

Technical Note: Bubble Sensors - Technology Overview

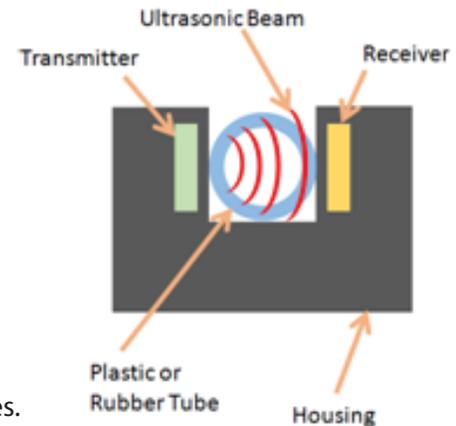
What is the operating principle for SMD (Strain Measurement Devices) bubble sensors?

Most SMD sensors are designed to operate non-invasively through the walls of a tube without the use of grease or other acoustic coupling materials. The most common applications for ultrasonic bubble sensors are medical devices, however bubble sensors also have many uses in other industries such as semiconductor, chemical, food and beverage, and oil & gas.

SMD Bubble Sensors are generally comprised a four main components - an ultrasonic transmitter, an ultrasonic receiver, signal processing circuitry, and a housing, see Figure 1.

The transducers are mounted in a housing such that a tube can be pressed into a slot between the transmitter and the receiver. The transmitter sends a pulse of ultrasonic energy through the housing and into the tube while the receiver looks for a received signal. Generally, there are three states that a tube can have:

- Liquid in tube: Most of the ultrasound travels through the tube and gets detected by a receiver on the opposite side
- Air in the tube: Most of the ultrasound is reflected at the tube-air interface and dissipates. Very little signal is detected by the receiver
- Bubble in the tube: The bubble blocks only a portion of the ultrasonic energy. The receiver circuitry interprets the signal and sends an alarm if the amount of received energy is below a set threshold.



Standard or Custom sensors?

SMD stocks custom sensors for almost any tubing size between 1/16" and 1/2" (1.6mm to 12.7mm) outside diameter. Typically, standard sensors are ideal for initial prototypes or proof-of-concept designs, however some customization is often required. Typical design considerations include:

- Does the sensor need to be calibrated or redesigned for a particular tube and bubble size?
- Is it advantageous to combine a bubble sensor with another type of sensor? (see our Technical Note: Combined Bubble and Occlusion Sensors)
- Does the application require a custom clamp to hold the tube in place? (See our FAQ on this topic)
- Does the test pin need to be activated? (see our Technical Note: Bubble Sensors - Test Pin)
- What sensor footprint and mounting scheme are required for the application?
- Does the sensor require a custom lead-out?
- Does the sensor require an inverted output? (see our note on inverted output and failsafe conditions in our FAQ)
- Does the sensor require custom electronics?
- Can the sensor be integrated into another component of the device?
- How fast is the liquid moving through the tubing? (see our Calculator: Bubble Flow Rate Calculator)