AvaSoft-Basic Software

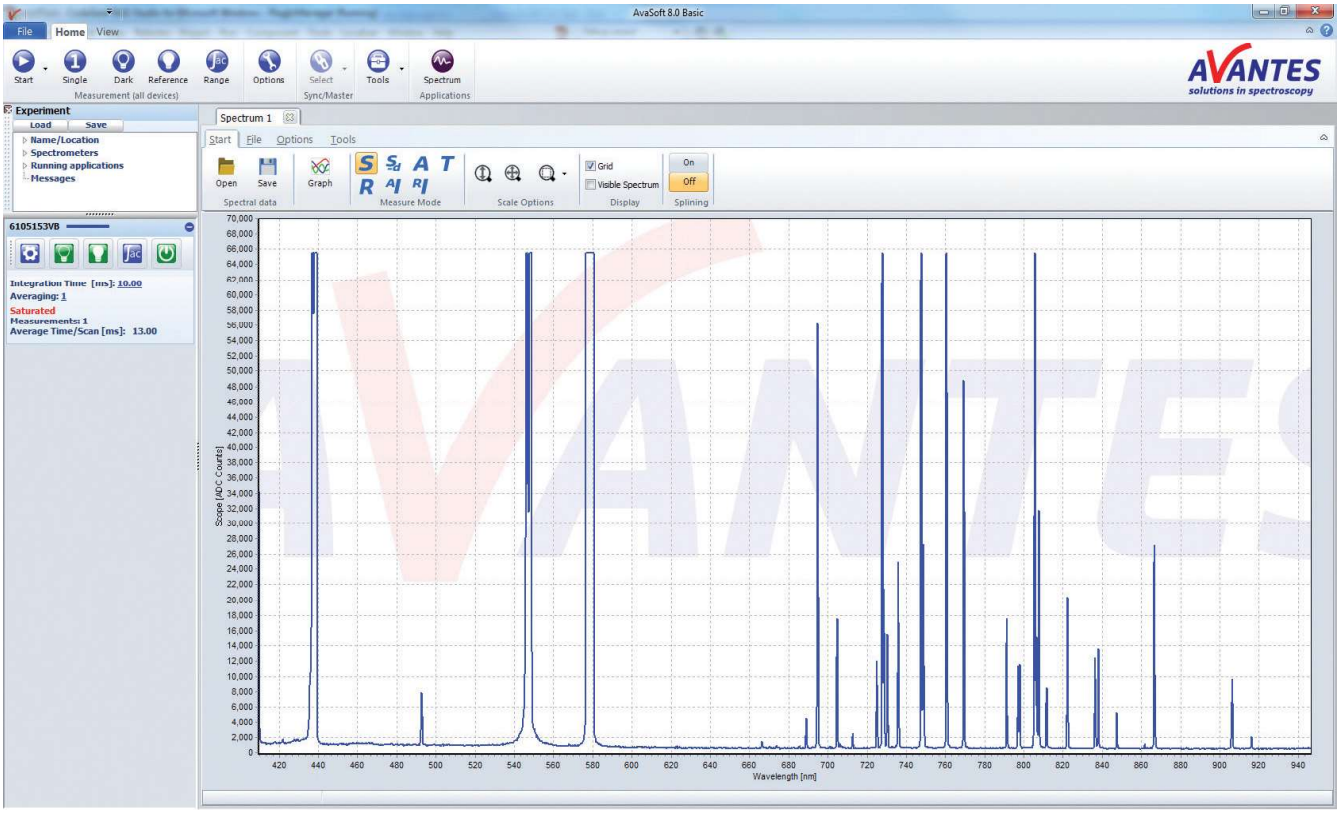
To facilitate the use of our AvaSpec series spectrometers, we provide our AvaSoft-Basic, free of charge. It features user-friendly controls, pull down menus and is mouse oriented. Mouse clicks control movements of a data cursor for instantaneous readout of wavelength, pixel and Y-axis magnitude. The multi-window and multi-monitor interface enables side by side comparison of measurements. Use mouse dragging for easy and fast zoom-in/out on both X and Y axes. An unlimited number of AvaSpec series spectrometers can be connected to the computer, either through USB or Ethernet.

In the main window, controls for on-line/off-line spectral analysis are available. Software icons facilitate easy saving of reference, dark and experiment spectra. Additionally, changing the measurement units to absorbance, transmittance, irradiance or raw scope data can be done with one click of the mouse. Rescaling the Y-axis, setting the scale for X- and Y-axis and peak/valley searching are also available.

Instrument control and data collection parameters are user-definable, such as detector integration time, auto-dark correction, signal averaging and spectral smoothing. Saved graphics can be exported to ASCII and be exported into Excel and other data processing software.

Other options are a 3D display functionality and the option to save a graph directly as a PDF-file. File management features flexible file filters.

The latest version of AvaSoft-Basic can be downloaded from the Avantes website. Please contact us for upgrading to AvaSoft-Full or –All.



Ordering Information

AvaSoft-Basic	• Free Basic Spectrometer software for Windows

For the latest information, go to www.avantes.com

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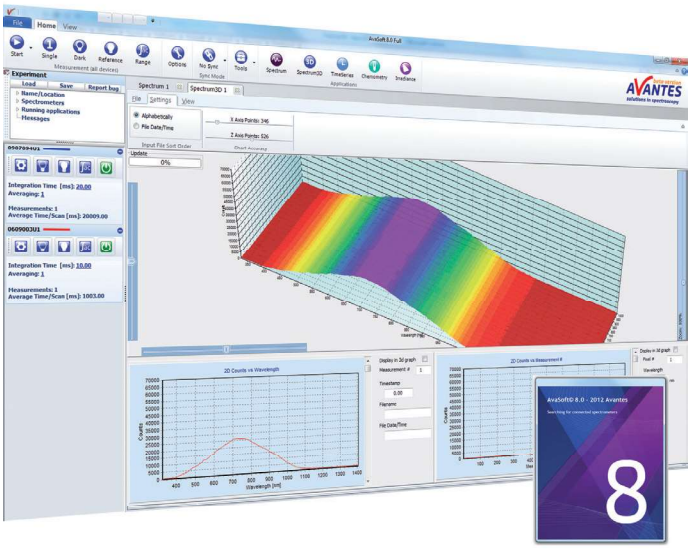
AvaSoft-Full and AvaSoft-All

AvaSoft-Full

The AvaSoft-Full version offers many more possibilities and options than AvaSoft-Basic. In the table below you can find the similarities and differences between the two versions.

AvaSoft-All

For the greatest flexibility, AvaSoft-All includes AvaSoft-Full and all application modules described in the subsequent pages. This means you can do color, irradiance, chemometry measurements, process control and real-time exporting to Excel all in one convenient software package.

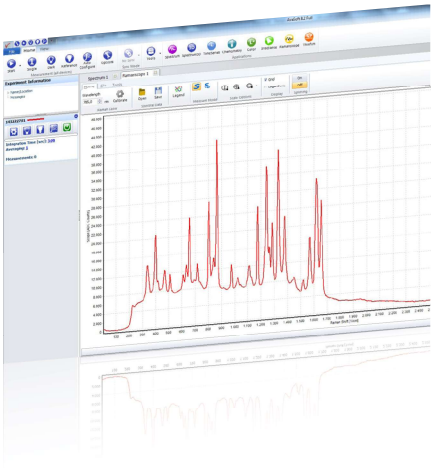


Comparison AvaSoft-Basic and AvaSoft-Full	Basic	Full	All
Editable data collection parameters per channel, such as detector integration time, auto-dark correction, signal averaging, spline interpolation and spectral smoothing.	X	X	X
Display data in scope-, transmittance-, absorbance-, or relative irradiance mode. Multiple spectrometer channels are displayed in the same graph, optional grid display. 3D display for multiple spectra in time series.	X	X	X
Save spectra, and display online measurements against (multiple) saved spectra background. Print (multiple) spectra in color. Convert saved spectra to ASCII format in equidistance (nm) with start wavelength in nm. Automatic save spectra periodically (save a spectrum every x seconds).	X	X	X
Help menu option to find quickly a description about any AvaSoft topic.	X	X	X
Time Series, in which the output of user defined functions, integrals, peaks (intensity, wavelength) can be followed simultaneously against time. Functions can be entered in Visual-Basic script. Time series measurements can be saved/loaded and printed. Zoom- and panning functions can be applied to expand quickly an interesting part of the time series measurement to the full graph.		X	X
Auto Wavelength Calibration. In combination with a Mercury-Argon Light Source, a number of peaks can be detected automatically. These peaks are then compared with the wavelengths where they should have been detected, and a regression fit is performed to calculate the best wavelength calibration coefficients.		X	X
Correct for drift. Master and slave channels with similar range can be used to correct for changes in the light source.		X	X
Save live to file.		X	X
Store to RAM for ultrafast Data saving for a limited amount of scans.		X	X
External Trigger control to acquire spectral data only if a TTL signal is presented with optional integration time delay settings.		X	X
Convert spectra to other file formats		X	X
Merging spectra of multiple channels to one spectrum.		X	X
Full Width Half Max calculations, online or on saved spectra. Graphically displayed. Integral calculations, online or on saved spectra, graphically displayed.		X	X
Auto-configure integration time: AvaSoft searches for an optimal integration time.		X	X
Automatic Save Dark by TTL shutter.		X	X
LIBS application.		X	X
Thin film application.			X
Raman application.			X
Irradiance application.			X
Color application.			X

Ordering Information

AvaSoft-Full	• Full version AvaSpec software for Microsoft Windows
AvaSoft-All	• Full version AvaSpec software, including all applications

AvaSoft - Color



For online and offline reflective color measurements, AvaSoft-COL is the ideal companion. This application provides a precise way to perform color measurements using the basic principles and techniques defined by the International Commission on Illumination (CIE). The CIE 1976 L*a*b* color parameters are calculated, along with other parameters, like Hue, Chroma and X, Y, Z.

These parameters can be displayed in a CIELAB chart or in a graph versus time. Another possibility is saving the measured L*a*b* values to an online database and using one of the products from the database as a reference color. Color differences (ΔE_{Lab}, ΔL^*, Δa^*, or Δb^*) are made through comparing the measured L*a*b* values to the stored database values.

The color of an object can be expressed by the CIE 1976 (L*a*b*) color space. L* describes the brightness of the color. A positive value of a* describes the redness of the color, a negative a* the greenness. Similarly, yellowness is a positive b*, where blue is a negative b*. The L*a*b* values are derived from the CIE tristimulus values X, Y and Z of the sample (object) and the standard illuminant tristimulus values X_n, Y_n and Z_n.

The standard illuminant tristimulus values for X_n, Y_n, and Z_n are constant and depend only on the type of standard illuminant that has been chosen.

The CIE tristimulus values X, Y and Z of the color of an object are obtained by multiplying the relative power P of a standard illuminant, the reflectance R (or the transmittance) of the object, and the 1931 or 1964 CIE standard observer functions x_n, y_n and z_n (2 and 10 degree angles). The integral of these products over all the wavelengths in the visible spectrum (380 to 780 nm with a 5 nm interval) gives the tristimulus values.

Color chart

The color chart display features:

- Display in CIELAB chart, the actual sample color as well as the reference color with the corresponding ΔE_{Lab}, ΔL^*, Δa^*, or Δb^* values are displayed and saved as well.
- The settings for the LAB chart display can be changed, such as no graphical display of reference and sample color in order to speed up the measurements.
- The standard observer angle is selectable for 2° or 10°.
- The reference color can be saved to and loaded from a color database. The database contains, apart from all color parameters, a product ID and a display of the actual color. The database can be sorted alphabetically or in either value column.

Time series

The time series display has following features:

- Display in time series can be selected for any number of channels.
- For each channel a color parameter (L*, a*, b*, hue, C, X, Y, Z, ΔE_{Lab}, ΔL^*, Δa^*, or Δb^*) can be selected. For each channel a different reference color can be selected, enabling color sorting.
- For each channel the time axis can be set to a different scale, allowing simultaneous display of long time and short term monitoring of the same parameter.
- For each channel the actual measured color, as well as the reference color (if in ΔE_{Lab}, ΔL^*, Δa^*, or Δb^* mode) is displayed.
- The saved time series data can be displayed with extensive zooming and dragging options.

Ordering Information

AvaSoft-COL	• Color application add-on software, to be ordered with AvaSoft-Full
AvaSoft-A11	• Full version AvaSpec software (includes AvaSoft-COL, -IRRAD, -Raman and, -ThinFilm)

AvaSoft - Irradiance

Avantes spectrometers measure radiated optical energy, which can be quantified as a radiant flux, in energy per second (Watt) radiated from a source. The radiated optical energy can also be correlated with human vision (photometry), as defined in the CIE, to obtain a spectral luminous efficiency function to characterize the vision of an average human observer.
An Avantes irradiance calibrated spectrometer system can measure both radiometric as well as photometric quantities. Radiometric quantities are radiant energy (in Joule), Radiant power or flux (in Watt) or irradiance (Watt per cm^2). Related photometric quantities are luminous flux (lumen) or illuminance (lux or lumen per m^2).

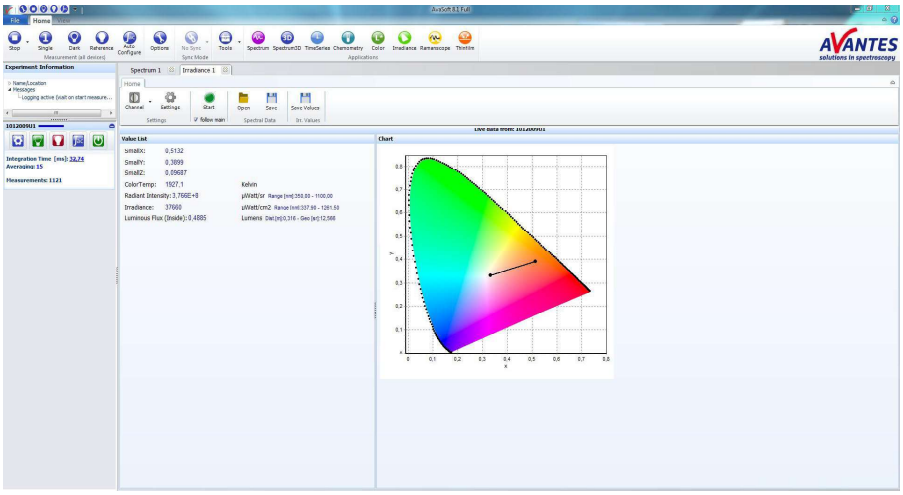
The measured spectral distribution is used to calculate the above-mentioned para–meters. An intensity calibrated light source such as those in Avantes' factory calibration laboratory or our field calibration lamps, the AvaLight-HAL-CAL or AvaLight-DH-CAL, with known energy output (in µWatt/cm^2/nm) are used as a reference. Calibrations can be performed at Avantes' factory laboratory or in the field and stored on the EEPROM of the spectrometer (or an independent file) for future usage. AvaSoft-IRRAD Software is required for either type of calibration.

The color of light parameters can be expressed by the chromaticity coordinates x, y and z. These chromaticity coordinates are obtained by taking the ratios of the tristimulus values (X, Y and Z) to their sum. The tristimulus values X, Y and Z and the spectral irradiance are computed in a wavelength range from 380 nm to 780 nm, using a 1 nm interval. These parameters, as well as the coordinates u and v, and the color temperature of an external light source can be calculated and displayed in real-time in the AvaSoft-IRRAD module.

The CRI color-rendering index of a light source is also included in the AvaSoft IRRAD module. The color rendering index of a light source with a color temperature <5000K is a measure of how close a light source matches a perfect black body radiant. Additionally AvaSoft-IRRAD features a setting for auto-adjusting the integration time during a time sequence measurement, so a large dynamic range can be achieved for applications that have both a very high light level and a very low light level, such as solar measurements.

AvaSoft-IRRAD enables two ways to display and save calculated output:

- Data can be displayed as spectral irradiance in µWatt/nm versus wavelength. Additionally, the following output parameters can be displayed: radiometric quantities µWatt/cm^2, µJoule/cm^2, µWatt or µJoule, photometric quantities Lux or Lumen, color coordinates X, Y, Z, x, y, z, u, v, color rendering index and color temperature, and number of photons µMol/s•m^2, µMol/m^2, µMol/s and µMol. The AvaSoft-IRRAD module also displays raw data in Scope mode as well as the X-Y Chromaticity diagram, including parameters, which are useful for LED measurements, such as: Dominant Wavelength, Purity, Central Wavelength, Peak Wavelength, Centroïd, etc.
- In Time Measurement mode, any number of functions can be displayed simultaneously against time. For each function, a different radiometric, photometric, photon or color coordinate output parameter and/or wavelength range may be selected, as well as a different spectrometer channel.



Ordering Information

AvaSoft-IRRAD	• Irradiance application add-on software, to be ordered with AvaSoft-Full
AvaSoft-All	• Full version AvaSpec software (includes AvaSoft-COL, -IRRAD, -Raman and, -ThinFilm)
IRRAD-DLL	• 32-bit DLL for Irradiance/LED application

AvaSoft - Chemometry

The AvaSoft-CHEM module enables online concentration determination with a spectroscopy system. Lambert-Beer's law states there is a linear relationship between absorbance and concentration:

A = e * c * l

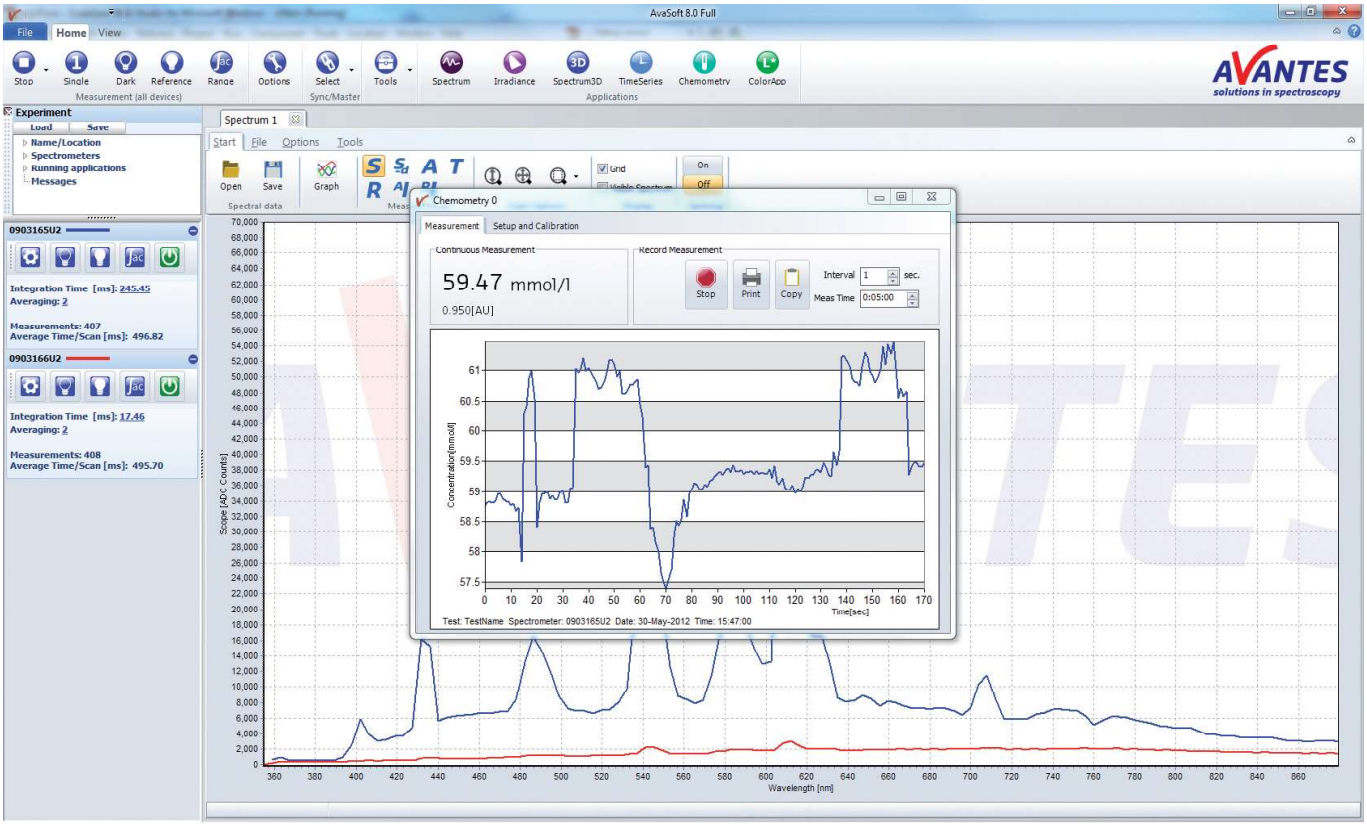
Where A is the absorbance (or extinction), e is the extinction coefficient of the compound to be measured, c is the concentration and l is the optical path length.

In practice this relation is only linear at reasonably low absorbance levels (less than 2 Au). To measure the absorbance, a few samples with known concentrations are needed. It is important to always measure the absorbance at the same wavelength and use more samples of different concentrations in order to provide a better chemometric model.

The absorbance values are used in AvaSoft-CHEM to create a linear (or second order - quadratic) calibration line. This calibration line is then used to measure the concentration of unknown samples or to measure the change in concentration over time.

AvaSoft-CHEM can display and save the calculated concentration in the following ways:

- Online display of concentration in a separate display window
- Up to eight history channel functions can be selected to display and save concentration values against time. This application can be combined with the Excel and Process-Control applications.



Ordering Information

AvaSoft-Full	• Chemometry application software for concentration measurements, included with AvaSoft-Full

Download the latest software for your spectrometer at www.avantes.com!

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Raman Spectroscopy Software

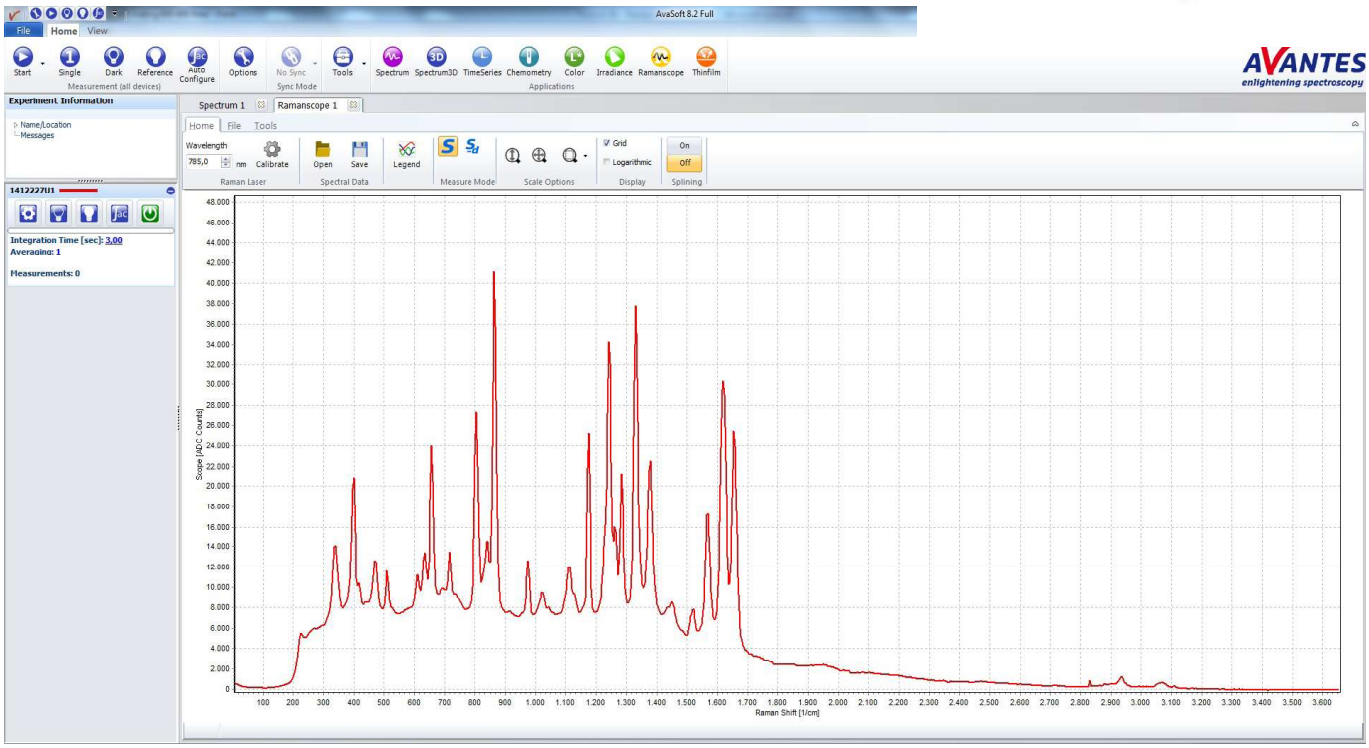
Included with the AvaRaman systems, AvaSoft-Raman enables full control over your Raman spectroscopy system.

In addition to most of the features available in AvaSoft-FULL, AvaSoft-Raman, which is a standalone application, also features:

- Display of the wavelength axis in cm^{-1}
- Auto calibration routines to determine the excitation laser peak (please note that an AvaRaman-Calibration tile is needed, sold separately)
- Integration time progress bar to indicate integration time status for longer spectral acquisitions
- View signal in normalized counts
- Software baseline correction for fluorescence suppression

AvaSoft-Raman also features history channel functions to monitor peak values or concentration versus time.

Process control and export to Excel add on modules are also available for online analyses and control.



Ordering Information

Avasoft-Raman	• Raman application add-on software, to be ordered with AvaSoft-Full
Avasoft-All	• Full version AvaSpec software (includes AvaSoft-COL, -IRRAD, -Raman and, -ThinFilm)

We offer three years limited warranty on all Avantes spectrometers, light sources (excl. bulb) and accessories.

AvaSoft-Thinfilm

AvaSoft-Thinfilm software is a standalone package to control the system and conduct measurements on thin film coatings.

The software calculates a layer thickness from the reflection interference spectrum for optically transparent layers with known optical parameters. Two different methods for thin film calculations are implemented in the AvaSoft-Thinfilm software: the Fast Fourier Transform (FFT) and the best-fit optimization algorithm (match spectrum). The FFT method determines the frequency of the interference pattern; this is mostly used for thick layers. The match spectrum optimization determines the best fit for various thickness calculations. Fitting parameters are adjustable for quality of fit monitoring and to speed up the data processing.

Included in the software is an extensive database of the optical constants "n" and "k" of substrates and coatings. The database includes substrate and coating materials used in important application fields, such as semiconductor and optical coatings.

Process-control and export to Excel add-ons modules are also available for AvaSoft-Thinfilm.

Ordering Information

AvaSoft-ThinFilm	• Thin film add-on software, to be ordered with AvaSoft-Full
AvaSoft-All	• Full version AvaSpec software (includes AvaSoft-COL, -IRRAD, -Raman and, -ThinFilm)

Panorama© Spectroscopy Software

Panorama© software is a sophisticated modular spectroscopy software application for demanding end users that require special analytical functions. The software enables manipulation of all 2D and 3D spectroscopic data with just a few mouse clicks. Manipulation operations can be undone and redone unlimited times with ease. Math operation history contains frequently used mathematical operations that are automatically stored and applied to subsequent data sets.
By adding the Security module all data manipulations are logged in an audit trail. This trail is attached to the manipulated object for full CFR 21 part 11 compliance. In the audit train window, changed control history of an object can be tracked. Software user permission levels may also be assigned.
The Panorama-Quantify module enables major multivariate analysis methods such as PLS-1, PLS-2, SIMPLS, MLR, PCA, PCR for sophisticated NIR spectroscopy analysis.

Some of the mathematical options included in the Panorama-Pro software are:

- ATR correct / multiplicative scatter corrections / standard normal variate correction
- Exponential functions
- Zapping / cutting
- Arithmetic calculation / spectrum arithmetic
- Noise statistics / user defined peak evaluation
- Detrending / stretch x-axis
- Data point manipulation
- Thickness correction / advanced two-point baseline correction
- Unit conversion for X- and Y-axis
- Converting of many known data formats
- Calculate polynomial fits

Available add-ons to Panorama-Pro are:

- A Search module, which includes a powerful library module that allows archiving and searching of spectroscopic data on libraries or on your own hard disk
- Reaction Monitoring module provides users with optimal support analyzing
- characteristic properties and features of spectroscopic data. This facilitates quantification and
- prediction of spectroscopic trends based on 2D and 3D data spectral.

Ordering Information

Panorama-Pro	• Spectroscopic Mathematic Data processing Software package, 2D/3D display
Panorama-Search	• Add-on to Panorama Pro, incl. library module & spectrum search module
Panorama-Quantify	• Add-on to Panorama Pro, incl. Multivariate Data Analysis with PLS, MLR
Panorama-Raman	• Add-on to Panorama Pro, incl. Raman Interpretation and functional group assignment
Panorama-Security	• Add-on to Panorama Pro, full 21 CFR part 11 compliance. Ideal for FDA/GXP regulated environments

Specline Analytical Software

To easily identify and analyze atoms, ions and molecules, Specline© analytical software offers an extensive database. It enables analysis of spectral data, imported directly from AvaSoft spectroscopy software along with other standard formats.

This unique database for atoms and molecules makes line identification fast and easy. To support you in analyzing and comparing the spectra, many evaluation functions are available including:

- Search algorithms for automatic peak finding in the spectra
- Identification of atoms, molecules and their ions using the included extensive database
- Data evaluation and smoothing, integral, scaling, peak value, calibration, arithmetic of spectra (+,-,*,/)
- Comparison of data: several spectra can be overlaid and compared, even when they have different file formats
- Search the periodic table for atoms and ions, wavelength and intensity range
- Data export to ASCII, binary and Excel (CSV) formats, graphical export to BMP, WMF and WPG formats

Ordering Information

AvaLIBS-Specline-A	• Spectroscopy software for peak finding and identifying spectral lines, complete version with database for atoms and ions
AvaLIBS-Specline-AM	• Spectroscopy software for peak finding and identifying spectral lines and molecular bands, complete version with data base for atoms, molecules and ions
AvaLIBS-Specline-AMS	• Spectroscopy software for peak finding and identifying spectral lines and molecular bands, complete version with data base for atoms, molecules, extended by many special molecules (e.g molecular hydrogen and polyatomic molecules)

Interface Packages and Libraries for Windows and Linux

AvaSpec-DLL Windows and Linux interface packages

Available in both Linux and Windows versions, the interface packages allow you to easily write custom software solutions for AvaSpec series spectrometers.

The Windows version, AvaSpec-DLL, is 32-bit software that works seamlessly under 64-bit versions of Windows in a mode called WoW64. The Windows version also includes a 64-bit version (AvaSpecx64.DLL) which can be used when a 64-bit programming environment is used.

The software can be used for the following actions:

- Establishing connections to one or more connected USB spectrometers, activation and deactivation.
- Setting and retrieving device hardware parameters from the spectrometer's EEPROM. This includes wavelength coeffi-cients, gain and offset values and optional parameters that can be added. These include non-linearity calibration, irradiance calibration and others. Data collection parameters, such as integration time, averaging, smoothing and start/stop pixel can be stored to the EEPROM.
- Data acquisitioning and transferring of the spectra to your application
- Communicating with other devices by using TTL and/or analog output signals. The AvaSpec series spectrometers are equipped with a 26-pin digital I/O connector: 3 grounds, 1 digital-in (predefined for external hardware trigger), 3 programmable digital-in, 1 digital-out to control a pulsed light source (such as AvaLight-XE), 1 digital-out to synchronize a pulsed laser (e.g. for LIBS applications) and 10 programmable (TTL level with 6 outputs programmable with pulse width modulation – PWM) digital-out signals. 2 analog-out and 2 analog-in are included as well. The packages include options to control the TTLs of this external I/O connector. The hardware synchronization between the connected spectrometers can be software controlled.
  The packages also include a number of sample programs to give examples on how to write your programs. They are an excellent starting position.

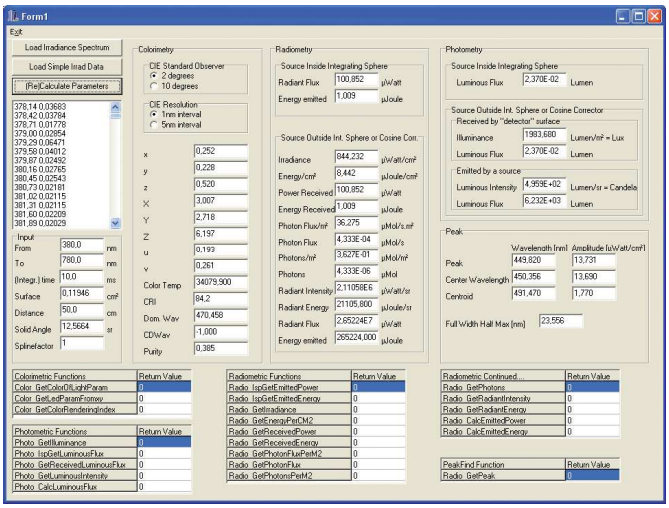
Example source codes in multiple languages are included. Please visit our website for the complete list. You can find them on the interface packages page in our software overview (www.avantes.com/products/software).

FOM-DLL Windows interface package for fiber-optic multiplexer

To facilitate writing custom software solutions for the fiber-optic multiplexer under Windows, the FOM-DLL has been developed. It runs under Windows and contains options to control the position of the multiplexer to one of the 16 positions, travel to the step motor's reference position and to request status information. Example source code in Visual C++, Delphi, C++ Builder and LabView demonstrate how to use the MUX-DLL is included in the package.

Irradiance-DLL

The Irradiance-DLL includes the possibility to calculate colorimetric, radiometric, photometric and peak parameters from an array of irradiance values (µW/nm•cm^2) as well as the CRI. Example programs in C++ and Labview are included as well. It runs under Windows.



Ordering Information

AvaSpec-DLL	• Interface DLL package for AvaSpec-EVO platform for Windows
FOM-DLL	• Interface DLL package for Fiber-optic Multiplexer (FOM-UVIR400-1x16, FOM-UVIR400-4x4 and FOM-UVIR400-2x8) for Windows
IRRAD-DLL	• 32-bit DLL for Irradiance/LED application for Windows
LINUX-LIBRARY	• Linux interface package

We also offer calibrations for your AvaSpec series spectrometer! Contact us for more information or advice.

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