Burkert Radar Level Transmitter

A practical guide to burkert radar level transmitter, covering the reader intent, the relationship to burkert radar level transmitter, 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 automation, selecting the correct level measurement technology is critical for process safety, efficiency, and inventory management. Among the various non-contact methods available, the burkert radar level transmitter stands out as a sophisticated solution for challenging liquid and solid applications. This guide provides a technical overview of radar measurement principles, an analysis of the Burkert product range, and practical engineering considerations for successful deployment in industrial environments.

Understanding Radar Level Measurement Principles

Before selecting a specific instrument, it is essential to understand the physics governing radar technology. Radar (Radio Detection and Ranging) level transmitters operate on the Time-of-Flight (ToF) principle. The device emits high-frequency electromagnetic waves—typically in the microwave spectrum—which travel at the speed of light, reflect off the surface of the medium, and return to the sensor antenna.

Pulse Radar vs. FMCW

Most modern Radar Level Meters utilize one of two primary modulation techniques:

1. Pulse Radar: The transmitter emits a series of short microwave pulses. The time elapsed between the emission and the reception of the reflected signal is measured to calculate the distance. This method is energy-efficient and suitable for many standard applications.

2. Frequency Modulated Continuous Wave (FMCW): The transmitter emits a continuous signal with a constantly changing frequency (a frequency sweep). The difference in frequency between the emitted signal and the reflected signal is proportional to the distance. FMCW is generally more accurate and provides a better signal-to-noise ratio, making it ideal for complex environments with turbulence or surface foam.

The Role of Frequency

The frequency of the radar signal (measured in GHz) significantly impacts performance. Lower frequencies (approx. 6 GHz to 26 GHz) are less affected by steam or dust but have wider beam angles. Higher frequencies (approx. 80 GHz) provide a much narrower beam, allowing for easier installation in narrow tanks or vessels with internal obstructions like agitators and heating coils.

Overview of the Burkert Radar Level Transmitter Range

Burkert offers several models under their Type 81xx series, each designed for specific process conditions. Below is an analysis of the most common configurations found in chemical, water treatment, and food processing industries.

Type 8136: General Purpose

Designed for continuous level measurement in small to medium-sized vessels. It typically operates at 26 GHz, providing a balance between signal strength and antenna size. It is widely used in water treatment and storage tanks for acids and alkalis.

Type 8137: High-Pressure and High-Temperature

This model is engineered for more demanding process conditions, featuring robust process connections and materials capable of withstanding higher pressures (up to 160 bar) and temperatures. It is frequently employed in chemical reactors and pressurized storage.

Type 8138: Hygienic Applications

Specifically designed for the pharmaceutical and food and beverage industries, the Type 8138 features a flush-mounted antenna and hygienic process connections (such as Tri-Clamp). The materials are FDA-compliant, and the design ensures no dead spaces where bacteria could accumulate.

Type 8139: 80 GHz High-Precision

The Type 8139 utilizes 80 GHz technology. The narrow beam angle (often as small as 3 degrees) allows the transmitter to be mounted close to tank walls or in vessels with significant internal hardware without interference from false echoes.

Technical Selection Criteria

Selecting the right burkert radar level transmitter requires a detailed assessment of the application environment. The following table provides a comparison of key technical specifications to assist in the preliminary selection process.

Selection Table: Comparison of Radar Transmitter Characteristics

Feature	Type 8136	Type 8137	Type 8138	Type 8139
Technology	26 GHz Pulse	26 GHz Pulse	26 GHz Pulse	80 GHz FMCW
Measuring Range	Up to 20 m	Up to 30 m	Up to 30 m	Up to 30 m
Process Temp.	-40 to +80 °C	-40 to +200 °C	-40 to +150 °C	-40 to +200 °C
Process Pressure	-1 to 3 bar	-1 to 160 bar	-1 to 16 bar	-1 to 25 bar
Accuracy	±2 mm	±2 mm	±2 mm	±1 mm
Best Use Case	Water/Waste	Chemical/Oil	Food/Pharma	Narrow Tanks/Agitators

Critical Engineering Considerations

Dielectric Constant (dk)

The dielectric constant of the medium is the most critical factor in radar measurement. It determines how much energy is reflected back to the sensor. Materials with high dielectric constants (e.g., water, dk ≈ 80) reflect signals strongly. Materials with low dielectric constants (e.g., hydrocarbons, dk < 2) reflect very little energy, requiring more sensitive electronics or larger antennas to ensure a reliable reading.

Beam Angle and False Echoes

The beam angle determines the "footprint" of the radar signal at the surface of the liquid. If the beam hits internal obstructions like ladders, pipes, or agitator blades, it creates false echoes. While modern software can "map out" these static reflections, it is always better to install the transmitter in a location where the signal path is clear. The 80 GHz transmitters are particularly useful here because their narrow beam minimizes contact with tank internals.

Blocking Distance (Dead Band)

Every radar transmitter has a "blocking distance" or "dead band" immediately below the antenna (typically 50 mm to 200 mm). In this zone, the device cannot accurately measure the level. Engineers must ensure that the maximum expected liquid level does not enter this zone to avoid signal loss or erratic readings.

Installation Guidelines

To ensure the longevity and accuracy of a burkert radar level transmitter, follow these installation best practices:

1. Nozzle Height: The antenna should ideally extend slightly beyond the mounting nozzle to prevent reflections from the nozzle walls. If the nozzle is very long, a higher frequency (80 GHz) unit is recommended.

2. Orientation: The transmitter should be mounted vertically, perpendicular to the liquid surface. For solids (silos), an aiming flange may be required to point the beam at the angle of repose.

3. Avoid the Center: Do not mount the transmitter in the exact center of a domed tank, as this can focus unwanted reflections back to the sensor. Position it at approximately 1/3 of the tank radius.

4. Inflow Interference: Ensure the radar beam does not cross the path of the incoming product stream, as the falling liquid or granules will cause significant signal interference.

Limitations and Common Risks

While radar is a highly versatile technology, it is not a universal solution. Engineers should be aware of the following limitations:

Heavy Foam: Extremely thick, dense foam (like shaving cream) can absorb the radar signal entirely, leading to a "loss of echo." In such cases, a guided wave radar or a hydrostatic pressure sensor might be more appropriate.

Vessel Material: Radar cannot see through metal tanks. For plastic or fiberglass tanks, it is possible to measure from the outside looking in, provided the material is not conductive and the signal loss is accounted for.

Extreme Turbulence: Rapidly moving surfaces can scatter the radar signal. While software filtering helps, severe turbulence may require the use of a stilling well to provide a calm surface for measurement.

Frequently Asked Questions (FAQ)

Q: Can a burkert radar level transmitter be used for solids?

A: Yes, models like the Type 8137 and 8139 are capable of measuring bulk solids. However, the dielectric constant and the dust levels during filling must be considered. 80 GHz models are generally preferred for solids due to their superior signal focus.

Q: How does condensation affect the measurement?

A: Condensation on the antenna can attenuate the signal. Many Burkert transmitters feature encapsulated antennas or PTFE covers designed to shed droplets. In extreme cases, an air purge connection can be used to keep the antenna face clean.

Q: Is calibration required on-site?

A: Most units are pre-calibrated from the factory. However, "teaching" the unit the specific tank geometry (false echo suppression) is a standard part of the commissioning process to ensure accuracy in complex vessels.

Q: What is the difference between 2-wire and 4-wire versions?

A: 2-wire transmitters are loop-powered (the signal and power share the same wires), which simplifies wiring. 4-wire transmitters have separate power and signal lines, often providing more power for signal processing in very difficult applications.

Conclusion

The implementation of a burkert radar level transmitter offers a high-precision, low-maintenance solution for industrial level monitoring. By understanding the relationship between frequency, dielectric constants, and tank geometry, engineers can select a device that provides reliable data even in volatile or hygienic environments. For applications requiring specialized configurations or alternative technologies, exploring a broader range of Radar Level Meters can ensure the optimal fit for specific process requirements.