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168 Diode Array & 166 Programmable Detector Modules



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System Gold® Detectors

Beckman 166 and 168 Detector Modules address all of your ultra violet / visible (UV/VIS) detection needs. For extremely high sensitivity analyses, choose the model 166 Programmable Wavelength Module. For analyses that require multi-wavelength detection, characterization of spectra and/or peak purity determination, choose the model 168 Diode Array Detector Module.

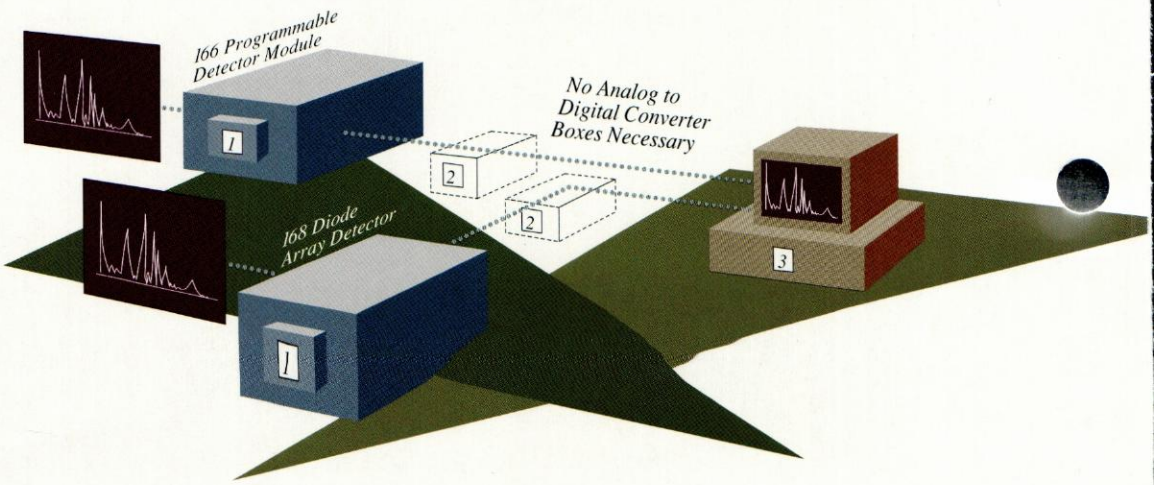
- Detectors output digital data directly to the PC.
- Analog to Digital (A/D) boxes are unnecessary, eliminating the need to validate additional hardware.
- Automatic control of your fraction collector.
- Choice of flow cells – for any application.
- Pre-aligned lamps for optimal detector response.
- Built-in diagnostics.
- Operates with Gold Software for data collection and analysis.
- The Beckman Plus - Applications Assistance, Training, Field Service Support and Support for Regulatory Compliance.

Accurate Chromatographic Data

1. System Gold Detector absorbance readings are directly output in a digital format.

2. Because communication is direct between the computer and module, expensive A/D boxes are unnecessary.

3. Data is displayed in true absorbance units and stored directly to the hard disk drive.

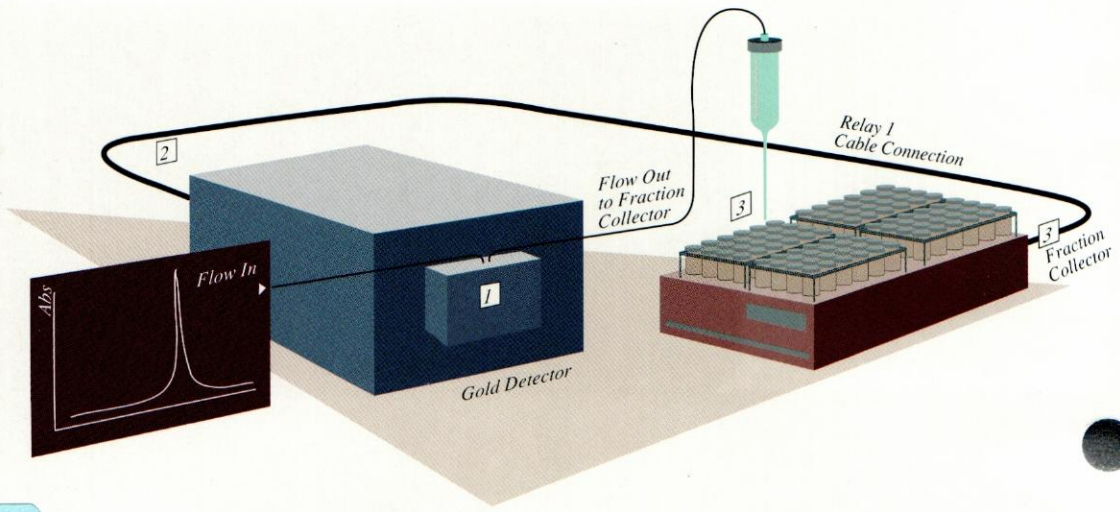


Automated Fraction Collection

1. As the peak is detected inside the flow cell, a relay in the detector closes.

2. Because the relay signal will reach the fraction collector faster than the sample, the detector delays the signal by a specified amount.

3. The arrival of the delayed relay signal coincides with the sample at the fraction collector. The fraction collector switches to a new tube and collects the sample.



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The 166 Programmable Wavelength Detector

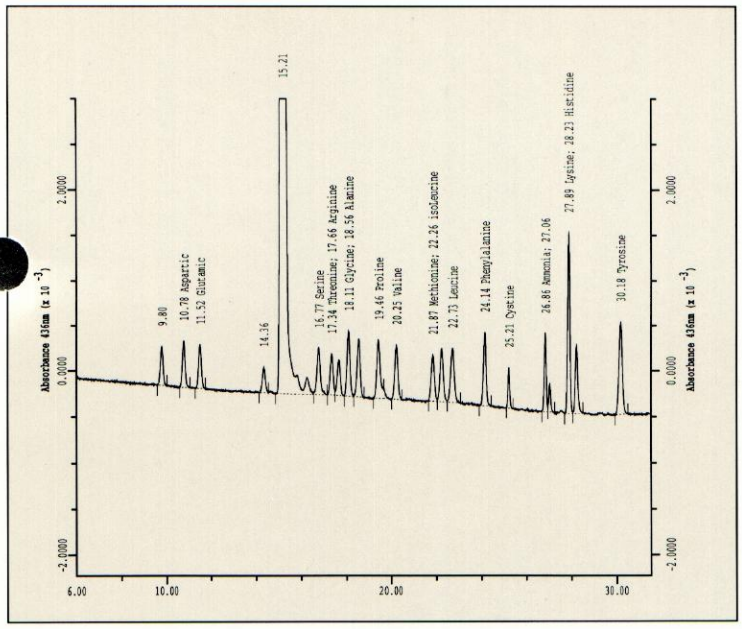
For the highest sensitivity over a wide wavelength range, the l66 is the detector of choice. A unique monochromator and flow cell design help enhance signal to noise levels. As a result you will be able to detect compounds at even lower concentration levels than conventional UV detectors.

Spanning a l90 nm to 700 nm wavelength range, the 166 covers all routine applications. Besides programmable wavelength control, other programmable features include auto zero, alarm and lamp shut off. For applications requiring high sensitivity at visible wavelengths, there's an optional tungsten lamp.

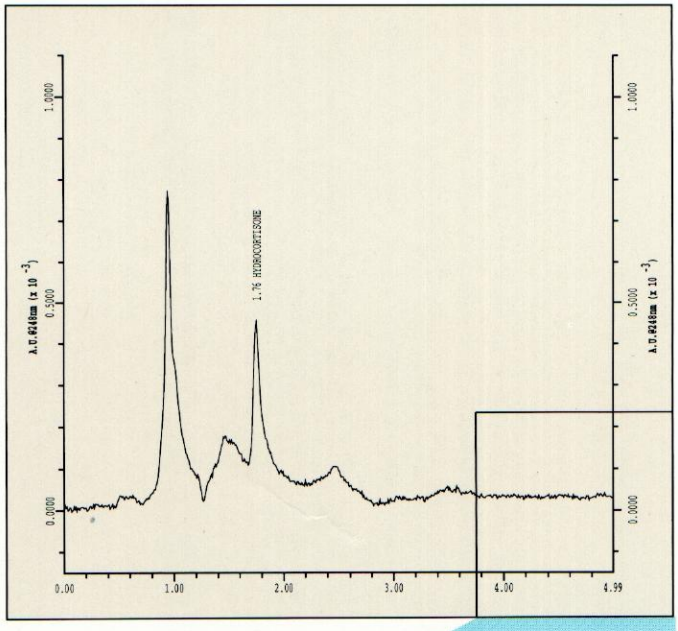
Easy access makes exchanging flow cells quick and simple. And the variety of flow cells – micro, analytical, semi-preparative and preparative – lets you adapt to many different modes of separation. Analog output is available with or without peak detect marks.

The Beckman 166 Programmable Wavelength Detector offers the best cost/performance ratio available in HPLC detection.

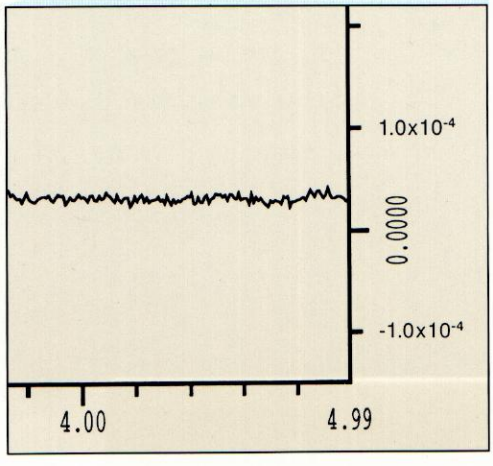
Unsurpassed Sensitivity at Any Wavelength



DABS amino acid chromatogram (10 picomoles of each amino acid), demonstrating the high sensitivity achieved when using the 166 detector with a visible lamp at 436 nm.



Hydrocortisone sample (1.5 picomoles), demonstrating the high sensitivity achieved when using the 166 detector with a UV lamp at 248 nm.



Typical 166 short-term noise is less than 2 x 10^{-5} AU peak-to-peak with flowing methanol at 1 ml/min (between 220 nm to 280 nm).

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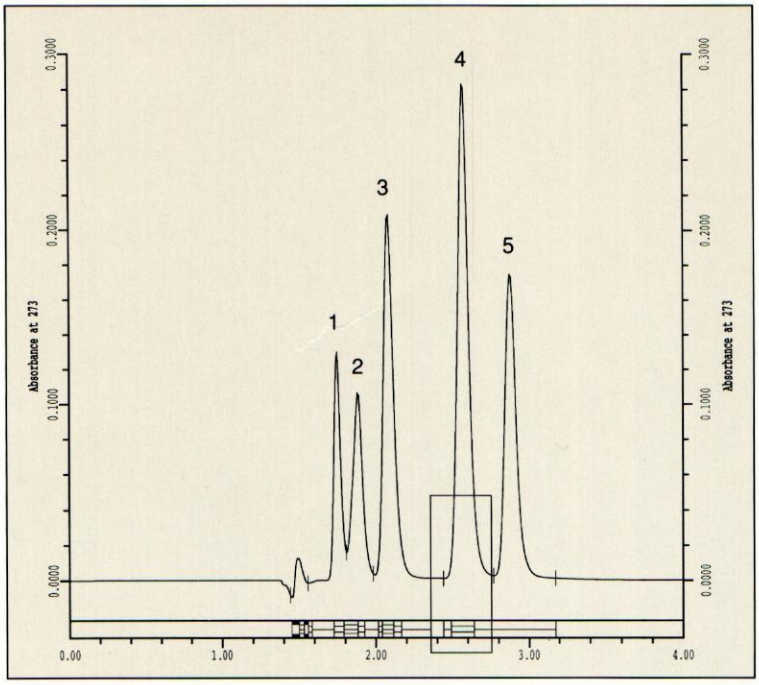
The 168 Diode Array Detector

Designed for applications involving co-eluting components, the 168 features a powerful Real Time Purity (RTP) algorithm. RTP constantly examines a moving window of spectra, looking for differential changes in spectral absorbance over time. This information is communicated to the user through easy-to-read purity bars – one bar indicating a single eluting component, two bars for two components and three bars indicating three components.

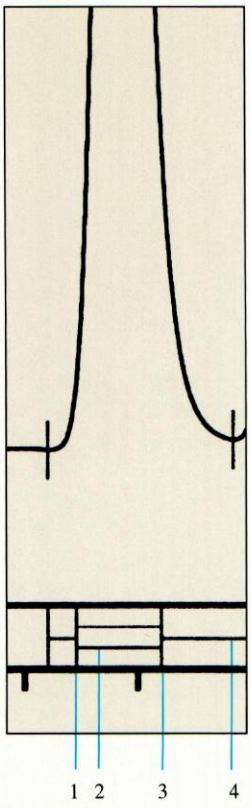
Three microprocessors and powerful firmware are used in the 168 to process and analyze data from the 512 element array. RTP requires power this substantial to execute the 4000+ calculations per second necessary to make purity determinations. Because the algorithm for these demanding RTP calculations is designed into the detector, the PC is not burdened with making purity determinations– a quality unique to this advanced 168 detector. Now, you're more productive, because your computer is free to operate a second system,* reprocess chromatograms or execute a host of other chromatographic functions.

In addition to the powerful electronics within the 168, lamp changes can be made in a snap on the slide out optical bench; there's no need to unstack all your modules. The flow cell and cuvette reader can also be quickly accessed from the front of the detector.

Chromatogram with RTP Bars



Nine caffeine metabolites co-eluting as five peaks. A quick look at the real time purity bars below the peaks, indicates that co-elution clearly occurs in the first, second, third and fourth peaks, while the last peak is pure.



A Closer Inspection of the Purity Bars Beneath Peak 4

1) *First component begins eluting (peak start).*
2) *Second component begins co-eluting with first.*
3) *First component exits flow cell.*
4) *Second component exits flow cell (peak end).*

** See technical specifications.*

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Multi-Channel Versatility

The 168 functions as a dual-channel, multi-wavelength detector with scanning capabilities. A reference channel with adjustable bandwidth is available to compensate for abnormalities in mobile phase background or to minimize interference from extraneous peaks. A built-in peak detect channel provides three different features: it triggers the fraction collector interface, controls the "eyes" of the RTP algorithm and identifies information-rich areas of the chromatogram for selective scan saving.

Time	Channel A		Channel B		Reference		Peak Detect				
	Wave-lnth	Band-width	Wave-lnth	Band-width	Wave-lnth	Band-width	Wave-lnth	Band-width	Thres-hold	Peak Width	Relay 1
-INIT-	273	16	255	100	440	40	255	100	0.0030	0.133	-
1.55									0.0030		
1.70											
2.00	■										
2.40											
10.00											

168 time programming screen showing four independent wavelength channels.

- *Channel A Detection*
- *Channel B Detection*
- *Reference Channel*
- *Peak Detect Channel*

Highest Spectral Resolution & Flexible Data Collection

512 diodes provide the highest spectral resolution available – 1 nm/diode – across the entire UV/VIS wavelength range.

And to provide the most flexible data collection, the 168 incorporates five different scan-saving modes – apex, purity, resolution, fixed rate and save scan on impurity. While most diode array detectors collect unnecessary baseline data that can quickly fill a typical hard disk drive, the 168 allows you to collect data only where there is relevant sample information. Because scans can be saved based on the peak detect channel you can choose to save scans on the peak apex (one scan per peak), the upslope, apex and downslope (three scans per peak) or at a fixed rate from peak start to peak end (multiple scans per peak). Even where a peak is found to be impure. Additionally, fixed rate scanning can be employed for unknown samples.

You can also view spectra in real time without collecting them. And you can do so while simultaneously viewing your chromatographic run. This display can be appropriately scaled any time during the run.

Time	Save Scan Control						Auto Zero	Stop Data	Lamp	End	Alarm
	Scan Mode	Scan On Impurity	Wavelength From	Wavelength To	Intr-val	Dur.					
-INIT-	-	-	-	-	-	-	YES	-	-	-	-
1.55	A		200	300	1	0.25					■
1.70	P										
2.00	R										
2.40	2	ON	200	360		5.00					
10.00										YES	

168 time programming screen demonstrating flexible scan saving.

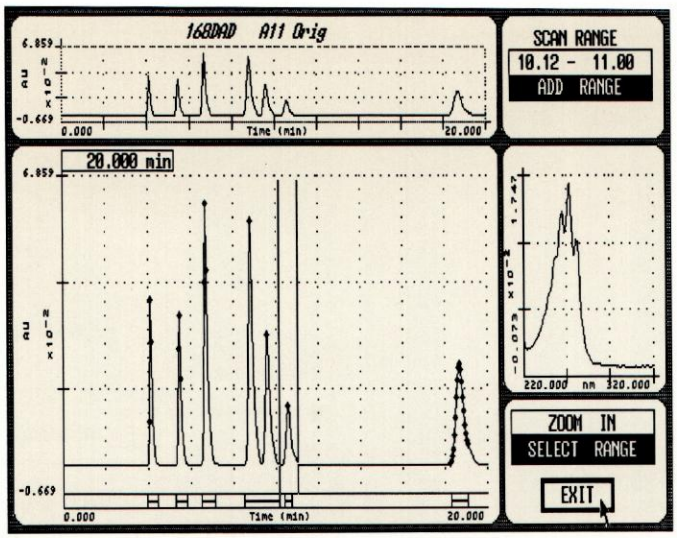
- *Scan-save mode (e.g. A=apex scan mode)*
- *Wavelength range for scan-saving*
- *Interval setting for spectral resolution (up to 1 nm/diode)*
- *Scan save duration*

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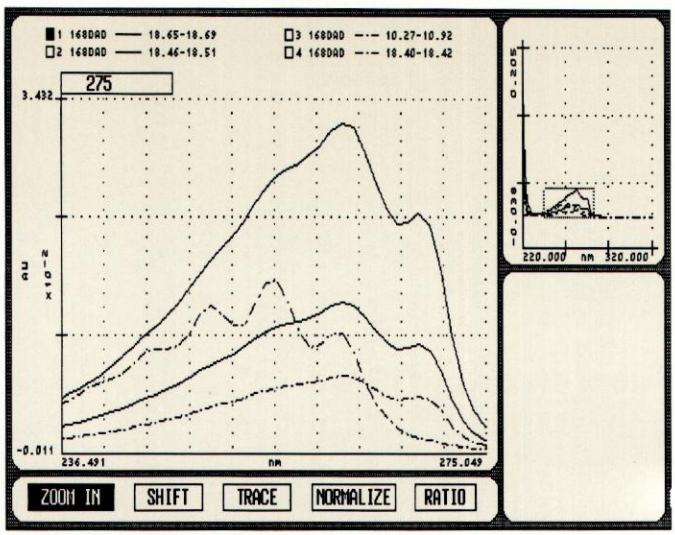
Scan Graphics
Viewing & Analysis

Scan Graphics lets you efficiently view, analyze and compare spectral data. Whether it's the first or fifth derivative, or correlation coefficients, you can confirm peak purity in a variety of ways.

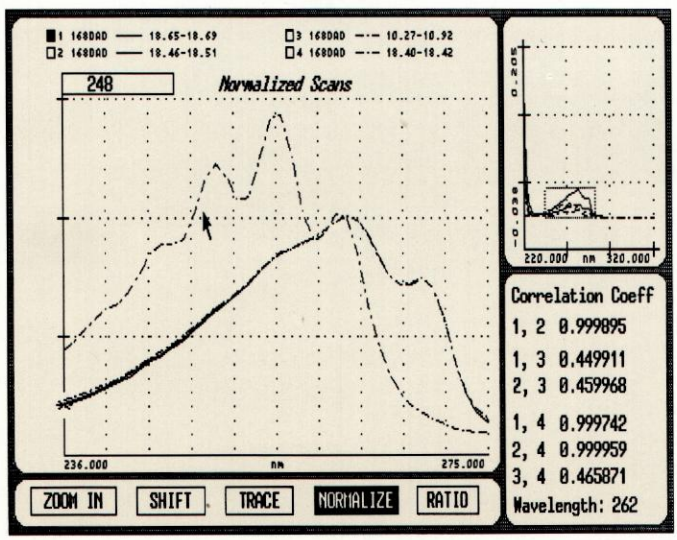
Multiple spectra can be compared, then normalized to correct for concentration differences. Spectra can also be subtracted to eliminate interfering mobile phase absorbance. Even absorbance maximas and absorbance ratios can be determined. As shown in the following graphs, the way in which spectra are selected for viewing is uniquely simple with Scan Graphics.



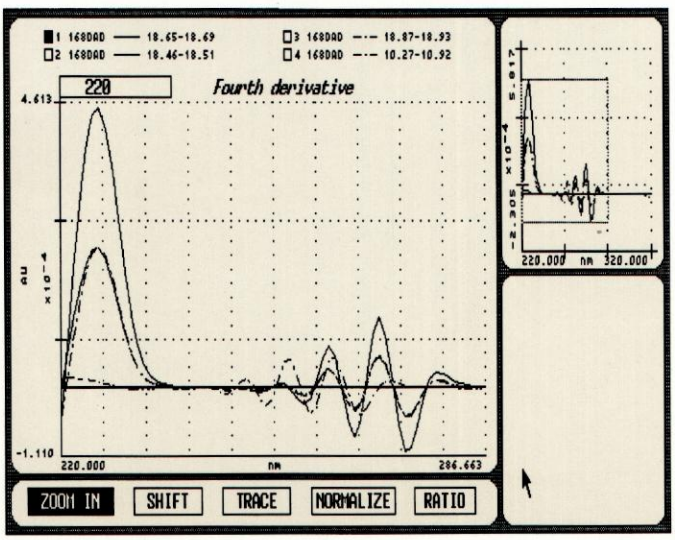
Each spectrum is represented by a dot on the chromatogram. A range of spectra is selected for display. Up to eight spectra can be placed in the Scan Graphics clipboard.



Any one of up to four spectra in the clipboard can be viewed for comparison.



Normalization corrects for concentration differences in spectra.



Derivatives can help confirm purity information obtained from the Real Time Purity (RTP) Algorithm.

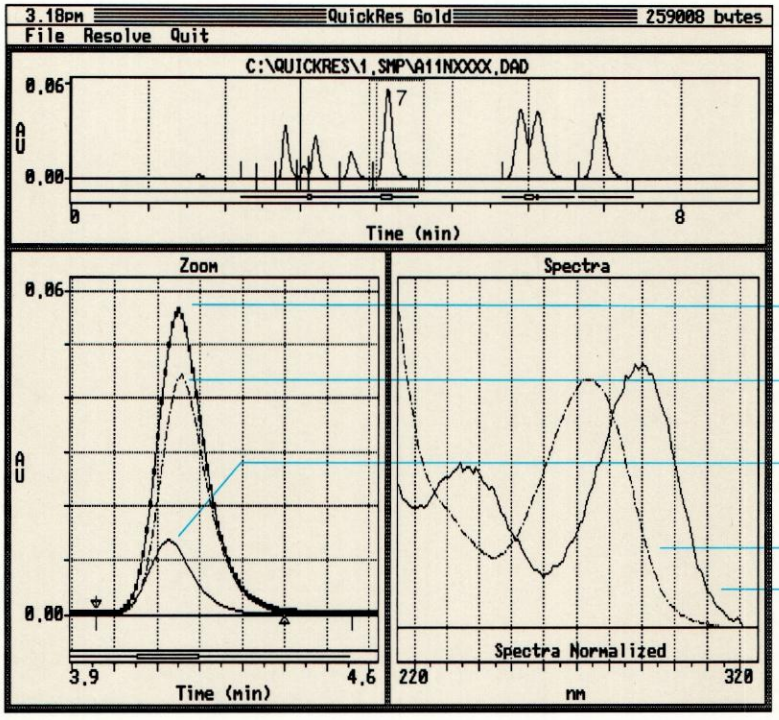
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QuickRes

Using logic similar to the RTP algorithm, the QuickRes Gold Software option works with the 168 to further analyze co-eluting components. You not only get a quantitative read on the relative peak areas, but also the spectra for each of the two un-resolved components. This saves time in the methods development lab, since it reveals the effects of mobile phase composition on the elution order of co-eluting peaks. And aids in identifying which components are hidden in the composite peak. For the quality control lab, this means QuickRes Gold can offer the benefit of faster contaminant identification.

QuickRes Resolved Spectra of Peak #7 Components



Composite chromatogram (Component A and Component B)

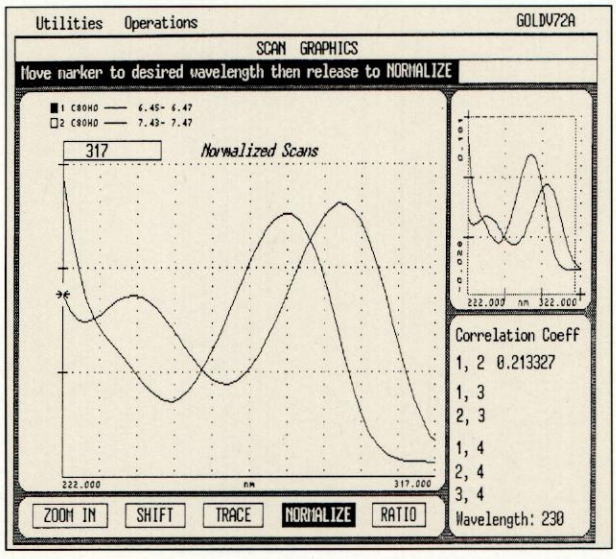
Component A (resolved by QuickRes Gold)

Component B (resolved by QuickRes Gold)

Resolved Spectra (Component A)

Resolved Spectra (Component B)

Scan Graphics Screen Showing the Actual Spectra for Each Component Present in Peak #7



		NAME	CHAN	LEV	REP	TYPE	DIRECTORY
COLLECTION	DATA	1	A	1	1	Orig	C:\GOLD\QRTEST\CM185
QUICKRES	DATA	1	K	9786	65	V;	Orig

Peak Number	Retention Time	Number of Components	Component Number	Peak Area	Peak Percent
1	2.275	1	1		
2	2.558	1	1		
3	2.792	1	1		
4	3.042	2	1		
5	3.192	2	1		
6	3.667	1	1		
7	4.150	2	1	0.267	29.265
			2	0.644	70.735
8	5.900	2	1		
9	6.125	2	1	0.830	47.520
			2	0.917	52.480
10	6.933	1	1		

QuickRes report demonstrating the ability to quantitatively evaluate areas of co-eluting peaks.

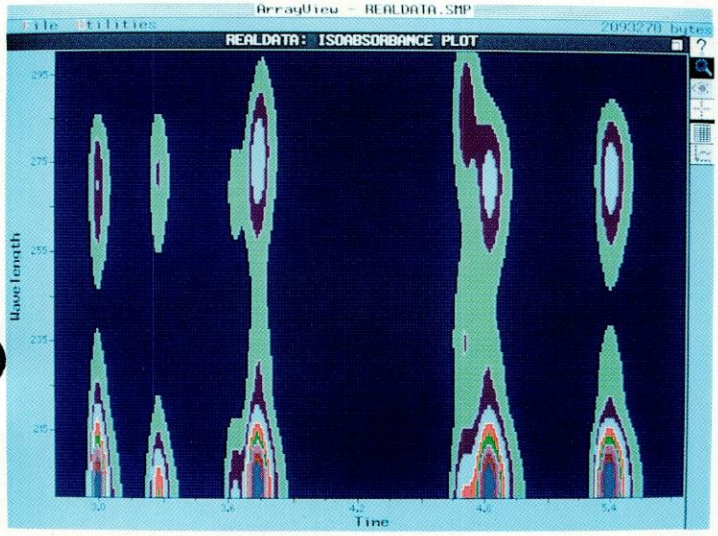
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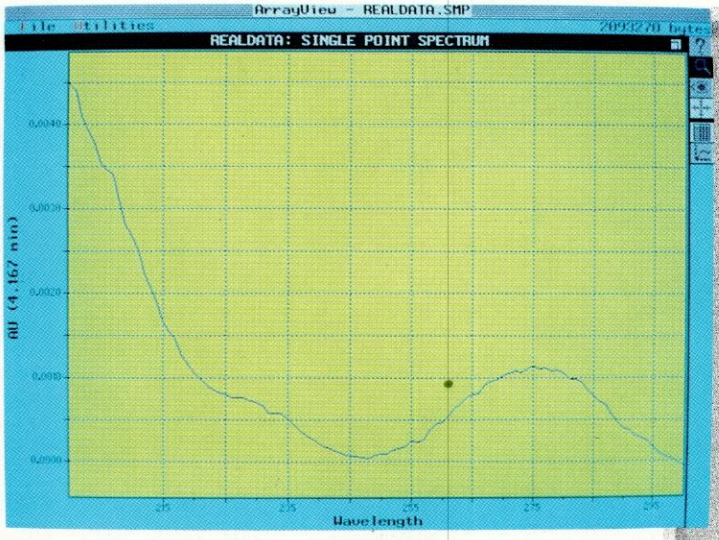
ArrayView

ArrayView is a software graphics option perfect for extracting even more information from 168 data. ArrayView allows chromatographers who work with primarily unknown samples to recreate a chromatogram at any wavelength after the run. While not originally collected during the run, any chromatogram can be retrieved, stored and accurately integrated using Gold Software.

ArrayView also offers an overview of collected data through 3-D views and isoabsorbance plots. The 4-in-1 display shows (clockwise from upper left) an isoabsorbance plot, a spectrum, a 3-D view and a chromatogram.



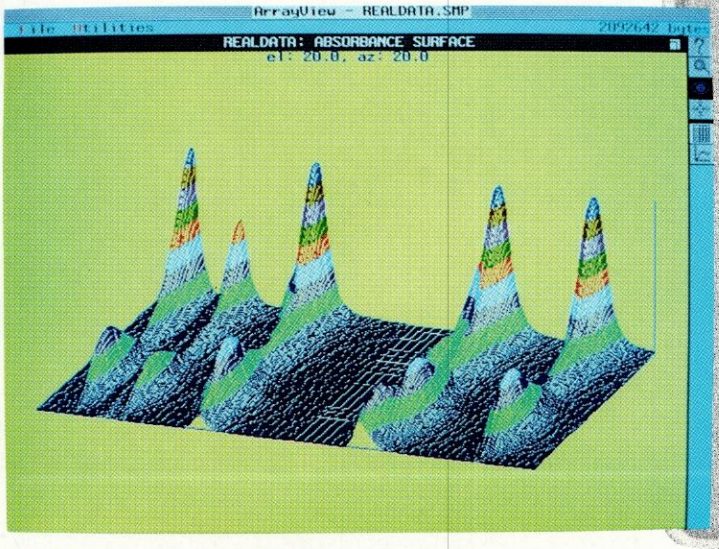
Asymmetrical Isoabsorbance Plot may indicate impurity.



Spectrum helps confirm identity.



Chromatograms can be viewed at any wavelength for selection of optimal settings.



3-D Plot provides overall view of unknown sample.

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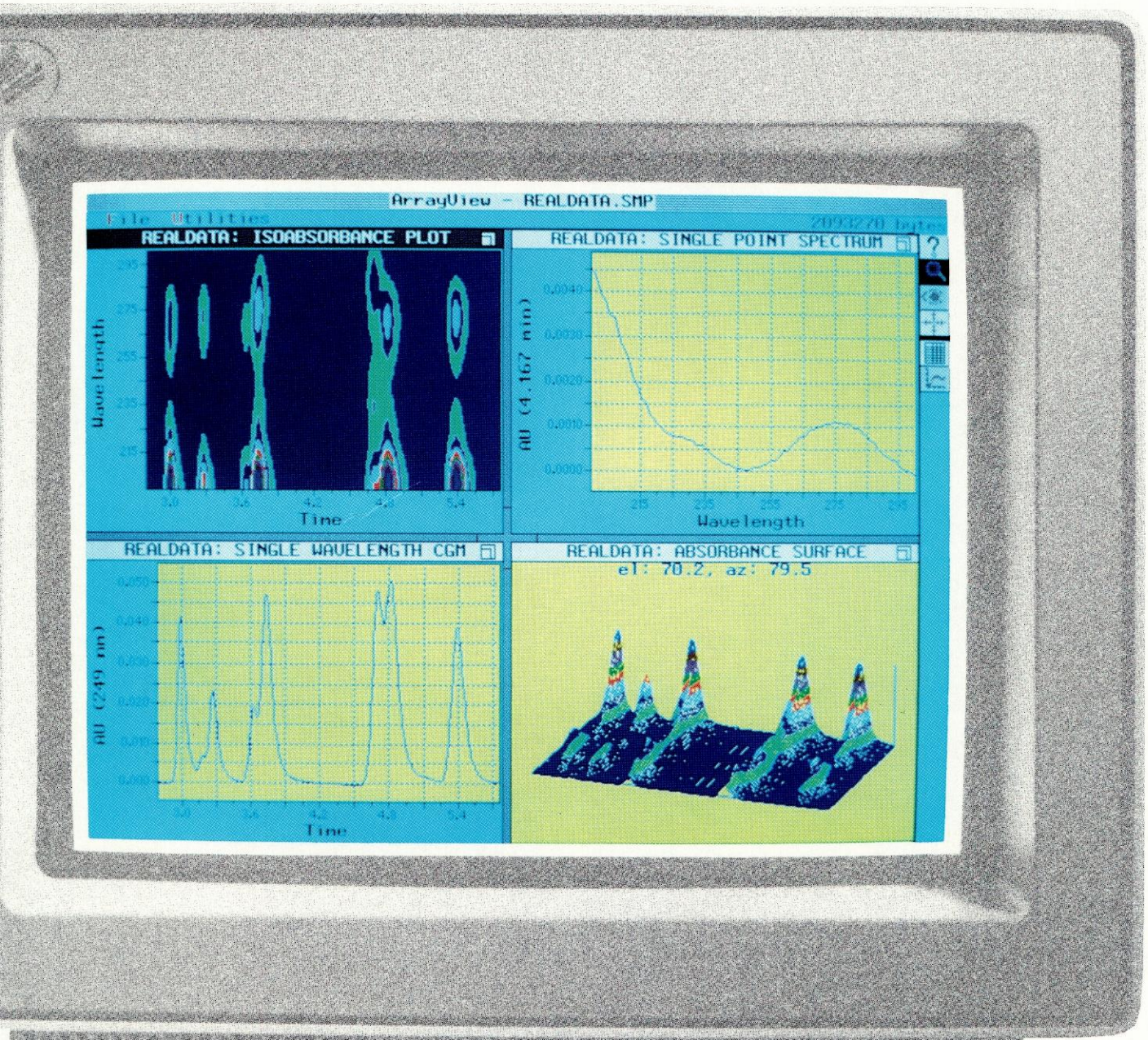
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This unique display provides many useful and time-saving features. For example, if you zoom in on a section of the isoabsorbance map, you'll also zoom in on the 3-D view, with the spectra and chromatogram appropriately scaled. In fact, each of the four windows can be expanded for closer examination.

Because of its graphical interface, ArrayView can be mastered quickly.

The 168 Diode Array Detector teamed with RTP algorithm, Scan Graphics, QuickRes and ArrayView allows the most useful information to be extracted from the abundant amount of data you generate.

And you get all this performance and versatility with Beckman reliability.



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Technical Specifications

THE BECKMAN Plus SCIENCE SUPPORT SOLUTIONS

166 Programmable Detector Module

Wavelength Range:	190-700 nm.
Light Sources:	UV Source, Pre-aligned D_2 Lamp: 190-360 nm or 361-700 nm. Visible Source, Pre-aligned Tungsten Lamp (optional) 361-700 nm.
Wavelength Accuracy:	±2 nm after auto calibration.
Wavelength Repeatability:	±0.5 nm.
Spectral Bandwidth:	<5 nm at 254 nm.
Linearity:	±1% from 0.1 to 1.0 AU; ±.001 AU below 0.1 AU; 5% from 1.0 AU to 1.5 AU.
Sensitivity Range:	Fully variable from 0.001 to 2.0 AUFS.
Baseline Noise:	Typically 2 x 10^{-5} AU peak-to-peak (1.1 sec rise time @ 220-280 nm, 1 mL/min methanol).
Rise Time:	Selectable from 0.0 to 5.0 seconds.
Analytical Flowcell:	11µL volume, 10 mm path, 1000 psi max. pressure.
Optional Flowcells:	*Micro:* 4µL, 5 mm path; *Semi-prep:* 2 mm path; *Prep:* 0.5 mm path.
Baseline Drift:	<1 x 10^{-4} AU/hr at constant temp (±1°C).
Analog Outputs:	1) *Recorder:* 10 mV full scale; 2) *Integrator:* 1 V full scale.
Memory Protection:	Battery memory backup maintains parameters for minimum of one week.
Time-Programmable Functions:	Wavelength, Range, Rise Time, Auto Zero, Event Mark, Relays ON/OFF, Lamp ON/OFF, Peak Detect, Peak Threshold, Alarm; *Time increments:* 0.01 min to 999.99 min.
Fraction Collector Baseline Detect Relay:	Contact closure occurs when a baseline is being monitored (relay duration settable).
Fraction Collector Peak Detect Relay:	Contact closure occurs when a peak is being monitored (relay duration settable).
External Inputs:	Start File, Lamp OFF, Event Mark, Auto Zero, Stop Data.
External Outputs:	Ready for Injection, Peak Detect, Two Time-Programmable Relays, Event Mark.
Electrical:	*Voltage:* 90-130 VAC or 198-264 VAC, 50 or 60 Hz; *Power:* 130 Watts.
Dimensions:	*Length:* 20.5" (52.1 cm); *Width:* 12.0" (30.5 cm); *Height:* 8.0" (20.3 cm).
Weight:	22.0 lbs (10.0 kg).

NOTE: All specifications measured at 254 nm unless otherwise noted. Specifications subject to change without notice.

	Ordering Information
238800	**166 Programmable Detector Module**
Complete with scan graphics software. Requires Gold Software version 5.1 or later. See below.	
	Gold Software
239023	• For AT bus/5.25" disk drive
239790	• For AT bus/3.5" disk drive
239788	• For MicroChannel bus/3.5" disk drive

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168 Diode Array Detector Module

Wavelength Range:	190-600 nm.
Light Source:	UV Source, Pre-aligned D_2 Lamp: 190-600 nm.
Diodes:	Single array, 512 diodes, 1 nm per diode.
Wavelength Accuracy:	±1 nm.
Bandwidth:	Adjustable 4 to 410 nm.
Linearity:	±1% to 1.5 AU with acetone at 265 nm.
Sensitivity Range:	Adjustable from .001 to 2.0 AUFS, no lower limit with digital signal and System Gold Software.
Baseline Noise:	1 x 10^{-4} AU.
Baseline Drift:	2 x 10^{-3} AU/hr.
Analog Rise Time:	Selectable from 0.0 to 5.0 seconds; *Default:* 1.1 second.
Analog Output:	Two channels, 10 mV or 1V.
Analog Range:	.001 to 1.5 AUFS selectable in .001 increments.
Scan Speed:	Adjustable 0.5-16 Hz depending on mode; 50 mSec duration.
Scan Modes:	Five scan modes – *Fixed Rate, Apex, Purity, Resolution, Scan on impurity.*
Flowcells, Standard:	*Analytical*–11µL volume, 10 mm path, 1000 psi max. pressure.
Flowcells, Optional:	*Micro*–4µL volume, 5 mm path; *Semi-prep:* 1µL volume, 2 mm path.
Memory Protection:	Battery memory backup maintains parameters for minimum of one week.
Time-Programmable Functions:	Wavelength, Bandwidth, Scan Mode, Scan Range/Duration, Scan Storage, Programming Reference, Data Stop, Lamp ON/OFF, Relays ON/OFF, Alarm, Auto Zero, Peak Detect.
Fraction Collector Baseline Detect Relay:	100 ms contact closure occurs whenever peak begins or ends.
External Inputs:	Ready for injection, Four Time-Programmable Relays, Event Mark.
External Outputs:	Start Method, Lamp OFF, Event Mark, Auto Zero.
Environment:	*Ambient Temperature:* 4-40° C; *Relative Humidity:* 35-80%.
Electrical:	*Voltage:* 90-130 VAC or 198-264 VAC, 50 or 60 Hz; *Power:* 130 watts.
Dimensions:	*Length:* 20.5" (52.1 cm); *Width:* 12.0" (30.5 cm); *Height:* 8.0" (20.3 cm); *Weight:* 30 lbs (13.6 kg).

NOTE: Computers running Gold Software with a diode array detector system cannot be configured to operate a second diode array detector based system. Specifications subject to change without notice.

	Ordering Information
239868	**168 Diode Array Detector Module**
Complete with Scan Graphics software. Requires Gold Software version 5.1 or later. See below.	
	Gold Software Options
241512	• ArrayView Gold Software
241385	• QuickRes Gold Software
477163	• ArrayView and QuickRes

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