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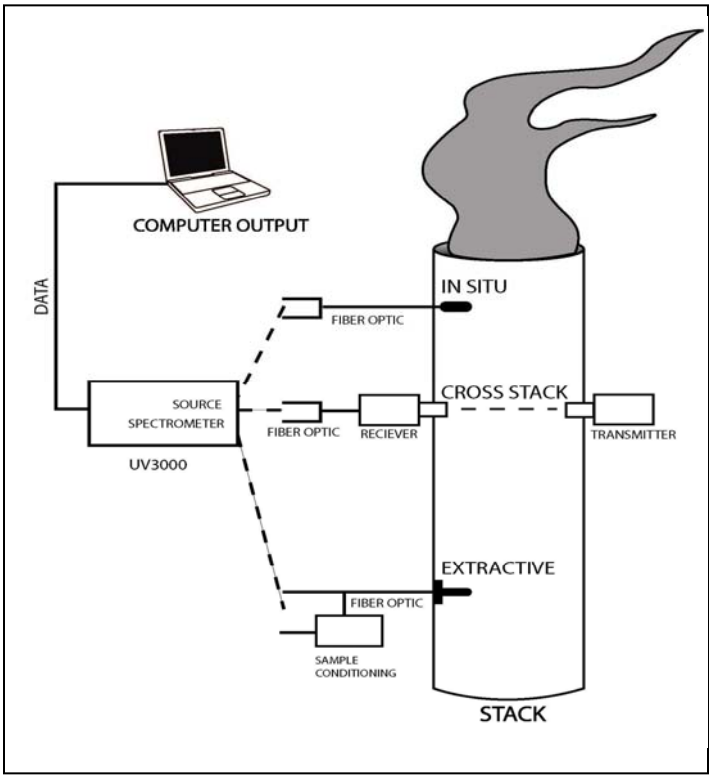
Technical Bulletin – Stack Monitoring

Stack Monitoring Options

Generally, Cerex has the capability to accommodate 3 types of Stack Sampling Scenarios; A single UV3000 system has the capability to adapt to each of these 3 scenarios with the purchase of optional sampling equipment.



In addition to stack sampling, the system can then easily be adapted to process monitoring, or even ambient (closed or open path) monitoring.

Extractive - In this method, the gas sample is removed from the stack and transported to the analyzer for analysis. However, in most cases some **conditioning** of the sample is required to remove water vapor and particulate matter. A variety of different pathlength **cells** are available, and the selection of what cell to use is a function of the gas and concentration range found in the stack.
In the case of Cerex Cells, each of these opto/mechanical assemblies is fiber-optically linked to the main UV3000 analyzer.

Cross Stack – This method represents a form of "in-situ" monitoring, as the sample never leaves the stack. In effect, this is also remote sensing, because the sample never touches any sampling apparatus. An optical beam passes across the stack diameter, and that optical beam is the absorption path which enables the analysis.

In-Situ – A gas probe is inserted into the wall of the stack. An optical beam is contained within the probe. This optical beam represents the absorption path which enables the analysis. The sample is drawn into the probe, but remains at the conditions found in the stack. The sample is never removed or extracted from the stack.

In each case, the UV3000 connects via fiber optic to the opto-mechanical hardware that is utilized under each method. The gas absorption is monitored, and continuous, real-time indications of concentration are reported and logged.

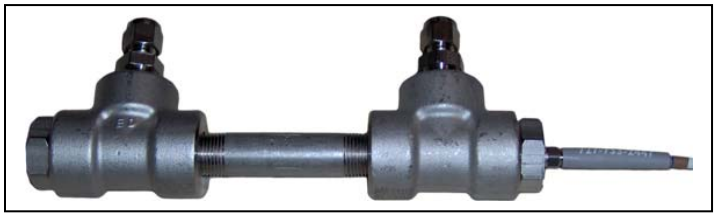
Next we will describe the specific options that are available with each stack monitoring method;

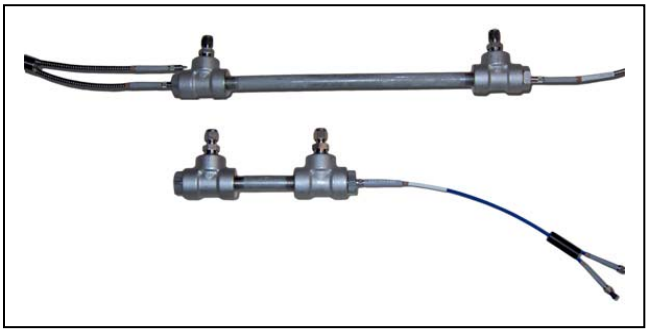
EXTRACTIVE

Short Path Linear Flow-Through Cells

The Cerex Short Path linear cells are designed with several unique features that make them very user-friendly in applications that require flexibility in pathlength;

- Cells are offered in a wide variety of materials to adapt in harsh chemical or temperature conditions
- Cells easily disassemble in the event cleaning is required
- The path length is User-Selectable. The center section of the cell is constructed of standard stainless-steel pipe with standard NPT threads. Any standard pipe "nipple" can be used as the body of the cell. This enables the user to choose any standard off-the-shelf size, or even create a custom-length cell.
- Heater can easily be added
- Paths of up to 1.5 meter are recommended (using Xenon)
- Paths of up to 0.5 meters are recommended (using D2)
- Standard Compression fittings for Gas Inlet and Outlet





300-100 (10cm) – Fiber Optically Coupled 10-Centimeter path Flow Cell – General Purpose, Light Duty

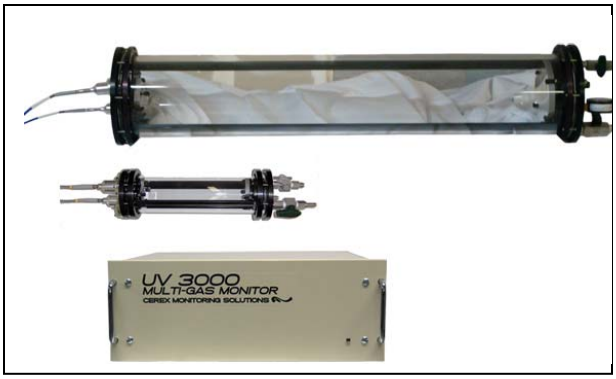
Long Path Multipass Cells

5 meter path – Low volume

Gas inlet and outlet valves are shown on the right side of the cell. The left side of the cell supports the optical input and output ports.

20 meter path – Larger Volume

Shown right are the relative size comparisons of the 20 meter cell, 5 meter cell, and UV3000 Primary Analyzer built into the 19" Rackmount Configuration.

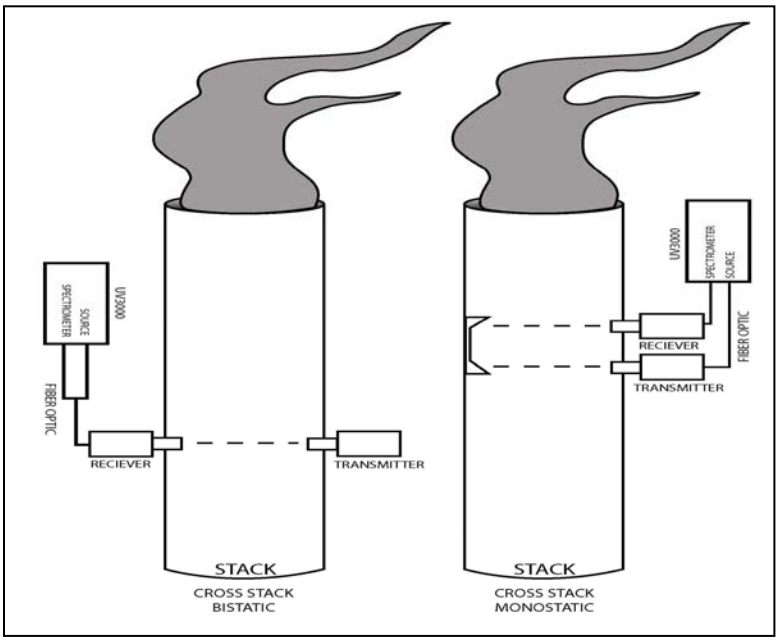


Extractive Probe, with complete Sample Conditioning

The SPP-100 system comes complete with a sample extraction probe, and all of the hardware required to condition the stack sample prior to the gas entering the gas Cell for analysis.

SPP-100 Sample Extraction System with Conditioning

Cross-Stack Monitoring Optical System



The cross stack optical system is typically built custom for every application. This is due to the fact that the diameter of the stack at the measuring height is different in every case. In addition the available size of the access port also is a limitation in some applications.

The concentration of measurable gases within the stack also determine whether the optical pathlength achieved by the system is indeed large enough to allow enough absorption to detect the compounds at the required minimum detectable limit (MDL). In addition, if the concentrations range very high, and the path is too long, then so much absorption could occur that certain spectral regions of analysis could be rendered useless due to complete loss of available uv light.

Monostatic system

The monostatic configuration consists of a Transmitter and Receiver located side-by-side. The beam path is completed at the opposite end of the stack with a retro-reflector or mirrored transfer optic. This design offers the following benefits;

- Double path through the stack achieves lower detections of gases
- Only a reflector is required at one end of the path – easier installation details

Bistatic System

The bistatic configuration consists of a Transmitter located at one end of the path, and the Receiver located at the opposite end. The beam passes through the sample one time

In both designed, the optical system is fiber-optically coupled to the main UV3000 analyzer. Depending on the gases to be analyzed, and the amount of particulates within the stack, the appropriate UV source (Deuterium or Xenon) is chosen. Xenon has the benefit of higher optical power to cut through heavy particulate scattering. Deuterium has the benefit of enabling the monitoring of the deep-uv subset of compounds.

For the purposes of this proposal, the two optional optical systems are simply identified as " Cross Stack – Short Path" and "Cross-Stack – Long Path.

P/N 300-250 Cross Stack – Short Path
Used on Stacks of 1 meter diameter or less
Available in monostatic or bistatic optical designs
Please specify length of fiber to interconnect the optics and main UV3000 analyzer

P/N 300-350 Cross Stack – Long Path
Used on stacks with diameter greater than 1 meter.
Available in monostatic or bistatic designs
Please specify length of fiber to interconnect the optics and main UV3000 analyzer

In-Situ Stack Probe

In Situ Probes are normally custom-specified and priced according to the effective pathlength of the probe.
The concentration of measurable gases within the stack determine whether the optical pathlength achieved by the system is indeed large enough to allow enough absorption to detect the compounds at the required minimum detectable limit (MDL). In addition, if the concentrations range very high, and the path is too long, then so much absorption could occur that certain spectral regions of analysis could be rendered useless due to complete loss of available uv light.

In-Situ probes are available in a variety of paths ranging from a few millimeters up to 1 meter.
Each probe is fiber-optically coupled back to the primary UV3000 Analyzer

Most models that we offer have the provision built-in to inject a zero gas or calibration gas ahead of the sample stream.

300-420 Probes up to pathlength of 20mm
300-430 Probes from 20mm up to 1 meter

Extractive Probe, with complete Sample Conditioning

Specifications are attached in a separate document.
The SPP-100 system comes complete with a sample extraction probe, and all of the hardware required to condition the stack sample prior to the gas entering the gas Cell for analysis.

SPP-100 Sample Extraction System with Conditioning