

APPLICATION NOTES

CFT50 Digital Coriolis Mass Flow Transmitter Custody Transfer



Achieving accurate material accountability in custody transfers with certified Foxboro digital Coriolis measurement



BENEFITS

- ▶ Unprecedented precision in liquid custody transfer applications
- ▶ OIML certified
- ▶ More accurate product accountability
- ▶ Unmatched single-pass measurement repeatability for rapid, productive proving
- ▶ Excellent repeatability even in small-volume provers
- ▶ No pulse output damping; no guesswork

ABOUT THE CFT50 DIGITAL CORIOLIS TRANSMITTER

The Foxboro CFT50 digital Coriolis mass flow transmitter features a patented digital processing system. Its revolutionary design allows a mass flowmeter to operate uninterruptedly during difficult-to-measure applications such as custody transfer with problematic liquid/gas flow. Fully capable of performing transfer measurement with empty or partially empty flowtube conditions, the CFT50 provides advanced flowtube control algorithms to control all stages of gas void fraction for continuous, repeatable, precise measurement. This digital platform's rapid response also eliminates the need for pulse output signal damping.

CUSTOMER CHALLENGE

Billions of dollars' worth of crude oil and petroleum products changes ownership daily in fields, pipelines, truckyards, tanker ports, railyards, refineries, and other custody transfer points worldwide. The traditional custody transfer systems used to track these transactions have measurement uncertainty factors estimated at 0.15 percent. This translates to millions of dollars' worth of value that may remain unaccounted for on every trading day.

Conventional flow devices such as turbine or positive displacement meters have long been used in custody transfer. While these instruments can attain the necessary high levels of accuracy, their cost of ownership can also be high, since their mechanical moving parts wear out.

Coriolis meters have emerged as alternatives to mechanical flowmeters because they provide greater accuracy, direct measurement of mass and density for precise volume calculation, elimination of rotating parts, and avoidance of added pipe runs or flow conditioners.

However, conventional Coriolis meters falter when they encounter two-phase flow containing both gas and liquid — a common occurrence in batch custody transfer. For instance, many process liquids contain some amount of entrained air. Also problematic are liquids saturated with dissolved gas, which can flash to gas phase during transfer. In all these cases, meters exhibit bursts of no measurement, or wrong measurement. They may even stall out completely.

Other perceived problems with conventional Coriolis meters include pulse output integrity and meter zero shift. Unlike a mechanical meter, the Coriolis transmitter has a pulse output generated by a microprocessor. The delay time of this "manufactured" pulse, combined with necessary signal filtering, may cause reported mass flow to lag behind true measurement. This can make it difficult — especially with small-volume provers — for a Coriolis meter to prove. Finally, some users struggle to maintain a good meter zero as process materials change.

By minimizing wasted materials left on the bottom of transport vessels and by boosting transfer yields, these advanced Coriolis flowmeters provide more accurate transaction material accountability.



FOXBORO SOLUTION

Custody transfer users now have a reliable answer. The innovative Foxboro CFT50 digital Coriolis flow transmitter from Invensys uses breakthrough technology to accurately and rapidly measure custody transfer without mismeasurement, stalls, or stoppage.

It's a solution that has been certified by the International Organization of Legal Metrology (OIML) for custody transfer applications.

This product's patented microprocessor-based system uniquely prevents the erratic flowtube vibrations that cause measurement failures with liquid/gas flows. The transmitter was developed by Invensys in a collaborative effort with Oxford University. Its flowtube drive signal is digitally synthesized, providing excellent meter control in challenging conditions. And independent trials show the meter's advanced algorithms can respond to a step change in flow within 25 milliseconds (versus traditional response times measured in the tens of seconds), correcting for the effects of an empty flowtube or entrained gas. This superior digital control and processing also compensate for any pulse output lags, while superior repeatability eliminates any zeroing instabilities.

RESULTS

Users report performance in applications such as provers easily exceeds the results of both displacement meter or conventional Coriolis meters. CFT50 measurement is ideal for liquid CO₂, which can flash to gas phase during transfer, and for rapid emptying of railcars or tank trucks, where high volumes of air mix with the liquid transferred from the bottom of the tank. The Foxboro CFT50 can also improve custody transfer of materials with entrained gas, including petrochemicals and specialty chemicals (as well as pharmaceutical ingredients, dairy products, and more).

In addition, the meter's superior response time boosts productivity of proving applications. In fact, where pipeline fluids varying from light, liquefied petroleum gases to heavy crude oils pass through a common flowmeter that thus must be proven several times daily, a proving run may now take as little as 20 seconds.

By minimizing wasted materials left on the bottom of transport vessels and by boosting transfer yields, these advanced Coriolis flowmeters provide more accurate transaction material accountability plus — improved bottom-line performance.



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