



# UV-visible spectroscopy solutions

for chemical analysis



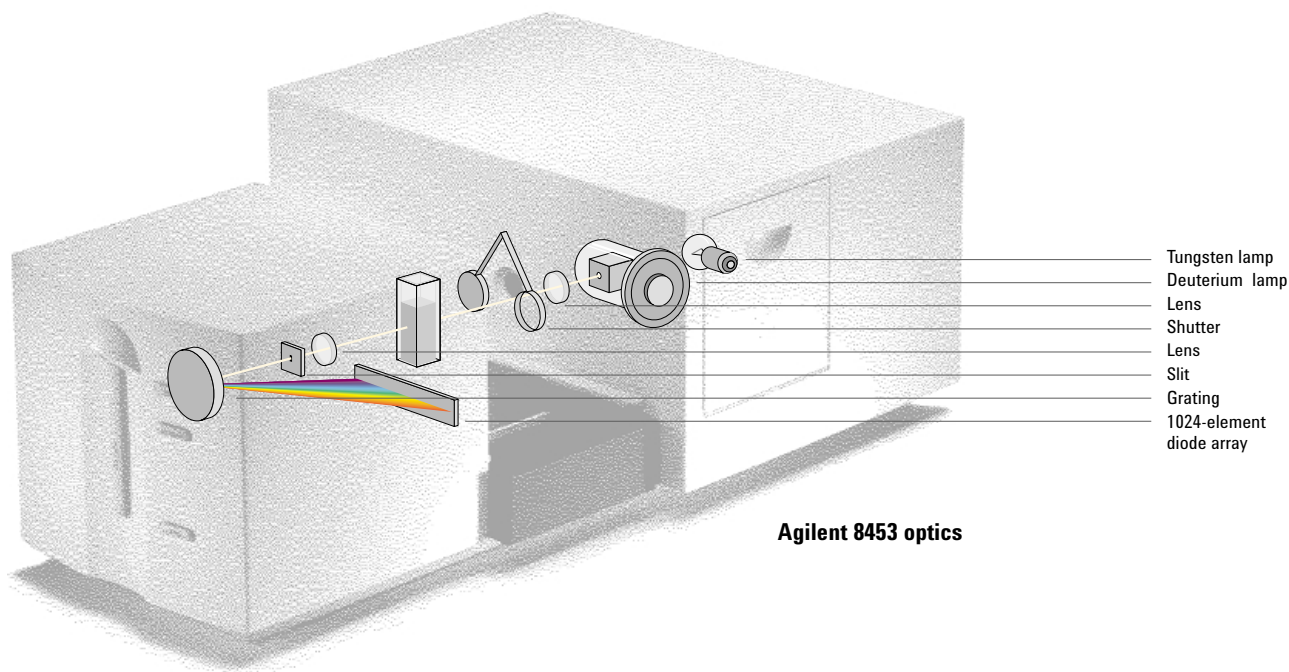
**Agilent 8453 UV-visible spectrophotometer**

Our measure is your success.



# Agilent's UV-visible systems

UV-visible spectroscopy solutions that satisfy the diverse needs of analysts in routine QA/QC, research, and method development laboratories.



## The Agilent 8453 UV-visible spectrophotometer offers the latest in diode-array technology:

- Small footprint to save bench space
- Prealigned deuterium and tungsten lamp light sources for trouble-free maintenance
- Built-in buttons to measure sample, standard, and blank for convenient measurements even when wearing gloves
- Thermally stable ceramic spectrograph for a wide operating temperature range
- Communication through GPIB or LAN for dedicated or networked PC control
- Firmware upgrade from PC for easy participation in future developments
- Built-in GPIO interface for control of accessories
- Compliance with all requirements of the European Pharmacopoeia (EP) and United States Pharmacopoeia (USP)

## The diode-array advantages

Backed by over two decades of experience in the development and manufacture of diode-array spectrophotometers, the Agilent 8453 gives you clear advantages.

- Fast spectral scanning for complete spectral information useful for:
  - proof of identity and pureness of the sample
  - additional information for "out of specification test result" investigation in a regulated environment
  - re-evaluation with different method
  - multi-wavelength applications such as user-defined equations
  - multicomponent analysis of mixtures
- Open sample area for convenient sample handling
- High throughput optics guarantees excellent signal-to-noise for high sensitivity
- Virtually absolute wavelength resettability allows selection of optimum wavelength and use of electronic standards
- Exceptional ruggedness and reliability

## Optical performance

The Agilent 8453 offers the advantages of a diode array plus significant improvements in optical performance:

- 190 – 1100 nm wavelength range
- 1 nm slit width
- < 0.03 % stray light

## Good Laboratory Practice

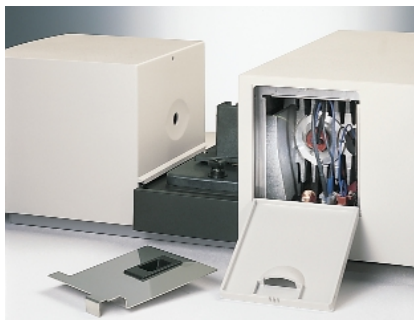
The Agilent 8453 supports compliance with GLP regulations:

- Serial and firmware revision number held in firmware
- Own clock for time and date stamps of the spectra
- Extensive self-test procedures that check the electronics and key optical characteristics to ensure consistent performance between validation
- Built-in electronic logbooks, which contain the results of self-tests, notes in instrument maintenance, events and errors

**Sipper operation is easy with built-in measurement buttons**



**Side door for easy lamp change**



**Open sample area means large accessories are easy to use – here the Peltier cell holder**



## Specifications – Agilent 8453 UV-Visible spectrophotometer

### Optical performance

Wavelength range	190–1100 nm	
Slit width	1 nm	
EP resolution test	> 1.6	toluene in hexane, ratio abs. at 269 nm/266 nm
Stray light	< 0.03 %	at 340 nm (NaNO <sub>2</sub> , ASTM)
	< 0.05 %	at 220 nm (NaI, ASTM)
	< 1 %	at 198 nm (KCl, EP)
Wavelength accuracy	< ± 0.5 nm	0.5-second scan (NIST 2034)
	< ± 0.2 nm	at 486.0 and 656.1 nm
Wavelength reproducibility	< ± 0.02 nm	ten consecutive scans (NIST 2034)
Photometric accuracy	< ± 0.005 A	at 440.0, 465.0, 546.1, 590.0, and 635.0 nm, 1 A (NIST 930e)
	< ± 0.01 A	at 235, 257, 313, 350, 430 nm, (potassium dichromate, EP method)
Photometric noise	< 0.0002 A	sixty 0.5 second scans at 0 A, 500 nm, rms
Photometric stability	< 0.001 A/h	at 0 A, 340 nm, after 1-hour warm up, measured over 1 hour, every 5 seconds, constant ambient temp.
Baseline flatness	< 0.001 A	0.5-second blank, 0.5-second scan, rms
Typical scan time	1.5 second	full range
Shortest scan time	0.1 second	full range
Time until next scan	0.1 second	full range, 0.1-second scan, up to 150 consecutive scans

### Physical dimensions

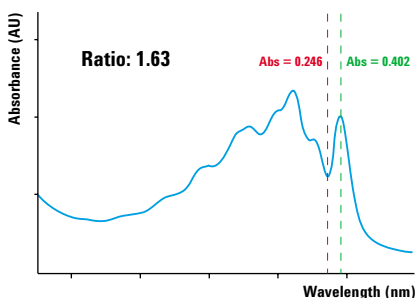
Height x width x depth	185 x 344 x 560 mm (7.3 x 13.5 x 22.0 inches)
Weight	16.5 kg (36.3 lb)

### Power requirements

Line voltage	90–264 V AC
Line frequency	47–63 Hz
Power consumption	70 VA typical

### Environmental conditions

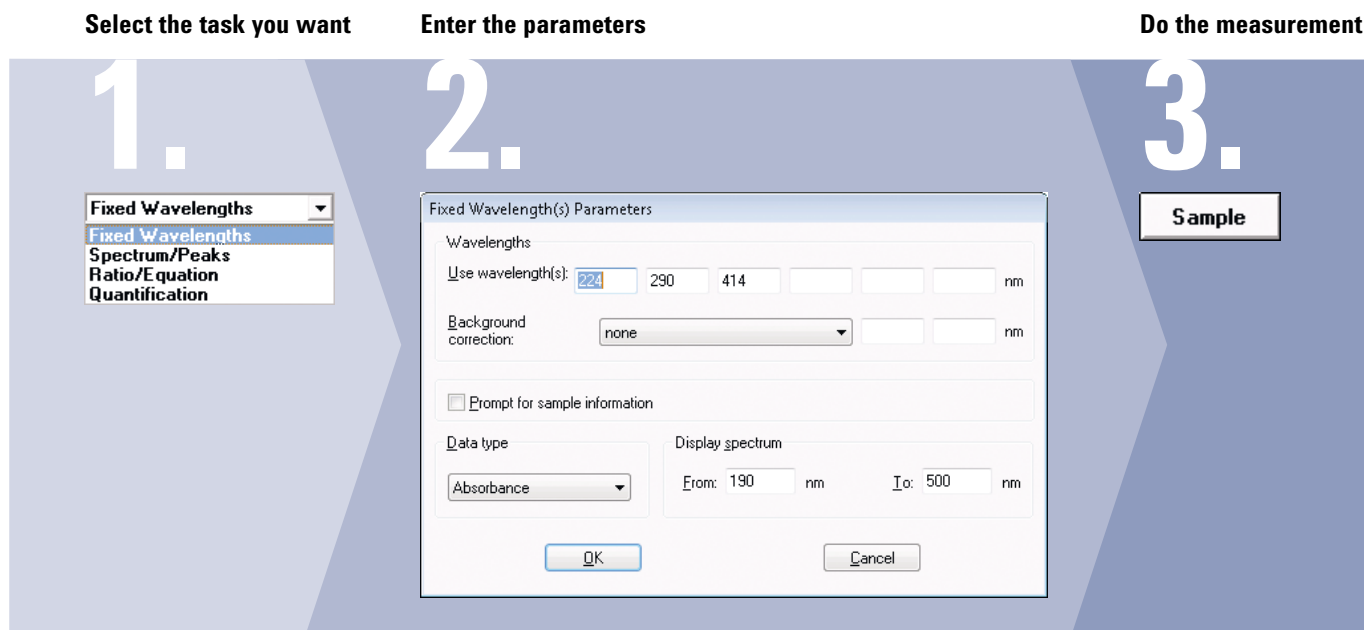
Operating temperature	0–50 °C (32–122 °F)
Non-operating temperature	-40–70 °C (-4–158 °F)
Humidity	< 95 %, at 25–40 °C (77–104 °F)



**Spectrum of a 0.02 % v/v solution of toluene in hexane**

# Solutions for general purpose tasks

Easy to learn and easy to use for increased productivity



## Easy to use

The Agilent 8453 UV-visible spectroscopy system may well be the easiest UV-visible system you will ever use.

## Three steps are all you need to get results:

1. Select the task you want
2. Enter the parameters and
3. Do the measurement

## Graphical user interface

Usability tests performed with actual users in their own labs initiated a completely new approach to user interface design. The Agilent 8453 UV-visible spectroscopy system uses symbolic graphics to:

- make the system intuitive, easy to learn, and easy to use,
- provide confirmation of current status at a glance,
- provide visual confirmation of actions, and
- provide fast access to frequently performed activities.

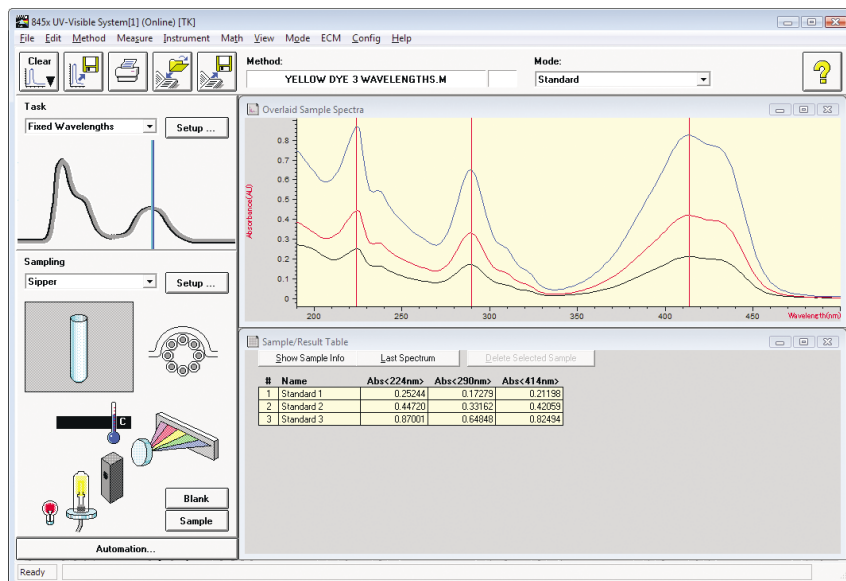
## Automation

A single dialog box makes setup for automated analyses easy and quick. You can use automation to guide an operator through a series of manual measurements, or combine it with sampling accessories to provide semi- or fully automated analysis. The automation function controls

- the Agilent sipper system
- the Agilent XY autosampler
- the Agilent multicell transport

The optional control samples allow you to run an automatic system suitability test before quantitative analyses.

**Your results are displayed automatically**



**You may  
print a report**



### Compatibility

The Agilent UV-visible ChemStation uses the Microsoft® Windows environment so you can run other programs, such as word processors and spreadsheets, at the same time, and transfer data using copy-and-paste.

### Clear and simple reports

Generating reports could not be easier. Simply click the printer icon in the toolbar and a standard report is printed. When possible this standard report is printed on a single sheet of paper. The report format depends upon the task in use but all reports include essential GLP information such as method and data file name, date, time, operator, overlay of sample spectra and result table.

### Productivity

The Agilent 8453 system is a highly productive UV-visible spectroscopy system. Its combination of ease of learning, ease of use, fast spectral acquisition, fast data evaluation, report generation, and automation lets you get results fast – even if you only use the system occasionally.

Add diagnostic tools such as performance verification, system documentation, and the extreme reliability of the system and you will spend the minimum time with administration or maintenance and repair.

# Solutions for research and development

The power and flexibility to develop the optimum method and solve the toughest problems

## Powerful data analysis

The advanced software provides unprecedented interactive and programmable data analysis capability:

- 21 mathematical functions for processing spectra that you can combine in any sequence
- Flexible use of any number of single or multiple wavelengths, or average a range of values
- Evaluation using user-entered equations, single-component or multi-component analysis
- Up to four different types of data analysis performed on one set of data in parallel
- Comparison of data evaluation results using different analysis parameters
- Use confirmation analysis with quantitative methods to check the identity and purity of samples, and to detect if measurements are being made outside the linear range of the analysis

## Enterprise content management

Agilent OpenLAB enterprise content manager (ECM) facilitates creation of a knowledge base of UV-visible ChemStation methods and data across larger entities based on web services.

## Method development tools

Four special utilities are provided to assist the user in developing the best parameters for quantitative analysis:

- Evaluate Standards for linearity – performs a single component calibration at each wavelength over a user-specified wavelength. It determines the correlation coefficient and uncertainty at each wavelength.
- Compare Calibrations – puts the results from two independent calibrations side by side on the screen for comparison.
- Optimize Wavelength for selectivity and accuracy – quantifies a user-selected sample at all wavelengths and plots the quantification results against wavelength.
- Test Method for precision – calculates the average and standard deviation of multiple analyses of an identical sample.

## Multicomponent analysis

Multicomponent UV-visible analysis can provide a real alternative to time-consuming separations. Fast electronic scanning, spectral curve fitting of standards to unknowns, excellent wavelength reproducibility, and maximum-likelihood statistics make sure that results are superior to those obtained with conventional mechanical-scanning spectrophotometers. Calibration is simple and fast using pure standards or mixtures of standards. Statistics for the fit of the standards to the sample spectra give you confidence in your results.

## Customization

Virtually every aspect of the system can be customized through macro programming.

A series of predefined reports are available in the software. However, to fulfill specific needs, the user can define their own customized reports based on the predefined reports or user defined template.

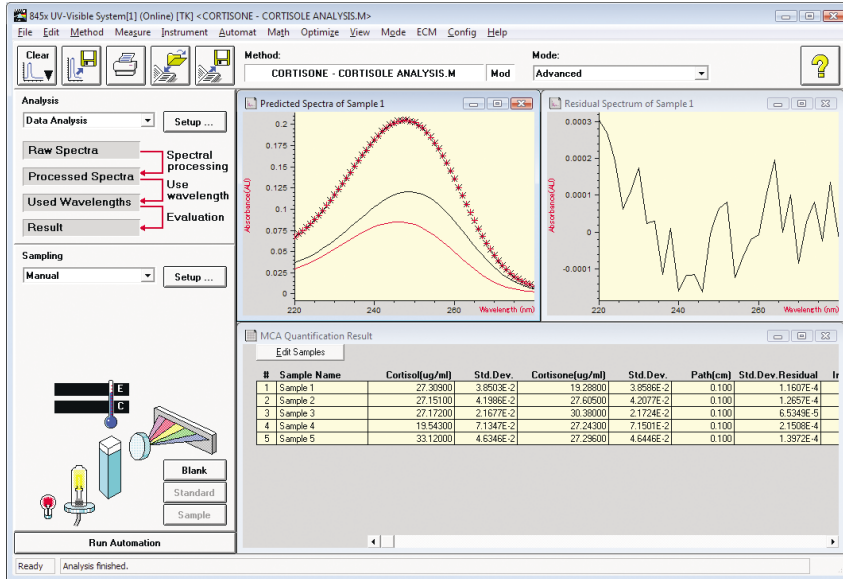
## Electronic records and signatures

The advanced mode can be combined with the security pack to support 21 CFR part 11.

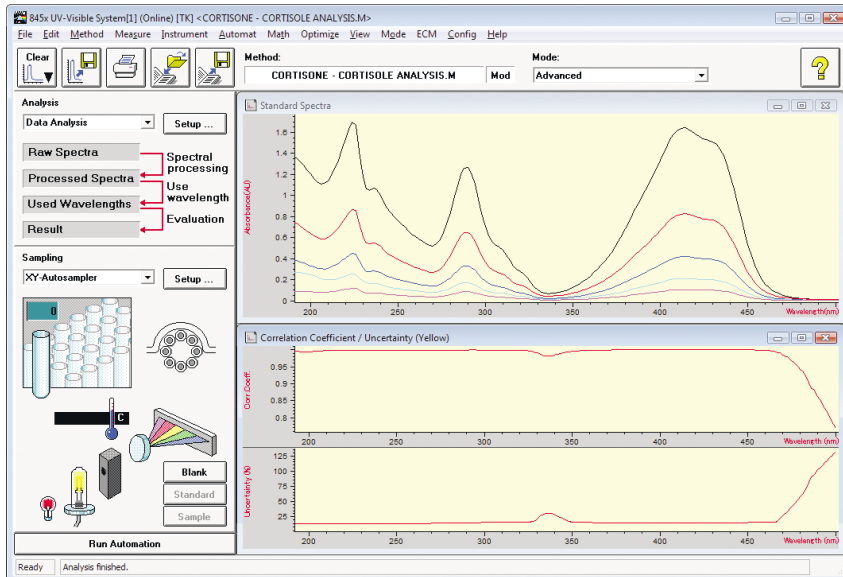
## Advanced automation

With the advanced automation capability you can perform fully automatically complex measurement, data evaluation, and report generation sequences using single or multiple methods for different types of samples. It can also be used to guide an operator through a complex sequence of manual measurement operations. Complex methods or automation processes that you develop on the advanced system can be transferred to and executed on the general purpose system.





Multi-component analysis with diagnostic tools that show the quality of the results



The Optimize Standards function shows the wavelengths that give the best calibration

# Solutions for biochemical analysis

Key biochemical applications in a single, easy-to-use system

## Ease of use

The biochemical analysis software builds on the Agilent 8453 UV-visible spectroscopy system. It provides the additional tasks that the biochemist needs and uses the same easy-to-use graphical user interface. Preprogrammed methods for protein and nucleic acid analysis help you get up and running fast.

## Proteins and nucleic acids

Standard methods are provided for the qualitative and quantitative analysis of nucleic acids and proteins:

- 260/280 nm ratios for nucleic acid purity
- Warburg-Christian calculation of concentration of nucleic acid or protein in mixtures
- Biuret, Lowry, Modified Lowry, Bradford, Bicinchoninic acid, and Trinitrobenzene sulfonate protein quantification methods

## Microsampling

A frequent problem for the biochemist is the small sample volume available for analysis. With the Agilent 8453 spectrophotometer you can use microcells requiring as little as 15  $\mu\text{L}$  of sample for qualitative and precise quantitative analysis.

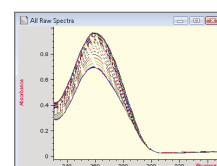
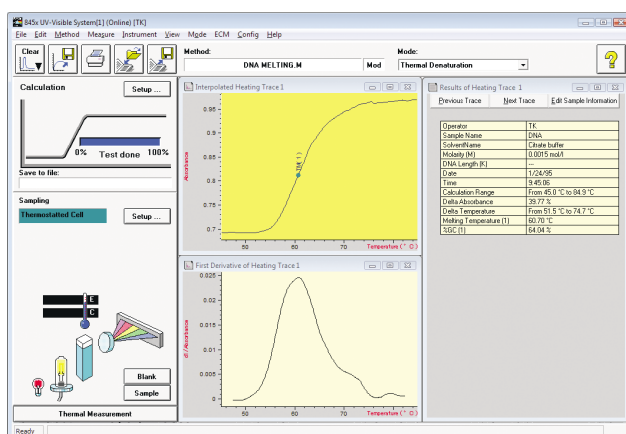
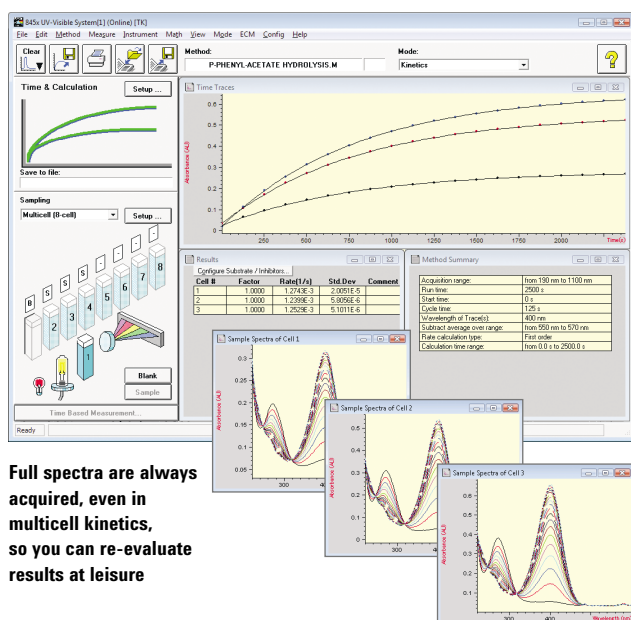
## Multicell kinetics

For productivity with enzyme kinetic measurements the optional eight-position multicell transport can be used. You can freely configure which positions contain samples and blanks and you can select to subtract the rate of one cell from the others.

You can evaluate kinetic rates at a single wavelength or subtract a reference wavelength. Rate calculation methods include initial rate, zero order, first order, and delta absorbance. For a single cell you can also display and calculate rates at up to six individual wavelengths.

## Thermal denaturation

With the Peltier temperature controller you can perform thermal denaturation experiments such as DNA melt testing and protein unfolding. You can select your own multi-step heating and cooling program and, while the run is in progress, you are kept up to date with display of actual and target temperature, and the thermal denaturation trace at your specified wavelength. Results can be evaluated using average or derivative methods to calculate transition temperatures and standard or user-entered equations to calculate %GC.





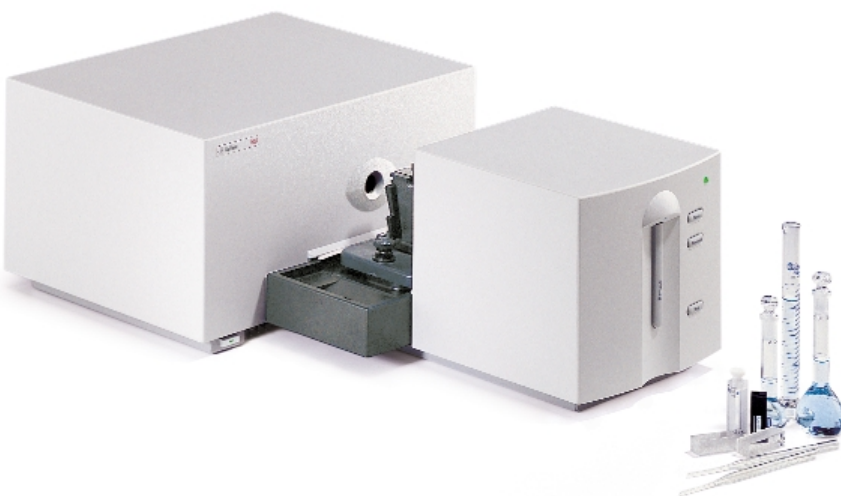
# Solutions for chemical analysis

## At a glance

### Selection of software modules

Adapt the 8453 spectroscopy system to your needs by adding different software modules to the general-purpose software. One or more modules can be added to at the same time to support different applications.

- General-purpose software, including verification and diagnostics, for standard applications
- Advanced software for more capabilities in data evaluation, method development and automation
- Biochemical analysis software, including kinetics and thermal denaturation
- Dissolution testing software for single and multibath dissolution testing
- OpenLAB enterprise content manager for handling and sharing methods and data across the web
- Security pack software to support compliance with 21 CFR Part 11

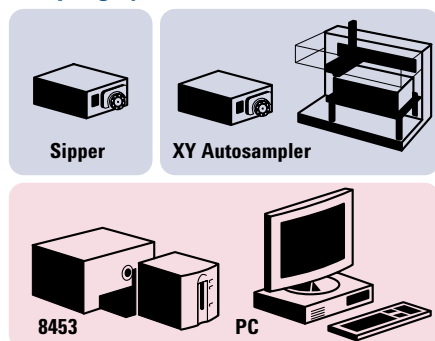


### Increasing productivity

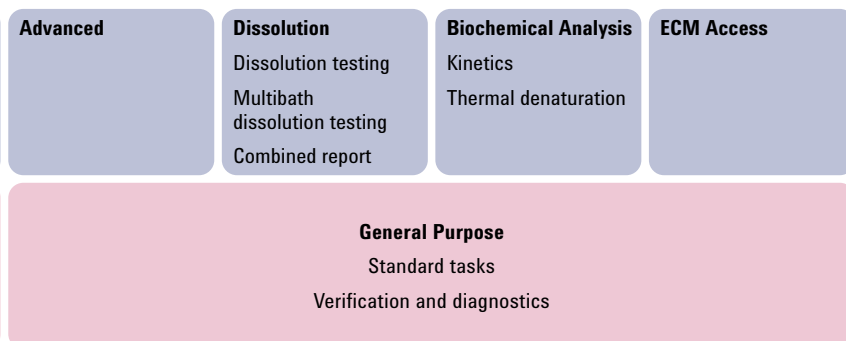
The UV-visible ChemStation software allows control of different sampling systems to increase throughput. A common feature of the general purpose, advanced and dissolution software is that the predefined methods work with different sampling systems – without changing parameters.

Therefore, a method developed for manual sampling can easily be used with a sipper or autosampler, depending on the actual demand.

### Sampling systems



### Add-on software modules



**8453 spectroscopy system with general purpose UV-visible ChemStation software**

# Accessories

## Cell holders

Agilent Technologies offers a range of single cell holders, providing you with the ability to analyze a wide variety of samples. Unless otherwise stated the holders accept cells with path lengths up to 10 mm.

**Standard cell holder:** Ensures quick and precise cell positioning for each measurement. Supplied standard with all Agilent spectrophotometers.

**Thermostatable cell holder:** When connected to a circulating-water bath, ensures constant sample temperature for temperature-sensitive analyses. An optional accessory provides water-driven stirring with magnetic stirring bar for 10-mm cells.

**Long-path length cell holder:** Holds rectangular and cylindrical cells with path lengths up to 100 mm.

## Multicell transport

The multicell transport provides a significant increase in productivity when you need to do simple, repetitive measurements on a small number of samples, or when you want to follow changes in several samples (for example, enzyme kinetic studies). The multicell transport features:

- Full control through software
- Eight cell positions (for example, one blank and seven samples)
- Random access to all positions
- Water-thermostatable using external water bath, 5–90 °C temperature range and  $\pm 0.3$  degrees temperature difference between any two cells at 37 °C
- Less than 1 second to move between adjacent cells
- $\pm 0.1$  mm position repeatability
- Optional water-driven magnetic stirring module

## Sipper system

For repetitive measurement of liquid samples a sipper system improves productivity and eliminates errors caused by manual cell handling. The Agilent sipper system comprises a peristaltic pump and a quartz flow cell:

- Full control through software
- Variable pump, delay, and return time
- Flow cell with 10 mm path length, 3 mm diameter, and 80  $\mu$ L volume
- Constant-speed peristaltic pump with Tygon pump tubing
- Minimum sample volume of approximately 1 mL
- Typical sampling time of 20 seconds

## Peltier thermostatted cell holder

Use the Peltier controller and cell holder when you require precise or variable temperature control:

- Built-in magnetic stirrer
- Heat exchanger for sample pre-heating when using sipper system
- Fully controlled through software and GPIB interface
- External sensor for precise sample temperature (optional)
- Typical range of 10–100 °C (–10 to +80 degrees relative to ambient) without need for water cooling
- Accuracy of  $\pm 0.2$  degrees at 20–40 °C,  $\pm 0.3$  degrees at 0–20 °C and 40–60 °C,  $\pm 0.5$  degrees at 60–100 °C
- Reproducibility of  $\pm 0.1$  degrees at 0–60 °C,  $\pm 0.2$  degrees at > 60 °C
- Stiring speed of 40–1000 rpm



Cell holders



Multicell transport



Peltier thermostatted cell holder

### Autosampler

Combine an XY autosampler with a sipper system and you can measure large numbers of samples fully automatically in unattended mode. The XY autosampler features:

- Full control through software
- Capacity of up to 240 samples
- Wash station for optional rinsing between samples
- 10–13-mm diameter sample tubes with maximum height of 100 mm
- Typical transit time (adjacent samples) of approximately 6 seconds (including raising and lowering probe)
- Typical time per sample of 25 seconds (including sipper operation time)
- Minimum sample volume of 2 mL.

### Cells

Agilent Technologies offers a range of quartz cells for standard and flow-through operation including:

- Regular rectangular cells with path lengths of 1, 2, and 10 mm
- Cylindrical cell with 100-mm path length
- Stopped cells to protect your sample from air and ideal for use with the external sensor of the Peltier temperature controller

- Flow cells of different designs with screw fittings and path lengths of 0.1, 0.2, 0.5, 1, 2, 5 and 10 mm
- Semi-micro and micro cells with path lengths of 2 and 10 mm for minimum sample volumes of 15 and 60  $\mu\text{L}$  respectively

### Third-party accessories

A wide range of accessories, designed for or compatible with Agilent spectrophotometers are available:

- **Custom Sensors & Technology** fiber optics coupler, fibers and sampling devices
- **DBS** Peltier devices for single cell and multicell transport
- **Gilson** autosamplers that are controlled directly from the Agilent UV-visible ChemStation software
- **Labsphere** diffuse reflectance accessories
- **Applied Photophysics** stopped-flow accessory for fast kinetics
- **Hi-Tech** stopped-flow accessory for fast kinetics
- **Distek** dissolution baths

### Agilent support

Agilent has support centers in 85 countries supplying a wide range of support products that can be tailored to your needs.

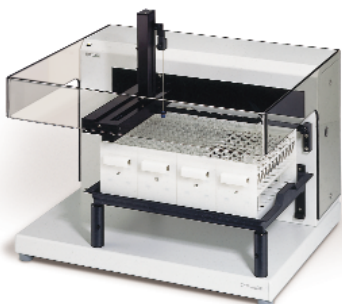
For example, the Agilent network of Analytical Response Centers provides direct access to support professionals who help you resolve operational difficulties, and offer assistance and advice on running Agilent chemical analysis software. They also help you to solve analytical problems, to keep your equipment up to date, and to maintain GLP standards.

All of us at Agilent are here to help you meet your chemical analysis goals, not just now but also long into the future.

Ask your Agilent representative for more details or see the Agilent Columns and Supplies Catalog. [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)



Sipper system



Autosampler



Cells

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