

# Mass Flow Measurements Of Liquids

Model No:-MFML-1000

## Feature & Application

- Imbedded micro-processor controller
- Wide turn-down ratio 300 : 1
- Accuracy  $\pm 3.0\%$  reading
- Repeatability  $\pm 1.15\%$  FS
- 16 x 2 Backlit LCD display
- 4 Digits for flow, 8 Digits for totalizer
- Auto-shifting decimal point(Optional)
- 24 VDC/VAC, 85-265 VAC power supply
- 4-20mA, 0-5 VDC, alarm, pulse, RS-485 output (Optional)
- Smart field-programmable using key or PC
- Reverse DC power polarity protection(Optional)
- Built-in surge protection, EMI-RFI immunity
- Non-heat convection sensor, Non-direction sensor(Optional)
- Measurable wet compressed air
- Calibration Certificate



## General

The model MFML-1000 series Thermal Mass Flow Meter is the instrument of choice for reliable and accurate gas mass flow measurement, which is based on constant temperature differential technology for air and other process gases in range from 0 – 100 NMPS. Because neither temperature nor pressure measurement are required. **MFML-1000** series reduces installation cost and vastly improves system accuracy.

The meter is easily installed or retrofitted with minimum down time and provides superior long term process reproducibility and easy serviceability. **MFML-1000** inline type flow meters are available in probe sizes from 1/4” to 6” with either NPT or flange connection, and insertion type flow meters are available in probe sizes from 4” to 36” with either compression fitting or flange connection. The transmitter provides a 4-20 mA linear output signal and optionally an RS485 serialized digital output signal. Other analog outputs are also available.

**MFML-1000** series flow meter utilizes a constant temperature differential (dT) technology.

The sensor has two elements. The reference RTD measures the gas temperature. The electronics heats the heated element above the gas temperature. It is the job of the electronics to maintain a constant dT between the gas temperature and the heated element.

As the mass flow increases, the increased number of gas molecules remove more heat from the heated element. The electronics senses this temperature reduction and adds additional power in order to maintain a constant dT.

The amount of power delivered to the heated element, therefore, is just proportional to the mass flow rate.



## Performance Specs

- Accuracy
  - ±3.00 % Reading
  - Straight pipe run 10 x ID (Up-stream) for Insertion meter
  - 5. x ID (Down-stream) for Insertion meter
- Repeatability
  - ±1.15 % Full Scale
- Response time
  - 2.00 sec ( one time constant )
- Gases
  - Air, Argon, Nitrogen, Oxygen, Methane, Propane, Butan
  - Carbon Dioxide, Butane, Natural Gas, Digester Gas
  - Hydrogen, Ammonia, Mixed Gas, Others
- Temperature
  - Standard sensor : -40 ~ 121 °C
  - High temp sensor : - 0 ~ 204 °C
  - Ultra high temp sensor : - 0 ~ 370 °C
  - Enclosure : -40 ~70°C without LCD display
  - 0 ~ 60°C with LCD display
- Power supply
  - Standard : 24 VDC 0.25 Amp
  - Option : 85 ~ 250 VAC 50/60 Hz 10 watts
  - Built-In Surge Protection
  - DC reverse polarity protection - operation
- Output
  - 4-20 mA DC, 0-5 VDC, Alarm, Pulse, RS485

## Operating Specs

- Flow units
  - Nm3/hr, Nm3/min, Kg/day, Kg/hr, Kg/min, Kg/sec
  - SCFM, SCFH, Lb/day, Lb/hr, Lb/min, Lb/sec
  - NLPH, NLPM, SLPM, SMPS, NMPS, SFPM
- Flow Velocity
  - 0 ~ 150 NMPS ( standard)-based on Air at 0°C 1 atm
  - 0 ~ 250 NMPS ( option )-based on Air at 0°C 1 atm

Pipe Size	Nm3/hr	SCFM
0.25 inch	0 - 27	0 - 16
0.5 inch	0 - 82	0 - 48
0.75 inch	0 - 204	0 - 120
1.0 inch	0 - 326	0 - 192
1.25 inch	0 - 564	0 - 332
1.5 inch	0 - 760	0 - 450
2.0 inch	0 - 1280	0 - 750
2.5 inch	0 - 1855	0 - 1090
3.0 inch	0 - 2720	0 - 1600
4.0 inch	0 - 4893	0 - 2880
6.0 inch	0 - 10870	0 - 6400
note : reference gas Air		
Stda condition Nm3/hr : 0°C 1 atm , SCFM : 70°F 1 atm		

- Gas Pressure ( Maximum )
  - NPT 500 psig ( 34.5 barg )
  - 150# Flange 230 psig ( 16 barg )
  - For high pressure, consult factory
  - Note : pressure rating based on 38°C ( 100°F )

## Physical Specs

- Sensor material
  - Standard : 316 Stainless Steel
  - Optional : Hastelloy-C 276
- Enclosure
  - Weather-Proof, NEMA 4X, IP66
  - Non-hazardous area location
  - Option : remote NEMA 4X, J-box
- Remote cable
  - 3 conductor w/ shield 2.0 sq ( 100 M max )

## Dimensional Specs

In-Line Flow Meter Dimension in cm ( inch )			
Size	L2	C	HH
0.25 in	14.7(5.80)	25.0 (9.8)	20.7 (7.9)
0.5 in	30.5(12.0)	25.0 (9.8)	20.7 (7.9)
0.75 in	30.5(12.0)	25.0 (9.8)	20.7 (7.9)
1.0 in	30.5(12.0)	25.0 (9.8)	20.7 (7.9)
1.25 in	30.5(12.0)	25.0 (9.8)	20.7 (7.9)
1.5 in	30.5(12.0)	25.0 (9.8)	20.7 (7.9)
2.0 in	30.5(12.0)	25.0 (9.8)	20.7 (7.9)
2.5 in	45.7(18.0)	27.0(10.6)	22.0 (8.7)
3.0 in	45.7(18.0)	27.0(10.6)	22.0 (8.7)
4.0 in	45.7(18.0)	27.0(10.6)	22.0 (8.7)
6.0 in	61.0(24.0)	30.0(11.8)	25.0 (9.8)

INSERTION METER

<p>FRONT VIEW COMPRESSION FITTING TYPE</p>	<p>SIDE VIEW COMPRESSION FITTING TYPE</p>

<p>JUNCTION BOX WITH REMOTE CABLE COMPRESSION FITTING TYPE</p>	<p>SIDE VIEW OF REMOTE ENCLOSURE MOUNTING BRACKET</p>
	<p>REMOTE ENCLOSURE - MOUNTING BRACKET NEMA 4X WEATHER-PROOF</p>

<p>SMART ELECTRONICS DEVICE LOCATION &amp; CONFIGURATION BUTTON</p>	
<p>Enclosure External View</p>	<p>Smart Electronic inside Enclosure</p>

• MFML reserves the right to make changes without further notice to any products to improve reliability, function, or design.

IN-LINE METER

<p>FRONT VIEW ANSI 150# RF FLANGE 1/2-inch ~ 8-inch</p>	<p>SIDE VIEW ANSI 150# RF FLANGE 1/2-inch ~ 8-inch</p>

<p>FRONT VIEW NPT MALE FITTING 1/4-inch ~ 8-inch</p>	<p>SIDE VIEW NPT MALE FITTING 1/4-inch ~ 8-inch</p>

<p>JUNCTION BOX WITH REMOTE CABLE ANSI 150# RF FLANGE 1/2-inch ~ 8-inch</p>	<p>SIDE VIEW OF REMOTE ENCLOSURE MOUNTING BRACKET</p>
	<p>REMOTE ENCLOSURE - MOUNTING BRACKET NEMA 4X WEATHER-PROOF</p>

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Parent Model Code		MFML-1000	Thermal Mass Flow Meter for In-Line Pipe
Feature 1	Flow Body Size	025P	1/4 inch 316 SST PIPE with npt male ends ( schedule 40 )
		050P	1/2 inch 316 SST PIPE with npt male ends ( schedule 40 )
		075P	3/4 inch 316 SST PIPE with npt male ends ( schedule 40 )
		100P	1 inch 316 SST PIPE with npt male ends ( schedule 40 )
		150P	1-1/2 inch 316 SST PIPE with npt male ends ( schedule 40 )
		200P	2 inch 316 SST PIPE with npt male ends ( schedule 40 )
		250P	2-1/2 inch 316 SST PIPE with npt male ends ( schedule 40 )
		400P	4 inch 316 SST PIPE with npt male ends ( schedule 40 )
		600P	6 inch 316 SST PIPE with npt male ends ( schedule 40 )
		050F	1/2 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		075F	3/4 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		100F	1 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		150F	1-1/2 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		200F	2 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		250F	2-1/2 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		400F	4 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
		600F	6 inch 316 SST PIPE with 150# RF flange ( schedule 40 )
Feature 2	Sensor Material	SM1	316 stainless steel sensor and flow body
		SM2	Hastelloy C-276 sensor w/ 316SS flow body & fitting
Feature 3	Sensor Temperature	ST1	Standard Sensor -40 ~ 121°C ( -40 ~ 250 °F )
		ST2	High Temperature Sensor 0 ~ 204°C ( 32 ~ 400 °F )
		ST3	Ultra High Temperature Sensor 0 ~ 343°C ( 32 ~ 650 °F )
Feature 4	Electronic Enclosure	E1	Local NEMA 4X enclosure , 24 VDC Powered
		E2	Local NEMA 4X enclosure , 85 ~ 250 VAC Powered
		E3	Remote NEMA 4X enclosure , 24 VDC Powered, no cable
		E4	Remote NEMA 4X enclosure , 85 ~ 250 VAC Powered, no cable
Feature 5	Display	DO	None
		D1	16 x 2 Alphanumeric Backlit LCD Display
Feature 6	Digital Communication	C0	None
		C1	RS485 Communication
Feature 7	Calibration	GC1	Air, N2 : MF less than 2040 NM3H ( 1200 SCFM )
		GC2	Air, N2 : MF above than 2040 NM3H ( 1200 SCFM )
		GC3	Ar,CO2, H2, CH4, Natural Gas, O2: MF < 1700 NM3H
		GC4	Ar,CO2, H2, CH4, Natural Gas, O2: MF > 1700 NM3H
		GC5	CO,He, Ammonia, Propane, Digester gas : MF < 1700 NM3H
		GC6	CO,He, Ammonia, Propane, Digester gas : MF > 1700 NM3H
		GC7	All other gases
Feature 8	Option	1010	Remote Cable 3 conductor w/ shield 2.0 sq ( 100 meter max )
		1020	Flow meter cleaning for Oxygen Service
		1030	NABL certificate

Parent Model Code		MFML-1000	Thermal Mass Flow Meter for Insertion Type
Feature 1	Probe Length	10L	Insertion Meter with 10 cm 316 SST material
		20L	Insertion Meter with 20 cm 316 SST material
		30L	Insertion Meter with 30 cm 316 SST material
		50L	Insertion Meter with 50 cm 316 SST material
		80L	Insertion Meter with 80 cm 316 SST material
		100L	Insertion Meter with 100 cm 316 SST material
		150L	Insertion Meter with 150 cm 316 SST material
		SPL	Special on request
Feature 2	Probe Diameter	050	1/2 inch OD with SST316
		075	3/4 inch OD with SST316
Feature 3	Sensor and Probe Material	SM1	316 Stainless Steel
		SM2	Hastelloy C-276 sensor w/ 316SS probe & fitting
Feature 4	Sensor Temperature	ST1	Standard Sensor -40 ~ 121°C ( -40 ~ 250 °F )
		ST2	High Temperature Sensor 0 ~ 204°C ( 32 ~ 400 °F )
		ST3	Ultra High Temperature Sensor 0 ~ 373°C ( 32 ~ 700 °F )
Feature 5	Enclosure	E1	Local NEMA 4X enclosure , 24 VDC Powered
		E2	Local NEMA 4X enclosure , 85 ~ 250 VAC Powered
		E3	Remote NEMA 4X enclosure , 24 VDC Powered, no cable
		E4	Remote NEMA 4X enclosure , 85 ~ 250 VAC Powered, no cable
Feature 6	Display	DO	None
		D1	16 x 2 Alphanumeric Backlit LCD Display
Feature 7	Digital Communication	C0	None
		C1	RS485 Communication
Feature 8	Mounting Accessory	M0	None
		M1	316 SST compression fitting
		M2	316 SST compression fitting with Teflon ferrule
		M3	1-inch ANSI 150# RF flange
		M9	On request
Feature 9	Calibration	GC1	Air, N2 : MF less than 2040 NM3H ( 1200 SCFM )
		GC2	Air, N2 : MF above than 2040 NM3H ( 1200 SCFM )
		GC3	Ar,CO2, H2, CH4, Natural Gas, O2: MF < 1700 NM3H
		GC4	Ar,CO2, H2, CH4, Natural Gas, O2: MF > 1700 NM3H
		GC5	CO,He, Ammonia, Propane, Digester gas : MF < 1700 NM3H
		GC6	CO,He, Ammonia, Propane, Digester gas : MF > 1700 NM3H
		GC7	All other gases
Feature 10	Options	1010	Remote Cable 3 conductor w/ shield 2.0 sq ( 100 meter max )
		1020	Flow meter cleaning for Oxygen Service
		1030	NABL certificate