MEASUREMENT IQ FOR GAS

Honeywell

TABLE OF CONTENTS

A BETTER PATH TO DECREASING UNCERTAINTY IN GAS MEASUREMENTS

Managing uncertainty in gas measurement is crucial to operations. In legal metrology, it characterizes the dispersion of the values attributed to a measured quantity.

In practice, this means the value obtained from a flow measurement is simply the best estimate of the flow-rate. The real flow-rate could be slightly higher or lower, and the uncertainty defines the possible range of values at the specified confidence level for this measurement.

The greater the uncertainty, the less confidence the operator can have in those measured volumes and energy.

This matters in two respects. First, increased uncertainty is an indicator of potential inaccuracy that can lead to losses. These can rapidly accumulate because meter errors are not usually random; rather than balancing out, they tend to consistently overstate or understate the correct flow rate. Consequently, **an error of just 0.5% in an ultrasonic gas measurement** could add up to $1 million in lost revenue over a year.

Second, growing uncertainty often indicates a measurement fault or an unexpected change in operating conditions. It can, therefore, be an early warning of issues that, if unaddressed, could lead to process disruption or unplanned downtime.

NEW STANDARDS FOR ACCURACY

> **The traditional answer to the risk of meter inaccuracy is periodic recalibration. This can be either according to a fixed timetable or to a risk-based method (where operators extend periods between recalibration on the evidence of stable results).**

There are two concerns with these approaches. The first is that they are inefficient in terms of maintenance, necessarily resulting in recalibration in the absence of any underlying inaccuracy. That is in all respect true even the case with risk-based approaches, because recalibration still takes place at specified maximum intervals, regardless of meter performance. The result is unnecessary work and higher maintenance costs. This approach also reduces availability and asset utilization since meters must be taken offline for recalibration – another contribution to operational inefficiency.

The more significant issue with recalibration, however, is that it risks being ineffective. Measurement errors that develop between recalibrations are likely to go undetected. That's particularly true in large, complex operations with a high number of metering stations or where meters are geographically remote so that diagnostic information is difficult to retrieve. Even in smaller, simpler operations where operators regularly review diagnostic data, though, they may fail to take account changes to process condition that reduce certainty.

The result is that there may be significant periods during which meters are outside their design performance, but, since they have not (yet) failed, this goes undetected. During these periods, losses can accumulate.

We see the issues around recalibration increasingly recognized in standards, which now prefer reliance on diagnostics data. The third edition of the **American Gas Association Report No. 9 (AGA 9)**, published in 2017, features a new section on recalibration:

> "No time-based recalibration interval is recommended in this document. The overall accuracy requirements of the user's measurement application, along with user operating procedures, comparisons to original baseline data, and manufacturer's recommendations, can be considered to determine when recalibration may be needed.
>
> Research and industry experience indicate that meter diagnostic data is more effective in determining the need for recalibration rather than using a time-based interval."

Similarly, in 2019, **ISO 17089-1 *Measurement of fluid flow in closed conduits — Ultrasonic meters for gas – Part 1*** also included a new section on recalibration. It reads as follows: "USMs [ultrasonic meters] can deliver extended diagnostic information through which it may be possible to demonstrate the functionality of a USM. Also, the measured speed of sound of the USM may be compared with the speed of sound calculated from pressure, temperature, and gas composition, to check the mutual consistency of the four instruments involved. Due to the extended diagnostic capabilities, this document advocates the addition and use of automated diagnostics instead of labour-intensive quality checks."

ACTIONABLE INTELLIGENCE

Regardless of the regulation, the primary driver for performing uncertainty calculations is the desire to reduce measurement losses.

The fundamental problem with traditional approaches is **a lack of real-time visibility of the gas measurement system**. Uncertainty is calculated at a fixed point when the meter and related equipment are working correctly at a defined flow rate. This benchmark determines uncertainty for different flow rates, even though the health of equipment might have degraded.

Even if a condition-based monitoring system is in place to tell the operator that accuracy may have been reduced, they do not know by how much it has increased the uncertainty unless they redo the uncertainty calculation. If done manually, it could become rapidly out of date. For large numbers of meters, it is also impractical.

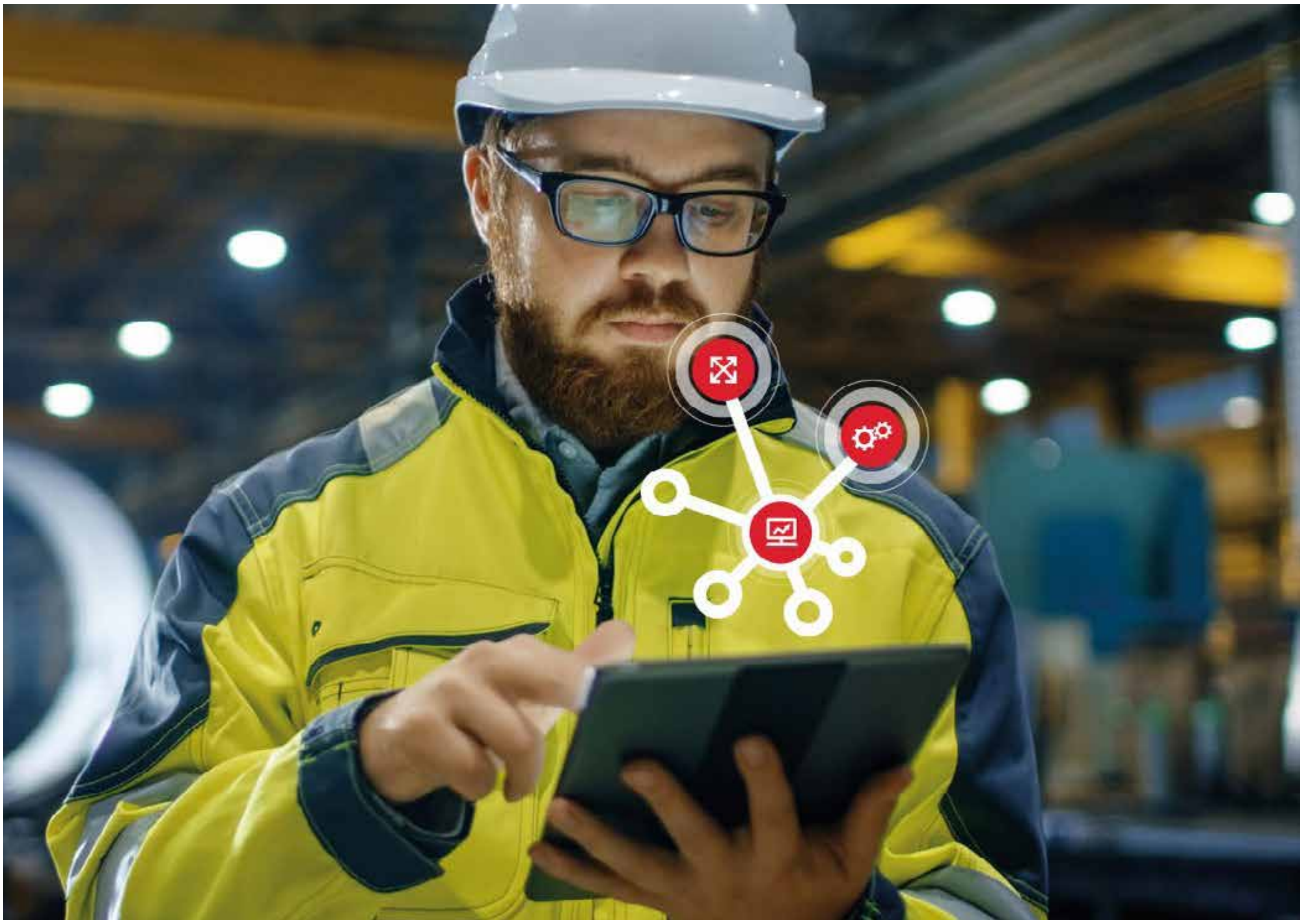
What is required is a dynamic measure, making use of diagnostic, flow and process information to provide real-time uncertainty calculations. This is what Honeywell's Measurement IQ for Gas solution provides.

The solution connects to meters and associated equipment across the enterprise and provides real-time calculations based on the actual, current flow rate. To do so, it draws on a wide range of uncertainty contributors. For the primary measurement (USM) the main uncertainty contributors (sources) are:

- **Calibration uncertainty -** The uncertainty associated with the measurement error determined during calibration
- **Linearization uncertainty -** The uncertainty caused by assuming a linear error curve between calibration points
- **Installation uncertainty -** The uncertainty caused by the deviating flow and process conditions compared to the calibration
- **Repeatability -** The variation between successive measurement results, carried out under the same conditions
- **Meter status –** The accuracy state of the meter, determined through condition-based monitoring.

This analysis enables it to provide insights from the meter's diagnostic data and compare its operational performance to its original design intent. The diagnostics analysis is traceable back to the meter's first gas or wet calibration at an independent calibration facility. The insight the real time uncertainty calculation provides enables operators to identify growing uncertainty and direct meter maintenance accordingly. Moreover, the real time uncertainty calculation shows the most significant contributors to uncertainty. Operators can, therefore, assess the impact of changing components such as temperature or pressure transmitters, for example, against the effect on uncertainty for cost/benefit analysis.

Finally, the real-time uncertainty calculation supports making informed decisions around operation modes where there are multiple streams enabling operators to choose which meters to use according to flow rates and uncertainty levels. The approach provides not only visibility of uncertainty but actionable intelligence on how it can be best and most effectively and efficiently managed.



QUALITY
AND QUANTITY

The flow is not the sole measurement that matters, however. When billing is calculated according to energy, the heating value of gas delivered is also critical.

Gas chromatographs (GCs) provide the analysis required for this calculation, but again they are subject to drift. This error can also have a significant impact on measurement accuracy and result in undetected losses.

Periodic calibration results are used to provide similar intelligence here as well. Measurement IQ records the response factor for each component of the gas, which is compared to a certified concentration in the calibration bottle. If the GC is performing correctly, the response factors should remain stable.

Using these figures, the software plots the response factors on a graph to reveal outliers, indicating a problem. It can also be used to monitor any drift in the response factors away from their factory calibration (long term drift) or their previous calibration (short term drift).

Several factors may contribute to the drift: an empty calibration bottle, closed calibration line or faulty gas chromatograph inlet, for example. These can be rapidly identified and addressed to maintain accurate gas analysis.

As with the meter diagnostics, the challenge is not merely to collect the information, but to automate analysis and turn the data into real-time insights that operators can act on. Doing so not only enables us to reduce uncertainty and losses, but also provides a basis on which to evaluate decisions on maintaining and enhancing the measurement operation.

EXPAND YOUR VISION

Expanding the proven capabilities of Measurement IQ, and connect remotely to all distributed assets and get a wider view and deeper insights to drive up measurement accuracy across the organization.

Taking control of measurements across stations, across sites, and across the globe helps to prioritize actions, reduce gas measurement errors in real-time and reduce the need for on-site maintenance.

Manage all your metering equipment optimally with MIQ Optimize. With a single enterprise-wide view of the gas measurement equipment that delivers clear and actionable recommendations.

For more information

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