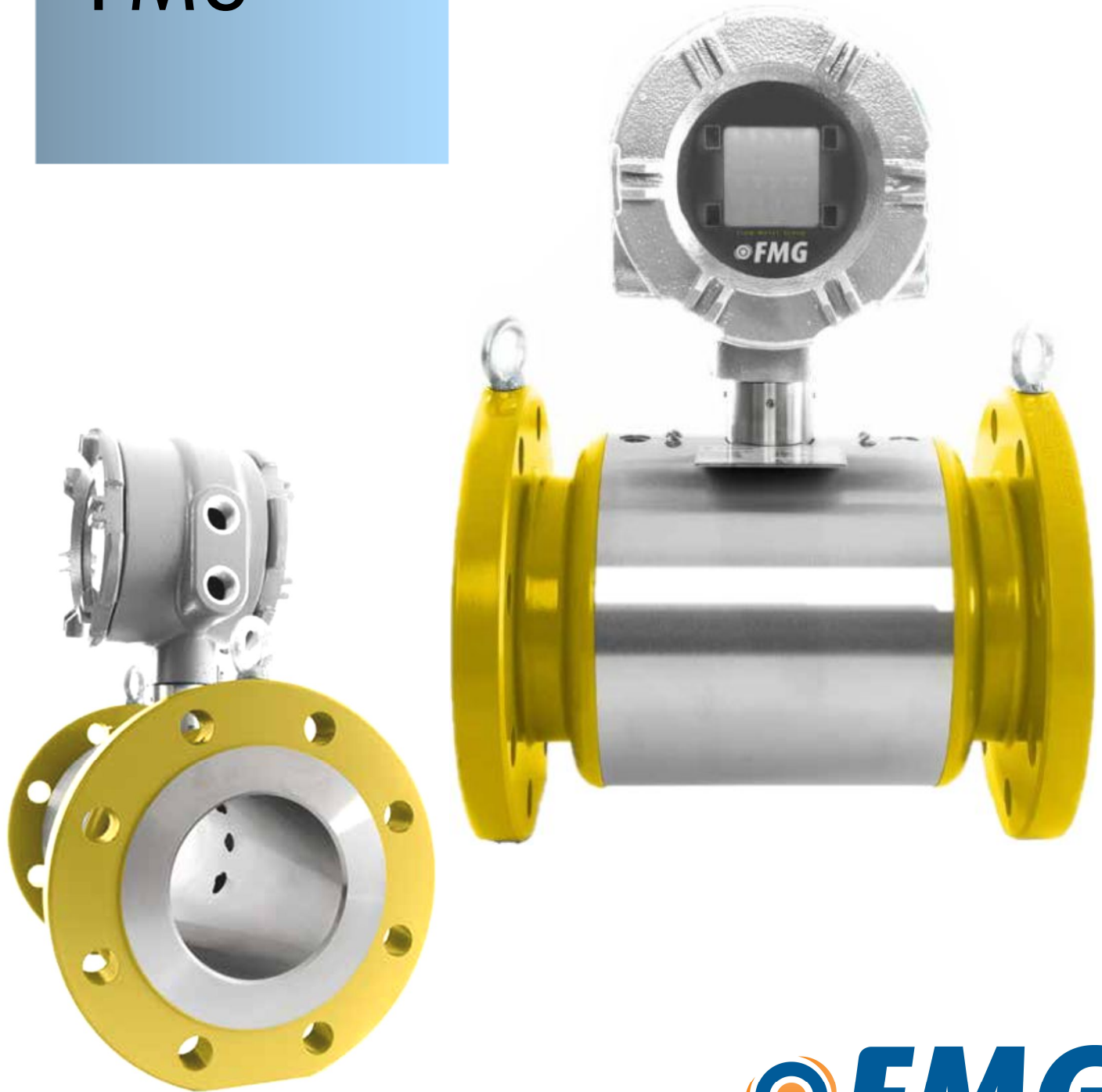


ULTRASONIC METER SERIES

FMU



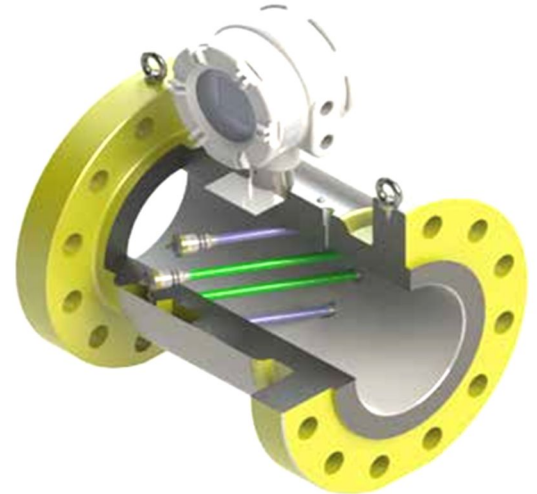
The best way to predict the future is to create it

Introduction

Today there is an increasing need to monitor emissions and improve energy efficiency in order to meet new environmental and economic challenges. This is driving the requirement for better and cheaper methods of measuring gas flow in difficult applications such as shale and coal seam gas well heads, flare gas stacks, landfill and biogas. The gases in these applications are usually dirty and wet and they can contain corrosive gases and liquids. Until now, there have been no suitable flowmeters for many of these applications. The new FMU ultrasonic flowmeters use the patented **Broadband Continuous Wave**® signal process and high efficiency titanium transducers to provide reliable and precise flow measurement even in the most extreme applications. The FMU is a multipath ultrasonic flowmeter with sensor pairs arranged in four chordal paths ensuring good interrogation of the flow profile. The titanium encapsulated sensor technology assures reliable and maintenance free performance even in extreme applications.

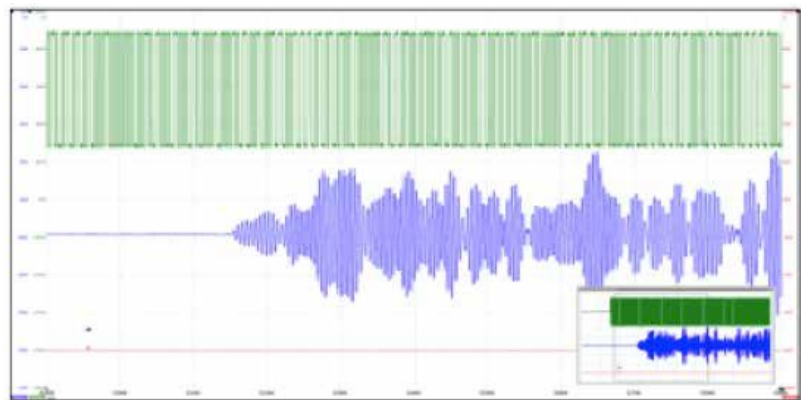
Four Paths for Accuracy and Reliability

The FMU has four paths as standard. It has been tested to meet the international standards for custody transfer metering including AGA-9 and OIMLR137. Integration of the flow across the paths provides accurate measurement even with varying flow profiles caused by changes in flow velocity, gas composition and pressure or upstream pipe configuration. Fast response is maintained by the simultaneous transmission on more than one path using Broadband Continuous Wave processing. The measured flow profile provides a diagnostic tool. Should one path fail, the Path Substitution Algorithm uses historical flow data to continue reliable flow measurements until the path recovers or remedial action is taken.

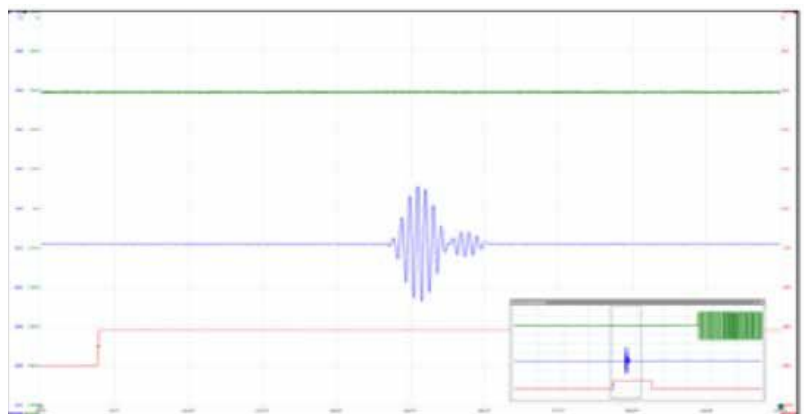


Broadband Continuous Wave

Most ultrasonic flowmeters transmit a short burst of ultrasonic energy consisting of between one and four pulses or cycles. A few ultrasonic meters use a short code consisting of a few cycles to as much as a few dozen cycles. The FMU ultrasonic flowmeter transmits many thousands of cycles in an almost continuous stream of encoded pulses. At the receiver, the signal is decoded in real time to reconstruct the receive signal that is precise and resistant to signal noise and interference in difficult applications. Extending the transmitted power over a long period rather than a few short pulses means that much lower transmit voltages are used, resulting in safety and low power. In addition, other ultrasonic flowmeters can only transmit on one acoustic path at a time. The Broadband Continuous Wave system, using codes that do not interfere, can transmit on two or more paths simultaneously. Simultaneous transmission means a faster response time and better performance in fluctuating or pulsating flow.



Encoded Transmitted Signal (green) and received signal (blue)



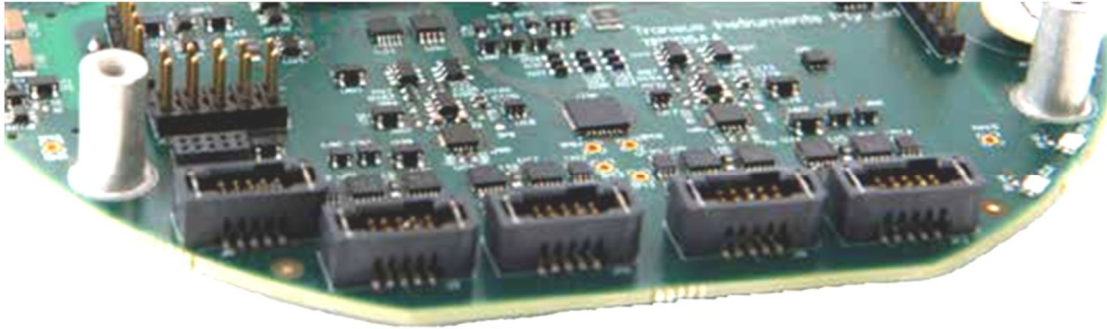
Decoded received signal (blue)

Versatile I/O

The FMU Series comes standard with a Pulse/ Frequency output. An optional I/O Option Board can provide an isolated RS485 and two additional isolated Pulse-Frequency outputs. All I/O is intrinsically safe.

Loop Powered

Power and 4-20mA flow data may be obtained from a single pair of wires. This also means that the FMU Series are inherently low power instruments so they are ideal for remote applications where only solar or battery power is available.



Approvals

- OIML R137 (NMI)
- MID 2014/32/EU (NMI)
- Compliant with AGA9
- ATEX Ex ia IIC T4 Ga
- FM - Class I. Division 1, Group A, B, C, D T4

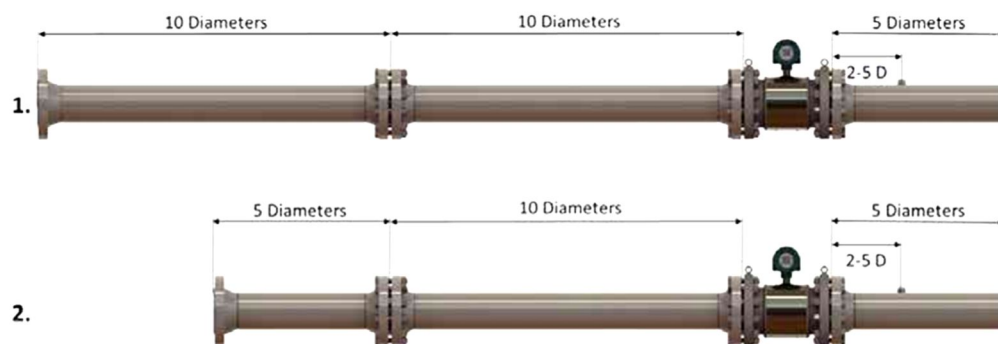
Harsh Environment

The FMU Series epoxy coated aluminium alloy electronic housing, rated to IP66 and NEMA 4X, is designed to be used outdoors in almost any environment. The ambient operating temperature covers the range -40°F to +140°F. The ultrasonic sensors have all titanium wetted surfaces and are designed for process gas temperature from -22°F to +176°.

Installations

The FMU series ultrasonic meters can be installed in both horizontal and vertical position. As Class 0.5 (OIML R137) minimum inlet sections as shown below are required.

Installation Configurations:



Configuration 1 - Conservative configuration with flow conditioner (AGA9)

Configuration 2 - Recommended configuration with flow conditioner (OIML R137 approved)

Manufacturer approved configuration: without flow conditioner: 10D upstream, min 3D downstream

For bi-directional flow:

- The upstream piping spools and flow conditioner as applicable from configuration 1 and 2 can be used on both ends
- Any thermowell should be positioned 3 - 5 diameters away from meter flanges

Intrinsically Safe

The FMU Series are Intrinsically Safe (ATEX/IECEx Intrinsically Safe for Zone 0). Installation is simple and economical as no special precautions are required for wiring and housing. The versatile keypad and display can be accessed in a hazardous area without special precautions, so start-up and diagnostic monitoring is quick and simple. Field wiring may also be accessed without the need to shut down the meter and lose

Difficult Applications

The titanium ultrasonic sensors are remarkably efficient and coupled with the Broadband Continuous Wave processing can reliably measure the most challenging applications such as wet and dirty gases, varying gas compositions and attenuating gases. The combination of the efficient transducers and the Broadband Continuous Wave processing is also resistant to acoustic noise such as valve noise, which has been the bane of other ultrasonic meters.



Diagnostics & Condition Monitoring

The FMU Series four path design provides an indication of the velocity profile in the flowmeter. The velocity profile is created by the upstream pipework. By calculating velocity ratios between the ultrasonic paths, a good monitoring of the flow profile is realized. The flowmeter calculates Profile and Symmetry Factors which can be used for condition monitoring of the measurement and the gas flow. In addition, the FMU flowmeter provides diagnostics for turbulence by means of the standard deviation of the instantaneous path velocity measurements. The standard deviation provides an excellent diagnostic for turbulence, pulsation and fluctuations. Additional meter diagnostics such as velocity of sound, signal-to-noise ratio and signal strength are available to the user as well.

Pressure Drop

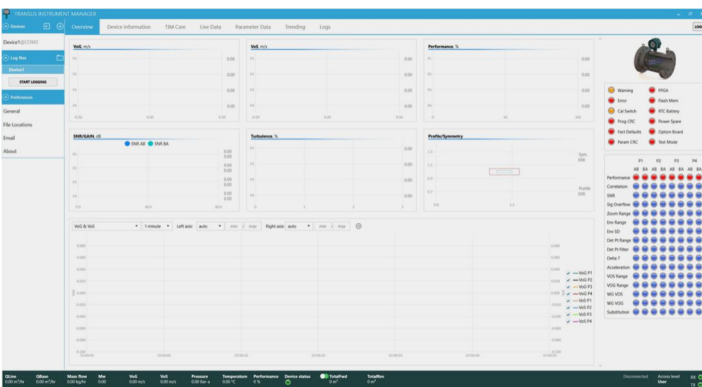
The FMU Series flow body is a “straight through” design resulting in virtually no pressure drop.

Main Features

- Flow Range 140—490,000cfh
- Diameters 2” to 12”
- Pressure Ratings ANSI 150 to ANSI 600
- MID & OIML Approved
- AGA 9 Compliant
- Intrinsically Safe
- Low Power Consumption
- Coded Broad Band Continuous Wave
- Titanium Sensors For All Pressures
- No Reflection Path

Pressure and Temperature Sensors

Pressure and Temperature process sensors may be added as an option. With the FMU Series special software, these sensors may be used for volume correction, and for gas composition analysis in applications such a biogas and flare gas.



SFC3000 Flow Computer

The SFC3000 is far more than just a dedicated flow computer. It can operate on a number of levels from a supervisory machine to a stand alone flow computer or as a system component. With its touch screen, VGA display and extensive processing capabilities, combined with simple to use controls and unique operating software it can function as a complete station supervisor integrated into a flow computer housing. Designed specifically to meet the needs of the world wide liquid hydrocarbon and gas measurement markets, the SFC3000 is intended to positively contribute to both management and conservation of the worlds dwindling energy resources by providing both versatile and accurate measurement and incorporating state of the art designs and components.

Functionality

Measurement conforming to AGA, ISO, API standards of:

- Dry and Wet Natural Gas
- Hydrocarbon Liquids
- Other Gases e.g. Nitrogen
- Other Gases e.g. Water
- Individual stream I/O boards, 1 to 5 fiscal streams
- Using Meter types:
 - Pulse generating flow meters
 - Most common Ultrasonic flow meters
 - DP transmitters with Orifice or Venturi measurement

Supervisory Features

- Alarm/Event/Data logging and recording
- Printer report generation
- System Diagram display
- Network Communication
- Station Controller Functions
- Valve Control and remote operation
- Maintenance Functions
- Stream Summation
- PID/Sampler Functions



Main Features

- Stand alone flow computing function
- Flow Computing combined with supervisory function
- 2Gb memory for Alarm, Audit and Data logging
- Easy installation and interfacing
- Extremely accurate
- Interfaces with wide variety of metering equipment and all popular GC's
- Free Configurable Display:
 - System Diagrams
 - Trending and graphical displays
 - Language options

Flow Computer Approvals

Designed to comply with:

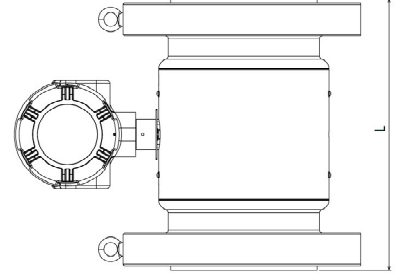
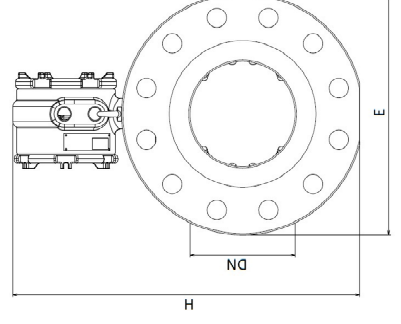
- MID European approval
- API Chapter 21, OIML R117
- NMI Metrology requirement

Calculations

- Dry and Wet Natural Gas
- ISO 5167, AGA 3, AGA 8, AGA 10
- ISO 6976, PTZ, NX19, SGERG or Direct Density

Technical Specifications		
	Imperial	Metric
Principle of Operation	Broadband continuous wave - transit time	
Sizes	2 - 16" ANSI150 - ANSI600	DN50 - DN400 PN10 - PN100 Others on request
Flange Type	ANSI, DIN, others on request	
Pressure Ranges	14.5 - 1480 psi	1 - 102 bar
Ambient Temperature	-40 to +140 °F	-40 to +60 °C
Process Temperature	-22 to +178 °F -13 to +131 °F	-30 to +80 °C -25 to +55 °C (according to OIML R137)
Typical Uncertainty	Better than 1% (Qt - Qmax) factory calibration Better than 0.5% (Qt - Qmax) according to OIML R137 Better than 2% (Qmin - Qt) factory calibration Better than 1% (Qmin - Qt) according to OIML R137	
Repeatability	0.1%	
Turndown	100:1 (Pipe Size Dependent)	
Meter Body Materials	Carbon Steel Welded Steel Aluminium Others on request	
Meter Body Surface Treatment	Three layer epoxy coating Standard RAL1004 Other colors on request	
Material Certification	EN 10204 3.1 Others on request	
Pressure Port	1/4" NPT female	
Electronic Enclosure Material	Epoxy painted, low copper aluminium alloy	
Power Supply	18 - 28 VDC, 670mW max	
User Interface	128x128 dot matrix LC Display, 4 Keys	
Interface Ports	1x USB (not intrinsically safe) 1x 4 - 20 mA 1x Frequency Output	
Optional Interface Ports	1x RS485, two wire, externally powered 2x Digital, software configure pulse, alarm, frequency output 1x Temperature sensor 1x Pressure sensor	
Communication Protocols	MODBUS (RS485 and USB)	
Hazardous Area Certification	ATEX Ex ia IIC T4 Ga, Zone 0 IECEx Ex ia IIC T4 Ga CSA/FM - Class I, Division 1, Group A, B, C, D T4 (PENDING)	
Ingress Protection	IP66, NEMA 4X	

Nominal Pipe Size		Flowranges					Dimensions			
inch	Schedule	Base Rating (Qmax) Atm. Air cfh	Qmin Atm. Air cfh	Internal Diameter inch	Turndown	Rating	L - Length inch	H - Height inch	E - Width inch	Weight lbs
2*	40	11,010	130	2.067	85	150	10.2	13.4	6.1	55
	80	9,690	110	1.939	89	300	10.2	13.6	6.5	60
3	40	21,230	250	3.068	85	150	11.8	14.6	7.5	77
	80	18,970	220	2.900	87	300	11.8	15.0	8.3	79
4	40	34,980	420	4.026	84	150	11.8	16.1	9.1	95
	80	31,600	380	3.826	84	300	11.8	16.6	10.0	110
6	40	71,090	720	6.065	99	150	13.8	18.0	11.0	126
	80	64,150	650	5.761	99	300	15.7	18.8	12.6	212
8	40	123,110	1,240	10.020	100	150	15.7	20.1	14.0	271
	80	112,370	1,130	9.562	100	300	17.7	20.3	13.6	320
10	40	194,100	1,950	11.938	100	300	19.7	20.9	15.0	386
	80	176,700	1,770	11.376	100	600	19.7	22.4	16.5	434
12	STD	278,200	2,790	13.126	100	300	21.7	24.0	17.5	540
	80	250,200	2,510	12.500	100	600	21.7	25.2	20.1	668
14	STD	339,200	3,400	13.126	100	300	23.6	26.6	20.5	628
	80	302,000	3,020	12.500	100	600	23.6	27.4	22.0	829
16	STD	449,500	4,500	15.000	100	300	23.6	27.8	23.0	893
	80	395,900	3,960	14.314	100	600	23.6	28.7	23.8	959
						300	27.6	29.7	25.6	1367
						600	27.6	30.5	27.2	1455



*) The 2" FMU meter will be only supplied with 3-path configuration



FLOW METER GROUP B.V. (FMG)

FMG is an engineering/manufacturing company specializing in the development and production of energy and gas measurement systems. Located in the Netherlands, FMG produces a wide range of rotary and turbine gas meters, volume conversion devices, master meters and calibration benches. Unique product features include Self-Diagnosis and tamper prevention. All products and services are certified by the Dutch NMI and comply with the latest EU and/or OIML directives.

Flow Meters

FMG offers a large variety of flow meters ranging from very small (3.5cfh) up to very large (245,000cfh) flow rates and in pressures from atmospheric to 1450 psi. All FMG meters comply with international safety and metrological standards. Meters designated for fiscal use are tested, certified and approved by the Netherlands Metrological Institute NMI.

FMG has added extra features to the meters in terms of increased accuracy, protection from manipulation, increased rangeability and superior performance in order to exceed existing and future standards.



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rev.003
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