



# AST8300 CCD Camera

The AST8300 is an innovative camera for astrophotography based on KAF8300 CCD sensor. It offers great technical characteristics together with a completely new software approach, thanks to its powerful embedded microprocessor, putting the AST8300 camera in a class by itself.



## FEATURES

- 5.5e- typical readout noise (about 6e- total noise)
- Embedded 7 positions filter-wheel + shutter
- 42°C delta-T double stage peltier at as low as 2.2A
- New concept low-vacuum sensor chamber
- Powerful microprocessor for stand alone wires-free operation (no PC needed)
- PC like (OS based, graphical desktop, Web access, install/create apps, ...)
- 4.3" Touch-Screen Color Display (detachable)
- Ethernet/Wifi connection to PC / tablet / smartphone
- 8GB internal storage plus external USB pen / hard-disk
- 2 USB, serial, I2C, SPI, +3.3V, +5V, +12V output power supplies
- Configurable I/O lines (triggers, alarms, custom interfaces, ...)

## SMARTCAMERA APPROACH

The AST8300 camera is equipped with a powerful embedded processor. Thanks to this "intelligence", the AST8300 can do onboard all the operations that other cameras can only do by means of an external PC.

Similar to a powerful astrophotography-oriented DSRL, the AST8300 offers a complete suite of easy to use graphical applications that can be accessed using the large 4.3" touch-screen monitor, including photo sequences programming with filters management, temperature setting and monitor, liveview and focus modes, images review and postprocessing.

More advanced applications are included, like autoguiding capability using an external USB camera/webcam. Moreover, thanks to the completely Open Source license of the software and the Linux OS, other applications can be easily added by the users, giving the camera more and more capabilities: our aim is to create a community of AST8300 users and software developers which will add leading edge contents, ranging from innovative readout modes to web enabled applications.

## CCD SENSOR



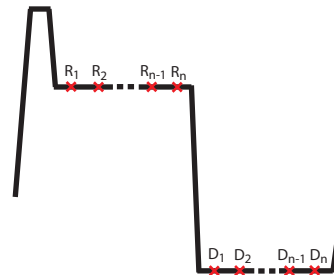
The Truesense (formerly Kodak) KAF-8300 is a 22.5 mm diagonal (4/3 Format) high performance monochrome full frame CCD image sensor.

Each pixel contains blooming protection by means of a lateral overflow drain thereby preventing image corruption during

high light level conditions. For the color version, the 5.4 μm square pixels are patterned with an RGB mosaic color filter with overlying microlenses for improved color response and reproduction.

## READ NOISE

The embedded processor is also used for a new software approach to readout: instead of the classical analogue CDS, the AST8300 uses a multi-sample digital CDS. The idea is to sample the reset and the data level multiple times and reduce the noise by averaging the data: the more times you sample the levels, the more accurate is the measurement of the pixel value.



$$PxI = \frac{(R_1+R_2 \dots +R_n) - (D_1+D_2 \dots +D_n)}{n}$$

Averaging 16 samples for the reset and data levels, the AST8300 can readout the photo at as low as 5.5e- noise.

Samples (n)	Noise (e-)	Download Time (sec)
2	7.5	10
16	5.5	30

Having the capability of digitally sampling the levels and a good calculation power onboard, makes it possible to experiment custom readout modes to further improve the noise levels.



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## USE MODES



Having an intelligence inside and a 4.3" touchscreen display, the camera can operate in stand alone mode, that is without any external PC. For users willing to operate the camera through a PC, the Touch LCD can be detached and the AST8300 connected using an Ethernet cable or a Wifi USB pen. When using a Wifi pen, the camera can be operated also through a tablet or a smartphone. The camera will display on the PC/tablet/smartphone the same applications available on the Touch LCD.

Connection	Interface	AST onboard SW
ETH	PC / VNC	X
WIFI	PC / VNC	X
WIFI	Tablet or Smartphone / VNC	X
Stand-Alone	AST Embedded Touch LCD	X

## MECHANICAL

The AST8300 features compact dimensions: it consists on a cylinder-shaped camera body with a diameter of 126 mm and an height of 70 mm; weight is 880 gr. The case is entirely made of aluminium alloy built by high-precision CNC lathe and milling machines with no die cast elements, finished with a double treatment: anodization and external high resistance powder coating. The sensor chamber is low vacuum-proof and most of the air inside can be removed through the chamber valve using the included hand operated vacuum pump. This operation, that can be done in a few seconds, generates a low vacuum that will last for at least 48h, avoiding frost forming an minimizing convection heat transfer.



## FILTER-WHEEL



The AST8300 incorporates an internal seven position filter-wheel. The filter-wheel accepts standard unmounted 27mm filters. The eighth position of the filter-wheel is occupied by the shutter. The exact position of the filter-wheel is controlled through an optical sensor.

## CCD

Sensor	Truesense KAF-8300 (monochrome/color)
Pixel Array	3326 x 2504 pixels
CCD Size	17.96 x 13.52 mm
Total Pixels	8.3 Million
Full Well Capacity	~25,500 e-
Dark Current	0.015 e- / pixel / sec at -20°C
Antiblooming	1000x

## CAMERA PERFORMANCES

Shutter	Mechanical
Interfaces	USB 2.0 Host FS, Host/Device HS, Ethernet, UART, SPI, I2C, GPIOs
Camera Body Size	126 mm diam. x 70 mm
Mounting	T-Thread M42x0.75
Weight	880 gr (w/ filter-wheel, w/o display and filters)
Backfocus	25 mm (including filter-wheel)

## CAMERA CHARACTERISTICS

Sampling Mode	Digital multi-sample CDS
A/D Conversion	16 bit
Gain	0.91 e- / ADU
Read Noise	~ 6 e- rms (typ)
Binning Modes	up to 10x10
Digitization Rate	from 270 Kpxls/sec to 1 Mpxls/sec
Frame Download	from 10 sec to 30 sec
Cooling Max DeltaT	- 42 °C regulated
Temp. Tegulation	± 0.1 °C
Power	12VDC @ 2.2 A max (full operational)



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## ONBOARD CAMERA SOFTWARE

The camera provides a complete set of onboard applications to make and manage photos. The applications are displayed on the touch LCD in stand alone mode or are available via VNC when used with PC / Tablet / Smartphones. The applications have two customizable skins: the daylight mode and the night mode.

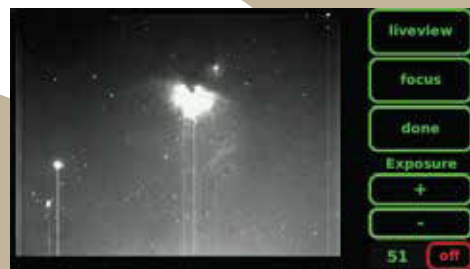


### < Desktop

At startup the camera shows a desktop that allows the user to access to the onboard applications.

### Liveview >

When in liveview mode, the camera is put in 10x5 binning, giving very high sensitivity and very fast readout: with a few seconds exposure, even faint objects will be visible on the display, allowing a quick and easy framing of the target. Exposure can be increased and decreased on the fly.



### < Focus

The user can enable the focus mode by selecting a star on the display. The camera starts downloading a small area around the selected star as fast as 2-3 frames per second, while showing the FWHM and profile graph, thus allowing a fast and precise focus. The dimension of the area surrounding the star and the exposure can be changed on the fly.



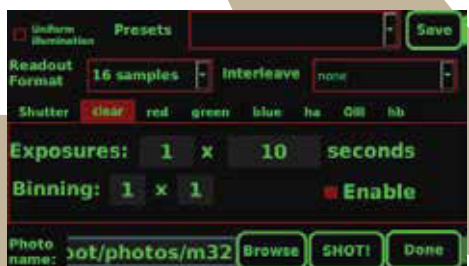
### Temperature Control >

The user selects a temperature setpoint as well as the minimum number of seconds required to ramp up and down the peltier. After the ramp is complete, the program takes control of the peltier power using a PID algorithm. A plot of the temperature covering the previous 5 minutes is shown to monitor the accuracy of the temperature control.



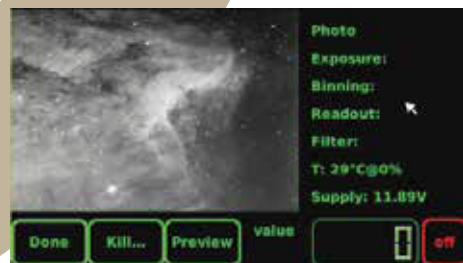
### < Control and make Photos

For each filter, the user can define and make a sequence of exposures, with different binning, exposure time and readout mode. The user can choose the name of the photo and save/load presets to speedup operations.



### Status Monitoring & Logging >

This graphical interface is used to monitor the photo sequence. It shows the photo info, the current exposure in the sequence, the remaining time, the current temperature, the TEC power and the supply voltage. When touching the image, the corresponding image intensity value is displayed in the value box.



### < Images Review

The user can load an image on the internal storage and navigate it using different zoom levels and stretching, thus allowing an easy assesment of the photos. The user can also select an auto stretching modality which maximizes the gray levels use.



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## ONBOARD CAMERA SOFTWARE

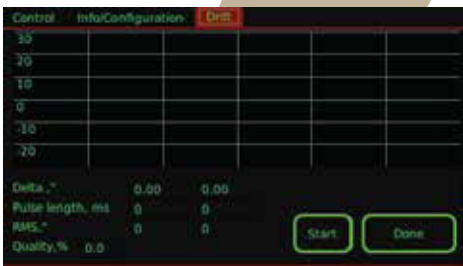


### < Filterwheel

The Filterwheel tool is used to control, where available, the integrated filter wheel, to select a filter for the Find and focus tool. The calibrate button resets the wheel to the default position. This command is automatically executed during camera powerup process. The go button moves the wheel to the selected filter position and together with direction and step +/- buttons are needed during the filter installation procedure.

### GoTo >

The GoTo tool allow the camera to automatically control the pointing of the Telescope toward a specific sky object selecting it from an embedded library. When selected the sky object its basic astronomical data together with its picture are showed and then simply touching the Go button the telescope moves toward it.

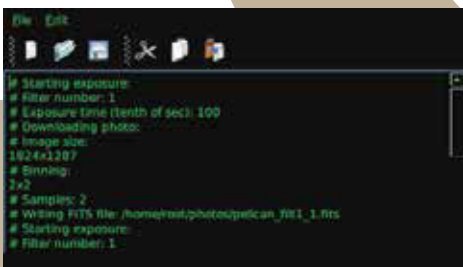
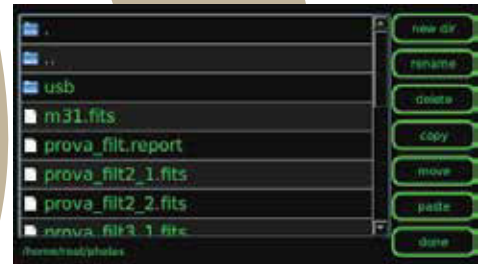


### < Auto-Guider

The autoguider tool is based on Lin\_guider Linux program and used to compensate for the tracking errors of the telescope mount during the exposure time. This sw is compatible with most guide cameras and mount actuators. Both video and actuator parameter are fully configurable. While guiding is possible to monitor drift graph, current values of corrections and statistics.

### File manager >

The File Manager tool is used to administrate the photos. The user can create a new directory and rename, delete, copy, move and paste a file.



### < Text Editor

The Text Editor tool is used to read, modify and save text files. It allows basic operations like copy/cut/paste of text using the menu or the icon bar.

## ACCESSORIES

A rich set of accessories are available: Touch-Screen 4.3' LCD, Filters for the integrated filterwheel, Opto-isolated Mount Cable, External 12V wall plug power supply, Serial Programmer camera cable, USB WiFi Dongle.

## ORDERING INFORMATION

**Mono** **AST8300-A-M-FW**

**Color** **AST8300-A-C-FW**



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