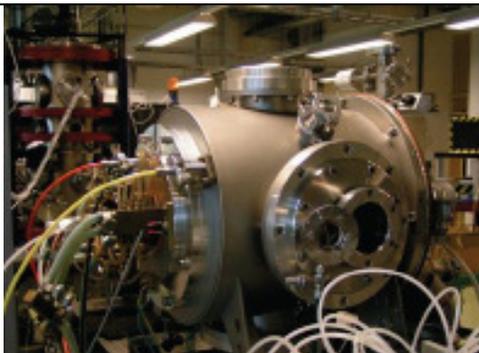


Application Note:

Vacuum Spectroscopy



Optical Emission Spectroscopy System measuring vacuum reaction chamber

Spectroscopic measurements conducted in vacuum environments range from reflection measurements during coating processes through high speed plasma monitoring during a reaction. These techniques are frequently used for sophisticated process control monitoring such as end point detection. This procedure involves monitoring a peak or wavelength range to detect a process inflection point characterized by a spectral shift which signals the end of the process. High vacuum (~10⁻³ torr) and ultra-high vacuum (~10⁻⁹ torr) measurements require special consideration when selecting a spectrometer and the associated fiber optics used for sampling. Avantes has worked extensively with customers operating in vacuum environments and offers a variety of instruments and accessories to meet the needs of vacuum spectroscopy.

Spectrometers

Avantes AvaSpec instrument line can be configured for operation in vacuum environments. Customers wishing to monitor processes within a vacuum environment in the visible and deep UV (190-800 nm), may consider our AvaSpec-ULS2048L-USB2 or AvaSpec-ULS2048-USB2 spectrometers in single or multi-channel configurations. Spectral acquisition is achieved through fiber optic cable, bundles or probes which collect spectral emissions at the surface or a quartz window into the chamber or reflection/emission inside the chamber through the use of a vacuum feedthrough (see fiber optics on back).

VUV Spectrometers

For customers interested in the VUV wavelengths, the AvaSpec series is also available in a specialized configuration with purge ports to facilitate evacuation of the optical bench using inert gases. The Purge-ULS option features two purge ports on the back of the spectrometer along with a magnesium fluoride window behind the slit and a top cover seal in the optical bench. This configuration is offered with a choice of a deep UV coated detector for operation down to 160 nm or window-less back-thinned detector which facilitates operation down to 120 nm. VUV configurations such as these often require specialized grating selections.



Multi-channel spectrometer with 10 channel configuration

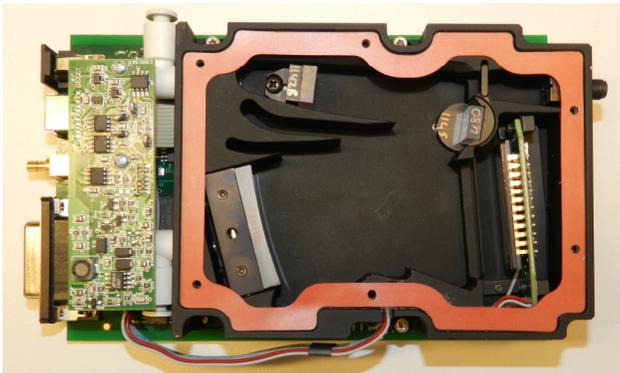
All Avantes spectrometers are available in single, dual or multi-channel configurations. Avantes' unique instrument platform enables true synchronous operation of our multi-channel spectrometers so as to facilitate simultaneous acquisition of spectral data from all instruments in an array.

Avantes OEM spectrometer modules are available for system integrators or industrial customers who seek to integrate spectrometers into a larger system. Avantes OEM instruments consist of our Avabench-75 optical bench and the independent AS5216 and AS-M5216 electronics boards or our new integrated ULSi in which the optical bench and electronics board are integrated into one monolithic module. OEMs can opt to use only our optical bench or the combined optical bench and electronics board.

Instrument Control Software

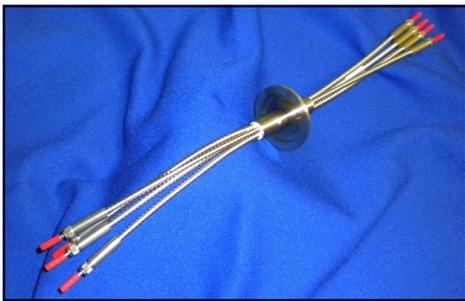
Avantes proprietary AvaSoft software is a Windows-based 32 and 64 bit compatible software package which enables a variety of measurement modes. AvaSoft facilitates the connection of multiple spectrometers and the merging of spectra into a single graph and data file.

OEM and integrator customers typically use Avantes AS5216 dynamic linking library to control the spectrometer. Avantes AS5216 DLL software development kit is 32 and 64 bit compatible and comes with sample programs in Matlab, Linux, LabView, C#, C++, Visual Basic and Borland Delphi.



AvaSpec-2048-USB2 single channel purge spectrometer

Fiber Optics for Vacuum



KF40 vacuum feedthrough with 4 individual fiber optics

For vacuum applications operating from 190-800 nm, the use of fiber optics for spectral acquisition is possible. Fiber assemblies for use inside vacuum environments require the use of special epoxies rated for their minimal outgassing. Typically stainless steel (BX) or chrome-plated brass jacketings are used in these applications. Avantes offers a variety of standard and custom fiber assemblies for use in vacuum environments. Avantes reflection probes are available in a multitude of configurations to meet the needs of every measurement challenge. High temperature assemblies are available for environments ranging from 200 up to 500C.

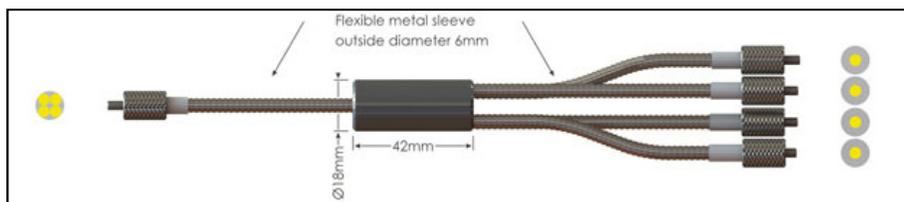
Vacuum feedthrough options range from our low cost bolt-style feedthrough to a variety of custom configured flange style feedthroughs with Conflat 1.33/2.75 or KF-40 flanges.



Avantes low cost bolt-style vacuum feedthrough

High OH Solarization resistant fiber is recommended for wavelength ranges from 190-250 nm. Avantes unique broadband fiber is well suited to the wavelength ranges from 250-2500 nm and combines the advantages of high and low OH fiber with superior transmission across the range.

Avantes instruments and fiber optics support a multitude of vacuum applications. In addition to our standard offerings, we also develop custom engineered systems for specific applications. Contact an Avantes Sales Engineer at infousa@avantes.com in the Americas.



Avantes multi-furcated fiber assemblies are available as bundles to collect emitted light or probes to collect reflected light

Application	Vacuum Spectroscopy
Spectrometers	AvaSpec-ULS2048-USB2 (Starline) and AvaSpec-ULS2048L-USB2 (Starline) —2048 pixels AvaSpec-ULS2048X16-USB2 (Sensline) - back-thinned CCD—2048 pixels PURGE-ULS Option
Gratings Range & Resolution	VUV gratings (120-200 nm) available upon request Grating UC—200-450 nm (resolution 0.2 to 5 nm (FWHM)—slit dependent) Grating UB—200-750 nm (resolution 0.4 to 4.6 nm (FWHM) - slit dependent) Grating VB—360-850 nm (resolution 0.4 to 4.6 nm (FWHM) - slit dependent)
Fiber Optics	Multi-furcated fibers optic splitters—see Avantes catalog FC-VFT-XXXX—vacuum feedthroughs FCR-7UVIR400-2-BX reflection probes