DIAGNOSTIC instruments, inc.

BOOST™

emccd BT 2000

The SPOT™ BOOST™ BT 2000 back illuminated EMCCD has single photon detection capability without an image intensifier, combined with greater than 90% QE of a back-illuminated sensor. Containing a 512 x 512 L3Vision™ Frame Transfer CCD sensor from E2V Technologies, it enables charge to be multiplied on the sensor before it is read out, while utilizing the full QE performance of the CCD sensor. The EMCCD gain of the camera can be varied from unity up to a thousand times directly through the software. The system offers up to 10 MHz pixel readout rate, both EMCCD and conventional amplifier outputs and benefits from minimized dark current with unequaled thermoelectric cooling down to –100° C.

Camera Specs

• EMCCD Technology	Ultimate in sensitivity from EMCCD gain – even single photon signals are amplified above the noise floor.
• True Linear gain	Control EMCCD gain with a linear, quantified scale – ask for a gain value and get it corrected to the CCD temperature.
• > 90% QE back-illuminated sensor	Maximum possible photon collection efficiency
• Variable readout rates up to 10 MHz	Quantitative accuracy at all speeds
• Vacuum sealed cooling	Critical for sustained vacuum integrity to maintain unequalled cooling and QE performance
• Thermoelectric cooling to –100° C possible	Critical for elimination of dark current detection limit – an EMCCD must!
• 512 x 512 Frame Transfer sensor	High resolution, large field of view and fast, shutterless imaging
• High dynamic range	Extended sensor dynamic range (readout speed dependent) and matched digitization for quantization of dim and bright signals
• Built-in C-mount compatible shutter	Easy means to record control dark images – excellent for optimization of experimental set-up
• EM protect	EM gain register is protected from accidental damage using built-in algorithms. Also limits long-term gain aging.

Camera Overview

Active Pixels	512 x 512
Pixel Size (WxH; µm)	16 x 16
Image Area (mm)	8.2 x 8.2
Active Area pixel well depth (e-, typical)	200,000
Gain Register pixel well depth (e-, typical)	800,000 [3]
Max Readout Rate (MHz)	10
Frame Rate (frames per sec)	35 to >500
Read Noise (e-)	<1 EM gain < 50 conventional @10 MHz

System Characteristics

Peak QE	>92%
Pixel Readout Rate (MHz)	
Electron Multiplying Amplifier	10, 5, 3, 1
Conventional Amplifier	3 and 1
Digitization @ 10, 5, 3 & 1 MHz readout rate	True 14-bit (16-bit available-See Boost model BT-2001)
Vertical Clock Speed (µs)	0.3 to 3.3 (variable)
Linear Electron Multiplier Gain (software controlled)	1 – 1000 times
Non-Linearity	<1%
Triggering	Internal, external, external start
Camera window type	Single window with double-sided AR coating–standard for BV model

Dark Current & Dark Current Background Events [5]

@ -85° C (e-/pix/sec)	0.001
EMCCD-Amplified Background Events [6] (events/pix) @ 1000 x gain and -85° C	0.005

Noise

System Readout Noise (typical; e-) [7]	**Typical**	**with Electron Multiplication**
10MHz through EMCCD amplifier	49	<1
5MHz through EMCCD amplifier	40	<1

Operating & Storage Conditions

Operating Temperature	0° C to 30° C ambient
Relative Humidity	< 70% (non-condensing)
Storage Temperature	-25° C to 55° C

Computer Requirements

To handle data transfer rates of 10MHz readout over extended sequential (kinetic) series, a powerful computer is recommended, e.g:

- 3 GHz Pentium (or better)
- 1GB RAM
- 10,000 rpm SATA hard drive, preferred for extended kinetic series

Power Requirements [8]:
0.6A @ +12V | 0.3A @ -12V | 3.0A @ +5V

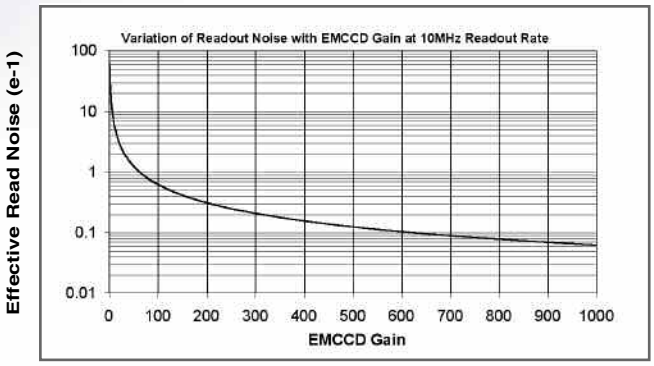
Also:

- PCI-compatible computer
- PCI slot must have bus master capability
- Available auxiliary internal power connector
- 32 Mbytes free hard disc space

Operating System:
Windows 2000 or XP operating system

Need more information?
Contact us at:
Phone: **586.731.6000** • Fax: **586.731.6469**
e-mail: **info@diaginc.com**
website: **www.diaginc.com**
For footnote review: **www.diaginc.com/boostnotes**

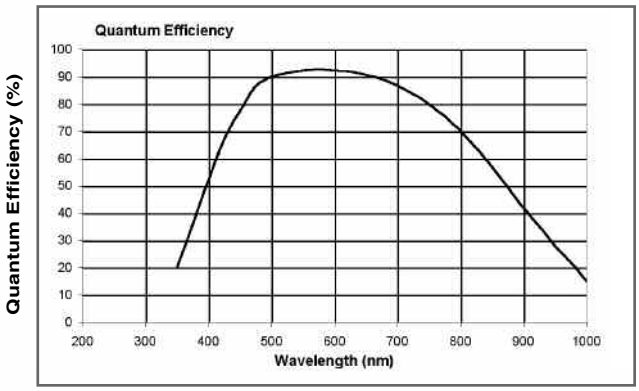
Noise & EMCCD Gain



Cooling Temperature

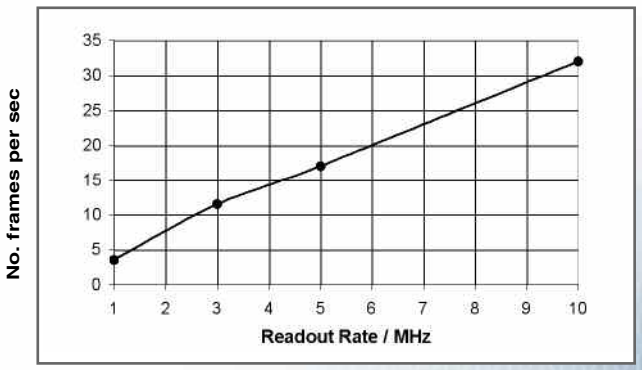
Air-cooled (ambient air @ 20° C)	-85
Water cooled using Re-circulator (RC180) (ambient air @ 20° C)	-90
Water-cooled using Chiller (water @ 12° C, 0.75 l / min)	-100

Quantum Efficiency



Quantum Efficiency at 575nm and –20° C [9]

Full Frame Rate [10]



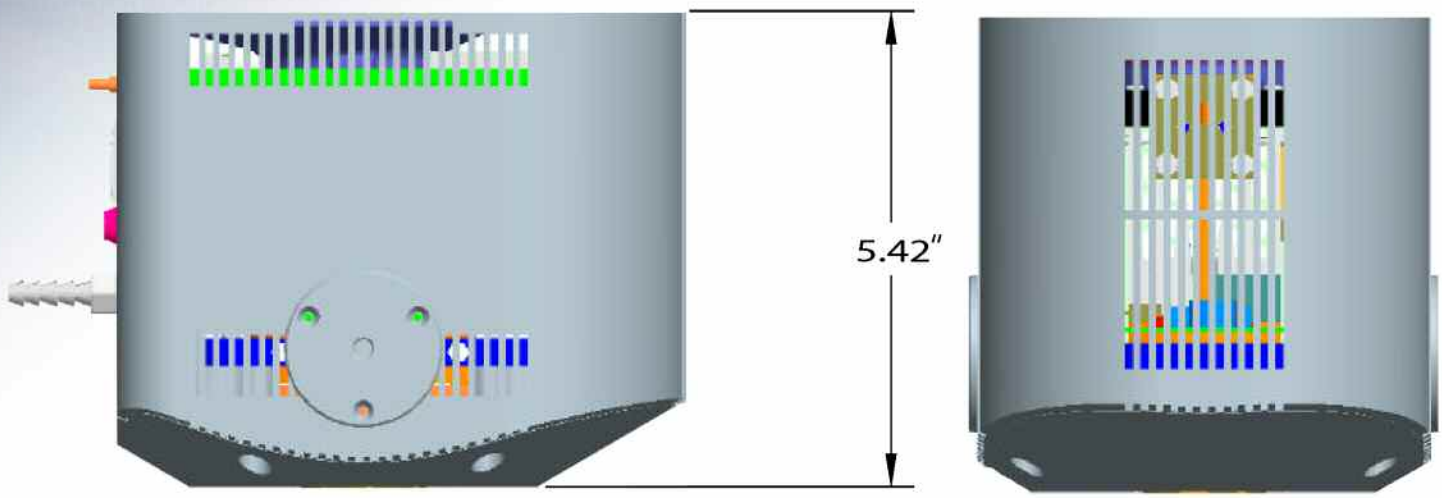
Max Frames per Sec [11]

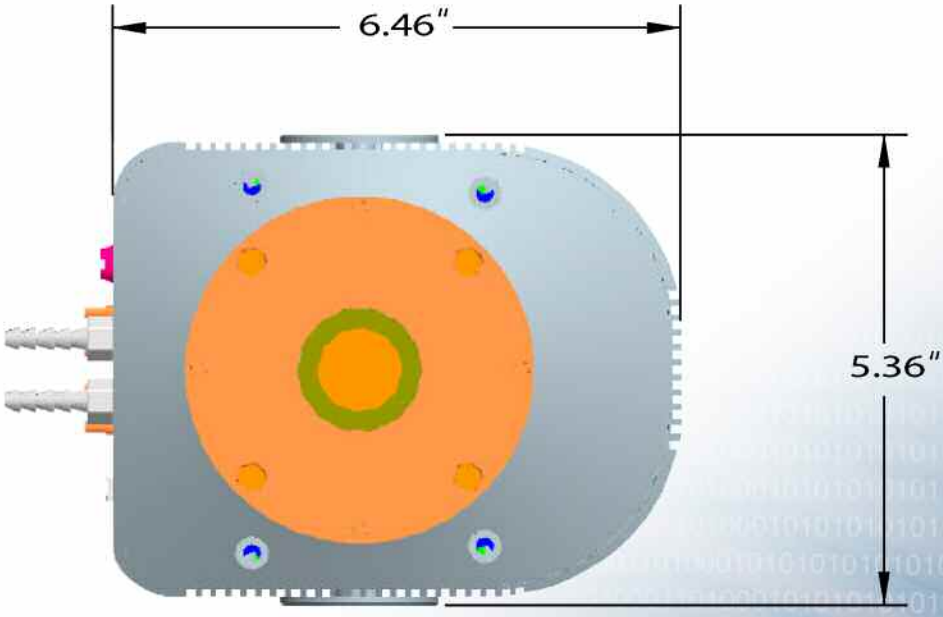
Array size	**512 x 512**	**256 x 256**	**128 x 128**	**512 H x 100 V**
Binning	**(full frame)**			
1x1	35	68	132	168
2x1	68	132	248	313
2x2	68	132	248	313
4x1	131	246	439	549
4x4	131	246	439	549

DIAGNOSTIC instruments, inc.

BOOST™

dimensions





DIAGNOSTIC instruments, inc.