

SBIG Research Series
STL-1001E, STL-1302E, STL-4020M,
STL-6303E and STL-11000M
Large Format CCD Cameras



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Research Series Dual Head, Triple Sensor, Self-Guiding, Large Format CCD Cameras

The Research Series Self-Guiding CCD cameras from SBIG represent a new step forward in the field of astronomical imaging. These cooled, large format cameras leave nothing to be desired in the way of features and functionality. All Research models include the following:

- Large area imaging CCDs, up to 35mm format
- 1 Megapixel to 11 Megapixels
- Built-in 657x495 pixel TC-237H guiding CCD
- Optional remote guiding head with TC-237H CCD
- Internal 2" filter carousel
- Two-stage thermoelectric cooling
- Provision for water circulation, cooling to -50 degrees C below ambient
- Fast USB electronics, up to 425,000 pixels per second transfer rate
- Professional software: CCDOPS version 5, CCDSoftV5
- Software selectable binning modes, 1x1, 2x2, 3x3, 9x9, 1xN
- 12VDC Operation
- Status and Power level indicator lights
- Optional Nikon camera lens adapter
- Universal 90-240VAC power supply
- Custom waterproof, dustproof, crushproof Pelican carrying and storage case.

The Research Series cameras support a variety of imaging sensors. The 4 Megapixel STL-4020M and the 11 Megapixel STL-11000M with interline CCDs offer large imaging areas, excellent anti-blooming characteristics and high pixel density at a reasonable cost. The CCD used in the 11 Megapixel STL-11000M camera is a full 35mm format CCD. These cameras are excellent choices for wide field imaging with short focal length scopes.



**Research Series Camera with Optional
Nikon Camera Lens Adapter**

accomplished with the camera control software. Optional LRGB and UBVRI filter sets are available from SBIG. The front cover of the camera is easily removed for changing filters. Since the CCD is in a separate sealed chamber, removal of the front cover to change filters does not expose the CCD to dust or air and the desiccant does not need to be recharged after replacing the cover. Extra carousels may be purchased for



**Research Series Camera with
Optional Remote Guiding Head**

The STL-1001E, STL-1301E and STL-6303E with full frame CCDs offer high quantum efficiency and greater dynamic range. These cameras are the best choices for use on telescopes with longer focal lengths.

The built-in guiding CCD is a TC-237H frame transfer device with high sensitivity and a 657x495 pixel array. The optional remote guiding head contains an identical TC-237H CCD. When the remote head is attached to the main camera the user can select either the internal or the remote guiding CCD for self-guiding a long exposure.

The internal filter carousel makes adding an expensive 2" filter wheel unnecessary. The built-in filter carousel accepts both 50mm unmounted round filters and filters mounted in 48mm threaded cells. Filter selection is

quick and easy transition between filter sets. A shutter mechanism is also located inside the camera body, between the filter wheel and the sealed CCD chamber.

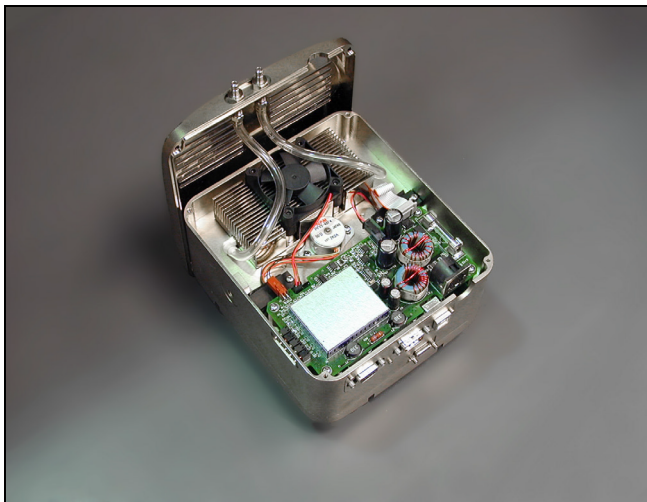
We have added an internal 12VDC regulated power supply to the camera for simplified power requirements and greater tolerance of input voltage variation. When operating in the field from a 12V battery, current drain, power cord extensions and cold temperatures may cause the input voltage to drop below 12 volts. The internal regulated supply will accommodate some variation in input voltage (from about 10 volts to 18 volts) and keep the camera operating normally. This will allow for longer power cords to be used with less concern for voltage drops so long as the input voltage stays within a certain range. A set of indicator LEDs will let you know if your input voltage at the camera is getting too low for normal operation. A universal 90-240VAC, 50-60 Hz power supply is also included for operation from virtually any line voltage in the world.



Filter Carousel with 2" Filters Inside Front Cover

The standard cooling design utilizes a very efficient two-stage TE cooler for maximum performance with large format detectors. Each camera is also liquid assist ready so that additional cooling in warm climates may be achieved by circulating water if needed. We are currently testing a special magnetic levitating fan to eliminate even the smallest vibration. Cooling to -50 Degrees C below ambient can be achieved with this system.

A set of five LED indicator lights on the side panel of the camera provides critical camera status information. The green LED lets you know the camera is booting up and gives camera exposure status during normal operation. One red LED provides a warning if the heat-sink gets too hot. This could happen, for instance, if you were running high power to the cooler and the fan failed for some reason. In this case the camera automatically reduces power to the two-stage cooler to prevent damage. One amber LED warns of an input voltage drop to 11 volts or less but the camera will continue functioning normally. The second amber LED warns of an input voltage drop to 10 volts but the camera will still continue functioning normally. The last red LED warns of an input voltage drop to 9 volts or less. In this case, the camera automatically turns off the TE cooler and continues to operate normally without cooling until the voltage drops to the point that the camera shuts down (around < 7 volts).



Power Supply and Heat Exchanger Inside Back Cover

All of these unique features make the Research Series cameras unmatched in features and flexibility. For more information please visit the SBIG web site at <http://www.sbig.com> or contact SBIG at (805) 571-7244, e-mail to sbig@sbig.com

Model STL-1001E Typical Specificaitons

CCD SPECIFICATIONS

Imaging CCD	Kodak Enhanced KAF-1001E
Pixel Array	1024 x 1024 pixels, 24.6 x 24.6 mm
Total Pixels	1.0 million
Pixel Size	24 x 24 microns
Full Well Capacity (NABG)	150,000 e ⁻
Dark Current	9 e ⁻ /pixel/second at 0 degrees C
Antiblooming	NABG only

READOUT SPECIFICATIONS

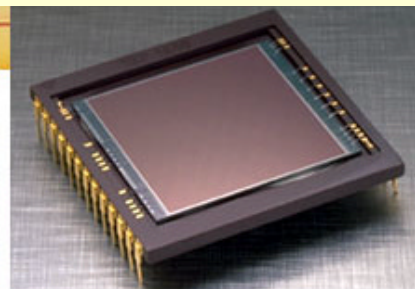
Shutter	Electromechanical
Exposure	0.12 to 3600 seconds, 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	2.0e ⁻ /ADU
Read Noise	15e ⁻ RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3
Full Frame Download	2.5 seconds

SYSTEM SPECIFICATIONS

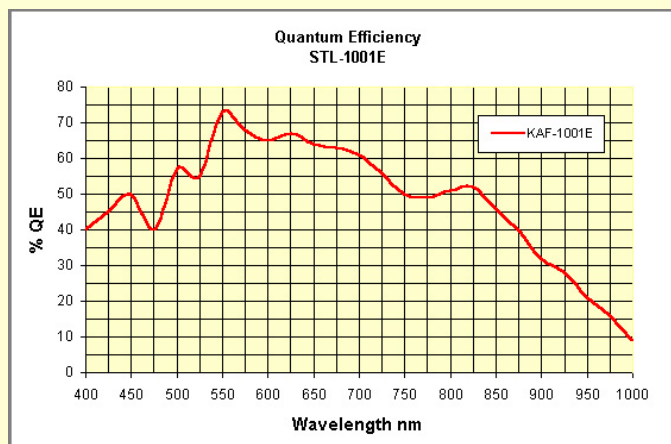
Cooling - standard	Two-Stage Thermoelectric, Water Assist, -40 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	10 - 18VDC, 12VDC nominal, Universal AC to 12VDC desktop supply
Computer Interface	USB 1.1
Computer Compatibility	Windows 98/NT/2000/Me/XP/Mac OS-X
Guiding	Dual CCD Self-Guiding Standard, Remote Guiding Head Optional

PHYSICAL SPECIFICATIONS

Dimensions	6.5 x 6 x 3.5" (16.5 x 15.2x8.9cm)
Weight	4 pounds (1.8 Kg) without filters
Internal Filter Carousel	5 positions for 48mm threaded cells or 2" unmounted filters (optional)
Mounting	2" nosepiece included
Backfocus	Approximately 1.7 inches (~4.3 cm) with 2" nosepiece attached



KAF-1001E
Quantum Efficiency
(Spectral Response)



Model STL-4020M/CM Typical Specifications

CCD SPECIFICATIONS

Imaging CCD	Kodak Enhanced KAI-4021M (KAI-4021CM in single-shot color model)
Pixel Array	2048 x 2048 pixels, 15.2 x 15.2 mm
Total Pixels	4.2 million
Pixel Size	7.4 x 7.4 microns
Full Well Capacity (NABG)	40,000 e ⁻
Dark Current	0.07e ⁻ /pixel/second @ 0 degrees C
Antiblooming	ABG only

READOUT SPECIFICATIONS

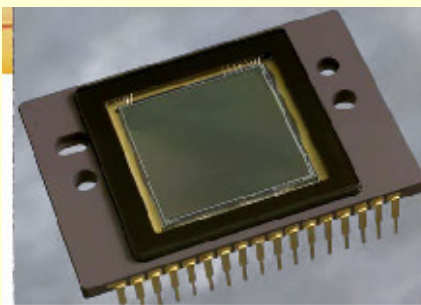
Shutter	Electromechanical
Exposure	0.001 to 3600 seconds, 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	0.6e ⁻ /ADU
Read Noise	7.9e ⁻ RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3
Full Frame Download	9.8 seconds

SYSTEM SPECIFICATIONS

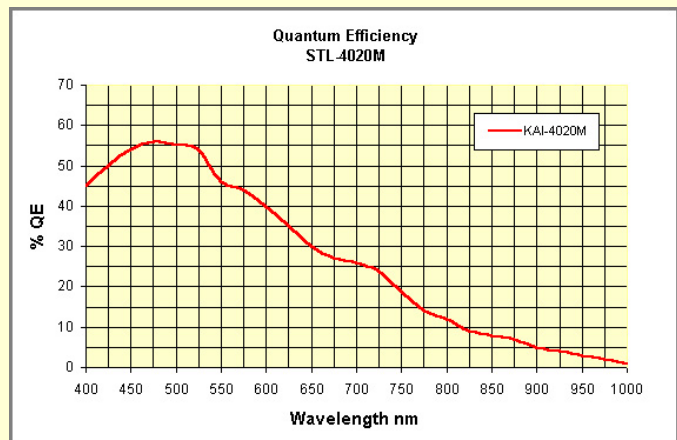
Cooling - standard	Two-Stage Thermoelectric, Water Assist, -40 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	10 – 18VDC, 12VDC nominal, Universal AC to 12VDC desktop supply
Computer Interface	USB 1.1
Computer Compatibility	Windows 98/NT/2000/Me/XP/Mac OS-X
Guiding	Dual CCD Self-Guiding Standard, Remote Guiding Head Optional

PHYSICAL SPECIFICATIONS

Dimensions	6.5 x 6 x 3.5" (16.5 x 15.2x8.9cm)
Weight	4 pounds (1.8 Kg) without filters
Internal Filter Carousel	5 positions for 48mm threaded cells or 2" unmounted filters (optional)
Mounting	2" nosepiece included
Backfocus	Approximately 1.7 inches (~4.3 cm) with 2" nosepiece attached



**KAI-4020M CCD
Quantum Efficiency
(Spectral Response)**



Model STL-1301E Typical Specifications

CCD SPECIFICATIONS

Imaging CCD	Kodak Enhanced KAF-1301E
Pixel Array	1280 x 1024 pixels, 20.5 x 16.4 mm
Total Pixels	1.3 million
Pixel Size	16 x 16 microns
Full Well Capacity (NABG)	120,000 e ⁻
Dark Current	3e ⁻ /pixel/second @ 0 degrees C.
Antiblooming	NABG standard, ABG optional

READOUT SPECIFICATIONS

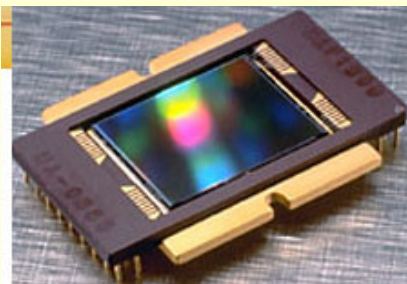
Shutter	Electromechanical
Exposure	0.12 to 3600 seconds, 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	1.6e ⁻ /ADU
Read Noise	17e ⁻ RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3
Full Frame Download	3 seconds

SYSTEM SPECIFICATIONS

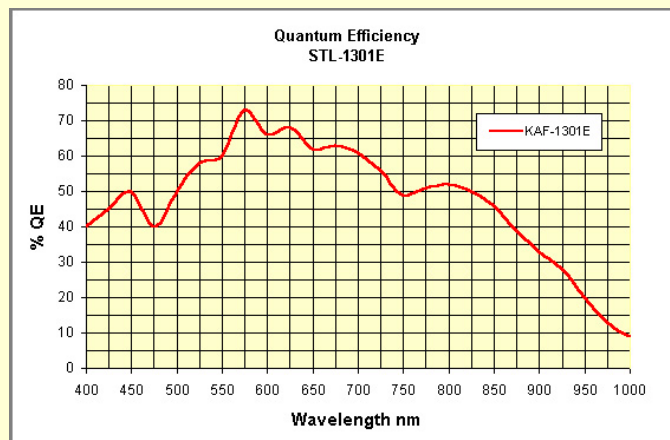
Cooling - standard	Two-Stage Thermoelectric, Water Assist, -40 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	10 - 18VDC, 12VDC nominal, Universal AC to 12VDC desktop supply
Computer Interface	USB 1.1
Computer Compatibility	Windows 98/NT/2000/Me/XP/Mac OS-X
Guiding	Dual CCD Self-Guiding Standard, Remote Guiding Head Optional

PHYSICAL SPECIFICATIONS

Dimensions	6.5 x 6 x 3.5" (16.5 x 15.2x8.9cm)
Weight	4 pounds (1.8 Kg) without filters
Internal Filter Carousel	5 positions for 48mm threaded cells or 2" unmounted filters (optional)
Mounting	2" nosepiece included
Backfocus	Approximately 1.7 inches (~4.3 cm) with 2" nosepiece attached



KAF-1301E
Quantum Efficiency
(Spectral Response)



Model STL-6303E Typical Specifications

CCD SPECIFICATIONS

Imaging CCD	Kodak Enhanced KAF-6303E
Pixel Array	3060 x 2040 pixels, 27.5 x 18.4 mm
Total Pixels	6 million
Pixel Size	9 x 9 microns
Full Well Capacity (NABG)	100,000 e ⁻
Dark Current	0.3e ⁻ /pixel/second @ 0 degrees C
Antiblooming	NABG standard, ABG optional

READOUT SPECIFICATIONS

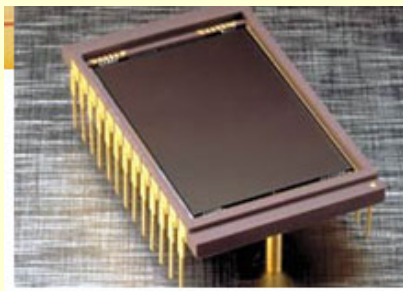
Shutter	Electromechanical
Exposure	0.12 to 3600 seconds, 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	1.4e ⁻ /ADU unbinned, 2.3e ⁻ binned
Read Noise	13.5e ⁻ RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3
Full Frame Download	14 seconds

SYSTEM SPECIFICATIONS

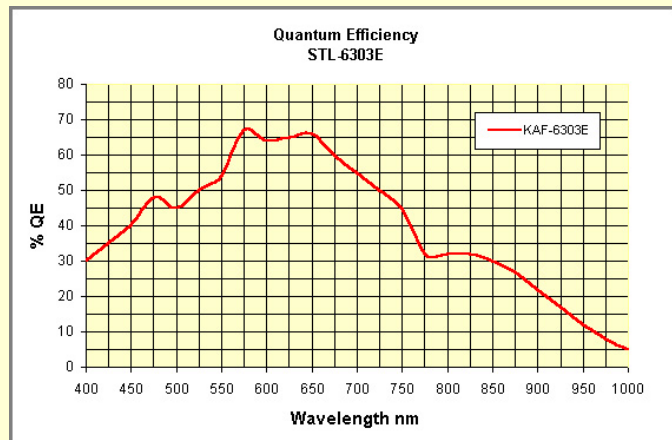
Cooling - standard	Two-Stage Thermoelectric, Water Assist, -40 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	10 - 18VDC, 12VDC nominal, Universal AC to 12VDC desktop supply
Computer Interface	USB 1.1
Computer Compatibility	Windows 98/NT/2000/Me/XP/Mac OS-X
Guiding	Dual CCD Self-Guiding Standard, Remote Guiding Head Optional

PHYSICAL SPECIFICATIONS

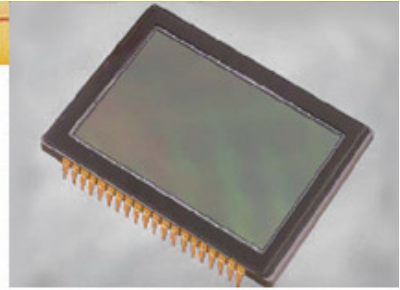
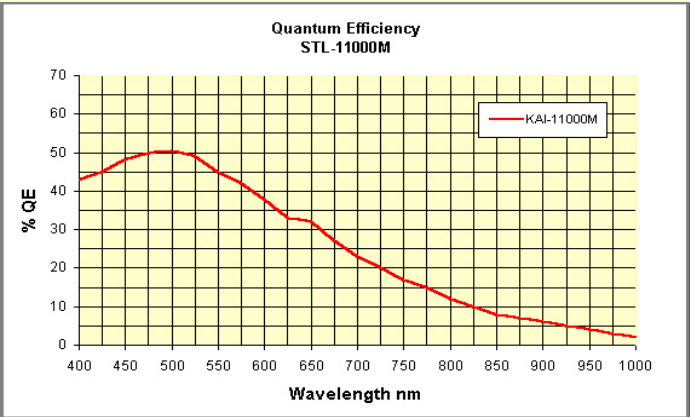
Dimensions	6.5 x 6 x 3.5" (16.5 x 15.2x8.9cm)
Weight	4 pounds (1.8 Kg) without filters
Internal Filter Carousel	5 positions for 48mm threaded cells or 2" unmounted filters (optional)
Mounting	2" nosepiece included
Backfocus	Approximately 1.7 inches (~4.3 cm) with 2" nosepiece attached




**KAF-6303E
Quantum Efficiency
(Spectral Response)**



Model STL-11000M/CM Typical Specifications

CD SPECIFICATIONS																													
Imaging CCD	Kodak Enhanced KAI-11000M (KAI-11000CM in single-shot color model)																												
Pixel Array	4008 x 2672 pixels, 36 x 24 mm																												
Total Pixels	11 million																												
Pixel Size	9 x 9 microns																												
Full Well Capacity (NABG)	50,000 e-																												
Dark Current	0.5 e-/pixel/sec @ 0 degrees C																												
Antiblooming	ABG only																												
READOUT SPECIFICATIONS																													
Shutter	Electromechanical																												
Exposure	0.001 to 3600 seconds, 10ms resolution																												
Correlated Double Sampling	Yes																												
A/D Converter	16 bits																												
A/D Gain	0.8e-/ADU unbinned, 1.6e- binned																												
Read Noise	13e- RMS																												
Binning Modes	1 x 1, 2 x 2, 3 x 3																												
Full Frame Download	26 seconds																												
SYSTEM SPECIFICATIONS																													
Cooling - standard	Two-Stage Thermoelectric, Water Assist, -40 C from Ambient Typical																												
Temperature Regulation	±0.1°C																												
Power	10 - 18VDC, 12VDC, 4.5A nominal, Universal AC to 12VDC desktop supply																												
Computer Interface	USB 1.1																												
Computer Compatibility	Windows 98/NT/2000/Me/XP/Mac OS-X																												
Guiding	Dual CCD Self-Guiding Standard, Remote Guiding Head Optional																												
PHYSICAL SPECIFICATIONS																													
Dimensions	6.5 x 6 x 3.5" (16.5 x 15.2x8.9cm)																												
Weight	4 pounds (1.8 Kg) without filters																												
Internal Filter Carousel	5 positions for 48mm threaded cells or 2" unmounted filters (optional)																												
Mounting	2" nosepiece included																												
Backfocus	Approximately 1.7 inches (~4.3 cm) with 2" nosepiece attached																												
 <p>KAI-11000M Quantum Efficiency (Spectral Response)</p>	 <p>Quantum Efficiency STL-11000M</p> <table border="1"> <caption>Approximate data points from the Quantum Efficiency graph</caption> <thead> <tr> <th>Wavelength (nm)</th> <th>% QE</th> </tr> </thead> <tbody> <tr><td>400</td><td>45</td></tr> <tr><td>450</td><td>48</td></tr> <tr><td>500</td><td>50</td></tr> <tr><td>550</td><td>45</td></tr> <tr><td>600</td><td>38</td></tr> <tr><td>650</td><td>32</td></tr> <tr><td>700</td><td>25</td></tr> <tr><td>750</td><td>18</td></tr> <tr><td>800</td><td>12</td></tr> <tr><td>850</td><td>8</td></tr> <tr><td>900</td><td>6</td></tr> <tr><td>950</td><td>5</td></tr> <tr><td>1000</td><td>4</td></tr> </tbody> </table>	Wavelength (nm)	% QE	400	45	450	48	500	50	550	45	600	38	650	32	700	25	750	18	800	12	850	8	900	6	950	5	1000	4
Wavelength (nm)	% QE																												
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850	8																												
900	6																												
950	5																												
1000	4																												

Remote Guiding Head Specifications (Typical)

Dimensions	2.75 x 2 x 2 inches (7 x 5 x 5 cm) excluding nosepiece, desiccant plug and connector
Weight	Approx. 0.5 lbs. (0.23kg)
Camera Interface	A small flexible cable, 3' long (6' optional) to the camera provides power, control signal and image transfer.
Computer Interface	USB 1.1 through main camera to computer. Proprietary protocol between remote head and camera body.
Telescope Interface	T-thread or supplied 1.25" nosepiece, optional T-thread to C-mount and 35mm camera lens adapters are available
Shutter	Internal Mechanical Shutter for dark frames plus electronic shutter (frame transfer) for short exposures
Power Requirements	None (Remote head receives power through the head cable from the main camera)
Mounting connections	1/4-20 threaded holes on two sides of head
Cooling	Single-stage TE cooling to approximately -25 degrees C below ambient
	<p>REMOTE GUIDING HEAD SENSOR</p> <p>CCD: Texas Instruments TC-237H Pixel Array: 657 x 495 pixels Pixel Size: 7.4 x 7.4 microns CCD Size: 4.9 x 3.7 mm Cooling: Single-stage Thermoelectric Antiblooming: Yes</p>