New Technology Review

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Balluff SmartLevel™ Technology
Accurate, Reliable Level Detection

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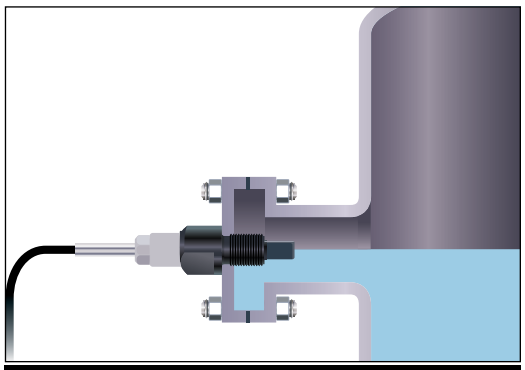
Level detection applications of dipolar or heavily foaming liquids are a difficult task for standard capacitive sensors today: Thicker container walls require time consuming setup procedures. Material build up of adhesive media on inside container walls cause sensors to repeatedly false trigger. Now, for the first time there is a comprehensive solution – a new, self-adjusting capacitive sensor technology that overcomes all these problems.

Capacitive sensors are commonly used for indirect presence detection of a wide range of non-metallic objects and liquids. In level sensing applications, capacitive sensors can be mounted in two different ways, depending on the target material and the tank wall composition. In direct sensing mode, the sensor is in direct contact with the target material in order to indicate if the material level rises above or falls below the sensor location. In indirect sensing, the sensor is typically mounted flush against a non-metallic wall to detect the target material through the container wall. The advantages here are obvious – the container wall doesn't have to be penetrated, which reduces the risk of leakage and allows lower installation costs.



SmartLevel™ sensor installed in direct sensing mode.

SmartLevel™ sensor installed in indirect sensing mode.

The active sensing area of a capacitive sensor is comparable to open electrodes of a capacitor. Both electrodes are in a feedback loop of a high frequency oscillator arranged in a way that they are in harmonic balance. The oscillator doesn't react unless a target material is introduced into the electro-static field formed between the two electrodes. The target material causes a change proportional to its dielectric constant in the couple capacitance which causes the oscillator amplitude to rise.
A signal evaluation circuit activates the output at the user-adjusted threshold level.

In order to get reliable and dependable sensing results, the user is required to use a trim potentiometer to adjust the signal sensitivity to meet the application requirements. Generally speaking a capacitive sensor would be adjusted to the point where it always ignores the non-metallic container wall but activates safely from the sum of container wall and target material capacitance.

Here lies the major difficulty. Standard capacitive sensors often false trigger when confronted by applications involving liquids which create films or material build-up on container walls or the sensor itself. Setup procedures are usually difficult, time consuming, and error-prone – or just plain impossible. Frequent readjustments offer only short-term results and the overall operational reliability of conventional capacitive sensors is unsatisfactory.

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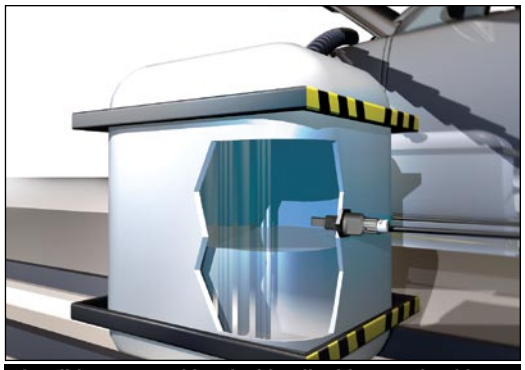
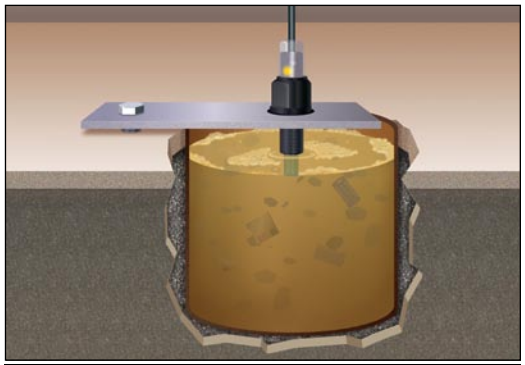
Enter SmartLevel™

Balluff's new SmartLevel™ sensors eliminate virtually all problems associated with standard capacitive level sensor technology. SmartLevel sensors accurately sense correct levels of aqueous or high conductive liquids through glass or plastic walls up to 12 mm thick. Balluff's SmartLevel technology allows these sensors to automatically distinguish between non-metallic tank walls, possible interferences from foaming of material build-ups, and the true level in the tank. SmartLevel sensors also readjust themselves when confronted with changing container compositions during checking procedures or changes in liquids during different production runs. These sensors are simple to install and require no teach-in. They find true liquid level automatically for "mount and forget it" convenience.



Conditions caused by sloshing liquids contained in pallet applications are no problem for SmartLevel sensors.

In virtually all applications, Balluff SmartLevel sensors never require maintenance cleaning procedures. This means for the first time a capacitive sensor can operate accurately for an indefinite amount of time regardless of debris build up and/or in the presence of heavy foam, eliminating downtime and production loss. No false triggering, no maintenance, no process interruptions.



The SmartLevel sensor, shown here in a sump installation, is accurate in spite of foaming, film, and the presence of foreign material, even in direct sensing mode.

SmartLevel sensors are suitable for all water-based liquids and other highly conductive liquid compositions such as acids, detergents, and organic wastes. Common applications include filling situations, storage and mixing stations, and general process monitoring in chemical or medical environments.

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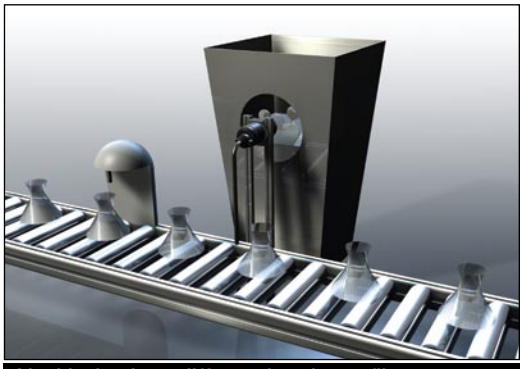
SmartLevel sensors work with a special high-frequency oscillator whose amplitude is correlated to two independently acting sensing electrodes. These electrodes continuously try to force themselves into a balanced state. This is how the sensor measures independently (contrary to standard capacitive sensors) the capacitance of the container wall without ground reference and the capacitance of the conductivity of the liquid with ground reference.

Without having material introduced into the sensor's field, the amplitude of the oscillator is at a nominal state. Once an empty container wall creates a capacitance, the amplitude rises above the nominal level but will never lead to a valid switching condition – unlike a standard capacitive sensor. A conductive liquid which rises in the container approaching the sensor's field, will create a second much higher capacitance reference to ground. This second capacitance, being significantly higher than the first one, affects the oscillation inversely to the first one and pulls the amplitude down to 0V, triggering the sensor's output.

This technology is the reason SmartLevel sensors provide an extraordinary level of reliability and safety, do not require any individual adjustments to the specific container wall, and do not falsely recognize material build-up, foaming, or filming in the application.



Liquids that have different foaming or film characteristics in automated fluid handling equipment are perfect applications for SmartLevel sensors.

Another reason why SmartLevel sensors compensate for differing conditions is because these sensors work at the frequency of 6.5 MHz, which is about 7-times higher than a standard capacitive sensor. This high AC frequency reduces the reactance part of the impedance between the active sensor surface and the material build-up, allowing the sensor to detect true level without interference; as long as the capacitance and the sum of capacitance and the conductivity of the liquid is sufficiently large.

SmartLevel sensors provide cost-effective, reliable, and easy-to-use point-level monitoring for a wide array of industries and applications. Balluff offers this technology exclusively in a wide array of sensor configurations to accommodate a full range of different applications and environments.

For more information, visit www.balluff.com/smartlevel.

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