



M-2111 Series Ultrasonic Flow Meter

**High Accuracy/Non-contact
Flow Sensing in PFA**

Description

The M-2111 Series handles a wide range of flow rates and connection sizes. The flow meter consists of a Flow Detector and a Signal Converter. All the wetted parts are made of PFA. There are no mechanical seals or moving parts. The flow detector has non-contact transducers and a flow tube design without dead pockets. The M-2111 is an ideal choice for use in the semiconductor industry where extreme cleanliness and anti-corrosiveness are required.

Measurement Principle

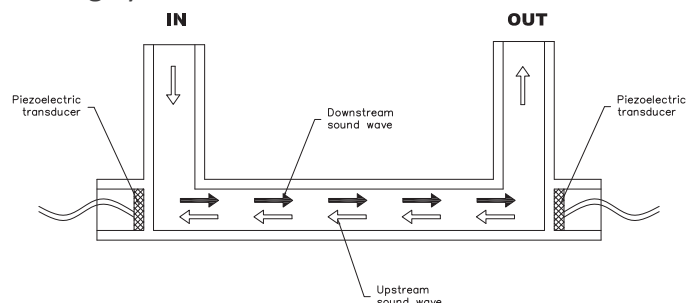
The fluid to be measured flows through the U or Z shaped tube. Two piezoelectric transducers, mounted at both ends of the measuring section, generate and receive an ultrasonic wave alternately. The wave traveling with the fluid is accelerated and the wave traveling against the fluid is slowed. The difference in transit time of the wave signals is proportional to the velocity of the fluid.

Applications

- CMP, ECD, Electroless Deposition, Wet Clean and Track tools in semiconductor manufacturing
- Solar PV equipment
- Medical Devices
- Wet process / Chemical distribution systems
- Laser equipment
- Cooling systems

Key Features

- Accuracy $\pm 1\%$ of reading
- Repeatability $\pm 0.5\%$ of reading
- All wetted parts made of New PFA (AP-211SH)
- Contamination free from ions or particles
- Corrosion resistant, no metal parts
- Wide rangeability of 100:1 (Typical)
- Easy installation with compact meter body
- Low flow measurements down to 2 mL/min
- Measures viscous fluids
- Ease of parameter configuration through front panel LCD and Keypad, or PC communication software



Flow Detector Specifications

Measurable Fluid : Liquids

Speed of Sound in Fluid: 1000 to 2200 m/s

Fluid Temperature : 10°C – 180°C *

Fluid Pressure : 0 to 70 psig

Fluid Kinematic Viscosity : 0.8x10⁻⁶ m²/s to 4.5x10⁻⁵ m²/s **

Process Connection : PFA Tube End

Enclosure Classification : IP65

Flow Range : Refer to Table1

*** Consult Malema for higher temperature applications.******Consult Malema for higher viscosity applications.****Table 1. Flow Range and Connecting Tube Size**

Range Code	Flow Range (L/min)	Connection Tube Size
	Max. Range	
04	0 - 3.0	1/4" or 3/8"
06	0 - 8.0	3/8"
10	0 - 20.0	1/2"
15	0 - 50.0	3/4"
20	0 - 80.0	1"

Table 2. Accuracy and Repeatability

Range Code	Accuracy	Repeatability
04	± 5 mL/min below 500 mL/min* ± 1% of reading above 500 mL/min	± 0.5 mL/min below 100 mL/min ± 0.5% of reading above 100 mL/min
06	± 12 mL/min below 1200 mL/min ± 1% of reading above 1200 mL/min	± 3 mL/min below 600 mL/min ± 0.5% of reading above 600 mL/min
10	± 0.047 LPM below 4.7 LPM ± 1% of reading above 4.7 LPM	± 0.024 LPM below 4.7 LPM ± 0.5% of reading above 4.7 LPM
15	± 0.106 LPM below 10.6 LPM ± 1% of reading above 10.6 LPM	± 0.053 LPM below 10.6 LPM ± 0.5% of reading above 10.6 LPM
20	± 0.188 LPM below 18.8 LPM ± 1% of reading above 18.8 LPM	± 0.094 LPM below 18.8 LPM ± 0.5% of reading above 18.8 LPM

*** Flow meter specified with 100 mL/min full scale or less can be provided with ± 2 mL/min accuracy.****Please consult the factory for special requirements.****Note: Accuracy statement is based on a room temperature DIW calibration.****Table 3. Materials of Flow Detector**

Part Name		Material
Wetted Part	Body	PFA
	Tube	PFA
Housing (Size 10 / 15 / 20)		PTFE
End Cap (Size 04 / 06)		PP
Cable Fitting		PP
Cable Jacket		PU

Table 4. Pressure Loss Factor

Range Code	K
04	3.04
06	0.537
10	0.0625
15	0.0120
20	0.00377

Pressure Loss for water(kPa) = K x Q²
Where K : Factor and Q : Flowrate (L/min)

Signal Converter Options

Depending on the application, the signal converter can be selected with or without a display.

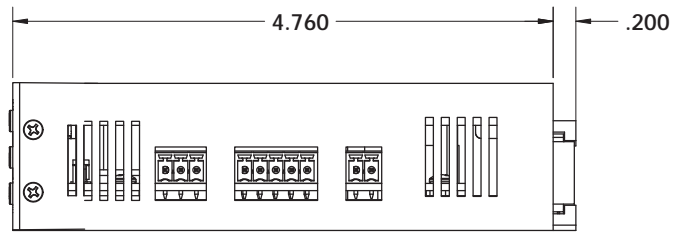
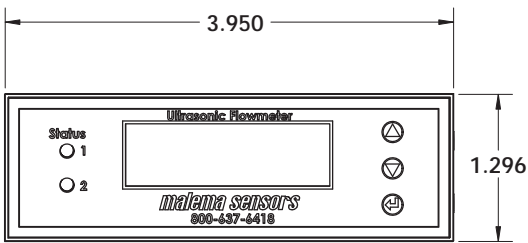
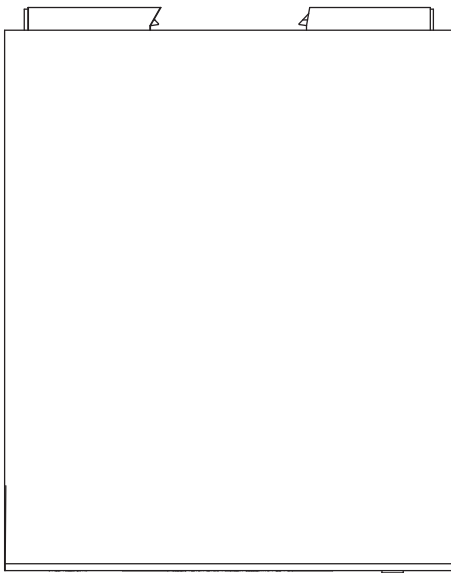
DSP (Digital Signal Processing) Technology

Conventional ultrasonic flow meters encounter difficulty in measuring fluids containing bubbles because the bubbles interfere with the ultrasonic signal transmission. Digital signal processing has improved the bubble immunity of this series of flow meters by virtue of sampling the entire wave signal and proven its advantage.

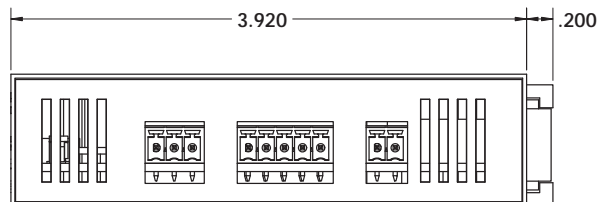
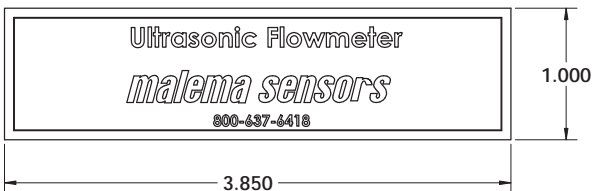
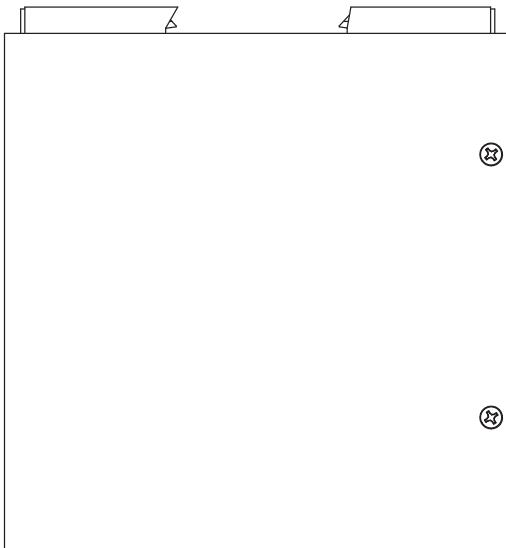
DSP Versions

USC-B01 (without display) & **USC-D01** (with display)

Input Power	24 Vdc \pm 10%
Power Consumption	3.3 W Max. Approx @ 140 mA (Continuous) Max. 200 mA, start-up current
Ambient Temperature / Humidity	0°C to 50°C / 30% ~ 80% RH
Installation	DIN Rail Mounting
Enclosure Class	IP 20 (Indoor use)
Materials	USC-B01 - Polycarbonate
Weight	USC-B01 - 225 grams / USC-D01 - 530 grams
EMC	EN61326
Sensor Cable	Shielded twisted pair
Electrical Connection	Pluggable screw terminals, accepts 28 to 16 AWG wire
Analog Output	Current O/P: Active: 4 to 20 mA (Max. Load < 900 ohms) Passive: 4 to 20 mA (Max. Load < 1200 ohms @ 30 V max.) Voltage O/P: 0 to 10 Vdc (min. impedance > 10 K)
Pulse Output	Open Collector (sinking)/Max. 30 Vdc, 200 mA max. Pulse (Hz) - 10 KHz max., Configurable Pulse (Volume) - Pulse weight configurable from 0.1 mL
Digital Output	Open Collector / Max. 30 Vdc, 200 mA max. two digital Output configurable for Low flow rate/High flow rate/Totalizer greater than/Totalizer less than/Signal strength less/Positive totalizer pulse LED Alarm indication
Digital Input	Zeroing - Momentarily pull-up to 24Vdc for activation Totalizer Reset - Contact closure or Vdc pull-up (5 Vdc max)
Low Flow Cut-off	Configurable
Linearization	Max. 14 points (Configurable)
Display (Optional)	LCD: 2 line 16 digits alpha numeric (with backlight) with LED alarm indication
Digital Communication	RS 485 and RS 232

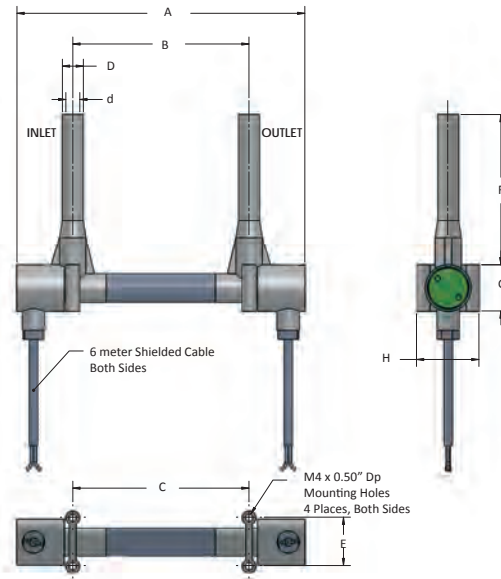


Converter USC-B01

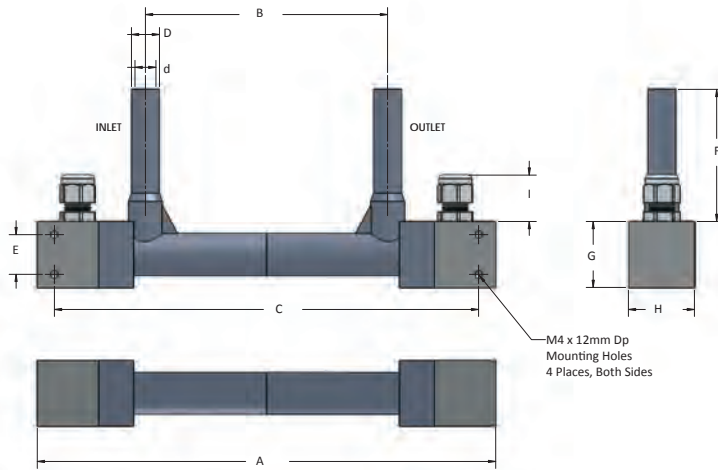


Dimensions (Flow Detectors)

M-2111 (04 / 06)



M-2111 (10 / 15 / 20)



Range Code	Connecting Tube Size	Dimensions (inch)									
		D	d	A	B	C	E	F	G	H	I
04	1/4"	0.25	0.156	5.1	3.1	3.1	0.9	2	0.8	1.1	-
04	3/8"	0.375	0.25	5.1	3.1	3.1	0.9	2.7	0.8	1.1	-
06	3/8"	0.375	0.25	5.9	3.9	3.9	0.9	2.7	0.8	1.1	-
10	1/2"	0.5	0.375	8.2	4.3	7.6	0.7	2.4	1.2	1.2	0.8
15	3/4"	0.75	0.625	11.3	6.5	10	1	1.7	1.6	1.6	0.8
20	1"	1	0.876	13.7	8.7	12.2	1	2.1	1.6	1.6	0.8

M-2111

Ordering Information

Ultrasonic Flow Meter

Model Code											Description	
M-2111	-	F	*	*	**	-	*	-	*	-		***
Body Material		F										PFA
Connection Size (OD)		2										1/4"
		3										3/8"
		4										1/2"
		6										3/4"
		8										1"
Connection Type		1										Tube Ends
		2										Flare
		3										Pillar Super 300
Range Code		04										0 - 3 Lpm
		06										0 - 8 Lpm
		10										0 - 20 Lpm
		15										0 - 50 Lpm
		20										0 - 80 Lpm
						-						
Converter						D						DSP Converter with display
						B						DSP Converter without display
						-						
Geometry						U						U - Shape
						Z						Z - Shape
						-						
											xxx	Unique PN identifier

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