

Radar Level Transmitter Em940

A practical guide to radar level transmitter em940, covering the reader intent, the relationship to radar level transmitter em940, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



level-measurement

Main topic: Radar Level Meters

<https://www.level-meters.com/products/radar-level-meters/>

In the landscape of industrial process control, achieving precise liquid and solid level measurement is critical for operational safety and efficiency. Among the various technologies available, Radar Level Meters have emerged as the gold standard for non-contact measurement. The radar level transmitter EM940 represents a significant advancement in this field, utilizing high-frequency signals to overcome challenges that traditional sensors cannot manage.

This guide explores the underlying principles of radar technology, the specific technical advantages of the EM940 series, and practical considerations for engineering selection and installation in industrial environments.

Understanding the Measurement Principle: FMCW vs. Pulsed Radar

Before evaluating specific hardware like the radar level transmitter EM940, it is essential to understand how radar instruments calculate distance. Industrial radar transmitters generally operate on one of two principles: Pulsed Radar or Frequency Modulated Continuous Wave (FMCW).

Pulsed Radar

Pulsed radar instruments emit a short microwave signal and measure the "Time of Flight" (ToF) required for the pulse to travel to the product surface and return to the sensor. While effective for many applications, pulsed radar can struggle with low-dielectric materials or environments with heavy turbulence.

FMCW Radar (The EM940 Standard)

The radar level transmitter EM940 typically utilizes FMCW technology. Instead of sending a single pulse, the transmitter emits a continuous signal with a constantly changing frequency. As the signal reflects off the medium and returns to the antenna, there is a frequency difference between the emitted and received signals. This frequency shift is directly proportional to the distance.

FMCW offers several advantages over pulsed systems:

Superior Accuracy: The continuous nature of the signal allows for more precise signal processing.

Better Signal-to-Noise Ratio: It can distinguish the true level from background noise caused by tank internals.

Higher Resolution: Ideal for detecting small changes in level in compact vessels.

Technical Profile of the Radar Level Transmitter EM940

The EM940 is specifically designed for high-precision applications, often operating at 80GHz. This high frequency is a defining characteristic that sets it apart from older 6GHz or 26GHz models.

Key Features

- 1. Narrow Beam Angle:** At 80GHz, the EM940 produces a very narrow beam (often as small as 3 degrees). This allows the signal to avoid obstructions like agitators, heating coils, or narrow nozzles.
- 2. Large Dynamic Range:** It can detect weak reflections from materials with low dielectric constants (ϵ_r), such as plastic pellets or certain oils.
- 3. Small Blind Zone:** The EM940 can measure levels very close to the antenna, maximizing the usable volume of the tank.
- 4. Robust Housing:** Designed for harsh environments, including chemical processing and water treatment plants.

Engineering Selection: Comparing Technologies

Choosing the right instrument requires comparing the EM940 against other common level measurement technologies. The following table provides a quick reference for selection criteria.

Feature	Radar Level Transmitter EM940	26GHz Radar	Ultrasonic Sensor	Hydrostatic Transmitter
Measurement Range	Up to 120m	Up to 30m-70m	Up to 15m	Varies by pressure
Beam Angle	~3° - 8°	~10° - 20°	~10°	N/A (Contact)
Accuracy	±1mm to ±2mm	±3mm to ±5mm	±0.25% of range	±0.1% to ±0.5%
Process Temp.	-40°C to +200°C+	-40°C to +150°C	-40°C to +80°C	-40°C to +100°C
Effect of Vapor	Minimal	Low	High	None
Contact Type	Non-contact	Non-contact	Non-contact	Contact

Installation Guidelines for the EM940

Proper installation is paramount to ensuring the accuracy and longevity of the radar level transmitter EM940. Even the most advanced 80GHz radar can fail if the physical placement is incorrect.

1. Nozzle Height and Diameter

Because the EM940 has a narrow beam, it is less sensitive to nozzle interference than lower-frequency radars. However, the antenna should ideally extend slightly below the nozzle or be flush with the tank roof to prevent signal ringing within the nozzle itself.

2. Avoiding Obstructions

While the narrow beam helps avoid internal structures, the transmitter should still be mounted at a distance from the tank wall (typically at least 200mm or 1/6th of the tank diameter) to avoid side-wall reflections. Ensure the signal path is clear of agitator blades, ladders, and inflow streams.

| 3. Orientation and Polarization

The EM940 usually has a polarization marker on the housing. Aligning this marker toward the tank wall can help minimize the impact of interference reflections in horizontal cylindrical tanks or vessels with complex internal geometries.

| 4. Environmental Protection

In outdoor installations, a sunshade is recommended to prevent extreme temperature fluctuations from affecting the electronics. For high-pressure or corrosive chemical applications, ensure the process connection (flange or thread) and the wetted materials (PTFE, PEEK, or Stainless Steel) are compatible with the medium.

| Application Scenarios for the EM940

Welk provides level measurement solutions across various sectors. The radar level transmitter EM940 is particularly effective in the following scenarios:

Chemical Processing: Measuring aggressive acids or bases in tall, narrow storage tanks where internal structures are present. The non-contact nature prevents sensor corrosion.

Water and Wastewater Treatment: Monitoring levels in deep wells, pump stations, or chemical dosing tanks. The EM940 is unaffected by steam, foam (depending on density), or ambient temperature changes that often baffle ultrasonic sensors.

Oil and Gas: Precise inventory management of hydrocarbons. The high accuracy ($\pm 1\text{mm}$) is essential for custody transfer and leak detection.

Solid Bulk Storage: Measuring the level of grain, cement, or plastic powder in silos. The high-frequency signal penetrates dust clouds more effectively than optical or ultrasonic alternatives.

| Limitations and Operational Considerations

Despite its versatility, the radar level transmitter EM940 has limitations that engineers must account for during the design phase:

Dielectric Constant (ϵ_r): Radar relies on the reflection of waves. Materials with extremely low dielectric constants (e.g., liquefied gases with $\epsilon_r < 1.4$) may require a stilling well or a guided wave radar alternative to concentrate the signal.

Heavy Foam: While high-frequency radar can penetrate light foam, extremely dense or thick foam may absorb the radar signal, leading to a "loss of echo" error. In such cases, mechanical float-based systems or hydrostatic sensors may be required.

Surface Turbulence: Extreme boiling or rapid agitation can scatter the radar signal. While the EM940's advanced algorithms can filter much of this out, a stilling well is the most reliable solution for highly turbulent surfaces.

| Maintenance and Troubleshooting

Radar transmitters are generally low-maintenance because they have no moving parts. However, periodic checks are recommended:

1. **Antenna Cleaning:** In applications with heavy condensation or material buildup (like wastewater or viscous chemicals), the antenna face should be inspected. Many EM940 units feature a flat-face design that resists buildup, but manual cleaning with a soft cloth may be necessary if signal strength drops.

2. **Signal Diagnostics:** Modern Radar Level Meters provide echo curves. By analyzing the echo curve via HART or a local display, technicians can identify if an obstruction has moved into the beam path or if the signal is being attenuated by foam.

3. **Power Supply Check:** Ensure the 4-20mA loop or digital bus (Modbus/Profibus) is providing stable voltage. Fluctuations in power can lead to intermittent signal loss.

| Frequently Asked Questions (FAQ)

Q: Can the EM940 measure through a plastic tank roof?

A: Yes. Because radar waves can penetrate non-conductive materials like plastics (PE, PP, PVC) and glass, the EM940 can often measure levels from outside the tank, provided the roof material is not too thick and does not contain metal reinforcement.

Q: Is the EM940 suitable for vacuum applications?

A: Yes. Radar signals do not require a medium (like air) to travel, making them ideal for vacuum tanks where ultrasonic sensors (which require air) would fail.

Q: How does the EM940 handle heavy dust in a silo?

A: The 80GHz frequency is highly effective at penetrating dust. However, in extremely dusty environments, a dust shield or a compressed air purging system may be used to keep the antenna face clear of heavy deposits.

Q: What is the minimum dielectric constant the EM940 can detect?

A: Generally, the EM940 can detect materials with a dielectric constant as low as 1.6 in open applications, and even lower if a stilling well is used.

| Conclusion

The radar level transmitter EM940 is a high-performance instrument that addresses the complexities of modern industrial level measurement. By leveraging 80GHz FMCW technology, it provides the precision, narrow beam focusing, and reliability required for critical applications in water treatment, chemical processing, and beyond. When selecting a transmitter, engineers should prioritize the dielectric properties of the medium and the physical constraints of the vessel to ensure the EM940 delivers its full technical potential.