Ultrasonic Gas Flowmeter

MPU 200 Series B

Specifications

Issue/Rev. 0.4 (10/11)

Bulletin SSKS004

***The MPU 200 Series B Ultrasonic Gas Flow Meter** is a single path ultrasonic meter with non-intrusive and flush mounted transducers providing undisturbed and accurate measurement of gas flow in numerous applications. The MPU 200 is an excellent choice as a backup meter to more accurate instruments, as check meters or in applications where reliability is of highest priority.*

Features

- **Optimum Path Placement** – Single path meters naturally have higher uncertainties than multi-path meters due to the influence of different flow profiles and Reynolds number. The MPU 200 however has a unique lateral position of the path which minimizes the effect of changing Reynolds number on the accuracy of the meter.
- **Wet Gas and Contaminants** – In addition to the minimum influence of Reynolds number, the path placement on the MPU 200 also makes it ideal for applications containing wet gas or other types of contaminants in the gas. The path is straight to avoid any difficulties often experienced with reflective designs in "dirty" applications. It is located above the center of the pipe to avoid any issues if liquids etc., gather in the bottom the pipe, and the design around the transducer port is optimized for self drainage.
- **Digital Ultrasonic Signal Processing** – The MPU 200 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.
- **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 200 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.

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

- **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.

Principle of Operation

The MPU 200 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 200 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 200 transducers are non-intrusive and flush mounted ensuring minimum risk for clogging up 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 and wet high pressure gas applications.

Operating Specifications

Flow Range

Size	Meter/Second	Feet/Second
4-30 in.	0.4-30 and higher	1.3-98 and higher

Operating Pressure Range

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

Nominal Accuracy

+/-1,5 - 2,5% depending on the application

Temperature

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

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 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 Flow Meters 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

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

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.

Note: **Power-down normally open*

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)
4"	24.4" 620 mm	322 lb 146 kg	24.4" 620 mm	342 lb 155 kg	24.4" 620 mm	375 lb 170 kg	24.4" 620 mm	392 lb 178 kg	25.7" 652 mm	437 lb 198 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 or other flange types/classes please consult the factory.*

Catalog Code

The following guide defines the correct ultrasonic flow meter 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"

Revisions included in SSKS004 Issue/Rev. 0.4 (10/11):
Page 3: Installation section revised.

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