



Ted Farnon from Micronics reviews the Potential for Non-invasive Ultrasonic Level and Liquid Flow Technology in the Process Industry

Balancing the need for improved monitoring and metering of Processes and Building Services within tight financial limits requires innovative management and the use of technology with lower installation and lifetime maintenance costs. Finding funds to improve performance in the area of metering and monitoring is often difficult. Ultrasonic flow and Level technology can provide attractive solutions to this dilemma and a fast return on capital invested!



Improvements in the performance and reliability of ultrasonic meters have resulted in significant global sales growth. The non-invasive character of some ultrasonic devices for both level, open channel and Clamp-On closed pipe flow metering can deliver cost-effective installation and maintenance, whilst the accuracy and initial costs of the instruments compare favourably with those using other technologies. Cost savings of up to 90 percent of installation costs are achievable when compared with technologies requiring in-line installation with additional operational benefits at installation time and beyond. Non-invasive installations obviate the need for system downtime in closed pipe pumping operations and further facilitate energy savings as no hardware is inserted into the line to create any unrecoverable pressure drop.

Operating Principles

Ultrasonic flow meters use either Transit-time or Doppler measuring principles, or both. Transit-time flow meters employ a pair of transducers that are clamped to the outside of a closed pipe and operate as ultrasonic transceivers. The pulses are first transmitted in the direction of the fluid flow and then against the flow. The difference in transit-time of the signals is proportional to the flow velocity and, when multiplied with the cross-sectional area of the pipe, a measure of the flow rate is obtained.

Doppler flow meters use sound transmitted through the pipe wall from a single transducer mounted on the outside surface. Sound bursts are reflected from entrained particles or air bubbles at a different frequency. This frequency change is directly proportional to the flow velocity and facilitates the calculation of volumetric flow.

Tank level or open channel flow measurement instruments use the transmission time of sound pulses reflected from the liquid surface back to the transducer to calculate liquid height. Newly introduced open channel instruments use a submerged ultrasonic sensor that measures flow velocity and height to calculate flow volume.

Typical Configurations

Clamp-on designs enable meters to be employed with minimal installation cost and time and ensure that corrosion or contaminating effects from the liquid have no impact on performance. Portable designs are often, battery powered and suitable for system commissioning and balancing maintenance, surveys, emergency meter application and to validate results from existing meters. Fixed Clamp-On meters offer a viable, cost-effective alternative for many in-line meter applications. Both Portable and Fixed generally incorporate local displays, graphics options and industry standard serial communications for integration with SCADA or other Process Automation systems.

Ultrasonic liquid level measuring instruments can be used for open, closed channel or tank applications. In the case of open channel

applications they may be mounted above a fixed weir or flume or at the bottom below the liquid/air interface to calculate volumetric flow in conjunction with a flow velocity sensor.

Applications

Ultrasonic liquid-level, flow measurement and monitoring technology is applied across a wide range of process control applications.

Transit-time and Doppler flow meters both require full pipes, for true flow rate measurements, in closed pipes. Dual mode flow meters are also available to provide transit-time and Doppler technologies to assure accurate results regardless of fluid characteristics.

In Ultrasonic open-channel flow measurements a transducer is mounted above or at the bottom of the channel and transmits a signal to the surface of the liquid. The transit time of the reflected signal is used to determine the level of the liquid, which is used in conjunction with flow velocity measurements to calculate the flow rate.

Typical applications for ultrasonic instruments in industrial process applications include: process liquid flow measurements, clean water flow metering, flow confirmation, effluent discharge monitoring, local and remote liquid level measurements, leak detection and thermal energy flow measurements. Some examples of process plant applications are provided in the following paragraphs.

Prelude Engineering Ltd. has applied the Ultraflo 2000 Clamp-on flow meter to many applications in pharmaceutical plants around the world. They find they solve previous problems by eliminating any possibility of contamination and saving a great deal of expense.

At one GlaxoSmithKline plant Clamp-On meters provide flow measurement for variable speed control of 3 pumps to maintain constant flow rate with varying demand. The meters provide control signals for the pump inverter drives on the ultra pure water supply, resulting in more efficient operation and significant installation and operational cost savings.

Shotton Paper the largest News Print Plant in the UK are using Clamp-on portable and fixed ultrasonic products for their North Wales plant. As an example a Micronics Portaflow - Time of Flight is used around the plant for a range of measurements to confirm and check system flows and two years ago they installed two Dedicated Doppler Meters for stock flow measurement. The Doppler meters were chosen because they were non-invasive and as such a cost-effective alternative to non-flange in-line metering. The process flow is Thin Stock 0.8 to 0.9%. Andy Gibbson the engineer responsible is pleased with the meters, which have proved to be a good reliable solution.

In the area of short-term investigation, monitoring and commissioning of wet systems to identify waste and scope for improvement products such as Micronics



Portaflow 300 portable flow meter and logger can provide valuable insight. For example one was used to analyse flow rates in an existing 75 kW motor pump circuit, which led to replacement of the oversized pump with an 11 kW unit and significant cost savings.

At an automotive plant near Derby multiple Doppler flow meters have been installed to measure paint over spray collected by water curtains, which is re-circulated to filter out the paint particles. The liquid flow rate is monitored to detect the need for corrective action.

Performance improvements in Clamp-On and other Non-invasive Ultrasonic meters have made them comparable and in some applications superior to traditional in-line meters. Improved reliability and having the advantage of vastly reduced installation costs and overall life time costs it is not difficult to see why Ultrasonic instruments and meters can offer the process industry the solutions they require to effect further improvements in performance and efficiency.

Micronics Ltd
High Wycombe
Bucks

Can be contacted on:

Tel: 01628 642 058

Fax: 01628 531 540

E-mail: sales@micronicsltd.co.uk

Web: www.micronicsltd.co.uk

