

# Ultrasonic Flowmeter



## M-1500 Plus

Non-invasive Inline DSP Ultrasonic Flowmeter



- Accuracy  $\pm 2\%$  of Reading
- All wetted parts made of PFA Contamination free from ions or particles
- Minute flow measurements down to 4 mL/min\*
- Easy configuration in front panel with LCD display
- Bi-directional flow reading capabilities\*\*

The M-1500 Plus consists of an inline flow sensor and externally mounted controller unit. The flow sensor is a straight-through PFA tube that uses ultrasonic sensing technology to measure the flow rate. There are no moving parts or mechanical seals. The M-1500 Plus is an ideal choice for use in the semiconductor industry where extreme cleanliness and anti-corrosiveness are required. The Controller Electronics receives the raw flow rate signal from the sensor and provides flow rate information in terms of analog output, pulse output, serial and LCD. The output signals are user-scalable.

## Operating Principle

This flowmeter uses a non-intrusive method to determine the flow rate of the liquid. Two piezoelectric rings (transducers) are mounted on the outer diameter of the flow tube and are excited producing a vibration. Alternately each transducer's ultrasonic disturbance transmits through the tubing wall and is propagated along with the liquid flow and back against the flow. The propagation wave velocity varies with flow rate and is proportional to flow rate. The flow rate can be determined by measuring the variation of these propagation wave velocities. (Covered by U.S. Patent nos. 6055868 & 5974897)

## Features

The M-1500 Plus utilizes the latest digital signal processing (DSP) technology and features significant reduction of adverse influence of bubbles in measured fluids which is a common problem in semiconductor and chemical processes. Normally, ultrasonic flowmeters have difficulty in measuring fluid containing bubbles. This is because the bubbles interfere with ultrasonic signal passage. With our DSP technology and accumulated field experience, the measurement accuracy of fluids with bubbles capability has been remarkably improved.

\* Please contact the factory for special flow ranges

\*\* Flow direction configurable through LCD display panel

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## Specifications

Table 1: Performance Specification

|               |   |
|---------------|---|
| Flow Range*   | 4 to 600 mL/min                           |
| Accuracy**    | ± 2% R.D. for flow rates over 50 mL/min   |
|               | ± 1 mL/min for flow rates under 50 mL/min |
| Repeatability | ± 0.5%                                    |

\* Please contact the factory for special flow ranges

\*\* Special calibration is available upon request

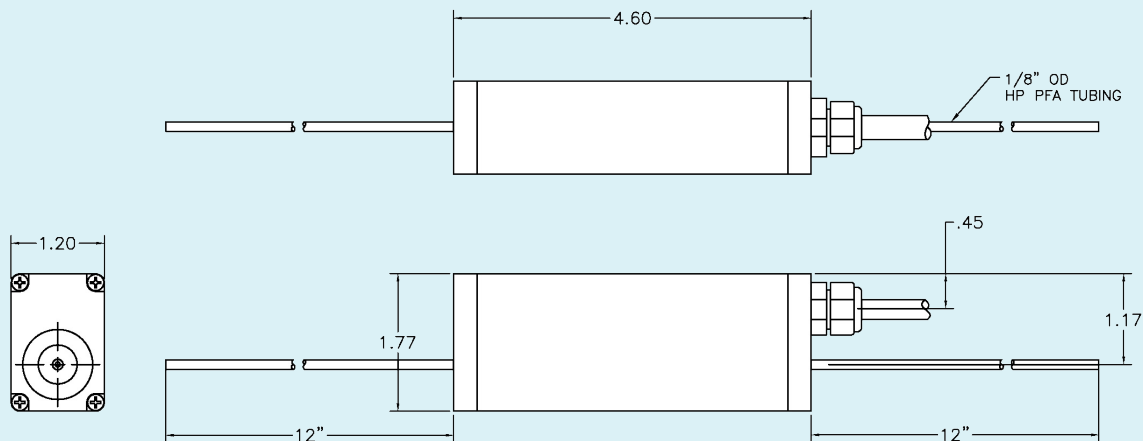
Table 2: Functional Specification

|                            |         |   |
|----------------------------|---------|---|
| Analog Output              | Current | Isolated 4 - 20 mA (Maximum load resistance of 500 Ω) current output                |
|                            | Voltage | 0 to 10 VDC   |
| Pulse Output               |         | Isolated Open Collector (15 VDC, 15 mA)<br>Frequency of 1 kHz at 100% of full scale |
| Low Flow Cut-off           |         | User settable   |
| Power Supply               |         | 12 - 36 VDC   |
| Power Consumption          |         | 5 W continuous (1.5 A on start-up)  |
| Ambient Temperature        |         | 32 - 115 °F (0 - 46 °C)   |
| Fluid Temperature          |         | 50 - 140 °F (10 - 60 °C)  |
| Maximum Operating Pressure |         | 70 psig   |

Table 3: Sensor Material Specifications

|                          |                                    |
|--------------------------|------------------------------------|
| Enclosure Classification | IP56 / NEMA 4X                     |
| Cable Material           | PTFE jacketed cabling              |
| Cable Length             | 2 meters (standard)                |
| Non-wetted Parts         | FEP, Peek, PP, PTFE, PVDF, Viton A |
| Wetted Parts             | High Purity PFA                    |

## Sensor Dimensions



# Ultrasonic Flowmeter

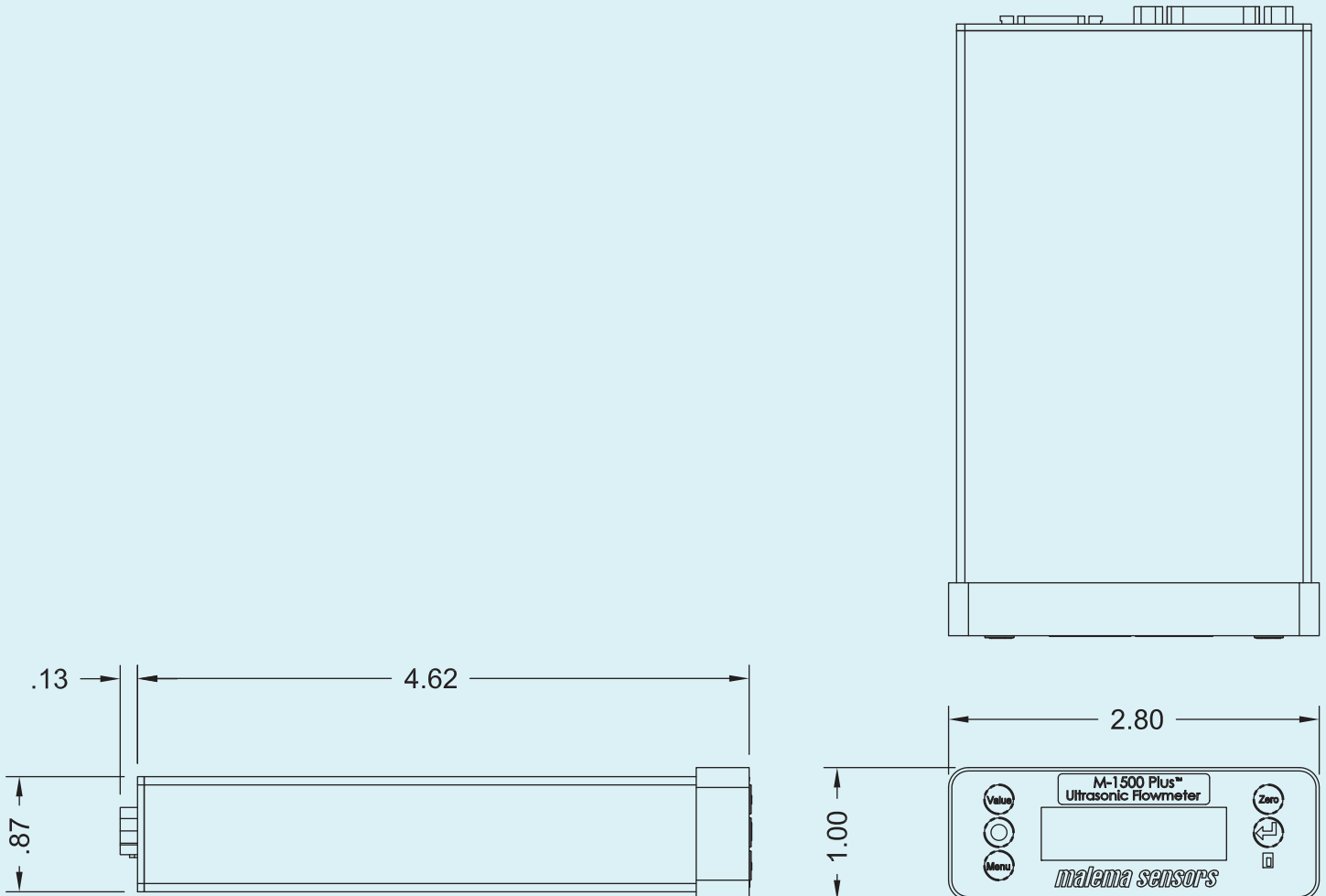
Table 4: Flow Range and Tubing Dimensions

|               |             |       |
|---------------|-------------|-------|
| Flow Range    | 4 - 600 ccm |       |
| Tube Diameter | Inner       | 1/16" |
|               | Outer       | 1/8"  |

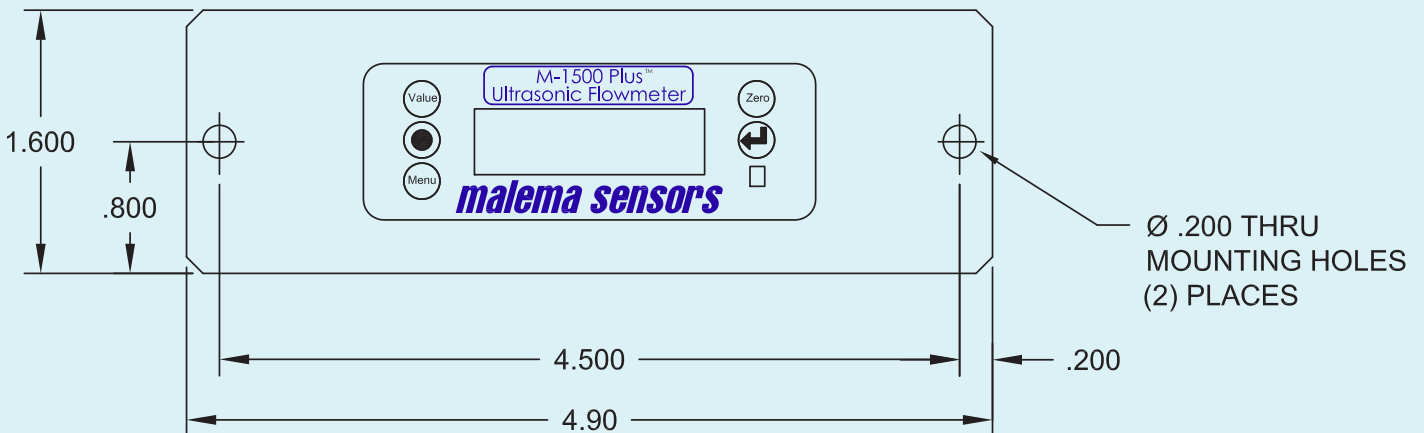
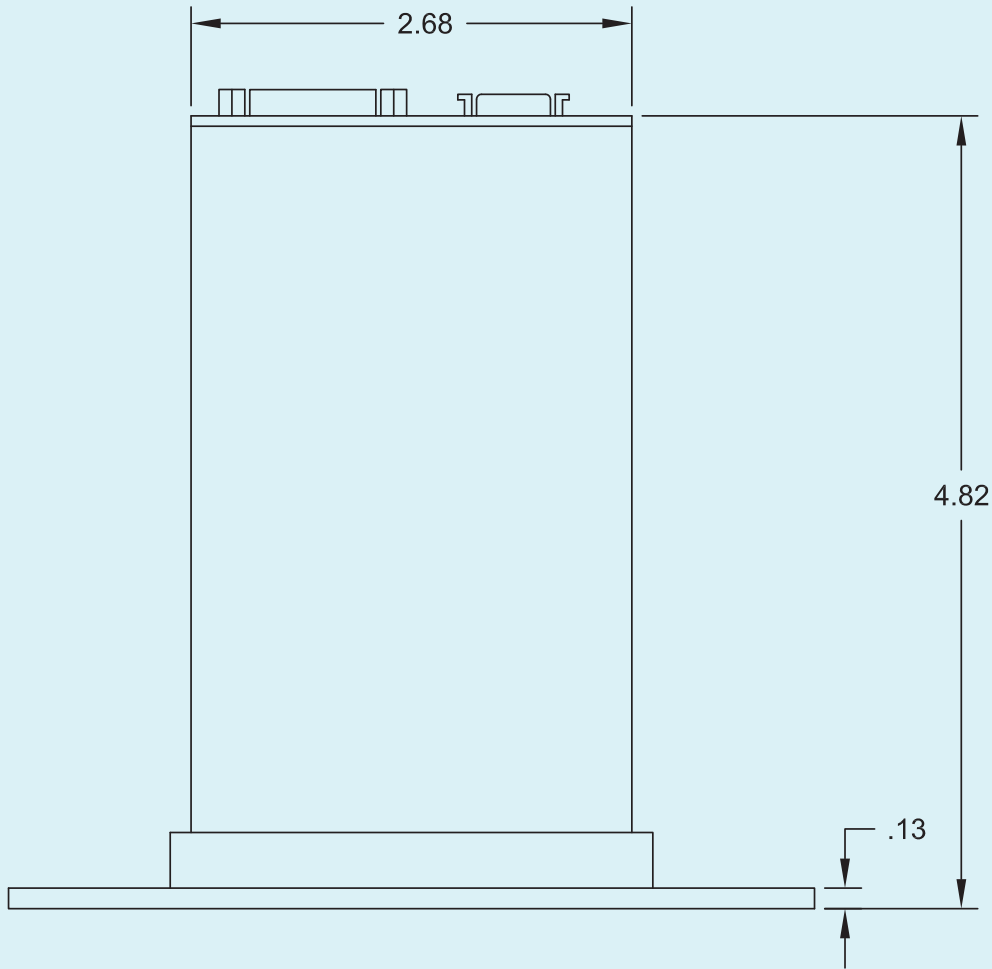
Table 5: Converter Material Specifications

|                          |                            |
|--------------------------|----------------------------|
| Enclosure Classification | IP20 (indoor use)          |
| Mass                     | 156 g (5.5 oz)             |
| Materials                | Anodized Aluminum, Plastic |

## Converter Dimensions



## Mounting Bracket Dimensions



## Cautions On Installation

- Installation Area for Flow Detector: Select the area of pipe where no air or gas bubbles exist in the flow.
- Mounting of flow detector: Recommend to install detector vertically with upward flow, in order to prevent deposit of slurry or bubbles in low flowrate conditions.
- Location of control valve: If a flow control valve is installed in the piping, it should be located on the downstream side of the flow detector to keep the fluid pressure high. The high fluid pressure will prevent the formation of bubbles in the flow.
- Noise Suppression: All electrical noise sources near the flowmeter, such as power relays or solenoid valves, should be fitted with a surge suppressor.
- Signal Cable Wiring: Keep signal cables away from high voltage or high current power cables to avoid induced electrical noise.

## Ordering Information

| Model Code       |   |  |  |  |   |  |  |  |   | Description                       |
|------------------|---|--|--|--|---|--|--|--|---|-----------------------------------|
| M-1500P          | - |  |  |  | - |  |  |  | - |                                   |
|                  | - |  |  |  |   |  |  |  |   |                                   |
| Tube Material    | T |  |  |  |   |  |  |  |   | PFA                               |
| Tube Size        | 1 |  |  |  |   |  |  |  |   | 1/8" OD                           |
| Connection       | 1 |  |  |  |   |  |  |  |   | Tube ends                         |
|                  |   |  |  |  | - |  |  |  |   |                                   |
| Mounting Bracket |   |  |  |  | 0 |  |  |  |   | Without Mounting Bracket          |
|                  |   |  |  |  | 1 |  |  |  |   | With Mounting Bracket             |
| Converter        |   |  |  |  | 1 |  |  |  |   | Standard                          |
|                  |   |  |  |  | 2 |  |  |  |   | Custom                            |
| Output           |   |  |  |  | 1 |  |  |  |   | 0 to 10 VDC                       |
|                  |   |  |  |  | 2 |  |  |  |   | 4 to 20 mA                        |
|                  |   |  |  |  |   |  |  |  | - |                                   |
|                  |   |  |  |  |   |  |  |  |   | XXX Unique Part Number Identifier |