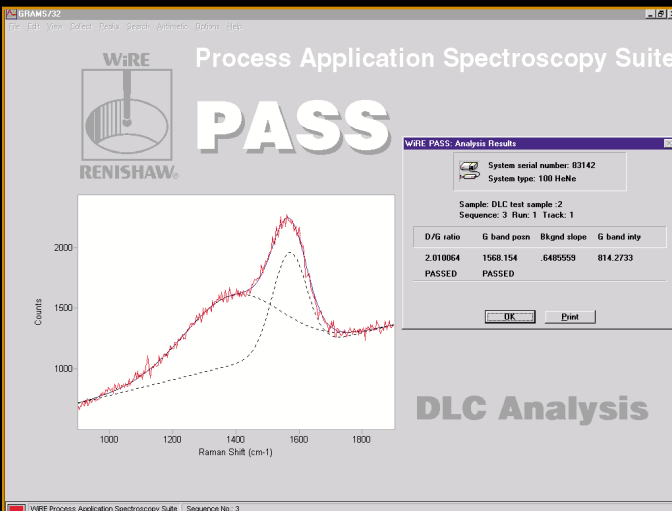
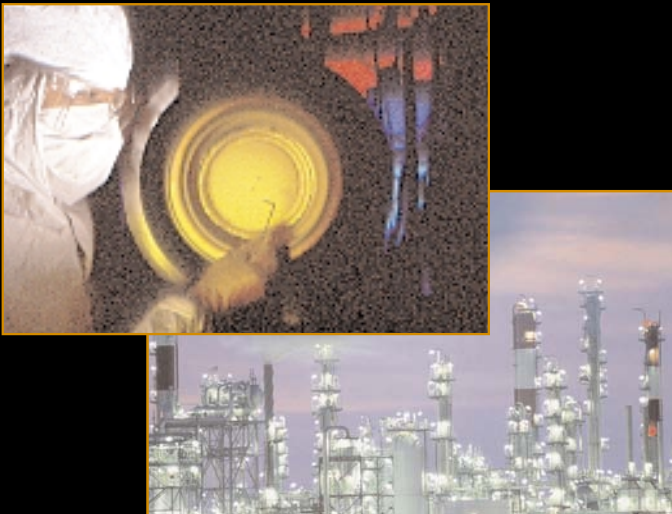


System 100 Raman Analyzer



A compact Raman spectrometer for process monitoring and laboratory use

- rugged design
- high optical efficiency for rapid analysis
- simultaneous measurement at up to four sampling stations
- remote sampling 100 m from the Process Analyzer
- internal standard for calibration
- powerful data capture and analysis software
- application specific software (PASS)

Renishaw is an ISO 9001 manufacturing company

RENISHAW 

System 100 Process Analyzer

Analyzer

The Renishaw System 100 Process Analyzer allows *in situ* Raman monitoring in the laboratory, pilot plant, or process line. It has been designed specifically for easy integration into the process line.

- rugged components for an extended trouble-free lifetime
- optimum optical design for rapid analysis
- tested to withstand industrial environments
- modular to allow rapid switch-over of components
- application specific designs ensure optimum performance
- turnkey operation for ease of use
- cooled CCD detector (-70°C) for high sensitivity measurements
- up to four sampling stations per control unit (linked by fiber optics) for flexibility and system cost reductions
- each sampling station may be 100 m away from the control unit (with optional extended cables)
- up to four lasers (of the same or differing wavelengths), each one serving one or more sampling stations
- internal reference source for self-calibration
- optional external reference source for calibration transfer
- suitable for Class 100 clean room environments
- uses same data and user-interface standards as Renishaw's other spectroscopy products to reduce operator training requirements
- custom software interfaces available

Control unit

The control unit houses the detector, a single-stage spectrometer, and an internal reference source.

The detector is a Renishaw RenCam electrically-cooled (-70°C) charge-coupled-device (CCD). This state-of-the-art device offers ultra-low noise and high efficiency, yet requires minimal maintenance.

The spectrometer has efficient f/1.4 optics, and a single diffraction grating mounted on a Renishaw encoded grating stage. The moveable grating allows different excitation wavelengths and Raman spectral ranges to be used without the need to change the grating. Alternatively, a fixed grating can be used for specific applications.

The control unit also houses a light source for use as a wavelength calibration standard, and can have an external source connected to act as an intensity standard for calibration transfer between different instruments.



control unit
dimensions:
660 mm x 310 mm x 176 mm

The Raman effect

Raman scattering can be observed by shining laser light onto a material. Some of the photons of light scatter from the structure and make it vibrate. The photons lose energy in the process.

The resulting spectrum of light reveals the frequencies of vibration of the structure. The frequencies mainly depend on:

- the masses of the vibrating atoms
- the nature of the chemical bonds
- the stresses in the molecule or crystal.

The intensity of the scattered light depends not only on the intensity of the incident light, but also on the number of atoms being illuminated. Thus the thickness of thin films can be determined.

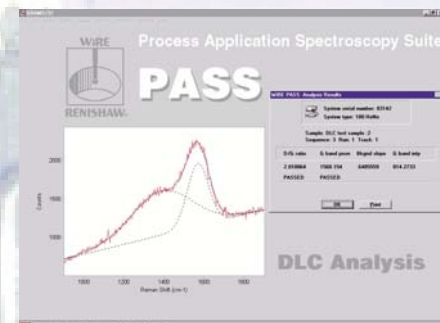
Software

Renishaw's Process Application Spectroscopy Suite (PASS) package and Galactic Industries GRAMS/32C[®] software enable users to transfer efficiently their applications from the laboratory to the production line.

Users in the laboratory may be given full access to all the software features to enable them to develop the process monitoring algorithms. Password security features can be used to limit access to certain production line staff, and to restrict which software features can be changed. The same software is used in both cases, making method validation and transfer easy.

The software also gives users access to the interface ports of the system; this enables communication with automatic sample handling and control hardware.

A chemometric analysis package is available for both quantitative and qualitative multivariate analysis.



Sampling stations

Each sampling station consists of a fiber optic probe with application specific sample interface. The ability to have up to four sampling stations on one analyzer allows the process engineer to:

- monitor the homogeneity of the process at several locations
- monitor the development of a reaction along the process line
- develop specialist process control by monitoring species concentrations at different analysis points

A variety of fiber optic probes are available, ranging from larger rugged high-efficiency probes to miniature pen-sized probes. Probes are also available with integrated video cameras, allowing the user to display the probe's view on the computer screen; this makes alignment and trouble-shooting easy.

Various sampling interfaces are available including:

- vial/ampule/cuvette holders for laboratory use
- windowed interfaces on chemical/polymer lines for *in situ* process monitoring
- specialist dip probes for direct use in the process stream
- miniature probes for use in laboratories, quality control applications, and in the field



Rugged probe for process monitoring applications, with video camera.

Dimensions:
395 mm x 107 mm x 64 mm



Miniature probe for use in laboratories, and in applications where size constraints prevent the use of the rugged probe.

Diameter: 12.5 mm

Lasers

The System 100 gives the user maximum flexibility in laser choice.

- multiple stations - one laser can be used for several sampling stations. Spectra can be acquired from all stations simultaneously
- multiple-excitation-wavelengths - several lasers can each supply a corresponding probe. Spectra are acquired sequentially from each set of like-excitation-wavelength probes
- external lasers - for easy access and remote location
- fiber coupling - standard FC/PC connectorized fibers in rugged protection tube. Fully interlocked for maximum safety, with automatic laser cut-off facility



Renishaw 780 nm diode laser - a compact laser for Raman applications

Dimensions:
380 mm x 140 mm x 127 mm

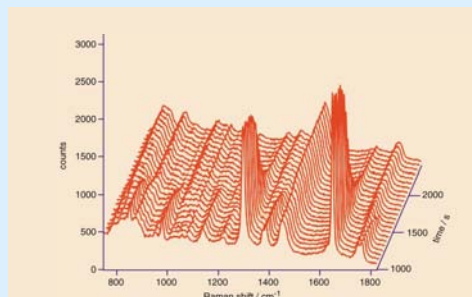
Specifications

- excitation wavelength488 nm, 514.5 nm, 532 nm, 632.8 nm, 780 nm, 785 nm (others available on request)
- fiber lengths2 m to over 100 m
- spectral resolutiondown to 1.5 cm⁻¹ (application dependent)
- spectrographf/1.4, single diffraction grating
- electronic interfacing8 user-definable digital lines; 4 input, 4 open-collector output, accessed via 9-way D-type connector
- designs for Zone 2 hazardous areas available on request

Renishaw reserves the right to change specifications without notice

Polymers

On-line process monitoring can accurately track reaction progress, leading to improved yield and reduced down-time.

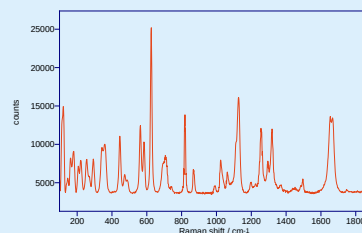


Monitoring the polymerization of a mixture of vinyl acetate and versatic acid vinyl ester, 785 nm excitation.

Note the changes in the spectra with time as the monomers polymerize (courtesy of Wacker Chemie, Germany).

Pharmaceuticals

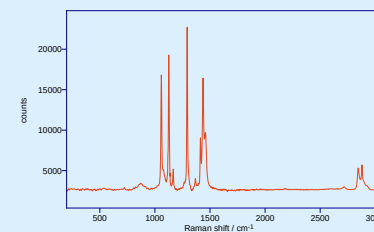
The Analyzer can monitor the quality of both incipient and excipient components of pharmaceuticals.



Vitamin C tablet, 785 nm excitation

Fibers

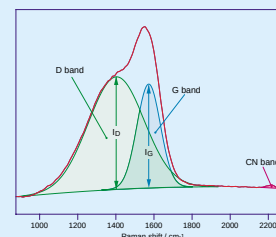
The Analyzer can monitor the processing of drawn fibers (e.g. nylon) on the production line.



Polyethylene (high density), 785 nm excitation

Coatings

The Process Analyzer can measure the chemical structure of hard coatings such as diamond-like carbon, and be used to ensure coatings have the appropriate qualities, such as high wear resistance.



Diamond-like carbon coating on a hard disk, 514.5 nm excitation

Global solutions from Renishaw

Renishaw is an established world leader in metrology, providing high performance, cost-effective solutions for measurement and increased productivity. A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Renishaw designs, develops and manufactures products which conform to ISO 9001 standards.

Renishaw provides innovative solutions with the following products:

- Probe systems for inspection on CMMs (co-ordinate measuring machines).
- Systems for job set-up, tool setting and inspection on machine tools.
- Scanning and digitising systems.
- Laser and automated ballbar systems for performance measurement and calibration of machines.
- Encoder systems for high accuracy position feedback.
- Spectroscopy systems for non-destructive material analysis in laboratory and process environments.



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