4 Things You Didn’t Know a Radar Sensor Could Do and What It Means for Your Level Measurement

By now, chemical industry operators and engineers have certain expectations of through-air radar sensors: They expect an accurate, low-maintenance instrument that delivers a reliable level measurement through condensation, buildup, and unpredictable temperatures. That’s the standard. However, there are things through-air radar sensors are capable of that go beyond the scope an average level measurement. This paper covers a few uncommon things radar level sensors can do and how these special capabilities benefit users.

1. Measure through non-conductive materials

Operators have been using radar sensors to measure through vessel windows and plastic tanks for decades. This practice is not only common to the chemical industry but is also frequently found in wastewater treatment facilities and pharmaceutical plants as well. Suspending a radar sensor above a window or tank prevents exposure to harsh chemicals, reducing the sensor’s required maintenance and in most cases extending its service life. This is hardly breaking news but what many operators may not know is that this benefit extends beyond plastic and glass. Radar sensors can measure through many non-conductive materials. For example, at VEGA Americas we’ve had success using radar to measure level through refractory brick. Sensor performance may vary based upon the material one is trying to measure through, so operators should contact their level instrumentation supplier with questions about specific applications.

What it means: By mounting a radar sensor outside a vessel, users can save time and money on maintenance and replacement without giving up any measurement accuracy.

2. Pair with a separation valve

In applications measuring harsh, caustic chemicals, many operators separate their level detectors from the process with a valve. This is a common practice and frankly, a smart move. External access allows the user to keep the process moving during maintenance work or when replacing a faulty sensor. You can also look at the wisdom of mounting a level instrument on a valve this way: If a problem arises with an instrument inside of a tank, that particular tank—or worse, an entire line—might have to be shut down, potentially leading to thousands of dollars in lost production. That’s why many users play it safe and separate the sensor from the process.

Pairing a valve with a 26 GHz radar sensor has a history of difficulty because the interior surfaces of the valve reflect radar signals back to the sensor, creating an excess of signal noise at the top of the measurement. 80 GHz radar technology presents chemical-industry users a new option for liquid level measurement, even when a sensor is mounted on a valve. These higher-frequency sensors emit a radar beam as narrow as 3°, so a smaller portion of the signals contact the valve interior, minimizing noise and creating a clear picture of level inside a tank. 80 GHz radar sensors have been installed successfully on a broad range of 3-in. and 4-in. ball valves and VEGA Americas has recently begun testing 80 GHz sensors on gate valves. The results of these tests have been consistently successful thus far.

What it means: Users with 80 GHz radar can separate the sensor from the process at will.

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3. Mount almost anywhere

Excepting conical vessels, the best practice for mounting a radar sensor at the top of a tank is to install it 200-500mm from a vessel wall. The reason for this suggested method is proven and scientifically sound: Microwave signals don't necessarily reflect from a product in a straight line like a racquetball hit square against a flat wall. Because of the width of the path they travel, signals are more likely—especially in solids applications—to scatter, particularly in tanks with domed roofs where the problem is exacerbated. In any case, signal scattering is troublesome for through-air radar that converts time of flight to level. When signals pinball from the product around the vessel back to the product and eventually return to the sensor's antenna, the sensor thinks the level is lower based on the signal's time of flight. For this reason, instrumentation manufacturers have long cautioned against mounting a sensor in the center of a tank roof. It's in the manual and everything.

What you are about to read is not in the manual. It's recommended you consult your level sensor manufacturer before you attempt the setup I'm about to describe.

80 GHz radar sensors emit microwave signals that travel a path three times as narrow as their 26 GHz predecessors. This means fewer signals bounce scatter around a tank and confuse a level measurement with a long time of flight. This improvement allows for mounting closer to the center of a tank.

To reiterate, the best practice is to follow the mounting instructions in the radar sensor's manual. However, anyone reading this knows that best practices can't always be followed; sometimes a sensor has to be mounted where a compatible process connection is available. That's a less risky proposition than it's ever been.

What it means: Operators can now mount a sensor virtually anywhere on a tank without sacrificing signal clarity thanks to the excellent focus of 80 GHz radar sensors.

4. Measure low-dK liquids

I'd guess that everyone who works in chemical processing has struggled to accurately measure a liquid with low dielectric constant (dK). These unreflective products demand a highly-sensitive measurement device to detect the weak signals they return to the antenna. In the past, if a liquid's dielectric constant was too low, radar might not be sensitive enough to measure it. That's changed due to advancements in dynamic range.

Measured in decibels (dB), dynamic range is an indicator of sensitivity. The larger the dynamic range of a radar sensor, the smaller the signals it can measure. VEGA's 80 GHz radar for liquid level, the VEGAPULS 64, has a dynamic range of 120 dB, large enough to measure any liquid chemical regardless of dK value.

What it means: Dielectric constant is no longer a barrier to using a radar sensor for level measurement if said sensor's dynamic range is sufficiently large.

Conclusion

Radar level sensors have come a long way in the last twenty years. In addition to being more focused, more accurate, and more compatible with unreflective products, through-air radar instruments offer several ancillary benefits that make achieving a level measurement easier. Users can now exercise more creative liberty than they ever have in terms of where and how to mount a radar instrument and what they can measure with it.

Learn more about 80 GHz radar

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