

Inline Ultrasonic Flowmeter



The M-1500 Series consists of an inline primary flow sensor and externally mounted controller unit. The flow sensor is a straight-through flowtube that uses ultrasonic sensing technology to measure the rate of flow. The Controller Electronics receives the raw flowrate signal from the sensor and provides flowrate information in terms of analog and pulse output signals. (Both the LCD display and output signals are user-scalable)

Operation

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)

Installation

The standard unit may be installed in any orientation. For increased stability and continuous reliability in bubble related flow streams, the preferred mounting location is upstream of regulators or control valves as this minimizes bubbles from impacting flowmeter performance. Please contact factory for individual application installation recommendations.

M-1500 Series

**Non - Invasive
Inline Ultrasonic Flowmeter
(No Moving Parts)**

Features

- Ultrasonic flow sensing technology - robust proven technology
- Capable of measuring flows from 1 - 4000 ml/min
- Measuring accuracy of $\pm 2\%$ of READING (5% of reading below 20% of flow range)
- Compact design - ideal for use in semiconductor process tools
- Sensors/Transducers sit outside tube - hence completely non-invasive
- No pressure drop - since there is no obstruction in flow path
- Minimal bubble entrapment compared to other designs due to INLINE flow path
- Ideal for precise measurements in low flow applications
- No moving parts: hence no particle generation
- Fast response time (0.1 sec) ideal for CMP process measurements where flow fluctuations are high due to use of peristaltic pumps
- Flow measurements possible in both flow directions
- Remote programmability through USB interface
- Transducers resistant to harsh chemical environments (NEMA 4X compliance)

Applications

- CVD, CMP, and lithography tools
- Medical Devices
- Wet process systems
- Corrosive chemical distribution
- Laser equipment
- Cooling systems

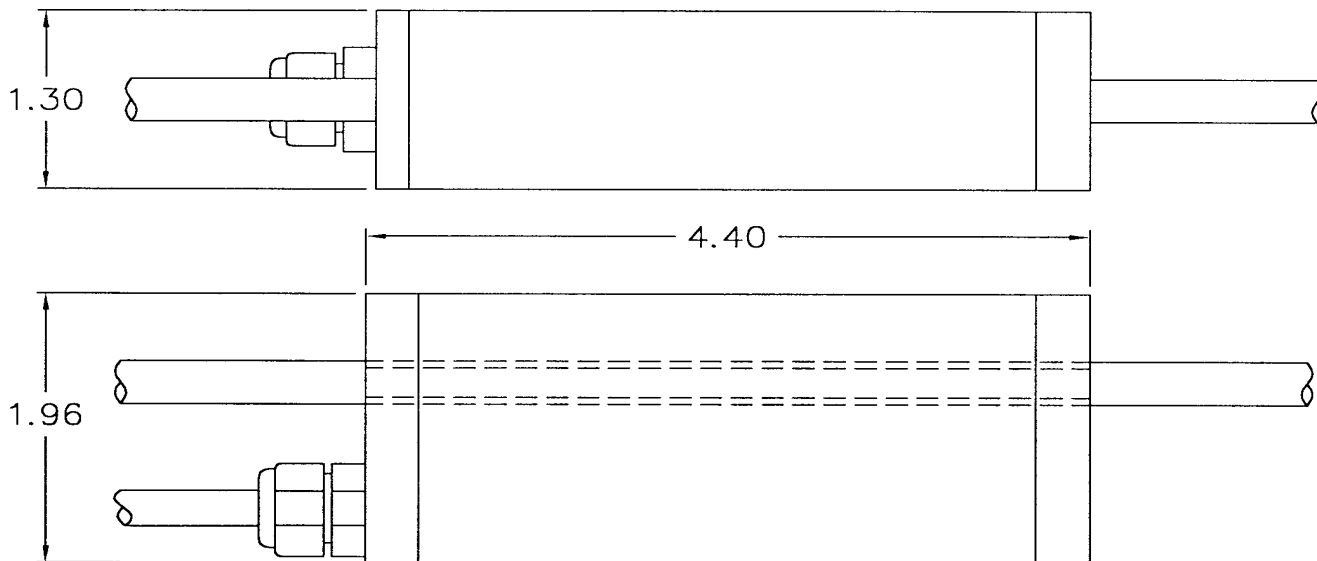
Certifications

Applied for UL and CE certificates.

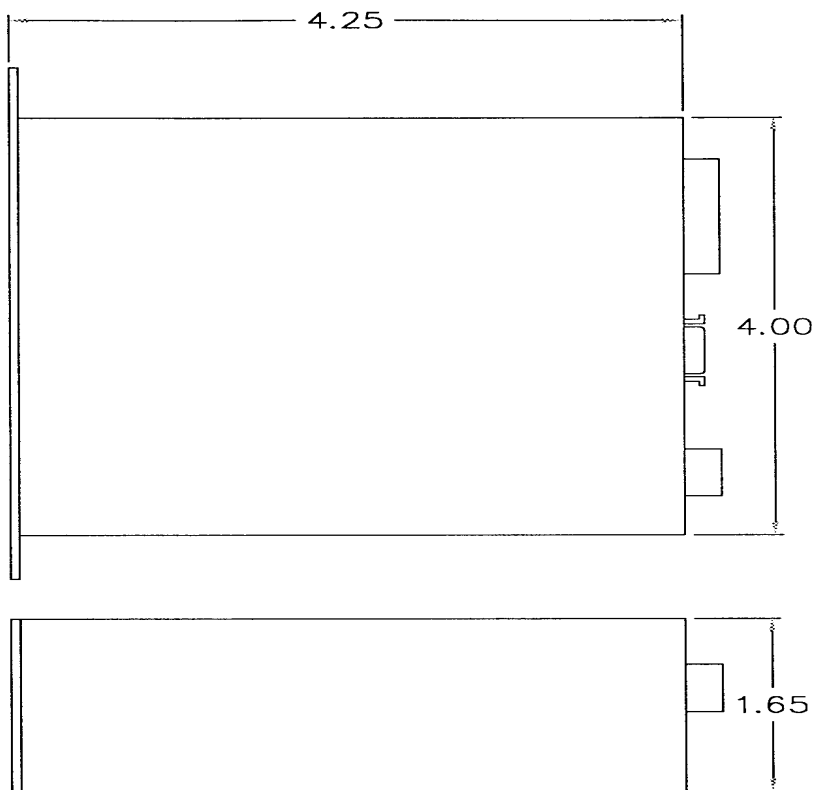
M-1500 Series

Dimensional Drawing

SENSOR DIMENSIONS



DIMENSIONS FOR SINGLE CONTROLLER



Inline Ultrasonic Flowmeter

Specifications

Performance Specifications

Flow Range: 1 - 4000 ml/min
 Accuracy: $\pm 2\%$ of reading
 (for 20 - 100% of flow range)
 $\pm 5\%$ of reading for 0 - 20%
 of flow range.
 Repeatability: $\pm 0.5\%$

Functional Specifications

Analog Output: Isolated 4-20 mA (Maximum load
 resistance of 500 ohm) current
 output.
 Pulse Output: Isolated Open Collector (15V, 15 mA)
 Frequency of 1000 hz at flow rate
 of 100%
 Low flow cut off: 2% - Enabled by Dip Switch
 Electrical Input: 24 VDC $\pm 10\%$
 300mA
 Optional Display: 4 digit 7 segment display, indicates
 instantaneous flow rate in ml/min
 Ambient Temperature range: 32 - 115 F (0 - 46 deg C)
 Fluid Temperature range: 50 - 140 F (10 - 60 deg C)
 Maximum Operating Pressure: 70 psig for PFA
 Cable Material: PTFE Jacketed Custom
 shielded cable.
 Cable Length: 3 Meters max.
 Fluid Viscosity: 8 cP max.¹
 Time Constant: Field Adjustable(0.1s to 5s)

¹ Higher viscosities would require special tube sizing and custom calibration.

Material Specifications

Sensor : PP or PTFE or PVDF
 Non-wetted parts: Peek, PP, PVDF, VitonA, FEP
 Wetted parts: PFA (high purity)

Physical Specifications

Sensor unit: Equivalent to NEMA 4X(IP65)
 Controller: Equivalent to NEMA 2 (IP20)
 Sensor Unit Dimensions : 1.3" (W) X 2.0" (H) X 4.4" (D)
 Single Controller Dimensions :4.0" (W) X 1.65" (H) X 4.3" (D)

Tube Sizes*

Tube Diameter (inches)		Flow Range (ml/min)**	
Inner Diameter	Outer Diameter	Lower Flow Range***	Higher Flow Range***
		1/32	1/16
1/16	1/8	4 - 200	12 - 600
1/8	1/4	20 - 500	160 - 4000

* Other sizes available upon request

** Better flow resolution and accuracy can be offered over smaller
 flow ranges

*** Selectable by DIP switch

Ordering Information

Standard part Numbering						Options				
M	-	Model	-	Material	Tube O.D.	Connection Type	-	Future Option	Converter	Analog Output
M	-	1500	-	T - PFA	0 - 1/16" 1 - 1/8" 2 - 1/4"	1 - Tube End Connection	-	0 - Standard	1 - Standard 2 - Custom	1 - Voltage Output 2 - Current Output