


Gas Detection at the *Speed of Sound* **GASSONIC**




GASSONIC Ultrasonic Gas Leak Detection

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Co Founder Gassonic A/S

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GASSONIC

About Gassonic



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About Gassonic **GASSONIC**


- 1995 – Originated in Denmark
- 2006 – Acquired by General Monitors
- 2010 – Gassonic & GM acquired by MSA

Over 4,000 detectors installed in the field

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UGLD



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UGLD Application Area **GASSONIC**

- Instant detection of flammable gas leaks
- Pressurized gas installations
- Outdoor or ventilated areas
- Explosion hazardous
- Fixed installations



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Gas Release Event Tree **GASSONIC**

Deployment of early response to improve hazard management

EVENT TREE FOR GAS RELEASE

Gas Release	Immediate Ignition	Vapor Cloud Forms & Ignites	Liquid Rainout & Ignition	Explosion Occurs	Toxic Chemical	Outcome
ULTRASONIC GAS DETECTION	Yes					Jet Fire
	No	Yes		Yes		Vapor Cloud Explosion
	No	No		No		Flash Fire
	No	No	Yes			Pool Fire
CONVENTIONAL GAS DETECTION		No			Yes	Toxic Exposure
		No			No	No Consequences But Environmental Impact

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Leak Rate vs. LEL GASSONIC

Lower Explosive Level (% LEL):
A concentration measurement in a pre-defined point that may create a true picture of the nature of the gas leak

Leak rate (kg/s):
Detection related to the leak rate, makes it possible to introduce a performance standard for the gas leak detection system.

Example: Gas leaks with a leak rate of 0.1 kg/s (0.22 pounds/sec) or more must be detected.

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What is a Leak? GASSONIC

- Performance standard is 0.1 kg/sec (0.22 pounds/sec)
- Leak rate (mass flow rate) categories for methane based gas leaks (Ref: HSE from UK):
 - Minor gas leak: 0 – 0.1 kg/s
 - Significant gas leak: 0.1 – 1 kg/s
 - Major gas leak: 1 kg/s or larger
- A 0.1 kg/sec Methane leak: 4 mm (0.16 in) hole size at 45 Bar (653 psi) gas pressure

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Operation Modes GASSONIC

Earlier generations of UGLDs only "listened" for the gas leak noise in the ultrasonic frequency range from 25 kHz and higher. Utilizing ANN, the OBSERVER-i frequency range can be lowered down to 12 kHz without interference from unwanted background noise. The lower frequency range significantly increases the detection radius.

Acoustic frequency range of the GASSONIC OBSERVER-i Third Generation Ultrasonic Gas Leak Detector
Due to the extended frequency range, a longer leak detection range can be obtained.

Acoustic frequency range of First and Second Generation Ultrasonic Gas Leak Detectors

20KHZ HUMAN HEARING 12KHZ 20KHZ ULTRASOUND 100KHZ

Acoustic sound within the human hearing range.
Most background noise in plants and other industrial facilities, including turbines, motors, and compressors, falls within this frequency range.

Acoustic sound beyond the human hearing range.
Very few background noise will occur in this area. Leaking gas produces acoustical sound within this range.

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Real Gas Leak Test with Ultrasonic Detectors GASSONIC

Live gas leak test on a North Sea off-shore installation:

Leak size: 3 mm
Gas pressure: 55 Bar (808 psi)
Leak rate: 0.06 kg/s

Within 4-5 meters the gas concentration around the leak was below 5% LEL!

None of the existing gas detection systems alarmed!

The ultrasonic gas leak detector detected the leak up to 19 meters away!

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Total Speed Of Response GASSONIC

Ultrasonic leak noise vs. gas accumulation

TOTAL SPEED OF RESPONSE (CONVENTIONAL): $T_{total} = T_{detector} + T_{gas}$

TOTAL SPEED OF RESPONSE (UGLD): $T_{total} = T_{detector} + T_{ultrasonic}$

90% response
50% response

T_{total} for UGLD
 T_{total} for conventional detector

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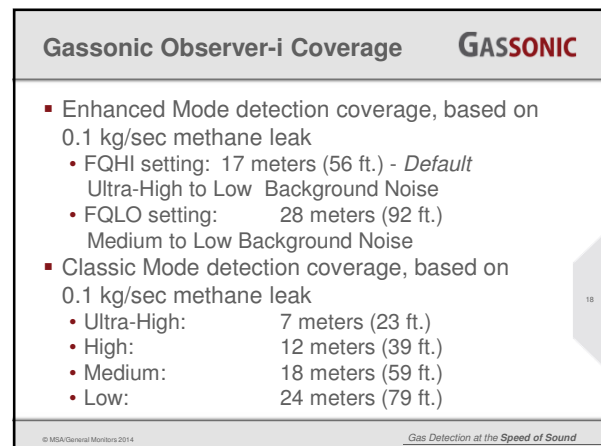
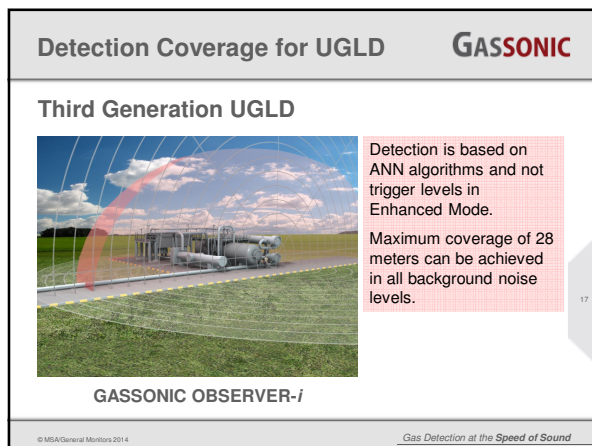
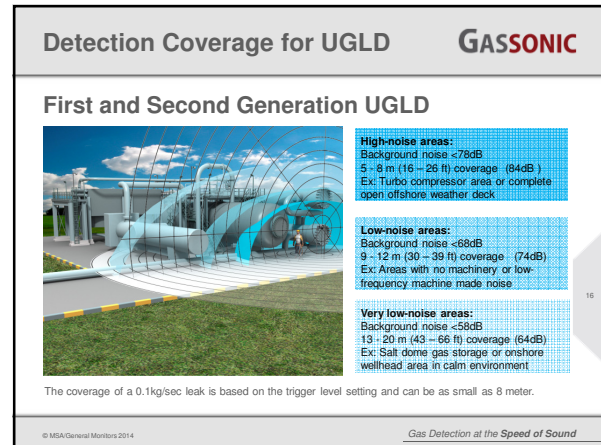
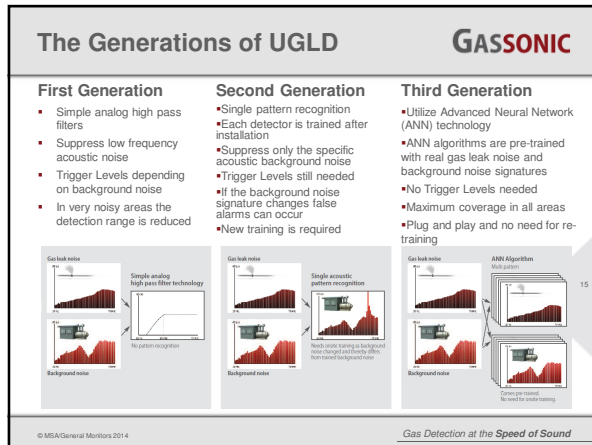
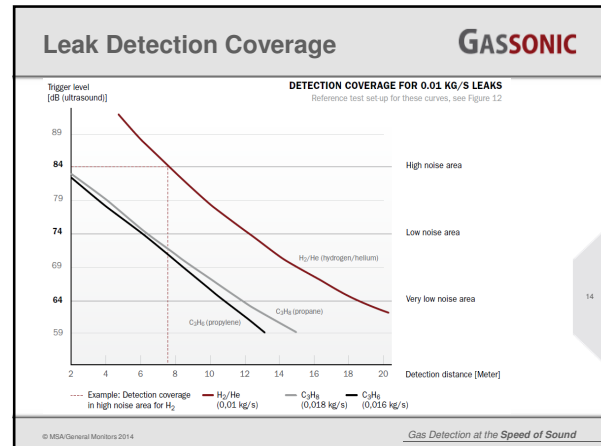
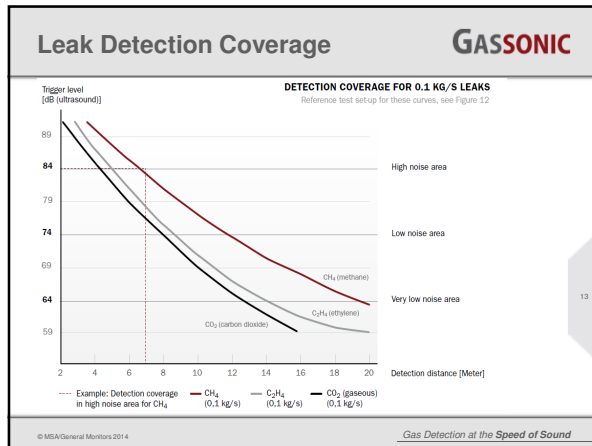
Gas Detection Limitations GASSONIC

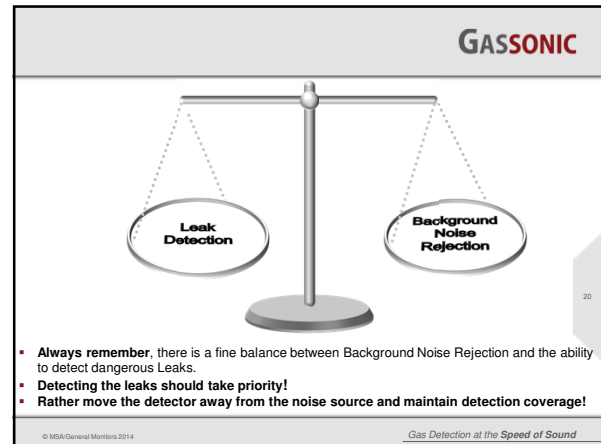
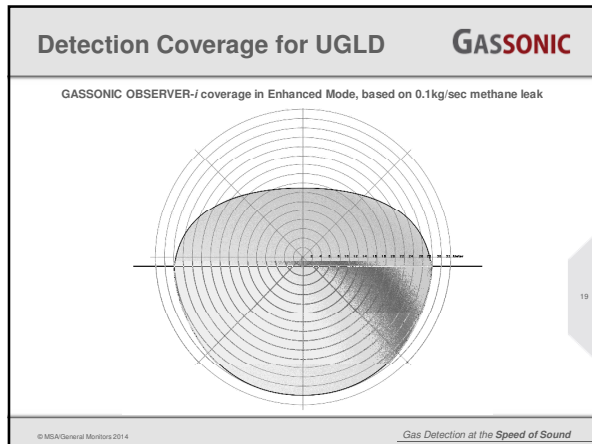
- Why traditional technologies can be problematic
 - Changing wind directions
 - Gas dilution
 - Direction of the leak
- Acoustic technology limitations
 - Low pressure (2 Bar/29 psi min, 10 Bar/150 psi normal)
 - Not suited for liquids

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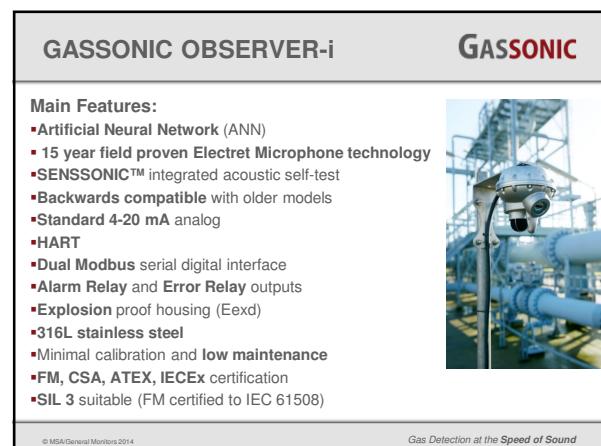
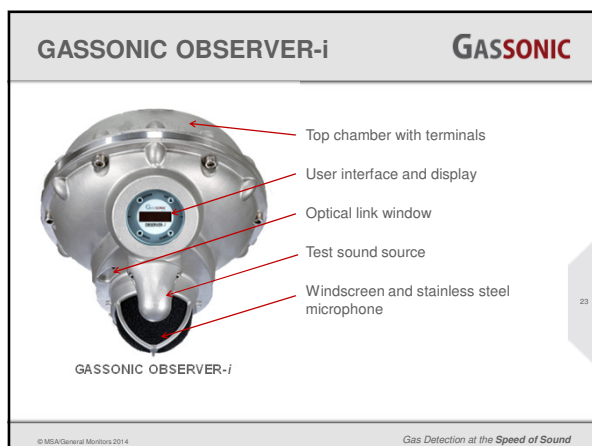


Detector Type Comparison **GASSONIC**

	Surveyor UltraSonic IS-5	Observer H UltraSonic EX-5	Gassonic Observer-i
Area Classification	Intrinsically Safe	Explosion proof	Explosion proof
Dynamic range	44 to 104 dB	58 to 104 dB	40 to 120 dB
Operation Mode	Classic (dB trigger levels)	Classic (dB trigger levels)	Classic / Enhanced
Coverage (0.1kg/s)	5 to 20 meters	5 to 20 meters	28 meters
Self Test	No	Yes	Yes
Sensor	S.S. Microphone	S.S. Microphone	S.S. Microphone
Safety Integrity Level	SIL 2	SIL 2	SIL 3
Test and Calibration	1701 / SB100	1701 / SB100	1701 / SB100

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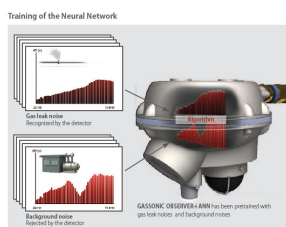
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Artificial Neural Network (ANN)

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- True ANN, not "single fingerprint" learning
- ANN is similar to face recognition, but with noise sources
- Programmed to ignore background noise and only respond to leaks
- No complicated setup and special software
- No need for background noise mapping before installation
- No need for re-training when plant conditions change



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Microphone technologies

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Two technologies used for converting sound waves into electrical signal used by modern ultrasonic gas leak detectors:

- Piezo based microphone technology
- Electret based microphone technology

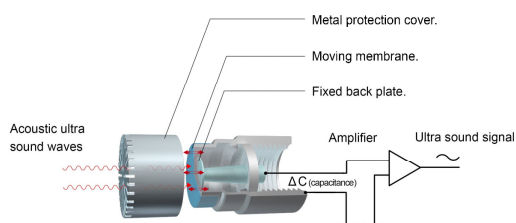
BOTH TYPES OF MICROPHONE TECHNOLOGY INCORPORATE MICRO MOVEMENTS!

Be careful, some vendor claim "no moving parts", it is a false claim!

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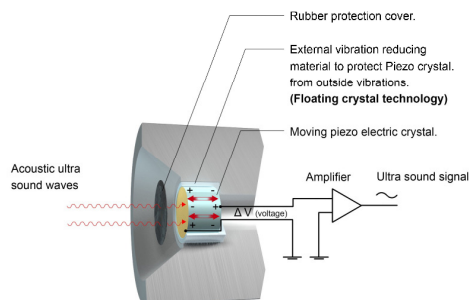
Electret microphones (Moving membrane)

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Piezo microphones (Moving crystal)

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Gas Detection at the Speed of Sound

Optimal microphone technology

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Why Electret microphones instead of Piezo microphones?:

- Best linear frequency responds
- Best temperature stability
- Very wide directional characteristic, wide detection range
- 15 years field proven technology

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Number of microphones

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Why one microphone versus multiple microphones:

- Due to piezo microphones "narrow directional characteristic", four microphones necessary to cover 360 deg.
- Electret Microphones has very wide directional characteristic so only one microphone is needed

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Microphones

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Why Electret microphones instead of Piezo microphones?:

- Best linear frequency responds
- Best temperature stability
- 15 years field proven technology

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Gas Detection at the Speed of Sound

Test and calibration with Gassonic 1701 tester.

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Provide **Traceable** Test and IF necessary **Traceable** Calibration.



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Gas Detection at the Speed of Sound

Test and calibration with Gassonic 1701 tester.

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The GASSONIC OBSERVER-i can be tested, linked to ISO9001 traceable international calibration standards:

- Ensures ALL GASSONIC OBSERVER-i always have same detection coverage.
- Ensures same detection coverage in life time of detectors
- Ensures that test and calibration of each detector can be documented to traceable standards.

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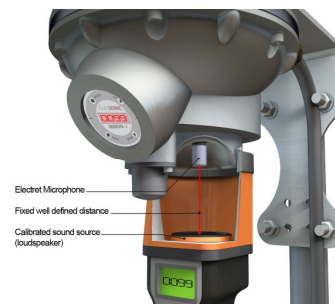
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Controlled test and calibration

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- Fixed distance between sound source and microphone
- No interfering background noise due to closed test chamber



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BE carefull, myth to be killed!

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Following statement are false:

“Calibrated for life.....”

Nothing is calibrated for life, all instrumentation needs a traceable reference to repeatedly prove stability!, therefore the use of the Gassonic 1701 tester.

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Self Test principles

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There are two types of self test principles:

- Electronic self test
- Semi acoustic self test
- Full Senssonic Acoustic Selftest

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Electronic selftest

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- Electronic selftest only test internal electronic circuits behind electret/piezo microphone sensor.
- Blocked electret/piezo microphone sensor or blocked windscreen not tested.

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Semi Acoustic Selftest

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- Semi Acoustic selftest only test internal electronic electret/piezo microphone sensor.
- Blocked windscreen not tested!.

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Senssonic Acoustic Selftest

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- Full Senssonic selftest tests internal **electronic, microphone sensor, and windscreen protection**
- Full Senssonic selftest ensures that microphone failure, or blocked windscreen are constantly checked every 15 minutes to ensure no loss in detection performance

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Gassonic acoustic selftest (SENSSONIC™)

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Gassonic SENSSONIC™ selftest includes full acoustic selftest of the Gassonic Observer-I

- Real acoustic self test includes the following tests:
 - All relevant electronic circuits are tested
 - Microphone membrane are tested
 - Windscreen are tested
- Ensure full failsafe operation of detector
- Providing the only **true and safe** test of detector

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Gassonic acoustic selftest (Senssonic)

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- SENSSONIC™ built-in acoustic integrity test
 - External loop configuration
 - Controlled functionality and integrity test every 15 minutes
 - No unrevealed failures between inspections
 - Fault indicated on 4-20 mA, Error Relay, Display, Modbus, and HART

Test transducer

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Field replaceable parts

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Gassonic Observer-i can be serviced in the field, does NOT need to go back to factory for service:

- Microphone sensor can be replaced in the field
- SENSSONIC™ self test sensor can be replaced in the field

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Operation Modes GASSONIC

- The GASSONIC OBSERVER-i has two output modes
 - Enhanced Mode (ANN)
 - Classic Mode (Backwards compatible with the Observer H / UltraSonic EX-5)

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Operation Modes GASSONIC

- The GASSONIC OBSERVER-i has two output modes
 - Enhanced Mode (ANN)
 - Classic Mode (Backwards compatible with the Observer H / UltraSonic EX-5)

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Classic Mode GASSONIC

- Need Trigger Level and Delay Time
- Trigger Level determines the coverage (Sensitivity)
- 40 to 120 dB = 4 to 20 mA
(Better than Observer H / UltraSonic EX-5)

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Enhanced Mode GASSONIC

- NO Trigger Level needed**, only Delay Time
- Three output modes: Discrete SPL (EAO1), Discrete (EAO2), SPL Only (EAO3)
 - EAO1 and EAO2 has discrete AO similar to MSIR Flame Detector (16 mA Warning, 20 mA Alarm)
 - EAO1 40 to 120 dB = 4 to 12 mA, 16 mA = Warning, 20 mA = Alarm
 - EAO2 40 to 120 dB = 4 mA Normal, 16 mA Warning, 20 mA Alarm

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Operation Modes GASSONIC

OBSERVER-i Classic Mode and Observer H / UltraSonic EX-5 analog output comparison

SPL	OBSERVER-i mA	UltraSonic EX-5 Observer H mA
40	4.0	
44	4.8	
49	5.8	
54	6.8	
58	7.6	4.0
59	7.8	4.3
64	8.8	6.1
69	9.8	7.8
74	10.8	9.6
79	11.8	11.3
84	12.8	13.0
89	13.8	14.8
94	14.8	16.5
99	15.8	18.3
104	16.8	20.0
109	17.8	
114	18.8	
120	20.0	

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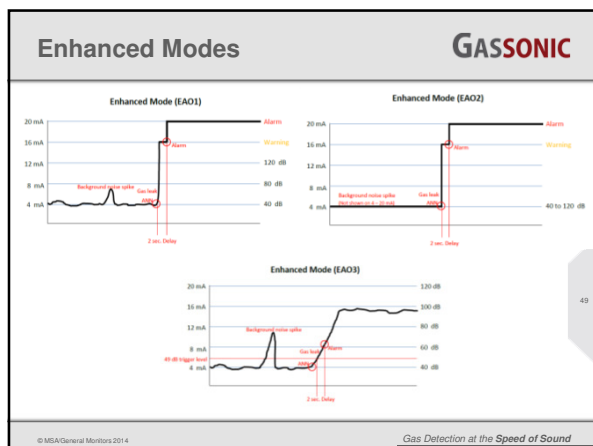
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Operation Modes GASSONIC

- Alarm Function in Enhanced Mode
 - It is an "AND" function
 - Sound level has to pass ANN Sensitivity Level "AND" a real gas leak identified
 - ANN Sensitivity Level default at 59 dB can be set as low as 44 dB (recommended)

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Testing GASSONIC

1701 Portable Test & Calibration Unit

- Intrinsically Safe (ATEX, C-UL)
- Verify the operation and if necessary, calibrate the GASSONIC UGLD
- Requires no electrical connection to the UGLD
- Traceable and calibrated to international standards
- Tests full dynamic range as well as delay function
- No need to open up detector or remove parts in the field

SB100 Bump Tester

- Intrinsically Safe (CSA, FM, ATEX, IECEx)
- For bump test of GASSONIC UGLDs
- Not a calibrated device
- Remote testing up to 18m (59ft) away
- Does not replace gas leak simulation
- GASSONIC OBSERVER-i recognizes the SB100 sound signature

Gas Detection at the Speed of Sound

Testing GASSONIC

1701 Portable Test & Calibration Unit

- Prior to testing
 - Clean windscreen and optical link window
- Testing/Calibration
 - Traceable to international standards
 - Gain Test (functionality/tolerance)
 - Delay Test (Loop to F&G System)
 - Calibration if required by plant procedures
- Maintenance
 - Factory calibration needed every 2 years

Gas Detection at the Speed of Sound

Testing GASSONIC

SB100 Bump Tester

- Remote Bump Testing
 - Cannot be used for calibration
 - Testing up to 18m (59ft)
 - The table below does not correspond to real gas leaks (Gas leak simulation is recommended)

Test Range Distance	Average Sound Level Reading* +/- 5 dB
4 m (13 ft)	88
6 m (20 ft)	82
8 m (26 ft)	78
10 m (33 ft)	74
12 m (39 ft)	70
14 m (46 ft)	68
16 m (52 ft)	64
18 m (59 ft)	60

*As tested on the GASSONIC OBSERVER-i, OBSERVER, GASSONIC Surveyor, MSA EX-5, and MSA 5-S.

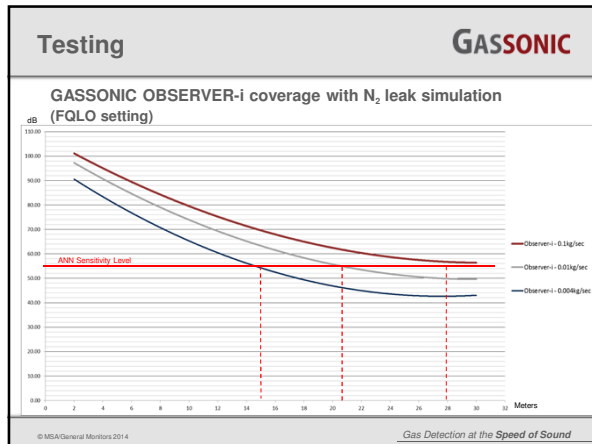
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Testing GASSONIC

Gas Leak Simulation

- Recommended gas leak equipment
 - 4 meter long high pressure hose with regulator, valve and nozzle
 - 2 or 4 mm nozzle
- Testing procedure
 - Maximum 0.1 kg/sec (0.22 pound/sec) leak rate from a standard 50 Liter nitrogen cylinder
 - Leak testing performed at coverage perimeters

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Installations Worldwide **GASSONIC**

- Most of the major end-users within the oil and gas industry are implementing UGLD technology for projects worldwide

Europe, Africa, Middle East, Far East/Central Asia, Australasia

- North Sea: England, Norway (Sleipner, Gullfaks)
- Caspian Sea Region: Azerbaijan (Shah Deniz), Russia (Sakhalin II), Kazakhstan (Kashagan)
- Middle East: Oman (Saih Rawl, Saih Nihyada, Al-Kawther, Harweel)
- Far East/Central Asia: China (Bohai Bay), Malaysia (Shell Bintulu), Pakistan (Rehmat), Indonesia (Tangguh)
- Africa: Equatorial Guinea (Marathon ALBA), Algeria (Hassi Berkine)

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Installations Worldwide **GASSONIC**

- More than 4000 GASSONIC UGLDs installed worldwide

The Americas

- USA - Dow Chemical, Chevron Global Gas, Caledonia Energy, Shell Offshore, Chevron Pipeline, EnCana, Seneca Resources
- Canada - Dow Chemical, Nexen, EnCana, SBM
- Trinidad & Tobago - BP, BG, NGC
- Chile - Chile LNG
- Argentina - Total
- Mexico - Pemex

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Installations Worldwide **GASSONIC**

Full Senssonic Self

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Existing Installations **GASSONIC**

Onshore Wellheads

Ultrasonic detectors installed on wellheads in Europe and Africa

Major gas supplier in Europe using only ultrasonic detectors at its outdoor gas plants

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Existing Installations
Offshore Platform

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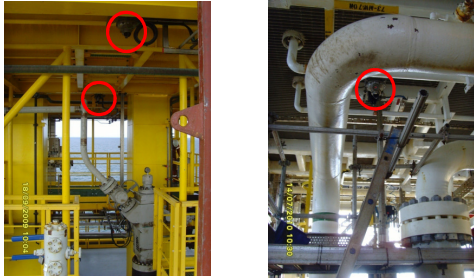
7 out of 9 Ultrasonic detectors installed on a Hess weather deck in the North Sea.

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Existing Installations
Offshore Platform

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Observers offshore



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Thank you for your Attention!

Any Questions?

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