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Ultrasonic vs. Coriolis Meters: Which Makes Sense for My Application?

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Flow meters are necessary in a variety of drinking and wastewater treatment applications. They may be used for measuring chemicals being metered, and regulating pump input and output, for tracking water loss, for measuring fluid flow in the system, and more.

Among flow metering technologies, Coriolis meters are known for their extreme accuracy, often between +/-0.1% to 0.2%. However, this extreme accuracy comes with an extreme price tag. Before committing to such an investment, it's important to know the pros and cons of Coriolis meter technology, and how it compares to alternative technologies which are more economically priced, such as ultrasonic meters.

How Coriolis and Ultrasonic Meters Work

Coriolis meters measure the mass flow rate of a fluid by utilizing one or more vibrating tubes. As the fluid moves through the tubes, the interaction between its flow and the tube's vibration creates a measurable deflection or twist in the tubes. This deflection is directly proportional to the mass flow rate of the fluid. Sensors detect the phase shift between the inlet and outlet ends of the tubes, and the meter's electronics use this information to calculate the mass flow accurately.

By comparison, ultrasonic meters (Figure 1) measure the volumetric flow rate of a fluid using sound waves. Ultrasonic pulses are transmitted between transducers placed on opposite sides of the pipe. These pulses travel both upstream and downstream of the flow. When the fluid is moving, the sound waves traveling with the flow move faster than those traveling against it, creating a measurable time difference, or "transit time," which is used to calculate the flow velocity and

ultimately flow rate. Some ultrasonic meters can also use the Doppler effect, relying on sound reflections from particles or bubbles within the fluid, to measure flow.

The key difference between each type of meter is that the Coriolis meter measures mass, while ultrasonic meters measure velocity. That means the accuracy of the former is not impacted by changes in temperature, density, or viscosity. Coriolis meters measure mass, regardless of the phase it is in. This is why they are often preferred in oil and gas applications.



Figure 1. An example of an ultrasonic meter connected to a chemical metering pump. This type of meter can accurately measure low flows and requires little to no maintenance.

Where Each Type of Meter Excels

Both Coriolis and ultrasonic meters have their advantages. Some areas of consideration include:

Calibration. All meters need to be calibrated upon installation. However, Coriolis meters are susceptible to zero drift, where the reading for zero flow shifts over time to read some or negative flow. This occurs as a result of wear and tear on the tubes used to measure mass flow, as well as pressure fluctuations. Ultrasonic meters have no moving parts that can suffer wear and tear, and as a result rarely need to be recalibrated.

Maintenance. For similar reasons, Coriolis meters require more maintenance than ultrasonic meters. Caustic, abrasive, and

other chemicals can corrode the meter's tubes, requiring not just recalibration but sometimes replacement. The only component of ultrasonic meters that are exposed to the liquid are the transducers, but since the meters are often installed at the crown of the pipe, they are not always submerged and thus less likely to corrode.

Pressure. Changes in fluid pressure are common in many water treatment applications. While this does not impact ultrasonic measurement accuracy, it can be disruptive to Coriolis meters. Pulsations and other pressure variations can cause vibrations in the tube, resulting in inaccurate readings. To minimize this, pressure or pulsation dampeners may be needed, which increases system complexity and cost.

Low flows. Coriolis meters have a limited flow range, and they become inaccurate at lower flow rates. Most can only provide readings down to about 3 ft/s, whereas ultrasonic meters can measure flows as low as 0.5ft/s. This makes ultrasonic meters a more practical and cost-effective choice for applications like water treatment where low flows are common, especially at smaller well sites.

Choosing the Best Alternative for Your Application

The final determination will depend heavily on the application in question. Coriolis meters are preferred in applications with fluctuating temperatures and fluid densities. However, very few water treatment systems have such complications.

There is no need to overbuy technology, and while Coriolis meters offer exceptional accuracy, their high cost, maintenance requirements, and limitations in low-flow scenarios make them less practical for many water treatment applications.

Ultrasonic meters provide a more cost-effective and reliable alternative, especially in systems with low flow rates or less demanding conditions. An added bonus is the nearly maintenance-free operation of ultrasonic meters.