



Your Photonics Partner

Raman Solution

MiniRam™ & MiniRam™ III

Performance & Portability with Affordability



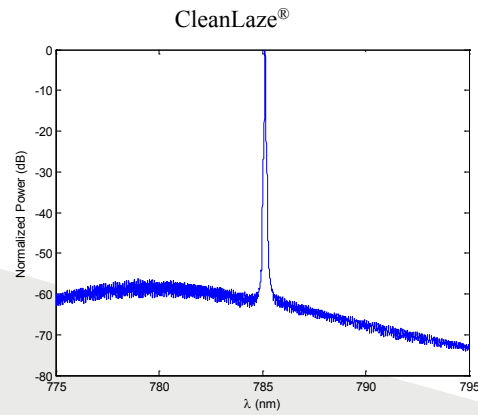
Features:

- Spectral Resolution of 10cm^{-1}
- 175cm^{-1} of the Rayleigh Line
 - 65cm^{-1} Option Available
- Small Footprint and Lightweight
- Patented CleanLaze® Technology for Laser Stabilization
- TE Cooled 2048 pixel CCD Detector
- Fiber Optic Interface for Convenient Sampling

The MiniRam series is available in two models: MiniRam™ and MiniRam™ III

MiniRam™ is ideal for Raman education and feasibility studies.

MiniRam™ III is completely field-portable with battery operation and an integrated tablet PC. Designed for mobile applications where both portability and high performance are required. Ideal for incoming QC for raw material identification/verification and field-based forensic analysis.



Excitation Wavelength
Laser

Creating Raman Scatter

In Raman spectroscopy it is essential to utilize a clean, narrow bandwidth laser due to the fact that the quality of the Raman peaks are directly affected by the sharpness and stability of the delivered light source. The MiniRam™ series spectrometer systems feature a patented CleanLaze® technology with a linewidth < 0.3nm when equipped with our 785nm laser. This technology results in the correct center wavelength and avoids the phenomenon of “mode hopping.” In addition, the laser output power can be adjusted in the software from 0 - 100%, allowing you to maximize the signal-to-noise ratio and minimize integration time.

Laser lifetime of 10,000 hours ensures quality data for years to come!

Near-Excitation Raman
Filter

Collects Data within 175cm⁻¹ of the Rayleigh Line

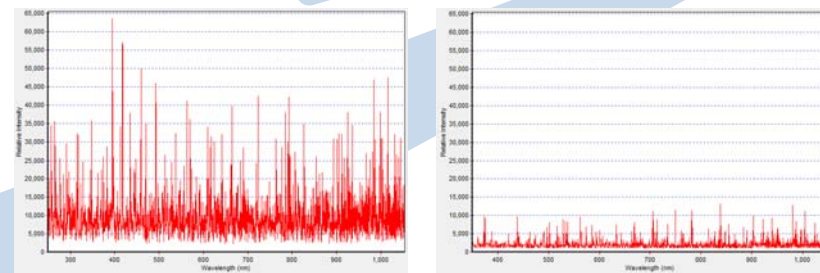
The center wavelength of the laser line is precisely maintained even when the peak power is increased by utilizing a series of high end filters. A laser line filter is used to clean up any side bands and ensure a narrow excitation is delivered to the sample by removing all secondary excitation lines before exciting the sample. The light collected from the sample is then filtered via a notch filter. Finally, an ultra steep long pass filter further removes lingering laser line to allow accurate measurement of Raman peaks as close as 175cm⁻¹ from the Rayleigh line. An E-grade Filter upgrade is available allowing the measurement of Raman peaks as close as 65cm⁻¹ from the Rayleigh line.

Low-Light Level
Detector

Cooled Detector for Low-Light Level Detection

Cooling an array detector with a built-in thermoelectric cooler (TEC) is an effective way to reduce dark current and noise to enhance the dynamic range and detection limit. The graphs to the left show the dark current and noise for an uncooled versus a cooled CCD detector at an integration time of 30 seconds. Operating at room temperature, the dark current nearly saturates the uncooled CCD. When the CCD is cooled to 14°C, the dark current is reduced by four times. This allows the spectrometer to operate at long integration times and detect weak optical signals.

Dark Current: Uncooled vs. Cooled CCD Detectors at 30 Seconds



Room Temperature

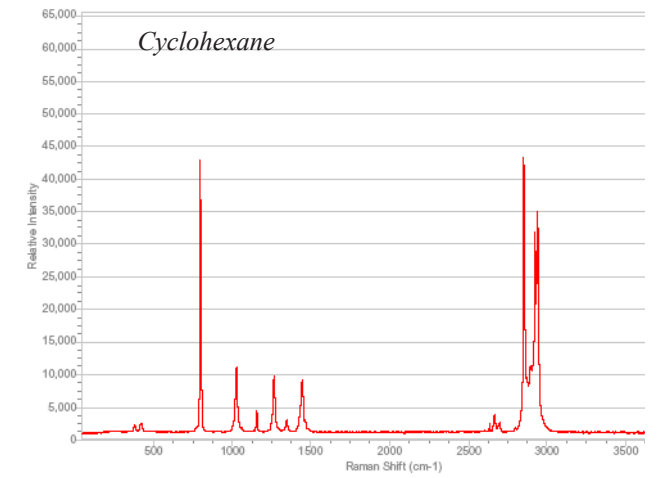
Cooled to 14°C

High Resolution
Spectrometer

Optimized for Raman Spectroscopy

The standard configurations for the spectrometer are 785nm and 532nm laser excitation wavelengths. You can customize your spectrometer by choosing from a variety of excitation wavelengths. With our Crossed Czerny-Turner optical design, spectral resolution of 10cm⁻¹ can be achieved, while at the same time keeping the footprint of our MiniRam series small, which brings enormous advantage for field Raman applications.

MiniRam™ III comes with 785nm laser excitation only.



Easy Sampling
Probe

Easy Transition Between Sample Types

The probe allows for measurement of various materials in the form of liquids, gels, powders, or solids under both lab conditions (Lab Grade) or demanding environmental conditions (Industrial Grade). Constructed with state-of-the-art telecom packaging techniques, the probe has a flexible fiber coupling encased in a durable protective jacketing material which delivers Rayleigh scatter rejection as high as 10 photons per billion. Wavelength excitation probes come in 532nm or 785nm.

Custom wavelength excitation probes available.

Convenient

Portability Small Footprint and Lightweight

The small footprint and lightweight design is convenient for mobile Raman applications as well as bench-top applications.

MiniRam™ III is battery operated and features an integrated computer so there is no need for a separate laptop or desktop, making it ideal for applications needing bench-top portability.

Interface

Integrated Computer State-of-the-Art Touch Screen

The MiniRam™ III features an embedded version of Windows XP and a 5” LVDS touch screen with LED backlighting, the intelligent GUI is easy to use. With an ATOM Z500 1.6GHz CPU, 8GB Compact Flash Hard Drive, 1 GB RAM, 1 USB Port, 1 Ethernet Port and Video Output capabilities this system provides a total solution for Raman spectroscopy applications.

Why Choose Raman?

- No sample preparation required
- Measure through glass, quartz, plastic (non-contact)
- Samples can be solid, liquid or gas, transparent or opaque
- Small sample size to reduce cost
- Wide spectral coverage for diversity of applications
- Spectra that is more clean and precise than FTIR or NIR



Software

We offer comprehensive software packages that provide solutions for your application needs.

Powerful calculations, easy data management, and user friendly!

BWSpec™

The foundation for all B&W Tek, Inc. software platforms, BWSpec™ is ideal for broad Raman applications

BWID™

Built on the proven BWSpec™ platform, BWID™ is optimized for identification and verification of materials

BWID™-PHARMA

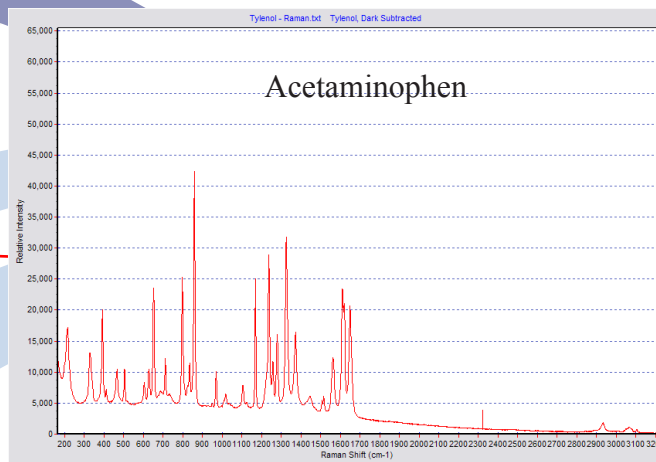
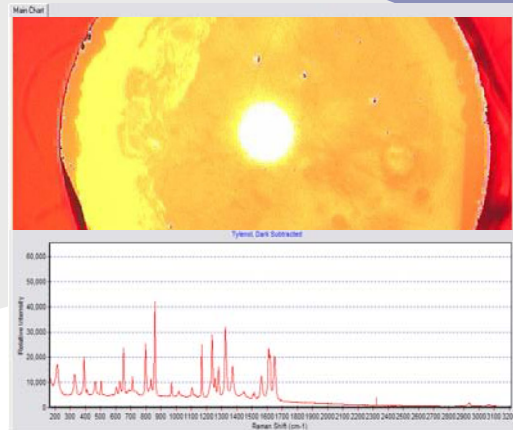
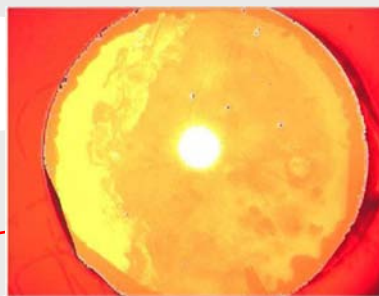
For industrial Raman applications that require federal compliance: BWID™-Pharma supports FDA 21 CFR Part 11 Compliance

BWSpec™

BWSpec™ is a spectral data acquisition software developed by B&W Tek, Inc. for use with our spectrometers, systems, and accessories. It is included with the purchase of any product which uses it to operate. The software delivers a wide range of features designed to perform complex measurements and calculations at the click of a button. BWSpec™ features multiple data formats and the capability to optimize scanning parameters such as integration time and laser output power control. In addition to data acquisition and data processing, other features include automatic dark removal, spectrum smoothing, and manual/auto baseline correction. The software also contains an OCX interface for users to collect spectra in Thermo Scientific GRAMS/AI®.

Key Features

- * Compatible with our spectrometers, systems, and accessories (if applicable)
- * Raman measurements
- * Continuous and single scan acquisition
- * Dark subtract
- * Spectral file format: txt, spc
- * Spectral file exportable to Excel®
- * Manual and automatic baseline correction
- * Peak smoothing algorithms: FFT, Savitzky-Golay, Boxcar
- * Thermo Scientific GRAMS/AI® OCX control interface



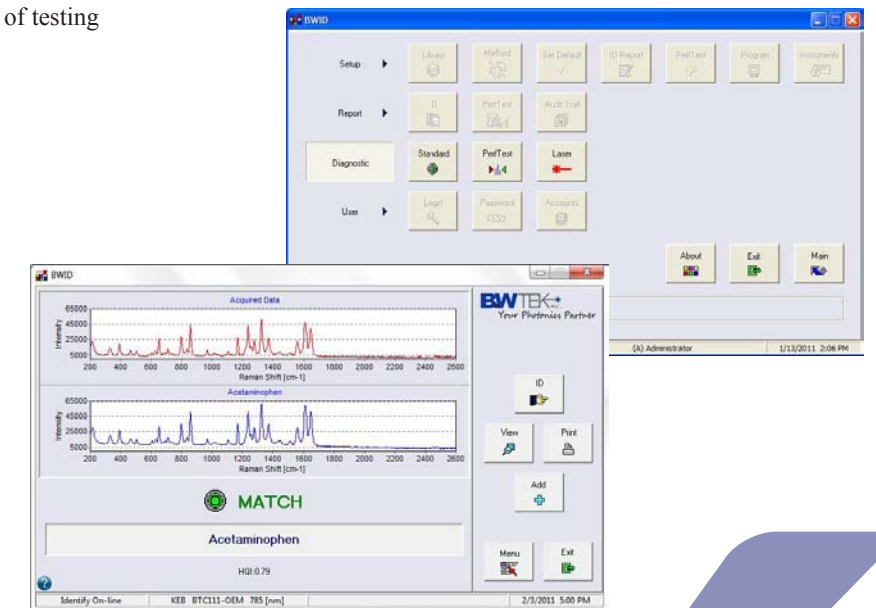
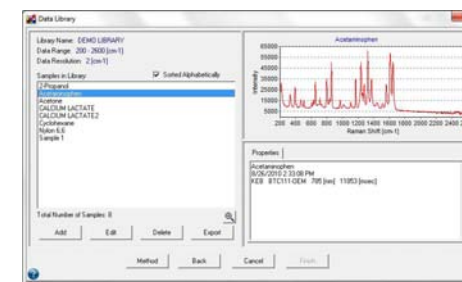
Dedicated Raman Software

BWID™

BWID™ has been specifically designed for Raman spectroscopy. This software will rapidly identify and verify materials stored in your own personal easy-to-create library or easy-to-load third-party library. One click is all you need to create or expand a Raman library. The combination of BWID™ and any of B&W Tek's Raman spectrometer systems unite to create a powerful and effective solution for identification and verification of materials. The reporting capability enables a user to save, view, and print any analysis report.

Key Features

- * Fast identification of unknown materials with "MATCH" or "NO MATCH" results
- * Fast verification of known materials with "PASS" or "FAIL" results
- * User-definable method for automated sequences of testing
- * Facilitates inspection of incoming raw materials
- * Build user-defined spectral libraries
- * Supports third-party libraries
- * Seven search algorithms
- * Capable of automatic performance test
- * Simplified menu driven GUI
- * Save, View and Print Analysis Reports

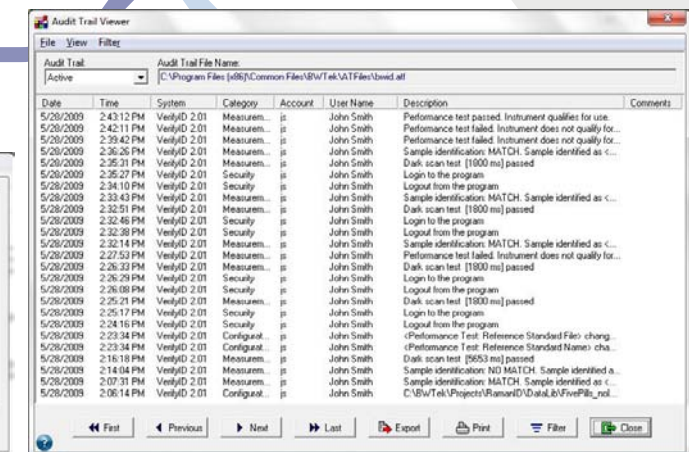
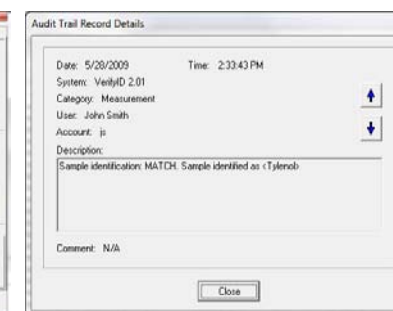
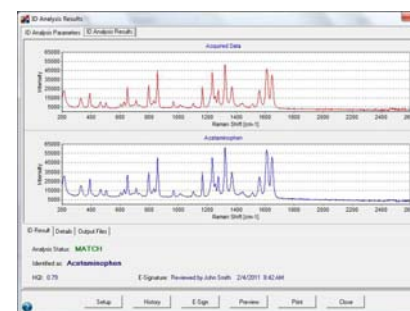


BWID™-PHARMA

BWID™-PHARMA is designed for pharmaceutical manufacturing facilities that are facing the increasing need for 100% inspection of incoming raw materials. In addition to all the features provided in BWID™, BWID™-PHARMA provides enhanced system access security and an audit trail of data activities that support compliance with the FDA 21 CFR Part 11 regulation for Electronic Records and Electronic Signatures, benefiting pharmaceutical system validations including Installation Qualifications (IQs) and Operational Qualifications (OQs) procedures.

Key Features

- * Includes all BWID™ features
- * FDA 21 CFR Part 11 Regulation Compliance: Electronic ID Signatures for Records Analysis: Review, Reject, Approve
- * Three user levels: Administrator, Developer, Operator
- * System Access Security
- * Audit Trails
- * Pharmaceutical System Validations - IQ and OQ Procedures



Applications & Experience



Bioscience and Medical Diagnosis:

- Subtle changes within biomolecules, such as drug interactions, tissue healing, cosmetics, disease diagnosis
- Intercellular SERS localization and interaction. Identification of drug binding to cells for Drug-DNA and cellular interaction analysis
- Investigation of microorganisms in single cells; yeast cell classifications, single bacterium
- Oxygenation measurements of blood and tissue
- Molecular level cancer detection (cervical, lung, etc.)
- Cardiovascular disease diagnosis (atherosclerosis)



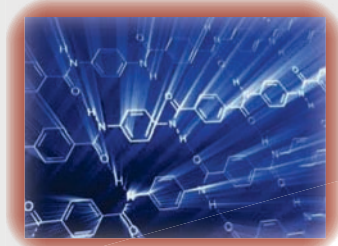
Pharmaceutical Industry:

- Analysis of tablets, liquids, and gel caps
- High throughput screening techniques
- Crystallization, end point detection
- Process Analytical Technology (PAT) on-line, at-line monitoring and control: real-time monitoring of drying, coating, and blending
- Identification and analysis of API, additives, and excipients
- Drug identification control device: Purity and Quality
- Raw material inspection: 100% incoming material identification & verification



Raman Microscopy:

- Pharmaceutical drug analysis: micro-Raman and localized molecular species analysis in complex drug mixtures, such as beta-carotene in multivitamins
- Material science thin film analysis, such as diamond film quality characterization
- Trace forensic evidence analysis, including fibers, fabrics, pigments, inks, etc.



Polymers and Chemical Processes:

- Quality Control: Incoming/Outgoing
- Identification of contaminants during manufacturing
- Real time monitoring of polymerization
- Predicting the morphological properties of polymers
- Multivariate Analysis/Chemometrics to predict physical properties: glass transition temperature, crystallization temperature, etc.
- Chemical composition analysis



Environmental Science:

- Water pollution detection using SERS technology
- Identification of contaminants in water
- Petrochemical analysis
- Identification and analysis of sediments in water

Applications & Experience

Forensic Analysis:

- Nondestructive drug and narcotic drug identification
- Explosives: exact chemical compositions of materials, PETN, RDX and binding agents within explosive materials
- Identification and analysis of toxic solvents and bio-warfare agents
- Trace forensic evidence analysis, including fibers, fabrics, pigments, inks, etc., by Raman microscopy



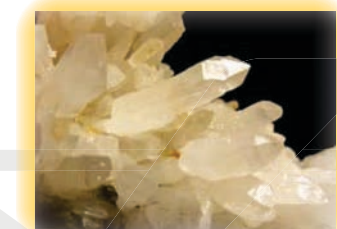
Gemology:

- Non-invasive gemstone identification and examination
- Identify unknown gemstone by unique Raman signal
- Identification of isomorph or subspecies of gemstone
- Analysis of gemstone origin through Raman microscopy
- Anti-counterfeiting, such as identification of diamond from zircon



Geology and Mineralogy:

- Identification of geological materials
- Examination of inclusions in minerals
- Analysis of cement clinker by Raman microscopy
- Ancient fossil analysis



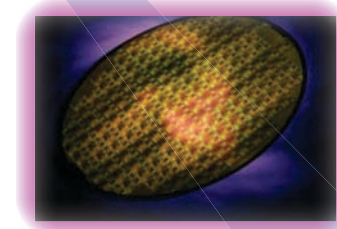
Food & Agriculture Industry:

- Measuring the unsaturated fatty acid in food oils
- Detecting bacteria and/or contaminants in food products
- Identification of additive drugs: nutraceuticals in fruit drinks
- Analysis of components in grain kernel



Semiconductor & Solar Industry:

- Characterization of silicon crystallinity: Monitoring of the Raman band shift as silicon crystallinity changes from amorphous to a polycrystalline structure
- Analysis of micron sized particles in situ to provide information on potential contamination
- Mechanical stress monitoring for semiconductor process



Raman Accessories

Meeting Your Application Needs

Raman Probe Options

Two Raman probe options are available to allow sampling of various materials in the form of liquids, gels, powder, or solids under lab conditions (Lab Grade) or demanding environmental conditions (Industrial Grade).

	Lab Grade (BAC100 / BAC102)	Industrial Grade (BAC101)
Excitation Fiber	105µm core w/ FC/PC connector	
Collection Fiber	200nm core with SMA 905 male connector	
Fiber Length	1.5m	
Excitation Wavelength	785nm, 532nm, Other options available	
Laser Blocking	OD6 default, OD8 optional	
Shaft Material	SS 316L	SS 316L, Hastelloy C-276, Titanium
Shaft Diameter	9.5mm	12mm
Shaft Length	76.2mm	76.2mm (Standard) Custom Lengths Available
Window Material	Quartz	Fused Silica, Sapphire, Sapphire Ball Lens
Seal Material	Adhesive sealed	Kalrez® O-ring, Custom
Working Distance	5.90mm	5mm, 10mm, 20mm
Spot Size	85µm	85µm
Maximum Pressure	30 PSI	300 PSI
Maximum Temperature	80°C	300°C at probe tip
Hand Trigger	BAC102 Only	N/A



Lab Grade



Industrial Grade



BAC150*

Easy and Precise Sampling

With a small laser spot size of 85µm, laser focus at the sample area becomes critical in all dimensions. The BAC150 precision probe mount accessory provides coarse and fine adjustment knobs for the X, Y, and Z axes. Z-axis adjustment allows for laser focusing on the desired plane in order to maximize the Raman signal.

Raman Microscopy Made Simple

The BAC151A is a Raman micro-positioning system that is compatible with all B&W Tek Raman systems. It was designed to offer the highest level of flexibility in facilitating Raman sampling in various applications. BAC151A can be configured in different ways so that the system can be tailored for the exact requirement for your applications. The unique feature of dual laser wavelength port provides flexibility for one system to be coupled with two different laser wavelengths. The integrated camera allows precision Raman sampling through camera monitoring of the laser beam and imaging details. When coupled with B&W Tek's portable Raman spectrometers, this video microscope system provides the advantages of a Raman microscopy at a fraction of the cost of most research instrument. With tripod accessories available, the video head can be mounted to the tripod easily.

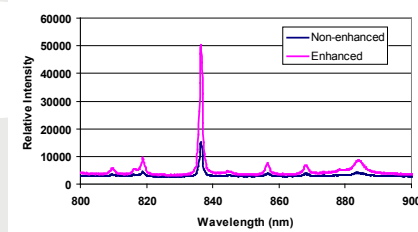


BAC151A

Innovative Signal Enhancement

Our Enhanced Raman Cuvette Holder (BCR100A) is a uniquely designed sampling device that can increase Raman signal up to 3x's in comparison to a standard cuvette holder by utilizing precise focusing; featuring a three point locking mechanism for reproducibility. The enhanced Raman cuvette holder can be used with any standard 12.5mm x 12.5mm size cuvette to hold liquid or powder samples.

The BCR100A brings many advantages to Raman measurements; High Stability, Repeatability, Enhanced Raman Signal.



BCR100A*

Third-party Software - Thermo Scientific GRAMS/AI®

Thermo Scientific GRAMS/AI® Lab software package: for processing and managing spectroscopy data

PLSplus/IQ for Thermo Scientific GRAMS/AI 8: for creating qualitative and quantitative chemometric calibration models

Spectral ID for Thermo Scientific GRAMS/AI 8: for qualitative material identification through spectral library search



Liquid Sample Flow Cell

Liquid sample flow cell is a sampling device designed for Raman on-line process monitoring. It provides a sampling platform with high throughput and stability.

Our Flow Cells are constructed with your choice of three different cell materials, 316 SS, Titanium, or Teflon. Window options include Quartz or Sapphire. The BAC160 uses a Kalrez® O-ring which creates a chemical resistant sampling device.

Custom cell material and window construction available upon request.

Cell Material	316 SS, Titanium, or Teflon
Fitting	0.5in Swagelok
Tubing OD	0.5in – 2in
O-ring Material	Kalrez® O-ring Other materials on request
Window Material	Quartz Sapphire Other materials on request
Working Distance	Fixed
Excitation Wavelength Range	300nm – 2500nm
Maximum Temperature	150°C
Maximum Pressure	150 PSI



(*probe not included)

Laser Safety Goggles

Raman spectrometer systems use Class IIIb lasers. Class IIIb lasers produce radiation that can cause damage to the eyes when viewed directly or indirectly. B&W Tek, Inc. recommends Laser Safety Goggles for Raman spectrometer systems.



Carrying Case

A rolling black suitcase with protective foam inserts is available for transporting your specific Raman spectrometer systems.



(*probe not included)

Ask about our Extended Warranty Program for our Raman Spectrometer Systems

MiniRam™ Series Specifications

	MiniRam™	MiniRam™ III
Lasers		
532nm Excitation	< 50mW	N/A
785nm Excitation	< 300mW	< 300mW
Laser Power Control	532nm†, 785nm	785nm
Spectrometer		
Spectral Range (532nm Laser)	175cm ⁻¹ - 4000cm ⁻¹	N/A
Spectral Resolution (532nm)	15cm ⁻¹ @ 614nm*	N/A
Spectral Range (785nm Laser)	175cm ⁻¹ - 3150cm ⁻¹	175cm ⁻¹ - 3150cm ⁻¹
Spectral Resolution (785nm)	10cm ⁻¹ @ 912nm*	10cm ⁻¹ @ 912nm*
Detector		
Detector Type	TE Cooled Linear Array	
Pixel Number	2048	
Pixel Size	14µm x 200µm	
TE Cooling Temperature	14°C	
Dynamic Range	300:1 (typical)	
Digitization Resolution	16-bit or 65,535:1	
Readout Speed	500 kHz	
Integration Time	5ms - 65,535ms	
Electronics		
Compute Interface	USB 2.0 / 1.1	Embedded
USB	None	1 External Port (2.0)
Trigger Mode	N/A	Standard TTL
Ethernet	N/A	1 Port
Power Consumption	15W	Typical 27W
Power Options		
DC (Standard)	5V DC	~19V DC
Battery	Optional	Standard
AC (100 - 240V AC, 50 - 60Hz)	Optional	N/A
Physical		
Dimensions	22.6 x 16.3 x 8.4cm (8.9 x 6.4 x 3.3in)	25.7 x 21.1 x 11.4cm (10.1 x 8.3 x 4.5in)
Weight	~1.95 kg (~4.3 lbs)	~3.26 kg (~7.2 lbs)
Operating Temperature	10°C - 35°C	10°C - 35°C
Storage Temperature	-10°C - 60°C	-10°C - 60°C
Humidity	10% - 85%	10% - 85%

MiniRam™ Series Ordering Information

Model	Description
MiniRam-785	MiniRam system with 785nm excitation, Spectral Range: 175 – 3150cm ⁻¹ , *Spectral Resolution (FWHM): 10cm ⁻¹ @912nm, Laser Output Power: < 300mW
MiniRam-532	MiniRam system with 532nm excitation, Spectral Range: 175 – 4000cm ⁻¹ , *Spectral Resolution (FWHM): 15cm ⁻¹ @614nm, Laser Output Power: < 50mW
MiniRamIII-785	MiniRam III with 785nm excitation, Spectral Range: 175 – 3150cm ⁻¹ , *Spectral Resolution (FWHM): 10cm ⁻¹ @912nm, Laser Output Power: < 300mW

* Typical Resolution Measured Using Pen Lamp Emission

Accessories

Name	Model	Description
Lab Grade Raman Probe	BAC100-532	Lab Grade Raman probe for 532nm excitation.
	BAC100-785	Lab Grade Raman probe for 785nm excitation.
Lab Grade Raman Probe with Trigger	BAC102-532	Lab Grade Raman probe for 532nm excitation with trigger button on probe (for use with systems featuring an AUX port).
	BAC102-785	Lab Grade Raman probe for 785nm excitation with trigger button on probe (for use with systems featuring an AUX port).
Industrial Grade Raman Probe	BAC101-532	Industrial Grade Raman probe for 532nm excitation.
	BAC101-785	Industrial Grade Raman probe for 785nm excitation.
Replacement Shaft	RSS100	Replacement shaft for Lab Grade Raman probe (BAC100 & BAC102).
Raman Probe Immersion Shaft	RIS100-FS	Immersion shaft for B&W Tek Lab Grade Raman probe, Stainless Steel body, Fused Silica Window, for taking Raman measurements immersed in liquids.
	RIS100-SA	Immersion shaft for B&W Tek Lab Grade Raman probe, Stainless Steel body, Sapphire Window for taking Raman measurements immersed in liquids.
Raman Cuvette Holder	BCR100A	Liquid Sample Cuvette Holder for use with B&W Tek, Inc. BAC100 & BAC102 Raman probes. Raman Signal enhancement up to 3x's compared to standard cuvette holders.
Raman Probe Holder	BAC150	Probe holder for use with B&W Tek, Inc. Raman probes. Coarse and Fine adjustments for X, Y, and Z axes.
Video Microscope Sampling System	BAC151A-532	Video microscope sampling system for 532nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes. Includes one 20x objective.
	BAC151A-785	Video microscope sampling system for 785nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes. Includes one 20x objective.
	BAC151A	Video microscope sampling system with dual wavelength filters for 532nm and 785nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes. Includes one 20x objective.
Raman Probe Microscope Adaptor	PMA100	Probe microscope adaptor for Lab Grade Raman probe (BAC100 & BAC102). Compatible with industry standard microscope objective lenses.
	PMA101	Probe microscope adaptor for Industrial Grade Raman probe (BAC101). Compatible with industry standard microscope objective lenses.
Raman Flow Cell	BAC160-Ti	Raman Flow Cell, Titanium, designed for on-line process monitoring.
	BAC160-SS	Raman Flow Cell, Stainless Steel, designed for on-line process monitoring.
	BAC160-TF	Raman Flow Cell, Teflon, designed for on-line process monitoring.
Laser Safety Goggles	BAC063-532	Laser Safety Goggles for 532nm Class IIIB lasers only.
	BAC063-785	Laser Safety Goggles for 785nm Class IIIB lasers only.



Software

Name / Model	Description
BWSpec™	Operation software for B&W Tek, Inc. Raman Spectrometer Systems
BWID™ Standard	Material identification software for B&W Tek, Inc. Raman spectrometer systems
BWID™ Pharma	Material identification software for B&W Tek, Inc. Raman spectrometer systems. For use in Pharmaceutical Industry. FDA 21 CFR Part 11 Regulation Compliance: Electronic Records and Electronic Signatures
IQ/OQ package	Installation Qualification and Operator Qualification package for BWID-Pharma
BAC083	GRAMS/AI® 8 Lab Pack
BAC084	PLSplusIQ for Thermo Scientific GRAMS/AI® 8
BAC085	Spectral ID for Thermo Scientific GRAMS/AI® 8

Service Plan

Name / Model	Description
Service Plan	Extended one year warranty for B&W Tek, Inc. Raman spectrometer systems

†Center wavelength and linewidth not guaranteed
*Typical Resolution Measured Using Pen Lamp Emission



Additional Laser Products

- **High Power Lasers**
Up to 200 W with wavelengths from 635nm - 2000nm
- **Solid-State Lasers**
TEM₀₀ beam quality from 4mW - 2500mW
- **Fiber Coupled Lasers**
Multi-mode or single-mode fiber coupled lasers up to 20W with wavelengths from 635nm - 2000nm
- **Multi-channel Lasers**
Custom configurations 960nm -1650nm



BWF5
High Power Laser



CleanLaze®
Turnkey End User Package

Additional Spectroscopy Products

- **UV-Vis-NIR Spectrometer Modules**
Compact, USB interface, plug-and-play
- **i-Spec Spectrophotometers**
Models from 190nm - 2500nm
- **Raman Spectrometer Systems**
Portable systems: 785nm, 532nm, and custom
- **Raman Microscopy and Micro Sampling**
Confocal Raman microscopes & video micro sampling accessories
- **Sampling Accessories**
Cuvette holders, optical fibers, fiber probes, etc.



i-Raman™
Portable Raman System



i-trometer™
Back-thinned CCD
Array Spectrometer

To find out more:

Contact our Application Team for your unique solution

Let us run your sample! - Feasibility Studies Available

Distribution in the UK

Lambda
photometrics

Lambda Photometrics Ltd, Lambda House, Batford Mill, Harpenden, Hertfordshire AL5 5BZ

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