

M-3100 Series

Clamp-On Ultrasonic Flow Meter





The Malema M-3100 Series Clamp-On Ultrasonic Flow Meter is a non-invasive ultrasonic transit-time flow measurement system consisting of the M-3100T Transmitter and M-3150S Clamp-on Ultrasonic Flow Sensor. Designed to measure the fluid velocity of liquid within closed conduit (pipe), the flow meters are installed on the pipe without disrupting the flow path, eliminating risks of leakage or contamination.

Key Features

- No contamination due to non-contact flow measurement
- Compact DIN rail mount version
- Analog and digital output options
- RS-485 Modbus digital communication
- Parameters (range, filters, etc.) are configurable through user-friendly Malema GUI, PC application software

Applications

- CMP
- ECD
- Electroless Deposition
- Wet Clean and Track Tools
- Solar PV Equipments
- Wet Process / Chemical Distribution System
- Laser Equipment
- Cooling Systems

Measurement Principle

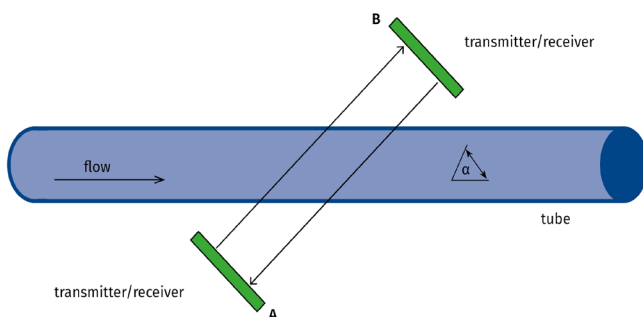


Figure 1: Sensor Structure

The M-3100S Clamp-On Ultrasonic Flow Meter utilizes the transit time method to determine flow rate. Two ultrasonic piezo ceramics function as both transmitter and receiver for the burst of sound energy that is sent between them. For each transmission, the difference in transit time that it takes for the pulse to travel between the ceramics is measured. As the difference in transit time is directly related to the velocity of the liquid, it can be used as the basis to determine the volumetric flow rate.

When sending ultrasonic signals through the measuring section, the transit time difference depends on the flow direction of the medium. The ultrasonic sound signals sent along the flow direction and volume flow of the medium, i.e. downstream, need less time to travel through the measurement section than the ultrasonic sound signals sent against the flow direction, i.e. upstream. The calculation of the flow rate is then carried out inside the M-3100S Clamp-On Ultrasonic Flow Meter.

Sensor Specifications

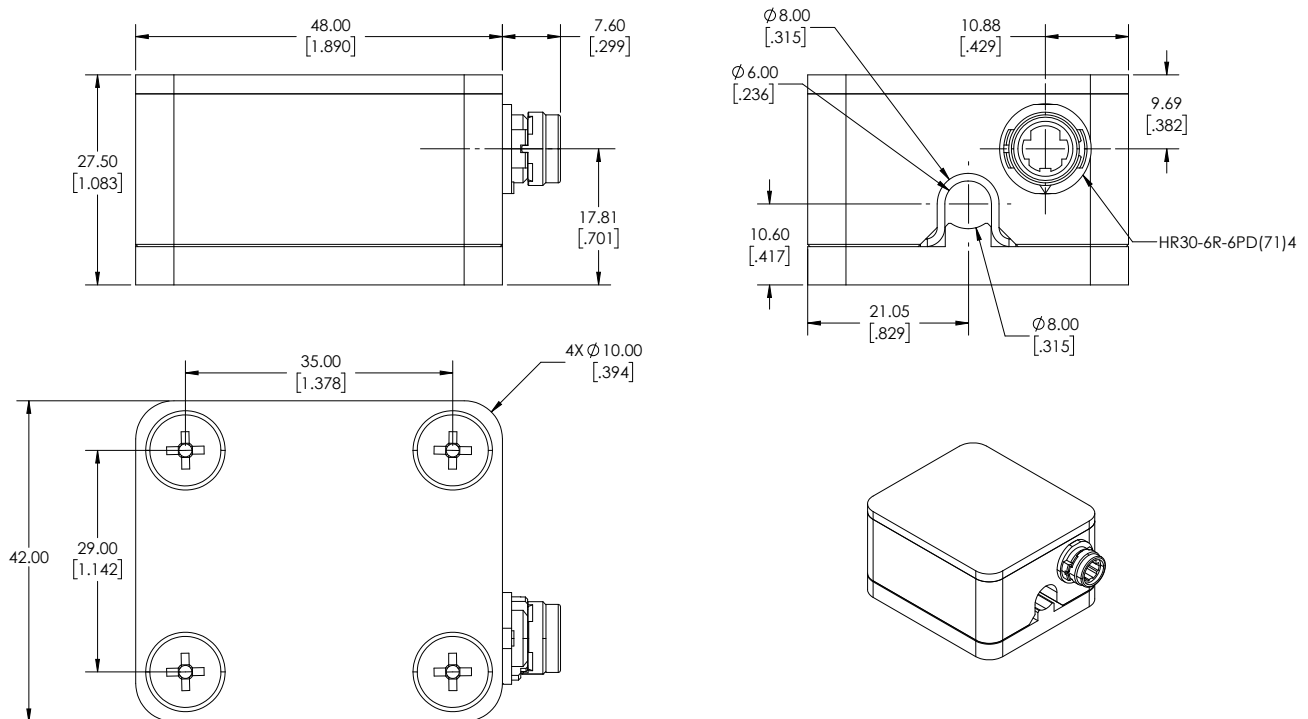
Model M-3100S

Part No.		0250		0375		0500	
Flow Range		0–3 LPM		0–8 LPM		0–20 LPM	
Accuracy	Flow >20% of Full Scale	±2%		±2%		±2%	
	Flow <20% of Full Scale	±10 ml/min		±30 ml/min		±100 ml/min	
Repeatability	Flow >20% of Full Scale	±1%		±1%		±1%	
	Flow <20% of Full Scale	±5 ml/min		±15 ml/min		±50 ml/min	
Operating Pressure		6.5 Bar		6.5 Bar		6.5 Bar	
Operating Temperature		10°C–60°C		10°C–60°C		10°C–60°C	
Ambient Temperature		0°C–40°C		0°C–40°C		0°C–40°C	
Tube Material		PFA		PFA		PFA	
Tube Dimensions		Inch	mm	Inch	mm	Inch	mm
ID		1/8"	3.2	1/4"	6.4	3/8"	9.5
OD		1/4"	6.4	3/8"	9.5	1/2"	12.7
Sensor Enclosure Rating		IP65		IP65		IP65	
Electrical Connection		Hisrose		Hisrose		Hisrose	

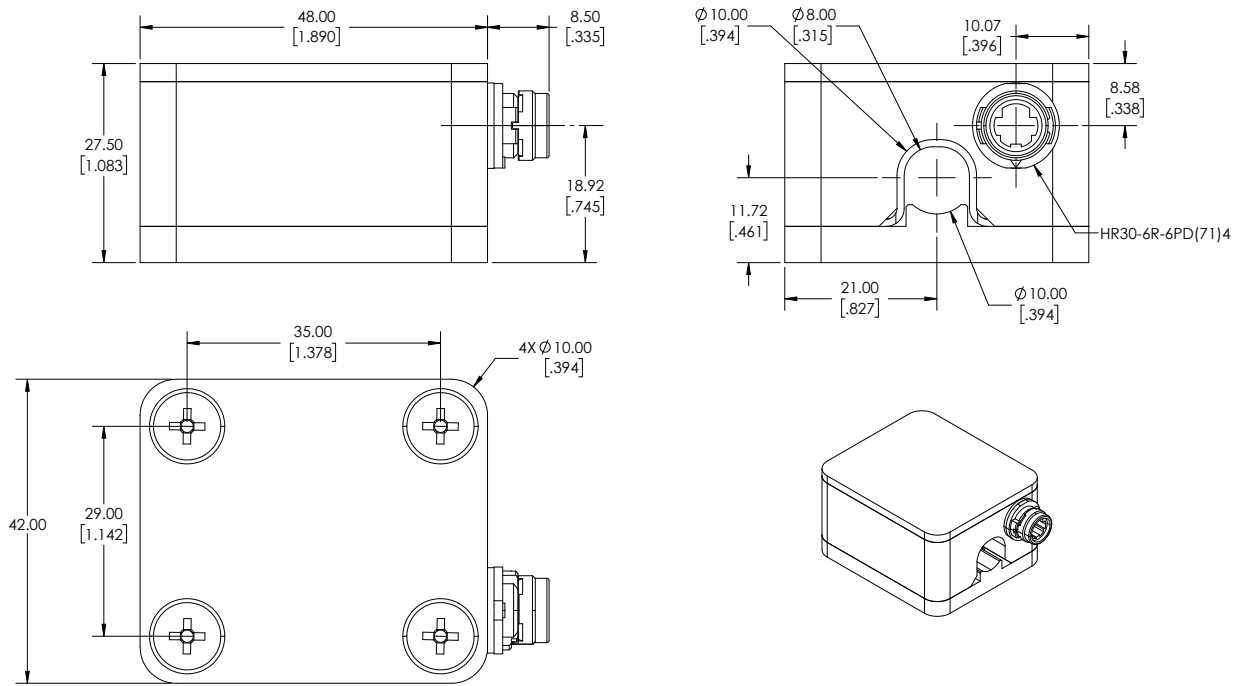
Dimensional Drawings

For Reference Only

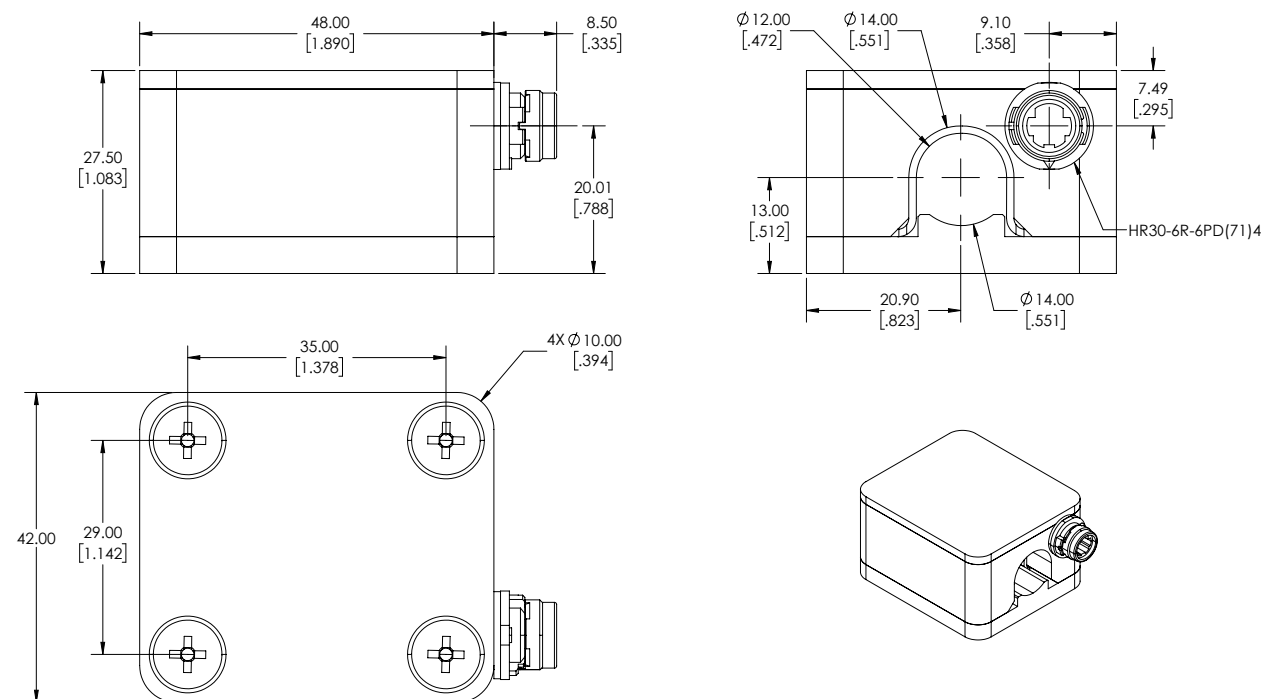
1/4"



3/8"



1/2"



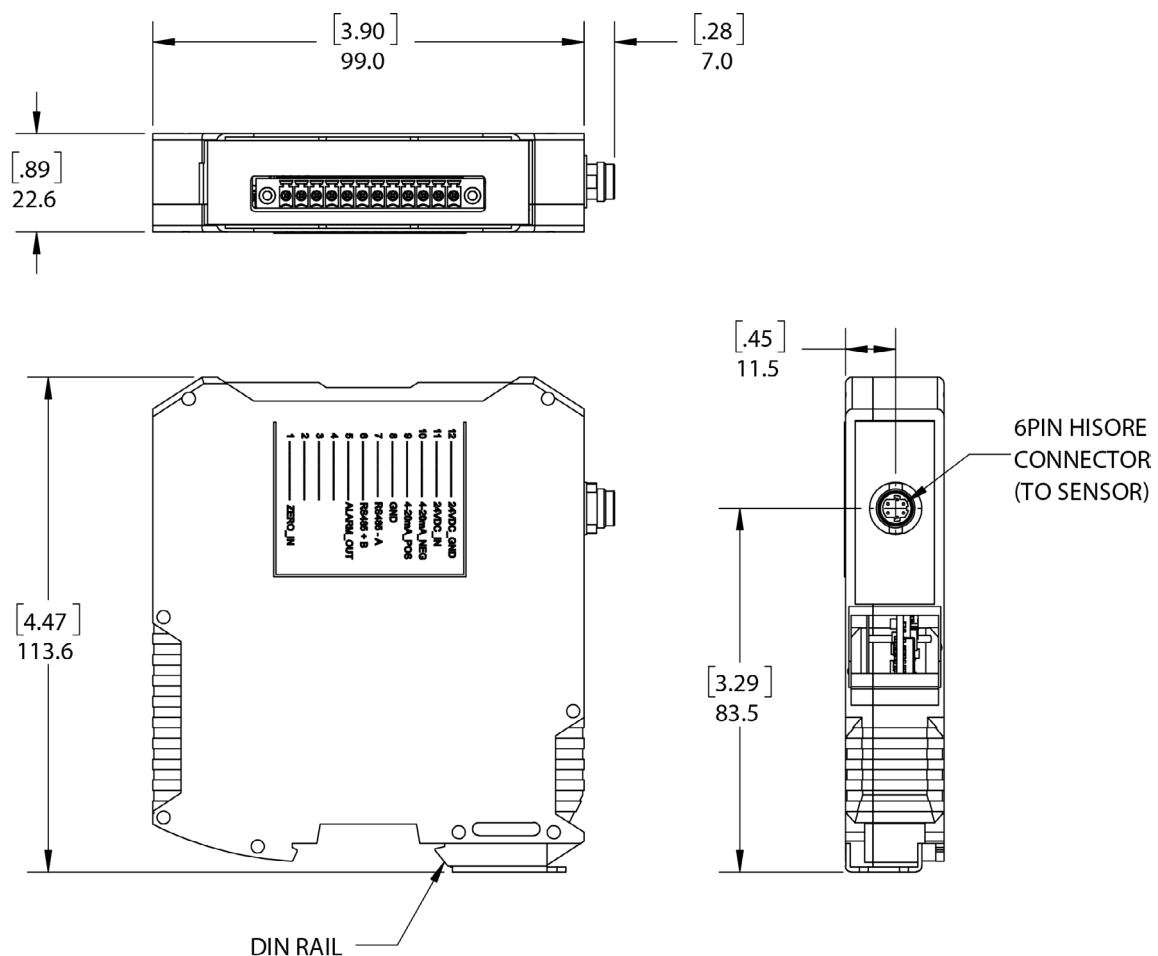
Signal Converter Specifications

Model M-3100T (Single Channel)

Mounting	DIN Rail
Enclosure Rating	IP20
Power Supply	24 V Dc $\pm 10\%$
Ambient Temperature	0°C–40°C
Humidity	30-85% Relative Humidity (No Condensation)
Power Consumption	125 mA
Analog Output	Current O/P: Active: 4-20 mA (Max. Load < 900 Ω) or Passive: 4-20 mA (max. load < 1,200 Ω) or Voltage Output: 0-10 V DC (min. load > 10K Ω)
Digital Input	Flow zero or totalizer reset. Zeroing. Momentary pull-up to 24 V DC for activation
Digital Output	Open Collector / Max. 30 V DC, 200 mA max. Configurable for Low Flow Rate, High Flow Rate, Totalizer Greater Than, Totalizer Less Than, Signal Strength Less, Positive Totalizer Pulse
Communication	MODBUS over RS-485

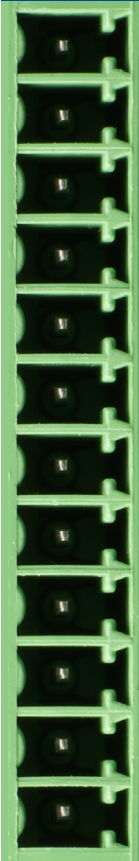
Dimensional Drawings

For Reference Only



DIMS: MM [IN]

Connection Specifications

	Pin No.	Description	Function	Comments
	1	ZERO_IN	Zero flow signal Input	Make sure the fluid in the tube is stationary and pullup this pin to 24V DC supply line momentarily to zero the flow rate
	2	Reset_Totalizer	Resets the flow totalizer to 0	Momentary pull-up to 24 V DC
	3	PULSE_OUT	Pulse (Hz) - 10 KHz max, Configurable Pulse (Volume) - Pulse weight Configurable from 0.1 mL	Open Collector 30 V DC, 200 mA max
	4	Earth Ground	EM Shielding	Required for CE certification
	5	ALARM_OUT	Digital alarm output, open collector, 30 V DC/200mA	V DC alarm output triggered based on programmable parameter settings, i.e. signal strength or flow > or flow < or pulse from PC GUI
	6	RS485 + (B)	Digital communication	MODBUS signals used to communicate with device or PC GUI for user parameter configuration settings
	7	RS485 - (A)	Digital communication	MODBUS signals used to communicate with device or PC GUI for user parameter configuration settings
	8	GND	Digital alarm output (GND)	
	9	4-20mA POS	Analog output	Analog 4-20 mA flow rate output
	10	4-20mA NEG	Analog output (GND)	
	11	24VDC_IN	Power supply input, 24V DC $\pm 10\%$	Power supply
	12	24VDC_GND	Power supply input (GND)	

Ordering Information

Sensor

Model Code						Description
Model	OD	Wall Thickness	Electrical Connection	Cable Length	Extension ID	
M-3100S-						Clamp-on sensor for PFA tubes
	0250					1/4" OD
	0375					3/8" OD
	0500					1/2" OD
		1				Standard
		2				Thick
			A			Connector
				0		Reserved
					-S01	Standard Version
					-XXX	Factory assigned Unique ID for custom versions

Transmitter

Model Code				Description
Model	Analog Output	Digital Communication	Extension ID	
M-3100T				Single-Channel (for use with one M-3100S Sensor)
	-1			1x 4-20 mA Analog output for volumetric flow rate (for M-3100T Signal Converter)
		M		MODBUS over TCP/IP
		X		None
			-S01	Standard Version
			-XXX	Factory assigned Unique ID for custom versions

Accessories: Sensor-Transmitter Interconnecting cable

Model Code				Description
Model	Type	Length	Extension ID	
M-3100C				Sensor-Transmitter Interconnecting cable
	A			From sensor to bulkhead
	C			From sensor to bulkhead
		1		1 m*
		2		2 m*
		3		3 m**
		Z		Custom***
			-S01	Standard Version
			-XXX	Factory assigned Unique ID for custom versions

*Total length of cables (A+B or A+C) not to exceed 3 m.

**Only available for type C.

***Consult factory.

Accessories: I/O and Power Cable

Model Code		Description
Model	Extension ID	
M-3100IO		I/O and Power Cable
	-01	1 meter 12 Core I/O and Power Cable
	-02	2 meter 12 Core I/O and Power Cable with free leads
	-03	3 meter 12 Core I/O and Power Cable with free leads
	-ZZ	Custom Length 12 Core I/O and Power Cable with free leads



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