Absolute molecular weight

Molecular conformation

Molecular size

Solution viscosity

Viscotek

TDAmax

Setting the Standard for Advanced GPC/SEC Systems

Detailed specification sheets from www.viscotek.com

Malvern

Viscotek TDAmax

Advanced GPC/SEC System

Introducing the TDAmax system - the leading solution in advanced GPC/SEC chromatography

Gel Permeation Chromatography/Size Exclusion Chromatography (GPC/SEC) is the technique of choice for rapid and reliable characterization of molecular weight and molecular weight distribution for all types of macromolecules – proteins, natural polymers and synthetic polymers.

The Viscotek TDAmax is a complete, advanced, multi-detector GPC/SEC system suitable for all macromolecular applications. It consists of three unique and complementary components – The Triple or Tetra Detector Array (TDA), the GPCmax integrated solvent and sample delivery module and the OmniSEC software.

Proteins

- Absolute molecular weight
- Aggregation
- Protein size and density
- Oligomeric composition
- A_2 Second virial coefficient

Polymers

- Absolute molecular weight
- Molecular weight distribution
- Branching and structure
- Molecular size
- Copolymer composition

The TDA - Four advanced detectors for macromolecular characterisation:

1 Refractive Index for concentration

2 Viscometer for size and structure

3 Light Scattering for molecular weight

4 UV for chemical composition

- **Comprehensive characterisation of all types of macromolecules - proteins, natural polymers and synthetic polymers**
- **Absolute molecular weight using Low Angle Light Scattering (LALS) or Right Angle Light Scattering (RALS)**
- **High-sensitivity Viscometer detector for intrinsic viscosity and structural information such as polymer branching**
- **Molecular size information expressed as both the hydrodynamic radius (down to <1nm) and radius of gyration**
- **Protein conformation, stability, aggregation and quaternary structure**
- **Copolymer, conjugates and blends can be fully characterized with UV detector option**

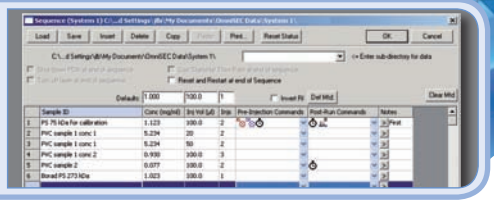
Viscotek TDAmax

Advanced GPC/SEC System

Fully automated, accurate and precise measurements from an easy to use, complete system

1

Enter sample information in sequence table

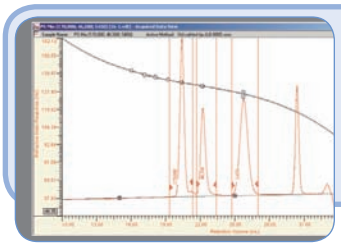


Fill vials and place in the autosampler tray

2

3

Click on 'Start' and let the system work unattended

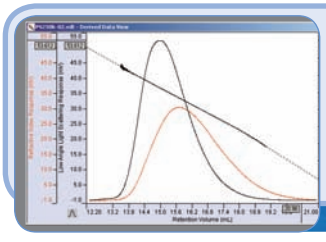


Analyse data even while measuring samples

4

5

From raw data to results in two clicks



View the results and reports directly, or remotely process the data

6

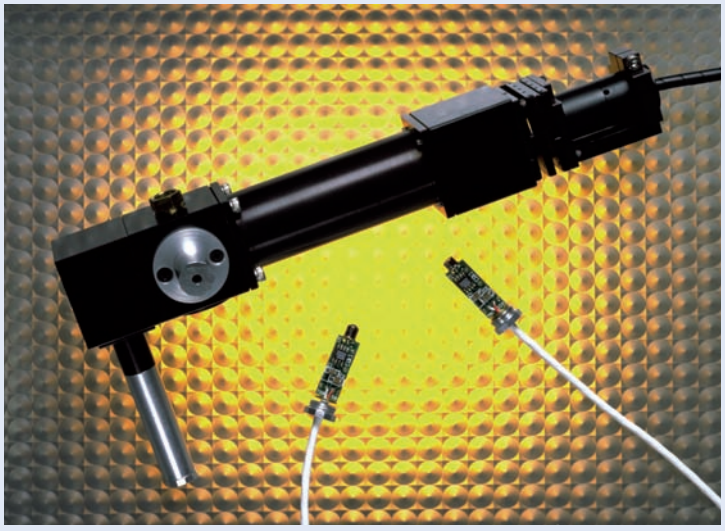
The TDA (Triple/Tetra Detector Array)

The Viscotek TDA sets the standard for GPC/SEC technology and is the world's leading multi-detector platform. As a Triple Detector Array it employs refractive index, viscometer and light scattering detectors all acting in concert, with each detector providing complimentary data on the macromolecules being analyzed.

In its Tetra Detector format, the addition of a UV detector provides a wealth of additional compositional data particularly when the optional Photodiode Array (PDA or DAD) is used to make spectral measurement of all wavelengths simultaneously.

In either format, it offers precise and accurate temperature control by housing all the detector cells and the chromatographic columns together in the same thermal chamber. This arrangement minimizes inter-detector volumes to reduce band broadening effects and ensures that detectors, connecting tubing and columns reside at the same temperature during the analysis. This provides unmatched baseline stability and data reproducibility, delivering reliable, robust results.

Light scattering detector



The powerful light scattering detector provides two separate measurement points. The unique 7° Low Angle (LALS) detector measures the absolute molecular weight of even the largest macromolecules directly without need of data fitting, extrapolation or correction. To complement the LALS, and to enable the highest sensitivity measurements for small molecules such as proteins, the 90° Right Angle (RALS) detector is employed. The intelligent OmniSEC software collects data from both detectors and uses the appropriate signal for the sample being analysed. This maximises the signal-to-noise and the accuracy of the molecular weight determination, even when a sample contains complex mixtures of large and small molecules. A low cell volume of just 18µL, coupled with unmatched optical efficiency, ensure low band broadening and high sensitivity.

Viscometer Detector

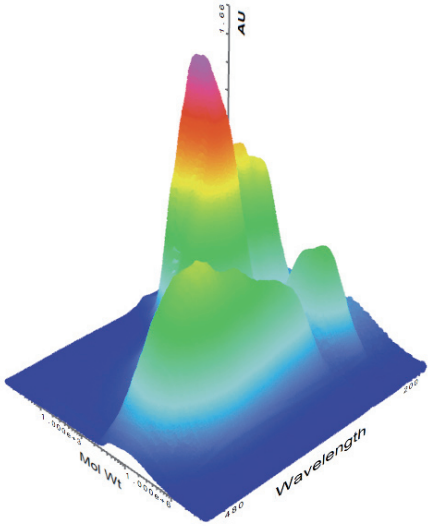
The differential viscometer detector provides a measurement of intrinsic viscosity and allows for the determination of molecular size, conformation and structure. Viscotek invented and patented the first differential viscometer detector and the latest version in the TDA is a testament to that experience – with high sensitivity, unrivalled baseline stability and the widest applications flexibility. It is the only viscometer detector to feature Digital Inert Transducer (DIT) technology. These unique new devices give a faster, more sensitive response to viscosity changes compared to the traditional magnetic-reluctance transducers. In addition, the innovative construction in 316 stainless steel means they are chemically robust with few limitations on salts or pH. In the measuring flow-path, the use of inert capillaries means the analysis of proteins and other biomolecules can be completed with confidence.

Refractive Index (RI) Detector

Accurate measurement of the polymer or protein concentration profile is essential for good molecular weight or structure data. The high-sensitivity RI in the TDA has been designed specifically with multi-detection GPC/SEC in mind. It features a high power light source for maximum sensitivity and stability. The light source is wavelength-matched with the LALS detector to give accurate determination of molecular weight and the specific refractive index increment (dn/dc). The RI detector can be automatically purged from the software or as part of a programmed sample sequence and the carefully designed purging system eliminates major temperature changes, giving rapid baseline recovery. The unique design allows the detector to be in series between the light scattering and viscometer detectors. This is the only configuration which gives maximum signals on all detectors in a multi-detector GPC/SEC system.

Ultraviolet (UV) Detectors

As well as an alternative concentration detector, the UV detector is an excellent tool for the compositional analysis in, for example, co-polymers or protein conjugates. The Viscotek TDA offers two UV options. The first is a programmable UV detector that allows the monitoring of a single wavelength during the experiment. The OmniSEC software collects the RI and UV signals and processes them together to establish the RI/UV ratio across the chromatographic peaks. This allows calculation of the % composition of two components in the sample with respect to the molecular weight – for example, styrene/butadiene or protein/PEG. The addition of a PDA detector allows the mapping of the molecular weight to the full UV spectrum and opens a new window on the compositional variation of the macromolecules under investigation.

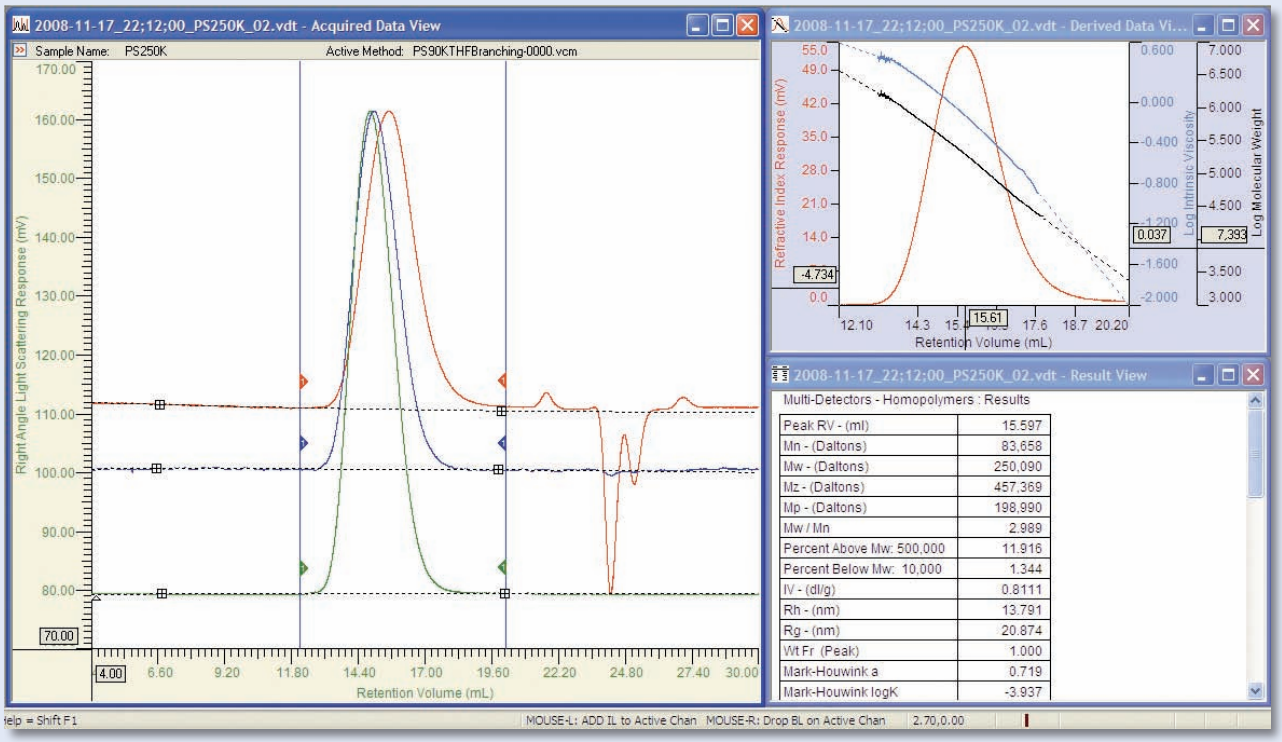


The OmniSEC (GPC/SEC software)

OmniSEC is a powerful yet easy to use GPC/SEC software for instrument control, data acquisition, analysis and reporting. It is at the heart of the TDAmax providing an integrated solution that helps you maximize the information and efficiency of your experiments. Simply load your samples and the software controls all the sequencing, enabling truly automatic unattended operation.

Support for:

- Multi detection (Single/Dual/Triple/Tetra)
- Absolute molecular weight
- Protein analysis
- Molecular conformation/branching
- Copolymer analysis
- Intrinsic viscosity
- Flow Injection Polymer Analysis (FIPA)
- Universal calibration
- Conventional calibration

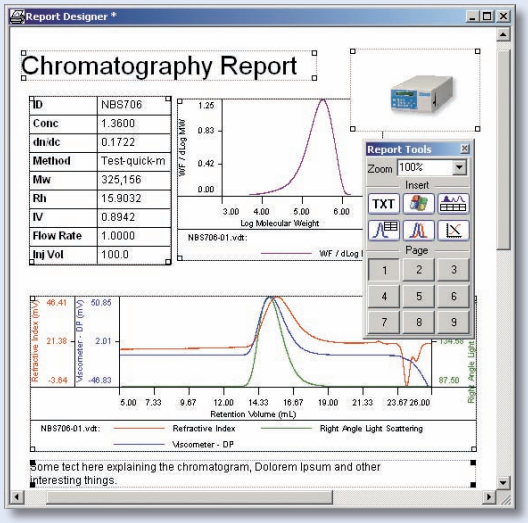


With automatic peak and baseline setting, accurate and robust results are calculated in two clicks of the mouse

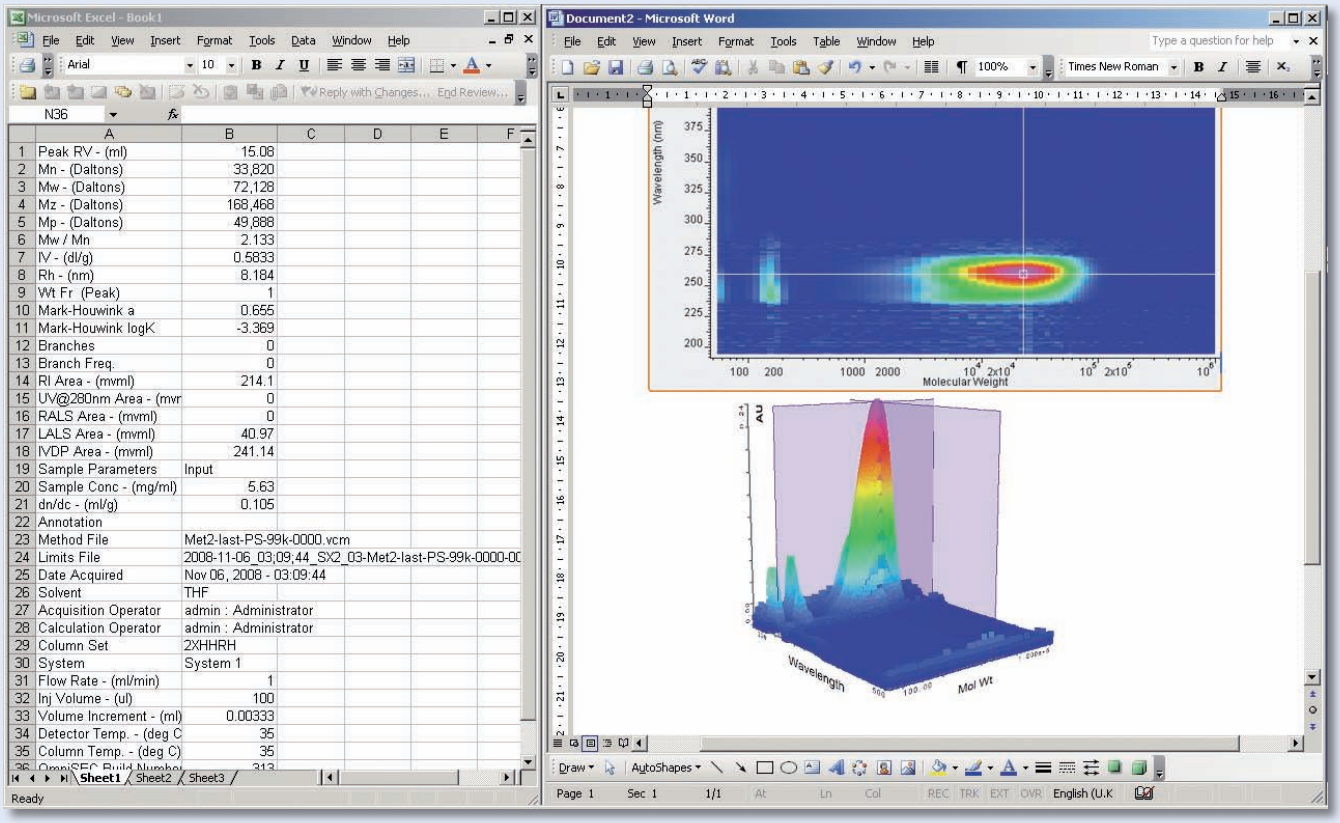
Advanced GPC/SEC System

OmniSEC contains many convenient and productive features:

- Two clicks from raw data to results
- Built-in, intuitive report designer
- Manual or fully automatic baseline setting
- Automatic determination of dn/dc, UV extinction coefficient and A_2
- Proven asymmetric band broadening corrections
- Fully automatic process control/LIMS mode
- Integrated help system to guide users
- Full export capability of raw data, results and intermediate calculations
- Enables compliance with 21 CFR part 11



Customized, uniform reports are easily created using the intuitive report designer



Export the result, contour plots, 3D graph or even raw and calculated data to your favourite application

GPCmax integrated solvent and sample delivery module

The GPCmax is the world's leading solvent and sample delivery module exclusively for GPC/SEC applications. Designed by GPC/SEC practitioners to deliver unparalleled robustness and performance for these demanding applications, it provides the reliable and stable chromatographic foundation for the TDAmax Triple and Tetra detection systems. The GPCmax can be controlled from the front panel or the OmniSEC software. For serious chromatographers, demanding high throughput and the highest reproducibility and accuracy, the GPCmax is the perfect choice.

Degasser & Eluent Sensor

The GPCmax is equipped with an inline degasser to remove dissolved gases and allow optimum performance of the pump. Furthermore, it improves baselines on all the detectors. To avoid damage to valuable GPC columns, the GPCmax includes an automatic eluent sensor which will stop the flow if it detects the solvent supply is dangerously low.

Pump

The dual piston pump of the GPCmax is optimized for GPC/SEC and advanced detector requirements. It provides an extremely low pulsation and stable eluent flow, to allow optimum performance of concentration, viscosity and light scattering detectors. The pump features a unique user programmable soft start/stop to maximize the lifetime of your columns by protecting them from pressure shocks. The pump is compatible with any solvent, even acidic buffers.

Advanced GPC/SEC System

Autosampler

The GPCmax features a programmable, variable volume autosampler which handles up to 120 vials and has both heated and cooled sample tray options. The Autosampler provides the system with reliable, accurate and reproducible injection volumes, enabling comprehensive macromolecular characterizations to be made with confidence. In addition, the advanced programming features via the OmniSEC software allows tasks like dn/dc or 2nd virial coefficient (A_2) determinations to be completed simply and unattended.

Sample ID	*Injection*	*Mw (Da)*	*[η] (dL/g)*	*Rh (nm)*
Broad PS	1	266,050	0.737	14.58
Broad PS	2	265,779	0.739	14.59
Broad PS	3	266,344	0.736	14.58
Broad PS	4	265,844	0.736	14.57
Broad PS	5	267,043	0.737	14.60
Broad PS	6	266,414	0.740	14.61
Broad PS	7	266,002	0.737	14.58
Broad PS	8	266,413	0.742	14.62
Broad PS	9	266,744	0.740	14.62
Broad PS	10	266,122	0.737	14.58
	Avg.	266,276	0.738	14.594
	Std. Dev.	399	0.002	0.016
	RSD (%)	0.15	0.27	0.11

The TDAmax system gives unprecedented reproducibility of results

Columns and Standards

A comprehensive selection of columns and standards for all types of GPC/SEC are available as part of the Viscotek range.

Columns for:

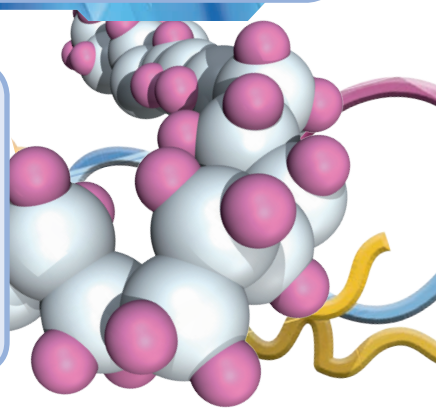
- Protein Analysis
- Aqueous soluble polymers
- Organic soluble polymers
- High Temperature GPC
- Cationic or anionic polymers
- Functionalised polymers

Standards:

- Pre-weighed and bulk polymers
- Polystyrene (PS)
- Polymethylmethacrylate (PMMA)
- Polyethylene glycol (PEG)
- Dextran
- Pullulan

Aftersales Support

The quality of Malvern's aftersales support is one of the key reasons for our continuing success in today's demanding laboratory and process markets. By choosing Malvern products, users not only choose technical excellence but gain access to a worldwide network of highly trained and experienced teams of technical support professionals dedicated to ensuring that their instruments continue to deliver returns at the highest level



The Viscotek TDAmax delivers

You asked for	We give you
Absolute Molecular Weight	A low angle light scattering detector measuring absolute molecular weight without assumptions, corrections or extrapolation for robust and reliable results.
Molecular Size	Comprehensive molecular size information (R_h and R_g) down to less than 1nm for full characterization of your protein, polymer or macromolecular complex.
Intrinsic Viscosity	A sensitive differential bridge viscometer with DIT technology. Resistant to high salt concentrations and aggressive eluents to enable measurement of intrinsic viscosity and molecular density in all applications.
Molecular conformation	Triple or Tetra detection gives advanced information on structure, conformation, aggregation, branching and copolymer or conjugate composition.
Easy to use, yet powerful software	As simple as two clicks from data to results but with the power to handle branching and compositional studies with full customizable reporting. Performs all GPC/SEC calculation types and enables 21 CFR part 11 compliance.
Robustness and Reliability	Intelligent design, robust construction and easy serviceability lead to a reliable system that can handle all GPC/SEC applications and solvents with confidence.
Support	The Malvern worldwide support structure, application notes, on-demand presentations, and live help desk.

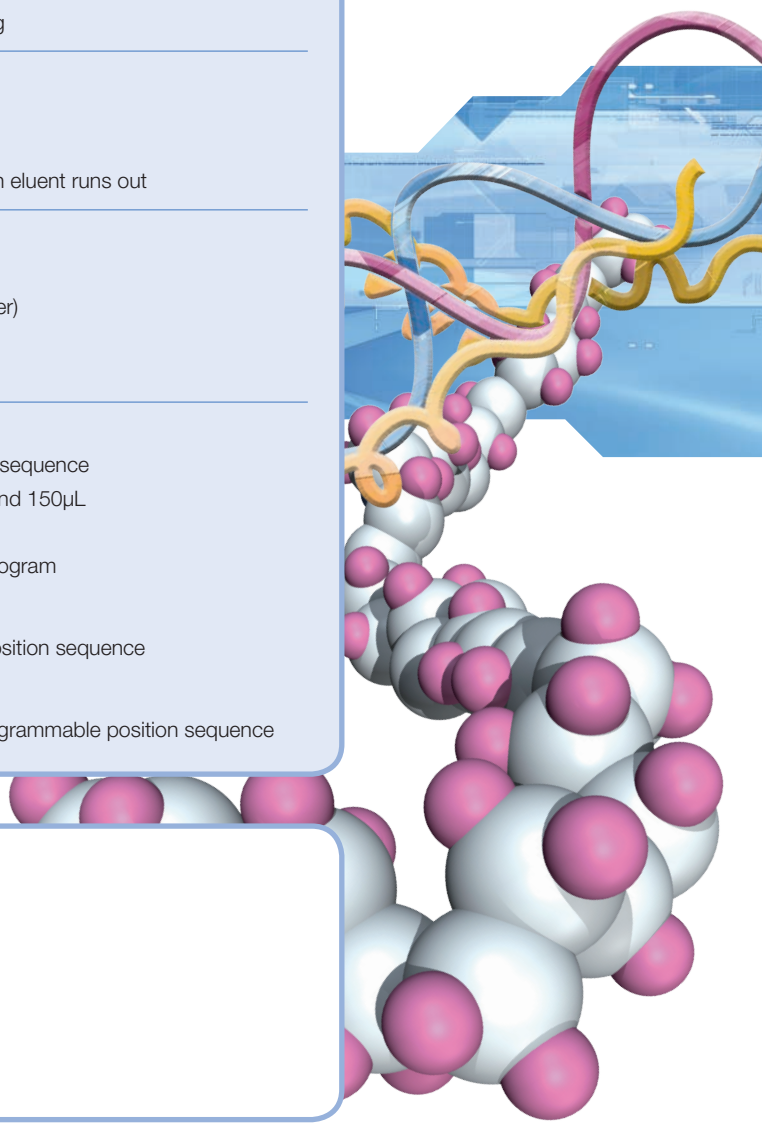
Specifications

OmniSEC	
Acquisition	6 channels, 5Hz, unlimited acquisition time
Calculation modules	Conventional, Universal, Light Scattering, Triple, Copolymer, Protein specific, FIPA
Results output	M_n, M_w, M_z, M_p, M_w/M_n, IV [η], R_h, R_g, Branching Number, Branching Frequency, Number of Arms, Weight Fraction, Concentration, MH-a, MH-k, dn/dc, dA/dc. A_2
Minimum PC specification	Windows XP or higher, 100 GB HD, 2GB RAM, 1.8 GHz processor, Graphics 1024x768, 16-bit colour depth
TDA	
Temperature control	Ambient to 80ºC all detector cells and columns
Detector configuration	All detector cells in series for full signals
Column capacity	Up to 5 x 30cm GPC/SEC columns
Interface	6 channel digital interface to OmniSEC software
Dimensions	2 analog inputs, RI and UV/LS 41cm x 28cm x 54cm (W x H x D); 30Kg
Light scattering detector:	
Measuring principle	RALS, 90º angle; LALS, 7º angle, with high efficiency optics
Light Source	Temperature controlled laser diode, 3mW, 670nm
Cell	Ultra low volume 18µL
Data rate	100Hz collection, DSP with 5Hz to OmniSEC
Refractive index detector:	
Measuring principle	Deflection
Light Source	LED
Cell	45° quartz glass, 12µL volume
Purging	3 modes, Manual, Automatic and Programmable
Data rate	100Hz collection, DSP with 5Hz to OmniSEC
Viscometer detector:	
Measuring principle	Inert, 4 capillary differential Wheatstone bridge configuration
Transducers	Digital Inert Transducer technology with over-pressure protection
Measuring volume	18µL
Purging	3 modes, Manual, Automatic and Programmable
Data rate	100Hz collection, DSP with 5Hz to OmniSEC
UV detector	
Wavelength	190 to 740nm
Light Source	Deuterium; Tungsten halogen is optional
Cell volume	10µL
Data rate	Analog collection of single wavelength (programmable), A-to-D with 5Hz to OmniSEC
UV-PDA detector	
Wavelength/resolution	190 to 500nm or 430 to 710nm on 256 diode array
Light Source	Deuterium (190-500nm) or Tungsten (430-710nm)
Cell volume	10µL
Data rate	256 channels at 1Hz direct to OmniSEC

continued over

Specifications (continued)

GPCmax	
Operation and Control	By OmniSEC software or from front panel
Dimensions	55cm x 38cm x 53cm (W x H x D); 37kg
Degasser	
Channels/volume	Two channels, 8ml per channel
Performance	<0.5 ppm oxygen at 0.5 mL/min
Eluent Sensor	User selectable, stops GPC pump when eluent runs out
Pump	
Flow rate range	0.01 to 9.99 mL/min
Pulsation	Less than 1% (measured with viscometer)
Pressure Reading	MPa or PSI
Soft start/stop	User programmable in mL/min/min
Autosampler	
Capacity (Standard)	120 vials, freely programmable position sequence
Range	Variable injection volume, between 20 and 150µL
Reproducibility	Better than 0.5 %
Carryover	Less than 0.1%, depending on wash program
Cooling option	4°C to 40°C
Capacity (with cooling option)	60 vials cooled, freely programmable position sequence
Heated tray option	65°C fixed in one tray
Capacity (with heating option)	60 vials heated, 60 unheated, freely programmable position sequence



Viscotek Corp.
15600 West Hardy Road • Houston • TX 77060 • USA
Telephone: 800 375 5966 • **Facsimile:** 281 931 4336

A Malvern company.

more information at www.viscotek.com

Viscotek TDAmax

detailed specifications at www.viscotek.com

MRK1252-01