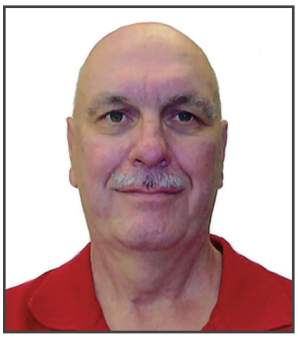

ULTRASONIC FLOW METERS

Richard Winters | Circuit Rider

First, I will give you the technical explanation of how this technology works according to and taken directly from Wikipedia:

Ultrasonic flow meters measure the difference between the transit time of ultrasonic pulses propagating with and against the flow direction. This time difference is a measure for the average velocity of the fluid along the path of the ultrasonic beam. By using the absolute transit times t_{up} and t_{down}, both the averaged fluid velocity v and the speed of sound c can be calculated. Using these two transit times, the distance between receiving and transmitting transducers L and the inclination angle α, if we assume that sound has to go against the flow when going up and along the flow when returning down, then one can write the following equations from the definition of velocity:

$$c - v\cos\alpha = \frac{L}{t_{up}} \quad \text{and} \quad c + v\cos\alpha = \frac{L}{t_{down}}$$

By adding and subtracting the above equations we get,

$$v = \frac{L}{2\cos(\alpha)}\,\frac{t_{up} - t_{down}}{t_{up}\,t_{down}} \quad \text{and} \quad c = \frac{L}{2}\,\frac{t_{up} + t_{down}}{t_{up}\,t_{down}}$$

where v is the average velocity of the fluid along the sound path and c is the speed of sound.

Before we continue, let me put the previous paragraph in simple terms. Basically, there are no moving parts to this type of meter. Sensors are placed on both ends of the tube inside the meter and the flow is measured by the time the water takes to pass by each sensor.

Now that we know how this works, let's talk about how this relates to our industry. First let us talk about the benefits of this technology. With no moving parts and minimal maintenance requirements, ultrasonic meters are a non-intrusive alternative for measuring flows. Another reason for this type of metering was taken from the Water World Magazine: For several years now there has been an increasing movement away from "intrusive" flow meters across numerous flow measurement applications including building maintenance, manufacturing, and, most recently, water and wastewater departments. The reason? These types of meters - magnetic, vortex shedding, turbine, positive displacement, Coriolis, venturi, and others - come in direct contact with the flows they are measuring and many of them have moving parts or electrodes that can become fouled over time. Particulate buildup in the parts of the meters exposed to the flow translates into a need for maintenance, cleaning, and calibration. These maintenance demands have led managers to consider alternative solutions.

Another reason to consider this type of metering is the accuracy that comes with them. Unlike mechanical water meters, ultrasonic meters use solid-state measurement technology. With no moving parts, ultrasonic meters operate quietly and improve accuracy and long-term reliability. Typical accuracy is within plus or minus 1.5 percent over the normal operating range of the meter and within plus or minus 3 percent at extended low flows.

Another benefit that usually goes unmentioned, is the safety factor that can be obtained using this type of meter. I responded to a water system that wanted help rebuilding a water meter in a pit that had been in use for over 100 years. The pit was very small and obviously a confined space. After inspecting the valves and piping to this meter, I suggested that they might want to consider an alternate plan that would be a whole lot safer and provide them with a more accurate meter. The ultrasonic meter could be installed without disturbing any of the old valves or piping that could fail catastrophically if disturbed. After consulting with their engineers, they all agreed that it was a much better way to proceed.

The best thing I recently found out about with this technology is their ability to hear leaks in your distribution systems. The meter pictured below can detect leaks in the distribution system as far as .5 miles from its location. The truly amazing feature of this meter is the fact that it listens for the leak in the water channel, not through the pipe material. With all the plastic pipes now being used in distribution systems, and the fact that finding leaks in the usual way is nearly impossible, I believe these meters will soon be in great demand. These meters are available in sizes up to 1 inch.

I hope this article provided you with a little information that you can use in your future metering needs. Obviously, this only touches the surface of this topic, and I would recommend that you google ultrasonic metering to see the vast world of information available on the subject. 💧💧💧