Foxboro® CFT50 Digital Coriolis Mass Flow Transmitter

CFT50 liquid CO_2 measurement solves problems of accurately measuring multi-phase carbon dioxide flow

Summary

The Foxboro CFT50 digital Coriolis mass flow transmitter features a patented digital processing system and allows mass flowmeters to operate uninterruptedly during difficult-to-measure applications.

Business Value

The Foxboro CFT50 digital Coriolis mass flow transmitter improves control and eliminates downtime, losses and workarounds.

About The CFT50 Digital Coriolis Transmitter

The Foxboro® CFT50 Coriolis Mass Flow Transmitter features a patented digital processing system that allows mass flowmeters to operate uninterrupted during traditionally difficult to measure applications, including two-phase flow. Capable of performing in batch applications starting with empty flowtube conditions, the CFT50 is designed to control the Coriolis meter throughout all stages of gas void fraction for continuous, precise measurement.

Benefits

- Precise measurement of carbon dioxide (CO_2) in two-phase flow
- Ensured product quality through accurate and consistent CO_2 metering
- Improved liquid CO_2 material accountability during transfer from delivery vessels
- Increased production efficiency and reduced labor and maintenance costs

Ask about our next generation flow transmitter, Model CFT51 which offers all of these benefits and more!

Technical Challenge

CO_2 gives the sparkle to sparkling wines, the fizz to soda, and the trademark sound of freshness when opening a beer. Part of the value of CO_2 comes from its ability to shift from liquid to gaseous phase easily, however this property also makes it very difficult to get an accurate reading of its flow rate. This jeopardizes product quality, production efficiency, and material accountability.

Under normal atmospheric temperatures and pressures, CO_2 is actually a gas, and becomes liquid only when compressed or pressurized. To maintain this liquid state until carbonation is desired, the pressure must be kept around 230 psi and the temperature between -5°F to -10°F. If either of these conditions is not met, the liquid CO_2 flashes back to a gas. This problem is particularly prevalent when liquid CO_2 is unloaded from its delivery vessel — a railroad car or transport tanker — into a storage tank. During the unloading, as the pressure drops, a small amount of the liquefied CO_2 flashes back into a gaseous state.

Further complicating CO_2 flow measurement is another two-phase problem: the undesirable presence of air at the beginning and end of the transfer.

Turbine flowmeters, the traditional devices for measuring the flow of liquid CO_2 moving from the transport vehicles to storage tanks, cannot handle two-phase flow of any type very well. Because they measure by volume rather than mass, changes in external variables such as pressure and temperature results in highly inaccurate flow measurements. Moreover, the turbine action itself introduces pressure changes, which can lead to flashing.

Turbine flowmeters do not fare much better with entrained air. Typically, the flowmeter starts empty, suffers the “hit” from the onset of liquid CO_2, meters the bulk of the CO_2, then encounters two-phase flow at the end of the batch. When the pipeline is empty at the start and end of the CO_2 transfer, turbine meters spin out of control causing inaccurate flow measurement with the possibility of a discrepancy between the amount of liquid CO_2 delivered and the amount billed.

In addition to their limitations in measuring two-phase flow, turbine meters are hampered by the mechanical structure. They have numerous moving parts, which require extensive maintenance, even when properly maintained.

Foxboro, in a collaborative effort with Oxford University, UK, has developed a digital mass flowmeter, which provides consistent, highly accurate measures of two-phase CO_2 liquid flow.

The Foxboro Solution

Foxboro's CFT50 Digital Coriolis Mass Flowmeter built on Foxboro technology measures the flow of CO_2 in liquid or gaseous state and in the presence of any portion of air. The CFT50 measures mass instead of volume, and its measurements are independent of other physical parameters and ambient conditions. Changes in temperature, pressure, density, viscosity, and flow profile do not affect the CFT50 readings. With the ability to handle two-phase flow and compensate digitally for physical conditions, the advanced Coriolis flowmeters are ideal for CO_2 liquid metering applications, including traditionally difficult situations such as tank truck and tanker loading and unloading.

The CFT50 features patented signal processing techniques to provide useful measurements of both mass flow and density, and operational aspects of keeping the Coriolis meter running steadily in single-phase or two-phase flow conditions. One of the many patents it has received involves an advanced control and measurement system with high-speed digital signal processing signal processing that responds to changing flow conditions many times faster than standard Coriolis flowmeters. Another patent relates to detecting and compensating for two-phase flow conditions and generating a validated mass flow measurement.

Results

Foxboro's CFT50 Coriolis measurement technology has proven itself in a number of beverage applications. One major beer producer has found that the CFT50 transmitter is a reliable answer to the challenging transfer of liquid CO_2, providing highly accurate, consistent flow measurement. In other beer and beverage applications, the CFT50's multivariable measurement capabilities have overcome flow issues. Mass flow, density, and temperature are the primary variables measured, which are used to derive other variables such as volume flow, solid contents, concentrations, and complex density functions. The CFT50's versatility has allowed beverage producers to improve product quality and batch production throughout, while reducing labor and maintenance costs.

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