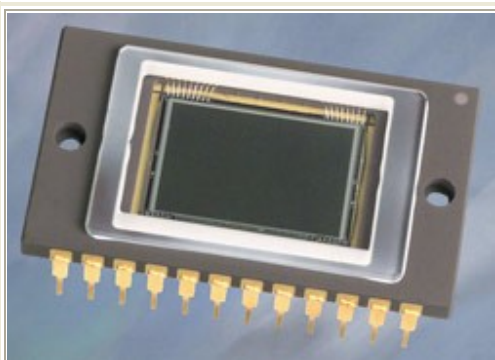


MODEL ST-10XE / ST-10XME CCD IMAGING CAMERAS

The Model ST-10XE and ST-10XME are the latest large array, high resolution CCD cameras from SBIG. The body is identical to the ST-7XE, ST-8XE and ST-9XE models with some slight modifications to accommodate the larger detector. The ST-10XE contains an enhanced KAF-3200E imaging detector from Kodak. The ST-10XME contains an enhanced KAF-3200ME imaging detector from Kodak. The only difference between the CCDs is the addition of a micro lens layer over the pixels of the KAF-3200ME CCD for increased sensitivity. These 3.2 megapixel CCDs have a Full Frame Resolution of 2184 x 1472 pixels at 6.8 microns making them the ultimate cameras for wide field apochromatic refractors. The active imaging area is 17% greater than the ST-8E and the arrays contain approximately twice as many pixels. The imaging camera includes an electro-mechanical shutter, 16 bit analog to digital (A/D) converter, regulated temperature control with all of the electronics integrated into the CCD head. Communication to the PC is through the USB port at up to 425,000 pixels per second.



**ST-10XE CCD IMAGING
CAMERA**



Multi-megapixel KAF-3200E

The KODAK DIGITAL SCIENCE™ KAF-3200E Image Sensor is a high density, 3.2 million pixel, full-frame Blue Plus image sensor. It joins the family of Kodak Blue Plus sensors with improved quantum efficiency across the visible spectrum. Ultra-low dark current of less than 1e-/pixel/second at 0° C (typical) allows moderate cooling for applications involving extended exposures. With an improved liquid cooling design, the ST-10XE/XME cameras will reach approximately 45° C below ambient temperature for best performance even in hot

climates. The KAF-3200ME is the same CCD as the KAF-3200E with the exception of the addition of micro lenses over the pixels. This has the effect of increasing the effective quantum efficiency of the CCD. There is a minor blooming effect similar to diffraction spikes that is sometimes seen when imaging with the micro lens version and short fast optical systems. For this reason we continue to offer both either types of CCD.

Although the ST-10XE/XME camera is a perfect match to high quality refractors in high resolution mode, with 3.2 million pixels the ST-10XE/XME is easily adapted to a variety of focal lengths. The various binning modes of 6.8, 13.6 and 20.4 micron pixels allow you to match the focal length of a wide range of telescopes and lenses to this imaging camera. There are also half-frame and quarter-frame modes available for each resolution setting. Moreover, even when binned 2x2 or 3x3 the number of pixels is still comparable to the ST-7XE, ST-8XE and ST-9XE as the table below illustrates. For example, in addition to 2184 x 1472 at 6.8 microns, the user can elect to image at 1092 x 736 with 6.8 micron pixels or 1092 x 736 with 13.6 micron pixels. In "low" resolution, full frame mode, the ST-10EXE/XME still operates much like a ST-9XE with 36% more pixels and 43% larger field of view! The various combinations of useable frame and pixel sizes makes this an extremely versatile camera.

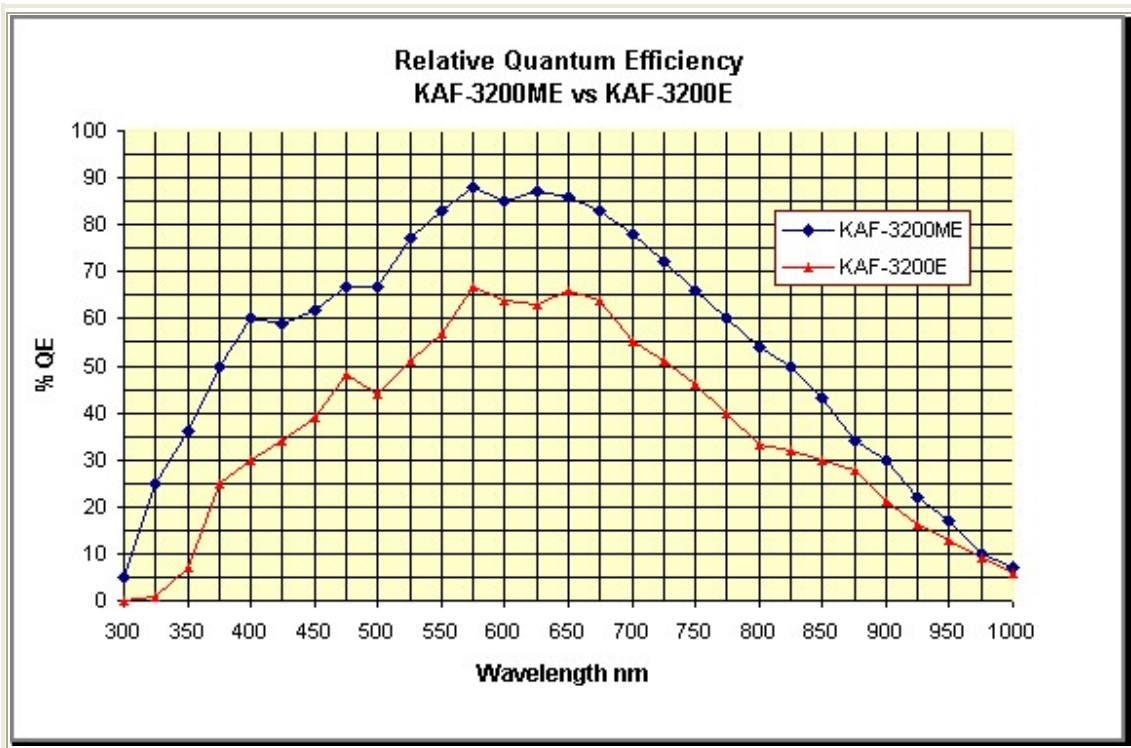
	Full Frame	Half Frame	Quarter Frame
High Res (unbinned)	2184 x 1472 6.8 microns	1092 x 736 6.8 microns	548 x 370 6.8 microns
Medium Res (binned 2x2)	1092 x 736 13.6 microns	546 x 368 13.6 microns	275 x 186 13.6 microns
Low Res (bin 3x3)	728 x 490 20.4 microns	364 x 245 20.4 microns	184 x 124 20.4 microns

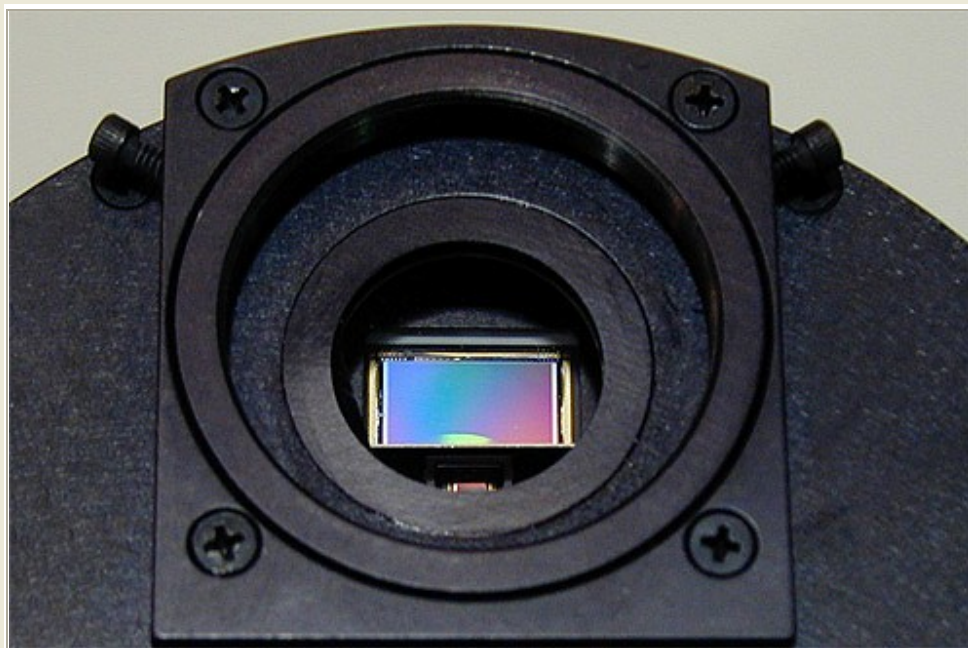
The file size of high resolution images can be reduced by about half by saving the images in SBIG compressed file format. The benefit of this format is that the compression is lossless, unlike JPEG and other compression techniques. The original file size and amount of compression varies somewhat depending on the content of the image and the resolution mode selected, but the information contained in the table below is typical.

Resolution Modes (Binning)	Pixel Array (Full Frame)	Uncompressed Image Size	Compressed Image Size
High Res Mode (1x1)	2184 x 1472	~ 6.4 Mb	~ 3.4 Mb
Med Res Mode (2x2)	1092 x 736	~ 1.6 Mb	~ 1.1 Mb
Low Res Mode (3x3)	728 x 490	~ 715 Kb	~ 500 Kb

The ST-10XE/XME camera utilizes SBIG's newest high speed analog and digital electronics with a USB interface to the PC. This new interface is up to 14 times faster than our older parallel interface. The full frame download rate for the ST-10XE/XME is

approximately 8.7 seconds. For finding and centering objects and for focusing, various binning or partial frame modes may be selected to significantly shorten the download time. For instance, in focus mode with a 20 x 20 pixel box the download time is about 0.5 seconds per frame. CCDOPS software also has an Auto Resolution feature that makes using this type of large array easier. The Model ST-10XE/XME camera maintains similar performance, low noise and high QE as the ST-8XE camera. In fact, the ST-10XE/XME has slightly less dark current and lower read noise than the ST-8XE. The dual CCD structure also allows the full range of existing accessories to work with the ST-10XE/XME: The AO-7 Adaptive Optics System, CFW8 color filter wheel, camera lens adapters, etc., are all the same for the ST-10XE/XME as the ST-8XE.





The Multi-Megapixel KAF-3200E enhanced CCD installed in the ST-10XE Camera.

ST-10XE/XME Typical Specifications

CCD Specifications

Imaging CCD ST-10XME	Kodak KAF-3200E/ME + Texas Instruments TC-237
Imaging CCD ST-10XE	Kodak KAF-3200E + Texas Instruments TC-237
Pixel Array	2184 x 1472 pixels 14.9 x 10 mm
Total Pixels	3.2 million
Pixel Size	6.8 x 6.8 microns
Full Well Capacity	77,000 e⁻
Dark Current	0.9 e⁻/pixel/sec at 0° C
Antiblooming	Non-ABG only

Readout Specifications

Shutter	Electromechanical
Exposure	0.11 to 3600 seconds, 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	1.5e⁻/ADU
Read Noise	9e⁻ RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3 1 x N, 2 x N, 3 x N
Pixel Digitization Rate	up to 420,000 pixels per second
Focus Frame Update Rate 20 x 20 pixels	2 frames per second
Full Frame Acquisition With High Speed USB	8.7 seconds

Optical Specifications

	24" FL	30" FL	42" FL	80" FL
Detector Field of View	1.4 x 0.9 degrees	1.1 x .74 degrees	.8 x .5 degrees	25 x 17 arcminutes
Pixel (6.8u) Field of View	2.3 x 2.3 arcseconds	1.8 x 1.8 arcseconds	1.3 x 1.3 arcseconds	.7 x .7 arcseconds
Limiting Magnitude				Magnitude 14 in 1 second
<i>(for 3 arcsec FWHM stars)</i>				Magnitude 18 in 1 minute

System Specifications

Cooling - standard	Single Stage Thermoelectric, Active Fan, Liquid assist, -45 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	5 VDC at 1.5 amps, ±12 VDC at 0.5 amp Desktop Power Supply Included
Computer Interface	USB
Computer Compatibility	Windows 95/98/NT/Me/2000/XP
Guiding	Dual CCD Self-Guiding

Physical Dimensions

Optical Head	5 inches diameter x 3 inches 12.5 cm diameter x 7.5 deep 2.2 pounds/1 Kg
CPU	All electronics integrated into Optical Head, No CPU
Mounting	T-Thread, 1.25" and 2" nosepieces included
Backfocus	0.92 inches/2.3 cm