



Your Photonics Partner

Raman Solution

## MiniRam™ & MiniRam™ II

Performance & Portability with Affordability



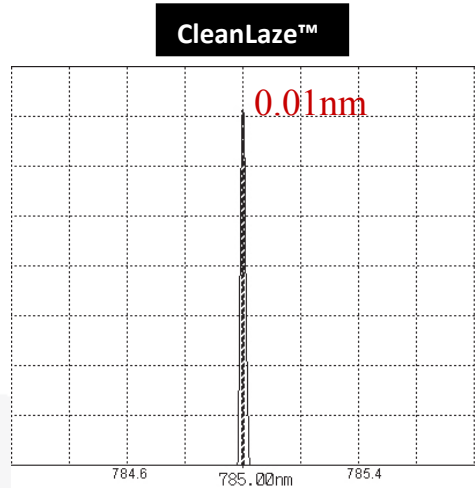
### Features:

- Spectral Resolution of  $10\text{cm}^{-1}$
- $175\text{cm}^{-1}$  of the Raleigh Line
- Small footprint and lightweight
- CleanLaze™ with linewidth as narrow as  $0.01\text{nm}$
- TE Cooled 2048 pixel CCD detector
- Fiber optic interface for convenient sampling

# The MiniRam series is our most cost-effective Raman solution available in two models: MiniRam™ and MiniRam™ II

MiniRam™ is highly affordable which makes it ideal for Raman education and feasibility studies.

MiniRam™ II is completely field-portable with battery operation and an integrated handtop 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

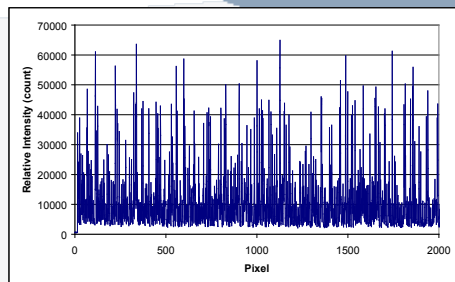
In Raman spectroscopy, it is essential to utilize a clean, narrow bandwidth laser due to the fact that the quality of the Raman peaks are directly affected by the sharpness and stability of the delivered light source. The MiniRam series spectrometer systems feature a patented CleanLaze™ technology with linewidth as narrow as 0.01nm when equipped with a 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. Our standard automatic shutter will reduce photobleaching for a variety of different sample types.

## Near-Excitation Raman Filter

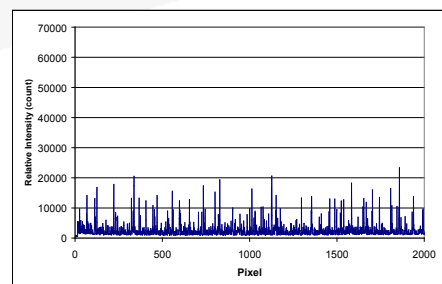
### Collect Data within 175cm<sup>-1</sup> of the Raleigh Line

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<sup>-1</sup> from the Raleigh line.

Dark Current: Uncooled and Cooled CCD Detectors at 30 seconds



Room Temperature



Cooled to 14°C

## Low Light Level Detector

### Cooled Detector for Low Light Level Detection

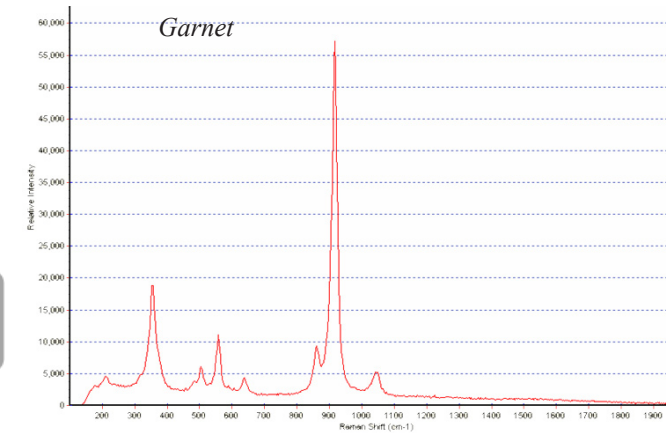
Cooling an array detector with a built-in thermoelectric cooler (TEC) is an effective way to reduce dark current and noise and enhance the dynamic range and detection limit. The graphs below show the dark current and noise for an uncooled versus a cooled CCD detector at an integration time of 30 seconds.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

## High Resolution Spectrometer

### Optimized for Raman Spectroscopy

The spectrometer is configurable for 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<sup>-1</sup> 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 II comes with 785nm laser excitation only.



## Easy Sampling Probe

### Easy Transition Between Sample Types

Taking measurements is easy - just point and “trigger!” By enabling the trigger option, 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. Available for use with two excitation wavelengths: 785nm and 532nm.

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™ II, is battery operational and integrated with a 5” LCD screen, Bluetooth capable, handtop PC. The battery is a rechargeable lithium battery with operation time around 3 hours making the MiniRam™ II completely field-portable.

## 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

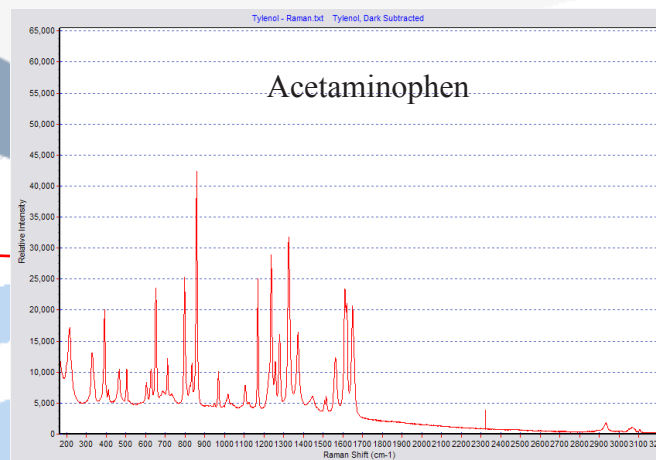
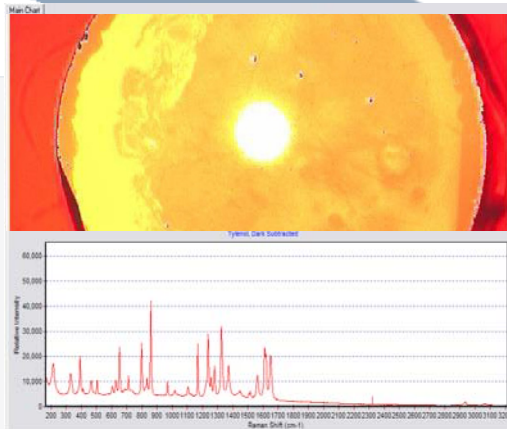
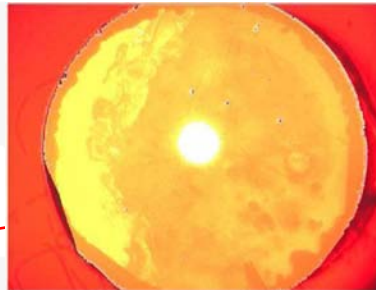
For industrial Raman applications that require federal compliance: BWID™-Pharma supports FDA 21 CFR Part 11 Compliance

## 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 allow complex measurements and calculations to be done 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. With powerful data acquisition and data processing, other features include automatic dark removal, spectrum smoothing, and manual/auto baseline correction. The software also contains OCX interface for users to collect spectrum in 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
- \* GRAMS/AI® OCX control interface

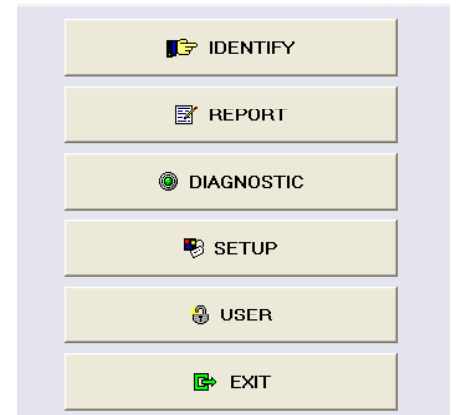
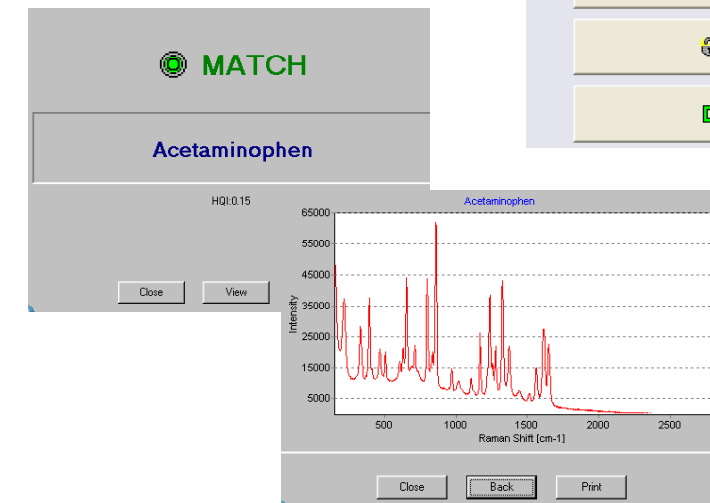


## BWID™

BWID™ has been designed specifically for Raman spectroscopy. This software will rapidly identify and verify materials stored in your own personal easy-to-create library or an 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

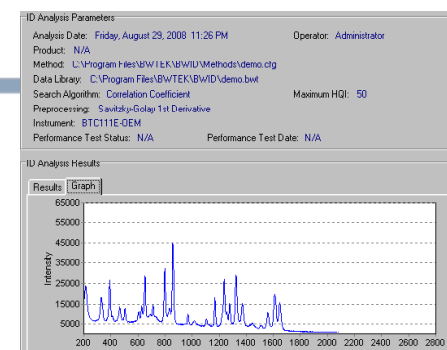


## BWID™-PHARMA

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. It is of great benefit for pharmaceutical system validations including IQ and OQ procedures.

### Key Features

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



Audit Trail File Name:				Audit Trail Record Details		Comments
C:\Program Files\B&WTEK\BWID\bwid.aif						
Date	Time	System				
8/29/2008	11:20:4...	BWID 2				
8/29/2008	11:20:2...	BWID 2				
8/29/2008	11:20:1...	BWID 2				
8/29/2008	11:14:2...	BWID 2				
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8/29/2008	11:04:3...	BWID 2				
8/29/2008	11:03:5...	BWID 2				
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8/29/2008	10:22:4...	BWID 2				
8/29/2008	10:22:1...	BWID 2				
8/29/2008	10:22:0...	BWID 2				
8/29/2008	10:22:0...	BWID 2.00	Security	bwadmin	Administrator	Logout from the program

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# 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 materials 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

## 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 analysis of inclusions
- Anti-counterfeiting, such as identification of diamond from zircon

## Geology and Mineralogy



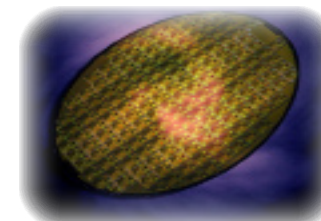
- Identification of geological materials
- Examination of inclusions in minerals
- Analysis of cement clinker by Raman microscopy
- Ancient fossil analysis

## Food & Agriculture Industry



- Measuring the unsaturated fatty acid in food oils
- Detecting bacteria and/or contaminants in food products
- Identification of additive drugs: nutraceuticals and 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

## 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)	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 - 203.2mm (Custom lengths available)
Window Material	Standard flat 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



Lab Grade

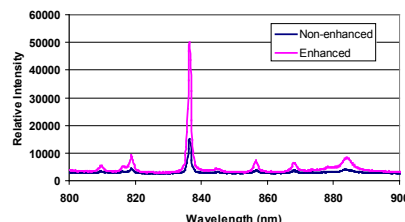


Industrial Grade

## 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 a precise focusing mechanism, 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\*

## 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 or Titanium
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
Weight	0.5 lbs



BAC160\*



(\*probe not included)

# Meeting Your Application Needs

## 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.

BAC150\*



## Raman Microscopy Made Simple

The BAC151 is a visual assisted sampling platform that utilizes video precision spot sampling at a fraction of the cost of a typical Raman Microscope. The digital camera and LED illuminator allows for precise target and focusing of the spot size by way of an on screen display via BWSpec™ software or an added external monitor. Standard objectives from 10x's - 100x's can be utilized and sample images can be easily recorded and saved. Both coarse and fine adjustment knobs are available for the X, Y, and Z-axis control. Bright and dark field illumination optimizes the light required for various sample surfaces. Compatible with our Lab and Industrial Grade Raman probes, this video microscope system provides advantages of Raman microscopy at a fraction of the cost compared to similar research instruments.

BAC151\*



## Third-party Software - GRAMS/AI®

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

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

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



## 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

Black suitcase with wheels and custom cut foam inserted for transporting your specific Raman spectrometer systems.

Suitcase	Dimensions
MiniRam™ II	58.4cm (H) x 38.1cm (W) x 27.9cm (D) {23in (H) x 15in (W) x 11in (D)}
i-Raman™	61cm (H) x 42cm (W) x 35cm (D) {24in (H) x 16.5in (W) x 13.8in (D)}



(\*probe not included)

Ask about our Extended Warranty Program for our Raman Spectrometer Systems

# MiniRam™ Series Specifications

	MiniRam™	MiniRam™ II
<b>Lasers</b>		
532nm Excitation	Yes	No
785nm Excitation	Yes	Yes
Laser Power Control	Yes	Yes
<b>Spectrometer</b>		
Spectral Range (785nm Laser)	175cm <sup>-1</sup> - 3150cm <sup>-1</sup>	175cm <sup>-1</sup> - 3150cm <sup>-1</sup>
Spectral Range (532nm Laser)	175cm <sup>-1</sup> - 4000cm <sup>-1</sup>	175cm <sup>-1</sup> - 4000cm <sup>-1</sup>
Spectral Resolution	10cm <sup>-1</sup> - 20cm <sup>-1</sup>	10cm <sup>-1</sup> - 20cm <sup>-1</sup>
Stray Light Rejection	0.07% at 800nm	0.07% at 800nm
<b>Detector</b>		
Detector Type	TE Cooled	TE Cooled
Pixel Number	2048	2048
TE Cooling Temperature	14°C	14°C
Max Quantum Efficiency	90%	90%
Well Depth	62,500 Electrons	62,500 Electrons
Dynamic Range	300:1 (typical)	300:1 (typical)
Digitization Resolution	16-bit or 65,535:1	16-bit or 65,535:1
Readout Speed	250kHz	250kHz
Integration Time	9ms - 65535ms	9ms - 65535ms
<b>Electronics</b>		
USB	1 External Port 2.0 / 1.1	1 External Port 2.0 / 1.1
Trigger Mode	5V TTL I/O	5V TTL I/O
Power Input	110 - 240VAC, 50 - 60Hz	110 - 240VAC, 50 - 60Hz
Bluetooth	N/A	Yes
Ethernet	N/A	Yes
<b>Power Options</b>		
AC	Standard	N/A
DC	Optional	N/A
Battery	Optional w/ DC only	Standard
<b>Physical</b>		
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)	~2.90 kg (~6.4 lbs)



# MiniRam™ Series Ordering Information

Model	Description
MiniRam-785	MiniRam system with 785nm excitation, Spectral Range: 175 – 3150cm <sup>-1</sup> , Spectral Resolution (FWHM): 10cm <sup>-1</sup> , Laser Output Power: < 300mW
MiniRam-532	MiniRam system with 532nm excitation, Spectral Range: 175 – 4000cm <sup>-1</sup> , Spectral Resolution (FWHM): 20cm <sup>-1</sup> , Laser Output Power: < 50mW
MiniRamII-785	MiniRam II with 785nm excitation, Spectral Range: 175 – 3150cm <sup>-1</sup> , Spectral Resolution (FWHM): 10cm <sup>-1</sup> , Laser Output Power: < 300mW

## Accessories

Name	Model	Description
Raman Probe - Lab Grade	BAC100-532	Lab Grade Raman probe for 532nm excitation
	BAC100-785	Lab Grade Raman probe for 785nm excitation
Raman Probe - Industrial Grade	BAC101-532	Industrial Grade Raman probe for 532nm excitation
	BAC101-785	Industrial Grade Raman probe for 785nm excitation
Raman Cuvette Holder	BCR100A	Sample Cuvette Holder for use with B&W Tek, Inc. 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	BAC151-532	Video microscope sampling system for 532nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes
	BAC151-785	Video microscope sampling system for 785nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes
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
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.
Replacement Shaft	RSS100	Replacement shaft for Lab Grade Raman probe (BAC100)
Raman Probe Microscope Adaptor	PMA100	Probe microscope adapter for Lab Grade Raman probe (BAC100). Compatible with industry standard microscope objective lenses.
	PMA101	Probe microscope adapter for Industrial Grade Raman probe (BAC101). Compatible with industry standard microscope objective lenses.
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
Carrying Case	RCC100	Storage / Carrying Case for MiniRam II
Battery Option	BAC090	Li-Polymer battery pack for use with MiniRam II (charging cradle not included)
	BCC100	External charging cradle for MiniRam II battery pack
	EBP105	External Li-Polymer battery pack for MiniRam

## 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 GRAMS/AI® 8
BAC085	Spectral ID for GRAMS/AI® 8

## Service Plan

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



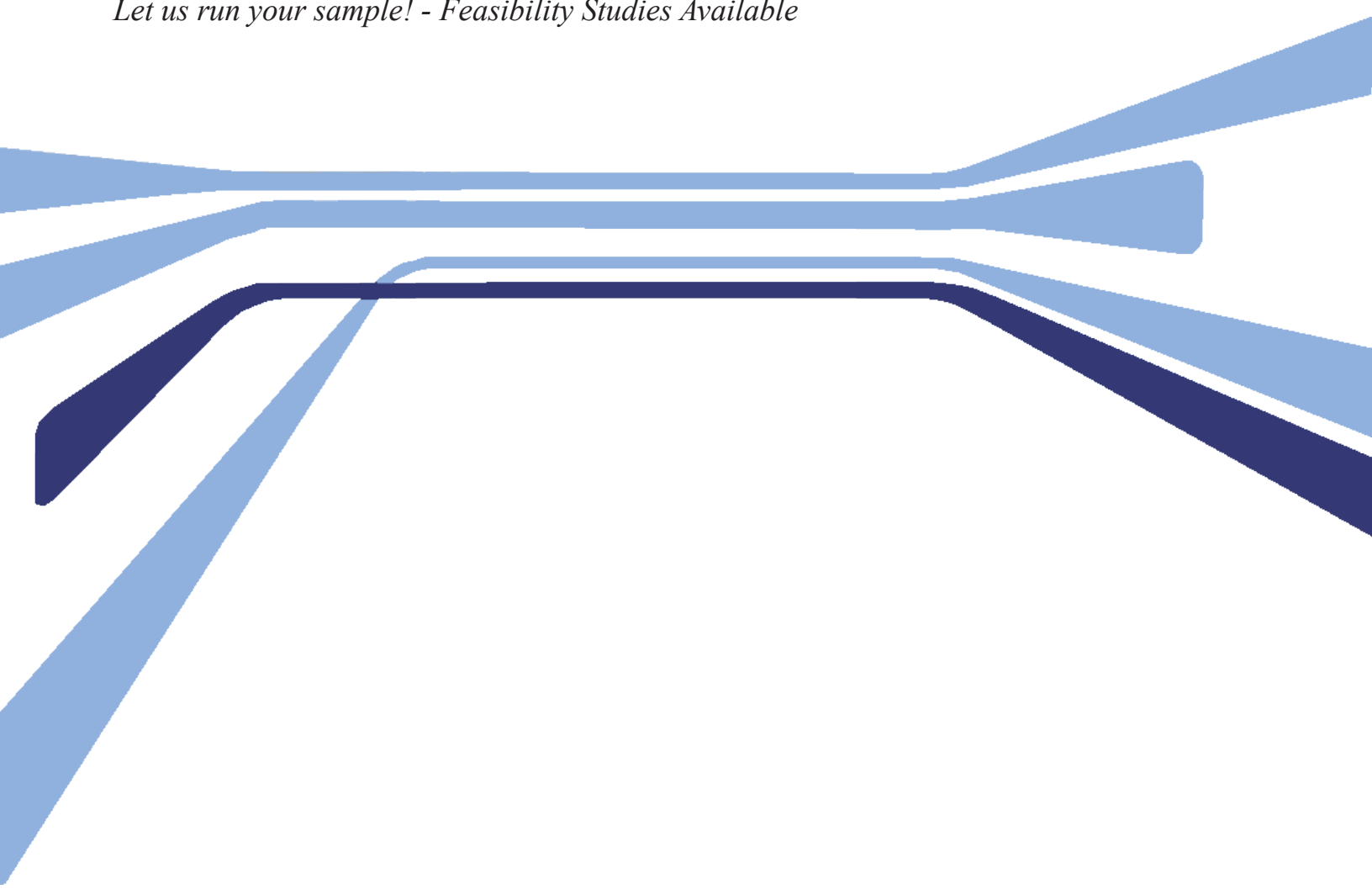


*Your Photonics Partner*

**To find out more:**

*Contact our Application Team for your unique solution*

*Let us run your sample! - Feasibility Studies Available*



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