

FlexSonic™ Acoustic Detector AC100 Sensor ATX10 Transmitter

SAFETY CERTIFIED FLEXSONIC ACOUSTIC DETECTOR

This manual addresses the specific requirements and recommendations applicable to the proper installation, operation, and maintenance of all Safety-Certified (SIL-Certified) FlexSonic™ Acoustic Detector product versions. For complete information regarding system overview, performance, installation, operation, maintenance and specifications of the FlexSonic Acoustic Detector, refer to instruction manual 95-8657.

QUALITY POLICY STATEMENT

All quality assurance control measures necessary for safety management as specified in IEC 61508 Part 1 have been implemented. The quality management system of Det-Tronics is based on the requirements of EN ISO 9001 and ANSI/ASQC Q9001 through the application of the United Technologies Company Achieving Competitive Excellence (ACE) program. In addition, the Quality Management System complies with the European ATEX Directive, EN ISO/IEC 80079-34, and supervised testing requirements per ISO 17025.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of personnel performing the operations. Information that raises potential safety issues is indicated by the word "Warning". Always read and understand these safety messages.



WARNING

The FlexSonic Acoustic Detector is intended for use in hazardous environments that may include explosive levels of flammable gases and vapors. This product must be properly installed, operated and maintained. Improper installation or use could result in an explosion or fire resulting in death or serious injury.

- Do not remove the cover of a junction box in explosive environments when device power is on and circuits are live.
- Device must be properly installed to meet hazardous area explosion-proof/non-incendive and intrinsic safety requirements.

DESIGN

The FlexSonic Acoustic Detector recognizes the unique ultrasonic frequency content of events such as gas leaks.

The FlexSonic Acoustic Detector consists of one Model AC100 Acoustic Sensor connected to one Model ATX10 Transmitter. The device communicates function/status via a 4-20 mA output signal with HART communication.

The FlexSonic Acoustic Detector is compatible with the FlexVu® Model UD10 Universal Display, as well as other devices that are able to monitor a 4-20 mA dc signal. All alarm functions are provided by the monitoring device.

The FlexSonic Acoustic Detector is classified as Type B smart element according to IEC61508. The device contains self-diagnostics and sends the current output to a specified failure state upon internal detection of a failure (see instruction manual 95-8657 for details).

Safety-Certification of the FlexSonic Acoustic Detector includes:

- the 4-20 mA output of the ATX10 Transmitter in combination with the AC100 Acoustic Sensor.

Non-Interfering Interfaces

Safety Certification of the FlexSonic Acoustic Detector includes the following non-interfering interfaces:

- Magnetic switches
- HART communication
- RS485 communication
- LEDs
- SD card

The HART communication protocol is non-interfering and may be used for diagnostics within the SIL 2 safety loop in the Safety operation mode. Diagnostics are defined as read only information. Local HART communication with the FlexSonic Acoustic Detector using a handheld HART field communicator, or AMS program connected to the 4-20 mA output, is acceptable. Proper analog signal loop resistance must be installed as documented in the instruction manual to enable local HART communication.

RS485 communication is used in conjunction with the Acoustic Inspector software package - consult manufacturer or instruction manual for details.

VALID INPUT RANGE

FlexSonic Acoustic Detector fault and alarm annunciation is provided on the 4-20 mA signal output loop by signaling to a specific mA current output level. The user SIF must monitor the 4-20 mA output for fault and alarm conditions and take appropriate actions according to the specific requirements of the SIF. The receiving device must be programmed to indicate a fault condition when current levels reach under-current of 3.6 mA or less or over-current of 21 mA or more.

NOTE

The FlexSonic Acoustic Detector analog signal is not safety-rated during detector warm-up. Alternative means should be used at the job site to ensure facility safety during these activities.

DIAGNOSTIC RESPONSE TIME

The FlexSonic Acoustic Detector will perform all critical diagnostic functions within one hour, worst case diagnostic detection time.

The Acoustic Detector will annunciate a fault if the safety response time is delayed by greater than 1 second due to SD card (optional) operations. This fault is not applicable if the SD card option is disabled.

ACOUSTIC INTEGRITY TEST

The FlexSonic Acoustic Detector periodic Acoustic Integrity Check (AIC) is designed to generate a fault when the unit's acoustic response has been significantly reduced. The unit continues to detect during an AIC fault, however, the detection capability may be reduced.

CERTIFICATION

The FlexSonic Acoustic Detector Safety-Certified version is certified SIL 2 Capable by *exida®* to IEC61508 for single input use in low demand, SIL 2 Safety Instrumented Systems.

SAFETY-CERTIFIED PRODUCT IDENTIFICATION

Safety Certification of all FlexSonic Acoustic Detector models meeting SIL 2 safety standards is clearly identified on the product label.

INSTALLATION

NOTE

For complete information regarding performance, installation, operation, maintenance and specifications of the FlexSonic Acoustic Detector, refer to instruction manual 95-8657.

No special or additional detector installation requirements exist above and beyond the standard installation practices documented in the FlexSonic Acoustic Detector instruction manual.

Environmental operating specifications for the FlexSonic Acoustic Detector are applicable as published in the general specifications section in the instruction manual. The device shall not be exposed to environments that exceed its specified environmental limits.

The FlexSonic Acoustic Detector operating power distribution system should be designed and installed so the terminal voltage does not drop below 9 Vdc when measured at any specific location. The external system providing power to the FlexSonic Acoustic Detector must have over-voltage protection that ensures supply voltage does not exceed 30 Vdc.

The user shall correctly install all shielding and grounding for device and ensure that maximum cable lengths are not exceeded.

NOTE

All safety functions of the FlexSonic Acoustic Detector are active within 30 seconds of power-up without any user action required.

COMMON MISUSE SCENARIOS

Refer to the Installation, General Application Information, and Maintenance sections of the instruction manual for information on avoidance and resolution of common misuse scenarios. No special application restrictions are necessary to meet the safety certification requirements.

NOTE

If the user suspects that damage or misuse has occurred to the FlexSonic Acoustic Detector, a full proof test shall be performed.

GENERAL APPLICATION CONSIDERATIONS

- The user shall understand the effects of and limit the number of devices that are voted to declare alarm.
- The user shall understand the effects of the time delay parameter and limit the length so that desired SIF hazard detection is achieved. Alarm time delay should be sufficient to prevent false alarms from friendly or known gas releases (e.g. intermediate process venting normal to SIS operation).

START-UP AND COMMISSIONING

Commissioning Personnel

The Safety Certified FlexSonic Acoustic Detector can be commissioned by any qualified person with knowledge of acoustic detection instruments and the configuration device being used.

Refer to the Installation section provided in the FlexSonic Acoustic Detector instruction manual for details.

Configuration

A HART handheld or RS485 communication device can be used to monitor internal status or to modify the factory settings of the FlexSonic Acoustic Detector. Refer to the FlexSonic Acoustic Detector HART Addendum (number 95-8698) for guidance on using HART communication.

Alternate protection measures must be used as needed while modifications to safety related parameters are being made, including while the device is in learn mode.

Cloned configuration data as well as learn data should only be used at the exact physical location that it was developed.

The device must be powered down during SD card removal and installation.

While in the process of calibrating the 4-20 mA output, the detector is not able to signal an alarm. During this time, the device is not performing its safety function.

The periodic AIC frequency / fail count combination must allow for fault indication within 1 hour or less (e.g. a configuration of 10 minute intervals and consecutive fail count of 3 will cause a fault in 30 minutes).

NOTE

Prior to device configuration all alarm outputs must be bypassed. The device is not safety certified during configuration change activities.

NOTE

All configuration changes to the FlexSonic Acoustic Detector (including any changes via SD card operations) must be verified by the user via a proof test, power cycle and re-check of settings, or other appropriate method. The safety functionality must be validated prior to reliance on the product for safety protection.

Configuration Protection

Upon completion of installation and commissioning, it is required that the user password-protect the safety related parameters that are accessible via HART or RS485 in order to prevent accidental or deliberate change of configuration data during normal operation. To password protect the FlexSonic Acoustic Detector, the user must set the write-protect function to “on” and enter an 8 character password. The user should check the write protect status to ensure that it is set to “on”.

The user will be required to disable write protect prior to any future configuration changes, and must re-enable write protect upon completion of these changes to ensure that HART and RS485 communication remain non-interfering.

OPERATION, MAINTENANCE, INSPECTION AND PROOF TESTING

All normal installation and startup recommendations as documented in the FlexSonic Acoustic Detector instruction manual are applicable to the Safety Certified FlexSonic Acoustic Detector.

Safety-Certified FlexSonic Acoustic Detectors require proof testing to be performed in all cases.

Personnel performing proof test procedures shall be competent to perform the task. All proof test results must be recorded and analyzed. Any corrective actions taken must be documented in the event that an error is found in the safety functionality. The proof tests must be performed prior to commissioning the device and at least as often as specified in Table 1.

WARNING

Failure to perform the specified testing and inspection may lower or void the SIL rating for the product or system.

VISUAL FIELD INSPECTION PROOF TEST

Tools Required: None

Visual inspection of all Safety-Certified FlexSonic Acoustic Detectors shall be conducted as needed to confirm that no external blockage of the sensor cover exists, eg. debris, trash, snow, mud, external equipment, etc. Corrective action shall include removal of such impediments should they exist. All acoustic detectors must be inspected to ensure that they are capable of providing expected performance and protection.

Completion of Visual Field Inspection Proof Test must be recorded and documented in the SIS logbook.

RESPONSE PROOF TEST

Tools Required: Magnetic tool available from Det-Tronics, or HART handheld communicator

The Manual AIC test provides a self check of the acoustic detector safety function. All acoustic detectors must be performance tested using the Manual AIC test procedure and inspected to ensure that they are capable of providing expected performance and protection. The Manual AIC test can be initiated and reset by placing the magnetic tool on the icons on the ATX10 display, via HART command, or via RS485 command.

Table 1—Frequency for Performing Proof Tests

Proof Test Name	Commissioning	Frequency
Visual Field Inspection Proof Test	Yes	As needed, depending on level and type of contaminants present
Response Proof Test	Yes	1 year

WARNING

Any external alarm equipment, systems or signaling devices that could be automatically initiated by performing this test must be disabled or bypassed before performing this test!

Response Proof Test Sequence

NOTE

Verification of the LED function is optional as the LEDs are not part of the safety function.

1. Inhibit alarm and fault response at the control device.
2. Place the magnet at the 'TEST' icon on the ATX10 faceplate for at least 3 seconds or issue an Active Manual AIC test command via digital communication (HART or RS485).
3. Activation of the Manual AIC test results in a flashing green LED and an audible tone.
4. Verify correct change of state at the control device: a successful alarm proof test results in a latched 20 mA output and red alarm LED; an unsuccessful proof test results in a latched 2 mA output and a flashing yellow fault LED.
5. Following a Manual AIC test, reset the detector by placing the magnet at the 'RESET' icon on the ATX10 faceplate for at least 3 seconds, or by issuing a reset command via digital communication (HART or RS485). Actuating the Reset command resets any alarms or faults and places the detector back in the normal operating mode.
6. Verify that the device returns to a 4 mA output.
7. Re-activate alarm and fault response at the control device.

Completion of the Response Proof Test must be recorded and documented in the SIS logbook.

WARNING

Any external alarm equipment, systems or signaling devices that were disabled must be re-activated at the conclusion of proof testing activities.

NOTE

The use of the Manual AIC test shall be limited to maintenance and proof test activities.

CALIBRATION

Field calibration of the acoustic detector is not necessary or available.

FAULT/FAILURE ACTION PLAN

In the event that an AIC test does not result in an acceptable Response Proof Test, then the standard Maintenance and Device Repair and Return procedures as listed in the FlexSonic Acoustic Detector instruction manual must be followed. Any failure to successfully complete the Response Proof Test must be recorded and documented in the SIS logbook.

PRODUCT REPAIR

Field repair of the FlexSonic Acoustic Detector is limited to replacement of the sensor cover and/or foam particulate filter. All other device repairs must be conducted at the factory. No firmware changes are permitted or authorized. All failures detected by the device diagnostics or by the proof tests that cannot be resolved through the procedures described in the FAULT/FAILURE ACTION PLAN section must be reported to the manufacturer.

OPERATING, ENVIRONMENTAL, AND PERFORMANCE SPECIFICATIONS

The Safety-Certified FlexSonic Acoustic Detector product versions fully comply with, and must be operated in accordance with the functional, environmental, and performance specifications provided in the FlexSonic Acoustic Detector instruction manual. A 24 hour mean time to repair should be assumed for safety availability calculations.

SPARE PARTS

Refer to "Ordering Information" in the FlexSonic Acoustic Detector instruction manual. Safety Certification is based on a sufficient number of spares to achieve a 24 hour mean time to repair.

CERTIFICATION AND FAILURE RATE DATA

All Safety-Certified FlexSonic Acoustic Detectors are certified compliant to:

IEC61508: 2010

Type B Element

Systematic Capability: SIL 2 certified

HFT: 0

Low Demand Mode

PFDavg should be calculated for any safety instrumented function using the FlexSonic Acoustic Detector. (Refer to FMEDA report for necessary information, including DU rate.)

Safety Accuracy: $\pm 10\%$ of applied acoustic leak pressure.

Safety Response Time: Refer to the FlexSonic Acoustic Detector instruction manual for details.

Product Life: 10 years, based on manufacturer data.

All failure rate data for SIL verification is in the FMEDA report, which is available upon request.

ADDITIONAL CERTIFICATIONS

FM, CSA, ATEX, IECEx, CE, and others.

Refer to the FlexSonic Acoustic Detector Instruction Manual for details.

For complete information regarding performance, installation, operation, maintenance and specifications of the FlexSonic Acoustic Detector, refer to instruction manual 95-8657.

TERMS AND DEFINITIONS

AMS	Asset Management System
FMEDA	Failure Mode Effects and Diagnostics Analysis
HART	Highway Addressable Remote Transducer
HFT	Hardware Fault Tolerance
PF	Probability of Failure on Demand (Probability of Dangerous Failure)
PFDavg	Average Probability of Failure on Demand
SFF	Safe Failure Fraction
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
AC100	Acoustic Sensor (contains microphone, AIC acoustic source, and associated circuitry)
ATX10	Transmitter for acoustic spectrum analysis and control functions
Acoustic Detector	Consists of one Model AC100 Sensor and one Model ATX10 Transmitter
UD10	FlexVu® Model UD10 Universal Display

IEC 61508 Failure Rates in FIT¹

Failure Category	λ_{sd}	λ_{su}^2	λ_{dd}	λ_{du}	SFF ³
Acoustic Detector Analog Output (consists of one Model AC100 Sensor and one Model ATX10 Transmitter)	0	125	1925	97	95.5

¹ FIT = 1 Failure / 10⁹ Hours

² It is important to realize that the No Effect failures are no longer included in the Safe Undetected failure category according to IEC 61508, ed2, 2010.

³ Safe Failure Fraction needs to be calculated on (sub)system level.

Specifications subject to change without notice.

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