

# UV-VIS-NIR

Varian  
Cary 100/300/400/500  
Spectrophotometers



**VARIAN**

High performance, flexibility and ease-of-use are just some of the words that are associated with the Cary range of UV-Vis-NIR spectrophotometers. If you want to invest your money in an instrument that meets all of your needs today, as well as future requirements that you may not have even thought of yet, feel confident that a Cary is that instrument. The Cary range is extensive, with instruments to suit most budgets and applications.

**Cary 50\*** This innovative instrument represents the budget end of the Cary line.

**Cary 100** A low to mid-priced instrument, the Cary 100 is suitable for routine and research laboratory work.

**Cary 300** represents a cost effective, research-grade instrument for laboratories doing analyses of biological or highly absorbing samples.

**Cary 400** This research-grade instrument represents the top-of-the-line UV-Vis spectrophotometer. (Optional deep UV version also available.)

**Cary 500** extends the capabilities of the Cary 400 up to 3300 nm. If you want an instrument that will measure any sample then the Cary 500 is the best choice.

**Cary Eclipse Fluorescence\*** spectrophotometer compliments the Cary UV-Vis range by offering the first truly new mid-range fluorescence instrument in more than 10 years.

\* Refer to separate brochure for details





“ For investigators who on occasion must push a spectrophotometer to the very limits of its performance capability to obtain the information they need, and yet have to have an instrument which is adaptable to many different applications ”



**Howard Cary**  
The Cary Philosophy 1947

Applied Physics Corporation (known later as Cary instruments) was founded in January, 1946, by Howard Cary, William W. Miller, George W. Downs, and Russell E. Vaniman. Howard Cary made important contributions to analytical instrumentation in the mid 1930s and early 1940s. He founded Cary instruments just after leaving his position as vice-president in charge of development with Beckman Instruments, where he had been for 11 years.

In April 1947 Applied Physics Corporation delivered the first commercial recording UV-Vis spectrophotometer, a Cary 11, to Mellon Institute in Pittsburgh, USA.



At that time Applied Physics Corp had only 12 employees. In 1954 the Cary family grew to include the Cary 14.

By that time the Cary name had become synonymous with high performance and reliability.

In 1966 Cary merged into Varian and in 1972 the Cary operation moved from Monrovia to Varian's main facilities in Palo Alto, California. In 1982 the Cary operation was moved to the Varian Techtron facility in Melbourne, Australia. During the mid to late 1980s the Melbourne based factory was very busy researching and developing a whole new generation of Cary instruments.

Using the best optical and performance characteristics of the past Cary instruments and the latest technology in electronics and software the Cary 1, 3, 4 and 5 were created. On the 50th anniversary of the first Cary a whole new series of Cary instruments, the Cary 50, Cary 100, Cary 300, Cary 400 and Cary 500 were born. In 1999, the Cary range was extended to include the Cary Eclipse fluorescence spectrophotometer, offering the excellent specifications and modern software that has become the Cary standard.

Fifty years of experience, starting with the Cary 11, serial number 2, circa 1947.



Cary 11 UV-Vis	Cary 14 UV-Vis-NIR	Cary 15 UV-Vis	Cary 16 UV-Vis	Cary 17 UV-Vis-NIR	Cary 118 UV-Vis
1947	1954	1961	1964	1970	1972

**You're not just buying a Cary,  
you're buying a relationship**

But what if you need help with your Cary instrument? Thanks to the wonders of our electronic age there are many options and sources of information for you to access, including:

- Free access to other Cary users around the world via an Internet mailing list. If you have access to email then you can ask any question you like, for example, 'Has anyone measured this type of sample before?' Your email will be automatically sent to all other Cary users who subscribe to the list. Experts at Varian also belong to this list, so you are assured of getting the answer you need. Varian also uses the mailing list to notify users of new products, new application notes and other useful information.
- You can call your Varian office and get over-the-phone support or request an on-site service call.

- If you purchase the Tele-diagnostics option then Varian can test your instrument remotely to try and find the fault. This saves you money and gives you access to Varian experts—no matter where they are.

- Varian's website contains many application notes. You can use these to find out how to measure a particular sample or how to optimize the use of your Cary. A visit to the website will also give you information on the latest software and hardware releases.

- If you need parts or supplies for your Cary then our website has an extensive list. If you aren't connected to the Internet then you can receive the parts and supplies catalog on CD ROM.



Varian on the Net  
<http://www.varianinc.com>  
 Varian maintains a comprehensive website. To go directly to the UV-Vis-NIR section, visit <http://www.varianinc.com/osi/uv>



Cary 17D UV-Vis-NIR	Cary 219 UV-Vis	Cary 2400 UV-Vis-NIR	Cary 1 & 3 UV-Vis	Cary 4 UV-Vis Cary 5 UV-Vis-NIR	Cary 50 Series Cary 100-500 Series	Cary Eclipse Series
1975	1977	1987	1989	1990	1997	1999

# Cary 100 & 300

The Cary 300 has a premonochromator, extending its range past 5.0 Abs

A phase locked wavelength drive prevents peak shifts and peak suppression at high scan speeds

The sealed optics prevent exposure to corrosive environments

Variable slits provide optimum control over spectral resolution

Quartz overcoating protects the optics from the environment and allows cleaning without damage to their reflective surface

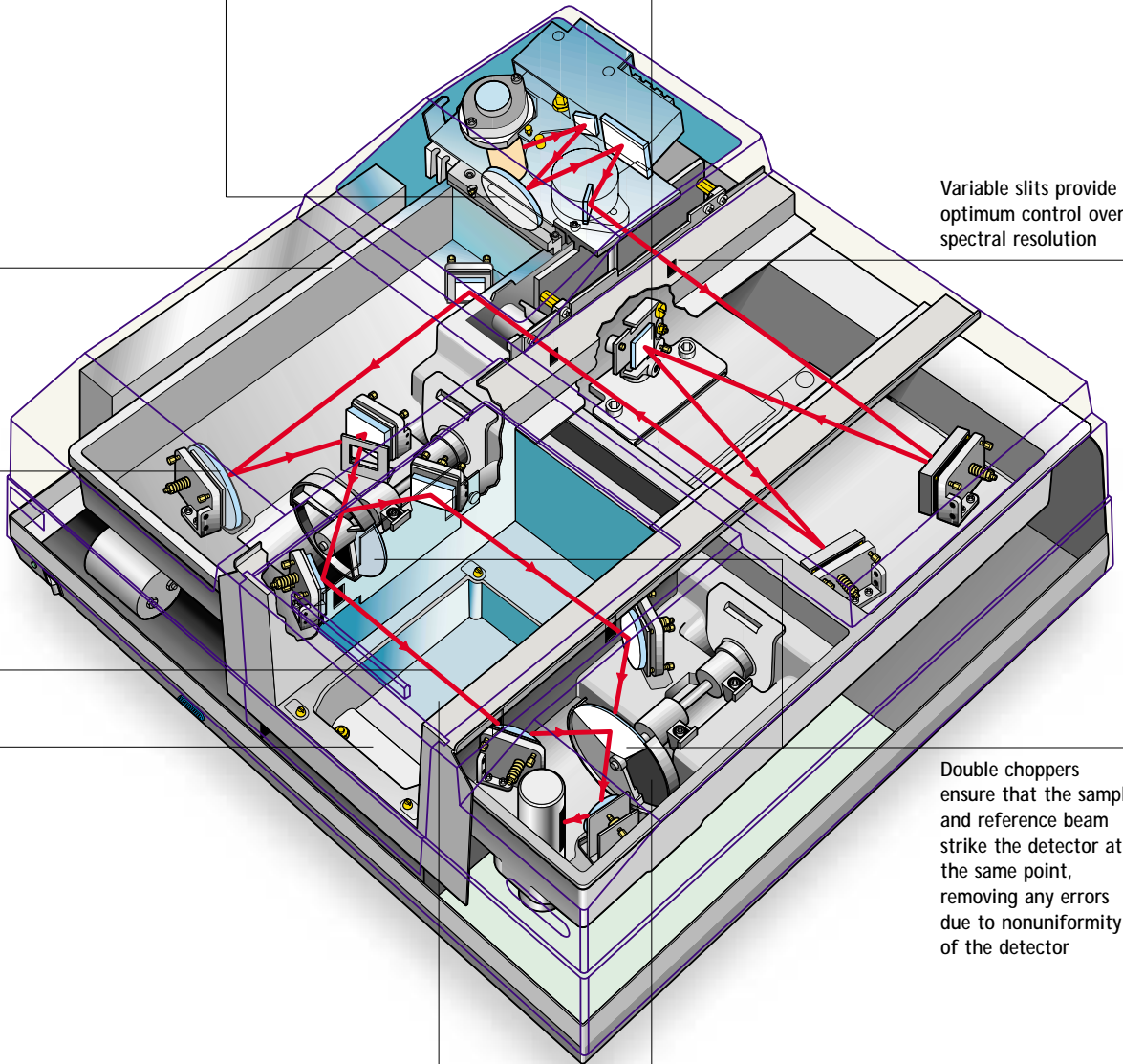
Although the Cary 100 and 300 are double beam design you can elect to operate them in single, double or dual-single beam modes

The Accessory Controller offers centralized accessory control. This makes it easier to service the instrument as there is only one set of accessory electronics. You can also communicate with non-Varian accessories via the Accessory Controller

Double choppers ensure that the sample and reference beam strike the detector at the same point, removing any errors due to nonuniformity of the detector

The large sample compartment gives you more flexibility in sample size

The patented optical system eliminates residual chopper wobble, preventing any image movement on the detector



# Cary 400 & 500

The lamp turret has provision for a third lamp of your choice. The turret can be completely removed if you wish to install another light source

The slits can be fixed in the NIR as well as the UV-Vis

The out-of-plane design of the double Littrow monochromator reduces photometric noise and stray light, and produces excellent resolution

A 'floating' solid aluminium casting isolates the optics from external disturbances

The Cary 400/500 wavelength drive can change wavelengths at 16 000 nm/min in the UV-Vis and at 64 000 nm/min in the NIR

The monochromator and sample compartments have separate nitrogen purging plumbing

Schwarzchild coupling optics ensure a high level of light throughput. This produces more accurate measurements at low transmission levels

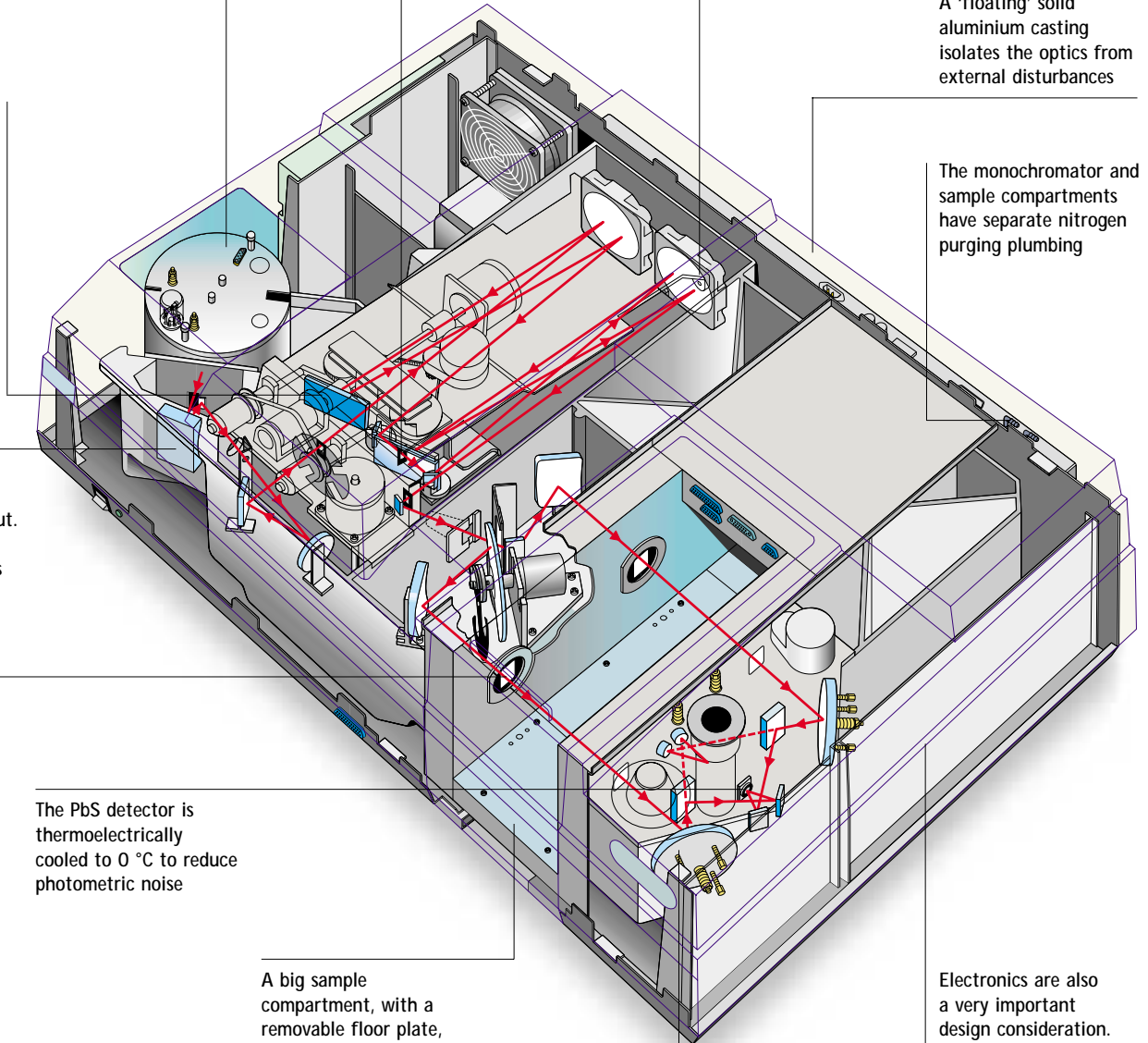
The sample compartment windows are tilted to prevent back-reflection and thus incorrect results

The PbS detector is thermoelectrically cooled to 0 °C to reduce photometric noise

A big sample compartment, with a removable floor plate, gives you maximum flexibility when mounting samples

The optics are silica overcoated, so that they can be cleaned without damage to the reflective surface

Electronics are also a very important design consideration. The extended dynamic range of the Cary instruments is a result of this. The Cary 400 and 500 instruments for example, are specified to measure up to 7 Abs with reference beam attenuation

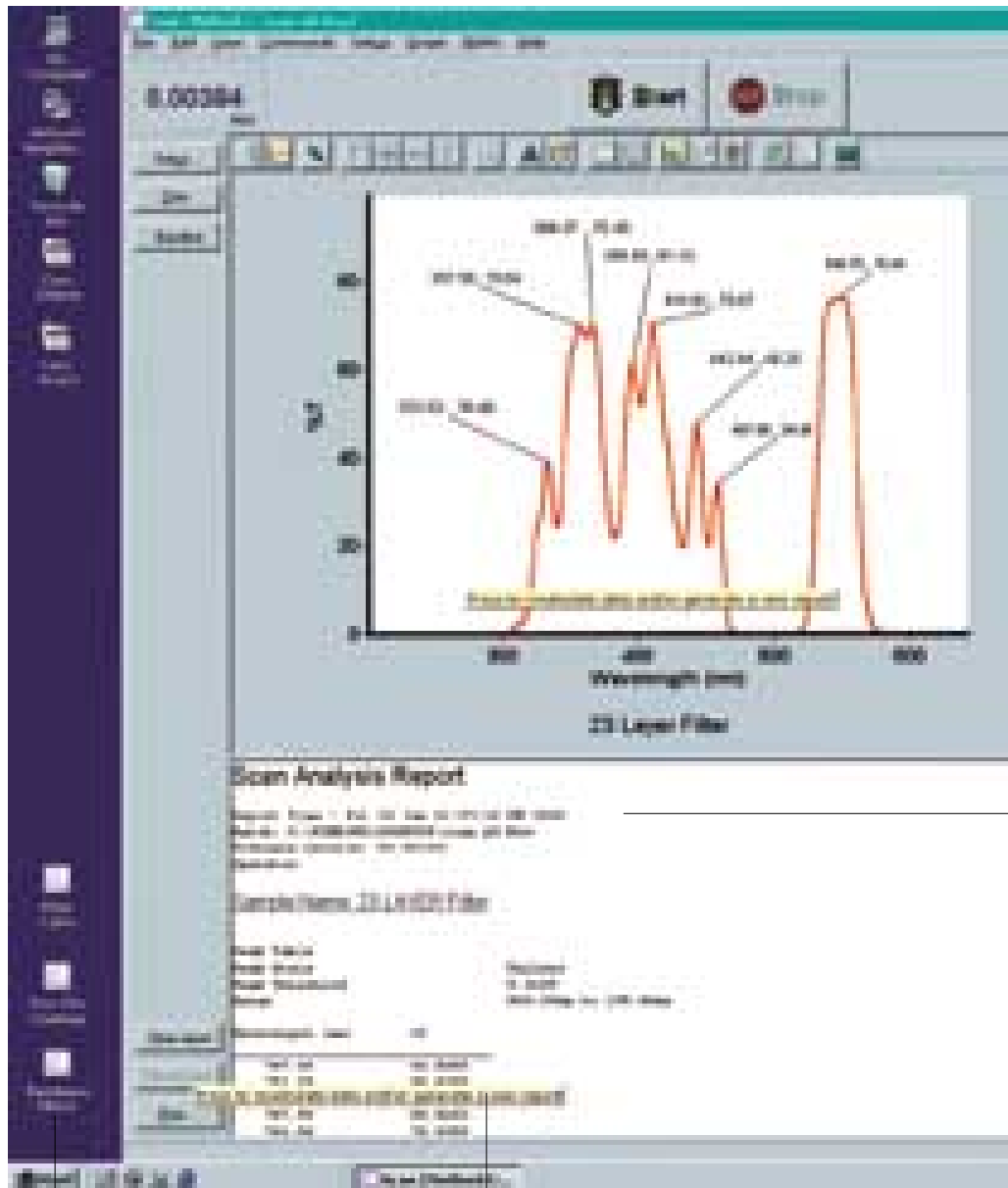


## Cary Win UV software—just what you asked for

The Cary Win UV software has a modular design which means that you are only buying the functionality that you need. It also means that if your use of the spectrophotometer changes in the future it is simple to upgrade to meet your new requirements. Of course, the Cary Win UV software takes advantage of Windows® 32-bit functionality such as multitasking and file association, for example you can drag and drop a data file onto a Cary application and it will be immediately loaded.

Several Cary packages are available for the most common UV-Vis-NIR applications. These packages bundle together appropriate software modules with an instrument to suit each application.

The three general use packages are Scan, Conc and Bio. Packages are also available for Tablet Dissolution, Color Analysis, Ultra-Violet Protection and the list is continuously growing. Of course, you can then add any of the Cary accessories that you need.



### Auto load icons

Just click on the appropriate icon and the application and the correct method will load, ready for you to measure samples.

### Hint text

Having trouble figuring out what a particular button or control does? Just hold the mouse pointer over the object until the hint text pops up with an explanation.



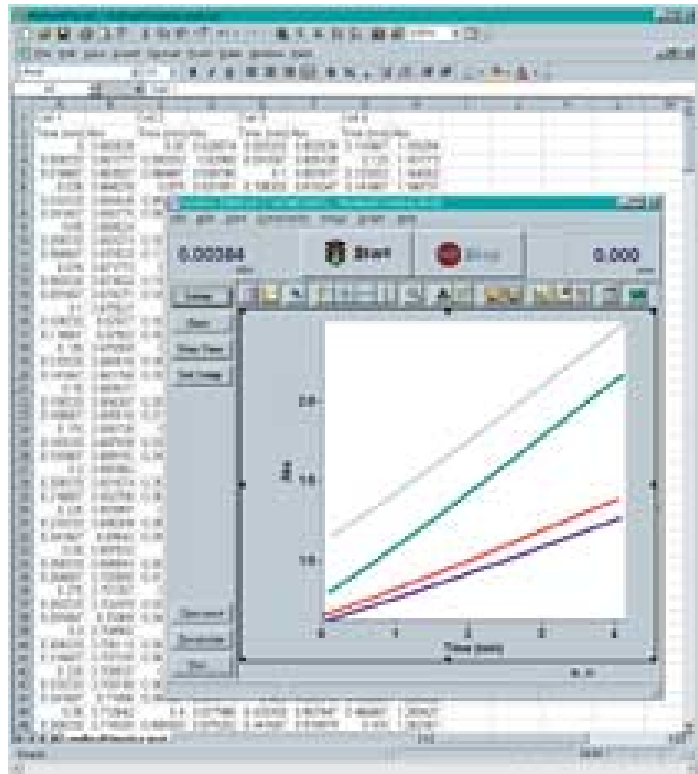


**Single window operation**

All controls can be accessed from this window, making operation quick and easy.

**Graphics tool bar**

The Cary software features a toolbar to give you quick access to the most common graphics operations such as zooming, adding text and changing the axes ranges.



The Auto Convert function allows you to automatically convert your data files for use in another program. You can also elect to store your data files in formats that can be directly imported into a spreadsheet.

**Batch files**

You can store all method and report parameters, calculations and graphical displays, and the actual data in one file. This saves time as you simply recall one file instead of several.

Method	Calibration No.	Wavelength (nm)	Wavelength (nm)	Wavelength (nm)	Wavelength (nm)
1	1	210.0	210.0	210.0	210.0
2	2	210.0	210.0	210.0	210.0
3	3	210.0	210.0	210.0	210.0
4	4	210.0	210.0	210.0	210.0
5	5	210.0	210.0	210.0	210.0
6	6	210.0	210.0	210.0	210.0
7	7	210.0	210.0	210.0	210.0
8	8	210.0	210.0	210.0	210.0
9	9	210.0	210.0	210.0	210.0
10	10	210.0	210.0	210.0	210.0

The Cary WinUV comes with the inbuilt Applications Development Language (ADL), a computer language which can be used to automate your laboratory's measurements. You can download a range of customized ADL programs from Varian's website or develop your own.

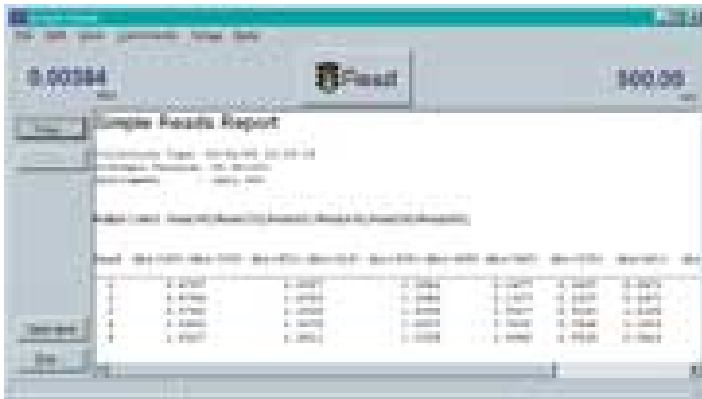


The Cary WinUV software includes step-by-step videos of hardware installation and use.

## Scanning—any way you want

The Cary Scan package is available for each of the Cary 100, 300, 400 and 500 instruments. It consists of the following software modules:

- Scanning software with Maths module
- Simple Reads module
- Advanced Reads module
- Instrument Validation module
- GLP module for file security
- Applications Development Language (ADL)



## Making simple things simpler

The Simple Reads application is an example of how the modular concept of the Cary software makes day-to-day measurements easy. Modular software gives you the advantage of only having to deal with controls that are appropriate for what you want to do.

For example, to measure a sample at a single wavelength, simply do the following:

### Step 1

Double click on the Simple Reads icon on the desktop.

### Step 2

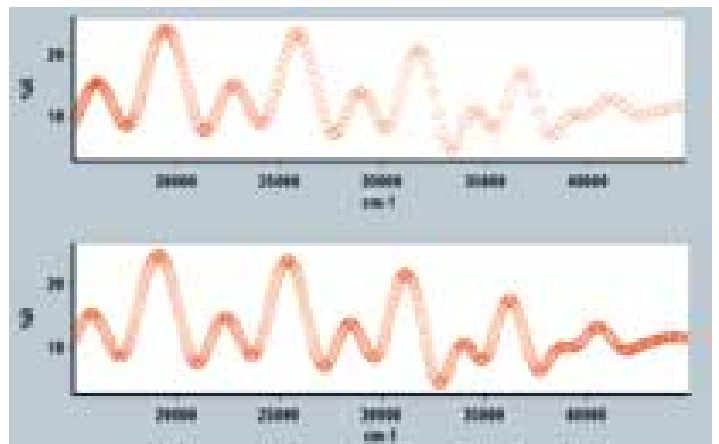
Click on the Setup button, set the wavelength.

### Step 3

Press the Zero button.

### Step 4

Press the Read button.





### What makes Cary wavelength scanning so good?

Most spectrophotometers can scan, it's a basic function. However, in addition to the basic requirements of wavelength accuracy and a wide dynamic range, the Cary instruments offer a host of special features:

#### Independent NIR control

The Cary 500 enables you to independently control the parameters in the UV-Vis and NIR regions so you don't have to compromise when scanning across the whole range. For example, if you want more detail in the NIR without sacrificing measurement time, just set a narrow SBW and small data interval in the NIR and a wider SBW and larger data interval (and thus a faster scan speed) in the UV-Vis.

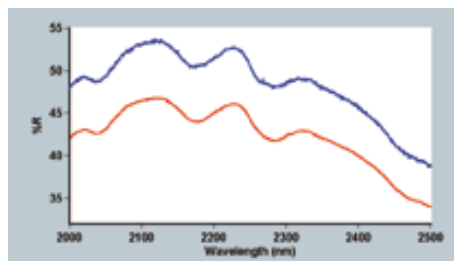
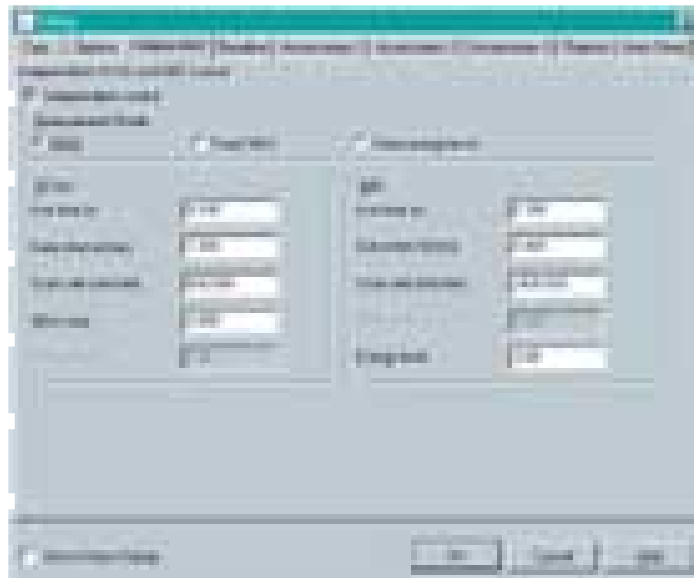
#### Multiple ordinate modes

Instead of collecting your data in Absorbance or %Transmission and then converting it to the mode that you want, you can save time by collecting the data directly in the ordinate mode you need. Choose from: Abs, %T, %R, Absorptivity, Log Abs, Kubelka Munk F(R), Log Kubelka Munk Log F(R), Log (1/R)

#### Flexible abscissa modes

Select from several abscissa modes including: wavelength, interval scanning (collecting data every 5 nm) and linear wavenumber scanning

With the Cary Scan system you can scan directly in wavenumber ( $\text{cm}^{-1}$ ) (lower scan). The instrument is driven so that the wavenumber interval is constant, rather than collecting the data in wavelength and then converting it to wavenumber, with the resulting uneven spread of data points (upper scan).



Signal-to-noise mode is a unique method of collecting data available only on the Cary instruments. It allows you to control the level of precision you want across the whole scan.

This saves time because the system will scan quickly in areas of high energy throughput and slow down in areas where the energy is less. Shown here is the same sample measured with (bottom) and without (top) signal-to-noise mode.

The Cary 500 instrument allows you to independently control the parameters in the UV-Vis and NIR regions, including the spectral bandwidth, data interval and averaging time. This gives you complete control over the quality of the data and the speed of its acquisition.



**Why is a Cary so good for Life Science measurements?**

The Cary Bio package is available for each of the Cary 100, 300 and 400 instruments. It consists of the following software modules:

- Simple Reads module
- Advanced Reads module
- Scanning module
- Kinetics module
- Enzyme Kinetics module
- Scanning Kinetics module
- RNA/DNA Estimation module
- Thermal denaturation and renaturation module
- Instrument Validate module
- GLP module program for file security
- Applications Development Language (ADL)

These packages are ideal for the multi-user, multi-discipline Life Science laboratories.

**Stirring is smooth and easy to control**

The stirring mechanism of the Cary peltier thermostatted cell holders relies on a rotating magnetic field, generated by an alternating electric current. This ensures reliable operation with no fluctuations in stirring speed and allows complete control over the speed of the stirring. Up to 12 cells can be stirred at a constant rate for extended periods of time.

**Excellent temperature control**

The temperature control of the peltier thermostatted cell holders (either the multicell or single cell versions) is extremely stable over time, with a typical variation being  $\pm 0.05$  °C. The cell to cell variation is also minimal with a maximum difference of 0.2 °C at 37 °C. The temperature inside the cuvette can be monitored with the Temperature Probe accessory.



The Temperature Probe accessory allows the measurement of the temperature inside the cuvette.

The Cary's focussed beam and high energy throughput means that volumes as small as 2.5  $\mu$ L can be measured accurately. A range of ultra-microcells and semi-microcells are available from Varian.

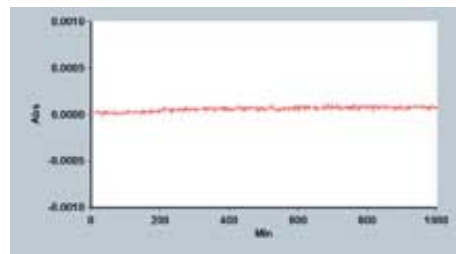
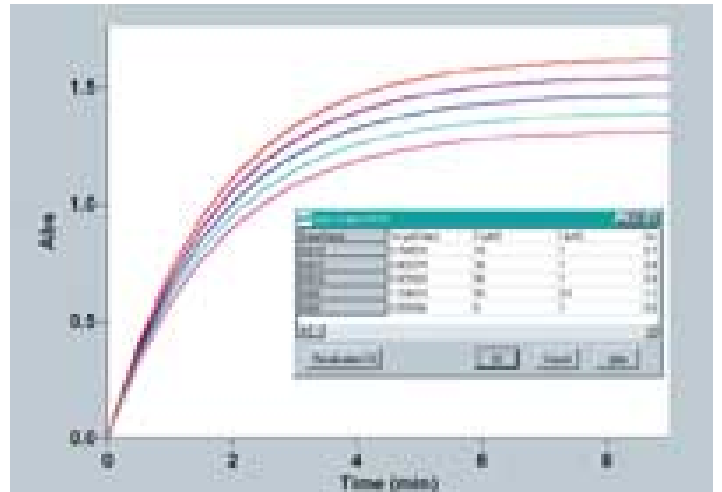
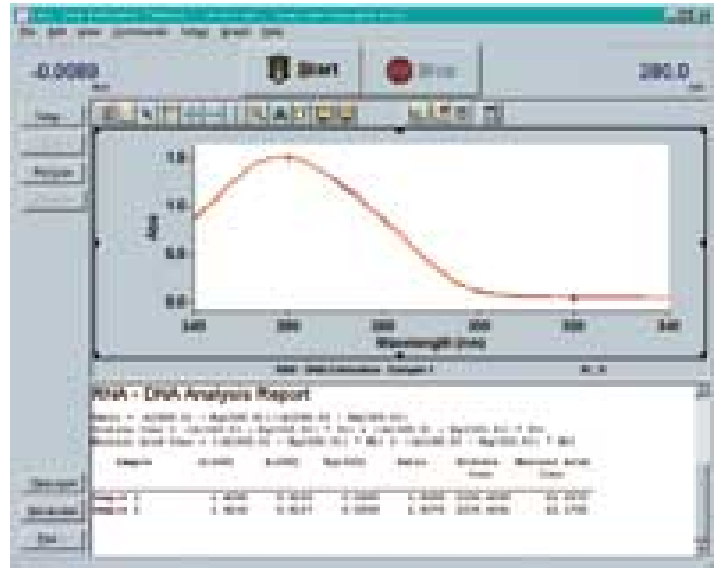




**Data security guaranteed**

Some spectrophotometers only store data at the end of a run, so if the power fails during the analysis you have to start again. The Cary software stores data as it is acquired, so even if someone accidentally pulls the power plug, you'll still have the data up to that point.

The Diffuse Reflectance Accessory is ideal for turbid solutions. The scattered light is gathered by the integrating sphere which minimizes the level of 'noise' in your data.



The optical design of the Cary instruments ensures excellent photometric stability. This means that any absorbance change you observe during a kinetics run is due only to the sample, not to drift in the instrument.

The RNA/DNA Estimation application has built in methods that enable you to determine the purity and the type of nucleic acid present in your sample. Warburg and Christian calculations are also available for nucleic acid and protein quantification. (Top.)

Enter sample information such as the pH, ionic strength, etc., in the User Data Form. This information is then stored with the data file. (Middle.)

## What functionality does Cary offer for kinetics measurements?

Part of the Cary Bio package is the Kinetics application. This application is ideal for determining the rates of reactions and enzyme activity.

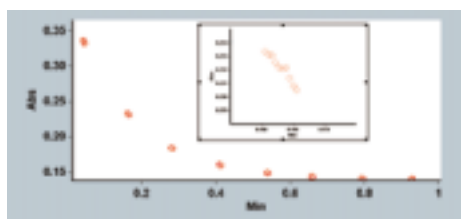
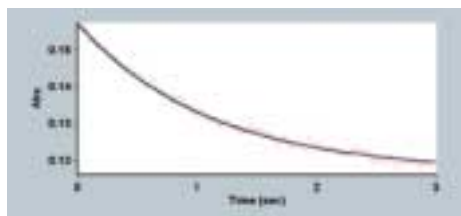
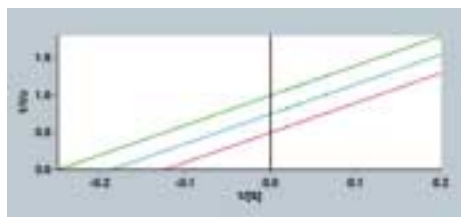
## Can I vary the data collection rate?

If you have a reaction which starts off very fast and then slows you may want to collect data at different rates over the course of the reaction—fast at the start (up to 30 data points per second) and then slower during the later part of the reaction. To do this, simply specify multiple data collection rates for different time segments of the assay.

The Kinetics software also caters for long, slow reactions and is capable of collecting data for up to 8000 minutes without the restriction of a limited number of data points in a file.

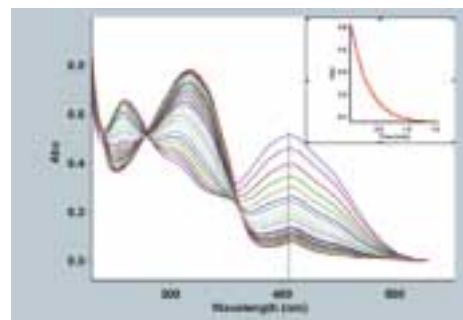
## Need an extension?

If you decide during an assay that you need to change the end time, you can extend the length of the assay without stopping the measurement. By using the Pause function prior to opening the sample compartment lid to add reagents, and using the Continue function once the lid is closed, you can also prevent spikes in your data.



You can collect your kinetics data and perform enzyme kinetics calculations all in the same application. The following plots are available: Lineweaver–Burk, Eadie–Hofstee, Hanes–Woolf, Eadie–Scatchard,  $V_0$  vs  $[S]$ , Dixon  $1/V_0$  vs  $[I]$ . (Top.)

Why do 12 experiments when you can do 1? The Dwell time option allows you to measure multiple data points per cell before moving to the next cell. Note how many data points were acquired by using the Dwell time feature—the insert is a zoomed section showing data points collected over 0.015 min. (Bottom.)

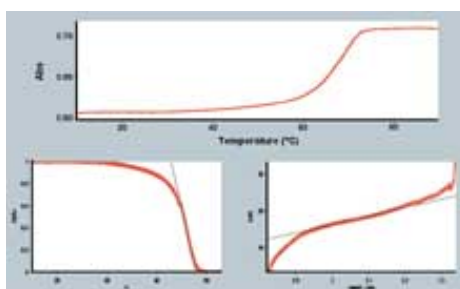
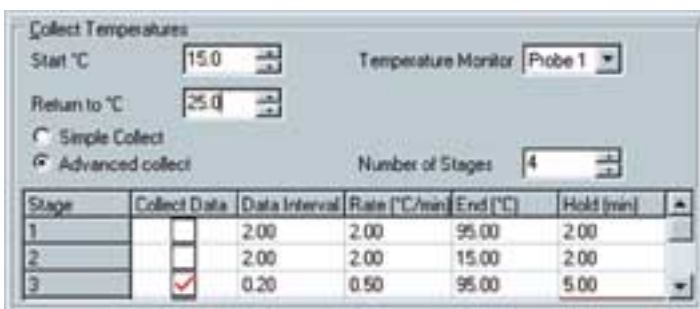


The Rapid Mix accessory allows you to automatically start an analysis in less than 1/10th of a second after the two components are mixed. (Middle.)

With a mouse-click you can obtain a kinetics curve from a series of repetitive curves. The insert shows the kinetic curve at 410nm. (Above.)



You can select up to 20 thermal denaturation and renaturation ramps within one data file. This means you can do annealing and thermal melt experiments all in one vessel.



With the excellent signal to noise performance of the Cary instruments, you can detect very small absorbance changes in  $T_m$  curves with ease.

## Thermal denaturation/renaturation measurements

The Cary Bio system includes the Thermal application software. Designed for DNA thermal melting experiments, it offers a number of unique features.

## Temperature control

The Temperature Controller accessory connects to the electrothermal multicell holder and allows temperature ramp rates as slow as 0.06 °C/min to be selected for high resolution DNA thermal melting experiments.

You can define up to 20 different temperature ramp rates and directions in the same data file. This ensures the highest possible accuracy for determining the thermal melting temperature by slowing the ramp rate and thus reducing the data interval close to the predicted thermal melt temperature. You can even specify the temperature you want your samples held at after the run has finished, eliminating the possibility of destroying them if they are held at high temperatures. For the ultimate in temperature control, use the Cary temperature probe accessory to obtain temperature data from directly inside cuvette.

## Comprehensive built-in calculations

The Thermal application software allows you to calculate the thermal melt temperature by either the first derivative method or the alpha method. Calculations for thermodynamic parameters for  $\Delta S$ ,  $\Delta H$ ,  $K$  at  $T_m$ ,  $\Delta G$  and  $K$  at user defined temperatures are also available.



**What about concentration measurements?**

The Cary Conc package is available for the Cary 100, 300 and 400 instruments. It contains the following software:

- Simple Reads module
- Advanced Reads module
- Concentration module
- Scanning module with Maths mode
- RNA/DNA Estimation module
- Instrument Validate module
- GLP module for file security
- Applications Development Language (ADL)

The system is ideal for Quality control laboratories and those who perform quantitative measurements, with a requirement for the occasional wavelength scan.

**Up to 30 standards and 500 samples**

Catering for up to 30 standards and up to 5 replicates (multiple readings on the same aliquot) you have maximum flexibility in terms of the level of precision you want in your results. The built-in weight and volume correction will give you the final result without your chemists having to perform additional calculations.

**Fibre optic measurement concentration**

The Remote Read Fibre optic probe enables you to dip a measuring probe into any vessel and initiate the reading from the built-in switch in probe. By rinsing between samples the carryover is non-existent and sample throughput is increased considerably. Also, you don't have to waste time transferring samples to the instrument cuvette.



**Unattended operation**

If unattended automation is important then the unique Fibre Optics SPS-5 Autosampler\* may be the solution. It can provide faster analysis times than are possible with typical autosamplers as there is no time taken for the sample to be pumped into a flowcell, and no waiting time for the cell contents to equilibrate. It also eliminates the solution pumping problems inherent in flowcell systems.

\* Patent pending

**The Fibre optic autosampler—fast and accurate**



**What about testing the performance of a Cary instrument?**

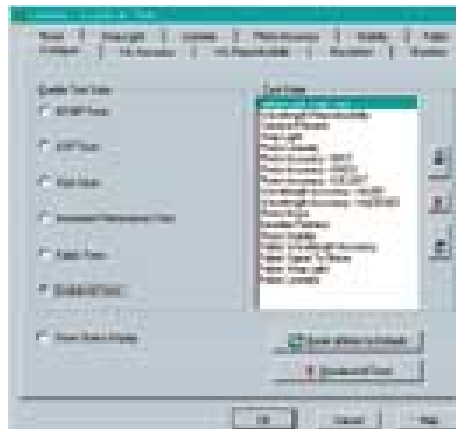
The Cary instruments are equipped with a range of tools to make instrument testing easy. Supplied with each package is the Instrument Validate module. This software automates the testing of the instrument hardware\*.

**GLP Compliance and Validation**

The Cary software is Good Laboratory Practise (GLP) compliant\*. If you need to validate your Cary system, Validation documentation is available for Cary instruments, software and accessories. Varian, Inc. service organisations around the world support validation of our instruments in a number of ways, including training programs, support agreements, hotlines, Telediagnosics, service contracts and certification. An overview of the Validation documentation and services Varian, Inc. provides is available from your local Varian, Inc. office.

**Can I get my Instrument recertified?**

At installation your instrument will be checked against specifications. As part of your ongoing validation program you may want to have your instrument recertified, to ensure that it is still meeting those specifications. Varian offers a recertification service which involves an on-site visit from a Varian Engineer who is equipped with various traceable standards and other test equipment. This means that you don't have to purchase and maintain expensive standard materials and if the instrument needs adjustment, the engineer will fix it for you.



The Validate module makes it easy to comply with regulatory requirements. Simply select which set of tests you wish to use, depending upon which regulatory agencies you are governed by, e.g. European or U.S. Pharmacopeia.

**Safety**

It is Varian's policy to manufacture safe products and to meet all legal requirements governing the design, manufacture and sale of safe products. As with all similar products, some or all of the following hazards may be present: high temperatures, high pressure gases, explosive gases, magnetic and radio frequency radiation, UV and visible light and electricity. Each product is designed to protect operators from potential hazards. Varian supplies instructions which describe the correct procedures for the operation and maintenance of each product.

Cary ultra-violet, visible, near infrared spectrophotometers are designed to measure the absorption of, the reflection off and the transmission through materials.

Varian's well established global network of subsidiaries and representatives offers complete Sales, Service, Training and Applications support for our range of scientific instruments.

\* For details refer to the separate Specifications brochure.



The Cary Series is certified to comply with the requirements of the EMC and LV directives of the European Union.

Varian offers a recertification service which certifies that your instrument is working correctly. The Varian engineer is equipped with a large kit of certified standard materials and other tools.



## The modular accessory concept

### What is the modular accessory concept?

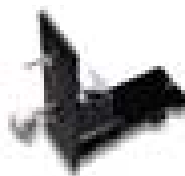
Each Cary accessory is built to provide a fundamental requirement and can be used with any other accessory which requires that functionality. For example, several accessories are thermostatable, but instead of building temperature control into each accessory, a single temperature controller plugs into the thermostatable accessories. This is the concept of modular design.

### How does this benefit me?

By only having to buy a fundamental requirement once, you will save money. For example, you may want to measure multiple cuvettes in an automated analysis as well as do gel scans. The fundamental requirement of moving something in the sample compartment is achieved with the Sample Transport accessory. So instead of having to buy a multicell holder with a built-in translation stage and a gel boat with a built-in translation stage, you simply put the appropriate accessory on top of the Sample Transport.

### I have built my own accessories, can I use them in a Cary?

All accessories are centrally controlled by the Accessory Controller, built into the Cary instruments. Instead of each accessory having their own electronics, the Accessory Controller provides the interface between the Cary software and the accessories. If your custom-built accessories will fit into a Cary, you can use the Accessory Controller to control them. Even external accessories, such as titrators, lasers and pH meters can be controlled.



Cary 400/500 Large Sample Specular Reflectance Accessory



Cary 100/300 Specular Reflectance Accessory



Cary 400/500 Specular Reflectance Accessory



Cary 400/500 Variable Angle Specular Reflectance Accessory



Cary 400/500 Internal Diffuse Reflectance Accessory



Labsphere DRA-CA-5500 Diffuse Reflectance Accessory



Labsphere DRA-CA-5500A 0/45° Accessory for Cary 400 & 500



Labsphere DRA-CA-30I Diffuse Reflectance Accessory



Labsphere DRA-CA-30 Diffuse Reflectance Accessory



Labsphere DRA-CA-50M Biconical Accessory



Cary 400/500 Praying Mantis Diffuse Accessory



Solid Sample Holders



Brewster Angle Holder



Depolarizer and Polarizer



Fixed Angle relative Specular Reflectance Accessories. Available in 12.5°, 30°, 45°, 60°



Rear Beam Attenuator



6x6 Multicell Holder—  
peltier thermostatable



Cary 100/300 8x6  
Multicell Holder  
ambient/water/



Temperature Controller



PCB-150 Peltier  
Water Bath



Peltier 1x1 thermostatted  
cell holder



Temperature probe



Routine Sampler  
Accessory—peltier



Sipper



Rapid Mix Accessory



Sample Transport fitted  
with the Film Holder



SPS-5 Autosampler



Cary 100/300 Fibre  
Optics Coupler



Cary 400/500 Fibre  
Optics Multiplexer



Total Fluorescence  
Accessory



Cary 100/300 Extended  
Sample Compartment



Cell Holders



Double Aperture Kit



Instrument Testing Kits



Varian is committed to a process of continuous improvement which demands that we understand and then meet or exceed the needs and expectations of our customers—both inside and outside the company—in everything we do.

Varian Analytical Instruments, serving worldwide markets in:

- Agriculture
- Basic Chemical
- Biotechnology
- Clinical
- Electronics
- Environmental
- Photonics
- Toxicology
- Pharmaceutical
- Food and Beverage
- Metals and Mining
- Petroleum and Petrochemical

GC, GC/MS, HPLC, AAS, ICP, ICP-MS, UV-Vis-NIR, Fluorescence, NMR, and Analytical Supplies



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