Distran Ultra Pro X

Alternative Test Method

Submitted to

The United States Environmental Protection Agency
Air Emission Measurement Center



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1. Scope and Application

This method describes the protocol for using the Distran Ultra Pro X to comply with 40 CFR §60.5398b requirements. The Distran Ultra Pro X serves as an alternative method for monitoring fugitive methane emissions. It provides an option to the current Best System of Emission Reductions (BSER) and applies to fugitive monitoring, inspection, and monitoring of covers and closed vent systems under 40 CFR part 60 subparts OOOOa, OOOOb, and OOOOc.

The method employs the state-of-the-art Distran Ultra Pro X ultrasound camera, which operates on the principle of Acoustic Leak Imaging (ALI). This sophisticated, gas-agnostic leak detection technology is capable of identifying leaks of any pressurized gas with high precision, including but not limited to gaseous hydrocarbons such as methane and ethane.

This method is broadly applicable across facilities in the Oil & Gas sector, including onshore well sites, storage tanks, gathering and boosting compressor stations, and natural gas processing plants. The method's sensitivity meets the stringent requirements for periodic screening at the component level, with a detection range of less than 0.5 meters and a leak rate threshold of less than 1 kg/h, ensuring reliability across diverse operational environments.

2. Summary of the method

This method uses the Distran Ultra Pro X, an advanced handheld acoustic camera that utilizes ALI technology to survey equipment, pinpoint and quantify fugitive gas emissions. This technology operates by detecting the ultrasound waves emitted by gas leaks. The device is equipped with a high-definition optical camera paired an array of 124 high-sensitivity microphones. As the ultrasound waves reach each microphone at slightly different times, the camera's powerful algorithms precisely reconstruct the position of the ultrasound sources. This acoustic data is overlaid in real-time onto the optical image displayed on the screen, allowing the user to easily identify the exact location of the leak.

During site surveys, the Ultra Pro X operators walk around the facilities systematically scanning all equipment components. During the inspection, pictures and videos can be recorded to be later integrated into reports. The data files can be transferred using the integrated SD card or the online data transfer platform Audalytics provided by Distran. Proficiency in using Ultra Pro X cameras requires initial operator training as discussed in section 10.2.

3. Definitions of method

ALI: Acoustic Leak Imaging (ALI) is a technology that detects and visualizes the location of gas leaks by capturing and analyzing the ultrasound waves emitted by escaping gas.

Audalytics: Distran's dedicated online data processing, storage and reporting platform.

ULFT: The Ultra Leak Flow Test (ULFT) is a gas leak simulator for demonstrating gas leaks.

Ultra Pro X: Distran's flagship acoustic camera.

4. Interferences

4.1. Industrial interferences

Interferences can come from other ultrasound sources such as vibrations and flow noise within the frequency range of the detector and can impact the operator’s ability to detect gas leaks. However, the indications generated by such sources differ from those produced by actual leaks. Through the provided training, operators learn to differentiate between these indications and genuine gas leak signals.

4.2. Weather conditions

Adverse weather conditions, such as rain and wind, can also reduce the camera's performance by generating ultrasound that leads to additional interference. To ensure optimal survey results, it is recommended to avoid conducting inspections during periods of heavy rain or when wind speeds exceed 50 km/h.

5. Safety

5.1. Disclaimer

While this section offers guidance, it may not address all safety concerns associated with using the Ultra Pro X camera in every industrial setting. It is the user’s responsibility to implement appropriate safety and health protocols and adhere to local safety regulations when operating the Distran Ultra Pro X and conducting leak detection surveys. The user manual and training provide essential instructions for the safe operation and protection of the device. Failure to follow these instructions could lead to electric shock, fire, personal injury, or damage to the camera. It is crucial to read all instructions thoroughly before using the camera.

5.2. Potentially explosive areas

The Ultra Pro X is IECEx and ATEX certified. Operators must strictly adhere to local regulations and coordinate with the plant's responsible office for work permits before operating the device in potentially explosive areas. For proper and safe use in explosive atmospheres, consult the additional installation instruction document provided, which outlines specific guidelines for these conditions. Compliance with these instructions is essential to ensure safety and regulatory adherence.

6. Equipment and Supplies

This method relies exclusively on the use of the Distran Ultra Pro X, as depicted in Figure 1 along with its accessories and described hereafter.

The Distran Ultra Pro X is a lightweight (1.5 kg) acoustic camera designed for one-handed operation, ensuring user safety during inspections. The front panel (red diamond in Figure 1) hosts the 124 high-sensitivity microphones arranged to optimize acoustic imaging, a fish-eye optical camera at the center, and integrated LEDs for use in low-light environments. The rear panel includes a capacitive touchscreen that displays real-time acoustic and optical images, as well as camera settings and menus. It also has two buttons: a black power button and a red action button for recording images, videos, and voice notes. These functions are also accessible via the touchscreen. The camera's frame includes a one-hand handle and mounts for neck and wrist straps. It is powered by a rechargeable lithium-ion battery, with an SD card slot for storing recorded media.



Figure 1: Distran Ultra Pro X and its accessories

7. Reagents and Standards

N/A – The operation of Distran Ultra Pro X does not involve the use of reagents.

8. Sample Collection, Preservation, Storage

N/A – The operation of Distran Ultra Pro X does not involve the collection, preservation nor storage of any sample.

9. Quality Control

9.1. Quality management system

Distran follows a comprehensive Quality Management System (QMS) that oversees the design, manufacturing and testing of its acoustic camera. The QMS is certified to ISO 9001:2015 by TÜV Rheinland Italia S.r.l. under certificate number 39 00 0272203,

ensuring consistent quality and reliability across all processes. Distran recommends several key processes to ensure quality assurance, which must be followed by the operator. These include pre-survey Ultra Pro X inspections, adherence to the operating envelope, good practices for conducting monitoring surveys, and comprehensive operator training.

9.2. Pre-survey Ultra Pro X inspections

Before conducting a survey, operators must perform a pre-survey inspection of the Ultra Pro X to ensure it is fully operational:

- Confirm that the SD card is properly inserted; if missing, insert a compatible SD card.
- Check the battery charge level, ensuring it is at least 50%, and then insert the battery.
- Inspect the device for any external damage that could affect functionality.
- Switch on the Ultra Pro X and allow the device to fully boot.
- Verify that the software loads correctly.
- Confirm the Ultra Pro X can generate an acoustic image in the presence of an acoustic source (e.g., using the ULFT[1]), ensuring the device is ready for use.

9.3. Operating Envelope Compliance

While end-users have the flexibility to define their own operating envelope based on site-specific conditions, Distran has established a recommended operating envelope to optimize the accuracy of leak detection using the Ultra Pro X acoustic camera.

To verify compliance with the Distran recommended envelope, follow these two steps:

1. Environmental Conditions: Ensure the inspection environment is free from heavy rain, and that wind speeds do not exceed 50 km/h (31 mph).

2. Performance Validation: Choose one of the two following options:

A. Simulate a gas leak at 3 bar (44 psi) using the Distran gas leak simulator (ULFT), ensuring the simulation occurs at a distance greater than 30 cm (12 inches). In a sufficiently quiet environment, the Ultra Pro X should display a single red spot centered around the ULFT image on the camera screen.

B. Set the Ultra Pro X to detect methane gas (CH_4) at 10 bars (145 psi) and select the flange model for a leak at a distance of 4 meters (16 feet). The camera's Limit of Detection (LoD1) should be less than 1500 L/h (53 scfh).

1 See section 17.1. for details about ULFT

9.4. Operator training and certification

To ensure optimal performance in leak detection, operators and organizations conducting surveys with the Distran Ultra Pro X are required to complete a comprehensive training program developed by Distran. This rigorous training ensures that all operators are equipped with the necessary theoretical knowledge, practical skills, and best practices for the safe and efficient use of the Ultra Pro X. It also provides a framework for continuous learning, ensuring operators remain current and proficient throughout their careers.

9.4.1. Initial training

Distran offers a comprehensive one-day training course, which includes both theoretical and field components.

A - Classroom Training

Classroom training provides operators with the essential theoretical foundation for using the Ultra Pro X camera. This lecture-based session covers the following critical areas:

- **Introduction to Acoustic Leak Imaging**: Operators are introduced to the basic principles of acoustic imaging.
- **Detection Parameters**: Detailed explanations of key camera settings, such as detection frequency or acoustic focus along with guidance on optimizing these settings for specific facility conditions.
- **Interference Identification**: Operators are trained to distinguish between false signals caused by additional ultrasound sources and actual gas leaks.
- **Operation and Maintenance**: Comprehensive instructions on camera operation and basic maintenance to ensure consistent and reliable performance.
- **Component Detection**: A review of the components to be monitored, with sample images of various types of leaks for reference.
- **Survey Procedures**: Step-by-step guidance on performing leak detection surveys according to the monitoring plan, including pre-survey verification checks to ensure camera accuracy.
- **Documentation and Recording**: Best practices for capturing and recording leak data, ensuring compliance with reporting standards while avoiding common errors.
- **LDAR Regulatory Requirements**: An overview of relevant regulatory requirements for Leak Detection and Repair (LDAR) programs, ensuring operators conduct surveys in full compliance with legal standards.

At the conclusion of the classroom training, operators must pass an assessment with a minimum score of 75% to receive a certificate of competency.

B - Field Training

Field training provides operators with practical, hands-on experience in real-world conditions, ensuring they can apply the knowledge gained from the classroom. The field training consists of:

- **Observation**: The trainee observes a senior operator during a one-hour leak detection survey to understand correct techniques and best practices.
- **Guided Inspection**: The trainee conducts a two-hour survey under the direct supervision of a senior operator, who verifies the results through a side-by-side comparison.
- **Independent Survey**: The trainee then performs an additional two-hour inspection independently, with the senior operator overseeing the process to ensure accuracy and adherence to procedures.

C - Final Field Test

The trainee must perform an independent leak survey in an area previously inspected by a senior operator. To successfully pass the field test, the trainee must meet the following criteria:

- Identify at least 90% of the leaks detected by the senior operator when five or more leaks are present.
- Detect all leaks if fewer than five are present.

If the trainee does not pass, the senior operator will provide feedback, and the trainee may retake the test after addressing the areas needing improvement.

9.4.2. Classroom Training – Refresher

Annual refresher training is rrecommended to ensure operators stay updated on best practices and any updates to the Ultra Pro X camera. This two-hour session, which can be delivered either in person or online, focuses on reinforcing key concepts, reviewing field best practices, and providing updates on new features or improvements to the equipment. All essential topics from the initial training are revisited during the refresher course to maintain operator proficiency.

9.4.3. Senior Operator Qualification

To qualify as a senior operator, individuals must demonstrate advanced competence in operating the Ultra Pro X camera by meeting the following criteria:

- Pass the classroom training exam with a minimum score of 75%.
- Successfully complete the final field test.

- Conduct at least 10 hours of inspections using the Ultra Pro X camera within the past 12 months.

Senior operators are required to complete an online refresher course every 12 months to maintain their certification and stay up to date with the latest developments in camera operation and field practices.

10. Calibration and Standardization

The Distran Ultra Pro X camera is delivered with factory calibration, and does not require routine calibration. However, to maintain optimal performance, Distran recommends servicing the camera every four years. This in-depth servicing includes verification of microphone calibration, optical-acoustic overlay alignment, Ex-integrity checks, and various performance assessments. If necessary, recalibration is performed as part of this process. Regular maintenance guarantees that the camera continues to provide accurate, high-performance leak detection and maintains its reliability throughout its operational lifespan.

11. Procedure

11.1. Pre-Survey Preparation

- **Monitoring Planning**: Establish a detailed and comprehensive monitoring plan that outlines the specific procedures for conducting the leak survey. This plan must fully comply with all relevant safety protocols and regulatory standards. It should employ a methodical approach to ensure complete coverage of all regulated components, utilizing tools such as route maps, GPS route tracing, or visual cues to guarantee no area is overlooked during the survey.
- **Operating Envelope Check**: Confirm that all environmental and operational conditions, including noise levels and atmospheric factors, are within the acceptable limits outlined in Section 9.2. If conditions fall outside the specified Operating Envelope, the survey should be delayed to ensure accuracy and compliance with operational safety standards.

11.2.
Survey Execution

- **Settings Optimization**: Configure the camera with the appropriate settings, including detection frequency, gas type, orifice geometry, and other parameters as appropriate, to ensure optimal performance for leak detection. These settings must be carefully tailored to align with the specific conditions of the facility and the characteristics of the target gases.
- **Distance Monitoring**: Maintain appropriate distance to components during the survey. Continuously monitor and adjust the distance to ensure accuracy and consistency in detecting potential leaks.
- **Interference Mitigation**: The operator must be trained to recognize potential interferences such as background noise from machinery or other ultrasound sources. Take necessary actions, such as adjusting positioning or distance, to minimize interference and ensure accurate leak detection.
- **Multi-Angle Inspection**: Each potentially leaking component must be inspected from at least three different angles to ensure comprehensive detection. Adjust angles to reduce the field of view if too many components are present, which may hinder accurate detection.

11.3. Leak Documentation and Reporting

- **Capturing Evidence**: If a leak is identified, capture a 5-second video (or longer) or a clear photograph showing the leak and the associated component.
- **Tagging and Recording**:
  - If immediate repair is not feasible, tag the leaking component for future repair.
  - Record all relevant details, including the date, time, location (with GPS if available), and specific component where the leak was detected. Securely store this information in the appropriate database for future reference and compliance audits.

This procedure ensures a structured and systematic approach to leak surveys, guaranteeing consistent detection, accurate documentation, and effective management of leaks across all surveyed sites.

12.
Data Analysis and Calculation

12.1. Data Acquisition

Acoustic and optical data are collected through the Ultra Pro X integrated sensors. Each microphone in the acoustic array generates a signal proportional to the sound pressure it detects, measuring the difference between the long-term averaged atmospheric pressure and the instantaneous local pressure. Simultaneously, the optical camera provides visual context by delivering a continuous stream of raw video.

12.2. Data processing

Data processing for the Distran Ultra Pro X is performed in real time directly on the device. The system's microphones capture sound pressure data synchronously, which is then converted into temporal audio. This audio data undergoes a Short-Term Fourier Transform (STFT), translating the temporal sound information into a frequency-domain representation. The resulting acoustic image is then overlaid with the optical image from the camera, creating a composite visual representation. This real-time computation provides the operator with an intuitive and immediate visualization of detected acoustic events.

12.3. Data interpretation

The leak indication is displayed directly within the composite image on the Ultra Pro X's screen, where the acoustic and optical data are overlaid, allowing for immediate and clear visualization of the leak location. This intuitive display minimizes the need for complex interpretation, making it easy for operators to identify leaks in real-time. However, in certain situations where additional verification is needed, operators may choose to use contact techniques such as a Flame Ionization Detector (FID) or soap spray to confirm the leak.

12.4. Leak rate estimation

To estimate the leak rate, the inspector must manually input key parameters, including the orifice geometry, gas type, and pressure at the leak source. Additionally, the distance to the leak is required, which can be determined using the Ultra Pro's acoustic auto-focus feature or by selecting the appropriate manual focus distance from the menu. Using these inputs, the Ultra Pro X's leak rate quantification module calculates an estimate of the leak rate, providing valuable data for further analysis and decision-making.

12.5. Limit of Detection

The Limit of Detection (LoD) represents the smallest leak that an acoustic camera, such as the Ultra Pro X, can reliably detect in real-time. The Ultra Pro X features a dynamic calculation of the LoD, which is shown in the lower left corner of the camera display. This value reflects the smallest detectable leak under the current acoustic conditions. It can be displayed as dB normalized at 1 meter or as an estimation of the leak rate, using the user-defined parameters for leak estimation.. This real-time LoD indication allows users to understand the sensitivity of the system in different sound environments, ensuring precise detection even in challenging conditions.

13. Method Performance

13.1. Spatial resolution

The Distran Ultra Pro X has a component-level spatial resolution (< 0.5 cm) andis capable of distinguishing two sources 5 cm apart when inspecting at 1 m and 28 cm apart when inspecting at 6 m.

13.2. Leak resolution

The Distran Ultra Pro X has demonstrated high sensitivity, detecting methane leaks as small as 1 g/h with a pressure difference of 0.2 bar and as small as 0.1 g/h at 70 bar. In line with the METEC test protocol, the Ultra Pro X achieved a 90% probability of detection for leak rates between 0.9 and 1.0 kg/h (METEC 2024), fully meeting the EPA's stringent 1 kg/h leak resolution requirement. Notably, even higher detection performance is anticipated in real-world oil and gas facilities, where elevated operating pressures are likely to enhance acoustic emissions[2].

2 See the Technology Description (Distran 2024) for additional details.

13.3. Limitations

The Distran Ultra Pro X's detection capabilities are dependent on the presence of ultrasound emissions from leaks, which limits its ability to detect leaks where the gas flow is laminar and does not generate acoustic waves. This is particularly relevant for small leaks through large orifices, such as vents or thief hatches, where turbulent flow is absent. Adverse meteorological conditions, like strong winds and rain, can further impact the device's performance by introducing ultrasound noise from raindrop impacts and structural vibrations, potentially masking weak gas leak emissions and increasing the Limit of Detection (LoD). Additionally, interference from strong ultrasound sources, such as pipe flow noise or rotating fans, can obscure smaller leaks. For accurate detection, a clear path for ultrasound waves to travel from the leak to the camera's microphones is essential, making leaks inside sealed cabinets or behind insulation difficult to detect with the Ultra Pro X. It is also not recommended for detecting underground leaks.

14. Pollution Prevention

N/A - Doesn’t apply.

15. Waste management

N/A - The Distran Ultra Pro X operation does not generate sample or waste.

16. References

Distran. (2024). Ultra Pro X Technology Description submitted to the EPA AEMC

METEC. (2024). Survey Emission Detection and Quantification Final Report for Distran Ultra Pro X.

17. Annex

17.1. Ultra Leak Flow Test (ULFT)



Figure 2: Ultra Leak Flow Test (ULFT)

The Ultra Leak Flow Test (ULFT) is a tool developed by Distran for demonstrating gas leaks. It uses a CO2 cartridge attached to a pressure regulator that controls the flow of gas through a 0.12 mm (0.0047 in) pinhole in a metal plate, simulating a leak. The pressure is shown on an integrated scale. This controlled leak is ideal for testing the functionality of leak detection devices like the Distran Ultra PRO X.