Installation and Operation Manual
X-TMF-GF Series-MFC-eng
Part Number: 541B137AAG
March, 2010

Brooks® GF Series
High Performance Gas Flow Controllers

Model GF125 Analog I/O

Model GF125 Digital I/O

Essential Instructions

Read this page before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brooks Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

Pressure Equipment Directive (PED)

All pressure equipment with an internal pressure greater than 0.5 bar (g) and a size larger than 25mm or 1" (inch) falls under the Pressure Equipment Directive (PED). The Directive is applicable within the European Economic Area (EU plus Norway, Iceland and Liechtenstein). Pressure equipment can be traded freely within this area once the PED has been complied with.

- Section 1 of this manual contains important safety and operating instructions related to the PED directive.
- Meters described in this manual are in compliance with EN directive 97/23/EC module H *Conformity Assessment.*
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Meters larger than 25mm or 1" (inch) are in compliance with category I, II, III of PED.
- Meters of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

ESD (Electrostatic Discharge)

⚠CAUTION

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of circuit boards or devices.

Handling Procedure:

1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, SMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

Dear Customer,

We appreciate this opportunity to service your flow measurement and control requirements with a Brooks Instrument device. Every day, flow customers all over the world turn to Brooks Instrument for solutions to their gas and liquid low-flow applications. Brooks provides an array of flow measurement and control products for various industries from biopharmaceuticals, oil and gas, fuel cell research and chemicals, to medical devices, analytical instrumentation, semiconductor manufacturing, and more.

The Brooks product you have just received is of the highest quality available, offering superior performance, reliability and value to the user. It is designed with the ever changing process conditions, accuracy requirements and hostile process environments in mind to provide you with a lifetime of dependable service.

We recommend that you read this manual in its entirety. Should you require any additional information concerning Brooks products and services, please contact your local Brooks Sales and Service Office listed on the back cover of this manual or visit www.BrooksInstrument.com.

Yours sincerely,

Brooks Instrument

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Figure Number

Table Number

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1-1 Introduction

This user guide covers the GF1XX Series High Performance Gas Flow Controller as shown in Figure 1-1. Included herein is the general product information, a product description, operating principles and features, installation instructions, performance checks, maintenance requirements, troubleshooting guidelines, and removal and return instructions.

Figure 1-1 GF1XX Series High Performance Gas Flow Controller Analog and Digital

1-2 Intended Use

The GF1XX is designed for semiconductor and other high purity manufacturing processes where fast settling times and superior flow accuracy are required. Some of the processes supported by the GF Series are sub-atmospheric deposition, low pressure plasma deposition, plasma enhanced atomic layer deposition, rapid thermal processing, UHP gas blending to name a few.

1-3 Product Support References

Refer to www.BrooksInstrument.com for Brooks sales and service locations and to obtain other documents that support the GF1XX. Those documents include:

- Brooks MultiFlo® Configurator Software Manual: X-SW-MultiFlo-eng (0199-002-0003). (Includes MultiFlo gas and flow range information)

- GF1XX Data Sheets: DS-TMF-GF100-MFC-eng (153-30648-000), DS-TMF-GF120-MFC-eng (153-30649-000) or DS-TMF-GF125-MFC-eng (153-30650-000) for GF100, GF120 or GF125, respectively. (Includes performance specifications and mechanical footprint).

1-4 Notice and Caution Statements

Warning, caution and notice statements are located throughout this manual in the ANSI format. A WARNING statement indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury. A CAUTION statement indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices. A NOTICE statement describes specific information that requires special attention.

1-5 Product Warranty

Product warranty information can be found on the Back Cover of this Manual and on the Brooks website at **www.BrooksInstrument.com**. This information provides general warranty information, limitations, disclaimers, and applicable warranty periods according to product group.

1-6 How to Order a GF1xx Device

Refer to Appendix A.

1-7 Industry Standard References

Refer to Appendix B.

1-8 GF1xx Gas Table

Refer to Appendix C.

1-9 Glossary of Terms and Acronyms

Table 1-1 Terms and Acronyms

Term or Acronym	Definition
CSR	Customer Special Requirement
CVD	Chemical Vapor Deposition
DeviceNet	A 5-wire local network I/O communication device that employs a command/response communication protocol
DSP	Digital Signal Processor
EPI Epitaxy (EPI).	A process technology where a pure silicon crystalline structure is deposited or “grown” on a bare wafer, enabling a high-purity starting point for building the semiconductor device.
HBD	Horizontal Base Down
GF1XX	Integrated Flow Controller
F.S.	Full Scale
LED	Light Emitting Diode
MFC	Mass Flow Controller
MultiFlo Configurator	I/O communication software package that configures gas and flow ranges
MultiFlo Technology	A physics-based calibration methodology that enables gas and flow range configuration within a defined standard configuration
PID	Proportional Integral Derivative Controller
PSIA	Pounds per Square Inch Absolute
PSID	Pounds per Square Inch Differential
PSIG	Pounds per Square Inch Gauge
PTI	Pressure Transient Insensitive. Reduces the effect of pressure fluctuations in gas flow. Applicable to GF125 only.
ROR	As pressure increases, flow increases at a pressure rate of rise, or ROR.
HC	Standard Configuration w/ Hastelloy® sensors (to reduce reaction to corrosive gases)
S.P.	Setpoint
Step Technology	Enables fast set point control through a high speed DSP and low volume drive circuit
VIU	Vertical mounting attitude with inlet side facing up

1-10 Patents

The GF1XX Series High Performance Gas Flow Controller may be protected by the following US patents and their international filings:

Patent/Pub. No.	Title
6343617	System and method of operation of a digital mass flow controller
6389364	System and method for a digital mass flow controller
6425281	Pressure insensitive gas control system
6445980	System and method for a variable gain proportional-integral (PI) controller
6539792	Method and apparatus for balancing resistance
6640822	System and method of operation of a digital mass flow controller
6681787	System and method of operation of a digital mass flow controller
6714878	System and method for a digital mass flow controller
6752166	Method and apparatus for providing a determined ratio of process fluids
6826953	Flow sensor
6845659	Variable resistance sensor with common reference leg
6910381	System and method of operation of an embedded system for a digital capacitance diaphragm gauge
6941965	Method and apparatus for providing a determined ratio of process fluids
6962164	System and method for a mass flow controller
7043374	Flow sensor signal conversion
7073392	Methods and apparatus for pressure compensation in a mass flow controller
7082824	Variable resistance sensor with common reference leg
7113895	System and method for filtering output in mass flow controllers and mass flow meters
7114511	System and method for a mass flow controller
7133785	Valve control system and method
7143774	Method and apparatus for providing a determined ratio of process fluids
7150201	System and method for measuring flow
7216019	Method and system for a mass flow controller with reduced pressure sensitivity
7231931	System and method for a mass flow controller
7243035	System and method for mass flow detection device calibration
7272512	Flow sensor signal conversion
7273063	Methods and apparatus for pressure compensation in a mass flow controller
7287434	System and method for measuring flow
7360551	Method and apparatus for providing a determined ratio of process fluids
7363182	System and method for mass flow detection device calibration
7380564	System and method for a mass flow controller
7409871	Mass flow meter or controller with inclination sensor
7412986	Method and system for flow measurement and validation of a mass flow controller
7424894	Method and apparatus for providing a determined ratio of process fluids
7434477	Methods and apparatus for pressure compensation in a mass flow controller

2-1 Introduction

This section provides a general description, operating principles, product labeling, model code descriptions, and operating features.

2-2 General Description

As shown in Figure 2-1, the GF1XX utilizes the industry standard IsoSensor™ thermal mass flow sensor and an absolute pressure transducer within the same MFC enclosure (transducer not included in the GF100 and GF120). The result is a faster response to setpoint commands and the elimination of flow variation associated with upstream/downstream pressure.

The GF1XX is equipped with PTI technology, which reduces the effect of pressure fluctuations on gas flow. In PTI technology, a signal from an integrated pressure transducer is combined with the standard thermal sensor output. The combined signals allow precise and stable flow, even when the line pressure is fluctuating.

The GF1XX also utilizes MultiFlo® technology that allows the user to configure standard configurations ("SHs") or "blanks" for a variety of pure gases and mixtures. As a result, MultiFlo® technology enables the user to reduce unique inventory requirements.

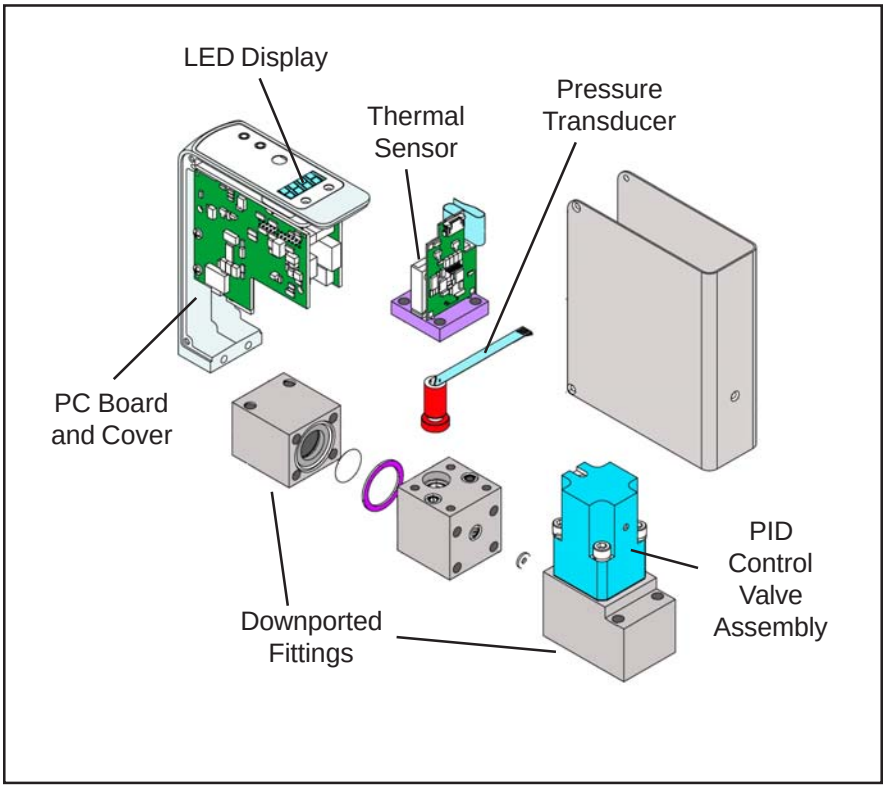

Figure 2-1 GF1XX General Description

2-3 Operating Principles

GF1XX operating principles are described in Figure 2-2.

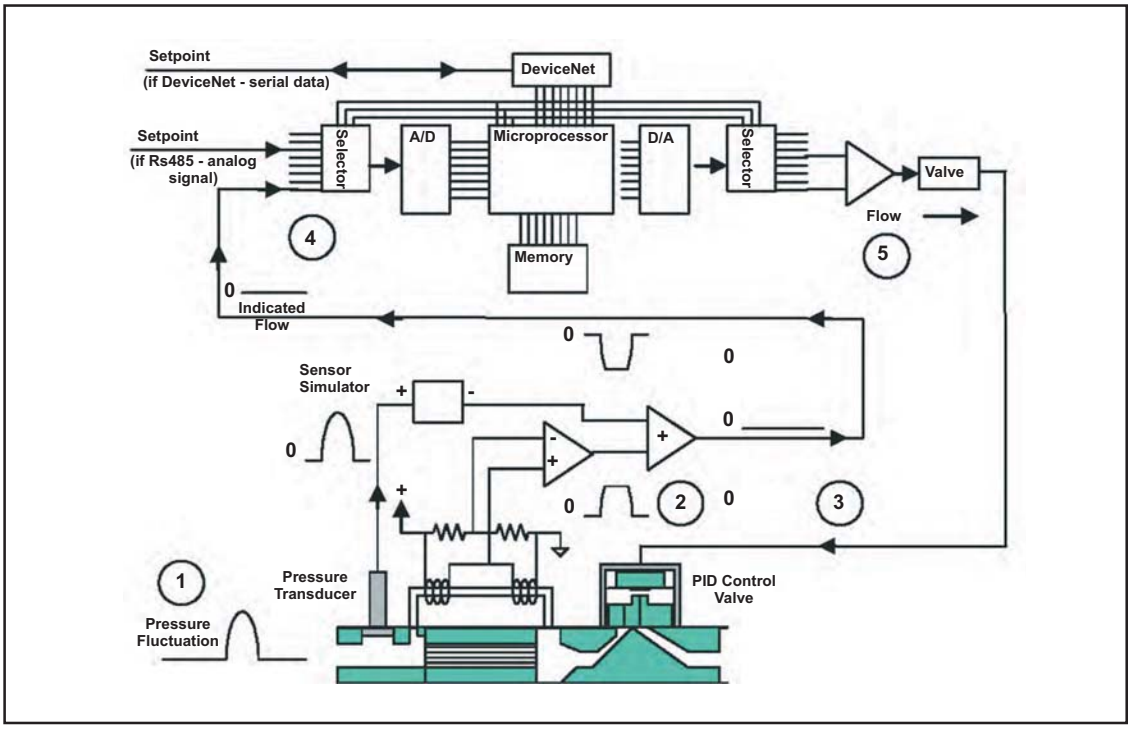

Figure 2-2 GF1XX Operating Principles

Operating principles are listed below by following #1-5 in Figure 2-2.

1. The GF125 uses a pressure transducer and support circuitry that sums the transducer signal in the sensor path (transducer not included in the GF100 and the GF120). Incoming pressure fluctuation results in a signal that is proportional to fluctuation.
2. The signal from the pressure transducer is inverted and then summed in with the original sensor signal.
3. The two summed signals cancel each other out.
4. The sensor signal that is applied to the microprocessor is undisturbed.
5. The flow of process gas is undisturbed by incoming pressure fluctuations.

2-4 Specifications for GF Series Controllers

⚠ WARNING

Do not operate this instrument in excess of the specifications listed below. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

⚠ CAUTION

It is the user's responsibility to select and approve all materials of construction. Careful attention to metallurgy, engineered materials and elastomeric materials is critical to safe operation.

Materials of Construction

Gas Path	SEMI F20 Compliant
Surface Finish	4 µ in Ra (0.1 µm Ra)
Seals	Metal
Weight	2.6 lbs (1.20 kg)

Electrical

Power Consumption	545 mA (max) @ 11 Vdc and 250 mA (max) @ 24 Vdc 6 watts (max) @ ±15 Vdc
Service Port	EMC 89/336/3EEC (CE), ODVA, RoHS/WEEE

Performance

Leak Integrity (external)	1×10^{-11} atm. cc/sec He
Valve Shut-Down (leak-by)	1% full scale N.C. 2% full scale N.O.
Warm-Up Time	30 minutes

Operating Conditions

	SH40-SH44	SH45-SH46	SH47-SH48	SH49-SH50
Flow Range	3-860 sccm	861-7200 sccm	7201-30000sccm	30001-55000sccm
Proof Pressure	140 psia max	140 psia max	140 psia max	140 psia max
Differential Pressure*	7-45 psid	10-45 psid	15-45 psid	25-45 psid**
Valve Configuration	Normally Closed	Normally Closed	Normally Closed	Normally Closed
Valve Configuration	Normally Open	Normally Open	Normally Open	Normally Open
Temperature Range	10°C-50°C	10°C-50°C	10°C-50°C	10°C-50°C

*Argon gas applications require an additional 10 psid differential pressure. Unless otherwise stated, all specifications and features comply with factory calibration conditions.
**Argon gas limited to 55,000 sccm on actual Argon gas.

2-4-1 Specifications for GF120XSD Series Controllers

NOTE: Materials of Construction, Electrical and Performance specifications are the same as stated in Section 2-4.

Operating Conditions for GF120XSD

Flow Range (FS)	5-200 sccm			
Min Operating Inlet Pressure	10 Torr for 5-10sccm	15 Torr for 11-20sccm	20 Torr for 21-50sccm	25 Torr for 51-200sccm
Burst Pressure	1500 psia max	1500 psia max	1500 psia max	1500 psia max
Proof Pressure	500 psia max	500 psia max	500 psia max	500 psia max
Differential Pressure*	10 Torr-30 psid Typ.	10 Torr-30 psid Typ	10 Torr-30 psid Typ	10 Torr-30 psid Typ
Valve Configuration	Normally Closed	Normally Closed	Normally Closed	Normally Closed
Temperature Range	10°C-50°C	10°C-50°C	10°C-50°C	10°C-50°C

*Typical pressure drop. Actual pressure drop wil be gas and flow range dependent. Consult technical support for details.

2-4-2 Specifications for GF120XSL Series Controllers

NOTE: Materials of Construction, Electrical and Performance specifications are the same as stated in Section 2-4.

Operating Conditions for GF120XSL

Flow Range (FS)	4-25 sccm		
Min Operating Inlet Pressure	6 Torr for 4-6sccm	10 Torr for 7-10sccm	12 Torr for 11-25sccm
Burst Pressure	1500 psia max	1500 psia max	1500 psia max
Proof Pressure	500 psia max	500 psia max	500 psia max
Differential Pressure*	10 Torr-30 psid Typ.	10 Torr-30 psid Typ	10 Torr-30 psid Typ
Valve Configuration	Normally Closed	Normally Closed	Normally Closed
Temperature Range	10°C-50°C	10°C-50°C	10°C-50°C

*Typical pressure drop. Actual pressure drop wil be gas and flow range dependent. Consult technical support for details.

2-5 Product Labeling

The GF1XX is generally described on the top label as shown in Table 2-1. The GF1XX configuration is described in greater detail on the side can label (Figure 2-3).

Table 2-1 GF1XX Top Label

Top Label Contents	Sample of "Top Label"
Serial Number	**A9253017027**
Gas/Range	**NH3 5000 sccm**
Part Number (or user defined)	**GF125C-845031**

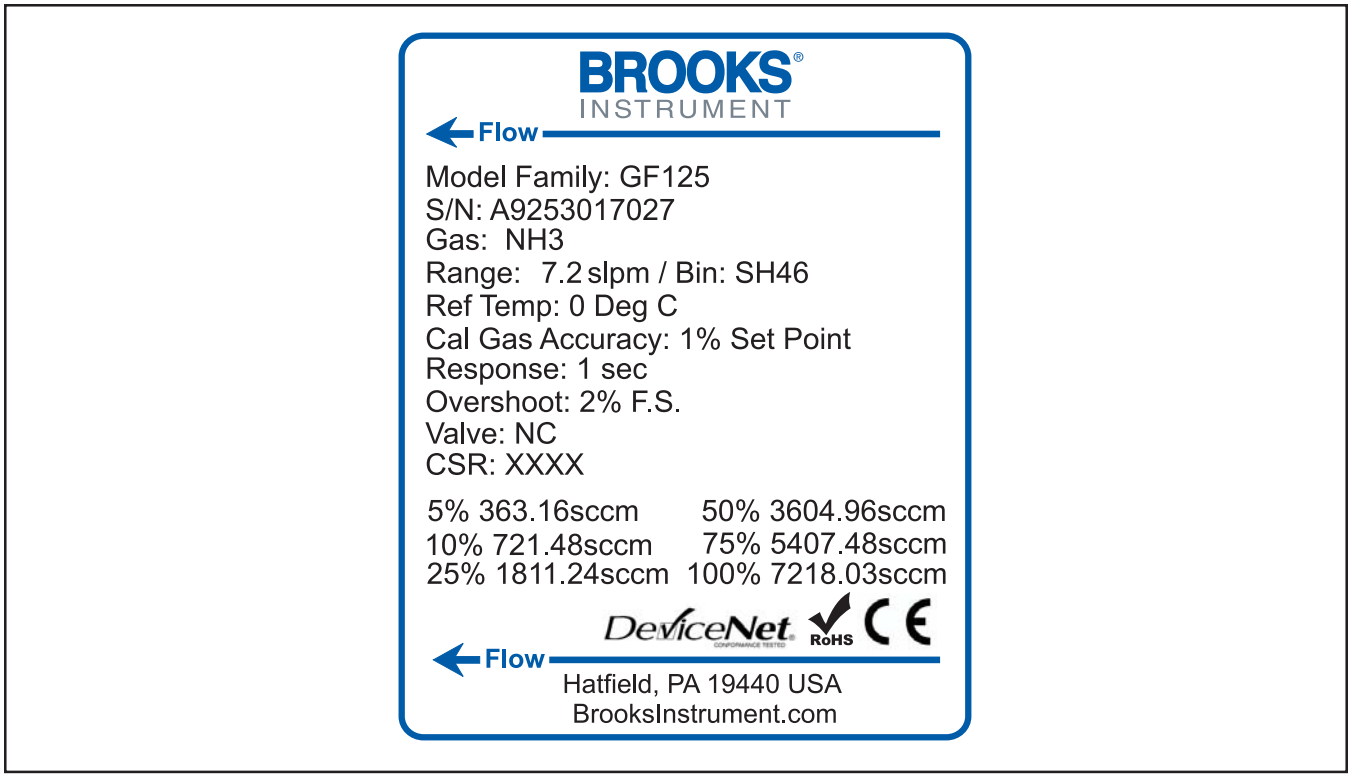

Figure 2-3 GF125 Side Can Label

2-6 Model Code Description

Gas Flow Controller models have a GF1XX prefix: GF1XXCXXC. The GF1XX is available in low, medium, and high flow configurations. Flow ranges are available from 3 to 55000 sccm (N2 equivalent). GF1XX models can have a 1.125 or a 1.5 inch mechanical footprint. The letter C next to the model number (i.e., GF1XXC) indicates that the flow controller is MultiFlo configurable to a specific flow range. Flow ranges and I/O communication protocols are identified in Table 2-2. A comprehensive Product Description Code (PDC) is shown in Appendix A.

Table 2-2 GF1XX Flow Range And Communication Protocols

Standard Configuration Bin Value	GF125 Footprint (inches)	Flow Range (N2 Equivalent) (min.-max. sccm)	Digital RS485 Analog	Digital DeviceNet
Low Flow				
SH40	1.125 or 1.5	3-10	YES	YES
SH41	1.125 or 1.5	11-30		
Medium Flow				
SH42	1.125 or 1.5	31-92		
SH43	1.125 or 1.5	93-280	YES	YES
SH44	1.125 or 1.5	281-860		
SH45	1.125 or 1.5	861-2600		
HighFlow				
SH46	1.125 or 1.5	2601-7200		
SH47	1.125 or 1.5	7201-15000	YES	YES
SH48	1.125 or 1.5	15001-30000		
SH49	1.125 or 1.5	30001-40000		
SH50	1.125 or 1.5	40001-55000		

2-7 Standard Features

GF1XX standard features are described in the following sections. Refer to Sections 2-3 to 2-4-2 for specifications and detailed operating parameters.

2-7-1 Mounting Attitude

Mounting attitudes are software configurable to various positions to fit your particular application. Various mounting attitude positions are described in Section 3.

2-7-2 Factory Setup Conditions

GF1XXs ordered as "Atmosphere" are configured with the GF1XX outlet exhausting to atmosphere. GF1XXs ordered as "Vacuum" are configured with the GF1XX exhausting to vacuum.

2-7-3 Calibration Traceability

Calibration traceability conforms to the National Institute of Standards and Technology (N.I.S.T.)

2-7-4 Manufacturing Environment

GF1XXs are assembled, calibrated, tested, and packaged at the factory in a Class 100 clean room environment.

2-7-5 Materials

GF1XXs use SEMI-F20 gas compliant materials with an available surface finish of 10 µ inch Ra for the GF100 and 4 µ inch Ra for the GF120 and GF125.

2-7-6 Auto Shut-Off

The Auto Shut-off feature closes the GF1XX valve when the set point drops below 1.5% of full scale.

2-7-7 LED Display

As shown in Figure 2-4, each GF1XX is equipped with an LED display panel located at the top of the device. Included on this panel are network and status indicators, an electronic signal display for temperature °C, pressure (psia/kPa), and % flow. The panel also has a switch to set GF1XX addresses and the data rate. This panel is described in greater detail in Section 5.

Figure 2-4 LED Display

2-8 Optional Features

Optional features are set at the factory to customer requirements. Basic optional features are described below. Refer to Appendix A for further details.

2-8-1 Control Valve Options

The GF1XX is configured at the factory to be Normally Closed or Normally Open. This configuration can not be modified by the user and must be selected when the order is placed.

2-8-2 Flow Direction Option

GF1XXs are only available in the standard configuration where the sensor is upstream and the valve is downstream.

2-8-3 Fittings Option

GF1XXs use downported fittings or conventional ¼" VCR® fittings.

2-8-4 I/O Communication

The GF1XX interfaces to DeviceNet or analog/RS485 protocols.

2-8-5 Cable Connector Options

GF1XXs use a 5-pin male connector (M12) that connects to the DeviceNet cable, or a 9-pin "D" male connector (UDG9) that connects to an analog/RS485 cable. Connector pin-out details are shown in Appendix D.

3-1 Introduction

This section discusses how to prepare your system and install the GF1XX.

The installation process consists of purging the gas supply line prior to installation, unpacking and inspecting the GF1XX, connecting the GF1XX to the gas supply line, and testing for leaks.

3-2 Flow Controller Installation Arrangement

Typical gas supply arrangements are shown in Figures 3-1 and 3-2. GF1XXs are often arranged inside a gas panel. Configure standard configurations ("SHs") or "blanks" for a variety of pure gases and mixtures. As a result, MultiFlo technology enables the user to reduce unique inventory requirements.

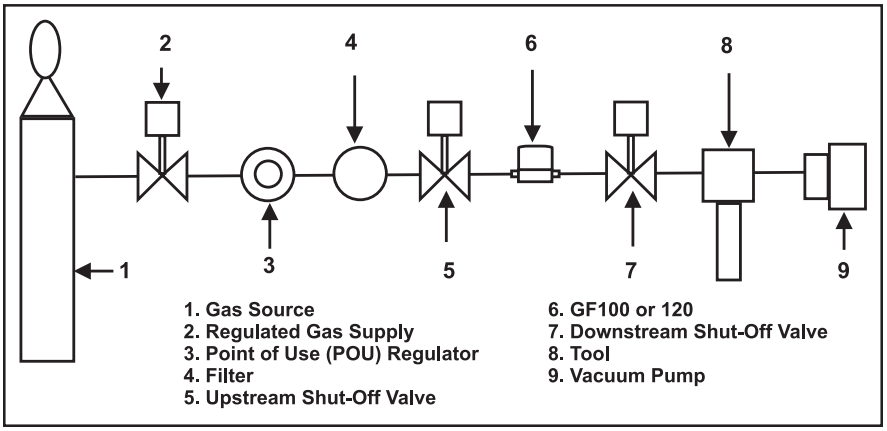

Figure 3-1 Typical Gas Supply Arrangement with non-PTI MFC

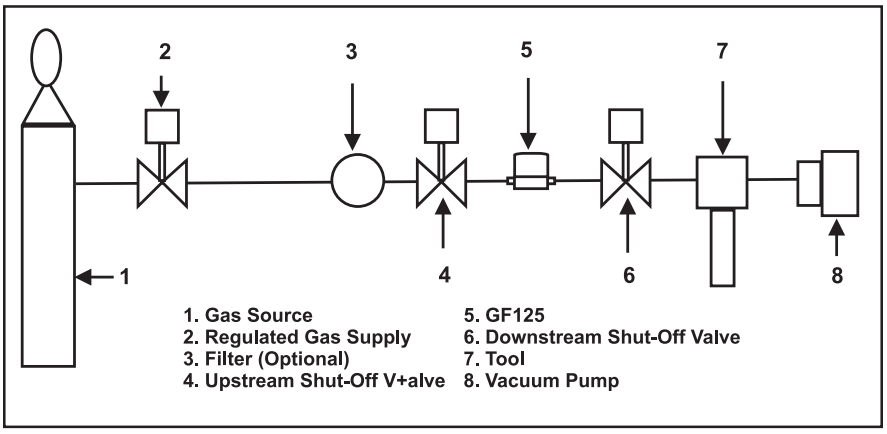

Figure 3-2 Typical Gas Supply Arrangement with PTI MFC

3-3 Purge the Gas Supply Line Before GF1XX Installation

⚠ CAUTION

For additional safety, it is recommended to close the two valves between the charged gas line and the GF1XX to be installed. See Figure 3-1 for more details.

⚠ NOTICE

It is recommended to archive service and calibration documentation for the GF1XX in order to determine the contamination state of each gas line and to assist service personnel.

⚠ CAUTION

DO NOT remove the shipping caps covering the inlet/outlet for VCR fittings, or DO NOT remove the blue tape on the bottom of the device for downported fittings before the GF1XX is actually being installed. Failure to comply will introduce contaminants into the GF1XX.

Before operating the GF1XX, the gas supply line must be completely purged with nitrogen or argon to ensure the line is free from toxic or flammable gases, contaminants, moisture, and oxygen. The purge gas must be free of moisture and oxygen to less than 100 ppb. Purge the gas lines as follows or in accordance to prescribed company and safety procedures.

1. Shut off the process gas supply valve(s) upstream of the GF1XX. If such a valve is not available, shut the valve on the gas panel. Tag the valve at this point to prevent accidental re-exposure of the process gas to the gas line.
2. Cycle purge the gas line with dry nitrogen or argon to fully flush out the process gas. Cycle purging consists of evacuating to a low pressure adequate to induce out-gassing and then purging to remove adhered moisture and oxygen. If a toxic or reactive gas is present and a clogged GF1XX is suspected, then proceed with caution. Pump down and purge the GF1XX from both downstream and upstream lines. If check valves are present in the gas line, both pumping down and purging are required. Pumping down without purging is inadequate. If a good vacuum source is not available, the GF1XX can be de-contaminated by purge only.
3. Repeat the purge cycle several times within 2-4 hours to complete the cleaning. For toxic and corrosive gasses, it is recommended to use 100-120 cycles.

3-4 Unpack and Inspect the GF1xx

Carefully remove the GF1XX from shipping container and verify that the GF1XX was not damaged during shipment. Notify the shipper immediately if damage has occurred. Refer to the nameplate on the GF1XX to verify that the model description is correct.

All products returned must have an assigned Returned Material Authorization (RMA) number before they are shipped back to the factory. Refer to Section 8 for further details.

3-5 Position and Mount the GF1XX

Position the GF1XX so that the gas flow is pointed in the direction of the grey arrow on the GF1XX label. The various mounting positions are described in Figure 3-3

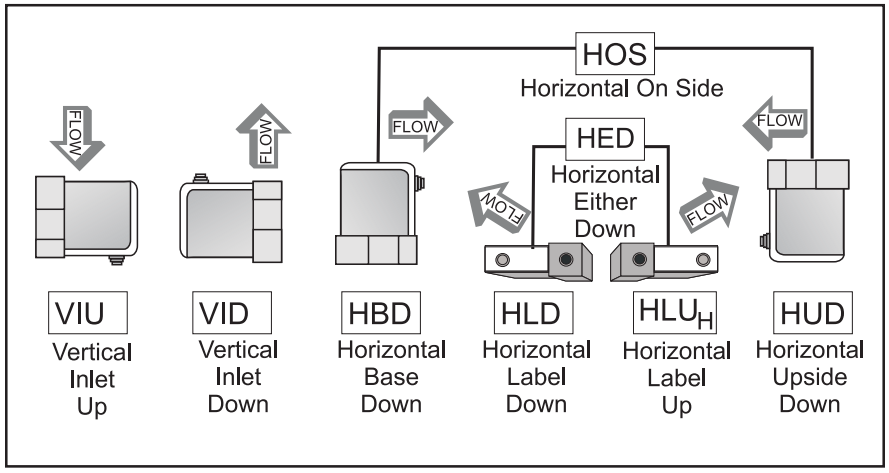

Figure 3-3 GF1XX Mounting Attitude Positions

The standard orientation for the GF1XX is Horizontal Base Down (HBD). The GF125 employs a proprietary algorithm that utilizes the internal pressure sensor to compensate for potential orientation effects when the MFC is used with certain higher density gases. Non HBD mounting orientations can be selected by using the MultiFlo software.

In the case of the GF100/120 Series, which does not have an internal pressure sensor, it is recommended that the MFC is re-zeroed with process gas following the recommended Brooks procedure (see zeroing bulletin FSB-001-0015 for futher information).

If your GF1XX is configured with downported fittings, follow Steps 1 though 4 below. If your GF1XX has VCR fittings, proceed to Step 5.

1. Refer to Figure 3-4. If downported fittings (1) are used, the GF1XX is mounted to K1 Series substrate blocks (2) with four screws (3). Metal C-seals or W-seals (4) (as provided by integrator) are inserted between the GF1XX and substrate blocks before the screws are installed. These metal seals must be replaced after each installation.

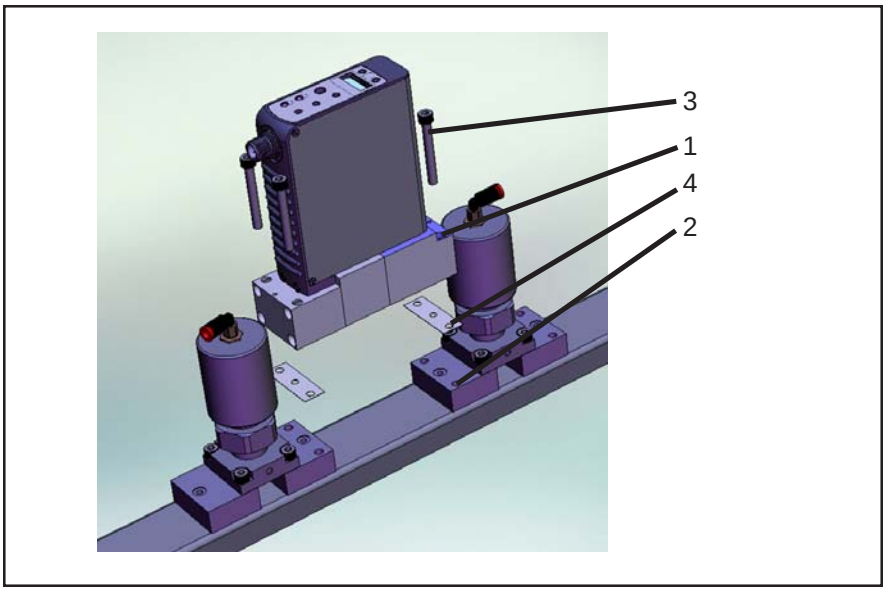

Figure 3-4 GF1XX Mounted to K1 Series Substrate Blocks

2. Select the mounting screws noted in Table 3-1 below for downported devices. M4 screws are used on 1.125" devices, K1S. M5 screws are used on 1.5" devices, K1R2 and K1H.

Table 3-1 K1 Series Fasteners

Connection	**Fastener Size**		
GF1xx to Subtstrate	K1S	K1R2	K1H
	M4 x 34mm or M4 x35mm	M5 x 30mm	M5 x 37mm

3. Refer to Figure 3-4. Insert the two mounting seals (4) over the gas flow path of the K1 block. Carefully align the GF1XX mounting holes onto the K1 substrate blocks. Using your fingers, install the screws through the GF1XX fitting and hand tighten.

4. Using a torque wrench and a metric hex key, tighten the screws to the torque value as described in Table 3-2 and Torque Pattern Figure 3-5.

Table 3-2 K1 Substrate Torque Data

Connection	Torque Pattern	Torque (Inch-Pounds)		
		K1S	K1R2	K1H
GF125 to Subtstrate	Use a square pattern as shown in Figure 3-5. Start at 25 inch-pounds and increase in increments of 10 inch-pounds until proper value is obtained.	45	45	45

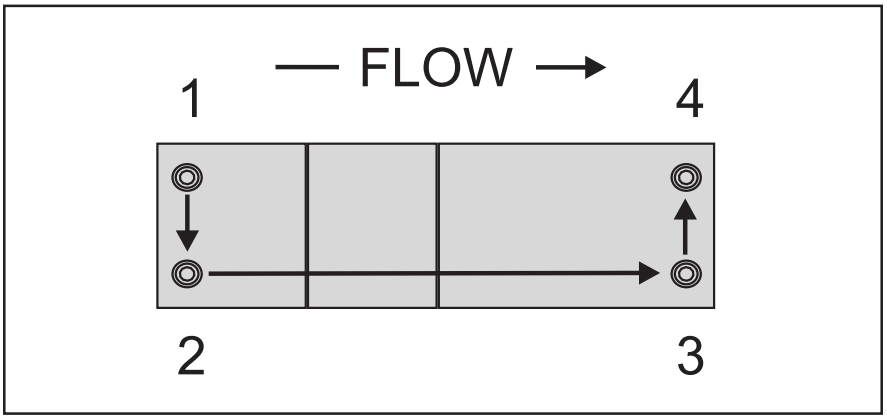

Figure 3-5 Mounting Screws Torque Pattern

5. If your GF1XX is configured with ¼" VCR fittings, secure the GF1XX block to the gas panel with two, 8-32-UNC-2B" screws. Then connect the inlet/ outlet fittings to the gas supply line using two wrenches. Tighten the fittings to manufacturer recommendations.

3-6 Perform a Leak Test

⚠WARNING

Before operating the flow controller, ensure all gas connections have been properly tightened and, where applicable, all electrical connections have been properly terminated.

It is critical to leak test the gas supply lines and GF1XX connections before turning on the process gas supply after any new installation. Check for leaks using a helium leak detector or any other appropriate leak test method. Follow leak test specifications as defined by integrator.

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4-1 Introduction

The MultiFlo Configurator application is used to configure the gas and range of the GF1XX. This section describes the MultiFlo Configurator and its usage.

4-2 MultiFlo Configurator

The MultiFlo Configurator application allows communication to the GF1XX through a personal laptop computer. Its primary function is to configure gas and flow ranges within six, defined standard configurations (SH). Flow ranges are configured to the Nitrogen equivalent. The MultiFlo Configurator interfaces to the GF1XX through 9 pin RS-232 on the PC to the diagnostic port on the MFC via a 2.5mm jack.

Refer to Figure 4.1 and obtain the MultiFlo Cable Adaptor (P/N A331710003) from Brooks.

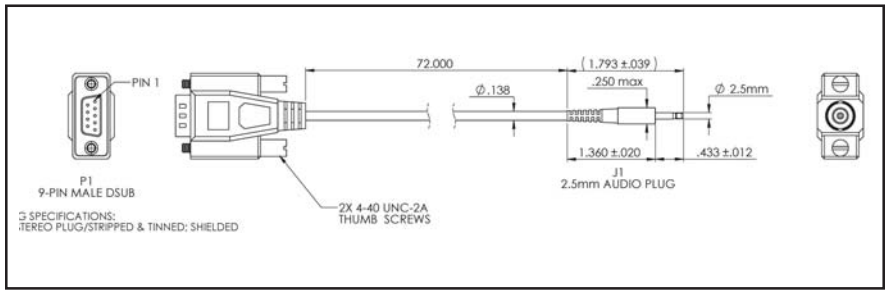

Figure 4-1 MultiFlo Cable Adaptor

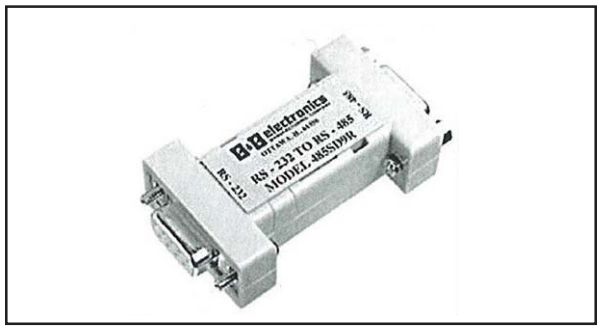

Figure 4-2 RS-232/RS-485 converter (P/N A3323000001)

Connect the MultiFlo Cable Adapter 2.5mm jack to the Diagnostic Port on the top of the device.

⚠ CAUTION

DO NOT make any connections to unlabeled connector pins. Any failure to comply could damage the GF1XX and/or the mating electrical device. Before connecting the cable, make sure that all pin connections of the mating cable have the same pin out connections. When installing and removing cables to and from your computer, make sure the power is turned off on your computer. This will prevent damage to your computer and associated equipment.

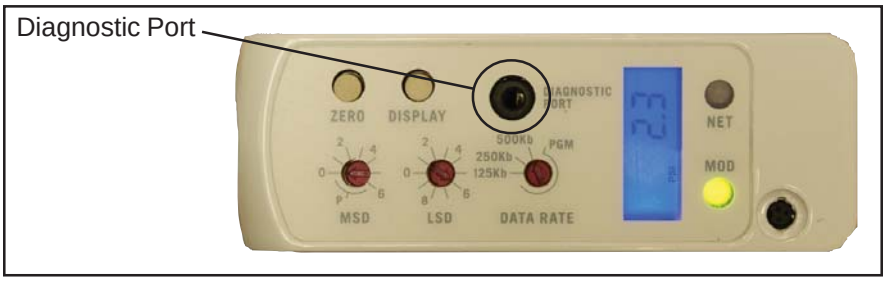

Figure 4-3 Diagnostic Port

Connect the RS-485 end of the converter to the 9-Pin RS-485 end of the MultiFlo Cable Adapter.
Connect the RS-232 end of the converter to the Serial Port of a laptop or PC.

Download the MultiFlo Configurator software into your computer from the Brooks Instrument website www.BrooksInstrument.com/Software.
Then install the MultiFlo Configurator as described in the MultiFlo Configurator Software Manual.

4-3 Configure the Gas and Flow Range

Using the MultiFlo Configurator software, configure the gas and flow range. Refer to Table 4-1 below. For field configuration software, contact your local Brooks Service Center.

Table 4-1 Gas and Flow Ranges - MultiFlo Configurable - N2 Equivalent

Standard MG-MR Bin Configurations	Flow range Code	Gas Flow Range (N2 Equivalent)
SH40	010C	3-10 sccm
SH41	030C	11-30 sccm
SH42	092C	31-92 sccm
SH43	280C	93-280 sccm
SH44	860C	281-860 sccm
SH45	2.6L	861-2600 sccm
SH46	7.2L	2601-7200 sccm
SH47	015L	7201-15000 sccm
SH48	030L	15001-30000 sccm
SH49	040L	30001-40000 sccm
SH50	055L	40001-55000 sccm

5-1 Introduction

⚠ NOTICE

If the GF1XX has been in the purge mode for a long period of time, wait until the GF1XX has cooled down before zeroing. The cool down period should be ~30 minutes for purges up to five minutes and at least 60 minutes after purging overnight.

Four major conditions are required to ensure the GF1XX is operating properly once installation has been completed:

- The GF1XX must be warmed up for at least 30 minutes.
- The active gas page must be correct.
- The GF1XX pressure transducer must be correctly zeroed.
- The GF1XX flow must be correctly zeroed.

This chapter describes how to zero and sequence the GF1XX for proper operation.

5-2 Zeroing Setup Process

The following steps are required before the GF1XX is zeroed.

1. Make sure that the GF1XX has been installed inside the equipment (panel) for at least four hours and powered up at least one hour prior to zeroing. This insures that the GF1XX is in its "use attitude" and is operating at normal temperature. If the GF1XX is subjected to a vacuum purge for more than one minute, turn off the GF1XX (ie., provide a zero setpoint) for a time period of twice the vacuum purge time.
2. Refer to Figure 3-1 (page 10). Open the upstream shut-off valve (5) and close the downstream shut-off valve (7). This eliminates a pressure drop across the GF1XX and subsequent leakage from the PID control valve inside the GF1XX.
3. Provide a 100% setpoint to the GF1XX for no longer than 60 seconds. This equalizes the pressure across the PID control valve.
4. Refer to Figure 3.1. Close the upstream shut-off valve (5) to prevent any pressure effects from the regulator (3).
5. Close the GF1XX and wait two minutes.
6. Read the output signal of the GF1XX. This output signal is the initial flow in percent of full scale. The output signal should be 0.0 (± 0.1%). If the output signal is too high, re-zero the GF1XX as described in Section 5-3.

5-3 Zeroing the GF1xx

Many high density gases exhibit slight changes in zero output as a function of inlet pressure. Gases such as tungsten hexafluoride and many fluoro-carbons are especially sensitive to this problem. Since inlet pressure is a potential source for zero errors, the pressure transducer on each GF1XX should be correctly set to zero after installation. The zeroing process is performed from the backlight LCD display on top of the GF1XX.

OEM tools using a microprocessor or computer for operating the GF1XX should sequence the GF1XX off between processes. To accomplish this, simply provide a zero set point. The GF1XX will shut off automatically.

⚠ NOTICE

Make sure you perform the zeroing set-up process in Section 5-2 before zeroing the GF1XX.

Shut-off valves, whether upstream or downstream from the GF1XX, should be programmed to turn on before the GF1XX is turned on and turned off after the GF1XX is turned off.

5-3-1 Zeroing the GF1xx Pressure Transducer from the LCD Display Panel

1. Place the GF1XX under a strong vacuum with the GF1XX set to 100% set point. Make sure that upstream valve is closed and the downstream valve is open. Allow time for the upstream pressure to bleed off.
2. Looking at the top of the GF1XX, press the "Display" button, starting at the MACID, four times to "PSI" or five times to "kPa" or until the LCD displays the labels "PSI" or "kPa". The GF1XX will display pressure in units of PSIA or kPa. Press and hold down the Zero button a minimum of 5 seconds or until the display reads 0.000, with the last two digits flickering at different values. The pressure transducer zeroing procedure can be done while the display is either in PSIA or kPA output. Refer to Figure 5-1.

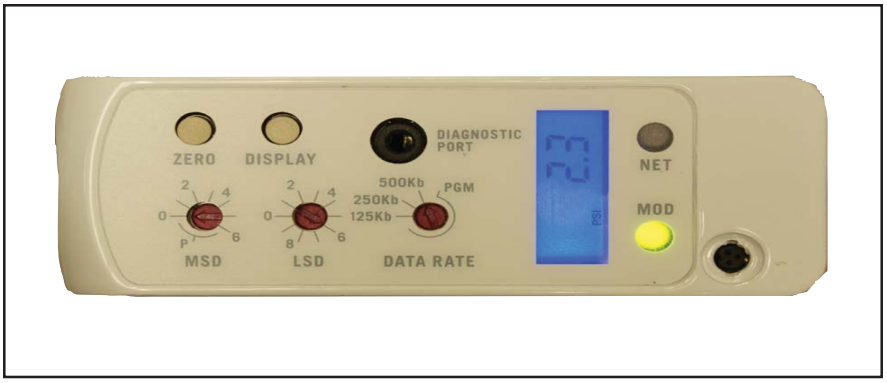

Figure 5-1 Display with PSI Reading

After completion of the pressure transducer zeroing, the LCD display will read 0.0 with the last two digits flickering as shown in Figure 5-2.

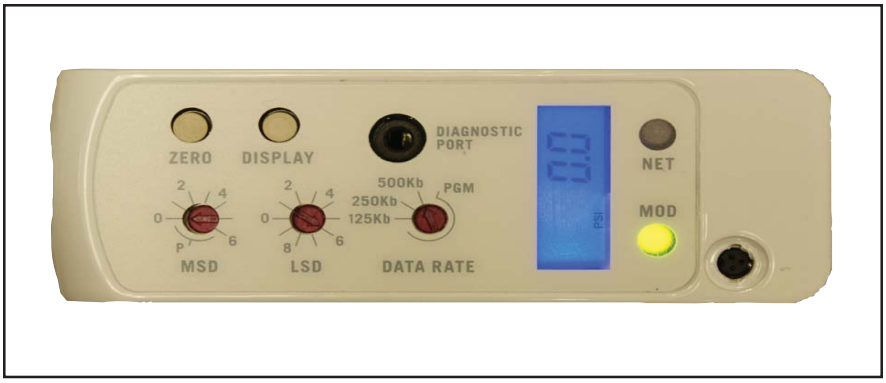

Figure 5-2 Display Reading Zero PSI

5-3-2 Zeroing GF1xx Flow from LCD Display Panel

1. Place the GF1XX under normal inlet operating pressure. Close the down stream valve to prevent any flow.
2. Looking at the top of the GF1XX, press the "Display" button until the LCD display label is "%FS" as shown in Figure 5-3. Three button depressions from the MACID label display.

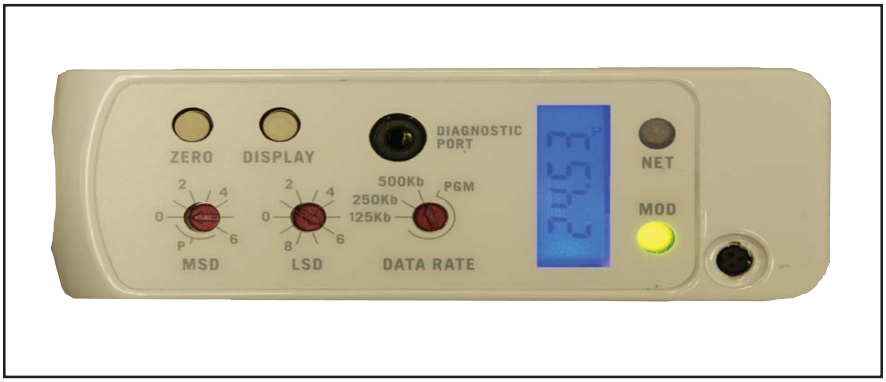

Figure 5-3 Display Set to %FS

3. Press and hold down the Zero button for a minimum of 5 seconds or until the "%FS" display reads 0.0 as shown in Figure 5.4. The %FS label will flash during this procedure.

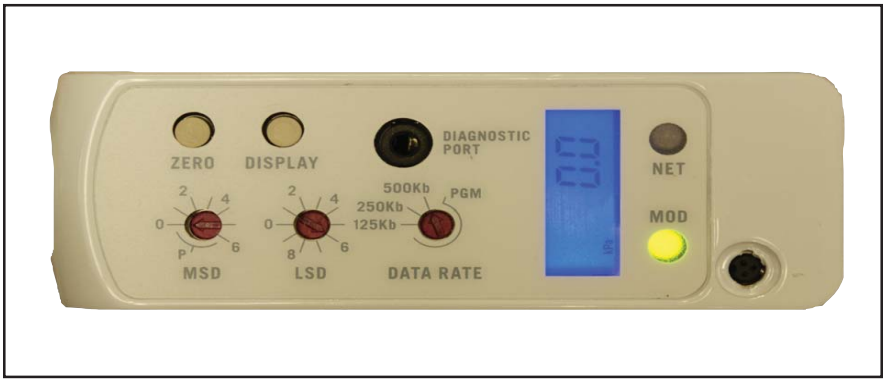

Figure 5-4 % Flow Display Set to Zero

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6-1 Introduction

GF1XX maintenance is discussed below in three areas: Routine Maintenance, Factory Calibration and Service, and On-Site Service.

6-2 Routine Maintenance

⚠ WARNING

METER/CONTROLLER SEAL COMPATIBILITY

Products in this manual may contain metal or elastomeric seals, gaskets, O-rings or valve seats. It is the "user's" responsibility to select materials that are compatible with their process and process conditions. Using materials that are not compatible with the process or process conditions could result in the Meter or Controller leaking process fluid outside the pressure boundary of the device, resulting in personnel injury or death.

It is recommended that the user check the Meter or Controller on a regular schedule to ensure that it is leak free as both metal and elastomeric seals, gaskets, O-rings and valve seats may change with age, exposure to process fluid, temperature, and /or pressure.

⚠ WARNING

If it becomes necessary to remove the instrument from the system, power to the device must be disconnected.

Any precision unit such as a flow controller requires occasional servicing, especially if it has been operating for an extended period of time. If reactive gases are being used, it is recommended that you send the GF1xx to a Brooks Service Center for cleaning and re-calibration at 6 month intervals, or twice a year. Refer to Section 8 for product removal, product packaging, and product return instructions.

It is also recommended to re-zero the GF1XX twice a year, or at 6 month intervals. Refer to Section 5 for zeroing instructions.

6-3 Factory Calibration and Service

Contact your local Brooks Service Center for unit availability, calibration, and service functions.

6-4 On-Site Service

GF1XXs are serviceable on site for zeroing and configuration functions. Otherwise, they must be maintained, cleaned, and repaired only through an authorized Brooks Service Center. If a Brooks product is repaired by anyone other than an authorized Brooks Service Center during the warranty period, the warranty shall be considered null and void.

7-1 Introduction

⚠ NOTICE

OEM tool problems are often caused by something other than the GF1XX. Therefore, Brooks recommends that you review both the OEM Tool Troubleshooting Checklist and the GF1XX Troubleshooting Guide before removing the GF1XX from your system. It is also suggested to contact your Brooks Service representative before removing the GF1XX from your system.

This section includes an OEM tool Troubleshooting Checklist and an GF1XX Troubleshooting Guide that identifies symptoms, possible causes, and corrective actions.

7-2 OEM Troubleshooting Checklist

1. Check environmental factors that could affect changes to GF1XX performance. The most common environmental factors are listed in Table 7-1.

Table 7-1 Environmental Factors

GF1XX Performance	Possible Causes
Inaccurate flow.	Temperature shift (steady state or transient). Inlet pressure shift (steady state or transient). Power supply problem. Electrical interference Dirty gas chamber Changes in gas.
Control problems. Can not reach setpoint. Oscillation.	Differential pressure not within operatiing range Inlet pressure not stable
Zeroing problems, Indicated zero is not stable.	Temperature shift (steady state or transient). Inlet pressure shift (steady state or transient). Power supply problem. Electrical interference

2. Check supply voltage and check for a consistent ground.
3. Insure OEM tool setpoint matches the setpoint at the GF1XX. Observe for consistency.
4. Verify isolations valves are open and the gas supply is turned on. Then verify operating pressures are within operating ranges.
5. Check GF1XX voltage response by moving the setpoint back and forth. Observe for voltage changes.

7-3 GF1XX Troubleshooting Guide

Table 7-2 GF1XX Troubleshooting Guide

Symptoms & Possible Causes	Corrective Action
1. No gas flow.	
Is the gas supply turned on?	Check shut-off valve and pressure readout. Open the gas supply.
Is the regulator turned on at the correct operating pressure?	Turn off the regulator and reset it to the recommended pressure as described in the Data Sheet.
Are any upstream or downstream shut-off valves closed, either by the system or because of failure?	Verify that the valves are open and operating properly.
Is the MOD LED light on the GF1XX lit solid green?	Observe the LED display panel on top of to verify. If the LED light is not lit, cycle power the to reboot.
Is the commanded setpoint from tool/system at 0.00 Vdc?	Use the tool software to verify.
Has the been commanded off by an active “valve closed” input?	Use the tool software to verify.
2. Flow out of range.	
Is the gas inlet/outlet pressure differential either too high or too low? NOTE: If the differential pressure is too high, voltage to the will be zero, which is abnormally low for the setpoint. If the differential is too low, voltage to will be at its maximum value, which is abnormally high for the set-point.	Verify that the pressure is correct for the gas and range. If required, adjust inlet/outlet pressure to achieve proper pressure reading.
Is the MOD LED light on the GF1XX lit solid green?	Observe the LED display panel at top of . If the LED light is not lit, cycle power the to reboot.
Is the setpoint correct for the required gas flow?	Use the tool software to verify.
Is the calibrated for the particular gas?	Check the side label. Run a flow check to verify.
Is the zero correct?	Zero the according to zeroing procedure in Section 5. Verify leak check rates are OK.
3. No gas control; flow is at or above maximum.	
Is the gas pressure across the too high?	Verify that the pressure is correct for the gas and range. If required, adjust inlet/outlet pressure to achieve proper pressure reading.
Are system valves open, or is the purge input activated?	Use tool software to verify.
Is the setpoint correct for the required flow?	Use tool software to verify.

Table 7-2 GF1XX Troubleshooting Guide (Continued)

Symptoms & Possible Causes	Corrective Action
4. No gas flow above some set-point.	
NOTE: When the setpoint is increased beyond this point, the GF1XX signal remains at some value lower than the set-point. Is the gas inlet/outlet differential pressure sufficient? NOTE: If the pressure reading. is too low, the valve voltage to the GF1XX will be at its maximum output. This condition will cause internal GF valve heating and inability to properly reach desired flow setpoints.	Verify that the pressure is correct for the gas and range. If required, adjust regulator to achieve proper pressure
Is the GF1XX calibrated for the gas flow?	Check GF1XX side label. Run a flow check to verify. If flow is incorrect, replace the GF1XX with a unit that is calibrated properly.
5. No gas flow below some set-point.	
NOTE: When the setpoint is decreased below this point, the GF1XX signal remains at some value higher than the setpoint. Is the gas inlet/outlet differential pressure too high, or above published setpoints? NOTE: If the differential pressure reading. is too high, voltage to the GF1XX will be at its maximum value when the setpoint is decreased below the point where flow decreases.	Verify that the pressure is correct for this gas and range. If required, adjust regulator to achieve proper pressure
Is the GF1XX leaking?	Check for contamination. Test the GF1XX for leak integrity. Replace the Unit GF1XX if leakage is detected.
6. Gas flow, or GF1XX pressure reading oscillates.	
Is the GF1XX calibrated for the gas flowing?	Check the GF1XX side can label. Run a flow check to verify. If flow is incorrect, replace the GF1XX.
Is there too much gas pressure across the GF1XX?	Verify that the pressure is correct for this gas and range. If required, adjust regulator to achieve proper pressure reading.

Table 7-2 GF1XX Troubleshooting Guide (Continued)

Symptoms & Possible Causes	Corrective Action
6. Gas flow, or GF1XX pressure reading oscillates.	
Are inlet and outlet pressures stable? NOTE: Most GF1XXs calibrated with nitrogen will oscillate with hydrogen or helium.	If outlet pressure is unstable, check for (no oscillation or hunting) a faulty vacuum pump, or hunting at a downstream valve. Check inlet pressure on tool. A faulty pressure regulator can make the GF1XX appear to oscillate. Adjust inlet pressure up or down by 2 psig increments until hunting disappears. Verify common gas pressure is within range. NOTE: Hunting or oscillation can be contributed to multiple GF1XXs sharing a common gas manifold. Therefore, inspect gas delivery sources to the gas box. (for example; two tools sharing a common gas bottle and calling for gas at the same time.) Valve leak. Unregulated gas pressure from Facilities.
7. GF1XX does not read zero pressure when gas is shut off.	
Is the differential pressure across the GF1XX really zero? Is the GF1XX configured properly in the tool software? Is the GF1XX mounted to the proper attitude?	Verify that the pressure is correct for the gas and range. If the GF1XX has been contaminated, it may not be able to close, and therefore, will not zero. Equalize the pressure across the GF1XX by opening it briefly. Set up the GF1XX for zeroing. Then perform the zeroing procedure in Section 5. Use the tool software to verify. Refer to the side can label on the GF1XX. The GF1xx should be calibrated in the attitude it will be operating at.
8. OEM tool does not read correct GF1XX zero reading.	
Is the differential pressure across the GF1XX really zero? Is the supply voltage within specified range? Is the GF1XX mounted in the proper attitude? Is the flow output signal of the GF1XX really zero?	GF1XX valve leakage. Incorrect MFC zero.
9. Zero Drift.	
Improper zero of the GF1XX? Excessive Valve leakage?	GF1XX aging or sensor stabilization. Zero is not correct.

Table 7-2 GF1XX Troubleshooting Guide (Continued)

Symptoms & Possible Causes	Corrective Action
10. Calibration Drift.	
Gas box temperature too high? Is it linear offset?	Zero is not correct.
11. GF1XX indicates Overshoot.	
If the tool is idle for an extended period of time, high inlet pressure or contamination will cause overshoot on first use.	
12.OEM tool indicates the wrong full scale value for GF1XX.	
Older version of Multiflo Configurator used to program GF1XX.	
13. GF1XX dumps large volume of gas into chamber when setpoint is commanded from the tool.	
The tool is commanding a setpoint before the pneumatic valves are opened. GF1XX and pneumatic timing may be offset. GF1XX overshoots.	
14. Tool display output doesn't match GF1XX flow output.	
Cable resistance causing offset in the tool's display.	Check GF1XX zero.

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8-1 Introduction

The following removal and return instructions are designed to minimize or eliminate contamination normally associated with the most highly reactive gases. Brooks has designed these instructions to reduce the overall exposure to foreign particles.

⚠ WARNING

If it becomes necessary to remove the instrument from the system, power to the device must be disconnected.

8-2 Purge Gas Lines Before Removing the GF1XX

Refer to Section 3 for purging instructions.

8-3 Remove and Replace GF1XX

Perform the following steps:

1. Remove the GF1XX connections.
2. Immediately hard cap the inlet and outlet fittings on the GF1XX.
3. While in the production area, insert the old GF1XX into a plastic bag and seal the bag. Keep the replacement GF1XX within the sealed bag until just prior to installation.
4. Ensure new seals are in place for downported fittings. Refer to Section 3 for details.
5. Inspect the upstream and downstream gas lines and the GF1XX inlet and outlet fittings for signs of contamination and damage.
6. Remove the new GF1XX from sealed bag, install the GF1XX and retighten gas panel components. Refer to Section 3 for installation details.
7. Once the GF1XX is installed, set the GF1XX to the purge state and cycle purge the gas line with nitrogen or argon to remove any moisture, oxygen, and contaminates. Refer to Section 3 for purging instructions.
8. Test for leaks at the GF1XX and at surrounding fittings.
9. Refill the gas line with process gas.
10. Warm up the GF1XX for ~30 minutes. Additional warm up time may be required in order to stabilize the GF1XX in its new environment. Monitor the zero drift and exercise it on and off with different setpoints.

8-4 Package the GF1XX

Perform the following steps when a GF1XX is transported to a Brooks Service Center.

1. All returned products must be accompanied with a Return Material Authorization (RMA) number. Call Brooks for a RMA number prior to shipment.
2. Insert the GF1XX into a plastic bag. Seal the bag.
3. Place the bag into a suitable shipping container.
4. Insert all documents into the container that describe any contaminated condition, failure symptom(s), and the location of the installation.
5. Fill out the Contamination Disclosure form and insert it into container.

8-5 Return Shipment of the GF1xx

Seal the shipping container and ship the GF1XX. Refer to the following addresses for Brooks World Wide Sales/Service locations nearest to you.

Americas
Brooks Instrument
915 Enterprise Blvd.
Allen, TX 75013-8003
USA
Tel 1+(888) 275 8946

Europe
Brooks Instrument GmbH
Zur Wetterwarte 50 Haus 377/B,
01109 Dresden
Germany
Tel +49 (0) 351 215 20 442

Asia
Brooks Instrument Korea, Ltd.
D-406 Bundang Techno Park 151
Sungnam, Kyungki-do, 463-070
Korea
Tel +82 31 708 2522

Instrument must have been purged in accordance with the following:

⚠WARNING

Before returning the device purge thoroughly with a dry inert gas such as Nitrogen before disconnecting gas connections. Failure to correctly purge the instrument could result in fire, explosion or death. Corrosion or contamination may occur upon exposure to air.

All flow instruments returned to Brooks require completion of Form RPR003-1, Brooks Instrument Decontamination Statement, along with a Material Safety Data Sheet (MSDS) for the gas(es) used in the instrument. Failure to provide this information will delay processing by Brooks personnel. Copies of these forms can be downloaded from the Brooks website www.BrooksInstrument.com or are available from any Brooks Instrument location listed above.

Table A-1 GF125 Product Description Code Table

GF125	C X	XX HA	C O	===> SH40 SH41 SH42 SH43 SH44 SH45 SH46 SH47 SH48 SH49 SH50	===> 010C 030C 092C 280C 860C 2.6L 7.2L 015L 030L 040L 055L	VX CX DX WX YX AX BX LX EX	A V	O	BB DX EX GX G1 KX	XXXX	A X	A X	000 021 XXX
Pressure Transient Insensitive (PTI) Flow Ranges from 3 sccm–30 slpm N_2 Equivalent	Configurable Gas Specific	Standard Application High Accuracy Calibration	Normally Closed Valve Normally Open Valve	Specify Gas Code and Range, i.e. “0004” = Argon and “0104” = 10 slpm Standard Configuration # 40, 3–10 sccm N_2 Equivalent Standard Configuration # 41, 11–30 sccm N_2 Equivalent Standard Configuration # 42, 31–92 sccm N_2 Equivalent Standard Configuration # 43, 93–280 sccm N_2 Equivalent Standard Configuration # 44, 281–860 sccm N_2 Equivalent Standard Configuration # 45, 861–2600 sccm N_2 Equivalent Standard Configuration # 46, 2601–7200 sccm N_2 Equivalent Standard Configuration # 47, 7201–15000 sccm N_2 Equivalent Standard Configuration # 48, 15001–30000 sccm N_2 Equivalent Standard Configuration # 49, 30001–40000 sccm N_2 Equivalent Standard Configuration # 50, 40001–55000 sccm N_2 Equivalent	1-1/2" VCR 1/4" 1-1/8" C Seal 92 mm 1-1/8" C Seal 80 mm 1-1/8" W Seal 92 mm 1-1/8" W Seal 80mm 1-1/2" C Seal 92 mm 1-1/2" W Seal 92 mm 1-1/8” C Seal 92mm w/ Poke Yoke 1-1/2" W Seal 80 mm	Atmosphere Vacuum	Standard Flow Sensor (Default)	5 Pin DeviceNet™ M8 w/Anolog 5 Pin DeviceNet™ M8 Cable to Cardedge (w/out VTP), RS485 through RJ11 Jacks; Display & Overlay w/180° Orientation 9 Pin D with RS-485 (UDG9), Display/Overlay w/180° Orientation 9 Pin D with RS-485 (UDG9) Cable Adapter to MKS 15 Pin D (UDK 15)	Customer Special Request Number	Auto Shut Off (Included) Auto Shut Off (Not Included)	Auto Zero (Included) Auto Zero (Not Included)	0°C Reference Calibration (Standard) 21°C Reference Calibration (Normal) Customer to Specify Temperature

Example:

GF125	C	XX	C	SH40	010C	VX	A	O	*DX	XXXX	A	A	000

Table A-2 GF100 Product Description Code Table

GF100	C	XX	C	SH40	010C	VX	A	O	*DX	XXXX	A	A	000

GF100 Flow Ranges from 3 sccm–30 slpm N_2 Equivalent

C Configurable
X Gas Specific

XX Standard Application

C Normally Closed Valve
O Normally Open Valve

===>	===>	Specify Gas Code and Range, i.e. "0004" = Argon and "010L" = 10 slpm
SH40	010C	Standard Configuration # 40, 3–10 sccm N_2 Equivalent
SH41	030C	Standard Configuration # 41, 11–30 sccm N_2 Equivalent
SH42	092C	Standard Configuration # 42, 31–92 sccm N_2 Equivalent
SH43	280C	Standard Configuration # 43, 93–280 sccm N_2 Equivalent
SH44	860C	Standard Configuration # 44, 281–860 sccm N_2 Equivalent
SH45	2.6L	Standard Configuration # 45, 861–2600 sccm N_2 Equivalent
SH46	7.2L	Standard Configuration # 46, 2601–7200 sccm N_2 Equivalent
SH47	015L	Standard Configuration # 47, 7201–15000 sccm N_2 Equivalent
SH48	030L	Standard Configuration # 48, 15001–30000 sccm N_2 Equivalent
SH49	040L	Standard Configuration # 49, 30001–40000 sccm N_2 Equivalent
SH50	055L	Standard Configuration # 50, 40001–55000 sccm N_2 Equivalent

VX 1-1/2" VCR 1/4"
CX 1-1/8" C Seal 92mm
DX 1-1/8" C Seal 80mm
WX 1-1/8" W Seal 92mm
YX 1-1/8 W Seal 80mm
AX 1-1/2" C Seal 92mm
BX 1-1/2" W Seal 92mm
LX 1-1/8" C Seal 92mm w/Poke Yoke

A Atmosphere
V Vacuum

O Standard Flow Sensor (Default)

DX 5 Pin DeviceNet™ M8
EX Cable Adapter to Cardedge (w/out VTP), RS485 through RJ11 Jacks; Display & Overlay w/ 180° Orientation
GX 9 Pin D with RS-485 (UDG9), Display/Overlay w/180° Orientation
G1 9 Pin D with RS-485 (UDG9)
KX Cable Adapter to MKS 15 Pin D (UDK 15)
BB 5 Pin DeviceNet™ M8 w/Analog

XXXX Customer Special Request Number

A Auto Shut Off (Included)
X Auto Shut Off (Not Included)

A Auto Zero (Included)
X Auto Zero (Not Included)

000 0°C Reference Calibration (Standard)
021 21°C Reference Calibration (Normal)
XXX Customer To Specify Temperature

Table A-3 GF120 Product Description Code Table

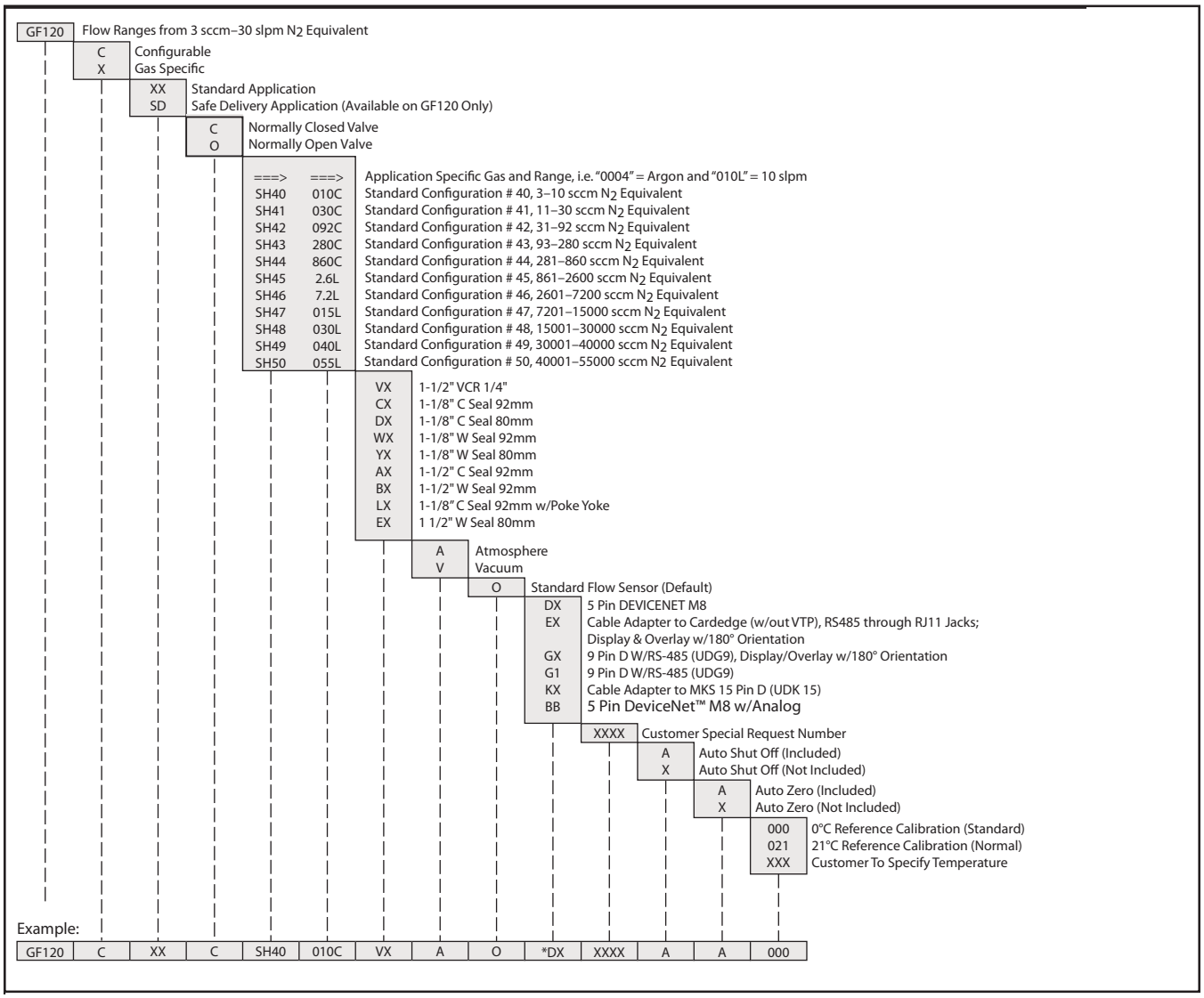
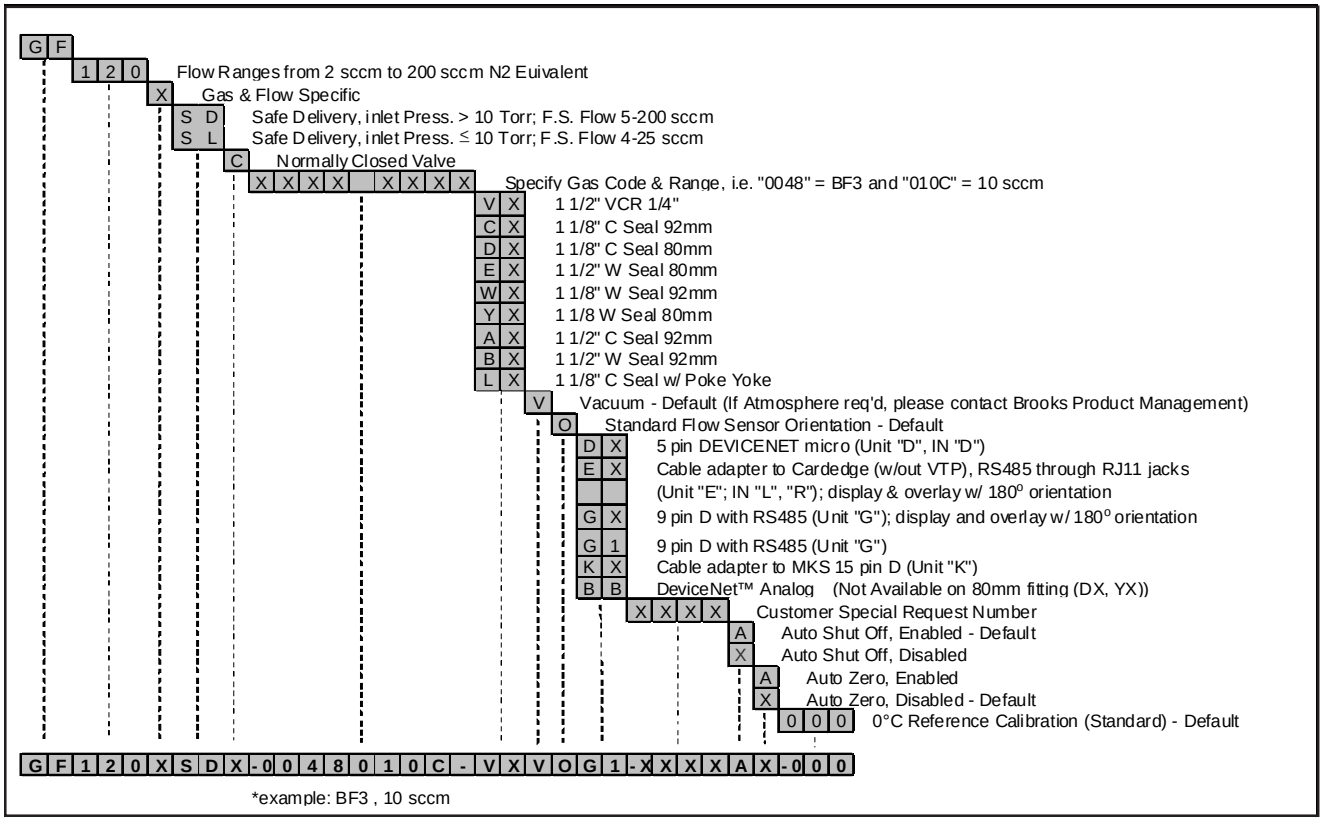


Table A-4 GF120XSD-SL Product Description Code Table



GF1XX Ordering Instructions

Refer to the Product Description Codes on the previous pages. Starting from the left, choose the product code options as follows:

1. Required performance model.
    a. Standard Performance, non-PTI: **GF100**
    b. High Performance, non-PTI: **GF120**
    c. High Performance, w/ PTI: **GF125**
2. Configurability
    a. Disabled: **X**, Default on GF100 (optional price adder for Configurability)
    b. Enabled: **C**, Standard on GF120 & GF125
3. Specialty Application
    a. High Accuracy, for GF125 only: **HA**
    b. Safe Delivery, for GF120 only: **SD**
    c. No Specialty App: **XX**
4. Valve Configuration
    a. Normally Closed: **C**
    b. Normally Open: **O**
5. Gas or SH MultiFlo Bin
    a. If Gas Specific, enter SEMI gas code: ex. **0013**, for N2
    b. If SH MuliFlow Bin: **SHnn**, nn being the required SHBin, 40 - 50
6. Maximum Flow
    a. If Gas Specific, enter maximum range in sccm, "C" or slm "L": ex. **500C**
    b. If SH Bin, enter defined maximum flow: ex. **860**, choosing SH44, 281 - 860 sccm
7. Fitting
    a. Enter 2-character option code as defined: ex. **CX**, 1 1/8" C Seal 92mm
8. Downstream Condition
    a. Outlet to Vacuum: **V**
    b. Outlet to Atmosphere: **A**
9. Sensor
    a. Orthogonal: **O**, this is default, non-selectable
10. Connector
    a. Enter 2-character option code as defined: ex. **DX**, DeviceNet
11. CSR
    a. Customer Special Requirement, contact Brooks Apps Engineering for review of requirement and creation of CSR: **nnnn**
    b. If DNET connector, CSR required to define DNET attributes: **0924**, generic, ODVA Std. configuration
    c. None Required: **XXXX**
12. Auto Shut-Off.
    a. Enabled: **A**
    b. Disabled: **X**
13. Auto Zero
    a. Enabled: **A**
    b. Disabled: **X**
14. Reference Temperature, Operating Temperature in Degrees C
    a. 0ºC Reference Calibration (Standard): **000**, default
    b. 21ºC Reference Calibration (Normal): **021**
    c. Customer to specify, range between 10ºC and 50ºC: **nnn**

Here is an example of a configured Product Description Code (PDC) for a GF125, Configurable, no Specialty Application, Valve Normally Closed, MultiFlo for 281-860 sccm, 1 1/8" C Seal 92mm, outlet to Vacuum, default sensor, DNET, no CSR, Auto Shut Off enabled, Auto Zero disabled and Default Reference Temperature:
GF125CXXC-SH44860C-CXVODX-0924AX-000

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Table B-1 Industry Standard References

Reference Number	Reference Description
MIL-STD-810	Method 514.4, Category 1, Transportation Requirement Method 516.4, Procedure 1, Functional Shock Test Requirement
SEMI E12	Standard temperature and pressure
SEMI E16	Guideline for determining and describing MFC leak rates
SEMI E17	Guideline for MFC transient characteristics tests
SEMI E18	Guideline for temperature specifications of the MFC
SEMI E27	Standard for MFC and MFM linearity
SEMI E28	Guideline for pressure specifications for the MFC
SEMI E52	Practice for referencing gases used in digital MFCs
SEMI E54	Sensor actuator network connections for DeviceNet
SEMI E56	Test method for detemining accuracy, linearity, repeatability, short-term reproducibility, hystereses of thermal MFCs
SEMI E66	Test method for determining particle contribution by MFCs
SEMI E67	Test method for determining reliabilty of MFCs
SEMI E68	Test method for determining warm-up time of MFCs
SEMI E69	Test method for reproducibilty and zero drift for thermal MFCs
SEMI E80	Test method for determining attitude sensitivity of MFCs
SEMI E16-90	Guidelines for determining and describing mass flow controllers leak rates
SEMI F19	Specification for the finish of the wetted surface of electro polished 216L stainless steel components
SEMI F20	Specifications for 316L stainless steel bar, extruded shapes, plate, and investment castings for components used in ultra-high purity semi manufacturing applications
SEMI F36	Guide for dimensions and connections of gas distribution components
SEMI F37	Method for determination of surface roughness parameters for gas distribution system components
SEMI F44	Guideline for standardization of machined stainless steel weld fittings
SEMI F45	Guideline for standardization of machined stainless steel reducing fittings
SEMI F47	Specifications for semiconductor processing equipment voltage sag immunity
SEMI S2	Environmental, Health and Safety Guidelines
SEMI S9	Dielectric testing
SEMI S10	Risk assessment
SEMI S12	Decontamination of fielded products

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C-1 GF1XX Gas Table

Table C-1 GF1XX Gas Table
(Reference the following pages C-1 Through C-4).

Table C-1 GF1XX Gas Table - Codes 1-97, Bins SH40 to SH45

Gas Code	Gas Symbol	Gas Name	Min inlet pressure for vac. exhaust (PSIA)				SH40		SH41		SH42		SH43		SH44		SH45	
			SH40-SH47	SH48	SH49	SH50	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1	He	Helium	19.7	24.7	29.7		5	14	15	42	43	128	129	400	401	1194	1195	3609
2	Ne	Neon	24.7				5	14	15	42	43	129	130	400	401	1207	1208	3650
4	Ar	Argon	24.7	29.7	39.7	44.7	5	14	15	42	43	130	131	400	401	1214	1215	3671
5	Kr	Krypton	29.7				4	11	12	32	33	100	101	300	301	930	931	2800
6	Xe	Xenon	24.7				3	6	7	19	20	58	59	178	179	546	547	1651
7	H2	Hydrogen	14.7	14.7	19.7		3	10	11	30	31	92	93	280	281	860	861	2600
8	Air	Air	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
9	CO	Carbon Monoxide	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
10	HBr	Hydrogen Bromide	24.7				3	8	9	25	26	77	78	235	236	723	724	2187
11	HCl	Hydrogen Chloride	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
13	N2	Nitrogen	24.7	29.7	29.7	32.7	3	10	11	30	31	92	93	280	281	860	861	2600
15	O2	Oxygen	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
16	NO	Nitric Oxide	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
17	HI	Hydrogen Iodide	24.7	29.7			3	5	6	15	16	46	47	141	142	432	433	1305
18	F2	Fluorine	24.7	29.7			3	9	10	27	28	83	84	254	255	780	781	2358
19	Cl2	Chlorine	24.7	29.7			3	6	7	19	20	57	58	173	174	531	532	1604
22	H2S	Hydrogen Sulfide	24.7	29.7			3	8	9	25	26	76	77	232	233	713	714	2155
23	H2Se	Hydrogen Selenide	24.7	29.7			3	7	8	22	23	66	67	202	203	620	621	1874
25	CO2	Carbon Dioxide	24.7	29.7	29.7	29.7	3	7	8	22	23	69	70	209	210	642	643	1942
27	N2O	Nitrous Oxide	24.7	29.7			3	7	8	21	22	65	66	200	201	611	612	1849
28	CH4	Methane	24.7	24.7	29.7		3	8	9	23	24	71	72	215	216	660	661	2000
29	NH3	Ammonia	24.7	24.7			3	8	9	24	25	73	74	223	224	685	686	2072
31	PH3	Phosphine	19.7	24.7			3	7	8	22	23	67	68	205	206	629	630	1901
32	SO2	Sulfur Dioxide	19.7	24.7			3	6	7	17	18	52	53	157	158	483	484	1459
33	CH3F	Methyl Fluoride	24.7	29.7			3	7	8	22	23	67	68	204	205	625	626	1890
34	COS	Carbonyl Sulfide	24.7	29.7			3	7	8	20	21	60	61	183	184	562	563	1700
38	C2H4	Ethylene	24.7	29.7			3	6	7	17	18	54	55	163	164	501	502	1516
39	SiH4	Silane	24.7	29.7			3	6	7	18	19	56	57	170	171	523	524	1581
42	C2H2	Acetylene	16.7	19.7			3	6	7	18	19	57	58	170	171	530	531	1600
43	GeH4	Germane	24.7	29.7			3	6	7	17	18	53	54	161	162	495	496	1500
48	BF3	Boron Trifluoride	19.7	24.7			3	5	6	16	17	50	51	150	151	457	458	1381
49	CHF3	Fluoroform (Freon-23)	24.7	24.7	24.7	26.7	3	5	6	16	17	48	49	145	146	445	446	1344
53	NF3	Nitrogen Trifluoride	24.7	29.7			3	5	6	15	16	46	47	140	141	430	431	1300
58	B2H6	Diborane	19.7	19.7			3	4	5	12	13	38	39	116	117	358	359	1082
62	PF3	Phosphorus Trifluoride	19.7	24.7			3	4	5	14	15	42	43	129	130	400	401	1200
63	CF4	Carbon Tetrafluoride (Freon-14)	24.7	24.7	24.7	26.7	3	4	5	13	14	40	41	121	122	372	373	1123
67	SiH2Cl2	Dichlorosilane	14.7	19.7			3	3	4	10	11	29	30	89	90	273	274	824
69	C3H6-b)	Propylene	19.7	19.7			3	4	5	12	13	36	37	110	111	338	339	1022
70	BCl3	Boron Trichloride	11.7	14.7			3	3	4	10	11	31	32	94	95	289	290	874
72	ClO3F	Perchloryl Fluoride	14.7	20.7			3	4	5	12	13	38	39	114	115	350	351	1060
77	ClF3	Chlorine Trifluoride	14.7	20.7			3	4	5	11	12	35	36	107	108	327	328	1000
85	C2H7N	Dimethylamine	9.7	14.7			3	3	4	11	12	34	35	101	102	310	311	960
88	SiF4	Silicon Tetrafluoride	19.7	24.7			3	4	5	11	12	34	35	103	104	316	317	1000
94	C2F4	Tetrafluoroethylene	19.7	19.7			3	3	4	10	11	31	32	100	101	300	301	900
97	Si2H6	DISILANE	19.7	19.7			3	3	4	10	11	30	31	92	93	282	283	853

For reference only, consult factory on the latest tables.

Table C-1 GF1XX Gas Table - Codes 1-97, Bins SH46 to SH50

		Min inlet pressure for vac. exhaust (PSIA)				SH46		SH47		SH48		SH49		SH50	
Gas Symbol	Gas Name	SH40-SH47	SH48	SH49	SH50	Low	High	Low	High	Low	High	Low	High	Low	High
He	Helium	19.7	24.7	29.7		3610	11100	11101	23100	23101	47000	47001	100000		
Ne	Neon	24.7				3651	10700	10701	22100						
Ar	Argon	24.7	29.7	39.7	44.7	3672	10000	10001	20200	20201	41000	41001	44000	44001	55000
Kr	Krypton	29.7				2801	7160	7161	14900						
Xe	Xenon	24.7				1652	4210	4211	8760						
H2	Hydrogen	14.7	14.7	19.7		2601	8000	8001	16400	16401	33000	33001	73000		
Air	Air	24.7	29.7			2601	7400	7401	15000	15001	30000				
CO	Carbon Monoxide	24.7	29.7			2601	7300	7301	15000	15001	30000				
HBr	Hydrogen Bromide	24.7				2188	5610	5611	11700						
HCl	Hydrogen Chloride	24.7	29.7			2601	6900	6901	14200	14201	29000				
N2	Nitrogen	24.7	29.7	29.7	32.7	2601	7200	7201	15000	15001	30000	30001	40000	40001	55000
O2	Oxygen	24.7	29.7			2601	7200	7201	15000	15001	30000				
NO	Nitric Oxide	24.7	29.7			2601	7200	7201	15000	15001	30000				
HI	Hydrogen Iodide	24.7	29.7			1306	3340	3341	6960	6961	13900				
F2	Fluorine	24.7	29.7			2359	6700	6701	14000	14001	28000				
Cl2	Chlorine	24.7	29.7			1605	4850	4851	10100	10101	20200				
H2S	Hydrogen Sulfide	24.7	29.7			2156	5900	5901	12100	12101	24100				
H2Se	Hydrogen Selenide	24.7	29.7			1875	4770	4771	10000	10001	20000				
CO2	Carbon Dioxide	24.7	29.7	29.7	29.7	1943	5300	5301	11000	11001	22000	22001	28000	28001	39000
N2O	Nitrous Oxide	24.7	29.7			1850	5100	5101	10400	10401	21000				
CH4	Methane	24.7	24.7	29.7		2001	5800	5801	12000	12001	24000	24001	46000		
NH3	Ammonia	24.7	24.7			2073	6000	6001	12200	12201	25000				
PH3	Phosphine	19.7	24.7			1902	5200	5201	10700	10701	21300				
SO2	Sulfur Dioxide	19.7	24.7			1460	3800	3801	7920	7921	15800				
CH3F	Methyl Fluoride	24.7	29.7			1891	5200	5201	10600	10601	21200				
COS	Carbonyl Sulfide	24.7	29.7			1701	4500	4501	9400	9401	18300				
C2H4	Ethylene	24.7	29.7			1517	4400	4401	9300	9301	18200				
SiH4	Silane	24.7	29.7			1582	4400	4401	9300	9301	18200				
C2H2	Acetylene	16.7	19.7			1601	4400	4401	9300	9301	18200				
GeH4	Germane	24.7	29.7			1501	4000	4001	8400	8401	16400				
BF3	Boron Trifluoride	19.7	24.7			1382	3800	3801	7900	7901	15500				
CHF3	Fluoroform (Freon-23)	24.7	24.7	24.7	26.7	1345	3600	3601	7600	7601	15000	15001	17000	17001	26000
NF3	Nitrogen Trifluoride	24.7	29.7			1301	3600	3601	7500	7501	15000				
B2H6	Diborane	19.7	19.7			1083	3100	3101	6400	6401	12600				
PF3	Phosphorus Trifluoride	19.7	24.7			1201	3200	3201	6800	6801	13300				
CF4	Carbon Tetrafluoride (Freon-14)	24.7	24.7	24.7	26.7	1124	3010	3011	6400	6401	12600	12601	17000	17001	22000
SiH2Cl2	Dichlorosilane	14.7	19.7			825	2140	2141	4450	4451	8900				
C3H6-b)	Propylene	19.7	19.7			1023	2800	2801	5900	5901	11700				
BCl3	Boron Trichloride	11.7	14.7			875	2230	2231	4650	4651	9300				
ClO3F	Perchloryl Fluoride	14.7	20.7			1061	2800	2801	5800	5801	11500				
ClF3	Chlorine Trifluoride	14.7	20.7			1001	2560	2561	5340	5341	10700				
C2H7N	Dimethylamine	9.7	14.7			961	2530	2531	5400	5401	10600				
SiF4	Silicon Tetrafluoride	19.7	24.7			1001	2600	2601	5400	5401	10600				
C2F4	Tetrafluoroethylene	19.7	19.7			901	2300	2301	4900	4901	9800				
Si2H6	DISILANE	19.7	19.7			854	2300	2301	4900	4901	9800				

For reference only, consult factory on the latest tables.
For gases not specified for SH49 & SH50, contact Brooks Product Marketing.

Table C-1 GF1XX Gas Table - Codes 99-965, Bins SH40 to SH45

Gas Code	Gas Symbol	Gas Name	Min inlet pressure for vac. exhaust (PSIA)				SH40		SH41		SH42		SH43		SH44		SH45	
			SH40-SH47	SH48	SH49	SH50	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Gas Code	Gas Symbol	Gas Name	Min inlet pressure for vac. exhaust				SH40		SH41		SH42		SH43		SH44		SH45	
			SH40-SH47	SH48	SH49	SH50	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
99	GeF4	Germanium Tetrafluoride	20.7	24.7			3	3	4	10	11	30	31	92	93	282	283	860
108	SiCl4	Silicon Tetrachloride	8.7						3	6	7	18	19	56	57	172	173	520
110	SF6	Sulfur Hexafluoride	19.7	19.7	19.7	20.7			3	8	9	25	26	77	78	237	238	715
118	C2F6	Hexafluoroethane (Freon-116)	19.7	19.7					3	8	9	23	24	71	72	218	219	658
121	WF6	Tungsten Hexafluoride	9.7	11.7					3	5	6	16	17	50	51	150	151	460
128	C3F8	Perfluoropropane	19.7	19.7					3	5	6	16	17	50	51	154	155	465
129	C4F8	Octafluorocyclobutane	19.7	19.7					3	5	6	16	17	50	51	154	155	465
138	C3F6	Hexafluoropropylene	19.7	19.7					3	6	7	20	21	60	61	184	185	556
155	C2HF5	PENTAFLUOROETHANE (FREON-125)	19.7	19.7					3	8	9	25	26	77	78	235	236	711
160	CH2F2	Difluoromethane	24.7	29.7			3	6	7	19	20	57	58	174	175	533	534	1612
185	CH6Si	Methylsilane (MONO)	9.7	14.7			3	4	5	12	13	37	38	111	112	340	341	1050
190	(CH3)3SiH	Trimethylsilane (TMSi)	6.7						3	7	8	20	21	62	63	189	190	572
266	C5F8	Octafluorocyclopentene	9.7	14.7					3	5	6	14	15	44	45	134	135	406
270	C4F6	Hexafluoro-2-butyne	9.7						3	6	7	19	20	57	58	176	177	533
297	C4F6-q)	Hexafluoro Butadiene-1-3	14.7	14.7					3	6	7	17	18	52	53	160	161	500
354	C5F8O	Epoxyperfluorocyclopentene	19.7	19.7					3	4	5	13	14	40	41	122	123	369
368	Si3H9N	Trisilylamine (TSA)	6.0	7.2					3	6	7	20	21	60	61	181	182	560
509	10%GeH4/H2	10%Germane/Hydrogen	20.7	20.7			3	9	10	28	29	86	87	260	261	800	801	2400
516	10%PH3/H2	10%Phosphine/Hydrogen	19.7	19.7			3	9	10	28	29	90	91	275	276	813	814	2500
536	20%O2/He	20%Oxygen/Helium	19.7	29.7			4	13	14	38	39	120	121	360	361	1102	1103	3331
542	5%H2/N2	5%Hydrogen/Nitrogen	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
557	1%B2H6/H2	1%DIBORANE/HYDROGEN	24.7	29.7			3	10	11	30	31	91	92	270	271	850	851	2510
563	1%PH3/H2	1%Phosphine/Hydrogen	19.7	19.7			3	10	11	30	31	90	91	273	274	850	851	2531
597	3%H2/N2	3%Hydrogen/Nitrogen	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
603	30%He/O2	30%Helium/Oxygen	24.7	29.7			4	11	12	33	34	100	101	301	302	950	951	2800
604	30%O2/He	30%Oxygen/Helium	19.7	29.7			4	12	13	37	38	113	114	345	346	1060	1061	3203
606	4%H2/He	4%Hydrogen/Helium	19.7	19.7			5	14	15	41	42	126	127	400	401	1200	1201	3600
607	4%H2/N2	4%Hydrogen/Nitrogen	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
615	5%B2H6/Ar	5%Diborane/Argon	24.7				4	12	13	38	39	116	117	353	354	1084	1085	3278
649	10%O2/He	10%Oxygen/Helium	19.7	24.7			5	13	14	41	42	123	124	380	381	1150	1151	3500
653	2%SiH4/N2	2%SILANE/NITROGEN	19.7	24.7			3	10	11	30	31	93	94	280	281	870	871	2600
654	5%B2H6/N2	5%Diborane/Nitrogen	24.7	29.7			3	9	10	28	29	86	87	262	263	804	805	2500
662	.8%B2H6/N2	.8%Diborane/Nitrogen	24.7	29.7			3	10	11	30	31	93	94	280	281	870	871	2600
762	5%H2/He	5%Hydrogen/Helium	19.7	19.7			5	14	15	41	42	125	126	400	401	1200	1201	3600
820	15%B2H6/H2	15%Diborane/Hydrogen	14.7	14.7			3	8	9	25	26	76	77	230	231	710	711	2120
878	3%C2H4/He	3%Ethylene/Helium	19.7	19.7			4	13	14	40	41	125	126	375	376	1150	1151	3500
897	2.7%C2H4/He	2.7%Ethylene/Helium	19.7	19.7			4	13	14	40	41	125	126	377	378	1158	1159	3502
898	1%GeH4/H2	1%Germane/Hydrogen	20.7	20.7			3	10	11	30	31	91	92	275	276	850	851	2530
910	.5%GeH4/H2	0.5%Germane/Hydrogen	20.7	20.7			3	10	11	30	31	92	93	280	281	860	861	2600
916	2%PH3/H2	2%Phosphine/Hydrogen	21.7	21.7			3	10	11	30	31	91	92	275	276	850	851	2530
930	3.9%H2/N2	3.9%Hydrogen/Nitrogen	24.7	29.7			3	10	11	30	31	92	93	280	281	860	861	2600
939	10%B2H6/He	10%Diborane/Helium	19.7	19.7			4	11	12	34	35	103	104	314	315	965	966	2918
946	30%C2H4/He	30%Ethylene/Helium	19.7	24.7			3	10	11	30	31	90	91	275	276	850	851	2551
950	10%H2/He	10%Hydrogen/Helium	19.7	19.7			4	13	14	40	41	125	126	380	381	1200	1201	3500
953	15%H2/B2H6	15%Hydrogen/Diborane	19.7	19.7			3	4	5	14	15	42	43	130	131	400	401	1200
958	17%CH4/CO2	17%Methane/Carbon Dioxide	24.7	29.7			3	7	8	23	24	70	71	210	211	650	651	2000
962	20%CH6Si/H2	20%Methylsilane (MONO)/Hydrogen	14.7	19.7			3	7	8	23	24	71	72	212	213	660	661	2000
965	50%CH3SiHC	50%Dichloromethylsilane/Hydrogen	11.7	13.7			3	4	5	14	15	42	43	130	131	400	401	1200

For reference only, consult factory on the latest tables.

Table C-1 GF1XX Gas Table - Codes 99-965, Bins SH46 to SH50

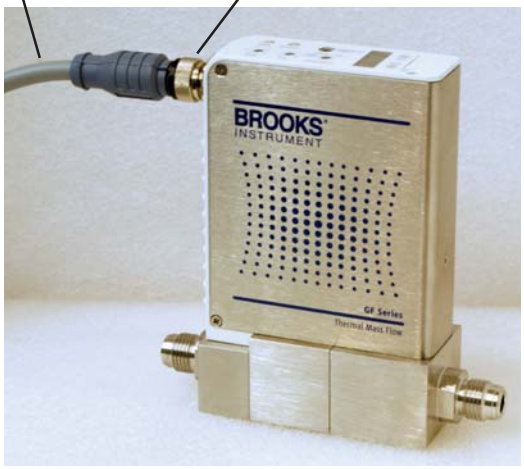
Gas Code	Gas Symbol	Gas Name	Min inlet pressure for vac. exhaust (PSIA)				SH46		SH47		SH48		SH49		SH50	
			SH40-SH47	SH48	SH49	SH50	Low	High	Low	High	Low	High	Low	High	Low	High
Gas Code	Gas Symbol	Gas Name	Min inlet pressure for vac. exhaust (PSIA)				SH46		SH47		SH48		SH49		SH50	
			SH40-SH47	SH48	SH49	SH50	Low	High	Low	High	Low	High	Low	High	Low	High
99	GeF4	Germanium Tetrafluoride	20.7	24.7			861	2200	2201	4700	4701	9400				
108	SiCl4	Silicon Tetrachloride	8.7				521	1320	1321	2750						
110	SF6	Sulfur Hexafluoride	19.7	19.7	19.7	20.7	716	1900	1901	4000	4001	8000	8001	8200	8201	13400
118	C2F6	Hexafluoroethane (Freon-116)	19.7	19.7			659	1750	1751	3700	3701	7400				
121	WF6	Tungsten Hexafluoride	9.7	11.7			461	1200	1201	2500	2501	5000				
128	C3F8	Perfluoropropane	19.7	19.7			466	1200	1201	2500	2501	5100				
129	C4F8	Octafluorocyclobutane	19.7	19.7			466	1170	1171	2430	2431	4900				
138	C3F6	Hexafluoropropylene	19.7	19.7			557	1470	1471	3050	3051	6110				
155	C2HF5	PENTAFLUOROETHANE (FREON-1	19.7	19.7			712	1900	1901	4000	4001	8000				
160	CH2F2	Difluoromethane	24.7	29.7			1613	4300	4301	9000	9001	18000				
185	CH6Si	Methylsilane (MONO)	9.7	14.7			1051	2800	2801	5900	5901	11600				
190	(CH3)3SiH	Trimethylsilane (TMSi)	6.7				573	1530	1531	3200						
266	C5F8	Octafluorocyclopentene	9.7	14.7			407	1050	1051	2200	2201	4500				
270	C4F6	Hexafluoro-2-butyne	9.7				534	1400	1401	2900						
297	C4F6-q)	Hexafluoro Butadiene-1-3	14.7	14.7			501	1270	1271	2640	2641	5270				
354	C5F8O	Epoxyperfluorocyclopentene	19.7	19.7			370	1000	1001	2100	2101	4200				
368	Si3H9N	Trisilylamine (TSA)	6.0	7.2			561	1410	1411	3000	3001	6000				
509	10%GeH4/H2	10%Germane/Hydrogen	20.7	20.7			2401	7200	7201	15000	15001	30000				
516	10%PH3/H2	10%Phosphine/Hydrogen	19.7	19.7			2501	7600	7601	15500	15501	31000				
536	20%O2/He	20%Oxygen/Helium	19.7	29.7			3332	10000	10001	21000	21001	42000				
542	5%H2/N2	5%Hydrogen/Nitrogen	24.7	29.7			2601	7400	7401	15100	15101	31000				
557	1%B2H6/H2	1%DIBORANE/HYDROGEN	24.7	29.7			2511	7900	7901	16100	16101	33000				
563	1%PH3/H2	1%Phosphine/Hydrogen	19.7	19.7			2532	7800	7801	16000	16001	32000				
597	3%H2/N2	3%Hydrogen/Nitrogen	24.7	29.7			2601	7400	7401	15100	15101	30100				
603	30%He/O2	30%Helium/Oxygen	24.7	29.7			2801	8100	8101	17000	17001	34000				
604	30%O2/He	30%Oxygen/Helium	19.7	29.7			3204	9700	9701	20000	20001	40000				
606	4%H2/He	4%Hydrogen/Helium	19.7	19.7			3601	11000	11001	23000	23001	46000				
607	4%H2/N2	4%Hydrogen/Nitrogen	24.7	29.7			2601	7400	7401	15100	15101	30100				
615	5%B2H6/Ar	5%Diborane/Argon	24.7				3279	8900	8901	18200						
649	10%O2/He	10%Oxygen/Helium	19.7	24.7			3501	10500	10501	22000	22001	44000				
653	2%SiH4/N2	2%SILANE/NITROGEN	19.7	24.7			2601	7300	7301	15000	15001	30000				
654	5%B2H6/N2	5%Diborane/Nitrogen	24.7	29.7			2501	7000	7001	14100	14101	28100				
662	.8%B2H6/N2	.8%Diborane/Nitrogen	24.7	29.7			2601	7300	7301	15000	15001	30000				
762	5%H2/He	5%Hydrogen/Helium	19.7	19.7			3601	11000	11001	23000	23001	46000				
820	15%B2H6/H2	15%Diborane/Hydrogen	14.7	14.7			2121	6500	6501	13300	13301	27000				
878	3%C2H4/He	3%Ethylene/Helium	19.7	19.7			3501	10700	10701	22100	22101	45000				
897	2.7%C2H4/He	2.7%Ethylene/Helium	19.7	19.7			3503	10700	10701	22200	22201	45000				
898	1%GeH4/H2	1%Germane/Hydrogen	20.7	20.7			2531	8000	8001	16200	16201	33000				
910	.5%GeH4/H2	0.5%Germane/Hydrogen	20.7	20.7			2601	8000	8001	16300	16301	33000				
916	2%PH3/H2	2%Phosphine/Hydrogen	21.7	21.7			2531	8000	8001	16200	16201	33000				
930	3.9%H2/N2	3.9%Hydrogen/Nitrogen	24.7	29.7			2601	7400	7401	15100	15101	30100				
939	10%B2H6/He	10%Diborane/Helium	19.7	19.7			2919	9000	9001	18400	18401	37000				
946	30%C2H4/He	30%Ethylene/Helium	19.7	24.7			2552	7800	7801	16000	16001	32000				
950	10%H2/He	10%Hydrogen/Helium	19.7	19.7			3501	10700	10701	22200	22201	45000				
953	15%H2/B2H6	15%Hydrogen/Diborane	19.7	19.7			1201	3400	3401	7100	7101	14000				
958	17%CH4/CO2	17%Methane/Carbon Dioxide	24.7	29.7			2001	5400	5401	11000	11001	22000				
962	20%CH6Si/H2	20%Methylsilane (MONO)/Hydrogen	14.7	19.7			2001	5900	5901	12000	12001	24000				
965	50%CH3SiHCl2/H2	50%Dichloromethylsilane/Hydrogen	11.7	13.7			1201	3100	3101	6600	6601	13000				

For reference only, consult factory on the latest tables.
For gases not specified for SH49 & SH50, contact Brooks Product Marketing.

D-1 Electrical Connection

D-1-1 DeviceNet Connections

DeviceNet is a 5 wire local network connection that employs a command response communication protocol for communicating between a master and slave. Obtain a DeviceNet communication cable (Micro M-12) and fasten it to the 5-pin connector as shown in Figure D-1.



Pin	Connection
1	Drain
2	V+ (11-25 Vdc)
3	V--
4	CAN-H
5	CAN-L

⚠ CAUTION

DO NOT apply more than 10 Inch-Pounds of torque to the cable coupling when connecting the cable to the device or damage may result to the connector.

Figure D-1 GF1XX DeviceNet Connection

D-1-2 Digital/Analog Connector

The GF Series devices are available with Analog 9-Pin D-Connectors shown in Figure D-2.

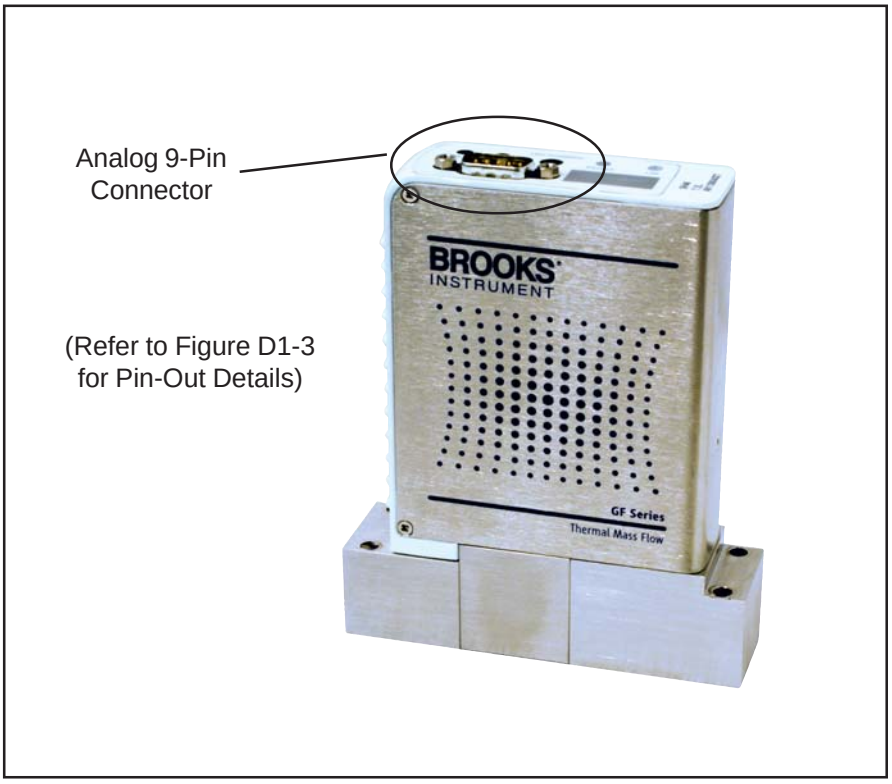
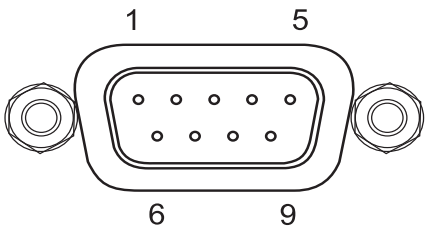


Figure D-2 GF1XX with 9-Pin Analog Connector

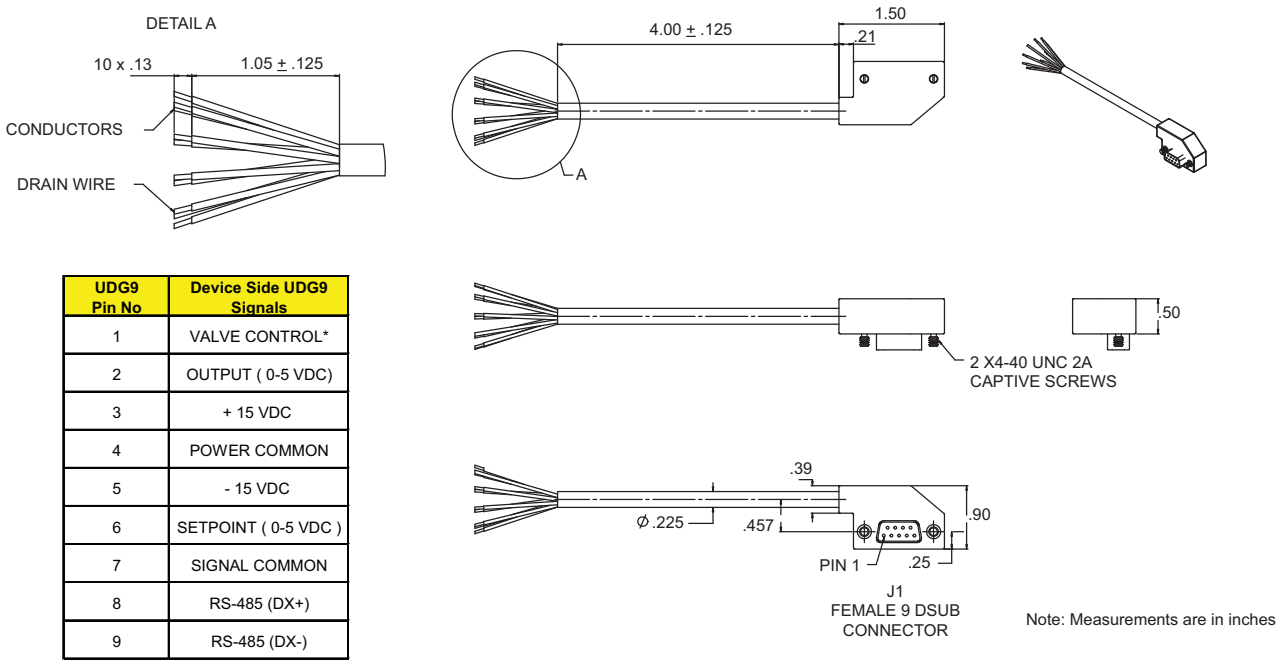


PIN	Connection
1	Valve Control
2	Output (0-5 Vdc)
3	+15 Vdc
4	Power Common
5	-15 Vdc
6	Setpoint (0-5 Vdc)
7	Signal Common
8	RS485 DX+
9	RS485 DX-

Figure D-3 Analog 9-Pin Connector (M)

D-1-3 Digital/Analog Adapters

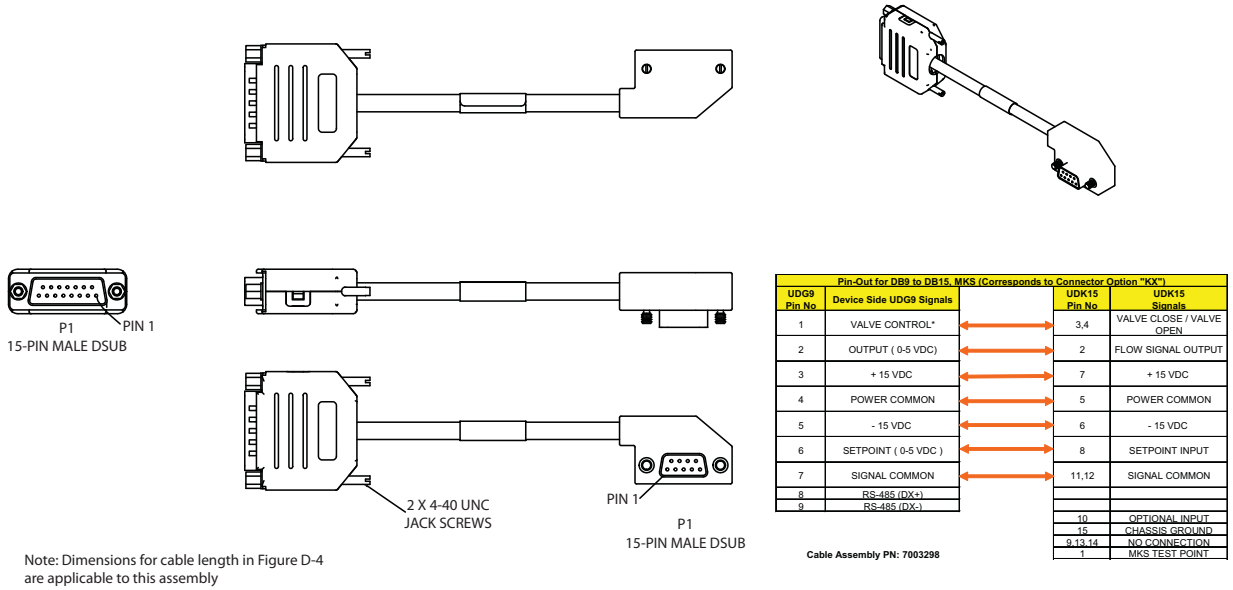
The GF Series devices are available with the following adapters.



UDG9 Pin No	Device Side UDG9 Signals
1	VALVE CONTROL*
2	OUTPUT (0-5 VDC)
3	+ 15 VDC
4	POWER COMMON
5	- 15 VDC
6	SETPOINT (0-5 VDC)
7	SIGNAL COMMON
8	RS-485 (DX+)
9	RS-485 (DX-)

Cable Assembly PN: 7003248

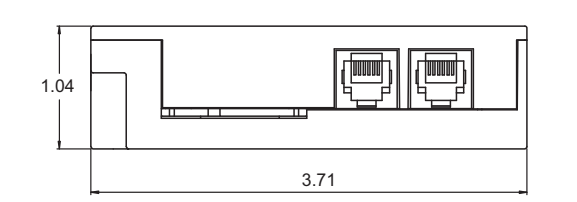
Figure D-4 DB9 to Open End Cable Adapter Assembly

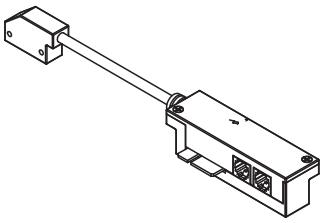


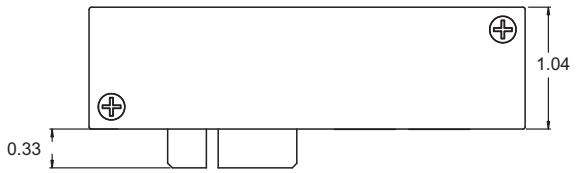
Pin-Out for DB9 to DB15, MKS (Corresponds to Connector Option "KK")				
UDG9 Pin No	Device Side UDG9 Signals		UDK15 Pin No	UDK15 Signals
1	VALVE CONTROL*	→	3,4	VALVE CLOSE / VALVE OPEN
2	OUTPUT (0-5 VDC)	→	2	FLOW SIGNAL OUTPUT
3	+ 15 VDC	→	7	+ 15 VDC
4	POWER COMMON	→	5	POWER COMMON
5	- 15 VDC	→	6	- 15 VDC
6	SETPOINT (0-5 VDC)	→	8	SETPOINT INPUT
7	SIGNAL COMMON	→	11,12	SIGNAL COMMON
8	RS-485 (DX+)			
9	RS-485 (DX-)			
			10	OPTIONAL INPUT
			15	CHASSIS GROUND
			9,13,14	NO CONNECTION
			1	MKS TEST POINT

Cable Assembly PN: 7003298

Figure D-5 DB9 to DB15, MKS Cable Adapter Assembly







Note: Measurements are in inches

Note: Dimensions for cable length in Figure D-4 are applicable to this assembly

Pin-Out for DB9 to Card Edge (Corresponds to Connector Option "EX")

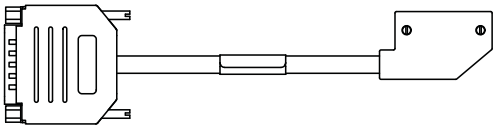
UDG9 Pin No	Device Side UDG9 Signals	MFC Card Edge Pin No	MFC 20-pin Edge Card with RS-485 Signals
1	VALVE CONTROL*	J	VALVE OFF
2	OUTPUT (0-5 VDC)	3	OUTPUT (0-5 VDC)
3	+ 15 VDC	4	+ 15 VDC
4	POWER COMMON	2	POWER COMMON
5	- 15 VDC	F	- 15 VDC
6	SETPOINT (0-5 VDC)	A	SETPOINT (0-5 VDC)
7	SIGNAL COMMON	B,C,10	SIGNAL COMMON
	DRAIN WIRE	8	RS-485 (DX+)
8	RS-485 (DX+)	9	RS-485 (DX-)
9	RS-485 (DX-)	6	SENSOR OUT
		1	CASE GROUND
		I	ZERO ALARM
		5,E,H	NO CONNECTION
		7,G	KEY WAY
		D	VALVE TEST POINT

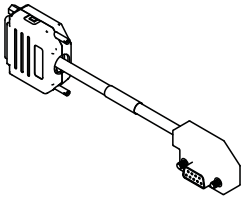
RJ11 J2 Pin No
1
2
3
4
5
6

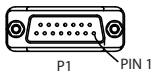
RJ11 J3 Pin No
1
2
3
4
5
6

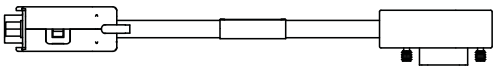
Cable Assembly PN: 7003083

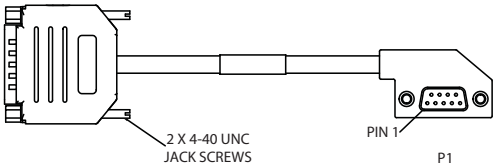
Figure D-6 DB9 to Card Edge Cable Adapter Assembly











Note: Dimensions for cable length in Figure D-4 are applicable to this assembly

Pin-Out for DB9 to DB15, UDU15

UDG9 Pin No	Device Side UDG9 Signals	UDU15 Pin No	UDU15 Signals
1	VALVE CONTROL*	9	VALVE OFF
2	OUTPUT (0-5 VDC)	6	OUTPUT (0-5 VDC)
3	+ 15 VDC	4	+ 15 VDC
4	POWER COMMON	7	POWER COMMON
5	- 15 VDC	11	- 15 VDC
6	SETPOINT (0-5 VDC)	15	SETPOINT (0-5 VDC)
7	SIGNAL COMMON	1,13,14	SIGNAL COMMON
8	RS-485 (DX+)	2	ZERO ALARM
9	RS-485 (DX-)	12	VALVE TEST POINT
	DRAIN WIRE	8	CASE GROUND
		3,5,10	NO CONNECTION

Cable Assembly PN: 7003071

Figure D-7 DB9 to DB15, UDU15 Cable Adapter Assembly

D-2 Dimensional Drawings

The following drawings represent the available configurations for the Brooks Models GF100, GF120 and GF125.

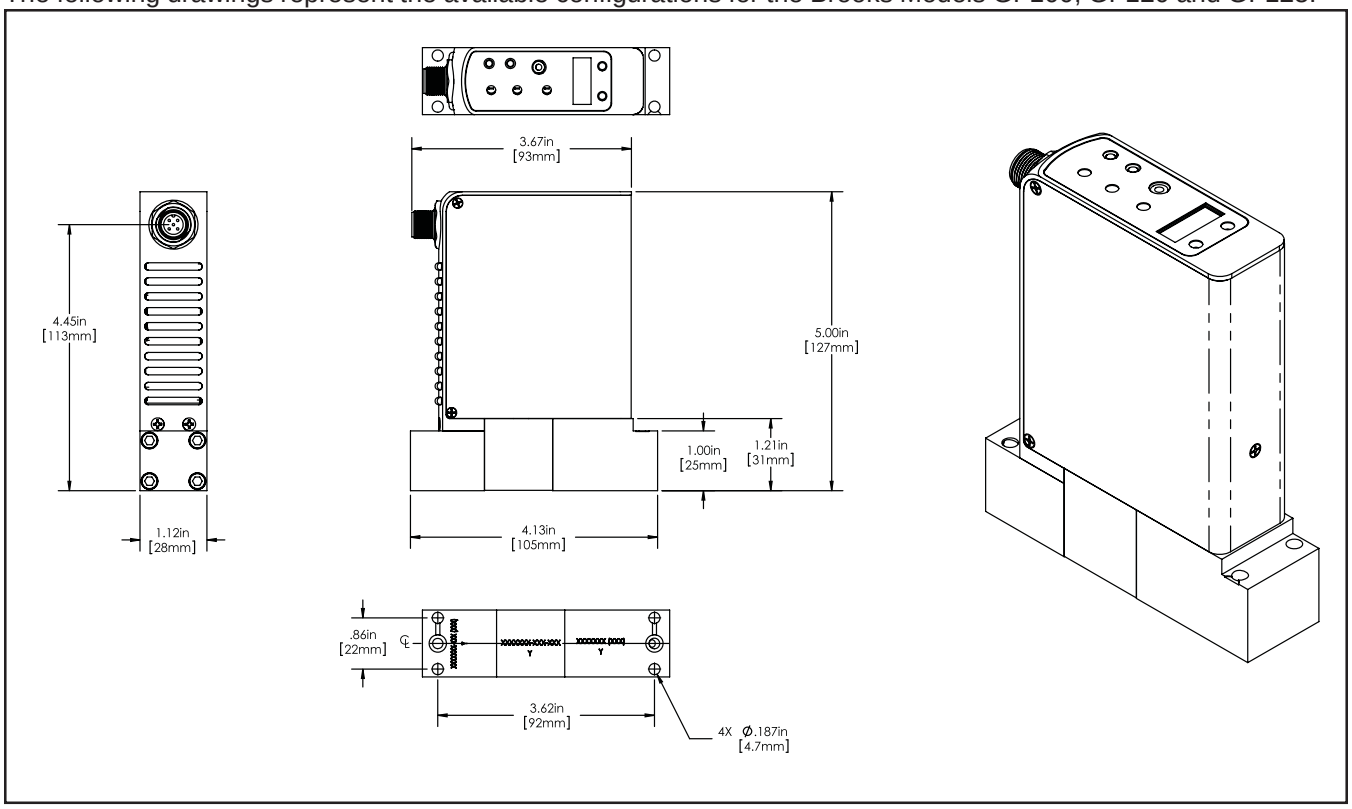


Figure D-8 DeviceNet 1-1/8" C-Seal 92mm Downported

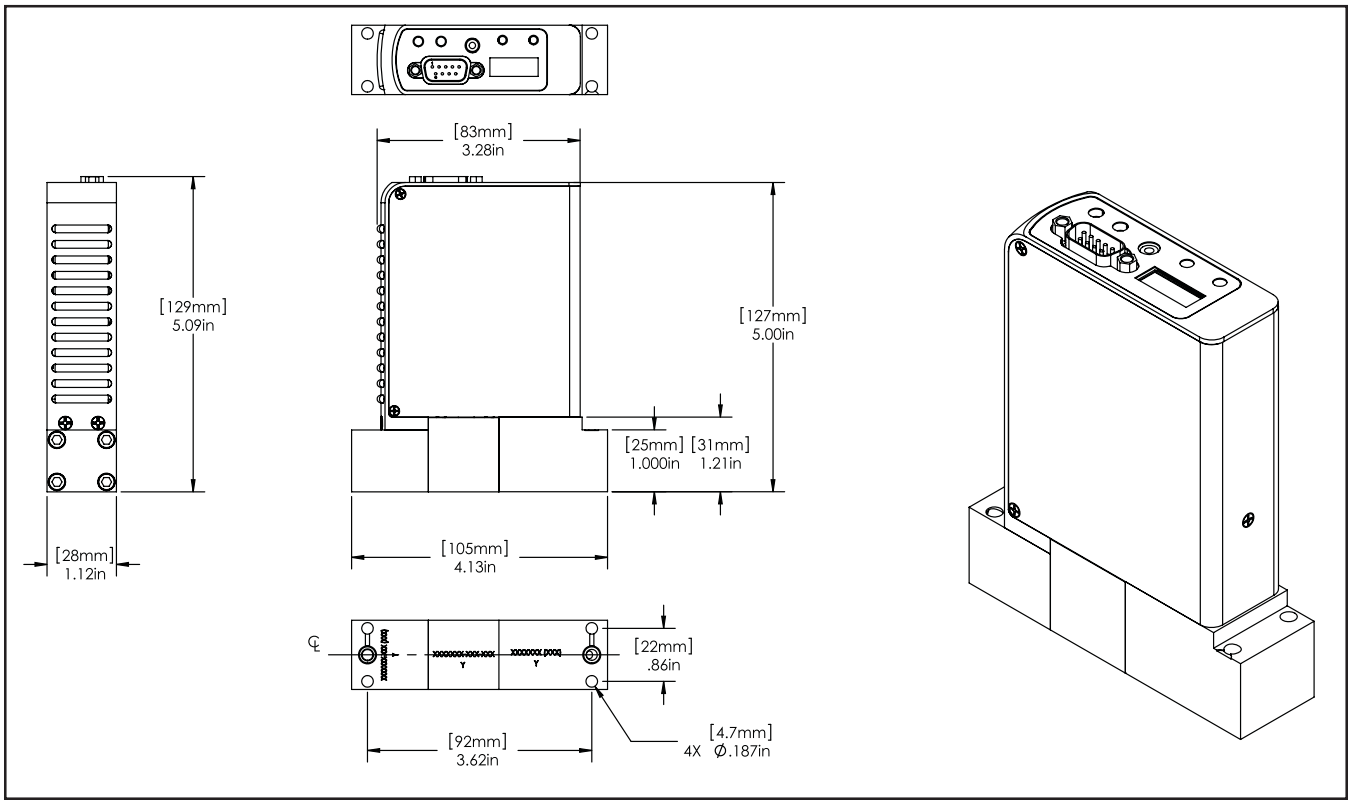


Figure D-9 Digital/Analog DB9, RS-485 1-1/8" C-Seal 92mm Downported

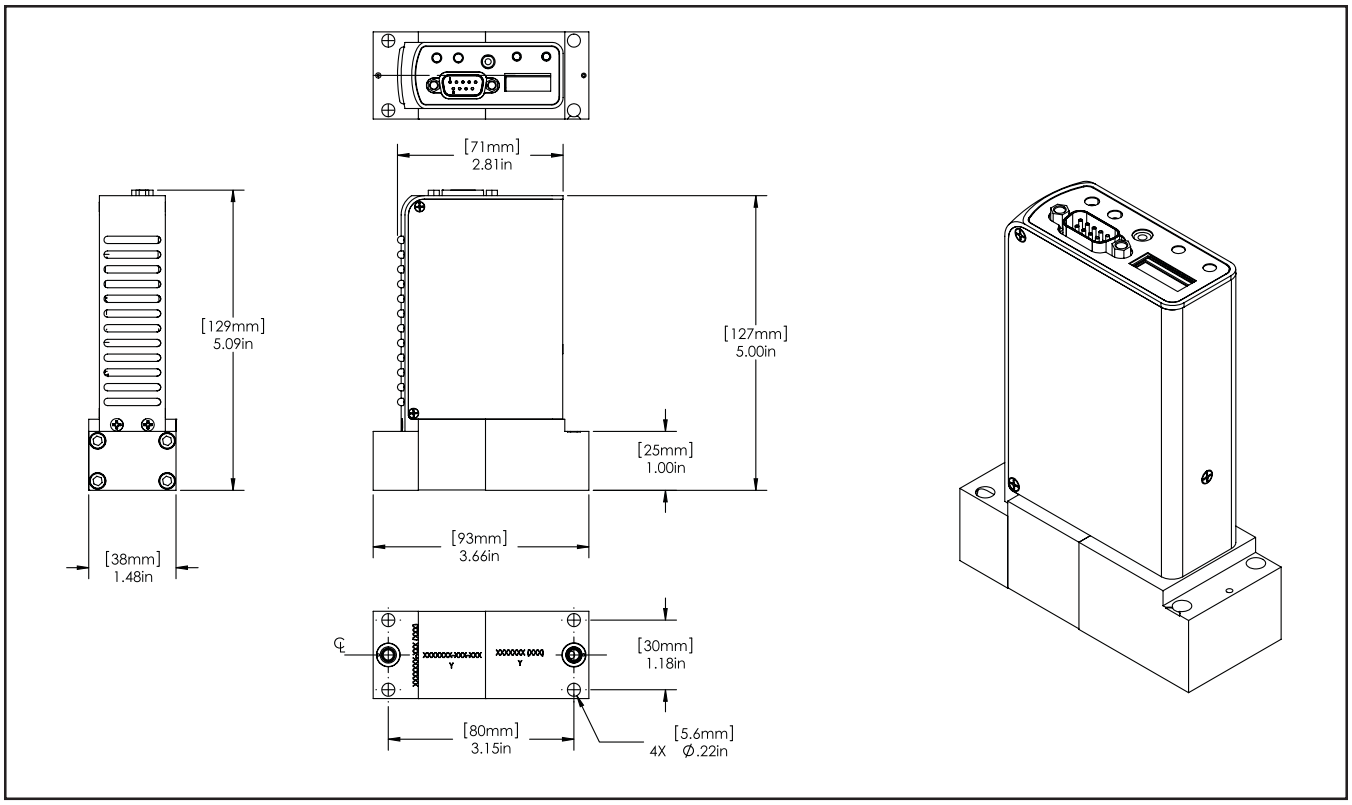


Figure D-10 Digital/Analog DB9, RS-485 1-1/2" W-Seal 80mm Downported

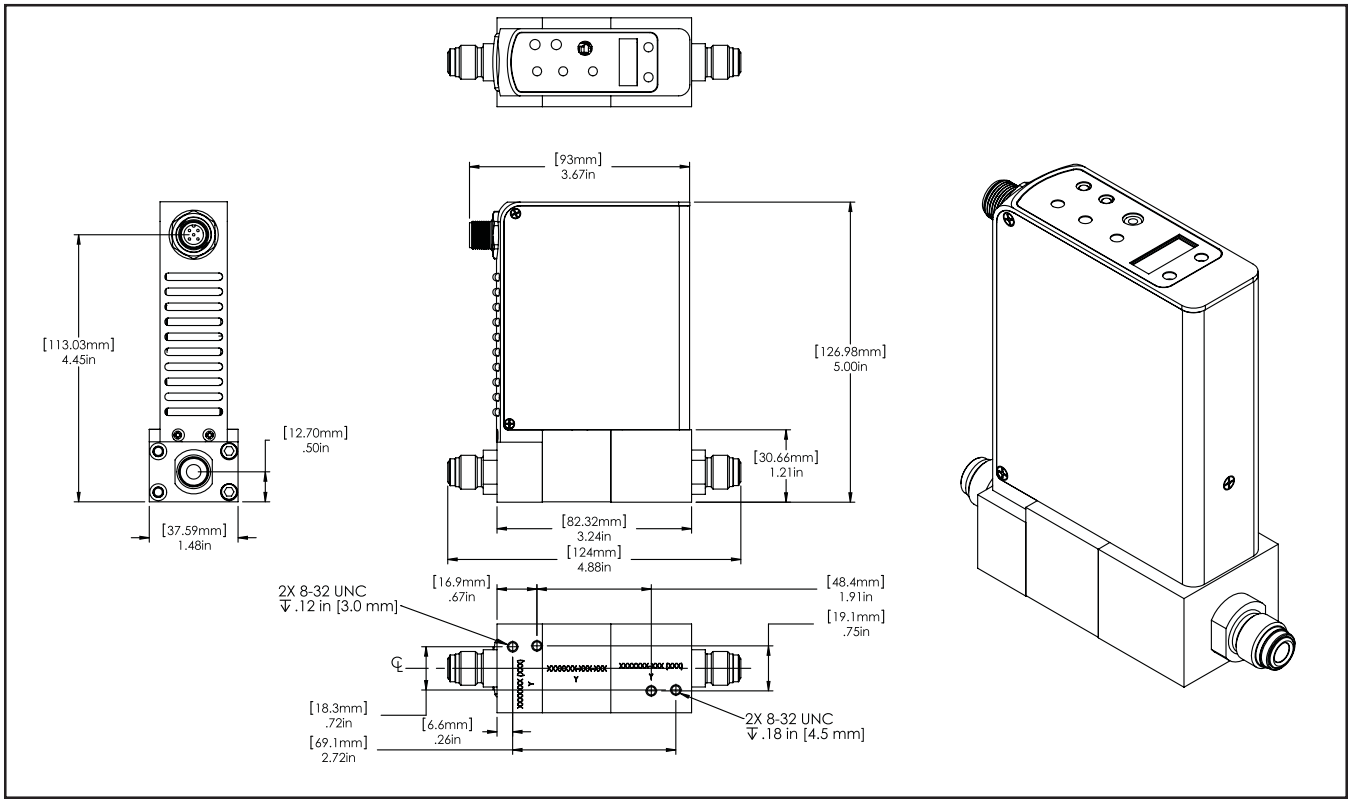


Figure D-11 DeviceNet 124mm 1/4" VCR Fittings

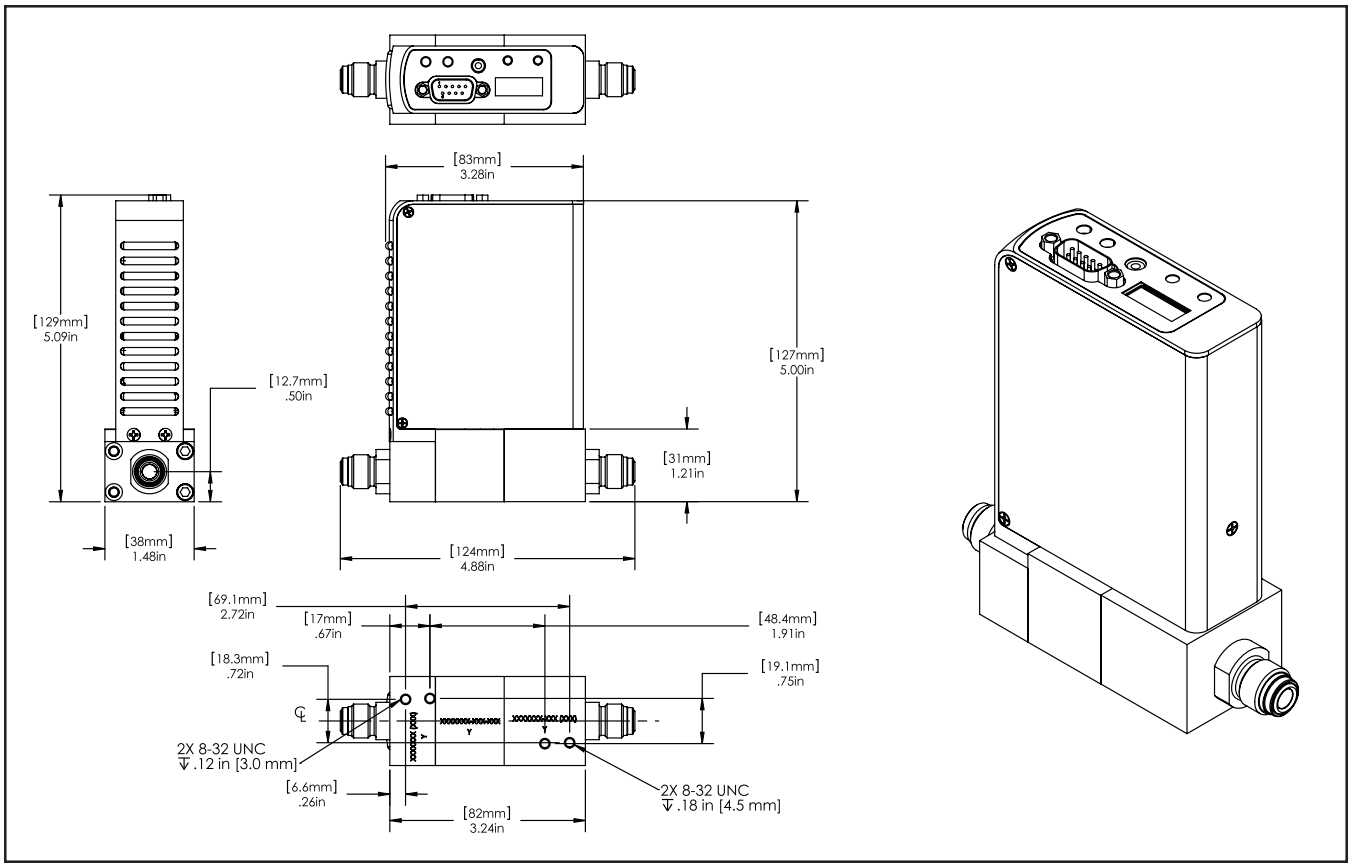


Figure D-12 Digital/Analog DB9, RS-485 124mm 1/4" VCR Fittings

LIMITED WARRANTY

Seller warrants that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and service and that the Software will execute the programming instructions provided by Seller until the expiration of the earlier of twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer.
All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense.
Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller.

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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.

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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.

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