

Q Adept™

Adept™



HPLC
COMPLETE RANGE





BENEFITS

- Ultra Fast Scanning**
- Superb Performance**
- Powerful Software**
- Total Flexibility**
- Excellent Reliability**
- Expandable Systems**
- High Pressure Mixing**
- Low Pressure Mixing**
- Video Tutorial**

The Complete Range of HPLC

Cecil Instruments offers both high pressure and low pressure gradient forming systems. The Adept series uses high pressure gradient mixing, while the Q-Adept system offers low pressure quaternary gradient formation, as well as ternary or binary gradients as required.

Both Adept and Q-Adept systems are fully CFR21 part 2 compliant. Single point control of modules, through PowerStream, is facilitated by the digital connections.

A revolutionary new UV-Visible Dynamic Absorbance Detector (DAD), offers all the spectral capabilities of Photodiode Array Detectors (PDA), with greatly improved performance as a variable wavelength detector (VWD), and half the time required to both scan and quantify an elution.

Cecil Instruments introduce WaveQuest, a breakthrough in UV-Visible detector design, which enables peaks to be scanned and quantified simultaneously, saving time.

Super fast wavelength scanning, produces a UV spectrum in 200ms. Powerful spectral processing software is designed for R&D, method development, purity determination etc, and reports for IQ, OQ and PQ checks, with electronic signatures available for CFR11 part 2 conformity.

Absolutely top performance as a variable wavelength detector, with data processing by PowerStream software, another Cecil Instruments development.

QUATERNARY HPLC SYSTEMS

Quaternary and Other Gradients

The Q-Adept systems provide the convenience of working with quaternary, Ternary or Binary gradients.

With the greatest of ease Q-Adept systems may be switched to isocratic use, or made to blend solvents for isocratic chromatography. Dynamic mixing of solvents is used to ensure the highest level of performance in gradient formation.

Convenience of Maintenance

Access for all maintenance is quick and simple without the requirement to dismantle the modular stack or gain access to the modules by removing covers. Piston back flushing is provided as standard to extend working life.

Systems Configuration

A series of chromatographic systems are offered covering the normal range of applications.

The flexibility of the design allows any system to be changed to a new configuration with the minimum of effort. A wide range of detectors is offered and ovens are available. Also the latest technology degasser is used for in-line degassing of solvents. The small volume of the degassing chamber reduces delivery times compared with other high volume degassers.

System Software

Systems may be controlled centrally by Cecil Instruments own PowerStream software. Using PowerStream, modules and complete systems may be controlled and results processed, manipulated, transferred or formatted as required.

PowerStream – System Manager

PowerStream is an entirely new chromatography management system developed by Cecil Instruments. Comprehensive data processing, spectral processing and full control of HPLC modules are provided.

PowerStream, developed to operate in Windows XP and Vista facilitates organisation of chromatography results and methods and provides digital control for a wide range of peripherals.

Operation is remarkably easy and help screens provide a complete operating guide.

Complete Flexibility

The complete range of chromatographic applications may be undertaken. Pumps may be fully programmed for any required gradient and the gradient profile may be overlaid on stored chromatograms for accurate mixture or flow adjustments. Mid elution wavelength control of the programmable UV detector is provided. Calibration curves, using any number of standards, may be computed and plotted for each component of interest and may subsequently be used to determine the concentration of unknown samples.

Comprehensive integration parameters are provided for accurate peak area and height calculations. Retention times for all peaks are tabulated.

Convenient Operation

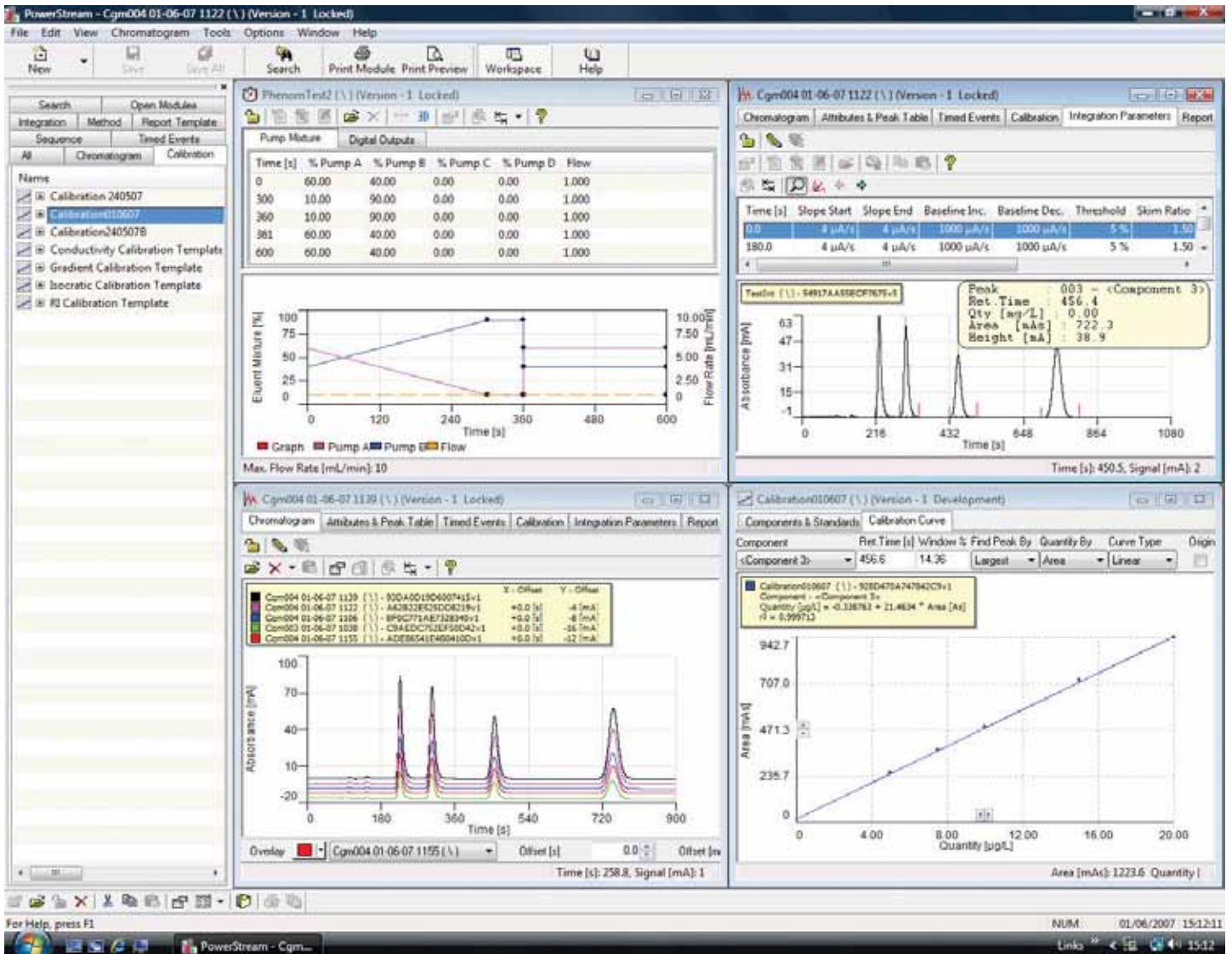
PowerStream is easy to use, with a fully interactive graphical interface and display providing full method development with customised parameters, data capture and manipulation of data and chromatograms. A video tutorial is included for clarity and rapid learning.

Method Operation

Method creation is simple and convenient. Firstly select the integration parameters, then all the hardware to be used for the experiment, and add any of the following parameters as required: Timed events, Integration parameters, Calibration curves and Reporting parameters.

Clear Screen Presentation

The clarity of screen presentation is illustrated by the composite display shown for a typical gradient elution.



ADEPT SYSTEM 1: Analytical Isocratic

This simple system is ideal for routine isocratic separations and quality assurance applications. High sensitivity is provided by the Adept CE 4201 UV-Visible variable wavelength detector with 8 μ L x 10mm flowcell. Precise delivery of the mobile phase is provided by the Adept CE 4100 dual piston high pressure solvent delivery pump which delivers flow rates from 0.001 to 10mL/min with a maximum operating pressure of 40MPa. The pump head is constructed with ceramic inserts to provide bio-compatibility.

The system may be upgraded to provide data processing and is supplied with column mounting panel and cover and Rheodyne injection valve with a 20 μ L loop, solvent and pipe organiser CE 4033, 8 μ L x 10mm flowcell and installation kit 4150 01 00.



ADEPT SYSTEM 2: Analytical Isocratic With Data Processing

This system uses the Adept CE 4100 dual piston pump and the Adept CE 4200 dual wavelength detector for added flexibility and is provided with PowerStream data processing software and interface unit, CE 4901.

PowerStream software, CE 4901, operates in Windows XP or Vista. It offers the same data processing power as the CE 4900 software but unlike the latter, offers no system control. The system is supplied complete with column and valve mounting panel, Rheodyne injection valve with 20 μ L loop, solvent and pipe organiser CE 4033, 8 μ L x 10mm cell and installation kit 4150 01 00.

ADEPT SYSTEM 3: Automatic Analytical Isocratic

Routine analysis of large numbers of samples may be carried out using this system which requires minimum operator attention. System control and data processing are provided by PowerStream software and interface CE 4900. The elegant, powerful and very easy to use software operates in Windows XP or Vista.

A choice of auto samplers accommodate 50 or 100 samples. The system, like all the Adept systems, uses the CE 4100 dual piston pump with delivery speeds from 0.001 to 10mL/min.

The CE 4200 dual wavelength detector has a very low noise level, less than $\pm 0.35 \times 10^{-5}A$ peak to peak and incredibly low drift $\pm 3 \times 10^{-5}A/h$ at temperature equilibrium. The $8\mu L \times 10mm$ flowcell, column panel and cover, solvent and pipe organiser CE 4033 and installation kit 4500 01 01 are provided.



ADEPT SYSTEM 4: Binary Gradient - High Pressure

Two Adept CE 4100 dual piston pumps, with flow rates from 0.001 to 10mL/min and a maximum operating pressure of 40MPa, are used with the dynamic mixer CE 4120.

The Adept dual wavelength UV-Visible detector CE 4200 is used with an $8\mu L \times 10mm$ flowcell. A column mounting panel, cover and Rheodyne valve with a $20\mu L$ loop are provided.

The software provides full system control and data processing using Windows XP or Vista. The system is supplied with solvent and pipe organiser CE 4033 and installation kit 4150 02 00.

This system offers the highest performance for binary gradient elution.

ADEPT SYSTEM 6: Automatic Binary Gradient – High Pressure

Two Adept CE 4100 pumps each deliver at flow rates of 0.001 to 10mL/min and are connected to a dynamic mixer CE 4120. The dual wavelength detector CE 4200, is stacked above the pumps.

The automatic sample injector CE 4800 which accommodates 50 samples completes the system, which is supplied with 8 μ L x 10mm flowcell and installation kit 4150 02 01.

The very high performance of the detector, with exceptionally low drift, provides a very stable system for extended measurements. Full system control and data processing are provided by the PowerStream system manager and software.



ADEPT SYSTEM R-1: Refractive Index

This system is ideal for use with compounds with low UV-visible absorption such as sugars, polymers, organic acids and triglycerides.

The CE 4700 differential refractive index detector with temperature control is highly stable and PowerStream software provides full data processing.

The Adept CE 4100 dual piston pump generates flow rates from 0.001 to 10mL/min at operating pressures up to 40MPa.

A Rheodyne injection valve with 20 μ L loop, column panel and cover, CE 4033 reservoir and pipe organiser and installation kit 4150 01 00 are supplied.

ADEPT SYSTEM C-1: Ion Chromatography

Ion chromatography or methods requiring a suppressor module are both possible. A full IonQuest, Ion Chromatography sales brochure is available on request.

The sensitive conductivity detector, CE 4710 with ranges from 0.01 μ S to 5000 μ S, houses the measuring cell in a thermostatted environment. The suppressor module CE 4715 is not provided, but is provided with System R-2 and System R-3.

Solvent delivery is by the CE 4100 dual piston pump. A Rheodyne injection valve is provided fitted with a 100 μ L loop. A CE 4601 heated three column oven is supplied, also a CE 4033 solvent bottle and pipe guide organiser.

For increased sensitivity a chemical suppressor module CE 4715 is available. The active element mounts within the column oven, together with its over-pressure protection valve.

Data processing and system control are provided by the CE 4900 interface and software. Installation kit 4150 05 00 is supplied with the system.



LOW PRESSURE GRADIENTS



Q-ADEPT SYSTEM Q-2: Binary - Low Pressure Gradient

This is a low pressure binary gradient forming system. It uses the CE 4100-2 dual piston pump with flow rates from 0.001 to 10mL/min and a maximum operating pressure of 40MPa. The pump has the facility for mixing two solvents for binary gradients and of course may be used in the isocratic mode.

The Adept CE 4200 dual wavelength detector is used with an 8 μ L x 10mm flowcell. The Rheodyne valve fitted with a 20 μ L loop is mounted with the column on the mounting panel CE 4050. The PowerStream chromatography system manager is mounted at the centre of the stack. Full control and data processing are provided for use with Windows XP or Vista.

A solvent reservoir and pipe organiser, CE 4034 and installation kit 4152 01 00 are also supplied.



Q-ADEPT SYSTEM Q-4: Quaternary - Low Pressure Gradient

This extremely popular quaternary low pressure gradient system is shown here with a Cecil column oven, which should be ordered extra if required. The CE4100-4 dual piston pump has flow rates from 0.001 to 10ml/min and a maximum operating pressure of 40MPa. The pump has all the facilities for gradient formation, with low pressure mixing of up to 4 solvents.

Four, proprietary, high performance, high reliability, proportioning valves are used to control up to four solvents and a high performance, low volume, dynamic mixer is used for ultimate gradient quality.

The Adept CE 4200 dual wavelength detector is used with an 8 μ L x 10mm flowcell. When an oven is not used the column may be mounted together with the valve on mounting panel CE 4050. The CE 4900 PowerStream chromatography system manager is placed at the centre of the very compact stack. Full control and data processing are provided for use in Windows XP or Vista.

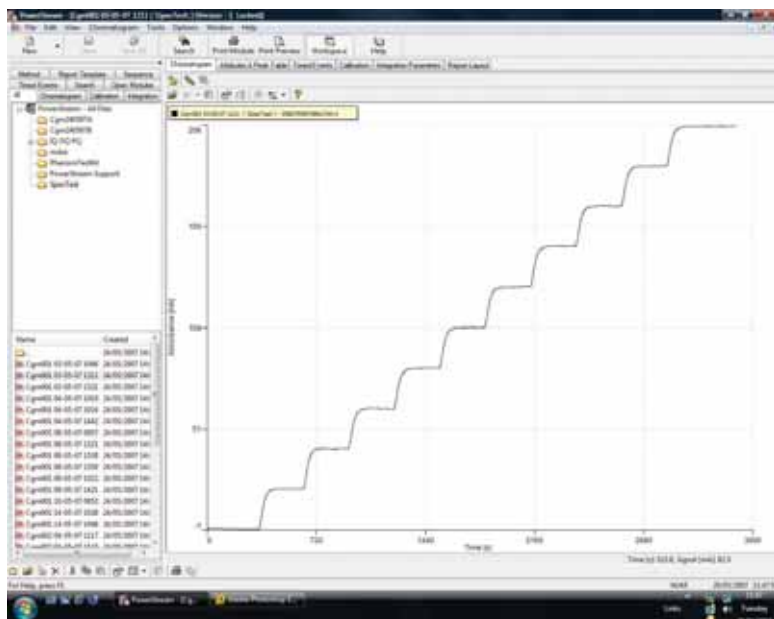
The system is supplied complete with solvent and pipe organiser, CE 4034, 8 μ L x 10mm flowcell and installation kit 4154 01 00.



Q-ADEPT SYSTEM Q-6: Automatic Quaternary - Low Pressure

This automatic version of system Q-4 is shown here.

The system is the same as system Q-4, but the injection valve is part of the autosampler to which it is fitted. Installation kit 4154 01 01 is supplied.



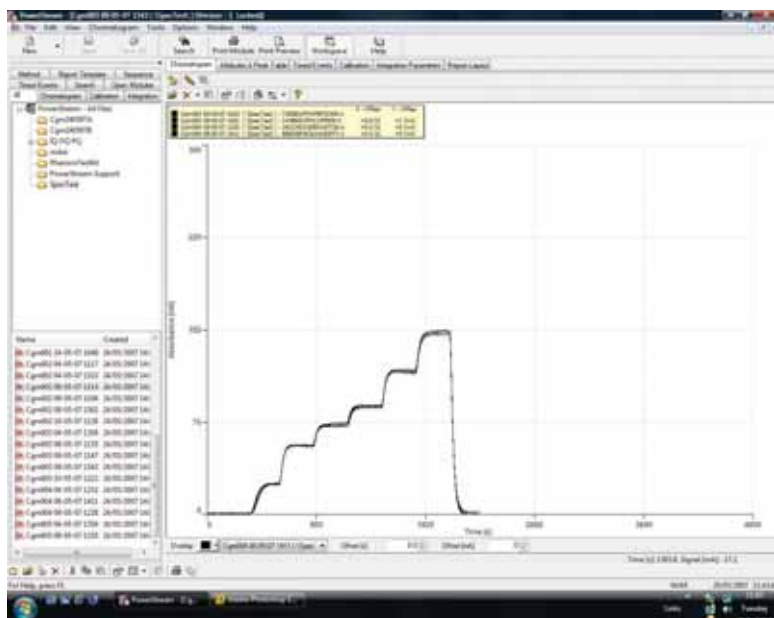
Accurate Gradient Formation

The quality of gradient formation by the Quaternary and Binary pump modules of the Q-Adept series is shown here.

The display shows a gradient formed in 10% steps, from 0-100%. The solvents used were 10% methanol in water and 0.1% acetone in 10% methanol in water. The measuring wavelength was 263nm.

The accuracy of the steps indicates the excellent performance of the low pressure mixing pump systems.

The display was produced by PowerStream software operating in Microsoft Vista.



Long Term Gradient Precision

The display of gradient steps shown is the result of overlapping 4 gradients generated over a period of 2 days.

The solvents used to form the gradient were 10% methanol in water and 0.6% acetone in 10% methanol in water, measured at 263nm.

The steps are 2, 2, 1, 1, 2, 2 % of acetone in water and shows the excellent reproducibility of results over an extended period.

The Advantages of WaveQuest

WaveQuest is a very advanced UV/Visible DAD detector, providing large time and cost savings over normal photodiode array detectors.

The ultra low drift of this detector compared with the very drift prone photo diode detectors means that only one detector – WaveQuest – is needed for both wavelength scanning and UV-Visible detection with the same stability as the best UV-Visible variable wavelength detectors.

Using it for both scanning and monitoring is therefore absolutely normal. Only one detector is needed for both tasks at the highest possible levels of performance. Spectral storage, library search of spectra and spectral match factors are all provided.

The second advantage, over normal photo diode array detectors, is that chromatograms may be both scanned and quantified at the same time, reducing the number of chromatography runs needed to one and not the usual two, thereby reducing experimental time by at least two.

INTEGRATION

Automatic Baseline

Manual Baseline

Drop Line

Sloping Baseline

Tangential Skimming

Exponential Skimming

Selectable Peak Detection

Sensitivity

HELP SCREENS

Complete Operating Guide

Q-ADEPT SYSTEM Q-4S : Method Development

This is the ideal system for sophisticated method development. The system offers power and flexibility and yet is compact and convenient to use.

The CE 4100-4 Quaternary pump is provided for low pressure mixing of up to 4 solvents. A dynamic mixer, built into the pump, provides excellent solvent mixing for reproducible gradients.

The Adept CE 4300 WaveQuest DAD fast scanning detector is supplied with an 8 μ L x 10mm flowcell and fitted with a mounting panel for the Rheodyne injection valve.

Peak purity, compound identification, match factors using library search and virtually drift free monitoring may be carried out using this excellent system on the same run as peaks are scanned and quantified simultaneously.

The PowerStream system controller is mounted at the centre of the stack and full control and data Processing are provided for use in Windows XP or Vista. A solvent and pipe organiser, CE 4034 and installation kit 4154 02 00 are provided.

The system is completed by the CE 4600 heated and cooled oven, which accommodates up to three columns.

System Q-4S

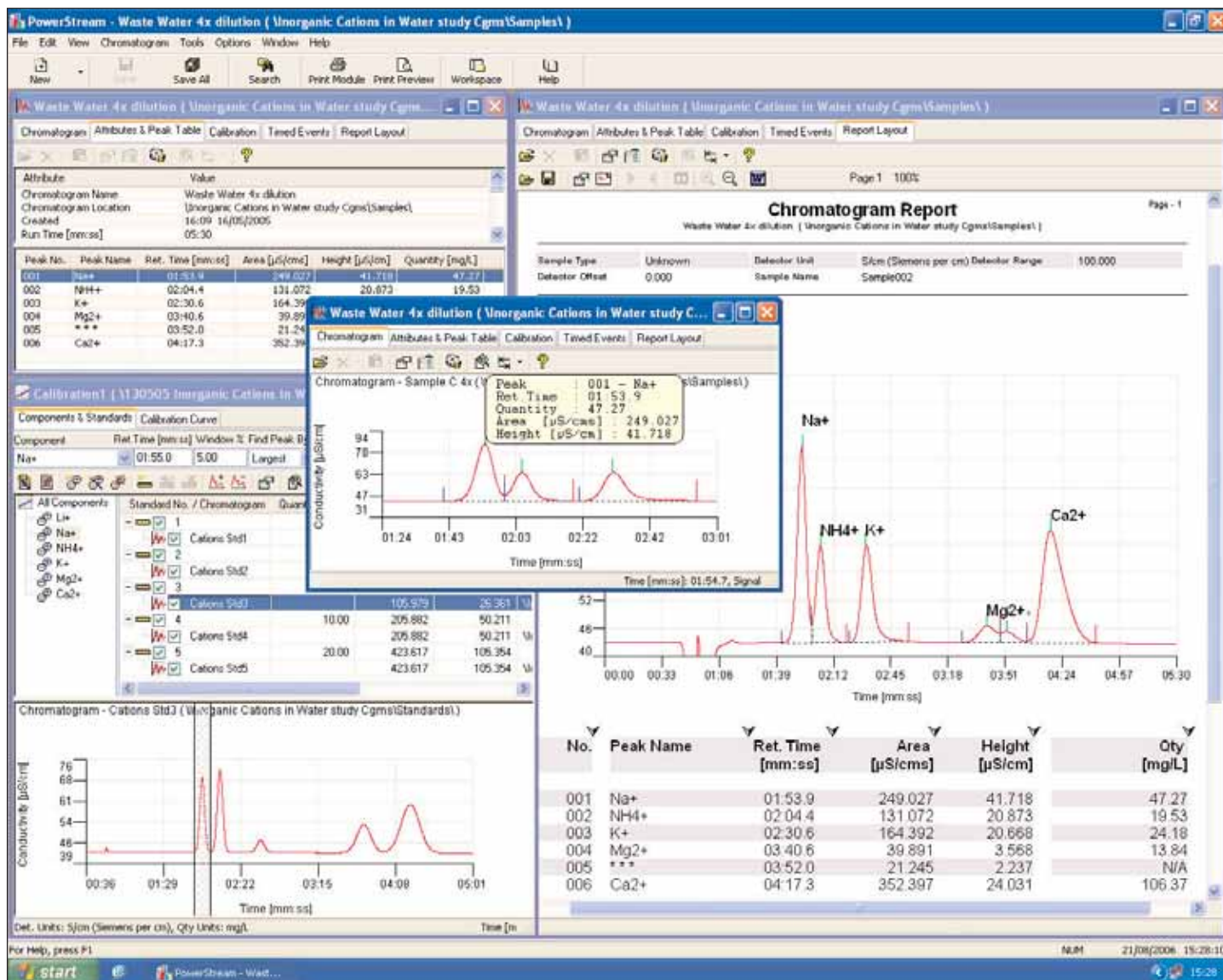
This is the system for sophisticated method development

- Q-Adept quaternary dual piston pump
- Rheodyne manual injection valve
- Column oven
- In-line vacuum degasser
- WaveQuest DAD for monitoring and spectral scanning of peaks
- Flowcell, 10mm pathlength 8 μ L volume

Chromatogram Presentation

The display shows a waste water cation analysis with a superimposed portion highlighting sodium. Detail and clarity are excellent and the software is both easy to use and sophisticated.

An interactive graphical display provides for method development, data capture and real time display of chromatograms during a run.





High-Pressure Pump: CE 4100

The Adept high-pressure pump is a dual piston design, as are the Q-Adept pumps. Stepper motor drive provides superb flow precision. Software drive compensation is used in all Cecil pumps to reduce pulsation to negligible levels, without the need for mechanical pulse damping.

Flow rates from 0.001 to 10mL/min are selectable in 0.001 steps at pressures up to 40MPa. Over and under pressure protection is provided.

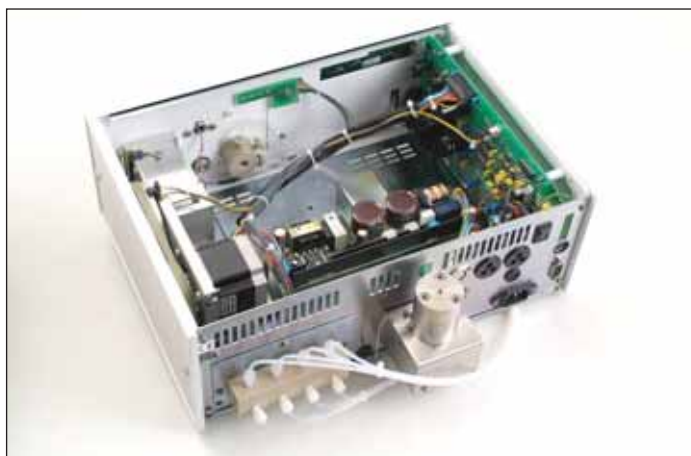
The pump heads have ceramic inserts for bio-compatibility with check valves of ruby and sapphire.



Binary Low Pressure Gradient Pump: CE 4100-2

Similar to the Q-Adept Quaternary pump, this pump has just two channels for low pressure mobile phase mixing. It may also be used for isocratic operation.

All pumps may be operated from their keypads and LCD screens or from a PC work station using the Cecil PowerStream software.



Quaternary Low Pressure Gradient Pump: CE 4100-4

The Q-Adept Quaternary pump is designed using all the years of experience of the Adept pumps, delivering mobile phase to the column at flowrates between 0.001 and 10mL/min at pressures up to 40MPa.

Quaternary low pressure mixing is provided by proprietary high speed mixing valves of proven performance and reliability. A dynamic mixer is used following the pre-mixing chamber for ultimate gradient performance. These all form part of the pump and are readily accessible without removing covers. The uncluttered design of the pump is shown here.



Semi-Preparative Pump: CE 4150

The dual piston pump has stepping motor drive like the analytical version.

The pump provides flow rates from 0.001 to 50mL/min at pressures up to 15MPa and the pump head is biocompatible.



Dual Wavelength UV Detector – CE 4200

The Adept CE 4200 is a detector of the highest specification and versatility, covering the range 190 to 700nm, with an optical bandwidth of approximately 8nm. Operation is by a keypad and 4 line LCD display of menus, prompts, parameters, wavelength, absorbance etc. It may also form part of any system controlled by PowerStream software.

Dual wavelength operation allows two wavelengths to be monitored simultaneously with their ratio also being available. Full programming using up to six wavelengths is also possible from the control panel.

Noise and drift performance are of the very highest order, $\pm 0.35 \times 10^{-5}A$ peak to peak, and $\pm 3 \times 10^{-5}A/h$ respectively, with straylight less than 0.02%. Up to 30 methods may be created and stored password protected, ensuring reproducible conditions when recalled. In stand-by mode an auto switch-on program saves operator time during warm-up.



Variable Wavelength UV Detector – CE 4201

The Adept CE 4201 detector is designed to monitor any single wavelength in the 190-700nm range. Optical bandwidth is approximately 8nm and stray light is less than 0.02%.

Calibration and test are automatic at switch-on. Software for validation procedures is available. Flowcells may be changed easily and without alignment adjustments and the Deuterium lamp is guaranteed for 1500 hours or 1 year, and is fitted with an hour counter.

Noise and drift performance are of a very high order. $< \pm 1 \times 10^{-5}A$ peak to peak and $< \pm 1 \times 10^{-4}A/h$ respectively. An automatic switch-on program is provided to save operator time during warm-up.

Refractive Index Detector – CE 4700

The Adept CE 4700 differential refractive index detector is suitable for compounds which show no active absorption in the UV region such as sugars or polymers. The highly stable detector is operated by a keypad and 2 x 16 character LCD display.

The flowcell is temperature controlled and drift and noise are both exceptionally low.

A built-in solenoid valve enables the reference cell to be conveniently flushed or filled. The unit is supplied with a column mounting panel and cover.

The signal output may be processed by PowerStream or connected to a recorder or integrator.



Conductivity Detector CE 4710

This entirely new design from Cecil Instruments provides exceptionally low noise and unrivalled baseline stability.

The conductivity cell has a volume of 0.5 μ L and is enclosed in a precisely thermostatted oven, which also houses a heat exchanger.





Fluorescence Detector CE 4500

The CE 4500 dual monochromator fluorescence detector is fully programmable, each monochromator covers the wavelength range 200-600nm and uses an adjustable frequency Xenon lamp for its source.

The wavelength range of the emission monochromator may be extended to 800nm by using a special photomultiplier.

The sensitivity is excellent and the module forms part of the normal system stack.



Electrochemical Detector CE 4702

This electrochemical detector is a new addition to the Cecil HPLC range. It has excellent performance and uses a glassy carbon active electrode to form part of a flowcell with a very low, 1.2 μ L, volume. Other active electrodes may be used.

The cell assembly is mounted in a Faraday cage, with easy access, to protect it from electromagnetic interference and its enclosure also protects it from temperature fluctuations.

PowerStream Interface – CE 4900

PowerStream is the powerful new chromatography software, developed by Cecil Instruments R & D, for HPLC system control and data processing. It is used in conjunction with DataStream software, also developed by Cecil Instruments, to provide data transfer and comprehensive display, processing and manipulation of spectral scans.

The PowerStream system manager interface unit, shown here, is designed as a space saving stackable module. The unit is supplied whenever CE 4900 PowerStream system control and data processing are required.

When system control is not required, PowerStream CE 4901 is provided, with an interface module without the control feature.



Auto-sample Injectors – CE 4800

A choice of autosampler is available for use with both Adept and Q-Adept systems.

The first, CE 4800-5, has a capacity of 50 samples and the second, CE 4800-1, a capacity of 100 samples.

These samplers can be seen in many of the photographs of automatic systems in this brochure.

A larger capacity sample changer is also available which accommodates 128 samples and a cooled option is available for temperatures down to 4°C.



Column Oven – Heated – CE 4601

The CE 4601 heated oven accommodates up to three columns and pre-columns with provision for pre-column heat exchanger to reduce column temperature gradients particularly at temperatures above 40°C.

The oven is heated by forced air circulation and is fitted with a leak detector system. The front opening door provides easy access to the columns. The temperature range of the oven is ambient to 85°C with a stability of $\pm 0.01^\circ\text{C}$.



Column Oven - Heated and Chilled – CE 4600

This oven is similar to the heated oven but is provided with thermoelectric cooling and heating for the columns over the range 5°C to 70°C. The lowest temperature is 12°C below ambient. Three columns and pre-columns may be accommodated.



Solvent Degassers

To enhance performance by reducing bubble formation two vacuum solvent degasser units are offered; the CE 4040 for up to four solvent lines and the CE 4020 for two channel operation. Each line can handle flows of 10mL/min and channels may be connected in parallel for increased flow rates.

Gas is removed to better than 1ppm at 1mL/min flow rate reducing baseline fluctuations and improving sensitivity. Solvents are only in contact with PTFE and inert materials, so the units are inert to HPLC solvents.



Solvent Reservoir and Pipe Organisers

The CE 4033 is a solvent organiser for three, one litre calibrated reservoirs and the CE 4034 shown here, is for four reservoirs for quaternary systems. They both fit neatly on top of the detector module and are fitted with a lifting handle and pipe guide to organise the pipes from the reservoirs. The units allow free access to the column, injector valve and flowcell.

Dynamic Mixers

Binary and Ternary dynamic mixers are available for gradient forming at pressures up to 40MPa. The CE 4120 and CE 4130 are for binary and ternary mixing respectively and are made from stainless steel and measure only 8cm x 10cm for convenient mounting on the detector.

For bio-compatibility mixers CE 4121 and CE 4131 are available in PEEK and operate up to pressures of 12MPa.

In the case of Quaternary and Binary low pressure gradient mixing systems, the dynamic mixer is part of the low pressure pump.





Universal UV/Visible Detector

WaveQuest the ultra fast scanning Dynamic Absorbance Detector (DAD) is a major advance in UV-visible detector design, offering time saving over a normal Photodiode Array (PDA) detector with greatly improved performance when used for chromatogram monitoring.

Very high speed scanning of eluting peaks, "on the fly", makes purity checks, the determination of optimum monitoring wavelengths for unfamiliar peaks (lambda max scans), and component identification of peaks using library spectra all possible, with considerable cost saving.

Ultra Fast Wavelength Scanning

WaveQuest - CE 4300, is a major advance in HPLC high speed scanning. This DAD, Dynamic Absorbance Detector, offers all the facilities of a standard Photo Diode Array detector with two advantages, vastly better drift performance for monitoring and more than half the time required to quantify and scan the peaks of a chromatographic elution. A UV scan may be made at 1000nm/s, taking only 200mS without peak degradation eliminating the need for a second elution.

Method development, purity determination, other R&D and Variable Wavelength Monitoring are possible to the highest quality.

Powerful signal processing software enables very high quality 'on-the-fly' scans to be triggered by eluting peaks without peak degradation. Eluting peaks may be integrated by PowerStream software at the same time as purity and identification is carried out.

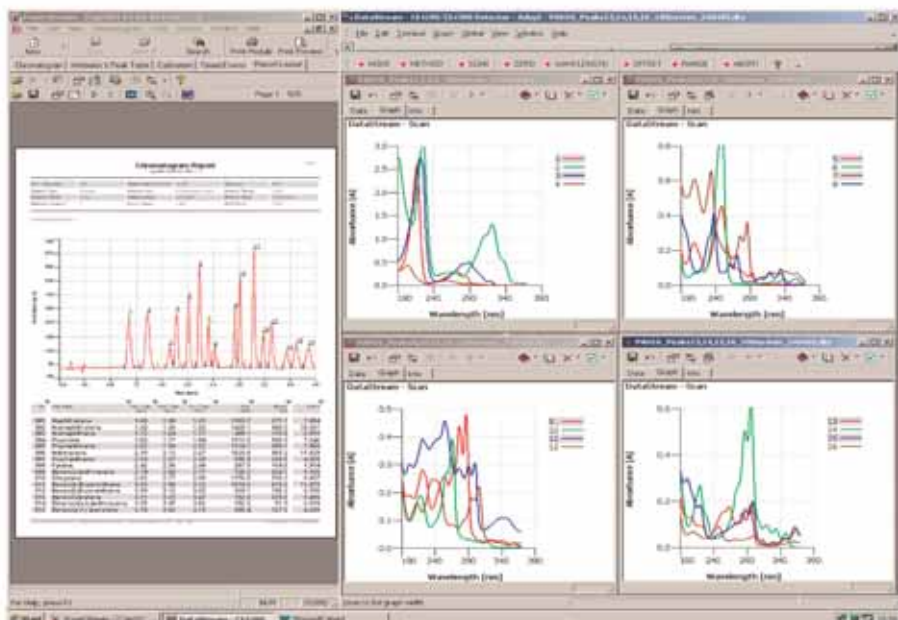
Spectral data is transferred by DataStream software to a PC workstation for spectral manipulation and processing. The software offers library facilities and the export of data. All data may be stored on disk.

One Detector Covers All UV Applications

A single beam Photodiode Array Detector (PDA), used for method development and other R & D, will often be replaced by a dual beam UV variable wavelength detector for routine monitoring, when the developed method is adopted, because of the poor drift performance of single beam PDA detectors. Their performance can be as much as 100 times worse. The Dynamic Absorbance Detector has a double beam optical system with very high all round performance and the lowest drift available.

The CE 4300 may therefore be used for method development, purity determination, etc. and also as a high performance UV detector for variable wavelength monitoring.

WaveQuest, which is less expensive than a PDA detector, therefore has a double cost advantage.



Fast Scans of Narrow Peaks

The ultra high speed scanning of the CE 4300 is shown. A very fast binary separation was carried out, on a Cecil gradient elution system 4S, of sixteen polyaromatic hydrocarbons, designated by the American Environmental Protection Agency as priority pollutants. The time for the elution was less than 4 minutes, using a 5cm column with a 3 micron packing.

Several of the peaks have widths at half height less than 1.5 seconds. The spectra of all peaks are displayed in real time and are shown here overlaid in groups of four.

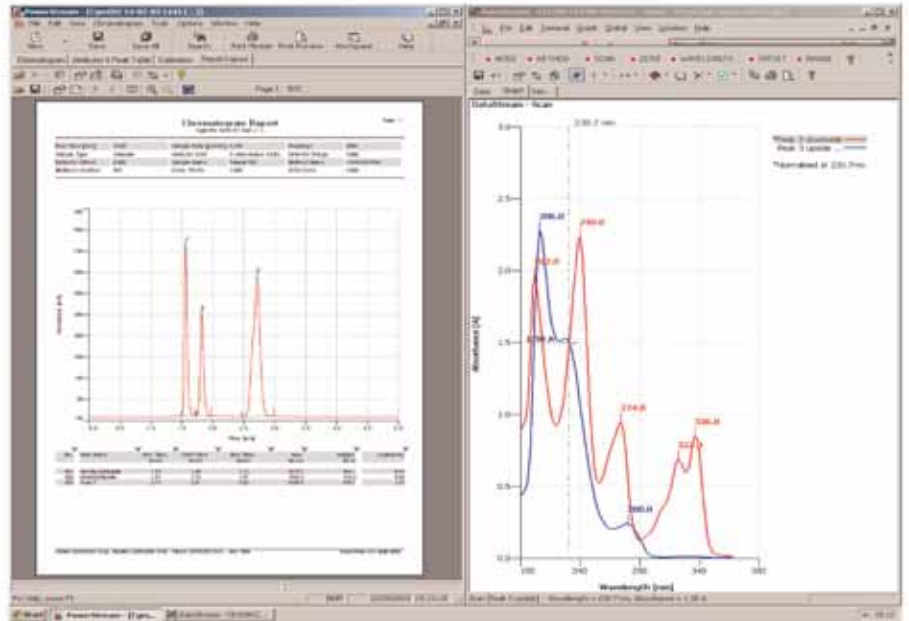
DRIFT FREE MONITORING

Peak Impurities Revealed

This chromatogram appears to be a three component mixture.

Purity checks were made with ultra fast "on-the-fly" scans on the ascending and descending sides of each peak. Peaks 1 and 2 gave identical spectral scans on each side, but peak 3 gave totally different spectra from its two sides indicating a major impurity producing the scan shown in red. Scans were compared by normalising and overlaying.

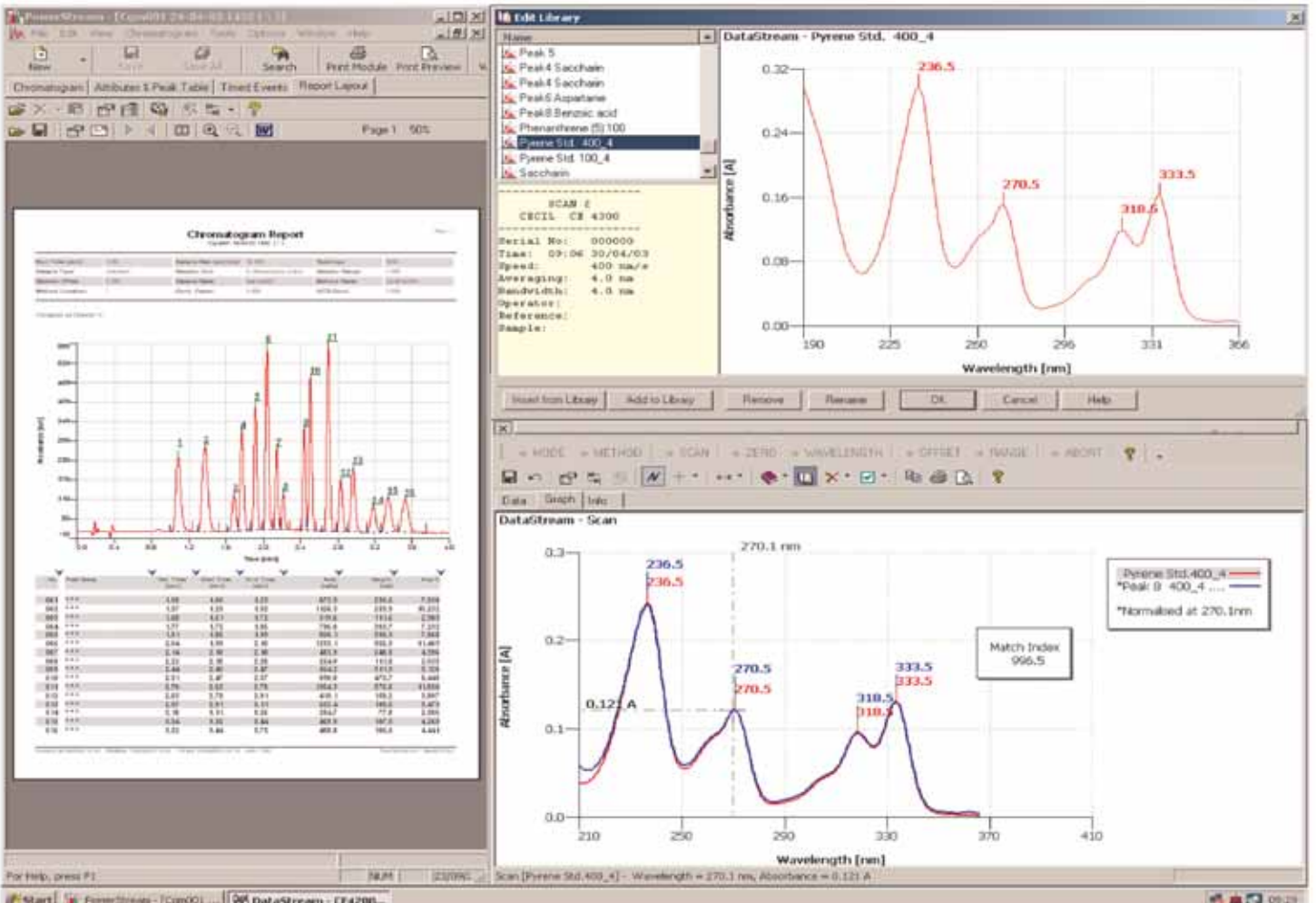
Despite the impurity, peak 3 appears visually symmetric and its calculated asymmetry factor was close to 1.00.

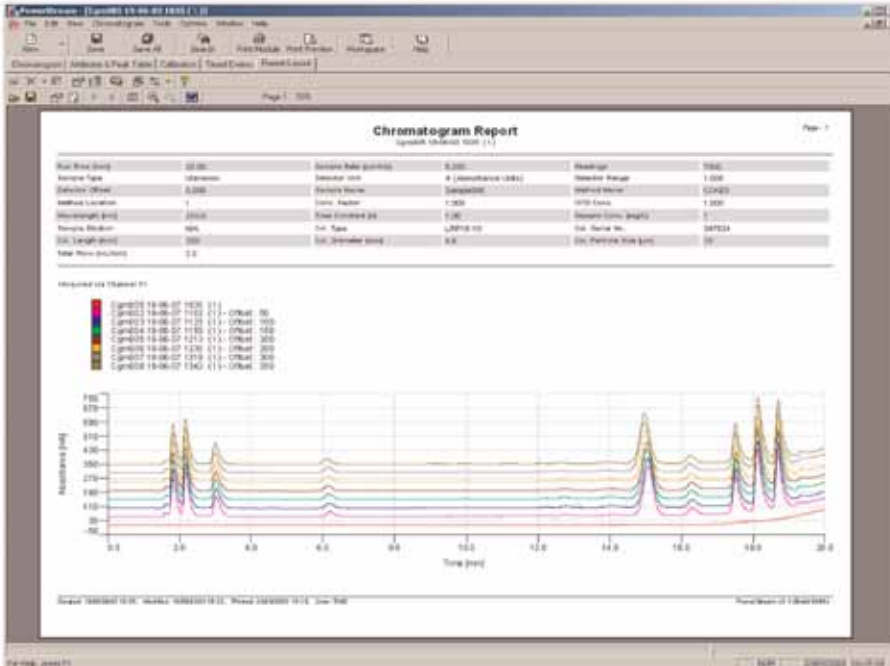


Compound Identification

The identity of the 16 peaks in the chromatogram shown was carried out by comparing the spectra with reference library spectra, which had been previously scanned and stored in the spectral library facility of the Adept System 4S used.

The spectrum from the reference library which matched the spectrum of peak 8, is shown and is then superimposed on the scan of peak 8. Clearly there is a close match and a programmed calculation of the match, or similarity, gave a match index of 996.5 as shown.





Simultaneous 4 Wavelength Monitoring

The traces shown here were obtained by monitoring four different wavelengths simultaneously for a ten minute period of an elution.

The experiment was carried out using a Cecil Adept System 4 with a WaveQuest, CE 4300, UV-Visible detector in its variable wavelength detector mode.

The very fast operating speed of the detector results in excellent quality peaks, captured in real time by DataStream, shown here in overlay.

This mode of operation is also available on the CE 4200 detector.

Component Summary			
Component - Caffeine			
Chromatogram Name	Sample ID	Ret. Time [min]	Area %
\\Cam008 19-06-07 1342	Sample008	18.13	18.482
\\Cgm007 19-06-07 1318	Sample007	18.12	18.617
\\Cam006 19-06-07 1236	Sample006	18.13	18.520
\\Cam005 19-06-07 1213	Sample005	18.13	18.469
\\Cam004 19-06-07 1150	Sample004	18.12	18.433
\\Cgm003 19-06-07 1125	Sample003	18.12	18.523
\\Cam002 19-06-07 1102	Sample002	18.11	18.451
Average		18.123	18.499
Std. Dev.		0.007	0.057
%RSD		0.04	0.33

Excellent Analytical Precision

The excellent precision of Adept Gradient System 4S, which uses the WaveQuest CE 4300 ultra fast scanning detector is demonstrated by seven repeat injections and elutions of a soft drink.

Each chromatogram is offset by 50mA. The phosphate buffer: methanol baseline was recorded first, and is shown on the plot.

The result for the component caffeine is shown in a summary report comment. This shows excellent reproducibility of 0.33% RSD.

Selecting Systems

The table shows a selection of the most popular systems which when ordered come complete with everything needed to make a fully working chromatographic system. Degasser units should be ordered separately.

The systems listed provide:

- All system modules
- Interconnection and power cables
- Pipes and tubing
- Solvent reservoir and pipe organiser
- Solvent bottles with drilled lids
- Standard flowcell
- Dynamic mixer
- Injection valve and loop (except automatic systems which have their own)
- Column and valve panel where appropriate
- Sample injection syringe
- Solvent inlet filter

Isocratic Systems

SYSTEM	TYPE	DETECTOR			AUTO SAMPLER		POWERSTREAM		PUMP CE4100
		VARIABLE λ	DUAL λ AND λ PROGRAM	D.A.D. λ SCANNING	50	100	DATA AND CONTROL	DATA ONLY	
1	Isocratic	●							●
2	Isocratic		●					●	●
2S	Isocratic, Scan			●			●		●
3	Isocratic, Auto		●		●		●		●
3S	Isocratic, Scan, Auto			●	●		●		●

Binary Gradient Systems

SYSTEM	TYPE	DETECTOR			AUTO SAMPLER		POWERSTREAM		2 X PUMP CE4100
		VARIABLE λ	DUAL λ AND λ PROGRAM	D.A.D. λ SCANNING	50	100	DATA AND CONTROL	DATA ONLY	
4	Binary		●				●		●
4S	Binary, Scan			●			●		●
6	Binary, Auto		●		●		●		●
6S	Binary, Scan, Auto			●	●		●		●

Q-Adept Quaternary Systems - Low Pressure Gradient

SYSTEM	TYPE	DETECTOR		AUTO SAMPLER		POWERSTREAM	PUMP CE4100-4
		DUAL λ AND λ PROGRAM	D.A.D. λ SCANNING	50	100		
Q-4	Quaternary	●				●	●
Q-4S	Quaternary, Scan		●			●	●
Q-6	Quaternary, Auto	●			●	●	●
Q-6S	Quaternary, Scan, Auto		●			●	●

Binary Systems - Low Pressure Gradient

SYSTEM	TYPE	DETECTOR		AUTO SAMPLER		POWERSTREAM	PUMP CE4100-2
		DUAL λ AND λ PROGRAM	D.A.D. λ SCANNING	50	100		
Q-2	Binary	●				●	●
Q-2S	Binary, Scan		●			●	●
Q-3	Binary, Auto	●			●	●	●
Q-3S	Binary, Scan, Auto		●			●	●

ION Chromatography Systems

SYSTEM	TYPE	CONDUCTIVITY DETECTOR	HEATED OVEN	POWERSTREAM	AUTO SAMPLER		SUPPRESSOR	PUMP CE4100
					50	100		
C-1	Manual	●	●	●				●
C-2	Manual, Suppressor	●	●	●			●	●
C-3	Suppressor, Auto	●	●	●	●		●	●

Refractive Index Systems

SYSTEM	TYPE	R1 DETECTOR	HEATED OVEN	POWERSTREAM DATA ONLY	AUTO SAMPLER		PUMP CE4100
					50	100	
R-1	Manual	●		●			●
R-2	Auto	●		●	●		●



System Modules and Components

All units are provided with mains cable, spare fuses and operating manual. All systems are supplied with connecting cables.

CE 4100	Solvent pump – high pressure, inert ceramic inserts	CE 4130	Dynamic mixer, s/s, high pressure ternary
CE 4100-2	Binary pump – low pressure gradients	CE 4131	Dynamic mixer, PEEK, high pressure ternary
CE 4100-4	Quaternary pump – low pressure gradient forming	CE 4020	Solvent degasser, two channels
CE 4200	UV detector, dual wavelength, programmable	CE 4040	Solvent degasser, four channels
CE 4201	UV variable wavelength detector	CE 4033	Solvent reservoir and pipe organiser, 3 solvents
CE 4300	Ultra fast wavelength scanning D A D	CE 4034	Solvent reservoir and pipe organiser, 4 solvents
CE 4500	Fluorescence detector, dual monochromator, scanning	CE 4050	Column panel, cover, Rheodyne valve, 20µL loop
CE 4600	Column oven, heated and chilled, for 3 columns	CE 4051	Column mounting panel and cover
CE 4601	Column oven, heated, for 3 columns	CE 4054	Rheodyne valve with mounting panel, 20µL loop
CE 4601C	Column oven, heated, for ion chromatography	CE 4715	Chemical suppressor, Anion background
CE 4700	Refractive index detector	1200 07 70	8µL x 10mm path length flow cell
CE 4710	Conductivity detector	1200 07 72	4µL x 10mm path length flow cell
CE 4720	Electrochemical detector	1200 07 74	12µL x 7mm pathlength flowcell
CE 4800-5	Auto-sampler with valve and 20µL loop - 50 vials	1200 07 71	30µL x 10mm pathlength flowcell
CE 4810-1	Auto-sampler with valve and 20µL loop - 100 vials	4150 01 00	Installation kit for isocratic systems
CE 4850	Fraction collector	4150 01 01	Installation kit for automatic isocratic systems
CE 4900	PowerStream software and interface	4150 02 00	Installation kit for high pressure binary gradient
CE 4901	PowerStream software and interface for data processing only	4150 02 01	Installation kit for automatic high pressure binary
CE 4120	Dynamic mixer, s/s high pressure binary	4152 01 00	Installation kit, low pressure binary systems
CE 4121	Dynamic mixer, PEEK, binary	4152 01 01	Installation kit, low pressure binary automatic
		4154 01 00	Installation kit, low pressure quaternary systems
		4154 01 01	Installation kit, low pressure quaternary automatic

Complete Systems

Systems may be ordered with a WaveQuest, CE 4300, ultra fast scanning detector in place of the CE 4200 Variable Wavelength Detector. To order a system place 'S' after the system number – e.g. Adept System 2S. Such systems are indicated in the 'choice' table.

Isocratic Systems

System 1 Analytical	CE 4100, CE 4201 with 8µL x 10mm flowcell, CE 4050 column mounting panel, Rheodyne valve with 20µL loop, CE 4033, installation kit 4150 01 00
System 2 Analytical with Data Processing	CE 4100, CE 4200 with 8µL x 10mm flowcell, CE 4901 PowerStream and interface, CE 4050 column panel and cover, Rheodyne valve with 20µL loop, CE 4033, installation kit 4150 01 00
System 3 Automatic Analytical	CE 4100, CE 4200, 8µL x 10mm flowcell, CE 4800, CE 4900 PowerStream and interface, CE 4051 column panel and cover, CE 4033, installation kit 4150 01 01

Gradient Systems

System 4 Binary Analytical	2 x CE 4100, CE 4200 with 8µL x 10mm flowcell, CE 4120, CE 4900 PowerStream and interface, CE 4050 column panel and cover, Rheodyne valve with 20µL loop, CE 4033, installation kit 4150 02 00
System 6 Automatic Binary	2 x CE 4100, CE 4200 with 8µL x 10mm flowcell, CE 4120, CE 4800-5, CE 4900 PowerStream, CE 4050 column panel, CE 4033, installation kit 4150 02 01

Ion Chromatography

System C-1 Ion Chromatography	CE 4100, CE 4710, CE4600, CE 4900 PowerStream, CE 4033, Rheodyne valve with 100µL loop, installation kit 4150 05 00
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Refractive Index

System R-1 Refractive Index – Isocratic	CE 4100, CE 4700 with divided flowcell, CE 4900 PowerStream and interface, CE 4050 column panel, cover and Rheodyne valve with 20µL loop, CE 4033, installation kit 4150 01 01
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Q-Adept Systems: Low Pressure Gradients

System Q-2 Binary	CE 4100-2, CE 4200, 8µL x 10mm flowcell, CE 4900 PowerStream and interface, CE 4050 column panel and cover, Rheodyne valve with 20µL loop, CE 4034, installation kit 4152 01 00
System Q-2S Binary/Scanning	CE 4100-2, CE 4300, 8µL x 10mm flowcell, CE 4900 PowerStream and interface, CE 4050 column panel and cover, Rheodyne valve with 20µL loop, CE 4034, installation kit 4152 01 00
System Q-3 Binary/Automatic	CE 4100-2, CE 4200, 8µL x 10mm flowcell, column panel and cover, CE 4900 PowerStream and interface, CE 4800-5 Autosampler with valve and 20µL loop, CE 4034, installation kit 4152 01 01
System Q-3S Binary/Scanning/Automatic	CE 4100-2, CE 4300, 8µL x 10mm flowcell, CE 4900 PowerStream and interface, CE 4050 column panel and cover, CE 4800-5 Autosampler with 20µL loop, CE 4034, installation kit 4154 02 01

Quaternary Low Pressure Gradients

System Q-4 Quaternary	CE 4100-4, CE 4200, 8µL x 10mm flowcell, CE 4900 PowerStream and interface, CE 4050 Column panel with cover, Rheodyne valve with 20µL loop, CE 4034, installation kit 4154 01 00
System Q-4S Quaternary/Scanning	CE 4100-4, CE 4300, 8µL x 10mm flowcell, CE 4900 PowerStream and interface, CE 4050 Column panel with cover, Rheodyne valve with 20µL loop, CE 4034, installation kit 4154 01 00
System Q-6 Quaternary/Automatic	CE 4100-4, CE 4200, 8µL x 10mm flowcell, column panel and cover, CE 4900 PowerStream and interface, CE 4800-5 Autosampler with valve and 20µL loop, CE 4034, installation kit 4154 01 01
System Q-6S Quaternary/Scanning/Automatic	CE 4100-4, CE 4300, 8µL x 10mm flowcell, column panel and cover, CE 4900 PowerStream and interface, CE 4800-1 Autosampler with valve and 20µL loop, CE 4034, installation kit 4154 01 01

SPECIFICATIONS



HPLC Pump CE 4100

Flow Rate	0.001 to 10mL/min in 0.001 steps
Flow Reproducibility	Better than 0.1%
Maximum Pressure	40MPa = 400 bar
User Interface	4 line back-lit display Full range of keys for menu and parameter selection Fast number entry keys
Over Pressure Cut-out	Adjustable between 3 and 40MPa
Low Pressure Cut-out	Adjustable between 0 and 40MPa
Material in contact with fluids	Ceramic inserts - biocompatible Check valves – ruby & sapphire
Pulsation	Better than $\pm 0.5\%$ at 2mL/min
Size & Weight	365 x 290 x 140mm, 7.5kg.
Power Requirements	115V or 230V, 50/60Hz, 40 Watt

Quaternary Low Pressure Pump CE 4100-4

Flow Rate	0.001 to 10mL/min in 0.001/min increments
Pressure Range	0-40MPa over flow range
Flow Accuracy	$< \pm 0.5\%$
Flow Precision	$< 0.1\%$ RSD
Pressure Pulsation	$< \pm 0.5\%$ at 2mL/min
Gradient Forming	Quaternary to Binary low pressure mixing and isocratic high pressure operation
Gradient Control	Using proprietary high-speed proportioning valves
Gradient Precision	Typically 0.2% RSD at 1mL/min
Material in contact with fluids	Ceramic inserts, ruby and sapphire check valves, PEEK

Binary Low Pressure Pump CE 4100-2

Gradient Forming	Binary gradient low pressure mixing and isocratic high pressure operation
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Other specifications as for the CE 4100-4

Dual Wavelength, Programmable UV Visible Detector CE 4200

All specifications as for the CE 4201 with the following advanced specifications

Noise	$\pm 0.35 \times 10^{-5}$ A at 230nm, 2s, using air test cell
Drift	$\pm 0.3 \times 10^{-4}$ A per hour at 230nm, 2s, using air test cell
Dual Wavelength Operation	Simultaneous measurements at 2 wavelengths. Output of absorbance ratio for the 2 wavelengths
Noise, Dual Wavelength	$\pm 2 \times 10^{-5}$ A peak to peak 230/280nm 1s time constant
Drift, Dual Wavelength	$\pm 1 \times 10^{-5}$ A/hour at constant temperature
Programmed Operation	Programs may be entered to change parameters, operating modes and select up to 6 different wavelengths in any time sequence.
Printer Output	Parallel printer port

UV-Visible Detector CE 4201

Optical System	Double beam with 1200 line/mm grating monochromator
Wavelength Range	190-700nm
Wavelength Accuracy	± 1 nm
Wavelength Precision	± 0.1 nm, single wavelength mode
Optical Bandwidth	8nm
Straylight	$< .02\%$, at 220nm
Lamp	Deuterium lamp with elapsed time indicator
Absorbance Range	0.001 to 2A full scale in 11 ranges
Time Constant	0.1, 0.2, 0.5, 1, 2, 5 and 10 seconds
Display	Four-line display of parameters, menus, prompts, wavelength, absorbance etc.
Fast Number Entry	By use of special number keys

Event Marking	From keypad or by external source
Method Storage	For up to 30 methods, security protected
Second Order Filter	Fast automatic insertion at 370nm
Noise	$\pm 1 \times 10^{-5}$ A peak to peak, 220nm, 2s time constant
Drift	$\pm 1 \times 10^{-4}$ A/hour at constant temperature
Linearity	Better than 1%, 0.001 – 2A
Automatic Power-up/off	Pre-programmed from keypad to save warm up time
Sample Flow Cell	8 μ L x 10mm pathlength Wetted surfaces PEEK, Teflon and Fused Silica Other cells available
Refractive Index Sensitivity	$< \pm 5 \times 10^{-4}$ A, water to methanol at 350nm
Flow Rate Sensitivity	$< \pm 3.5 \times 10^{-3}$ A, for flow change 1-2mL/min, 300nm
Outputs	Two absorbance outputs and absorbance ratio to recorder. All data available to PowerStream System Manager.
Inputs	Event, autozero
Size and Weight	365 x 290 x 140mm, 17kg
Power Requirements	115V or 230V, 50/60Hz, 50VA

D.A.D. Ultra Fast Scanning Detector – CE 4300

Optical System	Double beam
Monochromator	With 1200 Line/mm holographic grating
Wavelength Range	190-700nm
Optical Bandwidth	4nm
Digital Resolution	1nm
Wavelength Accuracy	1nm
Wavelength Reproducibility	0.1nm
Absorbance Range	0 to 3A
Sample Flowcell	8 μ L x 10mm pathlength
Scan Speeds	Up to 1000nm/s
Baseline Flatness	± 0.002 A over most of range
Straylight	$< 0.02\%$ at 220nm and 340nm
Noise	$< \pm 0.5 \times 10^{-4}$ A at 230nm, 2s air test cell
Drift	$< \pm 0.5 \times 10^{-4}$ A at 230nm, using air test cell
Calibration and Test	Automatic at switch-on
Display	Four line display of parameters, menus, prompts, wavelength, absorbance etc.
Number of Peak Scans	Up to 100 peaks for any single elution
Multiple Scans of a Peak	Up to 8 scans of any peak
Scan Trigger	At start, set absorbance value, point of inflection or at maximum
Scan Storage	Up to 100, password protected, unlimited with PowerStream
Method Storage	Up to 30 methods, password protected
Size	365 x 290 x 140mm, 17kg
Power Requirement	115V or 230V, 50/60Hz, 50 Watt

Refractive Index Detector CE 4700

Measuring Ranges	$\pm 10^{-4}$ Δn
Sensitivity	8×10^{-8} Δn
Noise	8×10^{-8} Δn
Time constants	0.1, 0.2, 0.5, 1, 2, 5, 10 seconds
Cell volume	9 μ L
Outputs	-1V to +1V, 20 bit resolution
Size and weight	360 x 140 x 260mm, 9.5kg
Power requirements	100-250V, 50/60Hz, 60 Watt

Fluorescence Detector Dual Monochromator CE 4500

Light Source	10W Xenon flash lamp, frequency programmable
Detector	Photomultiplier
Excitation Monochromator	200-650nm
Emission Monochromator	200-800nm, with extended range photomultiplier
Wavelength Scanning	Excitation and emission independently programmable
Sensitivity	S/N > 3000 for 4 μ g/L anthracene in methanol
Analogue Outputs	10mV, 100mV and 1V
Power Requirements	100/240V, 50/60Hz

SPECIFICATIONS



Conductivity Detector CE 4710

Conductance Display Range	0.01 – 5000µS/cm
Time Constant	0.1, 0.2, 0.5, 1, 1.5, 2, 5s
Autozero Range	Typically up to 10,000µS/cm
Synchronous Detection Frequency	5kHz
Noise	Less than ±1nS/cm, DI water, 1mL/min, 2s
Drift	Less than ±10nS/cm/h, DI water, 1mL/min,
Cell Volume	0.5µL
Cell Body	PEEK P1000 grade
Electrodes	316 stainless steel
Cell Pressure Rating	200psi
Operating Temperature	25 – 50°C; 35°C standard
Temperature Precision	± 0.01°C
Warm-up Time	10 minutes typical
Method Storage	Up to 100 with password protection
Outputs	0-1V analogue and RS232
Digital Control	By PowerStream software

Electrochemical Detector – CE 4720

Measuring Range	0.02 – 50nA full scale
Offset Compensation	±200nA
Time Constant	0.5, 1, 2 and 5s
Cell Volume	1.5µL standard

Cooled and Heated Oven – CE 4600

Temperature Range	5°C to 70°C (maximum 12°C below ambient)
Temperature and Set Point Readout	3 digit, bright LED display
Temperature Readout Resolution	0.1°C
Temperature Stability	± 0.01°C
Number of Columns	3 up to 25cm long with pre-columns accommodated
Heating Rate	30 mins to 60°C set point (ambient 25°C)
Stabilising Time	Negligible when set point reached
Leak Detection	Vapour detector – adjustable shut down level
Power Requirement	50 Watts, 100-250 V, 50/60Hz.
Size and Weight	390H x 118W x 220D 6.4kg.

Heated Oven – CE 4601

Temperature Range	Ambient to 85°C
Temperature and Set Point Readout	3 digit bright LED display
Temperature Readout Resolution	0.1°C
Temperature Stability	± 0.01°C
Number of Columns	3 up to 25cm long with pre-columns
Heating Rate	30 mins to set point of 65°C (ambient 25°C)
Stabilising Time	Negligible when set point reached
Leak Detection	Vapour detector – adjustable shut down level
Power Requirement	50 Watts, 100-250 V, 50/60Hz.
Size and Weight	390H x 118W x 220D 5.8kg.

Heated Ion Chromatography Oven – CE 4601C

As CE 4601 oven with:

Columns	Provision for 2 ion chromatography columns and pre-columns
Suppressor Module	Provision to accommodate suppressor module
Over Pressure Valve	Provision to accommodate pressure release valve, to protect suppressor module

Solvent Degassers CE 4020 / CE 4040

Number of flow channels	4 (CE4040), 2 (CE 4020)
Maximum Flowrate	10mL/min
Materials Contacting Solvents	PEEK, glass filled PTFE, Teflon AF
Gas removal	To better than 1ppm at 1mL/min

Workstation Computer Specification



System Requirements

- Personal Computer with Pentium class processor
- Pentium 1GHz or higher
- Microsoft Windows XP or Vista
- 512 MB of RAM or more
- Hard-disk space required: 150 MB
- CD-ROM drive
- Monitor resolution 1024 x 768 or better
- Microsoft Mouse or compatible pointing device
- Free RS232 serial connection or serial to USB converter

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

