pulsar MEASURE MENT

Is radar really the better ultrasonic?

Early ultrasonic systems were based on analog electronics and were very tricky to set up and unreliable in all but the simplest of applications. The biggest challenge then was 'false echoes,' which is where signals from hard elements that surrounded the measuring sound such as stanchions, struts, or stirrers that interfere with and overwhelm the 'true echo.'

So, it is no secret that ultrasonic measurement has been around for decades. But it required a mass of investment. Now, advancements in technology have meant that ultrasonic measurement has remained the top choice for water utilities across the UK and worldwide industry sectors. The latest systems and infrastructure improvements have been built specifically around the sophisticated control, security, and communications that are demanded by our UK water industry.

Ultrasonic measurement devices have evolved to be much more than that, from asset management and predictive maintenance to TOTEX and event duration management – today's industry is demanding more. These days, your average ultrasonic systems are more than just level sensors, they are small pump station controllers.

Ultrasonic measurement operates by exciting a piezoelectric crystal to emit a pulse of ultrasound. The sound reflects off objects and the return 'echoes' re-excite the crystal. The time taken for the signal to return is related to the distance of the reflecting object. Advancements in technology allow echoes from fixed objects within the path of the sound to be disregarded, and the true echo can be identified. Meaning that now, there are very few applications where this technology won't work.

The non-contacting nature of this technology means no moving parts, so no maintenance, making it a firm favorite within our UK water industry and various other sectors across the globe. Now, almost all wet wells are fitted with non-contacting ultrasonic devices, and level measurement isn't all that they are restricted to; they are widely used to pump control, differential measurement, and volume measurement.

Of course, when a technology has been around for as long as ultrasonic measurement, there are bound to be some myths and rumors bubbling under the surface. One of the latest being that radar measurement is superior to ultrasonic measurement. While radar does have its place and advantages in certain situations; the advancement of digital signal processing, low voltage, and high acoustic power output in ultrasonic transducers, has meant that nearly 95% of all applications can be solved with ultrasonic measurement. Using an ultrasonic with high acoustic power can give a robust and reliable signal return from a turbulent and foamy surface.

What are the benefits of ultrasonic?

Firstly, the technology is a well-proven, well understood measurement technique and is consistently and routinely used throughout industries all over the globe. You can rely on ultrasonic measurement to give you accurate and reliable readings every time, aside from its consistency, there are a huge number of standard control routines providing you with an outstanding level of control.

Today's market is more diverse, and we are seeing customers demanding more specific solutions to their measurement requirements. 'Low power, low power, low power...' today's businesses are constantly being reminded to reduce their power consumption and have their carbon footprint at the forefront of their minds. There are low power, loop, or battery-powered operating ultrasonic systems that have been developed to provide a solution to just that. These systems provide ideal answers to the issues of monitoring levels in remote locations and reducing power consumption on site. Advances in power management technology mean that the battery life of these systems is measured in years – something that has been unachievable in non-contacting systems over recent years.

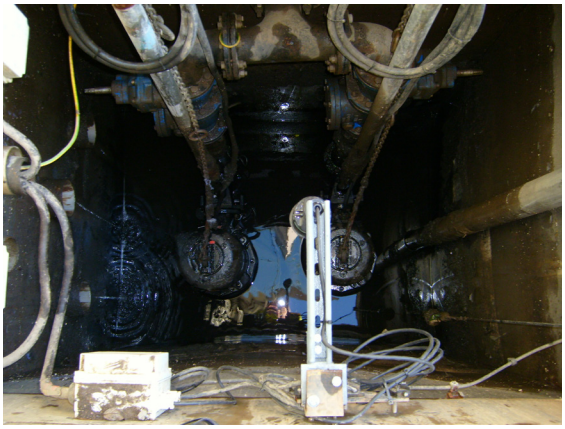
Plain and simple, a non-contacting system does an outstanding job deriving distance by firing a signal and listening for the return echo. But now, with millions spent on research and development, tens of thousands of installations, and a huge advancement in technology, ultrasonic measurement remains the foundation stone of process control and measurement.

What is radar?

Non-contacting radar technology comes in two different types, pulsed and Frequency Modulated Continuous Wave (FMCW). Both technologies work by emitting radiofrequency energy and measuring the time it takes for a signal to return from a target with a significantly higher dielectric constant than air.

The key difference between the two types of radar measurement is that pulsed radar emits a series of radiofrequency pulses and measures the time it takes for the signal to return from the target to the emitter. A challenge when at the speed of light, the signal will return in a fraction of a microsecond. Whereas, FMCW measures time of flight, but transmits continuously, constantly varying the frequency of the signal. The frequency of the returning signal is compared to the signal being emitted at that moment using a mathematical technique called Fast Fourier Transform (FFT). The difference between the two, corresponding to the time the signal has taken to return, FMCW is said to be the more accurate because of its narrower beam angle, and in most cases, a stronger signal.

How are radar and ultrasonic technologies different?



There is no difference in control and measurement functionality with radar and ultrasonic measurements. The only major factor in determining which technology to use is the measurement type. You can probably start by assuming that ultrasonic measurement will solve your problem. Even in the cluttered busy wet wells, we see in everyday sewage treatment applications.

Radar echo strength is also related to the dielectric constant of the reflecting object. If you are measuring something with a low dielectric constant and there are obstructions with a high dielectric constant, there will be some serious measurement problems. Ultrasonic is only concerned with the surface texture of the object for its ability to reflect sound, rather than what the object is made from

When should I consider radar technology?

1. Longer Range Open Channel Flow MCERT Applications

MCERT schemes are independent schemes designed to provide a framework for businesses to meet quality requirements. Under class 1 certification, the first three most accurate devices listed are ultrasonic, with a 0.04% combined accuracy, compared to radar on the same scheme having a class 2 certification with a combined accuracy of 0.22%. However, radar does have its advantages on those applications which are more than a few meters of the measurement range.

2. High-Temperature Applications

Where the surface of the substance being measured is hot, it can create a temperature gradient above the surface. This will affect the speed of sound and creates an inconsistent ultrasonic signal, which effectively will reduce the accuracy of the measurement.

3. Acoustic Noise Interface

Electrical noise interference can be ignored by using low voltage but high acoustic power ultrasonic measurement, however, sometimes acoustic noise can interfere with the signal. By using a radar sensor for these applications, it can eliminate this rare occurrence.

4. Foamy Applications

Radar measurement will produce more stable results than an ultrasonic sensor with limited acoustic power on foamy applications. This is because the foam interrupts the signal of the ultrasonic transducer; you can still get around this issue with ultrasonic measurement by using a sensor with high acoustic power. However, one thing that both technologies have in common, is that they can't see through the foam to the liquid surface.

5. Dosing Plants & IBC's

One clear advantage of radar is it can read through the container wall. This is particularly useful is chemical dosing plants where chemicals are supplied in plastic IBC tanks. The low dielectric constant of plastic means that you can accurately measure usage and stock levels, without having to introduce a new process connection to the container.

6. Digesters

One of the long-standing issues with ultrasonic measurement is that it has struggled with the inability to measure reliably within the methane-rich, elevated temperature, and pressurized environment of a sludge digester. With businesses all over the globe making a huge effort to be more environmentally friendly with bio-gas generation; radar measurement offers an easy way to measure levels within the digesters and with a standard set of communications and protocols that communicate with the rest of the site.

Conclusion

The simple answer is, whatever you are measuring or trying to achieve, you can rest-assured that ultrasonic measurement will achieve what you want it to. However, for the small 5% of the applications outlined above, radar will solve your problem. One thing that will be essential to the outcome of your measurement is ensuring you choose a controller that is retrofittable with both technologies. If suddenly your application changes or the conditions of the process change, and you need to swap the one technology for the other, you need to ensure you have a control system that enables you to do just that.

Having a control system with the flexibility for both technologies ensures that these decisions can be made quickly, without having to retrain your engineers, the expense of installing a new control system and service of on-site maintenance is made much simpler, you'll only need one set of control spares, meaning only one set of instructions to learn – but you'll have the ability to provide a solution quickly and effectively.

Delivering the Measure of Possibility

Pulsar Measurement offers worldwide professional support for all of our products, and our network of reps and distributors all offer full support and training. Our facilities in Malvern, UK and Largo, USA are home to technical support teams who are always available to answer your call or attend your site when required. Our global presence, with direct offices in the UK, USA, Canada, and Malaysia allow us to create close relationships with our customers and provide service, support, training, and information throughout the lifetime of your product.

By taking a step forward in echo processing technology, Pulsar Measurement addresses applications previously thought to be beyond the scope of ultrasonic measurement. This technology improves signal processing at the transducer head which has made it possible to increase resistance to electrical noise, enabling the transducer to 'zone in' on the true echo.

For more information, please visit our website:

www.pulsarmeasurement.com

pulsar MEASUREMENT

INFO@PULSARMEASUREMENT.COM

United States
11451 Belcher Road South
Largo, FL 33773
888-473-9546

Canada
16456 Sixsmith Drive
Long Sault, Ont. K0C 1P0
855-300-9151

United Kingdom
Cardinal Building, Enigma Commercial Centre
Sandy's Road, Malvern WR14 1JJ
+44 (0) 1684 891371

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