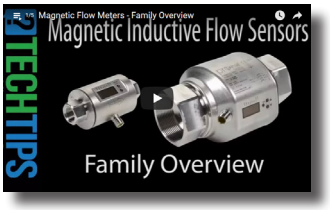
Magnetic-Inductive Flow Meters

ProSense FMM Series

Endress+Hauser Picomag Series

Magnetic-Inductive Flow Meter Application

Magnetic-inductive flow meters (Magmeters) are one of the most widely used technologies for liquid flow monitoring in industrial process markets such as wastewater, mining and minerals, utilities, food and beverage, and pharmaceuticals. To ensure reliable and accurate operation, some important application requirements should be considered. Meeting the minimum conductivity of the liquid and properly installing with a full pipe are required in order to avoid significant error or the meter not functioning at all. Additionally, the presences of air bubbles should be avoided as they will affect the accuracy of the meter's measurements. Installation location in the piping is important because disturbances in the flow caused by bends in the pipe, valves, reductions, etc. can cause inaccuracies. The Endress+Hauser Picomag series has no minimum inlet or outlet pipe run requirements making it ideal for small confined spaces. Refer to the magmeter's specifications and operating instruction documents for specific information regarding application and installation requirements.

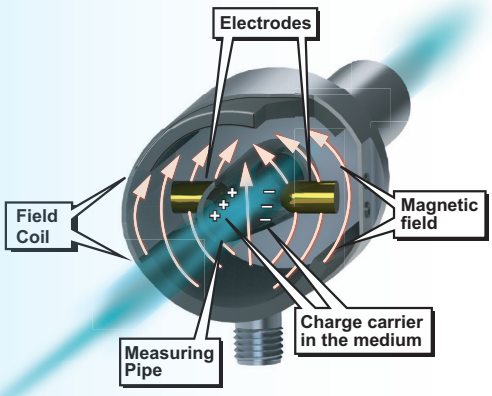


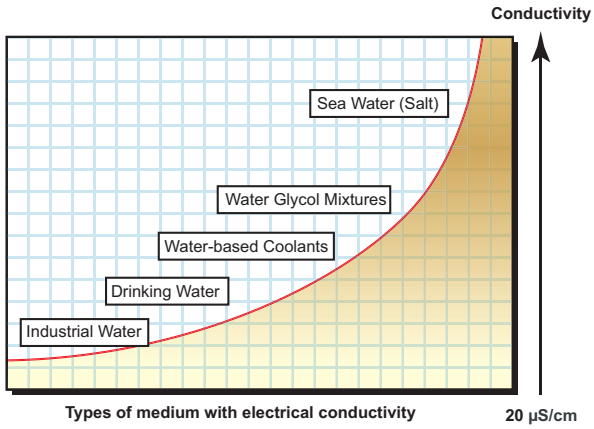
Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0002 for a short overview video of the FMM Series Magnetic-Inductive Flow Meters

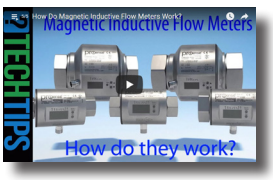
Magnetic-Inductive Flow Meter Measuring Principle

Magmeters operate by using the magnetic-inductive measuring principle in which a magnetic field is generated in the specified measuring pipe by current-carrying coils. When the media flows through the pipe, the ions of the conductive media are diverted perpendicularly to the magnetic field with the positive and negative charge carriers flowing in opposite directions. The two electrodes that are in contact with the medium then measure the voltage that is induced.

The measured signal voltage is proportional to the average flow velocity. By knowing the inside pipe diameter of the unit, the volumetric flow rate is determined. Magmeters are suitable for use with a variety of conductive liquids in industrial process applications such as those in the following graph:







Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0006 for a short video to learn how Magnetic Inductive Flow Meters works

Magnetic-Inductive Flow Meters

ProSense FMM Series Magnetic Flow Meter Selection Guide

Model	Price	Process Connection	Flow Range	Temperature Range	Display Units	Output 1	Output 2	Empty Pipe Detection
FMM50-1001	$556.00	1/2" FNPT	0 to 6.6 GPM	-4 to 176°F [-20 to 80°C]	GPM, GPH, GAL, or °F	Switch or pulse (flow)	Switch, analog or reset input (flow or temperature)	No
FMM75-1001	$602.00	3/4" FNPT	0 to 13.2 GPM					
FMM100-1001	$666.00	1" FNPT	0 to 26.4 GPM					
FMM150-1001	$997.00	1-1/2" FNPT	0 to 80 GPM			Switch, pulse or frequency (flow)		Yes
FMM200-1001	$1,075.00	2" FNPT	0 to 160 GPM					
FMM50-1002	$556.00	1/2" FNPT	0 to 6.6 GPM		GPM, GPH, LPM, m³/h, °F, °C	Analog 4-20 mA (temperature)	Analog 4-20 mA (flow)	No
FMM75-1002	$602.00	3/4" FNPT	0 to 13.2 GPM					
FMM100-1002	$666.00	1" FNPT	0 to 26.4 GPM					
FMM150-1002	$997.00	1-1/2" FNPT	0 to 79.3 GPM					Yes
FMM200-1002	$1,075.00	2" FNPT	0 to 158.5 GPM					

Endress+Hauser Picomag Magnetic-Inductive Liquid Flow Meter Selection

Part No.	Price	Process Connection	Flow Range	Temperature Range	Totalizer Range	Conductivity Range	Output 1	Output 2	Empty Pipe Detection
DMA15-AAACA1	$572.00	1/2" FNPT	0 to 9.2 GPM	14 to 158°F [10 to 70°C]	+/-3.436E10 liters	20 to 30,000 µS/cm	• Flow rate, analog or switch • Temperature, analog or switch • Conductivity, analog or switch • Volumetric flow totalizer pulse • Empty pipe detection switch • Flow totalizer reset digital input • Flow override digital input • IO-Link	• Flow rate, analog or switch • Temperature, analog or switch • Conductivity, analog or switch • Empty pipe detection switch • Flow totalizer reset digital input • Flow override digital input	Yes
DMA20-AAACA1	$688.00	3/4" FNPT	0 to 19.8 GPM						Yes
DMA25-AAACA1	$824.00	1" FNPT	0 to 39.6 GPM						Yes
DMA50-AAACA1	$1,106.00	2" FNPT	0 to 198.1 GPM			20 to 10,000 µS/cm			Yes

ProSense® FMM Series (-1001) Magnetic-Inductive Flow Meters

Part No.FMM75-1001

Part No. FMM200-1001

Overview

AutomationDirect's ProSense FMM Series (-1001) Magmeter is designed to reliably detect the flow rate of conductive media up to 160 gallons per minute. The stainless steel, mechanically-robust design mounts directly in-line providing a compact, low-profile installation for process control. A 4-digit numeric display with pushbutton setup indicates flow rate, fluid temperature and total flow volume with selectable engineering units. Two outputs are available to remotely monitor the binary or analog status of flow rate/volume and temperature parameters. Simple to setup, easy to install and with no moving parts, the FMM is a reliable alternative to traditional flow meters and mechanical flow switches.

Features

- 1/2 to 2" NPT female process connections
- Measure up to 160 GPM
- Measure fluid temperature in addition to flow and volume
- 4-digit numeric display with pushbutton setup
- Selectable engineering units: GPM, GPH, GAL, °F, °C
- Two outputs selectable for switch, pulse, frequency or analog signals
- 4-pin M12 quick disconnect
- 5-year warranty

#E320431

See the end of the section for a series of Overview and Setup Videos

Output Function Selections

Output 1:

- Flow rate switch
- Volumetric flow totalizer pulse
- Volumetric flow totalizer preset switch
- Flow rate frequency (1-1/2 and 2 inch models only)
- Empty pipe detection switch (1-1/2 and 2 inch models only)

Output 2:

- Flow rate switch
- Temperature switch
- Analog flow rate
- Analog temperature
- Volumetric flow totalizer reset input
- Empty pipe detection switch (1-1/2 and 2 inch models only)

ProSense FMM Series (-1001) Magnetic Flow Meters					
Model	***FMM50-1001***	***FMM75-1001***	***FMM100-1001***	***FMM150-1001***	***FMM200-1001***
Price	$556.00	$602.00	$666.00	$997.00	$1,075.00
Weight	1.09 lb	1.18 lb	1.30 lb	6.74 lb	6.75 lb
Range	0 to 6.6 GPM	0 to 13.2 GPM	0 to 26.4 GPM	0 to 80.0 GPM	0 to 160.0 GPM
Process Connection	1/2" FNPT	3/4" FNPT	1" FNPT	1-1/2" FNPT	2" FNPT
Application	Conductive liquids: ≥ 20 µS/cm (micro Siemens per centimeter) liquids / viscosity: < 70cSt (centiStoke) at 104°F				
Pressure Rating	232PSIG [16bar]				
Medium Temperature	14 to 158°F [-10 to 70°C]				
Operating Voltage	18 to 30VDC			18 to 32VDC	
Current Consumption	< 120mA			< 150mA	
Insulation Resistance	> 100MΩ (500VDC)				
Protection Class	III				
Reverse Polarity Protection	YES				
Output Functions					
Output Type / Function	OUT1: switch (N.O. or N.C. / PNP or NPN) / flow rate, volumetric flow totalizer preset, empty pipe detection (1-1/2 and 2") or pulse / volumetric flow totalizer or frequency / flow rate (1-1/2 and 2") OUT2: switch (N.O. or N.C. / PNP or NPN) / flow rate, temperature, empty pipe detection (1-1/2 and 2") or analog / flow rate,temperature or reset input / volumetric flow totalizer reset				
Switch/Pulse/Frequency Outputs	PNP / NPN Selectable N.O. / N.C. Selectable Current Rating: 2 x 200mA Voltage Drop: < 2V Short-circuit protection: Yes (non-latching) Overload protection: Yes Switch hysteresis or window function			PNP / NPN Selectable N.O. / N.C. Selectable Current Rating: 2 x 250mA Voltage Drop: < 2V Short-circuit protection: Yes (non-latching) Overload protection: Yes Switch hysteresis or window function 0.1 to 10000 Hz frequency	
Analog Output	4-20 mA max 22mA or 0-10 VDC selectable Max. load: 500Ω (4-20 mA) Min. load: 2000Ω (0-10 VDC)				

ProSense® FMM Series (-1001) Magnetic-Inductive Flow Meters

ProSense FMM Series (-1001) Magnetic Flow Meters					
Model	**FMM50-1001**	**FMM75-1001**	**FMM100-1001**	**FMM150-1001**	**FMM200-1001**
Flow Rate Monitoring					
Measuring Range	0.030 to 6.604 GPM	0.060 to 13.200 GPM	0.100 to 26.400 GPM	1.300 to 80.000 GPM	1.300 to 160.000 GPM
Display Range	-7.925 to 7.925 GPM	-15.840 to 15.840 GPM	-31.700 to 31.700 GPM	-96.000 to 96.000 GPM	-190.000 to 190.000 GPM
Resolution	0.010 GPM	0.020 GPM	0.050 GPM	0.100 GPM	0.100 GPM
Set Point, SP	0.060 to 6.600 GPM	0.120 to 13.200 GPM	0.250 to 26.400 GPM	1.700 to 80.000 GPM	2.100 to 160.000 GPM
Reset Point, rP	0.300 to 6.570 GPM	0.060 to 13.140 GPM	0.100 to 26.250 GPM	1.300 to 79.600 GPM	1.300 to 159.200 GPM
Analog Start Point, ASP	0.000 to 5.300 GPM	0.000 to 10.600 GPM	0.000 to 21.200 GPM	0.000 to 64.000 GPM	0.000 to 128.000 GPM
Analog End Point, AEP	1.300 to 6.600 GPM	2.600 to 13.200 GPM	5.200 to 26.400 GPM	16.000 to 80.000 GPM	32.000 to 160.000 GPM
In Steps Of	0.010 GPM	0.020 GPM	0.050 GPM	0.100 GPM	
Volumetric Flow Totalizer					
Pulse Value	0.010 to 30,300,000 GAL	0.010 to 99,990,000 GAL	0.010 to 100,000,000 GAL	0.020 to 80,000,000 GAL	0.020 to 160,000,000 GAL
Pulse Length	0.010 to 2s	0.005 to 2s	0.0025 to 2s	0.016 to 2s	0.008 to 2s
Temperature Monitoring					
Measuring Range	-4 to 176°F [-20 to 80°C]**				
Resolution	0.1°F	0.5°F			
Set Point, SP	-2.5 to 176°F			-2.0 to 176°F	
Reset Point, rP	-3.5 to 175.0°F			-3.0 to 175°F	
Analog Start Point, ASP	-4.0 to 140.5°F			-4.0 to 140°F	
Analog End Point, AEP	31.5 to 176.0°F			32.0 to 176°F	
In Steps Of	0.5°F				
Accuracy / Deviations					
Flow Monitoring					
*Accuracy**	± 0.8% MW + 0.5% VMR			± 0.8% MW + 0.5% VMR***	
*Repeatability**	± 0.2% VMR				
Temperature Monitoring					
Accuracy	± 4.5°K (Q > 0.26 GPM)			± 1°K (Q > 4.0 GPM)	
Reaction Times					
Power-On Delay Time	5s				
Flow Monitoring					
Start-Up Delay	N/A			0 to 50s	
Response Time	< 0.150s (dAP = 0)			< 0.350s (dAP = 0)	
Display Damping, dAP	0.0 to 5.0s				
Temperature Monitoring					
Response Time	T09 = 3s (Q > 4.0 GPM)				
Environment					
Ambient Temperature	14 to 140°F [-10 to 60°C]				
Storage Temperature	-13 to 176°F [-25 to 80°C]				
Protection	IP 67			IP 65, IP 67	

*** MW = Measured value**
VMR = Final value of the measuring range
**** Displays °F only**
***** > 4GPM medium and operating temperature of 72°F ± 7°F**

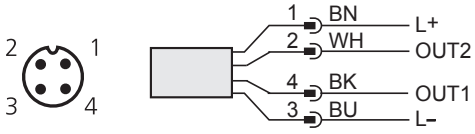
ProSense FMM Series (-1001) Magnetic-Inductive Flow Meters

ProSense FMM Series (-1001) Magnetic Flow Meters					
Model	***FMM50-1001***	***FMM75-1001***	***FMM100-1001***	***FMM150-1001***	***FMM200-1001***
Mechanical Data					
Process Connection	1/2" NPT female	3/4" NPT female	1" NPT female	1-1/2" NPT female	2" NPT female
Materials (wetted parts)	Stainless steel 316L / 1.4404; PEEK (polyether ether ketone); FKM			Stainless steel (1.4404 / 316L); stainless steel (1.4571/316Ti); PEEK; FKM	
Housing Materials	Stainless steel 316L / 1.4404; PBT-GF 20; PC; EPDM/X			Stainless steel 316L / 1.4404; stainless steel 316Ti / 1.4571; PEI; FKM; PBT-GF 20; elastolan	
Displays / Operating Elements					
Display	Display unit: 6 x LED green (GPM, GPH, GAL, °F, 10^3, 106) Switching Status: 2 x LED yellow Measured values: 4-digit alphanumeric display (7.5 mm) Programming: 4-digit alphanumeric display (7.5 mm)			Display unit: 6 x LED green (GPM, GPH, GAL, °F, 10^3, 106) Switching Status: 2 x LED yellow Measured values: 4-digit alphanumeric display (7.5 mm) Programming: 4-digit alphanumeric display (7.5 mm)	
Electrical Connection					
Connection	M12 connector; gold-plated contacts				
Tests / Approvals					
EMC	EN 61000-4-2: 4kV CD / 8kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2kV EN 61000-4-5 Surge: 0.5 kV EN61000-4-6 HF conducted: 10V				
Shock Resistance	DIN IEC 68-2-27: 20g (11ms)				
Vibration Resistance	DIN IEC 68-2-6: 5g (10 to 2,000Hz)				
Approvals*	UL (E320431), CE, RoHS				

*** To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page at www.automationdirect.com**

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Wiring Diagram



Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Colors to DIN EN 60947-5-2

For additional wiring details see individual product manuals.
Use FMM-GND1 if meter is installed in ungrounded pipe system.

Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Output Function Selections

Models:
FMM50-1001, FMM75-1001, FMM100-1001

Output 1:
Flow rate switch
Volumetric flow totalizer pulse
Volumetric flow totalizer preset switch

Output 2:
Flow rate switch
Temperature switch
Analog flow rate
Analog temperature
Volumetric flow totalizer reset input

Models:
FMM150-1001, FMM200-1001

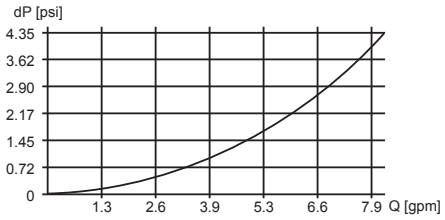
Output 1:
Flow rate switch
Volumetric flow totalizer pulse
Volumetric flow totalizer preset switch
Flow rate frequency
Empty pipe detection switch

Output 2:
Flow rate switch
Temperature switch
Analog flow rate
Analog temperature
Volumetric flow totalizer reset input
Empty pipe detection switch

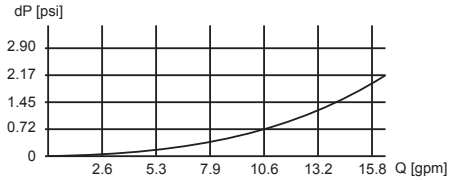
ProSense® FMM Series (-1001) Magnetic-Inductive Flow Meters

Pressure Loss/Flow Rate*

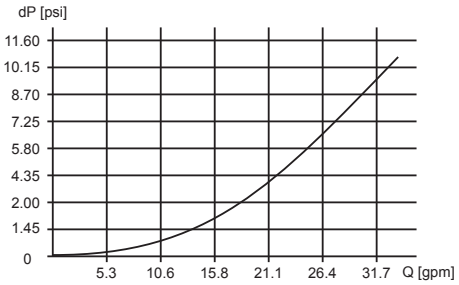
FMM50-1001



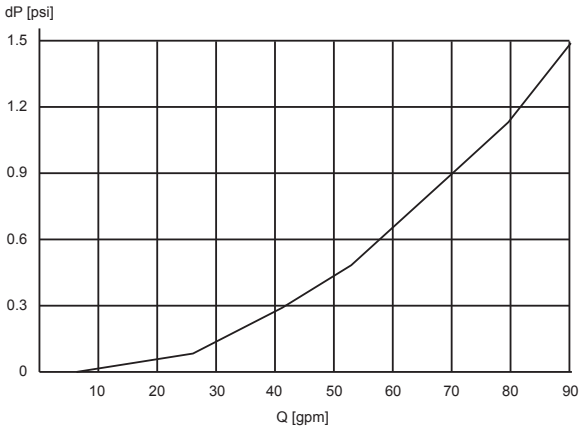
FMM75-1001



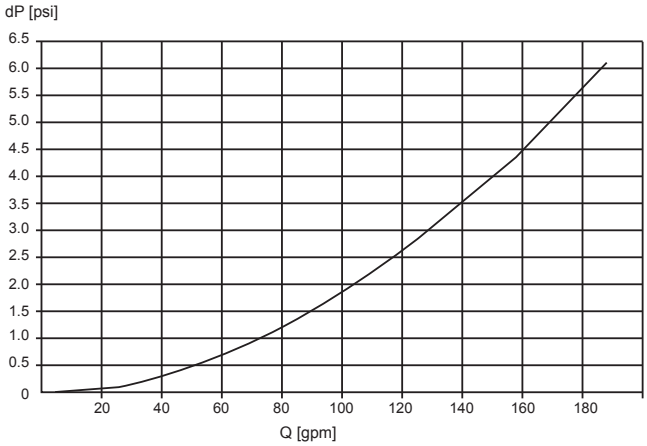
FMM100-1001



FMM150-1001



FMM200-1001

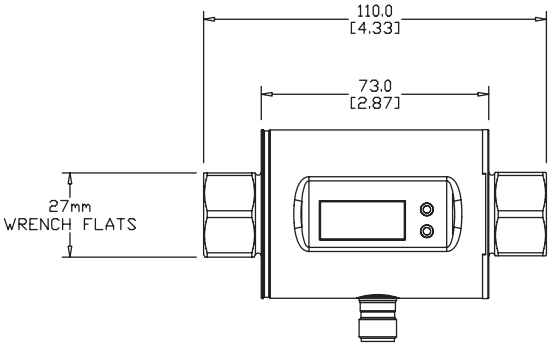


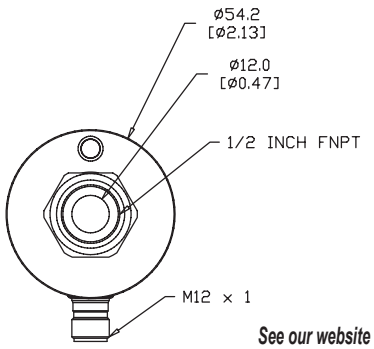
** when used with water @ 68˚F [20˚C]*

Dimensions

mm [inches]

Part No. FMM50-1001





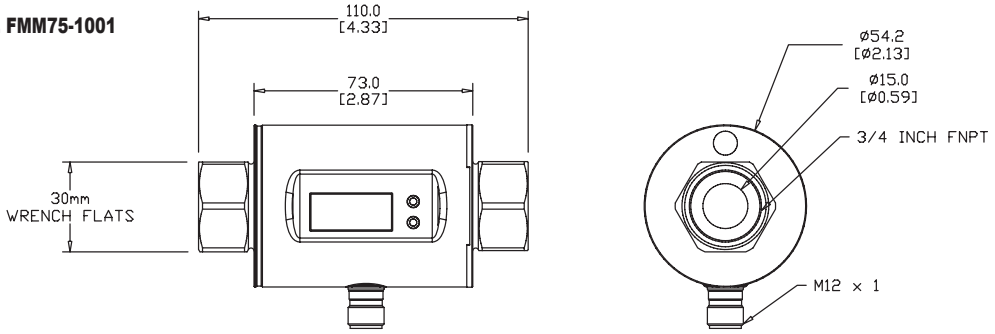
See our website www.AutomationDirect.com for complete Engineering drawings.

ProSense® FMM Series (-1001) Magnetic-Inductive Flow Meters

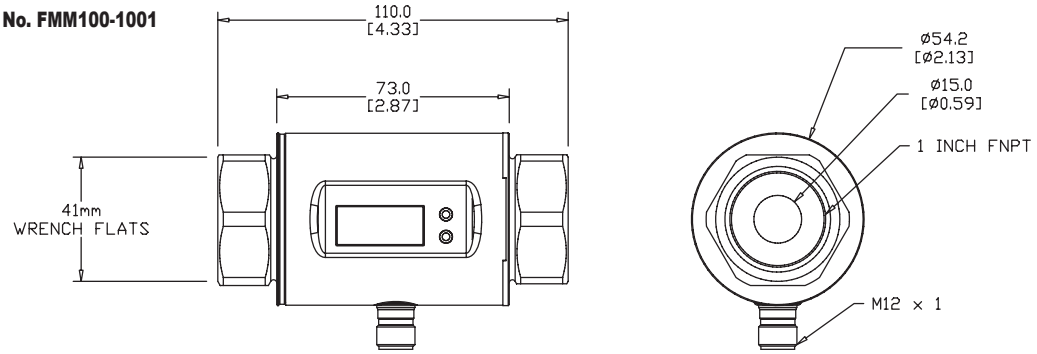
Dimensions

mm [inches]

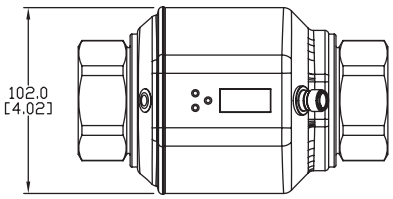
Part No. FMM75-1001

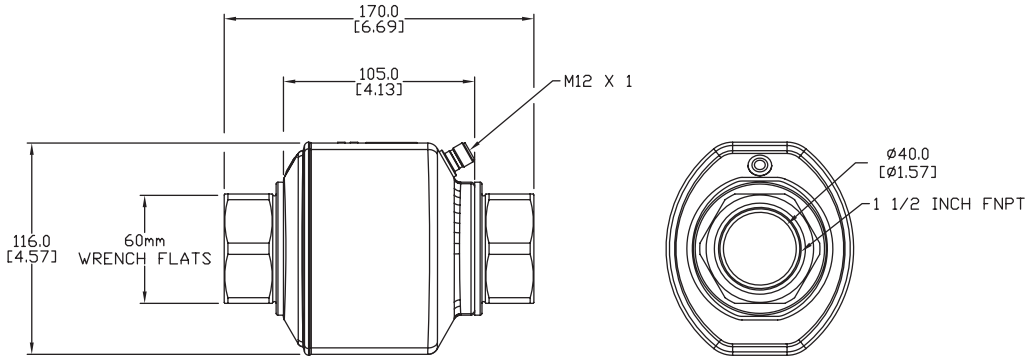


Part No. FMM100-1001



Part No. FMM150-1001





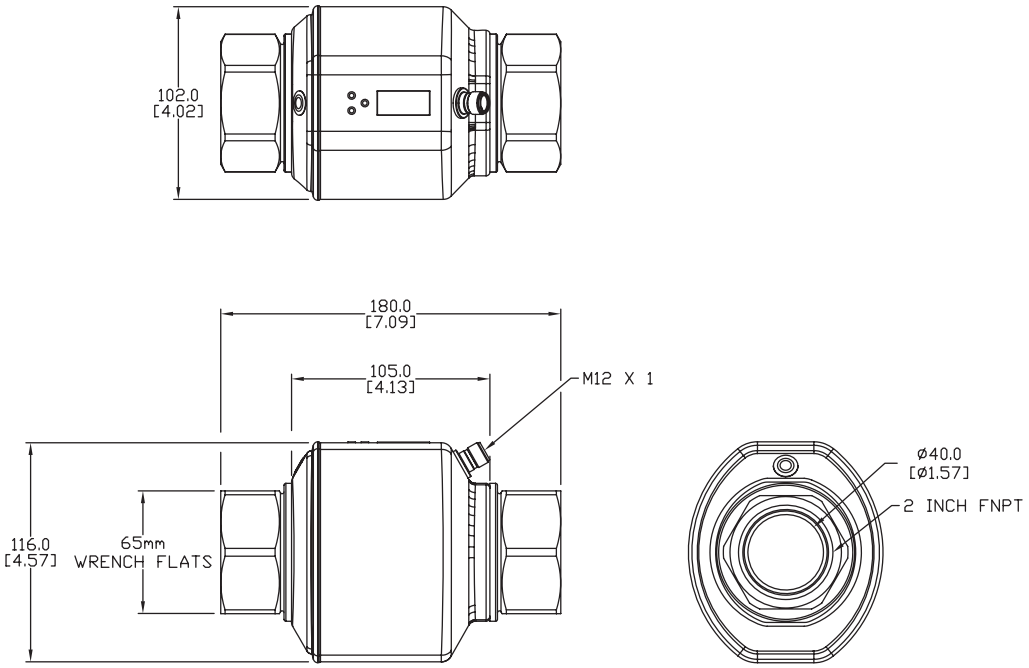
See our website www.AutomationDirect.com for complete Engineering drawings.

ProSense® FMM Series (-1001) Magnetic-Inductive Flow Meters

Dimensions

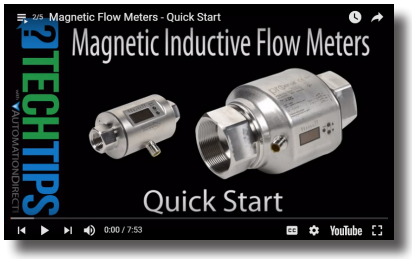
mm [inches]

Part No. FMM200-1001

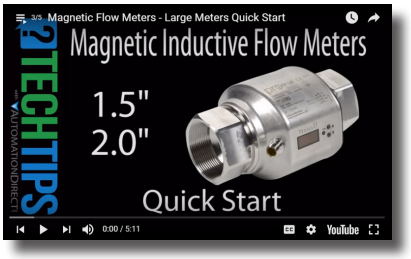


See our website www.AutomationDirect.com for complete Engineering drawings.

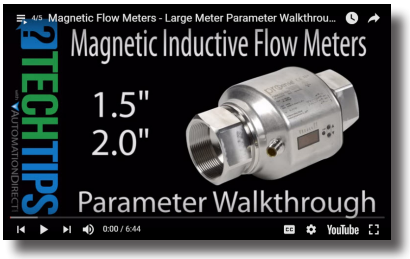
Video Links



Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0003 for a short Quick Start video for the 0.5", 0.75 and 1" FMM Series Magnetic-Inductive Flow Meters



Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0004 for a short Quick Start video for the 1.5" and 2.0" FMM Series Magnetic-Inductive Flow Meters



Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0005 for a short Parameter Setup video of the FMM Series Magnetic-Inductive Flow Meters using live demos.

Click or scan the above QR code to be taken to the installation insert for the FMM 50 and 75 -1001 Series Magnetic Flow Meters

Click or scan the above QR code to be taken to the installation insert for the FMM 150 and 200 -1001 Series Magnetic Flow Meters

ProSense® FMM Series (-1002) Magnetic-Inductive Flow Meters

Part No. FMM75-1002

Part No. FMM200-1002

Overview

AutomationDirect's ProSense FMM Series (-1002) Magmeters are designed to reliably detect the flow rate of conductive media up to 158.5 gallons per minute. The stainless steel, mechanically-robust design mounts directly in-line providing a compact, low-profile installation for process control. A 4-digit numeric display with pushbutton setup indicates flow rate and fluid temperature with selectable engineering units. Two outputs are available to remotely monitor the analog status of flow rate and temperature parameters. Simple to set up, easy to install and with no moving parts, the FMM series is a reliable alternative to traditional flow meters and mechanical flow switches.

Features

- 1/2 to 2" NPT female process connections
- Measure up to 158.5 GPM
- Measure fluid temperature in addition to flow
- 4-digit numeric display with pushbutton setup
- Selectable engineering units: GPM, GPH, LPM, m^3/h, °F, °C
- Two analog output signals
- 4-pin M12 quick disconnect
- 5-year warranty

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See the end of the section for a series of Overview and Setup Videos

Output Function Selections

Output 1:
- Analog temperature

Output 2:
- Analog flow rate

ProSense FMM Series (-1002) Magnetic Flow Meters					
Model	FMM50-1002	FMM75-1002	FMM100-1002	FMM150-1002	FMM200-1002
Price	$556.00	$602.00	$666.00	$997.00	$1,075.00
Weight	1.14 lb	1.23 lb	1.36 lb	6.76 lb	6.76 lb
Range	0 to 6.6 GPM	0 to 13.2 GPM	0 to 26.4 GPM	0 to 79.3 GPM	0 to 158.5 GPM
Process Connection	1/2" FNPT	3/4" FNPT	1" FNPT	1-1/2" FNPT	2" FNPT
Application	Conductive liquids: ≥ 20 µS/cm (micro Siemens per centimeter) liquids / viscosity: < 70cSt (centiStoke) at 104°F				
Pressure Rating	232PSIG [16bar]				
Medium Temperature	14 to 158°F [-10 to 70°C]				
Operating Voltage	20 to 30VDC			18 to 32VDC	
Current Consumption	120mA			< 150mA	
Insulation Resistance	> 100MΩ (500VDC)				
Protection Class	III				
Reverse Polarity Protection	YES				
Output Functions					
Output Type / Function	OUT1: analog signal / temperature OUT2: analog signal / flow				
Analog Output	4-20 mA max 22mA Max. load: 500Ω (4-20 mA) Overload protection: Yes				
Flow Rate Monitoring					
Measuring Range	0.030 to 6.600 GPM	0.020 to 13.200 GPM	0.100 to 26.400 GPM	1.300 to 79.300 GPM	1.300 to 158.500 GPM
Display Range	-7.920 to 7.920 GPM	-15.860 to 15.860 GPM	-31.700 to 31.700 GPM	-95.100 to 95.100 GPM	-190.200 to 190.200 GPM
Resolution	0.010 GPM	0.020 GPM	0.050 GPM	0.100 GPM	0.100 GPM
Analog Start Point, ASP	0.000 to 5.280 GPM	0.000 to 10.580 GPM	0.000 to 21.100 GPM	0.000 to 63.400 GPM	0.000 to 126.800 GPM
Analog End Point, AEP	1.320 to 6.600 GPM	2.640 to 13.220 GPM	5.300 to 26.400 GPM	15.900 to 79.300 GPM	31.700 to 158.500 GPM
In Steps Of	0.010 GPM	0.020 GPM	0.050 GPM	0.100 GPM	0.100 GPM

ProSense FMM Series (-1002) Magnetic-Inductive Flow Meters

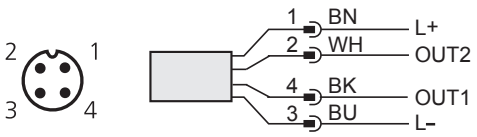
ProSense FMM Series (-1002) Magnetic Flow Meters					
Model	**FMM50-1002**	**FMM75-1002**	**FMM100-1002**	**FMM150-1002**	**FMM200-1002**
Temperature Monitoring					
Measuring Range	-4 to 176°F [-20 to 80°C]				
Resolution	0.5°F [0.2°C]				
Analog Start Point, ASP	-4.0 to 140°F [-20 to 60°C]				
Analog End Point, AEP	32 to 176.0°F [0.0 to 80°C]				
In Steps Of	0.5°F [0.28°C]				
Accuracy / Deviations					
Flow Monitoring					
Accuracy*	± 2% MW + 0.5% VMR			± 0.8% MW + 0.5% VMR***	
Repeatability*	± 0.2% VMR				
Temperature Monitoring					
Accuracy	± 2.5°K (Q > 0.26 GPM)			± 1°K (Q > 4.00 GPM)	
Reaction Times					
Power-On Delay Time	5s				
Flow Monitoring					
Response Time	< 0.150s (dAP = 0)			< 0.350s (dAP = 0)	
Display Damping, dAP	0.0 to 3.0s			0.0 to 5.0s	
Temperature Monitoring					
Response Time	T09 = 3s (Q > 4.00 GPM)				
Environment					
Ambient Temperature	14 to 140°F [-10 to 60°C]				
Storage Temperature	-13 to 176°F [-25 to 80°C]				
Protection	IP 67			IP 65, IP 67	
Mechanical Data					
Process Connection	1/2" NPT female	3/4" NPT female	1" NPT female	1-1/2" NPT female	2" NPT female
Materials (wetted parts)	Stainless steel 316L / 1.4404; PEEK (polyether ether ketone); FKM			Stainless steel (1.4404 / 316L); stainless steel (1.4571/316Ti); PEEK; FKM	
Housing Materials	Stainless steel 316L / 1.4404; PBT-GF 20; PC; EPDM/X			Stainless steel 316L / 1.4404; stainless steel 316Ti / 1.4571; PEI; FKM; PBT-GF 20; elastolan	
Displays / Operating Elements					
Display	Display unit: 6 x LED green (l/min, m³/h, GPM, GPH, °C, °F) Measured values: 4-digit alphanumeric display (7.5 mm) Programming: 4-digit alphanumeric display (7.5 mm)			Display unit: 6 x LED green (l/min, m³/h, GPM, GPH, °C, °F) Function display: 1 x LED yellow (10³) Measured values: 4-digit alphanumeric display (7.5 mm) Programming: 4-digit alphanumeric display (7.5 mm	
Electrical Connection					
Connection	M12 connector; gold-plated contacts				
Tests / Approvals					
EMC	EN 61000-4-2: 4kV CD / 8kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2kV EN 61000-4-5 Surge: 0.5 kV EN 61000-4-6 HF conducted: 10V				
Shock Resistance	DIN IEC 68-2-27: 20g (11ms)				
Vibration Resistance	DIN IEC 68-2-6: 5g (10 to 2,000Hz)				
Approvals**	UL (E320431), CE, RoHS				

*** MW = Measured value**
VMR = Final value of the measuring range
**** To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page at www.automationdirect.com**
***** > 4GPM medium and operating temperature of 72°F ± 7°F**

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

ProSense® FMM Series (-1002) Magnetic-Inductive Flow Meters

Wiring Diagram



Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Colors to DIN EN 60947-5-2

For additional wiring details see individual product manuals.
Use FMM-GND1 if meter is installed in ungrounded pipe system.

Output Function Selections

Models:
FMM50-1002, FMM75-1002, FMM100-1002, FMM150-1002, FMM200-1002

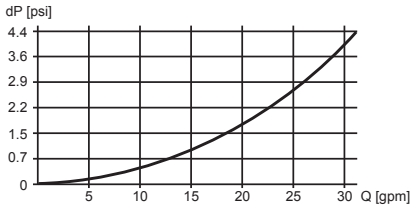
Output 1:
Analog temperature

Output 2:
Analog flow rate

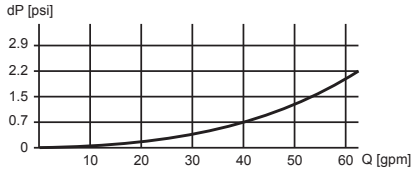
Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Pressure Loss/Flow Rate*

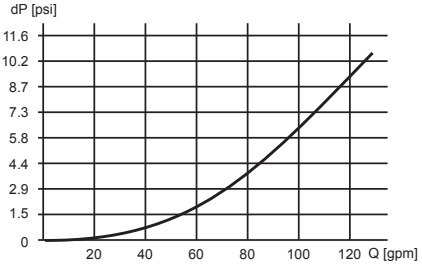
FMM50-1002



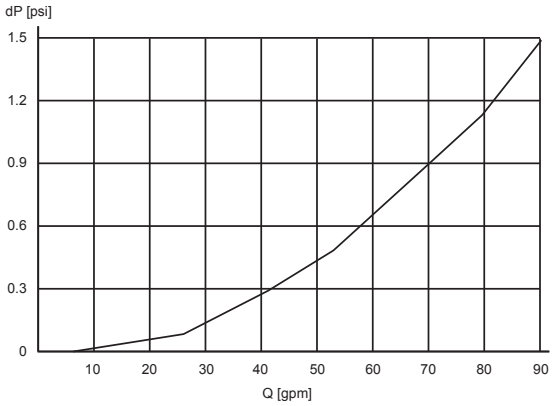
FMM75-1002



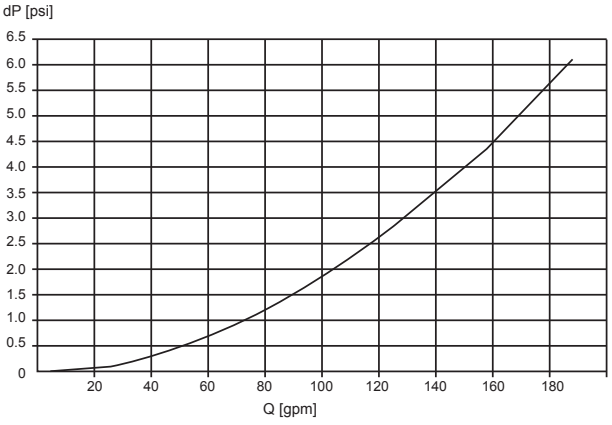
FMM100-1002



FMM150-1002



FMM200-1002



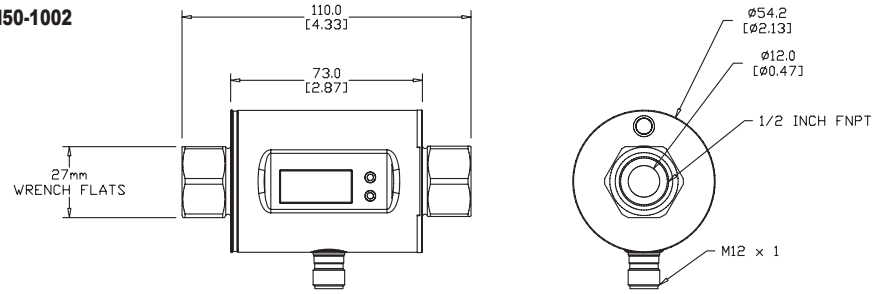
** when used with water @ 68˚F [20˚C]*

FMM Series (-1002) Magnetic-Inductive Flow Meters

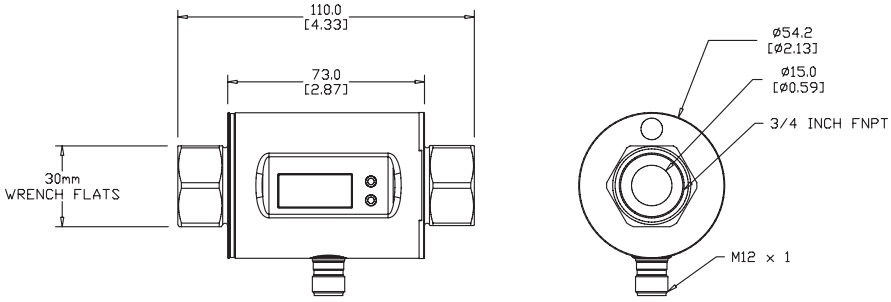
Dimensions

mm [inches]

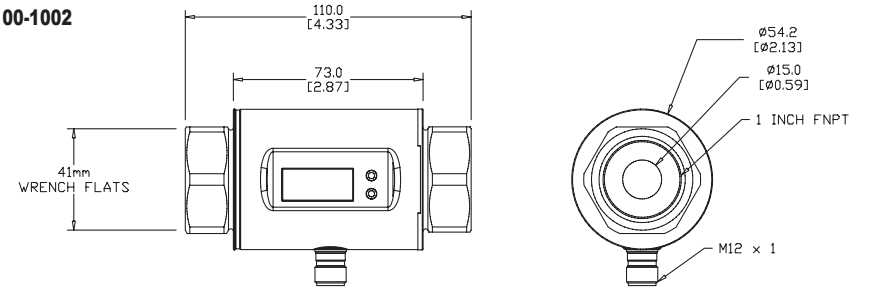
Part No. FMM50-1002



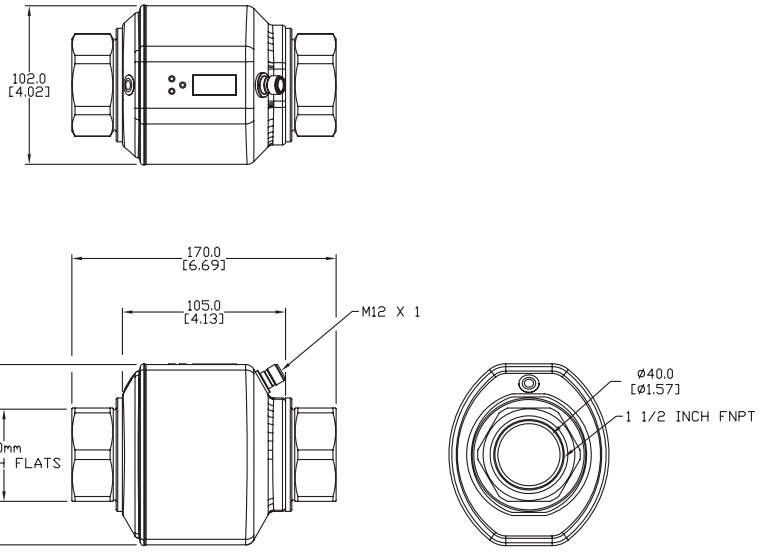
Part No. FMM75-1002



Part No. FMM100-1002



Part No. FMM150-1002



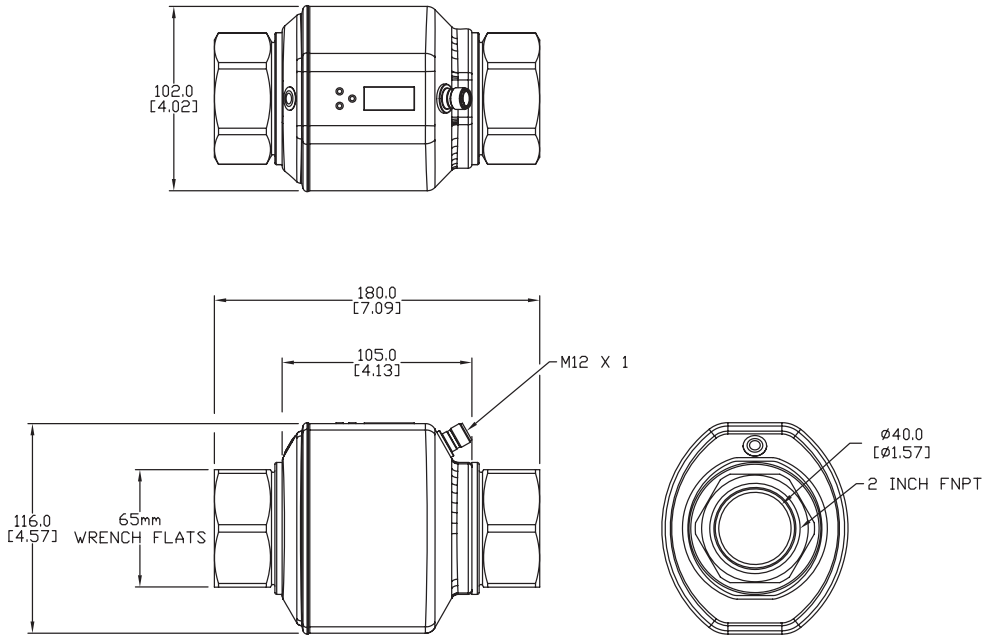
See our website www.AutomationDirect.com for complete Engineering drawings.

FMM Series (-1002) Magnetic-Inductive Flow Meters

Dimensions

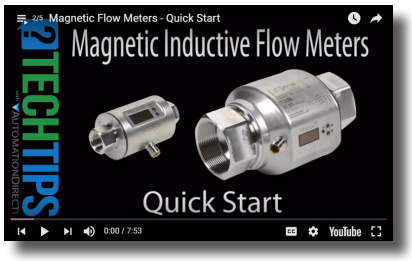
Part No. FMM200-1002

mm [inches]

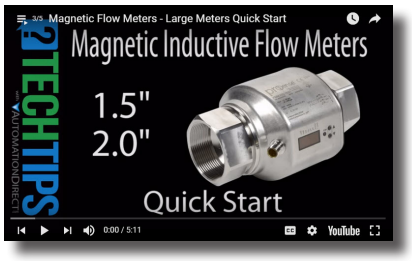


See our website www.AutomationDirect.com for complete Engineering drawings.

Video Links



Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0003 for a short Quick Start video for the 0.5", 0.75 and 1" FMM Series Magnetic-Inductive Flow Meters



Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0004 for a short Quick Start video for the 1.5" and 2.0" FMM Series Magnetic-Inductive Flow Meters

Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0005 for a short Parameter Setup video of the FMM Series Magnetic-Inductive Flow Meters using live demos.

Click or scan the above QR code to be taken to the installation insert for the FMM 50 and 75 -1002 Series Magnetic Flow Meters

Click or scan the above QR code to be taken to the installation insert for the FMM 150 and 200 -1002 Series Magnetic Flow Meters

ProSense® Magnetic-Inductive Flow Meter Accessories

The FMM-GND1 Grounding Clamp is used when an FMM series Magnetic-Inductive Flow Meter is installed in an ungrounded pipe system (e.g. PVC pipe).

Simply place the FMM-GND1 Grounding Clamp around the base of the M12 connector and attach a grounded wire to FMM-GND1 Grounding Clamp with the supplied machine screw and nut.

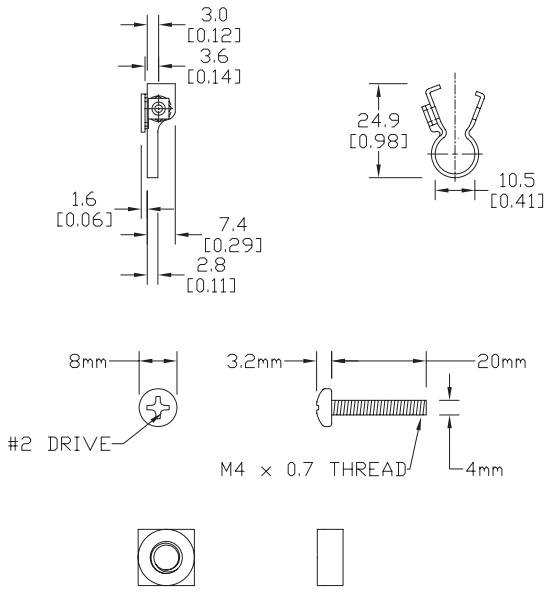
Note: Improper grounding may cause inaccurate readings

ProSense Magnetic Flow Meter Accessories			
Part No.	***Description***	***Price***	***Weight***
FMM-GND1	ProSense 316 stainless steel grounding clamp for magnetic flow meters with an M12 connector.	$7.50	0.015 lb

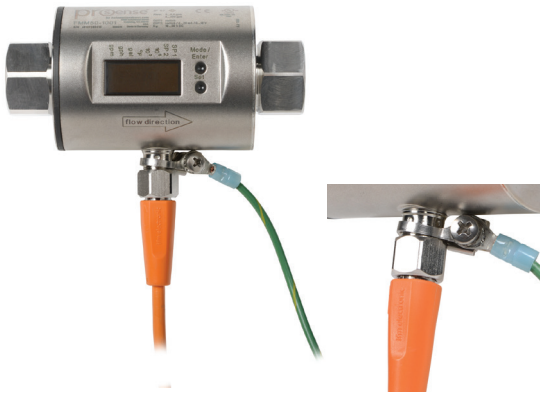
Dimensions

mm [inches]

Part No. FMM-GND1



See our website www.AutomationDirect.com for complete Engineering drawings.



Grounding Clamp Installation

The ProSense magnetic flow meter grounding clamp is installed as shown above.

Note: the ground wire shown above is not included.

Endress+Hauser
People for Process Automation

Picomag Magnetic-Inductive Liquid Flow Meters

Part No. DMA25-AAACA1

Features

- Small size is ideal for limited space and hard to reach installations
- No minimum inlet or outlet pipe run requirements
- ½" to 2" NPT female process connections
- Measure up to 198 GPM
- Measure process medium temperature and conductivity in addition to flow and total volume
- Large color display auto-rotates based on installation orientation
- Bluetooth wireless configuration and monitoring with the free SmartBlue for Android and iOS devices
- 4-pin M12 quick disconnect
- Two outputs selectable for switch, pulse, or analog signals
- IO-Link connectivity
- NSF/ANSI 61 drinking water certification and cULus Listed

The Endress+Hauser Picomag series magnetic-inductive flowmeter is designed for in-line flow measurement of conductive liquids such as drinking and industrial water with a minimum conductivity of 10 µS/cm. The small size of the Picomag series makes it ideal for use on process skids where space is often limited, or in difficult to reach locations. Because it requires no minimum inlet and outlet pipe runs, Picomag flowmeters can be mounted directly before or after a pipe bend.

Available with process connection sizes ranging from ½" to 2" female NPT, the Picomag series can measure flows up to 198 GPM with ±0.1% full scale accuracy. In addition to flow, Picomag can also measure the process liquid temperature from 14 to 158°F (-10 to 70°C) with ±4.5°F (±2.5°C) accuracy and conductivity up to 30,000 µS/cm with ±5 µS/cm accuracy. Available outputs include analog 4-20mA and 2-10VDC configurable for volumetric flow, rate, temperature, or conductivity; switching outputs configurable as NPN or PNP for limit or window switching based on flow temperature, conductivity, flow totalizer, or empty pipe detection; and pulse output for total flow volume. Additionally, one of the outputs can be configured for IO-Link connectivity providing flexible integration into automation systems. The Picomag also accepts a digital input used to reset the flow totalizer or set a flow override.

Picomag's large, user-friendly color display allows for quick reading of flow, temperature, conductivity, and totalizer values, as well as warning and alarm messages. For optimal readability, the screen rotates automatically depending on the installation orientation. Configuration parameters can be called up and monitored by simply knocking on the device.

The Picomag is configured and monitored with its Bluetooth wireless interface on Android and iOS devices via the free SmartBlue App. With a wireless connection distance of up to 32 ft Picomag is ideal for installation sites which are difficult to access.

The robust stainless steel Picomag flowmeter has high shock and vibration resistance, IP65/67 protection, a PEEK measuring tube, and is suitable for process medium temperature from 14 to 158°F with a maximum pressure of 232 psi. It fulfills EMC requirements according to IEC/EN 61326, is NSF/ANSI 61 certified for drinking water applications and is cULus Listed.

Download the free Endress+Hauser SmartBlue Mobile App for phone or tablet:

Download on the App Store | GET IT ON Google Play

Scan or click the QR code for the Picomag IO-Link Quick Start Guide

For a variety of cable options see our website www.AutomationDirect.com

cULus | NSF Component | CE | IO-Link

Picomag Magnetic-Inductive Liquid Flow Meter Selection

Part No.	Price	Connection	Flow Range	Temperature Range	Totalizer Range	Conductivity Range	Output 1	Output 2	Weight (lbs)	Drawing Link	Vendor Operating Instructions
DMA15-AAACA1	$572.00	1/2" FNPT	0 to 9.2 GPM	14 to 158°F [-10 to 70°C]	+/-3.436E10 liters	20 to 30,000 µS/cm	• Flow rate, analog or switch • Temperature, analog or switch • Conductivity, analog or switch • Volumetric flow totalizer pulse • Empty pipe detection switch • Flow totalizer reset digital input • Flow override digital input • IO-Link	• Flow rate, analog or switch • Temperature, analog or switch • Conductivity, analog or switch • Empty pipe detection switch • Flow totalizer reset digital input • Flow override digital input	1.1	PDF	PDF
DMA20-AAACA1	$688.00	3/4" FNPT	0 to 19.8 GPM						1.2	PDF	PDF
DMA25-AAACA1	$824.00	1" FNPT	0 to 39.6 GPM						1.3	PDF	PDF
DMA50-AAACA1	$1,106.00	2" FNPT	0 to 198.1 GPM			20 to 10,000 µS/cm			4.0	PDF	PDF

Endress+Hauser
People for Process Automation

Picomag Magnetic-Inductive Liquid Flow Meters

Picomag Magnetic-Inductive Liquid Flow Meter Specifications	
Input	
Measured Variables	Volume flow, temperature, conductivity
Measuring Range (volume flow measurement)	DN 15 (½"): 0.05 to 35 l/min (0.013 to 9.2 gal/min) DN 20 (¾"): 0.1 to 75 l/min (0.026 to 19.8 gal/min) DN 25 (1"): 0.2 to 150 l/min (0.052 to 39.6 gal/min) DN 50 (2"): 1.5 to 750 l/min (0.4 to 198.1 gal/min)
Measuring Range (medium temperature measurement)	–10 to +70°C (+14 to +158°F)
Measuring Range (conductivity measurement)	DN 15 (½"): 20 to 30,000 µS/cm DN 20 (¾"): 20 to 30,000 µS/cm DN 25 (1"): 20 to 30,000 µS/cm DN 50 (2"): 20 to 10,000 µS/cm
Digital Input	High or low active Switch-on level 15V Switch-off level 5V Internal resistance 7.5 kΩ
Output	
Current Output	≤ 500Ω
Voltage Output	≥ 600Ω
Pulse Output	Max. pulse rate: 10,000 Pulse/s
Signal On Alarm	Status signal (as per NAMUR Recommendation NE 107) Plain text display with remedial action
Switch Output	Switching behavior: PNP or NPN Max. load 250mA
Power Supply	
Electrical Connection	4-pin M12 x 1 A-coded
Supply Voltage Range	18 to 30 VDC (SELV, PELV, Class 2)
Power Consumption	Maximum 3 W Without outputs IO1 and IO2: 120mA With outputs IO1 and IO2: 120mA plus the effective load currents
Performance Characteristics	
Volume Flow Measurement	
Flow Rate Units	GPM, fl oz/min, l/min, l/sec, l/hr, m^3/hr, selectable
Flow Totalizer Units	Gal, kgal, fl oz, l, kl, Ml, m^3, selectable
Reference Operating Conditions	Water, +15 to +45 °C, 2 to 6 bar
Maximum Measured Error	± 0.8 % o.r. ±0.1 % o.f.s.
Repeatability	±0.2 % o.r.
Medium Temperature Measurement	
Temperature Units	°F, °C, selectable
Maximum Measured Error	± 2.5°C
Repeatability	± 0.5°C
Conductivity Measurement	
Conductivity Units	µS/cm, S/m, mS/cm, selectable
Repeatability	± 5 %o.r. ± 5 µS/cm
Maximum Measured Error, Current Output	
Additional Error	± 20µA @ device temperature of 25°C
Repeatability	± 10 µA
Response Time T90*	Typically 200ms
Maximum Measured Error, Voltage Output	
Additional error	± 60mV @ device temperature of 25°C
Repeatability	± 10mV
Response Time T90*	Typically 200ms

** The response time T90 is the time a measuring system needs to display 90% of the change of the measured value.*

Endress+Hauser
People for Process Automation

Picomag Magnetic-Inductive Liquid Flow Meters

Picomag Magnetic-Inductive Liquid Flow Meter Specifications Cont.	
Environment	
Ambient Temperature Range	–10 to +60°C (+14 to +140°F)
Storage Temperature	–25 to +85°C (–13 to +185°F)
Degree Of Protection	IP65/67, pollution degree 3
Humidity And Moisture	Suitable for indoor environments with up to 100% rh (wet and damp locations)
Operating Altitude	up to 2,000 M
Shock Resistance	20g (11ms) in accordance with IEC/EN60068-2-27
Vibration Resistance	Acceleration up to 5 g (10 to 2,000 Hz) in accordance with IEC/EN60068-2-6
Electromagnetic Compatibility (EMC)	According to IEC/EN61326 and/or IEC/EN55011 (Class A)
Process	
Medium Temperature Range	–10 to +70°C (+14 to +158°F) Permissible short-term temperature: maximum one hour 85°C (185°F) every 4 hours. Permissible short-term temperature with electronics switched off: maximum one hour 100°C (212°F) every 4 hours.
Medium Properties	Liquid, conductivity ≥ 10 µS/cm for flow measurement (≥ 20 µS/cm for conductivity measurement)
Pressure	Max. 16 BAR_{rel}
Materials	
Measuring tube	PEEK (Polyether ether ketone)
Electrodes, temperature sensor	1.4435/316L
Process connection	1.4404/316L
Housing	1.4404/316L, 1.4409/CF^3M
Seal	FKM (fluorine rubber)
Display window	Polycarbonate
Operability	
Display	4 measured variables can be displayed (volume flow, temperature, conductivity, totalizer)
Operation	Via Bluetooth® wireless technology Via IO-Link PDF
Digital Communication	Via IO-Link PDF
SmartBlue App	The device has a Bluetooth® wireless technology interface and can be operated and configured using the SmartBlue app. • The range under reference conditions is 10m (33ft) • Unauthorized access is prevented by means of encrypted communication and password encryption • The Bluetooth® wireless technology interface can be disabled

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Accessories

Part No. 71345225

Picomag Accessory			
Part No.	***Description***	***Price***	***Weight (lbs)***
71345225	Endress+Hauser grounding clamp, 316 stainless steel. For use with Endress+Hauser Picomag series flow meters.	$23.00	0.01

The Grounding Clamp is used when a Picomag series Magnetic-Inductive Flow Meter is installed in an ungrounded pipe system (e.g. PVC pipe). Simply place the Grounding Clamp around the base of the M12 connector and attach a grounded wire to the Grounding Clamp with the supplied machine screw and nut. Torque screw and nut assembly to 2.5 Nm.

Note: Improper grounding may cause inaccurate readings.

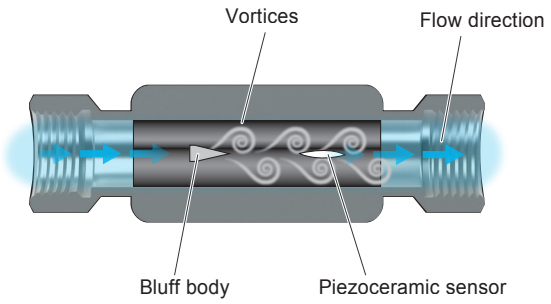
ProSense® VFS Series Vortex Flow Sensors

Vortex Flow Sensor Measuring Principle

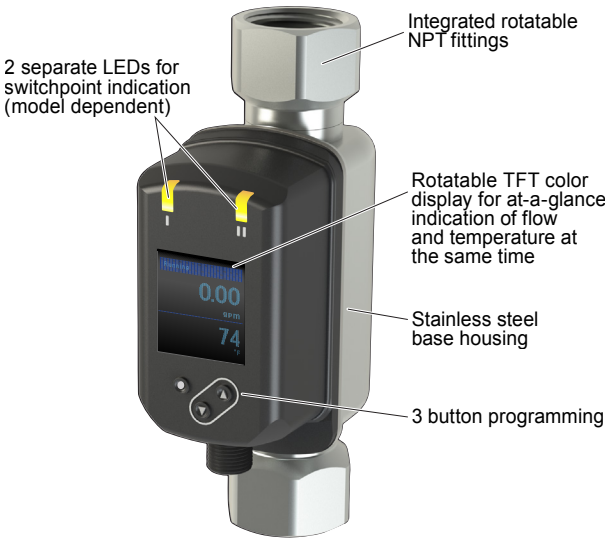
Vortex shedding or vortex flow sensing technology is based on the principle that liquid flow will produce alternating vortices downstream when passing by an obstacle in the flow. Inside of a vortex sensor the obstacle is a bluff body that has a broad, flat front and extends vertically in the center of the sensor. As the liquid flow reaches a certain velocity, alternating vortices form behind the bluff body, detach or shed from the bluff body, and flow downstream. A piezoceramic sensor in the sensor detects these vortices and the sensor electronics determine the flow velocity based on the frequency of the vortices. Because the cross-sectional area inside the meter is known, it can be used by the sensor to determine flow rate.

The vortex flow principle is a simple, low cost, and proven method for measuring flow of water-based liquids that is independent of the liquid's pressure or temperature fluctuations.

Vortex Flow Sensor Measuring Principle



VFS Series Vortex Flow Sensor Features



ProSense VFS Series Vortex Flow Sensor Selection Guide

Model	Price	Process Connection	Flow Range	Temperature Range	Display Units	Output 1	Output 2
VFS50-5-1001	$223.00	1/2" NPT female	0.26 to 5.28 GPM (16 to 317 GPH)	14 to 194°F	Switching status: 2 x LED, orange Measured values: alphanumeric TFT color display	PNP/NPN Switch or frequency (flow)	PNP/NPN Switch or frequency (flow or temperature)
VFS50-10-1001	$223.00		0.55 to 10.55 GPM (32 to 634 GPH)				
VFS75-26-1001	$240.00	3/4" NPT female	1.3 to 26.4 GPM (80 to 1585 GPH)				
VFS50-5-1002	$223.00	1/2" NPT female	0.26 to 5.28 GPM (16 to 317 GPH)		Measured values: alphanumeric TFT color display	4 to 20 mA scalable analog (temperature)	4 to 20 mA scalable analog (flow)
VFS50-10-1002	$223.00		0.55 to 10.55 GPM (32 to 634 GPH)				
VFS75-26-1002	$240.00	3/4" NPT female	1.3 to 26.4 GPM (80 to 1585 GPH)				

ProSense® VFS Series (-1001) Vortex Flow Sensors

Part No.VFSXX-X-1001

Overview

AutomationDirect's ProSense VFS series vortex flow sensors offer a very cost-effective solution optimized for monitoring water and deionized water flow in industrial applications. Vortex flow sensors are a reliable alternative to other flow sensing technologies and are a simple, low cost, and proven method for measuring flow of water-based liquids that is independent of the liquid's pressure or temperature fluctuations. Using the pushbuttons and display, the VFS series can be easily set up to measure both flow rate and temperature. The VFS series is available with ½" or ¾" NPT process connections. The VFS (-1001) series offers two separate outputs that can be used either as a flow or temperature limit switch or to monitor continuous flow rate or temperature. The TFT color display and switch point LEDs are used during configuration and operation to provide clear indication of both flow and temperature measured variables simultaneously.

Features

Optimized for measurement of water and deionized water flow applications
- Cost effective solution for flow switch or continuous flow measurement
- Volumetric flow rate and temperature measurement
- TFT color display with pushbutton setup
- 1/2" or 3/4" NPT rotatable process connections
- Two outputs selectable for switch or frequency signals
- 4-pin M12 quick disconnect electrical connection
- 5-year warranty

Output Function Selections

Output 1: 2 Selection Options
- Switching signal for flow limit value
- Frequency signal for flow

Output 2: 4 Selection Options
- Switching signal for flow limit value
- Switching signal for temperature limit value
- Frequency signal for flow
- Frequency signal for temperature

ProSense VFS Series (-1001) Vortex Flow Sensors			
Model	***VFS50-5-1001***	***VFS50-10-1001***	***VFS75-26-1001***
Price	$223.00	$223.00	$240.00
Application			
Media	Water and deionized water		
Medium Temperature*	14 to 194°F (-10 to 90°C)		
Pressure Rating**	174 psig (12 bar)		
Electrical Data			
Operating Voltage	18 to 30 VDC		
Current Consumption	< 30mA		
Insulation Resistance	100MΩ @ 500VDC		
Protection Class	III		
Reverse Polarity Protection	Yes		
Power-on Delay Time	< 3 seconds		
Outputs			
Number of Digital Outputs	2		
Output Signal	Switch or frequency PNP / NPN Selectable N.O. / N.C. Selectable Max. voltage drop: 2.5 VDC Current rating: 100mA Frequency: 0 to 1000 Hz		
Short-circuit Protection	Yes		
Overload Protection	Yes		

*** Water mixed with glycol or with dissolved solids, such as a saline solution, used to lower the freezing point will also increase the viscosity of the solution reducing the flow accuracy. See Flow Monitoring Accuracy in table below.**
**** Up to 104°F (40°C)**

ProSense® VFS Series (-1001) Vortex Flow Sensors

ProSense VFS Series (-1001) Vortex Flow Sensors			
Model	***VFS50-5-1001***	***VFS50-10-1001***	***VFS75-26-1001***
Flow Rate Monitoring			
Measuring Range*	0.26 to 5.28 GPM (16 to 317 GPH)	0.55 to 10.55 GPM (32 to 634 GPH)	1.3 to 26.4 GPM (80 to 1585 GPH)
Display Range	0 to 6.34 GPM (0 to 380 GPH)	0 to 12.7 GPM (0 to 760 GPH)	0 to 31.7 GPM (0 to 1900 GPH)
Resolution	0.02 GPM (1 GPH)	0.05 GPM (2 GPH)	0.1 GPM (5 GPH)
Set Point, SP	0.32 to 5.28 GPM (10 to 317 GPH)	0.65 to 10.55 GPM (38 to 634 GPH)	1.6 to 26.4 GPM (95 to 1585 GPH)
Reset Point, rP	0.26 to 5.24 GPM (16 to 314 GPH)	0.55 to 10.45 GPM (32 to 628 GPH)	1.3 to 26.2 GPM (80 to 1570 GPH)
Process Value End Point (@ FRP), FEP	1.06 to 5.28 GPM (63 to 317 GPH)	2.1 to 10.55 GPM (126 to 634 GPH)	5.3 to 26.4 GPM (315 to 1585 GPH)
In Steps Of	0.02 GPM (1 GPH)	0.05 GPM (2 GPH)	0.1 GPM (5 GPH)
Frequency at Process Value End Point, FRP	100 to 1,000 Hz		
Temperature Monitoring			
Measuring Range	14 to 194°F		
Display Range	-22 to 230°F		
Resolution	1°F		
Set Point, SP	16 to 194°F		
Reset Point, rP	14 to 192°F		
In Steps Of	1°F		
Process Value Start Point (@ 0Hz), FSP	14 to 158°F		
Process Value End Point (@ FRP), FEP	50 to 194°F		
Frequency at Process Value End Point, FRP	100 to 1,000 Hz		
Accuracy / Deviations			
Flow Monitoring			
Accuracy (In the Measuring Range)*	± 2% MEW (viscosity less than 2cSt)		
Repeatability	± 0.5% MEW		
Temperature Monitoring			
Accuracy	± 1K		
Reaction Times			
Flow Monitoring			
Response Time	1 second; (dAP = 0)		
Damping for the Switching Output dAP	0 to 5 seconds		
Temperature Monitoring			
Dynamic Response T05 / T09	T09 = 6 seconds		
Environment			
Ambient Temperature**	32 to 140°F (0 to 60°C)		
Storage Temperature	-4 to 176°F (-20 to 80°C)		
Protection	IP 65; IP 67		

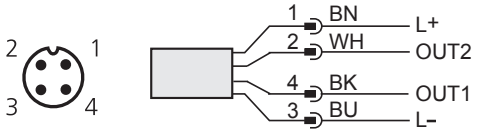
*** Measuring Range minimum flow rate at <2 cSt. For higher viscosties see Viscosity/Minimum Flow Rate chart.**
**** For viscosities from 2 to 4 cSt, accuracy is 3% of full range and from 4 to 14 cSt, accuracy is 4% of full range.**
***** Medium Temperature < 176°F (80°C); Ambient 32 to 140°F (0 to 60°C)**
Medium Temperature < 194°F (90°C); Ambient 32 to 122°F (0 to 50°C)
MEW = Final value of the measuring range

ProSense® VFS Series (-1001) Vortex Flow Sensors

ProSense VFS Series (-1001) Vortex Flow Sensors			
Model	***VFS50-5-1001***	***VFS50-10-1001***	***VFS75-26-1001***
Mechanical Data			
Weight	1.06 lbs	1.03 lbs	1.11 lbs
Process Connection	1/2" NPT female rotatable	1/2" NPT female rotatable	3/4" NPT female rotatable
Materials (wetted parts)	Stainless steel (1.4404 / 316L); ETFE; PA 6T; PPS; FKM		
Housing Materials	Stainless steel (1.4404 / 316L): PC; PBT+PC-GF30; PPS; TPE-U		
Tightening Torque	30Nm		
Displays / Operating Elements			
Display	25 x 25mm TFT LCD 2 x Orange LEDs		
Electrical Connection			
Connection	M12 connector; gold-plated contacts		
Tests / Approvals			
EMC	DIN EN 61000-6-2 DIN EN 61000-6-3		
Shock Resistance	DIN EN 60068-2-27: 5g (11ms)		
Vibration Resistance	DIN EN 60068-2-6: With water / 10 to 50 HZ 1mm DIN EN 60068-2-6: With water / 50 to 2,000 Hz 2g		
Pressure Equipment Directive	For group 2 fluids in accordance with sound engineering practices		
UL Approval	E320431		
CE	EMC; RoHS II		
To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page at www.automationdirect.com			

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Wiring Diagram



Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Colors to DIN EN 60947-5-2

For additional wiring details see individual product manuals.

Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Output Function Selections

Output 1:
Flow monitoring
Switching output
Frequency output

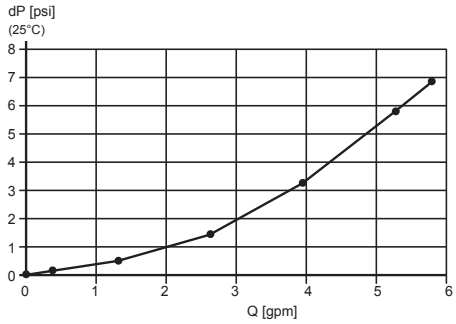
Output 2:
Flow monitoring or temperature monitoring
Switching output
Frequency output

Click or scan the above QR code to be taken to the installation insert for the VFS1001 Series Vortex Flow Sensors

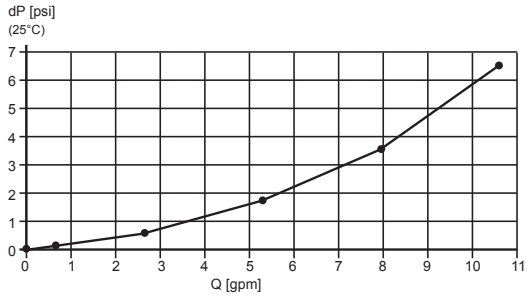
ProSense® VFS Series (-1001) Vortex Flow Sensors

Pressure Loss

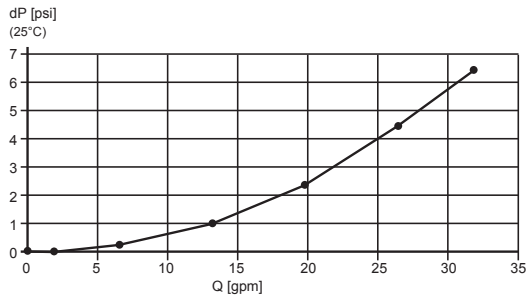
VFS50-5-1001



VFS50-10-1001

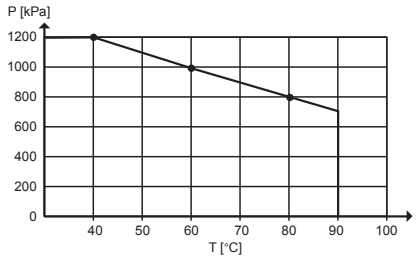


VFS75-26-1001

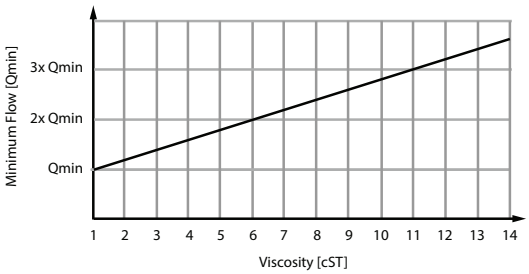


Pressure Rating

VFS50-5-1001
VFS50-10-1001
VFS75-26-1001

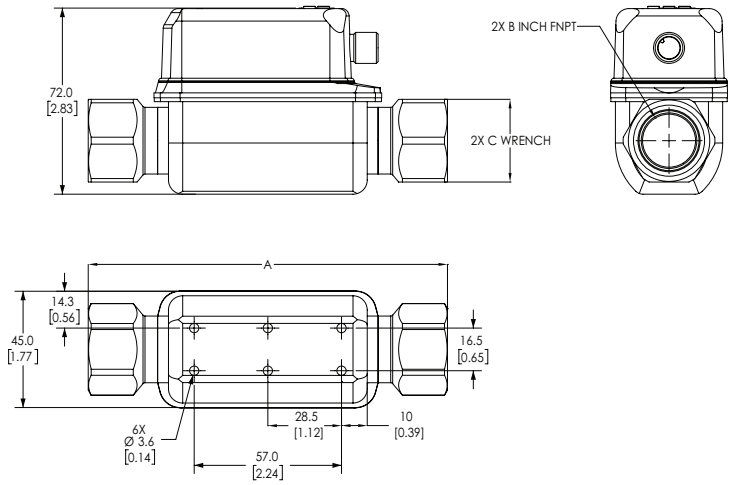


Viscosity/Minimum Flow Rate



Dimensions

mm [inches]



Model	A	B	C
VFS50-5-1001	119.0 [4.69]	1/2" FNPT	27.0 [1.06]
VFS50-10-1001	119.0 [4.69]	1/2" FNPT	27.0 [1.06]
VFS75-26-1001	139.0 [5.47]	3/4" FNPT	32.0 [1.26]

See our website www.AutomationDirect.com for complete Engineering drawings.

ProSense VFS Series (-1002) Vortex Flow Sensors

Part No.VFSXX-X-1001

Overview

AutomationDirect's ProSense VFS series vortex flow sensors offer a very cost-effective solution optimized for monitoring water and deionized water flow in industrial applications. Vortex flow sensors are a reliable alternative to other flow sensing technologies and are a simple, low cost, and proven method for measuring flow of water-based liquids that is independent of the liquid's pressure or temperature fluctuations. Using the pushbuttons and display, the VFS series can be easily set up to measure both flow rate and temperature. The VFS series is available with ½" or ¾" NPT process connections. The VFS (-1002) series offers two separate analog outputs that can be used for continuous flow rate and temperature measurement. The TFT color display is used during configuration and operation to provide clear indication of both flow and temperature measured variables simultaneously.

Features

- Optimized for measurement of water and deionized water flow applications
- Volumetric flow rate and temperature measurement
- TFT color display with pushbutton setup
- 1/2" or 3/4" NPT rotatable process connections
- Two analog output signals for flow and temperture
- 4-pin M12 quick disconnect electrical connection
- 5-year warranty

Output Function Selections

Output 1:

- Analog signal for temperature

Output 2:

- Analog signal for flow

ProSense VFS Series (-1002) Vortex Flow Sensors			
Model	***VFS50-5-1002***	***VFS50-10-1002***	***VFS75-26-1002***
Price	$223.00	$223.00	$240.00
Application			
Media	Water and deionized water		
Medium Temperature*	14 to 194°F (-10 to 90°C)		
Pressure Rating**	174 psi (12 bar)		
Electrical Data			
Operating Voltage	18 to 30 VDC		
Current Consumption	< 30mA		
Insulation Resistance	100MΩ @ 500VDC		
Protection Class	III		
Reverse Polarity Protection	Yes		
Power-on Delay Time	< 3 seconds		
Outputs			
Number of Digital Outputs	2		
Output Signal	Analog signal Output current: 4 to 20 mA Maximum load: 500Ω		
Short-Circuit Protection	Yes		
Overload Protection	Yes		

*** Water mixed with glycol or with dissolved solids, such as a saline solution, used to lower the freezing point will also increase the viscosity of the solution reducing the flow accuracy. See Flow Monitoring Accuracy in table below.**
**** Up to 104°F (40°C)**

ProSense® VFS Series (-1002) Vortex Flow Sensors

ProSense VFS Series (-1002) Vortex Flow Sensors			
Model	***VFS50-5-1002***	***VFS50-10-1002***	***VFS75-26-1002***
Flow Rate Monitoring			
Measuring Range*	0.26 to 5.28 GPM (16 to 317 GPH)	0.55 to 10.55 GPM (32 to 634 GPH)	1.3 to 26.4 GPM (80 to 1585 GPH)
Display Range	0 to 6.34 GPM (0 to 380 GPH)	0 to 12.7 GPM (0 to 760 GPH)	0 to 31.7 GPM (0 to 1900 GPH)
Resolution	0.02 GPM (1 GPH)	0.05 GPM (2 GPH)	0.1 GPM (5 GPH)
Analog Start Point, ASP2	0 to 4.22 GPM (0 to 254 GPH)	0 to 8.45 GPM (0 to 508 GPH)	0 to 21.1 GPM (0 to 1270 GPH)
Analog End Point, AEP2	1.06 to 5.28 GPM (63 to 317 GPH)	2.1 to 10.55 GPM (126 to 634 GPH)	5.3 to 26.4 GPM (315 to 1585 GPH)
In Steps Of	0.02 GPM (1 GPH)	0.05 GPM (2 GPH)	0.1 GPM (5 GPH)
Temperature Monitoring			
Measuring Range	14 to 194°F		
Display Range	-22 to 230°F		
Resolution	1°F		
Set Point, SP	16 to 194°F		
Reset Point, rP	14 to 192°F		
In Steps Of	1°F		
Analog Start Point, ASP1	14 to 158°F		
Analog End Point, AEP1	50 to 194°F		
Accuracy / Deviations			
Flow Monitoring			
Accuracy (In the Measuring Range)*	± 2% MEW (viscosity less than 2cSt)		
Repeatability	± 0.5% MEW		
Temperature Monitoring			
Accuracy	± 1K		
Reaction Times			
Flow Monitoring			
Response Time	1 second; (dAP = 0)		
Damping for the Switching Output dAP	0 to 5 seconds		
Temperature Monitoring			
Dynamic Response T05 / T09	T09 = 6 seconds		
Environment			
Ambient Temperature**	32 to 140°F (0 to 60°C)		
Storage Temperature	-4 to 176°F (-20 to 80°C)		
Protection	IP 65; IP 67		

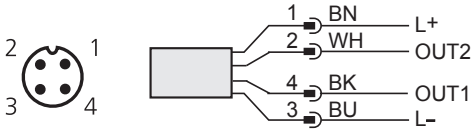
*** Measuring Range minimum flow rate at <2 cSt. For higher viscosties see Viscosity/Minimum Flow Rate chart.**
**** For viscosities from 2 to 4 cSt, accuracy is 3% of full range and from 4 to 14 cSt, accuracy is 4% of full range.**
***** Medium Temperature < 176°F (80°C); Ambient 32 to 140°F (0 to 60°C)**
Medium Temperature < 194°F (90°C); Ambient 32 to 122°F (0 to 50°C)
MEW = Final value of the measuring range

ProSense® VFS Series (-1002) Vortex Flow Sensors

ProSense FMM Series (-1002) Vortex Flow Sensors			
Model	***VFS50-5-1002***	***VFS50-10-1002***	***VFS75-26-1002***
Mechanical Data			
Weight	1.06 lbs	1.03 lbs	1.13 lbs
Process Connection	1/2" NPT female rotatable	1/2" NPT female rotatable	3/4" NPT female rotatable
Materials (wetted parts)	Stainless steel (1.4404 / 316L); ETFE; PA 6T; PPS; FKM		
Housing Materials	Stainless steel (1.4404 / 316L): PC; PBT+PC-GF30; PPS; TPE-U		
Tightening Torque	30Nm		
Displays / Operating Elements			
Display	25 x 25mm TFT LCD		
Electrical Connection			
Connection	M12 connector; gold-plated contacts		
Tests / Approvals			
EMC	DIN EN 61000-6-2 DIN EN 61000-6-3		
Shock Resistance	DIN EN 60068-2-27: 5g (11ms)		
Vibration Resistance	DIN EN 60068-2-6: With water / 10 to 50 HZ 1mm DIN EN 60068-2-6: With water / 50 to 2,000 Hz 2g		
Pressure Equipment Directive	For group 2 fluids in accordance with sound engineering practices		
UL Approval	E320431		
CE	EMC; RoHS II		
To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page at www.automationdirect.com			

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Wiring Diagram



Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Colors to DIN EN 60947-5-2

For additional wiring details see individual product manuals.

Output Function Selections

Output 1:
Analog temperature

Output 2:
Analog flow rate

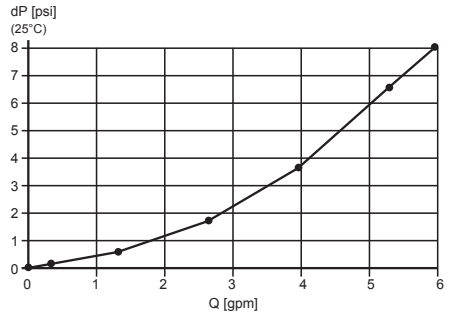
Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Click or scan the above QR code to be taken to the installation insert for the VFS1002 Series Vortex Flow Sensors

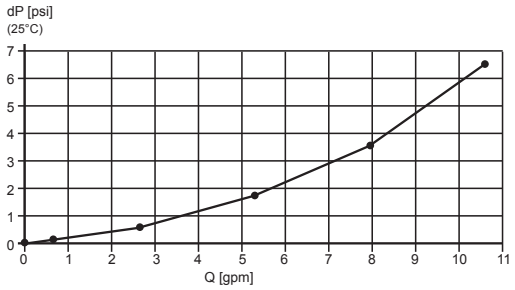
ProSense® VFS Series (-1002) Vortex Flow Sensors

Pressure Loss

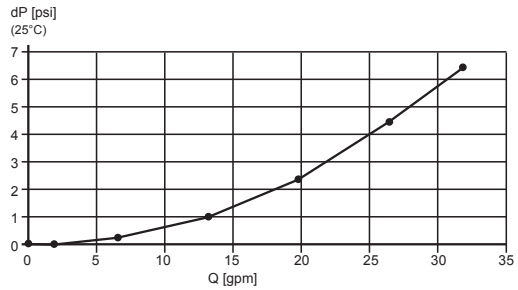
VFS50-5-1002



VFS50-10-1002

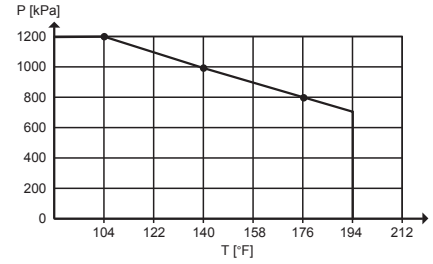


VFS75-26-1002

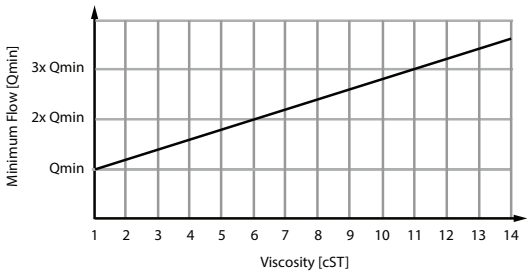


Pressure Rating

VFS50-5-1002
VFS50-10-1002
VFS75-26-1002

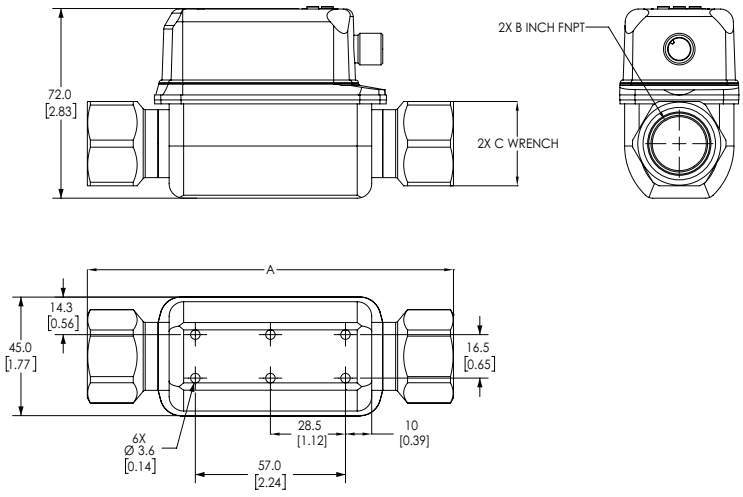


Viscosity/Minimum Flow Rate



Dimensions

mm [inches]



Model	A	B	C
VFS50-5-1002	119.0 [4.69]	1/2" FNPT	27.0 [1.06]
VFS50-10-1002	119.0 [4.69]	1/2" FNPT	27.0 [1.06]
VFS75-26-1002	139.0 [5.47]	3/4" FNPT	32.0 [1.26]

See our website www.AutomationDirect.com for complete Engineering drawings.

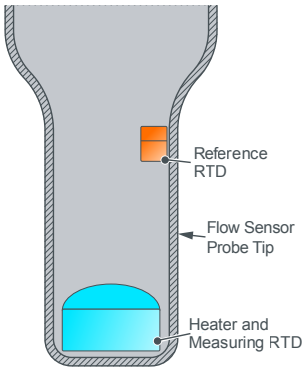
ProSense® FTS Series Liquid / Air Thermal Flow Sensors

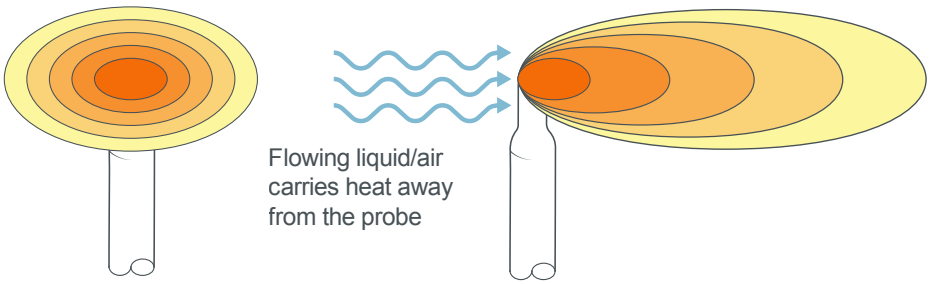
Thermal Flow Meter Measuring Principle

Thermal dispersion or thermal flow sensing technology is based on the principle of heat transfer and relies on the cooling effect of a flowing fluid or gas to monitor flow rate. The tip of a thermal flow sensor probe typically contains two RTD temperature sensors and a heater element. One RTD sensor located on the inside cylindrical wall of the thermal flow sensor probe measures the temperature of the fluid or gas and is used as a reference temperature. The second RTD sensor is located in the end of the sensor probe with the heater element. Electrical power is applied to the heater element which raises the temperature measured by the second RTD sensor creating a temperature difference with the reference RTD sensor. As fluid or gas flows, heat will be carried away from the sensor probe tip. Faster flow will transfer more heat resulting in a smaller temperature difference between the two RTD sensors. Slower flow will transfer less heat resulting in a greater temperature difference between the two RTD sensors. The difference in temperature between the two RTD sensors is used to determine the velocity or flow rate of the fluid or gas flowing past the sensor probe.

Applications

- Liquid or gas flow or no flow detection
- Flow rate monitoring for process control
- Pump run dry protection
- Cooling water or air
- Relief valve monitoring
- Combustion air flow
- Compressed air flow





ProSense FTS Series Thermal Flow Sensors Selection Guide

Model	Price	Process Connection	Probe Length	Flow Range	Temperature Range	Display Units	Output 1	Output 2
FTS100-1001	$263.00	None Use CF08-25N or CF08-50N for mounting (purchased separately)	100mm	Liquid: 0.15 to 9.85 ft/sec Air: 6 to 328 ft/sec	-4 to 212°F (-20 to 100°C)	5 x LED, green (fps, gpm, cfm, °F, 10³) Switching status: 2 x LED, yellow Measured values: alphanumeric display, red/green 4-digit	Flow switch PNP/NPN, N.O./N.C. selectable or flow monitoring frequency signal	Flow / temp. switch PNP/NPN, N.O./N.C. selectable or flow / temp. monitoring 4-20 mA or frequency signal
FTS200-1001	$274.00		200mm					
FTS100-1002	$263.00		100mm			5 x LED, green (fps, gpm, cfm, °F, 10³) Measured values: alphanumeric display, red/green 4-digit	Temp. monitoring 4-20 mA	Flow monitoring 4-20 mA
FTS200-1002	$274.00		200mm					

ProSense® FTS Series (-1001) Liquid / Air Thermal Flow Sensors

Part No. FTS100-1001

Overview

AutomationDirect's ProSense FTS series thermal flow sensors offer a very cost-effective solution optimized for monitoring water, glycol solutions, or air flow for applications where high accuracy is not required. With no moving parts, thermal flow sensors are a reliable alternative to other flow sensing technologies and mechanical flow switches. Using the pushbuttons and display the FTS series can be easily set up to measure flow velocity in feet per second (fps) or by entering the internal pipe diameter volumetric flow rate can be measured in gallons per minute (gpm) or cubic feet per minute (cfm). Available with probe lengths of either 100mm or 200mm the FTS can be used in pipes up to 16 inches in internal diameter. Flow velocity measurement in larger pipe sizes or other shapes such as rectangular ducts is also possible using feet per second (fps) operating mode. The FTS (-1001) series offers two separate outputs that can be used either as a flow or temperature limit switch or to monitor continuous flow rate or temperature. The 4-digit, two-color alphanumeric display and LEDs are used during configuration and provide clear indication of the measured variable. Installation is accomplished using the CF08 compression type progressive ring fitting accessory (purchased separately).

Features

- Cost effective solution for flow switch or flow transmitter measurement where high accuracy is not required
- Optimized for flow measurement of water, glycol solutions or air
- Volumetric flow rate measurement in pipe sizes up to 16 inches ID
- Measure fluid/air temperature in addition to flow
- 4-digit, two color alphanumeric display with pushbutton setup
- 100mm or 200mm probe length
- Two outputs selectable for switch, frequency or analog signals
- 4-pin M12 quick disconnect electrical connection
- 5-year warranty

Output Function Selections

Output 1: 2 selection options

- Switching signal for flow limit values
- Frequency signal for flow

Output 2: 6 selection options

- Switching signal for flow limit values
- Switching signal for temperature limit values
- Analog signal for flow
- Analog signal for temperature
- Frequency signal for flow
- Frequency signal for temperature

For a variety of cable options see our website www.AutomationDirect.com

ProSense FTS Series (-1001) Thermal Flow Sensors Specifications		
Model	***FTS100-1001***	***FTS200-1001***
Price	$263.00	$274.00
	Application	
Media	Water, glycol solutions and air	
Medium Temperature	-4°F to 212°F (-20°C to 100°C)	
Pressure Rating	50bar (725psi)	
	Electrical Data	
Operating Voltage	18 to 30 VDC	
Current Consumption	< 100mA	
Protection Class	III	
Reverse Polarity Protection	Yes	
Power-on Delay Time	10s	
	Outputs	
Outputs	OUT1: switch or frequency OUT2: switch, frequency, or analog	
Switch/Frequency Outputs	PNP / NPN Selectable N.O. / N.C. Selectable Max. voltage drop: 2.5 VDC Current rating: 250mA Frequency: 0 to 1000Hz	

ProSense® FTS Series (-1001) Liquid / Air Thermal Flow Sensors

ProSense FTS Series (-1001) Thermal Flow Sensors Specifications Continued		
Model	***FTS100-1001***	***FTS200-1001***
	Outputs Continued	
Analog Output	4 to 20 mA (scalable) Max. load: 350Ω	
Short-Circuit Protection	Yes	
Overload Protection	Yes	
	Measuring Range	
Probe Length (mm)	100mm	200mm
	Liquids (Water & Glycol Solutions)	
Measuring Range	0.15 to 9.85 ft/s	
Setting Range	0 to 9.85 ft/s	
Glycol Reference Medium*	35% Ethylene glycol solution	
	Gases (Air)	
Measuring Range	6 to 328 ft/s	
Setting Range	0 to 328 ft/s	
	Temperature Monitoring	
Measuring Range	-4 to 212°F (-20 to 100°C)	
Resolution	0.5°F	
	Accuracy / Deviations	
	Flow Monitoring	
Temperature Drift [fps x 1/K]	0.01 fps x 1/K (< 68°F; > 158°F)	
Max. Temperature Gradient of Medium [K/min]	100	
Accuracy (In the Measuring Range)	7% measured value (MW) + 2% measured end value (MEW); water: 68 to 158 °F; inlet length: 5 ft; DN25 (DIN 2448); mounting position according to instructions; Accuracy can differ for other media and mounting positions.	
Repeatability	0.05 m/s; (water; Flow velocity: 0.05 to 3 m/s)	
	Temperature Monitoring	
Temperature Drift	± 0.003 K/°F	
Accuracy [K]	± 0.3 / ± 1; (water; Flow velocity: 1 to 9.85 fps / air; Flow velocity: > 32.8 fps)	
	Reaction Times (per DIN EN 60751)	
Flow Response Time	Water; glycol: 0.8 s; air: 7 s (each T09)	
Temperature Response Time	1.5 s (T09); (water; Flow velocity: 1 to 9.85 fps)	

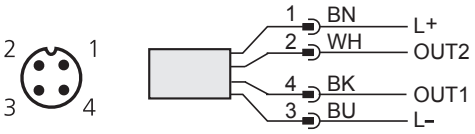
**The glycol medium setting on the sensor is designed for a 35% glycol/water solution. Increasing the glycol concentration decreases the measured value. Likewise, decreasing the concentration increases the measuring value. For a concentration of 50% glycol, there is an estimated decrease in measured value of about -25%. For a concentration of 15% glycol, there is an estimated increase in the measured value of about +25%.*

ProSense® FTS Series (-1001) Liquid / Air Thermal Flow Sensors

ProSense FTS Series (-1001) Thermal Flow Sensors Specifications Continued		
Model	***FTS100-1001***	***FTS200-1001***
	Operating Conditions	
Ambient temperature	-40 to 176°F (-40 to 80°C)	
Storage temperature	-40 to 212°F (-40 to 100°C)	
Protection	IP 65; IP 67	
	Tests / Approvals	
EMC	DIN EN 60947-5-9	
Shock resistance	DIN EN 60068-2-27 @ 50 g (11 ms)	
Vibration resistance	DIN EN 60068-2-6 @ 5 g (10 to 2000 Hz)	
UL approval	E320431	
CE	EMC; RoHS II	
	Mechanical Data	
Weight	0.65 lb (296.5 g)	
Material	Stainless steel (1.4404 / 316L); PBT-GF20; PBT-GF30	
Materials (wetted parts)	Stainless steel (1.4404 / 316L)	
Process Connection	Diameter 8mm	
	Displays / Operating Elements	
Display	Display Unit: 5 x LED, green (fps, gpm, cfm, °F, 10^3)	
	Switching status: 2 x LED, yellow	
	Measured values: alphanumeric display, red/green 4-digit, 9mm character height	
	Electrical Connection	
Connector	1 x M12	
Contacts	Gold plated	

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Wiring Diagram



Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Colors to DIN EN 60947-5-2

For additional wiring details see individual product manuals.

Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Output Function Selections

Models:
FTS100-1001. FTS200-1001
Output 1:
Switching output Volumetric flow rate monitoring
Frequency output Volumetric flow rate monitoring

Output 2:
Switching output Volumetric flow rate monitoring
Switching output Temperature monitoring
Analog output Volumetric flow rate monitoring
Analog output Temperature monitoring
Frequency output Volumetric flow rate monitoring
Frequency output Temperature monitoring

Click or scan the above QR code to be taken to the installation insert for the FTSx00-1001 Liquid/ Air Thermal Flow Switches

ProSense® FTS Series (-1002) Liquid / Air Thermal Flow Sensors

Part No. FTS200-1002

Overview

AutomationDirect's ProSense FTS series thermal flow sensors offer a very cost effective solution optimized for monitoring water, glycol solutions, or air flow for applications where high accuracy is not required. With no moving parts, thermal flow sensors are a reliable alternative to other flow sensing technologies and mechanical flow switches. Using the pushbuttons and display the FTS series can be easily set up to measure flow velocity in feet per second (fps) or by entering the internal pipe diameter volumetric flow rate can be measured in gallons per minute (gpm) or cubic feet per minute (cfm). Available with probe lengths of either 100mm or 200mm the FTS can be used in pipes up to 16 inches in internal diameter. Flow velocity measurement in larger pipe sizes or other shapes such as rectangular ducts is also possible using feet per second (fps) operating mode. The FTS (-1002) series offers two separate analog outputs that can be used monitor continuous flow rate and temperature. The 4-digit, two-color alphanumeric display and LEDs are used during configuration and provide clear indication of the measured variable. Installation is accomplished using the CF08 compression type progressive ring fitting accessory (purchased separately).

Features

- Cost effective solution for flow switch or flow transmitter measurement where high accuracy is not required
- Optimized for flow measurement of water, glycol solutions or air
- Volumetric flow rate measurement in pipe sizes up to 16 inches ID
- Measure fluid/air temperature in addition to flow
- 4-digit, two color alphanumeric display with pushbutton setup
- 100mm or 200mm probe length
- Two analog output signals for flow and temperature
- 4-pin M12 quick disconnect electrical connection
- 5-year warranty

For a variety of cable options see our website www.AutomationDirect.com

Output Function Selections

Output 1:

- Analog signal for temperature

Output 2:

- Analog signal for flow

ProSense FTS Series (-1002) Thermal Flow Sensors Specifications		
Model	***FTS100-1002***	***FTS200-1002***
Price	$263.00	$274.00
	Application	
Media	Water, glycol solutions and air	
Medium Temperature	-4°F to 212°F (-20°C to 100°C)	
Pressure Rating	50bar (725psi)	
	Electrical Data	
Operating Voltage	18 to 30 VDC	
Current Consumption	< 100mA	
Protection Class	III	
Reverse Polarity Protection	Yes	
Power-on Delay Time	10s	
	Outputs	
Outputs	OUT1: Analog OUT2: Analog	
Analog Output	4 to 20 mA (scalable) Max load: 350Ω	
Short-Circuit Protection	Yes	
Overload Protection	Yes	

ProSense® FTS Series (-1002) Liquid / Air Thermal Flow Sensors

ProSense FTS Series (-1002) Thermal Flow Sensors Specifications Continued		
Model	***FTS100-1002***	***FTS200-1002***
	Measuring Range	
Probe Length (mm)	100mm	200mm
	Liquids (Water & Glycol Solutions)	
Measuring Range	0.15 to 9.85 ft/s	
Resolution	0.05 ft/s	
Setting Range	0 to 9.85 ft/s	
Analog Start Point ASP	0 to 7.95 ft/s	
Analog End Point AEP	1.9 to 9.85 ft/s	
Glycol Reference Medium*	35% Ethylene glycol solution	
	Gases (Air)	
Measuring Range	6 to 328 ft/s	
Resolution	2 ft/s	
Setting Range	0 to 328 ft/s	
Analog Start Point ASP	0 to 264 ft/s	
Analog End Point AEP	64 to 328 ft/s	
	Temperature Monitoring	
Measuring Range	-4 to 212°F (-20 to 100°C)	
Resolution	0.5°F	
Analog Start Point ASP	-4 to 169°F (-20 to 76.1°C)	
Analog End Point AEP	39 to 212°F (3.9 to 100°C)	
In Steps Of	0.5°F	
	Accuracy / Deviations	
	Flow Monitoring	
Temperature Drift [fps x 1/K]	0.01 fps x 1/K (< 68°F; > 158°F)	
Max. Temperature Gradient of Medium [K/min]	100	
Accuracy (In the Measuring Range)	7% measured value (MW) + 2% measured end value (MEW); water: 68 to 158 °F; inlet length: 5 ft; DN25 (DIN 2448); mounting position according to instructions; Accuracy can differ for other media and mounting positions.	
Repeatability	0.05 m/s; (water; Flow velocity: 0.05 to 3 m/s)	
	Temperature Monitoring	
Temperature Drift	± 0.003 K/°F	
Accuracy [K]	± 0.3 / ± 1; (water; Flow velocity: 1 to 9.85 fps / air; Flow velocity: > 32.8 fps)	
	Reaction Times (per DIN EN 60751)	
Flow Response Time	Water; glycol: 0.8 s; air: 7 s (each T09)	
Temperature Response Time	1.5 s (T09); (water; Flow velocity: 1 to 9.85 fps)	

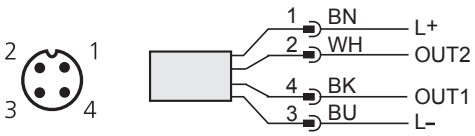
**The glycol medium setting on the sensor is designed for a 35% glycol/water solution. Increasing the glycol concentration decreases the measured value. Likewise, decreasing the concentration increases the measuring value. For a concentration of 50% glycol, there is an estimated decrease in measured value of about -25%. For a concentration of 15% glycol, there is an estimated increase in the measured value of about +25%.*

ProSense® FTS Series (-1002) Liquid / Air Thermal Flow Sensors

ProSense FTS Series (-1002) Thermal Flow Sensors Specifications Continued		
Model	***FTS100-1002***	***FTS200-1002***
	Operating Conditions	
Ambient temperature	-40 to 176°F (-40 to 80°C)	
Storage temperature	-40 to 212°F (-40 to 100°C)	
Protection	IP 65; IP 67	
	Tests / Approvals	
EMC	DIN EN 60947-5-9	
Shock resistance	DIN EN 60068-2-27 @ 50 g (11 ms)	
Vibration resistance	DIN EN 60068-2-6 @ 5 g (10 to 2000 Hz)	
UL approval	E320431	
CE	EMC; RoHS II	
	Mechanical Data	
Weight	0.65 lb (296.5 g)	
Material	Stainless steel (1.4404 / 316L); PBT-GF20; PBT-GF30	
Materials (wetted parts)	Stainless steel (1.4404 / 316L)	
Process Connection	Diameter 8mm	
	Displays / Operating Elements	
Display	Display Unit: 5 x LED, green (fps, gpm, cfm, °F, 10^3)	
	Measured values: alphanumeric display, red/green 4-digit, 9mm character height	
	Electrical Connection	
Connector	1 x M12	
Contacts	Gold plated	

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Wiring Diagram



Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Colors to DIN EN 60947-5-2

For additional wiring details see individual product manuals.

Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Output Function Selections

Models:
FTS100-1002. FTS200-1002
Output 1:
Analog output Temperature monitoring

Output 2:
Analog output Volumetric flow rate monitoring

Click or scan the above QR code to be taken to the installation insert for the FTSx00-1002 Liquid/ Air Thermal Flow Switches

ProSense® FTS Series Liquid / Air Thermal Flow Sensors

Liquid Flow Conversions

To convert from flow velocity to flow rate, use the following formula:

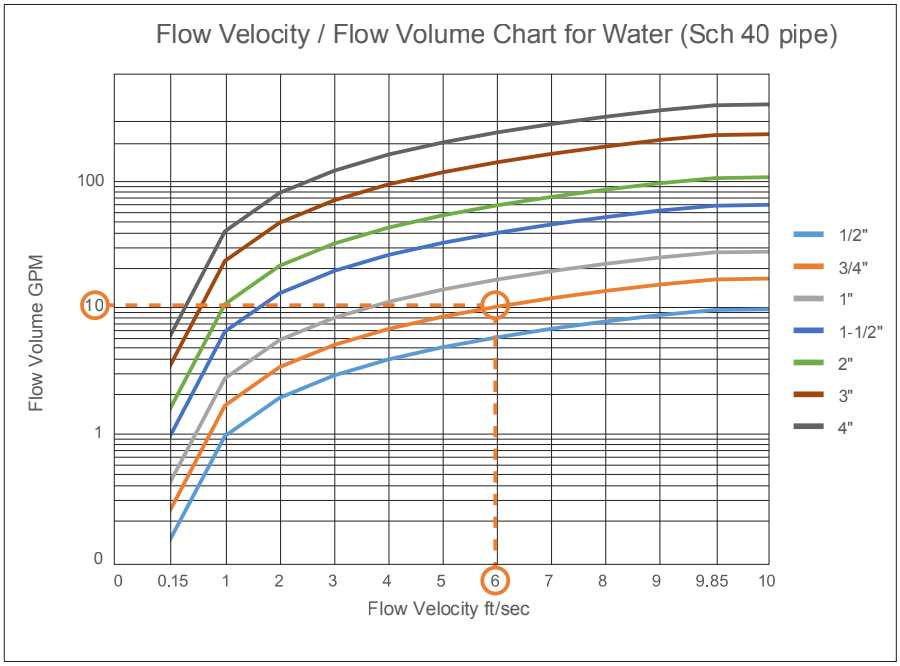
$$V = v \times A$$

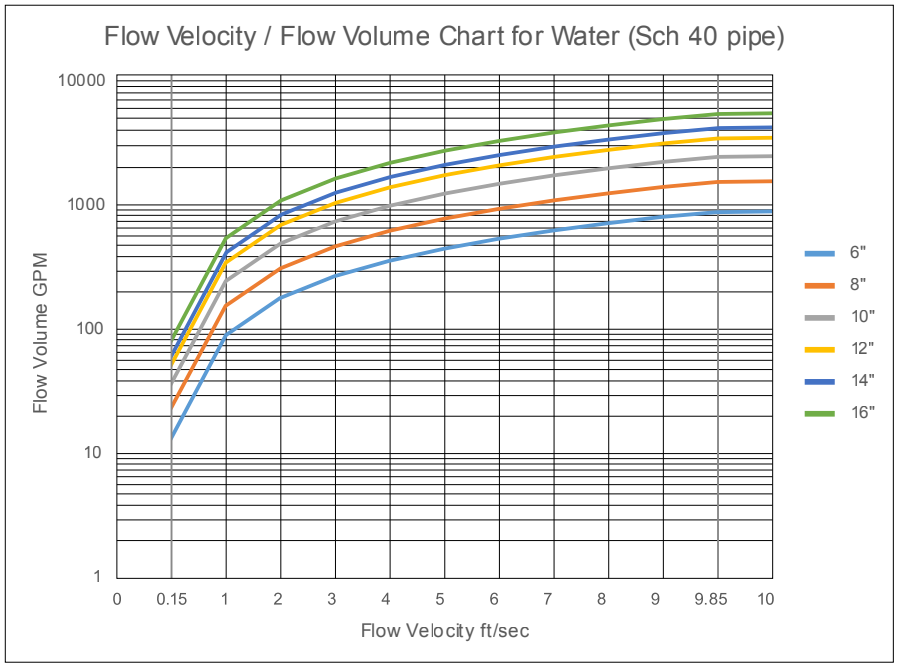
Where V = volumetric flow rate

v = flow velocity

A = cross sectional area of the pipe

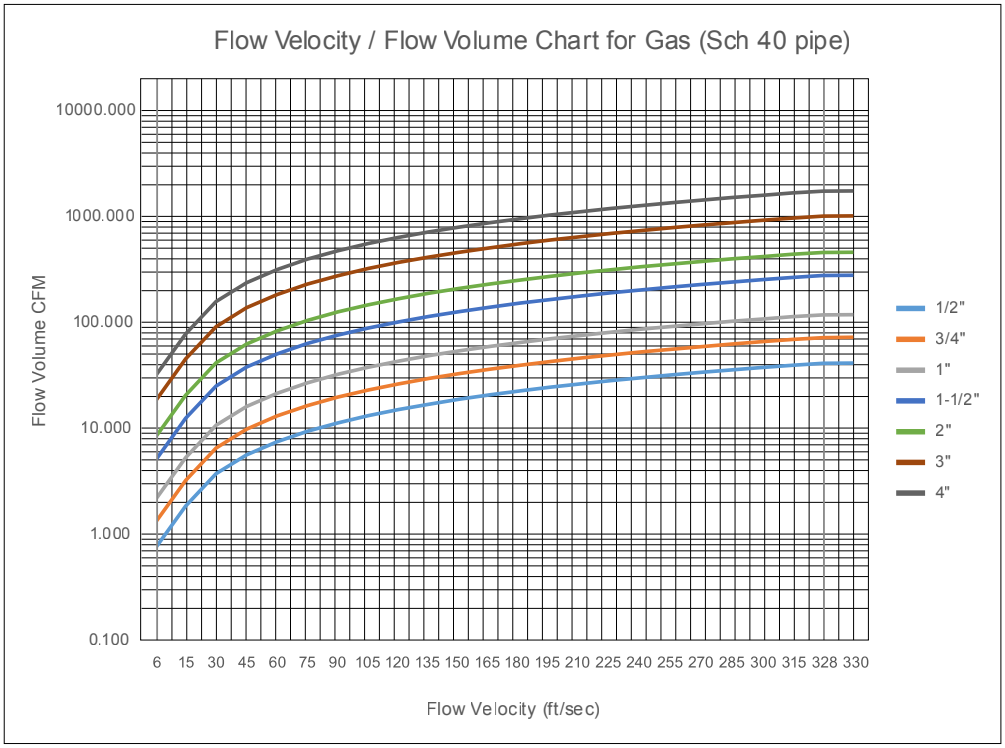
Take care to ensure all the units of measure are consistent. The following charts can be used in lieu of the calculation for round pipes. Find the volumetric flow rate on the y-axis. (Example: 10 GPM) Follow the line horizontally until it intersects the line for pipe diameter. (Example: 3/4" pipe diameter). From the intersection point, drop straight down to read the x-axis to find the given flow velocity. (Example: 6 ft/sec)





FTS Series Liquid / Air Thermal Flow Sensors

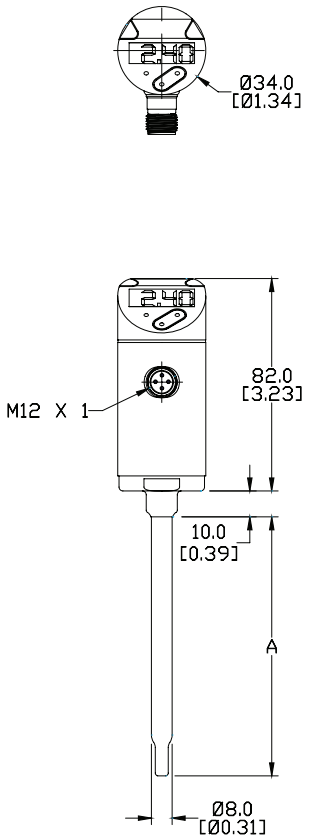
Gas Flow Conversions



FTS Series Liquid / Air Thermal Flow Sensors

Dimensions

mm [inches]



Dimensions mm [inches]	
Part No.	***A***
FTS100-100x	100mm [3.94 in]
FTS200-100x	200mm [7.87 in]

See our website *www.AutomationDirect.com* for complete Engineering drawings.

ProSense® FTS Series Liquid / Air Thermal Flow Sensor Accessories

FTS Series Liquid / Air Flow Sensor Accessories

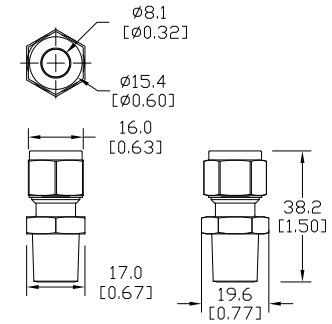
CF08-25N

CF08-50N

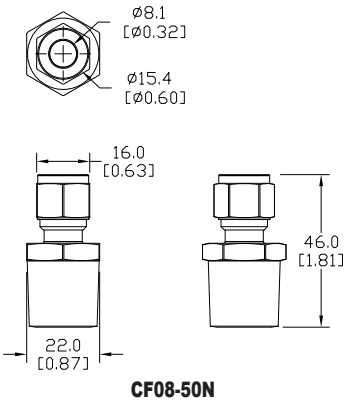
Part No.	Description	Pcs/Pkg	Weight (lbs)	Price
CF08-25N	ProSense compression fitting, stainless steel, 1/4in male NPT process connection. For use with 8mm outside diameter sensor probes.	1	0.1	$28.00
CF08-50N	ProSense compression fitting, stainless steel, 1/2in male NPT process connection. For use with 8mm outside diameter sensor probes.	1	0.2	$28.00

Dimensions

mm [inches]



CF08-25N



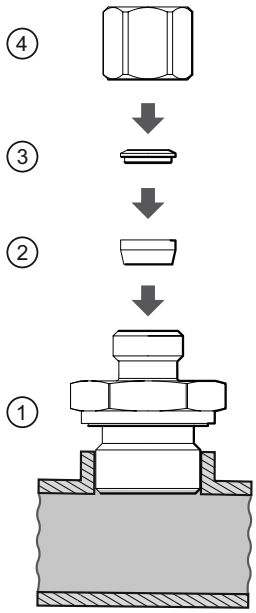
CF08-50N

See our website *www.AutomationDirect.com* for complete Engineering drawings.

Fitting Illustration

The CF compression fittings consist of four parts:

- 1. Screw fitting
- 2. First clamping ring
- 3. Second clamping ring
- 4. Coupling nut



Note: Once the FTS series unit is inserted to the correct depth and the coupling nut is tightened down, the first and second clamping rings will be joined together, compressed onto to the FTS probe and cannot be removed without damaging the unit probe. The coupling nut however can be loosened after compressing allowing for the FTS probe, clamping rings and coupling nut to be removed for FTS probe cleaning.

ProSense® FSD Series Flow Switches

Part No. FSD75-AP-6H

Part No. FSD1-AP-26H

Overview

The ProSense FSD Series flow switches monitor liquid media and provide reliable flow detection for various flow applications.

The ProSense FSD Series sensing principle ensures extremely fast response time and allows for a more precise setpoint setting. The setpoint can be easily set and locked with a setting screw.

The ProSense FSD Series flow switches are ideal for applications with rapid temperature changes or where fast response time is required, such as:

- Machine tool coolant flow
- HVAC cooling water flow
- Injection molding cooling water flow

Features

- Monitor 0.26 to 26.4 GPM (gallons per minute) in 2 models
- Immune to rapid temperature changes of media
- Fast response time of 10ms: great for cycling applications with a minimum of 10 million switching cycles
- Easy to set: turn dial to desired setpoint
- Able to be bench set outside the process
- 3/4" or 1" FNPT process connections
- Integrated check valve design allows the sensor to be mounted horizontally or vertically
- 4-pin M12 quick-disconnect
- IP65 / IP67
- LED output status indication
- 2-year warranty

#E320431

Click on the thumbnail or go to https://www.automationdirect.com/VID-FL-0001 for a short introductory video on the FSD Series Flow Switches

ProSense FSD Series Flow Switches				
Part No.	**Description**	**Quantity**	**Weight (lbs)**	**Price**
FSD75-AP-6H	24VDC, 0.26 to 6.6 GPM setpoint range, rotating dial adjustment with lock screw, 26.4 GPM max flow rate, nickel-plated brass housing with 3/4 in. FNPT process connections, N.O. DC PNP output. Cable sold separately.	1	1.0	$151.00
FSD1-AP-26H	24VDC, 1.32 to 26.4 GPM setpoint range, rotating dial adjustment with lock screw, 52.8 GPM max flow rate, nickel-plated brass housing with 1 in. FNPT process connections, N.O. DC PNP output. Cable sold separately.	1	1.6	$182.00

ProSense FSD Series Flow Switches Technical Specifications		
Model	**FSD75-AP-6H**	**FSD1-AP-26H**
Operating Voltage	20.4 to 26.4 VDC (must use a Class 2 power supply in order to comply with UL508 requirements)	
Electrical Connection	M12 (note: tightening torque < 0.6 Nm based on cable)	
Connection Pin Material	Gold-plated	
Output Function	Normally open (PNP)	
Output Maximum Load Current	100mA	
Current Consumption	< 15mA	
Voltage Drop	< 2.5 VDC	
Short-Circuit Protection	YES	
Reverse Polarity Protection	YES	
Overload Protection	YES	
Switching Cycles Minimum	10 million	
Response Time	10ms	
Accuracy*	± 5% of full range	
Repeatability	0.06 GPM	0.26 GPM
Process Connection	3/4" FNPT	1" FNPT
Medium	liquids (water, glycol solutions, oils)	
Maximum Viscosity	<68 centistokes	
Maximum Flow Rate	< 26.4 GPM	< 52.8 GPM
Setpoint Range	0.26 – 6.6 GPM	1.32 – 26.4 GPM
Hysteresis	0.13 – 0.53 GPM	0.8 – 1.58 GPM
Pressure Rating	362PSI	

** when used with water*

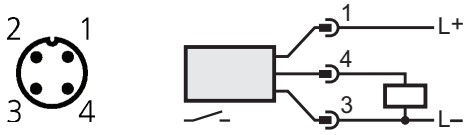
ProSense® FSD Series Flow Switches

ProSense FSD Series Flow Switches Environmental Specifications		
Model	***FSD75-AP-6H***	***FSD1-AP-26H***
Housing Material	Brass chemically nickel-plated; aluminum anodized; POM	
Materials (wetted parts)	Stainless steel (304S15); brass chemically nickel-plated*; PP (Polypropylene); Pocan PBT (Polybutylene terephthalate); O-ring:FPM (Viton)	
Operating Temperature	32 to 140°F (0 to 60°C)	
Medium Temperature	32 to 185°F (0 to 85°C)	
Storage Temperature	–40 to 212°F (–40 to 100°C)	
Protection	IP65 / IP67	
Protection Class	III	
Agency Approvals	cULus (#E320431), CE, RoHs	

** The brass contains between 1-2% lead by weight. Not recommended for use in potable water applications.*

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be mesured.

Wiring Diagrams



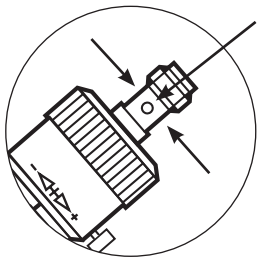
Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

LED Functions

The FSD units monitor the flow of liquid media such as: water, glycol solutions, and oils. The LED functions are as follows:

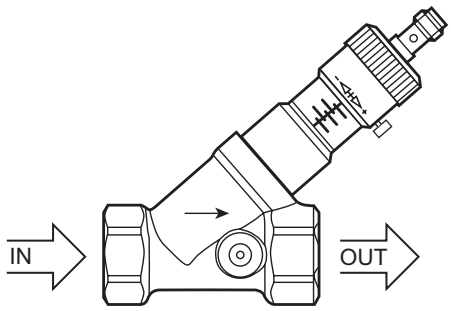
- Output closed (LED = ON), if volumetric flow quantity M setpoint.
- Output open (LED = OFF), if volumetric flow quantity I setpoint.



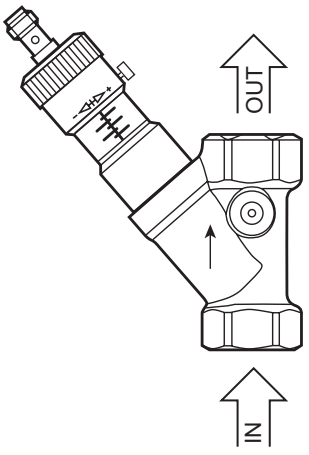
There are 4 LEDs (one on each side) on the top connector for easy visibility regardless of installation orientation.

Installation*:

For proper flow switch operation, the sensor should be installed as indicated in the Illustrations below (noting the flow direction arrow on the body of the sensor):



Horizontal Mounting



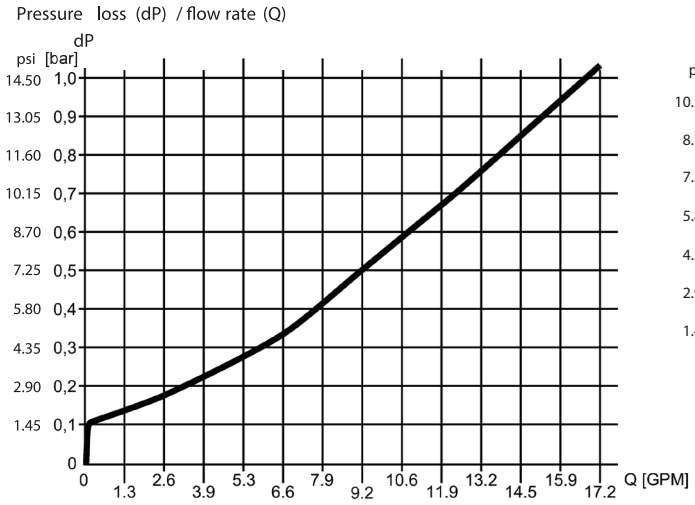
Vertical Mounting

** Integral check valve design allows the sensor to be mounted in any position (horizontally or vertically).*

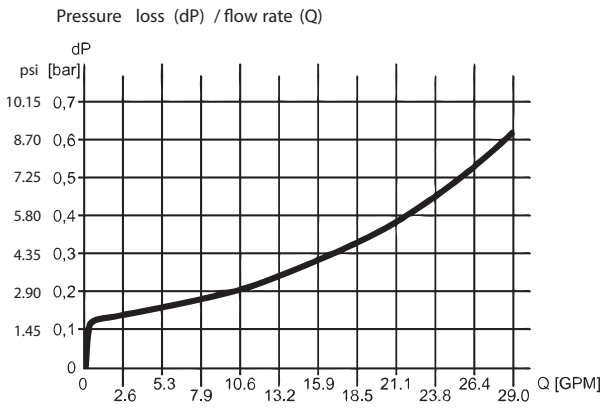
FSD Series Flow Switches

Pressure Loss/Flow Rate*

FSA75-42-6H



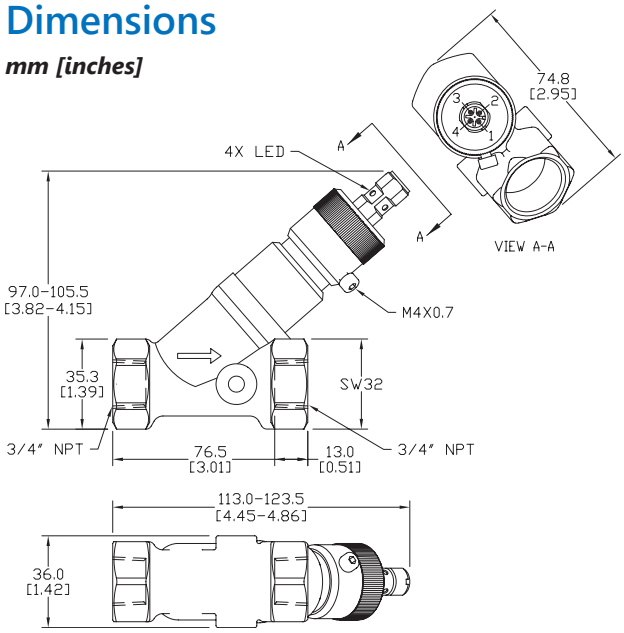
FSD1-AP-26H



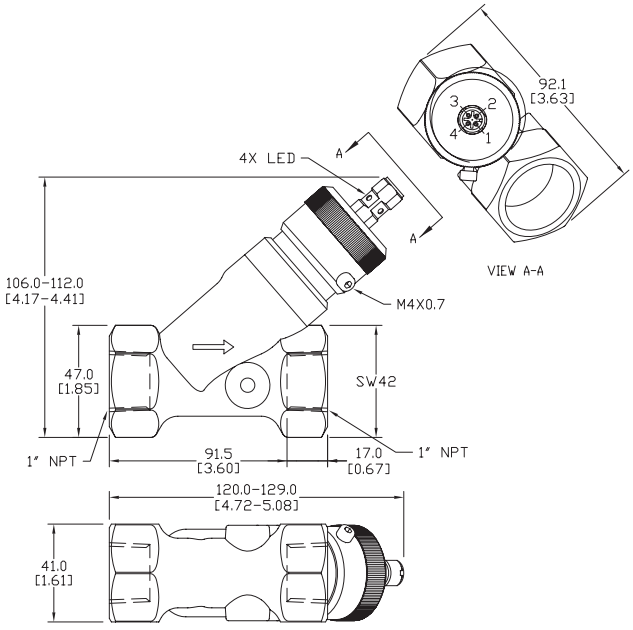
** when used with water*

Dimensions

mm [inches]



Part No. FSD75-AP-6H



Part No. FSD1-AP-26H

Click or scan the above QR code to be taken to the installation insert for the FSD75 Series Flow Switches

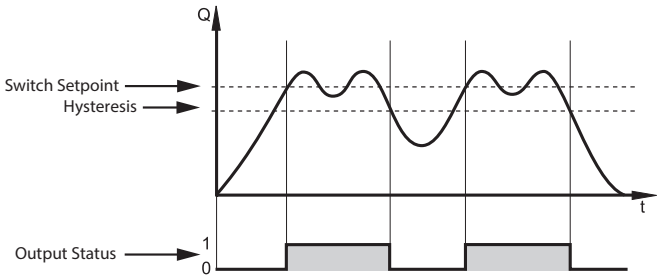
Click or scan the above QR code to be taken to the installation insert for the FSD1 Series Flow Switches

See our website *www.AutomationDirect.com* for complete Engineering drawings.

FSD Series Flow Switches

Operation & Setting

The flow sensor utilizes a spring-supported piston that is lifted by the flowing medium. The piston position is detected via an inductive sensor and is output as a binary signal. The spring resets the piston to its initial position with decreasing flow. This allows the sensor to be mounted in any position (horizontally or
vertically) and function as a check valve.



Note: Hysteresis varies based on switch setpoint.

Cutaway View

Setting FSD Series flow switches is quick and easy. There are two ways to set the flow switches - using a desired flow value and adjustment to existing flow.

Setting the ProSense FSD using a desired flow value

- 1. Loosen the locking screw.
- 2. Set the switching point by rotating the Setpoint dial until the desired flow value just becomes visible on the setting scale.
- 3. Tighten the locking screw.

Example in Figure 1: desired value = 2 GPM

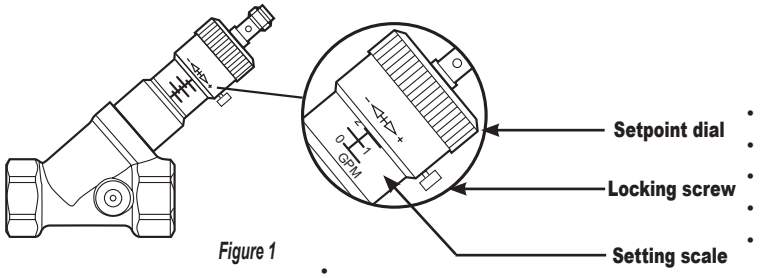


Figure 1

Adjustment to existing flow

- 1. Let the normal flow circulate in the installation.
- 2. Loosen the locking screw.
- 3. Set the switching point by rotating the Setpoint dial.
- • If the LED lights before setting: turn the Setpoint dial in the direction [+] until the LED goes out. Then turn in the opposite direction [-] until the LED lights.
- • If the LED does not light before setting: turn the Setpoint dial in the direction [-] until the LED lights.
- 4. Tighten the locking screw.

Correlation between the number of turns of the Setpoint dial and the switching point is that one complete turn of the Setpoint dial corresponds to an approximate gallons per minute rate. This is shown in the table below:

Part Number	*Gallons/Minute*	*Max. Gallons/Minute**
FSD75-AP-6H	0.8 GPM	6.6 GPM
FSD1-AP-26H	3.3 GPM	26.4 GPM

Do not turn the setting screw beyond the maximum value of the setting range to avoid faulty switching.

ProSense® FSA Series Flow Transmitters

Overview

The ProSense FSA Series flow transmitters monitor liquid media and provide an analog output proportional to flow rate for various flow applications.

The ProSense FSA Series sensing principle is based on differential pressure which ensures extremely fast response time and allows for a precise flow measurement. The ProSense flow transmitters are available in three flow ranges up to 27GPM.

The ProSense FSA Series flow transmitters are ideal for applications with rapid temperature changes or where fast response time is required, such as:

- Machine tool coolant flow
- HVAC cooling water flow
- Injection molding cooling water flow

Features

- Measure up to 27GPM (gallons per minute) in 3 models
- Immune to rapid temperature changes of media
- Fast response time of <10ms
- 3/4" or 1" FNPT process connections
- Integrated check valve design allows the sensor to be mounted horizontally or vertically
- 4-pin M12 quick-disconnect
- IP65 / IP67
- 2-year warranty

c UL us CE RoHS 2002/95/EC

ProSense FSA Series Flow Transmitters

Part No.	Description	Quantity	Weight (lbs)	Price
FSA75-42-6H	ProSense liquid flow transmitter, 0 to 6 GPM measuring range, 3/4 inch female NPT process connection, 4-20 mA analog output, 18 to 32 VDC operating voltage, 4-pin M12 quick-disconnect electrical connection. Purchase cable separately.	1	1.0	$170.00
FSA75-42-10H	ProSense liquid flow transmitter, 0 to 10 GPM measuring range, 3/4 inch female NPT process connection, 4-20 mA analog output, 18 to 32 VDC operating voltage, 4-pin M12 quick-disconnect electrical connection. Purchase cable separately.	1	1.0	$170.00
FSA1-42-27H	ProSense liquid flow transmitter, 0 to 27 GPM measuring range, 1 inch female NPT process connection, 4-20 mA analog output, 18 to 32 VDC operating voltage, 4-pin M12 quick-disconnect electrical connection. Purchase cable separately.	1	1.5	$199.00

ProSense FSA Series Flow Transmitters Technical Specifications

Model	FSA75-42-6H	FSA75-42-10H	FSA1-42-27H
Operating Voltage	18 to 32 VDC (SELV/PELV)**		
Electrical Connection	M12 (note: tightening torque <0.6 Nm based on cable)		
Connection Pin Material	Gold-plated		
Output Function	Analog		
Analog Output	4-20 mA (sourcing)		
Maximum Load	500Ω		
Current Consumption	<35mA		
Short-Circuit Protection	YES		
Reverse Polarity Protection	YES		
Overload Protection	YES		
Cycles	10 million minimum		
Response Time	<10ms		
Accuracy*	± 5% of full range		
Repeatability*	± 1% of full range		
Process Connection	3/4" FNPT		1" FNPT
Medium	Liquids (water, glycol solutions, oils), use of 200 micron filter recommended		
Maximum Flow Rate	26.4 GPM		52.8 GPM
Maximum Viscosity	<68 centistokes		
Flow Measuring Range	0 - 6 GPM	0 - 10 GPM	0 - 27 GPM
Pressure Rating	362 psig max operating / 724 psig proof pressure		

** When used with water @ 20˚C [68˚F]*

*** Voltage Supply According to EN50178 SELV (Safety Extra-Low Voltage) / PELV (Protected Extra-Low Voltage)*

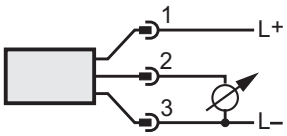
ProSense® FSA Series Flow Transmitters

ProSense FSA Series Flow Transmitters Environmental Specifications			
Model	***FSA75-42-6H***	***FSA75-42-10H***	***FSA1-42-27H***
Housing Material	Brass chemically nickel-plated; PP (Polypropylene); stainless steel (316L / 1.4404); aluminum anodized; PA (Polyamide)		
Materials (wetted parts)	Stainless steel (316 / 1.4401); brass chemically nickel-plated*; PP (Polypropylene); PPS (Polyphenylene sulfide); O-ring:FKM (Viton)		
Operating Temperature	32 to 140°F (0 to 60°C)		
Medium Temperature	14 to 212°F (-10 to 100°C)		
Storage Temperature	5 to 176°F (–15 to 80°C)		
Protection	IP65 / IP67		
Protection Class	III		
Agency Approvals	cULus (#E320431), CE, RoHs		

** The brass contains between 1-2% lead by weight. Not recommended for use in potable water applications.*

Note: Check the chemical compatibility of the sensor's wetted parts with the medium to be measured.

Wiring Diagrams

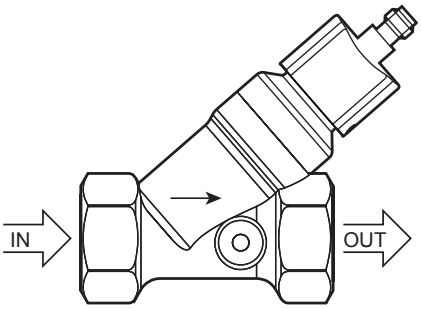


Cable Assembly Wiring Colors:
Pin 1 - Brown
Pin 2 - White
Pin 3 - Blue
Pin 4 - Black

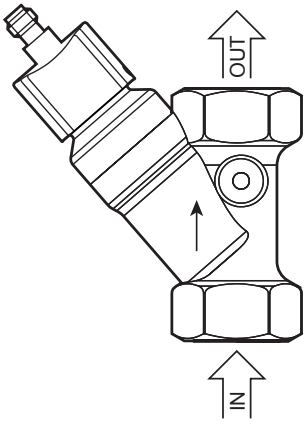
Note: Wiring colors are based on AutomationDirect CD12L and CD12M 4-pole cable assemblies.

Installation*:

For proper operation, please observe the flow direction arrows on the body of the sensor. The mounting orientation does not effect the operation of the unit.



Horizontal Mounting



Vertical Mounting

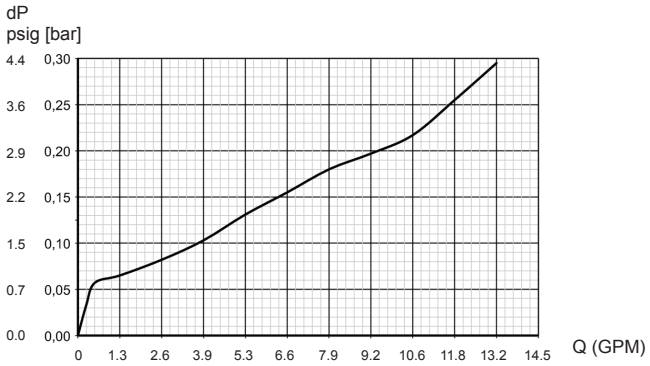
** Integral check valve design allows the sensor to be mounted in any position.*

1. Ferromagnetic materials in the surrounding environment should be at least 50mm from the housing of the unit.
2. Ferromagnetic piping may be used on the inlet and outlet connections.
3. Do not operate the unit in the vicinity of magnetic constant and alternating fields (e.g. welding systems).
4. If the sensors are installed side by side, observe a minimum distance of 50mm between the sensor axes.
5. Avoid downward flow in unpressurized pipes.

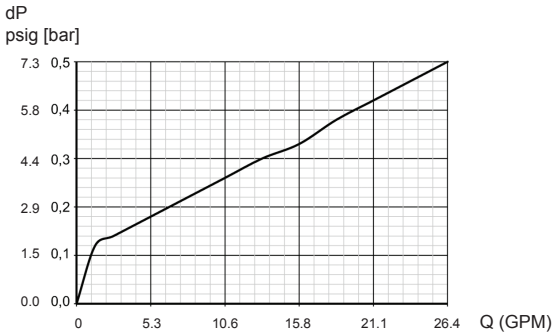
ProSense® FSA Series Flow Transmitters

Pressure Loss/Flow Rate*

FSA75-42-6H
FSA75-42-10H



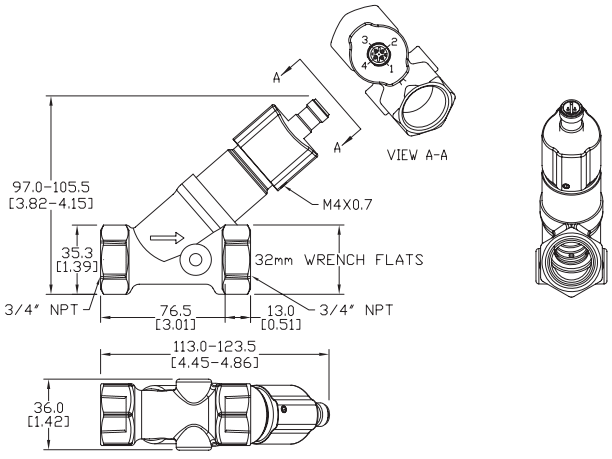
FSA1-42-27H



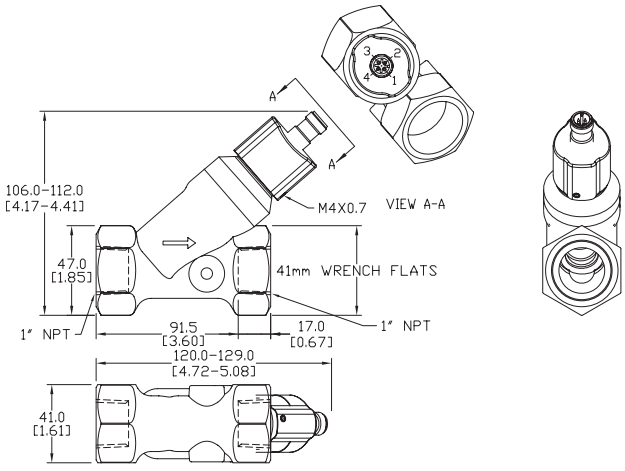
** when used with water @ 20˚C [68˚F]*

Dimensions

mm [inches]



Part No. FSA75-42-6H
FSA75-42-10H



Part No. FSA1-42-27H

See our website www.AutomationDirect.com for complete Engineering drawings.

ProSense® FSA Series Flow Transmitters

Operation

The flow sensor utilizes a spring-supported piston that is lifted by the flowing medium. By monitoring the piston position the flow rate is determined on the principle of differential pressure and is converted into an analog output signal (4 to 20 mA). The spring resets the piston to its initial position with decreasing flow. This allows the sensor to be mounted in any position (horizontally or vertically) and function as a check valve.

Part Number	*Flow Measuring Range (Gallons/Minute)*
FSA75-42-6H	0 to 6
FSA75-42-10H	0 to 10
FSA1-42-27H	0 to 27

Cutaway View

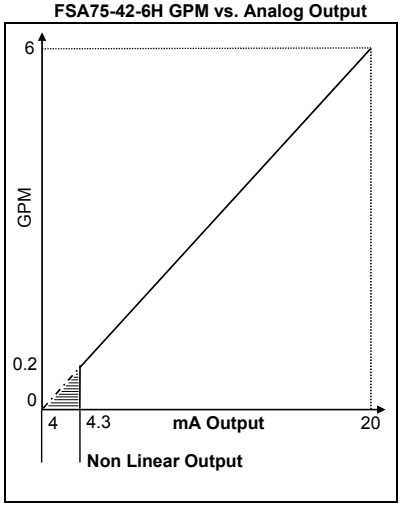
Function

The analog signal for water (20ºC [68˚F]) is linear from 4.3 mA to 20mA (4mA = no flow). For an output signal >20mA the flow rate is above the final value of the measuring range.

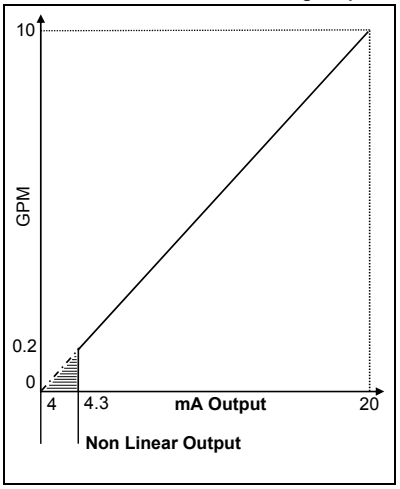
Click or scan the above QR code to be taken to the installation insert for the FSA Series Flow Transmitters

Analog Output Charts

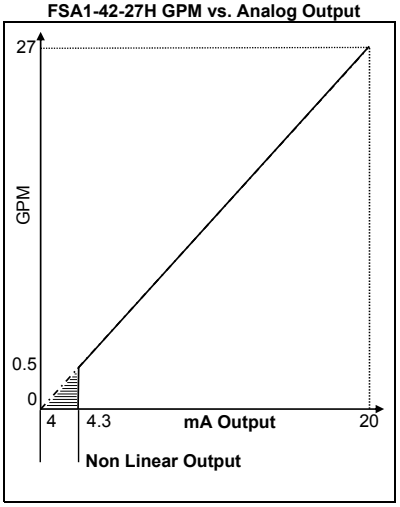
FSA75-42-6H GPM vs. Analog Output



FSA75-42-10H GPM vs. Analog Output



FSA1-42-27H GPM vs. Analog Output



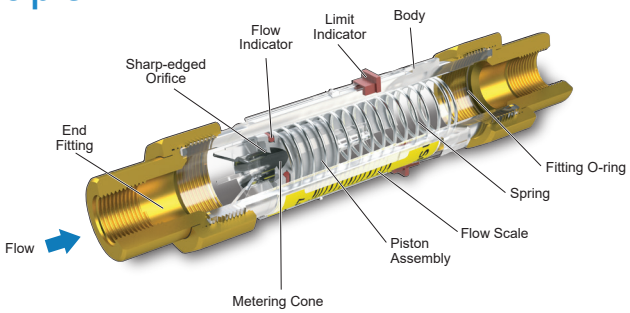
ProSense® FG1 Series Mechanical Variable Area Flow Meters

Overview

The ProSense FG1 Series of mechanical variable area flow meters provides visual indication of flow rate for water or petroleum based fluids. Constructed of high-impact polysulfone plastic, these flow meters are available with 1/2", 3/4" or 1" NPT process connections and several easy to read flow scales in both gallons per minute (GPM) and liters per minute (LPM). Their unique spring loaded variable area design allows the FG1 series flow meters to be installed in-line in any position without affecting accuracy and makes them relatively insensitive to shock and vibration. No special plumbing or accessories are required to stabilize turbulent flow because the FG1 series meters can be installed immediately adjacent to 90-degree elbows or other piping components allowing for system design flexibility. These meters provide +/-5% full scale accuracy when monitoring liquids with viscosity and specific gravity similar to the factory calibrated fluids and a repeatability of +/-1% that is important for cyclical applications requiring consistent readings. Two adjustable flow limit pointers are available to provide preset indication of high, low, or normal flow rates.

Variable Area Flow Meter Measuring Principle

The ProSense FG1 Series Flow Meter is a variable area instrument. A precision molded, sharp-edged Orifice, located within the Piston Assembly, forms an annular opening with the Metering Cone. Flow through the meter creates a pressure differential across the sharp-edged orifice, moving the piston against the Spring. The piston moves precisely, in direct proportion to the rate of flow. The calibrated spring opposes flow in the forward direction. This spring decreases viscosity sensitivity and allows the flow meters to be used in any position, including inverted. The indicated flow rate is measured by viewing the red Flow Indicator line on the piston relative to the numerical flow scale, mounted on the outer surface of the transparent flow meter body.



ProSense FG1 Series Mechanical Variable Area Flow Meter Selection						
Part No.	*Media Type*	*Process Connection*	*Measuring Range*	*Quantity*	*Weight (lbs)*	*Price*
FG1W-50BP-2	Water	1/2in female NPT	0.25 to 2.5 GPM (1 to 10 LPM)	1	1.0	$122.00
FG1W-50BP-4			0.5 to 4 GPM (2 to 15 LPM)	1	1.0	$122.00
FG1W-50BP-7			1 to 7 GPM (4 to 26 LPM)	1	1.0	$122.00
FG1W-50BP-10			1 to 10 GPM (4 to 35 LPM)	1	1.0	$122.00
FG1W-50BP-16			1 to 16 GPM (5 to 60 LPM)	1	1.0	$122.00
FG1W-75BP-2		3/4in male NPT	0.25 to 2.5 GPM (1 to 10 LPM)	1	1.0	$126.00
FG1W-75BP-4			0.5 to 4 GPM (2 to 15 LPM)	1	1.0	$126.00
FG1W-75BP-7			1 to 7 GPM (4 to 26 LPM)	1	1.0	$126.00
FG1W-75BP-10			1 to 10 GPM (4 to 35 LPM)	1	1.0	$126.00
FG1W-75BP-16			1 to 16 GPM (5 to 60 LPM)	1	1.0	$126.00
FG1W-75BP-18			3 to 18 GPM (15 to 65 LPM)	1	1.0	$126.00
FG1W-75BP-28			4 to 28 GPM (20 to 100 LPM)	1	1.0	$126.00
FG1W-100PP-2		1in male NPT	0.25 to 2.5 GPM (1 to 10 LPM)	1	0.5	$75.00
FG1W-100PP-4			0.5 to 4 GPM (2 to 15 LPM)	1	0.5	$75.00
FG1W-100PP-7			1 to 7 GPM (4 to 26 LPM)	1	0.5	$75.00
FG1W-100PP-10			1 to 10 GPM (4 to 35 LPM)	1	0.5	$75.00
FG1W-100PP-16			1 to 16 GPM (5 to 60 LPM)	1	0.5	$75.00
FG1W-100PP-18			3 to 18 GPM (15 to 65 LPM)	1	0.5	$75.00
FG1W-100PP-28			4 to 28 GPM (20 to 100 LPM)	1	0.5	$75.00

ProSense® FG1 Series Mechanical Variable Area Flow Meters

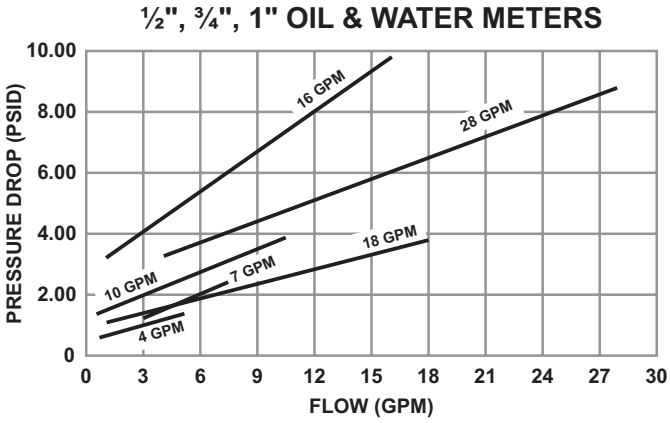
ProSense FG1 Series Mechanical Variable Area Flow Meter Selection (continued)						
Part No.	*Media Type*	*Process Connection*	*Measuring Range*	*Quantity*	*Weight (lbs)*	*Price*
FG1P-50BP-2	Oil	1/2in female NPT	0.25 to 2.5 GPM (1 to 10 LPM)	1	1.0	$128.00
FG1P-50BP-4			0.5 to 4 GPM (2 to 15 LPM)	1	1.0	$128.00
FG1P-50BP-7			1 to 7 GPM (4 to 26 LPM)	1	1.0	$128.00
FG1P-50BP-10			1 to 10 GPM (4 to 35 LPM)	1	1.0	$128.00
FG1P-50BP-16			1 to 16 GPM (5 to 60 LPM)	1	1.0	$128.00
FG1P-75BP-2		3/4in male NPT	0.25 to 2.5 GPM (1 to 10 LPM)	1	1.0	$134.00
FG1P-75BP-4			0.5 to 4 GPM (2 to 15 LPM)	1	1.0	$134.00
FG1P-75BP-7			1 to 7 GPM (4 to 26 LPM)	1	1.0	$134.00
FG1P-75BP-10			1 to 10 GPM (4 to 35 LPM)	1	1.0	$134.00
FG1P-75BP-16			1 to 16 GPM (5 to 60 LPM)	1	1.0	$134.00
FG1P-75BP-18			3 to 18 GPM (15 to 65 LPM)	1	1.0	$134.00
FG1P-75BP-28			4 to 28 GPM (20 to 100 LPM)	1	1.0	$134.00
FG1P-100PP-2		1in male NPT	0.25 to 2.5 GPM (1 to 10 LPM)	1	0.5	$82.00
FG1P-100PP-4			0.5 to 4 GPM (2 to 15 LPM)	1	0.5	$82.00
FG1P-100PP-7			1 to 7 GPM (4 to 26 LPM)	1	0.5	$82.00
FG1P-100PP-10			1 to 10 GPM (4 to 35 LPM)	1	0.5	$82.00
FG1P-100PP-16			1 to 16 GPM (5 to 60 LPM)	1	0.5	$82.00
FG1P-100PP-18			3 to 18 GPM (15 to 65 LPM)	1	0.5	$82.00
FG1P-100PP-28			4 to 28 GPM (20 to 100 LPM)	1	0.5	$82.00

ProSense FG1 Series Mechanical Variable Area Flow Meter Specifications			
Accuracy	±5% of full scale		
Repeatability	±1%		
Pressure Rating	325 psi (22.4 bar) Maximum		
Temperature Range	32…250° F (0…121° C)		
Fittings/Threads	NPT ANSI/ASME B1.20.3		
Materials	Wetted	Body	Polysulfone
		Piston	Polysulfone
		Cone	Polysulfone
		Spring	T300 Stainless Steel
		Retaining Rings	PH15-7MO Stainless Steel
		Seals	Buna-N
		Indicator Ring	Buna-N
		Fittings (1/2 and 3/4 NPT models)	C360 Brass
	Non-wetted	Limit Indicator	Polypropylene
		Scale	Polyester
Calibration Fluid	Oil	0.876 specific gravity, 32 cSt viscosity	
	Water	1.0 specific gravity, 1.0 cSt viscosity	

ProSense® FG1 Series Mechanical Variable Area Flow Meters

Pressure Drop/Flow Rate

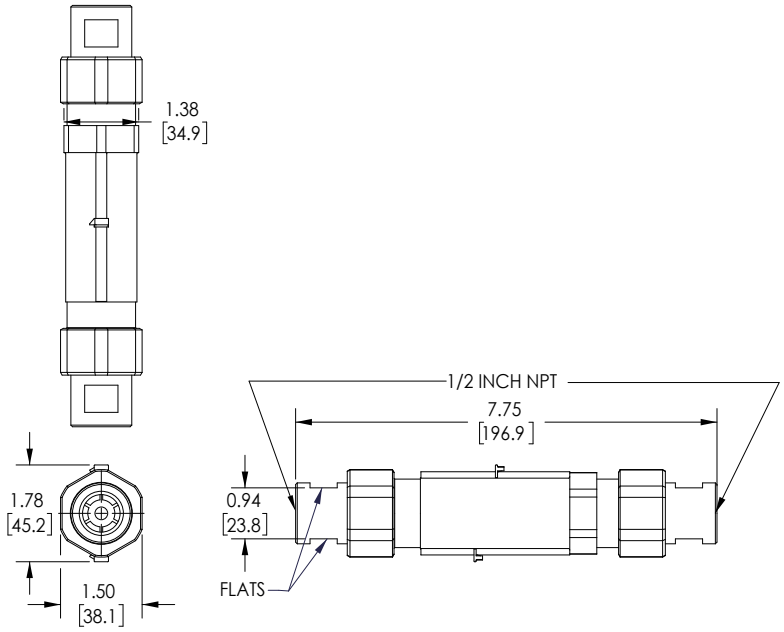
The pressure drop curve is valid for fluids with density and viscosity similar to factory calibration fluids. Fluids with higher viscosity than these test fluids yield a higher pressure drop through the flow meter and piping system per a given flow volume.



Click or scan the above QR code to be taken to the installation insert for the FG1 Series Variable Area Flow Meters

Dimensions

inches [mm]



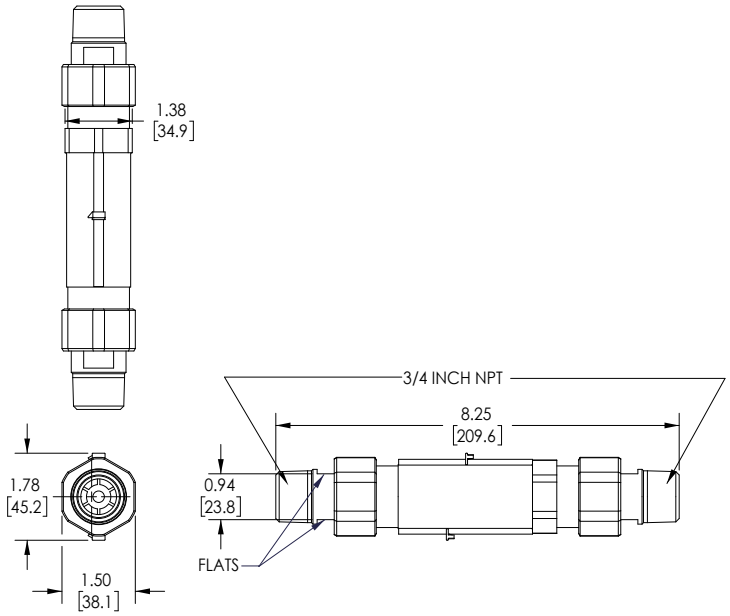
FG1x-50BP-x Models

See our website www.AutomationDirect.com for complete Engineering drawings.

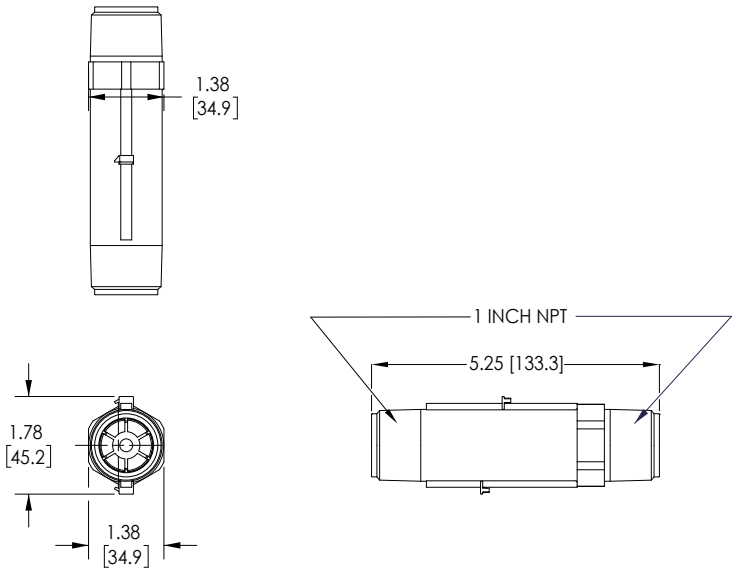
ProSense® FG1 Series Mechanical Variable Area Flow Meters

Dimensions

inches [mm]



FG1x-75BP-x Models



FG1x-100PP-x Models

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