

**Accurate. Reliable. Cost Effective.**  
Emissions Monitoring for Compliance & Process Improvement



# Differential Optical Absorption Spectrometer (DOAS)

Up to 4 simultaneous measurements including  
 $\text{SO}_2$ , NO,  $\text{NO}_2$ ,  $\text{NH}_3$ ,  $\text{HCHO}$ ,  $\text{SO}_3$ ,  $\text{O}_3$ , Benzene, Toluene  
in a CROSS STACK CONFIGURATION

**For EPA Compliance or Process Monitoring**



## Product Description

The DOAS is a continuous monitor designed to measure flue gases for both compliance and process monitoring. The Controller uses a Differential Optical Absorption Spectrometer (DOAS) System for unsurpassed

accuracy and performance. The measurements are made in-situ across the stack or duct in a single pass design. A Windows based software package is available to display the data on either a Host laptop PC or the client's existing data acquisition system.

## DOAS Instruments

A monitoring solution for every situation.

### DOAS-E - Extractive Analyzer

An analyzer incorporating an internal extractive cell in which the measurements are made. The low volume of the extractive cell makes the system suitable for applications where fast response and small gas volumes are important.

### DOAS-S - In-situ Stack Analyzer

An analyzer which interfaces with optics designed for durability, for in situ, real time stack and duct measurements. Fiber optics may be used to bring the light to and from the stack optics. Depending on the species being monitored fiber lengths of between 1 and 10 m can be used. In-situ monitoring is only applicable for low dust environments.

Improve energy efficiency, reduce costs, and safeguard work environments with in-situ, real time gas analyzers for CEMS, combustion, environmental, fugitive emissions, health, safety and process monitoring.



## DOAS Stack Systems

Industrial Gas Monitors.

For CEMS, combustion, environmental, fire detection, fugitive emissions, health, safety and process monitoring applications.

Providing accurate, reliable and continuous measurements at a real-time process level with an exceptional life cycle value.



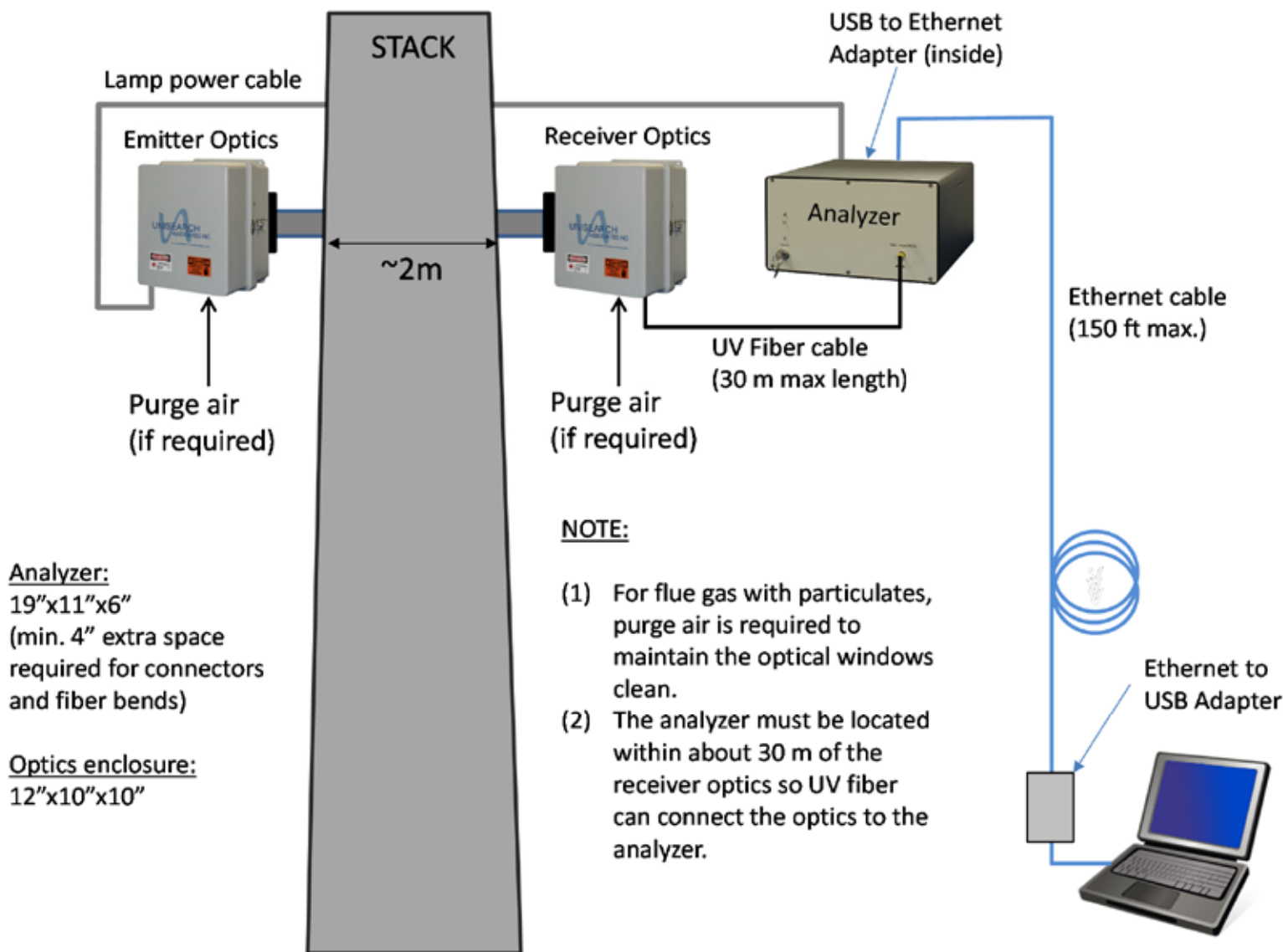
### DOASR-Rack Mount Analyzer

The analyzer should be mounted in a location that maintains the temperature in the range 0 to +45 °C and free from excessive vibration and humidity. If an environmentally controlled environment is not available, Cemtek Environmental can supply the analyzer in a temperature controlled small NEMA 4X enclosure that is heated and cooled to meet the specific application requirements. For Hazardous and explosive area applications options such as C1D1 or C1D2, the enclosure can be X or Z purged to meet the specific requirements.



The stack optics are mounted in NEMA-4 enclosures and may be located up to 30m from the analyzer. The temperature range over which the optics can perform to specifications is -40 °C to +60 °C. NEMA 4X and Class I, Div1 or 2 enclosure options are also available.

The client is responsible for installing flanges on the duct/stack to match the optical head flanges supplied by Cemtek. Please ensure that the flanges are within  $\pm 2^\circ$  of vertical and the bolt hole-pattern allows a 4-hole flange (Cemtek Flange) to be mounted horizontally. All cable installation and mounting of breakout boxes and the optics are the responsibility of the client.



**High Sensitivity (ppb) with D2 Lamp:** located in the launch optic NEMA enclosure  
Enhanced Stability and Sensitivity. D2 lamp life 1 to 1.5 years.

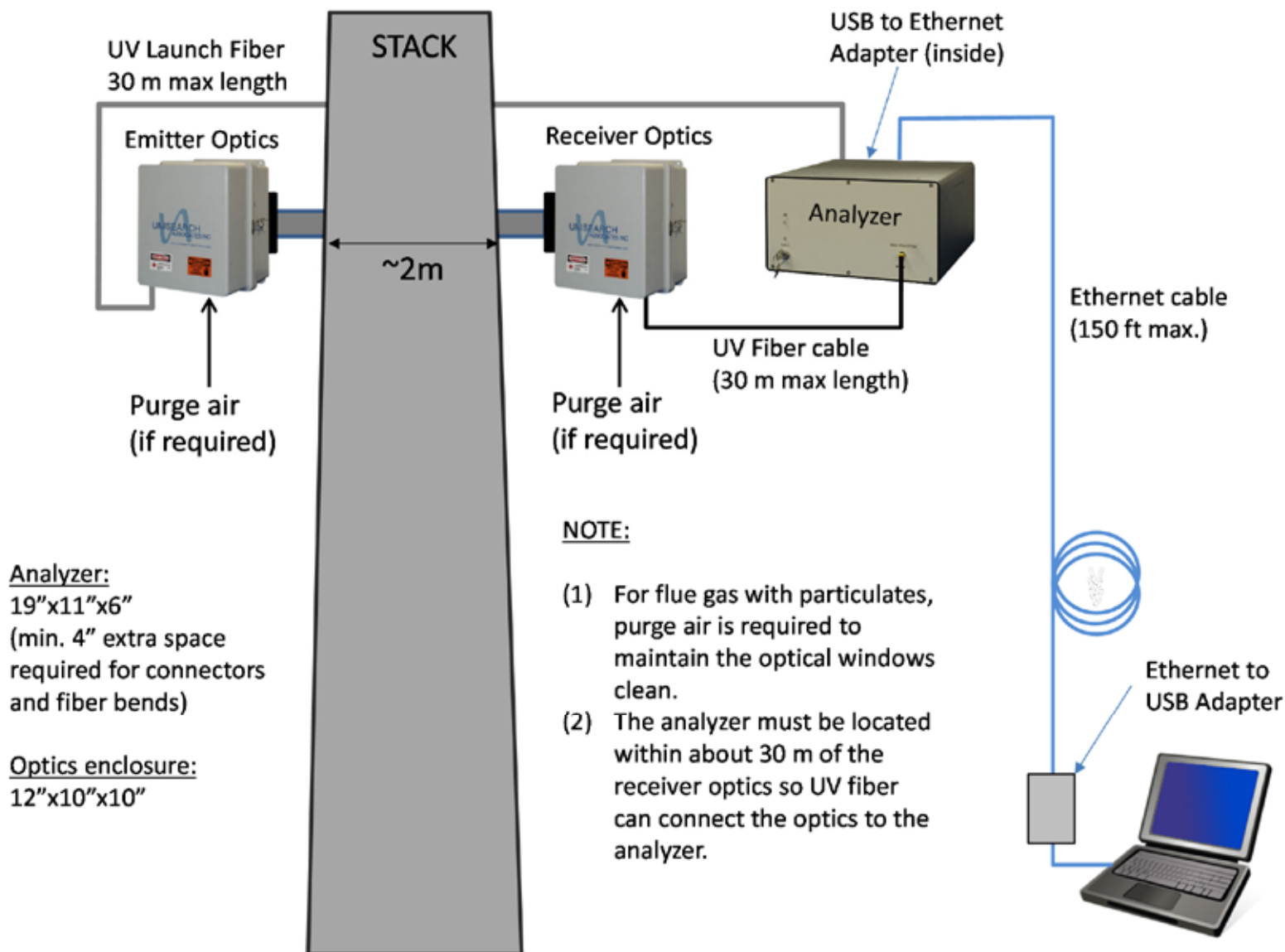


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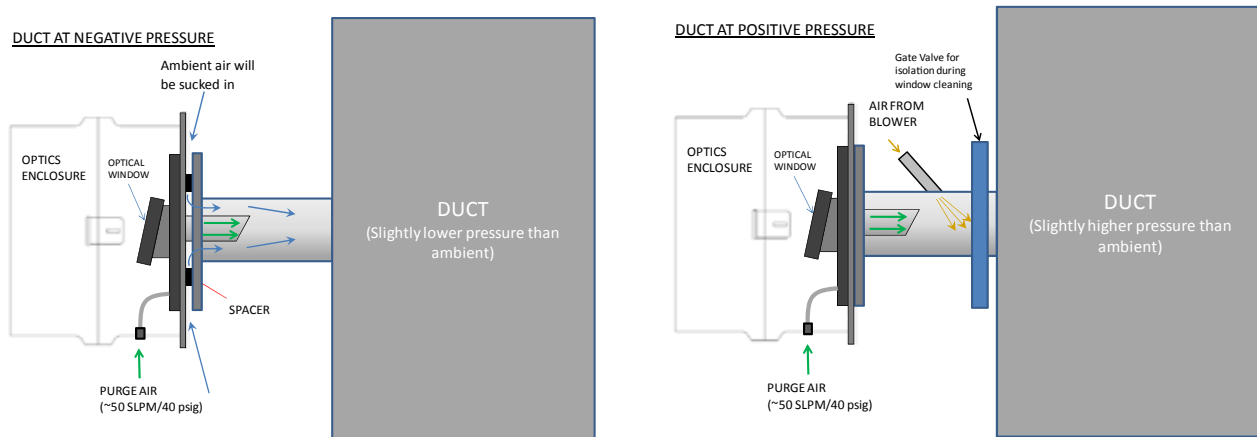
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**Standard Sensitivity (ppm).** Xe arc lamp located in the analyzer fiber optic delivery of the light to the launch NEMA Enclosure. Xe Lamp life 3 to 4 years.



Please, be advised that condensation on the windows protecting the optical element may occur. In order to avoid this, purge air will be required at each element. Please make sure that the purge air is dry, oil free, and delivered at a pressure of 20-40 KPa with a maximum flow of 50 liters per minute at each optical element. Flow rate will depend on the moisture and particulate level. A coarse valve should be supplied to control the flow at each optical element. Assuming that the duct is sub-ambient in pressure, we advise mounting the NEMA enclosure with 3mm washers (supplied) to allow ingress of external air into the pipe. This acts to blow the dust out of the connecting tubing and minimize scattering of the laser beam.



If the duct is above ambient then isolation valves should be installed to isolate the NEMA enclosures to allow for window cleaning during operations. Also, to keep the connecting pipe free of dust a blower arrangement is advised. Please note that if the dust loading is high, transmission of the near UV beam may be a limitation as smaller wavelengths have much higher scattering cross-section. Transmission of the beam highly depends on the particle size and the dust loading.

In the standard configuration, a light source, either pulsed Xe lamp or Deuterium lamp, is mounted in one of the enclosures. Collection optics in the enclosure on the opposite side of the duct collect the light and focus it into a fiber optic cable. If the duct gas is essentially particulate free the analyzer may be located up to 100 m from the receiving optics. Fiber optic collection and transmission to the analyzer is employed to get the light to the spectrometer located in the analyzer module. An on-board computer performs the data processing. The computer can be connected to the client's network and accessed from any location in the plant.

In the event that the light source cannot be mounted in the NEMA enclosure (ATEX requirements or no power available). A Xe arc lamp is located into the analyzer, and the light taken to the launch optic NEMA enclosure using fiber optic cabling. This may restrict the total path depending on light scattering from the dust particles in the flue gas.

Alternatively an extractive cell can be employed with a fiber-fiber configuration and the cell mounted on the stack per client requirements. Client is responsible for any sampling lines and pump or other means of passing the gas through the cell and disposal of the gas. Gas in the cell must be ~ atmospheric pressure.

**The DOAS system makes absorption measurement of the species indicated and requires no on-site calibration.** To audit the extractive system the client simply has to introduce a cell containing a known concentration of gas in front of light source in the launch optics, and compare the measured result with the gas standard concentration. An LCD on the analyzer front panel displays the concentration. The DOAS analyzer utilizes a gas flow thru cell and can be easily zero and span calibrated using standard EPA Protocol gases. The fittings for the calibration gases are located on the controller. The calibration will meet EPA standards as set by PS18.

## DOAS SPECIFICATIONS

USB ports for spectrometer control  
4-20 mA outputs for gas level and signal power for up to 4 species.  
Fault alarm dry-contact relay  
On-board computer with LasIRView V4.x software to operate the analyzer)

### Performance Specifications:

Precision:  $\pm 2\%$  of signal or detection limit, whichever is larger.  
Accuracy 5% of signal or detection limit (2% of range), whichever is larger.

### Specifications:

#### Stack / Duct Optics:

**Path Length:** Up to 2 meters

**Dynamic Range:** 5 orders of magnitude

**Response Time:** 0.1 seconds and higher

**Calibration:** Factory set

**Light Source:** Deuterium lamp/Xe Arc lamp

**Air Purge Requirements - depending on conditions**  
50 psi @ 15 L/min

#### **Environmental Conditions**

Gas: -100 to +1800 °C, 5 - 95% RH, 25 - 2000 mbar  
Optics: -40 to 65°C, 5-95% RH, 25 - 2000 mbar

#### **Optic Dimensions**

Transmitting / Receiving Optic Set: (Mounted inside NEMA enclosure) | (5 kg)

NEMA Enclosure: 13"(H) x 11"(W) x 10"(D)  
(33 x 28 x 25 cm) | (10 kg)

#### **Outputs & Networking**

USB, Optional 4-20mA, Status relays

#### **Data Logging and Display Software**

LasIRView,  
Optional Key available for diagnostic package

#### **Data Storage**

External storage via USB to external computer (included)

#### **Power Supply**

Input 100 - 240 VAC @50-60Hz, +12 VDC  
Output: 12V, 60w  
Operating Voltage: 12 VDC  
Optional 12V Battery

## Sensitivities

Gas	Detection Limits* (ppbv-m)	ug/m <sup>3</sup>
NO	600	800
NO <sub>2</sub>	75	150
NH <sub>3</sub>	10	8
HCHO	3000	4000
SO <sub>2</sub>	300	900
SO <sub>3</sub>	500	1850
O <sub>3</sub>	35	75
Benzene	170	600
Toluene	600	2450

\* Optimal. Detection limits will vary depending on measurement conditions.

DOAS instruments are designed and built to comply with CSA, UL and CE requirements:

General Safety: IEC 61010  
Electro-Motive Compliance: IEC / EN 61000



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