

7 Main Types of Level Sensing Methods - How do they differ?

Liquid level sensors have been around for decades, in markets such as food and beverage, industrial, medical and domestic, printing, agriculture, automotive and white goods for [leak detection](#) or level measurement. We often wonder why customers choose one technology over the other and it is a common question we are asked. Some equipment manufacturers may also be surprised at both the variety and intelligence of level sensing alternatives available on the market.

Processes that used to involve expensive pieces of equipment can now be achieved using creative, innovative and intelligent technologies that can be cost effective, reliable, robust, highly accurate and simple to install. Fluids that have historically been known to be extremely challenging to detect such as soap containing bubbles/foam, milk, and sticky substances such as glue and ink are now proving possible and easier to detect with the variety of level sensing technologies available.

But is there need for such technology—or any level sensing device is the question that many people may ask. However, with the competitive nature of the industry and the consistently wanting to improve quality, reduce costs, inefficiencies and waste kind of mentality, no company wants to take the risk at offering solutions that are not performing as best as they could be.

- Optical
- Vibrating or tuning fork
- Ultrasonic
- Float
- Capacitance
- Radar
- Conductivity or resistance

1. Optical Level Switches

Pros – Compact, no moving parts, high pressure and temperature capability, can detect tiny amounts of liquids

Cons – Invasive as the sensor requires contact with the liquid, requires power, certain thick substances can cause coating on the prism.

Applications – tank level measurement and [leak detection](#) applications

There are a range of technical terms used to describe this type of level sensing technology. Optical prism, electro-optic, single-point optical, optical level switch...the list goes on. For this purpose, we will use the term Optical Level Switch. The switch

operates very simply. Inside the sensor housing is an LED and a phototransistor. When the sensor tip is in air, the infrared light inside the sensor tip is reflected back to the detector. When in liquid, the infrared light is refracted out of the sensor tip, causing less energy to reach the detector. Being a solid-state device, these compact switches are ideal for a vast range of point level sensing applications, especially when reliability is essential. Optical liquid level switches are suitable for high, low or intermediate level detection in practically any tank, large or small. They are also suitable for detecting leaks preventing costly damage. Reflected light, such as in a small reflective tank, mirrored tanks, bubbles, milk or coating fluids can often cause issues with delayed readings.



[2. Capacitance](#)



Pros – Solid-state, can be non-invasive, compact, accurate

Cons – May require calibration, can only be used in certain liquids

Applications – Tank level monitoring in chemical, food, water treatment, power and brewery industries.

Capacitance level sensors operate in the way that process fluids have dielectric constants, significantly different to air. They measure the change in capacitance between two plates produced by changes in level. Two versions are available, one for fluids with high dielectric constants and one with low dielectric constants.

Capacitance level sensors work with a range of solids, liquids, and mixed materials. They are also available in contact and non-contact configurations meaning some of which can be attached outside the container/tank. When selecting a device, it is important to know that not every capacitance sensor works with every type of material or tank. In addition, the sensor needs to be calibrated to the specific material to excuse the varying dielectric constants and differences in the tank design. As this type of technology is contact based, the reliability of these sensors can be heavily influenced by fluids sticking to the probe.

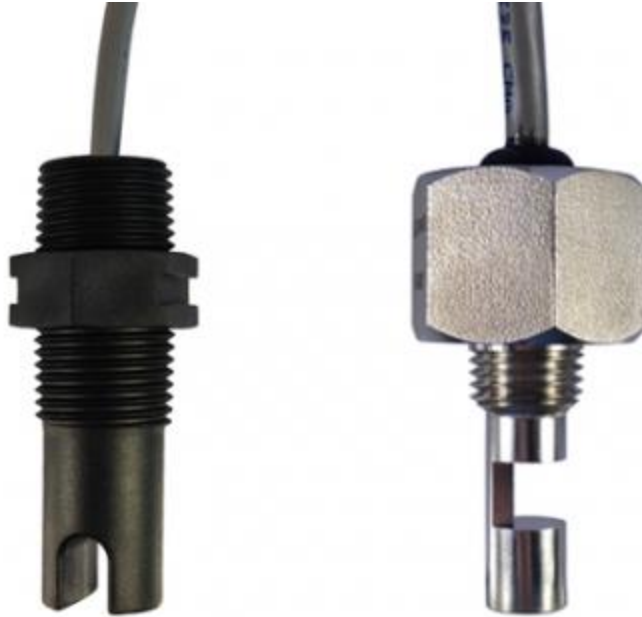
3. Ultrasonic

Pros – No moving parts, compact, reliable, not affected by media properties

Cons – expensive, invasive, performance can be affected by various elements in the environment

Applications – Non contact applications with highly viscous and bulk solids. Used in systems that require remote monitoring

Ultrasonic sensors measure levels by calculating the duration and strength of high frequency sound waves that are reflected off the surface of the liquid and back to the sensor – the time taken is relative to the distance between the sensor and the liquid. The length of time in which the sensor takes to react is affected by various elements in the atmosphere above the media such as turbulence, foam, temperature etc. Hence why the mounting position is critical in these devices.



[4. Microwave/Radar](#)



Pros – very accurate, no calibration required, multiple output options

Cons – expensive, can be affected by the environment, limited detection range

Applications – Moist, vaporous and dusty environments. They are also used in systems in which temperatures vary

In principle radar works in a similar way to ultrasonic, but the pulses travel at the speed of light and again; the reliability and repeatability can be affected – but this time by the dielectric constant of the fluid. However, radar can provide very precise level information and also compensate for fixed structures within the container. The downside can be that the initial cost of the sensor is relatively high, but several manufacturers are making this technology more accessible to the wider market. These sensors are among the handful of technologies that work well in foam and sticky substances.

5. Vibrating or Tuning Fork

Pros – Compact, cost effective

Cons – Invasive, number of uses are limited

Applications – [level control](#) of liquid, powders and fine grained solids within mining, chemical processing and food and beverage industries.

The vibrating sensor technology is perfect for solid and liquid level control, including sticky materials and foam, as well as powders and fine grained solids. However, the types of applications that can use tuning forks is limited to overfill or run dry type applications and they do not provide continuous process measurement. However can be used in conjunction with continuous level detection systems, acting as alarm points for over-filling and leaks.



6. Conductivity or Resistance



Pros – No moving parts, easy to use, low-cost

Cons – Invasive, liquids need to be conductive, probe erosion

Applications – Tank level measurement for boiler water, reagent monitoring, highly corrosive liquids

Conductive sensors are used for point-level sensing conductive liquids such as water and highly corrosive liquids. Simply put, two metallic probes of different lengths (one long, one short) insert into a tank. The long probe transmits a low voltage, the second shorter probe is cut so the tip is at the switching point. When the probes are in liquid, the current flows across both probes to activate the switch. One of the benefits to these devices is that they are safe due to their low voltages and currents. They are also easy to use and install but regular maintenance checks must be carried out to ensure there is no build up on the probe otherwise it will not perform properly.

7. Float Switch

Pros: Non-powered, direct indication, relatively inexpensive, various outputs

Cons: Invasive, moving parts, large in size, large amount of liquid has to be present before the float makes contact.

Applications: Tank level applications where water, oil, hydraulic fluids and chemicals are being used.

Float switches are one of the most cost effective but also well proven technologies for liquid level sensing. A float switch includes a magnet within a float and a magnetic reed switch contained within a secure housing. The float moves with the change in liquid and will cause the reed switch to either open or close depending on if it's in air or liquid. Although simple in design, this technology offers long-term reliability at an attractive price point.

Depending on what mounting style the user chooses heavily depends on the design and construction of the tank or container the switch will be situated. Typically, suppliers will offer a range of mounting options, with the most common being horizontal/side mounting and vertical mounting.

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