

841/2

A practical guide to 841/2, covering the reader intent, the relationship to 841/2, 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, precise level measurement is a cornerstone of operational efficiency, safety, and inventory management. The 841/2 series represents a sophisticated category of level measurement instruments designed to meet the rigorous demands of modern process industries. Whether managing volatile chemicals, wastewater, or bulk solids, understanding the technical nuances of the 841/2 series is essential for engineers and procurement professionals seeking reliable field instrumentation.

This guide explores the measurement principles, technical specifications, and practical application considerations for the 841/2 series, providing a comprehensive reference for selecting and implementing these devices in diverse industrial environments. For a broader look at available instrumentation, you may visit the Main Page to review product options and application support.

Measurement Principle: High-Frequency FMCW Radar

The 841/2 series primarily utilizes Frequency Modulated Continuous Wave (FMCW) radar technology, typically operating in the high-frequency 80 GHz band. Unlike traditional pulse radar, which measures the time-of-flight of a single microwave pulse, FMCW radar transmits a continuous signal with a frequency that varies over time (a linear frequency sweep or "chirp").

The FMCW Mechanism

1. **Signal Transmission:** The instrument emits a continuous microwave signal toward the medium's surface. The frequency of this signal increases linearly during the sweep.
2. **Reflection and Reception:** The signal reflects off the surface of the liquid or solid and returns to the antenna. Because the transmitter is constantly changing its frequency, there is a measurable difference between the frequency being transmitted at that moment and the frequency of the reflected signal that has just returned.

3. Frequency Difference (Beat Frequency): This frequency difference is directly proportional to the distance the signal traveled. By processing this "beat frequency" through Fast Fourier Transform (FFT) algorithms, the internal electronics calculate the exact distance to the material surface with high precision.

| Advantages of 80 GHz Technology

The high frequency of the 841/2 series allows for a much shorter wavelength compared to older 6 GHz or 26 GHz units. This results in a significantly narrower beam angle—often as low as 3 degrees. A narrow beam is critical for avoiding internal tank obstructions such as agitators, heating coils, and ladders, which can cause false echoes in lower-frequency systems.

| Technical Specifications and Selection Table

Choosing between the 841 and 842 variants depends largely on the physical state of the medium (liquid vs. solid) and the specific process conditions. The following table outlines the typical performance parameters for the 841/2 series.

Feature	841 (Liquid Optimized)	842 (Solid Optimized)
Measurement Range	Up to 30m (98 ft)	Up to 120m (393 ft)
Frequency Range	76 GHz – 81 GHz	76 GHz – 81 GHz
Measurement Accuracy	±2 mm	±5 mm
Beam Angle	3° to 8° (depending on antenna)	3° to 4°
Process Temperature	-40°C to +200°C	-40°C to +250°C
Process Pressure	-0.1 to 4.0 MPa	-0.1 to 0.3 MPa (Atmospheric)
Output Signal	4-20mA / HART / RS485 Modbus	4-20mA / HART / RS485 Modbus
Housing Material	Aluminum or Stainless Steel	Aluminum or Stainless Steel
Antenna Type	Lens Antenna (PTFE/PEEK)	Lens Antenna with Purge Port

When selecting a unit, engineers must confirm the dielectric constant (ϵ_r) of the medium. Materials with a low dielectric constant (e.g., hydrocarbons or dry powders) reflect less energy, potentially requiring a unit with higher sensitivity or a larger antenna to maintain signal integrity.

Industrial Applications: From Water Treatment to Aggressive Chemicals

The 841/2 series is engineered for versatility, finding use in several critical sectors where accuracy is non-negotiable.

| Water and Wastewater Management

In municipal water treatment, 841/2 sensors are used to monitor levels in open channels, wet wells, and chemical storage tanks (such as alum or sodium hypochlorite). The non-contact nature of the radar prevents sensor fouling from raw sewage or corrosive vapors, reducing maintenance cycles compared to hydrostatic or ultrasonic sensors.

| Chemical and Petrochemical Processing

The ability of the 841/2 to operate through plastic or glass windows makes it ideal for highly corrosive or toxic chemicals where the sensor must be isolated from the process. Furthermore, the high-frequency signal is less affected by vapor clouds or temperature gradients within the tank headspace, which often plague ultrasonic measurement devices.

| Bulk Solids and Silo Monitoring

The 842 variant is specifically designed for the challenges of solids measurement, such as dust clouds during filling and uneven material surfaces (slopes and cones). In cement silos or grain elevators, the narrow beam can be aimed precisely at the center of the discharge cone to provide an accurate volume calculation even in narrow, tall structures.

| Installation Engineering and Best Practices

Proper installation is the most significant factor in the long-term reliability of the 841/2 series. Even the most advanced radar can fail if placed incorrectly.

| 1. Positioning and Orientation

Avoid the Center: Do not install the sensor in the exact center of a domed tank, as multiple reflections from the tank walls can converge at the center and interfere with the signal.

Distance from Wall: Maintain a minimum distance from the tank wall (typically 200mm to 500mm) to prevent the beam from clipping the wall surface.

Inlet Interference: Ensure the beam path does not intersect with the filling stream. Material falling through the beam will cause significant signal noise and erratic readings.

| 2. Nozzle Considerations

The nozzle height and diameter are critical. For the 841/2 series, the antenna should ideally extend slightly beyond the bottom of the nozzle to prevent "ringing" or internal reflections within the nozzle neck. If a long nozzle is unavoidable, a unit with a smaller beam angle or a nozzle extension must be used.

| 3. Obstruction Avoidance

Internal structures like agitator blades can be mapped out using "false echo suppression" software. However, it is always better to physically position the sensor where it has a clear line of sight to the product surface throughout the entire measurement range.

| Limitations, Environmental Factors, and Maintenance

While the 841/2 series is robust, certain environmental factors can impact performance.

Heavy Foam: Extremely dense, thick foam can absorb radar signals rather than reflecting them. In applications with heavy foaming, a guided wave radar or a mechanical level gauge may be more appropriate.

Condensation and Buildup: While lens antennas are designed to shed droplets, heavy crystalline buildup or thick mud on the antenna face will eventually attenuate the signal. For these applications, a model with a compressed air purge port is recommended to keep the lens clean.

Dielectric Constant Limits: For materials with a dielectric constant below 1.4, the reflected signal may be too weak for standard non-contact radar. In these cases, increasing the antenna size or utilizing a stilling well can concentrate the signal.

| Maintenance Checklist

Visual Inspection: Check the housing for signs of corrosion or moisture ingress in the terminal compartment.

Signal Quality Check: Periodically review the echo curve via HART or a local display. A decreasing signal-to-noise ratio often indicates buildup on the antenna.

Calibration Verification: Compare the radar reading against a manual dip tape measurement annually to ensure no drift has occurred due to changes in process conditions.

| Frequently Asked Questions (FAQ)

Q: Can the 841/2 measure through a closed plastic tank?

A: Yes. Because microwaves can penetrate non-conductive materials, the 841/2 can measure the level inside a plastic or fiberglass tank without a hole being cut, provided the tank wall is not too thick and does not contain carbon black or metallic reinforcement.

Q: How does the 841/2 handle turbulence?

A: The 841/2 uses advanced signal processing and averaging algorithms to filter out the "noise" caused by surface ripples or turbulence. However, extreme turbulence may require the use of a stilling well to provide a calm surface for measurement.

Q: Is the 841/2 suitable for vacuum applications?

A: Yes, radar technology is unaffected by vacuum because it does not require a medium (like air) to transmit the signal. This is a primary advantage over ultrasonic sensors, which cannot function in a vacuum.

Q: What is the difference between the 841 and 842 in terms of hardware?

A: While they share the same core FMCW technology, the 842 is typically equipped with more powerful signal processing for low-reflectivity solids and often features a gimbal or swiveling flange to aim the beam at the material's angle of repose.

For technical assistance or to request a quote for specific process requirements, professionals are encouraged to consult the Main Page for detailed product documentation and expert support in level measurement technology.