical connectors and critical dimensions to easily fit existing systems. These compact designs fit both IGS and conventional gas panels.

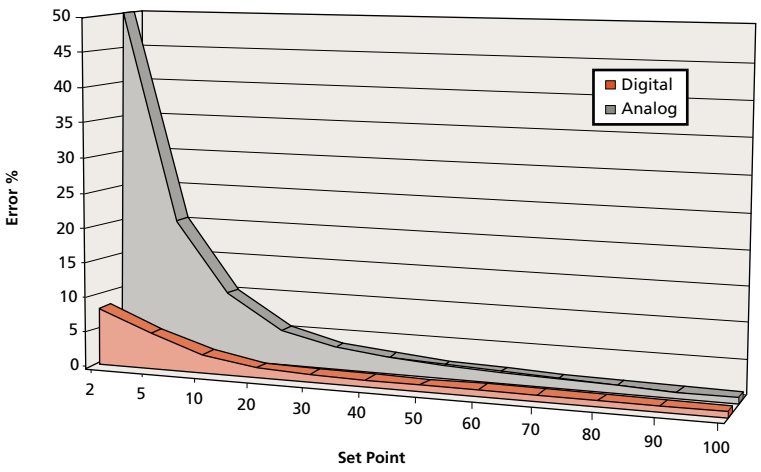


Figure 1. Digital Transformer™ MFCs provide superior accuracy compared to analog models

Maximum Ease and Versatility

Adaptable to any process environment, multi-gas, multi-range Transformer MFCs are easily field programmable to run process gases for selected ranges within the MFC's mechanical limits. For quick gas type and range reassignment, these top-performing MFCs allow for multiple gas selection options without recalibration, enabling them to run any gas for any flow range—10 sccm to 30 slm.

Substantial Cost Savings

Multi-gas, multi-range technology, combined with the outstanding Aera MFC performance you've come to rely on, reduces overall costs by minimizing inventory requirements. Just eight Transformer MFCs can replace *hundreds* of spares and part numbers. Single-gas MFCs require backup inventory for each process gas. Multi-gas, multi-range Transformer MFCs dramatically reduce such requirements because Transformer MFCs can replace any other MFC used in the process, regardless of gas type. For additional savings, only eight units are required for flows up to 30 slm—compared to nine units for competing models.

World-Class Service and Support

The Aera product family's record of reliability reflects a superior standard of design and manufacturing quality. Our support and repair capabilities demonstrate those same, high-quality standards. No matter what your need or location, our international network of support sites, exceptional application experience and expertise, and 24-hour-a-day, seven-day-a-week availability, ensure superior service and fast turnaround.

Transform your process with versatile Transformer™ MFCs and MFMs.

Specifications

Operational	780C, 780, 7800C, 7800	781C, 781, 7810C, 7810	782C, 782, 7820C, 7820
Full-Scale Ranges (N_2 Equivalent)	Single-gas models—10 sccm to 5 slm	Single-gas models—6 to 50 slm	Single-gas models—51 to 200 slm
	Multi-gas model (1)—10 to 30 sccm	Multi-gas model (7)—5001 to 10,000 sccm	
	Multi-gas model (2)—31 to 100 sccm	Multi-gas model (8)—10,001 to 30,000 sccm	
	Multi-gas model (3)—101 to 300 sccm		
	Multi-gas model (4)—301 to 1000 sccm		
	Multi-gas model (5)—1001 to 3000 sccm		
	Multi-gas model (6)—3001 to 5000 sccm		
Accuracy	≤ ±1% of set point (25 to 100% of full scale) ≤ ±0.25% of full scale (2 to 25% of full scale)		≤ ±2.0% of full scale
Settling Time	≤ 1.0 sec typical per SEMI E17-91 (above 10% of full scale)		≤ 4.0 sec
Linearity	≤ ±0.5% of full scale		≤ ±1.0% of full scale
Repeatability	≤ ±0.2% of full scale		
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	7 to 40 psiD (49 to 275 kPaD)		21 to 40 psiD (147 to 275 kPaD)
Max Operating Pressure	70 psiG (490 kPaG)		
Proof Pressure	140 psiG (981 kPaG)		
Temperature	5 to 45°C		
Alarm/Diagnostics	Flow, valve voltage, auto-zero adjustment, communications, and microprocessor errors		

Physical	780C, 780, 7800C, 7800	781C, 781, 7810C, 7810	782C, 782, 7820C, 7820
Control Valve Type	Normally-closed or normally-open solenoid		
Seals	Metal		
Materials	316LSS, 316SS, PTFE, KM45		
Standard Fittings	¼", ⅜" VCR® compatible; IGS bottom/surface mount (c-seal or w-seal)		
Surface Finish	Electropolished and ultra-cleaned to ≤ 5 Ra		
Attitude Sensitivity	May be mounted in any position		
Weight	1.0 kg (2.2 lb)		2.8 kg (6.2 lb)

Electrical	780C, 780, 7800C, 7800	781C, 781, 7810C, 7810	782C, 782, 7820C, 7820
Connection Type	9-pin D or DeviceNet®		
Input Power	+15 VDC ±2% at ≤ 140 mA, -15 VDC ±2% at ≤ 240 mA		
	DeviceNet®: +11 VDC at 550 mA, +24 VDC at 225 mA		
Power Consumption	4.5 W max		4.8 W max
Input Signal	Analog mode: 0 to 5 VDC (input impedance > 1 MΩ)		
	Digital mode: 0 to 100%		
	DeviceNet®: ODVA (125 K, 250 K, 500 Kbps)		
Output Indication	Analog mode: 0 to 5 VDC (output resistance ≥ 2 kΩ)		
	Digital mode: 0 to 100%		
	DeviceNet®: ODVA (125 K, 250 K, 500 Kbps)		
Digital/Service Communications	EIA standard, RS-485, two-wire, half-duplex, multi-drop with two RJ-11 connectors		

Note: For full model and suffix code information, see *Model and Suffix Codes* on next page.
Specifications are subject to change without notice.

Model and Suffix Codes

Mass Flow Controllers

Category	Description	Suffix Codes								
Product Type	Mass flow controller	FC-	…	…	…	…	…	…	…	
Connector Type[2]	DeviceNet®	…	DN	…	…	…	…	…	…	
	9-pin D	…	PA	…	…	…	…	…	…	
	Digital	…	D	…	…	…	…	…	…	
RoHS Compliance	Compliant with RoHS directives	…	…	R	…	…	…	…	…	
Full-Scale Flow Range[2]	10 sccm to 5 slm	…	…	…	780	…	…	…	…	…
		…	…	…	7800	…	…	…	…	…
		…	…	…	785	…	…	…	…	…
	6 to 50 slm	…	…	…	781	…	…	…	…	…
		…	…	…	7810	…	…	…	…	…
		…	…	…	786	…	…	…	…	…
	51 to 200 slm	…	…	…	782	…	…	…	…	…
		…	…	…	7820	…	…	…	…	…
Control Valve	Normally-closed	…	…	…	…	C	…	…	…	…
	Normally-open	…	…	…	…	…	…	…	…	…
Electronics[3]	UNIT 20-pin cardedge connector	…	…	…	…	…	U	…	…	…
	Top-mounted connector	…	…	…	…	…	T	…	…	…
	Side-mounted pigtail connector	…	…	…	…	…	Y	…	…	…
Fittings	¼" VCR® compatible	…	…	…	…	…	…	4V	…	…
	⅜" VCR® compatible (782x series only)	…	…	…	…	…	…	6V	…	…
	1.125" c-seal	…	…	…	…			BA	…	…
	1.125" w-seal	…	…	…	…	…	…	BW	…	…
	1.5" c-seal	…	…	…	…	…	…	BM	…	…
	1.5" w-seal	…	…	…	…	…	…	BF	…	…
Gas	Type of gas	…	…	…	…	…	…	…	N_2	…
Flow	Flow range of gas (sccm or slm)	…	…	…	…	…	…	…	…	…
Single-Gas Example		**FC-**	**PA**	**R**	**7800**	**C**	**T**	**4V**	**N_2**	**200 sccm**
(MFC with 9-pin D connector, RoHS compliant, normally-closed valve, top-mounted connector, ¼" VCR® compatible fittings, N_2 gas, 200 sccm full-scale range)										
Multi-Gas/Multi-Range	Configuration for MGMR functioning (see *Full-Scale Ranges* above for details for multi-gas models 1 through 8)	…	…	…	…	…	…	…		Multi -1 to -8 (10 sccm to 30 slm) N_2 equivalent
Multi-Gas Example		**FC-**	**PA**	**R**	**7800**	**C**	**T**	**4V**		**MULTI -3**
(MFC with 9-pin D connector, RoHS compliant, normally-closed valve, top-mounted connector, ¼" VCR® compatible fittings, 101 to 300 sccm full-scale range)										

[2] Three-digit flow range suffix codes are for DN series and D series models; Three-digit and four-digit flow range suffix codes are for available for PA series models. Consult factory for details.

[3] Electronic options "T" and "Y" are available only for compact 785 and 786 series.

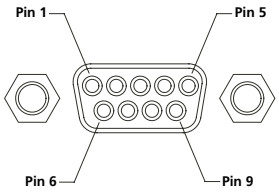
Category	Description	Suffix Codes							
Product Type	Mass flow meter	FM-	…	…	…	…	…	…	…
Connector Type[4]	DeviceNet®	…	DN	…	…	…	…	…	…
	9-pin D	…	PA	…	…	…	…	…	…
RoHS Compliance	Compliant with RoHS directives	…	…	R	…	…	…	…	…
Full-Scale Flow Range[4]	10 sccm to 5 slm	…	…	…	860	…	…	…	…
		…	…	…	8600	…	…	…	…
		…	…	…	865	…	…	…	…
	6 to 50 slm	…	…	…	861	…	…	…	…
		…	…	…	8610	…	…	…	…
		…	…	…	866	…	…	…	…
	51 to 400 slm	…	…	…	862	…	…	…	…
		…	…	…	8620	…	…	…	…
Electronics[3]	Top-mounted connector	…	…	…	…	T	…	…	…
	Side-mounted pigtail connector	…	…	…	…	Y	…	…	…
Fittings	¼" VCR® compatible	…	…	…	…	…	4V	…	…
	⅜" VCR® compatible (862x series only)	…	…	…	…	…	6V	…	…
	1.125" c-seal	…	…	…	…	…	BA	…	…
	1.125" w-seal	…	…	…	…	…	BW	…	…
	1.5" c-seal	…	…	…	…	…	BM	…	…
	1.5" w-seal	…	…	…	…	…	BF	…	…
Gas	Type of gas	…	…	…	…	…	…	N_2	…
Flow	Flow range of gas (sccm or slm)	…	…	…	…	…	…	…	…
Example		FM-	PA	R	8600	T	4V	N_2	200 sccm
(MFM with 9-pin D connector, RoHS compliant, top-mounted connector, ¼" VCR® compatible fittings, N_2 gas, 200 sccm full-scale range)									

[3] Electronic options "T" and "Y" are available only for compact 785 and 786 series.

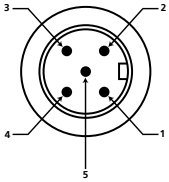
[4] Three-digit flow range suffix codes are for DN Series models; four-digit flow range suffix codes are for PA series models.

Electrical Connections

9-Pin D	
1	VALVE OPEN/CLOSED
2	OUTPUT (0 TO 5 VDC)
3	+15 VDC
4	COMMON (VALVE RETURN)
5	-15 VDC
6	CONTROL (0 TO 5 VDC)
7	COMMON
8	COMMON
9	VALVE TEST POINT (0 TO 13 VDC)



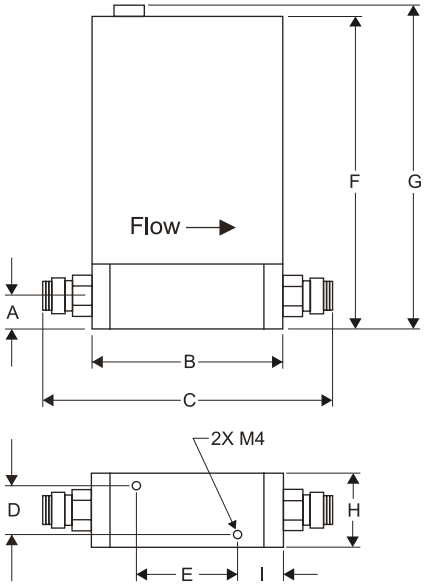
DeviceNet®	
1	DRAIN
2	V+
3	V-
4	CAN_H
5	CAN_L



Dimensions

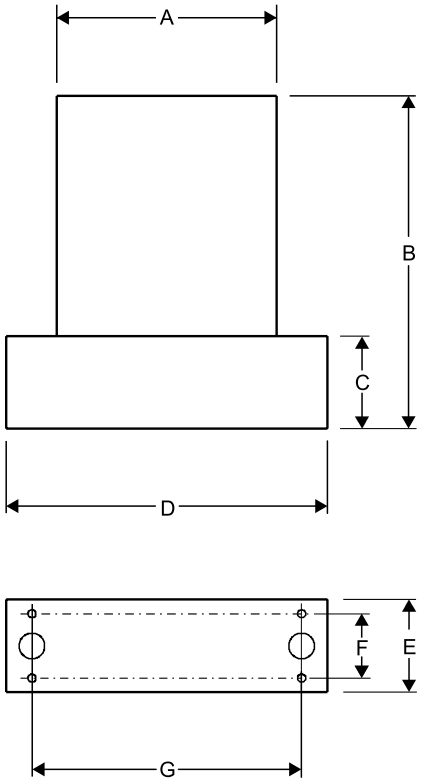
Models with VCR® Compatible Fittings

	780C, 780, 7800C, 7800, 781C, 781, 7810C, 7810, 860, 8600, 861, 8610	782C, 782, 7820C, 7820
A	12.7 mm (0.5")	15.0 mm (0.6")
B	83.0 mm (3.3")	115.0 mm (4.5")
C	124.0 mm (4.9")	¼" VCR® fittings: 183.8 mm (7.2")
		⅜" VCR® fittings: 192.3 mm (7.6")
D	18.0 mm (0.7")	25.5 mm (1.0")
E	69.0 mm (2.7")	90.0 mm (3.5")
F	127.0 mm (5.0")	150.0 (5.9")
G	132.0 mm (5.2")	154.0 mm (6.1")
H	28.6 mm (1.1")	38.0 mm (1.5")
I	7.0 mm (0.3")	24.4 mm (0.96")



Models with IGS Compatible Fittings

	780C, 780, 7800C, 7800, 781C, 781, 7810C, 7810 860, 8600, 861, 8610		Compact Series 785CT, 785T, 785CY, 785Y, 786CT, 786T, 786CY, 786Y 865T, 865Y, 866T, 866Y	
	1.125" IGS Fittings	1.5" IGS Fittings	1.125" IGS Fittings	1.5" IGS Fittings
A	70.4 mm (2.8")	70.4 mm (2.8")	70.4 mm (2.8")	70.4 mm (2.8")
B	127.0 mm (5.0")	127.0 mm (5.0")	127.0 mm (5.0")	127.0 mm (5.0")
C	25.4 mm (1.0")	25.4 mm (1.0")	25.4 mm (1.0")	25.4 mm (1.0")
D	105.0 mm (4.1")	105.0 mm (4.1")	92.8 mm (3.6")	92.8 mm (3.6")
E	28.6 mm (1.1")	38.1 mm (1.5")	28.6 mm (1.1")	28.6 mm (1.1")
F	21.8 mm (0.9")	30.0 mm (1.2")	21.8 mm (0.9")	30.0 mm (1.2")
G	92.0 mm (3.6")	92.0 mm (3.6")	79.8 mm (3.2")	79.8 mm (3.2")



For more information on Aera FC-7700 MFCs, visit:
www.advanced-energy.com/en/Aera_Transformer_MFCs.html

To view AE's comprehensive flow management portfolio, visit:
www.advanced-energy.com/en/Flow_Management.html

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