

# Locating Gauge

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



levelmeter.org

Main topic: Magnetic & Local Level Gauges

<https://www.level-meters.com/products/magnetic-level-gauges/>

In industrial process control, the term "locating gauge" refers to the critical instrument used to identify and visualize the exact position of a liquid level or interface within a vessel. While electronic sensors provide data to control rooms, the local locating gauge remains the primary point of physical verification for plant operators. These instruments, primarily categorized under Magnetic & Local Level Gauges, offer a fail-safe, power-independent method of monitoring fluid levels in environments ranging from simple water storage to high-pressure chemical reactors.

Understanding the mechanics, selection criteria, and installation requirements of these gauges is essential for maintaining plant safety and operational efficiency. This guide explores the engineering principles behind local level measurement and provides a framework for selecting the appropriate technology for specific industrial applications.

## **| Measurement Principles of Local Level Gauges**

To effectively serve as a locating gauge, an instrument must translate the internal fluid level of a tank into a visible external signal. The two most common physical principles used are direct visual observation and magnetic coupling.

### **| Direct Visual Observation (Sight Glass)**

Direct gauges use a transparent tube or window (typically borosilicate glass or plastic) connected to the vessel. Based on the principle of communicating vessels, the liquid level in the gauge naturally matches the level in the tank. While simple, these are limited by the fragility of the glass and the potential for leaks if the glass breaks.

### **| Magnetic Coupling Principle**

The modern standard for a robust locating gauge is the Magnetic Level Gauge (MLG). This system consists of three primary components:

1. The Chamber: A vertical column (bypass pipe) mounted to the side of the tank.

2. The Float: A high-precision, buoyant element containing a permanent magnet assembly. The float is engineered to match the specific gravity of the process fluid.
3. The Indicator: An external scale or set of magnetic flags mounted outside the chamber, isolated from the process fluid.

As the liquid level rises or falls, the float moves accordingly within the chamber. The magnetic field from the float penetrates the non-magnetic chamber wall (usually stainless steel) to flip the external flags or move a magnetic follower. This provides a clear, high-contrast visual representation of the level without any risk of fluid leakage to the external environment.

## | Key Components and Materials

When specifying a locating gauge for a project, the material of construction must be compatible with the chemical properties of the fluid and the ambient environment.

**Chamber Materials:** Most industrial gauges utilize 304 or 316L Stainless Steel. For highly corrosive environments, chambers may be constructed from Hastelloy, Monel, or lined with PTFE (Polytetrafluoroethylene).

**Float Design:** Floats are typically pressurized or reinforced to withstand the operating pressure of the vessel. For low-density fluids (e.g., liquefied gases), titanium floats are often used due to their high strength-to-weight ratio.

**Indicator Types:**

**Magnetic Flags:** Bi-color rollers (often red/white or yellow/black) that flip 180 degrees as the float passes. These are highly visible from a distance.

**Follower/Capsule:** A single magnetic shuttle that moves along a graduated scale. This is often preferred in high-vibration environments where flags might accidentally flip.



## Practical Selection Table

Choosing the right locating gauge requires balancing process conditions with visibility requirements. The following table outlines typical specifications for different gauge configurations.

| Feature             | Standard Magnetic Gauge | High-Pressure Magnetic Gauge | Lined Magnetic Gauge | Glass Sight Gauge      |
|---------------------|-------------------------|------------------------------|----------------------|------------------------|
| Max Pressure        | 40 bar (4.0 MPa)        | Up to 250 bar (25 MPa)       | 16 bar (1.6 MPa)     | 20 bar (2.0 MPa)       |
| Max Temperature     | 250°C                   | 450°C                        | 150°C                | 200°C                  |
| Visibility          | Excellent (Flags)       | Excellent (Flags)            | Good                 | Moderate               |
| Chemical Resistance | High (SS316)            | High (Alloys)                | Extreme (PTFE Lined) | Moderate               |
| Maintenance         | Low                     | Low                          | Moderate             | High                   |
| Safety              | High (No Glass)         | High (No Glass)              | High                 | Low (Risk of breakage) |

## Installation Considerations for Locating Gauges

The accuracy and reliability of a locating gauge depend heavily on correct installation. Because these instruments rely on buoyancy and magnetic fields, specific geometric and environmental factors must be addressed.

### 1. Orientation and Verticality

The gauge chamber must be installed perfectly vertical. Even a slight tilt can cause the float to rub against the chamber walls, leading to friction that prevents the float from tracking the liquid level accurately. A deviation of more than 3 degrees is generally considered unacceptable.

## | 2. Connection Types

Locating gauges are typically connected to the vessel via side-side, top-bottom, or side-bottom configurations. Common connection sizes include 1/2", 3/4", or 1" NPT threads or ANSI/DIN flanges. It is recommended to install isolation valves between the tank and the gauge to allow for maintenance without draining the entire vessel.

## | 3. Magnetic Interference

Since the gauge operates via magnetic coupling, it must be kept away from large ferrous structures or high-voltage power lines that could generate electromagnetic interference. Standard practice is to maintain at least 100mm of clearance from carbon steel supports or other magnetic instruments.

## | 4. Venting and Draining

Every locating gauge should be equipped with a vent plug at the top and a drain valve at the bottom. This allows operators to clear the chamber of debris or trapped gas, ensuring the float moves freely. In steam applications, the vent is critical for removing non-condensable gases that could affect the level reading.

## | Limitations and Operational Risks

While Magnetic & Local Level Gauges are highly reliable, engineers must be aware of their physical limitations:

**Specific Gravity Changes:** The float is calibrated for a specific fluid density. If the process fluid changes (e.g., switching from oil to water), the float may sink or ride too high, resulting in an inaccurate level reading. A change in density of more than 0.05 g/cm<sup>3</sup> usually requires a new float.

**Viscosity and Coating:** Highly viscous fluids or those that crystallize can impede float movement. In these cases, internal coatings or steam-traced jackets may be required to keep the fluid in a liquid state.

**Magnetic Particles:** If the process fluid contains iron filings or magnetic scale, these particles will adhere to the float's internal magnet. Over time, this buildup increases the float's weight and can eventually jam it inside the chamber. Magnetic filters (traps) should be installed in the bypass line if magnetic debris is expected.

**Extreme Turbulence:** In vessels with heavy agitation, the level inside the bypass chamber may fluctuate rapidly. Damping orifices or stilling wells can be used to stabilize the float.

## | Integrating Transmitters and Switches

A modern locating gauge often serves a dual purpose: providing a local visual check and transmitting data to a PLC or SCADA system. This is achieved by mounting external sensors to the chamber:

**Reed Switches:** These are clamped to the outside of the chamber at specific heights to provide high or low-level alarms. They are triggered by the float's magnetic field.

**Magnetostrictive Transmitters:** These provide a continuous 4-20mA or HART signal. They offer high precision (up to  $\pm 1\text{mm}$ ) and are easily calibrated without interrupting the process.

By adding these components, the locating gauge becomes a comprehensive level management station, combining the reliability of mechanical measurement with the connectivity of digital automation.

## | Frequently Asked Questions (FAQs)



## **Can a magnetic locating gauge be used for interface measurement?**

Yes. By engineering a float with a density that falls between the specific gravities of two immiscible liquids (e.g., oil and water), the gauge can accurately locate the interface level. The float will sink through the upper liquid and float on the lower liquid.

## **What maintenance is required for local level gauges?**

Maintenance is minimal. Periodic flushing of the chamber via the drain valve is recommended to remove sediment. The external indicator should be wiped down to ensure visibility, and the float should be inspected for signs of corrosion or wear during major plant turnarounds.

## **How do I handle applications with high vibration?**

In high-vibration environments, magnetic flags can sometimes "rattle" or flip prematurely. For these applications, a magnetic follower (a single capsule inside a glass or plastic tube) is more stable. Additionally, using heavy-duty mounting brackets can reduce the transfer of vibration from the vessel to the gauge.

## **Are these gauges suitable for cryogenic applications?**

Yes, but they require specialized insulation. For fluids like liquid nitrogen or LNG, the gauge is equipped with a non-frosting acrylic block over the indicator and a vacuum-jacketed chamber to prevent heat gain and ice buildup, which would otherwise obscure the visual reading.

## **| Conclusion**

The locating gauge remains an indispensable tool in the industrial landscape. By providing a clear, mechanical, and highly reliable visual reference, instruments like Magnetic & Local Level Gauges ensure that operators can always verify the status of their processes, even during power failures or electronic system malfunctions. When selecting a gauge, always prioritize material compatibility, pressure ratings, and the specific gravity of the media to ensure long-term accuracy and safety.