

Polagra

A practical guide to polagra, covering the reader intent, the relationship to polagra, 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 international trade fairs, Polagra stands as a cornerstone for the food and beverage industry, particularly in Central and Eastern Europe. Comprising specialized sectors such as Polagra Food and Polagra Tech, this event serves as a critical platform for showcasing advancements in food processing, packaging, and industrial automation. For engineering professionals and plant managers attending or following the developments at Polagra, the integration of precise level measurement technology is a recurring theme. Accurate monitoring of ingredients, finished products, and waste streams is essential for maintaining the high standards of efficiency and hygiene required in modern food production.

Industrial level measurement is not a one-size-fits-all solution. The diverse range of materials encountered in the food industry—from viscous liquids like chocolate and oils to granular solids like grain and sugar—requires a nuanced understanding of different measurement principles. This guide explores the core technologies used in industrial level sensing, their application within the food sector, and the selection criteria necessary for optimizing process control.

| Measurement Principles and Technology Overview

Before selecting a level meter for a food processing environment, it is vital to understand the physics behind the measurement. The most common technologies deployed in these settings include radar, ultrasonic, and hydrostatic level sensors.

| Radar Level Measurement (FMCW)

Radar level meters, particularly those utilizing Frequency Modulated Continuous Wave (FMCW) technology, are widely regarded as the gold standard for high-precision applications. These instruments emit a continuous radar signal with a constantly changing frequency. The signal reflects off the surface of the medium and returns to the sensor. The frequency difference between the emitted and received signal is proportional to the distance.

In the context of the food industry, 80GHz radar technology is increasingly popular. The high frequency allows for a narrower beam angle, which is crucial when measuring in small tanks or vessels with internal obstructions like agitators and heating coils. Radar is non-contact, meaning the sensor does not touch the medium, significantly reducing the risk of contamination—a primary concern for exhibitors and visitors at Polagra.

| Ultrasonic Level Sensors

Ultrasonic sensors operate on the Time-of-Flight (ToF) principle. The sensor emits an ultrasonic pulse that travels through the air, hits the surface of the material, and reflects back. By measuring the time taken for the round trip and knowing the speed of sound, the device calculates the distance to the product level.

While cost-effective, ultrasonic sensors are sensitive to environmental factors. The speed of sound changes with air temperature, requiring integrated temperature compensation. Furthermore, heavy foam, steam, or dust can absorb or scatter the sound waves, leading to signal loss. These are best suited for stable liquid applications or simple bulk solid monitoring where high-precision radar may be over-engineered.

| Hydrostatic Level Transmitters

Hydrostatic measurement is based on the principle that the pressure at the bottom of a tank is directly proportional to the height of the liquid column above it. The formula used is $P = \rho \cdot g \cdot h$, where P is pressure, ρ is the density of the liquid, g is gravity, and h is the height.

In food processing, hydrostatic sensors must feature flush-mounted diaphragms to prevent the buildup of bacteria in recesses. These sensors are highly reliable for vented tanks and are often used for measuring the level of milk, juices, and other homogeneous liquids. However, if the density of the liquid changes (e.g., due to temperature fluctuations or varying recipes), the sensor must be recalibrated to maintain accuracy.

Selection Criteria for Food and Beverage Environments

When evaluating technology at events like Polagra Tech, engineers must look beyond basic functionality. The food industry imposes strict regulatory and operational requirements that dictate the choice of instrumentation.

Hygienic Design and Materials

All instruments in contact with food products must adhere to sanitary standards. This typically involves the use of stainless steel 316L for wetted parts and high-grade plastics like PTFE or PEEK for sensor faces. The surface finish (Ra value) must be smooth enough to prevent microbial growth, usually requiring an $Ra < 0.8 \mu\text{m}$. Instruments should ideally be certified by bodies such as EHEDG or 3-A.

Resistance to CIP and SIP Processes

Clean-in-Place (CIP) and Sterilization-in-Place (SIP) are standard procedures in food plants. Level meters must be able to withstand high temperatures (often up to 140°C for SIP) and aggressive chemical cleaning agents (caustics and acids). An IP69K rating is often necessary to ensure the sensor housing can withstand high-pressure, high-temperature washdowns.

Process Conditions

Agitation: Many food processes involve mixing. Radar sensors with advanced signal processing can filter out "noise" created by agitator blades.

Foam: In brewing or dairy processing, foam is common. While radar can often penetrate light foam, heavy or dense foam may require specific frequencies or alternative technologies like guided wave radar (GWR).

Pressure and Vacuum: Some tanks operate under pressure or vacuum, which can affect the performance of certain sensors, particularly those relying on air-filled spaces like ultrasonic units.

Technical Selection Table

The following table provides a general comparison of common level measurement technologies used in the industrial sectors highlighted at Polagra.

Technology	Accuracy	Contact Type	Suitability for Solids	Suitability for Foam	Max Range (Typical)
80GHz Radar	±1 mm	Non-contact	Excellent	Good	Up to 120m
Ultrasonic	±0.25% of range	Non-contact	Limited	Poor	Up to 15m
Hydrostatic	±0.1% to 0.5%	Contact	Not Suitable	Excellent	Dependent on Pressure
Guided Wave Radar	±2 mm	Contact	Good	Excellent	Up to 75m
Level Switches	N/A (Point)	Contact	Good	Good	N/A

Installation Guidelines for Sanitary Applications

Correct installation is as important as selecting the right technology. Improperly mounted sensors can lead to false readings or create hygiene dead zones.

- Nozzle Height and Diameter:** For radar and ultrasonic sensors, the nozzle should be as short and wide as possible to prevent the signal from reflecting off the nozzle walls. For an 80GHz radar, a standard 50mm (2-inch) or 80mm (3-inch) nozzle is usually sufficient.
- Dead Zones (Blocking Distance):** Every non-contact sensor has a "dead zone" directly beneath the sensor face where measurement is impossible. Ensure the sensor is mounted high enough so that the maximum liquid level never enters this zone.

3. **Obstruction Avoidance:** Sensors should be mounted away from inlet pipes and internal structures. If an agitator is present, the sensor should be positioned such that the beam does not hit the shaft or blades directly, or the software must be configured with a "false signal suppression" map.

4. **Hygienic Connections:** Use standard sanitary fittings such as Tri-clamp, DIN 11851, or Varivent. These connections ensure a leak-proof seal and eliminate crevices where product could stagnate.

| Limitations and Operational Challenges

While modern instrumentation is highly advanced, certain limitations must be acknowledged to ensure long-term reliability.

Condensation: In hot processes, steam can condense on the sensor face. While radar signals can pass through thin layers of condensation, heavy droplets can cause signal attenuation. Sensors with convex lens designs are preferred as they allow moisture to run off.

Dust Accumulation: In silos for flour or sugar, dust can coat the sensor. High-frequency radar is generally resistant to this, but in extreme cases, air purging systems may be required to keep the antenna clean.

Dielectric Constant (Dk): Radar measurement depends on the reflectivity of the material, which is determined by its dielectric constant. Materials with a very low Dk (like certain dry oils or powders) reflect less energy, requiring more sensitive radar units or guided wave radar.

| Frequently Asked Questions (FAQ)

Q: Can a single level meter be used for both liquids and solids?

A: Some high-end radar level meters are versatile enough to handle both, but the configuration and antenna design may differ. Solids often require a swiveling flange to aim the beam at the material's angle of repose, whereas liquids require a vertical mount.

Q: How often do these instruments need calibration?

A: This depends on the technology and the criticality of the process. Hydrostatic sensors may drift over time and usually require annual calibration. Radar and ultrasonic sensors are generally more stable but should be verified periodically as part of a standard maintenance schedule.

Q: Is 80GHz radar always better than 26GHz radar?

A: Not necessarily. While 80GHz offers a narrower beam and better resolution, 26GHz radar may perform better in environments with extremely heavy steam or very thick foam, as the longer wavelength is less susceptible to scattering by small particles.

Q: How do I handle measurement in a tank with a heavy agitator?

A: The best approach is to use a radar sensor with a narrow beam angle and place it as far from the agitator shaft as possible. Most modern sensors also include software algorithms that can "learn" the position of the agitator blades and ignore the reflections they produce.

| Conclusion

As the industry gathers at events like Polagra to discuss the future of food production, the role of precise level measurement remains a fundamental component of the automation journey. Whether managing large-scale silos or small batch processing tanks, selecting the appropriate measurement principle—be it radar, ultrasonic, or hydrostatic—is essential for operational success. By adhering to hygienic standards and considering the specific physical properties of the media, engineers can ensure their processes remain efficient, safe, and compliant.

For further technical specifications and to explore a wide range of industrial measurement solutions tailored for these applications, you can review product options and application support on our Main Page.