

Wg21

A practical guide to wg21, covering the reader intent, the relationship to wg21, 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 field of industrial automation, the WG21 series represents a significant advancement in non-contact level measurement technology. Specifically designed as a high-frequency radar level transmitter, the WG21 utilizes 80GHz technology to provide precision and reliability in environments where traditional ultrasonic or lower-frequency radar sensors often struggle. This guide explores the engineering principles, selection criteria, and installation best practices for the WG21 to assist process engineers in optimizing their level monitoring systems.

| Measurement Principles of WG21 Radar Level Meters

The WG21 operates on the Frequency Modulated Continuous Wave (FMCW) principle. Unlike pulse radar, which measures the time-of-flight of a single microwave pulse, FMCW radar transmits a continuous signal with a frequency that increases linearly over time (a frequency sweep or "chirp").

When the transmitted signal reaches the surface of the medium, it is reflected back to the sensor's antenna. Because the transmitter is constantly sweeping the frequency, there is a distinct frequency difference between the signal currently being transmitted and the signal that has just returned. This difference, known as the beat frequency, is directly proportional to the distance between the sensor and the material surface.

| The 80GHz Advantage

The most defining characteristic of the WG21 is its 80GHz operating frequency. In radar physics, the beam angle is inversely proportional to the frequency and the antenna diameter. By utilizing the 80GHz band, the WG21 achieves a much narrower beam angle (typically as small as 3°) compared to standard 26GHz radar (which may have a beam angle of 10° or more).

This narrow beam provides several engineering advantages:

1. **Reduced Interference:** The signal is less likely to hit internal tank obstructions such as agitators, heating coils, or ladders.
2. **Small Nozzle Installation:** The high frequency allows for smaller antenna designs, enabling the WG21 to be installed on narrow nozzles without compromising signal quality.

3. High Precision: The wider bandwidth available at 80GHz allows for higher range resolution, resulting in measurement accuracy often reaching ± 1 mm.

Technical Specifications and Performance Characteristics

The WG21 is engineered for versatility across various industrial media, including liquids, slurries, and bulk solids. Its performance is characterized by its ability to penetrate dust and ignore steam, making it a robust choice for heavy industrial use.

Key Performance Metrics

Measurement Range: Typically up to 120 meters (approx. 393 feet), depending on the dielectric constant of the material.

Accuracy: ± 1 mm to ± 2 mm under reference conditions.

Frequency Range: 76 GHz to 81 GHz.

Beam Angle: 3° to 8° depending on the antenna type and size.

Process Temperature: Standard models handle -40°C to +80°C, with high-temperature variants reaching up to +200°C.

Process Pressure: -0.1 MPa to 2.0 MPa (Standard), with specialized flanges for higher pressure ratings.

For engineers evaluating these units, Welk provides a comprehensive range of configurations to suit specific chemical compatibilities and physical constraints. You can Review product options and application support to match these specifications to your specific facility requirements.

Practical Selection Criteria for WG21 Series

Selecting the correct WG21 configuration requires an analysis of the medium’s physical properties and the vessel's geometry. The following table outlines the primary selection factors for common industrial applications.

WG21 Selection Reference Table

Application Type	Recommended Antenna	Process Connection	Key Consideration
Corrosive Liquids	PTFE Sealed Lens	Threaded or Plastic Flange	Chemical resistance of the wetted parts is critical.
Bulk Solids/Silos	Stainless Steel Lens	Universal Flange	Dust penetration and beam angle to avoid wall reflections.
Small Tanks/Buffer Vessels	Compact Lens	G1½ Thread	Minimizing the blind zone and fitting into tight spaces.
High-Temp Processes	Extended Air Purge	Stainless Steel Flange	Cooling the electronics and preventing condensation on the lens.
Water Treatment	Standard Lens	Bracket or Flange	Cost-effectiveness and weatherproofing (IP67/IP68).

Material Compatibility

When selecting a WG21 unit, the material of the antenna must be compatible with the process vapors. For highly aggressive acids, a full PTFE (Polytetrafluoroethylene) encapsulation is recommended. For food and beverage applications, 316L stainless steel with a hygienic lens is standard to meet sanitary requirements.

| Installation Considerations and Best Practices

Proper installation is the most critical factor in ensuring the longevity and accuracy of a WG21 radar level meter. Even with 80GHz technology, poor placement can lead to signal loss or false readings.

| Mounting Position

1. **Avoid the Center:** Never install the sensor in the exact center of a circular tank. This can cause multiple reflections to converge at the antenna, leading to signal interference.
2. **Distance from Wall:** Maintain a minimum distance from the tank wall, typically 200 mm or 10% of the tank height, to prevent the beam from reflecting off the wall surface.
3. **Avoid the Inflow:** Do not mount the sensor directly above the material inlet. The falling stream of liquid or solid will interfere with the radar signal and cause erratic readings.

| Orientation and Alignment

The WG21 antenna should be mounted perpendicular to the surface of the medium. In liquid applications, this usually means a vertical orientation. In solids applications where the material forms a conical pile (repose angle), a swiveling flange may be necessary to aim the radar beam at the most representative point of the material surface.

| Nozzle Geometry

While the WG21 handles nozzles better than lower-frequency radars, the nozzle height should ideally be kept short. If a long nozzle is required, ensure the bottom of the antenna lens extends slightly past the bottom of the nozzle to prevent internal reflections within the pipe.

| Limitations and Environmental Factors

While the WG21 is a highly capable instrument, certain physical limitations must be acknowledged during the engineering phase.

| Dielectric Constant (DK)

Radar technology relies on the reflection of electromagnetic waves. Materials with a very low dielectric constant ($DK < 1.4$), such as certain liquefied gases or ultra-pure oils, reflect very little energy. In these cases, a guided wave radar or a larger antenna might be required to capture a sufficient signal.

| Foam and Turbulence

Heavy, dense foam can absorb radar signals rather than reflecting them. If a process involves thick foam (e.g., in certain fermentation or chemical mixing processes), the WG21 may experience signal attenuation. Similarly, extreme surface turbulence can scatter the radar beam. In such instances, using a stilling well or a bypass pipe can provide a calm surface for measurement.

| Condensation and Buildup

Although the 80GHz signal has strong penetration, significant buildup of sticky or conductive material on the lens can eventually degrade the signal. For applications prone to heavy condensation or dust accumulation, the WG21 should be equipped with an air purge connection to periodically clean the lens surface.

| Frequently Asked Questions (FAQs)

Q: Can the WG21 measure through a plastic tank lid?

A: Yes. Because plastic is non-conductive and has a low dielectric constant, radar waves can pass through it. This allows the WG21 to measure the level inside a plastic container without making an opening in the tank, provided the plastic is not too thick or reinforced with metal.

Q: How does the WG21 handle dust in grain silos?

A: The 80GHz frequency is highly effective at penetrating dust. Unlike ultrasonic sensors, which are affected by the density of the air and suspended particles, the WG21's electromagnetic waves are largely unaffected by dust, making it ideal for cement, grain, and coal silos.

Q: What is the "blind zone" of the WG21?

A: The blind zone (or dead zone) is the area immediately below the antenna where measurement is not possible. For the WG21, this is typically very small—often less than 50 mm to 100 mm—but it must be accounted for when the tank is completely full.

Q: Does the WG21 require periodic calibration?

A: Under normal operating conditions, the WG21 does not require routine recalibration because it has no moving parts and the frequency of the oscillator is extremely stable. However, a periodic "zero-point" check is recommended during scheduled maintenance to ensure no significant buildup has occurred on the lens.

| Conclusion

The WG21 radar level meter is a robust solution for modern industrial level measurement, offering a balance of precision, range, and ease of installation. By understanding the FMCW principle and the advantages of the 80GHz frequency band, engineers can significantly improve the reliability of their process data. Whether dealing with corrosive chemicals or dusty solids, the WG21 provides the technical specifications necessary to maintain safety and efficiency. For further technical documentation and to explore the full range of Welk instrumentation, visit the [Main Page](#).