Ultrasonic Flowmeter Market Is Expected To Grow Strongly

by **Jesse Yoder**, Founder, **Flow Research**, Wakefield, MA

The MPU-1200 from FMC Energy Systems at Moss Bluff Storage facility in Texas. This is an ultrasonic flowmeter designed to measure the flow of natural gas.

Controlotron's 1010GCS ultrasonic flowmeter.

Ultrasonic flowmeter sales are expected to grow at an average rate of 15.3 percent per year through 2005, according to a study published by Flow Research and Ducker Worldwide.

Reasons for the technology's growing use include the publication by the American Gas Association of a set of guidelines concerning use of the meters for natural gas measurement and the opening of calibration facilities in the U.S. and Canada.

Ultrasonic flowmeter sales worldwide totaled $240 million in 2000, not including ultrasonic open-channel meters.

How They Work

There are two main types of ultrasonic flowmeters—transit time and Doppler. A transit-time ultrasonic flowmeter has both a sender and a receiver. It sends two ultrasonic signals across the interior of a pipe at an angle: one with the flow and one against the flow. The meter then measures the "transit time" of each signal. When the ultrasonic signal travels with the flow, it travels faster than when it travels against the flow. The difference between the two transit times is proportional to flowrate.

Doppler flowmeters also send an ultrasonic signal across a pipe. Instead of tracking the time the signal takes to cross to the other side, a Doppler flowmeter relies on having the signal deflected by particles in the flowstream. These particles are traveling at the same speed as the flow. As the signal passes through the stream, its frequency shifts in proportion to the mean velocity of the fluid. A receiver detects the reflected signal and measures its frequency. The meter calculates flow by comparing the generated and detected frequencies. Doppler ultrasonic flowmeters are used with dirty liquids or slurries.

History

Ultrasonic flowmeters were first introduced for industrial use in 1963 by Tokyo Keiki, which later became Tokimec, in Japan. Tokimec is in Tokyo, Japan.

The GC868 ultrasonic flowmeter, a new clamp-on flowmeter from Panametrics, shown during a demonstration at West Coast Energy's main natural gas transit line coming into U.S. The application is 36-inch outer diameter, 0.5-inch wall thickness and pressure of 700 psig.

In 1972, Controlotron of Hauppauge, NY, became the first U.S. manufacturer to market ultrasonic flowmeters in the United States. In the late 1970s and early 1980s, both Panametrics of Waltham, MA, and Ultraflux of Poissy Cedex, France, experimented with ultrasonic flowmeters to measure gas flow.

Initially, ultrasonic flowmeters were not well understood, and were sometimes misapplied. Many technological improvements have been made in the past 10 years, and the limitations of ultrasonic meters are better understood. Advances in transit time technology have broadened the types of liquids that transit time flowmeters can handle. Many transit time meters today can handle liquids containing some impurities.

Custody Transfer Of Natural Gas

Ultrasonic flowmeter use has been growing rapidly over the past several years. Today, the meters are poised for substantial growth. Probably the single most important factor in the recent growth of ultrasonic flowmeter employment has been growth in the market for multipath ultrasonic meters for custody transfer of natural gas. The initial surge in growth began in 1995, when Groupe Europeen de Recherches GaziSres (GERG), published Technical Monograph 8 — Present status and future research on multipath ultrasonic gas flowmeters. This technical document laid out criteria for using the instruments to measure natural gas flow for custody transfer. Its publication gave a major boost to the sales of multipath ultrasonic flowmeters for natural gas in Europe.

After the GERG document was published in Europe, ultrasonic suppliers worked with the American Gas Association (AGA) to obtain approval of a similar document in the United States. This resulted in the publication of AGA-9 in June 1998. AGA-9 lays out criteria for buyers and sellers of natural gas to follow when using ultrasonic flowmeters for custody transfer of natural gas. AGA-9 resulted in another increase in the sales of multipath ultrasonic flowmeters for natural gas. This increase continued in 2001, and is continuing in 2002.

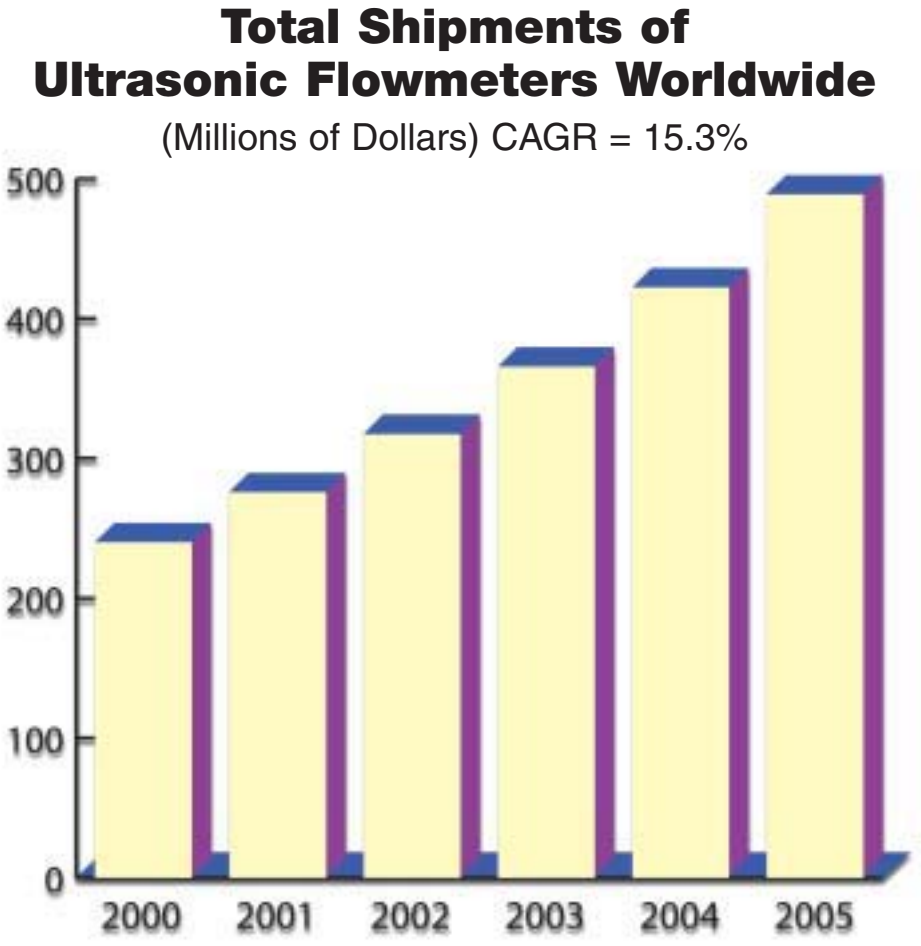
At the same time that ultrasonic flowmeters are being more widely used for natural gas, the demand for natural gas is increasing substantially. According to the U.S. Department of Energy, consumption of natural gas is expected to grow more rapidly than any other major fuel source between 1999 and 2020. By 2013, U.S. consumption of natural gas is projected to reach 30 trillion cubic feet, rising to near 35 trillion cubic feet in 2020. As a frame of reference, the year with the greatest consumption of natural gas in the U.S. is 1972, when 22.1 trillion cubic feet were consumed. (Report #DOE/EIA-0383 (2001).

Process And Flare Gas

Ultrasonic flowmeters also are being more widely used to measure process gas and flare gas. The use of ultrasonic meters for gas flow measurement has evolved substantially from the late 1970s and early 1980s, when this was first attempted. The use of wetted sensors provides greater accuracy. Insertion meters are used to measure flare gas in stacks, and ultrasonic flowmeters are used more widely in the chemical and refining industries. While the growth of ultrasonic meters to measure process and flare gases is not as rapid as is the growth of multipath meters for custody transfer of natural gas, it is still an important factor in the overall growth of ultrasonic meters.

Suppliers Continue To Enter The Market

The number of companies who are getting into the ultrasonic flowmeter market continues to grow. Since 1995, a number of new companies have entered the market. These include Siemens, Eastech Badger, FMC Energy Systems, Endress & Hauser, EMCO, Thermo-Electron, and Sick. Other companies, such as Caldon, have decided to extend the application of the ultrasonic flowmeters into new industries. Caldon, which has traditionally sold



into the nuclear industry, is now beginning to sell into the petroleum industry. As ultrasonic meter use continues to grow, it is very likely that more companies will enter the market.

Suppliers continue to bring out new ultrasonic flowmeter products for gas flow measurement. FMC Energy Systems (Houston, TX) is selling its MPU 1200 meter in the United States, a meter it obtained when it purchased Kongsberg Offshore in Norway. Panametrics introduced a clamp-on meter for measuring gas flow at the ISA 2001 show in Houston. Controlotron is also introducing new products in the gas flow measurement area.

An 8-inch Q.Sonic flowmeter from Instromet, designed to measure natural gas flow.

Advantages Of Ultrasonic Flowmeters

Ultrasonic flowmeters have a distinct advantage. Unlike Coriolis meters, ultrasonic flowmeters do well in large pipe sizes. More than half the Coriolis meters are sold for pipe sizes of two inches or less, while some Coriolis meters have successfully been used in four inch and six-inch lines. For pipes six inches and larger, ultrasonic flowmeters generally are a better choice.

Ultrasonic flowmeters have an advantage over magnetic flowmeters in that they can be used to measure the flow of nonconductive liquids, gases and steam.

Ultrasonic flowmeters have an advantage over vortex flowmeters in that they can meter low flows with better accuracy. Ultrasonic meters are also less intrusive, with the exception of insertion meters.

Ultrasonic flowmeters have an advantage over differential pressure (DP) flowmeters in that they are non-intrusive, with the exception of insertion meters. The intrusiveness of DP flowmeters varies with the primary element used.

Ultrasonic flowmeters claim several advantages over turbine meters. They are either less intrusive or non-intrusive, depending on the model. Also, they do not have moving parts that are subject to wear.

Growth Factors For Ultrasonic Flowmeters

Why is ultrasonic flowmeter use growing so rapidly? There are many reasons, including the advantages just discussed. Two other reasons include the development of multipath flowmeters and the greater availability of calibration facilities.

Development Of Multipath Flowmeters

One important technological improvement is the development of multipath transit time flowmeters, which use more than one ultrasonic signal or "path" in calculating flowrate. Each path requires a pair of sending and receiving transducers. By using more than one path, the flowmeter measures flow at more than one location in the flowstream, leading to greater accuracy.

Multipath flowmeters have been especially important in the use of transit time meters to measure natural gas flow. Suppliers such as Daniel, Instromet, and FMC Energy Systems have introduced four-path, five-path, and six-path transit time meters, respectively, to measure natural gas flow. Since the publication of AGA-9, there has been a substantial increase in the use of these meters for natural gas measurement, especially for custody transfer.

Natural gas is not the only area where multipath ultrasonic meters are being used. In 1997, Krohne introduced a five-path transit time meter for liquid applications. This meter is being used for custody transfer of liquids, and Krohne is seeking industry approvals for the use of this meter. Just as is the case with multipath meters for measuring the flow of natural gas, the five-path meter provides greater accuracy than single path meters.

More Calibration Facilities Available

One of the barriers to the increased use of ultrasonic flowmeters to measure natural gas flow has been the issue of meter calibration. Until 1999, there was no easily available calibration facility in the United States. Users wishing to have their meters calibrated had in many cases to send them to Europe. In 1999, Colorado Engineering Experimental Station Inc. (CEESI) opened its calibration facility in Iowa. This facility is now fully operational, and can calibrate large meters in the 30 to 36 inch range, as well as smaller meters. Users in the United States and Canada can now have their meters calibrated at CEESI in Iowa, avoiding the cost and delay of sending their meters to Europe.

Another calibration facility opened in Spring 2000 in Winnipeg, Manitoba, Canada. This facility will service the Canadian market, although it is also convenient to many users in the northern United States. Southwest Research Institute (SwRI) in San Antonio, TX, is another facility that is capable of performing calibrations, although they cannot easily calibrate ultrasonic flowmeters larger than those in the 16 to 20 inch range.

Where Is This Market Headed?

The next few years should be very active ones for the ultrasonic flowmeter market. With more than 50 suppliers worldwide, expect to see some consolidation among suppliers. Look for more of the broadline instrumentation suppliers to get into the market.

The ultrasonic flowmeter market for custody transfer of natural gas will continue to grow rapidly. And expect a steady stream of new products that feature enhanced performance as more suppliers try to improve their foothold in the fast-paced ultrasonic flowmeter marketplace. ***P&GJ***

About the author—Jesse Yoder, Ph.D., has 15 years experience as an analyst and writer in process control. He specializes in flowmeters and other field devices, including level, pressure, and temperature products. Prior to founding Flow Research, Yoder served as an analyst for several other market research companies. He has written more than 40 market research studies in industrial automation and process control. He recently completed a study entitled "The World Market for Ultrasonic Flowmeters" as part of a series of studies that includes all flow technologies. He can be contacted at (781) 245-3200 or jesse@flowresearch.com. For more information, visit www.flowresearch.com.