

GF100 Series - EtherCAT®

Metal Sealed, High-Purity/Ultra-High Purity
Thermal Mass Flow Controllers & Meters for Gases

Through hundreds of thousands of installations, the GF100 Series has been proven to have the fastest response time and most accurate performance of any mass flow controller on the market today, enabling precision gas chemistry control. Now enhanced with the speed of EtherCAT® (an Ethernet-based communication system known for its cost efficient cabling and application efficiency), the GF100 Series delivers improved key specifications for the increasing demands of semiconductor processes.



Features

Benefits

EtherCAT® Communication	Supports real-time EtherCAT® data acquisition capabilities.
Ultra-Stable Flow Sensor	Enables tighter low setpoint accuracy and reduces maintenance requirements ensuring long-term zero stability ($\leq 0.15\%$ of full scale drift per year).
Enhanced Pressure Transient Insensitivity	Reduces crosstalk sensitivity for consistent mass flow delivery and increases wafer-to-wafer consistency.
Zero Leak-by Control Valve	Valve shut down (up to $\leq 0.005\%$ full scale) to minimize the first wafer effect, improve tool matching, and wafer-to-wafer uniformity.
GF120 Safe Delivery System (SDS®)	Low pressure drop MFC for the delivery of subatmospheric safe delivery system (SDS) gases used in Implant and Etch processes.
MultiFlo™ Gas and Range Technology	Enables one MFC to support thousands of gas types and range combinations without removing it from the gas line or compromising on accuracy.

Product Specifications

	GF100	GF120	GF125	GF120XSL	GF120XSD
Performance¹					
Full Scale Flow Range	3 sccm - 55 slm			4 sccm - 25 sccm	> 25 sccm - 1 slpm
Flow Accuracy	+1% S.P. > 20 - 100%; +0.2% full scale 2 - 20%			±1% S.P. 35 - 100%; ±0.35% full scale 2 - 35%	
Repeatability & Reproducibility	5 - 100% = ± 0.15% of S.P. 2-5% = ± 0.015% of full scale				
Flow Settling Time (N.C. Valve)	< 1 sec	700 ms	300 ms (3 - 860 sccm) 400 ms (861 - 7200 sccm) 500 ms (7201 - 30000 sccm) <700 ms (30001 - 55000 sccm)	< 3 sec	
Flow Settling Time (N.O. Valve)	< 1.5 sec			---	
Pressure Insensitivity	N/A		< 1% S.P. up to 5 psi/sec upstream press. spike	---	
Control Range	2 - 100% (Normally Closed Valve) 3 - 100% (Normally Open Valve)			2 - 100% (Normally Closed Valve)	
MultiFlo™	Standard			---	
# of Bins	11 bins			---	
Valve Shut Down (N.C. Valve) ²	Standard Hastelloy Valve: < 0.15% of full scale Zero Leak Valve: SH40 – SH41 < 0.02% of full scale SH42 – SH50 < 0.005% of full scale			Standard Hastelloy Valve: <0.15% of full scale	
Valve Shut Down (N.O. Valve)	2% of full scale			---	
Zero Stability	< + 0.15% full scale per year			< + 0.6% full scale per year	
Temperature Coefficient	Zero: 0.005% full scale per °C; Span: 0.05% full scale per °C				

Ratings

Operating Temperature Range	10 - 50 °C				
Differential Pressure Range ³	3 - 860 sccm = 7 - 45 psid 861 - 7200 sccm = 10 - 45 psid 7201 - 55000 sccm = 15 - 45 psid			10 Torr - 30 psid typical For more details, consult factory	
Proof Pressure	700 psia max		140 psia max	700 psia max	
Design Pressure	800 psia max		170 psia max	800 psia max	
Burst Pressure	3000 psia max		500 psia max	3000 psia max	
Maximum Operating Pressure	500 psia max		100 psia max	up to 500 psia max	
Leak Integrity (External)	1 x 10 ⁻¹⁰ atm. cc/sec He				

Mechanical

Valve Type	Normally Closed (Standard or Zero Leak-by) Normally Open Meter (No Valve)			Normally Closed	
Wetted Materials	SEMI F20 HP Compliant, 316L VIM/VAR, Hastelloy C-22, 316L Stainless Steel, 304 Stainless Steel, KM-45, PCTFE (on optional Zero leak Valve)				
Surface Finish	10μ inch Ra		5μ inch Ra	5μ inch Ra	

Diagnostics & Display

Status Lights	Run, Error, Power, Network Status				
Alarms	Control Valve Output, Network Interruption, Temperature High/Low, Pressure High/Low, Power Surge/Sag				
Display Type	Top Mount Integrated LCD				
Viewing Angle / Viewing Distance	Rotatable / 10 feet				
Units Displayed / Resolution	Flow (%), Temp. (°C), Pressure (psia, kPa) / 0.1 (unit)				

¹ Based on factory N₂ calibration.

² The Zero Leak-by Valve can be ordered via the Customer Special Request process.

³ Argon gas applications require an additional 10 psid differential pressure. Devices greater than 30L require a 45 psia minimum inlet pressure. Low vapor pressure gases require an inlet pressure of > 100 Torr, with vacuum on outlet (example SiCl₄). Contact Brooks Technical Support for more information.

Product Specifications

GF100	GF120	GF125	GF120XSL	GF120XSD
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Electrical

Electrical Connection	Power via 5-pin M8 Connector, EtherCAT via RJ45 jacks
Digital Communication	EtherCAT
Diagnostics / Service Port	Micro-USB
Power Supply / Consumption	320 mA max. @ 18-30 Vdc, 230 mA max. @ 24 Vdc (under typical operating conditions)

Compliance

EMC	EMC Directive 2014/30/EU Evaluation Standard EN61326-1:2013
Environmental Compliance	RoHS Directive (2011/65/EU) REACH Directive EC (1907/2006)

Product Specifications

	GF101	GF121	GF126
Performance¹			
Full Scale Flow Range	55 slm - 300 slm		
Flow Accuracy	+1% S.P. > 35 - 100%; +0.35% full scale 2 - 35%		
Repeatability & Reproducibility	< + 0.15% S.P		
Response Time / Settling Time (N.C. Valve)	< 1 sec		
Pressure Insensitivity	Not Applicable	Ability to measure inlet pressure	
Control Range	5 - 100% (Normally Closed Valve)		
MultiFlo™	Standard		
# of Bins	4 bins		
Valve Shut Down (N.C. Valve)	< 2% of Full scale @30 N ₂ psig/atm out		
Zero Stability	< + 0.15% full scale per year		
Temperature Coefficient	Zero: 0.005% full scale per °C; Span: 0.05% full scale per °C		

Ratings			
Operating Temperature Range	10 - 50 °C		
Differential Pressure Range	30 - 90 psid		
Maximum Operating Pressure	Controller: 75 psig Meter: 150 psig		
Proof Pressure	700 psia	140 psia	
Design Pressure	800 psia	170 psia	
Burst Pressure	3000 psia	500 psia	
Leak Integrity (External)	1x10 ⁻¹⁰ atm. cc/sec He		

Mechanical			
Valve Type	Normally Closed Meter (No Valve)		
Wetted Materials	SEMI F20 HP Compliant, 316L VIM/VAR, Hastelloy C-22, 316L Stainless Steel, 304 Stainless Steel, KM-45		
Surface Finish	10µ inch Ra	5µ inch Ra	

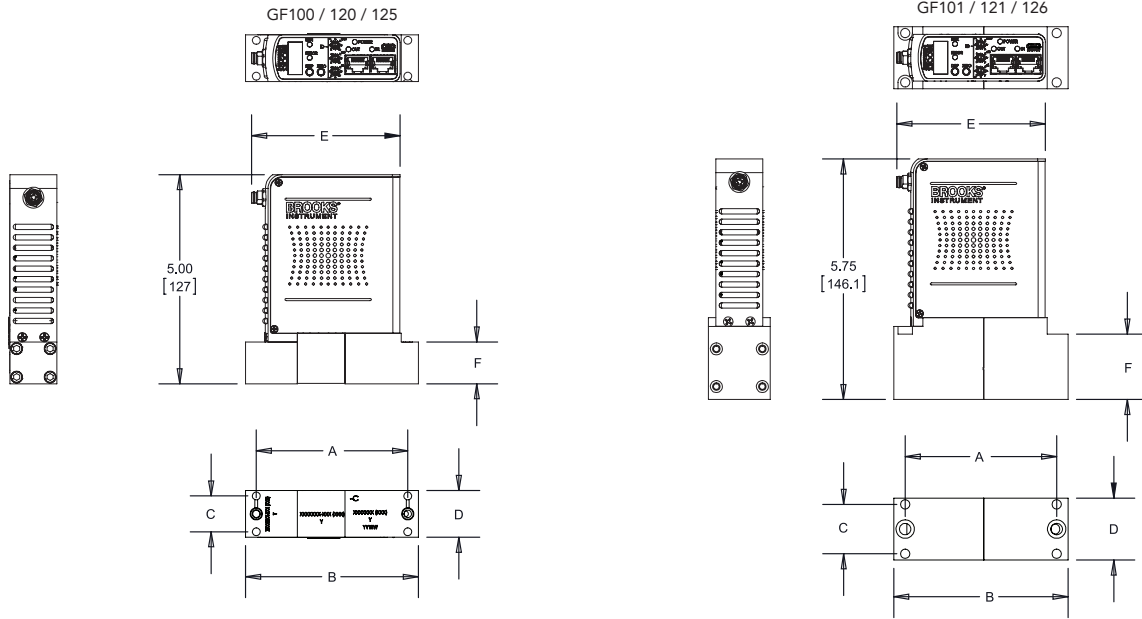
Diagnostics & Display			
Status Lights	Run, Error, Power, Network Status		
Alarms	Control Valve Output, Network Interruption, Temperature High/Low, Pressure High/Low, Power Surge/Sag		
Display Type	Top Mount Integrated LCD		
Viewing Angle / Viewing Distance	Rotatable / 10 feet		
Units Displayed / Resolution	Flow (%), Temp. (°C), Pressure (psia, kPa) / 0.1 (unit)		

Electrical			
Electrical Connection	Power via 5-pin M8 Connector, EtherCAT via RJ45 jacks		
Digital Communication	EtherCAT		
Diagnostics / Service Port	Micro-USB		
Power Supply / Consumption	320 mA max. @ 18-30 Vdc, 230 mA max. @ 24 Vdc (under typical operating conditions)		

Compliance			
EMC	Environmental Compliance		
Environmental Compliance	RoHS Directive (2011/65/EU) Reach Directive EC (1907/2006)		

¹ Based on factory N₂ calibration.

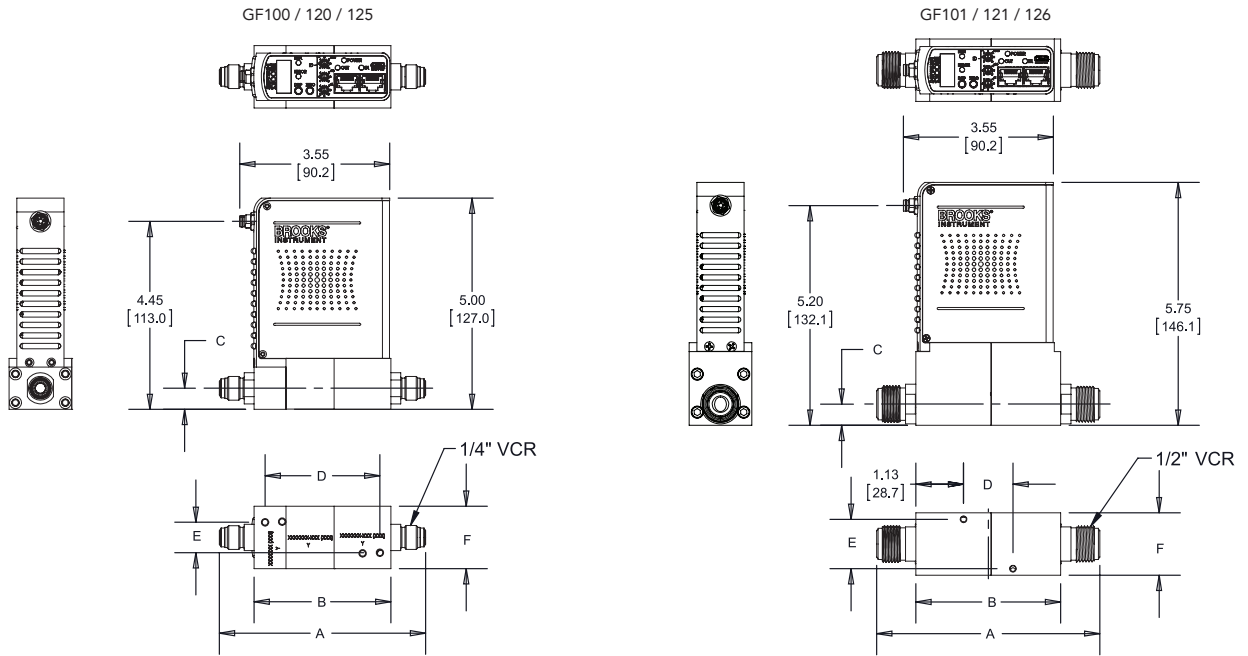
GF100 Series with EtherCAT® - Surface Mount Configurations



Fitting Option Code	Model	Seal Type	Dim A	Dim B	Dim C	Dim D	Dim E	Dim F
CX	GF100/120/125	C-SEAL	3.62in [92mm]	4.13in [105mm]	0.86in [21.7mm]	1.12in [28.4mm]	3.55in [90.2mm]	1.00in [25.4mm]
WX	GF100/120/125	W-SEAL	3.62in [92mm]	4.13in [105mm]	0.86in [21.7mm]	1.12in [28.4mm]	3.55in [90.2mm]	1.00in [25.4mm]
C1	GF101/121/126	C-SEAL	3.62in [92mm]	4.17in [106mm]	1.18in [30mm]	1.48in [37.6mm]	3.55in [90.2mm]	1.57in [39.8mm]
C2	GF101/121/126	C-SEAL	4.49in [114mm]	5.00in [127mm]	1.18in [30mm]	1.48in [37.6mm]	3.55in [90.2mm]	1.57in [39.8mm]

NOTE: [] ALTERNATE DIMENSION UNITS ARE FOR REFERENCE ONLY.

GF100 Series with EtherCAT® - VCR Configurations



Fitting Option Code	Model	VCR	Dim A	Dim B	Dim C	Dim D	Dim E	Dim F
VS	GF100/120/125	1/4"	4.88in [124mm]	3.24in [82mm]	0.50in [12.7mm]	2.72in [69mm]	0.72in [18mm]	1.12in [28.4mm]
VX	GF100/120/125	1/4"	4.88in [124mm]	3.24in [82mm]	0.50in [12.7mm]	2.72in [69mm]	0.72in [18mm]	1.48in [37.6mm]
V1	GF101/121/126	1/2"	5.28in [134.2mm]	3.43in [87mm]	0.50in [12.7mm]	1.17in [29.7mm]	1.17in [29.7mm]	1.48in [37.6mm]

NOTE: [] ALTERNATE DIMENSION UNITS ARE FOR REFERENCE ONLY.

Model Code - Standard Flow Range

Code Description	Code Option	Option Description
I. Base Model Code	GF	High-Purity / Ultra-High Purity Digital Mass Flow Controllers
II. Package / Finish Specifications	100	Flow range 3 sccm - 55 slpm N ₂ Equivalent.; 1 sec Response; 10 Ra
	120	Flow range 3 sccm - 55 slpm N ₂ Equivalent.; 700 msec Response; 5 Ra
	125	Pressure Transient Insensitive (PTI) Flow range 3 sccm -55 slpm N ₂ Equivalent; 300 - 700 msec Response; 5 Ra
III. Configurability	C	MultiFlo™ capable. Standard bins or specific gas/range may be selected.
	X	Not MultiFlo™ capable. Specific gas/range required. (must select w/ SD or SL special application)
IV. Special Application	XX	Standard
	SL	Safe Delivery System (GF120 only) Full scale flow range; 4 - 25 sccm, N ₂ Equivalent
	SD	Safe Delivery System (GF120 only) Full scale flow range; 25 sccm - 1 slpm, N ₂ Equivalent
V. Valve Configuration	O	Normally open valve (not available with SD, SL or VS options)
	C	Normally closed valve
	M	Meter (no valve)
VI. Gas or SH MultiFlo™ Bin	XXXX XXXX	Specific Gas Code & Range, i.e. "0004" = Argon and "010L" = 10 slpm
	SH40 010C	Standard Configuration #40, 3 - 10 sccm Nitrogen Equivalent
	SH41 030C	Standard Configuration #41, 11 - 30 sccm Nitrogen Equivalent
	SH42 092C	Standard Configuration #42, 31 - 92 sccm Nitrogen Equivalent
	SH43 280C	Standard Configuration #43,93 - 280 sccm Nitrogen Equivalent
	SH44 860C	Standard Configuration #44, 281 - 860 sccm Nitrogen Equivalent
	SH45 2.6L	Standard Configuration #45, 861 - 2600 sccm Nitrogen Equivalent
	SH46 7.2L	Standard Configuration #46, 2601 - 7200 sccm Nitrogen Equivalent
	SH47 015L	Standard Configuration #47, 7201 - 15000 sccm Nitrogen Equivalent
	SH48 030L	Standard Configuration #48, 15001 - 30000 sccm Nitrogen Equivalent
	SH49 040L	Standard Configuration #49, 30001 - 40000 sccm Nitrogen Equivalent
SH50 055L	Standard Configuration #50, 40001 - 55000 sccm Nitrogen Equivalent	
VII. Fitting	VS	1-1/8" body width, 1/4" VCR male
	VX	1-1/2" body width, 1/4" VCR male
	CX	1-1/8" body width, C Seal 92mm
	WX	1-1/8" body width, W Seal 92mm
VIII. Downstream Condition	A	Atmosphere
	V	Vacuum
IX. Sensor	O	Default Sensor Orientation
X. Communications / Connector	E0	EtherCAT Communication
XI. Customer Special Request	XXXX	Customer Special Request Number
XII. Auto Shut-Off	A	Auto Shut-Off (included)
	X	Auto Shut-Off (not included)
XIII. Auto Zero	X	Auto Zero (not included)
XIV. Reference Temperature	000	0 °C Reference Calibration (Standard) - Default Setting

Model Code - High Flow Range

Code Description	Code Option	Option Description
I. Base Model Code	GF	High-Purity / Ultra-High Purity Digital Mass Flow Controllers
II. Package / Finish Specifications	101	Flow range 55 - 300 slm N ₂ Equivalent.; 10 Ra HP wetted flow path
	121	Flow range 55 - 300 slm N ₂ Equivalent.; 5 Ra HP wetted flow path
	126	Flow range 55 - 300 slm N ₂ Equivalent.; 5 Ra HP wetted flow path & integrated pressure measurement
III. Configurability	C	MultiFlo capable. Standard bins or specific gas/range may be selected.
	X	Not MultiFlo™ capable. Specific gas/range required.
IV. Special Application	XX	Standard
V. Valve Configuration	C	Normally closed valve
	M	Meter (no valve)
VI. Gas or SH MultiFlo™ Bin	XXXX XXXX	Specific Gas Code & Range, i.e. "0004" = Argon and "010L" = 10 slpm
	SH51 055L	Standard Configuration #51, 55,001 sccm N ₂ Equivalent (0 °C Reference)
	SH52 100L	Standard Configuration #52, 55,002-100,000 sccm N ₂ Equivalent (0 °C Reference)
	SH53 200L	Standard Configuration #53, 100,001-200,000 sccm N ₂ Equivalent (0 °C Reference)
	SH54 300L	Standard Configuration #54, 200,001-300,000 N ₂ Equivalent (0 °C Reference)
VII. Fitting	V1	1-1/2" body width, 134mm 1/2" VCR male
	C1	1-1/2" body width, 92mm 3/8" C Seal
	C2	1-1/2" body width, 114mm C Seal
VIII. Downstream Condition	A	Atmosphere
	V	Vacuum
IX. Sensor	O	Default Sensor Orientation
X. Communications / Connector	E0	EtherCAT Communication
XI. Customer Special Request	XXXX	Customer Special Request Number
XII. Auto Shut-Off	A	Auto Shut-Off (included)
	X	Auto Shut-Off (not included)
XIII. Auto Zero	X	Auto Zero (not included)
XIV. Reference Temperature	000	0 °C Reference Calibration (Standard) - Default Setting

Sample Standard Model Code

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV				
GF	100	C	XX	M	-	SH40 010C	-	VX	A	O	E0	-	XXXX	A	X	-	000

Brooks is committed to assuring all of our customers receive the ideal pressure controllers for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration and is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.

Visit www.BrooksInstrument.com to locate the service location nearest to you.

START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required. For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

SEMINARS AND TRAINING

Brooks Instrument can provide customer seminars and dedicated training to engineers, end users, and maintenance persons. Please contact your nearest sales representative for more details. Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.



TRADEMARKS

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Data-Sheet-GF100-EtherCAT-EN/2024-04

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