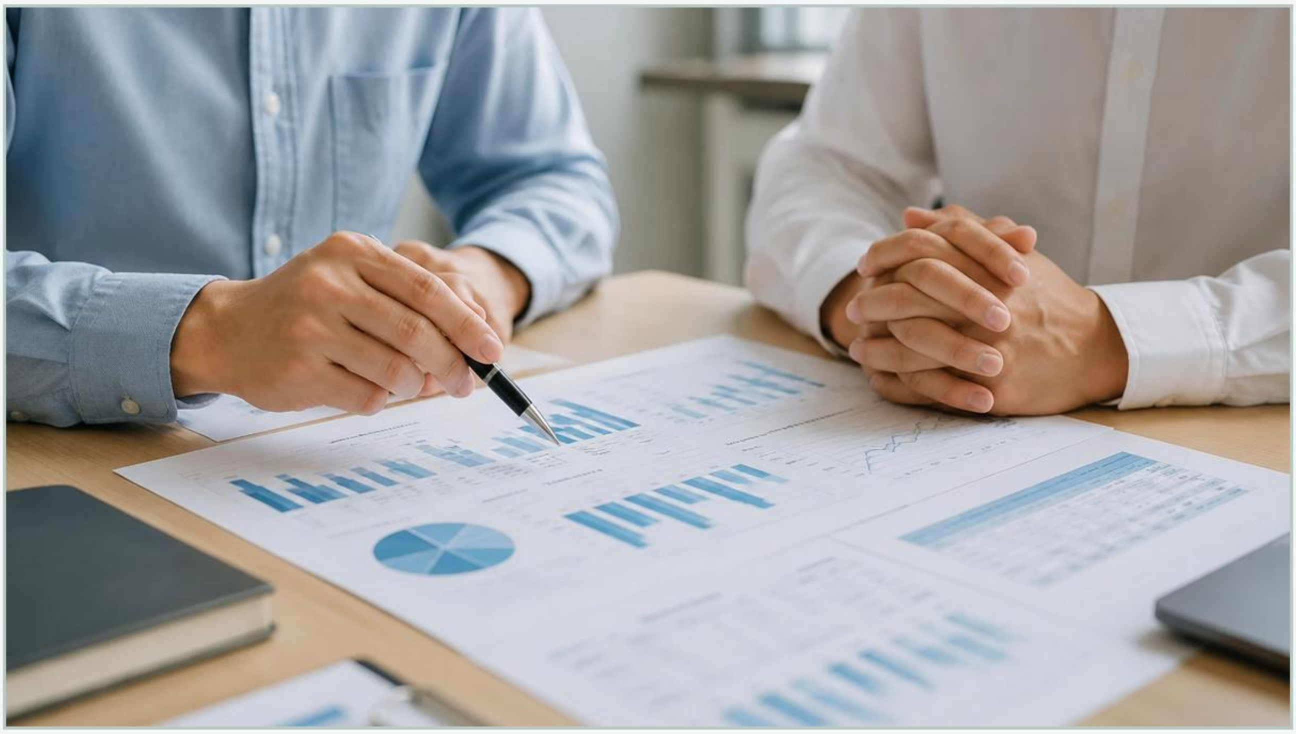
Pico and Hauser

A practical guide to pico and hauser, covering the reader intent, the relationship to pico and hauser, 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, the demand for miniaturization and high-precision measurement has led to the emergence of compact instrumentation often categorized under the "pico" designation. When discussing pico and hauser, engineers are typically referencing the intersection of ultra-compact sensor footprints with the rigorous industrial standards established by leading manufacturers like Endress+Hauser. This guide examines the technical requirements, measurement principles, and selection criteria for integrating compact level sensors into modern process environments.

Compact level measurement is no longer a niche requirement. As chemical skids, pharmaceutical pilot plants, and water treatment modules become increasingly dense, the space available for traditional, bulky transmitters has diminished. The shift toward pico-scale instrumentation requires a deep understanding of how physics behaves at a smaller scale, particularly regarding signal beam angles and internal vessel obstructions.

Principles of Compact Level Measurement

Before selecting a specific instrument, it is essential to understand the two primary non-contact technologies used in compact level sensing: Radar (Radio Detection and Ranging) and Ultrasonic measurement.

Radar Level Measurement (FMCW and Pulsed)

Radar level meters operate by emitting high-frequency electromagnetic waves, typically in the 26 GHz or 80 GHz range. In compact or "pico" applications, 80 GHz technology is preferred. The principle involves the Time of Flight (ToF) or Frequency Modulated Continuous Wave (FMCW) method. The sensor emits a signal that reflects off the surface of the medium and returns to the receiver.

The advantage of high-frequency radar in small-scale applications is the narrow beam angle. A standard 80 GHz radar can achieve a beam angle as narrow as 3 degrees, which is critical when mounting sensors in narrow nozzles or tanks with internal agitators. This precision ensures that the signal does not reflect off the tank walls, a common issue in confined spaces.

Ultrasonic Level Measurement

Ultrasonic sensors utilize sound waves rather than electromagnetic waves. The transducer emits an ultrasonic pulse that travels through the air, hits the liquid or solid surface, and echoes back. The distance is calculated based on the speed of sound.

While cost-effective, ultrasonic sensors in compact environments face limitations such as the "blocking distance" (or dead zone). This is the area immediately below the sensor where measurement is impossible because the transducer is still vibrating from the emission of the pulse. In pico-scale tanks, a large blocking distance can significantly reduce the usable measurement range.

Comparative Analysis: Pico-Scale Sensors vs. Standard Transmitters

When evaluating pico and hauser style solutions, it is helpful to compare the capabilities of compact sensors against traditional industrial transmitters. The following table outlines the key differences in a B2B engineering context.

Feature	Compact (Pico) Sensors	Standard Industrial Transmitters
Housing Diameter	40 mm – 80 mm	100 mm – 150 mm
Mounting Size	G1", G1½", or 2" Flange	3" to 6" Flanges
Frequency (Radar)	Typically 80 GHz	6 GHz, 26 GHz, or 80 GHz
Beam Angle	3° to 8°	10° to 25°
Dead Zone	Minimal (approx. 50 mm)	100 mm to 300 mm
Communication	4-20mA, Modbus, Bluetooth	4-20mA, HART, Profibus, Foundation Fieldbus

For many applications, the choice between these categories depends on the complexity of the process and the physical constraints of the installation site. For a broader overview of available technologies, engineers may consult the Main Page for detailed product specifications and application support.

Selection Criteria for Pico and Hauser Style Applications

Selecting the right instrument requires more than just checking the dimensions. Engineers must confirm several factual parameters to ensure long-term reliability.

1. Dielectric Constant (εr)

For radar measurement, the dielectric constant of the medium is the most critical factor. Materials with low εr (such as oils or hydrocarbons) reflect less energy than water-based liquids. In compact tanks, where the signal path is short, a low εr can lead to signal loss if the sensor is not high-sensitivity. Most modern pico-radar sensors can handle εr values as low as 1.4.

2. Process Temperature and Pressure

Compact sensors often use plastic housings (like PVDF or PBT) to save weight and cost. However, these materials have lower temperature and pressure ratings than stainless steel. It is vital to verify that the process does not exceed 80°C or 3 bar unless a specialized high-temperature compact version is selected.

3. Chemical Compatibility

The wetted parts of the sensor must be resistant to the medium. In the chemical and water treatment industries, PVDF is a common choice for its broad resistance to acids and bases. For food and beverage applications, 316L stainless steel with hygienic fittings (such as Tri-Clamp) is mandatory.

4. Mounting Environment

In small vessels, the proximity of the sensor to the wall is a major concern. If a sensor is mounted too close to the side, the signal may "cling" to the wall or reflect off weld seams. A general rule of thumb for pico-scale radar is to maintain a distance of at least 200 mm from the tank wall, though 80 GHz models can often be mounted closer.

Installation Considerations and Best Practices

Successful deployment of compact level instruments depends heavily on correct installation. Even the most advanced pico and hauser technology will fail if the physical environment is not optimized.

Nozzle Geometry: Ensure the sensor face extends slightly beyond the bottom of the mounting nozzle. If the sensor is recessed inside a tall, narrow nozzle, internal reflections (ringing) will occur, creating a false high-level reading.

Alignment: The sensor must be mounted perpendicular to the liquid surface. Even a 2-degree tilt can significantly reduce the strength of the return echo, especially on low-dielectric liquids.

Obstruction Mapping: Modern sensors allow for "False Echo Suppression." During commissioning, the tank should be empty or at its lowest level so the sensor can record and ignore static reflections from ladders, pipes, or agitator blades.

Venting: For hydrostatic level transmitters (another common compact solution), ensure the vent tube in the cable is not kinked or blocked. This tube allows the sensor to compensate for changes in atmospheric pressure.

Common Risks and Limitations in Small-Scale Level Sensing

While compact sensors offer flexibility, they are not universal solutions. Engineers should be aware of the following risks:

1. Condensation and Buildup: In small tanks, steam and vapor are more concentrated. Condensation on the sensor face can attenuate the signal. Sensors with a convex (lens) antenna design are preferred as they allow droplets to run off.

2. Foam Interference: Both radar and ultrasonic signals can be absorbed or scattered by thick foam. If the process involves heavy foaming (e.g., fermentation or surfactant mixing), a contact-based technology like a magnetic level gauge or a guided wave radar (GWR) may be more reliable.

3. Turbulence: Rapid filling or high-speed agitation can create a turbulent surface. This scatters the signal and can lead to "Lost Echo" errors. Increasing the damping or integration time in the sensor settings can help, but it will slow down the response time.

4. Power Supply Stability: Many compact sensors are two-wire loop-powered. In complex automation loops, voltage drops can cause the sensor to reboot or provide erratic readings. Ensure a stable 24V DC supply is maintained at the instrument terminals.

Frequently Asked Questions (FAQ)

Q: Can I use a pico-radar sensor for solids?

A: Yes, but with caution. Solids like plastic pellets or grain have an angle of repose. An 80 GHz radar is often necessary to get a reliable reflection from a sloped surface in a small silo.

Q: What is the difference between a pico sensor and a remote-head sensor?

A: A pico sensor integrates the antenna and the electronics into one small housing. A remote-head sensor separates the sensing element from the transmitter, which is useful in high-radiation or high-vibration areas.

Q: How do I calibrate a compact sensor without a display?

A: Most compact sensors now use Bluetooth or a USB-to-HART modem. You can calibrate the zero and span points using a smartphone app or a laptop with the manufacturer's software.

Q: Is there a minimum tank height for these sensors?

A: Technically, no, but for tanks shallower than 200 mm, the accuracy of the sensor (typically ±2 mm) becomes a larger percentage of the total volume. In very shallow applications, hydrostatic pressure or capacitive probes may be more precise.

Conclusion and Technical Confirmation

Implementing pico and hauser style instrumentation requires a balance between space-saving design and robust measurement performance. By prioritizing 80 GHz radar for narrow spaces and ensuring chemical compatibility with PVDF or stainless steel wetted parts, engineers can achieve high-reliability level monitoring in even the most constrained environments.

Before finalizing a project design, it is recommended to confirm the following data points:

The minimum and maximum dielectric constant of the process media.

The exact height of the mounting nozzle.

The presence of any internal obstructions within the 3-degree to 8-degree signal cone.

The communication protocol requirements for the existing PLC/SCADA system.

For further technical documentation, wiring diagrams, and a full catalog of industrial level measurement solutions, please refer to the Main Page. Selecting the correct instrument at the design phase prevents costly downtime and maintenance interventions during plant operation.