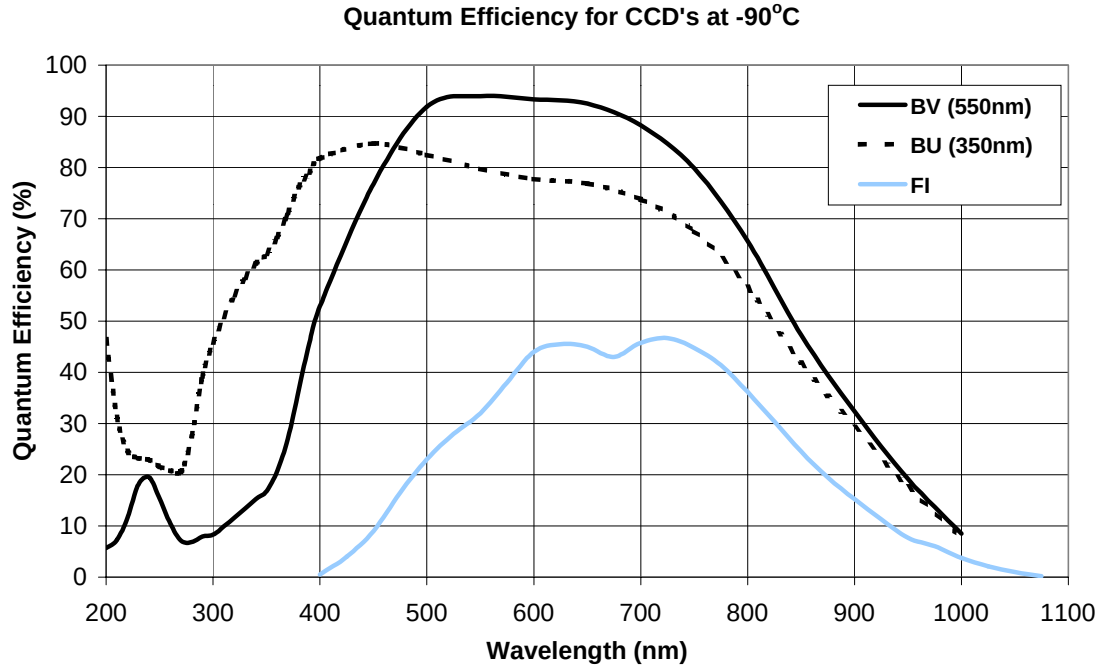
Andor's DU440 CCD is designed to offer the best performance characteristics over a wide range of spectroscopy applications. The 2048 x 512 array camera is ideally suited to rapid, multi-channel, low-light applications including fluorescence and Raman spectroscopy, where high resolution is important. The system boasts negligible dark current with thermoelectric cooling down to –90˚C.

| | | | | |
|---|---|---|---|---|
| ●Sensor | **Active Pixels** | 2048 x 512 | **Dummy Pixels**•1 | 50, 50, 0, 0 |
| | **Pixel Size (µm)** | 13.5 | **Image Area (mm)** | 27.6 x 6.9 |
| | **Pixel Well Depth ($e^-$, typical)** | 80,000 | **Register Well Depth ($e^-$, typical)** •2 | 600,000 |
| | **Linearity (%, maximum)**•3 | 1 | **Gain ($e^-$/count @ 1&2, 16, 32 µs)** | 2, 1.4, 0.7 |
| | **Vertical Clock Speed (µs)** | 16 | | |

| | | | |
|---|---|---|---|
| ●Noise | ***System Readout Noise ($e^-$)***•4 | ***Typical*** | ***Maximum:*** |
| | **31kHz pixel readout rate** | 3 | 4.5 |
| | **1MHz pixel readout rate** | 10 | 15 |

●Quantum Efficiency




**Peak Quantum Efficiency at room temperature [-90°C] *(%)***•5

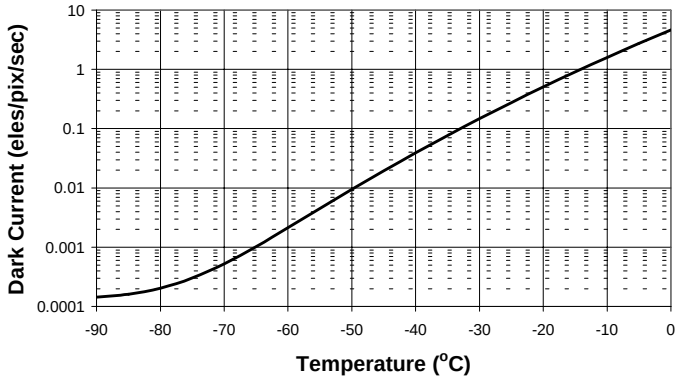
| *CCD Type* | | *Minimum* | *Typical* | |
|---|---|---|---|---|
| FI | @ 700 nm | 40 | 47 | [46] |
| BU | @ 400 nm | 80 | 90 | [82] |
| BV | @ 550 nm | 85 | 95 | [94] |

● **Features & Benefits**

| | |
|---|---|
| Peak QE of 95% | High detector sensitivity |
| Min operating temp of –90°C with TE cooling | Negligible dark current without the nuisance or safety concerns associated with $LN_2$ |
| Guaranteed hermetic vacuum seal | Ultimate reliability and sustained lifetime performance characteristics |
| Front- or back-illuminated design | Offers the best price/performance options |
| 13.5 x 13.5µm pixel size | Optimised pixel size for dynamic range and high resolution |
| Andor-MCD Software | Friendly Windows user interface offers system integration, automation and advanced data manipulation facilities |

● **Dark Current**

♦*6*




NOTE - Dark current for both FI and BI sensors

● **Temperature (°C)**

| | Auxiliary Cooling Connector | External PSU PS150 |
|---|---|---|
| **Air-cooled** *(ambient air @ 20°C)* | -65 | -75 |
| **Water-cooled** *(@ 10°C, 0.75 l / min)* | -80 | -90 |

● **Operating & Storage Conditions**

| | |
|---|---|
| operating temperature | 0°C to 30°C ambient |
| relative humidity | < 70% (non-condensing) |
| storage temperature | -25°C to 55°C |

● **Max Spectra per sec**

♦*7*

| | |
|---|---|
| **Full Vertical Binning** | 90 spectra/s |
| **50 row sub-image** | 333 spectra/s |

● **Computer Requirements**

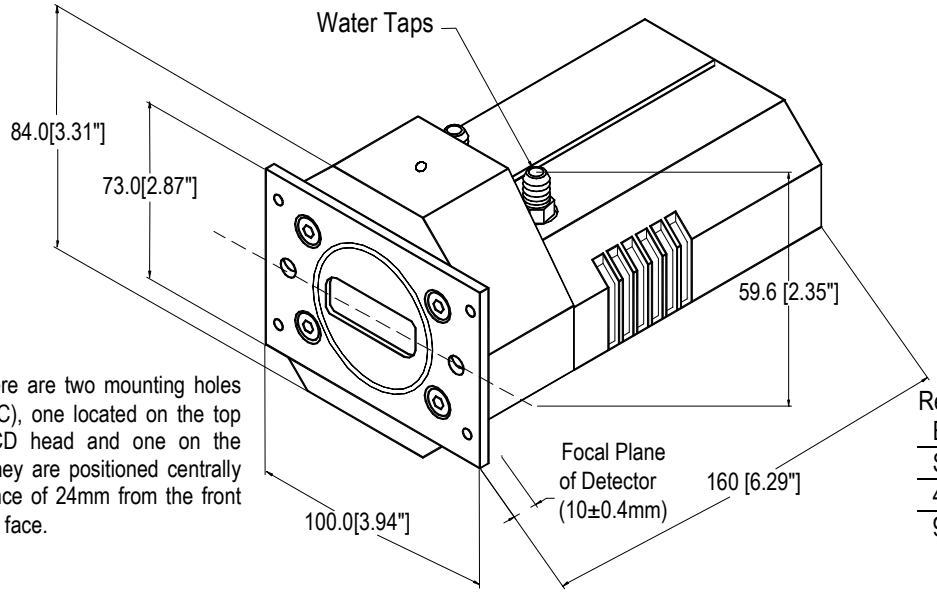
| **Minimum:** | | **Also:** |
|---|---|---|
| Windows 95/98: | 100MHz Pentium + 64Mbytes RAM | • PCI-compatible computer |
| Windows NT/2000: | 100MHz Pentium + 128Mbytes RAM | • PCI slot must have bus master capability |
| | | • Additional auxiliary internal power connector |
| **Recommended:** | | • 32 Mbytes free hard disc |
| 300MHz Pentium (or better) + 256 Mbytes RAM | | |

● **Power Requirements**

♦*8*

| (for kHz [MHz] operation) | | No Auxiliary Cooling Connector | | Auxiliary Cooling Connector | |
|---|---|---|---|---|---|
| **No cooling** | slot | 2.4A | [3A] | 2.4A | [3A] |
| | connector | - | - | - | - |
| **TE cooler on** | slot | 1.5A | [1.5A[ | 0A | [0A] |
| | connector | - | - | 2.2A | [2.2A] |
| **Total** | | 3.9A | [4.5A] | 4.6 A | [5.2A] |

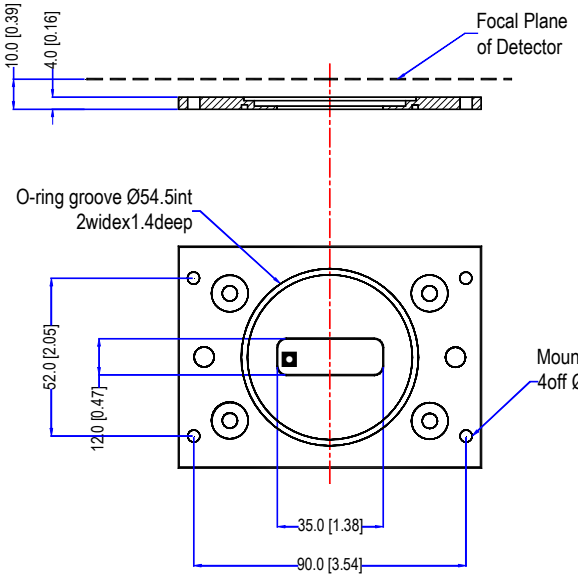
(Power drawn from +5V power supply; Optional external power supply (PS150) plugs into the mains)




Note: There are two mounting holes (1/4-20UNC), one located on the top of the CCD head and one on the bottom. They are positioned centrally at a distance of 24mm from the front of the front face.

Required Cable Clearance at back:

| Exit connector type | Clearance |
|---|---|
| Standard | 140 mm |
| 45° angle | 50 mm |
| 90° angle | 40 mm |




◘ = position of pixel (1,1)

**Weight:** 2 Kg [4 lb 8 oz]

● **For complete system use with…**

The DU440 requires one of the following controller card options

**CCI-001** PCI Controller card with 16-bit 62KHz & 31KHz pixel readout rate options

**CCI-010** PCI Controller card with 16-bit 1MHz, 500KHz, 62KHz & 31KHz pixel readout rate options

The DU440 also requires one of the following software options.

**Andor-MCD** software – a ready-to-run Windows 95, 98, 2000, ME or NT -based package with rich functionality for data acquisition and manipulation

**Andor-SDK-CCD** – a DLL driver and software development kit that lets you create your own applications for the Andor camera

The DU440 may be used with the following accessories

**PS150** Power Supply Module for achieving the lowest temperatures

**IO160** Breakout box for interface signals

**LM-NIKON-F** Nikon F-mount lens adaptor

**LMS-NIKON-F** Nikon F-mount lens adaptor with shutter

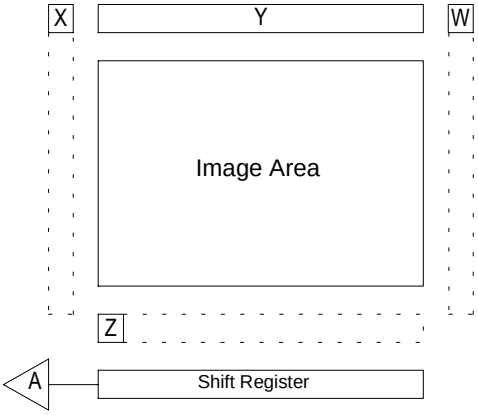
Contact Andor for details of spectrographs and adapters that can be used with the DU440. Contact details on back page.

♦1 Chip manufacturers may include a number of pixels or elements that are neither active nor part of the shift register. Andor refers to these pixels as dummy pixels and represents them in a 4-part notation (*W*,*X*,*Y*,*Z*), where:

*W* = dummy pixels to the right of the shift register (non-amplifier end)
*X* = dummy pixels to the left of the shift register (amplifier end)
*Y* = dummy pixels at the top of the image area
*Z* = dummy pixels between the shift register and the image area.

*A* = position of output amplifier

It should be noted that the elements can be made up of either pixels, rows or columns.
The diagram shows what is seen when looking at the front of the CCD.




♦2 The register well depth that is actually accessible by the CCD system is dependant on the gain setting.

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

♦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.

♦5 Quantum efficiency of the CCD sensor is measured by the CCD Manufacturer.

♦6 The graph shows typical dark current level as a function of temperature for front-illuminated (FI) and back-illuminated (BI) CCDs. Systems are specified in terms of minimum dark current achievable rather than absolute temperature. The dark current measurement is averaged over the CCD area excluding any regions of blemishes.

♦7 The max spectra/sec for spectroscopy CCDs is the maximum speed at which the device can acquire spectra in a standard system. It assumes a 1MHz digitization rate, internal trigger mode and full vertical binning. Also given is the rate for a 50 row high sub-image (crop mode) on a CCD in a standard system. Note that faster rates may be achieved by operating the CCD in Fast Kinetics mode.

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

♦9 Specifications subject to change

**Ordering Information:**

To order this camera
quote model number **DU440-**
**FI:** standard front-illuminated device
**BU2:** back-illuminated – AR coated for optimal performance in the 250 nm region
**BV:** back-illuminated – AR coated for optimal performance in the visible region

Need more information? Contact us at:

**US Office**
***Phone*** (860) 648-1085
***Fax*** (860) 648-1088

**International Office**
***Phone*** +44 28 9023 7126
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