**The Thermo Scientific Nicolet™ Almega™ XR family of dispersive Raman spectrometers are a series of research-grade Raman microscope systems designed for laboratory use. The highly-configurable, powerful, and productive instruments provide you with the answers to your application problems.**

# Nicolet Almega XR

High-Performance Dispersive Raman Spectrometers
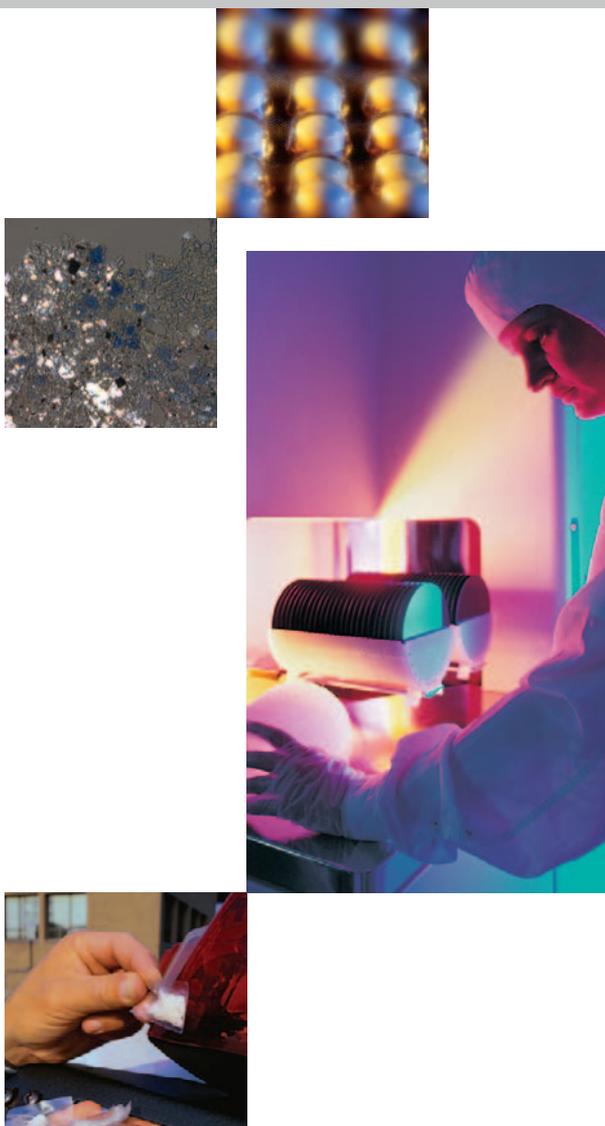
Dispersive Raman spectrometers utilize a form of vibrational spectroscopy to provide information regarding molecular structure. Raman spectra are used for identification and quantification of both organic and inorganic materials and are very sensitive to minor changes in molecular structure.

## Versatile, Easy Sampling

The Nicolet Almega XR system has many applications in the pharmaceutical, forensic, and semiconductor fields, and features specialized sampling options for many applications in these areas. The system can be configured for both micro and macro sampling of liquids and solids. No sample preparation nor dilution is necessary. Sampling is nondestructive and can often be performed directly through glass or plastic packaging, providing an excellent solution when non-invasive sampling is required. Aqueous-based solutions are readily analyzed with the Nicolet Almega XR spectrometer. Dispersive Raman provides useful information about these samples, unlike other vibrational spectroscopy techniques. Remote sampling with fiber-optics is also an option.

## Raman Microscopy

The Thermo Scientific Nicolet Almega XR microscope provides exceptional micro-Raman performance. The microscope is interfaced with the main spectrometer entirely using high-throughput, free-space optics. No fiber-optics are used. This provides a very small excitation laser spot size at the sample, eliminating the need to excite excessively large regions of the sample when working with very small samples. This greatly reduces the amount of interfering fluorescence generated by many samples. Combining this feature with the use of the integral confocal

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aperture and patented instrument alignment provides exceptional control of fluorescence, superior spatial resolution, and the ability to perform depth-profiling analysis.
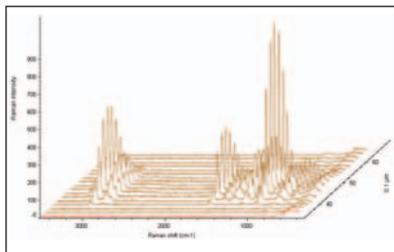


Notable features of the Nicolet Almega XR micro-Raman system include:

- Diffraction-limited spatial resolution
- Confocal microscopy and confocal depth profiling
- Polarization studies with automated polarizer option
- Crystal orientation independence with depolarizing kit option
- Selection of precise sample positioning options
    - Manual 2" x 3" stage
    - Motorized 4" x 3" stage
- Well-plate adapter
- Automated alignment to ensure peak performance at all times

## Visual Microscopy

The Nicolet Almega XR system provides excellent visible viewing capabilities in addition to high-performance Raman data collection. A high-quality Olympus BX series visible microscope provides the basis for visual microscopy on the system. These capabilities are augmented by either a dedicated color-video camera or a high-quality trinocular to provide viewing and image capture on the computer monitor or direct visual viewing for detailed examination. Additionally, the Olympus base permits the Nicolet Almega XR system to be equipped with a broad range of microscopy viewing options.

Viewing features include:

- Brightfield and darkfield viewing
- Transmission and reflection viewing and illumination option
- Polarized light viewing
- Large selection of standard and long working-distance objectives
- Motorized objective turret on some models
- Autofocus option with motorized stages

## Microscope Mapping

OMNIC™ Atlµs™ software combines the high spatial resolution of the Nicolet Almega XR system with automated data collection to produce extremely high-quality, information-rich Raman area maps. The maps can be displayed as 3D representations or chemical contour plots and each map includes a corresponding video image.
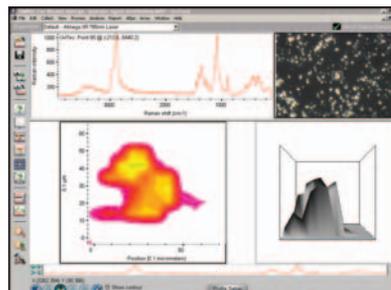


Mapping features include:

- Full spectral information available at every position on map
- Data quality of maps matches that of single point collection
- Completely automated data collection
- Mosaic™ imaging of areas larger than the field of view
- Supports perpetual reanalysis of maps to generate different chemical profiles
- Extensive array of post-processing routines can be applied before generating chemical profiles (e.g., baseline correction, smoothing and spectral subtraction)
- Storage of spectral data, video image, and chemical profiles in one file

## Macro Sampling



Since not all samples are microscopic, the Nicolet Almega XR spectrometer also provides macro sampling capability.
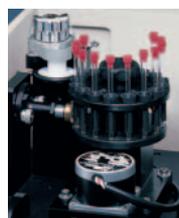
The optional macro compartment includes:

- Entirely software controlled switching between microscope and macro compartment
- Visible and safe laser beam path locator to facilitate optimizing custom accessories
- Automated sampling positioning with the x-y-z stage accessory
- Real-time spectral feedback when optimizing sampling geometries
- Polarization options
- Autosampler option for liquid and solid samples

## Flexible Options

The Nicolet Almega XR system is highly configurable and offers numerous options to meet the needs of specialized applications. Nearly all options can be added to systems in the field at any point. Configure the Nicolet Almega XR system to meet your needs today and have confidence that you will be able to expand your capability in the future.
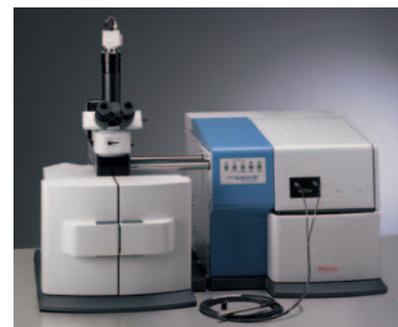


Flexible options include:

- Wide range of excitation lasers
- Port to bring in external excitation laser
- Simultaneous mounting of two excitation lasers and up to four gratings
- High and low resolution gratings
- Polarizer/depolarizer kits
- Specialized stage options
- Above and below ambient temperature sampling options
- Remote sampling options through fiber optics
- Extensive range of Olympus visual microscopy options

## Automation Makes Your Job Easier

The Nicolet Almega XR system offers an unmatched level of automation. Automation reduces manual operations, which removes subjectivity from the analysis, makes it easy to maintain the instrument at peak performance, and greatly increases productivity.



Automation features and options include:

- Patented[†] method for system autoalignment
- Automated grating switching
- Automated laser switching and alignment
- Automated Rayleigh rejection filter switching
- Automated calibration and referencing
- Automated white-light correction
- Automated dark current correction for instrument and detector background
- Automated stage control and mapping with motorized stages
- Autofocus option
- Automated switching between microscope and macro compartment

† US. Patent 6,661,509

## High-Performance Components

The Nicolet Almega XR system uses extremely high-performance optical components that are selected to be optimal for the spectral range of intended use. High brightness lasers permit focusing to extremely small spot sizes, avoiding excess fluorescence in the area surrounding the region of interest. High brightness lasers also provide energy densities at the sample that are far higher than ordinary lasers, sometimes in excess of 30 times higher, with much lower power outputs. High energy density at the sample enhances the Raman signal, improving results. The performance increases offered by these lasers are especially prominent with very small samples.

High-performance components available include:

- High-brightness lasers
- Gratings optimized for every laser frequency
- High-throughput filters
- High-sensitivity, TE-cooled silicon CCD array detector
- Wavelength optimal reflective optics coatings

## Complete Software Tools

The Nicolet Almega XR system is controlled by OMNIC software. OMNIC is a comprehensive and completely integrated package for data collection, data manipulation, library searching, report generation, and much more. It has been specifically designed to meet the needs of vibrational spectroscopy analysis and has incorporated the feedback of thousands of users to become the standard that it is today. In addition, specialized modules that provide comprehensive toolkits for specific applications are available. All software packages include extensive documentation.
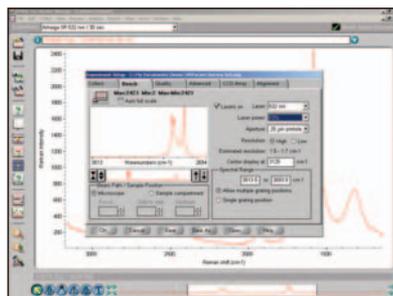
Overview of available software:

- **OMNIC –** for instrument control, data collection, data manipulation, library searching, library creation, and report generation.
- **TQ Analyst™ –** comprehensive quantitative analysis and chemometric modeling package supporting Beer's law, CLS, MLR, PCR, and PLS algorithms along with several popular classification algorithms.
- **OMNIC Macros –** provide a simple graphical interface to allow users to capture commonly used software procedures and SOPs as simple push button operations.
- **Atlµs –** spectroscopic mapping and chemical profiling software.
- **Array Automation –** automate data collection and analysis for array based samples such as well-plates and blister packs.
- **Data Integrity Software –** data security and digital signatures module for OMNIC.
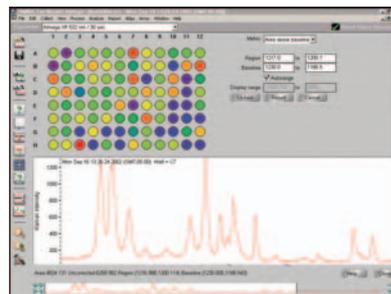
## Raman Libraries

When trying to identify unknown materials, collecting the spectrum is only half of the job. An extensive collection of high quality reference spectra will greatly enhance your ability to identify unknowns. We provide the largest collection of Raman spectral libraries offered anywhere. All library spectra have been collected by FT-Raman, so they are fluorescence free and cover the full spectral range. The collection consists of over 15,000 spectra, and is still growing. In addition, OMNIC software provides you with the ability to create your own libraries so you can grow your own collection with every new material that you measure.

## Laser Safety

Laser safety is a very important consideration when performing Raman experiments. The Nicolet Almega XR system offers an option to make it a fully integrated Class I laser product.* Configured with this option the Nicolet Almega XR system can reside in any standard laboratory environment with no need for special laser safety provisions, such as goggles, isolated areas, or interlocked lab entrance doorways.

*\* If the Class I option is not selected then the system is a Class IIIb laser product.*

### Nicolet Almega XR Dispersive Raman Spectrometer

**System**

| | |
|---|---|
| Olympus microscope, reflection illuminator | Standard |
| Transmission illuminator | Option |
| Supports brightfield and darkfield illumination* | Standard |
| Confocal optics including confocal aperture | Standard |
| Maintenance-free, extended-range TE-cooled Si CCD | Standard |
| Automated system calibration | Standard |
| Fully automated optical alignment | Standard |
| Class I laser safe enclosure for microscope | Option |
| Class I laser safe macro compartment | Option |
| Automated polarization analyzer | Option |
| Depolarization kit | Option |

**Performance**

| | |
|---|---|
| Laser options | 785 nm, 780 nm 633 nm, 532 nm, 473 nm (Others available as special order) |
| Grating options | High and low resolution for each wavelength |
| Spectral range: | |
| Absolute | 400 – 1050 nm |
| For 785 nm excitation | 100 – 3100 $cm^{-1}$ Raman shift |
| For 780 nm excitation | 100 – 3300 $cm^{-1}$ Raman shift |
| For 633 nm excitation | 100 – 4000 $cm^{-1}$ Raman shift |
| For 532 nm excitation | 100 – 4000 $cm^{-1}$ Raman shift |
| For 473 nm excitation | 100 – 4000 $cm^{-1}$ Raman shift |
| Spectral resolution | 2 $cm^{-1}$ ** FWHM (1 $cm^{-1}$ per CCD pixel element) |
| Spatial resolution | Diffraction limited (1 µm) ** |
| Confocal resolution | 2 µm |
| Confocal aperture | Size selectable slit or pinhole |

**Microscope**

Stages:

| | |
|---|---|
| 2" x 3" travel stage | Manual positioning |
| 4" x 3" travel motorized stage | 0.1 µm steps, 1.0 µm repeatability |
| Well plate automation option | Up to 1,536-well plates |
| Standard working distance objectives | 4X, 10X, 20X, 50X, 100X |
| Long working distance objectives | 10X, 20X, 50X, 100X |
| Microscope sampling geometry | 180° Refractive optics |

**Physical Dimensions**

| | |
|---|---|
| Optical bench configured with standard microscope | 114 cm (W)***, 77 cm (D), 89 cm (H)**** |
| Weight | 295 lbs., 134 kg |
| Optical bench with 300 mm wafer stage | 163 cm (W), 89 cm (D) 89 cm (H)**** (Additional clearance needed below front end to open door) |
| Macro sample compartment dimensions | 29 cm (W), 31 cm (D), 28 cm (H) |
| Macro compartment beam height | 8.9 cm |

**Warranty**

12-month warranty standard on the complete Nicolet Almega XR system. Extended warranties are available.

**Regulatory approval**

CE  LISTED ETL N0291537110  ETL N0291537110

*\* Requires appropriate objective*
*\*\* Varies with wavelength of excitation laser*
*\*\*\* Additional 15 cm clearance needed on right side for air cooling vent*
*\*\*\*\* Some lasers extend beyond the optical bench and will exceed these dimensions*

ISO 9001

Class I Laser Product

Avoid direct exposure to beam. Class IIIb Laser Product

PS50445_E 12/07M

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