



# LIBS and Raman

## Laser Based Spectroscopy

Laser Induced Breakdown Spectroscopy (LIBS) systems from Ocean Optics can help you analyze solids, liquids and gases with rapid results and little damage to your sample. Use our LIBS lineup for materials sorting, elemental analysis, elemental ratio monitoring, quality assurance, process control and more.

Raman spectroscopy is quickly becoming one of the preferred chemical identification techniques across a broad range of application areas. Ocean Optics provides modular probe- and cuvette-driven Raman spectroscopy along with a host of accessories and software.



### Tip

To convert a spectrum into Raman shifts, convert the excitation (laser) wavelength,  $\lambda_{EX}$  and each pixel wavelength,  $\lambda_i$ , into wavenumbers:  $Y = 10^7 / \lambda$ , where Y is the value in wavenumbers ( $cm^{-1}$ ). Once you have calculated both  $Y_{EX}$  and  $Y_i$ , simply subtract to get Raman shifts:

$$RS_i = Y_{EX} - Y_i$$

# Laser Induced Breakdown Spectroscopy

Reliable, Repeatable Identification and Analysis

LIBS technology is a powerful tool for rapid, real-time elemental analysis. With LIBS, there is virtually no sample preparation, excellent portability, real-time results and sensitivity down to parts-per-million and picogram levels.

With recent advances in broadband spectral detectors, LIBS is capable of detection and identification of a comprehensive range of metal and geological materials, as well as biological and chemical agents, hazardous materials and more.

The application areas of LIBS are growing dramatically. From environmental monitoring to materials analysis and from forensics to pharmaceuticals, LIBS fits the bill when simple and straightforward techniques are required.

## LIBS Benefits

- No sample preparation
- Very small samples required
- Trace element detection possible
- Modular and turnkey options available



## LIBS Comparison to Other Technologies

Parameter	LIBS	SEM/EDS	XRF	LA-ICP-MS	EPMA
Sample depth:	~50-100 $\mu\text{m}$	~5 $\mu\text{m}$	~100 $\mu\text{m}$	~80 $\mu\text{m}$	<1 $\mu\text{m}$
Sensitivity:	10-50 ppm	1000 ppm	100 ppm	<1 ppm	100 ppm
Precision:	Fair-good	Poor	Fair-good	Excellent	Fair
Accuracy:	Semi-quantitative	Qualitative	Semi-qualitative	Quantitative	Semi-quantitative
Analysis time:	Fast	Slow	Very slow	Slow	Slow
Sample consumption:	Almost non-destructive	Non-destructive	Non-destructive	Almost non-destructive	Non-destructive
Complexity:	Easy to use	Easy to use	Complicated	Complicated	Complicated
Discrimination:	Good	Poor	Good	Excellent	Fair



## Application Note

### LIBS for Defense

In an earlier LIBS application, closely related spores of the genus *Bacillus* were deposited on silver membrane filters for analysis using broadband Laser Induced Breakdown Spectroscopy. The observed spectral differences among the spores – *Bacillus subtilis*, *Geobacillus stearothermophilus* and *Bacillus pumilus* – provide evidence of the power of LIBS in resolving complex biological samples.

The presence of the spores' unique spectral lines, as well as different combinations of spectral lines, provide many opportunities for discrimination. While most of the unique peaks occurred in the *G. stearothermophilus* spectrum, spectral differences were observed in the spectra for all spores. Spore characteristics, such as surface profile and coat mineralization, may account for these differences.



The results reported for the *Bacillus* spores, along with others obtained for biological molecules (including nucleic acids and proteins), provide exciting evidence of the discriminating capability of Ocean Optics' LIBS systems.

# The Insight LIBS System

## High-Sensitivity Microanalysis

The Insight™ LIBS System is designed for the microanalysis of solid materials. The standard spectrometer within the Insight provides a broad spectral range (190-960 nm) and better than 0.1 nm resolution throughout the system.

Major and minor elements can be resolved and the 30,000+ points in a typical spectrum can be expanded to reveal lines separated by less than 0.2 nm in the UV range. The band of Ocean Optics spectrometers used in the Insight has excellent sensitivity to low-light levels enabling the spectral detection of trace elements.

### LIBS-INSIGHT-150MJ

High-end LIBS platform with 150 mJ laser, video, computer controlled XYZ, Chromium operating software and add LIBS quantitative software packages

### LIBS-INSIGHT-50MJ

High-end LIBS platform with 50 mJ laser, video, computer controlled XYZ, Chromium operating software and add LIBS quantitative software packages



### Build to High-Fidelity Measurements

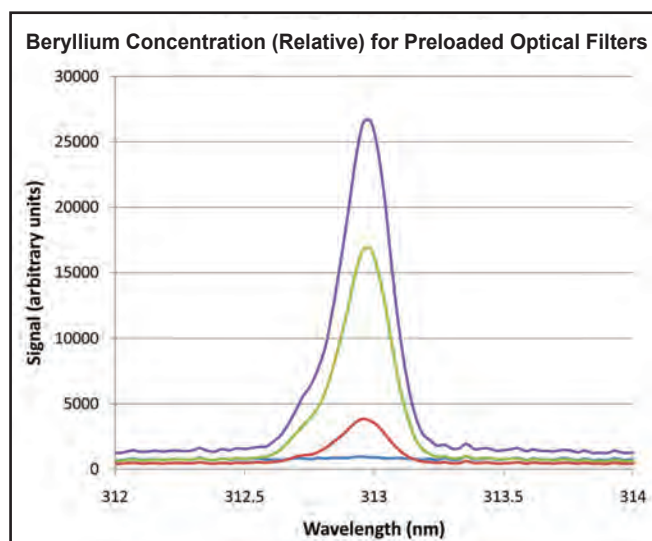
- Rugged Nd:YAG laser, sensitive spectrometer
- Built-in timing control circuit synchronizes laser and spectrometer
- Confocal video and laser planes ensure measurement repeatability
- Overall timing jitter with respect to external synch signal  $\leq 10$  ns
- Purged sample chamber
- Rotometer-regulated flexible "assist" gas nozzle for N<sub>2</sub>, He or Ar
- Class 1 safety enclosure

### Configurable

- Adjustable, coaxial lighting of sample
- Variable laser energy
- Variable spectrometer delay
- Software-selectable spot size from sub-5  $\mu$ m to 2 mm

### Powerful, Easy to Use

- Sample interrogation and analysis software tools
- Laser energy measurement and display
- User-selectable repetition rate
- User-selectable spot size of the laser beam via software control
- Single-shot, burst and continuous firing modes
- Color video microscope displays live sample images
- Computer connection: USB 2.0, OS: Windows XP or Windows 7
- Computer-controlled x/y stage for sample holding



### Software That Brings it All Together

The addLIBS™ Software included with Insight is designed to make plasma emission spectroscopy analysis easy. addLIBS allows you to explore spectra using partial NIST or in-house spectral libraries, annotate spectra, develop calibration methods using known samples and apply calibrations manually or automatically to unknown spectra.

Once a method is developed, it can be repeatedly applied without further analysis or it can be modified at will.

For more complicated data analysis, chemometric methods such as PLS are being implemented, and data can also be exported to standard analysis software such as GRAMS® or Excel®. Spectra are automatically ported from the instrument control software to addLIBS™ as they are acquired.

### Additional Software

Our SpecLine Software helps make the evaluation of spectra and identifying atomic lines simple and fast.

# LIBS2500plus System

## Qualitative Measurements in Real-Time



### Software

OOILIBS Application Software operates the LIBS2500plus as well as its firing laser. With OOILIBS, you have spectral saving and data-logging capabilities as well as material identification.

OOILIBSPLUS LIBS2500plus Windows-based Software

Specifications	
Spectrometer range:	200-980 nm
Resolution:	0.1 nm (FWHM)/ 0.05 peak
Detection:	CCDs with a combined 14,336 pixels
Frame rate:	500 Hz capability, computer-controlled
Integration time:	1 ms; variable in free-run mode
Trigger delay:	-121 $\mu$ s to +135 $\mu$ s in 500 ns steps, user-configured
Trigger jitter:	~20 ns
Trigger level:	TTL not to exceed 5.5 V
Interface:	USB 1.1 or USB 2.0
Operating systems:	Windows XP on desktop or notebook PCs
Software:	OOILIBS
Power requirement:	5 volts @ <1 amp, power supply included
Input optical fiber:	Sampling probe containing 7 fibers, 2 meters long (other lengths available) with 74-UV collimating lens and a sampling lens
Dimensions:	334 mm x 150 mm x 140 mm (spectrometer system only)
Weight:	6.36 kg (14 lb.)

The small-footprint LIBS2500plus system is a more modular approach to Laser Induced Breakdown Spectroscopy. Built around our popular HR2000+ optical bench and electronics, the LIBS2500plus delivers superior functionality in a completely enclosed system.

While traditional LIBS detection systems have a small spectral range, the LIBS2500plus provides broadband spectral analysis and – because of its noninvasive performance – it allows you to perform real-time in situ measurements within hostile industrial, chemical and biochemical environments. The LIBS2500plus has the equivalent of seven HR2000+ spectrometers combined and can be configured in various setups rather easily.

The LIBS2500plus is easily interfaced to your PC or notebook computer via USB and is compatible with Windows operating systems.

### Applications

- Environmental monitoring (soil contamination, particulates)
- Materials analysis (metals, plastics)
- Forensics and biomedical studies (teeth, bones)
- Military and safety applications (explosive particles, chemical and biological agents)
- Art restoration and conservation (pigments, precious metals)

LIBS Spectrometer Channels	
LIBS-CH-A	200-305 nm wavelength range
LIBS-CH-B	295-400 nm wavelength range
LIBS-CH-C	390-525 nm wavelength range
LIBS-CH-D	520-635 nm wavelength range
LIBS-CH-E	625-735 nm wavelength range
LIBS-CH-F	725-820 nm wavelength range
LIBS-CH-G	800-980 nm wavelength range

### Systems

Item	Description	Fiber Bundle
LIBS2500-7PLUS	7-channel spectrometer system, includes channels A-G	LIBS-BUN-7
LIBS2500-6PLUS	6-channel spectrometer system, choose 6 channels from A-G	LIBS-BUN-6
LIBS2500-5PLUS	5-channel spectrometer system, choose 5 channels from A-G	LIBS-BUN-5
LIBS2500-4PLUS	4-channel spectrometer system, choose 4 channels from A-G	LIBS-BUN-4
LIBS2500-3PLUS	3-channel spectrometer system, choose 3 channels from A-G	LIBS-BUN-3
LIBS2500-2PLUS	2-channel spectrometer system, choose 2 channels from A-G	BIF600-2-UV/VIS
LIBS2500-1PLUS	1-channel spectrometer system, choose 1 channel from A-G	P600-2-UV/VIS
LIBS2500-1+UPG	1-channel HR2000+ upgrade	LIBS Controller Cables

# LIBS2500plus System

## The Modular Solution



### Spectrometer

The LIBS2500plus is built around our HR2000+ high-resolution miniature spectrometer. This small-footprint spectrometer delivers excellent optical resolution and has a detector range of 200-1100 nm.

The HR2000+ boasts an impressive data transfer rate of a full scan to memory every 1-2 ms and an integration time of 1 ms to 65 seconds. For more information on the performance of the HR2000+, see page 30.

### Laser Power Options

Because power requirements vary by sample type, we offer two laser power options from a leading laser supplier, Big Sky Laser Technologies. For most applications we employ a Q-switched 1064 nm Nd:YAG laser, and for maximum versatility, we recommend a 200 mJ laser with attenuator to adjust the laser power according to the sample matrix.

Item Code	Description	Best Use
LIBS-LAS200ICE-450-20HZ	LIBS Laser, 200 mJ Ultra Laser CFRB66101B1-072	Glass and high OH content materials
LIBS-LASER	LIBS Laser, 50 mJ Ultra Laser ul130C11, 20 Hz	Metal and thin film samples

### Sample Chamber

Our LIBS-SC Sample Chamber is designed to function safely and provides clear view of the sample. The LIBS-SC features an eyewear-safe enclosure and a safety-interlock that prevents the laser from firing when the door is ajar. It houses a manually controlled x-y stage and provides illumination for the optional LIBS-IM-USB Imaging Module.

LIBS-SC	LIBS-SC-050	LIBS-SC-200
LIBS Sample Chamber utilized when Imaging Module is ordered	LIBS Sample Chamber utilized when 50 mJ laser is ordered - no Imaging Module	LIBS Sample Chamber utilized when 200 mJ laser is ordered - no Imaging Module

### Imaging Module

Our LIBS-IM-USB Imaging Module attaches directly to the LIBS-SC Sample Chamber and enables you to magnify a sample image and establish your precise laser ablation target. The imaging module is an ideal option for forensic applications, semiconductor analysis, gemology, metallurgy and more. The LIBS-IM-USB requires no external power supply when PC-powered over USB.

LIBS-IM-USB	LIBS-IM-USB-050	LIBS-IM-USB-200
LIBS Imaging Module, color, USB connection	LIBS Color Imaging Module for use when LIBS-LASER is incorporated	LIBS Color Imaging Module for use when LIBS-LAS-200ICE-450-20HZ is incorporated



### Fiber Bundles

LIBS-BUN-3	Fiber Bundle for 3-Channel LIBS2500plus
LIBS-BUN-4	Fiber Bundle for 4-Channel LIBS2500plus
LIBS-BUN-5	Fiber Bundle for 5-Channel LIBS2500plus
LIBS-BUN-6	Fiber Bundle for 6-Channel LIBS2500plus
LIBS-BUN-7	Fiber Bundle for 7-Channel LIBS2500plus
LIBS-BUN-8	Fiber Bundle for 8-Channel LIBS2500plus
LIBS-COLL	LIBS Collimator

# Raman Spectroscopy

## Reliable, Non-Destructive Measurement

Ocean Optics offers a complete range of fully integrated Raman systems for handheld, laboratory and educational applications. Most of our Raman systems include a high-sensitivity spectrometer, a 532 nm or 785 nm laser, operating software and sampling accessories for probe- or cuvette-based analysis.

Raman analysis is nondestructive, requires very limited sample preparation, and allows for sample volumes in the microliter range. In fact, Raman techniques can be used to acquire data through vial walls, pill pack windows and bags – packaging forms that are frequently used in the biomedical and pharmaceutical industries.

Our Raman spectrometers are especially useful for identifying spectral features, or fingerprints, that are often distinct and clearly separated.

We offer off-the-shelf and modular approaches, sampling accessories for a variety of environments, cuvettes for solution measurements and a full range of probes for measuring solids and liquids.



Model	PeakSeeker 785	PeakSeeker Pro 785E	PeakSeeker Pro 785	PeakSeeker Pro 532	PinPointer	QE65000 for Raman
Laser Wavelength	785 nm	785 nm	785 nm	532 nm	785 nm	532 or 785 nm
System	Diode Laser Spectrometer Probe Laptop PC Software	Diode Laser Spectrometer Probe Laptop PC Software	Diode Laser Spectrometer Probe Laptop PC Software	Diode Laser Spectrometer Probe Laptop PC Software	Diode Laser Spectrometer Probe Software Embedded Computer with LCD Display	Choose from Laser Probes Sample Holders Configure QE65000
Applications	Teaching labs, general purpose, moderate resolution Raman applications	Lab, industrial (pharmaceuticals), forensics	Lab, industrial (pharmaceuticals), forensics	Lab, industrial, security	Handheld, field-portable for on-site QC, forensics and security/inspection	General-purpose lab setups (aqueous solutions, powders, gels, tablets and surface media)
Item Code:	RAM-PKR-785	RAM-PRO-785E	RAM-PRO-785	RAM-PRO-532	RAM-PINPTR-785	QE65000, QE65000-RAMAN



### Technical Tip

Raman spectroscopy offers a number of benefits for testing and characterization. Like regular IR spectroscopy, it is rapid and non-destructive. Raman can capture data from a sample contained in plastic or other materials that are optically transparent to the wavelengths of interest.

Unlike IR spectroscopy, which falls spectrally within the water window, Raman spectroscopy can be used to capture data on aqueous samples or samples with high moisture content. And, with the emergence of economical diode lasers in the NIR spectral region, Raman is a more attractive

option for a wider range of applications than ever before.

So, how to select between a Raman system with a 785 nm laser and one with a 532 nm laser? The 785 nm version is designed to minimize the fluorescence signal, making it useful for chemical identification and fingerprinting. What's more, the 785 nm version generates well defined peaks for use in chemometric analysis and can provide semi-quantitative data. Other wavelength options are available.

For applications where C-OH structural information is important, the 532 nm version is your best option. Such measurements are typical of biological and pharmaceutical sample analysis, where researchers study characteristics of active ingredients, binders, fillers and excipients.

# Benchtop Raman Systems

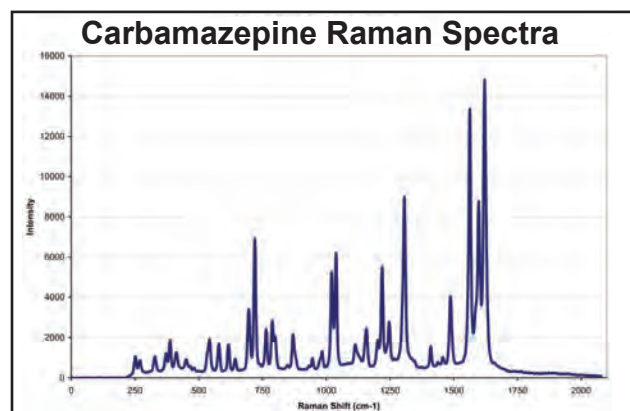
## Meet the PeakSeeker Pro Family



The PeakSeeker Pro™ family of benchtop Raman systems is accurate, cost-effective and easy to use.

These remarkable instruments use TE-cooled, high-efficiency CCD detector arrays and can be configured with either a 532 nm or 785 nm wavelength excitation laser.

PeakSeeker Pro is extremely versatile for measuring multiple sample types and comes with sampling accessories, software and USB connectivity that enables true plug and play operation.



### Versatility

You can sample solids, liquids and powders – even when samples are inside transparent packaging and containers such as bags, bottles and vials.

### Sensitivity

The PeakSeeker Pro fully meets the stringent requirements of USP Monograph 1120 for resolution, sensitivity and stability. The detector array is cooled to -20 °C. Deep blocking laser rejection filters obstruct Rayleigh scatter and isolate Raman scatter for valuable molecular analysis.

### Portability

The spectrometer is portable and lightweight. Rugged construction and ergonomic design allow it to be carried just about anywhere and set up for immediate use.

### Simplicity

Each PeakSeeker Pro system includes a notebook computer pre-loaded with RSIQ™ software for true point-and-click operation. Sample spectra are acquired within seconds.

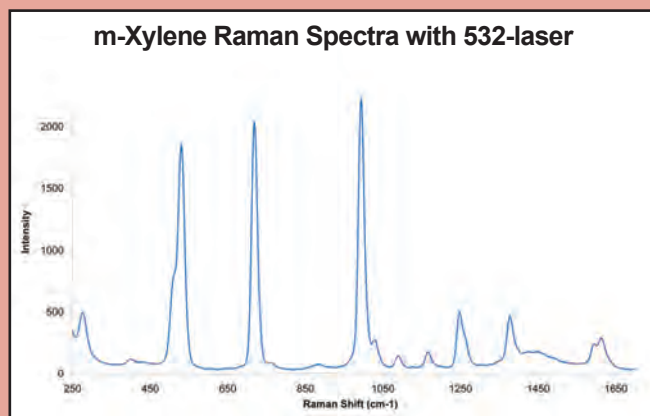
Specifications	RAM-PKR-785	RAM-PRO-785	RAM-PRO-785E	RAM-PRO-532
Laser wavelength:	785 nm	785 nm	785 nm	532 nm
Laser power:	5-300 mW	5-300 mW	5-300 mW	100 mW
Spectral range, Raman shift:	200-3000 cm-1	200-2000 cm-1	200-3900 cm-1	200-4500 cm-1
Resolution:	~12 cm-1	6 cm-1	10 cm-1	10 cm-1
Signal to noise ratio:	250:1 (at full signal)	1000:1 (at full signal)	1000:1 (at full signal)	1000:1 (at full signal)
Wavelength stability:	<1 cm-1 in 12 hours	<1 cm-1 in 12 hours	<1 cm-1 in 12 hours	<1 cm-1 in 12 hours
Photometric stability:	<4% in 12 hours	<1% in 12 hours	<1% in 12 hours	<1% in 12 hours
Optics:	0.22 NA, sample spot size 0.1-.03 mm	0.22 NA, sample spot size 0.1-.03 mm	0.22 NA, sample spot size 0.1-.03 mm	0.22 NA, sample spot size 0.1-.03 mm
Power input:	15 VDC from power adapter input = 11/240 VAC @ 50/60 Hz	15 VDC from power adapter input = 11/240 VAC @ 50/60 Hz	15 VDC from power adapter input = 11/240 VAC @ 50/60 Hz	15 VDC from power adapter input = 11/240 VAC @ 50/60 Hz
Operating temperature:	-25 °C-+45 °C	-25 °C-+45 °C	-25 °C-+45 °C	-25 °C-+45 °C
Dimensions (cm):	36 x 29 x 11	36 x 29 x 11	36 x 29 x 11	36 x 29 x 11
Weight (kg):	3.6	3.6	3.6	3.6

# QE65000-Raman

## Scientific-Grade Spectrometer for Raman



Raman spectroscopy is easily achieved with the QE65000-Raman setup. This powerful quantitative and qualitative tool is ideal for a wide range of analytical applications, both in the laboratory and in the field.



### Examples of QE65000 Configurations for Raman

Sample Config.	Spectral Range	Excitation Source	Grating p. 46	Slit p. 42	Resolution (approx.)
1	150-4000 cm <sup>-1</sup>	532 nm laser	H6	10 μm	~8 cm <sup>-1</sup>
2	150-4000 cm <sup>-1</sup>	532 nm laser	H6	25 μm	~10 cm <sup>-1</sup>
3	150-7500 cm <sup>-1</sup>	532 nm laser	H14	10 μm	~16 cm <sup>-1</sup>
4	150-7500 cm <sup>-1</sup>	532 nm laser	H14	25 μm	~19 cm <sup>-1</sup>
5	150-2100 cm <sup>-1</sup>	785 nm laser	H6	50 μm	~6 cm <sup>-1</sup>
6	150-2100 cm <sup>-1</sup>	785 nm laser	H6	100 μm	~8 cm <sup>-1</sup>
7	150-3950 cm <sup>-1</sup>	785 nm laser	H14	50 μm	~13 cm <sup>-1</sup>
8	150-3950 cm <sup>-1</sup>	785 nm laser	H14	100 μm	~18 cm <sup>-1</sup>

Our QE65000-Raman Spectrometer is a scientific-grade, preconfigured combination of detector, optical bench and electronics that provides you a remarkably sensitive system for demanding low-light level Raman applications.

The performance of the QE65000-Raman Spectrometer has been enhanced to provide lower stray light, improved efficiency in the UV and Shortwave NIR and better unit-to-unit reproducibility. The QE65000-Raman also delivers up to 90% quantum efficiency with high signal-to-noise and rapid signal processing speed. Also available are custom-configured QE65000 systems for Raman that take advantage of a broader range of gratings and accessories.

Item Code: QE65000-RAMAN

Physical	
Dimensions:	182 mm x 110 mm x 47 mm
Weight:	1.18 kg (without power supply)
Detector:	Hamamatsu S7031-1006
Detector range:	200-1100 nm
Pixel size:	24 μm <sup>2</sup>
Pixel well depth:	300,000 electrons/well, 1.5 m elec/column
Sensitivity:	22 electrons/count all λ; 26 photons/count @ 250 nm
Sensitivity:	~0.065 counts / e-
Quantum efficiency:	90% peak; 65% at 250 nm
Optical Bench	
Design:	f/4, Symmetrical crossed Czerny-Turner
Focal length:	101.6 mm input and output
Entrance aperture:	50 μm wide slit
HC6 grating:	Provides 123-170 nm range (bandwidth)
Detector collection lens option:	None
Collimating and focusing mirrors:	Standard only
UV enhanced window:	No
Fiber optic connector:	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range:	780 - 1100 nm (grating dependent)
Optical resolution:	~6-19 cm <sup>-1</sup> (depending on slit)
Signal-to-noise ratio:	1000:1 (at full signal)
A/D resolution:	16 bit
Dark noise:	3 RMS counts
Dynamic range:	7.5 x 10 <sup>9</sup> (system), 25000:1 for a single acquisition
Integration time:	8 ms to 15 minutes
Stray light:	<0.08% at 600 nm; 0.4% at 435 nm
Corrected linearity:	>99.8%
Temperature and Thermoelectric (TE) Cooling	
Temperature limits:	0 °C to 50 °C; no condensation
Set point:	Software controlled; lowest set point is 40 °C below ambient
Stability	+/-0.1 °C of set temperature in <2 minutes

# Multimode Laser

## High Power, Spectrum Stabilized

Our Multimode Laser Subsystem (LASER-785-IP-OEM) features high output power with a narrow spectral bandwidth. This unit's stabilized peak wavelength remains locked, regardless of case temperature.

Devices can be spectrally tailored to suit application needs and offer side mode suppression ratios better than 40 dB. This provides an extremely high signal-to-noise performance and makes this source ideal for Raman spectroscopy and pump laser applications.

We integrate this source with our high performance laser drive and temperature control M-Laser-Module for a truly turnkey solution for the laboratory. This module has a digital readout for easy set point adjustment, an independent master power key switch and laser enable switch, a remote interlock and an Emergency Power Off (EPO) button. Additional 785 nm and 532 nm laser options are available.

Specifications	
Dimensions:	110 mm x 89 mm x 53 mm
Weight:	600 g
Noise:	<0.5% RMS
Output fiber:	100 $\mu\text{m}$ @ 0.22 NA
Warm-up:	15 minutes
Temperature:	-10 $^{\circ}\text{C}$ to 40 $^{\circ}\text{C}$
Stability:	<3% peak-to-peak in 8 hours
Humidity:	5-95% non-condensing
Laser life:	10,000 hours
Power consumption:	3.0 A @ 5 VDC
Power output (CW):	>500 mW
Peak wavelengths:	785 +/- 0.3 nm
Spectral line width:	0.2 nm (typical)
Rise time:	<500 msec
Control:	TTL modulation -- 0 to 100 kHz
Connector:	SMA 905 or FC



### Making Raman More Accessible

For decades, Raman spectroscopy was a cumbersome, expensive research tool relegated to laboratories and arcane experiments. But today's economical, compact lasers and detectors make Raman spectroscopy a practical solution for non-destructive chemical identification across a range of new markets, including pharmaceutical processing, forensics and law enforcement and homeland security.

Raman has been considered a high resolution application, but for many identification problems in commercial markets, such laboratory-level resolution is not necessary. A high-performance Raman system will typically achieve resolution of 2 to 4  $\text{cm}^{-1}$ . Depending on choice of grating and entrance slit, lower-cost systems like the units in this section can still reach resolution of 6 to 11  $\text{cm}^{-1}$ . In other words, it is possible to obtain a system with resolution only 2-3x that of a laboratory instrument, for a cost that is an order of magnitude lower.

Our Raman systems are robust enough to operate in a range of environments. Thermal drift in the excitation wavelength may compromise SNR over time, but regular yearly or monthly calibration will catch this. The Raman signature will still be emitted at the correct wavelengths. Likewise, possible variations in power stability over time will affect intensity but not the shape or positioning of the peak.



# Handheld Raman Systems

## Easy, Fast and Accurate

The PinPointer™ delivers a full-featured Raman spectroscopy system in a remarkably affordable, true handheld format.

The lightweight unit is controlled by a pocket-sized computer and features easy-to-use RSIQ software for fast point-and-click operation.

Many substances emit a characteristic light when illuminated with a laser, the so-called Raman effect, that uniquely identifies molecular structure.

With a touch of a button, the PinPointer collects this emitted light scattered from a targeted object. Optional RSIQ-QUAL software will search thousands of stored reference material spectra to identify unknown substances. Within seconds, the detected chemicals are identified and displayed to the system user.



### Affordable, Compact, High Performance

The PinPointer provides the same performance as other handheld Raman spectrometers aimed at homeland security or on-site chemical identification but costs thousands less.

### Extensive Spectral Library

The RSIQ-QUAL software database covers most organic and inorganic substances encountered in the field by law enforcement, first responders and Homeland Security personnel. A specialized chemical database can be added upon request. Users can also create their own custom spectral libraries.

### Substance Identification of Packaged Materials

Solid, powder or liquid samples can be analyzed while still contained in plastic bags or glass or plastic bottles.

Specifications	
Excitation wavelength:	785 nm
Laser power:	5-300 mW
Raman spectral range:	200-3000 cm <sup>-1</sup>
Spectral resolution:	~12 cm <sup>-1</sup>
Signal-to-noise ratio:	250:1 (at full signal)
Raman shift stability:	< 1 cm <sup>-1</sup> in 12 hours
Photometric stability:	< 4% in 12 hours
Collection optics:	NA = 0.28, working distance = 5 mm spot size < 0.2 mm
Power:	Rechargeable battery, >4 hr. charge
Size:	216 mm x 109 mm x 63.5 mm (8.5" x 4.3" x 2.5")
Weight:	1.4 kg. (3 lb.)
Operating temperature:	-25 °C-70 °C

### Add-On Modules for RSIQ (sold separately)

**Item Code: RAM-RSIQ-CFR**

Supports compliance with 21 CFR Part 11 "Electronic Records and Signatures"

**Item Code: RAM-RSIQ-QUAL**

Manages and searches user-created or purchased Raman spectral libraries

**Item Code: RAM-RSIQ-QUANT**

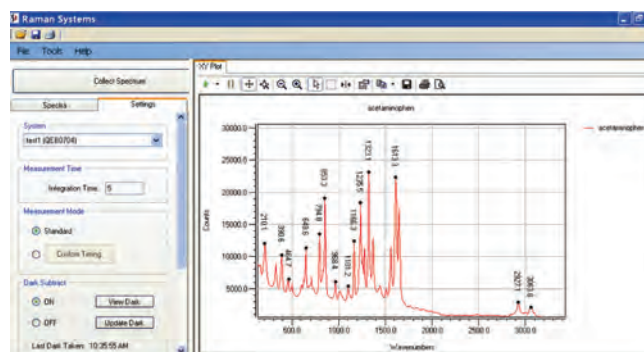
Multivariate analysis tool for calibration of PinPointer and PeakSeeker systems

**Item Code: RAM-RSI-LIB**

Database of Raman spectra; requires RAM-RSIQ-QUAL add-on

### RSIQ Software

PinPointer systems come with RSIQ software - a powerful database package with a simple interface and user-friendly operation. Its one-touch data acquisition and easy instrument verification make it the perfect companion for your Raman analysis. RSIQ features a comprehensive database of most organic and inorganic substances encountered in the field by law enforcement, first responders and Homeland Security personnel and you can add specialized chemical databases, or create your own, to suit your environment. The software is Windows compatible.



# Raman Probes

## Fiber Optic Probes for Raman Spectroscopy

We offer a number of fiber optic probes that are built specifically for Raman spectroscopy. The RIP-Series probes from InPhotonics provide optical filtering of the Rayleigh line and high-signal collection in a compact, rugged design. Compatible with Ocean Optics Raman systems, these probes are suitable for laboratory, industrial and environmental applications and are available for several excitation wavelengths.



RIP-RPS



RIP-RPB

### General Purpose

Item Code	Description	Dimensions
RIP-785-0.26	Raman Probe for 785 nm laser, steel jacketed fibers	107 x 38 x 12.7 mm, 0.26 m steel-jacketed fiber
RIP-RPB-532	Laboratory probe for use with lasers up to 3 nm from specified operating wavelength	107 x 38 x 12.7 mm, 9.5 OD x 38 mm extension, 1.5-meter fiber
RIP-RPB-532-FC	Raman coupled fiber probe for 532 nm with FC connector	107 x 380 x 9.57 mm, 1.5-meter fiber
RIP-RPB-785-FC	Raman coupled fiber probe for 785 nm with FC connector 7.5 mm working distance	107 x 380 x 9.57 mm, 1.5-meter fiber
RIP-RPB-785-SS	Raman coupled fiber probe for 785 nm with SMA connector 7.5 mm working distance	107 x 380 x 9.57 mm, 1.5-meter fiber
RIP-RPS-532	Stainless-steel focused probe 12.7 mm diameter	12.7 OD x 108 mm, 5-meter fiber
RIP-RPS-532-IP	Stainless-steel focused probe for 532 nm excitation wavelength setups	12.7 OD x 108 mm, 5-meter fiber
RIP-RPS-785	Stainless-steel focused probe for 785 nm excitation wavelength setups	12.7 OD x 108 mm, 5-meter fiber
RPB-785-0.6	Raman coupled probe for 785 nm, steel jacketed fibers	107 x 38 x 12.7 mm, 0.6 m steel-jacketed fiber

### Immersion Probes

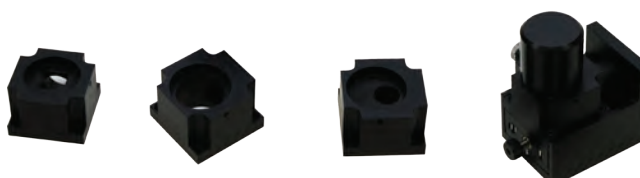
Item Code	Description	Dimensions
RIP-RP2-532	Stainless-steel immersion probe is immersible up to 200 °C and has adjustable working distance for 532 nm excitation wavelength setups	15.87 OD x 230 mm; 5-meter fiber
RIP-RP2-785	Stainless-steel immersion probe is immersible up to 200 °C and has adjustable working distance for 785 nm excitation wavelength setups	15.87 OD x 230 mm; 5-meter fiber
RIP-RPR-H-532	Hastelloy C immersion probe for use in process control applications up to 200 °C and 1500 psi; comes with sapphire window and has adjustable working distance for 532 nm excitation wavelength setups	15.87 OD x 230 mm; 5-meter fiber
RIP-RPR-H-785	Hastelloy C immersion probe for use in process control applications up to 200 °C and 1500 psi; comes with sapphire window and has adjustable working distance for 785 nm excitation wavelength setups	15.87 OD x 230 mm; 5-meter fiber
RIP-RPR-SS-532	Stainless-steel immersion probe for use in process control applications up to 200 °C and 1500 psi; sapphire window with adjustable working distance for 532 nm excitation wavelength setups	15.87 OD x 230 mm; 5-meter fiber
RIP-RPR-SS-785	Stainless-steel immersion probe for use in process control applications up to 200 °C and 1500 psi; sapphire window with adjustable working distance for 785 nm excitation wavelength setups	15.87 OD x 230 mm; 5-meter fiber

### Process Probes

Item Code	Description	Dimensions
RIP-RPP-532	Stainless-steel probe with external optics for process control applications up to 500 °C and 3000 psi; comes with sapphire lens and has short working distance for 532 nm excitation wavelength setups	9.52 OD x 300 mm; 5-meter fiber
RIP-RPP-785	Stainless-steel probe with external optics for process control applications up to 500 °C and 3000 psi; comes with sapphire lens and has short working distance for 785 nm excitation wavelength setups	9.52 OD x 300 mm; 5-meter fiber

### Raman Probe Accessories

Item Code	Description
OOA-RAMAN-SH	Raman Sample Holder
RAM-PR-I	Raman Immersion Measurement Tube
RIP-PA-SH	Compact Raman Sample Holder



For more on sample holders, see page 201.

# Raman Accessories

## RSM Video Raman Microscope



RSM Video Raman Microscope for PeakSeeker 532 Systems

Item Code: RAM-RSM-MIC-532

RSM Video Raman Microscope for PeakSeeker 785 Systems

Item Code: RAM-RSM-MIC-785

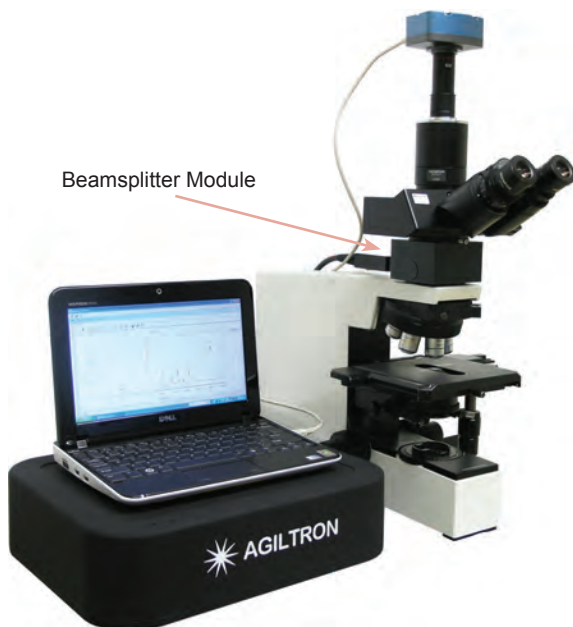
The Raman Systems RSM Video Raman Microscope is an upright laboratory microscope that couples to PeakSeeker Raman systems (sold separately). The RSM comes with a reflected light, Brightfield illuminator and a USB color video camera.

The USB color video camera facilitates precise sample positioning of the laser spot from the Raman spectrometer onto a solid sample surface.

Specifications	
Eyepiece:	Wide field 10X (22 mm) binocular
Objectives:	Infinity corrected
Magnification working distance:	4X 25 mm 10X 11 mm 20X 8 mm 50X 1.9 mm
Sample stage:	Dimensions: 190 mm × 150 mm
X-Y Range:	75 mm × 50 mm (manual)
Focusing:	Coaxial coarse and fine adjustment Fine focusing scale 0.002 mm
Illumination:	Brightfield Kohler 12V 30W brightness variable
Camera:	1.3 MP Color CMOS USB 2.0 C-mount 1.8 meter long USB cable 0.5X image reduction lens 0.01 mm line width stage micrometer Software CD

# Raman Accessories

## MSK Raman Microscope Kit



MSK Raman Microscope Kit for PeakSeeker 532 Systems

Item Code: RAM-MSK-MIC-KIT-532

MSK Raman Microscope Kit for PeakSeeker 785 Systems

Item Code: RAM-MSK-MIC-KIT-785

Turn your lab microscope into a Video Raman Spectroscope with the MSK Kit. The MSK has a Raman beamsplitter module that mounts below the eyepiece assembly and a USB color video camera that mounts onto a port above the eyepiece.

The Raman Beamsplitter Module works with Peak Seeker systems and mates to the external fiber optic probe. The Color Video Camera facilitates precise sample positioning of the laser spot from the Raman spectrometer.

The MSK Raman Microscopy Kit can be used with most modular upright microscopes fitted with reflected light illumination and infinite plan achromat objectives. The kit works with reflected light Kohler illuminators, fiber optic illuminators or a compact white LED Brightfield illuminator specially designed for the MSK (RAM-MSK-LED, sold separately).

### Components

Color Video Camera (included with kit):

1.3 MP Color CMOS Camera

USB 2.0

C-mount

1.8-meter USB Cable

0.5X Image Reduction Lens

0.01 mm line width stage Micrometer

# Raman Accessories

## Sample Holders

The OOA-HOLDER-RFA is a multipurpose sampling fixture that acts as a holder for Raman, fluorescence, absorbance and reflection measurements. Unlike other Raman sample holders, the OOA-HOLDER-RFA can be adjusted for a variety of lab techniques. Here are other notable features:

- Mobile XY-axis stage makes it easier to adjust the focus of your Raman probe
- Holder adjusts to accommodate 6.35 mm (1/4"), 9.5 mm (3/8") and 12.7 mm (1/2") OD probes
- Includes mirror and cuvette plugs to increase signal in absorbance and reflection measurements
- Has 90-degree cross-angle design for fluorescence measurements

The OOA-HOLDER-RFA is compact, lightweight and easy to load and unload. The holder offers other advantages as well: making it easier to block the ambient light with cuvette measurements; protecting against the damage caused by contact between the probe and cuvettes; fixing the probe in place using a simple setscrew; and allowing more freedom in adjusting the focus of the excitation light.

Item Code: OOA-HOLDER-RFA

OOA-HOLDER-RFA Specifications	
Dimensions:	110 mm x 70 mm x 130 mm LWH (standard); 155 mm x 70 mm x 162 mm (optional)
Material:	Aluminum
Mobile optical stage:	X axis = 10 mm Z axis = 12.5 mm
Probe sizes accommodated:	Raman probes = adjustable for 9.5 mm (3/8") or 12.7 mm (1/2") OD Reflection probes = 6.35 mm (1/4") OD
Cuvette pathlengths accommodated:	1 cm and 0.1 cm
Cuvette plug dimensions:	15 mm x 5.7 mm x 45 mm for 0.1 cm path-length cuvette
Mirror plug dimensions:	15 mm x 5.7 mm x 45 mm
Mirror plug wavelength range:	200-2500 nm; options available with better resistance to oxidization and fraying and with higher reflectivity at UV wavelengths



### Raman Sample Holders

Our Raman-only sample holder is a handy tool for analyzing liquids (and other specimens) using Raman probes and cuvettes. Its modular design makes it capable of accommodating a variety of cuvettes and vials.

Item Code: OOA-RAMAN-SH

# Raman Accessories

## The Finishing Touch to Your Setup

### Raman Caps

The RAM-MC-L Cap can be used for measurements through the walls of vials, bottles and other containers.

Item Code: RAM-MC-L

Our RAM-MC-S Cap is for direct contact with solids, tablets, powders, liquids and other samples.

Item Code: RAM-MC-S

The RAM-MC-VC is a verification calibration that is loaded with spectroscopic-grade Teflon.

Item Code: RAM-MC-VC

### Substrates and Standards

Klarite substrates provide a unique solution for trace-level molecular analysis using Surface Enhanced Raman Spectroscopy (SERS). SERS can help increase the sensitivity of Raman by many orders of magnitude, extending the range of Raman measurements to as low as parts-per-billion levels.

Surface Enhanced Raman Substrates mounted on glass slides (set of 5)

Item Code: RAM-SERS-KLARITE-5

Surface Enhanced Raman Substrates unmounted (set of 5)

Item Code: RAM-SERS-KLARITE-OEM-5

### Safety First

We offer laser safety goggles for use with 532 nm and 785 nm lasers.

Item Codes: RAM-GG-532, RAM-GG-785

# Analyze IQ Software

## Accurate Analysis of Spectroscopic Data

Analyze IQ Lab is an analytical chemistry software package designed for use in commercial R&D, forensics labs and academic research labs. Analyze IQ is designed to supersede existing software packages for spectral analysis and chemometrics.

In addition to standard chemometric techniques Analyze IQ provides users with access to innovative machine learning techniques that have been designed for spectral analysis. Testing has shown that these proprietary methods are more accurate than standard techniques, particularly when analyzing complex mixtures.

Analyze IQ Lab is the perfect complement to Ocean Optics' Raman spectroscopy systems.

### Analyze IQ Lab

The analytical chemistry software package designed for chemometric techniques such as PCR.

- Advanced spectral analysis
- Intuitive user interface
- Broad range of pre-processing options

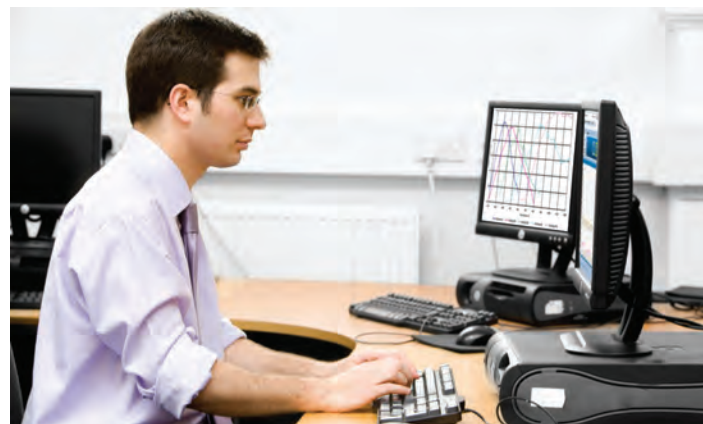
Item Code: RAM-ANIQ-LAB

### Spectra Manager

This spectral database and data management software allows you to easily manage your own library of spectra.

- Store CAS registry numbers and QA details
- Retrieve and list spectra by IUPAC and common names
- Track mixtures that use the same materials by lot numbers

Item Code: RAM-ANIQ-SPEC-MGR



### Raman Spectra Library

Available as an option to Spectra Manager, the Raman Spectra Library is a curated library of 1,870 Raman spectra, including the exact composition of each material and all associated data. You can incorporate a wide range of additional data, including manufacturer, lot, appearance, purity, IUPAC name, common name and more.

Item Code: RAM-ANIQ-RAMAN-LIB

### Predictor

Predictor is the embedded software module that deploys analytical models built using Analyze IQ Lab into third-party software packages. Its lower CPU and storage requirements make it perfect for integration into portable systems.

# UNLEASH THE POWER OF LIBS

The power of laser-induced breakdown spectroscopy is in your grasp with modular and turnkey LIBS options from Ocean Optics.

Select our newest offering, the fully-integrated Insight™ LIBS platform\* or customize your setup with our modular LIBS components, including laser and high-resolution spectrometers.



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\* The Insight LIBS system combines Ocean Optics high-resolution spectrometers with laser, sampling chamber and other components from Photon Machines – a world-class manufacturer of laser-based instrumentation

