Software

INTRODUCTION

AvaSoft is a software package that can be used to control all Avantes spectrometers and a wide range of accessories. The latest version can be used with Windows XP up to Windows 8. Since the initial version of AvaSoft in 1996, a major upgrade has been released at least once a year, featuring new options and possibilities.

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Our state of the art modular software is available as a scalable platform:

• AvaSoft-Basic: Everything needed for basic measurements and controlling your AvaSpec series spectrometer, including basic data acquisition. Basic allows you to save and display data in the following modes: scope, transmission, absorption and relative irradiance.

• AvaSoft-Full: Includes all possibilities of AvaSoft-Basic and adds many other options, such as history channel functions, auto-calibration procedures and external triggering.

• Application add-on modules for AvaSoft-Full enable special measurement procedures: color measurements, absolute irradiance, chemometrics, process control and real-time export to Excel.

• AvaSoft-All, which includes AvaSoft-Full and all add-on application modules in one package.

• Stand-alone AvaSoft packages for pre-configured systems, such as AvaSoft-Raman for our Raman line of systems and AvaSoft-Thinfilm for measurements with the AvaThinfilm system.

• Dynamic Link Library (DLL) interface packages with support for basic spectrometer control, color measurements and irradiance measurements.

Visit our website at www.avantes.com to download the latest version of the AvaSoft spectroscopy software free of charge. When no spectrometer is connected to the computer, AvaSoft will start in demo-mode, making it ideal to try out our software. In demo-mode, the software will work as AvaSoft-Full, making it possible to test spectrometer functions and display and analyze spectra offline.

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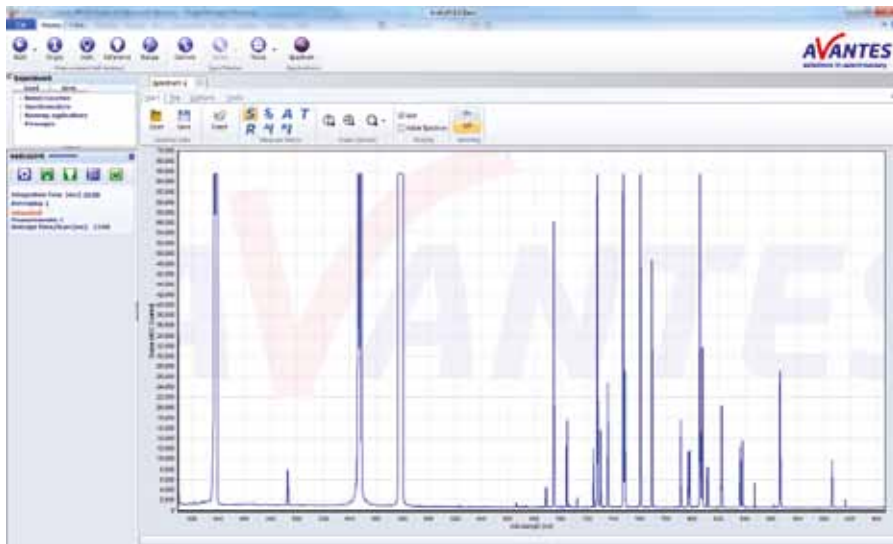
AvaSoft-Basic Software

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, by using the AvaGigE, through the network.

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

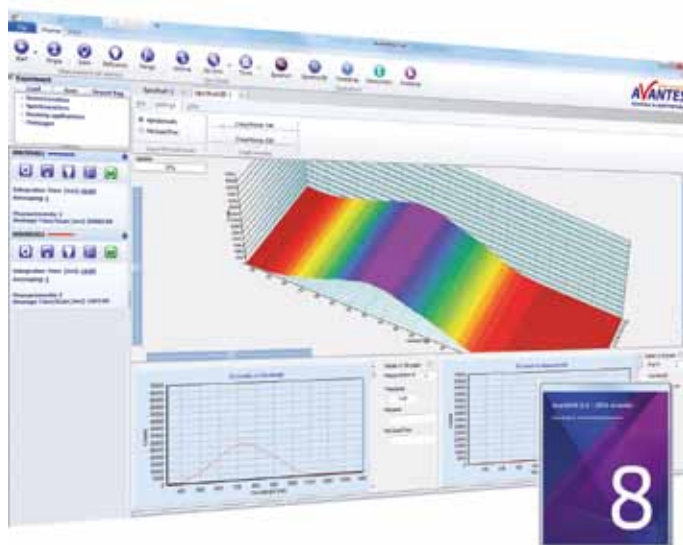|	
AvaSoft-Basic	• Free Basic Spectrometer software for Windows XP through 8

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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
Editable data collection parameters per channel, such as detector integration time, auto-dark correction, signal averaging, spline interpolation and spectral smoothing.	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
Zoom-, (Auto)scale- and panning functions to expand quickly an interesting part of the spectrum (both X- and Y-axis) to the full graph, save graph to a wide variety of file formats.	X	X
Mouse drag controls movement of a data cursor for instantaneous readout of wavelength- and Y-axis magnitude. Peak finder for moving cursor fast to nearest peak.	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.	X	X
Help menu option to find quickly a description about any AvaSoft topic.	X	X
History Channel Application, 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
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
Correct for drift. Master and slave channels with similar range can be used to correct for changes in the light source.		X
Automatic save spectra periodically (save a spectrum every x seconds).		X
Store to RAM for ultrafast Data saving for a limited amount of scans.		X
External Trigger control to acquire spectral data only if a TTL signal is presented with optional integration time delay settings.		X
Convert spectra to J-CAMP format for further data processing e.g. in GRAMS32.		X
Convert spectra to Excel, multiple spectra in one file, multiple channels in worksheets.		X
Merging spectra of multiple channels to one spectrum.		X
Full Width Half Max calculations, online or on saved spectra. Graphically displayed.		X
Integral calculations, online or on saved spectra, graphically displayed.		X
Auto-configure integration time: AvaSoft searches for an optimal integration time.		X
Automatic Save Dark by TTL shutter.		X
Auto-detect saturated pixels in a spectrum, optionally autocorrect inverted saturated pixels, optionally visualize saturated pixels and log saturated wavelength regions in time series.		X
LIBS application.		X

Custom made modifications are possible, please contact us for more details.

Ordering information

AvaSoft-Full	• Full version AvaSpec software for Microsoft Windows XP through 8
AvaSoft-All	• Full version AvaSpec software, including all applications

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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 done by 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
COLOR-DLL	• 32-bit DLL for Color application (see COLOR-DLL)

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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 cm²). Related photometric quantities are luminous flux (lumen) or illuminance (lux or lumen per m²).

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/cm²/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.
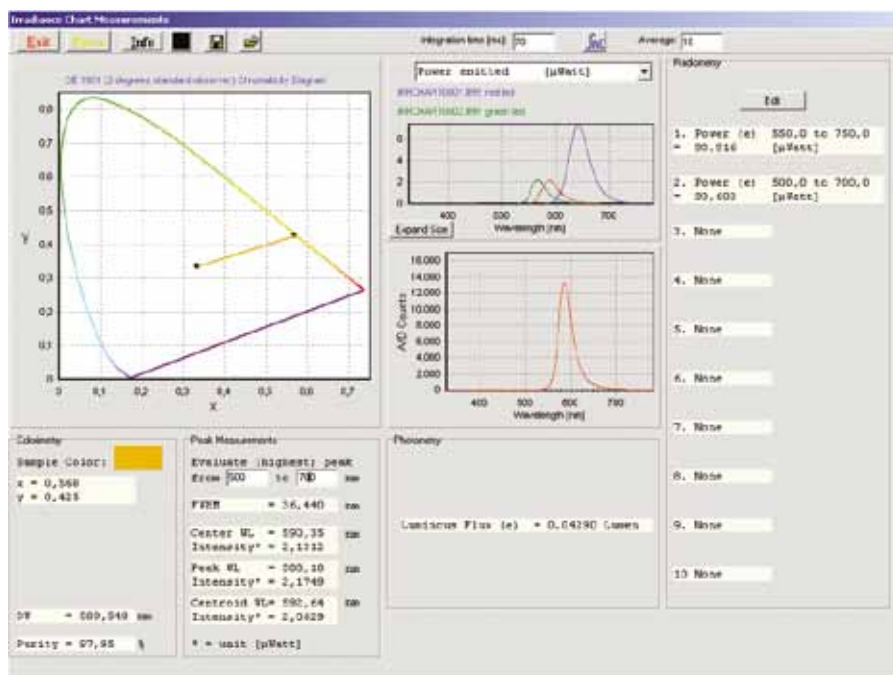
The color of light parameters can be expressed by the chromaticity coordinates x, y and z. These chromaticity coordinates are obtained by taking the ratios of the tristimulus values (X, Y and Z) to their sum. The tristimulus values X, Y and Z and the spectral irradiance are computed in a wavelength range 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 very high light level and 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/cm², µJoule/cm², 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•m², µMol/m², 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
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:
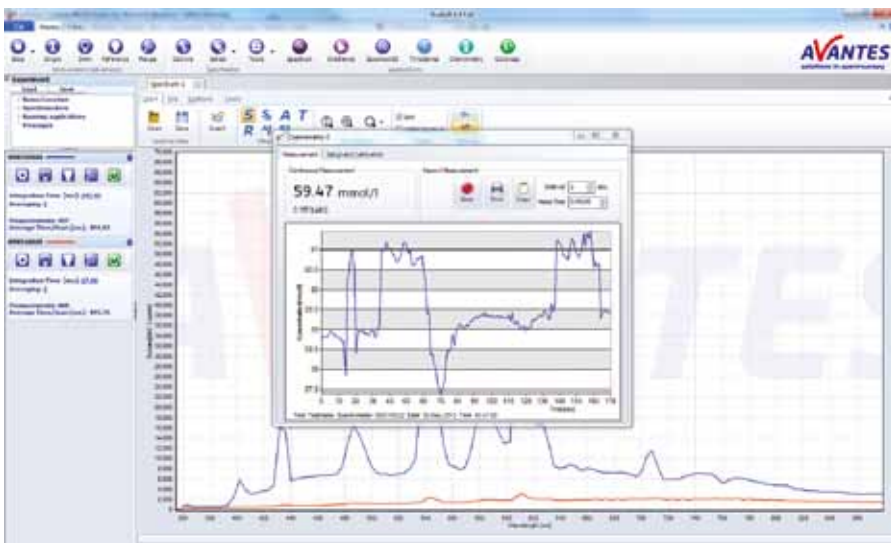
$$A = e * c * l$$

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 concentration are needed. It is important to always measure the absorbance at the same wavelength and using more samples of different concentrations provides 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

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Exporting in Real-time to Excel with AvaSoft

AvaSoft-Full supports post-process conversion of a saved spectrum to Excel, but to directly export to Excel in real-time, AvaSoft-XLS is required. This add on module enables the output of history channel data and/or complete spectra to Microsoft Excel in real-time. Due to the OLE (Object Link Embedding)-Automation, it enables remote control over Excel, including opening sheets and copying data into cells.
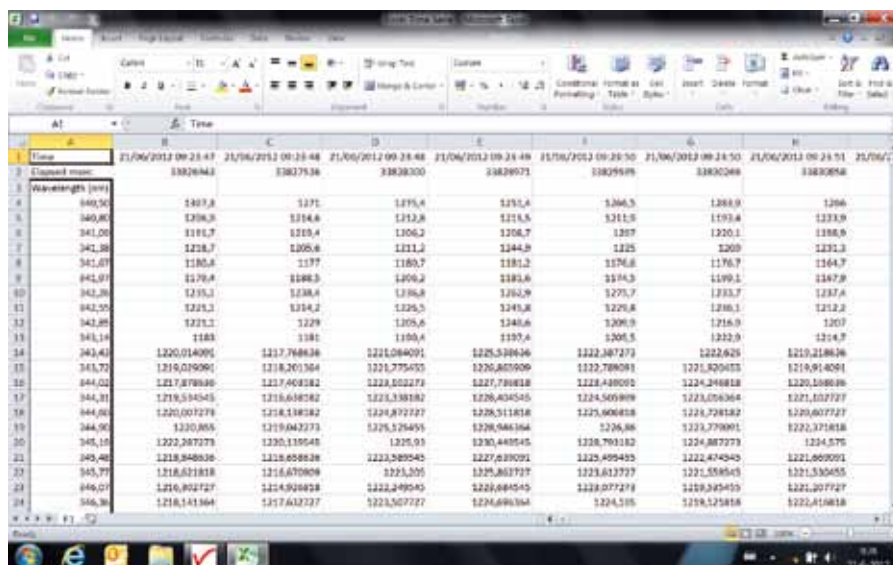
Two modes are available:
- Exporting data online to Excel workbooks; for each spectra or function output a new column or row is created. After a pre-defined number of scans, the export is stopped and the file is saved.
- Exporting data to a fixed position in a predefined Excel worksheet. This works in an overwrite mode; each output is copied to the same position as the previous one. The user can now address those data cells from other applications, such as Labview or Matlab, enabling on-line data processing and analyses.

The output functions to be exported can be history channel functions, color parameters (with AvaSoft-COL), irradiance parameters (in combination with AvaSoft-IRRAD) and chemometric parameters (with AvaSoft-CHEM).

Ordering information

AvaSoft-XLS	• Export online to Excel add-on software, to be ordered with AvaSoft-Full

AvaSoft - Process Control

The AvaSoft-PROC software module enables the user to define minimum and maximum threshold values for all time series functions. These can be user-defined functions, integrals or peak values (intensity, wavelength) as defined in the history application. In combination with AvaSoft-CHEM, AvaSoft-COL and/or AvaSoft-IRRAD, the process control functions can be facilitate chemometric, color and/or irradiance parameter measurements.

AvaSpec series spectrometers feature eight on-board TTL-output signals that will respond when the user defined thresholds for the time series functions are exceeded. In an industrial environment, these TTLs can be connected directly to PLCs. Two of the History Channel Functions are also available to be converted to analog outputs of 0-5V.

Fiber-optic Multiplexer Control Software

In order to facilitate customized software development for the Avantes Fiber-optic Multiplexer, Avantes has developed a DLL package. It enables full control over the multiplexer, allowing one to set all parameters:
- Find reference position (mandatory after power-up and after the stop command)
- Go to channel, move the disk to a specified optical channel from 1 to 16
- Go to step, the disk can move 360 degrees from the reference position.

With this feature the position of the disk can be set by the number of steps from the reference position. The 360 degrees are divided in 3200 motor steps.
- Immediately stop the motor,
- Get status, which will return the status, power and position of the motor

The motor speed parameters are given as parameters with the options to go to channel and go to step. Find reference position is done with a fixed speed.

Ordering information

FOM-DLL	• Interface DLL package for Fiber-optic Multiplexer (FOM-UVIR400-1x16, FOM-UVIR400-2x8 and FOM-UVIR400-4x4) for Windows XP through 8.

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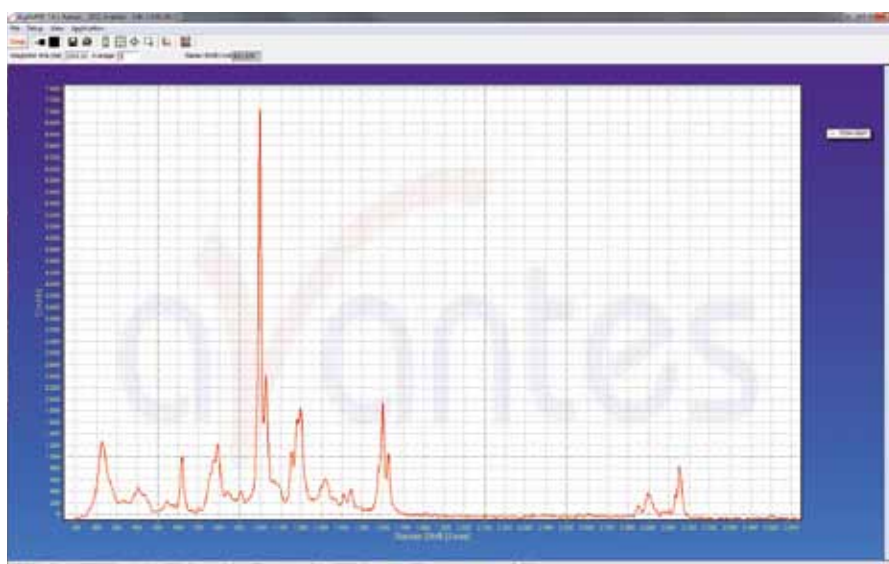solutions in spectroscopy

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 stand-alone Software for the AvaRaman system

Three years
limited warranty on all
Avantes spectrometers,
light sources and accessories

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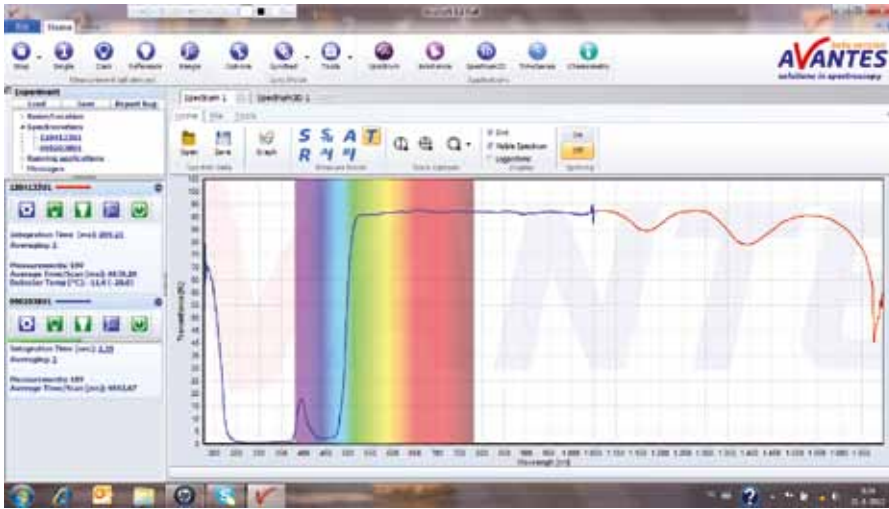
Thinfilm Metrology

Included with the AvaThinfilm system, 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

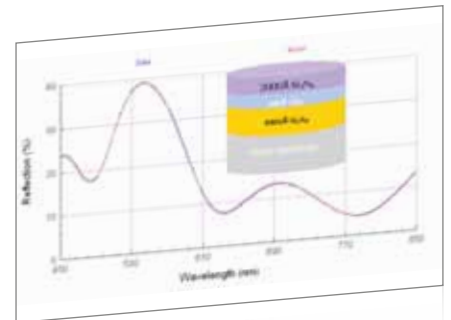|	
AvaSoft-Thinfilm	• Thin film stand-alone Software for the AvaThinfilm system

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Thinfilm Multi-Layer Measurement Software

To measure film thickness and optical constants (n & k) up to 5 layers, TFProbe© multilayer thin film measurement software is the ideal software. It can be used for real-time or in-line thickness and refractive index monitoring and it comes with a comprehensive optical constants database and library.

To facilitate nk table, dispersion or effective media approximation (EMA) for each individual film or substrate, an advanced optical constants editor is included. TFProbe© supports AvaSpec spectrometer systems single or multiple channel systems in the UV/VIS and NIR 200-1700 nm.

The software runs simulations on reflection, transmission and optical constants. It can perform simulations or measurement at non-normal incident angles. Various data output options and 2D & 3D graphic presentations are available in the graphical user interface.

TFProbe supports USB or RS-232 communication with a host controller. Auto log functions for spectrum, measured resolution and fitting graphs are included. For easy presentation, it also enables saving fitting graphs. Backside reflection correction for measuring films on transparent substrates is also supported, as well as transmission thin film measurements.

Ordering information

TFProbe®	• Thinfilm multilayer measurement software

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.
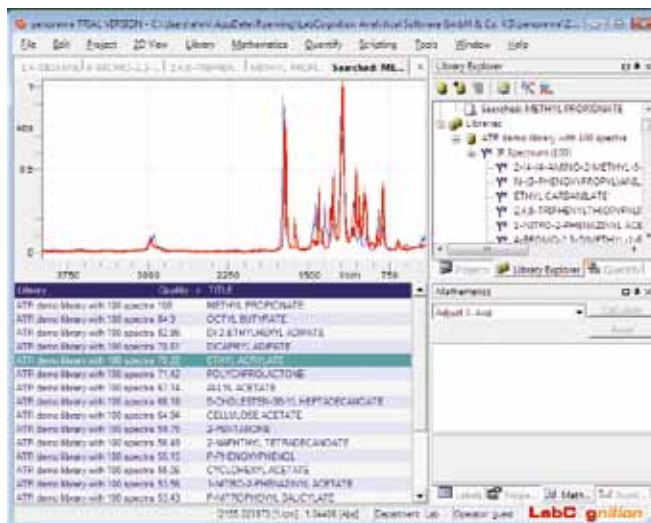
The Panorama-Quantify module enables major multivariate analysis methods such as PLS-1, PLS-2, SIMPLS, MLR, PCA, PCR for sophisticated NIR spectroscopy analysis.

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:
- 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

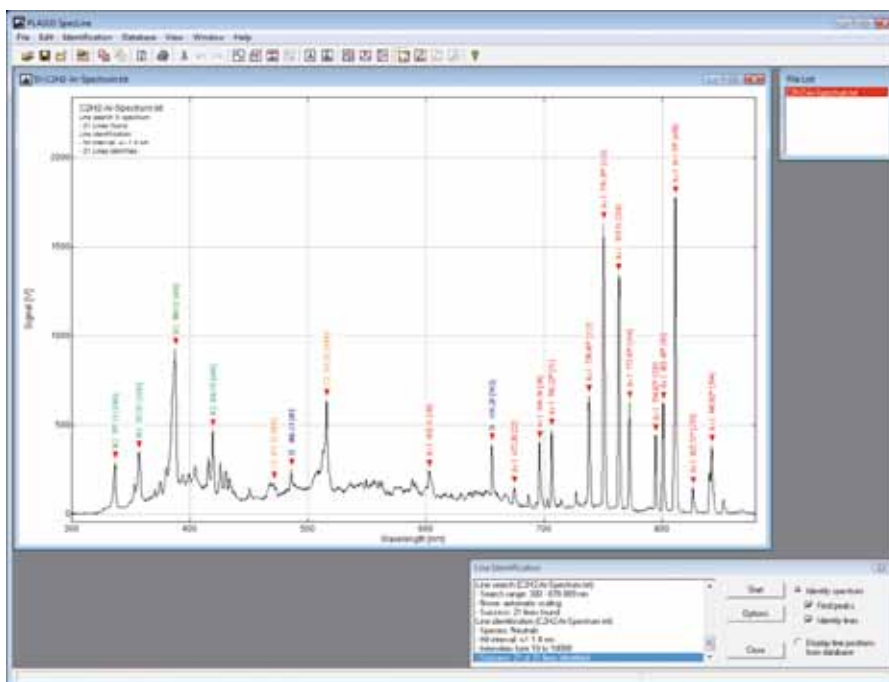|	
Panorama-Pro	• Spectroscopic Mathematic Data processing Software package, 2D/3D display
Panorama-Search	• Add-on to Panorama Pro, incl. library module & spectrum search module
Panorama-Quantify	• Add-on to Panorama Pro, incl. Multivariate Data Analysis with PLS, MLR
Panorama-Raman	• Add-on to Panorama 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

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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

AS-5216-DLL Windows and Linux interface packages

Available in both Linux and Windows (XP through 8) versions, the interface packages allow you to easily write custom software solutions for AvaSpec series spectrometers.

The Windows version, AS-5216-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 (as5216x64.dll) which can be used when a 64-bit programming environment is used.

The software can be used for the following actions:

- Establish connection 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 optio-nal 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 acquisition and transferring the spectra to your application
- Communicate 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 (pre-defined 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.

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 XP through 8 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.
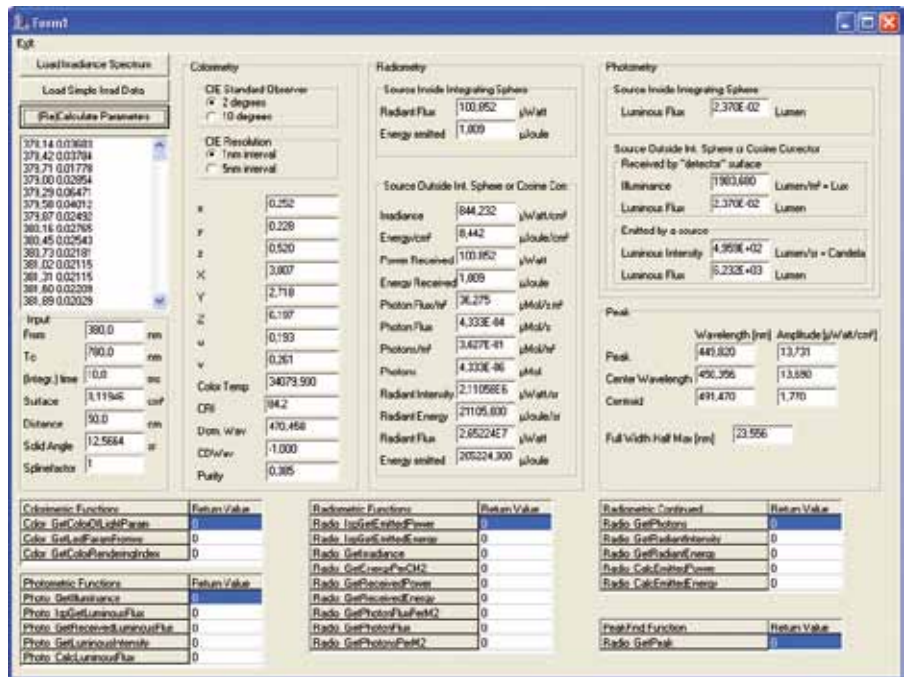
Color-DLL

The Color-DLL is used to calculate the color parameters L*, a* and b* as well as their hue angle (h*) and Chroma (C*) and X, Y, Z values from an array of reflection values, representing the reflectance values between 380 and 780 nm with a 5 nm interval. It runs under Windows XP through 8.

Besides the reflectance array, the function requires another input variable: the illuminant. A choice can be made between 7 different illuminants: A, B, C, D50, D55, D65 and D75.

An example program in Delphi is provided with the software package.

Irradiance-DLL

The Irradiance-DLL includes the possibility to calculate colorimetric, radiometric, photometric and peak parameters from an array of irradiance values ($\mu W/nm \cdot cm^2$) as well as the CRI. Example programs in C++ and Labview are included as well. It runs under Windows XP through 8.

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Ordering information

We can also calibrate
your AvaSpec series
spectrometer

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