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mks

Flow Solutions

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MF1

COMPACT, GENERAL PURPOSE MFC

The MF1 is a compact general purpose mass flow controller (MFC) with an all-metal sensor. The MF1 has multiple features and broad flexibility making it ideal for a wide range of applications. Full Scale ranges are available from 10 sccm up to 50 slm, providing fast, repeatable flow control to as low as 0.2 sccm. The MF1 is available in a number of process interfaces (Analog, EtherCAT®, PROFIBUS®-DP, PROFINET®, Modbus/RS485, USB, etc.) which allow easy and simple compatibility with a wide range of control equipment. The USB setup interface provides not only a means for configuration and diagnostics, but also serves as a communication link in non-industrial applications, e.g. use in a laboratory.

The small 2.8 x 1 inch (77 x 25 mm) footprint enables compact gas supply systems with improved performance compared to existing mass flow controllers. The MF1 employs the latest design in thermal sensors for mass flow measurement, with fast acting proportioning valve and control circuitry for fast settling time. The control valve is normally closed. Mass Flow Meter (MFM) versions of the MF1 are also available.

The MF1 can be powered either with +24VDC or ±15VDC, and thus is compatible with MFC power supplies and displays electronics from MKS or most other manufacturers.

Features & Benefits

For Demanding Processes

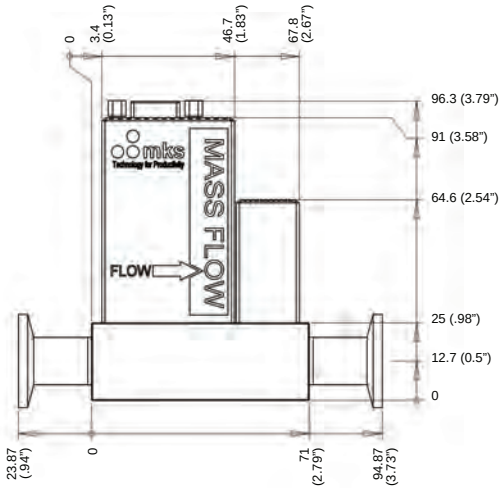
- Full Scale flow ranges from 10 sccm to 50 slm for precise and repeatable flow measurement and control across a wide range of applications
- Various process interfaces available: Analog, USB, PROFIBUS-DP, Modbus/ RS485, Modbus TCP, EtherCAT, PROFINET (other interfaces on request) for easy compatibility with tool controllers
- USB setup interface allows easy configuration and diagnostics with standard Microsoft® Windows tools (Windows Explorer, etc.)
- Multiple supply voltages (+24 VDC and ±15 VDC) for easy interface and tool compatibility
- Percent of Reading accuracy gives a broad dynamic range
- Multigas / multi-range for 16 gases reduces required MFC inventory
- Low internal leak rate of $<10^{-5}$ mbar l/sec (He)

Robust, Reliable Design

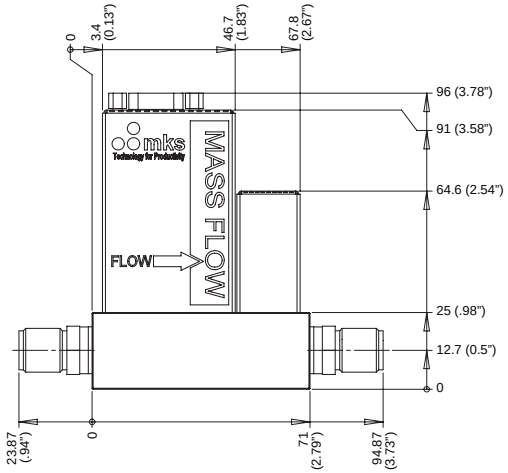
- Minimal use of elastomer seals enables use in demanding processes
- Compact 2.8” x 1” footprint (71.0mm x 25.4mm) without flanges
- Fast warm-up time minimizes expensive production downtime
- Compatible variants with earlier MKS MFCs and power supply and readout modules

Dimensional Drawings

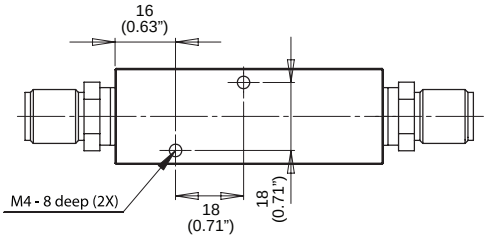
Front View MF1 (DN 16 KF)



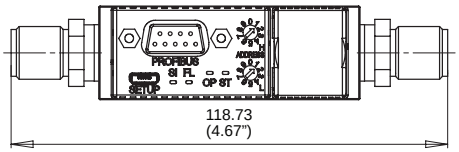
Front View MF1 (4 VCR male)



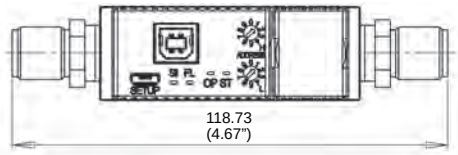
Bottom View MF1 (4 VCR male)



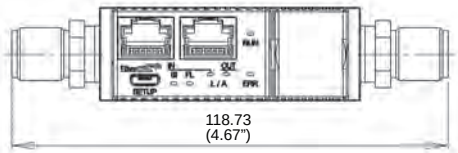
Top View MF1 (Process Version, 4 VCR male)



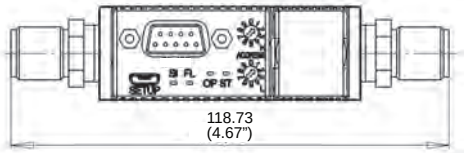
Top View MF1 (USB Version, 4 VCR male)



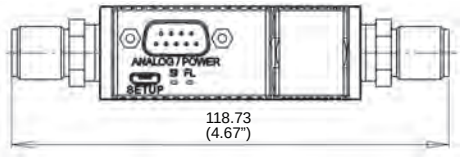
Top View MF1 (EtherCAT Version, 4 VCR male)



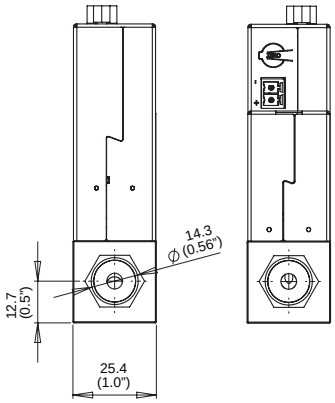
Top View MF1 (Modbus Process Version, 4 VCR male)



Top View MF1 (Analog IF Version, 4 VCR male)



Side Views MF1
(PROFIBUS, 4 VCR male, inlet and outlet side)



Fitting (compatible to)	Dimension L in mm
4VCR male	118.74 ± 1
4VCO male	110.6 ± 1
1/4" Swagelok*	107.6 ± 1
6 mm Swagelok*	107.6 ± 1
1/8" Swagelok*	107.6 ± 1
DN 16 KF	118.74 ± 1

*without nuts and ferrules

Dimensional Drawing —

Note: Unless otherwise specified, dimensions are nominal values in mm.

Specifications

Performance

Full Scale Ranges (N_2 equivalent)	10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 30000, 50000 sccm
Maximum Inlet Pressure	10 bar (g) (both MFC and MFM)
Normal Operating Pressure Differential (N_2, F.S., with atmospheric pressure at the MFC outlet)	
10 to 5000 sccm	0.7 to 2.7 bar (d)
10000, 20000 sccm	1.0 to 2.7 bar (d)
30000, 50000 sccm	1.4 to 2.7 bar (d)
Proof Pressure	10 bar
Burst Pressure	50 bar
Control Range	2% to 100% of F.S.
Measurement (Dynamic) Range	1% to 100% of F.S.
Typical Accuracy (with N_2 calibration gas) (including non-linearity, hysteresis and repeatability referenced to 1013 mbar and 0°C)	± (0.5% of Reading +0.2% of F.S.)
Repeatability	±0.2% of F.S.
Resolution	0.1% of F.S.
Temperature Coefficients	
Zero	<0.04% of F.S./°C
Span	<0.08% of Reading/°C
Pressure Coefficient	<0.02% of Reading / psi
Controller Settling Time (per SEMI Guideline E17-91)	<800 msec
Warm-up Time	~ 15 minutes
Normal Operating Temperature Range	0°C to 40°C
Storage Humidity	0 to 95% relative humidity, non-condensing
Storage Temperature	-20° to 80°C

Mechanical

Fittings (compatible with)	4 VCR®, 1/4" Swagelok®, 1/8" Swagelok®, 4 VCO®, 6 mm Swagelok®, DN 16 KF, MKS Surface Mount
Leak Integrity	
External (scc/sec He)	<1 x 10^{-9} mbar l/sec (He)
Through closed control valve (MFC only)	<1 x 10^{-5} mbar l/sec (He) at 1.7 bar (g) inlet to atmosphere (To assure no flow-through, a separate positive shut-off valve is required)
Wetted Materials	
MFC, Standard	1.4301 S.S. (V2A, ANSI 304), FKM, Nickel
MFC, Optional (seals and valve seal)	NBR, FFKM
Surface Finish	6.3µm Rz
Weight	~ 0.7 kg (1.6 lbs)

Electrical (Analog I/O)

Input Voltage Required	±15 VDC or +24 VDC (20.0 to 31.5 VDC)		
Maximum Supply Current	300mA @ +24VDC		
Analog Set Point Command Signal (Analog interface versions only)	Configurable:	Default:	0 to 5 VDC
		Zero:	0 to 2 VDC
		Full Scale:	5 to 10VDC
Analog Output Signal (Analog interface versions only)	Configurable:	Default:	0 to 5 VDC
		Zero:	0 to 2 VDC
		Full Scale:	5 to 10 VDC
Connector Type (Power)	Standard Industrial Terminal, 3.81 mm pitch (Phoenix Contact MC-series, 3.81 mm pitch)		
Connector Type (Setup)			
USB Setup Interface	micro-B		
Connector Types (Signal)			
Analog	9-pin D-Sub pin		
Analog	15-pin D-Sub pin		
PROFIBUS-DPV0/DPV1	9-pin D-Sub socket		
Modbus	9-pin D-Sub socket		
EtherCAT, PROFINET, Modbus TCP	2x RJ45		
USB Process Interface	B		
Compliance	CE		

Ordering Information

Electrical Interfaces

Pin	± 15 VDC Supply	Pin	+24 VDC Supply
1	Valve Override	1	Valve Override
2	Flow Signal	2	Flow Signal
3	+15V	3	+24V
4	Power Ground	4	Signal Ground
5	-15V	5	Power Ground
6	Set Point Signal	6	Set Point Signal
7	Signal Ground	7	Signal Ground
8	reserved	8	reserved
9	reserved	9	reserved

(no configuration necessary)

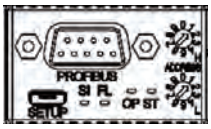
Pinout Analog 9 Pin Sub D —

Interface Option "A"
for supply voltage / analog Signal
Connector: 9-pin D-Sub

Pin	± 15 VDC Supply	Pin	+24 VDC Supply
1	reserved	1	reserved
2	Flow Signal	2	Flow Signal
3	Valve Close	3	Valve Close
4	Valve Open	4	Valve Open
5	Power Ground	5	Signal Ground
6	-15V	6	Power Ground
7	+15V	7	+24V
8	Set Point Signal	8	Set Point Signal
9	NC	9	NC
10	NC	10	NC
11	Signal Ground	11	Signal Ground
12	Signal Ground	12	Signal Ground
13	NC	13	NC
14	NC	14	NC
15	Chassis	15	Chassis

Pinout Analog 15 Pin Sub-D—

Interface Option "B"
for supply voltage / analog Signal
Connector: 15-pin D-Sub



Pinout PROFIBUS —

Interface Option "4/P"
PROFIBUS-DP Interface
Connector: 9-pin
D-Sub socket

Pin	
1	NC
2	NC
3	RXD/TXD -P
4	CNTR-P
5	DGND
6	VP
7	NC
8	RXD/TXP-N
9	NC

Ordering Code Example: MF1C01311CRAV0	**Code**	
MF1	MF1	
Variants		
Controller (standard MF1 length) with All-Metal Sensor	C	
Controller (length compatible to 1179A/B)	K* (on request)	
Meter (standard MF1 length) with All-Metal Sensor	M	
Meter (length compatible to 179A/B)	W* (on request)	
Gas To Be Calibrated For (SEMI Gas Code), other options on request		
N_2	013	
He	001	
Ar	004	
H_2	007	
Air	008	
O_2	015	
Full Scale Range of Calibrated Gas with Flow Unit (maximum 50000 sccm / 50 slm N_2 equivalent)		
10 sccm	11C	
20 sccm	21C	
50 sccm	51C	
100 sccm	12C	
200 sccm	22C	
500 sccm	52C	
1000 sccm	13C	
2000 sccm	23C	
5000 sccm	53C	
10000 sccm	14C	
20000 sccm	24C**	
30000 sccm	34C**	
50000 sccm	54C**	
10 slm (not for analog versions)	11L	
20 slm (not for analog versions)	21L**	
30 slm (not for analog versions)	31L**	
50 slm (not for analog versions)	51L**	
Fittings (compatible with)		
4 VCR male	R	
1/4" Swagelok	S	
1/8" Swagelok	P	
4 VCO male	G (on request)	
6 mm Swagelok	M	
DN 16 KF	D	
MKS Surface Mount	on request	
Interface		
Analog, 9-pin D-Sub male	A	
Analog, 15-pin D-Sub male	B	
PROFIBUS-DPV0, 9-pin D-Sub female	4	
PROFIBUS-DPV1, 9-pin D-Sub female	P	
Modbus, RS485, 9-pin D-Sub male	M	
USB	U	
EtherCAT	T	
PROFINET	F	
Modbus TCP, RJ45	L	
Seal Materials		
FKM (Plug = 70 FKM 576, Sealing = FKM1170)	V	
NBR (Plug = 70 NBR 150, Sealing = 70 NBR)	B (on request)	
FFKM (Plug = 75 Simriz 484, Sealing = FFPM/FFKM)	K*** (on request)	
Extras / Options Meaning of Extension Behind		
No Extras	0	Firmware Revision
Specials	SSS	Special Number
Initial Configuration File Supplied	C	Filename
Optional Accessories		
1-Channel Power Supply and Readout Unit with RS232		PR4000B-S2V2
2-Channel Power Supply and Readout Unit with RS232		PR4000B-F2V2
4-Channel Power Supply and Readout Unit with RS232		647C4R1N
8-Channel Power Supply and Readout Unit with RS232		647C8R1N
Cabling for MF1		
To connect MF1 with analog process interface to PR4000, 647, 247D, 246		CBE147-12-3M

* *Only available for fitting types 4 VCR, 1/4" Swagelok, and 6 mm Swagelok*
** *Not in conjunction with seal material FFKM*
*** *Not for Full Scale ranges larger than 10000 sccm N_2 equivalent*

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MF1 - 1/2018