RunCam Night Eagle Astro (first prototype version)

Tony George, March 9, 2017

Out of Box Evaluation

Attaching Connecting Cables

The first thing to do is to mount the cables to the camera. There are two cables:

- Power and video cable
- Menu selection Dongle

The power and video cable has a very thin wire to a very small two-prong connection to the camera. Initially, we had concerns about this connector surviving strain during use. To combat this, I attached the mounting bracket supplied in the package. With the bracket bar positioned along the back of the camera, I wrapped the cable around the bracket bar. This way, a tug on the cable pulls on the bracket bar instead of the connector. Here is a picture of the installation.

The Menu Selection Dongle has a much sturdier multi-pronged connector and larger cable. This can be connected directly to the camera.

Once the connectors are attached to the camera, just plug a 12V DC power supply to the camera power connector (a standard female 5.5mm/ 2.1mm center positive connector) and the camera will power up. The camera can accept any voltage between 5V and 21V DC. Testing has indicated there is no significant difference in camera performance with voltage setting.

First Impression on Power-Up

On power up, with the wide-angle lens attached and the lens cover on, the screen appears as a light gray with noise. I noticed that if I put the camera in the box it came in with the cover over the box and the cables dangling out the side, that the screen color got darker. This is an indication that the camera case is not totally light proof.

The camera came up in NTSC mode, with Max Gain setting at 9. With the menu selected, the background showed a distinct fluctuation in brightness in this mode, somewhat brighter and then darker. This fluctuation was not seen when the menu screen was off. The fluctuation disappeared after the camera was switched to PAL mode and then switched back to NTSC mode. PAL mode appeared to be more stable for this prototype camera.

There is one main menu.

The only menu selections that will be commonly used by astronomical observers are the:

- Image
- Video Standard
- Save and Exit

These will be discussed individually below.

Image

Here is the main menu for the Image submenu:

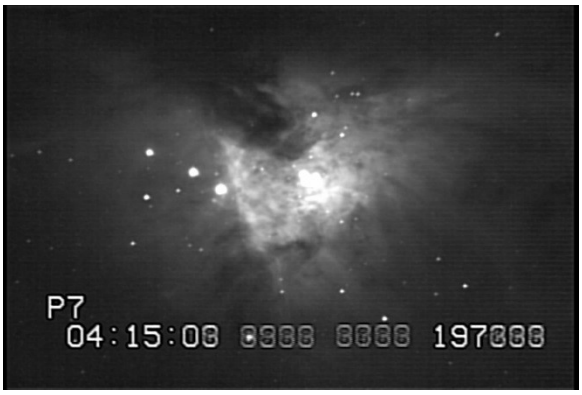
Sub Menus

- Max Gain – this menu has 9 settings, 1-9. These settings control the maximum gain used in the camera. When the field is very dark, these setting have an effect on how bright the stars will be. You can use this setting to control the degree of saturation of bright stars. However, when the field is bright, such as with the moon, they will have no effect, since the lowest gain setting will render the moon too bright to view. The Brightness menu has to be used to control the settings for bright scenes.
- Night Shutter – this menu has three settings, 1, 2, and 3. Night Shutter controls the degree on integration used in the camera.
    - NS1 is 2x integration – two fields integrated into one frame.
    - NS2 is 4x integration
    - NS3 is 8x integration
- 3D-NR – this menu has two settings – Auto and Manual. We did not see any effect of this setting at the Max Gain setting. Recommend this setting be set to Manual 0, for now until we understand this setting better.
- WDR – the menu has two settings – ON and OFF. ON has the effect of adding Gamma to the image, that is, enhancing low intensity light and reducing high intensity light. We recommend that the setting most conducive to the best visibility of the target star be used if photometry is

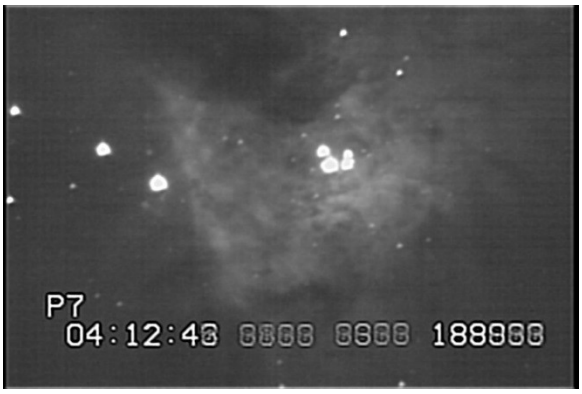
not a factor, such as when a simple occultation is expected. If photometry is a factor, use OFF, which should make the photometry of small mag drops or double stars more precise.

- Image Enhance. There are two sub menus for this setting – Sharpness and Saturation.
    - Sharpness: Has two settings, AUTO and MANUAL.
        - AUTO appears to start up in MANUAL 0
        - MANUAL has 15 settings, with 0 the least aggressive and 15 the most aggressive. A setting of 15 appears to enhance (brighten) fine detail in the same fashion that WDR ON enhances background noise.
    - Saturation: Has two settings, AUTO and MANUAL. Neither setting appears to have much effect at Max Gain. This may be a hold-over from a previous menu used in color cameras.
- Mirror has two settings: ON and OFF. OFF is normal view. ON, the image is reverse mirrored.
- Brightness: Controls the maximum brightness of the brightest portions of the image. It can be controlled between 8 and 250 in steps of 4 units, with 250 the maximum setting. This setting can be used to cut the brightness of very bright images such as the Moon to allow imaging of craters and lunar limb. It may also be helpful in the observation of lunar occultations to cut down lunar glare when bright stars are approaching the lunar limb. We recommend leaving this set to 250 unless observing the Moon. This setting will have no effect on the brightness of stars in a dark field, as Max Gain controls star brightness.
- Zoom In: This controls the image scale. It has 6 settings from 0 to 5. 0 is the widest angle view. 5 is the maximum zoom possible. Here are two images of M42indicating the effect of the zoom control:

  Zoom = 0



  Zoom = 5



Video Standard

There are two settings for Video Standard: NTSC or PAL. Set the camera to one setting that is compatible with your capture device. In North America, video recorders are typically set for NTSC. In Australia and Europe, they are set to PAL. Capture devices such as the StarTech SVID2USB23 device can handle each camera type, although the StarTech MUST be 'set' to accept each one using a program called Movavi, or, it can be set using a new capture program IOTA Video Capture [at the time of writing this review, the ability to change the StarTech setting is only available in a beta version].

Save and Exit

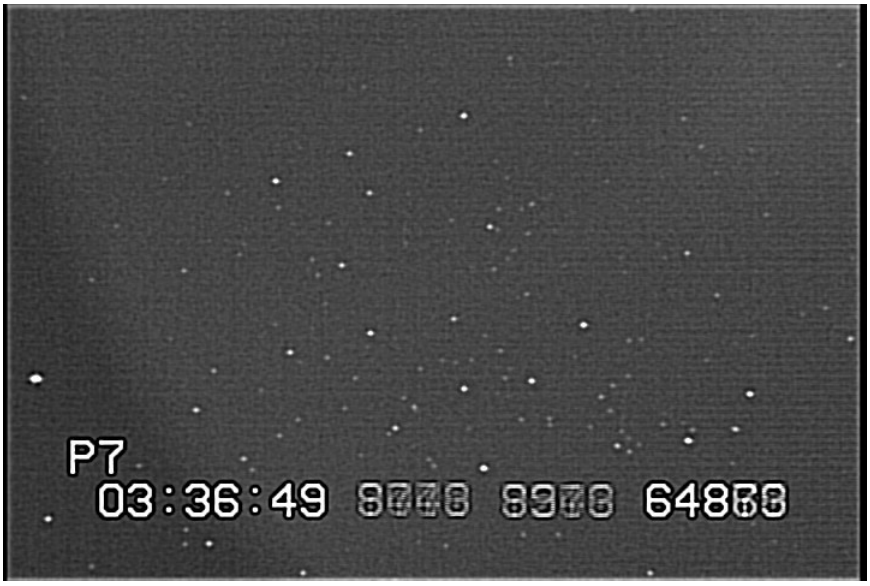
When you have selected the settings you want on Start-Up, press Save and Exit. Your settings will be saved. You can always return to the Factory settings by using the LOAD DEFAULT menu.

Camera Evaluation

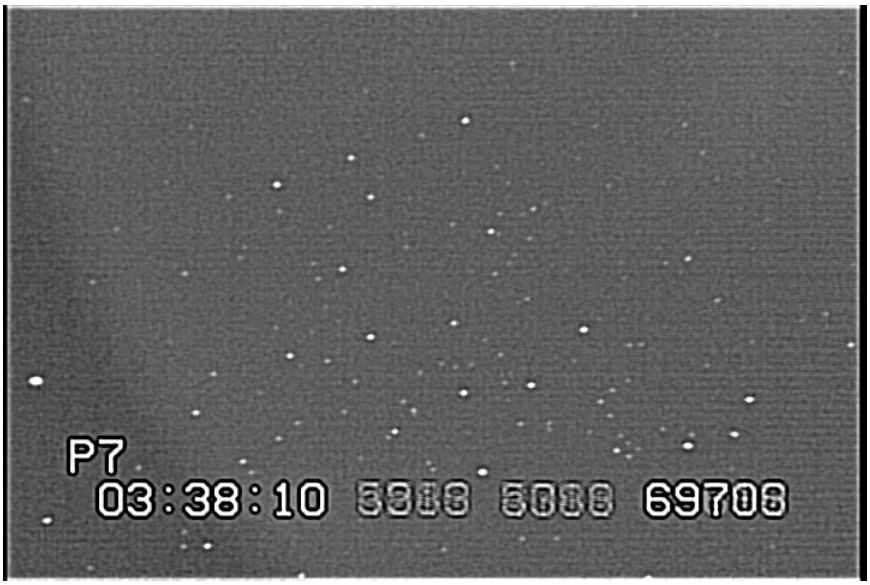
So, how does this camera work in real application? Various test were run to compare the Night Eagle Astro to other popular cameras used by IOTA observers. These include the WAT910HX (or BD), the higher-cost 'standard' of cameras currently in use, and the PC164C-EX2, the older lower-cost standard which is no longer available for purchase.

A 12-inch Meade LX200 GPS was used for testing. An f3.3 focal reducer was used in the field. M67 was used as a comparison star field for the WAT910HX and the Night Eagle Astro. The full moon was located only 10 degrees away from M67. 100 frames were stacked in Registax to enhance the visibility of the faintest stars. 100 frames were stacked in each test. Here are the comparative images, all taken at no integration:

Night Eagle Astro – WDR OFF

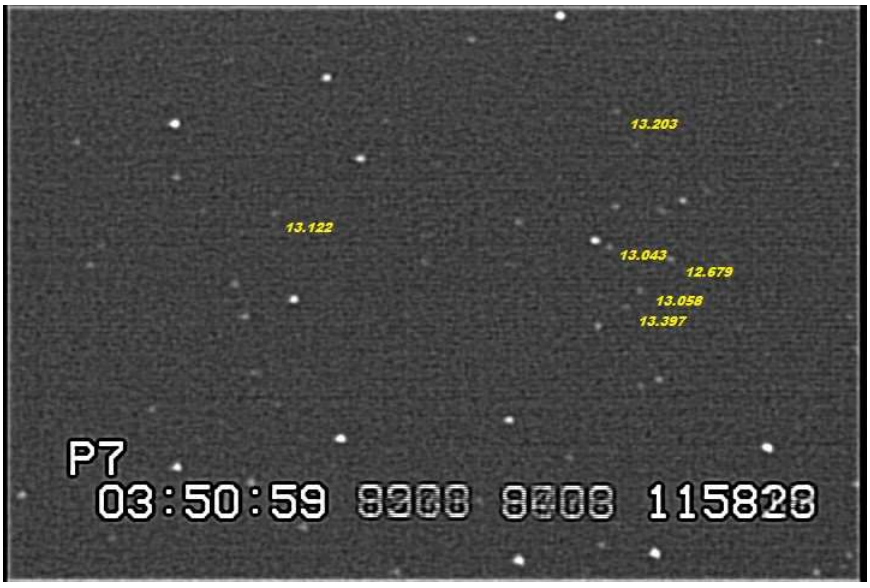


Night Eagle Astro – WDR ON



WAT910HX – Max Gain, Gamma = 1.0, Shutter = 1/60 sec

The Zoom In setting was used to better evaluate the limiting magnitude of the Night Eagle Astro. Here is the image annotated with star magnitudes from the UCAC4 catalog:

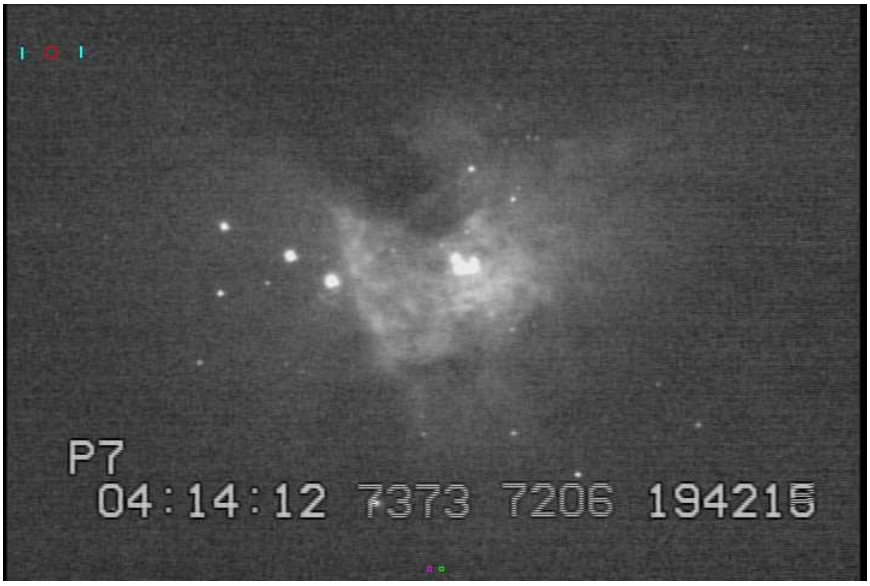


Stars down to magnitude 13.2 were visible. For occultations with large magnitude drops and 2-3 second durations, events with combined magnitudes of 12.5 could easily be captured with the Night Eagle on the 12-inch telescope at f3.3.

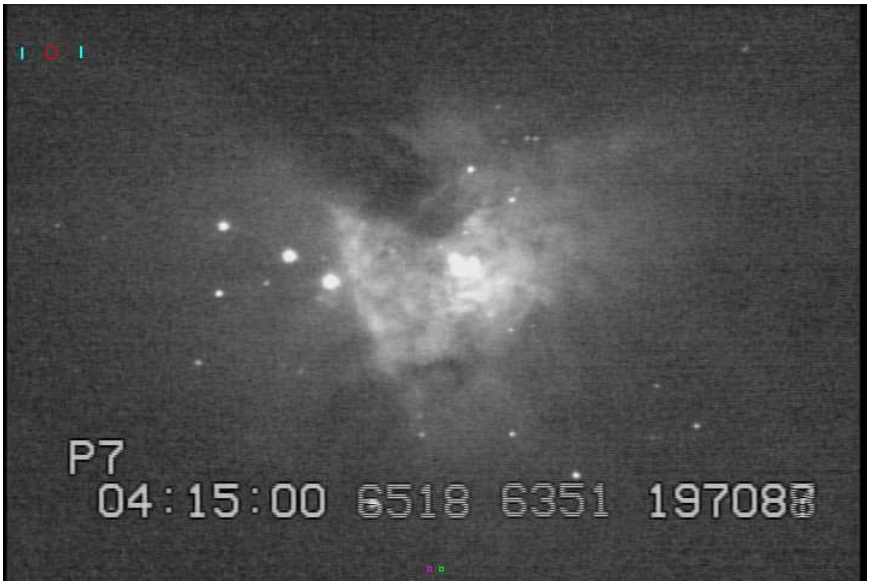
The new Astro version has a Night Shutter mode. This is three levels of integration. The default setting is NS1 or 2x (2 fields) integration. NS2 is 4x and NS3 is 8x. The following three images of M42 shows the differences between the three settings. All images were WDR OFF and MAX GAIN = 9.

NS1

NS2

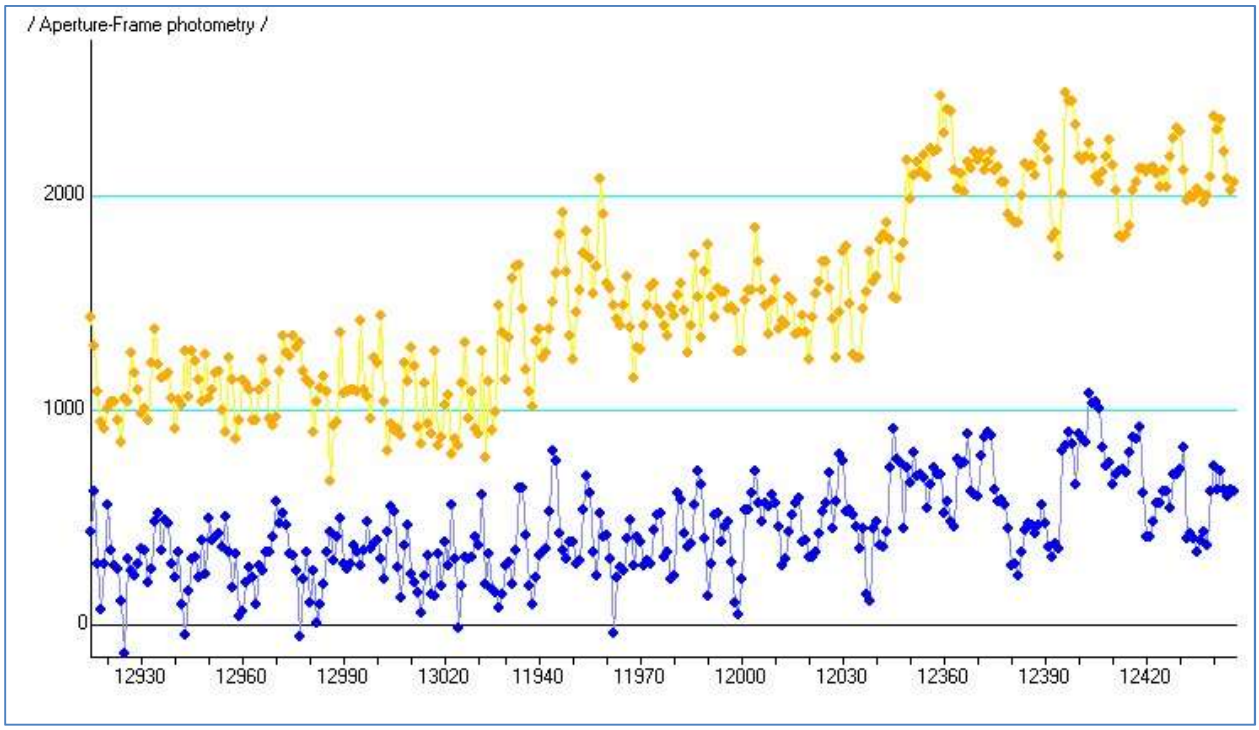


NS3



It is apparent that the Night Shutter settings extend the magnitude range of the camera beyond the limiting magnitude of non-integrating camera.

The Night Shutter mode was also evaluated by analyzing the brightness of two field stars in the M42 image in Limovie. Here is the light curve:



The gold trace shows three distinct steps in the star brightness between NS1, NS2, and NS3. Between NS1 and NS3, the measured brightness doubled. This allows the Night Eagle Astro to outperform other non-integrating CCD video cameras available for occultation astronomy.

The Brightnes setting was tested for use in lunar occultations. Here are two samples:

Brightness set to 250, notice the maximum brightness of the image allows saturated areas.

Brightness set to 8, notice that the glare is gone and lunar limb is visible. The brightness of stars approaching the lunar limb will be suppressed.

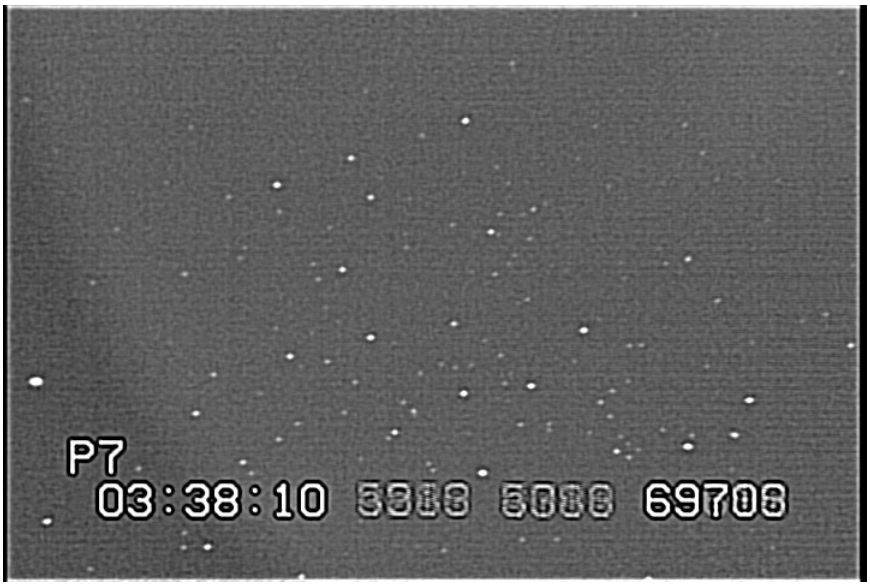
Observers of lunar occultations will have to find the best balance of Brightness setting to use for the brightness of the moon's limb and the brightness of the approaching star.

Wide Dynamic Range (WDR)

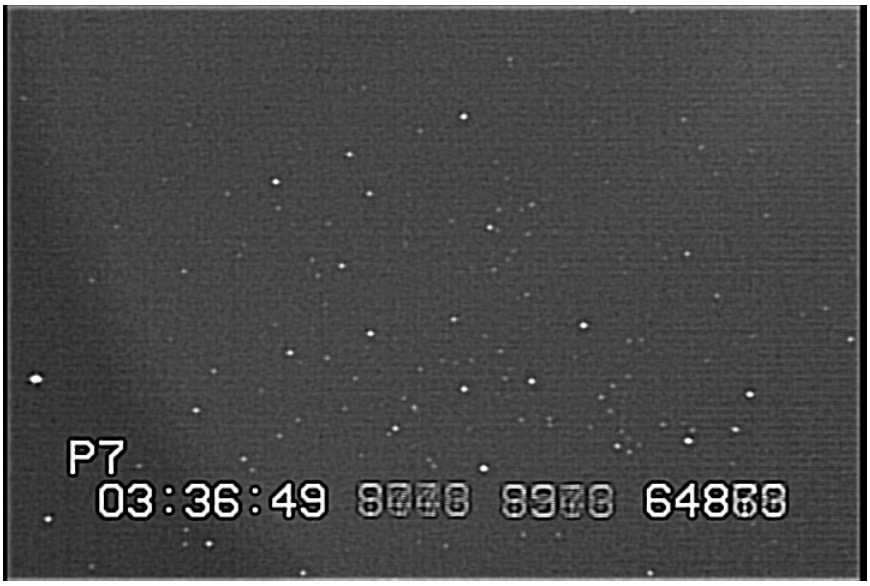
Wide Dynamic Range is used to compress the dynamic range of the camera so that brighter areas can be shown without saturation and faint areas can be enhanced so faint details are more visible.

Here are two examples of a stacked image using Registax to show the available detail in an image of M67 with WDR ON and OFF.

WDR ON:

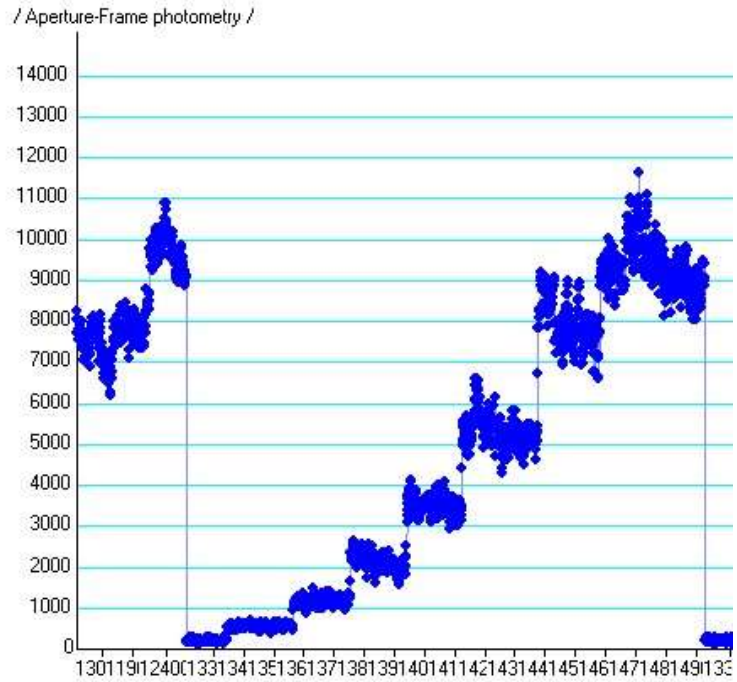


WDR OFF



WDR works much like extreme gamma settings do in other cameras.

Max Gain was reviewed by observing M42 and switching the gain setting from 1 through 9. A single star was imaged and the brightness analyzed by Limovie at each of the gain settings. Here is a chart of the results:



The increase in gain can be seen by the 9 steps visible in the light curve. One thing noticed in this light curve is that the gain setting at higher gain levels overshoots the initial gain and then stabilizes to a lower gain level. In practice, this should not be an issue for occultations, but for events where more

precise photometry is desired, the observer should not change gain settings immediately before the event to allow the gain setting to stabilize before the event is recorded.

Conclusions

The Night Eagle Astro is a better camera than the Night Eagle. It is better suited to occultation astronomy as it now has Gain control and Integration at three levels, extending the useful limiting magnitude of any observing system. Since the Night Eagle was previously found to be equivalent to the PC164C-EX2 camera, the Night Eagle Astro is also a better camera than the PC164C-EX2. It will be a suitable replacement for this older camera that is being phased out because it is no longer for sale and also because the older cameras are showing increasing numbers of hot pixels. To date, the RunCam Night Eagle and the Night Eagle Astro have not shown ANY hot pixels in testing.

The Night Eagle Astro is going to be offered as a co-branded product. That is, it will be advertised as being approved by IOTA. IOTA will have the ability to review future revisions to the camera and/or ask for future improvements. When the camera is available for sale, a website link will be provided for IOTA members to purchase the camera.