

# MPU 800c

Specification SSKS008 Issue/Rev. 0.3 (1/25)



## Gas Ultrasonic Flowmeter

The MPU 800c ultrasonic gas flowmeter combines accuracy and advanced technology using four measurement paths to meet international standards for custody-transfer gas-flow measurement. Designed with new features and enhanced performance from the Series C electronics, the MPU 800c provides the optimum price and performance solution for custody-transfer accuracy of gas measurement applications.

## Principle of Operation

The MPU 800c calculates flow rates by measuring the acoustic transit time of ultrasonic signals traveling back and forth across the flow. The signal transmission and detection is achieved using piezoelectric transducers, in pairs, with one located on each side of the measurement tube. The high-speed electronics measure transit time in both the upstream and downstream directions. This information is used to accurately calculate the flowing velocity and volumetric flow rate of gas through the meter.

## Features

- Touchscreen display—An optional touchscreen display can be attached as the front panel of the meter electronics or remotely mounted using the an optional wall-mounted display.
- 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 shutdown or recalibration due to servicing.
- Low maintenance—The meter does not have any moving parts that need replacement due to wear, providing stable measurement over the life of the meter. Non-intrusive parts help avoid product buildup on equipment.
- Compliance to international standards—The MPU 800c has been field tested and verified to multiple performance specifications and standards for an international market.
- Advanced electronics—The MPU 800c includes the cutting-edge speed, accuracy, and diagnostic capabilities of Smith Meter Series C electronics.
- Advanced noise immunity—The digital-signal filtering and processing of this unit increases noise immunity, enabling accurate measurement in difficult, high-noise installations.
- Onboard memory for diagnostic analysis—Enough storage for a nominal 28 days of process data. A detailed diagnostic analysis of process conditions and meter operation is possible following any process upset or alarm condition.

### Operating Specifications

Size	Velocity (meters/second)	Velocity (feet/second)	Flow Rate (actual cubic meters per hour (am <sup>3</sup> /h))	Flow Rate (AMCFD)
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### Operating Specifications

	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
4"	0.40	30.0	1.31	98.4	11.8	887	10	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	30.0	0.98	98.4	203	20,279	172	17,187
24"	0.30	30.0	0.98	98.4	296	29,582	251	25,072
30"	0.30	30.0	0.98	98.4	468	46,820	397	39,682
36"	0.20	25.0	0.66	82.0	453	56,665	384	48,026
48"	0.20	25.0	0.66	82.0	814	101,812	690	86,291
60"	0.20	25.0	0.66	82.0	1,281	160,092	1,085	135,687

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

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

where:

- SVF = standard volumetric flow
- AVF = actual volumetric flow
- Pactual = actual pressure
- Pstandard = standard pressure
- Tstandard = standard temperature
- Tactual = actual temperature

**NOTE:** Flow rates calculated for schedule STD pipe; other schedules will vary. Consult the factory for additional pipe sizes and schedules, as well as flow velocities outside of the normal minimum and maximum values.

## Operating Pressure Range

The operation pressure range is 1-to275 bar absolute (bara/15 to 3,990 pounds per square inch absolute (psia). Consult the factory for pressures up to 350 bar.

Maximum Working Pressure		
ASME Flange Class	Carbon Steel	Stainless Steel
150	285 psi (20 bar)	275 psi (19 bar)
300	740 psi (51 bar)	720 psi (50 bar)
600	1,480 psi (102 bar)	1,440 psi (99 bar)
900	2,220 psi (153 bar)	2,160 psi (149 bar)
1500	3,990 psi (275 bar)	3,600 psi (248 bar)

## Nominal Accuracy

For 10-diameter (D) upstream straight run and no flow conditioning:

- Without flow calibration:  $\leq \pm 0.5\%$  of measured value
- With flow calibration:  $\leq \pm 0.1\%$  of measured value

## Repeatability

- Repeatability:  $\leq \pm 0.1\%$  of measured value

## Weights and Measures Approvals and Compliance

Measurement Canada Notice of Approval AG-0639

Software according to WELMEC 7.2

International Organization of Legal Metrology (OIML) R137-1

American Gas Association (AGA) Report No. 9

ISO 17089-1

EU MID—Consult the factory

## Temperature

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

Operating ambient temperature: -13 to 140 °F (-25 to 60 °C)

Storage temperature: -40 to 140 °F (-40 to 60 °C)

## Standard Flange Connections

Typically, this flowmeter uses American National Standards Institute (ANSI) B16.5 raised face (RF) or ring-type joint (RTJ) face flanges. Other flange type connections are available on request.

## NACE Compliant

This flowmeter is designed for National Association of Corrosion Engineers (NACE) International standard MR0175 compliance.

## Meter Body and Flanges Materials of Construction

Carbon steel: A350 LF2

Stainless steel: A182 F316

For other options, consult the factory.

## Transducer Materials of Construction

This meter has a piezoelectric element that is fully encapsulated in a titanium housing. For hydrogen sulfide (H<sub>2</sub>S), hexanes, and heavier (C6+) applications, we offer special solutions such as special transducers.

## Instrument Power

This flowmeter uses direct current (DC) instrument input power to field-mounted electronics with 24 volts direct current (VDC), +20% to -15%, 0.5 ampere (amp) without an integrated display or 0.7 amp with an integrated display.

The power inrush is 10 amps for less than 20 milliseconds (ms) at 24 VDC. The DC power input circuitry is reverse-current protected and fused.

The unit is tested to 20 ms power dropout and 100 ms power brownout without shutdown. The meter restarts after power loss.

## Electrical Inputs

### Digital Inputs

**Quantity:** Two

**Function:**

- Input 1—Consult the factory
- Input 2—Dedicated to external weights and measures switch input

**Type:** Optically isolated, internally current limited digital input

**Input voltage range (volt (V)-high):** 5 to 28 VDC

**Maximum input frequency:** 10 kilohertz (kHz)

**V (high):** 5.5 VDC minimum to 28 VDC maximum

**V (low):** 1 VDC maximum

**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.

**Current at maximum voltage:** 20 milliamperes (mA)

**Maximum input impedance:** 1.67 kilohms

### Analog Input (4-20 mA)

**Quantity:** Two

**Type:** Two-wire, 4-20 mA current loop receiver, common neutral isolated from system ground, configurable as to function

**Span adjustment:** 3.8 to 22 mA span, user-configurable inside these limits

**Input burden:** 50 ohms

**Resolution:** 24 bits

**Voltage drop:** 2 V maximum

**Recommended cable:** Belden 8729, 9940, or equivalent

### Analog Input (Temperature Probe—Resistance Temperature Detector (RTD))

**Quantity:** One

**Type:** Four-wire, 100-ohm platinum-resistance temperature detector (PRTD)

**Temperature coefficient:** 0.00385 ohm/ohm/°C at 0 °C

**Temperature range:** -60 to 180 °C

**Offset:** Temperature probe offset is user configurable

**Self calibrating:** Lead-length compensation does not require resistance balancing of leads

## Electrical Output Communications

### Ethernet

- Institute of Electrical and Electronics Engineers (IEEE) 802.3 Ethernet operating at 10/100 megabits per second (Mbps)
- Modbus transmission control protocol/internet protocol (TCP/IP) at port 502

### 10/100Base-TX (Ethernet Over Twisted Pair)

- Maximum of two ports (one when fiber-optic option is enabled via jumpers; zero when integrated display is fitted and fiber optic is enabled)
- Automatic medium dependent interface crossover (MDI-X) interface works automatically with straight or crossover cable automatically
- RJ-45 connector per port
- Maximum distance between Ethernet devices is 100 meters (m) (328 feet (ft))
- Recommended cable is Category 5 or better

### 100Base-FX (Ethernet Over Fiber-Optic Cable)

- 1300-nanometer (nm) wavelength mechanical transfer registered jack (MT-RJ) connector
- Maximum distance between Ethernet devices: 2 kilometers (km) (6,561 ft)

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

- Recommended cable is 1-pair 62.5/125 micrometer (µm) multimode glass
- Transmitter output minimum optical power is -20 decibel volts (dBV) average
- Receiver input minimum optical power is -31 decibel milliwatts (dBm) average optical power budget (OPB) at 0.5 km with 9 decibel (dB) recommended cable
- OPB at 2 km with 6 dB recommended cable

## Serial Communication

**EIA-485 port:** Two wire

**Termination:** 120-ohm endpoint termination resistor included in circuit, user selectable via jumper

**Configuration:** Multidrop network

**Line protocol:** Half duplex

**Data Rate:** Selectable asynchronous data (Baud) rates of 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 bits per second (bps)

**Word length:** 7 or 8 bits

**Parity:** None, odd, or even

**Protocol:** Modbus remote terminal unit (RTU) or Modbus American Standard Code for Information Interchange (ASCII)

**Recommended cable:** Belden 3106A, 9841, or equivalent low capacitance cable

## HART

The optional Highway Addressable Remote Transducer (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 the tag number that references the customer-specific name of the meter in the field/customer reference
- Read range values and sensor limits
- Read and write user messages and dates

Common practice commands required for:

- Selection of engineering units
- Burst mode control

## Digital/Pulse Outputs

**Quantity:** Two

**Volume output:** Configurable K-factor

**Configuration selections:**

1. Quadrature
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 10 kHz nominal, over range up to 15 kHz

**Minimum pulse width:** > 66 microseconds ( $\mu$ s) (50% duty cycle nominal)

**24 VDC input power supply:** No-load of  $23 \pm 0.3$  volts peak-to-peak (Vpp) square wave

**270 ohm load:**  $12 \pm 0.3$  Vpp square wave (minimum)

**12 VDC external power supply for pulse output circuitry:** No load of  $11 \pm 0.3$  Vpp square wave

**270 ohm load:**  $6 \pm 0.3$  Vpp square wave (minimum)

**Current:** Maximum sink current of 300 mA @ 29 VDC

**Maximum source current:** 80 mA @ 29 VDC

**Recommended cable:** Belden 9402; up to 2,000 ft use 20 American Wire Gauge (AWG), up to 3,000 ft use 18 AWG.

**NOTE:** Shielded cable is recommended with the shield connected only at the receiving instrument. When using dual (quadrature) pulse output, the two conductors carrying the outputs must not be in the same pair and should ideally be individually shielded.

## Analog Output (4-20 mA)

**Quantity:** One

**Type:** Two-wire, loop powered, isolated from ground, user configurable as to function

**Span adjustment:** 3.8 to 21 mA user adjustable

**Alarm output:** 22.5 mA

**Resolution:** 16 bits

**Compliance voltage range:** 6 to 28 VDC

**Maximum load resistance at 10 VDC:** 250

**Recommended cable:** Belden 8729, 9940 or equivalent

## Alarm Output

**Quantity:** One

**Type:** Optically isolated solid-state output

**Polarity:** Open during alarm and power off

**Switch blocking voltage:** 30 VDC maximum

**Load current:** 125 mA maximum with 0.6 V drop

## Safety Classification

Electrical Safety Ex certifications are issued as follows:

### Model (Ultrasonic Transducer)

#### ATEX (European Community)

- PTB 07 ATEX 1018 Ex d IIC T4/T5
- Type US-A -40 to 80 °C Type US-B -55 to 100 °C IP66 enclosure

**NOTE:** Note: Transducer US-A and US-B are included in the IECEx (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 to 80 °C  
UTS-GB -55 to 100 °C IP66 enclosure

#### IECEx (Global Approach)

IECEx UL 09.0023X  
Ex d IIB T4/T5 Gb  
UTS-GA -40 to 80 °C  
UTS-GB -55 to 100 °C IP66 enclosure

#### INMETRO (Brazil) UL-BR 19.00079X (same ratings as IECEx)

#### UL/CUL (North American)

UL File E23545  
Class I, Division 1, Groups C and D; Class I, Zone 1, Groups IIB  
Type 4X  
UTS-GA -40 to 80 °C  
UTS-GB -55 to 100 °C

### Electronics Enclosure: Ultrasonic Meter Control (UMC)

#### ATEX (European Community)

DEMKO 13 ATEX 1204991X  
Ex d ia op is IIB T5 Gb (Um = 250 V) IP66 enclosure

Temperature ambient (Tamb) = -40 to 60 °C (display version)

Tamb = -40 to 60 °C (non-display version)

#### IECEx (Global Approach)

IECEx UL 13.0019X  
Ex d ia op is IIB T5 Gb (Um = 250 V) IP66 enclosure  
Tamb = -40 to 60 °C (display version)  
Ex d op is IIB T5 Gb IP66 enclosure  
Tamb = -40 to 60 °C (non-display version)  
INMETRO (Brazil) UL-BR 19.00087X (same ratings as IECEx)

#### UL/CUL (North American)

UL File E23545  
Class I, Division 1, Groups C and D; Class I, Zone 1, Groups IIB T5, IP66 enclosure  
Tamb = -40 to 55 °C (display version)  
Tamb = -40 to 60 °C (non-display version)

### Remote Mounted Display: Touchscreen Control Interface (TCI)

#### ATEX (European Community)

DEMKO 13 ATEX 1204991X  
Ex d ia op is IIB T5 Gb (Um=250V) IP66 enclosure  
Tamb = -40 to 60 °C (display version)

#### IECEx (Global Approach)

IECEx UL 13.0019X  
Ex d ia op is IIB T5 Gb (Um=250V) IP66 enclosure  
Tamb = -40 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 to 55 °C (display version)

## **Electronic Enclosure: (UMH) Flame-Proof Certifications ATEX and IECEx Only**

### **ATEX (European Community)**

BVS 17 ATEX E 052 X

Ex db op is IIB + H2 T5

Tamb = -50 to 60 °C

### **IECEx (Global Approach)**

IECEx BVS 17.0046X

Ex db op is IIB + H2 T5

Tamb = -50 to 60 °C

## **Pressure Safety Information**

### **American Society of Mechanical Engineers (ASME)**

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

### **Canadian Registration Number (CRN)**

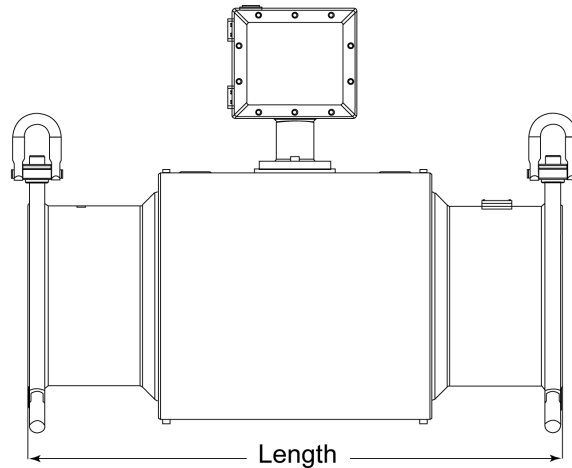
CRN certificates are available; consult the factory.

### **Pressure Equipment Directive (PED)**

EU declaration of conformity certificate is available;  
consult the factory.

## Dimensions and Weight

Dimensions are in inches (") to the nearest tenth (millimeters (mm) to the nearest whole mm). Each drawing is independently dimensioned from respective engineering drawings. Weight is measured in pounds (lb) (kilograms (kg)). For larger sizes or other flange types and classes, consult the factory.



Size	ASME Class 150		ASME Class 300		ASME Class 600		ASME Class 900		ASME Class 1500	
	Length	Weight	Length	Weight	Length	Weight	Length	Weight	Length	Weight
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" (1,118 mm)	1,200 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" (1,041 mm)	1,000 lb (455 kg)	48" (1,219 mm)	1,750 lb (795 kg)
16"	40" (1,016 mm)	800 lb (364 kg)	40" (1,016 mm)	1,000 lb (455 kg)	40" (1,016 mm)	1,250 lb (568 kg)	44" (1,118 mm)	1,500 lb (682 kg)	52" (1,321 mm)	3,100 lb (1,409 kg)
20"	46" (1,168 mm)	1,150 lb (523 kg)	46" (1,168 mm)	1,550 lb (705 kg)	46" (1,168 mm)	1,900 lb (864 kg)	51" (1,295 mm)	2,400 lb (1,091 kg)	60" (1,524 mm)	5,000 lb (2,273 kg)
24"	53" (1,346 mm)	1,800 lb (818 kg)	53" (1,346 mm)	2,400 lb (1,091 kg)	53" (1,346 mm)	2,850 lb (1,295 kg)	61" (1,549 mm)	4,250 lb (1,932 kg)	71" (1,803 mm)	8,000 lb (3,636 kg)

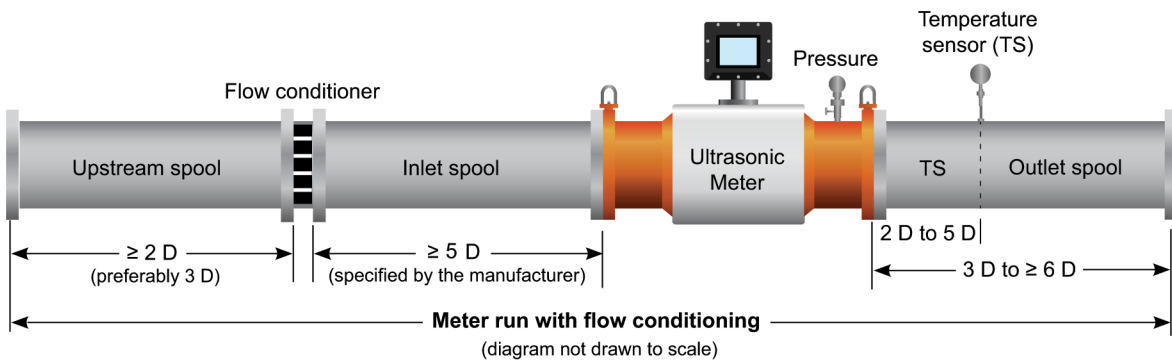
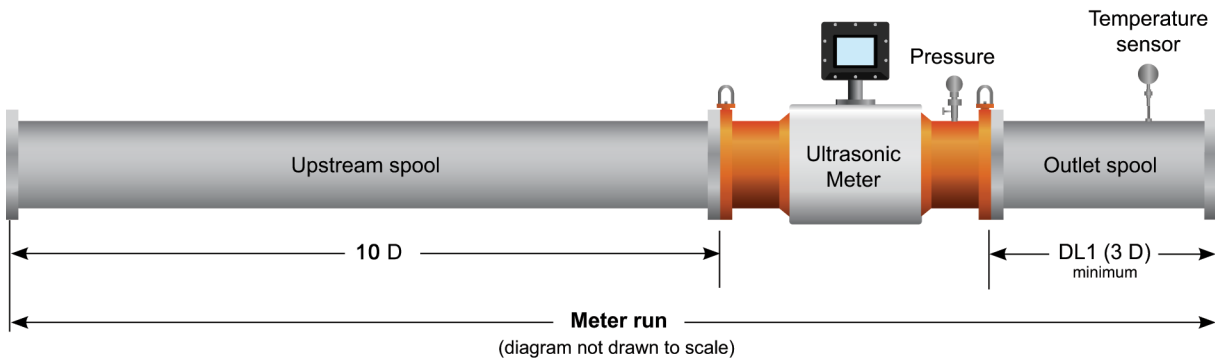


## Recommended Installation

Without flow conditioning, the recommended installation for the MPU 800c is a 10 D upstream straight run. For optimum performance, it is recommended to keep partial restrictions or variable flow diversions, such as control valves, away from the upstream area. Consult the factory for confirmation of suitability of the upstream piping geometry.

With flow conditioning, the recommended installation is 3 D, then the flow conditioner, then 5 D upstream straight pipe before the meter. Downstream of the meter is 3 D. For bi-directional measurement, the same upstream installation is repeated 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 the gasket protrude into the flow stream. For correct centering, it is recommended to use the centering dowel pin provided on the meter flange.



## 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

- 24 VDC instrument power
- Two 4-20 mA analog inputs
- One 4-wire RTD analog input
- One 4-20 mA analog output
- One optically isolated solid-state digital output dedicated to alarms
- Two digital inputs, one dedicated to weights & measures switch
- Two solid-state pulse outputs (0 to 10 kHz), user-configurable K-factor, quadrature
- Two 2-twisted pair Ethernet cables (10Base-T and 100Base-T)
- One optical fiber communication port
- One 2-wire EIA-485 serial cable

Ultrasonic Meter Body									
1	2	3	4	5	6	7	8	9	10
MPU8	S	0	6	1	1	S	S	B	C

#### Position 1: Model

MPU8—MPU 800c

#### Position 2: Transducer Hazardous Location Certifications

S—Standard: UL/CUL; ATEX; IECEx

#### Positions 3 and 4: Diameter

**NOTE:** For other sizes or custom inside diameter (ID), consult the factory.

**NOTE:** For other sizes or a custom ID, consult the factory.

04"

06"

08"

10"

12"

16"

20"

24"

#### 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 (consult the factory)

#### Position 6: Body Housing Materials

1—Carbon steel

2—300-series stainless steel

X—Special

#### Position 7: Transducer Material

**NOTE:** Note: "Special" transducer is required for any application not compatible with Buna-N elastomers or where other transducer materials are required.

S—Standard titanium

X—Special

#### 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

S—Standard

**NOTE:** Two ethernet and one optical

Meter Mounted Electronics Enclosure 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 enclosure

**Position 2: Housing Material**

A--Aluminum

S--300-series stainless steel

**Position 3: Housing Style**

P--Pedestal mount

H--Pedestal mount with height extension (high-temperature product applications)

C--ATEX Zone 1 only

**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" touchscreen control interface (TCI) (Position 3 option P or H only)

**NOTE:** The 5.7" touchscreen is required for MID (Welmec 7.2) if integral-/remote-mounted display or microFlow.net is not selected.

**NOTE:** The touchscreen display is only available with a pedestal mount or pedestal mount with height extension.

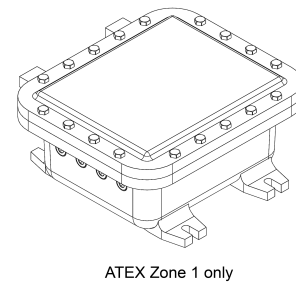
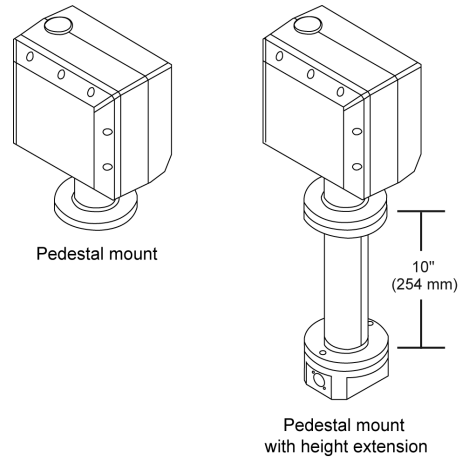
**Position 8: Additional Communication Options**

0--None

1--HART

2--Additional serial comm. port

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)	14.2 watts (W)
UMC - E - (A or S) - (P or H) - (M or N) - S - 0 - B - (0 or 1)	UMCB board assembly (without display)	6 W



Remote-Mounted Display with 5.7" TCI					
	1	2	3	4	5
TCI	E	A	S	N	S

**Position 1: Hazardous Location Certification**

E—Explosion-proof enclosure

**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

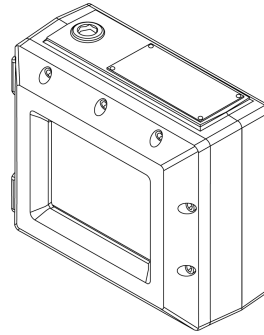
N—½" NPT thread

**Position 5: Software**

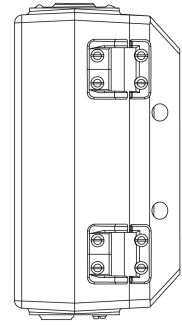
S—Standard

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	8 W



Housing with display surface mount



Housing with display side view

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacture 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.