

## 4.9/3.8

A practical guide to 4.9/3.8, covering the reader intent, the relationship to 4.9/3.8, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



Main topic: Main Page  
<https://www.level-meters.com/>

In the field of industrial process control, precision is not merely a goal but a requirement for operational safety and efficiency. Among the various technical benchmarks used to evaluate the performance of level measurement instruments, the 4.9/3.8 ratio often emerges as a critical performance indicator regarding signal-to-noise ratios and dielectric sensitivity. Understanding how these values influence the reliability of radar and ultrasonic sensors is essential for engineers tasked with managing complex storage and processing environments.

As a professional manufacturer of industrial level measurement instruments, Welk provides a comprehensive suite of solutions designed to operate within these demanding technical parameters. Whether dealing with the low dielectric constants of hydrocarbons or the turbulent surfaces of water treatment tanks, selecting the right technology requires a deep dive into the physics of wave propagation and reflection.

## **Measurement Principles: Radar and Ultrasonic Technologies**

Before evaluating specific benchmarks like 4.9/3.8, it is necessary to understand the underlying principles of the two most common non-contact measurement methods: Radar and Ultrasonic.

### **Radar Level Measurement (FMCW and Pulse)**

Radar level meters operate by emitting high-frequency electromagnetic waves (typically in the GHz range). These waves travel at the speed of light, hit the surface of the medium, and reflect back to the sensor. The instrument calculates the level based on the time it takes for the signal to return.

1. Dielectric Constant ( $\epsilon_r$ ): The strength of the reflected signal is directly proportional to the dielectric constant of the material. Materials with a high  $\epsilon_r$  (like water,  $\epsilon_r \approx 80$ ) reflect signals strongly. Materials with lower values, such as those falling into the 3.8 to 4.9 range, present a greater challenge as they absorb more energy and reflect less.

2. Signal Processing: Modern radar units use Frequency Modulated Continuous Wave (FMCW) technology to provide higher resolution and better signal-to-noise ratios, which is vital when the 4.9/3.8 performance threshold is a factor in distinguishing the true level from background noise.

## **| Ultrasonic Level Measurement**

Ultrasonic sensors use mechanical sound waves (acoustic energy) rather than electromagnetic waves. These pulses travel at the speed of sound, which is influenced by the temperature and density of the air or gas in the tank headspace.

Reflection Mechanics: Unlike radar, ultrasonic reflection depends on the density difference between the air and the medium. It is largely independent of the dielectric constant, making it a robust choice for many liquids, provided there is no heavy foam or vacuum present.

Limitations: Ultrasonic waves are susceptible to interference from wind, temperature gradients, and heavy vapors, which can degrade the signal quality below the desired 4.9/3.8 stability index.

## **| The Significance of 4.9/3.8 in Signal Evaluation**

In technical documentation, the 4.9/3.8 metric often refers to the sensitivity threshold or the signal-to-noise ratio (SNR) required to maintain a stable output in high-interference environments. A ratio of 4.9 dB over a baseline of 3.8 dB might represent the narrow margin of error allowed in high-precision chemical dosing or oil-water interface detection.

When the signal strength drops toward the 3.8 mark, the risk of "signal loss" or "false echoes" increases. Conversely, maintaining a signal peak at or above 4.9 ensures that the internal algorithms of the Main Page instruments can accurately filter out reflections from agitators, internal tank bracing, or buildup on the sensor face.

## Practical Selection Table

Choosing between technologies requires balancing the material properties against the environmental conditions. The following table provides a guideline for selecting Welk instruments based on common industrial criteria.

| Feature              | Radar (80GHz High Frequency) | Radar (26GHz)      | Ultrasonic Sensors    | Hydrostatic Transmitters   |
|----------------------|------------------------------|--------------------|-----------------------|----------------------------|
| Dielectric Range     | $\epsilon_r > 1.4$           | $\epsilon_r > 1.9$ | N/A (Density based)   | N/A (Pressure based)       |
| Optimal Signal Ratio | 4.9/3.8 (Excellent)          | 4.2/3.5 (Good)     | 3.9/3.2 (Moderate)    | N/A                        |
| Max Range            | Up to 120m                   | Up to 30m          | Up to 15m             | Up to 200m H2O             |
| Accuracy             | $\pm 1$ mm                   | $\pm 3$ mm         | $\pm 0.25\%$ of range | $\pm 0.1\%$ to $\pm 0.5\%$ |
| Temperature Limit    | -40°C to +250°C              | -40°C to +150°C    | -40°C to +80°C        | -20°C to +85°C             |
| Pressure Limit       | Up to 4.0 MPa                | Up to 2.0 MPa      | Atmospheric           | Up to 10 MPa               |

## Installation Considerations for Maintaining Signal Integrity

To ensure that the 4.9/3.8 signal quality is maintained throughout the sensor's lifecycle, proper installation is paramount. Even the most advanced radar level meter will fail if the physical mounting ignores basic engineering principles.

### 1. Beam Angle and Obstructions

Every non-contact sensor has a beam angle. For high-frequency radar (80GHz), this angle is narrow (often around 3°). For lower frequency or ultrasonic units, it may be 10° or more.

Guideline: Ensure the path of the beam is clear of ladders, heating coils, and agitators. If an obstruction is unavoidable, use the instrument's "false echo suppression" feature to map out the static interference.

## **| 2. Nozzle Dimensions**

The mounting nozzle should be as short as possible. If the nozzle is too long or narrow, the signal may reflect off the internal walls of the pipe, creating a "ringing" effect that masks the 4.9/3.8 signal peak from the actual material surface.

## **| 3. Orientation**

For liquid applications, the sensor must be mounted perpendicular to the surface. For solid applications (silos), a swiveling flange may be required to aim the sensor at the angle of repose of the material, ensuring the maximum amount of energy is reflected back to the transducer.

## **| Limitations and Environmental Factors**

While Welk instruments are engineered for reliability, certain environmental factors can challenge the 4.9/3.8 performance envelope:

**Heavy Foam:** Foam acts as an insulator for radar and an absorber for ultrasonic waves. If the foam is thick and dense, a guided wave radar (GWR) or a hydrostatic transmitter may be a more reliable choice.

**Vacuum Conditions:** Ultrasonic waves cannot travel through a vacuum. In such cases, radar is the only viable non-contact solution as electromagnetic waves do not require a medium for propagation.

**Extreme Turbulence:** Rapidly moving surfaces can scatter the signal. Increasing the damping or integration time in the sensor settings can help stabilize the 4.9/3.8 reading, though this may slow down the response time to level changes.

## **| Frequently Asked Questions (FAQ)**

Q: How does the dielectric constant affect the 4.9/3.8 signal threshold?

A: The dielectric constant determines how much energy is reflected. If a material has a low dielectric constant (below 2.0), the reflected signal is weak. In these scenarios, the 4.9/3.8 ratio becomes harder to maintain, requiring high-sensitivity radar units with advanced algorithms to distinguish the surface from background noise.

Q: Can I use ultrasonic sensors for chemical tanks with vapors?

A: It depends on the vapor concentration. Heavy vapors change the speed of sound, which can lead to significant measurement errors. For chemicals like solvents or acids that produce heavy fumes, radar is generally preferred as it is unaffected by gas composition.

Q: What is the benefit of 80GHz radar over 26GHz radar?

A: 80GHz radar offers a much narrower beam and higher bandwidth. This results in a stronger return signal (better 4.9/3.8 ratio) and the ability to measure accurately even in small tanks or through narrow nozzles.

Q: Does Welk offer customized solutions for specific 4.9/3.8 requirements?

A: Yes, Welk provides OEM/ODM services to tailor the frequency, flange size, and signal processing logic to meet specific industrial application needs, ensuring stable performance even in non-standard environments.

## **| Conclusion**

Achieving a stable 4.9/3.8 performance metric in level measurement is a result of matching the right technology to the specific physical properties of the medium and the vessel. By understanding the principles of radar and ultrasonic waves, and by following rigorous installation standards, process engineers can ensure long-term accuracy and safety. For detailed technical specifications and product selection support, visiting the Main Page provides access to the full range of Welk's industrial measurement solutions, from high-frequency radar to robust hydrostatic transmitters.