IMAGING

Andor's iXon^EM DV860 back illuminated EMCCD camera has single photon detection capability without an image intensifier, combined with greater than 90% QE of a back illuminated sensor. Containing a 128x128 L3Vision™ Frame Transfer CCD sensor from E2V Technologies, it utilizes a unique electron multiplying structure that is built into the silicon. This enables charge from each pixel to be multiplied on the sensor before it is read out, while utilizing the full QE performance of the CCD sensor. This camera is capable of greater than 500 full frames/sec, with much faster speeds available through use of sub-array and/or binning (>10,000 frames/sec). Andor exclusively offers this technology as a complete, software-controlled system for rapid, scientific, digital imaging applications. The system offers up to 10 MHz pixel readout rate and benefits from negligible dark current with unequalled thermoelectric cooling down to –90°C.

- EMCCD Technology
  .... Ultimate in Sensitivity from EMCCD gain – even single photon signals are amplified above the noise floor.
  Full QE of CCD chip is harnessed (no intensifier).

- Variable readout rates up to 10 MHz
  .... Quantitative accuracy at all speeds.
  Slower readout rate for enhanced 16-bit dynamic range.

- Greater than 500 full frames/sec
  .... Ideal for highly dynamic, low light experiments

- TE cooling to –90°C and guaranteed hermetic vacuum seal
  .... Minimized dark current without the aggravation or safety concerns associated with LN_2.

- 128x128 Frame Transfer sensor
  .... Ideal for fast, shutterless imaging

- High dynamic range and 16-bit digitization available ....
  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.

● **Camera Overview**

Active Pixels	128 x 128
Pixel Size (WxH; μm)	24 x 24
Image Area (mm)	3.1 x 3.1
Active Area pixel well depth (e⁻, typical)	160,000 (220,000 max)
Gain Register pixel well depth (e⁻, typical)	800,000
Max Readout Rate (MHz)	10
Frame Rate (frames per sec)	500 up to ~5,000
Read Noise (e⁻)	<1 to 62 @ 10 MHz

System Characteristics	Pixel Readout Rate (MHz)	10, 5, 3, 1
	Linearity (%, maximum) •1	1
	Vertical Clock Speed (μs)	0.1 to 6 (variable)
	Electron Multiplier Gain (software controlled)	1 – 1000 times
	Digitization @ 10, 5, 3 & 1 MHz readout rate	14-bit (16-bit available @ 1MHz)
	Dark Current @ -70 ºC (e⁻/pix/sec) •2	0.02
	@ -90 ºC (e⁻/pix/sec)	0.004
	Camera window type	Single window with double-sided AR coating – standard for BV model

● **Noise**

System Readout Noise (typical; e⁻) •3	**Typical**	*with Electron Multiplication*
10MHz through EMCCD amplifier	62	<1
5MHz through EMCCD amplifier	45	<1
1MHz (16-bit) through EMCCD amplifier	22	<1

● **Noise & EMCCD Gain**

Variation of Readout Noise with EMCCD Gain at 10MHz Readout Rate
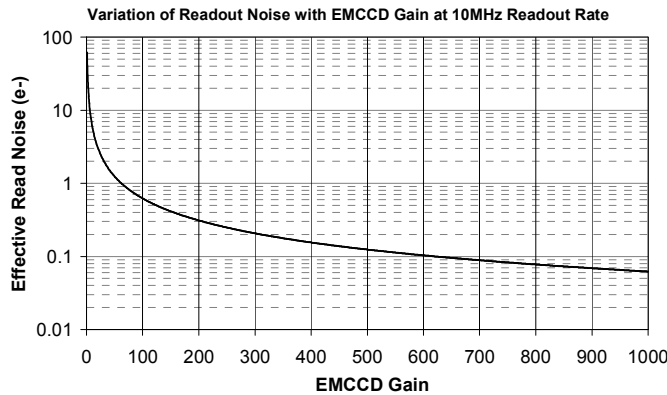
● **Minimum Temperature (°C)**

Air-cooled *(ambient air @ 20 °C)*	-70
Re-circulator (RC180) *(ambient air @ 20 °C)*	-85
Water-cooled *(@ 10 °C, 0.75 l / min)*	-90

● **Quantum Efficiency**

Quantum Efficiency for the back illuminated iXon camera at -20ºC
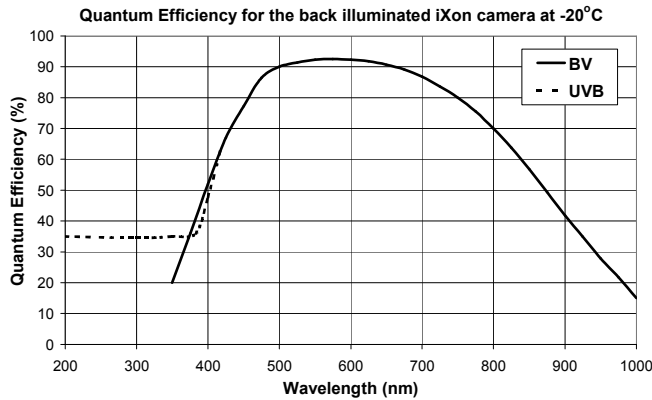
Peak Quantum Efficiency at –20°C temperature *(%)* •4

CCD Type		*Minimum*	*Typical*
BV	@ 575 nm	82	92.5
UVB	@ 575 nm	82	92.5

● **Max Frames per sec** [5]

- full frame rate of 500 frames per sec at 10MHz readout rate and 0.1µs vertical clock speed
- frame rates up to about 5,000 frames per sec are possible by the selection of smaller sub-arrays and shorter vertical shift speeds.
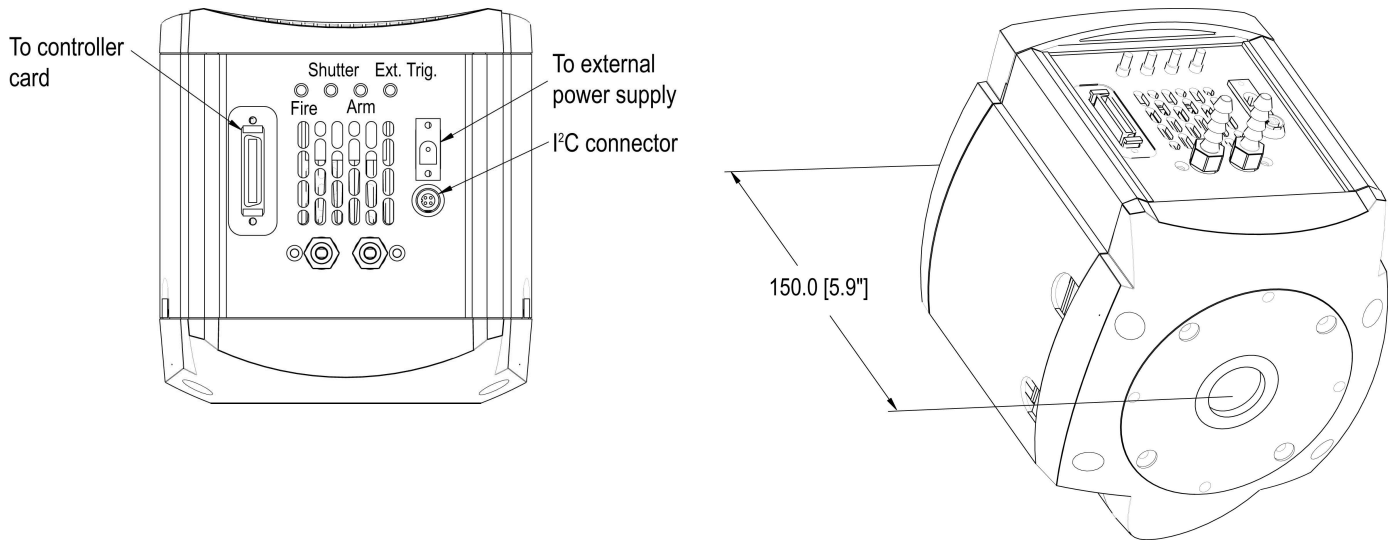
● **Full Frame Rate** [6]
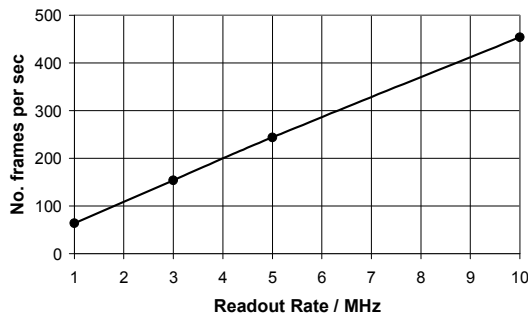
● **Power Requirements** [7]

0.6A	@ +12V
0.3A	@ -12V
3.0A	@ +5V

● **Operating & Storage Conditions**

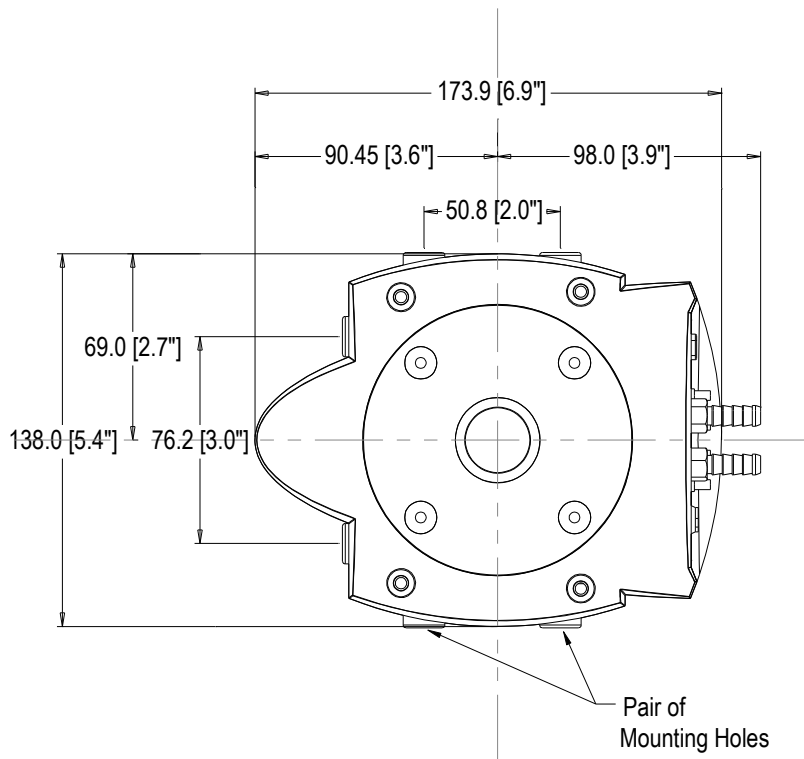|	
Operating Temperature	0°C to 30°C ambient
Relative Humidity	< 70% (non-condensing)
Storage Temperature	-25°C to 55°C

● **Computer Requirements**

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

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

Also:

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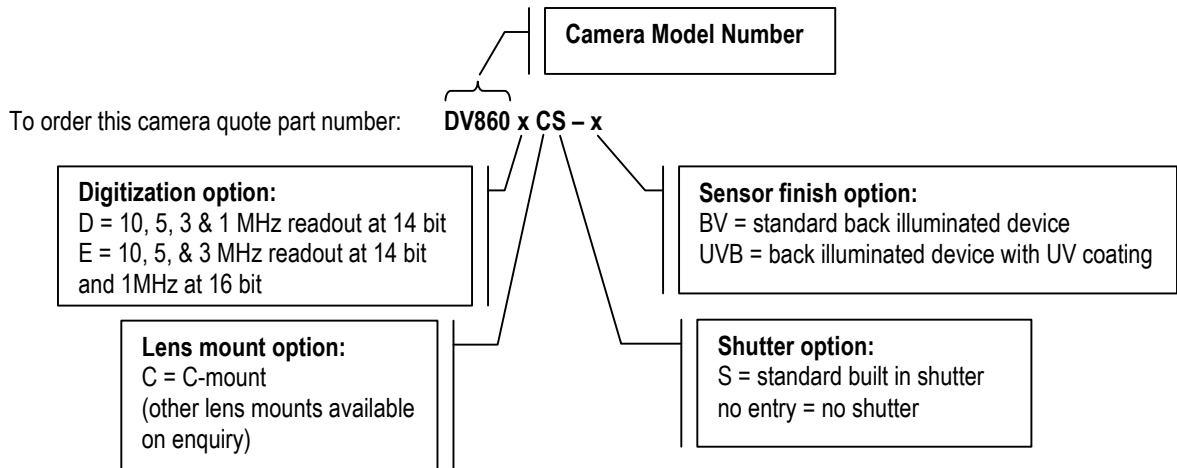- Available auxiliary internal power connector
- 32 Mbytes free hard disc

To controller card

Shutter Ext. Trig.

Fire Arm

To external power supply

I²C connector

150.0 [5.9"]

Weight: 3.1 Kg [7 lb 1 oz]

Dimensions in mm unless otherwise indicated.

173.9 [6.9"]

90.45 [3.6"]

98.0 [3.9"]

50.8 [2.0"]

69.0 [2.7"]

138.0 [5.4"]   76.2 [3.0"]

Pair of Mounting Holes

Note: The clearance from the C-mount face plate to the shutter is 6mm. Please ensure that when fitting a lens, to a system with a built in shutter, that it does not extend into the housing by more than 5mm.

Note: There are mounting holes (1/4-20UNC) located on three sides of the camera. They are positioned centrally at a distance of 40mm from the front of the front face.

● **Ordering Information**

Camera Model Number

To order this camera quote part number: **DV860 x CS – x**

Digitization option:
D = 10, 5, 3 & 1 MHz readout at 14 bit
E = 10, 5, & 3 MHz readout at 14 bit
and 1MHz at 16 bit

Sensor finish option:
BV = standard back illuminated device
UVB = back illuminated device with UV coating

Lens mount option:
C = C-mount
(other lens mounts available
on enquiry)

Shutter option:
S = standard built in shutter
no entry = no shutter

e.g. DV860DCS–UVB a back illuminated iXon EM DV860 camera with 14-bit digitization at 10, 5, 3 and 1MHz readout speeds,
EMCCD output amplifier, standard shutter and UV enhanced coating.

The iXon EM DV860 requires the following controller card:
 CCI-22   PCI controller card

The iXon EM DV860 also requires one of the following software options:
 Andor MCD – a ready-to-run Windows 95, 98, 2000, ME, NT or XP -based package with rich functionality
for data acquisition and processing
 Andor-SDK-CCD – a DLL driver and software development kit that let you create your own applications for the Andor camera.
 Andor iQ – a comprehensive multi-dimensional imaging software package. Offers tight synchronization of EMCCD with other microscopy hardware, along with comprehensive rendering and analysis functionality. Modular architecture for best price/performance package on the market.
 Third party software compatibility – Drivers are available so that the iXon EM range can be operated through a large variety of third party imaging packages. Contact Andor for further details

The iXon EM DV860 may be used with the following accessories:
 OPTION-C1-LM-C   C-mount lens adaptor (other mounts available on request)
 XW-RECR   Recirculator for enhanced cooling performance
 XW-CHIL-150   Ultra-compact chiller unit for ultimate cooling performance
 REMOTE CTRL KIT   Programmable remote control for controlling functions from anywhere around the optical set-up

Contact Andor for any of your custom requirements. (Contact details on back page)

NOTE - Specifications are subject to change without notice.

♦1   Linearity is measured from a plot of Signal vs. Exposure Time over the 14 or 16 bit dynamic range. Linearity is expressed as a percentage deviation from a straight line fit. This value is not measured on individual systems.

♦2   The dark current measurement is averaged over the CCD area excluding any regions of blemishes.

♦3   System Readout noise is for the entire system. It is a combination of CCD readout noise and A/D noise. Measurement is for Single Pixel readout with the CCD at a temperature of -50°C and minimum exposure time under dark conditions. Under Electron Multiplying conditions, the effective system readout noise is reduced to sub 1e⁻ levels. Noise values will change with pre-amplifier gain (PAG) selection. Values quoted are measured with highest available PAG setting.

♦4   Quantum efficiency of the CCD sensor as measured by the CCD Manufacturer.

♦5   The max frames / second for iXon^EM imaging CCDs is the maximum speed at which the device can acquire images in a standard system. Assumes internal trigger mode of operation.

♦6   The graph shows the full frame rates possible when reading out the sensor at 10, 5, 3 and 1 MHz pixel readout rates, and using 0.9μs vertical clock speed.

♦7   These power requirements are the maximum load that will be drawn from the computer for the camera head and controller card combined.

Need more information? Contact us at:

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