



UNISEARCH ASSOCIATES INC.

LasIR™ & DOAS
INSTRUMENTS
FOR
GAS MONITORING



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Unisearch Associates Inc. is a manufacturer of optical spectroscopy instruments for measuring and monitoring gases. We have a strong research and development base, and we are dedicated to providing solutions that meet our clients' unique requirements.

Unisearch Associates was founded in 1980 and has since been a world leader in the development of gas measurement technology based on Tunable Diode Laser Absorption Spectroscopy (TDLAS).

We manufactured and patented our first instrument, the high-sensitivity (sub-ppbv) LUMINOx NO₂ monitor, for commercial use four years after our establishment. Several hundred units were sold prior to our divestiture of the technology in 2005, following a change in the company's focus to optical products and their applications. We are now dedicated to innovating Tunable Diode Laser (TDL) and Differential Optical Absorption Spectroscopy (DOAS) technologies for gas emissions monitoring across a wide range of industries. Applications of these technologies include process control and regulatory measurement.

Our team consists of installation and service experts who ensure that any equipment you've purchased from us operates at peak efficiency. We also have a worldwide network of technical sales representatives to respond to your inquiries. Every member of our staff demonstrates mutual respect, professional conduct and a passion for excellence. Their commitment to providing high-precision instruments and quality service has helped us achieve our current position within the industry.

➤ **Cutting-edge Technology**

We have a strong Research and Development team that strives to improve the precision and accuracy of our instruments using the latest available technologies.

➤ **High-accuracy Equipment**

Our monitoring equipment can detect and measure trace amounts of gases for emissions monitoring purposes.

➤ **Environmentally Conscious**

Our instruments are used for the analysis of gas output to ensure compliance with industry standards and for informing reduction strategies.

➤ **Premium Quality**

Our products are built to effectively measure gases in harsh environments. They are made to last for continuous emissions and fence line monitoring as well as for process control.

➤ **Good Customer Service**

We strive in providing solutions to our customers based on their requirements. Being an original developer, we have a thorough knowledge of our products that help our customers make the best choices for them.

Gases that can be monitored

Gas Name	Chemical Formula
Ammonia	NH ₃
Water	H ₂ O
Hydrogen Sulfide	H ₂ S
Heavy Water	D ₂ O
Hydrogen Deuterium Oxide	HDO
Carbon monoxide	CO
Carbon dioxide	CO ₂
Oxygen	O ₂
Hydrogen Chloride	HCl
Hydrogen Fluoride	HF
Hydrogen Cyanide	HCN
Methane	CH ₄
Ethylene	C ₂ H ₄
Ethane	C ₂ H ₆
Acetylene	C ₂ H ₂
Sulfur dioxide	SO ₂
Nitric oxide	NO
Nitrogen dioxide	NO ₂
Nitrous oxide	N ₂ O
Nitrate	NO ₃
BTEX	
Benzene	C ₆ H ₆
Toluene	C ₇ H ₈
Ethyl benzene	C ₈ H ₁₀
Xylene	C ₈ H ₁₀
Formaldehyde	HCHO
Chlorine	Cl ₂

... and many more

Industries

- Airports
- Aluminum Smelters
- Carbon fiber manufacturing
- Cement
- Chemical
- Fertilizer
- Fire Detection
- Flue Gas Desulphurization
- Fossil Fuel Power Station
- Landfill
- Mining
- Nickel
- Nuclear
- Oil, Gas & Petrochemical
- Pulp & Paper
- Semiconductor
- Steel
- Sugar
- Wastewater Treatment

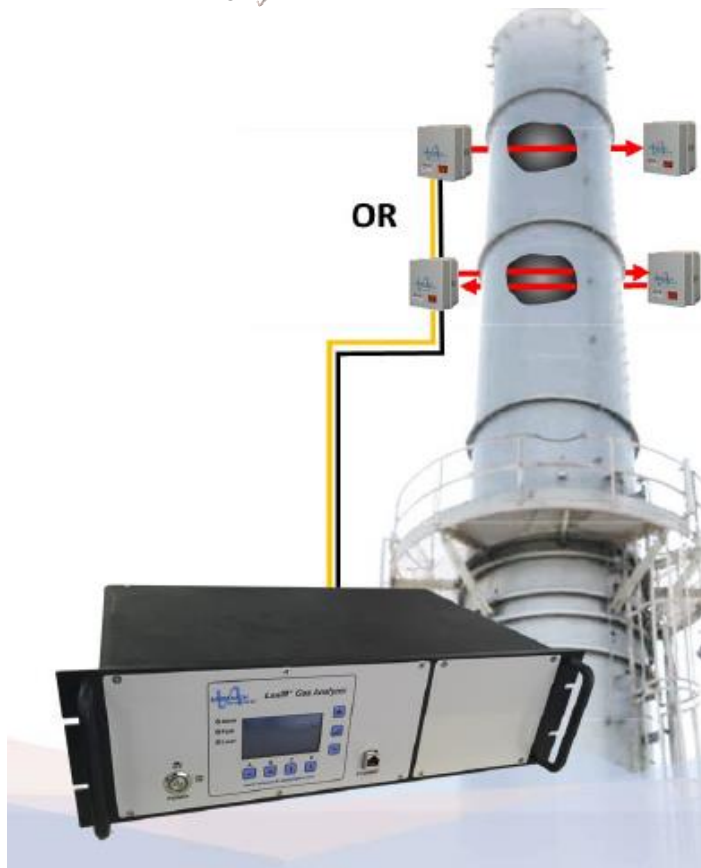
Unisearch LasIR™ Gas Analyzer is a continuous monitor designed to measure flue gases for both compliance and process monitoring. The Controller uses a near infrared (NIR) Tunable Diode Laser Absorption Spectrometer System utilizing a single mode laser mounted in a thermoelectric cooler for unsurpassed accuracy and performance. Since the spectral purity of the laser is high and the selected absorption feature is unique, measurements can be made free of interferences from any other gas. The measurements are made in-situ across the stack or duct in either a single or dual pass design (depending upon the application). A Windows based software package displays the data on either a Host laptop PC or the client's existing data acquisition system.

Gases that can be monitored:

- ✓ NH₃ + H₂O
- ✓ H₂S
- ✓ D₂O / HDO
- ✓ H₂O (ppm)
- ✓ CO / CO₂
- ✓ O₂
- ✓ HCl + H₂O
- ✓ HF
- ✓ HCN
- ✓ CH₄
- ✓ C₂H₄
- ✓ C₂H₆
- ... others

Industries:

- ✓ Aluminum
- ✓ Carbon Fiber
- ✓ Cement
- ✓ Fertilizer
- ✓ Early Fire Detection
- ✓ Flue Gas Desulfurization
- ✓ Fossil Fuel & Gas Power Station
- ✓ Nickel
- ✓ Nuclear
- ✓ Oil, Gas & Petrochemical
- ✓ Pulp & Paper
- ✓ Steel
- ✓ Wastewater Treatment
- ✓ Food



Features & Benefits:

- ✓ TDL (Tunable Diode Laser) technology for unmatched accuracy & reliability
- ✓ High sensitivity ppb to percent level measurements
- ✓ One analyzer can be used for up to 16 measurements points
- ✓ Performance designed Process Monitor
 - ✓ In-situ: Gas sampling/conditioning not required
 - ✓ Extractive: Gas sampling / conditioning required
 - ✓ Corrosive/toxic applications
 - ✓ Calibration not required
 - ✓ Inline/Offline Audit option available
- ✓ Exceeds US-EPA CEMS Regulation requirements
 - ✓ MACT & MATS - PS-18 Compliant
 - ✓ Boiler MACT O₂ and CO Compliance
 - ✓ Approved Zero & Span Calibration checks
- ✓ Extremely Fast (<1 second) response time
- ✓ Compact and simple to install
- ✓ Ambient conditions from -10°C to 50°C
- ✓ Operates in high dust/moisture applications
- ✓ Unaffected by stack/duct alignment changes
- ✓ Laser located in controller allowing for simple signal control and diagnostic access
- ✓ Moisture can be added as a second channel for several species
- ✓ Multi-component measurements are available for certain species, i.e. CO/CO₂, NH₃/HCN, CH₄/C₂H₆, H₂S/CO₂/H₂O
- ✓ Off Stack/Process extractive option
- ✓ Hazardous Area Div I & II options

Characteristics:

Laser	Near IR tunable diode laser (Telecommunication grade lasers for longevity, reliability and availability)
Detection Limits	NH ₃ < 0.5 ppm-m HCl < 0.3 ppm-m HF < 0.1 ppm-m Consult Factory for other gases
Calibration	Factory test results sent with every unit, internal reference cell, external portable audit module, or in-line flow through cell (NOTE: Field-calibration not required)
Outputs and Networking	Up to thirty-two 4-20 mA Analog Outputs, Ethernet, MODBUS-TCP/IP, Six Dry-Contact NC & NO Status Relays
Data Logging and Displaying Software	LasIRView (with Data Review and Statistical Analysis)
Power Supply	Input 100 – 240 VAC @50-60Hz, Output +12VDC
Response Time	< 1 second
Environment Conditions	-10°C to +50°C, 5 – 95% RH, 800 – 1,200 mbar
Gas Temperature & Pressure Compensation	4-20 mA inputs for each measurement point MODBUS register for each measurement point
Dynamic Range	5 orders of magnitude
Data Storage	Internal storage & External storage via Ethernet, RS232 or MODBUS-TCP/IP
Dimensions	Standard 19" rack-mount 5.25" (H) x 17" (W) x 11" (D) (13 x 43 x 28 cm) ~11 lb (~5 kg)

LasIR™ Fence Line Monitoring Gas Analyzer

Unisearch LasIR™ Gas Analyzer is a continuous monitor designed to measure open path both compliance The Controller uses a near infrared (NIR) Tunable Diode Laser Absorption Spectrometer System utilizing a single mode laser mounted in a thermoelectric cooler for unsurpassed accuracy and performance. Since the spectral purity of the laser is high and the selected absorption feature is unique, measurements can be made free of interferences from any other gas. A Windows based software package displays the data on either a host laptop PC or the client's existing data acquisition system.



Gases that can be monitored:

- ✓ $\text{NH}_3 + \text{H}_2\text{O}$
- ✓ H_2S
- ✓ CO / CO_2
- ✓ $\text{HCl} + \text{H}_2\text{O}$
- ✓ HF
- ✓ HCN
- ✓ CH_4
- ... others

Industries:

- ✓ Airports
- ✓ Aluminum
- ✓ Carbon Fiber
- ✓ Chemical
- ✓ Fertilizer
- ✓ Fire Detection
- ✓ Landfill
- ✓ Mining
- ✓ Nuclear
- ✓ Oil, Gas & Petrochemical
- ✓ Semiconductor

Features & Benefits:

- ✓ TDL (Tunable Diode Laser) technology for unmatched accuracy & reliability
- ✓ High sensitivity ppb to percent level measurements
- ✓ One analyzer can be used for up to 16 measurement points
- ✓ Moisture can be added as a second channel for many species
- ✓ Multi-component measurements are available for certain species, i.e. CO/CO₂, NH₃/HCN, CH₄/C₂H₆, H₂S/CO₂/H₂O
- ✓ Performance designed Compliance Monitor
 - ✓ Gas sampling/conditioning not required
 - ✓ Corrosive/toxic applications
 - ✓ Calibration not required
 - ✓ Inline/Offline Audit option available
- ✓ Exceeds US-EPA CEMS Regulation requirements
 - ✓ MACT & MATS - PS-18 Compliant
 - ✓ Boiler MACT O₂ and CO Compliance
 - ✓ Approved Zero & Span Calibration checks
- ✓ Extremely Fast (<1 second) response time
- ✓ Compact and simple to install
- ✓ Ambient conditions from -40°C to 70°C
- ✓ Operates in high dust/moisture applications
- ✓ Laser located in controller allowing for simple signal control and diagnostic access
- ✓ Off Stack/Process extractive option
- ✓ Hazardous Area Div I & II options

Characteristics:

Laser	Near IR tunable diode laser Telecommunication grade lasers for longevity, reliability and availability
Detection Limits	H ₂ S < 15 ppm-m CO < 0.05%-m CO ₂ < 0.05%-m HF < 0.1 ppm-m Consult Factory for other gases
Calibration	Factory test results sent with every unit, internal reference cell, external portable audit module, or in-line flow through cell (NOTE: Field calibration not required.)
Dynamic Range	5 orders of magnitude
Data Storage	Internal storage & External storage via Ethernet, RS232 or MODBUS-TCP/IP
Dimensions	Open Path Telescope: 7"(W) x 10"(H) x 14"(L) Retro-Reflector: 12"(W) x 12"(H) x 8"(D)
Response Time	< 1 second
Environment Conditions	-10°C to +50°C, 5 – 100% RH, 800 – 1,200 mbar
Outputs and Networking	Up to thirty-two 4-20 mA Analog Outputs, Ethernet, MODBUS-TCP/IP, RS232, Six Dry-Contact NC & NO Status Relays
Data Logging and Displaying Software	LasIRView (with Data Review and Statistical Analysis)
Power Supply	+12 VDC; 1A (100 – 240 VAC @50-60Hz to +12 VDC adapter supplied)

- ✓ LasIR™ Laser-based Portable Gas Monitor for Emissions Monitoring
- ✓ Allows for real-time measurement of target gases in a compact, weather-resistant design suitable for open-path and ambient-air monitoring.
- ✓ Compact and durable, this portable gas measurement equipment allows the user to move easily from one location to the next in order to analyze gas emissions in a variety of environments.
- ✓ Onboard memory allows to save data which can then be loaded into a computer for analysis.

Gases that can be monitored:

- ✓ $\text{NH}_3 + \text{H}_2\text{O}$
- ✓ H_2S
- ✓ CO / CO_2
- ✓ $\text{HCl} + \text{H}_2\text{O}$
- ✓ HF
- ✓ HCN
- ✓ CH_4
- ...others

Industries:

- ✓ Airports
- ✓ Aluminum
- ✓ Carbon Fiber
- ✓ Chemical
- ✓ Fertilizer
- ✓ Fire Detection
- ✓ Landfill
- ✓ Mining
- ✓ Nuclear
- ✓ Oil, Gas & Petrochemical
- ✓ Semiconductor



Characteristics:

Laser	Near IR tunable diode laser (Telecommunication grade lasers for longevity, reliability and availability)
Detection Limits	H ₂ S < 15 ppm-m CO < 0.05%-m CO ₂ < 0.05%-m HF < 0.1 ppm-m Consult Factory for other gases
Calibration	Factory Test results sent with every unit Internal reference cell, external portable audit module, sealed or flow through cell configurations
Dynamic Range	5 orders of magnitude
Data Storage	Internal storage & External storage via Ethernet
Dimensions	Open Path Telescope: 7"(W) x 10"(H) x 14"(L) Retro-Reflector: 12"(W) x 12"(H) x 8"(D)
Response Time	< 1 second
Environment Conditions	-10°C to +50°C, 5 – 95% RH, 800 – 1,200 mbar
Outputs and Networking	Ethernet, Six Dry-Contact NC & NO Status Relays
Data Logging and Displaying Software	LasIRView (with Data Review and Statistical Analysis)
Power Supply	+12 VDC; 1A (100 – 240 VAC @50-60Hz to +12 VDC adapter supplied)

PIMS - Pseudo In-situ Measurement System

PIMS (Pseudo In-situ Measurement System) is a patented specially-designed optical sensor of LasIR and DOAS gas analyzers. Each PIMS includes two units: The PIMS control box and the PIMS measurement unit. The PIMS control box includes temperature controllers, SSR, Solenoid valves, etc. to heat and control the temperature and switching of air flow of the PIMS measurement unit. The PIMS measurement unit includes gas sampling, filter purging, heating device, and a specially-designed gas cell. The gases in process duct or flue duct enter PIMS directly through sampling probe without conventional long sampling tube between sampling probe and measurement cell (or analyzer). Although gas sampling is required, its response time is close to an in-situ measurement system. Hence the name Pseudo In-situ Measurement System. A special filter located immediately upstream of the sampling probe, but still at flue gas temperature, restricts particles from entering the measurement cell. Automatic purge cycling keeps the filter clean. However if cleaning is necessary, the filter is easily accessible and may be cleaned externally or replaced in minutes. The PIMS is suited to measurements in which the flue gas particle/dust loading is too high to allow cross stack measurements, where access to only one side of a duct is possible or where regulatory protocols require calibration gases to be introduced into the sample gas stream.



Gases that can be monitored:

- ✓ $\text{NH}_3 + \text{H}_2\text{O}$
- ✓ CO / CO_2
- ✓ O_2
- ✓ SO_2
- ... others

Differential Optical Absorption Spectroscopy or DOAS, is based on the principle of measuring the differential absorption of the incoming signal in the wavelength region of interest after it has passed through a gas medium. It uses a broadband light source and the measurement is made over a large wavelength range (like FTIR and NDIR, and unlike TDL that uses a very narrow wavelength range). In general, overlap of absorption features of several gases is observed. This requires the use of multiple regression methods of analysis. The concentrations of gases are calculated by comparing the absorption signals with their stored reference signals. As in any broadband measurement technique, interference from other gases must be taken into account and corrected for to improve accuracy of the measurement. This requires a prior knowledge of the gas composition before the final measurements can be made.

DOAS is capable of measuring more than one species which either absorb in the same wavelength region (continuous monitoring of the species; e.g., NO, NH₃, SO₂ etc.) or in different wavelength regions (e.g., NO, NO₂, HCHO, Cl₂ etc.).

Gases that can be monitored:

- ✓ SO_x / NO_x
- ✓ BTEX
- ✓ HCHO
- ✓ Cl₂
- ... others



Industries:

- ✓ Cement
- ✓ Chemical
- ✓ Fertilizer
- ✓ Nickel
- ✓ Oil, Gas & Petrochemical
- ✓ Pulp & Paper



Unisearch currently provides DOAS instruments in two configurations. An in-situ stack monitoring system for use where dust levels in the flue gas are low and path length is no greater than a few meters. The second configuration is an extractive system which may be designed to have an internal or external flow through gas cell, depending on the sensitivity required. In both cases the analyzer is located close to or incorporated into the optical heads. Fiber optic coupled systems are possible, depending on the wavelength, which allow separation of the analyzer from the optics of up to a few 10's of meters.

Various organic and inorganic gases can be measured with DOAS with sensitivities down to ppbv levels. Many of these gases can also be measured at very high levels (several 10s of percent) with no dilution requirements. For example, SO₂ can be measured down to a few ppbv as well as from 0 to 100%. This makes the Unisearch DOAS system very flexible to a client's needs.

Characteristics:

UV-VIS Light source	Broadband Pulsed or Continuous Wave light emission source
Detection Limits	NO < 0.5 ppm-m SO ₂ < 0.02 ppm-m NO ₂ < 1 ppm-m
Calibration	Factory test results sent with every unit, in-line flow through cell option available
Dynamic Range	5 orders of magnitude
Data Logging and Displaying Software	Internal storage & External storage via Ethernet or MODBUS-TCP/IP
Response Time	< 5 second
Environment Conditions	-10°C to +50°C, 5 – 95% RH, 800 – 1,200 mbar
Outputs and Networking	Up to eight 4-20 mA Analog Outputs, Ethernet, MODBUS-TCP/IP, Six Dry-Contact NC & NO Status Relays
Data Logging and Displaying Software	LasIRView (with Data Review and Statistical Analysis)
Power Supply	Input 100 – 240 VAC @50-60Hz Output +12VDC

Continuous Ambient Air Quality Monitoring System (CAAQMS):

- ✓ Open Path Monitoring System
- ✓ Extractive Type Monitoring System
- ✓ Portable Type Monitoring System

Continuous Emission Monitoring System (CEMS):

- ✓ In-situ Stack type
- ✓ Extractive type
- ✓ Pseudo In-situ

Continuous Process Monitoring System:

- ✓ Open Path type
- ✓ In-Situ type
- ✓ Extractive type
- ✓ Pseudo In-situ



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