

Level measurement of clear liquids



LLT100 detects clear liquids, allowing new applications for laser level measurement.

Measurement made easy

01 LLT100 installed in a water treatment plant

Overview

The LLT100 is specifically made for industrial applications and harsh environments. It provides continuous, non-contact level measurement capabilities for process automation and inventory management. Building upon the success of the ABB laser level transmitters, the LLT100 can reliably detect the level of any liquid, even transparent, clear liquids.

Customer benefits

- Detect any liquid
 - Detect liquids of any color even transparent liquids,
 - Detect turbulent, agitated liquids independent of material properties or presence of gases.
- Easy setup
 - Swivel mounting flange for easy beam alignment,
 - Read signal amplitude from display to maximize performance,
 - Compute volume with linearization table.

Liquid detection

LLT100 uses laser time of flight to measure the level of solids or liquids. A limitation of laser level measurement products is their inability to measure clear, transparent liquids. LLT100 now fills this gap. By the use of improved laser pulse control, detection performance, and powerful algorithms, it can reliably measure any liquid.

LLT100 also comes in pressure rated models and is approved for use in explosive atmospheres.

New applications

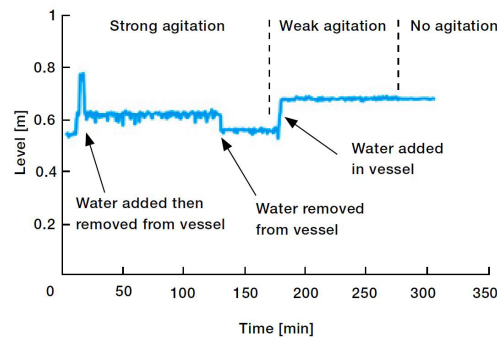
The new capabilities of the LLT100 open a wide range of new applications:

- Chemical tanks,
- Oils and hydrocarbons,
- Liquids in food and beverages,
- Water and waste water processing plants,
- Liquids in any industry such as mining, metals, power, pharmaceutical, and pulp and paper.

Clear water level measurement

The measurement of clear liquids was extensively tested in a number of different conditions. LLT100 performed well on all tested liquids, from colored liquids to transparent ones such as pure water or transparent mineral oil. Reliable measurements can be done at distances up to 30 m.

LLT100 also tracks the liquid surface level even in the presence of waves and surface agitation. In the figure below, waves are created in a clear water tank. There is no damping, so fast changes can be observed. As can be seen, LLT100 always detects the surface even in strong agitation. When no agitation is present, on the right of the plot, the standard deviation of the measured level is ± 1 mm, showing the repeatability and resolution of the measurement.

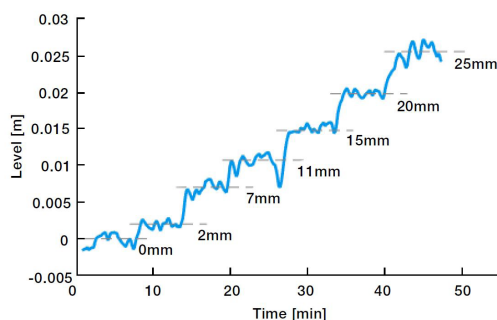


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In the presence of dense foam, the LLT100 will return the level of the top of the foam. However, the LLT100 is not confused by foam and the measurement is not lost or erratic.

Tracking small level changes

In this experiment, a clear water tank is filled by very small increments. Note that the level increments are of the order of a few milliliters. As can be seen, it is possible to track very small level changes. In this example, LLT100 tracks changes of the order of 5 mm and as small as 2 mm. Fluctuations are mostly due to agitation during filling the vessel.

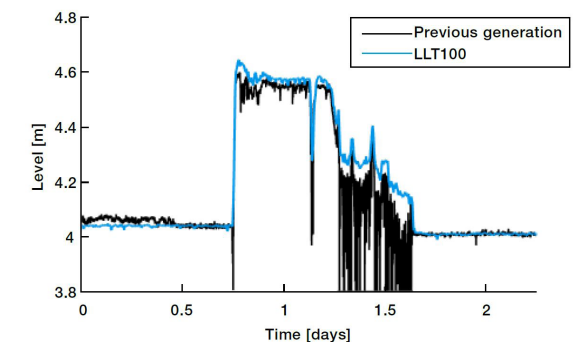


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Water treatment plan

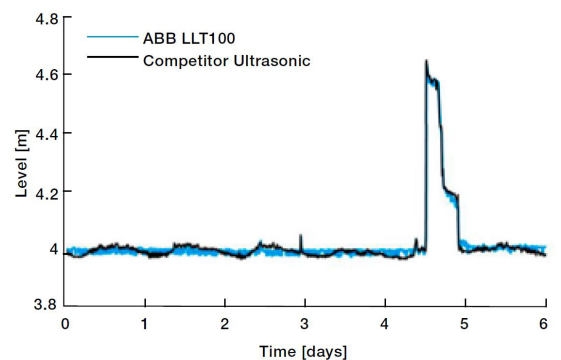
LLT100 units were installed in several water treatment plants in Quebec City, Canada. These units have been working for several months showing great performance. Significant improvement is seen compared to the previous generation of the product.

Results are reliable even over ambient temperature changes, level fluctuations, and water agitation. Plots of the level recorded over time shows how the LLT100 is superior to the previous generation when measuring clear liquids.



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Furthermore, the LLT100 was also installed next to a competitor's ultrasonic sensor for reference. The results also show the stability of the LLT100 output, unaffected by the daily temperature changes: the LLT100 line is straight when no filling occurs, while the competitor's product line shows a daily oscillation.



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Considerations for liquid applications

Product configuration

LLT100 comes with a variety of accessories for liquid applications:

- Heated window: Recommended in all applications where condensation can form on the transmitter window.
- Dust tube: Recommended when liquid splashing on the window can occur, increasing reliability and limiting maintenance.
- Swivel flange: Recommended to precisely align the laser beam perpendicular to the liquid surface.



Installation

Care must be taken to align the beam as perpendicular as possible to the liquid surface when measuring liquids. If for solid applications the beam can be aimed at almost any incident angle to the surface, for liquid applications the beam must be within $\pm 5^\circ$ of the vertical.

This can easily be achieved by monitoring the signal amplitude on the embedded display. In a typical installation, the LLT100 is placed on the swivel flange, and the user monitors the signal amplitude while he adjusts the flange angle. When the signal amplitude is maximized, the beam is perpendicular to the surface.

Software configuration

When configuring the LLT100 software for liquid applications, the following settings are recommended:

- Use the Clear liquid measurement mode;
- Enable both fill and empty rates filters and set them to realistic values;
- Use a median filter to limit the effect of surface agitation.