

The Siemens logo is displayed in a bold, teal, sans-serif font. It is positioned in the upper right corner of the image, within a white rectangular box. The background of the entire image is a photograph of a water treatment facility, showing large concrete basins, metal railings, and various pipes and tanks under a cloudy sky.

SIEMENS

Ingenuity for life

Simplifying filter bed level
measurement with the
SITRANS Probe LU240

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A wastewater treatment plant is a busy place with effluent flowing through every day, treated with a precise mix of chemicals and physical separation processes.

In this demanding environment, operators don't have time for devices that require constant maintenance and attention—there's enough to do in a day without tending to temperamental instruments. At each stage of operations, the plant depends on reliable and accurate level measurement.

Walking through a treatment facility, level instrumentation is at work everywhere:

- In chemical storage tanks, ensuring process chemicals don't run out or spill over the tanks that contain them
- At the headworks, taking level measurements from a flume or weir to calculate volumes of effluent first entering the plant
- In primary clarifiers, secondary clarifiers, sludge wells, filter beds, chemical tanks—you get the picture—controlling and monitoring levels

Most of these level measurements are usually carried out using ultrasonic level controllers and transmitters. Occasionally a plant might use radar transmitters due to the process connection limitations of a tank, chemical compatibility of the media, or if the measurement range requires it.

However, contacting level technology such as guided wave radar is seldom used—and when it is, finds itself mostly in ammonia level applications due to

the aggressive nature of such media. The molecular makeup of ammonia tends to degrade some materials at a rapid pace. Luckily, some guided wave radar transmitters feature special seals that are well suited for ammonia level applications. In such applications, this technology is the right choice.

But guided wave radar in a filter bed?

With that groundwork of level technologies in place, we turn to a large water treatment plant in North Carolina and its use of guided wave radar on a number of filter beds.

Among the level applications previously mentioned, monitoring the water level in a filter bed is quite easy—and rarely sees guided wave radar used. Most filter beds have excellent accessibility to install level instruments and their rectangular-shaped basins are usually free of obstructions that otherwise would interfere with an instrument's signal reaching down to the lowest point.

A couple of years ago, this wastewater treatment plant underwent a nearly 20 75.7 million-liter expansion to meet the demands of residential and commercial growth in the area that it serves. The expansion included the design of fast sand filter beds using wash water troughs and compressed air.

The large diameter wash water troughs about a meter apart. However, the influent trough pipe located above and between the wash water troughs leaves only a 0.61-meter gap in between them. This narrow gap between the large pipe and troughs prompted the use of guided wave radar level transmitters with

flexible cables as the sensing elements.

The trouble with buildup

During the washdown cycle, the water level is near the bottom of the basin and the water surface is quite turbulent. Operators were concerned that non-contacting technology would struggle in sending its signal through free space as it attempted to detect the level past the exposed troughs.

As well, considering the narrow area available for level measurement in this application, guided wave radar technology seemed to be the right choice.

In the control room, the historical trend graphs showed that, for the most part, these devices tracked the level steadily during normal operation and backwash cycles. However, the graphs also showed periods of intermittent high-level indication—some of the spikes lasting a short time and others lasting several minutes.

At the filter beds, organic material was accumulating on most of the guided wave radar transmitters' cables. This material was not uniformly spread out along the cable and the amount of this organic buildup also varied.

Although newer versions of guided wave radar transmitters can automatically suppress buildup, filter beds in an open environment are exposed to changing weather, insects, and anything else floating on the water surface or through the air.

Once debris begins to build up on cables or rods, moisture can more easily accumulate, and buildup will continue



Save time and maintenance costs with SITRANS Probe LU240's transparent lid. For manual observations, you no longer need to remove the device's lid, but instead can observe the values you need with ease.



Ultrasonics are ideal for environmental applications: our exclusive echo processing algorithms ensure reliable level readings every time. Accurate, proven features like auto-false echo suppression provide advanced capabilities you can depend on at a low cost of ownership.

to grow. The greater the moisture content on the buildup, the more conductive this buildup becomes.

To the transmitter, this accumulated material begins to appear as a real target, which eventually leads to inconsistent level measurements. Automatic suppression of this buildup is not enough to overcome this challenge—not only because of the dynamics of the buildup, but the end of the transmitter's cable must be completely unsubmerged for its automatic activation.

A temporary solution... and then a better one

Operators didn't immediately make the correlation between the intermittent high-level spikes and material sticking on the cables. They would occasionally spray the cables with high-pressure water jets during the periodic wash-downs to keep the basin and surrounding area clean.

After washdown and once residual water was cleared off the cables, the operation of the guided wave radar devices improved—that is, until buildup started to return, thereby causing inference again.

Operators needed a more permanent fix

As mentioned above, filter beds are an easy level measurement for transmitters using non-contacting ultrasonic technology. As the name implies, to obtain a level measurement with this technology, the sensor does not contact the liquid or solid's surface. Instead, the measurement is derived using the time of flight principle: the echo signal generated by the instrument is transmitted and received by the transducer and the corresponding distance or level can be viewed on the device's local display.

Most commonly, the 4-20 mA output signal is sent to the control room where it is relayed to an HMI (human machine interface). These days, with the environmental industry's ever-increasing digitalization efforts, level information can be interconnected with Siemens MindSphere for data analysis, better efficiency, and process management.

With non-contacting technology, the issue with buildup developing on the area of transmission is virtually nonexistent.

generated by the piezoelectric crystals used to generate the echo pulse means that ultrasonic devices have self-cleaning faces, literally shaking themselves clean of dirt, condensation and buildup in the application. This minimizes the negative effects of condensation that otherwise would degrade the transmitted and received echo signals.

With ultrasonic level technology's proven history in water applications, it was clear that by using a SITRANS Probe LU240 transmitter, with its large signal power and capabilities to mask unwanted reflections, a consistent level measurement might finally be possible.

Easy installation + excellent performance

Operators removed the existing guided wave radar device and installed the SITRANS Probe LU240 without trouble, even considering the narrow space restrictions between pipes.

Once the device was set up, the water level was lowered to expose the troughs. Operators activated the backwash cycle, which created a turbulent surface due to the air flow that is part of the process. During this critical time and subsequent cycles, the ultrasonic level transmitter tracked the level quite well.

The echo signals captured using SIMATIC PDM diagnostics software utility showed that at the lowest level, the transmitter could see the pipes, but they didn't cause interference with the level measurement. In fact, the echo signal reflecting from the water surface was so strong that operators didn't need to apply the instrument's Auto False Echo Suppression capabilities to negate the reflections caused by the pipes and troughs.

Back in the control room, operators compared the performance of the SITRANS Probe LU240 to the remaining guided wave radar transmitters in the other filter beds. The transducer section remained clean and the historical trend graph showed consistent level measurement.

Based on these results, operators removed another (and more troublesome!) guided wave radar transmitter on a nearby filter bed. Both SITRANS Probe LU240 transmitters have been operating flawlessly under the same conditions as the guided wave radar transmitters.

This maintenance-free solution and consistent performance proved that ultrasonic level technology is the right choice for this and many level applications found in the wastewater treatment process.

Benefits to your operation

The SITRANS Probe LU240 has a local display with push buttons that makes it easy to set up by simply following the built-in wizard.

With just a handful of parameter entries, the instrument is operational in minutes. The compact signal beam angle and high signal strength make it possible to install the device in level applications that at first seem to call for more specialized technology.

Not only is the SITRANS Probe LU240 more economical pricewise, but it is also a maintenance-free device. Its consistent performance gives you dependable control over the critical cycles necessary for your bed filter operations.

About the SITRANS Probe LU240

SITRANS Probe LU240 is a compact, rugged, and high-performance ultrasonic transmitter that is engineered to last. With the unparalleled control and access now possible with Industry 4.0, this digital age still requires accurate and rugged process instrumentation. The SITRANS Probe LU240 is a cost-effective, intelligent level solution ready for digitalization with Hart 7, providing value far beyond its initial cost.

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