MSA
The Safety Company

Ultrasonic Gas Leak Detection

Gas Detection at the Speed of Sound

SAFEGUARDING
PEOPLE, PLACES & THE PLANET

The Ultrasonic Advantage

Technologies that have traditionally been used in fixed installations to detect hydrocarbon gas leaks, such as Catalytic/IR Point Sensors and IR Open Path Sensors all have one limitation: in order for a leak to be detected, the gas itself must either be in close proximity to the detector or within a pre-defined area. Unfortunately, environmental conditions such as changing wind directions and quick dispersion of the gas cloud from a leaking outdoor installation often cause traditional gas detection systems to fail simply because the gas never reaches the detector.

MSA General Monitors® Ultrasonic Gas Leak Detectors are based on robust microphone technology; they detect outdoor leaks by sensing the distinct high frequency ultrasound emitted by all high pressure gas leaks. With the unique Gassonic® ultrasonic sensing technology, leaking gas itself does not have to reach the sensor – just the sound of the gas leaking.

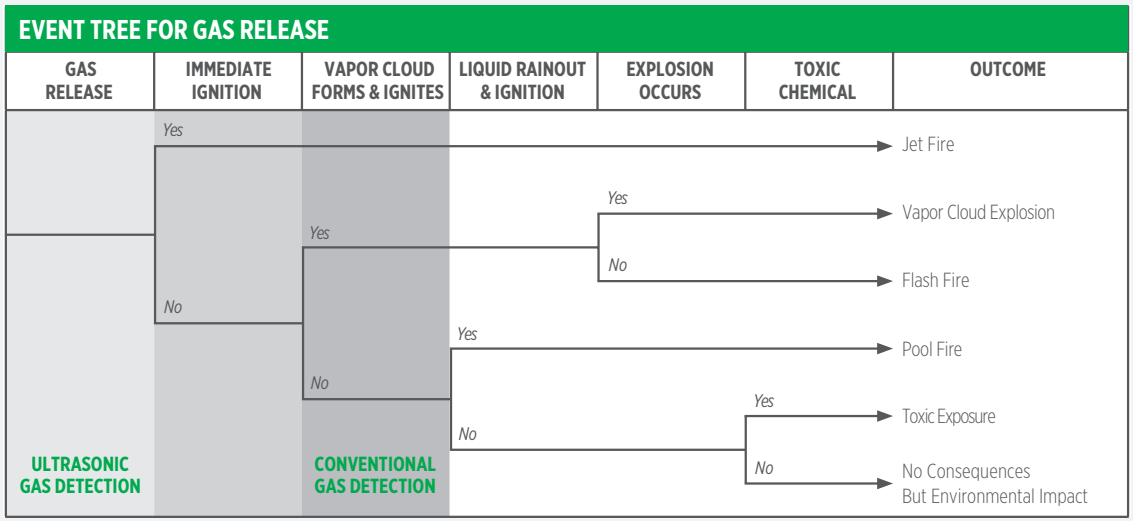
By adding MSA's Ultrasonic Gas Leak Detectors faster response times and lower operation costs can be obtained.

Significantly Increased Safety

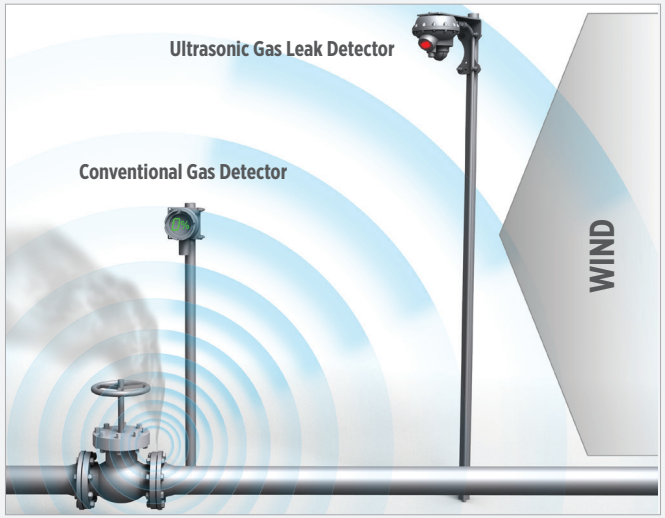
Plant operators are constantly looking at ways to reduce risk, prevent loss, and ensure safe and reliable production. One of the key elements in achieving this and increasing the overall efficiency is speeding up the response time of the Fire & Gas Detection System.

The **Gas Release Event Tree** below puts the effects of a gas leak into perspective. It is evident that the deployment of appropriate technology to detect hazards at the earliest stage (initiation), before they have time to develop or escalate has a significant impact on major accident risk reduction.

Traditional gas detection systems need to wait for the gas to form a vapor cloud, which may or may not ignite, and which may or may not allow loss prevention by enabling shutting down the gas facility in time. Ultrasonic Gas Leak Detectors (UGLD) respond at the speed of sound at gas leak initiation, unaffected by changing wind directions, and dilution of the gas (see graphic on right).



The gas release event tree illustrates the sequence of events that can take place in the event of a gas release. The figure shows that UGLD responds at gas leak initiation whereas conventional detectors only respond when the gas has accumulated and formed a vapor cloud.



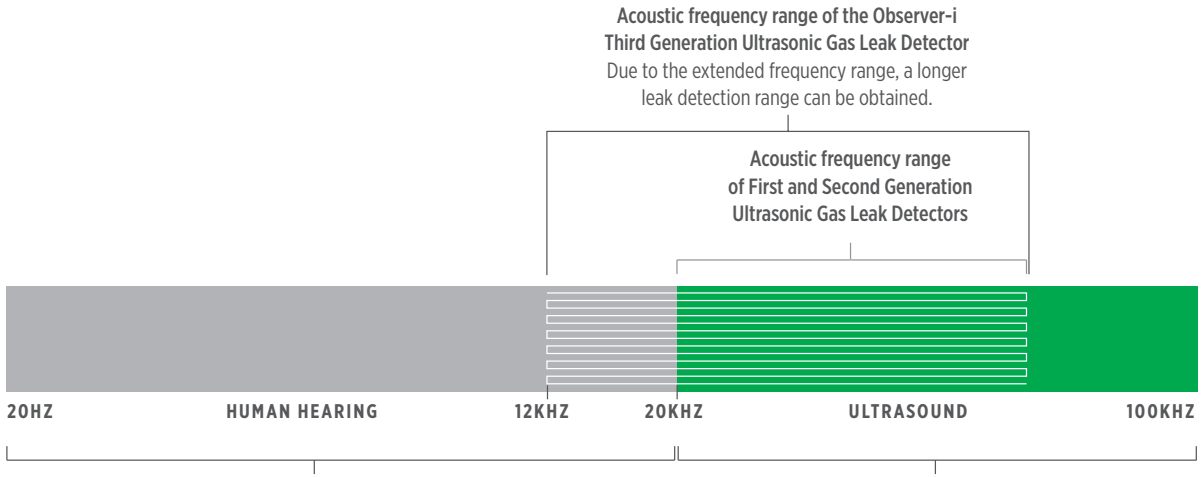
Ultrasonic gas leak detectors do not need physical contact with the gas. They are unaffected by wind, gas dilution, and the direction of the gas plume.

Ultrasonic Gas Leak Detection

A sound wave is simply a pressure pulse in the air, which is detected by the human ear the same way that it is detected by a microphone. The human ear can only perceive acoustic sound waves in the frequency range between 20 and 20.000 Hz (20 kHz) and that is why this frequency range is called the audible frequency range. Acoustic sound frequencies above 20 kHz are called ultrasound.

When pressurized gas is released through a leak, the hissing noise produced is called broad band acoustic noise, ranging from the audible frequency range into the ultrasonic frequency range. Earlier generations of Ultrasonic Gas Leak Detectors only "listened" for the gas leak noise in the ultrasonic frequency range from about 25 kHz and up, but by means of the new Artificial Neural Network sound algorithms in the General Monitors Observer® i, the detector's frequency range can be lowered down to 12 kHz without picking up unwanted background noise. The lower frequency range increases the detection radius of the Observer-i significantly in all application areas compared to earlier versions of Ultrasonic Gas Leak Detectors while still maintaining false alarm immunity.

Human Hearing vs. Ultrasound



Senssonic™ Acoustic Self-Test Technology

In field instrumentation, particularly in harsh outdoor environments, faults or breakdowns can occur. What is not acceptable is when such faults or breakdowns are left unrevealed, especially if safety is involved. To meet the challenge of ensuring failsafe operation for our most advanced Ultrasonic Gas Leak Detectors, we have developed the Senssonic self-test technology.

The Senssonic self-test technology provides a full acoustic integrity test of the Observer-i Ultrasonic Gas Leak Detector every 15 minutes using a high-quality sound transducer transmitting an air-borne ultrasonic signal to the detector's microphone system. This ensures that the microphone and the electronics are tested continuously within well-defined tolerances, and that the operator is warned if the detector should fail this regular test.

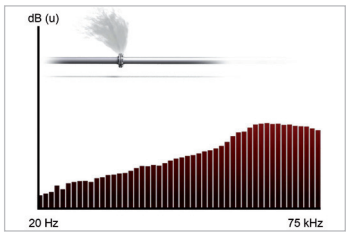
The Senssonic technology provides reliable and failsafe operation for our Ultrasonic Gas Leak Detectors, protecting your assets and ensuring human safety in your industrial facility.

The Senssonic technology is the only technology on the market to self-test both the microphone system and the protective windscreen protecting the microphone. This ensures that dirt or other contaminants on the detector wind screen, that could decrease leak detection performance, will be detected.

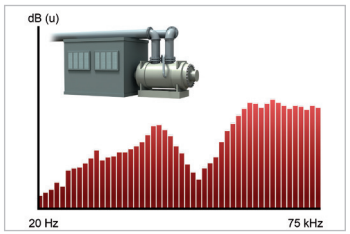
Why Neural Network Technology?

An essential performance parameter for an Ultrasonic Gas Leak Detector is to ensure high acoustic sensitivity to real gas leaks over a large area while at the same time minimizing the interference from background noise sources unrelated to gas leaks. To overcome the interference, first and second generation Ultrasonic Gas Leak Detector designs use either simple analog filters with alarm trigger levels to suppress low frequency background noise or complicated onsite "fingerprint learn" modes to mask out background noise. The Observer-i is a Third Generation Ultrasonic Gas Leak Detector that uses **A**rtificial **N**eural **N**etwork (ANN) algorithms in the detector's advanced sound processing design to distinguish between real gas leak noiseand unwanted background noise. The ANN uses a mathematical algorithm to search for familiarity in large and complex sets of data.

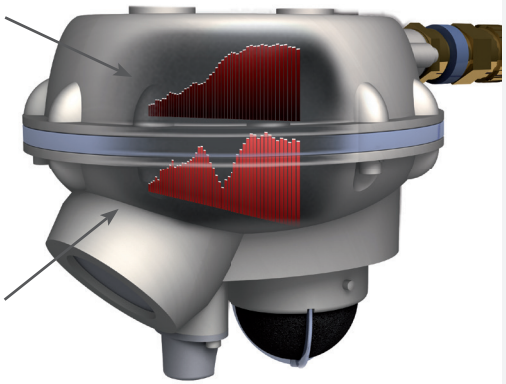
Training of the Neural Network



Gas leak noise
Recognized by the detector



Background noise
Rejected by the detector



Observer-i ANN has been pretrained with gas leak noises and background noises

ANN works very similar to how the human brain handles the constant flow of information. When we meet a person, the brain receives a massive amount of visual information through the eyes, and over time this substantial amount of information is used to recognize this person years later or even to identify further family members. When the brain has received visual information about other family members, it is easier for it to distinguish between family and non-family members. In other words, the more we train our brain to recognize familiarity, the better we will be able to recognize or deny a person's face. The brain does not look for an exact match, it looks for familiarity, and so does the ANN. But like the brain, the Neural Network needs to be trained first.

An Ultrasonic Gas Leak Detector does not have to recognize different people. It needs to effectively recognize the sound signature from a gas leak while at the same time rejecting sound signatures from acoustic background noise not related to gas leaks.

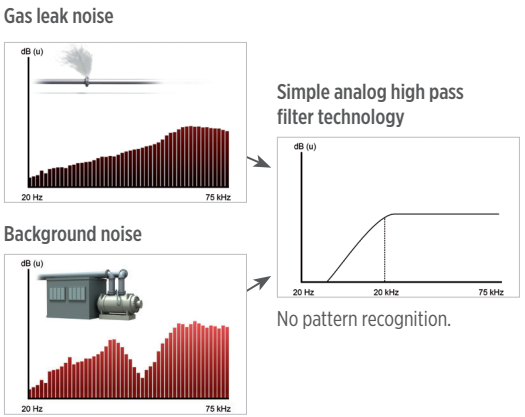
The Observer-i comes with pre-trained Neural Network algorithms that are a result of more than 10 years field experience and numerous acoustic data recordings from both onshore and offshore facilities to build and train the ANN algorithms. The detector does not require complicated onsite training procedures to adapt to specific acoustic plant conditions. Instead it performs optimally in all kinds of acoustical environments, right after installation.

Even if the background noise conditions change, the ANN algorithms will automatically compensate for that, so no re-training will be necessary.

The Three Generations of Ultrasonic Gas Leak Detectors

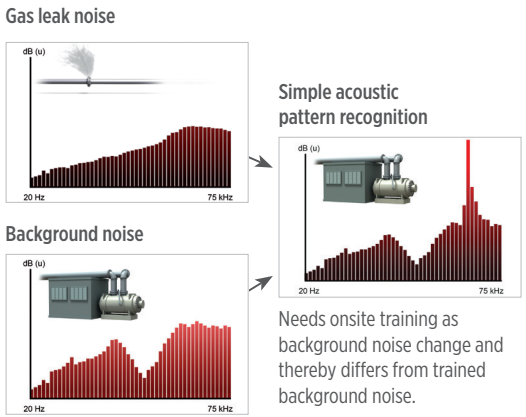
First Generation

First generation Ultrasonic Gas Leak Detectors use simple analog high pass filters to suppress low frequency acoustic noise from activating the detector. These detectors work well, but have a reduced detection range depending on the nature of the background noise, and in very noisy areas the detection range is reduced due to the need for high alarm trigger levels.



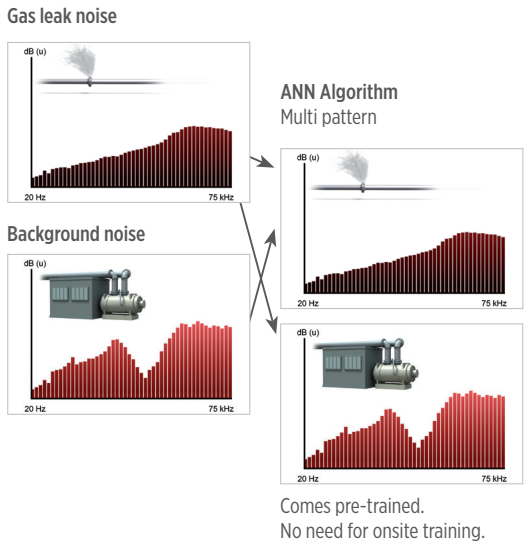
Second Generation

Second generation Ultrasonic Gas Leak Detectors utilize pattern recognition where each detector in the plant is trained after installation to suppress only the specific acoustic background noise the day the training took place. If the background noise signature changes due to changing plant process conditions, false alarms can occur, and a new training of the detector has to be performed, causing a change in the leak detection performance.



Third Generation

Third generation Ultrasonic Gas Leak Detectors use **A**rtificial **N**eural **N**etwork Technology where the neural network algorithms are pre-trained with noise signatures from both real gas leak noise and many background noise signatures (compressors, helicopters, choke valves, etc.). These Ultrasonic Gas Leak Detectors offer a combination of very easy installation and operation, also in changing plant conditions, while at the same time offering absolute market leading gas leak detection performance.



MSA—The Safety Company

Established in 1914, MSA Safety Incorporated is the global leader in the development, manufacture, and supply of safety products that protect people and facility infrastructures. Many MSA products integrate a combination of electronics, mechanical systems, and advanced materials to protect users against hazardous or life-threatening situations. The company's comprehensive product line is used by workers around the world in a broad range of markets, including the oil, gas, and petrochemical industry, the fire service, the construction industry, mining, and the military. MSA's core products include self-contained breathing apparatus, fixed gas and flame detection systems, portable gas detection instruments, industrial head protection products, firefighter helmets and protective apparel, and fall protection devices. With 2021 revenues of $1.4 billion, MSA employs approximately 4,800 people worldwide. The company is headquartered north of Pittsburgh in Cranberry Township, PA, and has manufacturing operations in the United States, Europe, Asia, and Latin America. With more than 40 international locations, MSA realizes approximately half of its revenue from outside North America. For more information visit MSA's web site at www.MSAsafety.com.

MSA operates in over 40 countries worldwide. To find an MSA office near you, please visit ***MSAsafety.com/offices***.

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