

SPECTROSCOPY CONFIGURATIONS FOR FLUORESCENCE APPLICATIONS



SOLUTIONS FOR FLUORESCENCE APPLICATIONS

Fluorescence spectroscopy refers to the measurement of the emission of light by a substance that has absorbed light of a different wavelength. In most cases, the emitted light is at a lower energy state but higher wavelength than the absorbed light. Fluorescence as a spectroscopy application technique is exploding with uses in many industries. It is used to detect counterfeits in the printing industry, protein measurement in life science, mineralogy, pathogen detection, and much more.

Generally, there are two types of fluorescence measurements, endogenous and exogenous. Endogenous fluorescence refers to fluorescence that is naturally occurring in a chemical species, plant, or animal subject. For example, chlorophyll in plants exhibits natural or endogenous fluorescence as does the protein tryptophan in animal tissue. Exogenous fluorescence refers to a fluorescence occurring as a result of the addition of a natural or chemically synthesized fluorophore. For example, fluorescein and indocyanine green are two commonly used fluorophores in medical applications.

Avantes instruments and accessories are frequently used in fluorescence applications. While the traditional go-to instrument for fluorescence is a fluorimeter, a functional solution for fluorescence measurements can be configured with Avantes spectrometers, light sources, and sample accessories. Spectrometer-based fluorescence solutions offer some advantages over traditional fluorimeter instruments including:

- **Size/portability** – enabling integration into handheld devices
- **Value** – these instruments often have a superior price/performance ratio
- **Micro-sampling** – through the use of fiber optic sampling
- **Speed** – Micro spectrometers can support sampling at very high speeds (ms time scales)
- **Non-invasive/non-contact sampling**

For these reasons and more Avantes instruments are often considered for integration into commercial systems for fluorescence detection to support medical and industrial applications.

EXAMPLES OF FLUORESCENCE APPLICATIONS

- **Protein Detection:** Enabling both total protein quantification and advanced applications like protein classification, identification, and proteomics.
- **Cancer Detection:** Facilitating high-sensitivity, real-time monitoring of fluorescent biomarkers in biological samples.
- **Identifying Radioactive byproduct:** Used to detect leaking radioactive byproducts in nuclear power generation via fluorescence analysis.
- **Fluorescence Microscopy:** provides spectral detection and analysis of fluorescent signals for improved imaging and quantification
- **DNA Sequencing:** Detects fluorescence signals from labeled nucleotides for base identification
- **Anti-Counterfeiting:** Fluorescent tags are added to the ink of currency

The following details some common configurations used in fluorescence applications. It is by no means a complete list of all possible configurations but it provides some ideas. Avantes is not a manufacturer of integrated turnkey solutions, rather a component supplier for fluorescence.

FLUORESCENCE CONFIGURATION

AVAFLUORIMETER SETUP WITH NEXOS™



● Spectrometer

AvaSpec-NEXOS™ 2048 CL or AvaSpec-Varius-2048CL (200-1100 nm or any subset) with slit-size dependent resolution; optional interface cable for automated shuttering.

● Fiber Optics

FC-UVIR600-1-MS 600 micron core broadband fiber optic cables

● Light Source

Avalight-XE-Mini-HP pulsed xenon light source and interface cable to spectrometer

● Fiber Optic Monochromator

FM-200-800: range 200-800 nm

● Direct Attach Cuvette/Cuvette Holder

CUV-DA-Direct Attach Cuvette Holder: facilitates orthogonal orientation of excitation and emission signals. Optional CUV-Cover-DA recommended

APPLICATIONS

While Avantes does not offer a true fluorimeter solution, through the combination of a broad-spectrum light source (Pulse xenon or tungsten halogen), a fiber optic monochromator and a broad-spectrum spectrometer, it is possible to create a functional fluorimeter for specific use cases. Available only in North America, the AvaFluorimeter is a configuration that allows end users to individually introduce excitation wavelengths into a sample and simultaneously measure fluorescence. The configuration may include:

FLUORESCENCE CONFIGURATION

AVAFLUORIMETER SETUP WITH AVASPEC-HERO



Spectrometer

AvaSpec-ULS2048X64TEC-EVO "Hero" with replaceable slit technology (200-1100 nm; slit-200 recommended – thermo-electrically cooled to support longer integration times.

Fiber Optics

FC-UVIR600-1-MS_ 600 micron core broadband fiber optic cables

Light Source

Avalight-XE-Mini-HP pulsed xenon light source and interface cable to spectrometer

Fiber Optic Monochromator

FM-200-800: range 200-800 nm

Direct Attach Cuvette/Cuvette Holder

CUV-DA-Direct Attach Cuvette Holder: facilitates orthogonal orientation of excitation and emission signals. Optional CUV-Cover-DA recommended

CUSTOMIZATION OPTIONS FOR AVAFLUORIMETER

Beyond the configurations shown above, Avantes AvaSpec instrument lines includes higher performance spectrometers for measurements of lower limits of detection with **higher signal to noise performance**. The [AvaSpec-ULS2048X64-EVO](#) from our SensLine product family provide for superior performance for more demanding applications.

Fluorescence measurements may also be performed with probe configurations such as the [FCR-UVIR200/600-2-IND](#) probe. Probes **provide greater flexibility** for bringing the measurement to the sample. For example many medical applications obviate the need for a probe to sample a smaller area or in vivo measurements on humans. Custom probes can be designed for skin measurements or even biopsy and endoscopy probes that facilitate fluorescence.

FLUORESCENCE CONFIGURATION WITH CUVETTE

CUVETTE SETUP WITH VARIUS™



● Spectrometer

AvaSpec-Varius2048CL or AvaSpec-NEXOS™ 2048 CL; or (200-1100 nm or any subset) with slit-size dependent resolution; optional interface cable for automated shuttering.

● Direct Attach Cuvette/Cuvette Holder

CUV-DA-Direct Attach Cuvette Holder:
Optional CUV-Cover-DA recommended

● Light Source

AvaLight-XE & Power supply (PS-12V-2.08A)
or AvaLight-LED-HP

● Fiber Optics

FC-UVIR600-1-MS or -MS – 1 or 2 units: 600 micron core broadband fiber optic cables

● FH-INL

Inline filter holder - 12.5 mm Longpass/band-pass filter holder

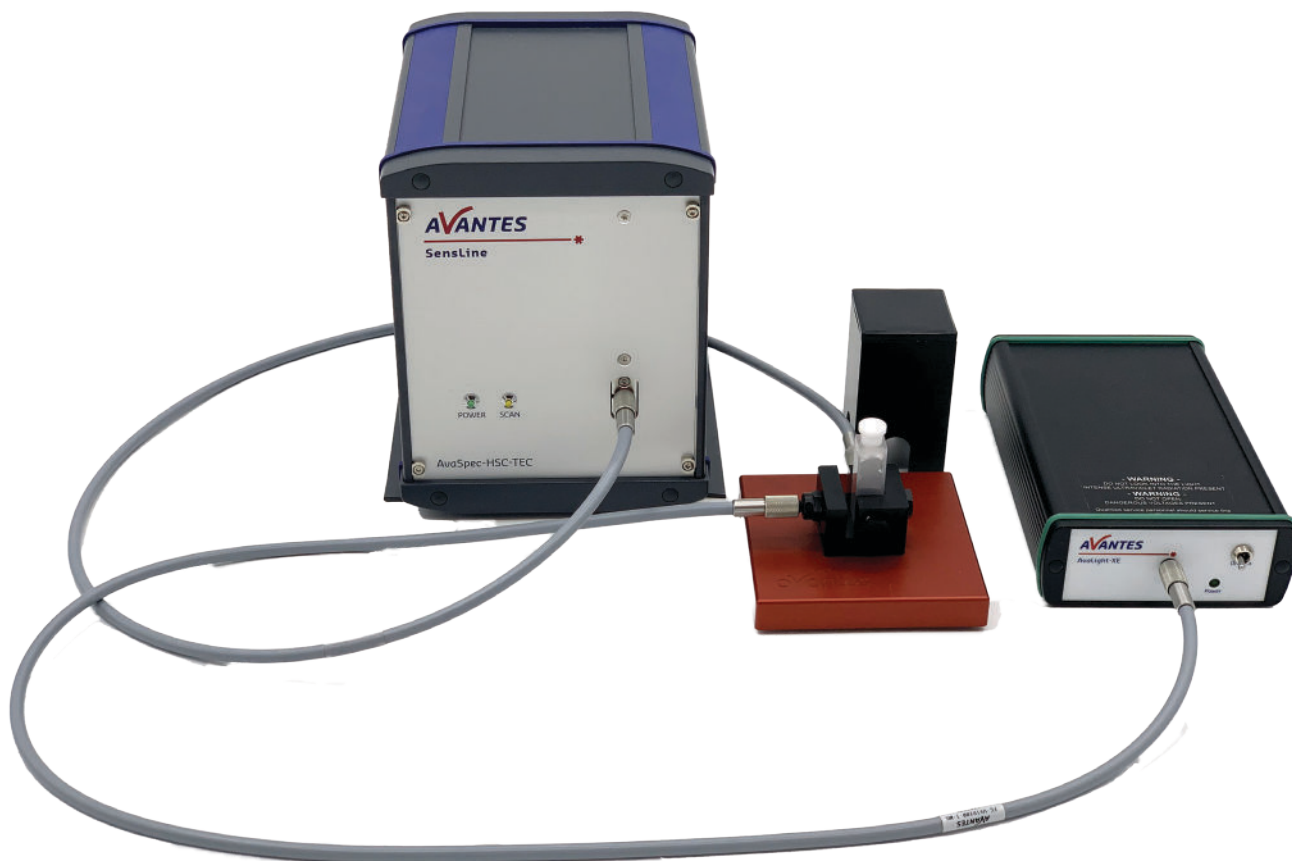
APPLICATION

For relatively simple cuvette measurements where excitation and emission are oriented at 90 degrees from one another, the following configurations are ideal.

While most fluorescence application do not require a thermo-electrically cooled spectrometer, this type of instrument available in the Avantes SensLine portfolio can be beneficial for use cases where the highest levels of stability and signal to noise is required. Both of these configurations facilitate fluorescence measurements of a signal excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and long-pass (emission) filtering. Custom cuvette cell holders or inserts are available upon request.

FLUORESCENCE CONFIGURATION WITH CUVETTE

CUVETTE SETUP WITH AVASPEC-HERO



● Spectrometer

AvaSpec-HERO: various range options from 200-1160 nm; large slit (100 or 100 microns)

● Direct Attach Cuvette/Cuvette Holder

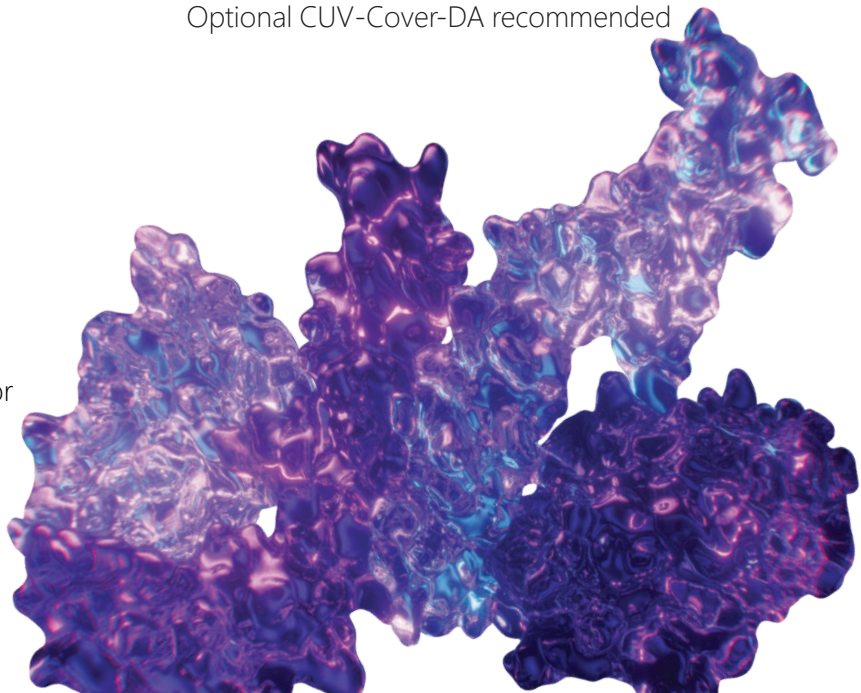
CUV-DA-Direct Attach Cuvette Holder:
Optional CUV-Cover-DA recommended

● Fiber Optics

FC-UVIR600-1-MS_ or -MS – 1 or 2 units: 600 micron core broadband fiber optic cables

● Light Source

AvaLight-XE & Power supply (PS-12V-2.08A) or
AvaLight-LED-HP



FLUORESCENCE CONFIGURATION FOR PROBE BASED LIQUID MEASUREMENTS



● Spectrometer

AvaSpec-NEXOS™ 2048 CL; or AvaSpec-Varius-2048CL (200-1100 nm or any subset) with slit-size dependent resolution; optional interface cable for automated shuttering.

● Fiber Optics

FC-UVIR600-1-MS or -MS – 1 or 2 units: 600 micron core broadband fiber optic cables

● Light Source

AvaLight-XE & Power supply (PS-12V-2.08A) or AvaLight-LED-HP

● Microfluidic Flow Cell

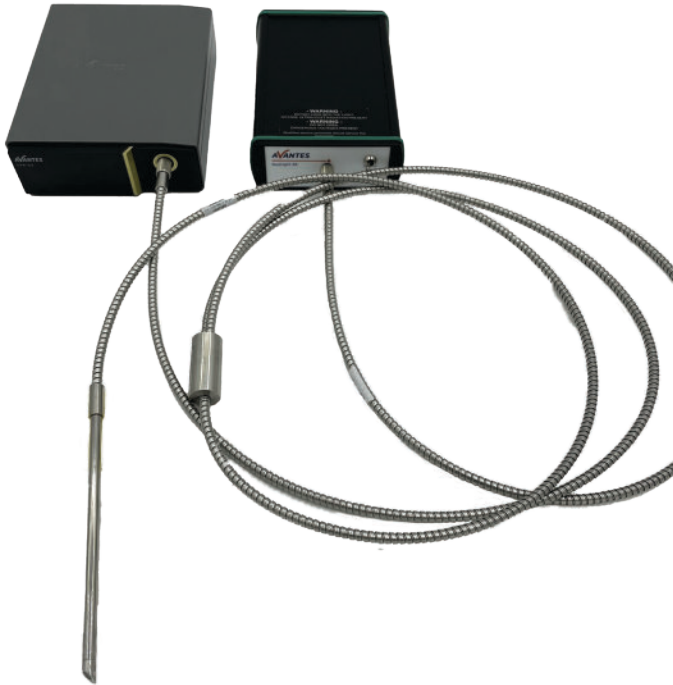
Flowcell-FL-Ultem – microfluidic flow cell (black Ultem material) with integrated compression seal windows – 1/16" tubing typical – ONLY AVAILABLE IN NORTH AMERICA

APPLICATION

Many fluorescence applications involve sampling on small micro-liter volume liquids which present problems for traditional cuvette measurements. Additionally, some fluorescence measurement require a continuous flow monitoring and this obviates the need for a flow cell.

This configuration facilitates fluorescence measurements of a single excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and long-pass (emission) filtering. Avantes also offers larger industrial flowcells for fluorescence such as the Flowcell-1/4"-FL

FLUORESCENCE CONFIGURATION FOR MICROFLUIDICS



● Spectrometer

AvaSpec-Varius2048CL or AvaSpec-NEXOS™ 2048 CL (200-1100 nm or any subset) with slit-size dependent resolution; optional interface cable for automated shuttering.

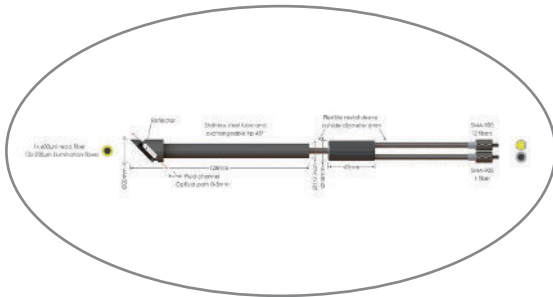
● Fiber Optics

FCR-7UVIR400-2-45-BX: Reflection probe, 45 degree window for liquids and powders with flexible Stainless Steel jacketing & couple piece

● Light Source

AvaLight-XE & Power supply (PS-12V-2.08A) or AvaLight-LED-HP

ALTERNATIVE PROBE OPTION



FCR-UV200/600-2-IND

Fluorescence measurements may also be performed with this which may require the use of band pass and long pass filters which allow for the separation of excitation from emission wavelengths. Avantes direct attached (FH-DA) and inline filter holders (FH-Inline), or an LED excitation source.

APPLICATION

Probe based fluorescence is one of the advantages intrinsic to a fiber optic-based spectrometers. Probe can be configured in a variety of sizes and shapes to facilitate direct measurement of a sample. Fiber optic probes allow for the measurement to be made in harsh conditions or small spaces while the instrument can be operated remotely. Handheld configurations featuring probes for sample are also a possibility.

As with the systems mentioned above, this configuration facilitates fluorescence measurements of a single excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and longpass (emission) filtering. Avantes offers a multitude of standard and custom probes which can be configured for fluorescence applications.

FLUORESCENCE CONFIGURATION WITH TEMPERATURE CONTROLLED CUVETTE HOLDER



● Spectrometer

Avaspec-ULS2048x64-EVO various range options from 200-1100 nm; large slit (100 or 100 microns)

● Fiber Optics

FC-UVIR600-1-MS/BX/ME – 600 micron core broadband fiber optic cables

● Light Source

AvaLight-XE & Power supply (PS-12V-2.08A) or AvaLight-LED-HP

● Temperature Controlled Cuvette Cell Holder

Air-cooled, temperature-controlled cuvette holder with a settable range from -15°C to +105°C, offering precise temperature control with $\pm 0.15^\circ\text{C}$ accuracy.

APPLICATION

Some fluorescence applications such as life science benefit from temperature stabilization at the sample. This can be facilitated through the use of a temperature controlled cuvette holder such as the CUV-UV/VIS-TC3-FL. This configuration may include a temperature controlled spectrometer or an uncooled instrument.

This configuration facilitates fluorescence measurements of a signal excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and long-pass (emission) filtering.

SUPPORT & ADVICE

Providing high-quality equipment is only part of what we do. The other equally important factor is the high level of service we deliver. Our organization includes various specializations to provide you with the best service and advice:

Feasibility studies

Our sales engineers perform feasibility studies to find the right solution.

Support team

Our support team never sleeps and provides you with the best service.

Demo program

Our demo program allows you to try our products for free to ensure you find the perfect solution.

MyAvantes

Personal platform where you'll find AvaSoft Software and other material

Online support

Helpful documents and tutorial videos for extra help with your products.



ABOUT AVANTES

Avantes is the leading innovator in the development of fiber-optic spectroscopy instruments and systems with nearly 30 years of experience developing customer-defined configurations.

With a long history of consulting with clients across diverse industries and applications, Avantes is an experienced partner, equipped to guide customers who want a solution tailored to their application and research needs. By building worldclass spectrometers and providing second-to-none customer service, Avantes offers customers the peace of mind that the Avantes solutions they purchase will meet, and exceed, their expectations.

Through our headquarters in Apeldoorn, the Netherlands and offices in the USA and China, our sales engineers work closely with our customers to recommend the optimal measurement solution. In addition to our direct offices, Avantes has a worldwide network of distributors in over 35 countries who are ready to assist you. Our production team, which is located at our headquarters in the Netherlands, is dedicated to quality workmanship and has a relentless drive to exceed customer expectations.

Curious how spectroscopy can help you reveal answers by measuring all kind of materials in-line at your production facility, in a lab or in the field? Please contact one of our technical experts, we are happy to help!



CONTACT

WE'RE HAPPY TO HELP

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