

M-2111 Series

High Accuracy/Non-contact Flow Sensing in PFA



Where Innovation Flows



Handling a wide range of flow rates and connection sizes, the Malema Sensors® M-2111 Series ultrasonic flow meter consists of a Flow Detector and a Signal Converter. All the wetted parts are made of HP 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

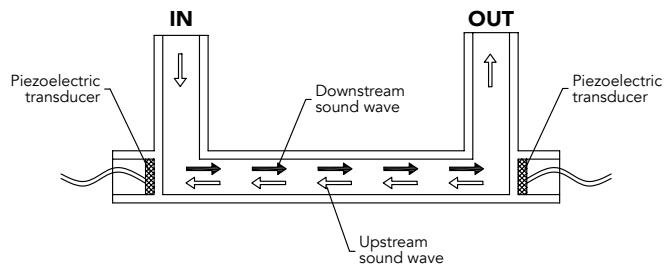
The fluid to be measured flows through the U or Z shaped tube. Two piezoelectric transducers, mounted at both ends of the measuring section, generate and receive an ultrasonic wave alternately. The wave traveling with the fluid is accelerated and the wave traveling against the fluid is slowed. The difference 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 out of HP PFA
- 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 – 60°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 factory for higher temperature applications.

**Consult factory for higher viscosity applications.

***Consult factory for other process connections.

Table 1. Flow Range and Connecting Tube Size

| Range Code | Flow Range (L/min) | Connecting Tube Size |
|------------|--------------------|----------------------|
| 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 l/min below 4.7 l/min ± 1% of reading above 4.7 l/min | ± 0.024 l/min below 4.7 l/min ± 0.5% of reading above 4.7 l/min |
| 15 | ± 0.106 l/min below 10.6 l/min ± 1% of reading above 10.6 l/min | ± 0.053 l/min below 10.6 l/min ± 0.5% of reading above 10.6 l/min |
| 20 | ± 0.188 l/min below 18.8 l/min ± 1% of reading above 18.8 l/min | ± 0.094 l/min below 18.8 l/min ± 0.5% of reading above 18.8 l/min |

* 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

Depending on the application, the signal converter can be selected between Display and Non- Display version.

DSP 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 has proven its advantage.

DSP Signal converter specifications

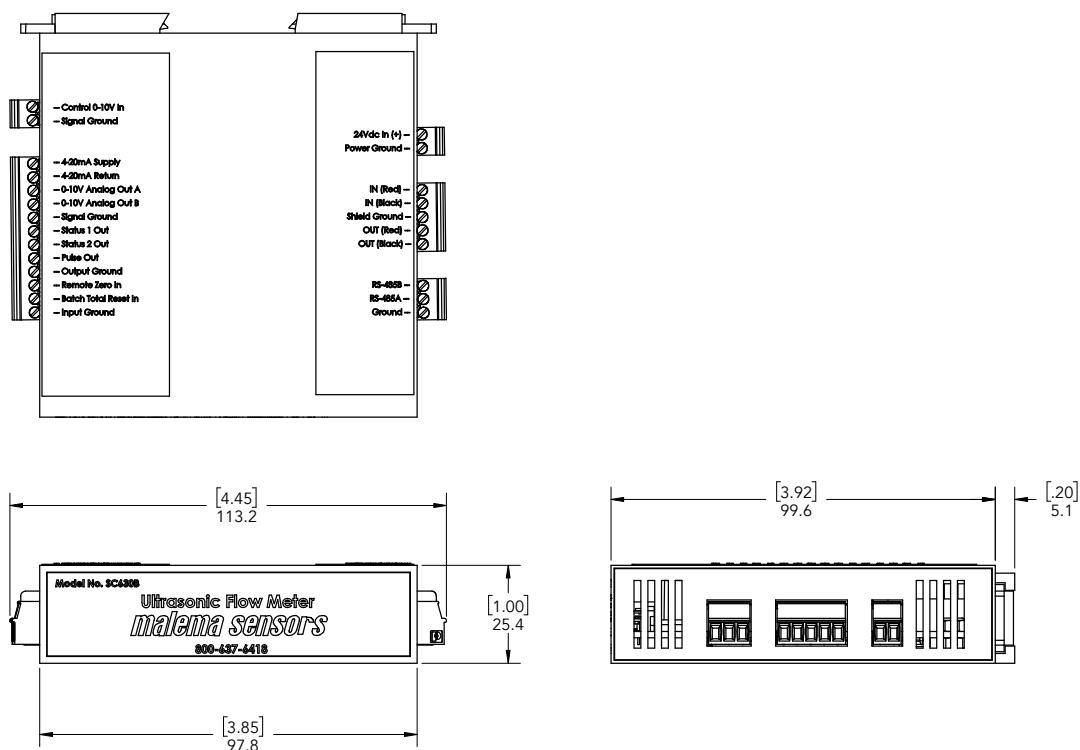
Model#SC630B (without display) Model#USC-D01 (with display)

| | |
|--------------------------------|---|
| Input Power | 24 Vdc \pm 10% |
| Power Consumption | 3.6W / Approx. 150 mA (Continuous) Max. 0.25 A, surge current |
| Ambient Temperature / Humidity | 0° C to 50°C / 30% ~ 80% RH |
| Installation | DIN rail mounting |
| Enclosure Class | IP20 (Indoor Use) |
| Materials | Model#SC630B - Polycarbonate |
| Weight | Model#SC630B - 225 grams / USC-D01 - 530 grams |
| EMC | EMC Directive 2014/30/EU |
| Sensor Cable | Shielded twisted pair * (Cable is 6 feet standard version) |
| 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 outputs 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 Cut-off | Configurable |
| Linearization | Programmable 0 to 125% of full scale |
| Linearization | Max. 14 points (Configurable) |
| Display (Optional) | LCD: 2 line 16 digits alpha numeric (with backlight) with LED alarm indication |
| Digital Communication | Modbus Over RS485 |

* Please check with factory for longer length cable

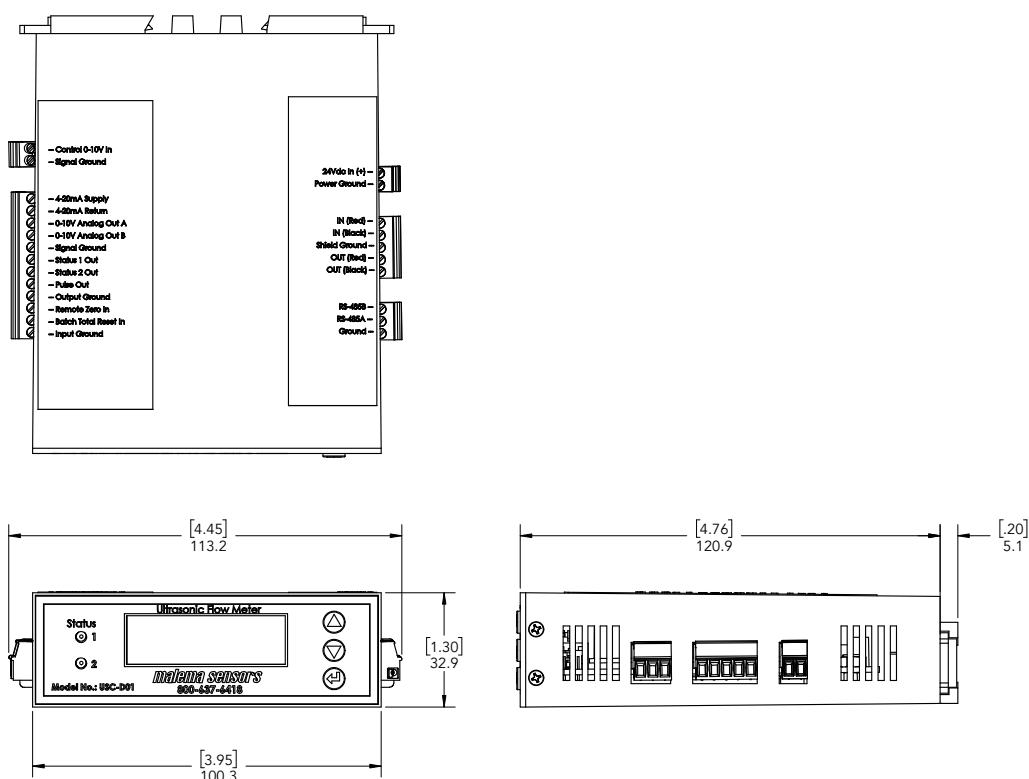
Dimensions (Converter SC630B) with DIN Rail mounting

Dimensions in inches



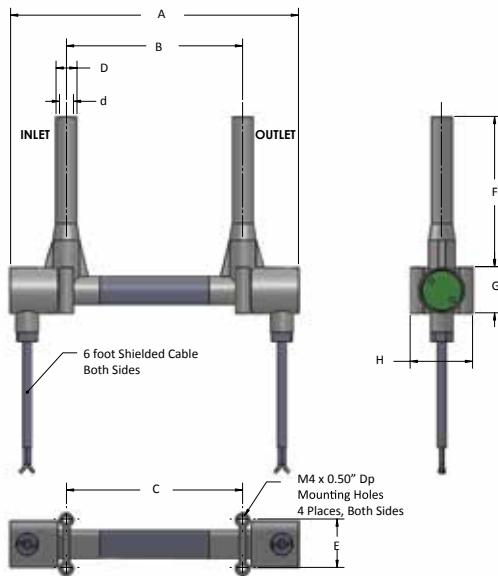
Dimensions (Converter USC - D01) with DIN Rail mounting

Dimensions in inches

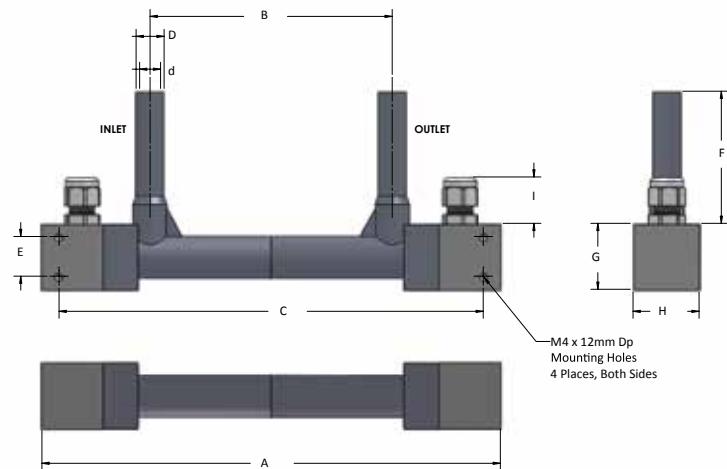


Dimensions (Flow Detectors)

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 | 2 | 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 |

Ordering Information

| 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 | | | | | | | | | 3 l/min |
| | | | 06 | | | | | | | | | 8 l/min |
| | | | 10 | | | | | | | | | 20 l/min |
| | | | 15 | | | | | | | | | 50 l/min |
| | | | 20 | | | | | | | | | 80 l/min |
| | | | - | | | | | | | | | |
| Converter | | | | D | | | | | | | | DSP Converter with display |
| | | | | B | | | | | | | | DSP Converter without display |
| | | | | - | | | | | | | | |
| Geometry | | | | U | | | | | | | | U - Shape |
| | | | | Z | | | | | | | | Z - Shape |
| | | | | - | | | | | | | | |
| | | | | XXX | | | | | | | | Unique PN identifier |

* Please check with factory for longer length cable



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