

624/4

A practical guide to 624/4, covering the reader intent, the relationship to 624/4, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



[levelmeter.org](https://www.level-meters.com/)

Main topic: Main Page

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

In the complex landscape of industrial process control, technical designations like 624/4 represent critical specifications for signal integrity and power distribution. In the field of level measurement, ensuring that sensors are correctly configured—often involving 4-wire systems for robust data transmission—is essential for maintaining accuracy in demanding environments. Whether managing water treatment facilities, chemical processing plants, or oil and gas storage, understanding the technical nuances of instrument wiring and signal output is a prerequisite for successful automation.

This guide explores the principles of level measurement technologies that utilize high-reliability configurations, the criteria for selecting the appropriate sensor, and the practical considerations for implementing 624/4-compliant systems in industrial settings.

Understanding the Role of 624/4 in Industrial Level Measurement

In industrial instrumentation, the 624/4 designation frequently refers to specific wiring configurations or cable specifications designed to handle both power and signal transmission with high noise immunity. In a typical level measurement application, a 4-wire (624/4) setup separates the power supply from the signal output. This is particularly advantageous for instruments that require higher power consumption, such as high-frequency radar level meters or sophisticated ultrasonic transmitters with integrated heating elements or advanced digital displays.

By utilizing a 4-wire configuration, engineers can ensure that the 4-20mA signal loop remains independent of the power fluctuations that might occur in the supply line. This isolation is a cornerstone of precision engineering, allowing for stable readings even over long cable runs in electrically noisy industrial environments. When evaluating options on the Main Page of a manufacturer's catalog, identifying whether a sensor supports these robust wiring standards is a key step in system design.

Fundamental Measurement Principles for Advanced Level Sensors

Before selecting a 624/4-compatible instrument, it is vital to understand the underlying physics of the different measurement technologies available. Each principle offers unique advantages depending on the medium and the environmental conditions.

1. Radar Level Measurement (FMCW and Pulse)

Radar level meters operate by emitting electromagnetic waves toward the surface of the material. The time it takes for the signal to reflect back is measured to determine the distance.

- Pulse Radar: Sends short microwave pulses and measures the transit time. It is energy-efficient but may struggle with low-dielectric materials.
- FMCW (Frequency Modulated Continuous Wave): Emits a continuous signal with a changing frequency. The difference in frequency between the emitted and received signal is proportional to the distance. FMCW radar provides superior accuracy (up to ± 2 mm) and is ideal for complex applications involving turbulence or vapor.

2. Ultrasonic Level Measurement

Ultrasonic sensors use sound waves above the range of human hearing. The sensor emits a sound pulse that bounces off the liquid or solid surface. The time-of-flight (ToF) is calculated to determine the level. Since sound speed is affected by air temperature, these sensors typically include integrated temperature compensation. They are cost-effective for open-air applications and non-corrosive liquids but are limited by vacuum conditions or high-pressure environments where sound cannot propagate effectively.

| 3. Hydrostatic Level Measurement

This contact-based method relies on the principle that the pressure at the bottom of a liquid column is proportional to the height of the liquid and its density ($P = \rho \cdot g \cdot h$). Hydrostatic transmitters are highly reliable for vented tanks and deep wells. In 624/4 configurations, these sensors can provide highly stable analog outputs even when submerged at depths exceeding 100 meters (328 feet).

| Technical Specifications and Evaluation Criteria

When integrating a 624/4 system, technical stakeholders must evaluate several parameters to ensure the instrument meets the application's demands. The following criteria are essential for a factual assessment:

Dielectric Constant (ϵ_r): For radar sensors, the reflectivity of the medium depends on its dielectric constant. Materials with $\epsilon_r < 1.4$ require high-sensitivity radar or guided wave radar (GWR).

Process Pressure and Temperature: Standard ultrasonic sensors are often limited to 3 bar (43.5 psi), whereas specialized radar or hydrostatic sensors can handle pressures exceeding 40 bar (580 psi) and temperatures up to 250°C (482°F).

Signal Output and Communication: While the 4-20mA analog signal is standard, many 624/4 systems also support digital protocols like HART, Modbus RS485, or Profibus, allowing for remote diagnostics and configuration.

Enclosure Rating: For outdoor or wash-down environments, an IP67 or IP68 rating is required to prevent moisture ingress into the wiring compartment.

| Selection Guide for 624/4 Applications

Choosing the right technology requires a comparison of performance characteristics. The table below provides a practical reference for common industrial scenarios.

Feature	Radar (80GHz)	Ultrasonic	Hydrostatic	Magnetic Gauge
Measurement Range	Up to 120m (393ft)	Up to 30m (98ft)	Up to 200m (656ft)	Up to 6m (20ft)
Accuracy	±2mm	±0.25% of range	±0.1% to ±0.5%	±5mm to ±10mm
Contact Type	Non-contact	Non-contact	Contact (Submerged)	Contact (Bypass)
Media Type	Liquids/Solids	Liquids/Slurries	Clear Liquids	Liquids
Effect of Foam	Minimal (FMCW)	High	None	None
Wiring Config	2-wire / 4-wire	2-wire / 4-wire	2-wire	N/A (Switch only)

| Installation Guidelines and Best Practices

Proper installation of 624/4-configured instruments is critical to prevent signal interference and mechanical failure. Engineers should adhere to the following checklists:

| Mechanical Mounting

Avoid Obstructions: For radar and ultrasonic sensors, ensure the signal beam path is clear of ladders, agitators, or inflow streams. A "dead zone" or "blocking distance" exists near the sensor face (typically 0.2m to 0.5m) where measurement is not possible.

Nozzle Geometry: The height and diameter of the mounting nozzle should follow manufacturer guidelines to prevent false echoes from the nozzle edge.

Positioning: Sensors should generally be installed at 1/3 of the tank radius to avoid wall interference while remaining far enough from the center to avoid multiple reflections in domed tanks.

| Electrical Wiring (624/4 Specifics)

Shielding: Use twisted-pair shielded cables for the 4-20mA signal line to minimize electromagnetic interference (EMI). The shield should be grounded at only one end (usually the control room side) to prevent ground loops.

Power Supply: Ensure the power supply meets the instrument's requirements (typically 24V DC or 220V AC for 4-wire units). Voltage drops over long distances must be calculated to ensure the terminal voltage remains within the specified operating range.

Cable Glands: Use certified cable glands that match the enclosure's IP rating. In hazardous areas, ATEX or IECEx certified flameproof glands are mandatory.

| Limitations and Operational Constraints

While 624/4 systems are robust, they are not universal solutions. Certain environmental factors can degrade performance:

1. **Heavy Foam:** Ultrasonic waves are often absorbed by dense foam, leading to signal loss. In such cases, high-frequency radar or hydrostatic transmitters are preferred.
2. **Vacuum Conditions:** Ultrasonic sensors cannot operate in a vacuum as sound requires a medium to travel. Radar is unaffected by vacuum.
3. **Rapid Temperature Changes:** While temperature compensation helps, extreme gradients can create "mirage" effects for ultrasonic sensors, bending the sound wave and causing errors.
4. **Build-up and Scaling:** For hydrostatic sensors, the accumulation of solids on the diaphragm can cause offset errors. Regular cleaning or the use of flush-diaphragm models is necessary for viscous media.

| Frequently Asked Questions (FAQ)

Q: What is the main advantage of a 4-wire (624/4) system over a 2-wire system?

A: A 4-wire system provides independent power and signal paths. This allows the instrument to draw more power for advanced signal processing, heating, or bright displays without affecting the accuracy of the 4-20mA current loop. It also provides better electrical isolation.

Q: Can 624/4 cables be used in hazardous areas?

A: Yes, provided the cable and the instrument are rated for the specific zone (e.g., Zone 0, 1, or 2). In intrinsically safe (IS) circuits, specific barriers must be used, and 2-wire configurations are more common, but 4-wire flameproof (Ex d) systems are standard for heavy-duty applications.

Q: How often should a 624/4 level meter be calibrated?

A: Calibration frequency depends on the industry and the criticality of the measurement. For most industrial applications, an annual verification is sufficient. However, in regulated industries like pharmaceuticals or food processing, semi-annual calibration may be required.

Q: Does the 624/4 configuration support digital communication?

A: Most modern 4-wire instruments include a digital overlay on the analog signal (like HART) or a dedicated digital port (like RS485 Modbus). This allows for easier integration into PLC and SCADA systems.

| Conclusion

Selecting and implementing a 624/4 level measurement system requires a balance of theoretical knowledge and practical engineering. By understanding the measurement principles of radar, ultrasonic, and hydrostatic technologies, and by adhering to strict installation and wiring standards, facilities can achieve high levels of operational efficiency and safety. For those seeking detailed product specifications or customized measurement solutions, visiting the Main Page of an established manufacturer like Welk provides access to the technical documentation and expert support necessary to finalize a project's instrumentation requirements.