DS-TMF-GF101-Series-MFC-eng
May, 2017

Data Sheet

GF Series
GF101/GF121/GF126

Thermal Mass Flow

GF High Flow Series

High Purity/Ultra-High Purity
High Flow
Digital Mass Flow Devices

Overview

Designed for semiconductor, MOCVD, and other gas flow control applications that require a high purity all-metal flow path, the Brooks GF Series mass flow controllers deliver outstanding performance, reliability, and flexibility. The GF101/121/126 extends the GF family to support flow rates up to 300 slpm N2 equivalent. The high flow design utilizes the proven GF sensor design and electronics. This high flow product provides excellent flow stability for purge lines in CVD, LPCVD, Diffusion, Epi processes, semiconductor chamber clean processes and MOCVD purge flows.

Product Description

Designed for high-flow applications like purge, the GF101/121/126 has all of the features/benefits of the GF100/120/125, but with extended performance for flow rates up to 300 slpm. Compared with competitive products offering a similar flow rate, the compact footprint of the GF101/121/126 allows users to design smaller, more efficient systems. It also provides better actual process gas accuracy over devices that use traditional single point conversion factors when switching to a new gas. The GF101/121/126 Series features an all metal seal flow path for durability and high leak integrity, precise, stable flow control with fast Sub-1 second settling times and 1% of reading accuracy to ensure reliable flow measurement or control in demanding gas flow applications. The GF101/121/126 achieves excellent internal to external leak integrity. A wide range of digital and analog I/O options offers the broadest range of communication protocols making the GF101/121/126 an ideal upgrade for existing MFCs.

Built on a common platform and interface, this series now enables an entire system to use one product platform:

- GF101/121/126 based on the same technology and design as the low flow GFs
  - Same sensor
  - Same electronics
  - Same low power support
- Smaller footprint than competitive MFCs
- Handles flow rates up to 300 slpm
- Metal seal for durability and high leak integrity
- Proprietary sensor technology
- Precise flow control with fast sub-1 second settling time
- 1% of reading accuracy
- Corrosion-resistant Hastelloy C-22 sensor tube

Product Description (continued)

Ultra Fast Response

By combining Brooks' patented flow sensor technology with a high speed ARM processor and fast acting diaphragm free valve assembly, the GF101/GF121/GF126 Series delivers up to 2 times faster response and settling time compared to other mass flow controllers, enabling:

- Reduced diverted gas consumption and associated abatement costs
- For processes requiring a slow ramped gas turn-on or time critical transitions between flow rates. A user programmable ramp function is provided
- Improved gas blending and dilution in MOCVD

Pressure Tolerant Flow Control

The GF High-Flow's hydraulically balanced valve is inherently less sensitive to line pressure disturbances caused by regulator droop and popping that can drive the traditional (valve) MFC's to over compensate and ring, resulting in flow disturbance that can impact the process, trip excess flow alarms or stir up particles.

Advanced Thermal Flow Measurement Sensor

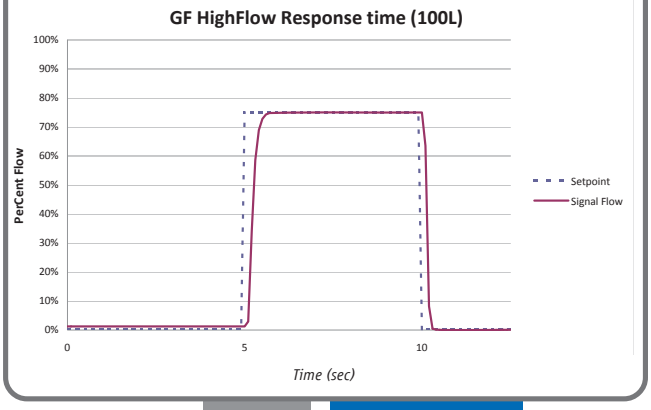
Brooks' proprietary sensor technology combines:

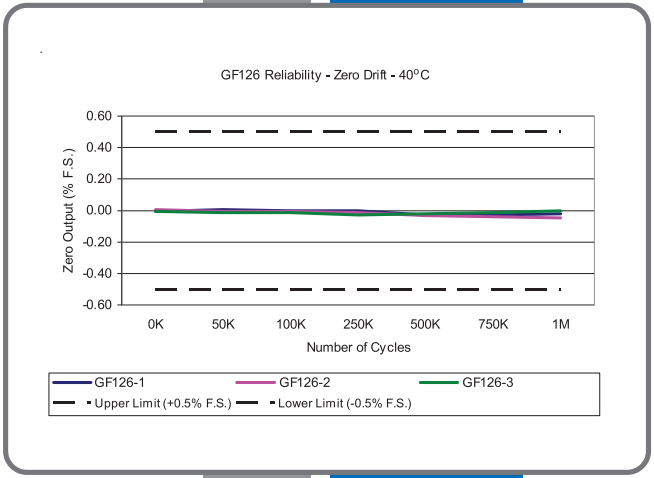
- Improved signal to noise performance for improved accuracy at low setpoints
- Improved reproducibility at elevated temperatures through new isothermal packaging, onboard conditioning electronics with ambient temperature sensing and compensation
- Improved long-term stability through enhanced sensor manufacturing and burn in process
- Highly corrosion resistant Hastelloy C-22 sensor tube
- Optimized temperature profile for gases prone to thermal decomposition
- Unique orthogonal sensor mounting orientation
  - -Eliminates sensor drift caused by valve heating effects
  - -Eliminates thermal siphoning effects for the most common mounting orientations

High Purity Flow Path

All metal, corrosion resistant flow path with reduced surface area and un-swept volumes for faster dry-down during purge steps:

- SEMI F-20 compliant wetted flow path
- 5 µ inch Ra max surface finish standard (10 µ inch Ra on GF101)





High Purity Flow Path

Product Description (continued)

Extensive Mechanical Configuration Support

GF101/GF121/GF126 Series supports all metal seal / UHP industry gas connection interface standards for full OEM and process coverage

- 92 mm, C Seal on 1.5" body
- 114 mm, C Seal on 1.5" body
- 134.2 mm, 1/2" VCR male on 1.5" body
- 150.4 mm, 1/2" VCR on 1.5 body
- 166 mm, 1/2" VCR on 1.5" body
- 168.6 mm, 1/2" VCR on 1.5" body

Accessories

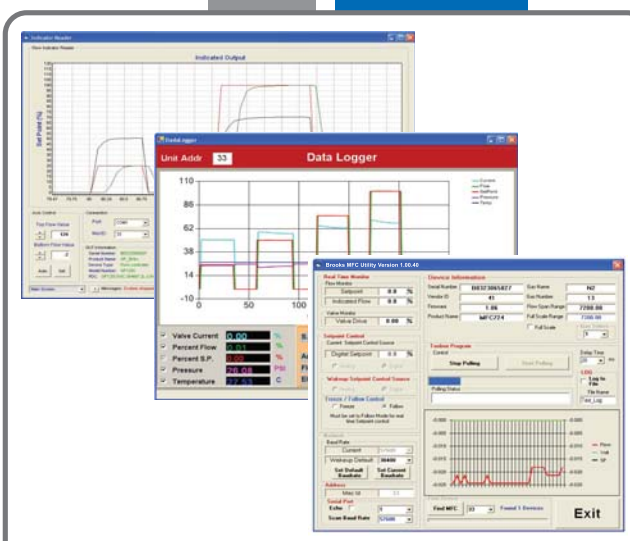
318Z137BNA: 1/2" VCR adapter to extend 134.2 mm lay length to 177 mm lay length
318Z138BNA: 1/2" VCR adapter to extend 134.2 mm lay length to 192.4 mm lay length

Enhanced Diagnostics

The mass flow controller remains the most complex and critical component in gas delivery systems. When dealing with UHP gas distribution or highly toxic or corrosive gases, removing the mass flow controller to determine if it is faulty should be the last resort. In response to this, Brooks pioneered smarter mass flow controllers with embedded self test routines and introduced an independent diagnostic/service port to provide the user with a simple interface, for troubleshooting without disturbing flow controller operation.

User Interface

The user interface has a high visibility LCD display that provides a local indication of Flow (%), Temperature (°C), Pressure (PSIA/KPa) and Network Address, selectable through the Display button. A Zero button provides a simple means to re-zero the mass flow controller as part of scheduled maintenance. The display is rotatable with a push button to enable improved readability based on how the MFC is mounted.



MFC on Gas Box

Communication Interface

Communication Interface

The GF101/GF121/GF126 Series supports analog 0-5 Vdc, RS485, and DeviceNet™ communication protocols. A range of low profile adapter cables facilitate replacing older mass flow controllers with the GF101/GF121/GF126 Series eliminating the need to carry mass flow controllers of same gas/range but different electrical connectors.

Features and Benefits

Features	Benefits
Metal Seal	High leak integrity. No periodic replacement of aging seals necessary
Adaptable Mechanical Configurations	Compact footprint enables easy retrofit to existing systems
Metrology	Measurement accuracy is traceable to international standards
User Accessible Service Port with Advanced Diagnostics with User-Friendly Interface	Convenient interface to diagnostics for maximum uptime. Ensures device is operating within user specified limits for high yield and maximum uptime
Corrosion Resistant Hastelloy T-Rise Sensor	Provides unmatched long-term sensor stability ensuring maximum yield and throughput
Pressure Transient Insensitivity (PTI)	Tighter process control

Product Specifications

Performance

	GF101	GF121	GF126
Full Scale Flow Range (N_2 Eq.)	55 to 300 slm		
Flow Accuracy	±1% S.P. > 35-100%, ±0.35% F.S. 2-35%		
Repeatability & Reproducibility	< ± 0.15% S.P.		
Linearity	± 0.5% F.S. (included in accuracy)		
Response Time (Settling Time) Normally Closed Valve	< 1 sec		
Pressure Transducer			Ability to measure inlet pressure
Control Range	5-100% (Normally Closed Valve)		
MultiFlo	Standard (All typical high flow rate process gases & mixtures supported)		
# of Bins	4 Bins		
Control Range	5-100% (Normally Closed Valve)		
Valve Shut Down (N.C. Valve)	< 2% of F.S. @ 30 N2 psig/atm out		
Zero Stability	< ± 0.5% F.S. per year		
Temperature Coefficient	Span: 0.05% S.P. per °C, Zero: 0.005% F.S. per °C		

Ratings

Operating Temperature Range	10-50°C
Differential Pressure Range	30-90 psid
Maximum Operating Pressure	Controller: 75 psig / Meter: 150 psig
Leak Integrity (external)	$1x10^{-10}$ atm. cc/sec He

Mechanical

Valve Type	Normally Closed Meter (no valve)	
Wetted Materials	GF101: SEMI F20 HP Compliant, 316L VIM/VAR, Hastelloy C-22, 316L Stainless Steel, 304 Stainless Steel, KM-45 GF121/GF126: SEMI F20 UHP Compliant, 316L VIM/VAR, Hastelloy C-22, 316L Stainless Steel, 304 Stainless Steel, KM-45	
Surface Finish	10µ inch Ra	5µ inch Ra (0.1 µm Ra)

Diagnostics & Display

Status Lights	MFC Health, Network Status
Alarms	Control Valve Output, Network Interruption
Display Type **Viewing Angle / Viewing Distance** **Units Displayed / Resolution**	Top Mount Integrated LCD Fixed / 10 feet Flow (%), Temp. (°C), Pressure (psia, kPa) / 0.1 (unit)

Electrical

Electrical Connection	RS485/Analog via 9-Pin "D" connector, DeviceNet™ via 5-Pin "M12" connector
Digital Communication	RS485+ (model specific), DeviceNet (model specific), RS485 Diagnostic Port (all models)
Diagnostic /Service Port	RS485 via 2.5mm jack
Power Supply/Consumption	DeviceNet: 545 mA max. @ +11-25 Vdc., 250mA max. @ 24 Vdc (Under typical operating conditions) RS485/Analog: 6 Watts max @ ±15 Vdc. (±10%) (Under typical operating conditions)

Compliance

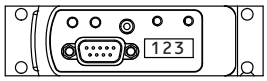
EMC	EC Directive 2004/108/EC CE: EN61326: 2006 (FCC Part 15 & Canada IC-subset of CE testing)
Environmental Compliance	RoHS Directive (2011/65/EU)
	REACH Directive EC 1907/2006

Electrical Interface Options

Base I/O Options

PDC Ordering Code G1

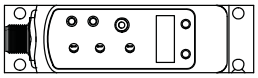
Description: Industry standard Analog / RS485 interface



Pin No.	Signals	
1	Valve Control	
2	Output (0-5 Vdc)	
3	+15 Vdc	+24 Vdc
4	Pwr Com	NC
5	-15 Vdc	Pwr Com
6	Setpoint (0-5 Vdc)	
7	Signal Common	
8	RS-485 (DX+)	
9	RS-485 (DX-)	

PDC Ordering Code DX

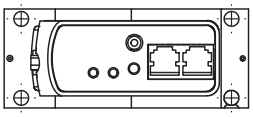
Description: Industry standard ODVA compliant DeviceNet interface



M12 Pin No.	Signals
1	Drain
2	V+ (11-25 Vdc)
3	V-
4	CAN-H
5	CAN-L

PDC Ordering Code SX

Description: Industry standard Analog 9-Pin Sub D connector and dual RJ11 RS485 ports

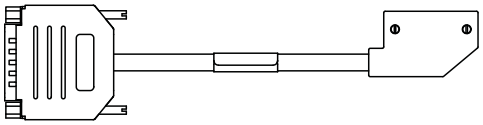


D-Sub Pin No.	Signals	
1	Valve Control	
2	Output (0-5 Vdc)	
3	+15 Vdc	+24 Vdc
4	Pwr Com	NC
5	-15 Vdc	Pwr Com
6	Setpoint (0-5 Vdc)	
7	Signal Common	
8	Signal Common	
9	Valve Test Point	
RJ11 J2 Pin No.	**Signals**	
3	RS-485 (DX-)	
4	RS-485 (DX+)	

All Base I/O options include: Diagnostic port communication RS485 via 2.5mm jack

I/O Options Using Base Model and Adapter Cable

A range of low profile adapter cables have been developed to support replacing older generation MFC's with different pinout configurations. The base MFC will be either a G1 or SX configuration, depending on the product being replaced.



PDC Ordering Code UX

Description: SX base I/O with 7003550 adapter for compatability with Unit UDU15

Pin No	Signals	
9	VALVE OFF	
6	OUTPUT (0-5 VDC)	
4	+15 VDC	+24 VDC
7	PWR COM	NC
11	-15 VDC	PWR COM
15	SETPOINT (0-5 VDC)	
1,13,14	SIGNAL COMMON	
2	ZERO ALARM	
12	VALVE TEST POINT	
8	CASE GROUND	
3,5,10	NO CONNECTION	

PDC Ordering Code: FX / JX

Description: SX base I/O with 7003069 (FX)/7001814 (JX) adapter for compatability with Unit UDF9/UDJ9

Pin No	Signals	
1	VALVE CONTROL*	
2	OUTPUT (0-5 VDC)	
3	+15 VDC	+24 VDC
4	PWR COM	NC
5	-15 VDC	PWR COM
6	SETPOINT (0-5 VDC)	
7	SIGNAL COMMON	
8	SIGNAL COMMON	
9	VALVE TEST POINT	

PDC Ordering Code: EX

Description: G1 base I/O with 7003083 adapter for compatability with Unit "E", IN "L", "R"

Pin No	Signals	
J	VALVE OFF	
3	OUTPUT (0-5 VDC)	
4	+15 VDC	+24 VDC
2	PWR COM	NC
F	-15 VDC	PWR COM
A	SETPOINT (0-5 VDC)	
B,C,10	SIGNAL COMMON	
1	CASE GROUND	
5, 6, 8, 9	NOT CONNECTED	
I, D, E, H	NOT CONNECTED	
7,G	KEY WAY	
RJ11 J2 Pin No	**RJ11 J3 Pin No**	
3	3	RS-485 (DX-)
4	4	RS-485 (DX+)

PDC Ordering Code: KX

Description: G1 base I/O with 7003298 adapter for compatability with Unit UDK15

Pin No	Signals	
3	VALVE CONTROL	
2	OUTPUT (0-5 VDC)	
7	+15 VDC	+24 VDC
5	PWR COM	NC
6	-15 VDC	PWR COM
8	SETPOINT (0-5 VDC)	
11,12	SIGNAL COMMON	
15	CASE GROUND	
1, 4, 9, 10, 13, 14	NO CONNECTION	

PDC Ordering Code: BX

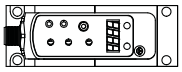
Description: G1 base I/O with 7003590 adapter for compatability with Brooks 15-Pin D

Pin No	Signals	
12	VALVE OVERRIDE	
2	OUTPUT (0-5 VDC)	
5	+15 VDC	+24 VDC
9	PWR COM	NC
6	-15 VDC	PWR COM
8	SETPOINT (0-5 VDC)	
1,10	SIGNAL COMMON	
3,4,7,11	NO CONNECTION	
13,14,15	NO CONNECTION	

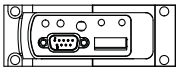
Other adapter options are available for the GF Series. Please contact Brooks Customer Service for more information.

Product Dimensions

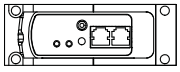
DNET

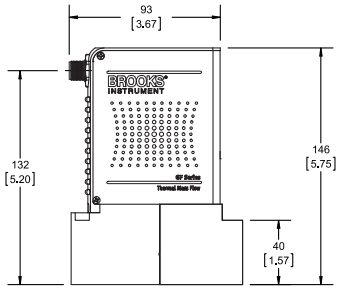


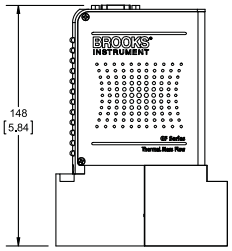
RS485

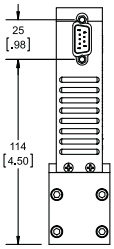


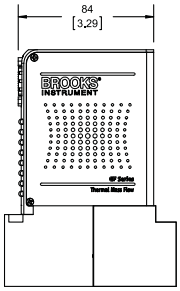
RS485/RJ11

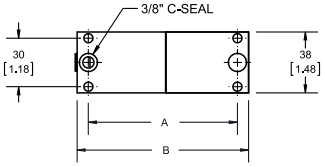






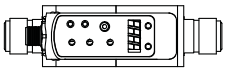




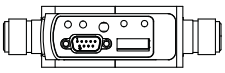


Fitting Option Code	Seal Type	Dim A	Dim B
C1	3/8" C-Seal	92 mm [3.62 in]	106 mm [4.17 in]
C2	3/8" C-Seal	114 mm [4.49 in]	127 mm [5.00 in]

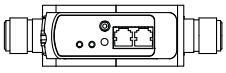
DNET

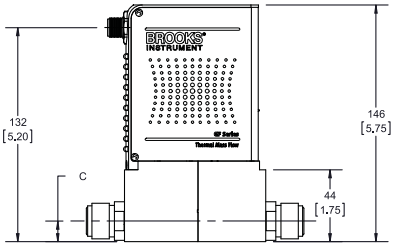


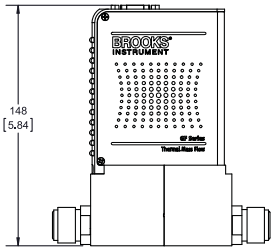
RS485

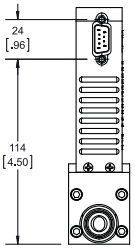


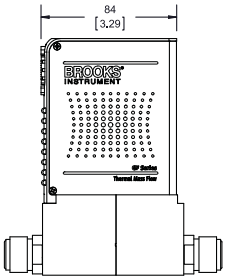
RS485/RJ11

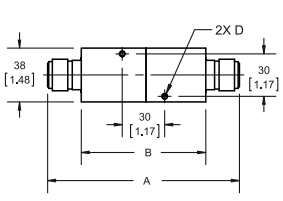




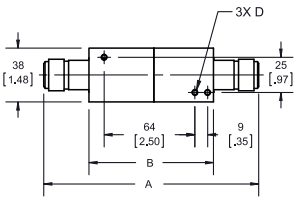




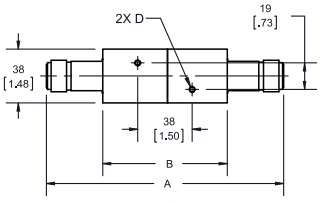




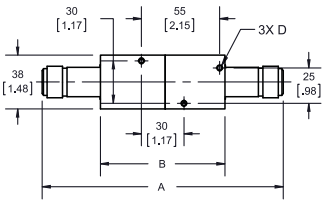
V1



V2



V3



V4

Fitting Option Code	Seal Type	Dim A	Dim B	Dim C	Dim D
V1	1/2" VCR	134.2 mm [5.28 in]	87 mm [3.43 in]	12.7 mm [0.50 in]	M4 X 0.7 X 5.8 [0.23] DEEP
V2	1/2" VCR	150.4 mm [5.92 in]	87 mm [3.43 in]	15.5 mm [0.61 in]	M4 X 0.7 X 5.8 [0.23] DEEP
V3	1/2" VCR	166 mm [6.54 in]	87 mm [3.43 in]	12.4 mm [0.49 in]	M4 X 0.7 X 5.8 [0.23] DEEP
V4	1/2" VCR	168.6 mm [6.64 in]	87 mm [3.43 in]	16.0 mm [0.63 in]	M4 X 0.7 X 5.8 [0.23] DEEP

Model Code

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 N2 Eq.; 10 Ra HP wetted flow path
		121	Flow range 55 - 300 slm N2 Eq.; 5 Ra UHP wetted flow path
		126	Flow range 55 - 300 slm N2 Eq.; 5 Ra UHP wetted flow path & integrated pressure measurement
III.	Configurability	C	MultiFlo capable
		X	Not configurable
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 "100L" = 100 slpm
		SH51 055L	Standard Configuration #51, 55,001 sccm N2 Equivalent (0°C Reference) Special Bin for low density gases, e.g. 73,002-120,000 He, 100,002-170,000 H2
		SH52 100L	Standard Configuration #52, 55,002-100,000 sccm N2 Equivalent (0°C Reference)
		SH53 200L	Standard Configuration #53, 100,001-200,000 sccm N2 Equivalent (0°C Reference)
		SH54 300L	Standard Configuration #54, 200,001-300,000 N2 Equivalent (0°C Reference)
VII.	Fitting	V1	1-1/2" body width, 134mm 1/2" VCR male
		V2	1-1/2" body width, 150.4mm 1/2" VCR male
		V3	1-1/2" body width, 166mm 1/2" VCR male
		V4	1-1/2" body width, 168.6mm 1/2" VCR male
		Order V1 + 318Z137BNA	1-1/2" body width, 177mm 1/2" VCR male
		Order V1 + 318Z138BNA	1-1/2" body width, 192.4mm 1/2" VCR male
		C1	1-1/2" body width, 92mm 3/8" C Seal
		C2	1-1/2" body width, 114mm 3/8" C Seal
VIII.	Downstream Condition	A	Atmosphere
		V	Vacuum
IX.	Sensor	O	Default Sensor Orientation

X.	Connector											
		BX	Cable adapter to 15 pin D Brooks (Unit "B","N"); adapts G1 base									
		EX	Cable adapter to card edge (w/out VTP), RS485 through RJ11 jacks (Unit"E"; IN "L", "R"); adapts G1 base									
		FX	Cable adapter with 9 pin STEC pin-out & jack screws (w/VTP) (Unit"F","O"); adapts SX base									
		G1	9-Pin D with RS485 (Unit"G")									
		JX	Cable adapter with 9 pin STEC pin-out & jack screws (w/VTP) (Unit"J","W"); adapts SX base									
		KX	Cable adapter to MKS 15-Pin D (Unit "K"); adapts G1 base									
		SX	9 pin D with STEC pin-out (w/VTP) (Unit"S","Q")									
		UX	Cable adapter to 15 pin D (w/VTP) (Unit & TN "U"); adapts SX base									
			DeviceNet Standard Configuration Parameters									
			I/O	Connector	Power On State	Full Scale Setting	Full Scale Setting	Full Scale Setting	Poll IO Instance Producer	Poll IO Instance Consumer	Poll IO State Transition	External Baud Rate
		D0	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	2	7	Executing	500KB
		D1	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	21	7	Executing	500KB
		D2	DeviceNet	5 Pin Micro	Idle	SCCM	Float	7FFFh	13	19	Executing	500KB
		D3	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	22	7	Executing	500KB
		D4	DeviceNet	5 Pin Micro	Executing	Count	Integer	6000h	22	8	Executing	500KB
		D5	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	6	8	Executing	500KB
		D6	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	3	7	Executing	500KB
		D7	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	6	8	Executing	500KB
		D8	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	3	7	Executing	500KB
		D9	DeviceNet	5 Pin Micro	Executing	Count	Integer	6000h	2	7	Executing	500KB
		DA	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	22	7	Executing	500KB
		DB	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	22	8	Executing	500KB
		DC	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	3	7	Idle	500KB
		DD	DeviceNet	5 Pin Micro	Executing	Count	Integer	7FFFh	22	8	Executing	500KB
		DE	DeviceNet	5 Pin Micro	Executing	SCCM	Float	6000h	15	19	Executing	500KB
		DX	DeviceNet	5 Pin Micro	To be defined by CSR							

XI.	Customer Special Request	XXXX	Customer Special Request Number
XII.	Auto Shut-Off	A	Auto Shut-Off (Included)
		X	Auto Shut-Off (Not Included) (Must be selected for meter)
XIII.	Auto Zero	A	Auto Zero (Included)
		X	Auto Zero (Not Included)
XIV.	Reference Temperature	000	0ºC Reference Calibration (Standard) - Default Setting

Sample Standard Model Code

I	II	III	IV	V		VI		VII	VIII	IX	X		XI	XII	XIII		XIV
GF	101	C	XX	C	-	SH52 100L	-	V1	A	0	G1	-	XXXX	A	X	-	000

Brooks Service and Support

Brooks is committed to assuring all of our customers receive the ideal flow solution 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.

CUSTOMER 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.

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