

## Data Sheet

DS-TMF-SLAMf-MFC-eng

November, 2008

# Brooks® Models SLAMf50, SLAMf51, SLAMf53 Mass Flow Controllers and Models SLAMf60, SLAMf61, SLAMf63 Mass Flow Meters

### General Features:

- Wide FS flow range for measurement and control of gases from 3 ccm to 2500 lpm, (N<sub>2</sub> eq.)
- Accuracy:  $\pm 1.0\%$  of rate up to 1100 lpm; 1% FS including linearity above 1100 lpm.
- Industry leading sensor stability. Long term drift performance of  $< 0.2\%$  per year. Increased system throughput by reducing maintenance and eliminating periodic recipe adjustment.
- Storage of up to 10 selectable calibration curves. Spares inventories are reduced by limiting the number of individual MFC/M's required, lowering inventory holding costs.
- NEMA 4X and IP66 weatherproof protection for 'Hosedown' applications such as: Food, Beverage, Pharmaceutical and Biotech.

### Control Response:

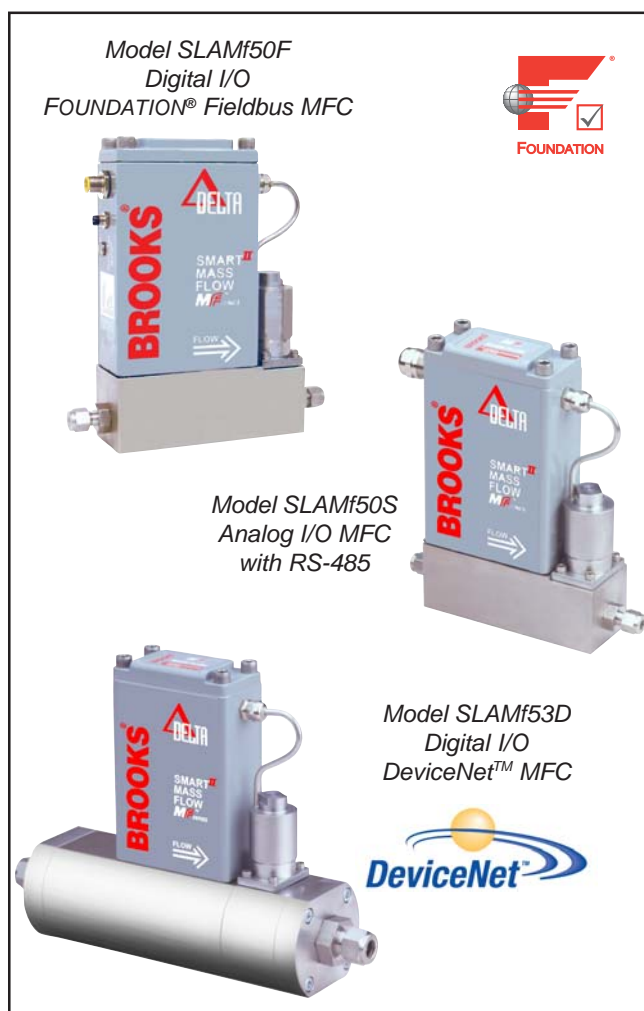
- Settling Time of less than 1 second. (better on request).
- Soft start can be used to tailor MFC performance to process requirements.
- Proprietary Adaptive Valve Control algorithm is available which assures that unexpected variations in process pressure do not cause flow to deviate from setpoint.

### Analog I/O Option:

- Cable Gland Opening (PG-11)
- Conduit Opening 1/2" NPTF or M20 x 1.5
- 0(1)-5 Volt or 0(4)-20 mA setpoint and flow signals
- Single sided 24 Volt DC power supply (13.5-27 volts DC range).
- Separate Valve-Override signal
- Precision 5 Volt Reference Output signal
- Compatible with Brooks' Model 0150 series secondary electronics
- TTL (open collector) Alarm Output signal

### Digital Communication Options:

- DeviceNet™, ODVA™ certified
- FOUNDATION™ Fieldbus, H1 Certified
- HART® based RS-485 multidrop



### DESCRIPTION

Brooks Instrument's SLAMf Series is an elastomer sealed digital thermal mass flow measurement and control instrument, which offers unparalleled flexibility and performance. The SLAMf Series MFC is designed for use in advanced gas handling systems. The result is the most accurate, repeatable, and responsive MFC on the market today!

## Brooks® Digital MFC's and MFM's

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### Wash-down Enclosure

The SLAMf Series comes equipped with an IP66 / NEMA4X rated enclosure. This makes these instruments perfect for wash-down or outdoor environments. So no matter how harsh the surroundings, the SLAMf Series keeps the process under control.

### Wide Flow Range

The SLAMf Series covers an extremely broad range of flowrates. Model SLAMf50 can have a full scale flow as low as 3 ccm. With a high turndown ratio of 50:1, accurate gas flow can be measured or controlled down to 0.06 ccm! Model SLAMf53 can meter or control gas flow up to 2500 lpm.

### Fast response Performance

The all-digital electronics and superior mechanical configuration in the SLAMf Series provide for ultra fast response characteristics. Settling times are specified as less than one second, but Brooks' Adaptive Valve Control can achieve response times of 0.2 sec.

### Broad Array of Communication Options

Brooks® offers traditional 0-5 volt and 4-20mA analog options as well as RS-485 digital communications ("S-protocol", based on HART). Brooks also offers control interface via digital network protocols like DeviceNet, a high-speed (up to 500k baud) digital communication network, or FOUNDATION® Fieldbus. Brooks' communication capabilities and device-profiles have been certified by the ODVA (Open DeviceNet Vendor's Association) and the ITK Interoperability Test Kit. Other network protocols are in development. Talk to your Brooks representative about your specific needs.

### Reduced Cost of Ownership

The SLAMf Series allows multi-gas and multi-range capabilities to reduce customer inventory. Storage and pre-programming of up to 10 gas calibrations easily permits users to switch between different gases and ranges on a single device.

## SPECIFICATIONS

### PERFORMANCE CHARACTERISTICS:

#### Flow Ranges

Models SLAMf50/SLAMf60

Any FS range from 0-3 ccm to 0-30 lpm N<sub>2</sub> eq.

Models SLAMf51/SLAMf61

Any FS range from 20-100 lpm N<sub>2</sub> eq.

Up to 200 lpm H<sub>2</sub> flow possible

Models SLAMf53/SLAMf63

Any FS range from 100-2500 lpm N<sub>2</sub> eq.

### Control Range

Turndown 50:1

### Accuracy (at calibration conditions)

±1.0% of rate (20% TO 100% FS),

±0.2% FS (below 20% FS) up to 1100 lpm (N<sub>2</sub> eq.)

(Optional: ±0.7% of rate ±0.2% FS ("S-Series" Spec.)

up to 1100 lpm (N<sub>2</sub> eq.)

Flow ranges above 1100 lpm and up to 2500 lpm (N<sub>2</sub> eq.);

±1.0% of FS.

### Repeatability

±0.20% of rate.

### Settling Time/Response Time

< 1 second to within ±2% FS of final value for a

0-100% command step (better on request)

for flow rates up to 100 lpm N<sub>2</sub> eq.

< 3 seconds to within ±2% FS of final value for a

0-100% command step (better on request)

for flow rates greater than 100 lpm N<sub>2</sub> eq. up to 2500

lpm N<sub>2</sub> eq.

### Sensitivity to Mounting Attitude

<0.2% FS maximum deviation from specified accuracy, after rezeroing.

### RATINGS:

#### Temperature Sensitivity

Zero: less than 0.05% FS per °C

Span: less than 0.05% FS per °C

#### Pressure Sensitivity

± 0.03% per psi up to 200 psig (13.79 bar) (N<sub>2</sub> eq.).

#### Maximum Operating Pressure

See Table 1

#### Pressure Equipment Directive (PED) 97/23/EC

See Table 1 below:

#### Pressure Differential Range (Controllers)

Minimum:

Model SLAMf50

5 psi (0.35 bar) up to 30 lpm N<sub>2</sub> eq.

Model SLAMf51

10 psi (0.69 bar) from 30 lpm to 100 lpm N<sub>2</sub> eq.

Model SLAMf53

7.5 psi (0.52 bar) at 500 lpm N<sub>2</sub> eq.

14.5 psi (1.00 bar) at 1000 lpm N<sub>2</sub> eq.

35.0 psi (2.41 bar) at 2500 lpm N<sub>2</sub> eq.

(consult factory for details)

High DP valve 30 to 290 psi (20 bar max.)

Low DP valve 7.5 to 30 psi (2 bar max.)

Minimum pressure drop depends on gas and FS flow rate (consult factory).

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Brooks® Digital MFC's and MFM's

Table 1 Flow Ranges and Pressure Ratings

Mass Flow Controller	Mass Flow Meter	Flow Ranges N2 Equivalent			Pressure Ratings	P.E.D. Module H Category
		Min. FS	Max. FS	Unit (2)		
Model:	Model:				Bar/psi	
SLAMF50 (1)	SLAMF60 (1)	0.003	30	lpm	100bar/1500psi	SEP
SLAMF51	SLAMF61	20	100	lpm	100bar/1500psi(3)	SEP
SLAMF53	SLAMF63	100	2500	lpm	70bar/1000psi	1 for all 150lbs flanges 2 for all other connections

(1) 300 bar (4500 psi) version optional  
(2) Referring to normal or standard conditions (on customer request)  
(3) 70 bar / 1000 psi for UL Certification

### Leak Integrity

Inboard to Outboard:  $1 \times 10^{-9}$  atm scc/sec Helium max.

### Ambient Temperature Limits

Operating: 0°C to 65°C (32°F to 149°F)  
Non-Operating: -25°C to 100°C (-13°F to 212°F)

### Fluid Temperature Limits

0°C to 65°C (32°F to 149°F)

### PHYSICAL CHARACTERISTICS:

#### Materials of Construction

Wetted parts - stainless steel with  
Viton® fluoroelastomers or Buna-N  
Optional: Kalrez®, Teflon®, Kalrez and EPDM

#### Outline Dimensions

Refer to Outline Drawings Figures 2 through 9

#### Process Connections

Refer to Outline Drawings Figures 2 through 9

### ELECTRICAL CHARACTERISTICS:

#### Electrical Connections

Analog I/O Pin Connections: (See Figure 1)  
Analog/RS-485 version: 15-pin D-Connector, male  
Digital I/O:

DeviceNet: 5-pin Micro-Connector, male  
FOUNDATION Fieldbus: 4-pin Micro-Connector, male

#### Power Supply Voltage

Analog option: (13.5-27 Vdc), 15 Vdc nominal  
Digital I/O:

DeviceNet I/O: 11-25 Vdc  
FOUNDATION Fieldbus I/O: 14-27 Vdc

### Power Requirements

	Watts, typical	Watts, max.
Analog I/O option, no valve:	1.6	1.8
Analog I/O option, with valve:	3.6	4.0
Digital I/O option, n.v.:	3.6	4.0
Digital I/O option, w.v.:	6.9	7.6

### Certifications:

#### EMC Directive 89/336/EEC:

Per EN 61326

#### Hazardous Location Classification

Non-Incendive  
Enclosure Type 4X / IP66  
Ambient Temperature:  $0^{\circ}\text{F} \geq T_{\text{amb}} \leq 150^{\circ}\text{F}$   
( $0^{\circ}\text{C} \geq T_{\text{amb}} \leq 65^{\circ}\text{C}$ )  
United States and Canada  
UL Listed: E73889 Volume1, Section 25  
UL Recognized: E73889 Volume 3, Section 4



Class1, Division 2,  
Groups A, B, C & D; Class II, Division 2  
Groups F & G; Suitable for Class III,  
Division 2; T4.  
Per UL 1604 and CSA-213

Class I, Zone 2, AEx nA II T4

Per ANSI/ISA 12.12.02 - 2003 and ANSI/UL 60079-15

Ex nA II T4

Per CSA - E79 - 15

Europe - ATEX Directive 94/9/EC

KEMA 04ATEX1290X



II 3 G EEx nA II T4  
II3 D T 135°C



Per EN 50021

#### Pressure Equipment Directive (97/23/EC)

See pressure Table 1 for further information

#### PC-based Support Tools

See Instruction manual X-TMF-SLAMf-MFC-eng  
for more information.

# Brooks® Digital MFC's and MFM's

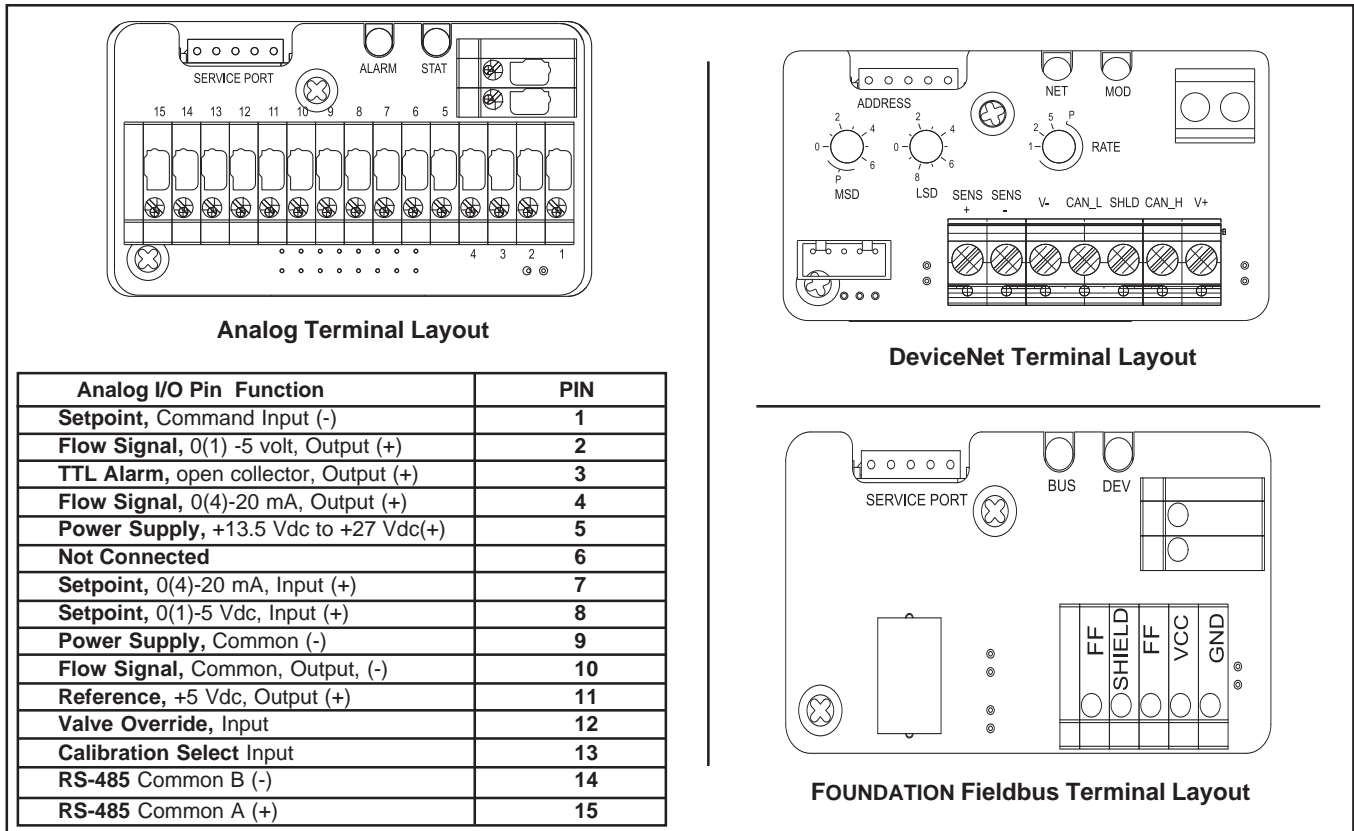


Figure 1 Analog, DeviceNet and FOUNDATION Fieldbus Terminal Layouts

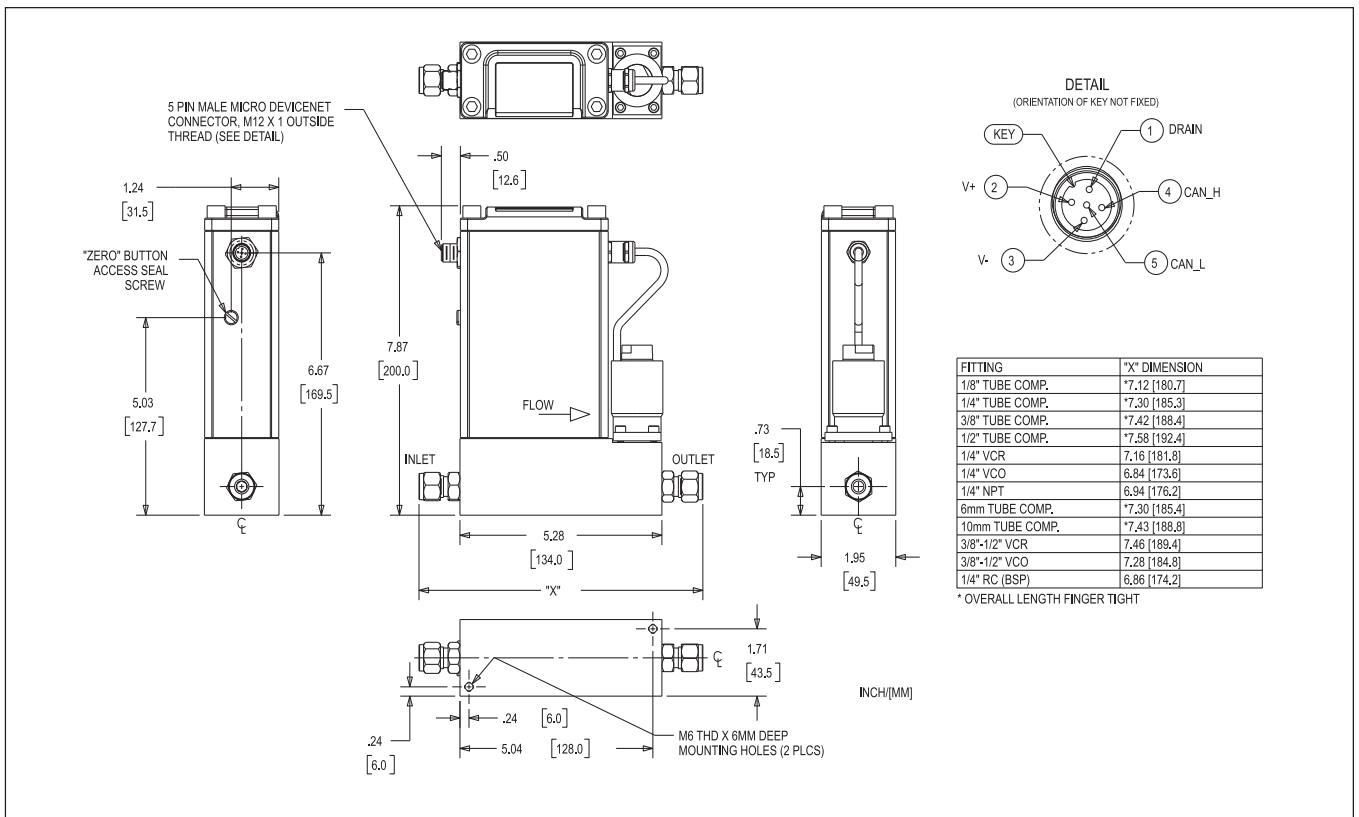


Figure 2 Model SLAMf50D Digital I/O DeviceNet MFC

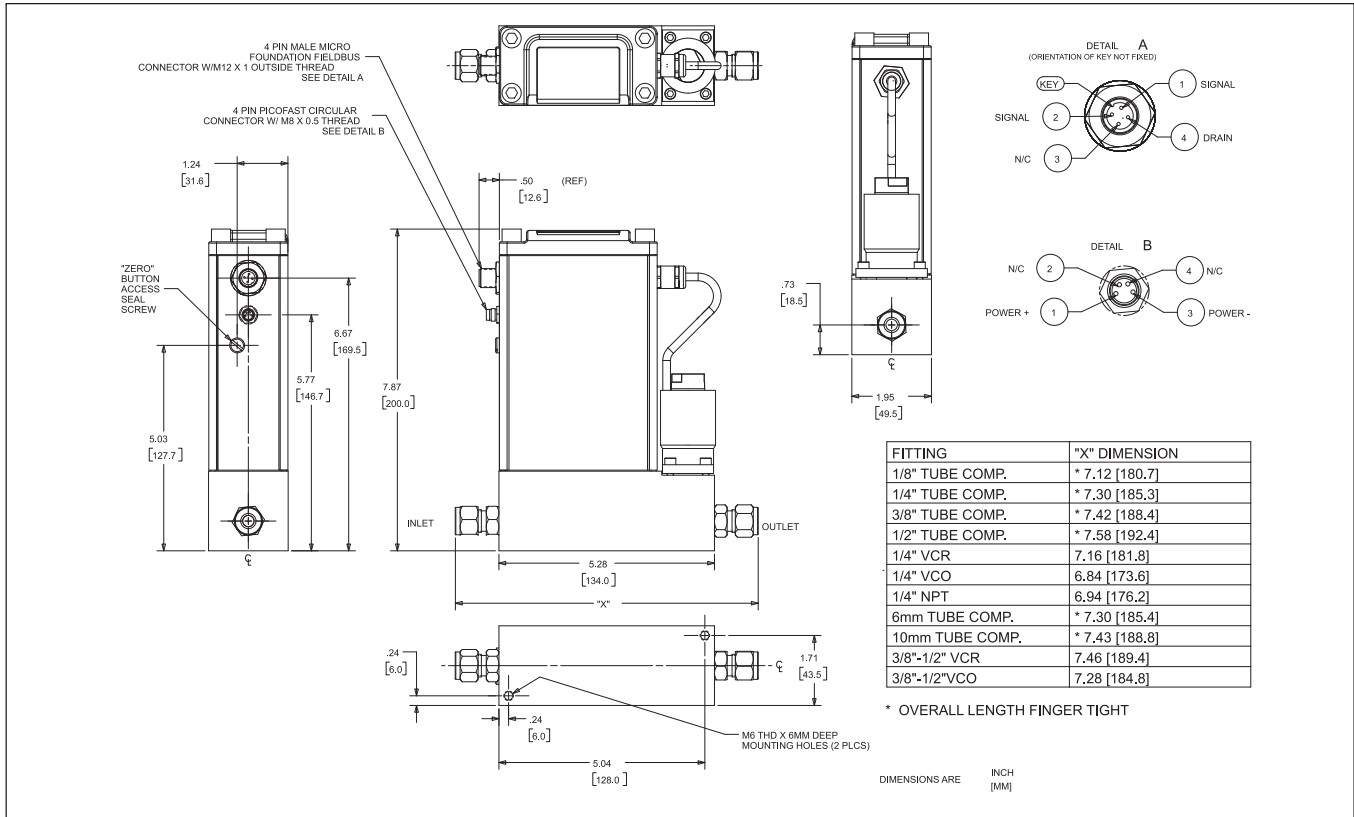


Figure 3 Model SLAMf50F Digital I/O FOUNDATION Fieldbus MFC

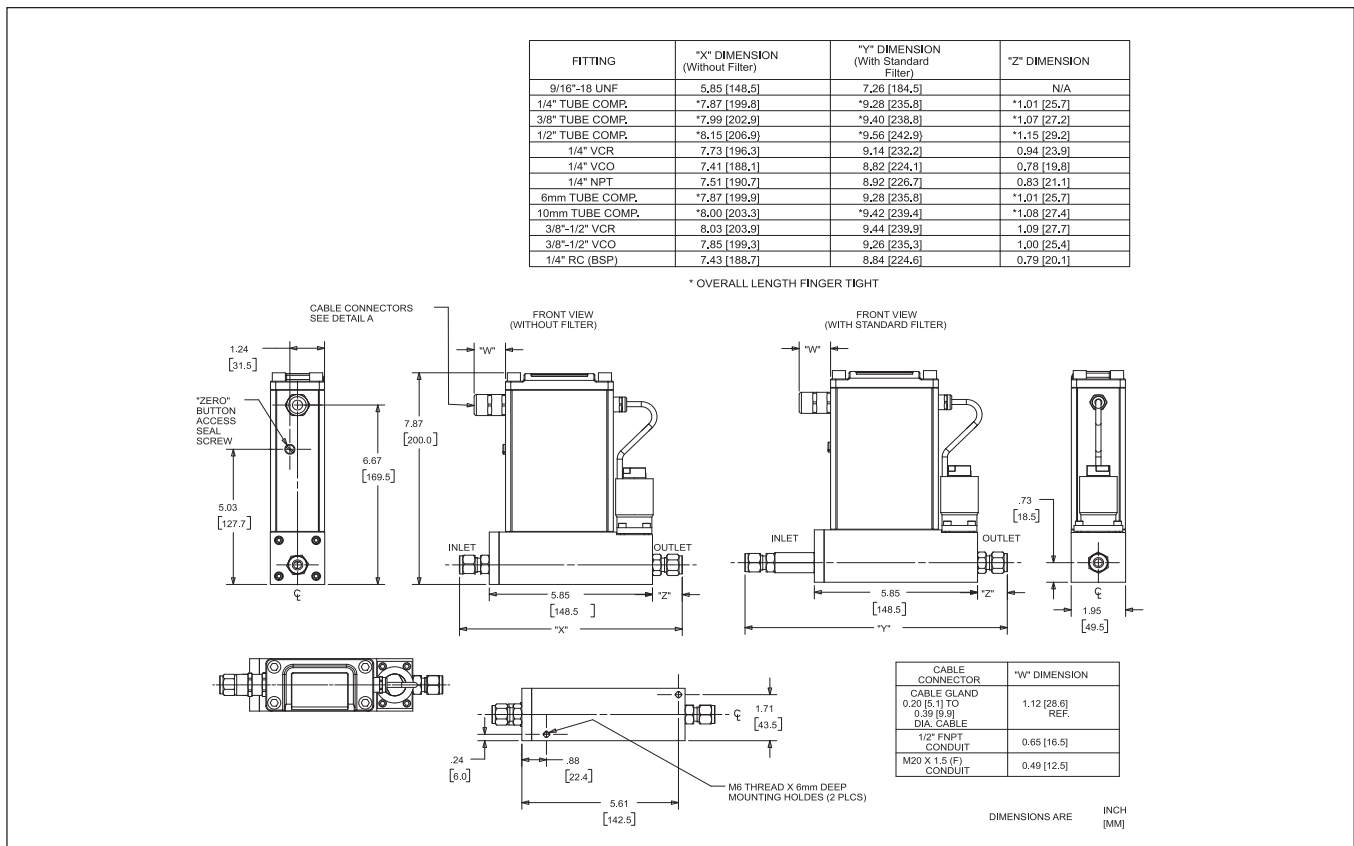


Figure 4 Model SLAMf51 with Cable Gland (PG11, M20 x 1.5, 1/2" NPT) MFC

# Brooks® Digital MFC's and MFM's

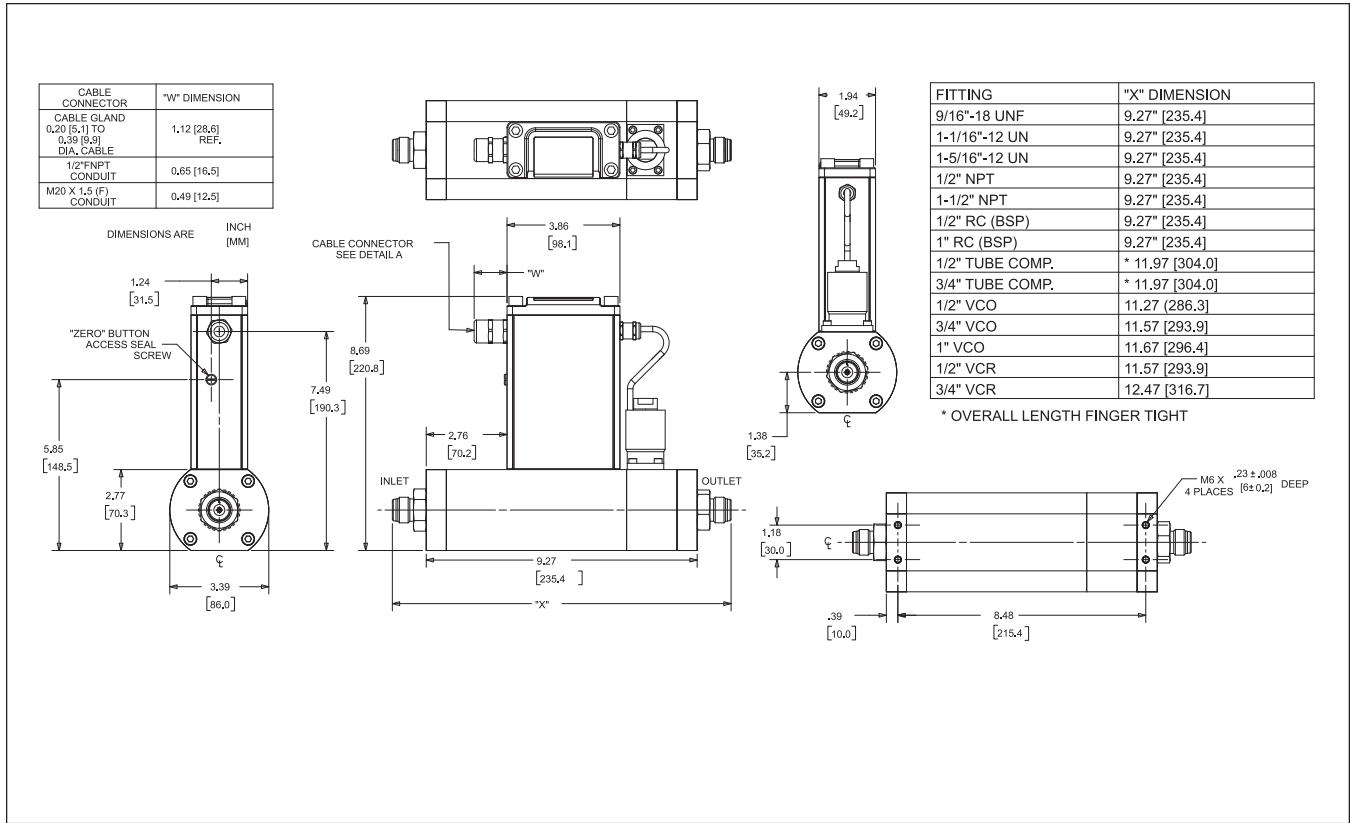


Figure 5 Model SLAMf53 with Cable Gland (PG11, M20 x 1.5, 1/2" NPT) MFC

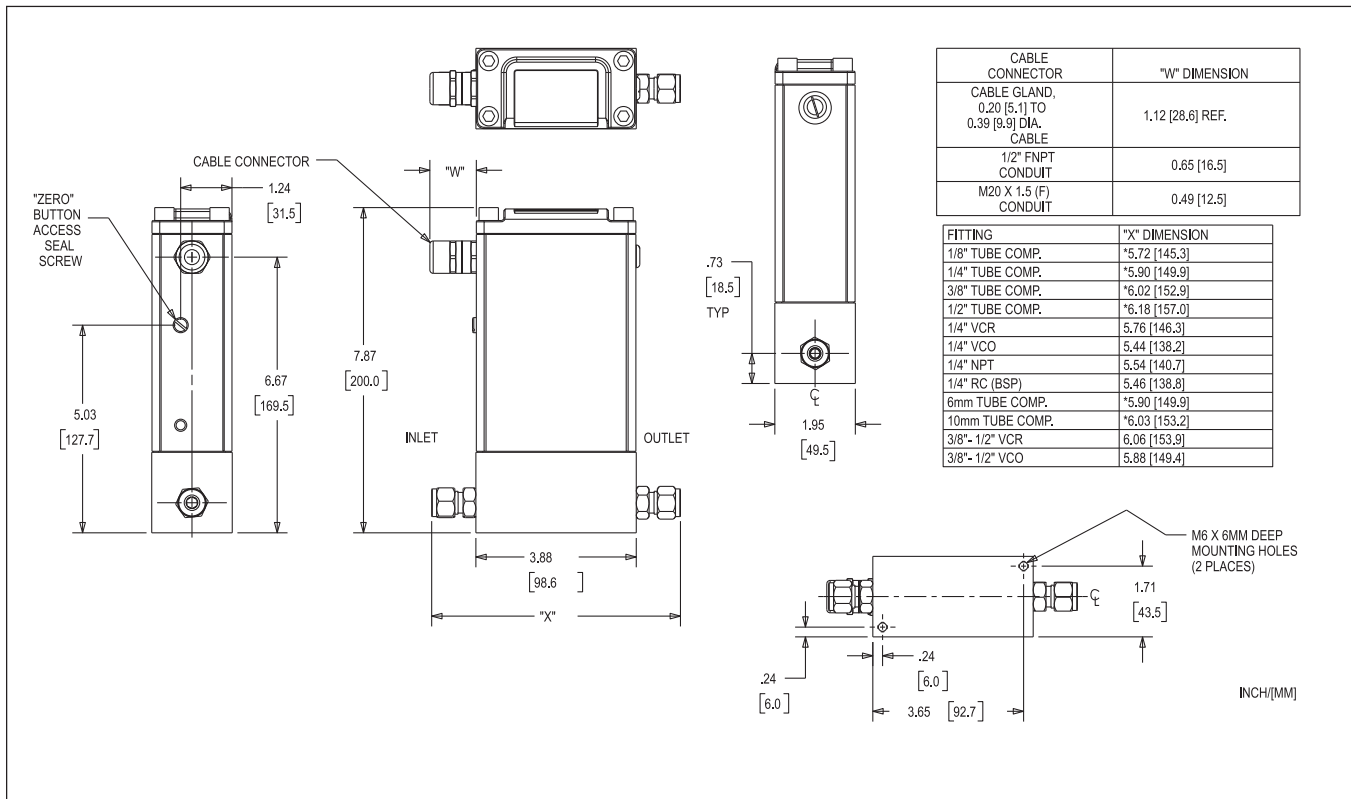


Figure 6 Model SLAMf60 with Cable Gland (PG11, M20 x 1.5, 1/2" NPT) MFM

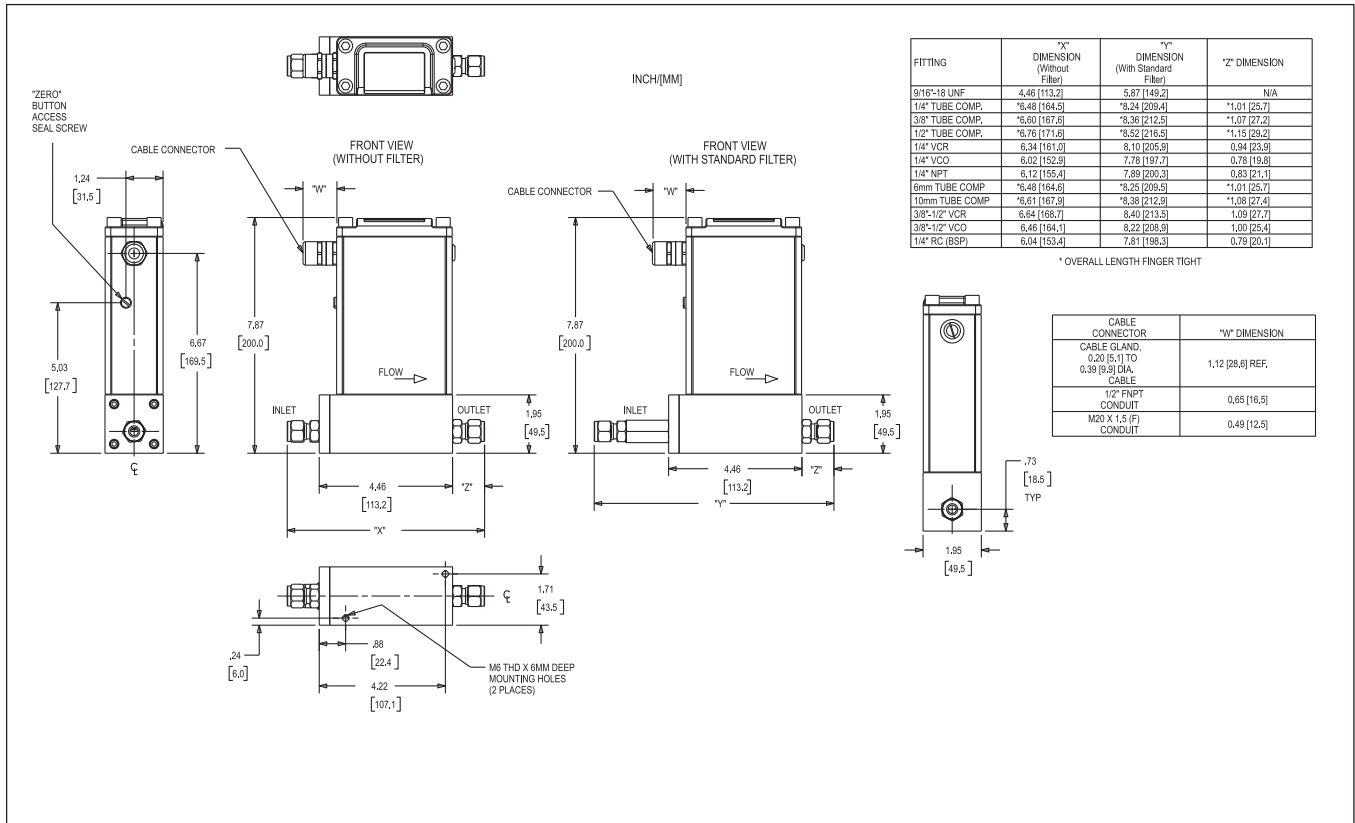


Figure 7 Model SLAMf61 with Cable Gland (PG11, M20 x 1.5, 1/2" NPT) MFM

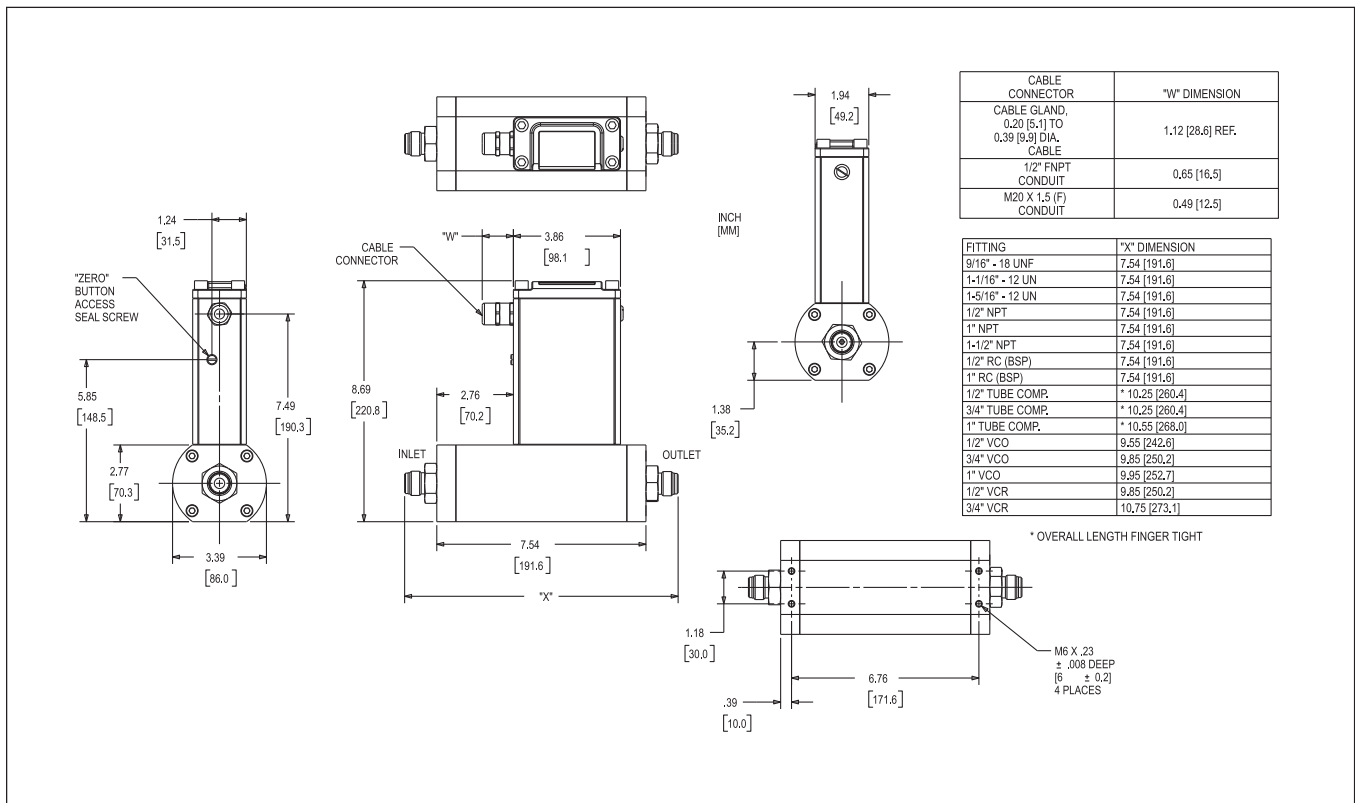


Figure 8 Model SLAMf63 with Cable Gland (PG11, M20 x 1.5, 1/2" NPT) MFM

## Brooks® Digital MFC's and MFM's

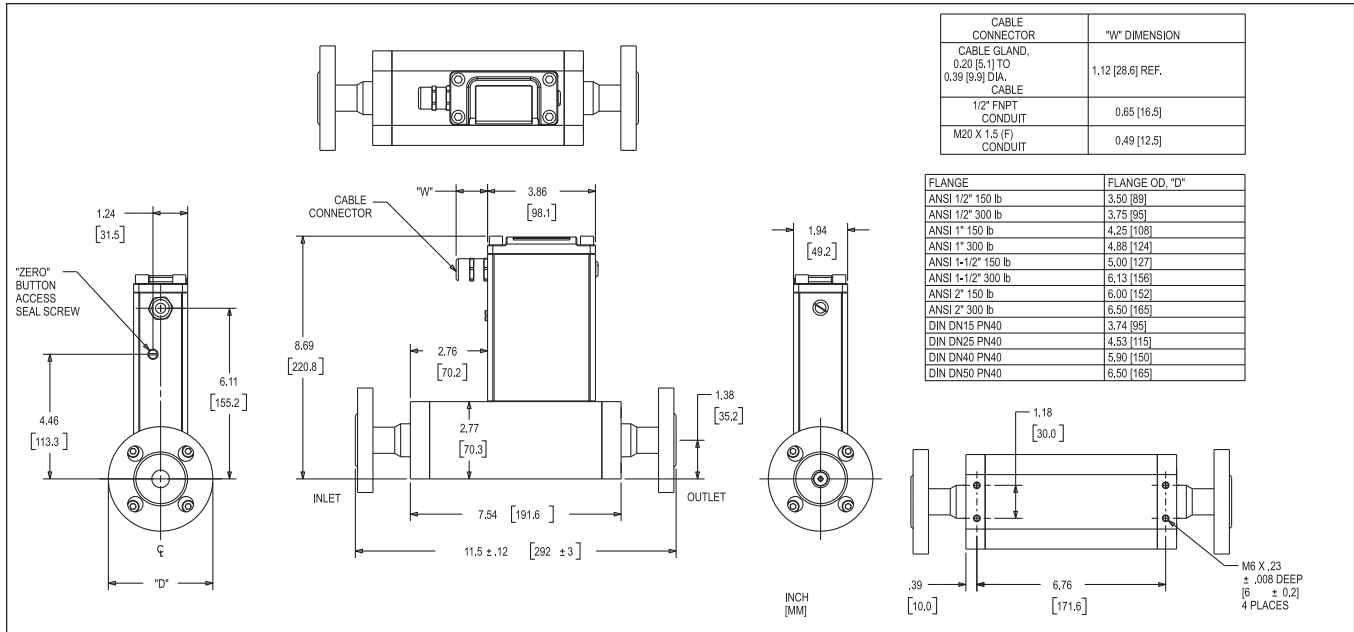


Figure 9 Model SLAMf63 with Cable Gland (PG11, M20 x 1.5, 1/2" NPT) with Flanged Connections MFM

### BROOKS SERVICE AND SUPPORT

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

Visit [www.BrooksInstrument.com](http://www.BrooksInstrument.com) to locate the service location nearest to you.

### START-UP SERVICE AND IN-SITU CALIBRATION

- Brooks Instrument can provide start-up service prior to operation when required, if necessary under in-situ conditions, and the results will be traceable to the relevant international quality standards.

### CUSTOMER SEMINARS AND TRAINING

- Brooks can provide customer seminars and dedicated training to engineers, end users and maintenance persons.

### HELP DESK

In case you need technical assistance:

Americas ☎ 1-888-554-FLOW  
 Europe ☎ +(31)-318-549-290 Within Netherlands ☎ 0318-549-290  
 Asia ☎ +011-81-3-5633-7100



Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

### TRADEMARKS

Brooks ..... Brooks Instrument, LLC  
 DeviceNet ..... Open DeviceNet Vendors Association, Inc.  
 FOUNDATION Fieldbus ..... Fieldbus FOUNDATION  
 HART ..... HART Communications Foundation  
 ITK ..... Fieldbus FOUNDATION  
 Kalrez ..... DuPont Dow Elastomers  
 ODVA ..... Open DeviceNet Vendors Association, Inc.  
 Teflon ..... E.I. DuPont de Nemours & Co.  
 VCO ..... Cajon Co.  
 VCR ..... Cajon Co.  
 Viton ..... DuPont Performance Elastomers

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