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Headwall

Data Sheet

Hyperspec® Extended VNIR Hyperspectral Imaging Spectrometer

Headwall's Hyperspec® Extended VNIR imaging spectrometer specifically targets the spectral range of 550 nanometers to 1700 nanometers to uniquely offer high resolution spectral imaging capabilities for a wide range of in-line manufacturing and remote sensing applications.

The award-winning, Hyperspec® imaging spectrometer family is built on a totally reflective concentric, f/2.0 optical design and optimized for imaging in harsh environments. All Hyperspec® instruments are based on Headwall's patented aberration-corrected, imaging design which feature the company's "original", high efficiency holographic diffraction gratings.

In order to minimize stray light and aberrations, transmissive optical components are not used within the imaging spectrometer. This platform is further enhanced by a telecentric optical input design which enables superior spectral and spatial imaging.

The Hyperspec® Extended VNIR imaging spectrometer is available in two configurations - as a lens-based imager or as a multi-channel/multi-point spectrometer; each model providing different capabilities to support application requirements such as frame rates, dynamic range, region of interest binning, price, and more.

The Hyperspec® Extended VNIR sensor is also available with the Hyperspec® Starter Kit, the Hyperspec® Reflectance/Fluorescence System, and in pan/tilt configurations for stationary deployment.

Applications:

- Food safety & quality
- LCD/display quality control
- Process monitoring
- Pharmaceutical manufacturing
- Photovoltaic manufacturing
- Semiconductor inspection
- Remote sensing & analysis
- Waste recycling & sorting

Key Benefits:

- Broad spectral range
- Superb imaging performance
- Exceptional spectral & spatial resolution
- Ideal for low light, low signal applications
- Accurate, consistent spectral measurement
- Compact with very wide field of view
- Low scatter or stray light
- Rugged design for durability & stability
- Cost effective deployment

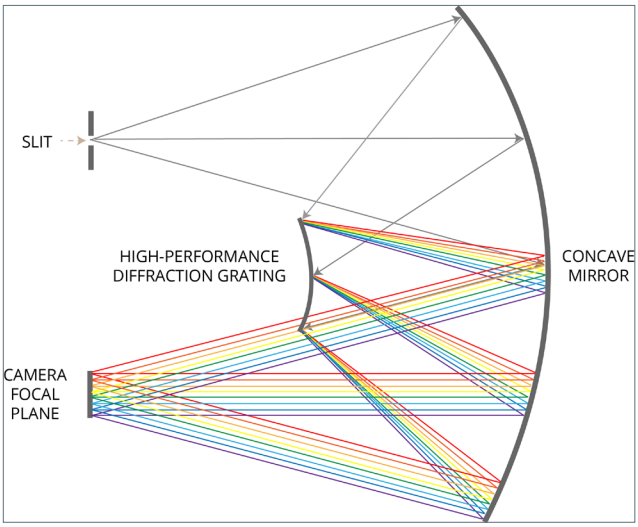
Application-Specific Solutions For Critical Environments

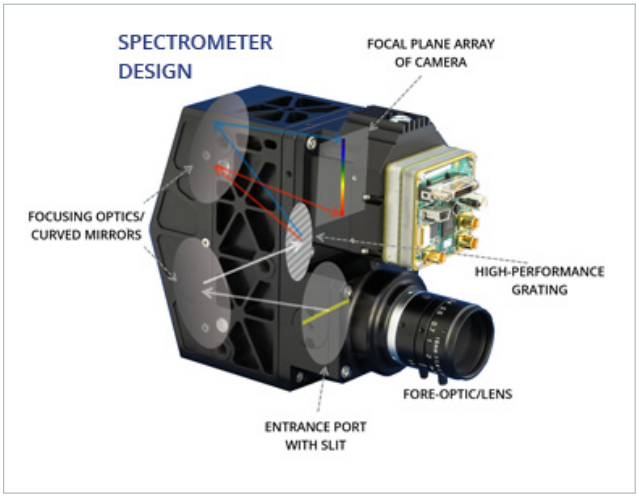
Hyperspec® Extended VNIR	S1	S2	X1
Wavelength Range	550-1700 nm		
Aperture	F/2.0		
Dispersion per Pixel	5.0 nm		
Slit Width (Interchangeable) Optional - 12, 16, 40, 60, 100	25µm		30µm
Slit Length	18 mm		
Spectral Resolution (25µ slit)	5-7 nm		
Spectral Bands	250	287	239
Spatial Bands	640		320
Aberration-corrected (smile)	Yes		
Aberration-corrected (keystone)	Yes		
Stray Light	< 0.02%		

Detector & Electronics	S1	S2	X1
Detector	VIS-InGaAs		
Dynamic Range	68 db		
Frame Rates (fps)	109+ (Full)		
Pixel Pitch (microns)	25µm		30µm
Read A/D	14 bit		
Binning	No		
Region of Interest	Yes		
Camera Control Interface	CameraLink™ & USB 2.0		

Environmental & Mechanical	
Operational Temperature	-10° C - 40° C
Storage	-10° C - 60° C
Relative Humidity	Non-Condensing
Weight	~8.2 lbs/3.7 kg

All-Reflective Concentric Imager





Headwall covers the hyperspectral range!

- UV-VIS (250-825nm)
- VNIR (380-1000nm)
- Extended VNIR (550-1700nm)
- NIR (900-1700nm)
- SWIR (950-2500nm)
- MWIR (3,000-5,000nm)
- LWIR (8,000-12,000nm)

About Headwall Photonics: Headwall is the leading designer and manufacturer of imaging spectrometers and spectral instrumentation for industrial, commercial, and government markets. Headwall's high performance spectrometers, spectral engines, and holographic diffraction gratings have been selected by OEM and end-user customers around the world for use in critical application environments. As a pioneer in advanced, patented optics technology, Headwall enjoys a market-leading position through the design and manufacture of spectral instrumentation that is customized for application-specific performance.

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Data Sheet

Hyperspec® NIR

Hyperspectral Imaging Spectrometer

Hyperspec NIR® imaging sensor for the 900nm to 1700nm spectral range

Headwall's Hyperspec® NIR family of integrated hyperspectral imaging sensors provides the foundation for utilizing hyperspectral imaging to achieve superior spectral sensing and chemical imaging results for mission-critical applications ranging from process monitoring to moving webs of product across conveyor lines to pharmaceutical manufacturing where precise spectral measurement is critical to the application.

The award-winning, Hyperspec® imaging spectrometer family is built on a totally reflective concentric, f/2.0 optical design and optimized for imaging in harsh environments. All Hyperspec® instruments are based on Headwall's patented aberration-corrected, imaging design which feature the company's "original", high efficiency holographic diffraction gratings.

In order to minimize stray light and aberrations, transmissive optical components are not used within the imaging spectrometer. This platform is further enhanced by a telecentric optical input design which enables superior spectral and spatial imaging.

The Hyperspec® NIR imaging spectrometer is available in three configurations:

USB 2.0, 100 Frames Per Second
CameraLink, 100 Frames Per Second
CameraLink, 350 Frames Per Second

In addition, Hyperspec® NIR sensors can be configured as multi-channel, fiber-based spectrometers for multi-point spectral analysis.

The Hyperspec® NIR sensors are also available with the Hyperspec® Starter Kit and in pan/tilt configurations for stationary deployment.

Application-Specific Solutions For Critical Environments

Applications:

- Food safety & quality
- Machine vision
- Moving webs of product
- Pharmaceutical manufacturing
- Pulp & paper
- Process control of biomass/biofuels
- Remote sensing & analysis
- Photovoltaic/semiconductors

Waste recycling & sorting

Key Benefits:

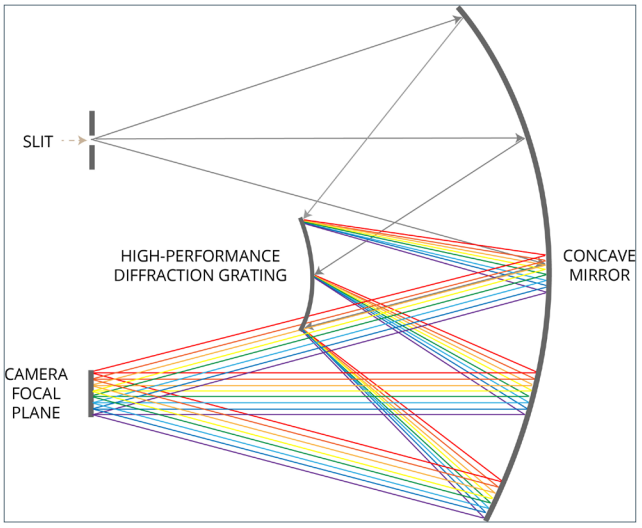
- Superb imaging performance
- Exceptional spectral & spatial resolution
- Ideal for low light, low signal applications
- Compact with very wide field of view
- Extremely high signal-to-noise
- Low scatter or stray light
- Rugged design for durability & stability
- Cost effective deployment

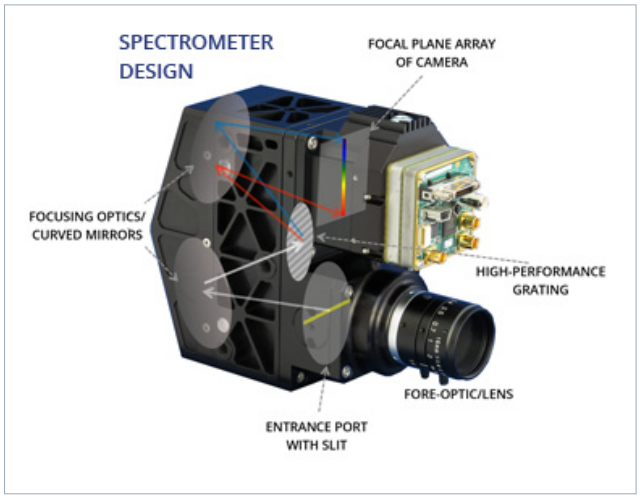
Hyperspec® NIR	XS-100	XS-350	XS-100-640
Wavelength Range (nm)	900-1700		
Aperture	F/2.0		
Dispersion per pixel	4.8		3.2
Slit Width (Interchangeable) Optional - 12, 16, 40, 60, 100	25 µm		
Slit Length	12 mm		
Spectral Resolution (25µ slit)	5 nm		4 nm
Spectral Bands	167		250
Spatial Bands	320		640
Smile - Aberration-corrected	Yes		
Keystone - Aberration-corrected	Yes		
Stray Light	< 0.25%		

Image Acquistion	XS-100	XS-350	XS-100-640
Detector	InGaAs		
Dynamic Range	68 db		
Frame Rates (Full frame)	100	350	100
Pixel Pitch (microns)	30		20
Read A/D	USB 12-bit		CameraLink
	CameraLink 14-bit		
Binning	No		
Region of Interest	Yes		
Camera Control Interface	USB 2.0		CameraLink
Image Acquisition	USB 2.0 or CameraLink		CameraLink

Environmental & Mechanical	XS-100	XS-350	XS-100-640
Operational Temperature	0° C - 50° C		
Storage Temperature	0° C - 70° C		
Relative Humidity - Non-Condensing	Yes		
Weight	8.8 lbs/4.1kg		

All-Reflective Concentric Imager





Headwall covers the hyperspectral range!

- UV-VIS (250-825nm)
- VNIR (380-1000nm)
- Extended VNIR (550-1700nm)
- NIR (900-1700nm)
- SWIR (950-2500nm)
- MWIR (3,000-5,000nm)
- LWIR (8,000-12,000nm)

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Hyperspec® UV
Hyperspectral Imaging Sensor

Hyperspec® UV imaging sensor for the 250-500nm spectral range

Headwall's Hyperspec® UV integrated hyperspectral imaging sensor provides the foundation for utilizing hyperspectral imaging to achieve superior spectral sensing and chemical imaging results for mission-critical applications ranging from biomedical applications to forensic science to process monitoring where UV measurement is a critical application parameter.

Key attributes of the hyperspectral imaging instrument are:

High performance aberration corrected hyperspectral imaging for 250 - 500nm
Fully reflective imager eliminates chromatic distortion over the entire wavelength range
Back-Illuminated CMOS sensor optimized for ultra-violet response
100% fill-factor and high Quantum Efficiency (QE) maximizes UV sensitivity & dynamic range
Greater than 50 frames per second digital readout

The award-winning, Hyperspec® imaging spectrometer family is built on a totally reflective concentric, f/2.0 optical design and optimized for imaging in harsh environments. All Hyperspec® instruments are based on Headwall's patented aberration-corrected, imaging design which feature the company's original holographic diffraction gratings.

In order to minimize stray light and aberrations, transmissive optical components are not used within the imaging spectrometer. This platform is further enhanced by a telecentric optical input design which enables superior spectral and spatial imaging.

The Hyperspec® UV sensors are also available with the Hyperspec® Starter Kit, the Hyperspec® Reflectance/Fluorescence System, and in pan/tilt configurations for stationary deployment or portable field-based deployment.

Application-Specific Solutions For Critical Environments

Applications:

- Biomedical research
- Chemical & biological analysis
- Food safety & quality
- Forensics
- Laboratory & healthcare
- Material identification
- Microscopy
- Multi-channel/multi-point
- Process control of biomass/biofuels

Key Benefits:

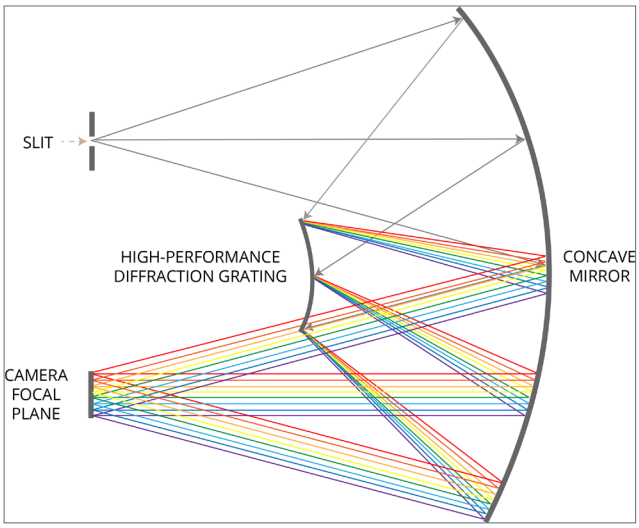
- Superb imaging performance
- High spectral/spatial resolution
- Ideal for low light, low signal applications
- Accurate, consistent spectral measurement
- Compact with very wide field of view
- Extremely high signal-to-noise
- Very portable - laboratory or field
- Rugged design for durability & stability
- Cost effective deployment

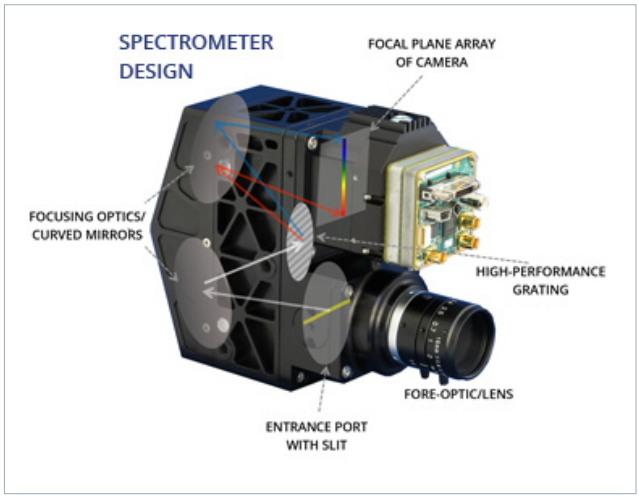
Hyperspec® UV Imaging Spectrometer	
Wavelength Range (nm)	250-500
Aperture	F/2.0
Dispersion per pixel	0.61nm
Slit Width (Interchangeable) Optional - 16, 40, 60, 100	25µm
Slit Length	12mm
Spectral Resolution (25µ slit)	2nm
Spectral Bands	409
Spatial Bands	1111
Smile - Aberration-corrected	Yes
Keystone - Aberration-corrected	Yes
Stray Light	< 0.02%

Image Acquistion	
FPA/Detector	CMOS
Pixel Fill Factor	100%
Frame Rates (fps)	50-1230
Pixel Pitch (microns)	10.8
Read A/D	10 bits
Shutter	2 Modes
Region of Interest	Yes
Digital Interface	CameraLink

Environmental & Mechanical	
Operational Temperature	0°C - 50°C
Power Consumption	2W @ 3.6VDC
Relative Humidity (Non-Condensing)	5-95%
Weight	~7 lbs

All-Reflective Concentric Imager





Headwall covers the hyperspectral range!

- UV-VIS (250-825nm)
- VNIR (380-1000nm)
- Extended VNIR (550-1700nm)
- NIR (900-1700nm)
- SWIR (950-2500nm)
- MWIR (3,000-5,000nm)
- LWIR (8,000-12,000nm)

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Data Sheet

Hyperspec® VNIR

Hyperspectral Imaging Spectrometer

Hyperspec® VNIR imaging sensor for the 380nm to 1000 nm spectral range

Headwall's Hyperspec® VNIR family of integrated hyperspectral imaging sensors provides the foundation for utilizing hyperspectral imaging to achieve superior spectral sensing and chemical imaging results for mission-critical applications ranging from process monitoring to moving webs of product across conveyor lines to non-invasive medical imaging where precise color measurement is critical to the application.

The award-winning, Hyperspec® imaging spectrometer family is built on a totally reflective concentric, f/2.0 optical design and optimized for imaging in harsh environments. All Hyperspec® instruments are based on Headwall's patented aberration-corrected, imaging design which feature *original* high efficiency holographic diffraction gratings rather than replicates.

In order to minimize stray light and aberrations, transmissive optical components are not used within the imaging spectrometer. This platform is further enhanced by a telecentric optical input design which enables superior spectral and spatial imaging.

The Hyperspec® VNIR imaging spectrometer is available in two configurations - as a lens-based imager or as a multi-channel/multi-point spectrometer; each model providing different capabilities to support application requirements such as frame rates, dynamic range, region of interest binning, price, and more.

The Hyperspec® VNIR sensors are also available with the Hyperspec® Starter Kit, the Hyperspec® Reflectance/Fluorescence System, and in pan/tilt configurations for stationary deployment. Hyperspec VNIR N-Series provides 12-236 frames per second (FPS) and USB connectivity. The A-Series provides greater than 90 FPS and Cameralink connectivity. The E-Series provides between 100-400 FPS and Cameralink connectivity.

Applications:

- Machine vision
- Moving webs of product
- Color measurement
- Pulp & paper
- Textile production
- Food safety & quality
- LCD/display quality control
- Microscopy & health sciences
- Multi-channel/multi-point spectroscopy
- Process control of biomass/biofuels
- Remote sensing & analysis
- Military, defense & homeland security
- Waste recycling & sorting

Key Benefits:

- Superb imaging performance
- Exceptional spectral & spatial resolution
- Ideal for low light, low signal applications
- Accurate, consistent spectral measurement
- Compact with very wide field of view
- Extremely high signal-to-noise
- Low scatter or stray light
- Rugged design for durability & stability
- Cost effective deployment

Application-Specific Solutions For Critical Environments

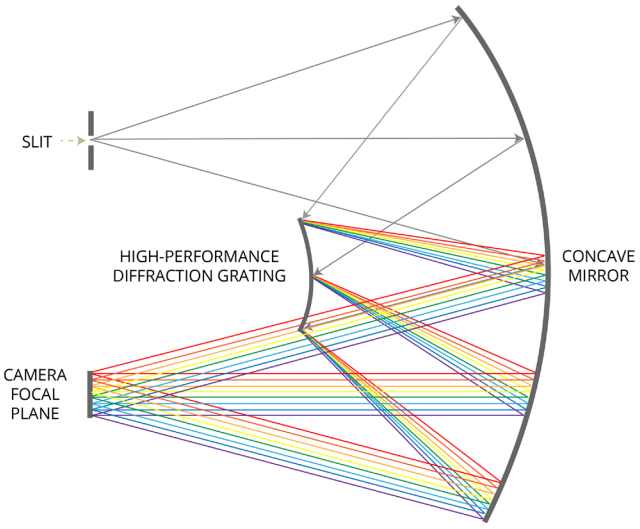
Hyperspec® VNIR Specifications

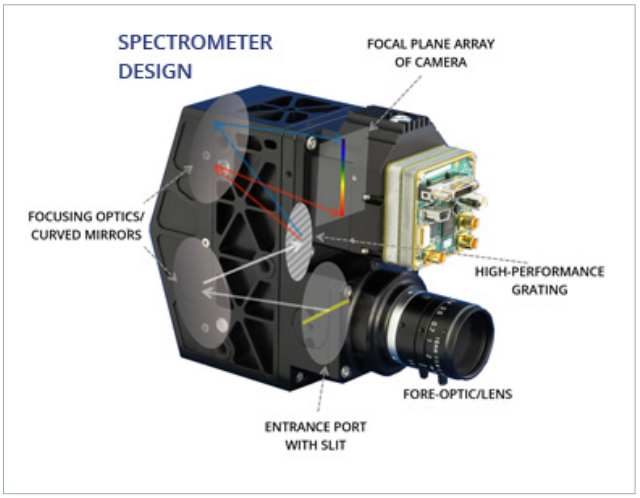
Hyperspec VNIR	A Series	N Series	E Series
Wavelength Range (nm)	400nm - 1000nm		
Aperture	F/2.0		
Dispersion per pixel	0.74 nm	0.80 nm	0.65 nm
Slit Width (Interchangeable) Optional - 16, 40, 60, 100	25 µm standard		
Slit Length	12 mm		
Spectral Resolution (25µ slit)	2-3 nm		
Spectral Bands	810	750	923
Spatial Bands	1000	1004	1600
Smile - Aberration-corrected	Yes		
Keystone - Aberration-corrected	Yes		
Stray Light	< 0.5%		

Image Acquisition	A Series	N Series	E Series
Detector	Silicon CCD		S-CMOS
Dynamic Range	60 dB	64 dB	88.6 dB
Frame Rates (fps)	> 90	12-236	100-400
Pixel Pitch (microns)	7.4	8.0	6.5
Read A/D	12 bit	14 bit	16 bit
Binning	Yes		
Region of Interest	Yes		
Camera Control Interface	base Cameralink	USB 2.0	full Cameralink

Environmental	A Series	N Series	E Series
Operational Temperature	0° C - 30° C	0° C - 30° C	10° C - 40° C
Storage Temperature	-20° C - 40° C	-25° C - 55° C	-10° C - 60° C
Relative Humidity (Non-Condensing)	< 70%	< 70%	10-80%
Weight	6.8 lbs/ 3.0 kg	7.5 lbs/ 3.4 kg	8 lbs/ 3.6 kg

All-Reflective Concentric Imager





Headwall covers the hyperspectral range!

- UV-VIS (250-825nm)
- VNIR (380-1000nm)
- Extended VNIR (550-1700nm)
- NIR (900-1700nm)
- SWIR (950-2500nm)
- MWIR (3,000-5,000nm)
- LWIR (8,000-12,000nm)

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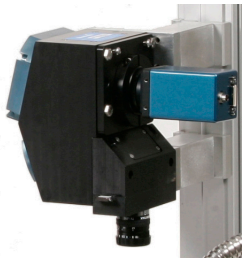
Hyperspec® Starter Kit For UV-VIS Applications

The Starter Kit provides everything needed for high performance imaging and sample scanning and can be used with an of Headwall's UV-VIS hyperspectral imagers. The kit includes illumination kit, full software control aboard Headwall's Hyperspec Data Processing Unit (HDPU), a moving web, and gantry.

The Starter Kits can be deployed almost anywhere hyperspectral imaging is needed - in the field or in the laboratory. Headwall's fully reflective, patented UV-VIS spectrometer design eliminates image aberrations while offering high resolution with a wide field of view. This represents a major advantage in the UV-VIS spectral range where spectral and spatial imaging performance is a critical success factor.

High Quantum-Efficiency (QE) detection electronics and 100% fill-factor means high signal-to-noise characteristics which maximizes UV sensitivity and dynamic range. A design-optimized objective lens comes with each Starter Kit, providing excellent chromatic compensation and imaging results over the 250nm-600nm UV-VIS spectral range. The 28mm focal-length lens provided with the Hyperspec UV Starter Kit has been optimized for high resolution of UV wavelengths.



Stable lighting for sample illumination for the Starter Kit is provided by a remote-controlled Pulsed Xenon UV light source that can operate up to 9,600 pulses per minute. This light source also includes two interchangeable filter windows: one isolates a 100nm illumination band centered at 360nm while the other isolates a 50nm illumination band at 275nm.

The HDPU contains a powerful GPU in addition to a high-speed CPU to deliver extremely fast capture, transfer and processing of the hyperspectral image data. The HDPU also comes with Headwall's Hyperspec® image-analysis and display software (Hyperspec III) that allows the user to export the data in industry-standard file formats.

Application-Specific Solutions For Critical Environments

Key Benefits:

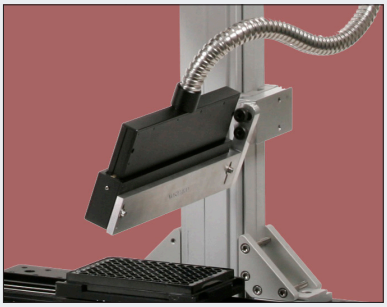
- Instantly scan sample materials & display hyperspectral results
- Determine spectral band differentiators
- Increased user productivity
- Cost-effective deployment
- Simple to set up, simple to use
- Flexibility to quickly modify configurations
- Quickly run multiple experiments
- Rapid development of spectral libraries

Key Features:

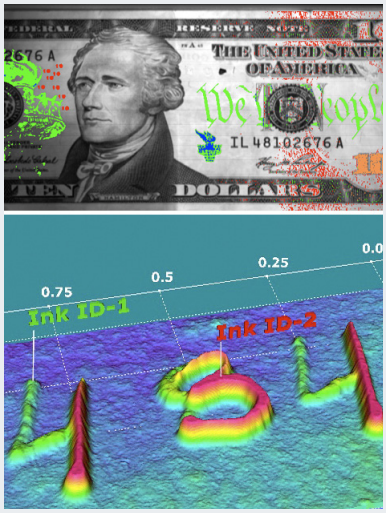
- Adjustable Hyperspec® mounting stage and gantry includes base plate, tower, and sensor mounting hardware
- Precision DC Servo linear stage and controller with 100mm travel distance (optional 250mm travel available)
- Lighting includes adjustable light line and light guide, 50mm wide standard/200mm optional
- Hyperspec® software manages hyperspectral data
- Optional darkening enclosure and high-speed Hyperspectral Data Processing Unit

An enclosure can be added to the UV Starter Kit to eliminate the effects of ambient or other light sources.

Headwall's Hyperspec Data Processing Unit (HDPU) comprises a high-performance CPU and GPU combination plus high-capacity storage to provide instantaneous management of hyperspectral image data



Power-stabilized Pulsed Xenon UV and Quartz Tungsten Halogen (QTH) light sources.



Headwall's spectrometers provide a highly resolved means of determining the spectral makeup of any reflective material, including documents, currency, food products, and more.

Image courtesy of Science GL

UV-VIS Starter Kit

Performance Guideline Table	
Spectral Region	250-600nm
F-Number	ƒ/2
Spectral Resolution	Variable, 2nm +
Spectral Bands	578
Spatial Bands	1280
Stray Light	As low as 0.02%
Frame Rate	50+
Camera Control	CameraLink
ROI	Yes, software-selectable
Shutter Type	Rolling shutter & Pseudo Snapshot
Exposure Time Range	Rolling shutter mode 30µs to 6 sec. Pseudo snapshot Mode 30µs to 260 milliseconds

Optical Characteristics for 28mm focal length lens	
Focal length	28.3 mm
ƒ stop	ƒ/3.5 to ƒ/16
Minimum Object Distance	25 cm
Image Format	ø 18 mm
Field of View	35,4°
Usable Spectral Range	220 nm to 900 nm
Optical Design	Multi-element, synthetic fused silica and UV-grade mono-crystal calcium fluoride
Front Accessory Filter Mount	M 32 x 0.5

Headwall Photonics is the world's leading manufacturer of Hyperspectral and Raman imagers for industry, defense/aerospace, and medical applications.

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