



USM GT400 Ultrasonic Flowmeter
Proven Technology. Superior Performance.

To remain competitive, today's natural gas industry is under pressure to reduce capital and operating costs, improve uptime and reduce risk.

Aging workforce, with nearly half of employees skilled in control and regulatory technologies are expected to retire over the next years.

Often, end users must cope with challenges such as high gas pressure or temperature, valve noise, and attenuation of signal due to contamination or the presence of liquids.

This requires intelligent solutions to maintain accuracy while transferring gas between the distributor and the recipient.

The USM GT400 ultrasonic flowmeter from Honeywell is the ultimate answer, providing high accuracy, reliability and long-term stability in the most demanding environments.

Honeywell's ultrasonic meters are designed for use in a wide range of gas custody transfer and secondary metering applications. Featuring advanced technology proven in the field for more than a decade, greater ease of use, and reduced maintenance requirements, they set the standard for precision and reliability.

Accuracy Ensured

Respected Product Lines

Honeywell is the right partner wherever natural gas needs to be moved, measured or stored. We are focused on the design and manufacture of products for the most demanding gas metering and regulating applications with our respected RMG and Mercury product lines.

Superior Technology

Today, intelligent solutions are needed to measure and analyze the quality and volume of natural gas at every stage of its movement, storage and utilization. Gas industry organizations can meet this requirement with Honeywell's Mercury and RMG product families, which are available individually or as complete systems for gas metering stations.

Proven Experience

No other control and instrumentation supplier has more experience in the fast growing natural gas market than Honeywell. From upstream gas production, to transmission, storage and distribution, we understand all facets of the industry.

Application Know-how

We partner closely with industrial, commercial and gas distribution customers to provide the right flow measurement solution to optimize operations at gas-fired power plants, gas to liquid (GTL) plants, liquefied natural gas (LNG) storage and export terminals, city gate facilities, petroleum refineries, metals and mineral processing plants, combined heat and power generation facilities, and all sites utilizing natural gas as a feedstock.

Expert Support

Our gas industry experts assist with developing standard operating procedures (SOPs) for gas metering station installations, validation routines, calibration procedures, and more. Integrated ultrasonic gas meters with control or SCADA platforms and data collection systems help you interpret meter diagnostics and troubleshoot operating problems.

Local Service

You can depend on Honeywell for long-term product reliability and performance, lowest total cost of ownership and installation. Global experience, locally applied.

Typical applications include:

- 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



Rely on Honeywell

- Over 150 years of combined experience in the natural gas industry
- Global domain expertise with local support
- Broad suite of products, from single instruments to turnkey solutions
- Seamless integration with plant-wide automation and security
- Guaranteed compliance and accuracy in custody transfer



A Better Solution

For natural gas processes with dry, wet, or corrosive and abrasive gases, or requiring bi-directional measurement with minimal or no pressure drop, ultrasonic devices generally offer better performance, greater reliability, and lower capital and ownership costs than intrusive, mechanical metering technologies.

Traditional flowmeters typically have moving parts and require more frequent repairs and maintenance than new-technology meters. End users may also be forced to utilize costly dual-meter runs to cover the entire range of flow rates and pressure.

Turbine flowmeters, in particular, have disadvantages versus ultrasonic meters in natural gas applications. They incorporate a spinning rotor, which is mounted on ball bearings and spins in proportion to the flow rate. The presence of the rotor in the flow stream creates pressure drop and makes the meter susceptible to impurities like sand in the fluid. In addition, rotors are moving parts, and along with bearings, are subject to continual wear.

Choose the Right Flowmeter

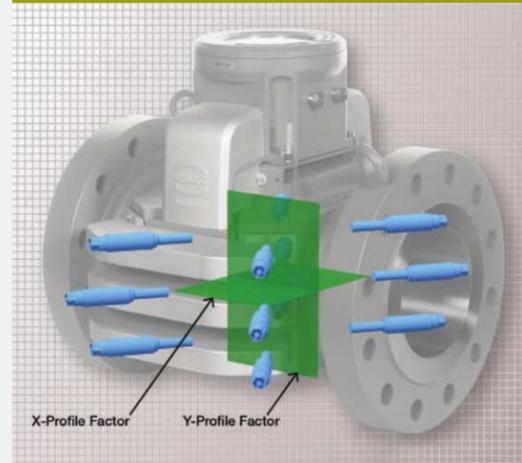
Over the past 20 years, ultrasonic flowmeters have been recognized as the device-of-choice to measure natural gas volume for fiscal accounting. Acceptance by gas pipeline companies has occurred due to the meter's superior precision, repeatability, capacity and rangeability, as well as its lower maintenance costs.

Ultrasonic flowmeters employ robust transducers generating repeatable pulses (amplitude and frequency). They also include high-speed electronics complete with an accurate clock to detect, resolve and time transmission/reception of sonic pulses with sufficient time domain resolution. The meters' transducer and electronics configuration permits high pulse transmission rates, and transit time measurement allows rapid integration of fluid flow velocity so accurately measured values can be reported once per second.

The most important development in ultrasonic technology in recent years has been the development of multipath meters, which are designed to average axial velocity components over the cross-section of a closed pipe. The American Gas Association (AGA) gave its approval to the use of ultrasonic meters for custody transfer of natural gas by issuing AGA-9. Previously, only differential pressure and turbine flowmeters were suitable for this purpose.

The Ultimate Answer

Honeywell's USM GT400 is an intelligent ultrasonic flowmeter which meets today's strict requirements for accurate and stable measurements in gas industry operations. This innovative meter improves upon existing ultrasonic designs with a superior multi-path measuring technique, field-proven electronics, sophisticated diagnostics, and user-friendly software to monitor the health of the flow metering system.



Honeywell's advanced 6 Cross ("X") path technology



120 kHz transducer

Features and Functions

Proven Multi-path Technology

Honeywell's innovative multi-path technology outperforms competitive ultrasonic meters in precision gas flow measurement. It has been proven in demanding applications across the industry for more than a decade.

The GT400 is designed with high stability against turbulence thanks to its direct path technology with six measuring paths on three levels. The paths are arrayed in an "X" pattern in horizontal planes: a central plane, and two geometrically similar planes. This orientation permits measurement of swirl, cross-flow and asymmetry, as well as transparent path velocity weighting per the Gauss-Chebyshev profile model for compressible fluids. It is particularly beneficial in city gate applications, where limited space for piping and installation can affect meter operation.

Field-proven Electronics

The GT400 incorporates electronics that have improved metering system uptime in installations worldwide. The electronics are used to optimize the meter's internal diagnostics; speed of sound (SoS) and flow velocity calculations; signal processing; data storage; interface to flow computers, gas chromatographs and SCADA systems; and field service diagnostics tools.

Plug & Play Transducer Design

At the heart of the GT400 are its transducers, which transmit and receive sound waves or acoustic pulses. The transit time difference between pairs of transducers is the most significant aspect of meter operation. With the GT400, all path-specific measurements are handled internally by the electronics.

Honeywell's Exd transducer consists of piezoelectric crystals fully encapsulated in Titanium housing for resistance to contamination. This unique design is plug & play and field-replaceable under pressure. The transducer operates at standard frequencies of 120 or 200 kHz for use in most gas metering applications; alternate frequency designs are available for use in noisy environments. Temperature range is -40°- 176° F (-40°- 80° C) and pressure range is 0-4351 psig (0-300 barg). Wide measuring ranges (120:1 and above) with correspondingly high flow velocities of more than 131 ft/s (40 m/s) are also possible.

Proprietary Detection Algorithm

The GT400 utilizes numerous criteria to validate pulses without compromising high firing rates (pulses per second). One of the criteria common to many instrumentation suppliers, including Honeywell, is peak identification and quantization of position and amplitude in the pulse envelope. However, most companies avoid the use of comparative analysis of pulses, or "stacking," since it is a burden on signal processing in noisy and turbulent environments—resulting in either data refresh rates exceeding one second, or a reduction of evaluated samples falling below statistical acceptability.

To improve its signal process capabilities, Honeywell implemented additional qualitative analysis to evaluate the pulse envelope and identify ultrasonic pulses, while still maintaining high firing rates. Our proprietary, MID-approved detection algorithm is key to insensitivity to regulator noise in many installations.

Advanced Noise Immunity

In a gas pipeline system, noise generated by piping configurations, valves, pressure regulators and nozzle jetting can impede the performance of some ultrasonic flowmeters. Honeywell addressed this problem with its proprietary MID-approved signal processing algorithm and unique Exd-rated transducer design, which work together to extend signal amplitude for a high signal-to-noise ratio (SNR) in comparison to traditional intrinsically safe transducers. Noise created at ultrasonic frequencies has marginal impact on the USM's measurements.



The GT400 provides improved overall performance thanks to:

- Rugged, non-intrusive design
- Bi-directional measurement
- Real-time system monitoring
- Direct path design
- Six-cross acoustic paths
- Direct "cross flow" measurement
- Dynamic 3-D flow profile modeling
- Extended diagnostic functions
- Precise flow profile identification
- Enhanced swirl and asymmetry measurement
- Best-in-class Exd transducer
- Superior noise suppression
- No moving parts or pressure drop
- Wide turndown ratio (>120:1)
- Low-to-high-pressure operation (0-4351 psig, 0-300 barg)
- Extended flow range (0.5-131 ft/s, 0.15-40 m/s)
- Excellent repeatability and measurement certainty

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Precision Delay Time Adjustment

For users of ultrasonic flowmeters, the test for system delay time and adjustment described in AGA 9 (6.3) is a critical requirement. Besides the time-of-flight of the ultrasonic pulses, delay times caused by signal-processing electronics, properties of the transducers and calculation algorithms can occur within the system. These delay times must be determined by laborious measurement techniques at the factory, since they cannot be identified directly.

Honeywell's patented "live" Precision Adjustment/Echo Measurement capability enables the most precise adjustment of delay time and avoids the disadvantages of related testing procedures. It also preserves measurement uncertainty resulting from in-situ auto calibration of system delay (T_w) after field replacement of transducers.

Intelligent Diagnostic Technique

One of the key advantages of ultrasonic flowmeters over all other flow measurement technologies is the availability of diagnostic information beyond just delivering pulses or signals proportional to the gas volume.

Honeywell offers the Windows™-based RMGView^{USM} parameterization and diagnostics software as an interface to robust condition monitoring capabilities. This application is easy to use and all data is displayed systematically in clearly arranged tables. It is also possible to combine selected measured values and parameters in user-defined tables.

First, RMGView^{USM} monitors the health of the 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, the software monitors calculated metering uncertainties and provides alarm notification.

CEESmaRT™ Compliant

The GT400 is compliant with CEESmaRT technology, a secure, cloud-based solution that is redefining condition-based monitoring (CBM) strategies for natural gas facilities. Unlike traditional CBM implementations that only monitor the ultrasonic meter, CEESmaRT continuously provides real-time verification of pressure and temperature transmitters, the flow computer and the gas chromatograph. This approach enables end users to increase the measurement certainty of the USM facility station, reduce the need for monthly site visits to verify the accuracy of process transmitters, and quickly identify problems with the calibration of the gas chromatograph.

Intuitive User Interface

Supplied with the GT400, RMGView^{USM} allows direct access to the electronic measuring system via a PC to read out all parameters; change parameters (if the calibration switch is enabled); represent measured values graphically; and create test certificates and data sheets, and output them as PDF files. The software facilitates real-time performance monitoring of the CBM parameters "live" in parallel with the standard operational features:

- Monitoring of AGC levels
- Indication of flow profile
- Monitoring of turbulence (profile factor)
- Comparison of the SoS of each path
- Identification of signal quality
- Comparison of SoS (per AGA 10) to estimated velocity of sound from the composition of natural gas and measured velocity of sound from the ultrasonic meter
- Monitoring the swirl angle



RMGView^{USM} facilitates real-time performance monitoring of CBM parameters

Benefits to Your Business

Thanks to the GT400, your business can realize significant benefits affecting your bottom line. These improvements are key to increased productivity—and profitability—in an increasingly competitive marketplace.

Lower CAPEX

With the GT400, users can reduce the cost of implementing an advanced gas metering system. This is due, in part, to the ability to employ smaller size meters with higher flow velocity, greater rangeability and extended turndown. The USM's crossed path arrangement also enables high-accuracy measurement without the need for long inlet piping. A single ultrasonic meter can often replace dual turbine meter runs in low- and high-flow applications. In addition, the USM's improved signal conditioning capabilities help do away with expensive noise reduction infrastructure.

Reduced OPEX

The GT400 is the ultimate answer to driving down maintenance and repair costs at gas metering sites. It is a non-mechanical device with no moving parts. The meter's operation is not directly impacted by contamination on the pipe wall, and the inclusion of high-reliability transducers—proven in service since 1999—minimize the need to send technicians to the field.

Improved Uptime

Natural gas facilities can avoid unplanned shutdowns and loss of production with ultrasonic technology. The flowmeter's rugged, MID-approved transducer features two-path redundancy for greater reliability in extreme situations. Its Titanium sensor surface is also contaminant-repellant, so personnel no longer have to shut down processes to allow for cleaning. Plus, the unit's plug & play design shortens the time required to exchange sensors.

Reduced Risk

Honeywell's knowledgeable subject matter experts work with customers on all aspects of product and application planning for ultrasonic flowmeter installations. We recognize the critical importance of service and support delivery throughout the entire project lifecycle. Our authorized field technicians can assist with start-up, commissioning and field service. This includes 24/7 on-site technical support, as well as dependable response to your spare parts needs with delivery within 48 hours.

A Trusted Partner

No other supplier has Honeywell's resources for the global natural gas metering and regulating market. With personnel working in key industry locations, including unmatched local technical support, we are your single-source partner for the gas value chain.

From detailed engineering, to project execution and training for operators and field technicians, you can trust Honeywell to help make your project more successful—and your operation more profitable.

High pressure > 58 psi/4 bar

Measuring Range	Qmin		Qmax		Qmin		Qmax	
	ACFH	ft/s	ACFH	ft/s	m ³ /h	m/s	m ³ /h	m/s
DN 100/4"	283	0.98	35315	122.82	8	0.30	1000	37.4
DN 150/6"	706	1.08	84755	129.93	20	0.33	2400	39.6
DN 200/8"	1130	0.99	148322	129.89	32	0.30	4200	39.6
DN 250/10"	1766	0.98	233077	129.91	50	0.30	6600	39.6
DN 300/12"	2472	0.97	331958	130.78	70	0.30	9400	39.9
DN 400/16"	4238	1.05	529720	131.73	120	0.32	15000	40.2
DN 500/20"	6357	1.01	829895	131.37	180	0.31	23500	40.0
DN 600/24"	9182	1.01	1200699	131.52	260	0.31	34000	40.1

Meter Dimensions	Diameter	Pressure Class	Length		Height		Width		Weight (ca.)	
			(mm)	(in)	(mm)	(in)	(mm)	(in)	(kg)	(lbs)
	DN 100/4"	ANSI 600	300	12	330	13	430	17	100	220
	DN 150/6"	ANSI 600	450	18	340	13	470	19	160	353
	DN 200/8"	ANSI 600	600	24	360	14	530	21	300	661
	DN 250/10"	ANSI 600	750	30	380	15	650	26	450	992
	DN 300/12"	ANSI 600	900	35	395	16	700	28	550	1213
	DN 400/16"	ANSI 600	1200	47	500	20	750	30	950	2094
	DN 500/20"	ANSI 600	1500	59	550	22	900	35	1500	3307
	DN 600/24"	ANSI 600	1200	47	550	22	1000	39	1550	3417

Technical Data	
Gases	Pipeline Quality Natural Gas, Air
Measurements	Volume Flow, Totalized Volume, Velocity of Gas, Speed of Sound, Swirl
Sizes	6", 8", 10", 12", 16", 20", 24" (ANSI 600); Consult Honeywell for sizes > 24".
Path Configuration	6 Direct Cross ("X") Path; 3 Planes
Measurement uncertainty (from Qt to Qmax)	
Dry calibration with Nitrogen acc. AGA 9	+/-0.5%
HP-flow calibration. Full measuring range (Qt to Qmax).	+/-0.1%
Repeatability	
Operating Pressure Range	14.5 psi (1 bar).....4351 (300 bar)
Flanges	up to ANSI600; Consult Honeywell for higher design pressure
Ambient Temperature	-40°F (-40°C) to 131°F (+55°C)
Gas Temperature Range	-40°F (-40°C) to 176°F (+80°C)
Operating Relative Humidity	up to 95% condensing
Measuring Interval	Typically 32 measurements/sec
Power supply	24 V/DC +/- 10%
Power requirement	Typically 7 W
Hazardous Area Approvals	CSA, FM: Class I, Div 1, Groups B, C, D T6; ATEX: Ex II 2G Ex de IIB + H2 T6; IECEx: Ex de IIB + H2 T6 Gb
Metrology Approvals	Measurement Canada, MID, PTB
Conformities	AGA9
Electrical Safety	EMV, Environmental
Analog output	0/4-20 mA (galvanically isolated, programmable, load resistor: max. 400 Ohm, Umax = 16 V)
Frequency outputs	2 HF-outputs with fmax = 5 kHz, Namur pr Open Collector
Digital I/O	2 X Programmable
Analog input for P&T	Galvanically isolated two-wire 4-20 mA p-transmitter or a 4-wire PT100
Interfaces	
RS 485-0	Service port with MODBUS-Protocol; RMGView ^{ISM} (max. cable length: 1640 ft); Ethernet via external module
RS 485-1	Customizable for special interfacing requirements
RS 485-2	MODBUS-protocol for interfacing with Flow Computers, SCADA; Ethernet via external module
Transducer Frequency	120 kHz/200 kHz for Sizes ≥ 8" (DN 200) 200 kHz for Sizes ≤ 6" (DN 150)
RMGView ^{ISM} Diagnostics Software	Visualization, flow data, diagnostics, configuration, parameter changes, export/import of parameters and data
Protection	IP66
Meter Body Material	Casted Steel; CS ASME A352 gr LCC
Material Electronics Housing	Aluminum cast
Color/Finish	Metallic Silver (RAL9006, 5-9% gloss) and blue (RAL Design 260 40 40, 5-9% gloss)
Installation outside	With weather protection cover and sun roof
Remarks	Consult Honeywell for special requirements

*Consult Honeywell for 4" and Sizes > 24"

Technical data is subject to change without notice.

