



## ProEM: 512B

The ProEM: 512B camera from Princeton Instruments is the most advanced EMCCD camera available on the market today, utilizing the latest low-noise read out electronics and a 512x512 back illuminated EMCCD to deliver single photon sensitivity. This true 2-in-1 camera features a high speed EM mode to capture fast kinetics and a low speed normal CCD mode with very low read noise for precision photometry applications. It provides advanced features such as solid baseline stability and linear EM gain control. The ProEM: 512B is cooled to below  $-80^{\circ}\text{C}$  using either air or liquid, or a combination of both. Its all metal, hermetic vacuum seals are warranted for life - the only such guarantee in the industry.

The ProEM: 512B EMCCD camera also features, for the first time, the latest Gigabit Ethernet (GigE) interface that allows remote operation over a single cable without the need for custom framegrabbers.

### FEATURES

### BENEFITS

Electron multiplication (EM) gain	Low-noise, impact-ionization process for single-photon sensitivity
OptiCAL™	Linear, absolute EM gain calibration using built in precision light source EM and Non-EM modes for the lowest noise and the best linearity.
BASE™	Baseline Active Stability Engine - stable bias for quantitative measurements
PINS™	Princeton Instruments Noise Suppression technology. Independently optimized EM and non-EM modes for the lowest noise and the best linearity.
Back-illuminated CCD	>90% peak quantum efficiency for the highest available sensitivity
Frame-transfer architecture	Allows 100% duty cycle imaging for tracking applications
Deep cooling	Thermoelectric cooling below $-80^{\circ}\text{C}$ minimizes dark current and allows long exposure times Camera can be cooled with air or water, or a combination of both, and fan can be permanently turned off for vibration-sensitive environments
Single optical window	Vacuum window is the only optical surface between incident light and the CCD surface - No losses due to multiple optical surfaces
Built-in shutter	Conveniently capture dark reference frames and protect camera from dust when not in use
Dual amplifiers	Individually optimized signal chains for a true 2-in-1 camera configuration, for high speed (EM mode) or long integration (normal CCD mode) applications
16-bit digitization	Wide dynamic range to capture dim and bright signals in a single image
10- and 5-MHz readout	Video rates at full-frame resolution. Use ROI/binning for hundreds of frames per second
100-kHz readout	Noise performance of a slow scan camera for precise photometry applications
Kinetics readout mode	Powerful readout mode offers microsecond time resolution between sub-frames
Gigabit Ethernet (GigE)	Reliable data transmission over 50m for remote operation
Software interface	Universal interface for easy custom programming, real-time focus & image access via circular buffers
C-mount (Adjustable)	Easily attaches to microscopes, standard lenses, or other optical equipment

### Applications:

Single molecule detection, spectroscopy, chemiluminescence, astronomy, adaptive optics, hyperspectral imaging, phosphor imaging and tomography

## SPECIFICATIONS

Image sensor	e2v CCD97; back-illuminated, frame-transfer EMCCD	
CCD format	512 x 512 imaging pixels 16 x 16 $\mu\text{m}$ pixels 8.2 x 8.2 mm imaging area (optically centered)	
	<b>EM mode</b>	<b>Normal CCD mode</b>
Read noise (typical)	25 e- rms @ 5 MHz 50 e- rms @ 10 MHz Read noise effectively reduced to <1 e- rms with on-chip multiplication gain enabled	3 e- rms @ 100 kHz 7 e- rms @ 1 MHz 12 e- rms @ 5 MHz
Full well (typical)	800 ke- (output node)	200 ke- (single pixel)
Non-Linearity	<2%	<1%
Analog gain (typical)	12, 6, 3 e-/ADU	3.2, 1.6, 0.8 e-/ADU
Deepest cooling temperature (@ +20°C ambient)	-80°C +/- 0.05°C (typical) -70°C +/- 0.05°C (guaranteed)	
Dark current @ -70°C	0.005 e-/p/sec (typical) 0.02 e-/p/sec (maximum)	
Clock induced charge (CIC) (typical)	0.005 e-/pixel/frame measured with 33msec exposure time and ~1000x multiplication gain	
Electron multiplication (EM) gain	1 to 1000x, controlled in linear, absolute steps	
Digitization	16 bits @ 10 MHz, 5 MHz, 1 MHz and 100kHz	
Vertical shift rate	300 nsec/row - 5 $\mu\text{sec}$ /row (variable)	
Binning	Flexible binning in vertical and 2x to 32x in horizontal	
Operating systems supported	Windows XP/Vista	
I/O signals	Exposure, Readout, Trigger In	
Operating environment	0 to 30°C ambient, 0 to 80% relative humidity, non-condensing	

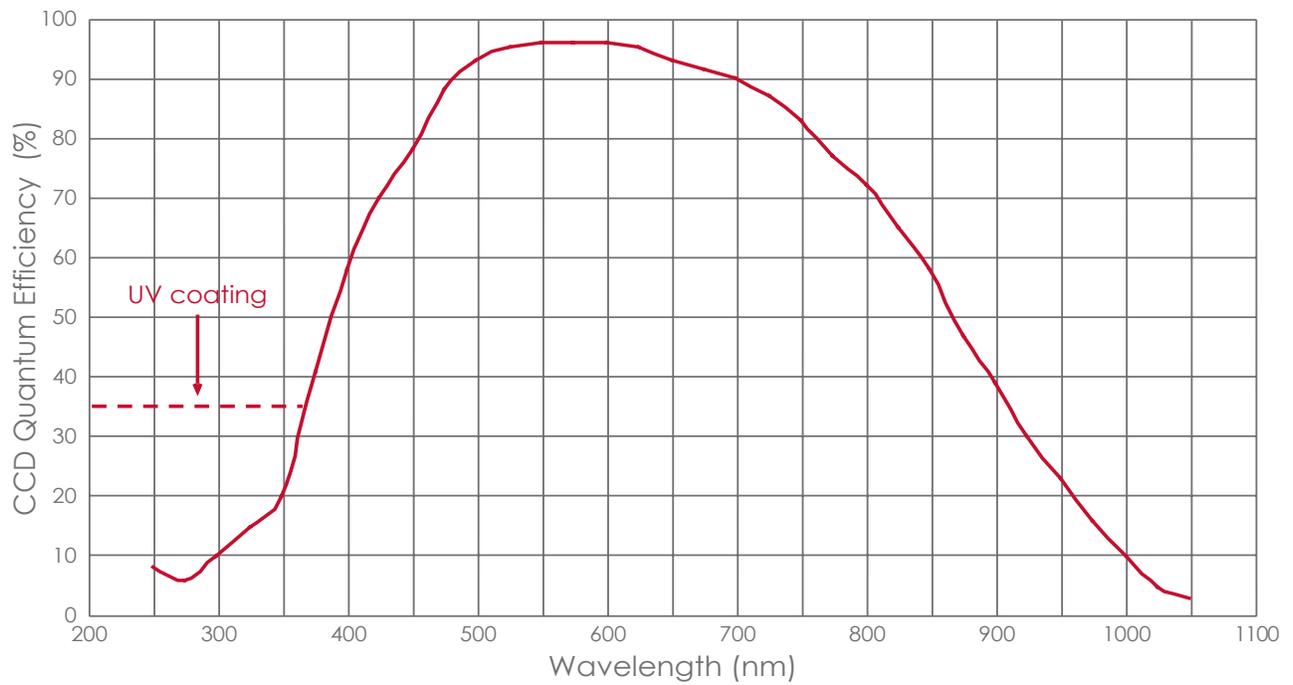
NOTE: All specifications subject to change

## FRAME RATE (fps)

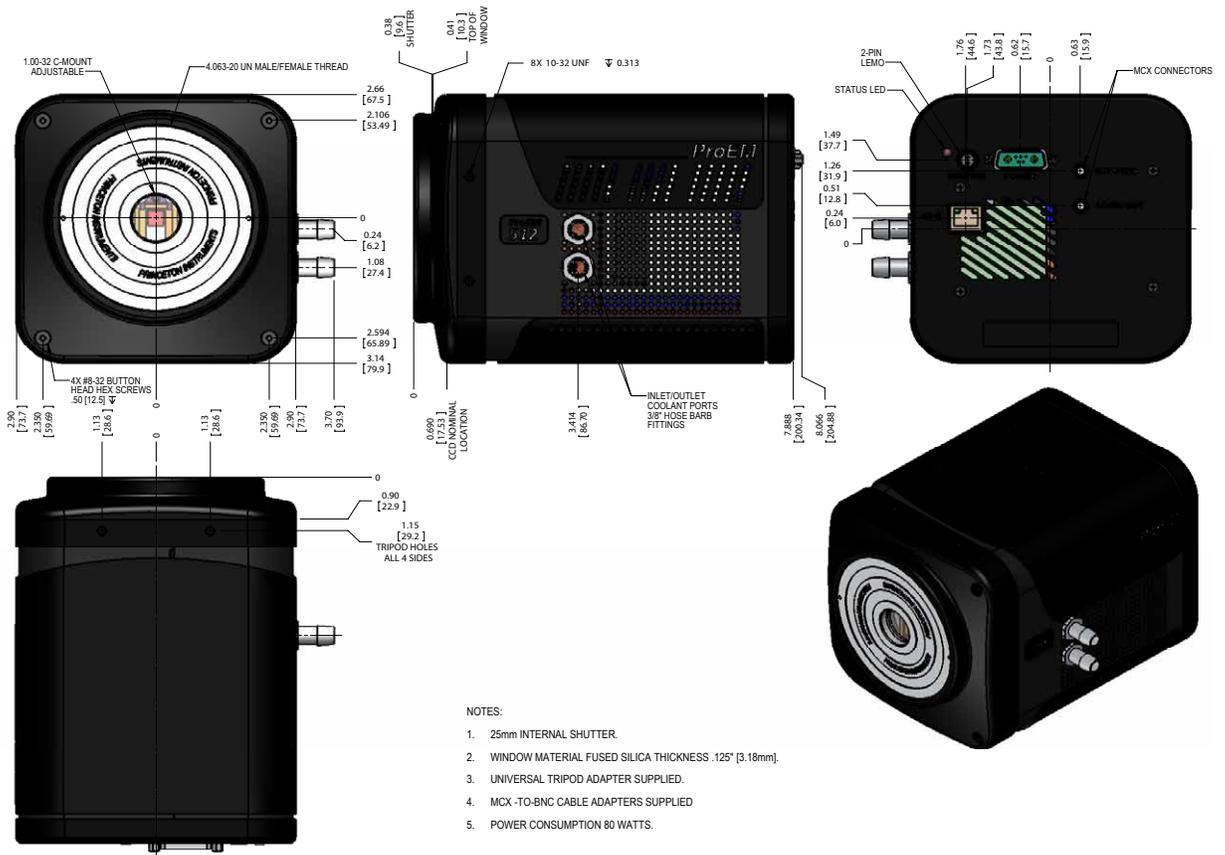
ROI/Bin	512 x 512	256 x 256	128 x 128	64 x 64	32 x 32
1 x 1	33	65	122	222	373
2 x 2	65	122	222	373	565
4 x 4	122	222	373	565	763
8 x 8	222	373	565	763	926

NOTE: Frame rate measured at 10 MHz digitization and 450 nsec/row vertical shift.  
"Custom chip" mode increases frame rate at reduced ROI by 2x to 3x.

## QUANTUM EFFICIENCY



## OUTLINE DRAWING



NOTES:

1. 25mm INTERNAL SHUTTER.
2. WINDOW MATERIAL FUSED SILICA THICKNESS .125" (3.18mm).
3. UNIVERSAL TRIPOD ADAPTER SUPPLIED.
4. MCX -TO-BNC CABLE ADAPTERS SUPPLIED.
5. POWER CONSUMPTION 80 WATTS.