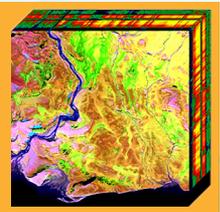
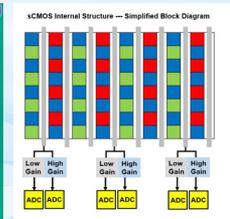
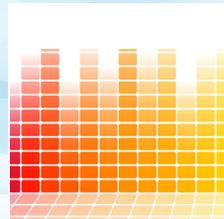
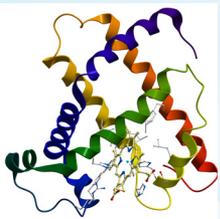


## Sylent™

Ultra-compact  
Scientific CMOS Camera



For OEM  
Industrial Applications

# Sylent

*The Quiet Camera*

[horiba.com/oem](http://horiba.com/oem)



# Sylent™ Scientific CMOS 4.2 MP Camera

## Overview: Model 4.2MP-U-6.5

The HORIBA Sylent scientific CMOS uncooled camera incorporates a novel back-illuminated 4.2 MP sensor with 6.5  $\mu\text{m}$  pixels and featuring a 13.3 mm x 13.3 mm active photosensitive area targeted to meet the most demanding photonic applications for the scientific and industrial sectors.

Sylent Model 4.2MP-U-6.5 boasts an ultra-compact design geared towards field-deployed robustness offering end users with high resolution, fast frame rate acquisitions that tout ultra-low noise ( $1.6 e^-$ ), good full well capacity ( $> 50 ke^-$ ), enhanced dynamic range (90 dB), high quantum efficiencies (up to 95%) ... all captured in an image with large field of view.

Cooled camera version available upon request.

## Applications

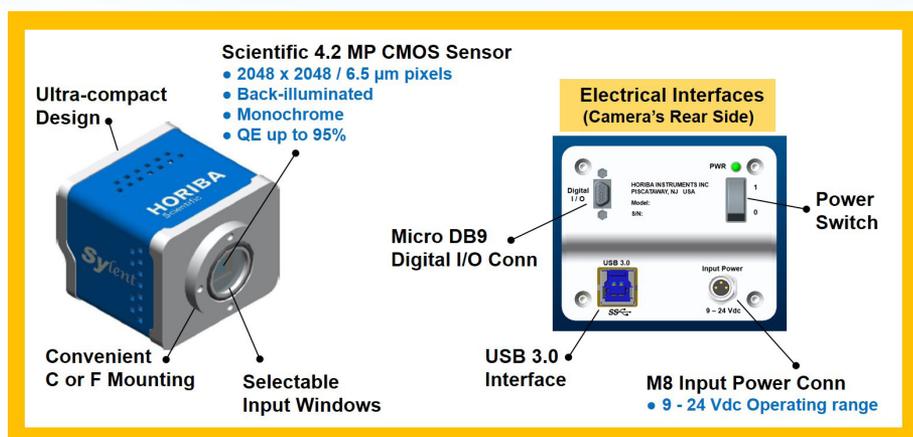
**Microscopy:** Fluorescence, Light Sheet Fluorescence Microscopy (LSFM), FRET, TRIF, FRAP, Live Cell Imaging, Spinning Disk Confocal, Structured Illumination, Hyperspectral Imaging, Bright-Field, Calcium Imaging, Bio-Luminescence, Biomedical Imaging, STORM

**Inspection:** Food, Manufacturing, Electronics, Flat Panel Display, Low-Light Machine Vision, Ophthalmology, Low Light Surveillance

**Spectroscopy:** Fluorescence, Phosphorescence, Photoluminescence, Raman, Hyperspectral Imaging, Semiconductor Inspection and Metrology

Industrial, Machine Vision, Robotics, Medical and Scientific Applications, Quality Inspection and Process Automation

## Design Highlights: Model 4.2MP-U-6.5-BI



## Features

Ultra-compact size

4.2 MP Back-illuminated monochrome scientific CMOS sensor

Unparalleled performance: low noise floor high full well

Exceptional response UV to NIR with QE up to 95%

43 fps @ full resolution high quality images ensuring collection of all data

High Dynamic Range mode: simultaneous image capture of bright and dim signals

High volume U.S.A. production capacity

## General Camera Specifications\*

Scientific CMOS Camera Attribute	Sylent Model 4.2MP-U-6.5-BI	
Scientific CMOS Sensor Type	Monochrome / Back-Illuminated (Front-illuminated upon request)	
Effective Pixels	4.2 Mega Pixel / Monochrome	
Active Pixels	2048 x 2048	
Pixel size (µm)	6.5 x 6.5	
Active Photosensitive Area (mm)	13.3 x 13.3 (Optical format: 1.2" / Diagonal 18.9 mm)	
Full Well	55 ke <sup>-</sup> typ	50 ke <sup>-</sup> min
Linear Full Well	53 ke <sup>-</sup> typ	48 ke <sup>-</sup> min
Read Noise Median	1.6 e <sup>-</sup> typ	2.5 e <sup>-</sup> max
Dynamic Range (HDR)	31,623:1 (90 dB) typ	
Non-Linearity	<0.6%	
Quantum Efficiency	Up to 95%	
Shutter Mode	Rolling	
Exposure Time	11.2 micro-second to seconds (defined only by Dark Current)	
Image Time Stamp Accuracy	Coarse: 1 micro-second	Fine: 20 nano-second
Triggering Modes (Frame Synchronization)	Internal Sync	
	External Sync --- Single or Multiple Triggers	
	External Sync --- Single / Multiple Triggers with Delays	
Pixel Readout Rates	50 MHz	25 MHz
Frame Rates (fps)	16 / 12 Bit	16 / 12 Bit
2048 x 2048	43	21
2048 x 1024	87	43
2048 x 512	174	87
Communication	USB 3.0	
External I/O Connector	9-Pin Micro D-Sub	
Power Connector	3-Pin M8	
Power On / Off Switch	Yes	
Environmental Conditions	Operating Temperature Range: +15 °C to +40 °C	
	Operating Humidity Range: <70% (non-condensing)	
	Storage Temperature Range: -20 °C to +60 °C	
Input Voltage Range	+9 to +24 Vdc	
Input Power	7.9 W typ (24 Vdc @ 0.329 Adc)	
Cooling	Fan (standard) / TE-cooling available upon request	
Window Material	Selectable / UV Grade Fused-Silica (Standard)	
Window Coating	Available AR Coating on request	
Lens Mount Adapter	C-Mount (Standard) / F-Mount (Optional) / Customizable on request	
Camera Size Without C-Mount	Inches: 2.38 x 2.87 x 2.94	mm: 60.4 x 72.9 x 74.7
Camera Size With C-Mount	Inches: 2.38 x 2.87 x 3.31	mm: 60.4 x 72.9 x 84.1
Weight	Lbs: 0.70	Grams: 318
Software Support	Custom API/SDK support for easy integration to C#, C++ applications and container applications supporting standard DLL library interface. Consult factory for 3rd party imaging software support.	

\* Specification values subject to change

## Design Features: Model 4.2MP-U-6.5-BI

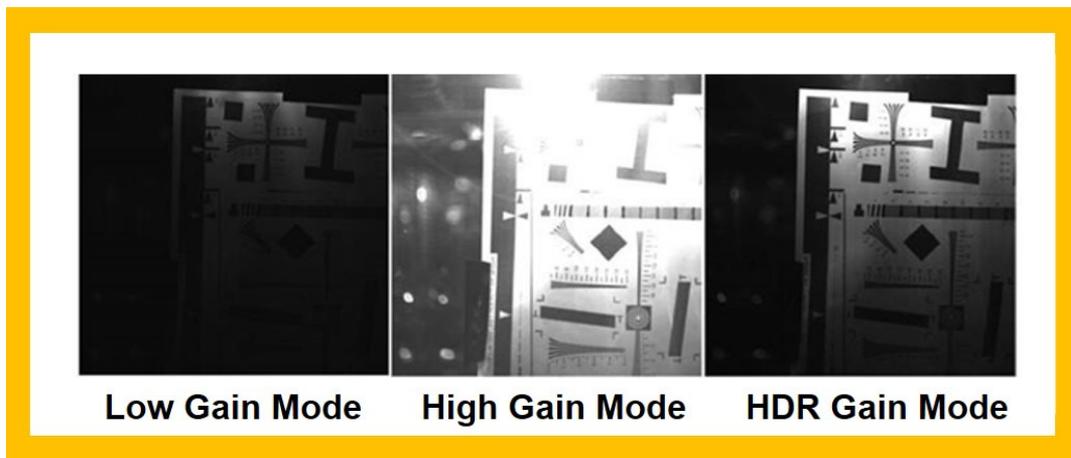
### Scientific 4.2 MP CMOS Sensor

At the heart of HORIBA's new Sylent scientific CMOS camera model lies a novel back-illuminated sensor architecture providing UV to NIR responsivity with quantum efficiencies (QE) of up to 95% ... without the use of performance limiting micro-lenses.

### Outstanding High Dynamic Range

In addition to the user selectable 12-bit High and Low gain operating modes, the Sylent 4.2MP-U-6.5-BI camera features an unprecedented 16-bit High Dynamic Range (HDR) mode (90 dB) allowing for the accurate capture of weak and bright signal regions simultaneously on a per image basis.

Here, Sylent's HDR mode leverages its sensor's Dual Amplifier/ADC structure to simultaneously sample each pixel's high gain (low noise) and low gain (high capacity) path and merge the appropriate digitized value (on a pixel-by-pixel basis) to extend the captured image's dynamic range to a 16-bit level without compromising sensitivity or linearity. As illustrated in the image collage below, trade-offs traditionally made by scientists and engineers to choose between the limitations of high gain (sensitivity) or low gain (capacity) acquisitions are overcome with this novel feature to meet the challenges of today's imaging and spectroscopic quantitative applications.



### USB 3.0 Interface

From a host communication standpoint, the Sylent 4.2MP-U-6.5-BI camera incorporates a USB 3.0 interface to handle the high data rates associated with its 4.2 MP scientific CMOS sensor, and achieves an impressive 43 fps for full resolution images. For the most demanding applications that require enhanced temporal resolution, increased frame rates are achieved by user selectable smaller ROI sizes.

### Timestamp Feature

HORIBA's new Sylent 4.2MP-U-6.5-BI camera model provides a user selectable coarse or fine "Timestamp" function per image that is accurate to 1  $\mu$ Sec and 20 nSec respectively. This "Timestamp" feature allows the user to have precise knowledge of acquired frame times as they relate to an application's temporal dynamics and is especially important for fast events ... to eliminate the ill effects of computer and interface latencies.

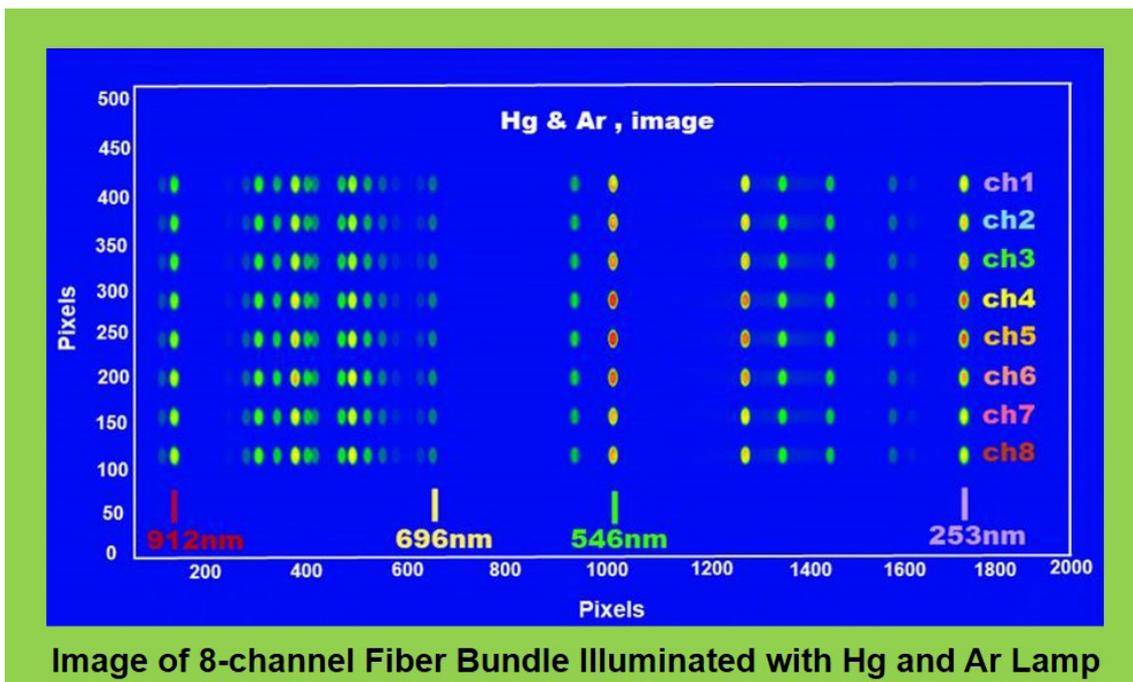
## Imaging Mode Frame Rates

Sensor Region of Interest (ROI)		USB 3.0 Maximum Frame Rate (fps)	
ROI Area	ROI Size by Pixels	50 MHz Pixel Rate	25 MHz Pixel Rate
mm x mm	W x H	16 / 12 Bit	16 / 12 Bit
13.3 x 13.3	2048 x 2048	43	21
9.1 x 9.1	1400 x 1400	63	31
7.8 x 7.8	1200 x 1200	74	37
6.7 x 6.7	1024 x 1024	86	43
3.3 x 3.3	512 x 512	172	86
1.7 x 1.7	256 x 256	342	171
0.8 x 0.8	128 x 128	671	337

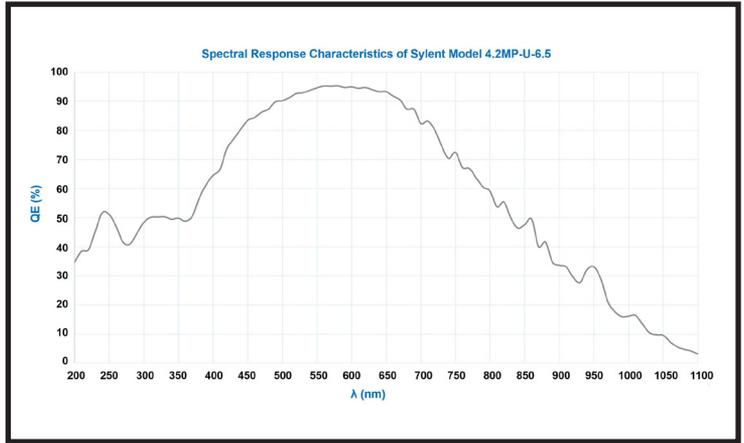
## Spectroscopy Mode Spectral Rates

Sensor Array Size	USB 3.0 Maximum Spectral Rate	
W x H	50 MHz Pixel Rate	25 MHz Pixel Rate
	16 / 12 Bit	16 / 12 Bit
Any x 8	6,944	3,610
Any x 16	4,255	2,183
Any x 32	2,415	1,224
Any x 64	1,294	652
Any x 1200	74	37
Any x 2048	43	21

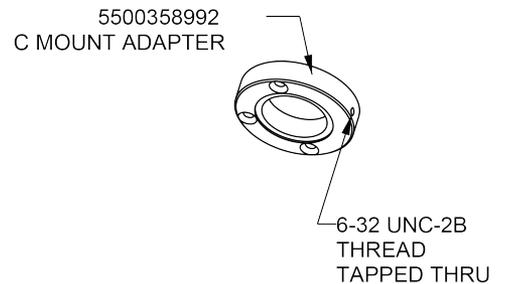
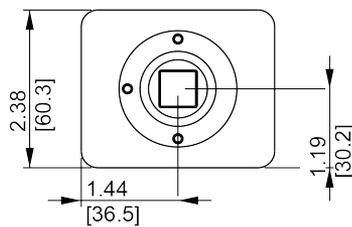
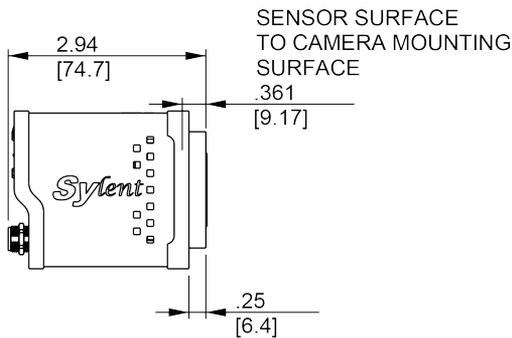
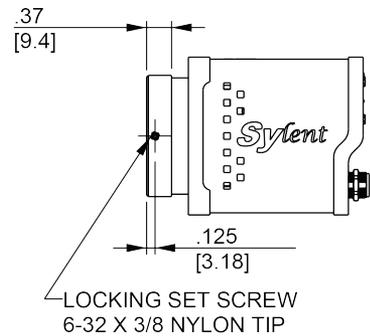
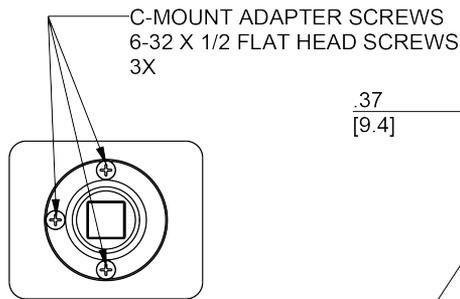
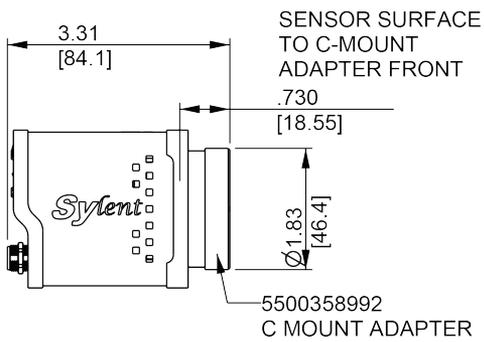
## Multi-track Mode Example Using Sylent



# Quantum Efficiency



# System Mechanical Drawings



NOTES:

1. UNITS ARE IN INCHES [MILLIMETERS] UNLESS OTHERWISE NOTED.
2. AVAILABLE ADAPTERS: C-MOUNT, F-MOUNT AND CUSTOMIZABLE

# Best Selling Miniature Spectrometers for OEM Industrial Applications

## Fiber-coupled USB Spectrometers:



### MiniVS20 Spectrometer with Linear UV-VIS CMOS or NIR INGAAS sensor

OEM hand-held spectrometer covering 190 to 1,700 nm for various low stray light applications

- Aberration-corrected concave holographic grating options
- VIS configuration featuring a 1.7" x 1.9" x 2" size combined with full F/2.3 optics for high signal-to-noise
- High throughput, compactness and long term reliability



### MiniVS70 VIS Spectrometer with FI CMOS or BI CCD

NEW miniaturized VS70 configuration

- Based on high performance aberration-corrected concave gratings fitted with a custom order-sorting filter to eliminate higher orders
- Low cost combined with high performance and low stray light
- Long term opto-mechanical stability and choice of front-illuminated linear CMOS or back-illuminated CCD sensors



### VS70 UV-VIS-NIR Spectrometer with uncooled / TE-cooled CCD

Most popular, compact versatile VS70 OEM Spectrometer and OES configurations

- Based on high performance aberration-corrected concave gratings with full F/2.3 aperture
- SINGLE or DUAL fiber channel versions available
- Affordable high throughput, robust and stable
- Electronics drivers ranging from **USB 2 to Ethernet and EtherCAT**



### CiCi-Raman-NIR with scientific camera optimized for 785 nm

Most compact OEM Raman spectrometer with aberration-corrected holographic grating

- Covers 150-3,300 cm<sup>-1</sup>
- High efficiency and low stray light
- Available in F/2.3 and in compact F/5 configurations
- -50° C deep-cooled scientific CCD camera with minimized etaloning and high NIR QE



### PoliSpectra® Quad Spectrometer for simultaneous acquisition of 4 VIS spectra

CCD spectrometer for simultaneous acquisition from 4 fiber inputs (470-730 nm)

- High-speed electronics (as fast as <1.5 msec readout time for 4 spectra)
- QUAD-channel high throughput system (f/2.3) and ultra-low stray light
- Industrial low light applications from low light fluorescence to reflectance



### PoliSpectra® M116 8-32 channel MultiTrack UV-VIS-NIR CMOS spectrometer

Fiber-coupled multi-spectra system with 8 to 32 channel simultaneous measurements

- Concentric optical design with UV extended spectral range provides minimized crosstalk
- High throughput USB 3 system featuring a fast 2D scientific BI CMOS running at 94 to 188 frames per second, acquiring 8, 16 or 32 simultaneous spectra (2048 pixels per spectrum)



### PoliSpectra® H116 Imaging Spectrometer for hyperspectral work from UV to NIR

Ultra-high performance rugged spectrometer for hyperspectral imaging with a 2D Scientific CMOS Camera

- For line-image scanning, in a push-broom hyperspectral configuration
- High throughput, USB 3 system featuring a fast 2D scientific BI CMOS with rolling shutter, running at 94 (HDR) to 188 (Standard Mode) frames per second (2048 pixels per spectrum)

# OEM Philosophy and Mission

## 3 Centers of Excellence Dedicated to OEM Spectroscopy and Camera Solutions in US, EU, and Asia

Our mission is to provide a complete development and manufacturing experience, from optical simulations to opto-mechanical design and prototyping of spectroscopic and camera systems extending to, and including, electronics, firmware, software design and first articles.

Our products provide superior performance, reliability and stability, combined with robust cost reduction. Capable of flexible high volume production capacity in quantities of hundreds to thousands per year, we offer full confidentiality providing "Black Boxes" or private labelling, using your logo or graphics.

Unmatched customer service is provided by our exceptionally experienced workforce featuring on-time delivery and flexibility, allowing scheduling modifications.

Adhering to Copy Exactly! (CE!) processes, our fully trained staff from engineering to manufacturing form a dedicated OEM engineering force that supports you over the lifetime of the product.

### Scientific Segment - OEM Products and Capabilities:

- Custom master optical diffraction gratings
- Diffraction grating replicas (concave, convex and flat)
- Spectrometers, optical assemblies with pre-aligned sensors (CCD, PDA, CMOS, InGaAs) using either customers' or HORIBA's OEM electronics
- OES spectrometers
- Spectroscopy systems or modular engines, such as mini fluorometers and mini Raman systems
- Single and double scanning monochromators
- Imaging spectrographs and spectrometers with CCD or CMOS cameras
- Multispectra spectrometers with multiple fiber inputs / MultiTrack spectroscopy
- Hyperspectral system with HORIBA or customer provided camera (Push-broom configurations)
- Cameras: Spectroscopic deep-cooled scientific cameras (1D and 2D CCD & InGaAs – FI and BI)
- OEM electronics for optosensors ranging from PD and PDA to CCD and CMOS sensors
- Imaging cameras: Uncooled and cooled with FI and BI high-end scientific CMOS
- VUV/FUV spectrometers and CCD vacuum and N2-purged cameras

## Other Scientific Deep Cooled CCD and InGaAs Camera Offerings

Sincerity®



Low Cost -50° C  
Air-cooled OEM Camera

Synapse® Plus



Deep-cooled -80° C to -100° C  
Air- or Water-cooled Camera

Synapse® EM



EM CCD  
Deep-cooled Camera

VUV Sincerity®



TE-cooled to -50° C (Vacuum)  
or -30° C with N2 purge

Synapse® InGaAs



Deep-cooled NIR Camera  
to -75° C (Water-cooled)

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