






Malvern | Material relationships

-  MOLECULAR WEIGHT
-  MOLECULAR SIZE
-  MOLECULAR STRUCTURE

MALVERN OMNISEC

RESOLVE, REVEAL, REALIZE

OMNISEC - A NEW STANDARD IN GPC/SEC

Malvern's **OMNISEC** is a complete gel permeation/size exclusion chromatography (GPC)/(SEC) solution consisting of systems, detectors and software.

Malvern's expertise has enabled the development of the most sensitive and accurate multi-detector GPC/SEC system for the characterization of synthetic and natural polymers, and proteins.

OMNISEC can accurately measure the most important characterization parameters including:

- Absolute molecular weight and molecular weight distribution
- Intrinsic viscosity and molecular structure
- Sample concentration
- And many more



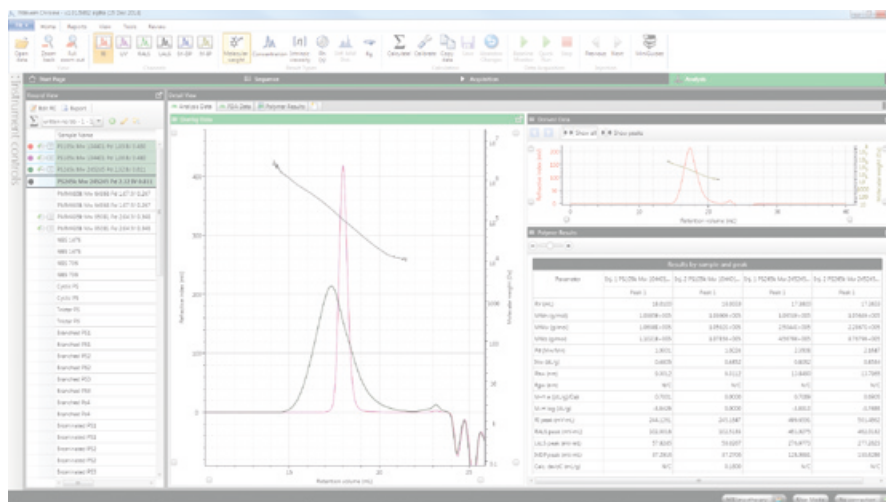
OMNISEC - AT A GLANCE

The complete, integrated OMNISEC solution is made up of 3 components:

OMNISEC RESOLVE - an integrated pump, degasser, autosampler and column oven for managing the separation in a single advanced unit.

OMNISEC REVEAL - an integrated multi-detector module for the characterization of synthetic and natural polymers, and proteins:

- The most sensitive light scattering detector in the world
- Unrivalled baseline stability on all detectors for greater sensitivity to low concentrations of sample
- Self balancing viscometer detector
- Wide UV/VIS wavelength range to cover all applications
- Simple and intuitive to use, due to advanced design features



OMNISEC software - completely new version 10 to make GPC/SEC analysis as easy and intuitive as possible. Supports the power of advanced detection, reduces workload and improves your productivity.

OMNISEC is easier to use

- Autosampler temperature control (4-60°C) protects proteins from degradation and improves polymer dissolution
- Waste-free injections from vials or 96-well microtiter plates
- The low volume degasser enables faster mobile phase exchange
- Inert (316 stainless steel) viscometer pressure transducers can tolerate a wider pH range
- System temperature control (up to 65°C) reduces operating backpressure
- Greater efficiency through work-flow based software for system control and analysis
- The revolutionary user exchangeable viscometer capillary module reduces service time and cost
- Integrated pump back seal washing reduces seal wear.

OMNISEC gives better results

- The new light scattering detector is the most sensitive on the market, enabling measurements of molecular weights as low as 200 Da, injection masses as low as 100 ng of material and samples with low dn/dc
- Integrated detectors module minimizes inter-detector band broadening
- Column and detector temperature control (20-65°C) improves resolution and stabilizes baselines
- Flexible autosampler delivers accurate and precise volumes for unsurpassed data reproducibility.

OMNISEC RESOLVE AND OMNISEC REVEAL

The complete GPC/SEC solution

OMNISEC RESOLVE has been designed using our 30 years of experience in GPC/SEC and precision electronics to achieve the highest possible standard in chromatographic performance. The efficient degasser, low-pulsation pump, outstanding autosampler and large capacity column oven combine to give reduced baseline noise and improved stability to maximize measurement sensitivity and accuracy.

OMNISEC REVEAL is the integrated multi-detector platform. It is available with refractive index, full range UV/Vis photodiode array, light scattering and viscosity detectors to meet the needs of a wide range of applications. Each detector is outstandingly sensitive and stable to ensure it delivers first class GPC/SEC data for every sample.



WITH OMNISEC YOU CAN...	WITH...
OMNISEC REVEAL	
Measure the concentration of almost any solute	Refractive Index (RI)
Measure the concentration of chromophore-containing samples	UV/Vis Absorbance (PDA)
Measure absolute molecular weight and molecular weight distribution of synthetic and natural polymers, and proteins	Light Scattering (LS)
Measure the intrinsic viscosity (IV) of your sample to investigate molecular structure and branching	Viscometer
Combine the results to measure other properties such as hydrodynamic radius (Rh), radius of gyration (Rg), and Mark-Houwink parameters	Triple Detection (TD)
Achieve better baseline stability for improved accuracy and sensitivity	Temperature controlled detectors
OMNISEC RESOLVE	
Improve baseline stability	Low pulsation pump
Reduce downtime with faster solvent changeover and equilibration	Low volume degasser
Protect fragile samples such as proteins from degradation	Temperature controlled autosampler (4-60°C)
Reduce viscosity of high viscous solvents such as DMSO	Waste free autosampler
Minimize waste of precious samples	Waste free autosampler
Improve separation quality and resolution	Integrated column oven

INTRODUCTION TO TECHNIQUE AND TECHNOLOGY

Absolute Molecular Weight, Molecular Size

The highest quality GPC/SEC measurement requires two things:

- a good separation of the sample - **RESOLVE**
- sensitive detectors to characterize the separated sample - **REVEAL**

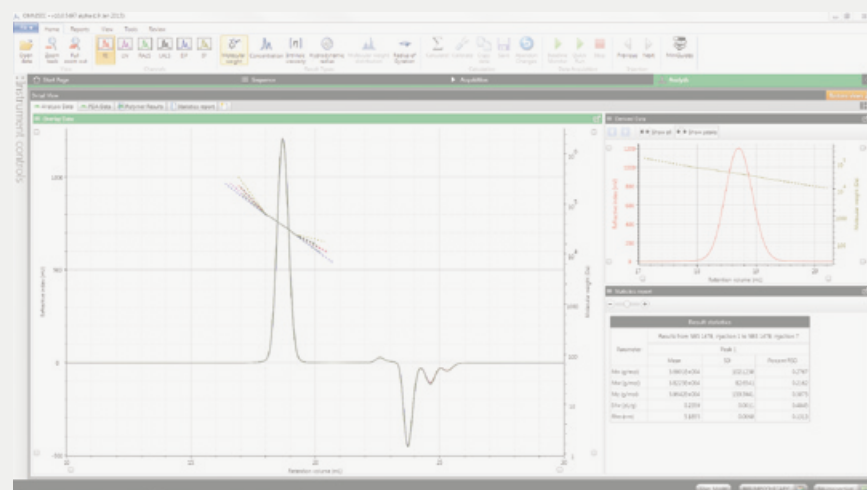
GPC/SEC Separation

As the dissolved sample flows through the porous column matrix, the individual molecules diffuse in and out of the pores. Larger molecules are excluded from more pores, and so travel through the column faster, eluting earlier while the smaller molecules elute later. The result is a separation by hydrodynamic size for measurement by the detectors.

Detection

Once separated, the sample can be characterized using one or more detectors to reveal its nature. Multi-detector GPC/SEC uses a combination of detectors to fully characterize the sample in a single experiment.

- Refractive index and absorbance (UV/Vis) detectors measure a sample's concentration
- Light scattering detectors measure absolute molecular weight
- A Viscosimeter measures intrinsic viscosity, which is representative of a molecular structure, density and branching



Performance delivered

OMNISEC delivers both the separation and detection performance required to generate the most sensitive and accurate results.

When a NIST standard is measured using OMNISEC, the standard deviation of 10 repeat injections of a solution containing only 5 µg of the sample is just 1%.

OMNISEC will provide the data quality for your application.

SYNTHETIC AND NATURAL POLYMERS

Absolute Molecular Weight, Molecular Size, Structure

Product performance

For both synthetic polymers and natural polymers, product performance is key to your success. For example:

- If a polymer molecular weight changes from the specification, it may be too weak or too difficult to process
- Poor control of PLA/PLGA molecular weight could result in uncontrolled drug release
- A change in branching level in polycarbonates will affect the final product brittleness
- Ineffectual derivatization or cross-linking of HA products may result in poor product performance and more rapid clearance from the body
- If the molecular weight of a cellulose derivative in eye-drops is too low it will be cleared too quickly from the eye

Take control of polymer performance

GPC is used in many industries as a development and QC tool. With a full understanding of your polymer's characteristics:

- The polymer manufacturer can appropriately grade and sell their product
- The polymer scientist can fully investigate the structure/molecular weight relationships
- A drug delivery scientist can optimize controlled release
- Hyaluronic acid can be marked for use in the appropriate surgical or cosmeceutical application
- The eye-drop manufacturer can better control clearance rates



PROTEINS

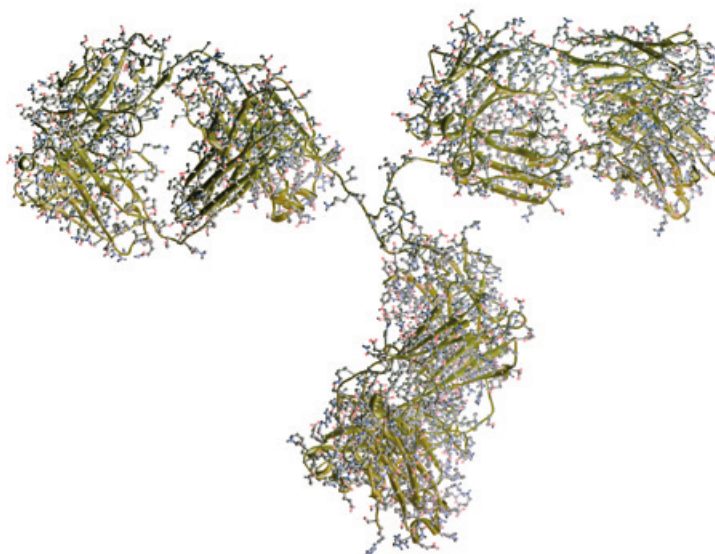
Absolute Molecular Weight, Aggregation, Conjugation

Molecular weight is important for proteins because it relates directly to their quaternary structure, oligomeric state and activity.

Protein aggregation in a biopharmaceutical reduces efficacy and risks an immunogenic reaction. With OMNISEC you can determine aggregate, molecular weight, size and structure.

Conjugation affects clearance rates and efficacy. With OMNISEC you can measure the extent of conjugation, for example, of PEGylated proteins.

Intrinsic viscosity relates to **protein structure** allowing you to distinguish between globular and fibrous aggregates. In addition, it can be used to calculate **hydrodynamic size** (R_h).



OMNISEC RESOLVE

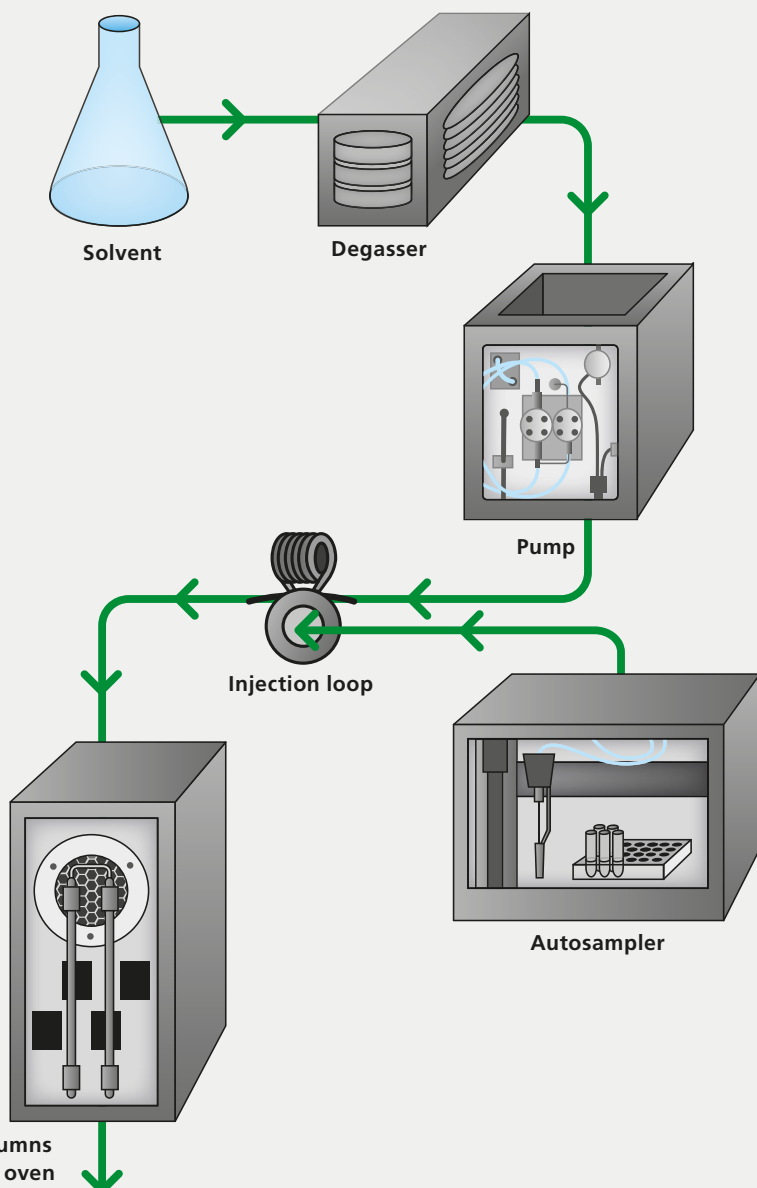
Integrated separations module

OMNISEC RESOLVE is a combined pump, degasser, autosampler and column oven for mobile phase delivery and sample injection.

What benefits does a complete GPC/SEC system that includes **OMNISEC RESOLVE** provide?

- A complete solution from a single manufacturer with an intuitive software package that handles everything from instrument control to data acquisition and data analysis
- Unattended operation using the autosampler, even with sensitive samples such as proteins, thanks to its temperature control

FEATURES OF OMNISEC RESOLVE



Degasser

- Low volume degasser makes for rapid solvent and buffer changeover
- Improved degassing efficiency means more stable detector baselines

Isocratic pump

- Self-priming and optimized for GPC/SEC to offer excellent flow rate stability to reduce baseline noise in all detectors
- Integrated backflushing automatically protects seals from mobile phase salt precipitation

Column oven

- Maintain a stable separation temperature from 20 to 65°C
- Accommodate up to 6 analytical columns or 1 GE Tricorn™ column

Autosampler

- Inject samples from vials or 96-well microtiter plates with unrivalled accuracy and precision
- Cool sensitive samples like proteins to 4°C to protect them from aggregation
- Warm viscous samples like those in DMSO to 60°C to improve injection volume accuracy
- Zero injection volume overhead mode prevents wastage of your most precious samples

OMNISEC REVEAL

Integrated multi detector module

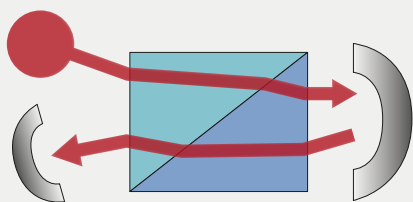
OMNISEC REVEAL is an integrated multi-detector module for advance GPC/ SEC measurements incorporating refractive index, UV/Vis absorbance, light scattering and intrinsic viscosity detectors. The high sensitivity and measurement quality that it provides ensures maximum return on your investment.

It can act as a stand alone detector connected to your existing GPC/SEC system or as a complete GPC/SEC solution in combination with the OMNISEC RESOLVE module.

An integrated design keeps all of the detectors in one compartment, affording multiple advantages:

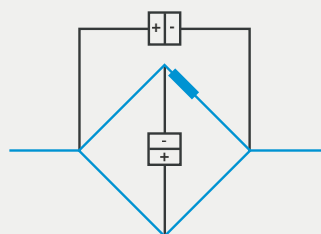
- Inter-detector tubing is minimized reducing band broadening to improve data quality and result accuracy
- The detectors and the inter-detector tubing are all maintained at the same temperature to further improve data quality by maintaining baseline stability

Refractive index



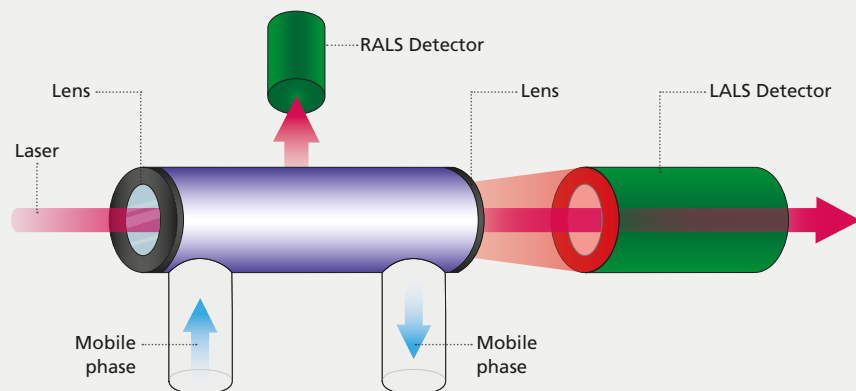
OMNISEC REVEAL's **refractive index detector** measures the concentration of almost any solute. Its robust flow cell allows it to be kept series with the other detectors, maximizing sensitivity and minimizing band broadening.

Intrinsic viscosity



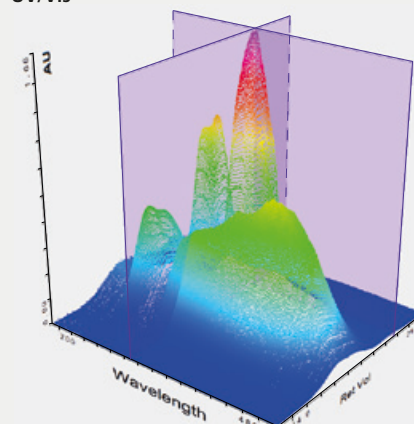
The new pressure transducers in OMNISEC REVEAL's **differential viscometer** improve baseline stability, sensitivity and robustness. Their 316 stainless steel construction means few limitations with salts or pH. It has an interchangeable capillary module for fast user replacement and the ability to self-balance for simple, automatic setup.

Light scattering



The unique **light scattering detector** combines the sensitivity of 90° Right Angle Light Scattering (RALS) with the accuracy of 7° Low-Angle Light Scattering (LALS). Its superior sensitivity makes it the ideal choice for measuring precious samples where only small injections can be afforded or for samples with low dn/dc, while its 18 µL flow cell minimizes band broadening.

UV/Vis



The **UV/Vis photodiode array (PDA)** covers wavelengths of 190-900 nm, opening up absorbance measurements to a wider application range.

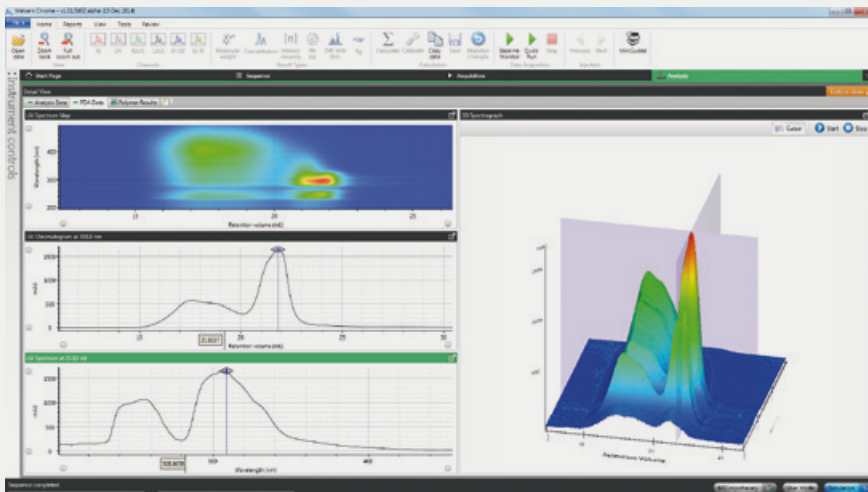
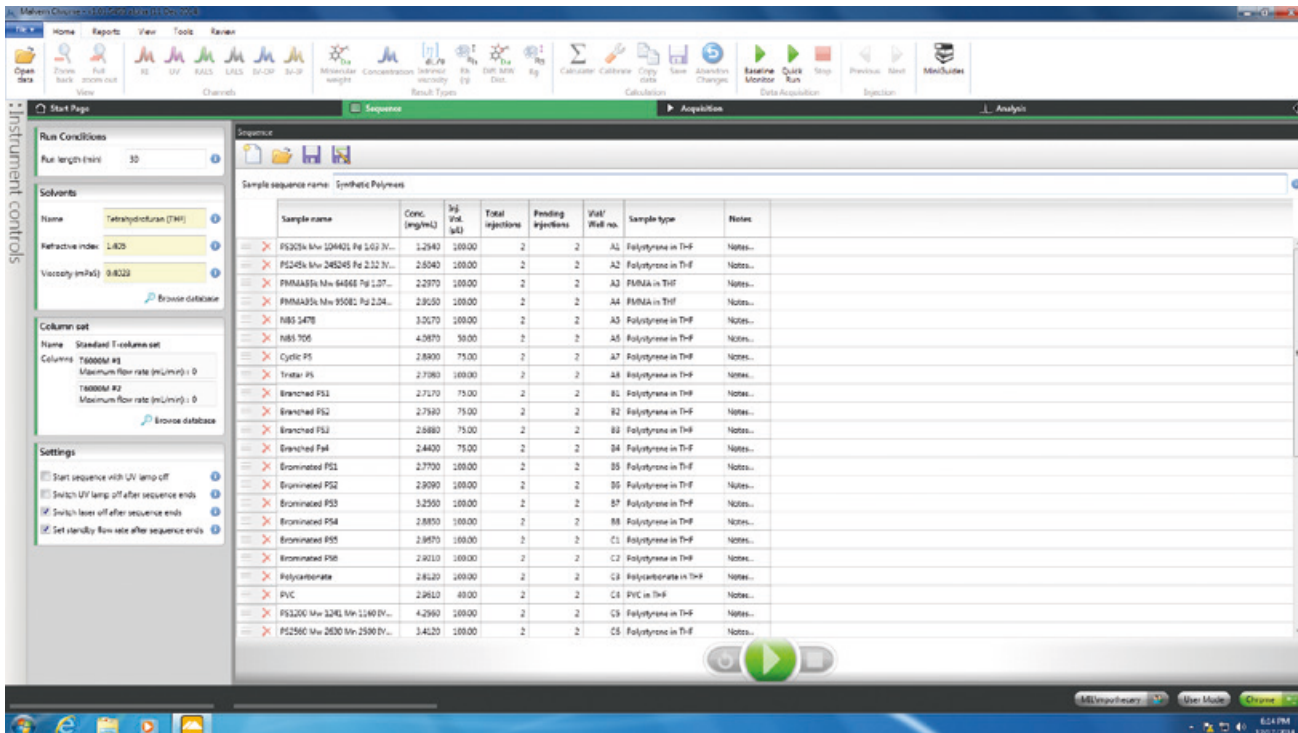
DEDICATED INTUITIVE SOFTWARE

Designed with the GPC/SEC workflow in mind

Workflow oriented software

OMNISEC software v10 has been designed with you and your priorities in mind. It makes GPC/SEC analysis as easy and intuitive as possible. The software is laid out to guide the user through setup, data acquisition and analysis in an intuitive workflow.

The software's advanced user interface reduces training requirements for new users.



Software features

Key features that make multi-detector analysis more valuable than ever include:

- Intuitive look and feel based upon the latest software tools
- Simple and customizable reporting to present only the data that is most important to you
- Overlay multiple injections and results quickly and easily
- Easy exporting of data
- 1-click from data to results!

VALIDATION AND SUPPORT

Malvern's materials characterization technology and expertise enables scientists and engineers to understand and control properties of dispersed systems. Malvern's instruments are used to measure particle size, particle shape, zeta potential, molecular weight, size and conformation, rheology and for chemical identification. This information helps accelerate R&D, enhance product quality, optimize process efficiency.

Areas we work in:

- ACADEMIC BIOCHEMICAL RESEARCH
- BIOPHARMACEUTICALS
- FOOD AND DRINK
- ASPHALT
- PHARMACEUTICAL
- COSMETICS AND PERSONAL CARE
- CHEMICALS
- MINING AND MINERALS
- POWER GENERATION
- CEMENT
- METAL POWDERS
- PLASTICS AND POLYMERS
- SURFACE COATINGS
- ELECTRONICS
- CERAMICS
- ADHESIVES AND SEALANTS



Excellence through experience

Many Malvern systems are used in highly regulated environments and product validation and R&D traceability are priorities for our customers. Operating to ISO9001: 2008 with TickIt accreditation for software development, Malvern is a major supplier to the highly demanding pharmaceutical and chemical industries. Malvern's products play pivotal roles in high quality research and manufacturing throughout the world. As a global supplier we believe we have responsibility to minimise the impact we have on the environment and operate to both ISO14001 and OHS18001.

Validation

To help our customers comply with the requirements of the Regulatory Authorities, such as the US Food and Drugs Administration (FDA) and the Medicines and Healthcare Products Regulatory Agency (MHRA), Malvern provides a comprehensive range of validation tools.

These aids follow a user's validation process through from Installation and Operational Qualification (IQ/OQ) to the maintenance phase with annual OQ renewals and the provision of standards for Performance Qualification (PQ). For products subject to FDA regulation, we have solutions to help with 21 CFR Part 11 compliance.

World-class service and support

Malvern offers professional support at all levels. Our intention is to increase your laboratory's productivity through the creation of a working relationship for the lifetime of your instrument providing service support, training and information.

- Global network of fully trained service personnel
- World-wide co-ordination for multi-national companies
- Technical support from the Malvern Helpdesk via telephone or email
- Range of maintenance contracts and service agreements to cover all requirements
- Validation support
- Consultancy-based on site training courses
- e-Learning training courses via the internet
- Classroom training courses
- Web Seminars
- Sample and application consultancy.

No other company offers more

SPECIFICATIONS

OMNISEC Molecular Characterization System			OMNISEC Molecular Characterization System		
	Parameter	Specification		Parameter	Specification
OMNISEC SYSTEM			OMNISEC REVEAL CONT.		
	Parameters measured	Concentration, dRI, dn/dc, dUV, dA/dc, Light scattering intensity (SLS), Molecular weight (Mn, Mw, Mz), Polydispersity, Radius of Gyration, Intrinsic viscosity, Mark-Houwink a & K, Hydrodynamic radius (viscosity)	4-capillary differential viscometer	Principle	4-capillary Wheatstone bridge with self-balancing mechanism and user-exchangeable capillaries
	Sample types	Synthetic polymers, Natural polymers (polysaccharides, DNA), Proteins		Differential pressure dynamic range	±2500 Pa
	Recommended computer specification	Windows 7 Professional 64 bit, 4th Gen Intel® Core I7 Processor (Quad Core HT, 3.4 GHz Turbo, w/HD Graphics, 8 GB 1600 MHz DDR3 memory, 500 GB 3.5 inch SATA (7200 RPM) HDD, Full-HD monitor		Differential pressure baseline noise	0.3 Pa
	Data collection rate	100 Hz		Inlet pressure dynamic range	100 kPa
	Patents	US 14/599,033, US20140060162A1 & EP2619543B1, US20140144214A1 & EP2619544A1		Inlet pressure baseline noise	0.01 kPa
				Baseline drift	<0.2 kPa
		Minimum quantifiable mass		1 µg of 100kDa molecular weight polystyrene in THF	
		Detector volume		17 µL/capillary	
		"Delay volume" volume		8 mL per column	
		Protection		Firmware-based transducer overpressure protection	
OMNISEC REVEAL			OMNISEC RESOLVE		
	Dimensions (W, D, H)	42, 64, 60 cm		Dimensions (W, D, H)	42, 64, 89 cm
	Weight	40 kg		Weight	62 kg
	Power requirements	600 W		Power requirements	600 W
	Detector temperature control range	20 - 65° C			
Differential refractive index detector	Dynamic range	±2.5 x10 ⁻⁴ RIU	Pump	Principle	Isocratic pump with continuous back seal washing
	Baseline noise	<10 ⁻⁷ RIU		Flow rate range	0.005 - 10 mL/min
	Baseline drift	<3x10 ⁻⁷ RIU/hr		Flow rate accuracy	±1%
	Minimum quantifiable mass	100 ng of 100kDa molecular weight polystyrene in THF		Pressure range	0 - 5000 PSI (34.5 MPa)
	Flow cell volume	12 µL		Pulsation	0.1456% @ 1 mL/min in water
Diode-array-based UV/Vis spectrometer	Baseline noise	2x10 ⁻⁵ AU	Degasser	Flow precision	0.25% RSD
	Baseline drift	5x10 ⁻⁴ AU/hr		Degassing capacity	>90%
	Wavelength range	190 - 900 nm		Volume	1850 µL
	Wavelength accuracy	<1 nm		Number of samples	Up to 192
	Wavelength resolution	0.6 nm		Sample container types	HPLC vials 96-well microtiter plates
	Number of wavelengths	1024		Temperature control range	4 - 60° C
Light scattering detector	Flow cell volume	7.5 µL	Autosampler	Injection volume range	1 - 300 µL
	Path length	10 mm		Injection volume accuracy	>99.5%
	Principle	RALS/LALS		Injection volume precision	<0.3% RSD in full loop mode <0.5% RSD in partial loop mode <1% RSD in µL pickup mode
	Operating angles	90° & 7°		Injection overhead volume	0 µL in µL pickup mode
	Dynamic range	2500 mV		Syringe volume	250 µL standard
	Baseline noise	<0.1 mV		Column capacity	6 x analytical (1 x Tricorn 10/300 GL)
	Baseline drift	<0.2 mV/hr		Temperature control range	20 - 65° C
	Minimum quantifiable mass	100 ng of 100kDa molecular weight polystyrene in THF			
	Molecular weight range	200 - >10 ⁷ g/mol			
	Flow cell volume	18 µL			
Laser	50 mW	Column oven			
Laser wavelength	640 nm				



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