

PIVOTAL

S Y S T E M S

GFC20™
GFC200™
GFC1000™
GFC2000™

The Future of
Flow Control



Widest Flow Range with Accuracy (Actual Gas) *0.5–100% Full Scale*

Best Flow Accuracy *±0.5% of Setpoint for 0.5–100% Full Scale*

Fastest Settling Time for Turn-On and Turndown *≤100ms: 10% - 100% Full Scale*
≤300ms: 0.5% - 10% Full Scale

Effect of Pressure and Temperature *Invariant*

Automated In Situ Calibration *NIST Traceable*

Innovative Control Technology *Robust Design, No Orifice*

Introduction

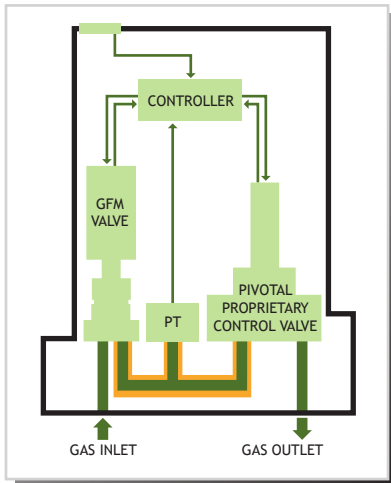
As process geometries within the semiconductor industry continue to shrink to 3nm and beyond, the need for highly accurate, responsive and repeatable gas flow control during wafer processing is essential. With the emergence of low gas flow rates, short processing times and continuous plasma processing, best-in-class MFCs are struggling to meet the accuracy, settling time and repeatability requirements demanded to ensure high yield and matched chambers.

Pivotal Systems' GFC paves the way for the future of gas flow control. The GFC combines Pivotal's patented, high accuracy GFM™ system with patented control valve technology. As such, it leapfrogs the current MFC technology by offering an order of magnitude improvement on key flow metrics, thereby enabling advanced wafer-manufacturing processes.

Feature Description

Automated Calibration and In Situ Diagnostics

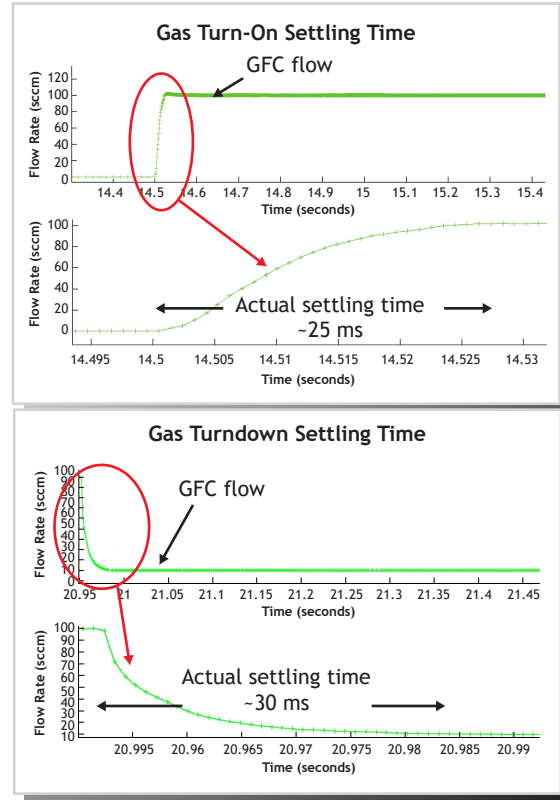
The GFC executes a robust calibration sequence on every run. This feature, unique to the Pivotal GFC, results in highly accurate NIST traceable measurements run-to-run and reduces downtime significantly.



PT PRESSURE TRANSDUCER
 NIST TRACEABLE CALIBRATED VOLUME

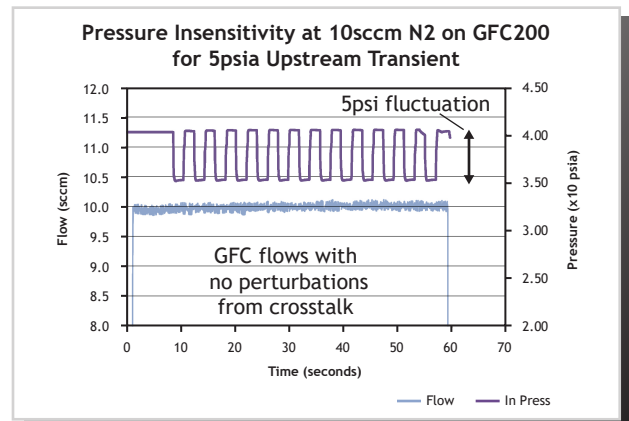
Settling Time

The GFC offers best-in-class settling times for flow controllers by providing settling times below 100 ms for both the gas turn-on and gas turndown. Refer to the following graphics.



Pressure and Temperature

The unique design of the Pivotal valve results in the GFC being unaffected by variations in the upstream or downstream pressure or temperature. The GFC does not need a temperature coefficient. Highly sensitive sensors monitor the gas pressure and temperature every milli-second and the control scheme accounts for any variations.



GFC Specifications

Performance	Flow range	0.1 - 2000 sccm (4 part numbers to cover this range)
	Flow Accuracy	±0.5% of Setpoint for actual gas: 0.1 - 20 sccm (GFC20) 1 - 200 sccm (GFC200) 5 - 1000 sccm (GFC1000), 10 - 2000 sccm (GFC2000)
	Settling Time	10% - 100% FS ≤ 100 ms, 0.5% - 10% FS ≤ 300 ms *
	Leak Integrity	≤ 1E-9 atm.cc/sec (He)
	Leak By Rate	0.01 sccm (GFC20), 0.1 sccm (GFC200), 0.5 sccm (GFC1000), 1.0 sccm (GFC2000)
	Repeatability	±0.2% of setpoint for 0.5%-100% FS
Operating Conditions	Supply Pressure	Standard: 100 - 300kPaG (14.5 - 43.5 psig) Low pressure gases C4H9F, SiH2Cl2, C3H10Si, BCl3, C4F6, C4F6-q, C4F8, C5F8, SiCl4 and WF6 the inlet pressure range can be as low as -81 kPaG (-11.7 psig) Refer to the Gas Bin Table on page 5 & 6 for the specific ranges.
	Downstream Pressure	Vacuum to 53 kPa (0 - 400 Torr)
	Proof Pressure	2.07 MPaG (300 psig)
	Design Pressure (Burst Pressure)	2.65 MPaG (385 psig)
	Operating Temperature	Standard: 15-50°C
Materials	Wetted Surface	316 SS per Semi F20
	Surface Finish	5 µin average Ra
	Seals	Metal (PCTFE - Optional)
Electrical	EtherCAT	24 VDC
	DeviceNet	11 - 24 VDC, 5 W
	Analog and RS-485	±15 VDC, 150 mA
	In-Rush Current	<200 mA

* There is a setpoint hold-time of 60 milliseconds during Analog control. This time is in addition to the reported settling time of this device. When running using Analog control, the GFC has a minimum setpoint sensitivity of ±50mV. The flow accuracy is unaffected. The measured setpoint and corresponding flow feedback may be different from the commanded setpoint by up to that amount. Analog calibration is recommended to align device input to the controller output.

Communication Protocols

Supported Protocols

The GFC supports analog, DeviceNet, RS-485 and Ethercat communication protocols.

Analog and RS-485 Interface

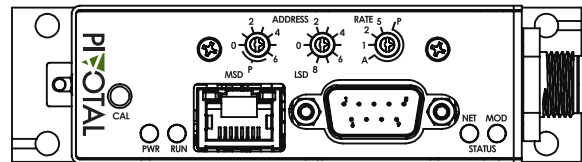
A 9-pin male D-sub connector on top of the GFC enclosure (right) is for operating in the analog and RS-485 modes.

DeviceNet Interface

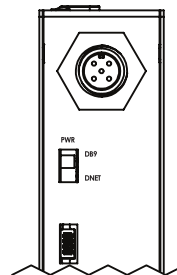
The industry standard, ODVA-compliant DeviceNet *thin* cable with a *micro* connector is located on the side of the GFC enclosure. The table on the right defines this connector's pins.

Ethercat Interface

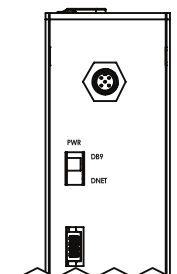
A 5 pin M8 power connector is located on the side of the GFC enclosure. The table on the right defines this connector's pins. Please refer to page 9 for a diagram of the communications port locations. Contact a sales representative for the ESI file.



For the analog and RS-485 modes, a suitable mating connector is Tyco PN# 1-747943-6.



DeviceNet		
Pin	Signal Name	Specification
1	Drain	
2	V+	+11 VDC to +24 VDC
3	V-	0 VDC
4	CAN_H	
5	CAN_L	



Ethercat		
Pin	Signal Name	Specification
1	V+	+24 VDC
2	Chassis Ground	
3	Power Common	
4	Unassigned	
5	Unassigned	

Product Description Code

Code	Description	Option	Option Description													
I	Base Model	GFC	Gas Flow Controller													
II	Special Application	XX	Standard Application													
		LP	Low Pressure Gases*													
III	Configurability	C	Multi-gas Standard Bins													
		X	Gas Configured													
IV	Gas or Standard Bins	XXXX XXXX	Specific Semi Gas Code and Range													
		PS01-020C	Pivotal Systems Standard Bin 01 0.1-20 sccm N2													
		PS02-200C	Pivotal Systems Standard Bin 02 21-200 sccm N2 **													
		PS03-001L	Pivotal Systems Standard Bin 03 201-1000 sccm N2 **													
		PS04-002L	Pivotal Systems Standard Bin 04 1001-2000 sccm N2 **													
V	Fitting & Body Width	01	VCR 1.125"													
		02	C-Seal 1.125"													
		03	W-Seal 1.125"													
		06	VCR 1.125" with PCTFE valve seats													
		07	C-Seal 1.125" with PCTFE valve seats													
		08	W-Seal 1.125" with PCTFE valve seats													
		09	VCR 1.125" with PCTFE in GFM valve seat Only													
		10	C-Seal 1.125" with PCTFE in GFM valve seat Only													
		11	W-Seal 1.125" with PCTFE in GFM valve seat Only													
		VI	Valve Configuration	C	Normally Closed											
		VII	Downstream Condition	V	Vacuum											
A	Atmospheric - This option can be used for all gases except low pressure gases. Inlet pressure must be ≥60 psia															
VIII	Communication Options	Option	I/O	Connector	Power on State	Full Scale Setting	Full Scale Setting	Full Scale Setting	Poll I/O Instance Producer	Poll I/O Instance Consumer	Poll I/O State Transition	SP Delay in ms	External Baud Rate	Mac ID		
		DA	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	2	7	Executing	0	500KB	63		
		DB	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	21	7	Executing	0	500KB	63		
		DC	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	2	8	Executing	0	500KB	63		
		DD	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	21	8	Executing	0	500KB	63		
		DE	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	6	8	Executing	0	500KB	63		
		DF	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	22	7	Executing	0	500KB	63		
		DG	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	3	7	Executing	0	500KB	63		
		DH	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	3	7	Executing	0	500KB	63		
		DI	DeviceNet	5 Pin Micro	Idle	SCCM	Float	6000h	14	19	Executing	0	500KB	63		
		DJ	DeviceNet	5 Pin Micro	Idle	SCCM	Float	6000h	23	20	Executing	0	500KB	63		
		DK	DeviceNet	5 Pin Micro	Idle	SCCM	Float	7FFFh	13	19	Executing	0	500KB	63		
		DL	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	6	8	Executing	0	500KB	63		
		DM	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	2	7	Executing	0	500KB	63		
		DN	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	22	7	Executing	0	500KB	63		
		DO	DeviceNet	5 Pin Micro	Idle	Count	Integer	6000h	22	8	Executing	0	500KB	63		
		DP	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	3	7	Executing	500 ms	500KB	63		
		DQ	DeviceNet	5 Pin Micro	Idle	Count	Integer	7FFFh	1	8	Executing	0	500KB	63		
		DR	DeviceNet	5 Pin Micro	Idle	Count	Integer	603d	22	8	Executing	0	500KB	63		
		EA	Ethercat	Comm: RJ45 Pwr: 5 pin Nano	INIT	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	
		Analog DB9 Pin-Out														
		Option	I/O	Connector	Valve Override	Flow Feedback	Power Supply +	Power Supply Common	Power Supply -	Flow Setpoint	Signal Ground	RS 485 +	RS 485 -	Test Point		
		AA	Analog	9-pin D	1	2	3	4	5	6	7	8	9	NA		
		AB	Analog	9-pin D	1	2	3	4	5	6	7, 8	NA	NA	9		
		AC	Analog	20-pin Honda	14	3	4	2	16	11	12	8	9	NA		
		AD	Analog	20-pin Honda	14	3	4	2	16	5	12	8	9	NA		
		AG	Analog	Card Edge-RJ11	J	3	4	2	F	A	B+C+10	3, 4	2, 3	NA		
		AH	Analog	DB9 to DB15	NA	NA	7	5	5	8	NA	NA	NA	NA		
		AK	Analog	20-pin Honda	1	2	3	4	5	6	7, 8	NA	NA	NA		
		AL	Analog	Card Edge	NA	3	4	2	F	A	B+C	NA	NA	NA		
		AM	Analog	Card Edge - Purge Enabled	D	3	4	2	F	A	B+C	NA	NA	NA		
		RA	RS-485	9-Pin D	NA	NA				NA	NA					
		RB	RS-485	9-Pin D	NA	NA				NA	NA					
RC	RS-485	9-Pin D, RJ45	NA	NA				NA	NA							
IX	Special Request	XXXX	Customer Special Request Number													

* Required for low pressure gases BCl3, C3F6, C3H2F6, C3H10Si, C4F6, C4F6-q, C4F8, C4H2F6, C4H9F, C5F8, SiH2Cl2, ClF3, SiCl4 and WF6.

** Not applicable when selecting Special Application LP (low pressure gases).

***The 1.5" W-seal is not available for 20 sccm GFC (Bin 1)

Note: If other configurations are required, please contact your sale representative.

Gas Bin Table (Page 1 of 2)

Title Gas	Gas #	Bin 1: 20 sccm			Bin 2: 200 sccm			Bin 3: 1000 sccm			Bin 4: 2000 sccm			Inlet Pressure Range (psig)	Max Down-stream Pressure (Torr)
		Min Flow	FS Setting		Min Flow	FS Setting		Min Flow	FS Setting		Min Flow	FS Setting			
			Min	Max		Min	Max		Min	Max		Min	Max		
Air	8	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
Ar	4	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
BCl ₃	70	0.1	6	10	1	11	100	5	101	500	-	-	-	0.3 - 8.2	400
C ₂ F ₆	118	0.1	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5/>35.3*	400
C ₂ F ₄ O	400	0.1	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5	400
C ₂ H ₂ F ₄	156	0.1	6	20	1	21	100	5	101	1000	10	1001	2000	14.5 - 43.5	400
C ₂ H ₃ F ₃	348	0.1	6	10	1	11	100	5	101	500	10	501	1000	14.5 - 43.5	400
C ₂ H ₆	54	0.1	6	20	1	21	100	5	101	1000	10	1001	2000	14.5 - 43.5	400
C ₂ H ₆ O	73	0.1	6	20	1	21	100	5	101	1000	10	1001	2000	14.5 - 43.5	400
C ₃ F ₆	138	0.1	6	20	1	21	200	5	201	500	-	-	-	3.3 - 43.5	400
C ₃ F ₈	128	0.1	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5	400
C ₃ H ₂ F ₄	393	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
C ₃ H ₂ F ₆	267	0.1	6	10	1	11	100	5	101	500	-	-	-	0.3 - 25	400
C ₃ H ₆	61	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
C ₃ H ₈	89	0.1	6	20	1	21	100	5	101	1000	10	1001	2000	14.5 - 43.5	400
C ₃ H ₈ O	187	0.1	6	10	1	11	100	5	101	500	10	501	1000	14.5 - 43.5	400
C ₃ H ₁₀ Si (TMS)	190	0.1	6	20	1	21	200	5	201	500	-	-	-	3.3 - 7.2	400
C ₄ F ₆	270	0.1	6	10	1	11	100	5	101	500	-	-	-	0.3 - 22.6	400
C ₄ F ₆ -q	297	0.1	6	10	1	11	100	5	101	500	-	-	-	0.3 - 15.9	400
C ₄ F ₈	129	0.1	6	20	1	21	200	5	201	500	-	-	-	3.3 - 29.2	400
C ₄ F ₈ -i	236	-	6	20	1	21	200	5	201	500	-	-	-	0.3 - 30	400
C ₄ H ₁₀	117	0.1	6	10	1	11	100	5	101	500	10	501	1000	0.3 - 22	400
C ₄ H ₁₀ -i	111	0.1	6	10	1	11	100	5	101	500	10	501	1000	0.3 - 38	400
C ₄ H ₂ F ₆	402	0.1	6	10	1	11	100	5	101	500	-	-	-	0.3 - 8	400
C ₄ H ₉ F	387	0.1	6	20	1	21	200	5	201	500	-	-	-	-3.7	Vacuum
C ₅ F ₈	266	0.1	6	10	1	11	100	5	101	500	-	-	-	-3.7 - -0.2	Vacuum
CF ₃ I	360	0.1	6	20	1	21	200	5	201	500	-	-	-	14.5 - 43.5/>35.3*	400
CF ₄	63	0.1	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5/>35.3*	400
CH ₂ F ₂	160	0.1	6	20	1	21	200	5	201	1000	10	1001	1500	14.5 - 43.5/>35.3*	400
CH ₃ F	33	0.1	6	20	1	21	200	5	201	1000	10	1001	1500	14.5 - 43.5/>35.3*	400
CHF ₃	49	0.1	6	20	1	21	200	5	201	1000	10	1001	1200	14.5 - 43.5	400
CH ₄	28	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
ClF ₃	77	0.1	6	10	1	21	100	5	101	500	-	-	-	0.3 - 12	400
Cl ₂	19	0.1	6	20	1	21	200	5	201	1000	10	1001	1500	14.5 - 43.5/>35.3*	400
CO	9	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
CO ₂	25	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
COS	34	0.1	6	20	1	21	200	5	201	1000	10	1001	1500	14.5 - 43.5/>35.3*	400
COS-Special	5022	0.1	6	20	1	21	200	5	201	1000	10	1001	1500	14.5 - 43.5/>35.3*	400
F ₂	18	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
GeH ₄	43	0.1	6	20	1	21	100	5	101	1000	10	1001	2000	14.5 - 43.5	400
H ₂	7	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
HBr	10	0.1	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5	400
HCl	11	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
He	1	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400

Sample Standard Application Model Code									
I	II	III	IV	V	VI	VII	VIII	IX	
GFC	XX	X	0004-500C	02	C	V	DA	XXXX	

Sample Pivotal System Blank Model Code									
I	II	III	IV	V	VI	VII	VIII	IX	
GFC	XX	C	PS02-200C	03	C	V	DI	XXXX	

Sample LP Application Model Code									
I	II	III	IV	V	VI	VII	VIII	IX	
GFC	LP	X	0266-500C	01	C	V	AA	XXXX	

Gas Bin Table (Page 2 of 2)

Title Gas	Gas #	Bin 1: 20 sccm			Bin 2: 200 sccm			Bin 3: 1000 sccm			Bin 4: 2000 sccm			Inlet Pressure Range (psig)	Max Downstream Pressure (Torr)
		Min Flow	FS Setting		Min Flow	FS Setting		Min Flow	FS Setting		Min Flow	FS Setting			
			Min	Max		Min	Max		Min	Max		Min	Max		
Kr	5	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
N ₂	13	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
N ₂ O	27	0.1	6	20	1	21	200	5	201	1000	10	1001	3000	14.5 - 43.5	400
Ne	2	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
NF ₃	53	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
NH ₃	29	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
O ₂	15	0.1	6	20	1	21	200	5	201	1000	10	1001	3000	14.5 - 43.5	400
PF ₃	62	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
SF ₆	110	0.1	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5/>35.3*	400
Si ₂ H ₆	97	0.1	6	20	1	21	200	5	201	1000	10	1001	1500	14.5 - 43.5	400
SiCl ₄	108	-	-	-	-	-	-	1	10	100	-	-	-	-11.7- -10.1	Vacuum
SiF ₄	88	-	6	20	1	21	200	5	201	1000	-	-	-	14.5 - 43.5	400
SiH ₂ Cl ₂	67	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	3.3 - 13.6	400
SiH ₄	39	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
SO ₂	32	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
WF ₆	121	0.1	6	10	1	11	100	5	101	500	-	-	-	-2.7 - 7.0	Vacuum
Xe	6	0.1	6	10	1	11	100	5	101	500	-	-	-	14.5 - 43.5	400
5% B ₂ H ₆ in Ar	615	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
5% B ₂ H ₆ in N ₂	654	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
6% B ₂ H ₆ in N ₂	927	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
10% B ₂ H ₆ in N ₂	666	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
2.7% C ₂ H ₄ in He	897	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
3% C ₂ H ₄ in He	878	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
30% C ₂ H ₄ in He	946	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
3% H ₂ in N ₂	597	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
4% H ₂ in N ₂	607	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
20% F ₂ in Ar	980	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
20% O ₂ in He	536	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
30% O ₂ in He	604	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
5% PH ₃ in H ₂	709	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
50% PH ₃ in SiH ₄	632	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
20% SiH ₄ in He	529	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	14.5 - 43.5	400
N ₂ Cal Atm	0	0.1	6	20	1	21	200	5	201	1000	10	1001	2000	45.3 - 75.3	760

Note: The maximum inlet pressure for non-low vapor pressure gases is 58.2 psia (401.3 kPa) flowing into vacuum up to 400T. When the gas is flowing atmosphere for verification tests the inlet pressure must be greater than 60 psia.

For any flows higher than the listed values, the upstream and downstream pressure conditions change from the standard, so please contact your sales representative to verify the pressure.

For low pressure gases C3H2F6, C3H10Si, C4H2F6, C5F8, SiCl4, BCl3, C4F6, C4F8 and WF6 a LP GFC is required. The inlet pressures stated in the table are for operation at 25C. For any flows outside this temperature and range, the gas may not perform as required.

For SiCl4, the minimum flow is 1 sccm assuming the pressure requirements are met.

If other configurations are required, please contact your sales representative.

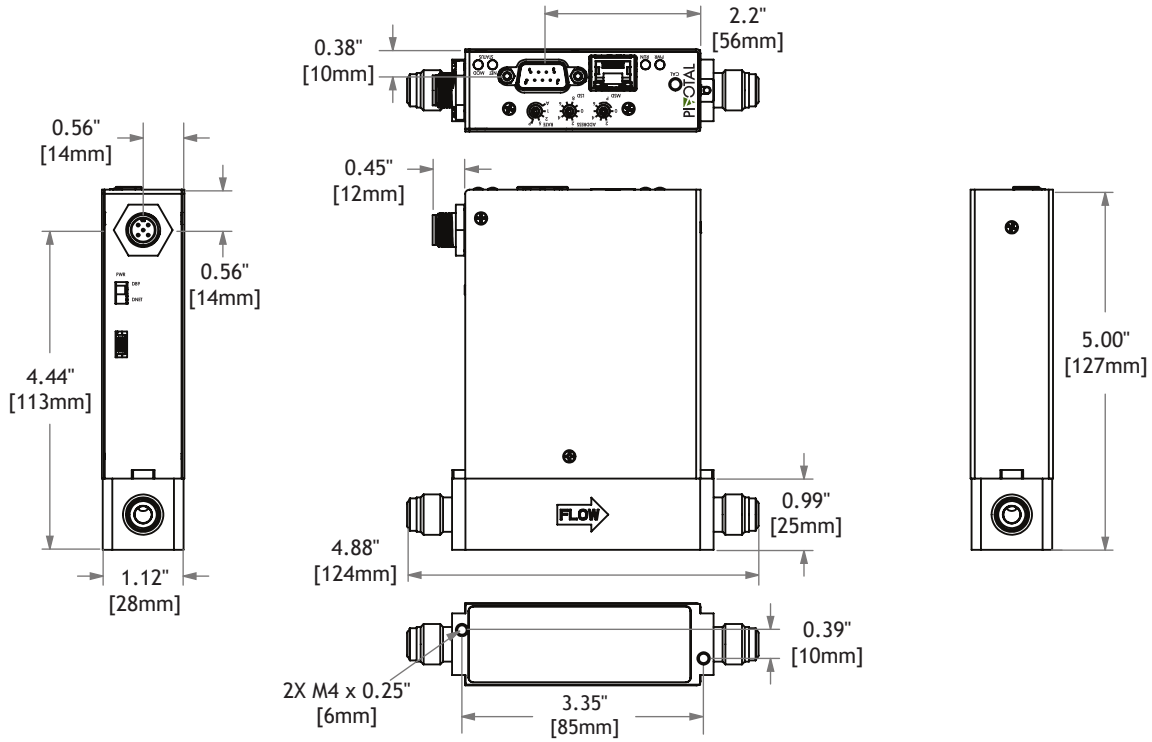
* For SF6, CF4, CF3I, CH2F2, CH3F, Cl2, COS, COS-Special, and C2F4, a customer special request (CSR126) is required with a minimum inlet pressure of 35.3psig for the specified higher full scale flows.

Sample Standard Application Model Code									
I	II	III	IV	V	VI	VII	VIII	IX	
GFC	XX	X	0654-750C	06	C	V	AB	XXXX	

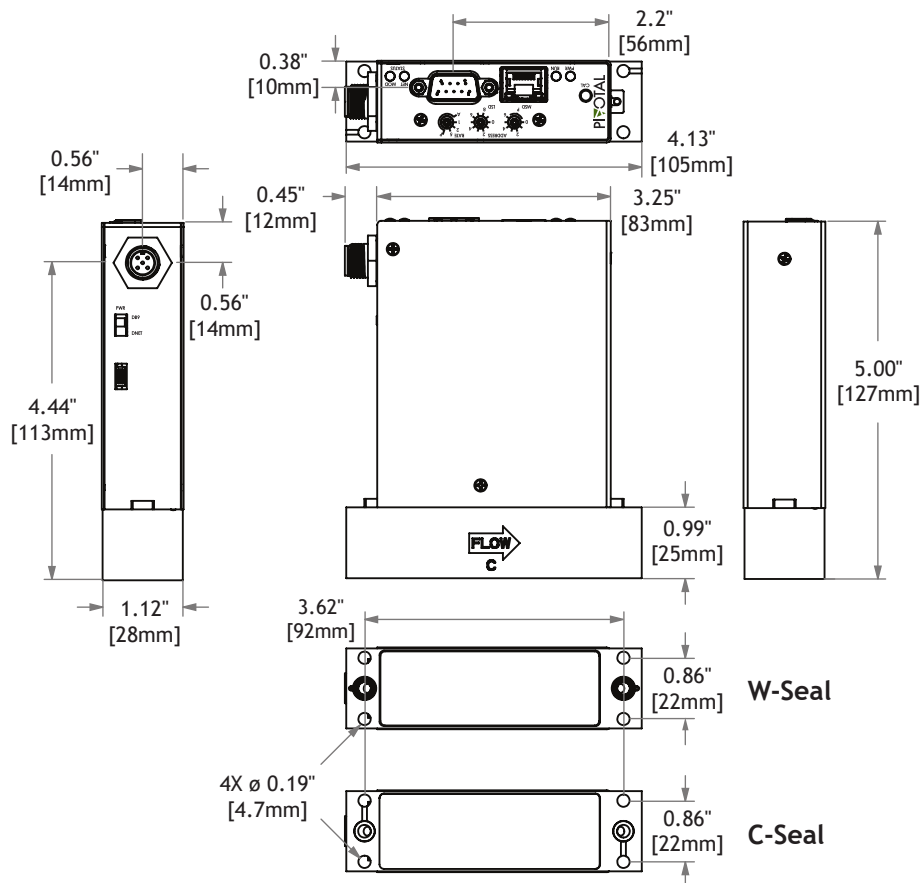
Sample Pivotal System Blank Model Code									
I	II	III	IV	V	VI	VII	VIII	IX	
GFC	XX	C	PS04-002L	07	C	V	RA	XXXX	

Sample LP Application Model Code									
I	II	III	IV	V	VI	VII	VIII	IX	
GFC	LP	X	0121-500C	08	C	V	EA	XXXX	

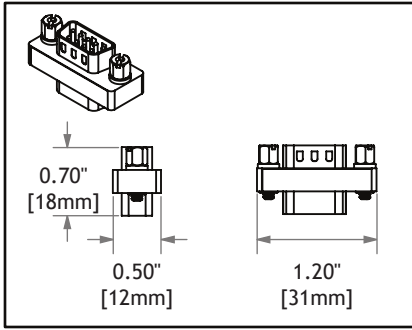
GFC VCR Dimensions



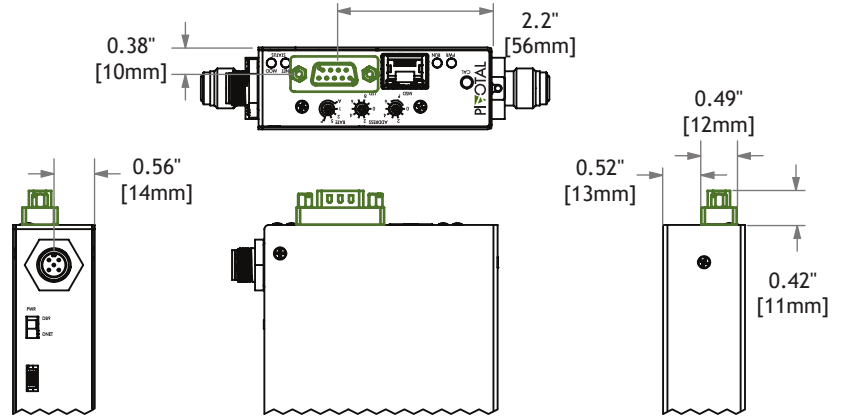
GFC C-Seal and W-Seal Dimensions



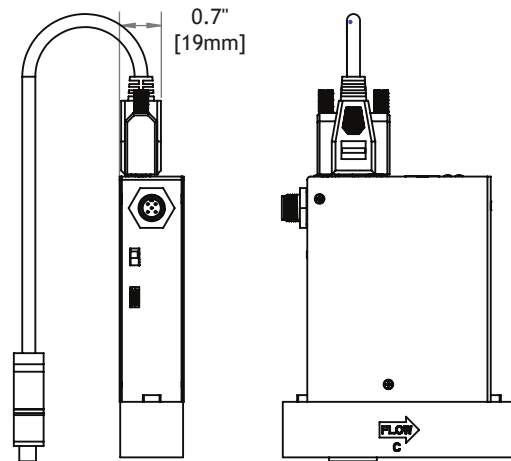
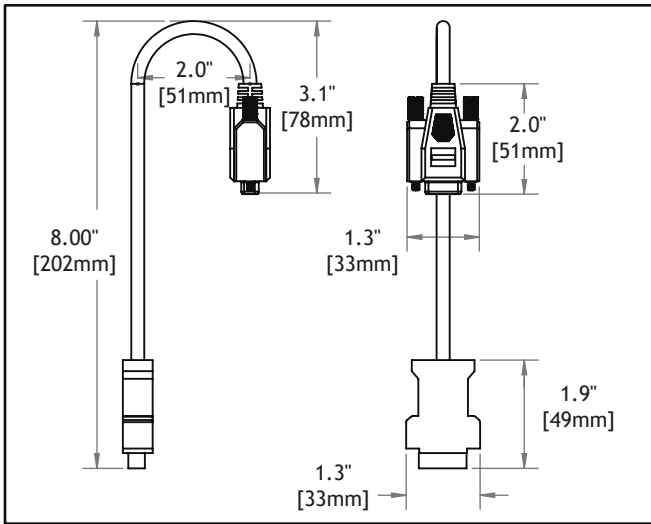
GFC Analog Adapter (AB)



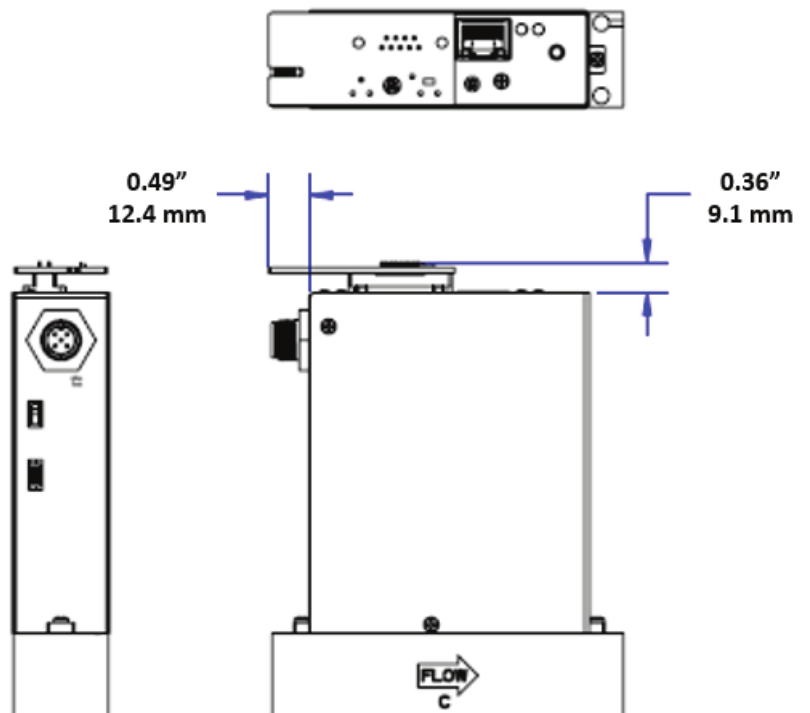
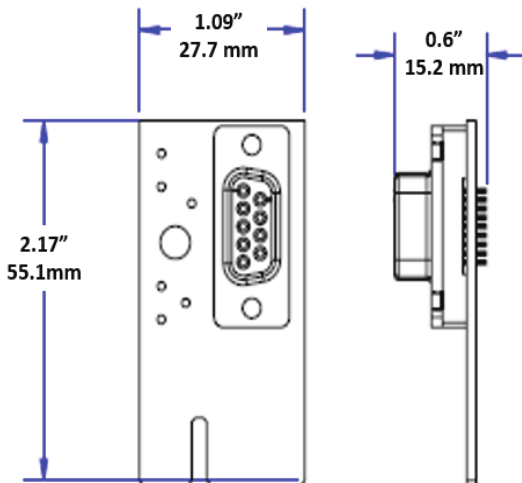
On the right is how the adapter (in green) is attached to the GFC.



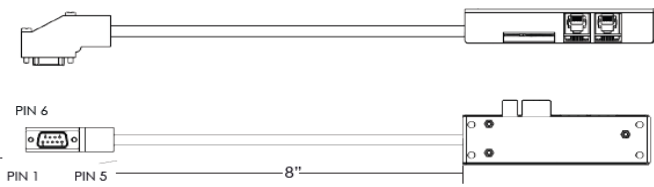
GFC Honda Adapter (AC/AD/AK)



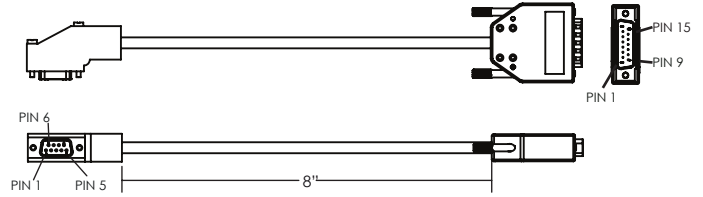
GFC Card Edge Analog Adapter (AL/AM)



GFC DB9 to Card Edge - RJ11 Cable (AG)

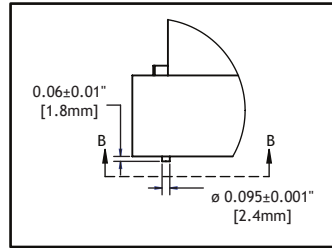
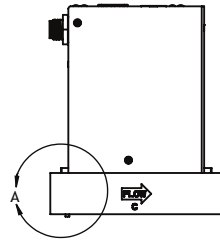


GFC DB9 to DB15 Adapter Cable (AH)

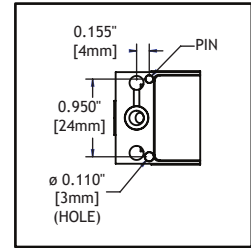


GFC C-Seal Poke Yoke Dimensions

Refer to the GFC C-seal drawing for more detail.

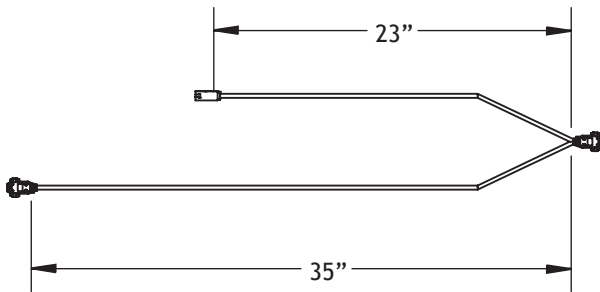


Detail A

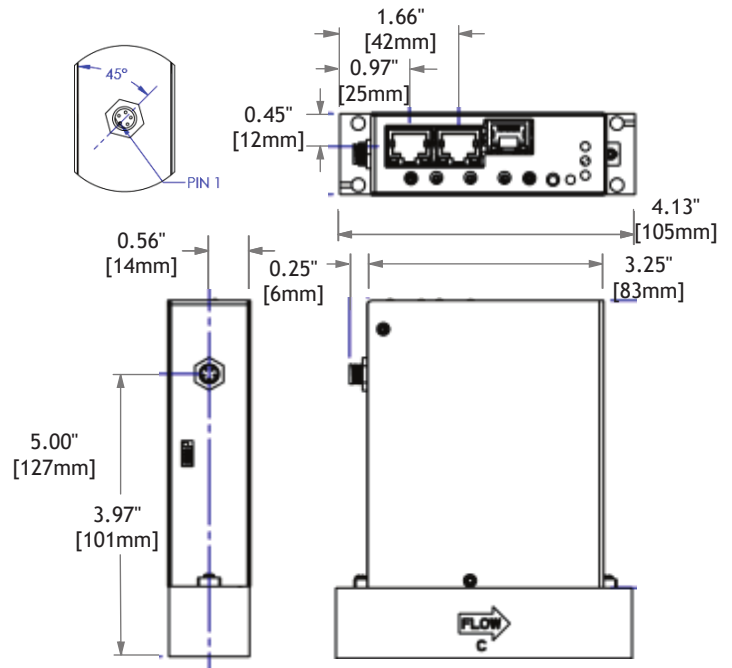


Section B-B

GFC FNET Cable (RC)



GFC Ethercat C-Seal and W-Seal Dimensions



About Pivotal

Pivotal Systems Corporation provides best-in-class monitoring and process control technology for the semiconductor manufacturing industry. Pivotal's vision is to enable an order of magnitude increase in fab productivity and capital efficiency for current and future technology nodes. This vision is achieved through its real time in situ process monitoring and control solutions. Founded in 2004 and based in Fremont, California, the company is led by veterans from the semiconductor and high-tech industries. For more information about Pivotal, visit www.pivotalsys.com or send an email to support@pivotalsys.com.

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