

Veega

A practical guide to veega, covering the reader intent, the relationship to veega, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



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In the landscape of industrial automation, precision in level measurement is not merely a requirement for operational efficiency but a cornerstone of safety and environmental compliance. The term *veega* has become synonymous with high-performance level sensing solutions, particularly in the realm of radar and ultrasonic technologies. For process engineers and procurement specialists, understanding the nuances of these technologies is essential for selecting the right instrument for complex applications ranging from chemical processing to wastewater treatment.

Industrial level measurement involves a variety of physical principles, each suited to specific media, vessel geometries, and environmental conditions. This guide examines the core technologies utilized in modern industrial settings, providing a technical foundation for those evaluating *veega*-class instrumentation.

| Understanding Level Measurement Principles

Before selecting a specific sensor, it is critical to understand the physics behind the measurement. Level measurement is generally categorized into point level detection (determining if a material has reached a specific height) and continuous level measurement (providing a real-time tracking of the level throughout the vessel's range).

| Radar Level Measurement (ToF)

Radar level transmitters operate on the Time-of-Flight (ToF) principle. The sensor emits an electromagnetic pulse or a continuous wave (FMCW) from the antenna. This signal travels at the speed of light, reflects off the surface of the medium, and returns to the receiver. The distance (d) is calculated using the formula:

$$d = \frac{c \times t}{2}$$

Where:

c is the speed of light.

t is the measured transit time.

High-frequency radar, often associated with veega standards, typically operates at 26 GHz or 80 GHz. The 80 GHz frequency allows for a much narrower beam angle, which is crucial for avoiding internal tank obstructions like agitators, heating coils, or ladders.

| Ultrasonic Level Measurement

Ultrasonic sensors function similarly to radar but use sound waves instead of electromagnetic waves. A transducer emits an ultrasonic pulse that reflects off the product surface. The speed of sound is significantly slower than the speed of light and is highly dependent on the air temperature within the vessel. Therefore, most ultrasonic sensors include an integrated temperature probe to compensate for variations in the speed of sound ($v \approx 331.5 + 0.6T$, where T is temperature in Celsius).

| Hydrostatic Pressure Measurement

This method relies on the principle that the pressure at the bottom of a liquid column is proportional to the height of the liquid and its specific gravity. The formula used is $P = \rho gh$, where P is pressure, ρ is density, g is gravity, and h is the height of the liquid. This is a reliable method for vented tanks but requires differential pressure measurement for pressurized vessels.

| Radar Level Measurement: The Industry Standard

Radar technology has largely displaced other methods in high-accuracy applications due to its non-contact nature and immunity to changes in vapor composition, pressure, and temperature. When evaluating veega-style radar sensors, two main types are considered:

1. **Non-Contact Radar:** These sensors are mounted at the top of the tank. They are ideal for corrosive media or applications where hygiene is paramount, as the instrument never touches the product. They are effective for both liquids and bulk solids.

2. Guided Wave Radar (GWR): GWR uses a probe (cable or rod) to guide the microwave signal to the surface. This is particularly effective for liquids with low dielectric constants (ϵ_r) or in applications with heavy foam, as the probe concentrates the signal energy.

| The Importance of Dielectric Constants

The reflectivity of a radar signal depends on the dielectric constant of the medium. Water has a high dielectric constant ($\epsilon_r \approx 80$), making it an excellent reflector. Hydrocarbons, however, have much lower values ($\epsilon_r \approx 1.7$ to 4), which may require more sensitive electronics or guided wave technology to ensure a reliable return signal.

| Ultrasonic Level Sensors for Open and Closed Systems

Ultrasonic technology remains a cost-effective solution for many water and wastewater applications. Because sound waves require a medium (air or gas) to travel, they cannot be used in a vacuum.

Key considerations for ultrasonic use include:

Foam: Heavy foam can absorb the ultrasonic pulse, leading to signal loss.

Dust and Vapors: High concentrations of dust in silos or heavy steam in tanks can attenuate the sound wave.

Dead Zone: Every ultrasonic sensor has a "blocking distance" or dead zone directly beneath the transducer where measurements cannot be taken. This must be factored into the tank design to prevent overfilling.

Selection Criteria for Industrial Level Instrumentation

Choosing between different technologies requires a systematic evaluation of the process environment. The following table provides a general comparison of common industrial level measurement technologies.

Technology	Media Type	Temperature Range	Pressure Range	Accuracy	Ideal Use Case
80GHz Radar	Liquid/Solid	-40 to 450°C	Up to 160 bar	±1 mm	Narrow tanks with obstructions
26GHz Radar	Liquid	-40 to 250°C	Up to 40 bar	±3 mm	General chemical storage
Ultrasonic	Liquid/Slurry	-40 to 80°C	Up to 3 bar	±0.25%	Water treatment, open channels
Hydrostatic	Liquid	-20 to 100°C	N/A	±0.5%	Deep wells, vented water tanks
Magnetic Gauge	Liquid	-196 to 400°C	Up to 300 bar	±5 mm	High-pressure boilers, toxic media

When reviewing options for your specific facility, you can Review product options and application support to find the exact match for your technical requirements.

Installation Best Practices and Considerations

Even the most advanced veega-class sensor will fail to perform if installed incorrectly. Engineering teams must adhere to strict installation guidelines to maintain accuracy and longevity.

| Nozzle Geometry

For radar and ultrasonic sensors, the nozzle should be as short and wide as possible. If the nozzle is too narrow or too long, the signal may reflect off the nozzle walls before reaching the product, creating "ringing" or false echoes. For an 80 GHz radar, nozzle interference is minimized due to the narrow beam, but it remains a factor for lower frequency units.

| Avoiding Obstructions

Sensors should not be installed directly above the filling stream, as the turbulence and the incoming material will disrupt the signal. Furthermore, the beam path should be clear of agitator blades, spray balls, and structural supports. If obstructions are unavoidable, many modern transmitters offer "false signal suppression" software to map out and ignore these static reflections.

| Orientation and Polarization

Radar waves are polarized. Rotating the sensor in its mounting can sometimes help minimize reflections from tank walls. For liquids, the sensor should be mounted perfectly vertical. For solids, a swiveling flange may be required to aim the sensor at the angle of repose of the material.

| Common Limitations and Troubleshooting

No single technology is a "silver bullet" for every application. Understanding limitations is key to preventing process downtime.

1. Condensation: In high-humidity environments, water droplets can form on the sensor face. While radar can often see through thin films of condensation, heavy buildup can cause signal attenuation. Sensors with PTFE-coated antennas or air purge connections are recommended for these cases.

2. Turbulence: Rapidly moving liquid surfaces can scatter the signal. In these instances, a stilling well (a pipe that extends into the liquid) can be used to provide a calm surface for the measurement.

3. Vacuum Conditions: As mentioned, ultrasonic sensors fail in vacuums. Radar is the preferred choice as electromagnetic waves do not require a medium for propagation.

4. Density Changes: Hydrostatic sensors are sensitive to changes in liquid density. If the media concentration or temperature changes significantly, the level reading will drift unless compensated for by a secondary pressure sensor or a density meter.

| Frequently Asked Questions (FAQ)

Q: How does 80 GHz radar differ from 26 GHz radar in practical terms?

A: The primary difference is the beam angle. An 80 GHz radar typically has a beam angle of about 3 to 6 degrees, whereas a 26 GHz radar may have an angle of 10 to 20 degrees. The narrower beam of the 80 GHz unit allows it to be used in taller, narrower vessels and makes it much easier to avoid internal obstructions.

Q: Can veega-style sensors be used for both liquids and solids?

A: Yes, but the configuration differs. Solids measurement requires sensors capable of handling low-reflectivity surfaces and the dust generated during filling. Radar is generally superior to ultrasonic for solids due to its ability to penetrate dust clouds.

Q: What maintenance is required for non-contact level meters?

A: Maintenance is minimal because there are no moving parts. However, periodic inspection of the antenna or transducer face for buildup or corrosion is recommended. Many digital transmitters now include self-diagnostic features that alert operators to signal degradation before a failure occurs.

Q: Is it necessary to recalibrate sensors after installation?

A: Most modern digital sensors are pre-calibrated at the factory. However, a "zero-point" calibration and a span check are usually performed during commissioning to account for the specific mounting height and tank geometry.

| Conclusion

Selecting a level measurement solution requires a deep dive into the physical properties of the process and the technical capabilities of the instrument. Whether you are looking for the high-frequency precision often associated with veega or a robust hydrostatic transmitter for water management, the priority should always be reliability and data integrity. For a comprehensive overview of available technologies and to consult with application engineers, visit the Main Page to explore professional-grade measurement instruments tailored for industrial automation.