

Model ST-10XE/XME CCD Imaging Camera



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INSTRUMENTS

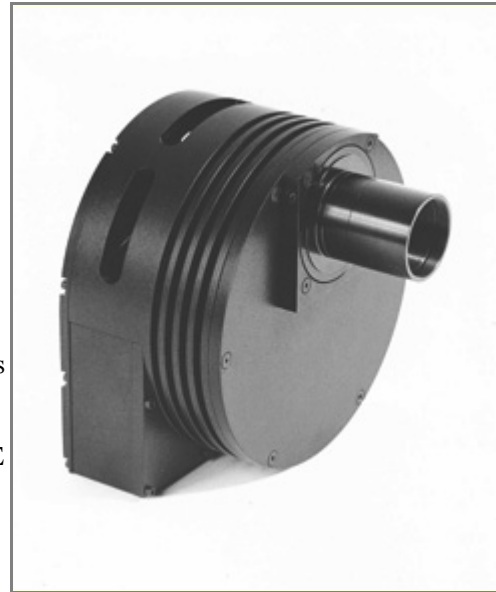
Model ST-10XE/XME Dual CCD Self-Guiding Camera



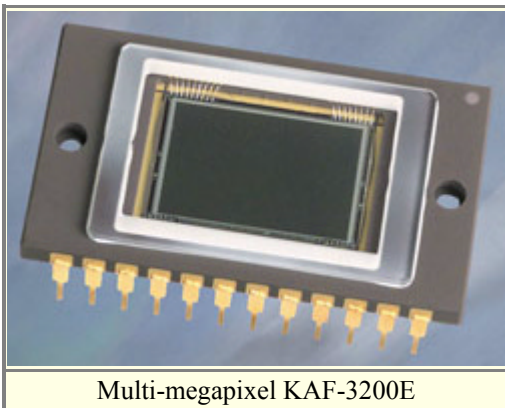
The Model ST-10XE and ST-10XME are the highest resolution CCD cameras in the "ST" series from SBIG. The body is identical to the ST-7XME, ST-8XME, ST-9XE, and ST-2000XM models with some slight modifications to accommodate the larger detector. The **ST-10XE** contains an enhanced KAF-3200E imaging detector 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-8XME 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, and built-in TC-237H, guiding CCD 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-10XME CCD IMAGING
CAMERA**



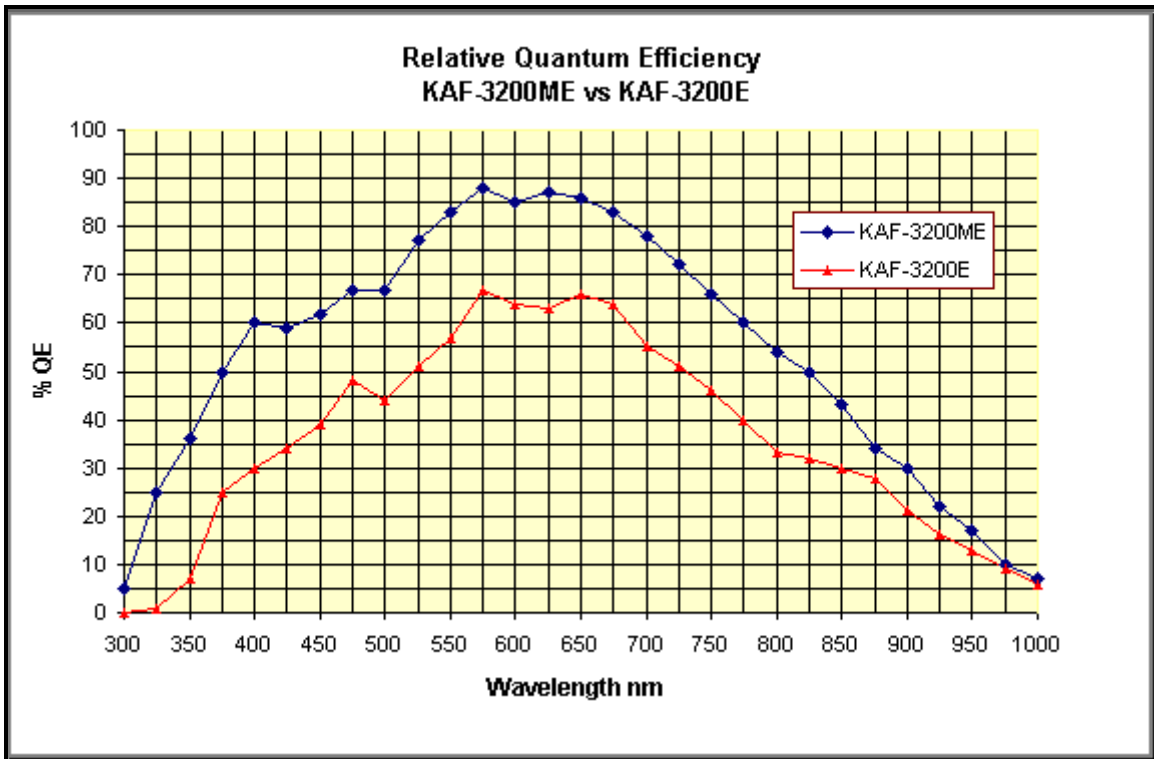
Multi-megapixel KAF-3200E

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. 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 make this an extremely versatile camera.



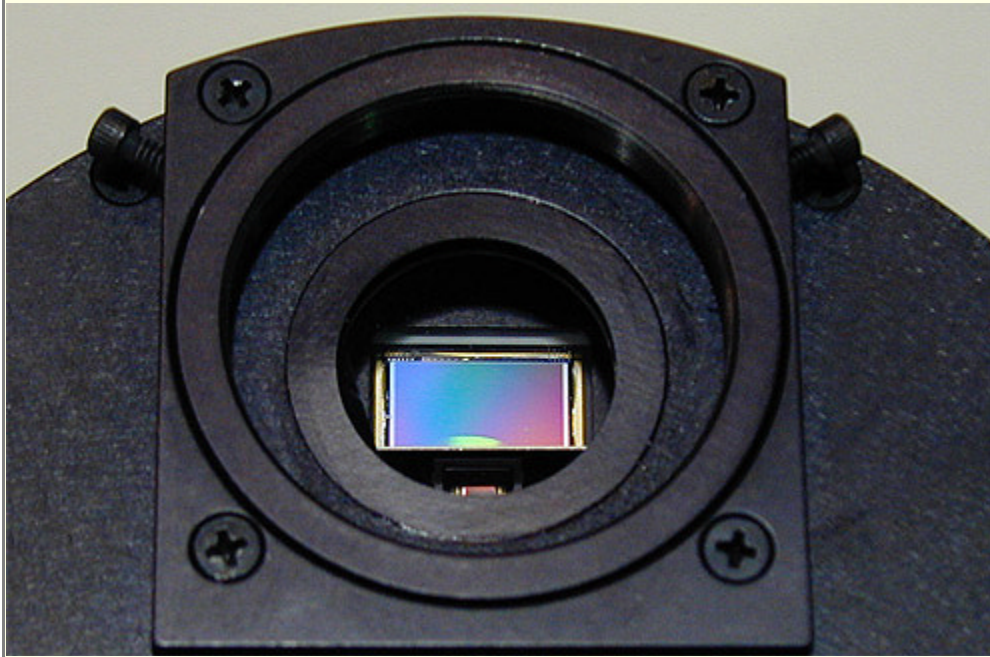
Rosette Nebula, ST-10 image courtesy Loke Tan



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.

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

The ST-10XE/XME camera utilizes SBIG's high speed analog and digital electronics with a USB interface to the PC. This interface is up to 14 times faster than our older parallel interface, and even using USB 1.1 is about as fast as competitors' cameras using USB 2.0. 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-8XME camera. In fact, the ST-10XE/XME has slightly less dark current and lower read noise than the ST-8XME. 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 and CFW10 color filter wheels, camera lens adapters, etc., are all the same for the ST-10XE/XME as the ST-8XME.



The Multi-Megapixel KAF-3200E enhanced CCD installed in the ST-10XE Camera.
Our highest resolution, dual sensor, self-guiding CCD camera.



Omega Centauri, ST-10 image. *Courtesy Peter Ward*



Veil Nebula, ST-10 image courtesy Loke Tan

ST-10XE/XME Typical Specifications

<i>CCD Specifications</i>	
<i>(ST-10XE) CCD</i>	Kodak KAF-3200E + TC-237
<i>(ST-10XME) CCD</i>	Kodak KAF-3200ME + TC237
<i>Pixel Array</i>	2184 x 1472 pixels, 14.9 x 10 mm
<i>Total Pixels</i>	3.2 million
<i>Pixel Size</i>	6.8 x 6.8 microns
<i>Full Well Capacity</i>	~77,000 e-
<i>Dark Current</i>	0.9e ⁻ /pixel/sec at 0° C
<i>Antiblooming</i>	Non-ABG only
<i>Readout Specifications</i>	
<i>Shutter</i>	Electromechanical
<i>Exposure</i>	0.11 to 3600 sec., 10ms resolution
<i>Correlated Double Sampling</i>	Yes
<i>A/D Converter</i>	16 bits
<i>A/D Gain</i>	1.3 e ⁻ /ADU
<i>Read Noise</i>	8.8 e ⁻ RMS
<i>Binning Modes</i>	1 x 1, 2 x 2, 3 x 3
<i>Pixel Digitization Rate</i>	Up to 420,000 pxels per second
<i>Full Frame Acquisition</i>	~8.7 seconds
<i>Optical Specifications (8" f/10)</i>	
<i>Field of View</i>	25 x 17 arcminutes
<i>Pixel Size</i>	.7 x .7 arcseconds
<i>Limiting Magnitude</i>	Magnitude 14 in 1 second
<i>(for 3 arcsec FWHM stars)</i>	Magnitude 18 in 1 minute
<i>System Specifications</i>	
<i>Cooling - standard</i>	Single Stage Thermoelectric, Active Fan, Water Assist Ready -45 C from Ambient Typical
<i>Temperature Regulation</i>	±0.1°C
<i>Power</i>	5 VDC at 1.5 amps, ±12 VDC at 0.5 amp desktop power supply included
<i>Computer Interface</i>	USB
<i>Computer Compatibility</i>	Win 98/NT/2000/Me/XP/Mac OS-X
<i>Guiding</i>	Dual CCD Self-Guiding
<i>Physical Dimensions</i>	
<i>Optical Head</i>	5 inches dia. x 3 inches 12.5 cm dia. x 7.5 cm deep, 2 pounds/0.9 Kg
<i>CPU</i>	All electronics integrated into Optical Head, No CPU
<i>Mounting</i>	T-Thread, 1.25" and 2" nosepieces included
<i>Backfocus</i>	0.92 inches/2.3 cm

Price and specifications subject to change without notice