

## Prime™ X

Spectrometer

### High Performance Back-thinned CCD Spectrometer



The Prime™ X features a high sensitivity -10°C TE Cooled linearly summed 512 x 58 element back-thinned (BT) CCD detector. The BT CCD offers superior quantum efficiency, signal-to-noise, and dynamic range, making it ideal for a variety of UV/Vis/NIR applications. A 1024 x 58 BT CCD is also available for increased range and resolution. Other features include a built-in 16-bit digitizer, USB 2.0 interface and external trigger.

Standard spectral configurations range from 200nm - 1050nm and resolutions range between 1.0nm and 10.0nm. Custom configurations are available for OEM applications.

#### Applications:

- Low Light Level UV and NIR Spectroscopy
- Raman and Fluorescence Spectroscopy
- Remote Sensing
- DNA Sequencing
- Semiconductor End Point Inspection
- LED Sorting and Characterizations
- LCD Display Measurements

#### Features:

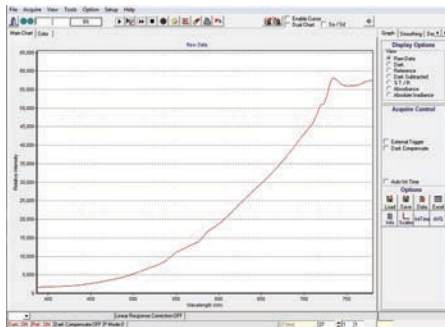
- Over 90% Peak QE
- Over 60% QE at 200nm
- High UV, Vis, and NIR Response
- 512 or 1024 Elements
- -10°C TE Cooled
- Optional Shutter Available

#### Accessories:

- Light Sources
- Fiber Patch Cords
- Fiber Sampling Probes
- Fiber Sample Holders

#### Software:

BWSpec™ is a spectral data acquisition software with a wide range of tools that are designed to perform complex measurements and calculations at the click of a button. It allows the user to choose between multiple data formats and offers optimization of scanning parameters, such as integration time. In addition to powerful data acquisition and data processing, other features include automatic dark removal, spectrum smoothing, and manual/auto baseline correction.



#### Specifications:

AC Power Input	100 - 240V AC, 50/60 Hz, 2.0 Amps @ 120V AC
Detector Type	Back-thinned CCD Array
Pixels	512 @ Equivalent 24mm x 1392mm (24x58) 1024 @ Equivalent 24mm x 1392mm (24x58)
Spectrograph f/#	3.5
Spectrograph Optical Layout	Crossed Czerny-Turner
Dynamic Range	75,000 (Typical) with Line Binning
Digitizer Resolution	16-bit or 65,535:1
Readout Speed	250 kHz
Data Transfer Speed	>50 Spectra Per Second Via USB 2.0
Integration Time	(512) 27 - 65,535ms x Multiplier (1024) 50 - 65,535ms x Multiplier
External Trigger	Aux Port
Operating Temperature	0°C to 35°C
TE Cooling	-10°C
Weight	Spectrometer: 3.1 lbs (1.4 kg) Power Supply: 2 lbs (0.9 kg)
Dimensions	Spectrometer: 4.2in x 7.0in x 3.5in (107mm x 178mm x 89mm) Power Supply: 9.8in x 6.6in x 2.2in (249mm x 169mm x 57mm)
Computer Interface	USB 2.0 / 1.1
Operating Systems	Windows: XP, Vista, 7

# Technical Details Prime™ X

Standard

## Fiber Coupler

### 1 Secures Fiber to Ensure Repeatable Results

By coupling a fiber optic to the SMA 905 adaptor, light will be guided to the slit and optically matched, ensuring reproducibility. For free space sampling, a diffuser or lens assembly can be connected directly to the SMA 905 adaptor.

Configurable

## Entrance Slit

### 2 Determines Photon Flux and Spectral Resolution

Light entering into a spectrometer's optical bench is vinyetted by a pre-mounted and aligned slit. This ultimately determines the spectral resolution and throughput of the spectrometer after grating selection. We offer a variety of slit widths to match your specific application needs: from 10µm - 200µm wide, with custom slits available.

Slit Option	Dimensions	512 Pixel Array Approx. Resolution 350 - 750nm	1024 Pixel Array Approx. Resolution 750 - 1050nm
10µm	10µm wide x 1mm high	Call	Call
25µm	25µm wide x 1mm high	~2.6nm	~1.5nm
50µm	50µm wide x 1mm high	~3.8nm	~2.5nm
100µm	100µm wide x 1mm high	~10.0nm	~5.0nm
200µm	200µm wide x 1mm high	Call	Call
Custom Slit Widths Available			

Standard

## Collimating Mirror

### 3 Collimates and Redirects Light Towards Grating

Both mirrors are *f/#* matched focusing mirrors coated with AlMg<sub>2</sub>, which produces approximately 95% reflectance when working in the UV-Vis spectrum. Aluminum (Al) provides reflectance and magnesium (Mg<sub>2</sub>) protects the aluminum from oxidation.

Configurable

## Diffraction Grating

### 4 Diffracts Light, Separating Spectral Components

The groove frequency of the grating determines two key aspects of the spectrometer's performance: the wavelength coverage and the spectral resolution. When the groove frequency is increased, the instrument will achieve higher resolution, but the wavelength coverage will decrease. Inversely, decreasing the groove frequency increases wavelength coverage at the cost of spectral resolution.

The blaze angle or blaze wavelength of the grating is also a key parameter in optimizing the spectrometer's performance. The blaze angle determines the maximum efficiency that the grating will have in a specific wavelength region.

Best Efficiency	Spectral Coverage (nm)	Grating
512 Pixel Array		
Vis / NIR	500-850	400/400
Vis	380-750	400/400
1024 Pixel Array		
UV / Vis	200-400	1200/250
UV / NIR	203-975	400/400
Vis / NIR	750-1050	600/1000
Custom Configurations Available		



Standard

## Focusing Mirror

### 5 Refocuses Dispersed Light onto Detector

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Standard

## Array Detector

### 6 Measures Entire Spectrum Simultaneously

The Prime™ X features a linearly summed 512 x 58 element back-thinned (BT) CCD detector where pixels are vertically binned, making an effective pixel size of 24µm x 24µm. As the incident light strikes the individual pixels across the BT CCD, each pixel represents a portion of the spectrum that the electronics can then translate and display with a given intensity using BWSpec™ software.

BT CCDs offer exceptional quantum efficiency from 200nm - 1000nm with a peak efficiency of > 90%. This BT CCD is ideal for low light level applications, featuring a large full-well capacity, low readout noise and MPP technology for dark current reduction. The BT CCD is different from a front-illuminated CCD in that it is mounted upside down on a rigid surface and thinned to less than 20 microns. This allows incoming photons to fall directly onto the individual pixels without having to penetrate through the gate structures, greatly reducing the probability that the photons will be absorbed or reflected.

Specifications		
	512 Pixel Array	1024 Pixel Array
Wavelength Range	380nm - 1050nm	200nm - 1050nm
Pixels	512 x 58	1024 x 58
Pixel Size	24µm x 24µm	
Well Depth	~30,000 e (typical)	
Digitization Rate	250 kHz	

Standard

## Thermoelectric Cooler

### 7 Reduces Dark Noise and Increases Detection Limits

Cooling an array detector with a built-in thermoelectric cooler (TEC) is an effective way to reduce dark current and noise, as well as to enhance the dynamic range and detection limit.

When the CCD detector array is cooled from a room temperature of 25°C down to -10°C by the TEC, the dark current is reduced by a factor of 14 and the dark noise is reduced by a factor of 3.7. This allows the spectrometer to operate at longer exposure times and to detect weaker optical signals.