Radar - the best option for level measurement?

Vladislav Snitko from Emerson explains the advantages of the latest non-contacting radar transmitters and why these compact, easy to use and cost-effective devices are now superseding inferior level measurement technologies in water and wastewater applications.

WHERE automated systems have been implemented within water applications, typically ultrasonic and hydrostatic measurement technology has been deployed for level measurement. However, both technologies have certain limitations, including measurement accuracy and device reliability issues. The performance of ultrasonic devices can be affected by a range of process or environmental conditions, meaning that they do not always provide accurate or reliable measurements. These conditions include temperature, pressure, foam, turbulence, build-up, the presence of gas in air, wind, dirt and spiderwebs. Although immune to the effects of foam and turbulence, the accuracy of hydrostatic submersible transmitters can be impacted by changes in density and temperature, as well as build-up. Also, because these hydrostatic devices are in direct contact with the media, they require frequent calibration and regular maintenance, which increases their total cost of ownership.

An alternative to these two technologies is provided by non-contacting radar transmitters, which deliver a range of significant benefits. They are extremely accurate, with measurements unaffected by temperature, pressure, light foam, condensation, build-up, wind, dirt or spiderwebs. No calibration is required and because they are not in contact with the material being measured, this helps to minimise maintenance requirements, maintain long-term reliability, and lower the total cost of ownership.

➤ The Rosemount 1208 Level and Flow Transmitter is designed specifically for water and wastewater measurement applications.

Non-contacting radar transmitters have typically been applied within the oil, gas and petrochemical industry, where extreme accuracy and reliability in safety-critical applications is essential. Although non-contacting radar is widely regarded as the best technology to meet the requirements of water and wastewater applications, the use of these devices within the industry has been limited. This is mostly because they have been considered too large, complex, and costly.

Smaller size and cost

However, the introduction of non-contacting radar transmitters designed specifically for water and wastewater applications has changed the status quo. These new devices, such as the Rosemount™ 1208 Level and Flow Transmitter Series from Emerson, not only provide elevated levels of accuracy and reliability, but are also compact, cost-effective, and easy to implement and use.

Designed and made to meet the demands of water applications, the transmitter has hazardous area approvals for when methane gases are present; can withstand submersion and outdoor conditions; and has drinking water approvals to ensure that it can be applied throughout the entire water supply chain. In terms of the accuracy and reliability of level measurements, the Rosemount transmitter surpasses that of ultrasonic and hydrostatic devices. Unlike previous non-contacting radar transmitters, this device features 80 gigahertz (GHz) fast-sweep frequency modulated continuous wave (FMCW) technology on a single electronic chip. It is this advancement which enables it to deliver precise measurements within a compact form that is both cost-effective and ideal for applications with space constraints.

The fast-sweep FMCW technology and advanced algorithms enables it to collect more information than legacy radar devices. It can achieve impressive level measurement accuracy of ± 2 millimetres (0.08 inches) at a range of 15 metres (49 feet), thereby helping organisations to increase their process visibility, optimise their operational efficiency and comply with environmental requirements.

Simple integration

One potential limiting factor in implementing new technology is that it might not be able to communicate over an existing network due to the variety of communication protocols that are used to connect equipment and devices.

The latest radar transmitters enable seamless integration with existing networks by supporting traditional process communications technologies such as 4-20mA and HART®, but also Bluetooth® wireless technology and IO-Link – which is being increasingly used within water and wastewater applications. IO-Link is backwards compatible with most fieldbus or industrial Ethernet host systems, including Modbus TCP, Ethernet/IP, OPC (Open Platform Communications) UA (Unified Architecture) and Profinet.

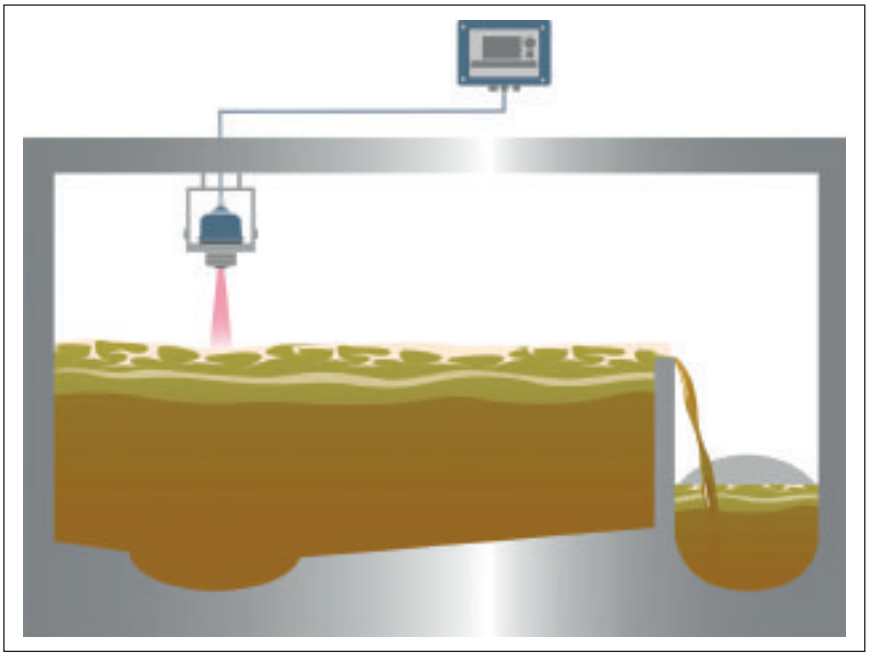
IO-Link connectivity helps to minimise installation complexity, enable simple integration into high-level automation networks, provide access to process insights that can enhance operational performance, and enable remote configuration and monitoring. Like IO-Link, HART connectivity also provides access to advanced diagnostics from the transmitters, which supports predictive maintenance and more effective troubleshooting. This leads to reduced downtime and increases operational efficiency.

Combined sewer overflows

Combined sewer overflows (CSOs) provide a good example of an application in which these new non-contacting radar transmitters can provide significant benefits. To ensure regulatory compliance, the water discharged from CSOs must be accurately monitored and recorded. Failure to do so can lead to substantial fines. However, these are harsh and challenging applications for measurement devices, with instruments frequently submerged, space restricted, and liquid surface conditions sometimes turbulent.

Ultrasonic sensors have traditionally been the preferred technology for level measurement in sewers, but non-contacting radar transmitters are now also being used. Although both technologies are non-contacting – so less susceptible to damage and easier to maintain – there is a significant difference between them in terms of reliability. As previously mentioned, the performance of ultrasonic sensors can be affected by air temperature, gases, wind and turbulence at the surface, whereas radar is unaffected by all these conditions.

The prohibitive cost, large size and set-up difficulty of radar transmitters have previously made organisations reluctant to select them for these applications, despite their superior accuracy and reliability. With the cost of the dedicated non-contacting radar for water level measurement applications now on a par with that of ultrasonic sensors, this is no longer a prohibiting factor. Size is also not an issue, and the compact and robust housing design of the latest radar transmitters is resistant to harsh sewer conditions and unaffected by submersion. Their accuracy and reliability in these conditions ensures that correct readings are recorded and reported, regulatory requirements are adhered to, and heavy fines are avoided.



➤ The latest non-contacting radar transmitters provide an accurate, reliable and cost-effective level and flow measurement solution in combined sewer overflow applications.

Reducing complexity

Although implementing non-contacting radar transmitters helps to achieve improved measurement accuracy and reliability, the technology has been criticised in the past for being difficult and time-consuming to set up. Without the correct set-up, devices can fall short of delivering the performance improvements that are possible. However, the term plug-and-play is often used in conjunction with the latest non-contacting radar devices as they can quickly and easily be set up by simply configuring the height of the application, either with a smartphone over Bluetooth connectivity, or via a controller with intuitive configuration wizard guides, such as Emerson's next-generation Rosemount 3490 Controller for level and flow measurement applications These wizard guides provide easy-to-follow on-screen instructions, making the set-up procedure significantly quicker and less complex for an operator to perform. Examples of applications where the Rosemount 3490 controller eases configurations are: level and pump control, open channel flow, differential level, and tank volume applications.

➤ The Rosemount 3490 Controller for level and flow measurement applications has been designed to reduce complexity and provide outstanding usability.

Accessing and providing accurate monitoring data to ensure regulatory compliance can be onerous and time-consuming. Automated solutions simplify the procedure of data logging, documentation handling and reporting. The latest controllers help reduce the complexity of this task by enabling a variety of flow measurements to be totalised, variables to be calculated and data to be easily logged. Reports can then be quickly generated and downloaded in an Excel format, to then be shared easily with regulatory authorities. This is possible because of the controllers' Ethernet connectivity, making the data logging procedure fast and straightforward.