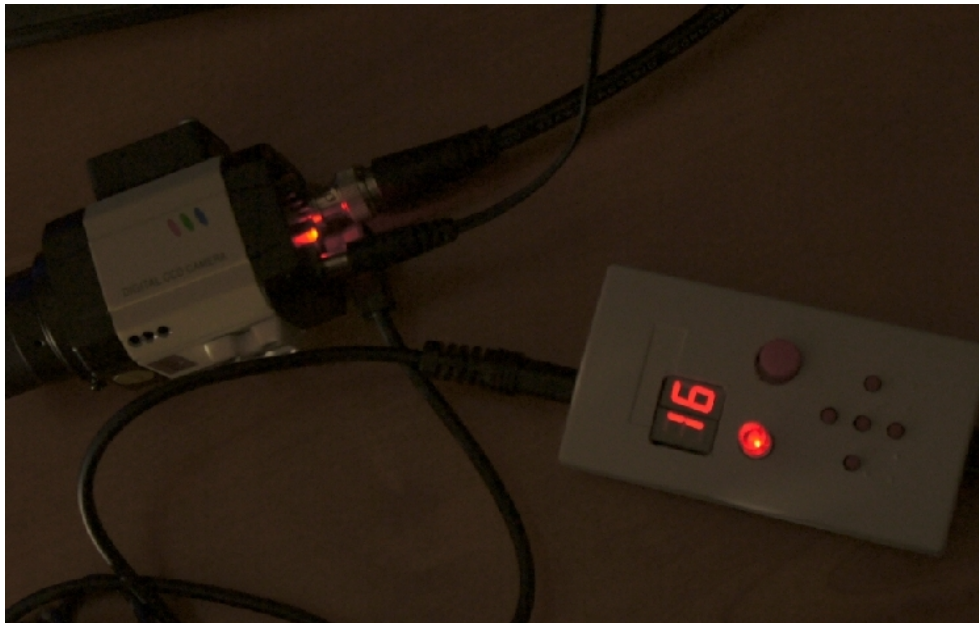


# **ASTRO-VIDEO SYSTEMS**

## **ADVANCED CAMERA OPERATING INSTRUCTIONS**

Copyright Astro-Video Systems , August 25<sup>th</sup> , 2013



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Users Support Group: <http://tech.groups.yahoo.com/group/astro-video>

**Note:** This equipment has been tested and found to comply with the limits for a **Class B** digital device pursuant to **Part 15** of the **FCC Rules**. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the receiver and the equipment.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- Shielded I/O cables to be used when operating this equipment.
- You are also warned, that any changes to this certified device will void your legal right to operate it.

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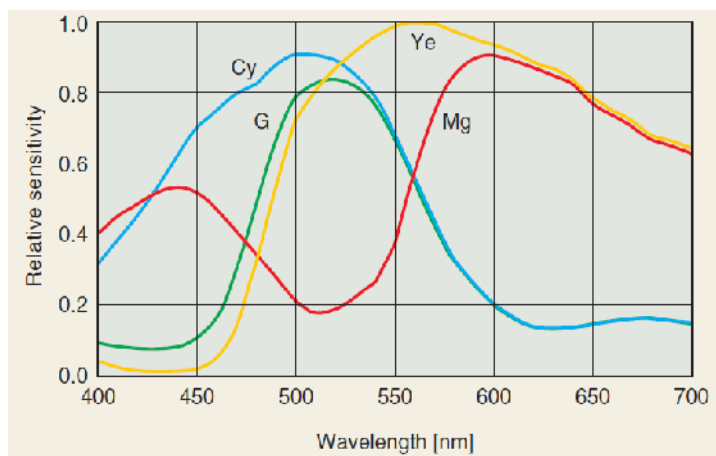
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## 1. Introduction

Congratulations and thank you for buying an Astro-Video Systems Advanced Camera model .

This camera has the following features and specifications :

- it is equipped with a 1/3" state of the art Sony 2<sup>nd</sup> generation SuperHad II CCD sensor of the highest sensitivity available today in any video camera .
- its sensitivity is rated by Sony at 2450mV , compared with the old gen 1 sensors at 1200-1400mV (depending on type) .
- YCMG complementary color filters matrix for maximum light transmission.
- extremely high sensitivity extending into near-IR , well past Hydrogen-Alpha spectral lines .



Left image shows relative spectral response of gen 2 SuperHAD CCD sensors as published by Sony .

- AMP-GLOW ELIMINATION circuit - this is NOT a digital gimmick. It does not work by digitally subtracting the amp glow signal after the fact to present an artificially uniform background of reduced dynamic range. This unique circuit simply drives the CCD sensor in a different mode than all other video cameras (because other video cameras are based on surveillance camera processors) . This new CCD drive mode simply DOES NOT GENERATE amp glow from the source , instead of trying to remove it later .

- lowest power design, generates lowest amount of self-heating .
- processor controlled variable speed fan based on internal temperature sensor .
- 9-14.5VDC operating voltage , ONLY 120mA max current draw . A modest 7Ah 12VDC battery pack would power the camera plus remote for 56 hours !

## 2. **Knowing Your Camera Parts**

Included with your camera are the following accessories :

- Astro-Video Systems Advanced Camera body
- 1.25" to C-mount adapter nosepiece
- 5mm C-mount spacer ring
- camera to remote handbox cable. This cable fits only one way and can not be plugged in any incorrect way. The remote cable to camera 4 pin connector is keyed and it too only fits the right way. The cable to remote connector is a 3.5mm coax plug. Please make sure this is plugged into the remote all the way , otherwise the remote will not power up.
- 12V car lighter adapter with red LED power indicator
- 20ft siamese video and power cable . The camera end of this cable has a male power plug , while the opposite end has a female jack (both 5.5mm with 2.1mm ). The power connection is center positive. There is a BNC to RCA adapter in case your monitor does not use BNC for composite video in .
- remote handbox



If any of the components in the left picture are missing , please contact Astro-Video Systems .

**IMPORTANT:DO NOT ATTEMPT TO DISASSEMBLE THE CAMERA. THERE ARE NO USER SERVICEABLE PARTS INSIDE . ANY ATTEMPT TO DISASSEMBLE THE CAMERA OR REMOTE WILL VOID THE WARRANTY .**

### 3. **Getting Started**

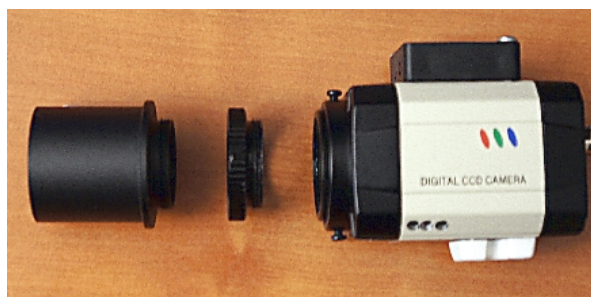
If you're familiar with video astronomy cameras , you can set up and start using this camera right out of the box.

REMOVE CAP:



Start by removing the cap off the camera C-mount .

ATTACH NOSEPIECE AND IF NEEDED 5MM SPACER:

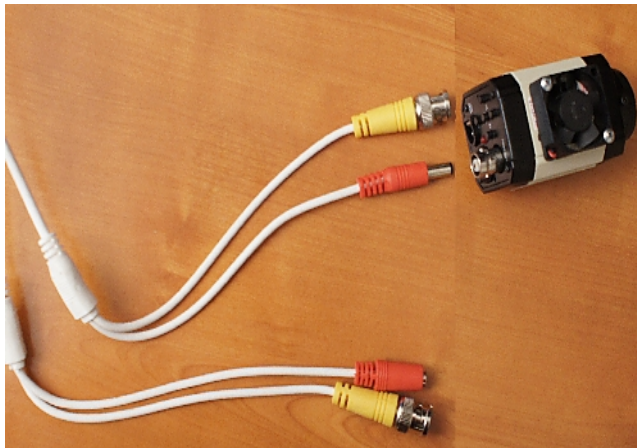


The camera has a standard CS-mount with a mount flange to sensor 12.5mm distance. If this distance is too small, it can be increased by adding spacers . Your camera was shipped with 1 pc. 5mm C-mount spacer .



This is what the camera, 5mm ring and 1.25" nosepiece should look like when assembled correctly.

## CONNECT POWER:



The power cable ends are NOT identical, one is male and plugs into the camera, the other is female and you plug the included 12V car lighter adapter into it .



## CONNECT BNC VIDEO AND REMOTE CABLES TO CAMERA:



Connect the BNC video cable to the camera and the other end to your monitor or video capture device .

If your monitor or video capture device uses an RCA style connector, use the included BNC to RCA short metal adapter as shown in above image .

#### 4. **Basic Connection - NO REMOTE**

A basic connection is achieved by plugging in only the video and power with no remote or computer connections, just as shown in the previous page image.

This has the advantage of a very simple and quick setup but has the disadvantage of being forced to use the camera OSD keys for any adjustments. Please note that in this configuration only the OSD menu functions are available.

**IMPORTANT :** Manual gain control is **NOT** available since there is no remote to control it.

All previously set menu options will be initialized with the values that were in effect when the camera was powered down.

Plug the 12V car adapter into your 12VDC power source (battery or AC/DC adapter) , switch on the monitor and you are ready to start viewing .



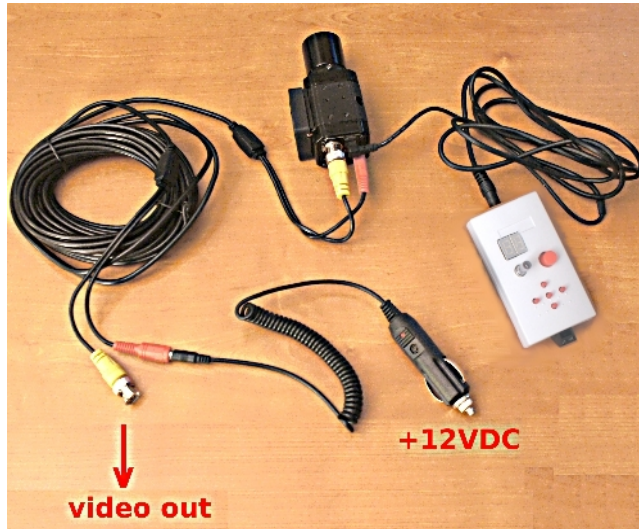
Your basic cable configuration should look like in the left image .

## 5. **Stand-Alone Remote Connection**

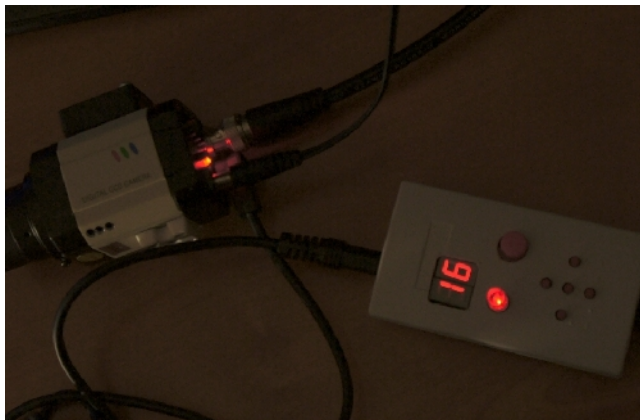
**NOTE: VERY IMPORTANT** - Go to SYSTEM Menu and set CAMERA ID to 1 .  
Set Baud rate to 38.4kbps or 38400 . The remote keys and computer control will not work with any other settings . Manual gain control is not affected.

A standalone remote setup consists of the camera with the power, video and remote cables plus the remote handbox connected , but no computer connection.

In this configuration, all camera functions are accessible from the remote , the manual gain , menu keys and image freeze .



This image shows a standalone remote configuration connection .



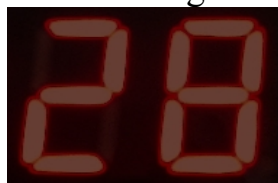
A 2-digit red LED display is situated on the remote right above the illuminated MANUAL GAIN CONTROL rotary knob .

A FREEZE IMAGE button is to the right of the manual gain control .

At power up the camera will start normally with a default low to medium gain .  
The remote gain display should read “16” in a dim red color .

If you're doing daytime terrestrial, solar etc observations, hold the large red FREEZE IMAGE key on the remote down while you power up.

The camera will start at a default low gain of “06” and the remote display will be much brighter in order to be visible outdoors during daytime.



Left image shows night time dim display, right side of image shows daytime brightness.

In both cases , after power up the user can still adjust gain to any desired value , the difference between the daytime and nighttime settings is the startup gain value and the display brightness .

Display brightness can only be changed at power up, in order to avoid being switched to bright accidentally during night observations .

**NOTE :** The remote handbox allows simultaneous use of the rotary gain control AND menu keys.

You may freely adjust the gain while you are in the middle of adjusting integration time .

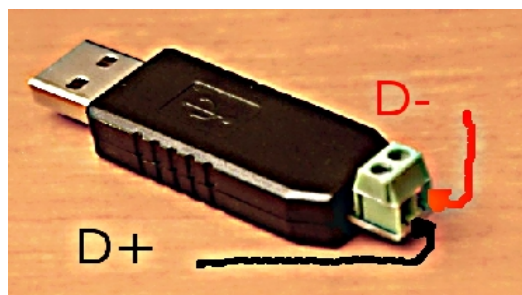
This is important because you do not have to navigate thru successive menus in order to adjust integration and gain one after another, they can simply be adjusted simultaneously . While you're in the integration time menu you can just turn the gain knob and see the results on screen immediately, without interrupting the menu operation of setting the integration.

## 6. Remote Computer Control

The remote handbox contains the necessary circuitry in order to allow computer control of the camera.

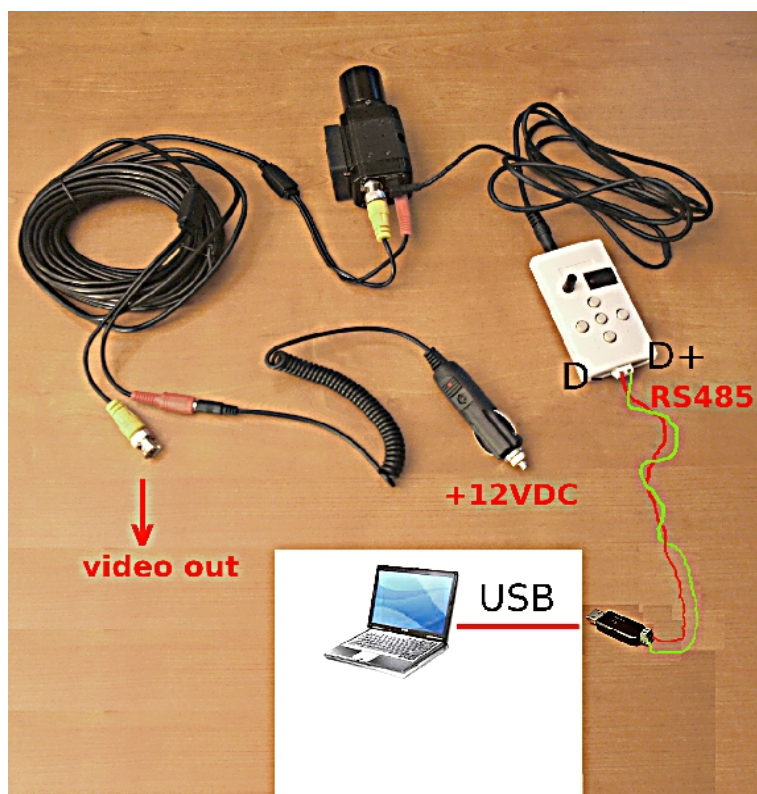
Use the supplied USB to RS485 adapter as shown below.

Connect any twisted wire pair to the USB to RS485 dongle noting the D+ and D- signals. Wire length can be up to 1000 ft .



Please note that RS485 control will not work if the wires are reversed (D+ wire connected to the D- screw terminal instead of D+ screw terminal ).

Connect the D+ and D- wires to the remote screw terminal block as in the photo below.

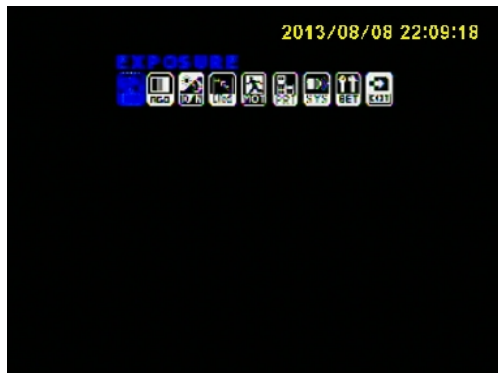


Install the USB to RS485 drivers downloaded from the Yahoo group FILES section .

Install the camera control software . Now you can control your camera remotely from your computer.

**NOTE:** computer control is only possible THRU the remote handbox as described . Do not attempt any other type of connection to control the camera . Any other type of connection to control the camera is not possible , will not work and will damage the camera and void the warranty .

## OSD Menu Operation



Pressing the center key opens the on screen menu top level , as shown in the picture to the left.

The LEFT/RIGHT keys are used to scroll horizontally thru the top menu icons.



Press the center key again and it opens the submenu for the icon that was highlighted in blue.

The leftmost is the EXPOSURE submenu .

Select NORMAL exposure using the L/R keys for all operating modes except for :

- very high dynamic range situations such as lunar viewing , when WDR can be used
- for synthetic coronagraph use HLI mode .



**NOTE :** Normal mode is linear . HLI, BLC, WDR are NOT linear and stretch the histogram based on different curves

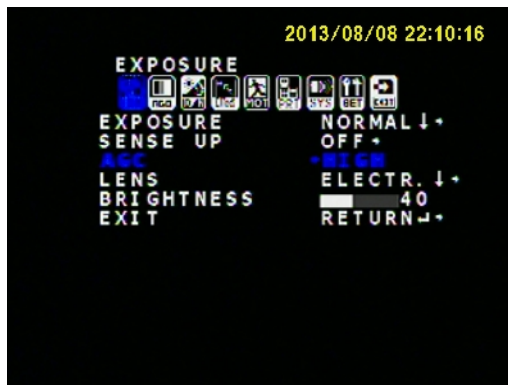


### SENSE-UP must be set to OFF

This is an automatic sense-up in which the camera attempts to set integration time based on an average scene illumination . It works on terrestrial targets but does not work on typical astronomical targets due to the large difference between the average scene illumination and target illumination.

### AGC must be OFF unless IN CAMERA

**FRAME STACKING IS USED for stacking up to 5 frames for up to 85 sec (3-D DNR).**



AGC must be set to low/med/high for 3D Noise Reduction to operate.

3D Noise Reduction “STACKS” successive image frames , a larger number of frames for the AGC HIGH and fewer frames for AGC LOW .

NOTE: IT WILL TAKE A FEW INTEGRATION CYCLES TO SEE THE EFFECT OF 3D NOISE REDUCTION. The higher the setting the more frames it takes for a final result.



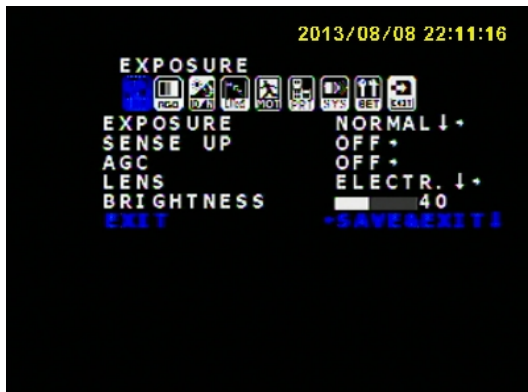
### Adjusting Integration Time

Scroll down to LENS and select ELECTRIC, then press the center key again to enter this sub-submenu .



Once in the ELECTRIC sub-submenu , scroll left and right to find the exposure time you need. Available values are from the longest single frame integration of x1024 cycles ( 17sec) to the shortest value of 1/100,000 sec (that is 10 microseconds) .





## Adjusting Manual Gain and AGC

The only way to adjust manual gain is via the remote or computer . The manual gain stays fixed at the value you selected, until you change it.

The manual gain is a real physical amplifier that exists in the camera, immediately after the CCD . It reads the CCD output at the gain you selected via the manual gain adjustment.

The Automatic Gain Control is a processing gain . It is the result of calculations performed by the camera's internal computer by adding and “stacking” successive image frames and then simply scaling the result . It is useful when 3D noise reduction from the ENHANCEMENTS menu is used, because that is the only time stacking several frames is performed in the camera.

## Gain vs. Integration Settings

Changing the manual gain readout by 10 counts has approximately the same effect on image brightness as changing the integration time by a factor of 2 .

The following combinations of integration and manual gain readout are producing the same image brightness:

x1024 and 13 , x512 and 23, x256 and 33 etc.

The following combinations are 2 full f-stops faster than the above:  
x1024 and 33 , x512 and 43 , x256 and 53 etc.

However, image noise increases more rapidly with increasing gain than with increasing integration time.

It is recommended to use the high gain + short integration settings for finding targets and for focusing, then switch to longer integration (with or without in camera up to 5 FRAME STACKING 3D-DNR) and lower gain to view noise free images .

**IMPORTANT FOR ALL MENU OPERATIONS: AFTER A SELECTION IS MADE , IT IS SAVED ONLY IF YOU SCROLL DOWN TO EXIT AND DO NOT EXIT! IF YOU EXIT ,THE CAMERA SIMPLY DISCARDS YOUR SETTING CHANGES. SELECT “SAVE&EXIT” AND PRESS SELECT (THE CENTER KEY) .**



## Adjusting Color Balance

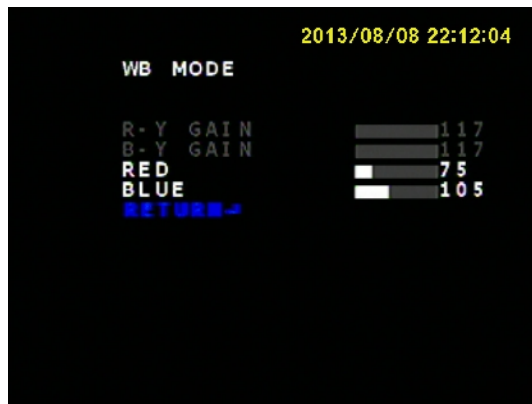
The Color Balance menu has several automatic modes , one push to measure and hold mode and a fully manual mode.



Manual mode is a good start because it is the only mode in which you know the exact color balance.

All other modes rely on the camera to measure something .

Manual mode relies on your input only.



In manual mode you adjust the gain for the colors RED and BLUE . A good starting point are the values shown in the left image.



The camera must be set to DAY if you want to observe in color. The camera must be set to NIGHT if no color (B&W only) operation is desired.



Under the EFFECT menu you can FREEZE/UNFREEZE the image but this function is performed a lot simpler by using the remote.

The MIRROR function allows mirroring along one or both axes in any combination .

### Using Digital Zoom



The DIGITAL ZOOM can be used for focusing on a star and temporarily zooming in at any power from x1.0 to x10.0 in small increments.

The digital image stabilizer and digital zoom are mutually exclusive .

### Adjusting Sharpness



A sharpness value of 20 is a good starting compromise . Lower values will give a softer image . Higher values might show more detail but there is a point past which sharpening artifacts become obvious in the form of black halos around bright stars .

### Adjusting Gamma



The GAMMA setting can be adjusted from 0.3 to 1.0 . A value of 0.3 brings up the most details from the dark image areas but a value of 1.0 has the most contrast. A value of 1.0 is used with LCD.

IF you use a LCD monitor, please set the MONITOR to LCD .

DPC must be set to AUTO in order for the camera to eliminate or reduce hot pixels .

The DPC effect will occur only after at least 3 integration cycles have elapsed since DPC was set .

## Compensating for Vignetting



Scroll down to LENS CORR.

Using the LEFT/RIGHT keys increase or decrease the amount of vignetting compensation that is applied.

A value of 0 means no compensation applied.

Vignetting compensation is applied in the form of variable gain which increases radially starting from the lowest gain value in the image center .

Its function is to apply a flat field correction.

## 85 sec In-Camera Stacking, 3D Noise Reduction , DPC

In hot environments the camera CCD will show more noise due to higher temperatures . Approximately 6 degrees increase in sensor temperature double the amount of noise .

The camera processor is capable of eliminating this noise by in camera stacking up to 5 successive frames.

The number of successive frames that are stacked is adjusted by selecting the 3D-DNR intensity in the range from 0 to 5.

0 means NO 3D-DNR is applied, 5 is the maximum. A setting of 5 means the camera stacks 5 successive frames . Please use this setting with the understanding that it will extend the integration time considerably. Stacking 5 frames of 17 sec each means a total integration time of  $5 \times 17 = 85$  sec (NTSC) to  $5 \times 20 = 100$  sec (PAL) .

This represents a total integration time of around 1 min and 1/2 and while a very powerful integration tool, increases the demands on mount tracking and polar alignment.

NOTE: the GAIN applied to the 3D-DNR process is set in the EXP menu by the AGC setting. If AGC is set to OFF the 3D-DNR will have almost no effect. The higher the AGC setting, the more effect 3D-DNR would have.

3D-DNR is based on stacking successive frames and as such, you need to be patient and allow the time for the camera to stack the number of frames.

The DPC function automatically removes hot pixels by digitally subtracting them. IT only has 2 settings, OFF and AUTO. There are no user parameters to adjust.

DPC also needs several successive frames to operate. As such, it will take several integration cycles to complete after the function is turned on OR AFTER INTEGRATION TIME WAS CHANGED , before hot pixels are removed.

## System Settings and RS232/485 Communications



The camera must be set to COMM ID = 1 .  
Any other COMM ID setting will result in the camera ignoring all further commands from remote or computer .

The BAUDRATE must be set to 38400 .  
Any other BAUDRATE setting will result in the camera ignoring all further commands from remote or computer , with the exception of MANUAL GAIN which will continue to operate .

TITLE can be switched on in order to overlay any user entered text .

**WARNING: DO NOT RESET CAMERA TO FACTORY SETTINGS FROM THE “EXIT” MENU. ALL YOUR SETTINGS WILL BE LOST. THE CAMERA WILL DEFAULT TO A CHINESE MENU AS SHOWN BELOW.**

## How to Exit the Chinese Menu and Restore Language Setting



Press the center SELECT key on the camera back or on the remote .

Your screen will display a menu similar to the image on the left.

Using the LEFT/RIGHT keys, move the blue highlight to the icon showed in the photo .

Press the SELECT center key.

This opens the SYSTEM menu but in Chinese as shown. Use ONLY the DOWN key to scroll down to the 5<sup>th</sup> position from top (CAMERA ID) .

Use now the LEFT/RIGHT keys to scroll thru the language selection.

After you made your selection, scroll down to EXIT and DO NOT EXIT!

Scroll RIGHT/LEFT until you reach SAVE&EXIT and select it , then press the center key. Only now your selection is saved.

## Specifications

Camera type	- composite video NTSC or PAL (must be selected when ordering)
Sensor	- ICX810AKA/811AKA SONY SuperHAD II CCD
Color filters	- complementary YCMG (yellow cyan magenta and green)
CCD size	- 1/3" size ( 6mm diagonal )
CCD defects	- CCD class 1 or better

Exposure time:

SHUTTER: - 1/100,000 sec (10microseconds) , 1/10,000 , 1/4,000 , 1/2,000  
1/1,000 , 1/500 , 1/250 , 1/120 , 1/100 , 1/60

LONG EXPOSURE

- x2 to x1024 (17sec) in single frame mode , or up to 5x17sec in  
3D-DNR internal frame stacking mode

FRAME STACKING in camera up to 85 sec NTSC/ 100sec PAL

- in camera up to 5 frames :  
17sec x 5 = 85 sec (NTSC)  
20sec x 5 = 100sec (PAL)

Gain	- HIGHEST GAIN with NO AMP-GLOW EXCLUSIVE CIRCUITRY - no other camera on the market has this circuit
Operating temp	- between -30 C to +60 C (Sony does not guarantee ANY type CCD sensor above +60C )
Dimensions	- 65mm x 42mm x 42mm
Video output	- BNC connector 75 Ohm
Power connector	- 5.5mm plug , 2.1mm center positive
Power	- +9VDC to +14VDC
Current	- less than 0.12A including remote (with fan running) - 0.1A for frame integration mode long exposures
Cooling	- temperature sensor , processor controlled variable speed fan
Communications	- RS485 , baud rate 38400 , camera ID =1 , PELCO-D protocol

Camera Processors:

1 pc 32 bit ARM based DSP with 8MB RAM

2 pc (one in camera and another in remote) 8 bit auxiliary processors

Camera DSP Processing Functions:

Exposure - linear (normal), wide dynamic range (100dB dynamic range) , BLC (back light compensation) , HLI (highlight inversion) = synthetic coronagraph with user adjustable inversion level

Gain control - Manual gain control camera front end for unmatched performance by any AGC type camera

Color balance modes - ATW , AWB , Manual , Push

Color modes - Color, B&W

Image FREEZE from remote , computer or camera keys

Image mirror left/right/up/down

Digital zoom - user selectable ON/OFF

Digital zoom range - from x1.0 , x1.1 , x1.2 to x10.0 in fractional increments

Image sharpness adjustment - continuous in 0 to 100 range

GAMMA - user selectable 0.3 , 0.45 , 0.6 , 1.0

**3D\_DNR - IN CAMERA NOISE REDUCTION BY IN CAMERA FRAME  
STACKING up to 5 frames for 5x17sec total integration time .**

CRT and LCD monitor settings

Automatic Pixel Correction - DPC (defective pixel correction) - user selectable  
ON/AUTO

FLAT FIELD CORRECTION - user adjustable from 0 (no correction applied) to 100  
(max correction applied). This compensates for vignetting in  
the telescope optical path , WITHOUT needing to take flats  
or use software!

REMOTE CONTROL HANDBOX :

- manual gain adjustment (red illuminated rotary control with detents ),
- manual gain digital display,
- user selectable display brightness
- menu keys
- IMAGE FREEZE button
- RS485 interface for computer connection included in remote

## **UPGRADING**

The Astro-Video Systems Advanced Camera firmware upgrades are free for the lifetime of the product.

Your camera hardware can also be upgraded to the next level of the **Peltier Cooled Unlimited Integration Advanced Camera** .

The Advanced Camera Complete System is also eligible for the Astro-Video Systems trade-in program (see website for details).