



**DIAGNOSTIC**  
instruments, inc.



# BOOST™

emccd BT 2100



The SPOT™ BOOST™ BT 2100 EMCCD has single photon detection capability without an image intensifier. Containing a 1004 x 1002 Impactron™ Frame Transfer CCD sensor from Texas Instruments, 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 35MHz pixel readout rate and benefits from minimized dark current with unequalled thermoelectric cooling down to  $-100^{\circ}\text{C}$

## CAMERA SPECS

- **EMCCD Technology**
- **True Linear gain**
- **One window design with double sided AR-coated window**
- **Fastest vertical clock speeds**
- **1004 x 1002 Frame Transfer sensor**
- **Readout rates up to 35MHz**
- **Fan control**
- **Vacuum sealed cooling**
- **Thermoelectric cooling to  $-100^{\circ}\text{C}$  possible**
- **Built-in C-mount compatible shutter**
- **EM protect**

Ultimate in sensitivity from EMCCD gain – even single photon signals are amplified above the noise floor.

Control EMCCD gain with a linear, quantified scale – ask for a gain value and get it corrected to the CCD temperature.

Highest possible throughput of photons to sensor. Can be used with C-mount magnifying lens without image curvature.

Maximum frame rate. Shorter exposures without smear.

Small pixel size ( $8 \times 8 \mu\text{m}$ ) delivering high resolution, large field of view and fast, shutterless imaging.

Quantitative accuracy at all speeds -  $\sim 31.5$  full frames/sec possible.

Set fan speed or turn off completely for no vibration!

Critical for sustained vacuum integrity to maintain unequalled cooling and QE performance

Critical for elimination of dark current detection limit – an EMCCD must!

Easy means to record control dark images – excellent for optimization of experimental set-up

EM gain register is protected from accidental damage using built-in algorithms. Also limits long-term gain aging.

## CAMERA OVERVIEW

<b>Active Pixels</b>	1004 x 1002
<b>Pixel Size (WxH; <math>\mu\text{m}</math>)</b>	8 x 8
<b>Image Area (mm)</b>	8 x 8
<b>Active Area pixel well depth (e-, typical)</b>	40,000
<b>Gain Register pixel well depth (e-, typical)</b>	80,000
<b>Max Readout Rate (MHz)</b>	35
<b>Frame Rate (frames per sec)</b>	31.5
<b>Read Noise (e-)</b>	< 25 @ 35MHz

## SYSTEM CHARACTERISTICS

<b>Peak QE</b>	65%
<b>Pixel Readout Rate (MHz)</b>	35, 27, 13
<b>Non-Linearity<sup>2</sup></b>	<1%
<b>Vertical Clock Speed (<math>\mu\text{s}</math>)</b>	0.5 to 1.9 (variable)
<b>Electron Multiplier Gain (software controlled)</b>	1 – 1000 times
<b>Digitization @ 35, 27 &amp; 13 MHz readout rate</b>	14-bit
<b>Camera window type</b>	Single window with double-sided AR coating

## NOISE

System Readout Noise (typical; e <sup>-</sup> ) <sup>4</sup>	Typical	with Electron Multiplication
35MHz through EMCCD amplifier	25	<1
13MHz through EMCCD amplifier	12	<1
<b>Dark Current</b>	0.05 e/p/s @ -85°C	

## OPERATING & STORAGE CONDITIONS

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

## COMPUTER REQUIREMENTS

**Minimum:**  
Windows 2000 or XP operating system

**Recommended:**  
3.2 GHz Pentium (or better) + 1 GB RAM  
SCSI or SATA RAID 0 hard disc  
– Seagate Barracuda, WD Caviar  
RE WD Raftor

**In all cases the operating system should be on a separate harddrive and the hardware controller should be on a separate PCI bus.**

**Power Requirements<sup>8</sup>:**  
1A @ +12V | 0.3A @ -12V | 3.0A @ +5V

### ALSO:

- PCI 2.2 or PCI-X 1.0 compatible computer
- PCI slot must have bus master capability
- Available auxiliary internal power connector
- 25 Mbytes free hard disc

### Need more information?

Contact us at:

Phone: 586.731.6000

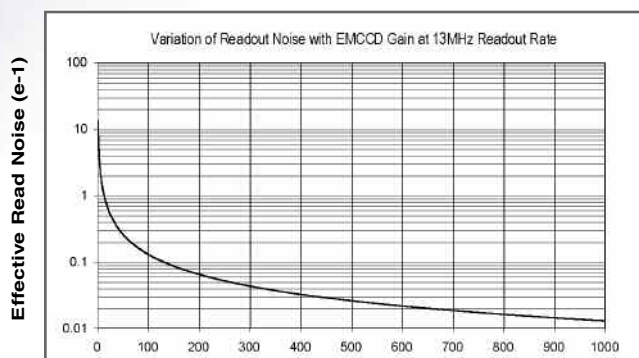
Fax: 586.731.6469

e-mail: [info@diaginc.com](mailto:info@diaginc.com)

website: [www.diaginc.com](http://www.diaginc.com)

For footnote review: [www.diaginc.com/boostnotes](http://www.diaginc.com/boostnotes)

## NOISE & EMCCD GAIN



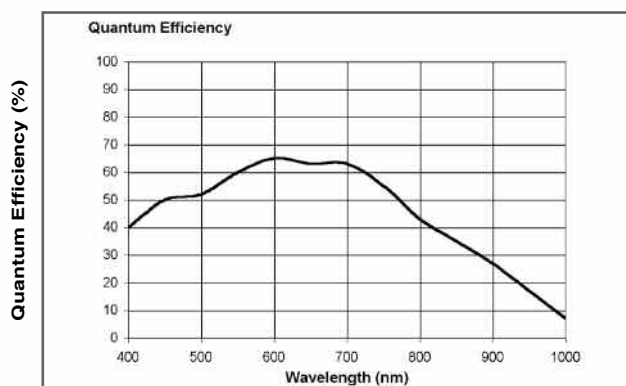
### Minimum Temperature (°C)

Air-cooled (ambient air @ 20° C) -85° C

Re-circulator (RC180) (ambient air @ 20° C) -90° C

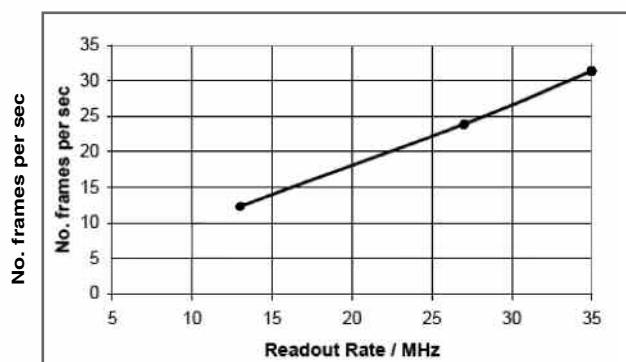
Water-cooled (@ 10° C, 0.75 l / min) -100° C

## QUANTUM EFFICIENCY



### Quantum Efficiency at 600nm and room temperature<sup>5</sup>

## FULL FRAME RATE<sup>6</sup>



## MAX FRAMES PER SEC<sup>7</sup>

Array size	1004 x 1002	502 x 501	251 x 250	125 x 125
<b>Binning (full frame)</b>				
1x1	31.5	60.5	113	199.2
2x2	58.7	109.9	194.5	318.5
4x4	104	185.2	304.9	446.4

**BOOST™** Model:BT 2100  
1004 x 1002 REV 7.10.06



# BOOST™

dimensions

