Blue-White®

Ultrasonic vs Magnetic Meters: Which Works Best For Low-Flow Applications?

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Flow meters are an important component in water treatment systems. Operators rely on the accuracy of a flow meter's readings, particularly for chemical dosing and other low-flow processes. Accuracy in metering depends on a range of factors, from the types and quality of liquid being metered to the meters themselves. Generally, the two most accurate meter technologies are static meters (i.e., those without moving parts), which includes ultrasonic and magnetic flow meters (mag meters). Both have their advantages, but the right fit will depend on the application. This makes it important to understand the pros and cons of each technology before making a purchase.

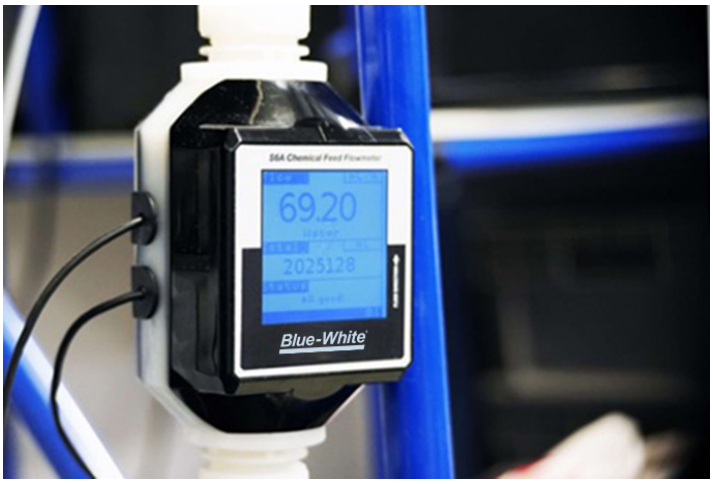

Figure 1. Blue-White's ultrasonic chemical flow meters utilize strainers to break up bubbles and reduce interference with the measurement signals. The addition of a temperature sensor and an integrated algorithm allows the unit to compensate for temperature variations that would otherwise result in inaccurate readings. Altogether, the system can accurately measure liquid chemical feed with flow rate readings as low as 10 mL/min.

How Meters Measure Flow

Ultrasonic meters detect and measure flow using sound waves, and Ultrasonic meters work in one of two ways. Doppler ultrasonic meters send out a signal and measure the change in frequency as it bounces back to determine the flow rate. To do this often requires bubbles, particles or a high concentration of solids that will reflect the sound wave back. By comparison, transit-time ultrasonic meters send two signals, one upstream and one downstream. The difference between them is proportional to the velocity of the liquid. However, bubbles and large solids will cause inaccurate readings.

Mag meters create a magnetic field and measure the voltage of any conductive material passing through the field. The major downside to this technology is that it requires liquids with specific properties or impurities. Mag meter work well with water with some natural mineral content (such as most drinking water), as well as acids and caustic liquids.

Comparison Factors

Accuracy. Both types of flow meters, ultrasonic meters and mag meters, have comparable accuracy under ideal conditions. The exact level of accuracy will depend heavily on the manufacturer and the application.

Impact of air bubbles. As mentioned, air bubbles can either aid or hinder a meter, depending on the technology. Mag meters, for example, will read air bubbles as flow and may read high if there is too much air in the fluid. Doppler ultrasonics actually rely on air bubbles for their reading, so the opposite is true in that the absence of air can cause inaccuracies.

For transit-time ultrasonics, air bubbles can be problematic, but there are solutions, such as including a strainer that mitigates the bubbles and installing the meter vertically rather than horizontally. This also works with substances like sodium hypochlorite, which can off-gas and cause similar problems in meter accuracy to air bubbles in general.

Impact of temperature. Both types of meters are impacted by fluid temperature. The conductivity of a fluid changes with temperature, which can cause inaccuracy for mag meters, particularly at low flow rates. Similarly, ultrasonic signals will travel faster in warmer fluid than colder fluid. Thankfully, some meters have temperature sensors and built-in algorithms that allow them to compensate for temperature changes.

Installation process. Mag meters require an invasive installation, which involves welding them in-line. Ultrasonics are often welded in place as well. Clamp-on ultrasonic meters are less invasive and easier to install, although they tend to be less accurate since the pipe itself dampens the signal.

Minimum flow range. The lowest possible detectable flow rate will depend less on the technology and more on the manufacturer and the intended application. For example, meters for administered chemicals need to have very low flow ranges. Some, such as those offered by Blue-White Industries (Figure 1), can detect as low as 10mL/min. This is ideal for municipal and industrial water treatment when operators need to be as precise as possible to avoid overdosing with a given additive.

Type of liquid. Although it has been discussed a bit already, the type of liquid and its properties matter when selecting a meter. For example, mag meters will not work well with hydrocarbons, distilled water, and non-conductive solutions, as these liquids have little or no electrical charge. Ultrasonic meters will not work with a liquid that dampens sound, which includes some polymers and dense slurries.

Cost. Mag meters tend to be more expensive than ultrasonic meters, although exact prices vary depending on the manufacturer, pipe size, application, and more.

Unique features/innovations. As with flow range, specific features will vary from product to product and manufacturer to manufacturer. Features like the above-mentioned strainer to reduce bubbles and temperature compensation algorithms are only available in some models, such as those offered by Blue-White Industries. Water treatment professionals should be sure to ask vendors about innovations that may be advantageous to the intended application before making a decision.