CEREX
MONITORING SOLUTIONS, LLC.

Product Guide 2017

AirSentry FTIR Open Path Multi-Gas Analyzer

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AirSentry FTIR Open Path Multi-Gas Analyzer

Description

The Cerex AirSentry FTIR is an open path analyzer with optional convertible point analyzer operation with the addition of an optional sample cell. In both modes the AirSentry FTIR allows real time, continuous monitoring. Capable of detecting 385 different gas species, flexibility for a wide variety of monitoring projects is simplified and comes at no additional cost. In open path operation the AirSentry FTIR uses a telescope to project a beam of IR light through the open air to a remote retro-reflector array (mono-static). The retro-reflector returns the beam to the analyzer where the absorption magnitudes and concentrations of each target gas present in the beam are measured and recorded according to USEPA TO-16 Methodology. The length of the total sample path determines the size of the retro-reflector array required as well as the minimum detection limits of the analyzer.

Far faster than, and half the cost of GCMS technology, and requiring no additional chemical consumables or associated analytic laboratory or sample handling costs, the AirSentry FTIR offers a variety of features available in no other technology. Unlike PID, FID and sacrificial sensor technology, the AirSentry FTIR cannot be poisoned, needs no ongoing calibration, measures concentrations individual gas species, needs no dilution system, needs no dryer or sample conditioning, and has only two consumable parts. Drift associated with common box type analyzers is inherently mitigated through the differential method employed. As well, the analyzer may be provisioned with a variety of data output formats to meet precise requirements.

Detectable Compounds

Detectable compounds include chemical warfare agents, pesticides, refrigerants, fluorocarbons, CFCs, combustion gases, solvents, process acids, refinery gases, NMHC's, natural gas industry compounds, fertilizer gases and more. More than 100 of the 187 USEPA specified HAPs are detectable. Due to the large number of compounds, the full list of compounds that may be detected with the AirSentry FTIR is provided in a separate spreadsheet for easy manipulation and review. Cerex typically configures the gas detection library specifically for each application.

Minimum Detection Limits

The minimum detection limits for the AirSentry FTIR are reported in two forms: Path Integrated MDLs, and Path Averaged MDLs. All minimum detection limits are published as a single gas measured in otherwise clean air with 64 scans (approximately 6-minute data output rate). The path integrated minimum detection limits define the concentrations of gases required for detection in a path one meter in length and is expressed in units of part per million meter (PPM-m).

The path integrated minimum detection limit may be used to determine the path averaged minimum detection limits for a specific installation. To determine the path averaged MDL in units of PPB, divide the path integrated MDL by the total sample path length in meters, then multiply the by 1000. Since the retro-reflector creates a double pass of the beam through the sample, the total sample path is always twice the distance between the analyzer and retro-reflector. The path averaged MDL represents the minimum concentration of gas required to be present everywhere in the sample path for detection to occur.

Mono-static Path Averaged Detection Limits

$$Path\ Averaged\ MDL\ PPB = \left(\frac{Path\ Integrated\ MDL\ PPM - m}{2\ x\ Distance\ to\ Retroreflector\ METERS}\right) X\ 1000$$

Installation

The system requires installation of the AirSentry FTIR and the Retro-reflector array with a clear line of sight between the two components. The infrared beam projected from the analyzer is eye-safe and the AirSentry FTIR may be installed directly in the breathing zone if desired.

Cerex recommends placing a protective structure over and around the AirSentry as well as the retro-reflector. This structure does not need to be complex. A simple structure to protect the analyzer and reflector from direct heating, snow, rain and wind is generally sufficient. For long path installations the mounting structure should be protected from insolation.

The AirSentry FTIR analyzer utilizes a heavy duty gear driven, precision pan and tilt mounting head P/N 282264 to allow precise alignment with the retro-reflector. The pan and tilt head has a 1.75" O.D. mounting post and may be mounted to heavy duty tripod P/N 282265 for rapid deployment and mobility, or it may be mounted to a fixed adapter P/N 88475 to allow installation on a concrete column or it may be mounted to a user supplied 1.75" I.D. Pole. Custom mounting adapters are available to allow mounting to superstructure or walls. The analyzer mounts to the pan and tilt head via a sliding dovetail mount. An option for an automated servo driven pan and tilt positioner is also provided in the event that one AirSentry FTIR is to be used to monitor multiple sample paths sequentially.

Retro-reflectors are housed in NEMA enclosures which may be affixed to virtually any superstructure at the installation site. Retro-reflectors up to 60 cube in size are typically mounted to concrete columns for fixed applications or to medium or heavy duty tripod for temporary monitoring. Larger retro-reflectors require customized mounting. Retro-reflectors should be mounted to perpendicular to the IR beam to maximize signal return. Retro-reflectors are available with optional heated, filtered purge air blowers to reduce the potential for condensation formation on optical surfaces. This improves signal throughput and longevity of the reflective surfaces, however AC power is required at the retro-reflector installation location.

Custom mount adapters are available to allow alternative mounting options. For installations in which the IR will not be within 15 degrees of normal to the retro-reflector, the retro-reflector should be angled via the mounting structure.

AirSentry FTIR and Retro-reflector Installation Options		
Component	Mounting Options	Pan and Tilt Head Required
AirSentry FTIR	Heavy Duty Tripod (P/N 282265)	Heavy Duty Pan and Tilt Head (P/N 282264) required for all mounting options.
	Fixed Mount Adaptor (P/N 88475)	
	User Supplied 1.75" I.D. Pole	
20 or 30 Cube Retro-reflector Array	Medium Duty Tripod (P/N 15004)	Medium Duty Pan and Tilt Head (P/N 15003) or Manual Pan and Tilt Head (P/N 15003A) required ONLY for installations in which the angle of the incoming beam is not within 15 degrees of normal.
	Fixed Mount Adaptor (P/N 17775)	
	User Supplied 1.75" O.D. Pole	
	Wall or Superstructure Mount	
40 or 60 Cube Retro-reflector Array	Heavy Duty Tripod (P/N 282265)	Heavy Duty Pan and Tilt Head (P/N 282264) required ONLY for installations in which the angle of the incoming beam is not within 15 degrees of normal.
	Fixed Mount Adaptor (P/N Custom)	
	User Supplied 1.75" I.D. Pole	
	Custom Mount Assembly	
90, 102 or 120 Cube Retro-reflector Array	Custom Mount	Angle provided by mount structure.

To mitigate the potential effects of electrically noisy environments the AirSentry FTIR utilizes a line filter and transient voltage suppression system as well as circuit breaker protection. Integrated internal ferrite chokes provide noise suppression for Input / Output and Communications ports. Fully shielded conduit is specified for cable connections to ancillary instruments for installation in electrically noisy areas. Please specify the available line voltage when ordering.

In environments with extremely high humidity such as coastal environments, Cerex recommends the AirSentry FTIR be installed with the precise total path length required to meet end-user minimum detection limit requirements. This provides attainment of the required minimum detection limits for the known target compounds while reducing retro-reflector hardware costs and minimizing interference due to water vapor. High humidity environments coupled with long sample path lengths inhibit detection of some gases through absorption of the IR light by water vapor.

Corrosive or HAZLOC Atmospheres

In corrosive atmospheres the AirSentry FTIR and retro-reflector may be installed in shelters and/or utilize factory clean air for purging the telescope bore and retro-reflector surfaces. For HAZLOC installation the instrument enclosure must be equipped with an optional Z-Purge (requires continuous, clean, dry factory air supplied at 0.1 – 3.5 SCFH at 5-120 PSI), as well as upgraded explosion proof thermoelectric cooling to allow operation in Class 1, Division 2, Groups A-D or ATEX Zone 2 locations.

Retro-reflectors without heated purge air may be installed in hazardous locations, however heated and purged units are for general classification areas only.

Regulatory Monitoring Compliance

When operated as an open path analyzer the AirSentry FTIR is method compliant with USEPA TO-16 for regulatory open path air monitoring.

When equipped with an optional external sample cell the AirSentry meets a variety of regulatory criteria for extractive stack monitoring.

AirSentry FTIR Regulatory Monitoring Compliance	
Open Path Mode	USEPA Compendium Method TO-16: Long-Path Open-Path Fourier Transform Infrared Monitoring Of Atmospheric Gases, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air
Point Analyzer Mode	USEPA Method 318: Extractive FTIR Method for Measurement of Emissions from Mineral Wool and Wool Fiberglass Industries. USEPA Method 320: Vapor Phase Organic and Inorganic Emissions by FTIR USEPA Method 321: Determination of HCl for Portland Cement Industries USEPA Performance Specification 15 for Extractive FTIR CEMS in Stationary Sources NIOSH Method 3800: Organic and Inorganic Gases by Extractive FTIR Spectrrometery ASTM Method D6348-03: Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared Spectrosopy

Calibration and Quality Assurance Audit

Under USEPA TO-16 Methodology the Cerex AirSentry FTIR needs no ongoing calibrations. The actual calibration of the instrument is inherent in the calibrated reference files provided by Cerex and used by the analyzer's gas detection and quantification algorithms. If desired the analyzer may be ordered with an optional 15cm internal QA cell permanently mounted in the beam path (P/N 282307). This option adds two compression ports to the analyzer chassis for calibration gas, and is required for compliance TO-16. Operator supplied calibration gas may be introduced into the cell for quality assurance audit. If desired Cerex supplied Data Processor software may be used with operator supplied calibration gas to create calibrated, insitu library files.

Consumable Items

Cryocooler Compressor (P/N 286300):

The Cerex AirSentry FTIR utilizes an ultra-sensitive MCT (mercury-cadmium-telluride) detector element that requires cooling to cryogenic temperatures (77 kelvin) to be fully responsive to the low levels of Infrared Radiation. Cryogenic cooling is provided by a closed cycle Stirling cryocooler compressor assembly. The cryocooler not only improves minimum detection limit performance, it also increases the spectral bandwidth that may be analyzed to increase the number of detectable compounds. These cryocooler devices were originally developed for use in missile technology, and have since been adapted to commercial detector cooling applications. Cerex is one of two manufacturers of open path FTIR analyzers that have successfully integrated cryocooler technology into our systems without suffering the negative effects of degraded signal to noise ratio. The cryocooler is an integral component of the detector module assembly and is not serviceable in the field. For replacement, the detector module assembly must be removed and returned for service. Alternatively, a replacement detector module assembly may be purchased and installed as necessary. The detector module assembly is field serviceable.

- Cryocooler Compressor provided with a warranty of 14 months
- Cryocooler Compressor MTTF 20,000 hours
- Compressor is replaced at a modest cost and comes with a renewed warranty. Approximately three week turn-around time.
- Alternatively, a spare detector assembly (P/N 286300) may be purchased to allow field replacement of the cryocooler. The original cryocooler may then be replaced as needed.

<u>Infrared Source (P/N 286004):</u>

The AirSentry FTIR utilizes a metallic glow bar to produce the infrared light required for gas detection. The source should be replaced every three years of operation and is field serviceable by the end-user.

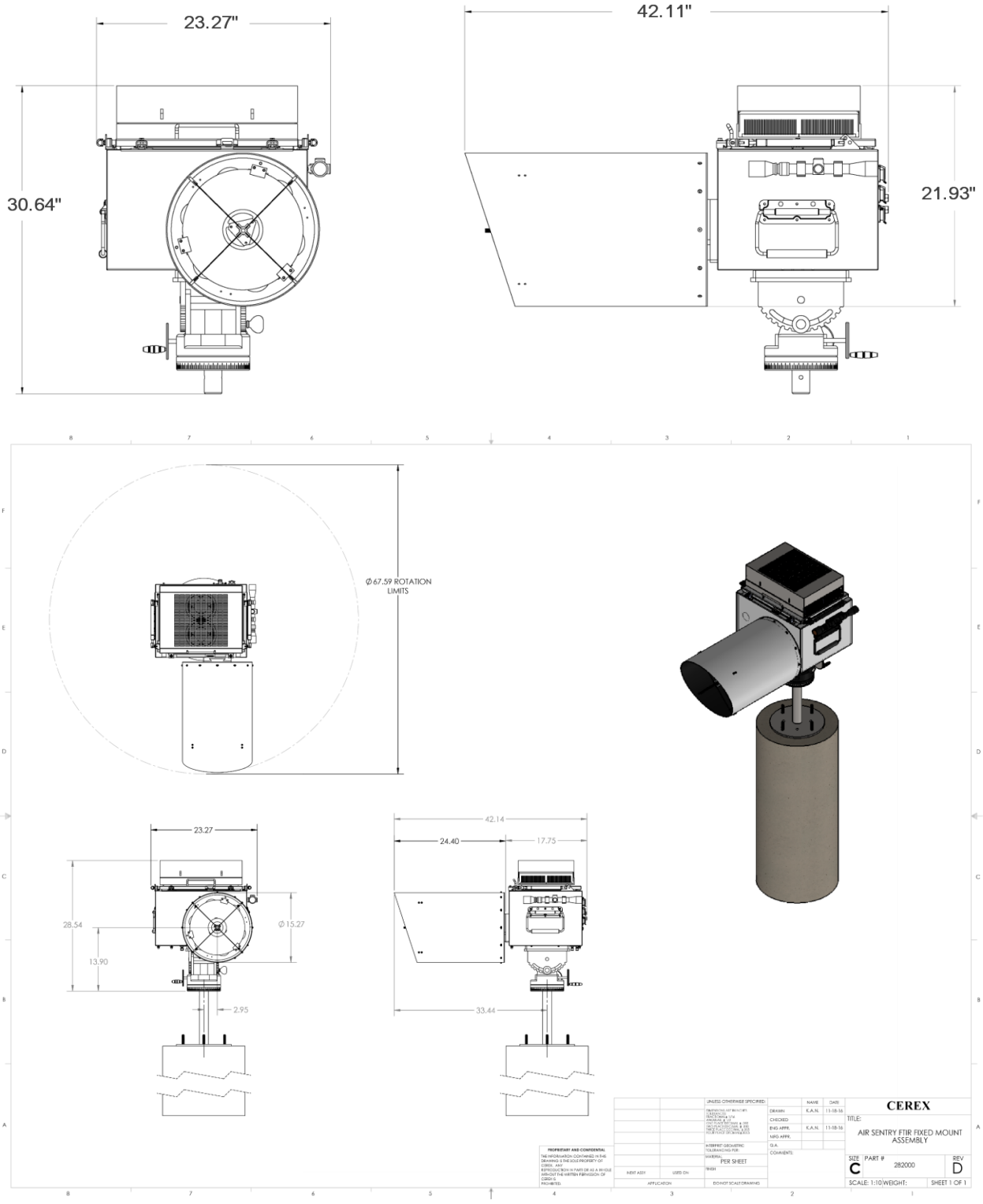
Routine Maintenance

The AirSentry requires minimum maintenance.

- Air Conditioner Exterior Heat Sink Cleaning – Every 6 months
- Air Conditioner Interior Heat Sink Cleaning – Annually
- Cryocooler Stirling Engine Renewal – 2 to 3 years
- IR Source Replacement – 3 to 5 years
- Retro-reflector Purge Air Filter Replacement – Quarterly or as needed. Only required for heated retro-reflectors.

AirSentry FTIR Dimensions

Figure 1 AirSentry FTIR Dimensions (inches)



Key Features of the AirSentry FTIR Air Monitoring System

- **Modulated Light Beam:** Modulating the light at this point in the optical design acts to allow AirSentry FTIR to remain immune from the effects of changes in ambient infrared energy. These effects manifest themselves in other systems as "baseline shifts" in the data. Such shifts are so erratic, that accurate unattended real-time processing is nearly impossible, and an "expert" (experienced PhD or other highly skilled individual) is nearly always required to Pole-process the data set. Since the AirSentry FTIR eliminates these effects through a better design, our system allows accurate concentration data to be calculated by the analytical software in real-time.
- **Optically Stable Interferometer:** The AirSentry FTIR interferometer is manufactured by Bomem, and employs a unique corner-cube design. The corner-cube enables optical stability, and freedom from spectral shifting that other systems experience as a result of temperature fluctuations. No "dynamic alignment" or other added equipment is required to further improve stability. As a result MTTF is vastly improved.
- **Ease of Setup and Alignment:** Since the system is "monostatic", meaning the source, and receiver are co-located, the optical beampath is completed with telescope and retro-reflector optics. The infrared beam is expanded, and then collimated within the 12-inch Cassegrain optical telescope. The retro-reflector offers the absolute easiest, fastest alignment possible under working field conditions.
- **Saves Raw Spectra and Performs Real-time Quantification:** In addition to real time quantification, the Single Beam raw data is always saved. This allows legal compliance and data defensibility under USEPA TO-16 methodology.
- **System-wide Reliability:** Unlike traditional single gas analyzers, the AirSentry FTIR has no ancillary hardware to fail. No carrier gas, no dryer or converter, no sample conditioning, no complex sample tube plumbing and no drift commonly associated with typical SO2, NOx and CO analyzers.
- **Advanced, Automated Software:** No costs associated with data analysis, sample handling, etc...
- **Real Time, Multi-Gas, PPB and Part per Trillion Level Detection Capabilities:** Real time detection of ppb levels of 385 compounds, including over 100 of the 187 USEPA identified HAPs.
- **Simplified Remote Access:** The analyzer may be accessed from any personal computer or smartphone if installed with Internet access or equipped with a common USB cellular modem.
- **Simplified Installation and Operation:** No tedious calibration routines or ancillary sample conditioning equipment to install, maintain or fail.
- **Easy conversion to point analyzer:** Telescope is secured to analyzer via dovetail mount and one screw. Remove the telescope and replace with a multi-pass cell for point and process monitoring applications.
- **Field Proven Performance:** The Cerex AirSentry FTIR has been deployed for monitoring by major petroleum manufactures, major chemical manufactures, government agencies and environmental consultants for more than twenty years worldwide. Our systems were used in desert warfare conditions by the United Nations during chemical warfare agent inspections, and used by the USEPA during the drafting of Method TO-16 for regulatory compliant air quality monitoring.

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