

55h

A practical guide to 55h, covering the reader intent, the relationship to 55h, 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 and process control, technical identifiers such as 55h often represent critical data points, command codes, or specific device addresses within digital communication protocols. For engineers and system integrators working with advanced level measurement instruments, understanding the nuances of these technical specifications is essential for ensuring seamless data transmission and accurate monitoring. This guide explores the role of digital identifiers like 55h in the context of level measurement, the underlying physics of modern sensors, and the practical considerations for selecting and installing these devices in demanding industrial environments.

The Evolution of Digital Communication in Level Measurement

Modern industrial processes rely on more than just simple analog signals. While the traditional 4-20mA loop remains a staple in the industry, the integration of digital protocols such as HART (Highway Addressable Remote Transducer), Modbus, and PROFIBUS has transformed how level meters communicate with control systems.

In these digital frameworks, hexadecimal codes like 55h (the hexadecimal representation of the decimal number 87) serve various functions. Depending on the specific protocol and manufacturer implementation, 55h may refer to a specific command code used to retrieve device status, a register address for a secondary process variable, or a part of a manufacturer-specific identification string. For instance, in certain HART-based systems, specific commands are utilized to calibrate the sensor or to diagnose signal interference.

At Welk, a professional manufacturer of industrial level measurement instruments, the focus is on providing sensors that not only measure accurately but also integrate effortlessly into these complex digital ecosystems. Whether utilizing 80GHz radar level meters or ultrasonic sensors, the ability to interpret and utilize digital codes like 55h ensures that operators can access real-time diagnostics and high-resolution data from the Main Page of their control interface.

Technical Principles: Radar and Ultrasonic Technologies

Before diving into the selection of hardware, it is vital to understand the measurement principles that govern the most common industrial level sensors.

Radar Level Measurement (FMCW and Pulse)

Radar level meters operate on the principle of electromagnetic wave propagation. There are two primary methods used in industrial applications: Frequency Modulated Continuous Wave (FMCW) and Pulse Radar.

1. FMCW Radar: The sensor emits a continuous signal with a constantly changing frequency. When the signal reflects off the material surface and returns to the antenna, the difference in frequency between the emitted and received signal is proportional to the distance. This method is highly accurate and is the standard for high-frequency 80GHz radar systems.
2. Pulse Radar: The sensor emits a short microwave pulse and measures the time it takes for the pulse to travel to the surface and back (Time of Flight).

Radar technology is particularly effective because electromagnetic waves do not require a medium for propagation and are largely unaffected by temperature, pressure, or vacuum conditions. This makes them ideal for volatile chemicals and high-pressure oil and gas storage.

Ultrasonic Level Measurement

Ultrasonic sensors use sound waves rather than electromagnetic waves. The transducer emits an ultrasonic pulse (typically in the range of 20 kHz to 200 kHz). The pulse reflects off the target surface and returns to the sensor. The distance is calculated based on the speed of sound in the air.

Unlike radar, the speed of sound is influenced by air temperature and composition. Therefore, most ultrasonic sensors include an integrated temperature sensor to compensate for these changes. Ultrasonic sensors are cost-effective solutions for water treatment and non-corrosive liquid storage where the atmosphere is relatively stable.

Interpreting 55h in the Context of Industrial Protocols

When a technician encounters 55h in a device manual or a data packet, it is usually within the context of the Data Link Layer or the Application Layer of the communication stack.

Command Structure: In many master-slave configurations, 55h might be part of a synchronization byte or a header designed to alert the receiver that a data packet is incoming.

Device Addressing: In older Modbus RTU configurations or proprietary serial strings, 55h could represent a specific slave ID, allowing the PLC to poll a specific level meter among a daisy-chain of multiple sensors.

Diagnostic Mapping: Advanced radar sensors often map internal error states to specific registers. A value of 55h in a status register might indicate a specific hardware state, such as a "Signal Lost" warning or a "High-Temperature Limit" reached.

Understanding these codes allows for faster commissioning and troubleshooting, reducing downtime in critical industrial processes.

Selection Guide: Choosing the Right Level Sensor

Selecting the correct instrument requires a thorough analysis of the process media, vessel geometry, and environmental conditions. The following table provides a comparison of common technologies offered by Welk.

Technology	Best For	Advantages	Limitations
80GHz Radar	Precise liquid/solid measurement, complex tanks	High accuracy ($\pm 2\text{mm}$), small beam angle, penetrates steam/dust	Higher initial cost
Ultrasonic	Water treatment, open channels, sumps	Non-contact, cost-effective, easy to install	Affected by foam, heavy steam, and vacuum
Hydrostatic	Deep wells, vented tanks, water towers	Simple principle, ignores surface foam, easy to submerge	Contacting method, density must be constant
Magnetic Gauge	High-pressure boilers, toxic chemicals	Visual indication + electronic output, no power for visual	Requires bypass pipe, moving parts (float)
Level Switch	Overfill protection, pump control	High reliability, simple ON/OFF signal	Point level only, no continuous measurement

| Key Evaluation Criteria

1. Dielectric Constant (ϵ_r): For radar sensors, the reflectivity of the material depends on its dielectric constant. Liquids like oil have a low ϵ_r (~ 2.0), while water has a high ϵ_r (~ 80). Sensors must be configured to handle low-reflectivity materials.
2. Measuring Range: Ensure the sensor can cover the full height of the tank. Radar can reach up to 120 meters, while ultrasonic is typically limited to 15-30 meters.
3. Process Connection: Consider whether a flange, thread, or bracket is required. For hygienic applications (food/pharma), tri-clamp fittings are standard.

| Installation and Commissioning Considerations

Proper installation is the most critical factor in the performance of a level meter. Even the most advanced 80GHz radar can fail if placed incorrectly.

| Avoiding Obstacles

The "beam angle" of a sensor determines the spread of the signal. If the beam hits internal tank structures like ladders, agitators, or heating coils, it will create false echoes (parasitic reflections).

Radar: High-frequency 80GHz radar has a very narrow beam (often $<3^\circ$), making it easier to avoid obstacles.

Ultrasonic: Typically has a wider beam (around 10°), requiring a larger clear path to the liquid surface.

| The Dead Zone (Blocking Distance)

Every non-contact sensor has a "dead zone" directly beneath the transducer where it cannot measure. This is the time required for the transducer to stop vibrating (ringing) after emitting a pulse and switch to receiving mode.

Ensure the maximum liquid level never enters this dead zone (typically 0.1m to 0.5m depending on the model).

| Mounting Position

Do not mount in the center: In cylindrical tanks, mounting in the exact center can cause multiple reflections to converge, distorting the signal.

Avoid the wall: Mounting too close to the tank wall will cause signal interference due to friction and weld seams.

Inlet flow: Never install the sensor directly above the filling inlet, as the turbulence and falling liquid will disrupt the measurement.

| Limitations and Troubleshooting

While modern instruments are robust, they are not immune to environmental challenges.

1. **Foam:** Heavy, thick foam can absorb ultrasonic and radar signals. In cases of extreme foam, a stilling well or a displacement-based measurement may be necessary.
2. **Dust and Vapor:** While radar penetrates dust easily, ultrasonic waves are scattered by high-density dust. In high-vapor environments, the speed of sound changes, leading to errors in ultrasonic readings unless properly compensated.
3. **Signal Loss (Error 55h or similar):** If a digital system reports a signal loss, check for condensation on the sensor face. Welk radar sensors often feature PTFE lenses to minimize buildup, but periodic cleaning may be required in sticky or crystallizing applications.

| Frequently Asked Questions (FAQ)

Q: Can I use an ultrasonic sensor in a vacuum tank?

A: No. Sound waves require a medium (air or gas) to travel. In a vacuum, ultrasonic measurement is impossible. Radar is the recommended technology for vacuum applications.

Q: How does the 55h code help in PLC programming?

A: In B2B industrial settings, 55h is often used as a constant in scripts to validate that the sensor is responding correctly. If the PLC sends a request and the response does not contain the expected hex header, it triggers a communication alarm.

Q: What is the maintenance requirement for radar level meters?

A: Radar meters are generally maintenance-free because they have no moving parts and are non-contact. However, inspecting the antenna for heavy coating or corrosion once a year is a best practice.

Q: Is 80GHz radar safe for human operators?

A: Yes. The power output of industrial radar level meters is extremely low, much lower than a standard mobile phone, and is fully compliant with international safety standards.

| Conclusion

Understanding technical specifications like 55h and the underlying physics of level measurement is essential for modern industrial operations. By selecting the appropriate technology—be it radar, ultrasonic, or hydrostatic—and following rigorous installation standards, facilities can achieve high levels of accuracy and safety. For those seeking reliable, cost-effective, and customized measurement solutions, exploring the comprehensive range of instruments on the Main Page provides the necessary foundation for optimized process automation. Welk continues to lead the industry by providing the technical clarity and high-performance hardware required to meet the challenges of tomorrow's industrial landscape.