

INSTRUCTION MANUAL

Orion® StarShoot 5 MP Solar System Camera

#52097



 **ORION**
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Figure 1. The 5 MP attached to telescope for solar system imaging.

Congratulations on your purchase of the Orion StarShoot 5 MP Solar System camera (5 MP). The 5 MP is a high resolution color CMOS camera designed for solar system imaging. The 5 MP can be used for the following purposes:

- Lunar Imaging
- Planetary Imaging
- Solar Imaging
- Terrestrial Imaging

Parts List

- Orion StarShoot 5 MP Solar System Camera (5 MP)
- 1.25" Nosepiece
- USB Cable
- Software CD
- Manual

System Requirements

Computer

The 5 MP requires a computer running Windows XP, Vista, 7, 8 or Mac OS X. The computer hardware should have at least the following:

- Pentium™ III Processor
- CD-ROM
- Connection to the Internet
- 512MB RAM
- Disk Space – 10GB or more is recommended
- Video Display –16-bit color or higher, 1280 x 960 or higher is recommended
- Mouse
- USB High Speed 2.0 port

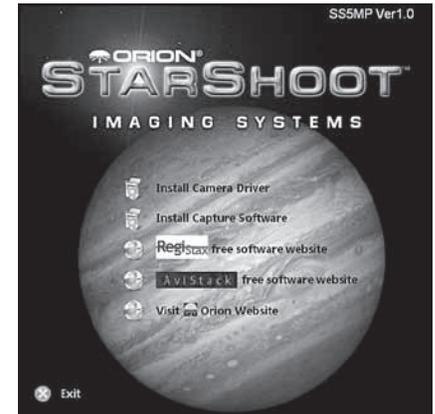


Figure 2. The launcher window (Windows).

Software and Driver Installation

Before the 5 MP can be used, software and camera drivers must be installed onto your computer. Do not connect the camera to your computer before you have installed the software.

Windows Software Installation

1. Insert the CD-ROM and wait for the Launcher window to appear (**Figure 2**). If you are using Windows Vista or Windows 7, the **AutoPlay** window will appear first, and then select **Run autorun.exe**
2. When the launcher appears, select **Install Camera Driver**. Go through the prompts until the driver is installed.
3. Once the camera driver is installed select **Install Capture Software** (which will install **Orion EZPlanCap**).
4. Links are also provided in order to download post processing software **RegiStax** and **AVIStack**. These are valuable tools that add to the astro-photographer's arsenal of post processing software.

Windows Installation of the Camera

1. Once the software installation is complete from the steps above, connect the **5 MP** to your computer's USB port using the provided USB cable.



Figure 3. EZPlanCap software (Windows).

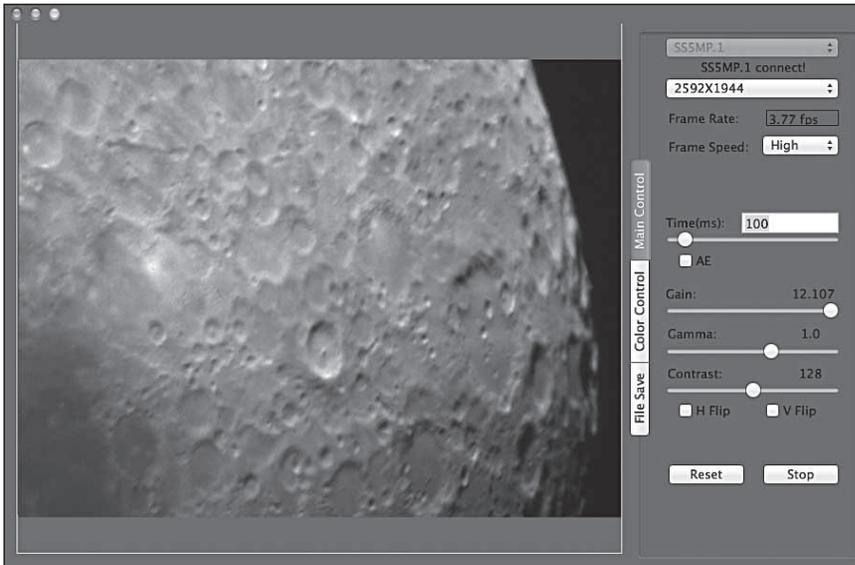


Figure 4. EZPlanCap software (Mac).

2. In Windows XP a **Found New Hardware Wizard** will appear. Windows 7, 8 or Vista will automatically install the device.
3. Windows XP will ask if you want to search for drivers and updates online. Select **No, not this time** and click **Next**.

4. Next, choose **Install the software automatically**.
5. Windows may note that the driver has not passed Windows Logo testing. This is normal. Click the **Continue Anyway** button. When the Wizard has completed, click the **Finish** button.

Windows Vista, Windows 7 and Window 8 will automatically detect and install the camera to your computer.

Mac Software Installation

Insert the CD-ROM and wait for the window to appear. Read the file "read-me.pdf" for installation instructions.

Also included on CD is Lynkeos a post processing tool for Macs. This software contains common post processing tools such as alignment and stacking for your planetary images.

Using the Camera for the First Time

We recommend using the camera for the first time in daylight to become familiar with the software interface and camera settings.

1. Setup your telescope and use an eyepiece to locate an object outside that is 200 yards or more away.
2. Plug the **5 MP** into your computer's USB port.
3. Remove the eyepiece and insert the **5 MP** into the 1.25" eyepiece holder on your telescope (**Figure 1**).
4. Open **Orion EZPlanCap** and select a resolution to connect to camera (**Figure 5 & 6**).
5. Windows users press the button "**Start Camera**" to connect to camera and begin streaming live video. Mac users press the "**Live**" button to connect with camera and begin streaming live video.
6. If no camera is seen, check cable connections and camera driver installation.

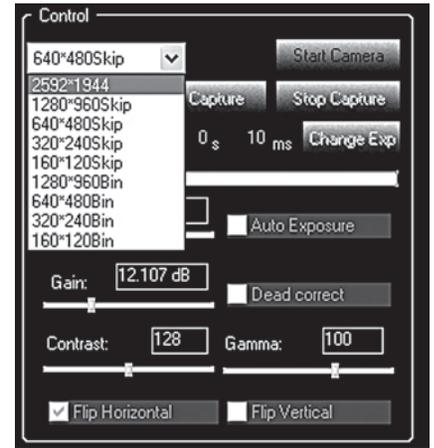


Figure 5. Selecting resolution (Windows).

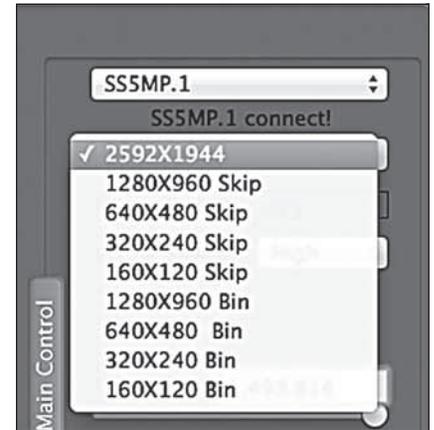


Figure 6. Selecting resolution (Mac).

7. If the image is white on the screen, it's overexposed. Adjust the exposure and gain as needed to reduce the brightness. For terrestrial imaging click the auto exposure (AE) checkbox. Uncheck to manually adjust.
8. Focus telescope until you get a sharp image on your computer screen.
9. To automatically select the white balance (WB) for color correction Windows users press “**One Push WB**” (Figure 9), Mac users press the “**White Balance**” button (Figure 10).
10. Experiment with the different camera settings. The exposure and gain will be the most frequently used settings.

GAIN: This is represented as a percentage of the total gain. Move the slider back and forth to adjust gain (Figure 7).

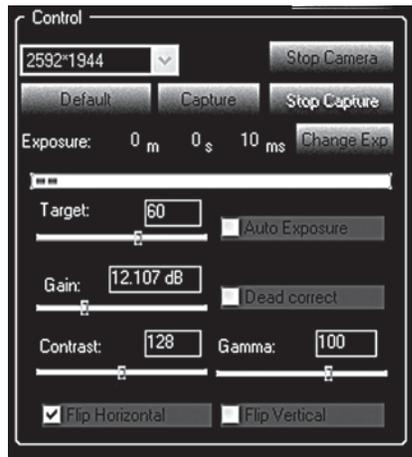


Figure 7. The camera Control interface (Windows).

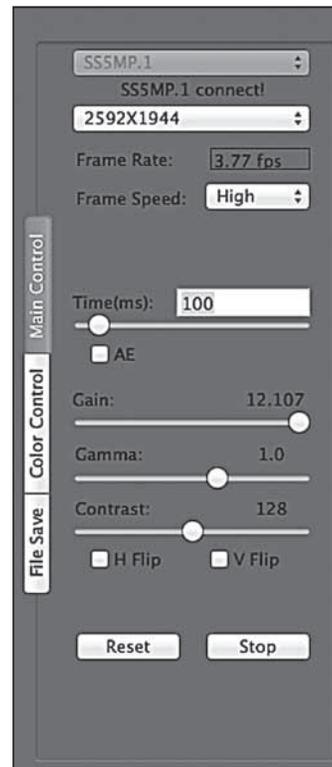


Figure 8. The camera Control interface (Mac).

EXPOSURE: This is represented in milliseconds. Move the slider back and forth to adjust exposure (Figure 8).

Windows users press “**Change Exp.**” and enter the value (Figure 7).

Dark Frame Correction

All CCD and CMOS cameras have inherent noise which becomes more apparent with longer exposure images. If you require taking longer exposures (typically longer than 3 seconds) you may start to see background noise, vertical lines and bright dots (hot pixels).

To automatically remove the noise and hot pixels, dark frames are used to subtract the noise and hot pixels from the live images. Best results are accomplished by capturing many dark frames and averaging them (Median Combine) into one resultant frame.

In order create dark frames the camera must be covered so that light is blocked from passing into the sensor. If using a telescope this can easily be accomplished by placing the lens cap on the telescope.

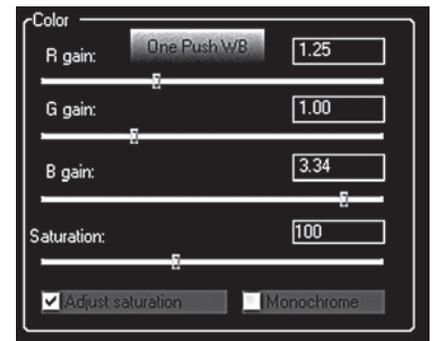


Figure 9. The Color interface (Windows).

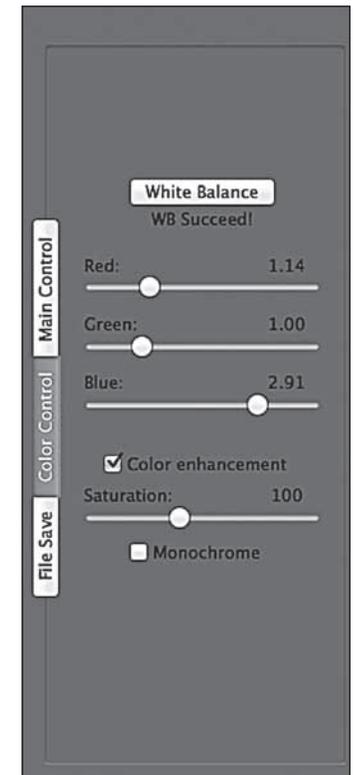


Figure 10. The Color interface (Mac).

To capture dark frames select the number of images to take (Dark Frame Quantity) and press the Calculate button (Figure 11 & 13). The user will now be prompted to cover their telescope and recording will begin.

When all dark frames have been recorded according to the value in Dark Frame Quantity, the user will be prompted to remove the lens cap. Before removing the lens cap select the dark frame removal checkbox. Notice how the image is much darker and cleaner. Remove the lens cap and see the difference. Higher gain and exposure values will benefit most from dark frame removal.

Note: Dark frames must match the live image resolution, exposure and gain values in order to work correctly. If you change any of these settings be sure to also retake the dark frames.

Image Capture

Select file format and press capture button (Figure 7 & 13).

Multiple images can be captured sequentially by entering the number of images to capture in the box (Figure 11 & 13).

Movies can also be captured in AVI format (Windows) or MOV format (Mac).

Note: Mac users can adjust the frame speed between low, normal and high (Figure 8) in order to reduce USB download speed problems. Switch to Low or normal if taking movie in full resolution to eliminate graphical glitches.

Planetary Imaging

Planetary imaging is also referred to as Solar System imaging, and includes the Moon, the Sun (with a proper full aperture solar filter!), the planets, and miscellaneous objects in Earth's orbit such as the International Space Station (ISS). The 5 MP is capable of capturing all these objects in real time.

Just about any telescope is suitable for the 5 MP when imaging the planets. The longer the focal length of the telescope, the larger and more detailed the images will appear. Unlike deep space astro-imaging, you actually want to have

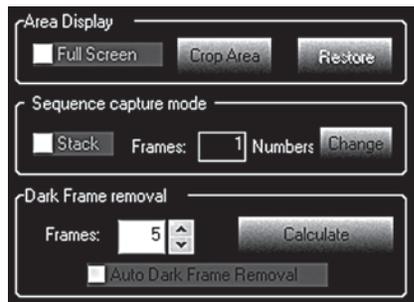


Figure 11. Dark Frame Removal (Windows).

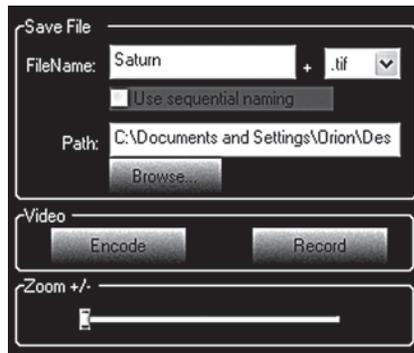


Figure 12. Saving files and Zoom (Windows).

a long focal length and focal ratio for planetary imaging. Adding a 2x, 3x or higher Barlow to the telescope to increase magnification is not uncommon for planetary imaging (Figure 14). The planets and other solar system objects are relatively bright and can be imaged with a darker or “slower” focal ratio.

To help capture those brief moments of good seeing, planetary imagers can select a smaller resolution to increase frame rates.

Select binning modes such as 640x480 4x4 for increased sensitivity (Figure 5 & 6). This mode gives great performance and sensitivity which is highly suitable for planetary imaging.

Smaller resolutions are generally better for short exposure, high magnification images.

High power planetary imaging often leaves the best focus up to your eyes when monitoring the live image. Use the zoom tool to aid in focus.

Select the fastest exposure time possible so that images appear less blurred and set the gain as high as possible without introducing too much graininess. Experiment with your telescope and camera to find the optimum settings for your particular setup.

The best planetary images will be obtained by aligning and stacking (combining) many individual images in order to improve image contrast, brightness, and detail.

A great way to obtain images for stacking is to take several seconds of video of the planet, then import the video into post processing software. Since the 5 MP has a maximum frame rate of 50+ frames per second at 640x480 resolution, you can literally obtain hundreds of images for stacking in seconds! You save time by taking one video instead of dozens of individual pictures!

It is recommended to capture hundreds (or even thousands) of frames when planetary imaging. The large amount of frames (either still images or movie file) can then be processed using stacking and aligning software such as RegiStax to give the best results.

Since you will be taking multiple images over a period of time, it is important you have a decent polar alignment in order to keep the planet within the field of view of the camera. To this end, having a motor drive (at least single-axis) will also be helpful. Otherwise, you will periodically need to rotate the R.A. slow-motion knob to keep the planet within the camera's field.

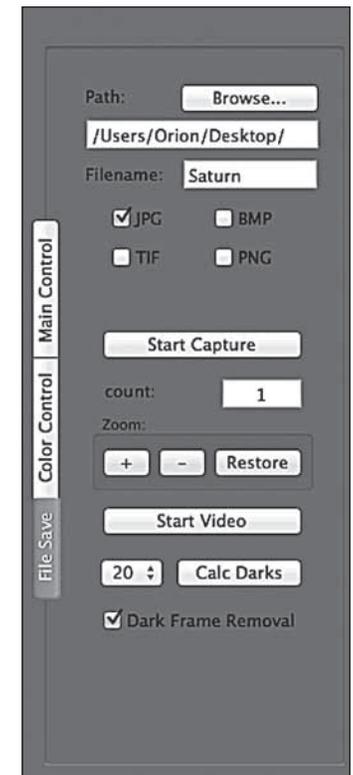


Figure 13. Saving files, Zoom and Dark Frame Removal (Mac).

We recommend a telescope mounted on a motorized altitude-azimuth or German Equatorial mount. You can potentially capture the Moon or a planetary image with a telescope that does not track, however you may not get optimum results. The sky moves 15 arcseconds per second! If you are imaging through a long focal length telescope, you essentially need to track the object or unwanted blurring could occur.

Setup the Camera and Telescope

- Locate and center the object you wish to image in your telescope using an eyepiece.
- Plug the **5 MP** into your computer's USB port.
- Remove the eyepiece from your telescope and insert the **5 MP**.
- Open **Orion EZPlanCap** and select a resolution.
- Connect to the camera.
- Gradually adjust the telescope focus until you get a sharp image on your computer screen.
- Increase gain and exposure if image too dim.
- Use the zoom feature as a focus aid.
- Select white balance (**Figure 9 & 10**).

Your frame rate will depend on such factors as your exposure time, computer processor speed and hard drive speed. Fainter objects will require longer exposures whereas bright objects like Jupiter or the Moon will require very short exposures. Start with 100ms and 50% gain, and then adjust the exposure as needed for the object you are imaging.

Imaging Tip: To speed up the frame rate, and to acquire a rough focus a little quicker, select resolution 640x480 4x4 binning mode. This will increase the frame rate and operate at 1/16th the resolution of the camera. Binning is also useful when using very long focal length telescopes.

Setup Capture

Once you have achieved focus and good color, you are ready to capture and save images to your computer.



Figure 14. Top: 5x Barlow, Middle: 3X Barlow, Bottom: No Barlow.



Figure 15. Lunar imaging.

View and Stack

After you have captured your images, you can review them in RegiStax, a free-ware program downloadable from the provided web link in the CD Launcher. Mac users can use the Lynkeos tool to align and stack their images.

We recommend stacking a minimum of 50 images or more. The individual images have low bit depth (255 brightness level counts), and background noise. Additionally, the individual images may be very soft since if you're imaging at high power, with or without the use of a Barlow. Stacking will improve the potential sharpness when processing in RegiStax. Stacking several hundred or more images is sometimes appropriate to get the most possible detail.

Binning

The 5 MP can bin 4x4 to achieve 640 x 480 resolution in color. Binning in color is a unique feature can provides great versatility to your planetary imaging. If you are using a telescope system with very long focal length, or if the local seeing conditions are poor, you may benefit from binning 4x4 to improve sharpness, sensitivity, and frame rate.

Select resolution 640x480 4x4 binning mode (**Figure 5 & 6**).

Lunar Imaging

Lunar imaging requires fast exposure times due to the high brightness of the moon. Similar techniques used to align and stack planetary images can also be used for lunar image processing. Full resolution Live Lunar images can be stunning when imaged under favorable conditions (**Figure 15**).

The current phase of the moon will dictate the exposure setting due to the vast difference in brightness during each phase.

Solar Imaging

Warning: Always use a full aperture Solar Filter when observing the Sun.

With a properly fitting full-aperture solar filter attached to your telescope, you can use the 5 MP to take images of the Sun and the sunspots on its surface.

(Filters available through Orion. Check the catalog or OrionTelescopes.com for more information).

Much like Planetary and Lunar imaging, solar imaging requires fast frame rates and exposure times.

Terrestrial Imaging

Nature and scenic imaging is possible with 5 MP when used with a telescope.

Use the X and Y flip when image is reversed or upside down.

When using with a telescope the aperture may need to be stopped down (reduced in size) in order to reduce the brightness during daytime.

Tips

Focusing

One of the hardest things to do in planetary imaging is achieving good focus. You can make this process easier by simply watching the Live Video window to focus. Depending upon the viewing conditions you may notice that the image goes in and out of focus, this is due to viewing conditions. This is to be expected and one of the reasons why post processing software can bring out the best in your captured images. Focus as best as possible with the average frame being at best focus to ensure more in focus frames than out of focus. Image processing software can then be used to select the best frames to combine for best results and can also reject the poorest frames.

Use the zoom feature to aid in focusing.

First zoom in on the target, focus, then zoom back out.

Refocus often throughout your imaging session. This ensures at least some of your images will have an excellent focus. It is also not uncommon for telescope movements to alter the focus slightly, so be sure to refocus for any new astro-imaging targets.

Choosing a Site for Astro-imaging

Once you have a focused image, you may find your image shifting and washed out. This can be caused by many environmental factors. Poor seeing (movement of molecules in the air, such as heat rising) and poor transparency (moisture, smoke, or other sky contaminants) will all serve to reduce image quality. That is why most major astronomical telescopes are on high mountains in thin air, to get above much of the seeing and transparency problems. Also, wind will move your telescope and affect images. Your eyes viewing through an eyepiece can change slightly to compensate for disturbances like these, but the camera cannot. Keep these factors in mind when choosing an observing site for astronomical imaging.

For the best astro-images, we recommend finding a location with dry air, some altitude, and away from city or streetlights. Even a nearby hilltop in the countryside can provide better viewing conditions than many convenient backyard locations.

Loss of Camera Connection

If the computer connection to the camera is interrupted, you will need to re-establish connection. This can happen due to several reasons; if a cable becomes unplugged, the computer “freezes”, or the software/hardware otherwise temporarily loses the data coming from the camera.

To re-establish camera connection, first close the Orion EZPlanCap program on your computer. Then, unplug and re-plug the camera into the computer’s USB port. Now, open Orion EZPlanCap, select camera resolution and press ‘Start Camera’ button (Windows) or “Live” button (Mac), The Live Video Window should now appear indicating re-established connection between camera and computer.

Using Focal Reducers and Barlow Lenses

Focal reducers serve to decrease the focal length of your telescope. This increases the field of view seen by the camera (decreases camera magnification). This can be useful for obtaining images of wider objects, such as the full Moon or a landscape vista.

Barlow lenses, or other tele-extendors, increase the focal length of your telescope, which makes the camera field of view narrower (increases camera magnification). This is useful for high-power planetary images (**Figure 14**). Keep in mind that when the focal length is doubled, the image will become four times dimmer, so a longer exposure may be necessary.

For best planetary imaging, you should shoot with an effective focal ratio (telescope focal length ÷ telescope aperture) of F/20 or greater. This will give you a good combination of image brightness and image scale for planets. For most telescopes, a Barlow lens will be required to obtain this focal ratio. For example, Schmidt-Cassegrain telescopes usually have a focal ratio of F/10. A 2x Barlow lens doubles the effective focal length of the telescope, which makes the focal ratio f/20. Similarly, a 3x Barlow lens will yield of focal ratio of F/30. You can also try using multiple Barlows to obtain even greater effective focal ratios. There is a

limit to how large a focal ratio your telescope and seeing conditions can handle, however. Experimentation will be needed to see what your telescope is capable of in the seeing conditions on a given night. If the image appears somewhat dim and fuzzy on the computer screen, you may want to consider removing the Barlow lens.

(Focal Reducers and Barlow lenses available through Orion, check the catalog or OrionTelescopes.com for more information).

Solar Filter

Warning: Always use a full aperture solar filter when viewing the sun.

With a properly fitting full-aperture solar filter attached to your telescope, you can use the SSAIO to take images of the Sun and the sunspots on its surface.

(Solar filters available through Orion, check the catalog or OrionTelescopes.com for more information).

Flip Mirror

As easy as flipping a switch, the Imaging Flip Mirror enables the astro-photographer to find, center and focus a target visually with a 1.25" telescope eyepiece, then photograph it with a CCD camera. All without swapping out any equipment. It's a real timer saver, making the normally tedious task of focusing with the CCD camera alone easier and quicker.

(Available through Orion, check the catalog or OrionTelescopes.com for more information).

USB Extension Cable

In many instances, it is likely a longer cable for the 5 MP will be needed in order to comfortably setup the telescope, camera, and computer.

(USB extension cable available through Orion, check the catalog or OrionTelescopes.com for more information).

Care and Maintenance

When the 5 MP is not in use, remove the nosepiece then attach the dust cap. This prevents dust from accumulating on the 5 MP's optical window. The optical window should only be cleaned if significant dust builds up or if the window is touched. Any quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated optics can be used to clean the glass surface of the 5 MP's optical window. Never use regular glass cleaner or cleaning fluid designed for eyeglasses. Before cleaning with fluid and tissue, blow any loose particle off the surface with a blower bulb or compressed air. Then apply some cleaning fluid to a tissue, never directly on the optics. Wipe the optical surface gently in a circular motion, then remove any excess fluid with a fresh lens tissue. Use caution, rubbing too hard may cause scratches.

(Cleaning products available through Orion, check the catalog or OrionTelescopes.com for more information).

Specifications

Camera Sensor:	Micron color CMOS Sensor
Sensor format:	1/2.5"
Pixel array:	2592 x 1944 (5 MP)
Pixel Size:	2.2µm x 2.2µm
Exposure Range:	1 ms to 5 s 999 ms
Max Frame Rate:	Up to 50 FPS @ 640 x 480 Up to 6 FPS @ 2592 x 1944
A/D Conversion:	8 bit
Thermoelectric cooling:	No
IR Cut filter:	Yes
Mounting:	1.25" nose piece

One-Year Limited Warranty

This Orion product is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid. Proof of purchase (such as a copy of the original receipt) is required. This warranty is only valid in the country of purchase.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights. It is not intended to remove or restrict your other legal rights under applicable local consumer law; your state or national statutory consumer rights governing the sale of consumer goods remain fully applicable.

For further warranty information, please visit
www.OrionTelescopes.com/warranty.

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