DV887 (back illuminated)

IMAGING

Andor's iXon DV887 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 512x512 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. Andor are the first to offer this technology as a complete, software controlled system for scientific digital imaging applications. The system offers up to 10 MHz pixel readout rate, both EMCCD and conventional amplifier outputs and benefits from minimized 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).
- > 90% QE back-illuminated sensor …. Maximum possible photon collection efficiency
- Variable readout rates up to10 MHz …. Quantitative accuracy at all speeds - 35 full frames/sec possible. Slower readout rate for enhanced 16-bit dynamic range.
- Selectable amplifier outputs – EMCCD and conventional …. Highly flexible camera optimized for both fast, ultra low-light imaging and 'bright-field' or conventional fluorescence imaging.
- TE cooling to –90°C and guaranteed hermetic vacuum seal …. Minimized dark current without the aggravation or safety concerns associated with LN_2. EMCCD gain is greater at lower temperatures.
- 512x512 Frame Transfer sensor …. High resolution, large field of view and 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	512 x 512
Pixel Size (WxH; μm)	16x16
Image Area (mm)	8.2 x 8.2
Active Area pixel well depth (e$^-$, typical)	220,000
Gain Register pixel well depth (e$^-$, typical)	800,000
Max Readout Rate (MHz)	10
Frame Rate (frames per sec)	34 to several 100's
Read Noise (e$^-$)	<1 to 62 @ 10MHz

● **System Characteristics**

Pixel Readout Rate (MHz)	10, 5, 3, 1
Linearity (%, maximum) [1]	1
Vertical Clock Speed (□s)	0.4 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)
Conventional Amplifier	3 and 1 MHz
Camera window type	Single window with double-sided AR coating – standard for BV model

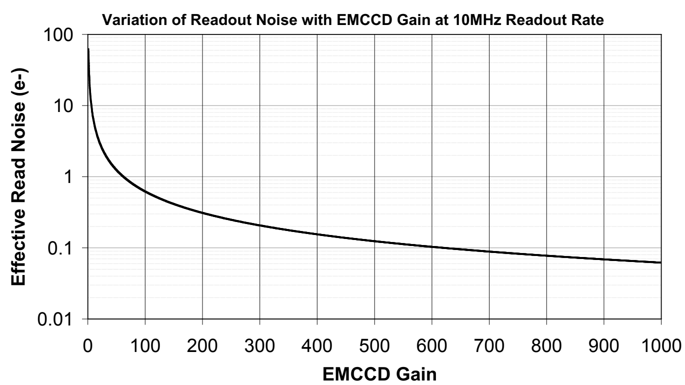
● **Dark Current & Background Events**

Dark Current [2] @ -70°C (e^-/pix/sec)	0.012
@ -90°C (e^-/pix/sec)	0.0035
EMCCD-Amplified Background Events [3] @ x1000 EM gain, 30ms exposure, -70°C (events/pix)	0.005

● **Noise**

System Readout Noise (typical; e^-) [4]	**Typical**	***with Electron Multiplication***
10MHz through EMCCD amplifier	62	<1
5MHz through EMCCD amplifier	45	<1
1MHz (16-bit) through EMCCD amplifier	22	<1
1MHz (16-bit) through conventional amplifier	7	N/A

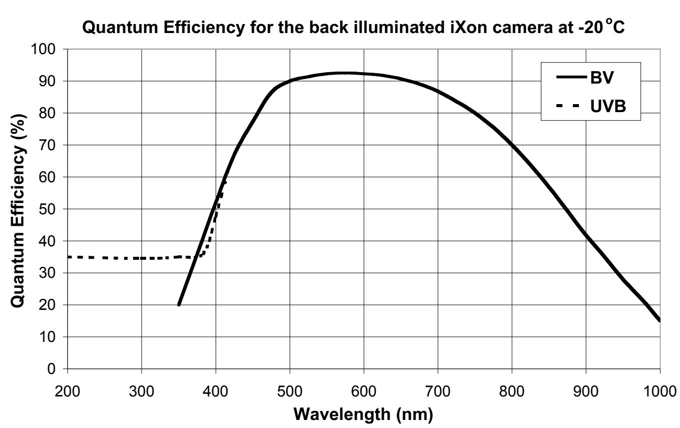
● **Noise & EMCCD Gain**



● **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**



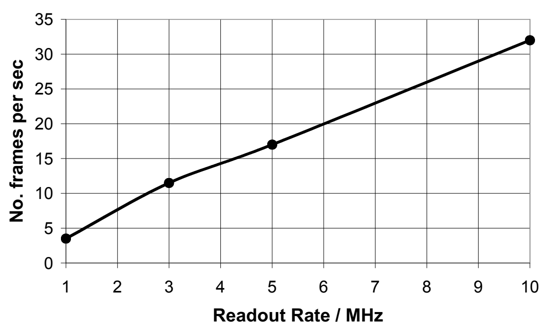
Peak Quantum Efficiency at –20°C temperature *(%)* [5]

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

- **Max Frames per sec** [6]

Binning \ Array size	512 x 512 (full frame)	256 x 256	128 x 128	512 H x 100 V
1x1	35	70	135	169
2x1	69	133	250	312
2x2	69	133	250	312
4x1	131	244	435	526
4x4	131	244	435	526

- **Full Frame Rate** [7]



- **Power Requirements** [7]

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

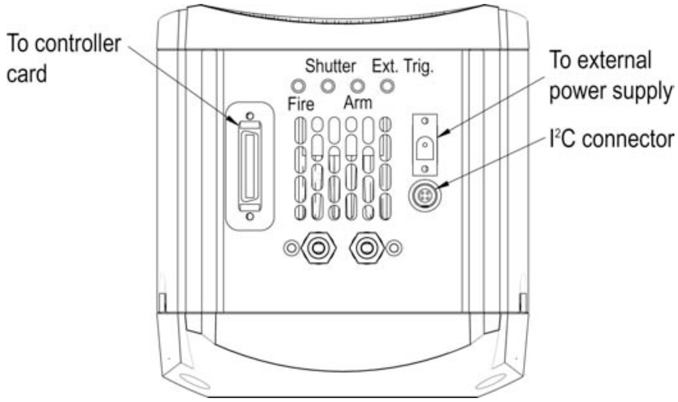
- **Operating & Storage Conditions**

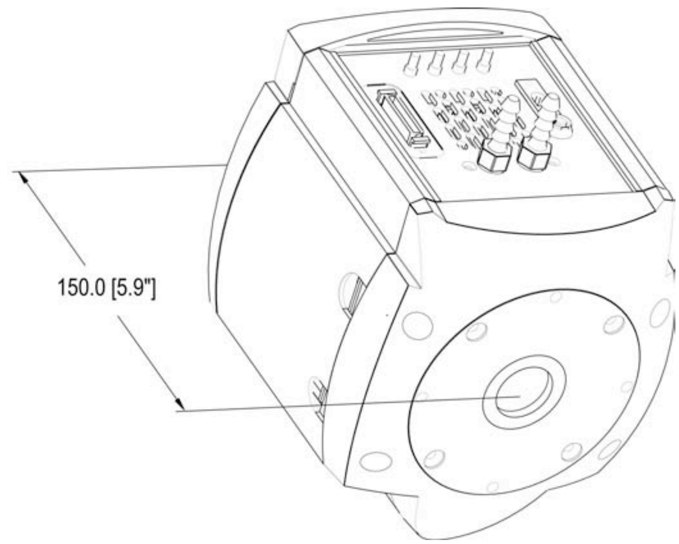
Operating Temperature	0ºC to 30ºC ambient
Relative Humidity	< 70% (non-condensing)
Storage Temperature	-25ºC to 55ºC

- **Computer Requirements**

To handle data transfer rates of 10MHz readout over extended kinetic series, a powerful computer is recommended, e.g:
- 2.4 GHz Pentium (or better)
- 1GB RAM
- Minimum of 10,000rpm hard drive, RAID 0 15,000rpm preferred for extended kinetic series

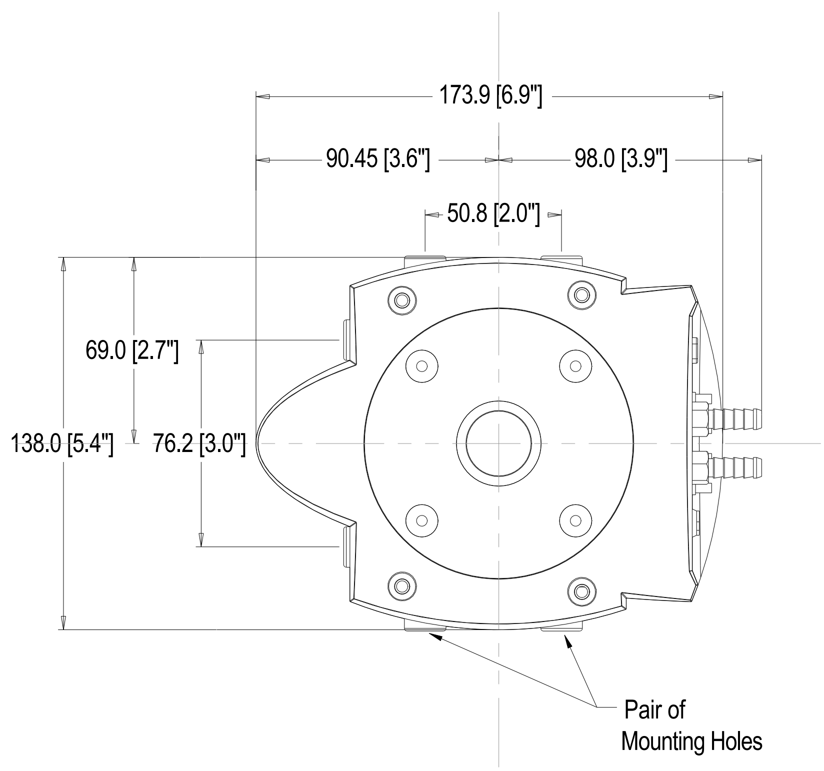
Also:
- PCI-compatible computer
- PCI slot must have bus master capability
- Available auxiliary internal power connector
- 32 Mbytes free hard disc





Weight: 3.1 Kg [7 lb 1 oz]

Dimensions in mm unless otherwise indicated.



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

To order this camera quote model number: **DV887 x CS - x**

Camera Model Number

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

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

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

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

e.g. DV887DCS–UVB a back illuminated iXon DV887 camera with 14-bit digitization at 10, 5, 3 and 1MHz readout speeds, EMCCD and conventional output amplifiers, standard shutter and UV-enhanced coating.

The iXon DV887 requires the following controller card:
CCI-22 PCI controller card

The iXon DV887 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.
Third party software compatibility – Drivers are available so that the iXon range can be operated through a large variety of third party imaging packages.

The iXon DV887 may be used with the following accessories:
OPTION-C1-LM-C C-mount lens adaptor (other mounts available on request)
RC180 200W Re-circulator for enhanced cooling performance

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 This value is obtained using the traditional method of measuring dark current, as for any CCD camera, i.e. taking a long integration time (with no EM gain applied) to get a darksignal that is well above the read noise. The dark current measurement is averaged over the CCD area excluding any regions of blemishes.

3 Using Electron Multiplication (EM) the iXon is capable of detecting single photons, therefore the true camera detection limit is set by the number of 'dark' background events. These background events consist of both residual thermally generated electrons and Clock Induced Charge (CIC) electrons (also referred to as Spurious Charge), each appearing as random single spikes that are well above the read noise floor.
A thresholding scheme is employed to count these single electron events and is quoted as a probability of an event per pixel. Acquisition conditions are full resolution and max frame rate (10 MHz readout; Frame-transfer mode; 0.4 µs vertical clock speed; x1000 EM gain; 30 ms exposure; -70°C). It is important to realise that to get to this single photon detection regime there must be sufficient cooling, such that there is significantly less than 1 event per pixel.

4 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.

5 Quantum efficiency of the CCD sensor as measured by the CCD Manufacturer.

6 The max frames / second for iXon imaging CCDs is the maximum speed at which the device can acquire images in a standard system. Shown are the frame rates at 10MHz digitization rates for a range of binning or array size combinations. All measurements are made with 0.4µs vertical clock speed. It also assumes internal trigger mode of operation.

7 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 3.4µs vertical clock speed.

8 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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