

144/3.6

A practical guide to 144/3.6, covering the reader intent, the relationship to 144/3.6, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



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

In the landscape of industrial automation and process control, technical specifications like 144/3.6 often represent critical benchmarks for power management and signal integrity in remote sensing applications. As industries transition toward decentralized monitoring—particularly in water treatment, chemical processing, and oil and gas—the demand for high-efficiency level measurement instruments has grown. Understanding the electrical and mechanical parameters of these devices is essential for ensuring long-term reliability and accuracy in the field.

Level measurement is not a one-size-fits-all discipline. It requires a deep understanding of the physical properties of the medium, the environmental conditions of the storage vessel, and the electrical requirements of the telemetry system. Whether utilizing a 3.6V high-energy density lithium power source for remote IoT nodes or integrating sensors into a 144mm DIN-rail architecture, engineers must prioritize compatibility and precision.

| Core Measurement Principles

Before selecting a level measurement solution, it is vital to understand the underlying physics that govern different sensor technologies. Each principle offers distinct advantages depending on the application requirements.

| Radar Level Measurement

Radar level meters operate on the Time of Flight (ToF) principle. The instrument emits a high-frequency electromagnetic wave (typically in the 26GHz or 80GHz range) toward the surface of the medium. The wave reflects off the surface and returns to the sensor. By measuring the time interval between emission and reception, the device calculates the distance to the product surface.

Radar technology is highly valued because it is non-contact and largely unaffected by changes in temperature, pressure, or the presence of vapors. Modern radar sensors are capable of penetrating dust and steam, making them ideal for challenging chemical reactors or large-scale storage tanks.

| Ultrasonic Level Measurement

Similar to radar, ultrasonic sensors use the ToF principle but employ acoustic waves instead of electromagnetic ones. The sensor emits an ultrasonic pulse that travels through the air, reflects off the liquid or solid surface, and returns to the transducer.

Because sound speed is influenced by air temperature, most ultrasonic level meters include an integrated temperature sensor to compensate for these variations. These sensors are cost-effective and widely used in water treatment and open-channel flow measurement. However, they are sensitive to surface foam and heavy turbulence, which can scatter the acoustic signal.

| Hydrostatic Level Measurement

Hydrostatic level transmitters measure the pressure exerted by a liquid column at a specific point. The principle is based on the formula:

$$P = \rho \times g \times h$$

Where P is pressure, ρ is the density of the liquid, g is the gravitational constant, and h is the height of the liquid.

By submerging a pressure-sensitive diaphragm at the bottom of a tank or well, the transmitter converts the liquid pressure into an electrical signal (typically 4-20mA). This method is highly reliable for deep wells and vented tanks where the liquid density remains constant.

| Magnetic Level Gauges

Magnetic level gauges utilize a float containing a permanent magnet that moves vertically with the liquid level in a bypass chamber. This magnet interacts with a series of bi-color flaps or a sensing element outside the chamber to provide a visual or electronic indication of the level. This mechanical approach is preferred for high-pressure or high-temperature applications where direct contact with the electronics must be avoided.

| The Significance of 144/3.6 in Modern Instrumentation

In the context of industrial telemetry, the specification 144/3.6 frequently relates to the power supply and form factor of remote monitoring units. Many wireless level transmitters are powered by 3.6V Lithium Thionyl Chloride (Li-SOCl₂) batteries. These batteries, such as the ER34615, provide the high energy density required for devices to operate for several years without maintenance.

The "144" often refers to the standardized dimensions or specific module configurations in control cabinets where these level meters interface with PLC (Programmable Logic Controller) systems. Ensuring that the sensor's power consumption aligns with the 3.6V threshold is critical for maintaining signal stability, especially when transmitting data over long distances via LoRaWAN, NB-IoT, or cellular networks. For a wider range of industrial solutions, engineers often Review product options and application support to ensure their hardware meets these specific electrical standards.

| Selection Criteria for Level Measurement

Choosing the correct instrument requires a systematic evaluation of the process environment. The following table provides a comparison of common technologies based on typical industrial needs.

| Technology Comparison Table

Feature	Radar Level Meter	Ultrasonic Sensor	Hydrostatic Transmitter	Magnetic Level Gauge
Measurement Type	Non-contact	Non-contact	Contact (Submerged)	Contact (Bypass)
Accuracy	±1mm to ±5mm	±0.25% of range	±0.1% to ±0.5% FS	±5mm to ±10mm
Max Range	Up to 120m (393 ft)	Up to 30m (98 ft)	Up to 200m (656 ft)	Up to 6m (20 ft)
Pressure Limit	Up to 160 bar	Atmospheric	Up to 40 bar	Up to 320 bar
Temp. Limit	Up to 450°C (842°F)	Up to 80°C (176°F)	Up to 80°C (176°F)	Up to 400°C (752°F)
Best Use Case	Corrosive chemicals	Wastewater sumps	Deep wells/boreholes	High-pressure boilers

Installation Considerations

- Proper installation is as critical as the selection of the technology itself. Even the most advanced radar or ultrasonic meter will fail if environmental factors are ignored.
- 1. Dead Zone (Blocking Distance):** Every non-contact sensor has a "dead zone" directly beneath the transducer where measurement is impossible. For ultrasonic sensors, this is typically 0.25m to 0.5m (10" to 20"). Ensure the maximum liquid level never enters this zone.
 - 2. Mounting Position:** Sensors should be mounted away from the tank wall to avoid false echoes. For radar and ultrasonic units, the beam should be perpendicular to the liquid surface. Avoid mounting sensors directly above the filling inlet, as the falling liquid will interfere with the signal.
 - 3. Stilling Wells:** In tanks with heavy agitation or surface foam, using a stilling well (a pipe that extends into the liquid) can provide a calm surface for the sensor to measure, significantly increasing accuracy.

4. Cable Protection: For hydrostatic transmitters, the vented cable must be protected from moisture ingress. A desiccant cartridge is often recommended to prevent condensation from forming inside the atmospheric vent tube.

| Limitations and Practical Boundaries

While modern level meters are robust, they are not without limitations. Engineers must be aware of the following constraints:

Vapor and Vacuum: Ultrasonic waves require a medium (air/gas) to travel. In a vacuum, ultrasonic sensors will not function. Radar, being electromagnetic, works perfectly in a vacuum but can be attenuated by heavy steam or certain gas compositions.

Dielectric Constant: Radar measurement relies on the dielectric constant (ϵ_r) of the medium. Materials with a very low dielectric constant (like certain oils or liquefied gases) reflect less energy, requiring high-sensitivity antennas or guided wave radar (GWR) configurations.

Specific Gravity Changes: Hydrostatic sensors are calibrated for a specific liquid density. If the density changes (e.g., due to temperature fluctuations or mixing of different fluids), the level reading will drift unless compensated for in the control system.

| Frequently Asked Questions (FAQs)

Q: Can a 3.6V battery-powered sensor transmit data in real-time?

A: While 3.6V systems are highly efficient, real-time transmission (e.g., every second) will deplete the battery quickly. Most 144/3.6 configurations use interval-based reporting (e.g., every 15 minutes) to extend battery life to 3-5 years.

Q: How do I handle foam in a chemical tank?

A: Foam absorbs ultrasonic signals and can scatter radar waves. For light foam, high-frequency radar (80GHz) is often effective. For heavy, thick foam, a hydrostatic transmitter or a magnetic level gauge is generally a more reliable choice.

Q: What is the benefit of a 144mm DIN-sized controller?

A: The 144mm standard (often 144x144mm) is a traditional size for panel-mounted displays and controllers. It provides ample space for clear visual readouts and multiple input/output (I/O) modules, making it easier for operators to monitor level data alongside other process variables.

Q: Is radar always better than ultrasonic?

A: Not necessarily. While radar is more versatile, ultrasonic sensors are significantly more affordable and perfectly adequate for simple water level monitoring in open channels or plastic tanks where chemical compatibility is not an issue.

| Maintenance and Long-term Reliability

To maintain the integrity of a 144/3.6 system, regular maintenance schedules should be established. For contact sensors like hydrostatic probes, the diaphragm should be inspected for scaling or sediment buildup, especially in wastewater applications. For non-contact sensors, the transducer face should be kept clean of condensation or dust accumulation.

In remote applications, monitoring the battery voltage of the 3.6V power supply is essential. Most modern transmitters include a low-battery alarm that can be integrated into a SCADA system, allowing maintenance teams to replace power cells before a total signal loss occurs. By adhering to these engineering principles and selection criteria, process industries can achieve precise, cost-effective, and reliable level measurement across their operations.