



## SIEMENS PROCESS INSTRUMENTATION

# Leading pipeline operator exceeds accuracy requirements with new clamp-on flow meter run design

In need of a new balance meter approach, a Midwestern pipeline company turned to Siemens for a cost-effective solution that saves \$100,000 compared to alternatives. Even before calibration, the SITRANS FS230 ultrasonic, non-intrusive flow meter delivered flow rate accuracy rivaling that of other dual-path flow meters three times its cost.

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A leading pipeline operator with tens of thousands of miles of pipelines has provided critical links between major natural-gas producing basins and downstream processors and markets across the U.S. for nearly a decade. The Midwestern company serves as both interstate and intrastate transportation and storage for a variety of end user customers, including producers, utilities and residential and commercial consumers.

As a transporter, the company commits to the safe and reliable transfer of natural gas in adherence to the guidelines set forth by the American Gas Association (AGA), including the specifications outlined in its AGA Report No. 9 Measurement of Gas by Multipath Ultrasonic Meters 3rd Ed. 2017.

Sustaining safety, the environment and profitability. The AGA guidelines help the pipeline operator maintain its unwavering focus on safety and the environment. They're frequently referenced during expansion to ensure compliance with regulations as well as operation according to safe and environmentally sound best practices. As a publicly traded master limited partnership, the company seeks to maximize its shareholder returns by minimizing capital and operating expenses. That's done by encouraging a culture of continuous improvement. Empowered to find efficiencies and cost-effective solutions wherever they can, its engineers look for opportunities to streamline the infrastructure and processes throughout its production facilities, transmission pipelines, storage facilities, and distribution systems to customers.

In 2020, while the pandemic took its toll on gas prices and demand plummeted, the company saw an opportunity to boost margins by designing a new meter run model for a compression plant, where a balance meter run was needed to re-circulate transmission level natural gas back to the plant when it was not in customer use. To minimize lost and unaccounted for gas (LAUF), the balance meter would need high-accuracy flow measurement without any significant reduction in performance.

Working with Siemens Process Instrumentation and a local fabrication company, the pipeline operator achieved first-time calibration results that exceeded accuracy requirements and delivered an immediate capex savings of as much as \$100,000 – plus the potential to multiply that number over time with opex savings.

**Customer:** Midwestern U.S. pipeline company

**Challenge:** In-line flow meters deliver accuracy and compliance but at a steep cost.

**Solution:** A new balance meter run designed with the Siemens SITRANS FS230 ultrasonic, non-intrusive flow meter.

**Benefits:** Extraordinary accuracy with big reductions in capex and opex costs.

### **Challenges: In-line flow meters deliver accuracy and compliance but at a steep cost**

Since their introduction to the midstream market many years ago, in-line ultrasonic meters have been the gold standard for accurately measuring gas in custody transfers, allocation measurement and meter balancing. The technology calculates gas-rate velocity by measuring the transit times of high-frequency sound pulses between two or more transducers.

In custody transfer applications, where flow rates must meet or exceed AGA-required accuracy levels and are commonly cross-checked with an additional customer meter, multi-path flow measurements with two or more path transducers are commonly used for more accurate measurements, as seen in Figure 1.

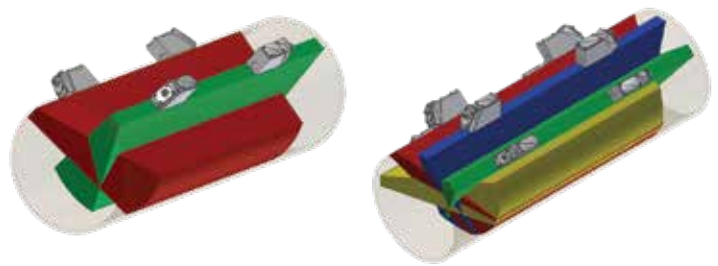


Figure 1. Dual-path transducer, left, and multi-path transducer, right.

But when the number of transducers increases, so too does the cost. Multi-path in-line meters start at \$80,000, a cost that can quickly grow from there. The high sticker price continues to climb when the calibration testing process is considered. Meter runs, which average around 40 feet long, must be shipped to a testing facility to undergo rigorous testing and calibration as a unit before they can be installed in a pipeline.

Once installed, in-line meters must be recalibrated on an annual basis. Each time, the company must coordinate service interruptions with the affected customer, shut off the flow of natural gas, purge the line, pull the meter run, ship it to a testing facility and ship it back. As a result, the opex and TCO (total cost of ownership) can be just as costly as the capex for in-line meters – sometimes even more.

**Solution:** A new balance meter run designed with the SITRANS FS230 ultrasonic, non-intrusive flow meter

During the design process, the need for a more cost-effective—yet equally reliable—solution led the pipeline operator to Siemens and, specifically, to the non-intrusive SITRANS FS230 clamp-on ultrasonic flow meter. Although the company was already using the SITRANS FS230 across its pipelines in a check measurement of other meters, to assess LAUF gas, it had never yet built a balance meter run design specifically around a dual-path ultrasonic meter like the FS230.

The updated meter run was developed in collaboration between the company, its local fabricator, Circle B Measurement & Fabrication, and Siemens. To prevent buildup from occurring inside the pipe, Circle B fabricated a carefully honed meter spool. In future designs, a nickel-plated finish can be added to minimize or eliminate carbon buildup, which can potentially cause inaccurate flow rate readings. A pressure port was added to the top of the meter.

The meter run was shipped to Colorado Engineering Experiment Station Inc. (CEESI) for calibration testing. The AGA No. 9 requires a flow meter to achieve certain accuracy levels prior to calibration at high and low flow rates. One of the main reasons the pipeline operator chose to work with CEESI was that they could test 12-inch and 16-inch pipes against real flow rates and show engineers the flow calibration in real time. By ensuring a consistent measurement across a wide range of flow rates, the company was able to keep its turndown ratios high.

Ceesi Flowrate [ACFH]	Meter Flowrate [ACFH]	Velocity [ft/sec]	Percent error [%]
308530.3	308313.3	69.9	-0.070
219754.6	219700.3	49.8	-0.025
44849.57	44887.22	10.2	0.084

Table 1. SITRANS FS230 Verification Results

The meter run’s “as-found” performance exceeded AGA No. 9 requirements out of the box. At both high and low flow rates, the SITRANS FS230 flow meter exceeded accuracy requirements after calibration, receiving error readings of just 0.02% and 0.08%, as seen in Table 1.

**Benefits: Extraordinary accuracy with big reductions in capex and opex costs**

Once calibrated, the well-designed meter run met AGA 9 requirements for custody transfer accuracy at a much lower cost than the company’s current custody transfer meter runs.

Even with the additional treatment and flow conditioners, the total cost of the meter run came in \$100,000 less than what an alternative with a competitor’s multi-path flow meter would have cost. The SITRANS FS230 employs WideBeam® transit-time technology, based on Lamb wave principles. This increases accuracy by producing a strong, focused signal that optimizes the signal-to-noise ratio and reduces sensitivity to changes in temperature, density, or viscosity.

The company believes that the savings will continue to add up over the lifecycle of the meter run, lowering the total cost of ownership. Unlike an insert meter, the transducers are mounted externally, making servicing easier if a pair of transducers need to be replaced; the company can simply swap the pair without process

shutdown. Maintenance of the balance meter run with the SITRANS FS230 ultrasonic flow meter no longer requires downtime or complex coordination with customers. Instead, it’s just a few hours of tech time.

*Even with the additional treatment and flow conditioners, the total cost of the balance meter run came in \$100,000 less than what an alternative with a competitor’s multi-path flow meter would have cost.*

In addition to using the high-accuracy SITRANS FS230 flow meters in its balance meter runs, the pipeline operator plans to use the meter design at customer transfer sites and will also continue using it for check and LAUF measurements along the pipelines.

Testing plays an important verification role in managing LAUF gas, a critical factor in ensuring a sound bottom line. To verify other balance and custody transfer meters are working correctly, the company’s engineers connect the clamp-on meters for a second reading and then compare the two numbers.

Company engineers have noted that the clamp-on meters help monitor and diagnose inaccuracy on longer pipelines particularly well. For example, on a 50-mile stretch of pipeline, with multiple distribution lines, the SITRANS FS230 has enable them to pinpoint what meter run needs calibrating by allowing them to move down the line, testing the runs one by one, until they’ve identified where the discrepancy lies.

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