TankScan
The power of data. Optimized.

White Paper

Which Level Sensor Should I Use in My Tank Level Monitoring Application?

By: John Brewer,
Senior Electrical Design Engineer -
ATEK Access Technologies

TankScan currently offers two types of level monitoring sensors – guided wave radar, **TSM8000 Series**, and ultrasonic, **TankScan TSU Series**. Depending on the application, both may be a good fit. However, there are benefits to each that might make one more suitable than the other.

Guided Wave Radar

Guided wave radar technology sends a high frequency pulse down a probe wire immersed in fluid and measures the time for a reflection off the fluid to return. The probe wire acts as a guide for the pulse, hence the name. The measured return time correlates to the distance in air from the monitor to the fluid, so knowing the tank dimensions, the fluid level in the tank can be calculated.

Guided wave radar works well from short to tall tanks with low to moderate viscosity fluids like gasoline, motor oil, agricultural chemicals, etc. It does not work well for highly viscous fluids or solutions that may stick to the probe wire and cause false readings.

Since the probe wire extends to the bottom of the tank, guided wave radar should not be installed in tanks with any mechanical stirring systems or equipment that may cause the probe wire to become tangled. In addition, a 2 to 4 inch clearance must be maintained around the wire to prevent interference with the signal. This includes distance from tank walls.

Installing guided wave radar, while fairly simple, requires accurate measurement of the probe wire length to maximize the readable range of the tank. There are regions at the top and bottom of the probe wire where

measurement is inaccurate or not possible. One such region exists in the first two to three inches from the monitor. Many tanks have crowns on top that will never be filled with fluid, or the monitor may be mounted on a short riser to eliminate this region at the top of the probe wire. At the bottom of the tank, accuracy decreases from 12 to six inches above the weight and within six inches no unique level measurements are discernable. Rather, the reflection from the weight will be read. Thus, the probe wire length needs to be cut such that the weight is only one or two inches from the bottom of the tank to maximize the measurable fluid range.

Mounting the monitor level is not critical, as the probe wire's weight forces the wire to suspend vertically into the tank.

A TankScan TSM8000 Guided Wave Radar Sensor can work on tank heights up to 35 ft and requires a gateway to send its data to the ATEK Intelligence Platform (AIP).

Ultrasonic

Ultrasonic sensors generate a sound wave that reflects off the fluid's surface. Level is measured similar to guided wave radar, where the time of flight is measured, correlated to the distance traveled in air, and with the tank dimensions used to calculate fluid level.

Ultrasonic works well in applications were contact with the fluid is not desired, such as highly viscous solutions. It works best in short to medium height tanks where there is a wide, obstruction-free path to the fluid's surface.

Ultrasonic sensors cannot be installed near the edge of tanks, as the sound wave typically occupies a 6° to 8° cone extending down from the sensor face. Anything in this zone may cause a reflection and generate a false reading. The taller the tank, the larger this obstruction free zone must be, unlike with guided wave radar, which only requires a constant 2- to 4-inch zone around the probe wire.

Ultrasonic sensors must also be installed such that the sensor face is perpendicular to the fluid, thus maximizing the amount of reflected signal back to the sensor. The fluid's surface must also be flat, and free of foam and any agitation, as this could absorb or alter the sound wave's reflection.

Since vapor or other contaminates in air affect the speed of sound in air, ultrasonic sensors do not work well in dusty environments or in condensing humidity. This issue is also present for guided wave radar, but to a lesser extent. It is recommended that tanks be vented to mitigate this.

Ultrasonic sensors are typically easier to install than guided wave radar sensors, since they simply screw into to a tank port with no probe wire to cut to length. But tank port risers and adapters must be chosen carefully, generally can't be taller than an inch or two, and must be smooth inside, or they could generate false reflections.

Depending on the ultrasonic sensor type, short or medium range, there is typically a 4-inch or 12-inch region at the top of the tank where the sensor will report any reflection as its minimum sensing length of 4-inch or 12-inch. Beyond that region ultrasonic sensors can accurately measure fluid level to extent of their range.

TankScan TSU ultrasonic monitors can work on tank heights up to 13 ft and utilizing a built in cellular radio will send level data to the AIP.

Communication

For applications where both sensor technologies would work, a deciding factor may be the communication protocol. All data is reported to AIP, but there are different methods of getting it there. Cellular and Ethernet (WiFi or LAN) communication are the methods used by TankScan products to transfer data to AIP.

The battery powered TankScan TSU monitors with their built in cellular radio is the better choice for applications lacking on site power and Ethernet service.

The battery powered TSM8000 monitors transfer their data via external gateway to the AIP. The gateway requires on site Ethernet or cellular services and AC power. Multiple TSM8000 monitors can wirelessly communicate with the same gateway but each must be within 1000 feet clear line of sight of the gateway.

Summary

	TSM8000 GUIDED WAVE RADAR	TSU ULTRASONIC
Short Tank (< 7 ft)	YES	YES
Medium Height Tank (7-13ft)	YES	YES
Tall Tank (> 13 ft)	YES	NO
Inaccurate Region at Top	NO	YES
Inaccurate Region at Bottom	YES	NO
Low Viscosity Fluid	YES	YES
High Viscosity Fluid	NO	YES
Fumes and Dust Present in Tank	YES	NO
Separate Gateway Required	YES	NO
Cellular Communication	YES	YES
Ethernet Communication	YES	NO
AC Power Needed	YES	NO

Repeatability and Accuracy

Repeatability and accuracy are terms often heard in the measurement world. Both are used to describe the quality of the sensor measurement. How do they relate?

Accuracy is how close a measured value is to the actual value. A measurement standard is required to determine accuracy.

Repeatability is how well the measured value is reproduced under the same conditions. Often, repeatability is more important than accuracy, since the accuracy error can be consistently accounted for.

TankScan products have better than 1% accuracy and repeatability. Units are calibrated and tested before they leave the factory.

204-0006-000 Rev. A 6/17

ATEK Access Technologies
10025 Valley View Road, Ste. 190
Eden Prairie, MN 55344 U.S.A.

PH: 1.800.523.6996
FAX: 1.800.589.3705
+1.218.829.9797

www.atekaccess.com

Access Technologies

Access the power of technology.