Aquarius

DOUBLE BEAM

UV:SPECTROPHOTOMETERS

CECIL

Variable or Fixed Bandwidth

The Aquarius spectrophotometers offer very high performance with fixed optical bandwidth of less than 2nm pharmacopoeia compliant, 1nm, or variable optical bandwidth of 0.5, 1, 2 and 4nm for high resolution applications.

The spectrophotometer's performance and powerful software are only normally available with much more expensive instruments.

Double Beam Optical System

The fully symmetrical double beam system of the Aquarius instruments provides the highest accuracy of measurement coupled with very high stability with time.

Both sample and reference beams are provided with the same space facilities, thus catering for the widest possible range of experimental requirements and not limited to just a simple cell in the reference beam.

Scans Viewed By Scrolling

By scrolling information across the display screen, the effective width of the screen is a massive 430mm.

Long scans, plots and other data may be viewed in much more detail, than with other instruments.

Powerful Integral Control

Rapid operation with ease of use is provided by the powerful software built into the computing system of the Aquarius instruments. The standard software is remarkably comprehensive but may be expanded, at any time, by E-SEF to release additional software modules when required.

Rapid Menu Operation

The large backlit high resolution LCD screen displays menus for all applications, with clear prompts for all entries and procedures. Scans, plots, curves and data are all displayed on the screen and may be reprocessed or manipulated before storing or producing a printout.

Secure Integral Memory

Generous built in secure memory allows scans, curves, plots, kinetic curves, as well as methods to be stored tamper proof protected by personal security codes.

Any scans, plots or data may be recalled from memory, with assured integrity, for reprocessing, manipulation and printing as required.

Dynamic Scan Recall

The Aquarius instruments are provided with the ability to store the last 25 or more scans or plots without the need to carry out a scan storage procedure. The scans or plots are automatically stored as they are made and may be recalled from a list on the display.

POWERFUL INTEGRAL SOFTWARE

Software Enhancement By E-SEF

This unique design feature - Encoded Software Enhancement Facility - provided by Cecil Instruments, enables any required additional software module to be released by an encoded entry. The encoded entry required is obtained by telephone, fax or E-mail, enabling you to expand your library of methods, without delay, when a new application arises within your laboratory.

Method Operation

Any procedure may be stored as a method in the security code protected integral memory of the Aquarius instruments. When a method is recalled, all instrument parameters are automatically set, without operator intervention, thus ensuring that the original conditions are exactly replicated.

Scan Storage

Scans, plots and curves may all be stored, for future use, with confidence in the integrity of the data. Integral memory is provided for up to 100 scans, protected by the operators personal security codes.

Reprocessing

Although scans may be in absorbance, transmittance or derivative format, any scan may be transformed to an alternative format by the very rapid reprocessing facility provided.

Fully Documented Scans

As shown below all scans are fully documented on screen and in hard copy.

Tables of all peaks and valleys are produced together with instrument, sample and operator details. Scans recalled from the instruments integral memory or by dynamic scan recall are also fully documented.

The screens shown are not two separate displays but part of a continuous display viewed by scrolling.

Benefits

Variable or Fixed Bandwidth

Large Backlit LCD Screen

Screen Scrolling

Scrolled Screen Width 430mm

Dynamic Scan Recall

Full Reference Sample Space

Method Storage

Spectral Storage

Curve Storage

Password Protected Storage

Multi/Single Cell Kinetics

Operates in 6 Languages

Performance

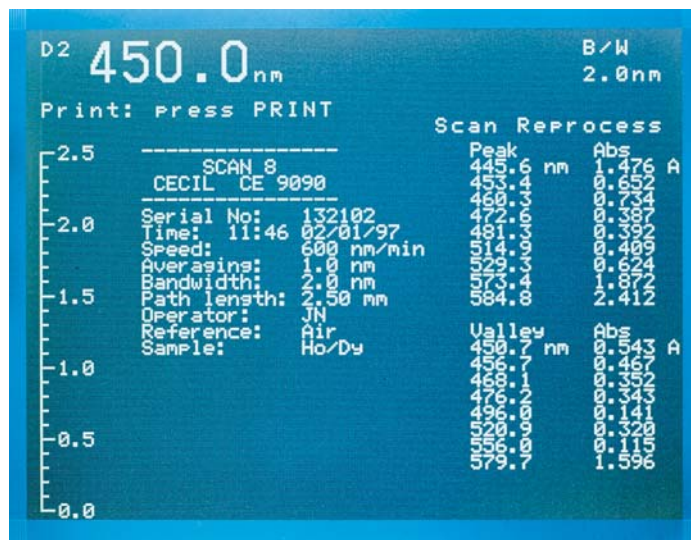**Bandwidth < 2nm or 1nm Variable 0.5, 1, 2, 4nm**

Stability ±0.0001A/H

Scan rate 1 to 4000nm/min

Wavelength Precision 0.1nm

Straylight <0.02%

Validation Software

Multi-User Convenience

Aquarius double beam instruments were designed for the greatest convenience in a laboratory where multi user operation is required.

All methods, stored scans, plots, curves and data remain in secure integral memory, tamper protected by passwords, readily accessible to all operators without the possibility of mislaid disks or plug in card modules.

Sampling Flexibility

The design of the double beam optical sampling allows almost identical space and facilities in both the sample and reference beams. Multi-cell reference sampling, with temperature control is therefore possible.

Operation is not limited to a single standard cell in the reference beam as in some other instruments.

Reflectance and Gel Scanning

Accessories include fixed angle and variable angle reflectance units and a gel scanning system for gels up to 100mm long.

DataStream

Data may be transferred from the spectrophotometer to a PC, or the software used to control the instrument from a PC. Datastream software, developed by Cecil Instruments, has a wide range of facilities including graphical and tabular presentation, normalisation of overlayed traces, point and peak pick using a cursor, library facilities, data storage in files on disk, history logging and copy and paste to other applications such as Excel, Word etc.

The photograph below shows an Aquarius instrument in use in Cecil Instruments applications laboratory.

DISPLAY SCROLLING OF SCANS

Curve and Line Fitting

A straight line, quadratic or cubic curve may automatically be fitted to a set of up to 30 standards. Fits may be made with an intercept or forced through zero. Replicate standards may be used for any given concentration. All entries are prompted for simplicity of operation. A quadratic curve fit is shown here.

## Editing Suspect Standards and Curve Storage
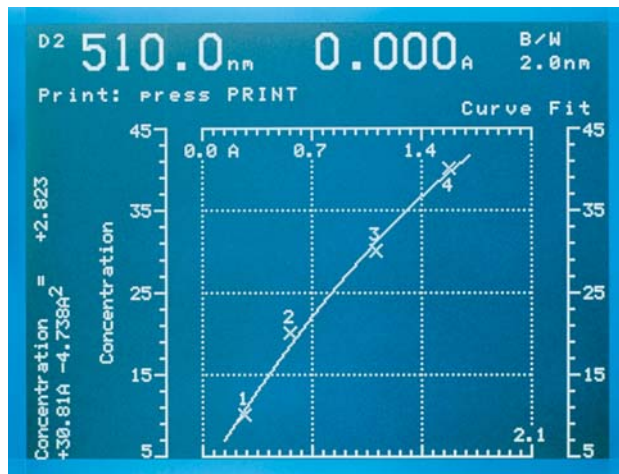
Suspect standards may be observed by inspection of the screen display and either deleted or substituted by a replicate standard.

Up to 30 curves may be stored in integral memory, security code protected for future use.

Derivative Spectra

Derivative spectroscopy is a powerful technique for revealing hidden information or enhancing fine detail in a spectral scan. Bands masked by other overlapping bands or distorted by a sloping background may be accurately located for quantification.

Derivative plots may be displayed on their own or superimposed on a wavelength scan, with or without an offset. The degree of smoothing used is operator entered and ranging is normally selected to be automatic.
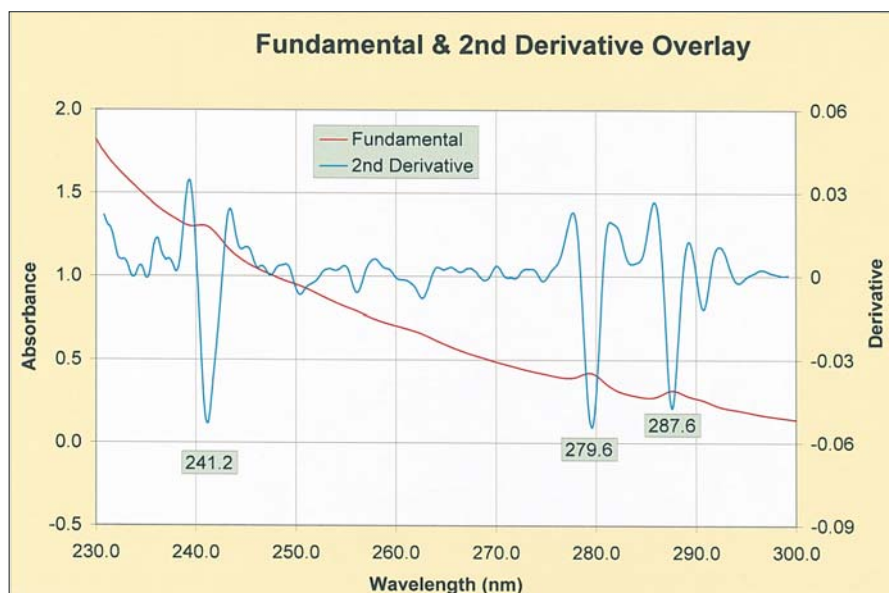
STANDARD SOFTWARE

Wavelength Scan

Peak and Valley Tabulation

Derivatives 1st-4th

Time/Rate Plot

Dynamic Scan Recall

Auto Sequential Scans

Scan Storage

Scan Overlay

Scan Reprocessing

Method Storage

Curve/Line Fit

Curve Storage

Editing of Standards

Absorbance Ratio

Absorbance Difference

Self Test and Calibration

Measurements in A, C, %T

Benzene vapour (0.5 nm. Bandwidth, 2.0 nm. Bandwidth)

Iodine vapour (0.5 nm Bandwidth, 2.0 nm Bandwidth)
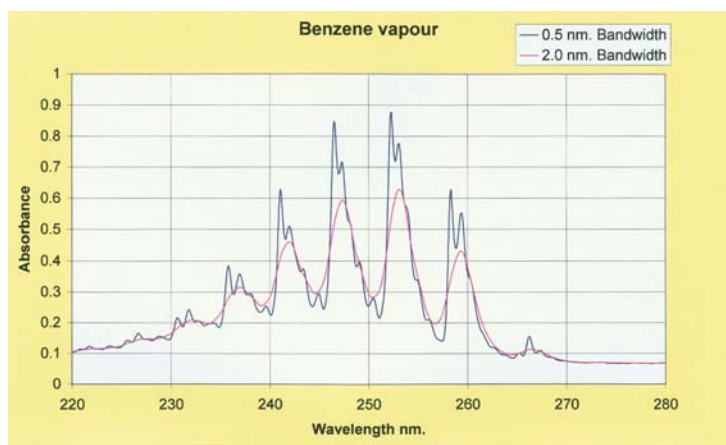
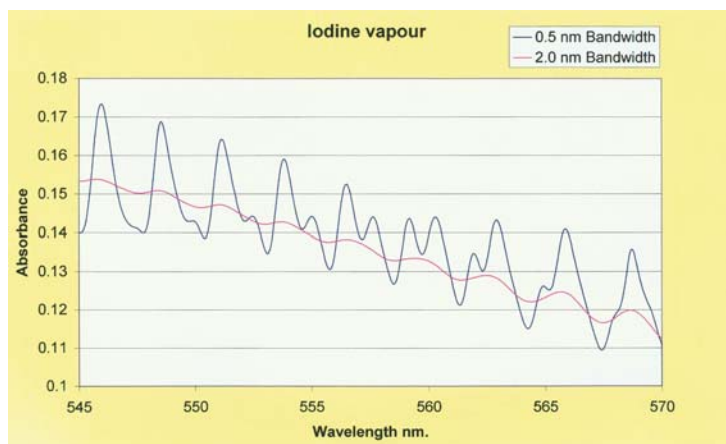## Optical Bandwidth

The Aquarius range provides the choice of fixed bandwidth of less than 2nm, 1nm, or variable bandwidth of 0.5, 1, 2 and 4nm. The variable resolution performance of the CE 7500 is ideal for samples with sharper features requiring high resolution - particularly vapours and some liquid samples.

The performance of the Aquarius CE 7500 is illustrated in the plots shown here of Benzene Vapour at two different bandwidths, 0.5nm and 2nm overlayed.

Also shown here is the spectrum of iodine vapour near 560nm.

The broad flat bands resulting from a scan at 2nm bandwidth are well resolved when scanned at 0.5nm bandwidth.

A 1 nm optical bandwith is provided by the CE 7400S version of the Aquarius, for applications requiring this particular performance.

Micro-Sipette Sampling

Samples of 300μl or less, and multiple samples, may be measured with very low cross contamination.

Samples are measured in the same cell enhancing accuracy and speed of measurement. The pump, in the sample compartment, is controlled by the instrument's microprocessor.

Ultra-Micro Sampling

Valuable samples, such as biological samples prepared with costly reagents, may be measured using a special ultra-microcell and holder. With the system, samples of 50μl or even less may be accurately measured.

Tablet Dissolution

The CE 7460 and CE 7560 versions of Aquarius are fitted with a special cell compartment and pipe port for tablet dissolution assays.

The instrument may be used with either a six or eight cell automatic changer.

SUPERB VERSATILITY

CECIL

Reaction Kinetics

Both single cell and multi cell Kinetics are available with reaction plots to screen and printer. Regression analysis is applied to the user-selected portion of reaction curves and results are reported in Units/Litre. Data may be reprocessed as required and curves stored. Sample temperature control is available for single cells and four and six cell changers.

Advanced Kinetics

An example of advanced kinetics is shown below where time based reaction data generated by the spectrophotometer has been transferred into Grafit, fitted to a curve and transformed into a more suitable format for mathematical interpolation and calculation. In this particular example, the basic data plot can yield the limiting rate (Vmax), the Michaelis constant (Km) and the initial linear portion (Vmax/Km).

This has been transformed into the Eadie-Hofstee format and plotted to give better precision in the calculation of these important factors and constants.

Other transformations are available such as Lineweaver-Burk and the Hill plot for allosteric enzyme systems.

PC Data Manipulation

Data may be transferred to a PC for use with spread sheets and other mathematical software packages.

More advanced reaction kinetics data manipulation may be readily performed with Grafit software. Linear, non-linear or polynomial curve fitting is easily accomplished together with non-linear regression analysis. A wide selection of standard equations are provided, together with an equation editor for customised equation fitting.

Data may also be transformed into other mathematical formats for plotting and calculation.
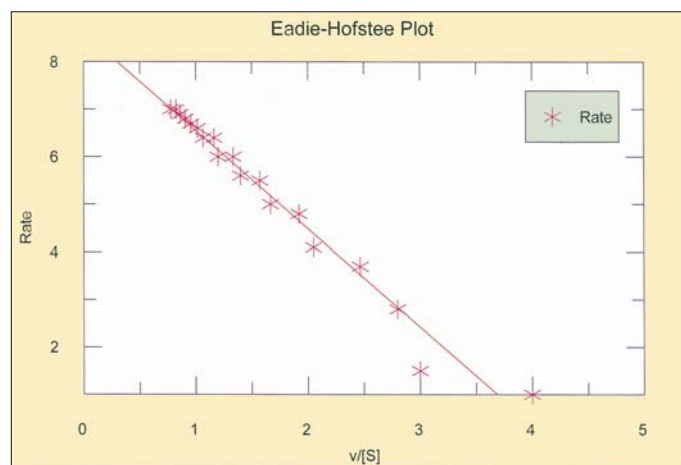
Band Quantification

Accurate quantitative assays using band area or height, corrected for background absorption, are exceptionally easy to carry out with the easy to use Aquarius instruments.

Analytical results are displayed and printed with construction lines enabling the quality of the parameters to be assessed.

The procedure may be stored as a method with security code protection in the integral memory of the instrument.
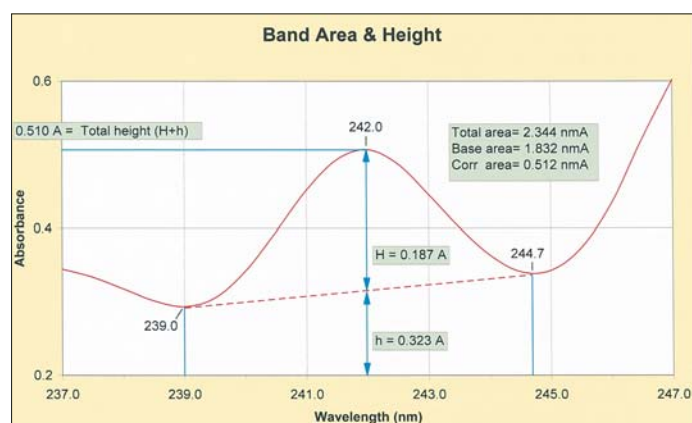
SCANNING

Double Beam Wavelength Scans

Scans at up to 4000nm/min are presented on screen or printed with all peaks annotated with wavelength and absorbance. Tables are also presented listing all peaks and troughs with values.

Display Scrolling

Use of the display scrolling facility enhances the effective screen size and enables spectra and data up to 430mm wide to be viewed.

Dynamic Scan Recall

The last 25 or more scans or plots are automatically retained for recall by entering their scan sequence number and may be reprocessed, overlaid or transferred to protected memory for future recall.

Overlaid Spectral Scans

Up to eight scans, including stored scans, may be overlaid, with or without offsets for convenient comparisons or further manipulation.

Difference Spectra

New wavelength scans or scans from store may be presented on screen and the difference spectra produced. The scans may be normalised enabling spectral stripping to reveal impurities or additives.

Derivative Spectra

Derivative spectra, up to fourth are readily produced, with selectable smoothing, either alone or superimposed on the fundamental, with or without an offset. Scaling is automatic with all peaks and troughs quantified.

Scan Storage

Up to 100 spectra may be stored in safe memory for future recall. Each spectrum is automatically allocated a recall number, when stored, and may be security code protected against tamper or deletion.

Programmed Scans

Automatic scans, single or repeat may be made of a cell program of up to 4, 6 or 8 cells. A programmed sequence of scans may also be made of a single sample.

Time Course Plots

Changing samples or flows may be examined and displayed by making a time course plot. Data may be reprocessed and stored, security code protected, with an automatically assigned recall number.

QUANTITATION

Powerful Quantification

Many quantitative methods are available including band area computation with background correction, differencing and stripping of spectra, wine and colour assays, mathematical calculations between several wavelengths, protein and DNA assays.

Curve and Line Fitting

A straight line, quadratic or cubic concentration curve may be fitted to up to 30 standards, with or without an intercept at the origin. Standards may be deleted and replaced and a new curve fitted.

Reaction Kinetics

Single cell kinetic measurements are possible with plots and data displayed on screen. Data may be reprocessed, regression analysis applied and curves stored, security code protected against tamper or deletion.

Multi-Cell Reaction Kinetics

Up to four or six cells are automatically measured with all reaction curves displayed on screen. Each curve may be selected for processing with the results of regression analysis printed.

Multi Wavelength Assays

Assays are provided using either two or three wavelengths. A wine colour assay is provided which may use up to ten different wavelengths.

DNA and Protein Assays

DNA and Protein assays may be made using either the 2 or 3 wavelength methods of Warburg and Christian. Also programmed are techniques and analytical procedures for assays by Lowry, Bradford, Biuret and BCA methods.

Band Area and Height Computation

Band areas with correction for sloping background absorption are readily quantified, with all details and construction displayed. Band areas may also be computed for derivative spectra to facilitate difficult quantification.

Cell Program

Using the various cell changers, measurements may be made on up to 4, 6 or 8 cells at a single wavelength with cycle time and number of cycles entered by the operator. A cell and wavelength program may be combined.

Wavelength Program

Measurements may be programmed for 10 different operator selected wavelengths with the cycle time and number of cycles selected by the operator. A wavelength and cell program may be combined.

CECIL

SYSTEM FUNCTIONS

Integral Control System

All control software is within the instrument, tamper proof, providing easy menu driven operation with massive safe storage for scans, plots, curves etc. PC control and data transfer to a PC are provided.

Equal Sample and Reference Facilities

Identical and generous sample and reference sampling facilities widens the scope of measurement, for example, to enable multi-cell sampling in both beams and accommodate bulky accessories in the reference beam.

Method Operation and Storage

Up to 30 sets of instrument parameters, including concentration curves may be stored, security code protected. When recalled, instrument parameters are automatically set, avoiding errors.

Multi-Language Operation

The operator may select from the six operating languages provided. Full Alpha Numeric entry is provided so that results may be fully documented for GLP.

Formula Entry and Computation

Mathematical formulae may be entered enabling complex calculations involving many wavelengths and cells to be carried out automatically.

Software Enhancement By E-SEF

E-SEF - Encoded Software Enhancement Facility - allows software modules to be enabled using encoded numbers provided by telephone, fax or E-mail. Software requirements may be tailored, at any time, as required.

Data Storage and Protection

Data, including 100 spectra, concentration curves, kinetics and time course plots may be stored in safe memory, security code protected against tamper or deletion using a four digit password.

Reprocessing

Scans, time course plots, reaction curves and gel scans may all be reprocessed to any required format on the display screen and then plotted.

Performance Validation

Software and certified standards enable wavelength accuracy, absorbance accuracy, bandwidth, stray light etc. to be validated. A timed and dated report includes the serial number of the instrument.

SAMPLING

Variable or Fixed Bandwidth

Optical bandwidth selectable down to 0.5nm is provided by the CE7500 and allows the fine structure of narrow bands to be resolved which remain unresolved at just under 2nm bandwidth in instruments such as the CE7400.

Double Beam Optical System

The fully symmetrical optical system measures sample and reference simultaneously for ultimate accuracy, precision and baseline flatness. Long term stability is up to ten times better than single beam systems.

Automatic Cell Changers

Automatic changers are available for 4, 6 or 8 cells, providing rapid sample changing or the facility for full programming.

Sipette Sampling

Samples down to 300 microlitres may be measured in a 10mm cell. Sampling is under control of the instrument's microprocessor system. Samples may be saved or pumped to waste.

Ultra-Micro Sampling

Samples of 50µl and less may be accurately measured assisted by the very small beam size of only 7 x 1mm. All normal cells up to 100mm pathlength are accommodated.

Sample Temperature Control

Water and thermoelectric temperature control are available for single cells and automatic cell changers. Temperature is set from the control panel and displayed on the screen in the latter case.

Dissolution Testing

Versions of the instruments fitted with a special cell compartment with piping port, are available for dissolution testing using Cecil TD software and a PC. Six and eight cell changers are available.

Batch Sampling

Automatic batch sampling for up to 100 samples is available. The pump fits within the sample compartment and volume etc is set from the control panel and displayed on screen. Batch number entry is provided.

Specular Reflectance

Special accessories enable specular reflectance measurements to be made. Both fixed angle and variable angle reflectance accessories are available. The latter is particularly useful for film thickness measurements.

Physical Sciences Applications

The near infrared region to 1100nm is covered by both instruments maintaining excellent performance. Measurements beyond 900nm can be of value in physical science applications such as the measurement of optical filters, heat absorbing filters and semi-conductors.

The transmission spectra of two different filters is shown here overlayed, demonstrating their characteristics beyond 900nm.

Optical filters
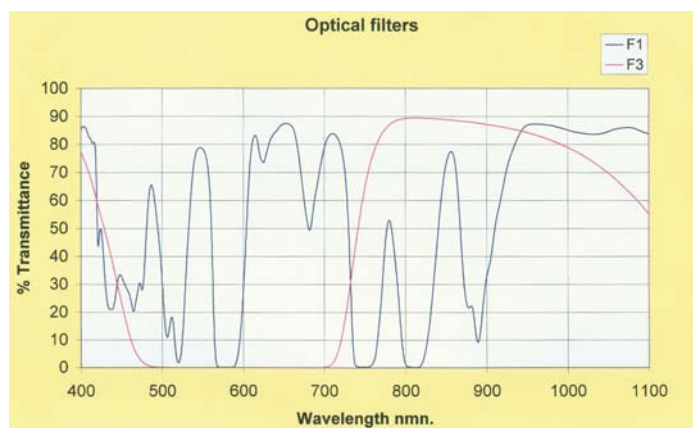
Instrument Validation

Assessment of instrument performance is readily carried out using the validation software module built into all Aquarius instruments and released by E-SEF, 'Encoded software enhancement facility'.

Laboratories subject to regulatory control, or following G.L.P. are provided with a range of Pharmacopoeia (EP/BP/USP) tests.

As well as these tests, tests using filters traceable to national standards with certificates of calibration issued by Cecil Instruments are available.

Pharmacopoeia and other tests are shown here.

Optical Bandwidth

The optical bandwidth of the instrument may be validated by measuring the half height width of the narrow deuterium emission line at 656.1nm. The measurement is carried out automatically.

Optical Bandwidth : Using 656.1 Deuterium Line

1.9 nm at half height
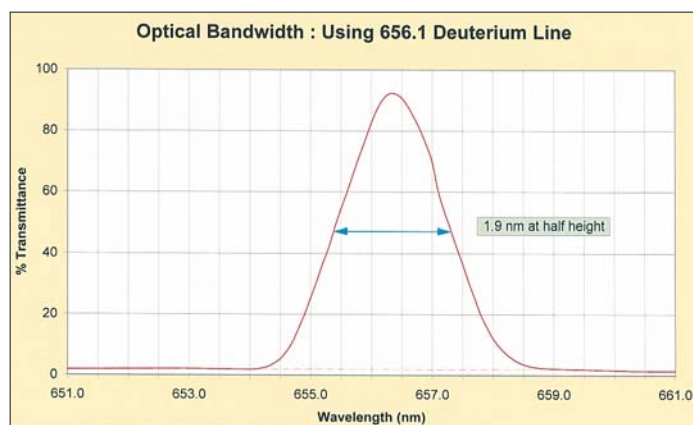
Validation Using Filters

Absorbance accuracy is most conveniently measured using certified filter sets calibrated by Cecil Instruments against NPL certified standards. Wavelength calibration is also carried out using certified filters.

Straylight

Straylight is measured following the Pharmacopoeia (EP/BP) test, using a 1.2% w/v solution of Potassium Chloride in water measured against water in the reference beam.

The more widely accepted ASTM tests at 220nm and 340nm are also available.

Stray Light at 200nm : KCl 1.2g/100ml

Stray light check:
Absorbance must exceed
2.0A at 200.0nm
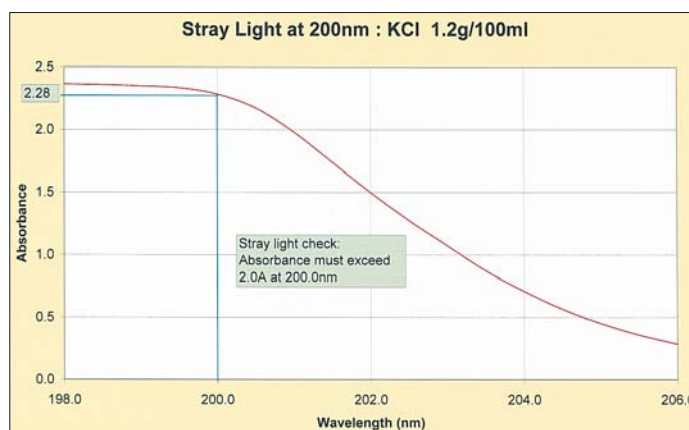
Absorbance Accuracy

The Pharmacopoeia (EP/BP) test for absorbance accuracy, using a 60mg/L solution of Potassium Dichromate in a 10mm pathlength cuvette, is shown here.

Absorbance Accuracy : K₂Cr₂O₇ 60mg/L
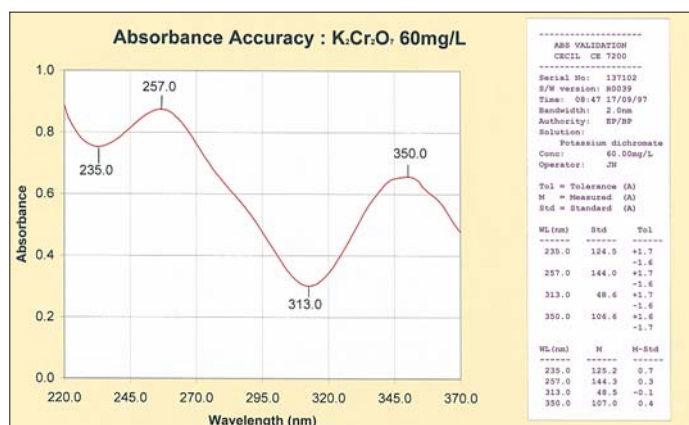
WIDEST ACCESSORY RANGE

Cell and Wavelength Programming

All Aquarius instruments are fully programmable. Cell programmes may use four, six or eight cell changers, with a single autozero or individual zeros for each cell.

Wavelength programmes are provided for up to ten different wavelengths and cell and wavelength programmes may be combined.
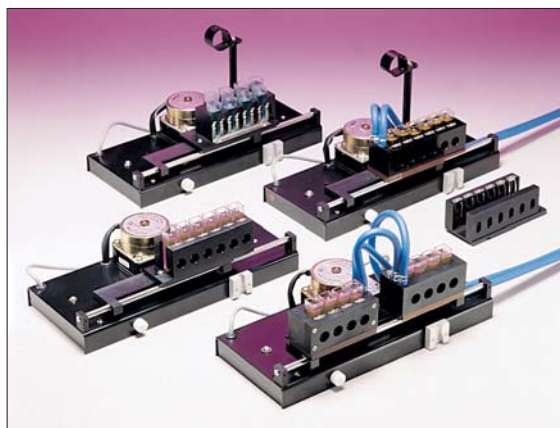

Sampling and Temperature Control

A complete range of sampling accessories is available. A selection of auto-sample changers, some with water temperature control, is shown on the left. Thermoelectric single, four, four plus four and six cell changers are shown above. Control is through the instrument microprocessor system with screen display of temperature.

ORDERING ACCESSORIES

Cell Holders	
Single cell holders - sample or reference	505 26 00
Micro sipette 10mm cell holder	503 26 00
Adjustable holder for micro cell	6600 57 00
50µl ultra microcell holder	8020 39 00
Holder for rectangular cells up to 100mm	595 27 00
Holder for cylindrical cells up to 100mm	595 26 00

Cell Changers	
Auto changer for 4 or 4 + 4 cells, requires holder	9070 31 00
Holder for 4 x 10mm cells sample or reference	594 54 00
Auto changer for 6 cells, requires holder	9070 34 00
Holder for 6 x 10mm cells	5500 33 00
Holder for 6 x 20mm cells	5500 34 00
Automatic 8 cell changer with holder	9070 32 00
4 position microcell holder	505 38 00

Sipette and Batch Sampling	
Return sipette system, requires holder and cell	9070 21 00
10mm sipette cell	202 07 02
20mm sipette cell	202 07 51
40mm sipette cell	202 07 54
Sipette 10mm cell holder	503 26 00
Batch sampler for 40 samples with pump	2020 82 00
Batch sampler for 100 samples with pump	2020 82 02

Reflectance	
Fixed angle reflectance accessory - pair	CE 575
Variable angle reflectance accessory	CE 574

Lamps	
Deuterium lamp with hours indicator	2202 01 42
Tungsten halide lamp - in pairs	2303 01 40

Temperature Control - Water Circulation	
Single or micro sipette cell holder	503 36 00
4 cell holder	202 36 16
2 x 4 cell holder, sample or reference	202 36 15
6 cell holder	5500 36 15

Temperature Control - Thermoelectric	
Thermoelectric Control System	7400 31 00
Holder for single or sipette cell	8020 56 00
4 cell holder	9070 57 00
2 x 4 cell holder	9070 58 00
6 cell holder	9070 59 00

Sample Stirring	
Electronic stirrer and sample cell holder	7200 31 00
Electronic stirrer and sample and reference holder	7200 32 00

Gel Scanning	
Gel scanner - requires trough or film holder	9070 39 00
Gel trough - 5mm x 100mm silica	570 07 02

Printers and Cables	
RS232 cable for 25 pin PC with protocol manual	2021 26 00
RS232 cable for 9 pin PC with protocol manual	2021 83 00
Laser Printer	8000 73 01
Dot matrix printer	8000 70 01
Colour ink jet printer	8000 72 01

Calibration Filters	
Holmium filter in holder	202 01 44
Didymium filter in holder	303 01 30
Set of 2 certified Wavelength filters in holders	303 40 00
Set of 4 certified Absorbance filters in holders	594 44 00
Set of 6 certified Absorbance filters in holders	594 66 00

Aquarius

SPECIFICATION

Optical System	Fully symmetrical double beam system
	All mirrors coated for long life
Monochromator	Modified Czerny-Turner design using 1200 L/mm holographic diffraction grating
Detectors	Two silicon diode detectors
Self Test and Calibration	Automatic at switch on
Wavelength Range and Accuracy	190 - 1100nm; 0.5nm
Wavelength Reproducibility	0.1nm
Wavelength Readout	Digital display on screen
Wavelength Selection	By GOTO Key and keypad entry
Optical Bandwidth	< 2nm CE7400; 0.5, 1, 2, 4nm CE7500
Stray Light	Less than 0.02% at 220nm, NaI; and 0.02% at 340nm, $NaNO_2$
Display Screen	Large backlit LCD displays spectra, menus, data, prompts and instrument status.
Display Scrolling	Provides viewing width of 430mm
Derivative Spectra	1st to 4th derivatives
Autozero	Automatic by press button
Photometric Readout	Digital display of A, %T and C on screen
Photometric Accuracy	±.004A at 1A
Photometric Noise	Less than ±0.0001A at 550nm, 2nm b/width
Baseline	Stored in non-volatile memory
Baseline Flatness	±0.001A (300nm/min, 200-1100nm) 2nm bandwidth
Baseline Stability	Better than ±0.0001A/hour
Computer Interface	Bi-directional RS 232 c
Scan Speeds	1-4000nm/min
Wavelength Scale Expansions	1-100nm/cm
Method Storage	30 methods may be stored and retrieved
Method Protection	Each protected by 4 digit passcode
Reaction Kinetics	With plots, reprocessing of data as required, for single cell or up to 6 cells
Overlaid Scans	Up to 8 scans may be overlaid
Cell Programming	Up to 4, 6 or 8 cells
Programme Cycles	From 1 to 9999
Programme Delay (cycle time)	From 0 seconds to 4 days (1 sec resolution)
Wavelength Programming	Up to 10 wavelengths. May be combined with a cell programme
Dynamic Scan Recall	Last 25 scans automatically stored on board
Storage of Spectra	100 spectra may be stored code protected
Concentration Curve Fitting	Linear, quadratic or cubic with editing of standards. 30 curves may be stored
Multi-language Operation	Six languages provided
Formula Entry and Computation	Complex formulae may be computed
Batch Sampling	Up to 100 samples under internal control
Date and Time Information	Printed from real time clock
Power Requirements	110-250V, 50/60Hz, 170 watts.
Dimensions and Weight	635 x 410 x 210mm; 33kg

Cecil Instruments policy is one of continuous development. We therefore reserve the right to change specification without notice.

ORDERING

CE 7400 Spectrophotometer
< 2nm pharma-compliant Optical bandpass. Wavelength range 190-1100nm.

CE 7400S Spectrophotometer
1 nm Optical bandpass.
Wavelength range 190-1100nm.

CE 7500 Spectrophotometer
0.5, 1, 2 and 4nm Optical bandpass.
Wavelength range 190-1100nm.

CE 7200 Spectrophotometer
<2 nm Optical bandpass.
Wavelength range 190-900nm.

CE 7460/CE 7560 Dissolution Spectros
Suitable for tablet dissolution monitoring using a choice of dissolution software and an automatic six or eight cell changer.

8000 70 01 Dot Matrix Printer and Cable

8000 72 01 Colour Ink Jet Printer and Cable

8000 73 01 Laser Printer and Cable

SOFTWARE MODULES

Program C
Cell program for up to 4, 6 or 8 cells

Program W
Wavelength program for up to 10 wavelengths and time interval measurements at a fixed wavelength

Quant M
Multi-wavelength assays at 2 or 3 wavelengths, Warburg and Christian assays at 2 or 3 wavelengths, wine/colour assay at up to 10 wavelengths

Quant P
Protein assays using Lowry, Bradford, Biuret, BCA and direct UV

Quant S
Quantification of corrected bands, difference spectra, spectral stripping

Kinetics
Kinetic measurements with plots and reprocessing of data

Kinetics M
Multi-cell Kinetics linked with autochanging of cells and plotting of reaction curves

Formulae
Construction and entry of mathematical formulae with multiple wavelengths and cells; automatic computation of results

Validation
Validation of absorbance, wavelength, bandwidth, stray light etc. using liquid samples or certified standards

DataStream
Data transfer to, or control by a PC. Graphical presentation, transfer of data to Excel, Word etc.

**ISO 9001
CERTIFIED COMPANY**