USM GT400 Ultrasonic Flowmeter

Optimized for Custody Transfer for Gas.

The GT400 ultrasonic flowmeter is a solution for the most demanding gas flow/volume measurement applications. This innovative 6-path meter replaces older, intrusive meter designs and outperforms other traditional ultrasonic multi-path meters in custody transfer applications. It is available in 4-inch to 24-inch line sizes with industry standard ±0.1% uncertainty. The GT400 is supported by Honeywell’s global expertise and unmatched local support capabilities.

Proven Technology. Superior Performance.
**Key Features**

- **Measurement capability**
  - Bidirectional measurement without pressure drop
  - Turn-down ratio > 120:1 at line conditions
  - Gas velocity up to 130 ft/s (40 m/s) for all sizes (fiscal metering)
  - Low-to-high pressure operation
  - Onboard AGA10 SoS calculation with direct GC input
- **Insensitive to regulator noise**
  - Proprietary, MID-approved firmware
  - Advanced signal conditioning and high-power transducers handle ultrasonic noise in a wide range without additional noise reducing installations
- **Insensitive to contamination**
  - since measurements are taken without ultrasound reflection, contamination on the pipe wall has no impact on the ultrasonic pulses. Furthermore, the Titanium sensor surface is contaminant-repellent.
- **Patented “Live” Precision Adjustment/Echo Measurement**
  - Reduces measurement uncertainty due to in-situ auto calibration of internal system delay time ($T_w$) after field replacement of transducers
- **Proven sensor technology**
  - Fully encapsulated, high-power Titanium sensors
  - Exd design: ±200 V, 120 kHz / 200 kHz
  - Operational pressure: 0-4351 psig (0-300 barg)
  - Plug-and-play, field-replaceable design
- **Compact design**
  - Standardized meter body length
  - < 24" 3DN meter body length
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- **Easy installation and commissioning**
  - “Honeywell User Experience” design enabling efficient operations for technicians
  - Advanced diagnostics
- **Standard System and Communication Capability**
  - RS485, Ethernet, analog and digital outputs, high-frequency output
  - Modbus (RTU, ASCII), TCP/IP
- **Industry approvals**
  - Metrological: Measurement Canada, PTB, MID
  - Hazardous area: CSA, ATEX, FM
  - Pressure: ASME, CRN, PED, TUV
- **Comprehensive service and support**
  - Subject Matter Experts for product and application consulting
  - Honeywell authorized local/regional field technicians for start-up, commissioning and field service
  - Local technical support (24/7) and responsiveness
  - Spare parts support responsiveness (delivery within 48 hours)
  - Training for operators and field technicians
  - Project engineering, proposals and estimating, and project execution

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**Applications**

- Fiscal metering
- Low-pressure custody/non-custody (atmospheric) transfer
- Allocation metering
- Check metering
- Gas transportation and distribution
- Underground gas storage (bi-directional)
- Gas-fired power plants
- Gas processing plants
- Refining and petrochemicals
- Industrial

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**RMGView™** facilitates real-time performance monitoring of CBM parameters

Honeywell’s advanced 6 Cross (“X”) path technology
Path Configurations

The six acoustic paths with their specific arrangement have the following significant advantages over 4-path meters:

- **Insensitivity**: The path arrangement according to Gauss-Chebyshev with its crossed paths makes the gas meter largely independent of the flow profile. Thus, high-accuracy measurement is achieved without a flow straightener even in the case of flow disturbances causing swirl, asymmetry or cross flow.

- **Center Paths**: The path arrangement allows for two center paths creating a measurement at the center of the flow profile, which has been proven as a valid diagnostic path within the ultrasonic measurement industry.

- **Symmetry**: The path arrangement provides for symmetry within the X, Y, and Z-planes for “3D fidelity.”

- **Redundancy**: The 6-path meter will not lose its custody transfer capability if any one or two of its acoustic paths fail. The failed paths will be reconstructed by means of a replacement-value transferability of the transducer.

- **Transferability**: The unique 6-path 3D symmetrical layout means that results achieved on a traditional test stand are more readily transferred to actual on-site, non-ideal conditions.

The transducer consists of a piezoelectric crystal fully encapsulated in Titanium housing and operating with a frequency of 120 kHz to 200 kHz. Its Exd design allows high signal amplitude resulting in high signal-to-noise ratio (SNR) in comparison to traditional intrinsically safe designed transducers. Ultrasonic noise created by gas pressure regulators and control valves at these frequencies has marginal impact on measurements. The transducer has been proven as a valid diagnostic path within the ultrasonic measurement industry.

- **Insensitivity**

**Echo Measurement**

The test for system delay time and adjustment described in AGA 9 (6.3) is necessary due to the fact, that beside the time-of-flight of the ultrasonic pulses, delay times may occur within the system, which are caused by the signal processing electronics, properties of the transducers and calculation algorithms. As these delay times cannot be identified directly, they must be determined at the factory by costly measurement methods. Assuming there is no flow through the meter, the time of flight of a sound pulse is given by the following equation:

\[ t = L/C \]

**Equation 1:**

**Where:**

- \( t \) = Transit time upstream (sec)
- \( L \) = Path length (ft or m)
- \( C \) = Theoretical Speed of Sound (ft/s or m/s)

To determine the system delay time “t,” all other measured values of this equation have to be determined exactly. The ultrasonic gas meter directly measures the time of flight “t.” The path length “L” can be measured exactly, at least for all meters with face-to-face arrangement of the transducers (working without reflections). More challenging is the determination of the theoretical SoS “C,” it can be calculated by the use of algorithms (AGA9/AGA10), taking into account the gas composition, as well as the actual gas temperature and pressure. To minimize the measurement uncertainty, the meter should be filled with a gas of well-known speed of sound (e.g., N2). Pressure and temperature have to be kept stable during the measurement and measured precisely. Most critical is the measurement of temperature, as levels of differing temperatures may occur inside of the meter.

Obviously, this method includes various possible sources of errors, which contribute to and increase the measurement uncertainty. Most importantly, it is not possible to verify this delay time “live” in the field, especially after a transducer exchange. Honeywell’s patented Precision Measurement/Echo Measurement method enables the most precise adjustment of delay time and avoids all disadvantages of the classical method described above. For this adjustment, two measurements have to be done per shot:

- **Time-of-flight between S1 and S2:**
- **First echo on the receive sensor:**

The fundamental equations are:

**Equation 2:**

\[ C_1 = L/(t_1 - t_w) \]

**Equation 3:**

\[ C_2 = 3L/(t_1 - t_w) \]

\[ C_1 = C_0 = \text{const. (for short times)} \]

Combining equation 2 and 3 and rearrange \( t \) to \( t_w \):

**Equation 4:**

\[ t_w = (3t_1 - t_2)/2 \]

**Where:**

- \( t_w \) = Transit time (sec)
- \( L \) = Path length (ft or m)
- \( C_2 \) = Speed of Sound (ft/s or m/s)
- \( t_w \) = Delay time (sec)

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- \( t_w \) = Delay time (sec)
• Determination of the delay time is done automatically
• Higher accuracy in the determination of SoS
• Live monitoring of the transducers
• Temperature, pressure, moisture, aging of sensors and electronics have no influence on the measurement result
• Verification of the meter can be performed in the field under operating conditions

Figure 6 shows in a very notable way the influence of "live" dry calibration in comparison to the standard modus without echo measurements.

As explained, this echo measurement method allows a much more accurate determination of the speed of sound, and the transit time determination is also more accurate. This implies that the flow measurement accuracy overall is higher than conventional ultrasonic meters without echo measurements.

New RMGView USM CBM

Key Features:

• Flow profile
• Performance by path
• Profile factor
• Asymmetry
• Turbulence
• Automatic gain (AGC)
• Signal-to-noise ratio (SNR)
• Speed of sound deviations

RMGViewUSM monitors the health of the USM GT400 and warns if there are any pending problems (e.g., transducer failure).

First, RMGViewUSM monitors the health of the USM GT400 and warns if there are any pending problems (e.g., transducer failure). Secondly, it monitors the gas process and alerts when there are any upset conditions (e.g., pipeline contamination, blockages or liquids in the gas stream). Thirdly, monitors calculated metering uncertainties and provides alarm notification.

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### USM GT400 Technical Data

- **Gases:** Pipeline Quality Natural Gas, Air
- **Measurements:** Volume Flow, Totalized volume, Velocity of Gas, Speed of Sound, Swirl
- **Path Configuration:** 6 Direct Cross (TX1, Path 2, Planes)
- **Measurement uncertainty:** from Qs to Qmax
- **Dry calibration with Nitrogen acc. ASA 9:** ±0.35%
- **HP-flow calibration. Full measuring range (Qt to Qmax).** ±0.1%
- **Operating Temperature Range:** -40°F (-40°C) to 176°F (+80°C)
- **Operating Pressure Range:** 14.5 psi (1 bar) to 4351 bar (300 bar)
- **Repeatability:** ±0.25%

**Gas Specifications**

- **Pipe Quality:** Natural Gas, Air
- **Operating Conditions:** See Table 1.
- **Accuracy Limits:** Full scale (Qt to Qmax)
- **Installation Outside:** With weather protection cover and sun roof
- **Color/Finish:** Metallic Silver (RAL9006, 5-9% gloss) and blue (RAL Design 260 40 40, 5-9% gloss)
- **Protection:** IP66
- **Protection Class:** 200 kHz for Sizes
- **Transducer Frequency:** 120 kHz/200 kHz for Sizes
- **Power Requirement:** Typically 7 W
- **Power Supply:** 24 V/DC +/- 10%
- **Measuring Interval:** Typically 32 measurements/sec
- **Operating Humidity:** up to 95% condensing
- **Gas Temperature Range:** -40°F (-40°C) to 176°F (+80°C)
- **Technical Data:**

#### USM GT400 Specifications

- **Diagnostics Software:** Visualization, flow data, diagnostics, configuration, parameter changes, export/import of parameters and data
- **Protection:** IP67
- **Meter Body Material:** Casted Steel; CS ANSI 022-0
- **Material Electronics Housing:** Aluminum cast
- **controller:** Netbird 2 (MODBUS protocol), Modbus TCP/IP for Ethernet communication
- **Transducer Frequency:** 120 kHz for Size ≤ 6” (DN 150)

**Remarks:** Consult Honeywell for special requirements.

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**Standard USM operation without t calibration vs. USM operation after precision-adjustment mode is switched on:**

**Standard USM Operation without t calibration, e.g. on the first factory start-up or after a sensor change.**

**USM Operation after Precision-Adjustment Mode is switched on! Real time Dry-Calibration under live conditions!**
Technical data is subject to change without notice.

For More Information
To learn more about Honeywell’s USM GT400, contact your Honeywell Process Solutions representative, or visit www.honeywellprocess.com.

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