MPU™ 600c

Bulletin SSKS007 Issue/Rev. 0.1 (8/17)

Three Path Gas Ultrasonic Flowmeter

The **MPU™ 600c Ultrasonic Gas Flowmeter** combines a cost effective design and high accuracy measurement for a variety of gas flow applications. With all new features and the enhanced performance of the Series C electronics, the MPU 600c provides the optimum solution for high accuracy gas system applications.

Principle of Operation

The MPU 600c calculates flow rate by measuring the acoustic transit time of ultrasonic signals traveling back and forth across the flow. The signal transmission and detection is achieved using two piezoelectric transducers located on each side of the measurement path.

The high speed electronics measure the transit time in both the upstream and downstream direction. This information is used to accurately calculate the flowing velocity and volumetric flow rate of gas through the meter.

FEATURES

- **Low Maintenance –** No moving parts that need replacement due to wear, providing stable measurement over the life of the meter. Non-intrusive parts help avoid product build up on equipment.
- **Advanced Electronics –** The new MPU 600c includes the cutting edge speed, accuracy and diagnostic capabilities of the Series C electronics.
- **In-line Transducer Replacement –** The transducers can easily and safely be removed under pressure using a transducer retraction tool with isolation valves eliminating the need for process shut down or re-calibration due to servicing.
- **Advanced Noise Immunity –** The digital signal filtering and processing increases noise immunity allowing for accurate measurement in difficult, high noise installations.
- **On Board Memory for Diagnostic Analysis –** On board memory stores 14 days of continuous process data making a detailed diagnostic analysis of process conditions and meter operation possible following any process upset or alarm condition.
- **Integrated or Remote Color Touch Screen Display –** The optional color touch screen display can be attached as the front panel of the meter electronics or remotely mounted using the optional wall mounted display. The color touch screen display assembly is explosion-proof and communicates via Ethernet with the meter electronics.
- **Web-based Interface –** Meter can directly interface with a web browser to serve as the operator interface display, eliminating the need for specialized software interfacing and improving accessibility and ease of use.

Operating Specifications								
Size	Velocity, m/sec		Velocity, ft/sec		Flow Rate, Am^3/h[1]		Flow Rate, AMCFD[1]	
	Min	Max	Min	Max	Min	Max	Min	Max
4"	0.40	30.0	1.31	98.4	11.8	887	10.0	752
6"	0.40	30.0	1.31	98.4	26.8	2,013	22.7	1,706
8"	0.40	30.0	1.31	98.4	46.5	3,486	39.4	2,954
10"	0.40	30.0	1.31	98.4	73.3	5,494	62.1	4,657
12"	0.40	30.0	1.31	98.4	105	7,880	89.1	6,679
16"	0.40	30.0	1.31	98.4	170	12,727	144	10,787
20"	0.30	26.0	0.98	85.3	203	17,575	172	14,895
24"	0.30	26.0	0.98	85.3	296	25,637	251	21,729
30"	0.30	26.0	0.98	85.3	468	40,577	397	34,391
36"	0.20	20.0	0.66	65.6	453	45,332	384	38,421
48"	0.20	20.0	0.66	65.6	814	81,449	690	69,033
60"	0.20	20.0	0.66	65.6	1,281	128,074	1,085	108,549

Flow rates calculated for schedule STD pipe, other schedules will vary. Consult factory for additional pipe sizes and schedules. Consult factory for flow velocities outside of the normal min and maximum values.

Operating Pressure Range
1-275 bar_a / 15 to 3,990 psi_a
Please consult factory for pressures up to 350 bar.

MAXIMUM WORKING PRESSURE - PSI (bar)		
ASME	Carbon Steel	Stainless Steel
150	285 (20)	275 (19)
300	740 (51)	720 (50)
600	1,480 (102)	1,440 (99)
900	2,220 (153)	2,160 (149)
1500	3,990 (275)	3,990 (275)

Nominal Accuracy
Without flow calibration: ≤ ±0.7% of measured value
With flow calibration: ≤ ±0.3% of measured value
Repeatability: ≤ ±0.1% of measured value

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:	-40°C to 60°C / -40°F to 140°F

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

NACE Compliant
Designed for NACE MR0175 compliance

Meter Body and Flanges Material
Carbon Steel: A350 LF2 Stainless Steel: A182 F316
For other options consult factory

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

1 Flow rates correspond to conditions of actual temperature and pressure (AVF). For ranges in units of standard volumetric flow (SVF) use the following:

$$SVF = AVF\left(\frac{P_{actual}}{P_{standard}}\right)\left(\frac{T_{standard}}{T_{actual}}\right)$$

Instrument Power

DC Instrument Input Power to Field Mounted Electronics

24 Vdc, +20% / -15%, 0.5A without integrated display
0.7A with integrated display
Power inrush: 10 Amps for < 20mS at 24 Vdc. The DC power input circuitry is reverse current protected and fused.
Tested to 20 milliseconds power dropout, 100 milliseconds power brownout without shut down. Meter will always restart orderly after power loss.

Electrical Inputs

Digital Inputs

Quantity: 2
Function: Input 1 – Consult Factory
Input 2 – Dedicated to external Weights & Measures switch input
Type: Optically isolated, internally current limited digital input
Input voltage range (V-high): 5 to 28 VDC
Maximum input frequency: 10KHz
V (high): 5.5 VDC minimum to 28 VDC maximum*
V (low): 1 VDC maximum*
Current at maximum voltage: 20mA maximum
Input impedance: 1.67 kΩ

***Note:** The input pulse must rise above V (high-minimum) for a period of time then fall below V (low) to be recognized as a pulse.

Analog Input (4-20mA)

Quantity: 2
Type: Two-wire, 4-20mA current loop receiver, common neutral isolated from system ground, programmable as to function
Span adjustment: 3.8mA to 22mA span, User-programmable inside these limits
Input burden: 50Ω
Resolution: 24-bit
Voltage drop: 2 Volts maximum
Recommended cable: Belden 8729, 9940 or equivalent

Analog Input (Temperature Probe – RTD)

Quantity: 1
Type: Four-wire, 100Ω Platinum Resistance Temperature Detector (PRTD)
Temperature coefficient: @ 0°C: 0.00385Ω/Ω/°C
Temperature range: -60°C to 180°C
Offset: Temperature probe offset is user-programmable
Self calibrating: Lead length compensation that requires no resistance balancing of leads

Electrical Outputs Communications

Ethernet

IEEE 802.3 Ethernet operating at 10/100 Mbps.
Modbus TCP/IP at port 502

10/100Base-TX (Ethernet over twisted pair)

Maximum of 2 ports (1 if fiber optic option is enabled via jumpers. 0 if integrated display is fitted and fiber optic is enabled)
Auto-MDIX – Will work with straight or crossover cable automatically
RJ-45 connector per port
Maximum distance between Ethernet devices: 100m (328ft)
Recommended cable: Category 5 or better

100Base-FX (Ethernet over fiber optic)

1300nm wavelength MT-RJ connector
Maximum Distance between Ethernet devices: 2km (6,561ft)*
Recommended cable: 1-pair 62.5/125 µm multimode glass
Transmitter output minimum optical power: -20dBv avg
Receiver input minimum optical power: -31dBm avg
Optical Power Budget (OPB) at 0.5km with recommended cable: 9dB
Optical Power Budget (OPB) at 2km with recommended cable: 6dB

***Note:** Optical losses in cables, connectors, and couplers can reduce this maximum limit.

Serial

EIA-485 Port: 2 wire
120Ω endpoint termination resister included in circuit, user selectable via jumper
Configuration: Multi-drop network
Line Protocol: Half duplex
Data Rate: Selectable asynchronous data (Baud) rates of 1200, 2400, 4800, 9600,19200, 38400, 57600 or 115200 bps.
Word Length: 7 or 8 bits
Parity: None, odd, or even
Protocol: MODBUS (RTU) or Modbus ASCII
Recommended cable: Belden 3106A, 9841, or equivalent low capacitance cable

HART

The optional HART interface operates over the 4-20 mA analog output and supports the following commands.

All Universal Commands:

- Read up to four dynamic variables
- Read and write TAG name
- Read range values and sensor limits
- Read and write user messages and date

Common Practice Commands required for:

- Selection of engineering units
- Burst mode control

Digital/Pulse Outputs

Quantity: 2
Volume output with programmable K-factor.
Configuration Selections:

1). Quadrature (I, Q)
2). Pulse (forward, reverse)
3). Pulse (pulse, direction)
4). Pulse (pulse, direction inverted)

Type: Current limited active output or open collector – jumper selectable
Switch blocking voltage (switch off): 30 Vdc maximum
Frequency Range: 0 to 10kHz nominal, overrange up to 15kHz
Minimum Pulse Width: > 66µs (50% duty cycle nominal)
24 VDC Input Power Supply: No Load: 23 ±0.3 Vp-p square wave
270Ω Load: 12 ±0.3 Vp-p square wave (minimum)
12 VDC external power supply for pulse output circuitry: No Load: 11 ±0.3 Vp-p square wave
270Ω Load: 6 ±0.3 Vp-p square wave (minimum)
Current: Maximum Sink Current: 300mA @ 29 Vdc
Maximum Source Current: 80mA @ 29 Vdc

Recommended cable: Belden 9402. Up to 2000 ft use 20AWG, up to 3000 ft use 18AWG. Shielded cable is recommended with the shield connected only at the receiving instrument. If using dual (quadrature) pulse output the two conductors carrying the outputs must not be in the same pair and ideally individually shielded.

Analog Output (4-20mA)

Quantity: 1
Type: Two-wire, loop powered, isolated from ground, user programmable as to function
Span adjustment: 3.8mA to 21mA User adjustable
Alarm output: 22.5mA
Resolution: 16-bit
Compliance voltage range: 6 VDC to 28 VDC
Maximum load resistance @ 10 VDC: 250
Recommended cable: Belden 8729, 9940 or equivalent

Alarm Output

Quantity: 1
Type: Optically-isolated solid state output
Polarity: Open during alarm and power off
Switch blocking voltage: 30 VDC maximum
Load current: 125mA maximum with 0.6 volt drop

Safety Classifications

Model (Ultrasonic Transducer

Explosion / Flame Proof certifications: UL, CUL, ATEX, IEC Ex

ATEX (European Community)
PTB 07 ATEX 1018
Ex d IIC T4/T5

Type US-A -40°C to +80°C

Type US-B -55°C to +100°C

IP 66

Note: *Transducer US-A and US-B are included in the IEC Ex (Global Approach) and are listed by UL for North America, see Model UTS*

Model UTS (Ultrasonic Transducer System)

ATEX (European Community)
DEMKO 09 ATEX 0907098X

Ex d IIB T4/T5 Gb

UTS-GA -40°C to +80°C

UTS-GB -55°C to +100°C

IP 66

IEC Ex (Global Approach)
IEC Ex UL 09.0023X
Ex d IIB T4/T5 Gb

UTS-GA -40°C to +80°C

UTS-GB -55°C to +100°C

IP 66

UL/CUL (North American)
UL File E23545
Class I, Division 1, Groups C & D
Class I, Zone 1, Groups IIB

Type 4X

UTS-GA -40°C to +80°C

UTS-GB -55°C to +100°C

Electronics Enclosure: Ultrasonic Meter Control (UMC)
Explosion / Flame Proof Certification UL, C-UL, ATEX, IEC-Ex

ATEX (European Community)
DEMKO 13 ATEX 1204991X
Ex d ia op is IIB T5 Gb (Um=250v) IP66 Tamb = -40°C to 60°C (Display Version)

Ex d op is IIB T5 Gb IP66 Tamb = -40°C to 60°C (Non Display Version)

IEC Ex (Global Approach)
IEC Ex UL 13.0019X
Ex d ia op is IIB T5 Gb (Um=250v) IP66 Tamb = -40°C to 60°C (Display Version)

Ex d op is IIB T5 Gb IP66 Tamb = -40°C to 60°C (Non Display Version)

UL/CUL (North American)
UL File E23545
Class I, Division 1, Groups C & D Class I, Zone 1, Groups IIB T5, IP66 Enclosure
Tamb = -40°C to 55°C (Display Version)
Tamb = -40°C to 60°C (Non Display Version)

Remote Mounted Display: Touch Screen Control Interface (TCI)

Explosion / Flame Proof Certification UL, C-UL, ATEX, IEC Ex

ATEX (European Community)
DEMKO 13 ATEX 1204991X

Ex d ia op is IIB T5 Gb (Um=250v) IP66 Tamb = -40°C to 60°C (Display Version)

IEC Ex (Global Approach)
IEC Ex UL 13.0019X

Ex d ia op is IIB T5 Gb (Um=250v) IP66 Tamb = -40°C to 60°C (Display Version)

UL/CUL (North American)
UL File E23545
Class I, Division 1, Groups C & D Class I, Zone 1, Groups IIB T5, IP66 Enclosure
Tamb = -40°C to 55°C (Display Version)

Pressure Safety Information

ASME
Designed to ASME B31.3 / ASME Section VIII Div. 1

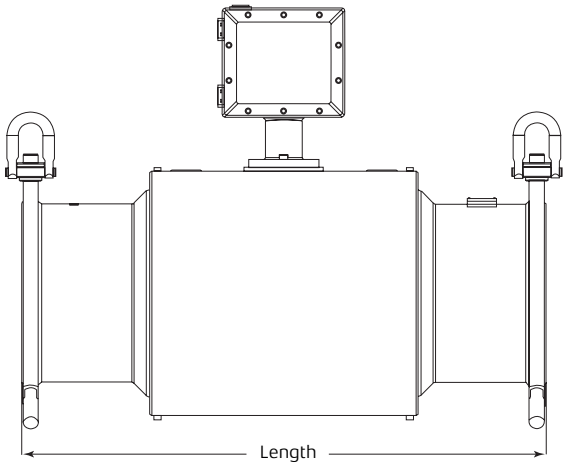
CRN
CRN certificates available, consult factory

PED
EC Conformity Certificate available, consult factory

Dimensions and Weights

Inches (mm) and Pounds (kg)

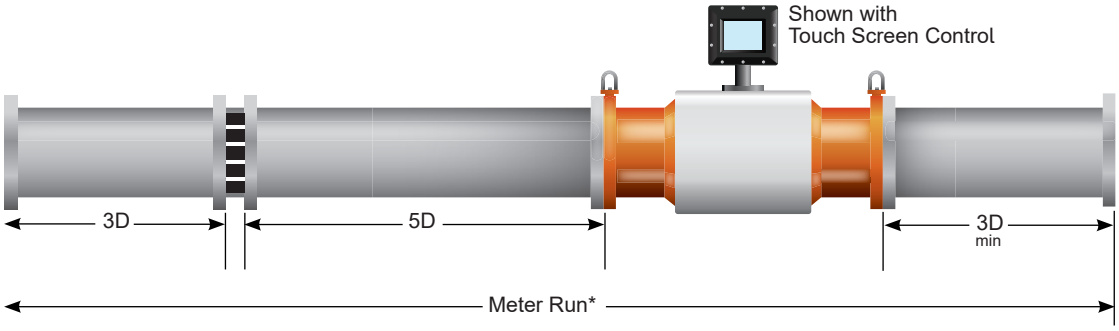
Dimensions – inches to the nearest tenth (millimetres to the nearest whole mm), each independently dimensioned from respective engineering drawings. For larger sizes or other flange types/classes please consult factory.



Size	ASME CLASS 150		ASME CLASS 300		ASME CLASS 600		ASME CLASS 900		ASME CLASS 1500	
	Length (mm/in)	Weight (lb/kg)	Length (mm/in)	Weight (lb/kg)	Length (mm/in)	Weight (lb/kg)	Length (mm/in)	Weight (lb/kg)	Length (mm/in)	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

Recommended Installation

The recommended installation for the MPU 600c is 3D, then the flow conditioner, then 5D upstream straight pipe before the meter. Downstream of the meter is 3D. For bi-directional measurement the same 3D+FC+5D is on both sides of the meter. The meter run must be the same pipe diameter as the meter inlet and concentrically centered so that neither the pipe edge nor gasket protrude into the fluid flow. For correct centering it is recommended to use the centering dowel pin provided on the meter flange.



* Diagram not drawn to scale.

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.

Standard Configuration

Instrument Power: 24 VDC
2 Analog Inputs: 4-20mA
1 Analog Input: 4-wire RTD
1 Analog Output: 4-20mA
1 Digital Output: Dedicated to alarm – Optically isolated solid-state output
2 Digital Inputs: 1 dedicated to Weights & Measures switch
2 Pulse Outputs: Solid-state output (0 - 10 kHz) user-programmable K-factor, Quadrature
2 Ethernet: 2 Twisted pair (10Base-T/100Base-T)
1 Serial: 2 Wire EIA-485

Ultrasonic Meter Body									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
MPU6	S	0	6	1	1	S	S	B	C

Position 1: Code

MPU6 – MPU 600c

Position 2: Certification

S – Standard: UL/CUL; ATEX; IEC Ex

Positions 3 and 4: Diameter[2]

06"
08"
10"
12"
Etc.

Position 5: End Connections

1 - Class 150 ASME Flange
2 - Class 300 ASME Flange
3 - Class 400 ASME Flange
4 - Class 600 ASME Flange
5 - Class 900 ASME Flange
6 - Class 1500 ASME Flange
7 - Class 2500 ASME Flange

Position 6: Body Housing Materials

1 - Carbon Steel
2 - 300 Series Stainless Steel
X - Special

Position 7: Transducer[3]

S - Standard Titanium
X - Retractable under pressure

Position 8: Transducer Type

S - Standard Transducer
L - Special

Position 9: Mechanical Certification

B - ASME B31.3
P - PED
C - CRN
X - Special

Position 10: Ethernet Connection

C - 2 Twisted Pair
F - 1 Twisted Pair and 1 Optical

2 For other sizes or custom ID, consult factory.
3 "Special" transducer requirement for any application not compatible with Buna-N Elastomers or where other transducer materials are required.

Meter Mounted Electronics Enclosure: Ultrasonic Meter Control (UMC)								
	1	2	3	4	5	6	7	8
UMC	E	A	P	N	S	0	B	0

Position 1: Hazardous Location Certification

E – Explosion Proof Certification UL, CUL, ATEX, IEC-Ex

Position 2: Housing Material

A – Aluminum
S – 300 Series Stainless Steel

Position 3: Housing Style

P – Pedestal Mount
H – Pedestal Mount w/Height Extension (High Temperature Product Applications)
E – Pedestal Mount with Exe Junction Box
C – Custom Enclosure

Position 4: Housing Electrical Entrances

M – M20 Thread
N – ½" NPT Thread

Position 5: Software

S – Standard UMC Software
X – Special

Position 6:

0 – Reserved

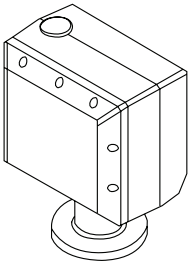
Position 7: Housing Cover

B – Blind Cover
T – 5.7" Touch Screen* (Position 3 option P or H only)**

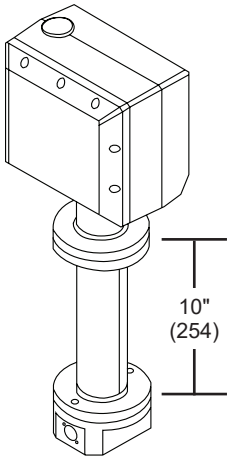
Position 8: Additional Communication Options

0 – None
1 – HART

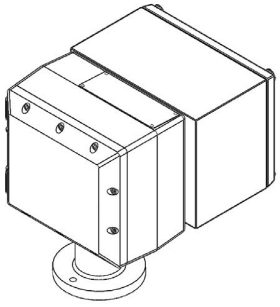
Model	Options and Option Combinations	Maximum Power (Based on Estimates)
UMC - E - (A or S) - (P or H) - (M or N) - S - 0 - T - (0 or 1)	UMCB board assembly (with display)	14.2W
UMC - E - (A or S) - (P or H) - (M or N) - S - 0 - B - (0 or 1)	UMCB board assembly (without display)	6W



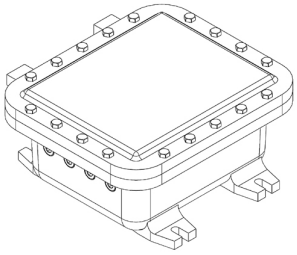
Pedestal Mount



Pedestal Mount with Height Extension



Pedestal Mount with Exe Junction Box



ATEX Zone 1 only

** Required for MID (Welmec 7.2) if remote mounted display or microFlow.net is not selected.*
***Touch screen display only available with pedestal Mount or Pedestal Mount with Height Extension.*

Remote Mounted Display: 5.7" Touch Screen Control Interface (TCI)					
	1	2	3	4	5
TCI	E	A	S	N	S

Position 1: Hazardous Location Certification

E – Explosion Proof Certification UL, C-UL, ATEX, IEC-Ex Class 1, Div 1, Gr C&D; Exd IIB Zone 1

Position 2: Housing Material

A – Aluminum
S – 300 Series Stainless Steel

Position 3: Housing Style

S – Surface Mount

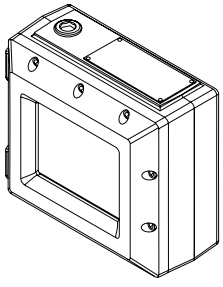
Position 4: Housing Entrances

M – M20 Thread
N – ½" NPT Thread

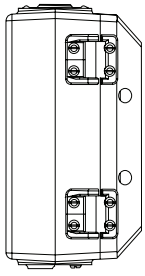
Position 5: Software

S – Standard
X – Special

Model	Options and Option Combinations	Maximum Power (based on estimates)
TCI - E - (A or S) - S - (M or N) - S	Display board assembly	8W



Housing With Display
Surface Mount



Housing With Display
Side View

Revisions included in SSKS007 Issue/Rev. 0.1 (8/17):
Page 5: Safety Classifications updated.

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

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