

BaySpec SuperGamut™ OEM

Spectrographs & Spectrometers



RUGGED SOLID STATE



HIGH RESOLUTION
HIGH THROUGHPUT



OPTIMIZED COOLING



COST EFFECTIVE



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BAYSPEC

Pervasive Spectroscopy

www.bayspec.com



Specifications

Model	UV-NIR	VIS-NIR	NIR 900-1700nm
PERFORMANCE			
Wavelength Range	*190-1100nm or any fraction of range customer specified	*400-1100nm or any fraction of range customer specified	*900-1700nm or any fraction of range customer specified
Resolution	~1-20 nm, slit dependent	~1-20nm, slit dependent	5-20nm slit dependent
Signal / Noise	>500	7,500	15,000
Stray light	0.05%	0.05%	0.05%
Wavelength Calibration	Factory Calibrated, independent of operating temperature	Factory Calibrated, independent of operating temperature	Factory Calibrated, independent of operating temperature
Integration time	10 μ s to 300 seconds	10 μ s to 300 seconds	20 μ s to 300 seconds
Dimensions	173 x 152 x 83 mm ³	154 x 94 x 50 mm ³	162 x 105 x 60 mm ³
Weight	1200 g	790g	830g
OPTICS			
f/ number	f/3	f/3	f/2
Grating	Concave Holographic	Volume Phase Grating (VPG [®])	Volume Phase Grating (VPG)
Entrance Aperture Slit	25 μ , 50 μ , 100 μ , 200 μ , or none	25 μ , 50 μ , 100 μ , 200 μ , or none	25 μ , 50 μ , 100 μ , 200 μ , or none
Fiber Optic	SMA, or custom design	FC/APC, or custom design	SMA, or custom design
DETECTOR SPECS			
Detector array	1024 or 2048 Active Pixels	1024 or 2048 Active Pixels	256, 512, or 1024 Active Pixels
Quantum Efficiency	85%	85%	95%
Detector	TE cooled CCD	TE cooled CCD	TE cooled InGaAs
A/D converter	16bit	16bit	16bit
COMPUTER			
Data Ports	USB 2.0 or RS232		
Trigger modes	Software or external TTL controlled		
Software	BaySpec "Spec 20/20" software SDK (C/C++, LabView)		
Operating System	Windows XP or later, 32-bit and 64-bit available		
Voltage	12V		

*Need a custom wavelength range? Contact our applications staff to help configure your optimized solution.

OEM Custom Examples



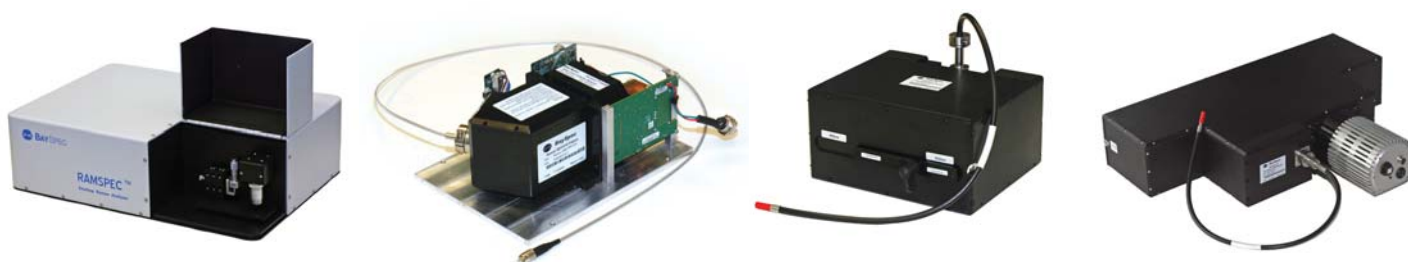


Specifications

Model	NIRS 1100-2200nm	NIRS 1250-2500nm	NIRS Custom
PERFORMANCE			
Wavelength Range	*1100-2200nm or customer specified	*1250-2500nm or customer specified	*190-2500nm or customer specify
Resolution	5 -20nm, slit dependent	5-20nm slit dependent	<1nm or specify
Signal / Noise	>500	>500	custom
Stray light	0.05%	0.05%	0.05%
Wavelength Calibration	Factory Calibrated, independent of operating temperature	Factory Calibrated, independent of operating temperature	Factory Calibrated, independent of operating temperature
Integration time	20 ms to 300 seconds	20 ms to 300 seconds	20 ms to 300 seconds
Dimensions	Spectrograph: 88 x 122 x 39 mm ³ Detector head: 167 x 103 x 84 mm ³	54 x 94 x 50 mm ³	custom
Weight	1.7 kg	5 kg	custom
OPTICS			
f/ number	f/2	f/2	custom
Grating	Volume Phase Grating (VPG)	Volume Phase Grating (VPG ®)	Volume Phase Grating (VPG ®)
Entrance Aperture Slit	25µ, 50µ, 100µ, 200µ, or none	25µ, 50µ, 100µ, 200µ, or none	25µ, 50µ, 100µ, 200µ, or none
Fiber Optic	SMA or custom design	SMA or custom design	SMA or custom design
DETECTOR SPECS			
Detector array	256, 512 Active Pixels	256, 512 Active Pixels	256, 512 Active Pixels
Quantum Efficiency	80%	80%	custom
Detector	3-stage TE cooled, InGaAs	3-stage TE cooled, InGaAs	custom
A/D converter	16bit	16bit	16bit
COMPUTER			
Data Ports	USB 2.0 or RS232		
Trigger modes	Software or external TTL controlled		
Software	BaySpec "Spec 20/20" software SDK (C/C++, LabView)		
Operating System	Windows XP or later, 32-bit and 64-bit available		
Voltage	12V		

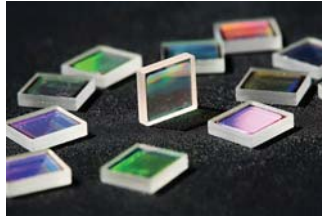
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OEM Custom Examples

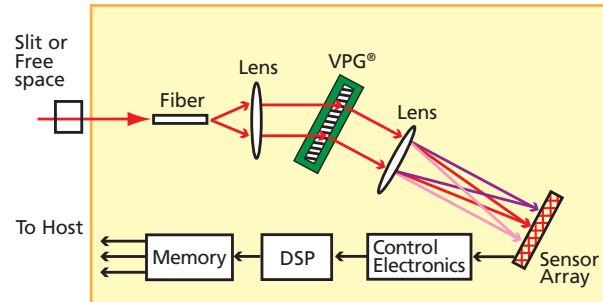


Volume Phase Gratings®

Central to any dispersive spectrometer is the grating, the dispersive element. Transmission VPGs offer generally higher efficiencies than traditional reflective gratings. For low signal applications this is a significant performance edge. BaySpec's Raman spectrometers are equipped with VPGs so that they have higher optical throughput than similar products on the market. These VPGs are designed and manufactured on site at BaySpec. The spectral coverage of the spectrometers is solely dictated by customers' needs and not limited by the availability of gratings from third party vendors.



Dispersive Spectrum Schematic



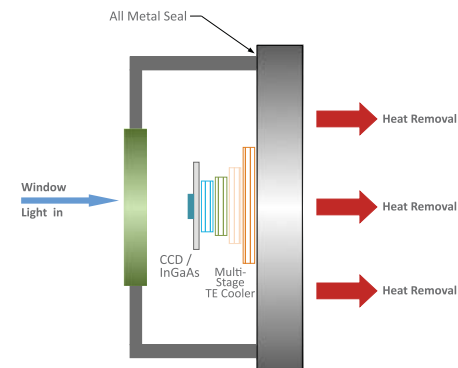
Schematic Diagram of the core Spectrometer Engine based a high-throughput Transmission Holographic Volume Phase Grating (VPG®)

Optimal Cooling

Instrumentation professionals have long recognized great potential for NIR/Raman spectroscopic analyzers in many application areas ranging from lab analysis to portable field monitors. Until now, however, NIR and Raman process analytical instrumentation were too big, too expensive, too fragile, and so sophisticated they required highly trained operators for “real-world” application use. One of the main drawbacks preventing the full potential realization of these spectroscopic applications owes itself to the photo detectors requiring deep cooling to achieve high sensitivity and high dynamic range.

A key component for the resolving many of the practical problems associated with measurement and diagnostics is related to the availability of ruggedized, sensitive, high dynamic range, yet low cost photo detectors that can operate at various environmental conditions and without the use of liquid nitrogen (LN2) cooling. High volume optical telecom device manufacturing has driven recent advances in the hermetic sealing process, thus, presenting a disruptive new picture today.

Photodetector cooling reduces the dark noise of the detector. The dark noise arises from statistical variation in the number of electrons thermally generated within the semiconductor structures, such as silicon in the case of CCDs (200nm to 1100nm) and InGaAs (900 nm to 2500 nm). The dark noise is directly dependent on the semiconductor temperature. The generation rate of thermal electrons at a given CCD temperature is referred to as dark current. Cooling the CCD reduces the dark current dramatically. The dark noise typically drops to half when the temperature of the CCD detector chip drops every 10°C (Refer to Fig. 1). The dark noise for InGaAs arrays are also reduced to half at every 7~8°C reduction in sensor temperature (Fig. 2). In practice, high-performance detectors and cameras are usually cooled to a temperature at which dark current is negligible over a typical exposure time.



Schematic Diagram-Thermo Electric Cooling Process
Example of Deep-cooled CCD/ or InGaAs detector

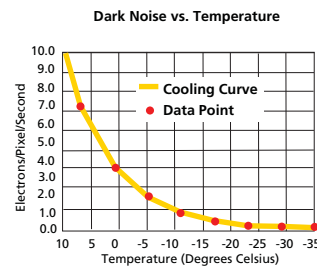


Figure 1: Nunavut CCD Detector Dark Noise vs. Temperature response curve

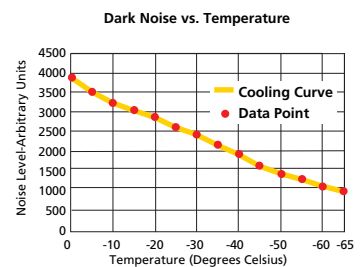


Figure 2: Nunavut InGaAs Detector Dark Noise vs. Temperature response curve

Right Detector for the Right Job

BaySpec offers a complete line of scientific-grade detector arrays covering the UV and visible ranges, out to the near infrared with sensitivity out to 2500 nm. Noise from dark currents is a challenging issue for NIR detectors, especially when the spectral range is extended to mid-IR. To ensure exceptional signal to noise ratio in every spectral range, BaySpec's detectors run thermoelectrically cooled to -55 °C. For even more demanding applications the detector array can be water cooled to -100 °C.

SuperGamut™ UV-Visible Spectrometers

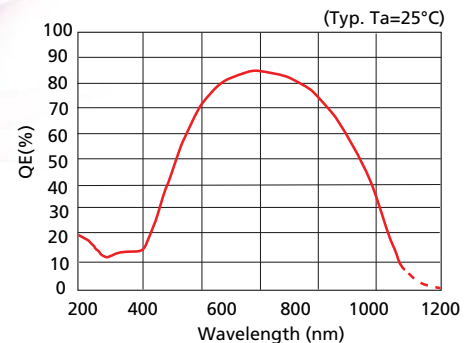
BaySpec's scientific-grade SuperGamut™ series Silicon CCD spectrometers are designed to meet real-world challenges for best-in-class performance, long-term reliability, and compact size. Benefiting from experience manufacturing high-volume spectral monitoring devices for the telecommunications industry, BaySpec's spectral devices utilize low-cost field proven components.



SuperGamut UV-NIR
190-1100nm Spectrometer



SuperGamut VIS-NIR
400-1100nm Spectrometer



The SuperGamut™ Series employs a highly efficient Volume Phase Grating (VPG®) as the spectral dispersion element and an ultra sensitive CCD array detector as the detection element, thereby providing high-speed parallel processing and continuous spectral measurements. As an input, the device uses a fiber optic input or slit optics arrangement based on customer preferences. The signal is spectrally dispersed with the VPG and the diffracted field is focused onto a CCD array detector. The control electronics read out the processed digital signal to extract required information. Both the raw data and the processed data are available to the host.

Ideal for:

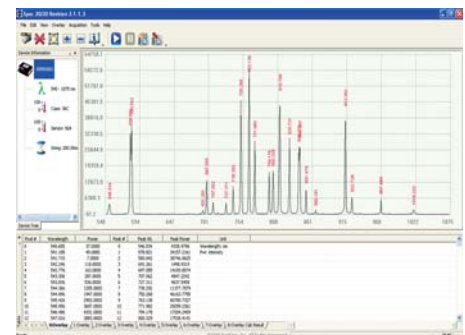
- Reflective
- Transmission
- Absorption
- Raman

Key design benefits:

- No moving parts reliability
- Ruggedized packaging for harsh environments
- Optimally cooled for low light detection
- User settable spectral data acquisition response time
- Outstanding optical throughput is achieved with f/3 design
- Compact size and high efficiency through transmission VPG grating
- Factory calibrated for long-life and low-maintenance
- Flexibility to integrate numerous types of fiber optic accessories

Applications:

- Colorimetry
- Raman spectroscopy
- Fluorescence
- Photoluminescence
- Transmission
- Reflectance
- Absorption
- Medical Diagnostics
- Thin films
- Beverage & Brewery
- Cosmetics
- Explosives detection
- Counterfeit detection
- Water quality
- Food safety
- Biomedical Research



SuperGamut™ Near Infrared (NIR) Spectrometers

BaySpec's Super Gamut™ series dispersive NIR spectral engines are designed to meet real-world challenges for best-in-class performance, long-term reliability, compact size and ultra-low power consumption. Benefiting from experience manufacturing high-volume optical channel performance monitoring devices for the telecommunications industry, BaySpec's NIR spectral devices utilize low-cost field proven components. For the first time in instrumentation history an affordable, accurate and ruggedized spectral device is a reality.



The Super Gamut Series employs a highly efficient Volume Phase Grating (VPG) as the spectral dispersion element and an ultra sensitive InGaAs array detector as the detection element, thereby providing high-speed parallel processing and continuous spectrum measurements. As an input, the device uses a fiber optic input or slit optics arrangement based on customer preferences. The signal is spectrally dispersed with the VPG and the diffracted field is focused onto an InGaAs array detector. The control electronics read out the processed digital signal to extract required information. Both the raw data and the processed data are available to the host.

Key design benefits:

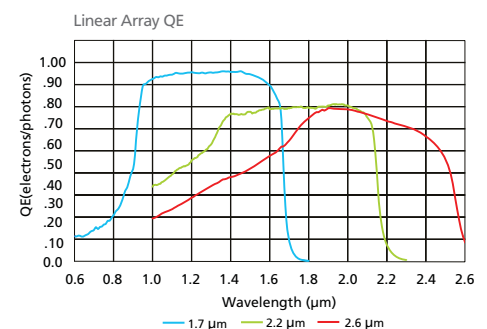
- Real-time spectral data acquisition with fast milli-sec response time
- Hermetic-sealing ensures reliable operation in harsh environments
- Outstanding optical throughput is achieved with VPG and f/2 design
- Covers wavelength ranges from 900-1700 nm, 1000-2200 nm, and 1000-2500 nm

Applications:

- Pharmaceuticals
- Medical Diagnostics
- Agriculture
- Semiconductors
- Beverage & Brewery
- Cosmetics
- Explosives detection
- Counterfeit detection
- Water quality
- Food safety
- Petrochemical
- Law Enforcement
- Pulp & Paper
- Mining
- Oil Exploration
- Biomedical Research
- Homeland Security

Ideal for:

- Grain sorting
- Blend uniformity
- Blood measurement
- Light source measurement
- Long wavelength Raman



SuperGamut Bench-top Instruments

BaySpec's SuperGamut series Systems are designed to meet real-world challenges for best-in-class performance, long-term reliability, compact size and ultra-low fluorescence interference for Raman instrumentation of chemical process and in-situ monitoring, such as pharmaceutical formulations, blending and reactions. Benefiting from experience manufacturing high-volume spectral monitoring devices for the telecommunications industry, BaySpec's NIR spectral devices utilize low-cost field proven components. For the first time in instrumentation history an affordable, accurate and ruggedized Raman spectral engine is a reality.



The SuperGamut Series employs a highly efficient Volume Phase Grating (VPG) as the spectral dispersion element and ultra-sensitive InGaAs array as the detection element, thereby providing high-speed parallel processing and continuous spectrum measurements. As an input, the device uses a fiber optic bundle or slit optics arrangement based on customer preferences.

Key features:

- Stable fiber laser illumination
- Outstanding optical throughput with VPG and f/1.8 design
- Deep cooled camera for low light detection
- Spec 2020 Windows-based software integrated for turn-key operation
- Easily customizable for single or multiple external fiber optic probes

Applications:

- Pharmaceutical formulations
- Blending, drying, granulations
- Reaction chemistry, yield
- Polymerization
- Polymer blending
- Petrochemical
- Food and Beverages
- Extrusion monitoring
- Biomass, bio-fuel
- Liquid Analysis
- Solid Analysis
- Qualitative and Quantitative Analysis

Key design benefits:

- High throughput transmission Volume Phase Grating (VPG)
- Fast optics
- High throughput
- No moving parts
- Low signal/noise
- Flexible film optic accessories



Reaction Monitoring Setup

Founded in 1999 with support from some of the leading corporations and venture capital firms in Silicon Valley, BaySpec is a vertically integrated spectral sensing company. The company designs, manufactures and markets advanced spectral instruments, from UV-VIS spectrometers to portable and benchtop, microscope Raman, NIR and Raman analyzers, for the biomedical, pharmaceuticals, chemical, food, semiconductor, homeland security, and the optical telecommunications industries.

Engineering and Product Development

- Shortest product development cycle in the industry
- Extensive Intellectual Property covering key aspects of our products
- In-house capabilities encompassing all the important and critical components, from lasers to gratings and state-of-the-art detectors

Production

- 48,000 square foot production facility, including 9,000 square foot Class 10,000 clean room
- History of producing and delivering more than 30,000 spectral engines of all types
- 100% made in the USA

Quality Control

Dedicated team, established procedures to ensure consistent and reliable product delivery



Safety and Environment

At BaySpec the safety of our employees and customers is our utmost concern. Rigorous training programs are implemented for laser, electrical, and hazardous materials safety. All products we release are extensively reviewed for any potential safety hazard. Every precaution is exercised, whether via hardware design or software control, to prevent safety issues from occurring. BaySpec is committed to green manufacturing techniques and processes. We strive to minimize or eliminate the use of hazardous materials in every manufacturing step, thus benefitting the health and well being of our employees and the environment. Our spectral sensing products are compact, and energy efficient and do not generate hazardous waste during normal usage.



Pervasive Spectroscopy

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All BaySpec products are made in the USA