FMC Technologies

Ultrasonic Gas Flowmeter

MPU 1200 Series B

Specifications

Issue/Rev. 0.5 (10/11)

Bulletin SSKS002

*The **MPU 1200 Series B Ultrasonic Gas Flowmeter** is a six path ultrasonic meter with non-intrusive and flush mounted transducers providing undisturbed and accurate measurement of gas flow. Compared to traditional gas metering systems, the MPU 1200 provides significant cost, space and weight savings for gas system applications.*

Features

- **Swirl and Crossflow Compensation** – Unique path placement of the meter's twelve ultrasonic transducers (6 pairs) allows superior compensation for swirl and cross-flow ensuring bi-directional flow measurements with nominal uncertainty of ±0.1% and repeatability of ±0.05% or better.
- **Digital Ultrasonic Signal Processing** – The MPU 1200 is able to tolerate substantially higher ultrasonic noise levels than most other ultrasonic meters – up to 20 times less sensitive to outside interference.
- **In-line Transducer Removal** – Utilizing a transducer retraction tool with isolation valves, transducers can be easily and safely removed, if required, without the need for process shut down and meter recalibration after transducer reinsertion or replacement.
- **AGA Report No. 9 Compliance** – The MPU 1200 has been field tested and verified to AGA 9 performance specifications by several independent testing facilities.
- **Advanced Electronics** – Extensive interface capabilities and high data speed allow for faster diagnostics and the ability to operate and communicate from remote locations or over the Internet.
- **Density Calculated from Sound Velocity** – The sound velocity is measured by the MPU 1200 and is used for the following: comparison to a gas chromatograph for meter health check; density calculations for condition checking; and mass flow rate calculations.
- **Pressure and Temperature Compensation** – Meter volume, signal path length and signal path angle variations due to pressure and temperature changes are compensated to ensure accurate, continuous measurement.
- **WinScreen Software** – Provides real-time logs, trends, signal performance and parameter reports for operational, diagnostics and maintenance purposes. The user-friendly, Windows-based program displays meter information, including visualization of flow regime, on one screen.

Transducer and cable protection covers are standard for UL/CUL units but are an option for ATEX units.

Principle of Operation

The MPU 1200 function is based on the well-established acoustic transit time principle. The measurement principle utilizes the fact that the direction and propagation velocity of an ultrasonic pulse will be modified by the flowing medium. An ultrasonic pulse propagating with the flow will experience an increase in velocity while an ultrasonic pulse propagating against the flow will experience a decrease in velocity. Turbulence and noise generated frequencies are filtered.

MPU 1200 measures the transit time of the ultrasonic signal that is transmitted. The start of the transmission and arrival of the correct signal is detected by the software.

MPU 1200 transducers are non-intrusive and flush mounted ensuring minimum risk for clogging by residues in the flow. The transducer is fully encapsulated, manufactured in titanium and is replaceable during operation and without the need for process shutdown and recalibration after replacement.

Applications

Dry, non-condensing, high pressure gas applications including:

- **Custody transfer of gas onshore and offshore**
- **Pipeline node bi-directional measurements**
- **Gas terminals**
- **Gas mixing stations**
- **Gas power plants**
- **Pipeline junctions**
- **Compressor stations**

Operating Specifications

Flow Range

Size	Meter/Second	Feet/Second
6-16 in.	0.4-30	1.3-98
18-30 in.	0.3-26	1.0-82
32-56 in.	0.2-20	0.7-65

Operating Pressure Range

1-275 bar_a / 1 to 3,990 psi_a
Higher pressures are available. Please consult factory for pressures above 275 bar.

Nominal Accuracy

With dry calibration: ≤±0.5% of measured value.

With flow calibration: ≤±0.1% of measured value.

Repeatability: ≤±0.05% of measured value.

Linearity: 0.7% (band).

Temperature

Operating flow temperature: -20°C to 70°C/-4°F to 158 °F.

Operating ambient temperature: -25°C to 60°C/ -13°F to 140°F.

Storage temperature: -20°C to 70°C/-4°F to 158°F.

Humidity

Up to 95%, non-condensing.

Standard Flange Connections

Typically ANSI B16.5 RF or RTJ face flanges. Other types of flange connections available on request.

Spool Piece

Carbon steel or stainless steel according to relevant regulations and customer's process conditions. Other material available on request.

Transducer

Piezoelectric element, fully encapsulated in titanium housing – special solution for H_2S and C_6^+ applications.

Instrument Power

DC Instrument Input Power to Field Mounted Electronics

24 VDC +15% / -10%, 0.5A.

Power inrush: 8 Amps for < 20mS at 24 VDC.

The DC power input circuitry is reverse current protected and fused.

Tested to 20 milliseconds power drop without shut down. Meter will always restart orderly after power loss.

AC Instrument Input Power to Field Mounted Electronics

120/240 VAC continuous, +/- 10%, 12 Watts, 48 to 63 Hz.

Power inrush: 6 Amps for <20mS at 120 VAC.

Power inrush: 3 Amps for <20mS at 240 VAC.

The AC circuitry is fuse-protected.

Power Interruption Tolerance: Interruption of power greater than 100 milliseconds (typical) will cause an orderly shutdown. Tested to 20 milliseconds power drop without shut down. Meter will always restart orderly after power loss.

Electrical Inputs

Digital Inputs

2 digital inputs

Type: High speed, optically isolated digital input. The input pulse must rise above V (high. min) for a period of time and then fall below V (low) to be recognized as a pulse.

V (high): 5 VDC minimum to 28 VDC maximum.

V (low): 1 VDC maximum.

Input impedance: 1.8 kΩ.

Frequency range: 0 to 10.0 kHz.

Mode: Single, dual, dual with power sensing, density.

Duty Cycle: 35/65 to 65/35 (on/off).

Analog Input (4-20mA)

Up to 2 analog inputs (maximum number of analog inputs and outputs are 2).

Type: Two-wire, 4-20mA current loop receiver, isolated from ground, programmable as to function.

Span Adjustment: Program adjustable.

Input Burden: 50Ω.

Resolution: One part in 65,536.

Voltage Drop: 2 Volts maximum.

Sampling rate: Software selectable

Analog Input (1-5 VDC)

Up to 2 analog inputs (maximum number of analog inputs and outputs are 2).

Type: Two-wire, 1-5 VDC voltage loop receiver, isolated from ground, programmable as to function.

Span Adjustment: Program adjustable.

Input Burden: 1 mΩ.

Resolution: One part in 65,536.

Sampling rate: One sample/ 300 mSec minimum.

Electrical Outputs

Communications

Ethernet

ANSI/IEEE 802.3 Ethernet channel operating at 10/100 Mbps.

Optical fiber (100Base-FL) or

Twisted pair (10Base-T/ 100Base-T)

Serial

Configuration: Multi-drop network.

Data Rate: Selectable asynchronous data (Baud) rates of 2400, 4800, 9600 or 19200 bps.

Data Format: One start bit, One stop bit, eight data bits - no parity.

Line Protocol: Half duplex, full duplex.

Protocol: MODBUS (RTU), DSFG (special option)

Ports

Two ports: Selectable from RS-485 and RS-232.

EIA-232 Port

RS-232 data communication.

EIA-485 Port

Operating Half-Duplex (2-wire) or Full Duplex (4-wire).

Multi-drop network for RS-485 data communication. Up to 16 Ultrasonic Gas Flowmeters can be connected onto the same Bus/ twisted pair.

Pulse Output

4 pulse outputs.

Type: Open collector type output. User- selectable pulse units, pulse rates and pulse width/duty cycle.

Volume output selectable for rate and incremental volume.

Single or Dual Quadrature (outputs 90 electrical degrees out of phase).

Polarity: Selectable (Normally Open or Normally Closed.

Switch Blocking Voltage (Switch Off): 30VDC maximum.

Load Current (Switch On): 10mA with 0.6 volts drop.

Frequency Range: 0 to 5kHz.

Duty Cycle: 50/50 (on/off).

Digital Outputs

2 digital outputs.

Type: Optically-isolated solid state output. User-programmable as to function.

Polarity: Programmable (Normally Open or Normally Closed)*.

Switch Blocking Voltage: 30 VDC maximum.

Load Current: 150mA maximum with 0.6 volt drop.

Note: **Power-down normally open.*

Analog Output (4-20mA)

Up to 2 analog outputs (maximum number of analog inputs and outputs are 2).

Type: Two-wire, 4-20mA current loop transmitter, isolated from ground, programmable as to function.

Span Adjustment: Program adjustable.

Accuracy: +/-0.025% of range.

Resolution: One part in 65,536.

Voltage Burden: 4 volts maximum.

Maximum Load Resistance: 250Ω.

Analog Output (1-5 VDC)

Up to 2 analog outputs (maximum number of analog inputs and outputs are 2).

Type: Two-wire, 1-5 VDC voltage loop transmitter, isolated from ground, programmable as to function.

Span Adjustment: Program adjustable.

Accuracy: +/-0.025% of range.

Resolution: One part in 65,536.

Approvals

Hazardous Classification

European type:

Ex Classification: Eex d IIB T5

ATEX Certification: Cert. no. Nemko 05ATEX1244
Cert. no. PTB 07ATEX1018

North American Type:

Ex Classification: Explosion proof, Class 1, Division I, Group C&D

UL/CUL Certification: E23545

Type Approvals

Russia: Gosstandart NO.C.29.004.A No. 10209

Indonesia: MIGAS 309738.04-DMT/1999

Malaysia: SIRIM NMC/448/12/4

China: CPA 2002-F235

AGA 9 and ISO 17089

CRN Approved

Pending

Installation

With flow conditioner (FC) we recommend 3D then the FC then 7D upstream straight pipe before the meter, 3D downstream straight pipe. For bi-directional measurement, the same 3D+FC+5D on both sides.

Dimensions

Inches

mm

Size	ANSI 150		ANSI 300		ANSI 600		ANSI 900		ANSI 1500	
	Length (in/mm)	Weight (lb/kg)	Length (in/mm)	Weight (lb/kg)	Length (in/mm)	Weight (lb/kg)	Length (in/mm)	Weight (lb/kg)	Length (in/mm)	Weight (lb/kg)
6"	29" 737 mm	325 lb 148 kg	29" 737 mm	375 lb 170 kg	29" 737 mm	450 lb 205 kg	31" 787 mm	575 lb 261 kg	34" 864 mm	775 lb 352 kg
8"	31" 787 mm	400 lb 182 kg	31" 787 mm	450 lb 205 kg	31" 787 mm	525 lb 239 kg	34" 864 mm	600 lb 273 kg	38" 965 mm	800 lb 364 kg
10"	35" 889 mm	425 lb 193 kg	35" 889 mm	500 lb 227 kg	35" 889 mm	650 lb 295 kg	38" 965 mm	800 lb 364 kg	44" 1118 mm	1200 lb 545 kg
12"	37" 940 mm	550 lb 250 kg	37" 940 mm	650 lb 295 kg	37" 940 mm	800 lb 364 kg	41" 1041 mm	1000 lb 455 kg	48" 1219 mm	1750 lb 795 kg
16"	40" 1016 mm	800 lb 364 kg	40" 1016 mm	1000 lb 455 kg	40" 1016 mm	1250 lb 568 kg	44" 1118 mm	1500 lb 682 kg	52" 1321 mm	3100 lb 1409 kg
20"	46" 1168 mm	1150 lb 523 kg	46" 1168 mm	1550 lb 705 kg	46" 1168 mm	1900 lb 864 kg	51" 1295 mm	2400 lb 1091 kg	60" 1524 mm	5000 lb 2273 kg
24"	53" 1346 mm	1800 lb 818 kg	53" 1346 mm	2400 lb 1091 kg	53" 1346 mm	2850 lb 1295 kg	61" 1549 mm	4250 lb 1932 kg	71" 1803 mm	8000 lb 3636 kg

Notes: *Dimensions – inches to the nearest tenth and millimeters to the nearest whole mm, each independently dimensioned from respective engineering drawings. For larger sizes please consult the factory.*

Catalog Code

The following guide defines the correct ultrasonic flowmeter for a given application and the respective catalog code. This code is part of the ordering information and should be included on the purchase order.

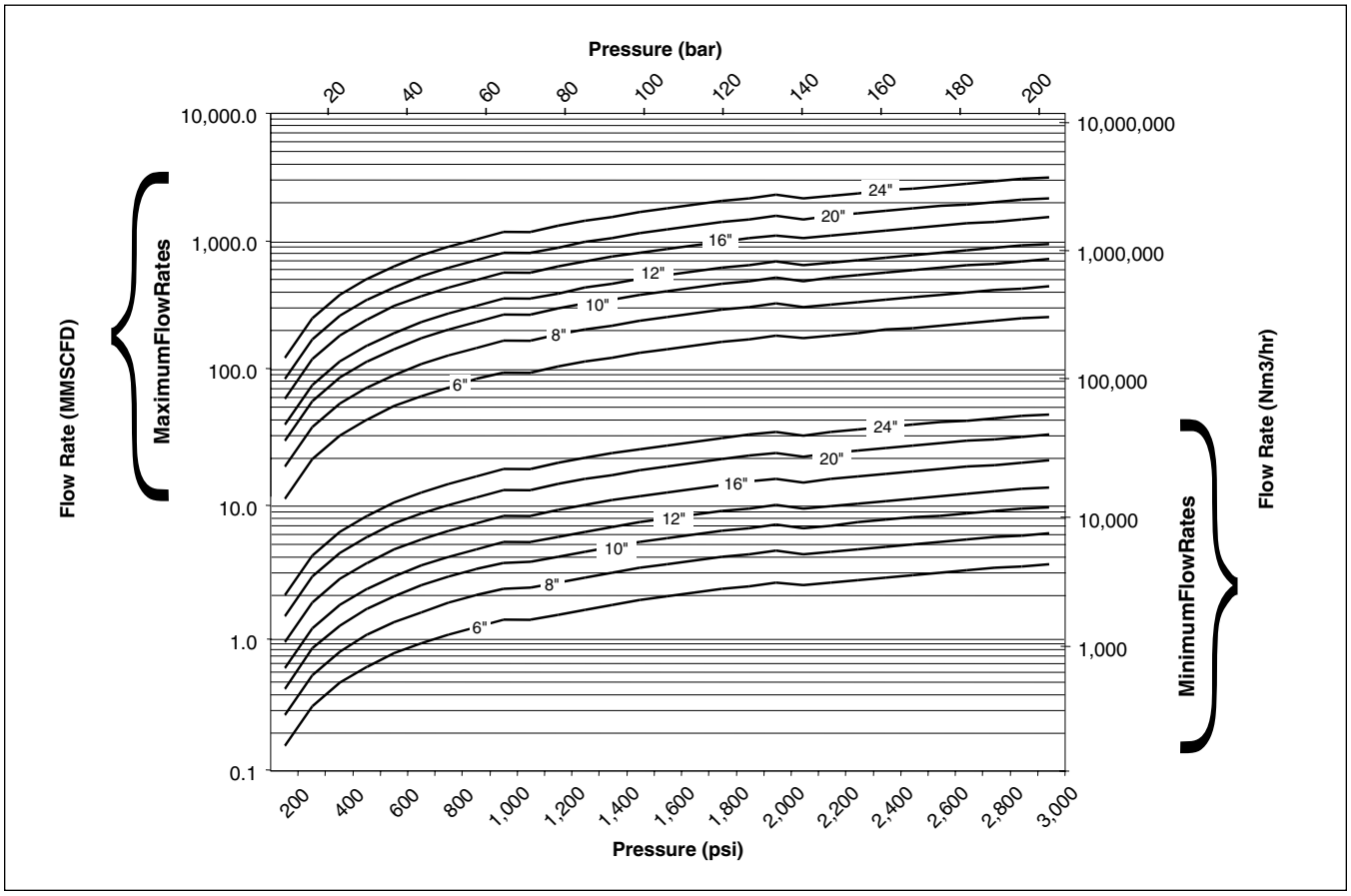
MPU	1	2	3	4	5	6	7	8	9	10	11	12	13	Description
Model	1	2												1200 [6]
	0	8												800 [1,2]
	0	6												600 [1,2]
	0	2												200 [1,2]
Certification			U											US Model – Explosion Proof Certification
			A											European Model – ATEX Certification
Diameter														Diameter in Inches (eg. 06 = 6", 12 = 12")
Flanges						1								150
						2								300
						3								400
						4								600
						5								900
						6								1500
						7								2500
Transducer							S							Standard
							R							Retractable Under Pressure
Optional Interfaces									0					Not Required
									F					Fiber Optic Ethernet (100Base-FL)
Local Display [3]										0				Not Required
										D				With Local Display
Analog Input [4]											0			Not Required
											1			1 Analog Input (4-20 mA)
											2			2 Analog Inputs (4-20 mA)
											3			1 Analog Input (1-5VDC)
											4			2 Analog Inputs (1-5VDC)
Analog Output [4]												0		Not Required
												1		1 Analog Output (4-20 mA)
												2		2 Analog Outputs (4-20 mA)
												3		1 Analog Output (1-5VDC)
												4		2 Analog Outputs (1-5VDC)
Additional Communication Board [5]													0	Not Required
													C	With Additional Communication Board

Standard configuration:

Instrument Input Power:	24 VDC or 120/240VAC
2 digital inputs	High-speed, optically isolated
2 digital outputs	Optically-isolated solid-state output
4 Pulse outputs	Optically-isolated solid-state output (0 - 5kHz), user-programmable pulse units, pulse rates and pulse width/duty cycle, single or dual quadrature.
Ethernet:	Twisted pair (10Base-T / 100Base-T)
Serial:	Two programmable ports, selected from: RS-485, RS-232

1 Not available with NMi approval (pending)
2 Not available with PTB approval (pending)
3 Required with PTB and NMi approval
4 Maximum no. of analog I/O ports: 2
5 Not commercially available yet
6 Not available in 4"

Sizing and Minimum/Maximum Flow Rate Chart [7]



7 These are typical minimum and maximum flow rates to estimate sizing of the meters for application conditions. For specific applications, data must be submitted to FMC Measurement Solutions for calculations and analysis.
Schedule 40 pipe is used for pressures up to 900 psi; Schedule 80 pipe is used for pressures ranging from 1,000 to 1,900 psi; Schedule 120 pipe is used for pressures of 2,000 psi and above; Temperature used in these calculations is 15°C / 59°F

Revisions included in SSKS002 Issue/Rev. 0.5 (10/11):
Page 3: Installation section revised.

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