

Ultrasonic Flowmeter



M-1600 Series Noncontact Inline Flowmeter

Features

- Accuracy +2% over 1 m/s
- Flow range 110 to 18,000 ml/min
- Straight and Clean (no metal parts)
- Maintenance free (no moving parts)
- Corrosion resistant, no metal part exposed
- Simple, light weight and Compact
- Easy configuration in front panel with LCD display
- Wide rangeability
- Built in Linearizer
- Panel mount converter

The M-1600 Series is a flowmeter designed for applications involving liquids such as water, CMP slurries, and corrosive chemicals. The flowmeter consists of a straight sensor and a controller. The only wetted part is PFA. There are no mechanical seals or moving parts and M-1600 has non-contact transducers mounted on straight tube. This straight flow tube design ensures that there are no dead pockets of fluid. The M-1600 should be mounted in the vertical direction to get best results. The M-1600 covers low flow rates in tube sizes of 3/8", and 1/2" where clamp-on type ultrasonic flowmeters can not be used.

Applications

- Pure water and ultra-pure water in semiconductor manufacturing plants.
- CMP slurries
- Flow measurements for Chemical feeds
- Highly corrosive chemicals measurement
- Very low flow measurement of liquid

Operating Principle

The fluid to be measured flows through the straight PFA tube. Two piezoelectric transducer, A & B, mounted externally on the measuring section of the flow tube generate and receive an ultrasound alternately. The sound from one Piezoelectric transducer goes through the tube wall and into the fluid at angle θ and travelling with the fluid. The sound reflected on the opposite wall is then detected by the other Piezoelectric transducer. The sound traveling along the flow is accelerated and the sound traveling against fluid is slowed. The difference in transit time of sounds is proportional to the velocity of the fluid.

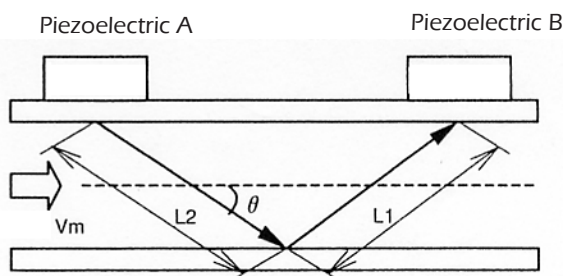


Figure 1. Operating Principle

$$\Delta t = \frac{L_1 + L_2}{C_0 - V_m \cos \theta} - \frac{L_1 + L_2}{C_0 + V_m \cos \theta}$$

Δt : Transit time difference

C_0 : Velocity of sound

V_m : Fluid velocity

Sensor Specifications

Measuring Range	110 - 9000 ccm	230 - 18000 ccm
Pipe Sizes (OD x ID)	0.375 x 0.250 in 9.53 x 6.35 mm	0.500 x 0.375 in 12.7 x 9.53 mm
Accuracy	+/- 2% R.D. (by water)	
Measuring Medium	Water, Slurry, Chemicals	
Measuring Temperature	10 - 40 Deg C (50 - 104 F)	
Pressure	0 - 0.5 MPa (75 psig max)	
Wet Material	PFA	
Housing Material	ABS	
Connection	PFA tube end	
Weight	Approx. 300 g (0.661 lbs)	
Cable Length	5m	

Controller Specifications

Method	Ultrasonic Transmitting Time Difference
Operating Conditions	Temperature 0 - 50 C Humidity: 30 - 80 % RH (without dew)
Output	1) 4 - 20 mA (Load resistance 0 to 500 ohms) or 0 to 10V 2) Scaled Pulse Open collector max. 30 V DC, max 20mA Pulse Width: 0.5 ms (Max. 1000 Hz) 50 ms (Max. 10 Hz) 100 ms (Max. 5 Hz) 3) Alarm/ Preset count Open collector (2 points) Max. 30 V DC, max. 20mA
Installation	Panel Mount
Low Cut-off	0 to 10% of full scale (adjustable)
Linearizer	15 line-segment approximation
Display	LCD / 2 line 16 digit alphanumeric Flow rate, Total flow, and Flow velocity
Alarm	2 LED
Data Entry	By 4 key switches in front panel
Power	24 V DC +/- 10%, 150 mA (1.5 A/starting)
Enclosure Classification	IP20 (Indoor use)
Materials	Panel - ABS, Housing - steel
Color	Panel - gray, Housing - black
Dimensions	96 W x 48 H x 172 D
Weight	Approx. 500g (1.1 lbs)

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Terminal Block Connections

No	Polarity	Connection
1	+	Current output (4 to 20 mA)
2	-	
3	+	Pulse output (Open Collector)
4	-	
5	+	Flow rate alarm (H) or Preset total (HH) (Open Collector)
6	-	
7	+	Flow rate alarm (L) or Preset total (H) (Open Collector)
8	+	Reset total
9	-	
10	GND	Ground
11	0 V	Power supply (24 V DC)
12	24 V	

Cautions

Installation Area for Flow Detector: Select the area of pipe where no air or gas bubbles exist in the flow.

Mounting of Flow Detector: Flow detector can be mounted horizontally, vertically or at a slant. However, the flow tube must always be filled with liquid.

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 maintain a high fluid pressure.

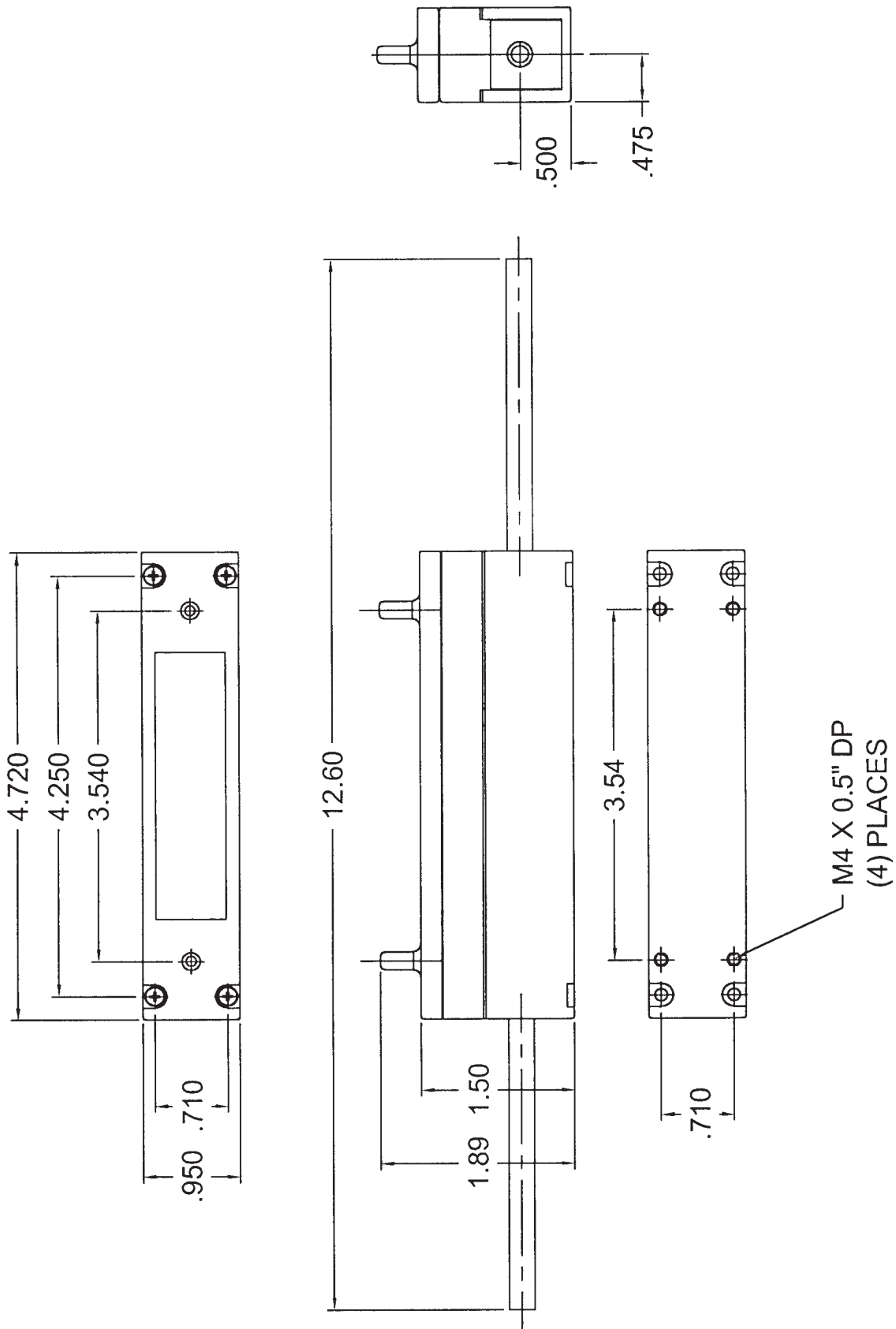
Noise Suppression: All electrical noise sources near the flowmeter, such as power relays or solenoid valves, should be fitted with a surge suppressor.

Signal Cable Wiring: Keep signal cables away from high voltage or high current power cables to avoid induced electrical noise.

Ordering Information

Standard part Numbering							Options			
M	-	Model	-	Material	Tube O.D.	Connection Type	-	Cable Length	Analog Output	Future Option
M	-	1600	-	T - PFA	3 - 3/8" 4 - 1/2"	1 - Tube End Connection	-	0 - 5 m (Std) 1 - 10 m	1 - Voltage Output 2 - Current Output	0 - Standard

Dimensional Drawing (Sensor)



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Dimensional Drawing (Controller)

