Ultrasonic gas custody transfer meter Portfolio

- **Q.Sonic\textsuperscript{max}, the new benchmark in accuracy**
  The world’s first eight-path meter combining both reflective and direct measurements delivers the lowest possible uncertainty in the most demanding operations.

- **Q.Sonic\textsuperscript{plus}, our multipath custody transfer standard**
  The patented path configuration enables the measurement of both swirl and asymmetry, resulting in unequalled profile recognition and diagnostic possibilities.

- **TwinSonic\textsuperscript{plus}, two independent measurements in one meter body, ultrasonic gas meter**
  It combines the field-proven Q.Sonic\textsuperscript{plus} ultrasonic meter with an additional independent check measurement for verification in the same body.
Our Business

Natural Gas – Midstream applications

- Q.Sonic\textsuperscript{max}, our multipath ultrasonic gas meter highest industry standard for custody transfer
- Combining the best out of two worlds to maintain the lowest uncertainty with high robustness to meet the individual operational demands

Industry Needs

- High reliability and availability
- Lowest uncertainty
- Easy to maintain and intuitive operation
- Fast detection of liquid and dirt build-up
- Easy connectivity from classical to modern communications

Problems We Solve

- No exclusions from the standard or restricted flow rate to meet OIML accuracy class 0.5
- Globally certified Ultrasonic meter
- Reliability as proven in thousands installations
- State of the Art HMI and diagnostic software
Q.Sonic\textsuperscript{max}: A new benchmark in custody transfer accuracy

- Patented multipath configuration, fully symmetrical layout of two swirl paths with double reflection and six direct paths.
- Highest levels of accuracy and insight to boost the reliability, performance and efficiency of custody transfer applications
- Best in class OIML Class 0.5 even in severe disturbance conditions
- Short inlet (5D)
- Market leading ultrasonic metering technology
- Advanced diagnostics software
Ultrasonic measurement: How does it work?

Absolute travel time measurement

\[ t_{ab} = \frac{L}{c + v \cdot \cos \varphi} \]

\[ t_{ba} = \frac{L}{c - v \cdot \cos \varphi} \]

\[ v_m = \frac{L}{2 \cdot \cos \varphi} \left( \frac{1}{t_{ab}} - \frac{1}{t_{ba}} \right) \]

\[ v: \text{average gas velocity} \]
\[ c: \text{velocity of sound (VOS)} \]
Ultrasonic measurement: How does it work?

**Calculation of Volume Flow**

\[ A = \frac{\pi}{4} \cdot D_i^2 \quad [m^2] \]

\[ Q_L = V_m \cdot A \cdot 3600 \quad [m^3/h] \]

\[ Q_L = \frac{L}{2 \cdot \cos (\varphi)} \cdot \left( \frac{1}{t_{ab}} - \frac{1}{t_{ba}} \right) \cdot A \cdot 3600 \quad [m^3/h] \]

**Q_L calculation based on:**

1. Measured Gas Velocity Resulting From Difference in Transit Time
2. Internal Area of Meter Body (Mechanically & Acoustically Verified)
3. Multiplication Factor For Desired Units
The Intelligent Gas Solutions Across The Gas Value Chain

**Reduced risk** through field-proven technology within many installations to certified high-accuracy global flow standards

**Improved accuracy** of measurement under non-ideal flow conditions with the unique patented 8-path configuration

**Improved measurement confidence** through the most accurate acoustic path configuration available to the market

**Improved performance** through dynamic meter body correction and path geometry

**Improved reliability** through state of the art transducers and electronics
Ultrasonic Gas Meter Q.Sonic$^{\text{max}}$

**Multipath custody transfer standard**

- 8-path (2 swirls + 6 directs). Swirls for linearity and stability. Directs for enhanced robustness
- Sizes 4” to 36”
- ANSI Class 150 to 900
- Build-in p (option) + T sensor
- Modular electronics
- Graphic touch screen
- OIML R137-1 2012 accuracy class 0.5 approved
- ISO 17089-1:2010 approved
- AGA 9 compliant
- MID approved
- ATEX / IECEx / FM / CSA approved
Unique (Patented) Path Arrangement

- Patented 8-path configuration, fully symmetrical layout of two swirl paths with double reflection and six direct paths
- Highest level of flow profile recognition makes it less sensitive to installation effects
- Meets the ISO17089-1, AGA9 and OIML R137 (accuracy class 0.5) 2012 requirements
- Measurement of swirl component (double reflecting paths)
- The ultrasonic signal ‘collects’ more gas velocity information when traveling longer, and at different positions, through the gas
- Flow profile detection with swirl and asymmetry measurement
- Pipe wall condition monitoring
- First to detect liquid formation
Full Titanium Transducers

- Fully encapsulated intrinsic safe titanium transducers
- Nominal frequency 200 kHz
- Compact design
  - Overall length 65/xx mm
  - Diameter (hole) 18 mm
- High Signal to Noise Ratio (SNR)
- Operational Pressure 0-350 barg*
- Operational Temperature -50 to +80 deg C
- High-grade titanium for enhanced corrosion resistance
- Smooth surface to minimize contamination
- Self draining orientation
- Plug-n-Play field replaceable

*min. pressure depending from size and gas composition
Signal Processing Unit (SPU) Series 6

- Enhanced interface possibilities
  - Ethernet/Serial
  - Freely definable Modbus communication (slave/client and master/server)
- Embedded archives
  - Events
  - Hourly/daily consumptions
- Graphical touch display
- Built-in web server for remote front panel
- Freely definable user displays
- Second (multiple) language support
- Intergrated Flow computer (IFC) option
- Separate compartment for the terminal connections
SonicExplorer® for Configuration, Diagnostics and Health monitoring

- User-friendly software
- Simulator for training
- Intuitive & Configurable Dashboards
- Multi Meter data base
- Configuration, setting and documentation
- Extended Diagnostics
- Health reporting
- Actual signal analysis
- Customer service pack (automated collection of relevant data for off-site analysis)
- Industrial Cyber Security
  - Runs on the latest OS
  - Multilevel password protection preventing unauthorized access
Q.Sonic$^{\text{max}}$ – Installation (Accuracy Class 0.5)

Designed in the lab to perform in the realities of the field. Manifolds, elbows, reducers, short inlets and other elements all have a significant effect on the profile of the gas flow.

Without flow conditioner: $5D - \text{Q.Sonic}^{\text{max}} - 3D$

(mild disturbance)

With flow conditioner: $(5D) - \text{Flow Conditioner CPA}50E - 5D - \text{Q.Sonic}^{\text{max}} - 3D$
## Type testing

### Perturbation test @ TCC

![Image of a testing setup]

### Table B.1 Piping configurations for flow disturbances

<table>
<thead>
<tr>
<th>Test</th>
<th>Test conditions</th>
<th>Remarks</th>
<th>Turbine</th>
<th>Ultrasonic</th>
<th>Thermal</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Reference conditions</td>
<td>approx. 80 D straight line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>approx. 10 D straight line (see Note)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>A single 90° bend</td>
<td>radius elbow: 1.5 D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Double out-of-plane bend</td>
<td>rotating right; radius elbows: 1.5 D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Double out-of-plane bend</td>
<td>rotating left; radius elbows: 1.5 D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Expander</td>
<td>one step difference of the pipe diameter is applied</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Reducer</td>
<td>angle of expansion/reduction part: ≤ 15°</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Diameter step on the upstream flange</td>
<td>approx. +3 % and −3 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>Half pipe area plate</td>
<td>image shows first bend in piping and mounting of half-moon plate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MPE Class 1.0 vs 0.5 during type testing

Accuracy class 1.0 ± 0,33% \(Q_t\) to \(Q_{\text{max}}\)

Accuracy class 0.5 ± 0,16% \(Q_t\) to \(Q_{\text{max}}\)

Error %

Gas velocity m/s

Error %

Gas velocity m/s
Flow disturbance test results

Class 0.5 limit

Deviation to Baseline (%)
The Q.Sonic\textsuperscript{max} showed excellent measurement behavior during the complete testing. The shift compared to the reference conditions (baseline with 80D inlet) at the different flow disturbances is <0.1%. All errors were well within the accuracy limits of a class 0.5 (0.167%).
What is the benefit for the end user

How Honeywell creates value
• No compromise on OIML accuracy class 0.5

Benefits
• First USM that maintains the lowest uncertainty due to installation effect in all situations (0.17%), no exclusions from the standard or restricted on the flow rate to be class 0.5 compliant

Results
• Reduced uncertainty of 0.08% with HON solution vs. other USMs could correlate to $9,360 monthly or $112,320 annual savings...when considering a daily throughput of 100 MMSCFD at $3.90 MCF