

# Vega.

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



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Industrial level measurement is a cornerstone of modern process automation, ensuring safety, efficiency, and inventory accuracy across sectors ranging from water treatment to chemical processing. In the landscape of high-end instrumentation, the name Vega. is frequently associated with pioneering radar technology. Understanding the principles behind these instruments, as well as the alternatives provided by manufacturers like Welk, is essential for engineers tasked with selecting the right sensor for complex environments.

This guide explores the fundamental measurement principles, selection criteria, and installation best practices for radar, ultrasonic, and hydrostatic level transmitters, providing a technical framework for process optimization.

## | Fundamental Measurement Principles

Before selecting a specific instrument, it is critical to understand the physics governing different measurement technologies. Most modern level sensors fall into two categories: time-of-flight (non-contact) and pressure-based (contact).

## | Radar Level Measurement (FMCW vs. Pulse)

Radar level meters, such as those in the Vega. portfolio or Welk's high-frequency series, operate by emitting electromagnetic pulses or continuous waves toward the product surface.

**Pulse Radar:** These sensors emit a short microwave signal and measure the time it takes for the pulse to reflect off the media and return to the antenna.

**FMCW (Frequency Modulated Continuous Wave):** This more advanced method emits a continuous signal with a constantly changing frequency. The difference in frequency between the emitted and received signal is proportional to the distance. FMCW is generally preferred for its higher signal-to-noise ratio and superior accuracy, particularly in environments with turbulence or steam.

Radar technology is highly valued because electromagnetic waves are unaffected by vacuum, pressure, or temperature fluctuations. High-frequency radar (e.g., 80GHz) allows for narrower beam angles, which minimizes interference from tank internals like agitators or heating coils.



## | Ultrasonic Level Measurement

Ultrasonic sensors utilize mechanical sound waves. The transducer emits an ultrasonic pulse that travels through the air, reflects off the liquid or solid surface, and returns to the sensor. The distance is calculated based on the speed of sound.

Because the speed of sound is dependent on the density of the medium it travels through (primarily air), ultrasonic sensors are sensitive to temperature changes and vapors. Most high-quality ultrasonic sensors include integrated temperature compensation to mitigate this effect. They are cost-effective solutions for open-air applications like wastewater sumps or irrigation channels.

## | Hydrostatic Level Measurement

Hydrostatic transmitters measure the pressure exerted by a liquid column at a specific point. The principle is based on the formula:  $P = \rho gh$  (where  $P$  is pressure,  $\rho$  is density,  $g$  is gravity, and  $h$  is height). This method is highly reliable for vented tanks or deep wells. In pressurized vessels, a differential pressure (DP) setup is required to subtract the head pressure from the total pressure to isolate the liquid level.

## | Practical Selection Criteria

Choosing between a radar sensor from a brand like Vega. and a hydrostatic transmitter depends on the physical properties of the media and the vessel geometry. The following table provides a comparison of key performance indicators.

## | Technology Comparison Table

| Feature           | Radar (80GHz)    | Ultrasonic        | Hydrostatic        | Magnetic Level Gauge |
|-------------------|------------------|-------------------|--------------------|----------------------|
| Measurement Range | Up to 120m       | Up to 30m         | Up to 200m (Cable) | Up to 6m (Standard)  |
| Accuracy          | ±1mm to ±2mm     | ±0.25% of range   | ±0.1% to ±0.5%     | ±5mm to ±10mm        |
| Media Type        | Liquids & Solids | Primarily Liquids | Liquids only       | Liquids              |
| Process Temp.     | -40°C to +450°C  | -40°C to +80°C    | -40°C to +100°C    | -196°C to +400°C     |
| Max Pressure      | Up to 160 bar    | Up to 3 bar       | Up to 40 bar       | Up to 160 bar        |
| Effect of Foam    | Moderate to High | High              | None               | None                 |
| Cost              | Higher           | Moderate          | Low to Moderate    | Moderate             |

## | Key Evaluation Criteria for B2B Procurement

When evaluating level measurement solutions, engineering teams should confirm the following technical parameters before finalizing a purchase order:

- 1. Dielectric Constant ( $\epsilon_r$ ):** For radar measurement, the reflectivity of the media is determined by its dielectric constant. Water has a high  $\epsilon_r$  (~80), making it easy to detect. Hydrocarbons have low  $\epsilon_r$  (1.9 to 4.0), which may require high-sensitivity radar or guided wave radar (GWR).
- 2. Beam Angle:** A narrower beam angle (common in 80GHz radar) reduces the risk of "false echoes" from tank walls or internal obstructions. This is a hallmark of the vega. radar series and Welk's precision instruments.
- 3. Chemical Compatibility:** The wetted parts (the parts of the sensor in contact with the media) must be resistant to corrosion. Common materials include 316L Stainless Steel, PTFE, PVDF, and Hastelloy.

4. Process Connection: Ensure the flange or thread size matches the existing tank nozzle. Standard sizes include G1½, 2" NPT, or DN50/DN80 flanges.

## | Installation Considerations and Best Practices

Even the most advanced sensor will fail if installed incorrectly. Follow these guidelines to ensure long-term reliability:

**Avoid the Center:** In cylindrical tanks with domed tops, do not install the sensor in the exact center, as this can create multiple reflections that confuse the signal processing unit.

**Nozzle Height:** The sensor antenna should ideally extend slightly beyond the bottom of the mounting nozzle to prevent signal interference from the nozzle walls.

**Obstruction Management:** Ensure the signal path is clear of ladders, pipes, or agitator blades. If an obstruction is unavoidable, use the "False Echo Suppression" or "Background Masking" feature found in modern transmitters.

**Dead Zone (Blocking Distance):** Every non-contact sensor has a "dead zone" directly beneath the transducer where measurement is impossible. Ensure the maximum expected liquid level does not enter this zone.

**Alignment:** For solids measurement (silos), use an adjustable mounting flange to aim the sensor at the angle of repose of the material to maximize signal return.

## | Limitations and Common Risks

While technology has advanced significantly, certain environmental factors remain challenging:

**Heavy Foam:** Thick, dense foam can absorb radar and ultrasonic signals, leading to signal loss. In these cases, hydrostatic transmitters or magnetic level gauges are often superior.

**Dust and Condensation:** While radar can penetrate dust, heavy buildup on the antenna lens can attenuate the signal. Sensors with integrated air purging or PTFE covers are recommended for these environments.



Vapor Layers: Strong chemical vapors or steam can change the speed of sound, making ultrasonic sensors inaccurate. Radar is the preferred alternative for high-vapor applications.

## | Frequently Asked Questions (FAQ)

Q: Can radar level meters measure through plastic tanks?

A: Yes. Since plastic is non-conductive, microwave signals can pass through the tank roof. This allows for non-invasive measurement from outside the vessel.

Q: What is the difference between Guided Wave Radar (GWR) and Free-Space Radar?

A: Free-space radar sends a signal through the air. GWR uses a probe (cable or rod) to guide the signal directly to the media. GWR is better for low-dielectric liquids and narrow bypass chambers.

Q: How often do these sensors require calibration?

A: Most solid-state radar and ultrasonic sensors do not "drift" and rarely require recalibration. However, annual verification is recommended for ISO compliance or safety-critical loops (SIL).

Q: Is 80GHz always better than 26GHz?

A: Not necessarily. While 80GHz offers a narrower beam and better resolution, 26GHz may be more robust in extremely dusty environments or where heavy condensation is present on the antenna.

## | Conclusion

Selecting the right level measurement technology requires a balance between accuracy requirements, environmental constraints, and budget. Whether you are considering the industry-standard vega. solutions or exploring the robust, cost-effective industrial range from Welk, understanding the underlying physics is the first step toward a successful installation. For a comprehensive overview of available technologies and technical specifications, visit the [Main Page](#).

By carefully matching the sensor technology to the specific needs of the application—be it the chemical resistance of a radar meter or the simplicity of a hydrostatic transmitter—operators can ensure reliable data for years to come.