Model ST-2000XM/XCM
CCD Imaging Camera

SBIG

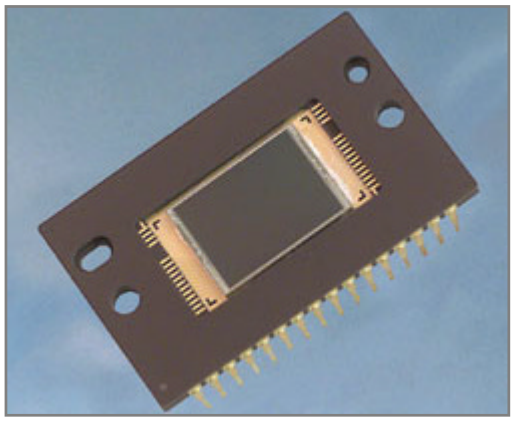
ASTRONOMICAL
INSTRUMENTS

Model ST-2000XM Dual CCD Self-Guiding Camera

ST-2000XM CCD IMAGING CAMERA

Our customers have been invaluable sources of inspiration and direction. It was in direct response to customer inquiries that we developed the ST-2000XM. Now those casual imagers who wanted something bigger and better but not at such a high price as the ST-8 or ST-10 have got what they asked for. The ST-2000XM has been developed to meet the needs of the astro imager looking for:

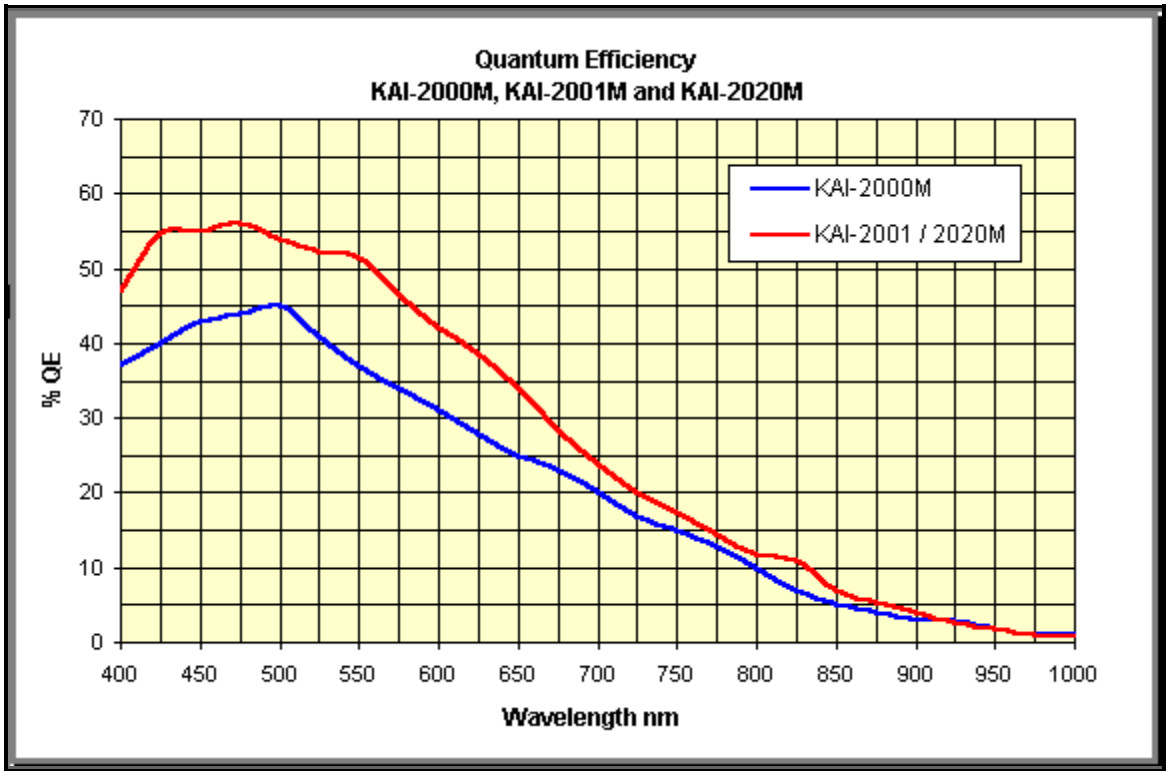
- A relatively large CCD with a generous field of view
- Lots of pixels - more than a megapixel
- Good sensitivity
- Low noise
- Antiblooming protection
- High resolution on smaller telescopes
- Flexibility of binning 2x2 on larger scopes with good image size
- Self-guiding
- High speed download
- Professional software
- Easy to use
- Full compliment of optional custom accessories
- Lower price
- SBIG quality and support



The new model ST-2000XM uses an high quality interline CCD from Kodak, the KODAK DIGITAL SCIENCE™ KAI-2020M Image Sensor Megapixel Progressive Scan Interline CCD. The KODAK DIGITAL SCIENCE™ KAI-2020M is a high-performance multi-megapixel image sensor designed for a wide range of scientific, medical imaging, and machine vision applications. The 7.4 mm square pixels with microlenses provide high sensitivity and the large full well capacity results in high dynamic range. The vertical overflow drain structure provides antiblooming protection, and enables electronic shuttering for precise exposure control. Other features include low dark current, negligible lag and low smear. The KAI-2020M CCD is a 2 megapixel progressive scan detector with an active image area of 1.92 million pixels. The active image area is 1600 x 1200 pixels. This array is 75% larger than the Sony CCD used in competitors' "megapixel" cameras and the ST-2000XM is a self-guiding camera, utilizing SBIG's patented dual sensor design. The imaging CCD is nearly the same size as the KAF-1603ME used in the ST-8XME but due to the smaller pixel size it contains nearly half a million more pixels than the ST-8XME. Full frame download time is approximately 4.5 seconds with our high speed USB 1.1 electronics. This camera is also fully compatible with all of our existing accessories such as the CFW8 filter wheel and AO-7 adaptive optics device. The ST-2000XM has antiblooming protection and the quantum efficiency is comparable to the ABG versions of the new enhanced full frame "E" detectors used in the ST-7XE cameras with a shift in the peak sensitivity toward the blue. Compared to the ABG versions of the full frame "E" series cameras, the ST-2000XM is more sensitive in the blue and green, and slightly less sensitive in the red. Moreover, because the ST-2000XM has two CCDs (a guiding CCD as well as an imaging CCD) in the same camera head, it is

capable of self-guiding without any compromise in the quantum efficiency of the imaging CCD. In other words, not only CAN it self-guide, it can do so without having to double the exposure time to compensate for the guiding feature. Kodak has improved the sensitivity and noise performance of this CCD since it was introduced, and we now use the latest higher QE, lower noise KAI-2020M in all ST-2000 cameras.

The ST-2000XM is a complete camera system. There is no need to add in the additional cost of an interface or an autoguider or a nosepiece or better software to make these cameras actually operate as they should. Everything that is needed to make the camera operational is included in the base price



Each ST-2000XM camera system INCLUDES at no additional cost:

- Rugged camera body with imaging and autoguiding CCDs and new analog and digital electronics
- ***2 Megapixel KAI-2020M imaging CCD***
- ***Built-in TC-237 CCD autoguider with 10X the sensitivity of an ST-4***
- ***High speed USB 1.1 interface (up to 421,000 pixels per second)***
- New I^2C bi-directional expansion port
- Standard accessory / telescope port
- User rechargeable desiccant plug (no need to return the camera to the factory for frosting problems)
- "Dummy" desiccant plug for dust prevention during recharging procedure
- Internal shutter
- 2" Nosepiece
- Cooling Fan - on/off controlled by software
- New heat exchanger design with water cooling capability
- Tripod mount 1/4-20 threaded side plate
- T-thread ring
- 15 foot USB cable (third party USB extenders available for up to 500 meters!)

- Adapter plug for telescope interface cable (for autoguiding)
- Telescope interface cable (for autoguiding)
- Universal 90-240VAC power supply with remote on/off switch
- SBIG's CCDOPS version 5 camera control software
- ***Software Bisque's CCDSoftV5*** camera control and image processing software
- Software Bisque's TheSky version 5, level II
- Operating Manual
- Custom design hard carrying case with pre-cut foam for your camera

What you get with the ST-2000XM	***Feature***	***ST-2000XM***
Megapixels	High Pixel Count	2 million (1.92 million image area)
Good pixel resolution on small scopes	Small pixels	7.4 microns
Big field of view on small and medium scopes	Large CCD Array	1648 x 1214 (1600 x 1200 image area)
High blue response	QE at 400 nm	47%
Mechanical shutter for dark frames	Auto dark frames	Yes
Second CCD included	Self-guiding	Yes
Regulated cooling to 0.1 degrees	Reuse Dark Frames	Yes
Improved cooling capability	Water cooling available	Included (up to -45C delta)
Premium software: CCDSoftV5 and TheSky	Extra Software	Included at no additional cost
Fast electronics	High Speed A/D	~425,000 pixels / sec
Fast Full Frame Downloads	High Speed USB 1.1	~4.5 sec

ST-2000XM First Light Images:

M51. ST-2000XM.
This LRGB test shot was taken by Ron Wodaski through a 6" refractor using a CFW8A filter wheel. The Luminance frame was 7x3 minutes and four sets of RGB frames were 3:3:3 minutes. The full field of view is shown above reduced 50% to 600 x 800. The central portion at high resolution is shown below.

ST-2000XM Typical Specifications

CCD Specifications	
CCD	Kodak KAI-2020M + TC-237
Pixel Array	1600 x 1200 pixels, 11.8 x 8.9 mm
Total Pixels	2 million
Pixel Size	7.4 x 7.4 microns
Full Well Capacity	45,000 e- unbinned 90,000 e- binned 2x2
Dark Current	0.5e^-/pixel/sec at 0° C
Antiblooming	Standard

Readout Specifications	
Shutter	Electromechanical
Exposure	0.001 to 3600 sec., 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	0.6e- /ADU unbinned, 0.9 e- binned
Read Noise	7.9 e- RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3, and 1 x N, 2 x N, 3 x N
Pixel Digitization Rate	Up to 425,000 pxels per second
Full Frame Acquisition	4.5 seconds

Optical Specifications (8" f/10)	
Field of View	20 x 15 arcminutes
Pixel Size	.75 x .75 arcseconds
Limiting Magnitude	Magnitude 14 in 1 second
(for 3 arcsec FWHM stars)	Magnitude 18 in 1 minute

System Specifications	
Cooling - standard	Single Stage Thermoelectric, Active Fan, Water Assist Ready -35 C from ambient with air only -45 C from Ambient with water
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 98/NT/2000/Me/XP Mac OS-X Linux (third party suppliers)
Guiding	Dual CCD Self-Guiding

Physical Dimensions	
Optical Head	5 inches dia. x 3 inches 12.5 cm dia. x 7.5 cm deep, 2 pounds/0.9 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

Price and specifications subject to change without notice

Model ST-2000XCM Dual CCD, Self-Guiding Camera with Single-Shot Color CCD

ST-2000XCM Single-Shot Color CCD IMAGING CAMERA

The ST-2000XCM is the same camera as the ST-2000XM monochrome, except that it uses a Kodak KAI-2020CM color CCD for single-shot color imaging. The KAI-2020CM CCD is a high-performance 2 million pixel sensor designed for a wide range of medical, scientific and machine vision applications. The 7.4 um square pixels with microlenses provide high sensitivity and the large full well capacity results in high dynamic range. The vertical overflow drain structure provides antiblooming protection and enables electronic shuttering for precise exposure control. Other features include low read noise, low dark current, negligible lag and low smear.

Like the monochrome version, the ST-2000XCM has an active image area of 1600 x 1200 pixels. This array is 75% larger than the Sony CCD used in competitors' "megapixel" one shot color cameras and the ST-2000XCM is a self-guiding camera, utilizing SBIG's patented dual sensor design. The imaging CCD is nearly the same size as the KAF-1603ME used in the ST-8XME but due to the smaller pixel size it contains nearly half a million more pixels than the ST-8XME. Full frame download time is approximately 4.5 seconds with our high speed USB 1.1 electronics. This camera is also fully compatible with all of our existing accessories such as the AO-7 adaptive optics device.

M33. ST-2000XCM Single-Shot Color

The benefit of one-shot color is that no external color filters are used and self-guiding is always done through an unfiltered optical train (except for a UV/IR blocker if required). This makes finding guide stars easier and guiding a single exposure takes less time than guiding three or four RGB or LRGB exposures through color filters. On the other hand, the benefit of the monochrome version is that the filters can be selected by the user to match the CCD characteristics better, to perform photometry, or to do narrow band imaging. Ultimately, the monochrome camera with custom filters will produce a superior result. The trade-off is ease of use vs. sensitivity and flexibility.

ST-2000XCM Typical Specifications

CCD Specifications	
CCD	Kodak KAI-2020CM + TC-237
Pixel Array	1600 x 1200 pixels, 11.8 x 8.9 mm
Total Pixels	2 million
Pixel Size	7.4 x 7.4 microns
Full Well Capacity	45,000 e- unbinned 90,000 e- binned 2x2
Dark Current	0.5e^-/pixel/sec at 0° C
Antiblooming	Standard

Readout Specifications	
Shutter	Electromechanical
Exposure	0.001 to 3600 sec., 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	0.6e- /ADU unbinned, 0.9 e- binned
Read Noise	7.9 e- RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3, and 1 x N, 2 x N, 3 x N
Pixel Digitization Rate	Up to 425,000 pxels per second
Full Frame Acquisition	4.5 seconds

Optical Specifications (8" f/10)	
Field of View	20 x 15 arcminutes
Pixel Size	.75 x .75 arcseconds
Limiting Magnitude	Magnitude 14 in 1 second
(for 3 arcsec FWHM stars)	Magnitude 18 in 1 minute

System Specifications	
Cooling - standard	Single Stage Thermoelectric, Active Fan, Water Assist Ready -35 C from ambient with air only -45 C from Ambient with water
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 98/NT/2000/Me/XP Mac OS-X Linux (third party suppliers)
Guiding	Dual CCD Self-Guiding

Physical Dimensions	
Optical Head	5 inches dia. x 3 inches 12.5 cm dia. x 7.5 cm deep, 2 pounds/0.9 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

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