...SEE the Future

Princeton Instruments

Quad-RO: 4096

4096 x 4096 imaging array | 15 x 15 µm pixels

The Princeton Instruments **Quad-RO: 4096** is a fully integrated, low noise 4-port readout camera designed for indirect imaging of phosphor screens. This advanced design based on PI's ultra-low noise electronics and state-of-the-art cooling technology. The unique camera design with fiber-optic faceplate extended outside the vacuum offers outstanding flexibility to optimize system performance at any X-ray energy. The compact design with the industry standard Firewire (IEEE 1394a) interface makes this camera perfect for OEM applications. The software selectable dual speed operations, at 500 kHz or 1 MHz, allow users to optimize camera performance for demanding applications.

Applications: X-ray microtomography, X-ray phase contrast imaging, industrialand medical imaging, X-ray diffraction, Crystallography, and Electron Imaging

Features	Benefits
4096 x 4096 Imaging Array 15 x 15 µm pixels	Largest image area with highest spatial resolution
1 : 1 fiberoptic ratio*	Highest sensitivity with distortion and vignetting free operation
221 fiberoptic ratio*	Largest affordable field of view (160+ mm diam)
Scientific Grade CCD	Low noise, few cosmetic defects, linear response
Low noise electronics	Best performance for demanding low energy X-ray imaging applications
16-bit Dual Digitizers	Dual-speed digitization allow complete freedom to select between "low noise" for highest SNR or "fast operation" for high frame rate
Software selectable gains	Flexibility to optimize SNR and Dynamic range
Thermoelectric cooling	Liquid cooling for vibration and worry free operation and ease of use
Flexible ROI/binning	Allows faster frame rate and/or sensitivity, 4k x 4k, 2k x 2k, 1k x 1k and 512 x 512
Electronically balanced 4-output ports	Very uniform image at any intensity level for raw image display
Firewire (IEEE-1394a) interface	Industry standard interface for ease of integration
WinView	Offers powerful, easy-to-use software package for acquisition, display Easy for integration for OEM
Linux driver and PVCAM	Universal programming interface for easy custom programming and integration
Custom phosphors*	Gd_2O_2S: Tb Available for 8 keV, 12 keV and 17 keV Resolution of 60 to 80 um Emission wavelength ~ 550 nm

*Contact PI for information about additional fiber-optic ratios and phosphors.

Quad-RO: 4096 Specifications

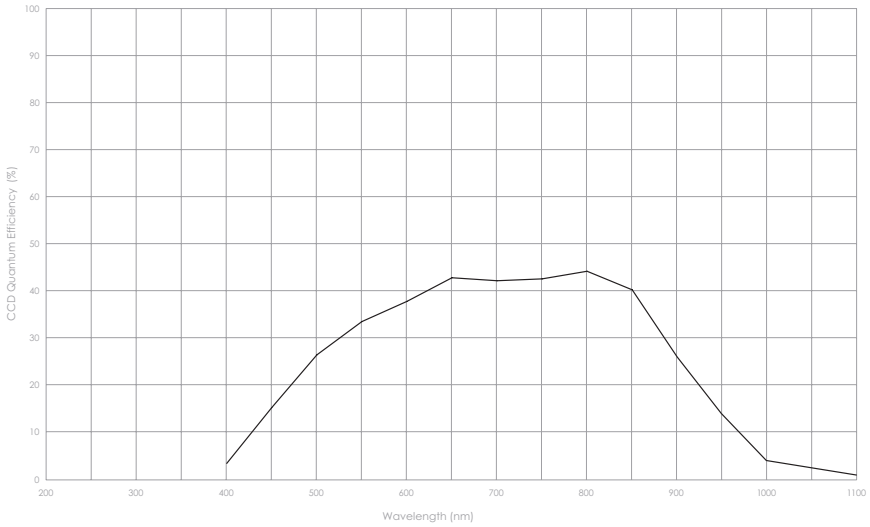
CCD image sensor	Front-illuminated, scientific-grade, MPP device
CCD format	4096 x 4096 imaging pixels 15 x 15 µm pixels 100% fill factor 61.44 x 61.44 mm image area
Full well capacity **Single pixel** **Output node**	 100 ke- (typical) ; 80 ke- (min) 450 ke- (typical) ; 400 ke- (min)
System read noise / port **@ 500 kHz** **@ 1 MHz**	 9 e- rms (typical) ; 10 e- rms (max) 12 e- rms (typical) ; 16 e- rms (max)
ADC speed / bits	500 kHz/ 16 bits and 1 MHz/ 16 bits
System gain / X-ray energy **1:1 fiber-optic** **2.7:1 taper**	 ~ 40 e-/ 8 keV, ~ 60 e-/12 keV, ~ 85 e-/17 keV ~ 5.5 e-/8 keV, ~ 8 e-/12 keV, ~ 11.5 e-/17 keV
Software selectable gains	2e-, 4e- and 8e-/ADU ; available at all speeds
Dark Current @ -45oC operation	0.06 e-/p/sec (typical); 0.1 e-/p/sec (max)
Deepest cooling temperature Thermoelectric (+5 oC liquid) **1:1 fiber-optic** **2.7:1 taper**	 -45 °C (typical); -40 °C (guaranteed) -45 °C (typical); -40 °C (guaranteed)
4-port electronics	Four independent A/D converter circuits electronically balanced to < 1 %
Nonlinearity @ 1 MHz	≤1 %
Parallel shift rate	180 µsec
Thermostating precision	±0.1 °C (for stable baseline performance)
I/O signals	OUTPUT: Two BNC connectors - SCAN, READY INPUT: One BNC connector - trigger-in
Operating environment	+5 °C to +30 °C ambient, < 50% relative humidity
Certification	CE
Dimensions **1:1 fiber-optic** **2.7:1 taper**	 6.00" (155 mm) x 6.00" (155 mm) x 9.32" (237 mm)
Weight **1:1 fiber-optic** **2.7:1 taper**	 23 lbs (10.5 kg) 43.5 lbs (19.75 kg)

Note: Specifications are subject to change without notice
Contact PI for CCD grades and latest specifications

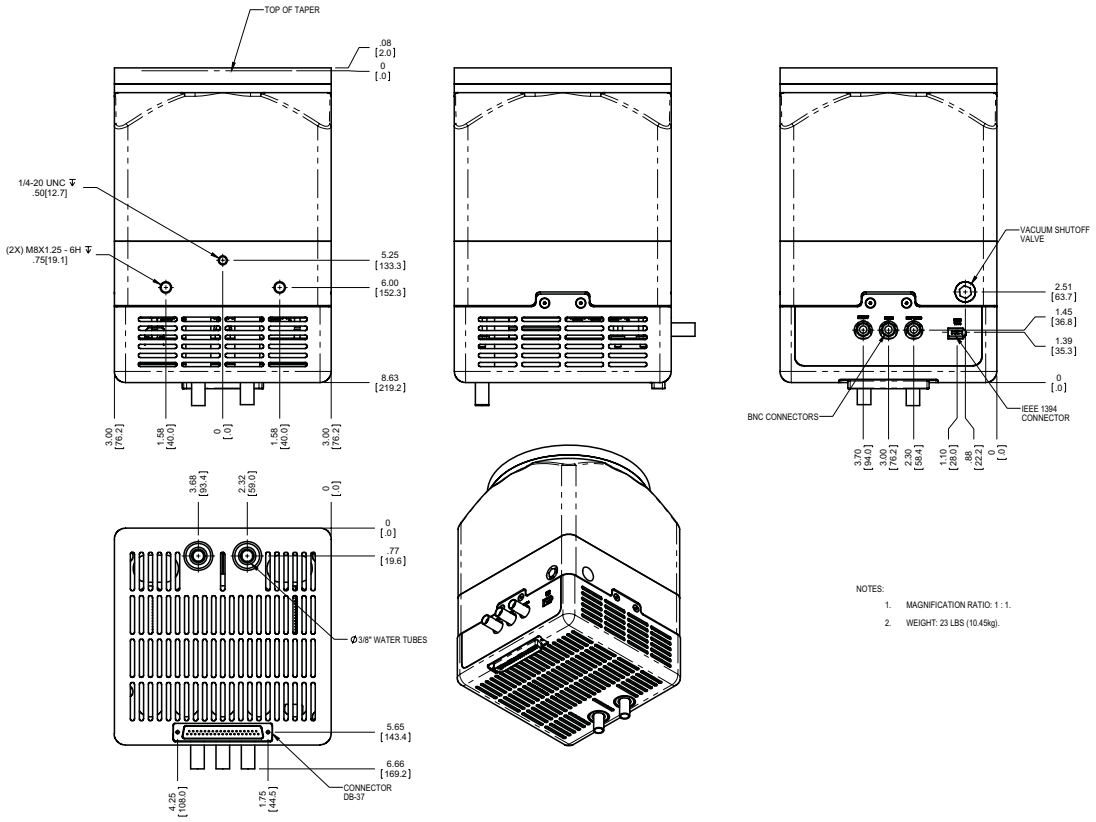
Reaout Speed

Binning	@ 1 MHz	@ 500 kHz
1 x 1	4.87 sec (0.2 fps)	9.106 sec (0.11 fps)
2 x 2	2.2 sec (0.454 fps)	3.197 sec (0.313 fps)
4 x 4	1.19 sec (0.84 fps)	1.452 sec (0.688 fps)
8 x 8	0.756 sec (1.322 fps)	0.817 sec (1.224 fps)
16 x16	0.562 sec (1.78 fps)	0.581 sec (1.72 fps)

Quantum Efficiency Curve



Quad-RO Drawing



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