



FUNCTIONAL SAFETY MANUAL

UltraSonic EX-5

Ultrasonic Gas Leak Detector



The information and technical data disclosed in this document may be used and disseminated only for the purposes and to the extent specifically authorized in writing by MSA.

Instruction Manual

MSA reserves the right to change published specifications and designs without prior notice.

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MANEX5SAFETY
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This manual describes the functional safety related information for the installation, operation, configuration, and maintenance of the UltraSonic EX-5 ultrasonic gas leak detector. This manual does not describe installation requirements in hazardous locations.

For complete information regarding performance, installation, operation, maintenance, and specifications of the UltraSonic EX-5, please refer to the product instruction manual.

It is MSA's mission to benefit society by providing safety solutions through industry-leading products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

The safety product you have purchased should be handled carefully, and installed and maintained in accordance with the associated product instruction manual. Remember, this product is for your safety.



WARNING: TOXIC, COMBUSTIBLE, AND FLAMMABLE GASES AND VAPORS ARE VERY DANGEROUS. USE EXTREME CAUTION WHEN THESE HAZARDS ARE PRESENT.

INTRODUCTION

General Description

The UltraSonic EX-5 is a microphone based ultrasonic gas leak detector that detects gas leaks by sensing the airborne ultrasound emitted from leaking gas at high pressure and responds with a 4-20 mA analog output, proportional to the acoustic sound pressure level (SPL) in dB, or optional relay output. Ultrasound emitted from a gas leak is not affected by wind direction or diluted as is a gas cloud. This makes the UltraSonic EX-5 the optimal choice for instant and reliable fixed gas leak detection in outdoor applications. The UltraSonic EX-5 is regarded as a Type B field device per IEC 61508.

The safety function of the UltraSonic EX-5 does not include:

- RS-485 or Modbus digital communication
- HART communication

RS-485, Modbus, and HART communication are typically used for field device setup, diagnostics, and troubleshooting. Carefully observe requirements for interfacing in hazardous locations. RS-485, Modbus, and HART communication are non-interfering functions and do not interrupt the safety critical function of the detector.

INSTALLATION

NOTE: Power should remain disconnected until all other wiring connections are made.

For complete information on the installation of the UltraSonic EX-5 acoustic detector refer to the product instruction manual.

Installation and Maintenance must be carried out by suitably skilled and competent personnel only. Before opening and working on the UltraSonic EX-5 in hazardous locations, be sure that power is off.

Install and maintain all hazardous area equipment in accordance with the relevant regulations and practices of the country concerned.

Detector Location Considerations

The UltraSonic EX-5 Detector does not have to be in contact with the leaking gas itself. It will detect the gas leak instantly even if the gas is carried away by wind or diluted in the air. However, factors that should be considered when locating an acoustic detector are

- Background noise levels
- Correct mounting
- Physical obstructions

Additionally, the unit should be mounted free from shock and vibration and convenient for visual inspection and cleaning. Though the detectors are RFI resistant, they should not be located near radio transmitters, high magnetic or electrical fields, or in areas with similar interference.

No special or additional detector mounting, wiring, power, or tool requirements exist beyond the standard installation practices documented in the product instruction manual for the UltraSonic EX-5.



WARNING: The inner six screws for the UltraSonic EX-5 should not be unscrewed and the bottom compartments should not be opened. The warranty will be void if the bottom part is opened.

OPERATION AND MAINTENANCE

For complete operation, configuration, and maintenance information for the UltraSonic EX-5 acoustic detector refer to the product instruction manual.

Before connecting a unit, check to make sure power is turned off. Before power up check all wiring connections.

The UltraSonic EX-5 performs internal diagnostics on critical faults every two seconds, an acoustic self-test every 15 minutes, and a memory check every 24 hours. Upon detection of a fault the unit will respond with tripping the fault relay and outputting fault level analog output current per Table 2, below.

Upon the detection of an acoustic fault the detector trips the fault relay and outputs an analog output pulse for 5 seconds per Table 2. After the pulse the unit returns to normal detection mode and is able to detect gas however, the detection capability may be reduced due to the acoustic fault. Refer to the product instruction manual for suggestions to clear the fault.

NOTE: During the acoustic self-test the unit is off-line for 8 seconds. In the unlikely event that an acoustic fault occurs immediately after the acoustic test, indication of this fault will occur 16.5 minutes later, at the completion of the next acoustic test.

High readings of ultrasonic sound level may indicate an explosive concentration of gas at the sensor. A subsequent fall in the ultrasonic sound level does not imply that safe working conditions have been restored.

The UltraSonic EX-5 is tested and calibrated as part of the manufacturing process. However, prior to use, it is good practice to establish and follow a regular maintenance schedule. This can be done using the UltraSonic test and calibration unit. Carefully follow test and calibration procedures described in this section of the product instruction manual.

Refer to the Troubleshooting Section in the product instruction manual in the event of a fault condition. In addition, spare parts should be on-hand to maintain the four hour repair time. Refer to the Replacement Parts section of the instruction manual for more information.

SPECIFICATIONS

Table 1 and Table 2 list specifications for the UltraSonic EX-5. For a complete list of specifications refer to the UltraSonic EX-5 product instruction manual.

UltraSonic EX-5	
Instruction Manual P/N	MANEX-5
Operating Temp Range:	-40°C to 60°C
Humidity Range:	0 to 100% RH
Input Power:	15 VDC – 36 VDC
Vibration sensitivity:	0.13 m/s ² perpendicular to the membrane will trigger the unit in the most sensitive range (44dB SPL)

Table 1 – Environmental/Electrical Specifications

Analog Output Level	UltraSonic EX-5 Mode
0 mA	Start Up
0, 1.25 mA, or 3.5 mA	Fault
1 mA, 1.25 mA, or 3.5 mA pulse for 5 seconds	Acoustic Error
3.0 mA or 3.5 mA	Set Up
4 – 20 mA	58 – 104 dB
> 20 mA	Over range

Table 2 – Analog Output Specifications for the UltraSonic EX-5 (600Ω Max)

CERTIFICATIONS AND FAILURE RATE DATA

The UltraSonic EX-5 has gone through rigorous reliability and functional safety assessments, which have resulted in the acoustic detector being certified to IEC 61508 Parts 1, 2, and 3, by FM Approvals. The reliability assessment is a failure rate prediction that assumes an average temperature of 40°C and an environmental factor equivalent to Ground Fixed. It is assumed that the detectors will be installed in a Safety Instrumented System operating in a Low Demand environment per IEC 61508. Table 3 lists the SIL parameters for the UltraSonic EX-5.

Parameter	UltraSonic EX-5 Analog Output (Source)	UltraSonic EX-5 Analog Output (Sink)	UltraSonic EX-5 Relay Output
FM Certificate	3044405	3044405	3044405
Mean Time Between Failure (MTBF)	13 years	13 years	13 years
λ_{DD} (Fails per hour)	4.07E-6	4.17E-6	4.03E-6
λ_{DU} (Fails per hour)	6.12E-8	6.16E-8	2.88E-7
SFF	>99%	>99%	97%
SIL *	3	3	2
Diagnostic Test Interval	2 seconds (critical faults) 15 minutes (acoustic self-test) 24 hours (memory check)		
Typical Response Time	<1 second**		
PFDavg1oo1***	2.85E-4	2.86E-4	1.28E-3

Table 3 – SIL Parameters for UltraSonic EX-5

* Hardware Fault Tolerance = 0

** Does not include user-selectable delays

*** PFDavg1oo1 assumes a 4 hour repair time and 1 year proof test interval.

Agency Approvals

The UltraSonic EX-5 is certified by ATEX, IECEx, FM, CSA and IEC 61508 (per FM Approvals)



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