

INSTRUCTION MANUAL

Orion StarShoot™ Solar System Color Imaging Camera V

#51450-1.3MP StarShoot, #51451-3MP StarShoot



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Welcome to a new world of adventure. Your new StarShoot Solar System Imaging Camera V (SS-V) is capable of capturing detailed, fullcolor images of astronomical objects in our solar system. The planets, Moon, and Sun (with optional solar filter) can all be imaged to create spectacular views on your computer which can be saved for emailing or printing later. The SS-V can even be used during the day to take images of terrestrial subjects. You'll find that this inexpensive, yet capable and easy to use, camera will enhance all of your journeys with your telescope. Please read this instruction manual before attempting to use the camera or install the needed software.

Parts List

- StarShoot Solar System Color Imaging Camera V (SS-V)
- USB Cable
- Instruction booklet

Drivers and software are available as a download from our website. Before plugging in the camera, please go to www.telescope.com/StarshootV for both Mac and Windows software.

System Requirements

Telescope

The SS-V can be used with virtually any telescope that is compatible with 1.25" format eyepieces. The camera simply is inserted into a focuser in the same way as a standard eyepiece (**Figure 1**). If you use a star diagonal, you should remove it before installing the SS-V. If your telescope does not have enough inward focus travel, you will need to use an optional 1.25" Barlow lens to extend the telescope's focal plane to the camera's imaging plane (Barlow sold separately). For most types of astro-imaging with the SS-V, using a telescope with a focal length of at least 1000mm is recommended. Otherwise, the image scale may be too small. To increase the effective focal length of your system, use a Barlow lens or other type of tele-extender lens.



Figure 1. *The SS-V attached to the telescope focuser.*

Mount

While using an motorized mount is recommended to achieve the best results, one is not absolutely required for imaging with the SS-V, as the maximum exposure time is

only a fraction of a second, astronomical objects will not drift significantly through a telescope attached to an altazimuth mount or Dobsonian base during single image captures. Use a sturdy mount that is appropriately sized for the telescope tube being used. For obtaining the best planetary images, however, we do recommend a motorized mount. Planetary imaging requires combining many individual images, and having a motorized equatorial mount or a computerized Alt-Az mount will prevent the planet from drifting out of the field of view of the camera during the time it takes to acquire the large number of images necessary.

Computer

A computer is required for normal use of the SS-V. For astro-imaging in the field at night, a laptop computer is highly recommended. For windows users the camera driver and Orion Capture software requires Windows 7, 8, or 10. For Mac, the software requires OS X (10.11 and newer).

Software and Driver Installation

Before the camera can be used, image capture software and a camera driver must be installed onto your computer.

Windows Installation

Do not plug the camera into your computer yet. This needs to be done after installing the driver and software. Turn on your computer and allow the Windows operating system to load as normal. Using a web browser, go to www.telescope.com/StarshootV and locate the download .zip file for your Windows computer.

Unzip the TCapture install file, making sure to note what directory the computer will unzip the file to. Double click on TCapture.exe to start the install process. **Note – you may be required to be logged in as administrator in order to successfully install the software.** Choose the language you wish to use, and click through the next few windows:

1. Please choose the default directory for installation for the easiest install. If you wish to set a customer directory, you may do so during installation.
2. TCapture will ask to select the components for install (**Figure 2**). Select Full installation, and leave the default check boxes alone to install the driver and software. If you wish to install additional video compressor plugins, you may do so at this time, but they are not necessary for standard imaging through the software.

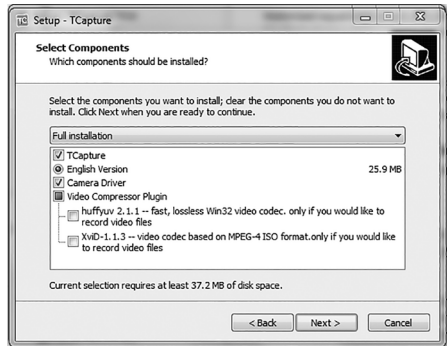


Figure 2. Select the components to install.

3. On the next screen involving selecting additional tasks, leave the yes box unchecked. **(Figure 3).**
4. Finally, the system will ask if you wish to install the device driver. Click install, and the software will take a few moments to install. Click finish when prompted.
5. Once the software has been installed, the computer will recognize the camera when it is plugged into an available USB 2.0 port. Plug the camera in, and then open TCapture to start imaging.

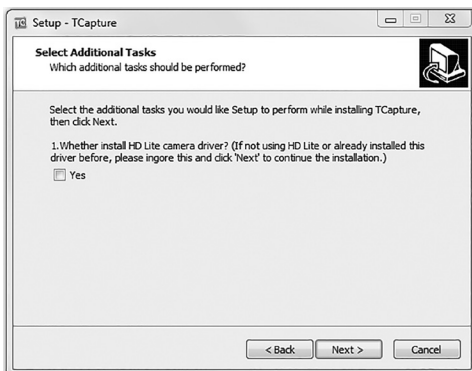


Figure 3. Leave the 'yes' box unchecked.

Mac Installation

Mac installation is extremely easy. Using a web browser, go to www.telescope.com/StarshootV and locate the ISListen download file for your Mac (OS 10.11 and later).

1. Plug the camera into an available USB slot on your computer.
2. Open the ISListen software you previously downloaded, and the program will recognize the camera you have plugged in.

Image Processing Software

There are many popular free Image processing software to be used with your AVI files to enhance your astro Images. Image Processing Software such as RegiStax or AviStack can align and stack (combine) hundreds of individual images into a single resultant image and perform some additional image processing to bring out subtle details or to make the image appear more pleasing overall.

For detailed information on the image processing software consult the websites of each software provider. Tutorials and user groups can be found online also.

Registax: <http://www.astronomie.be/registax/>

AviStack: <http://www.avistack.de/>

Lynkeos (Mac stacking software): <http://lynkeos.sourceforge.net>

Getting Started During Daylight

We recommend using the SS-V for the first time during the day. This way, you can become familiar with the camera and its functions without having to stumble around

in the dark. Set up your telescope and mount so the optical tube is pointing at an object at least a couple of hundred feet away. Insert an eyepiece and focus as you normally would.

To obtain first images with the SS-V, follow these step-by-step instructions:

Windows:

1. Plug the camera into your computer's USB port.
2. Double click the TCCapture icon now installed on your computer's desktop.
3. TCCapture will automatically connect directly to your camera with a live preview window. Your live preview window will only show light and dark before the camera is coupled to your telescope.
4. You can select the preview resolution as well as the actual capture resolution under the "Main Control" tab on the left side (**Figure 4**).
5. To connect the camera to the telescope, simply replace the telescope's 1.25" eyepiece with the camera. Make sure the securing thumbscrew on the focuser drawtube is tightened after the camera is inserted.
6. You will now need to refocus the camera for the centered object. Focusing will be the hardest thing to learn in the initial stages. If you are starting out in daylight, as is recommended, you may need to turn the exposure control of the camera down before attempting to focus. This is done by adjusting the exposure slider left and right (**Figure 4**). You may also use the "auto exposure" checkbox to have the software attempt to find the right exposure for your conditions (auto-exposure works very well during the daytime, or when imaging the moon and the moon's surface covers most of the field of view). If the daytime image brightness is still too bright to produce an acceptable image on your computer screen, you may need to stop-down the aperture of your telescope.
7. Look at the live preview window on the computer screen and adjust the focus knob accordingly to determine best image focus.
8. Image orientation can be changed by rotating the camera within the focuser drawtube. Simply loosen the thumbscrew on the drawtube and rotate the camera until the desired image orientation is achieved. Retighten the thumbscrew on the focuser drawtube when done. You may need to slightly

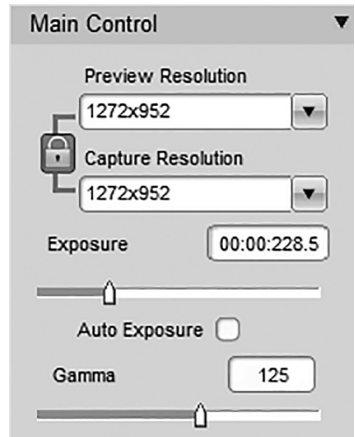


Figure 4. Resolution and exposure control.

refocus (using the telescope's focus knob) if the focuser drawtube has moved a bit inward or outward when the camera was rotated.

9. If shooting a single image, select the file format (either .tif or .jpg) in the File Save Tab on the left side, and then click Capture to save your image.
10. If shooting a video, click Rec Config to adjust the video settings, and then click the Video button to record your .avi.
11. Saved files appear below the live preview window, and you can change where files get saved using the Path dialog box or the Browse button under the File Save tab.

You have now taken your first images with the SS-V! This simple method of imaging is exactly how the camera is used to capture terrestrial subjects during day-light hours. Close-up images of birds and other wildlife or faraway vistas can all be obtained in this way with the SS-V. Solar images can also be taken during the day with an optional full-aperture solar filter over the front of the telescope. Take some time to use the camera and software during the day to become familiar and comfortable with their basic operation. For best results, you can optimize your images with the camera controls.

Mac OS X

1. Plug the camera into your computer's USB port.
2. Double click the ISListen icon now installed on your computer's desktop.
3. Choose the resolution you would like from the pulldown list (**Figure 5**)
4. Click Live to start a live preview window
5. Proceed as described above in the Windows section. Exposure control, gain, and other camera control functions behave in a similar way. Video recording can be set to the frame rate desired, and coupled with the number of frames, will determine the length of the video.

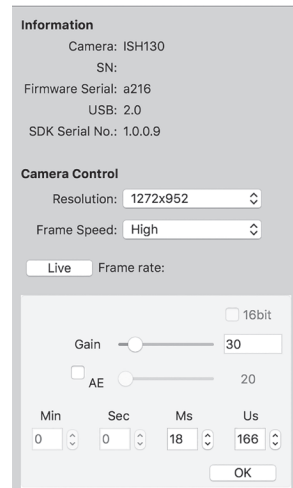


Figure 5. Mac main control window

Camera Controls

For best images, you can adjust the camera controls through the control software to fine tune the image. You can see how the camera controls affect an image in the live preview window. Adjusting the exposure slider, or by entering specific exposure times will change how bright the image appears. The auto exposure button (AE) will let the program guess as to the best exposure. Be careful with auto exposure – it may work well for evenly illuminated daytime scenes or microscope views, but images of a small planet in the middle of a large black sky will confuse the auto exposure

system, leading to overexposure. For planetary imaging, it's best to manually adjust the exposure.

From the tabs on the left, you can also adjust the gain, gamma, contrast, and saturation, among other variables such as color shifts. Gain allows you to make the chip more sensitive at the same exposure value, at the expense of more electronic noise in the image. Try to keep the gain fairly low in order to produce a smooth image. First adjust the exposure value, and if needed, then try adjusting gain to produce the desired image.

Astronomical Imaging

Now that you're familiar with basic camera and software operation, it's time to take the SS-V out at night under the stars to capture some astronomical images. We recommend starting with the Moon, as it is easy to acquire into the camera's field of view, and typically does not require stacking of multiple exposures as planetary images do.

Imaging the Moon

Imaging the Moon is much like imaging terrestrial objects during the day. Since the exposure is very short, it is not critical that the telescope be precisely polar aligned. When the moon is past half full, it is hard to get detail due to the tremendous glare off of the lunar surface. Most detail, even on a sliver of a moon, will be at the terminator (that tiny thin line between the shadow and light, see **Figure 6**). To get more of the moon in the image, a focal reducer will need to be used. For close-ups of craters use a Barlow lens (see "Using Focal Reducers and Barlow Lenses").

Imaging Planets

The best planetary images will be obtained by stacking (combining) many individual images in order to improve image contrast, brightness, and detail (**Figure 7, 8**). A great way to obtain images for stacking is to take several seconds of video of the planet, then break the video into individual frames for stacking. Since the SS-V has a video mode, you can literally obtain hun-

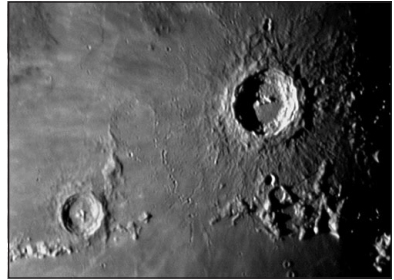


Figure 6. *The moon's surface detail looks the best along the terminator.*

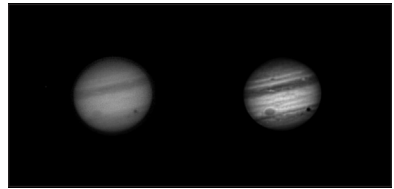


Figure 7. *Jupiter with Ganymede and shadow in transit. Left. Live image Right. 500 frames Aligned, stacked and enhanced using Registax Image Processing Software (Windows). Image taken with Orion 180mm Mak-Cass telescope.*

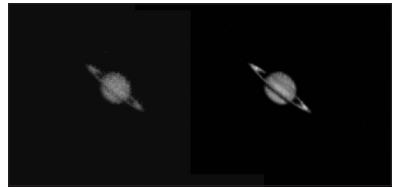


Figure 8. *Saturn. Left. Live image Right. 100 frames Aligned, stacked and enhanced using Lynkeos Image Processing Software (Mac OS X). Image taken with Orion 180mm Mak-Cass telescope.*

dreds of images for stacking in seconds! You save time by taking one video instead of dozens of individual pictures! 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.

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 preview 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. 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 camera control program on your computer. Then, unplug and re-plug the camera into the computer's USB port. Now, re-open TCapture (Windows) or ISListen (Mac OS X), and the live preview window should work again 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-extenders, 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. 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 \div 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 *Telescope.com* for more information).

Filters

For some types of planetary imaging, you may want to use color filters to bring out subtle details. Any standard Orion 1.25" filter will thread into the front of the SS-V's barrel. Try using different color filters on a planet to see which filters help best show planetary details. Neutral-density Moon filters and variable-polarizer filters are useful to reduce the glare from the moon. They can also be used to reduce the glare from Venus.

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 SS-V to take images of the Sun and the sunspots on its surface. (Filters available through Orion, check the catalog or *telescope.com* for more information).

Things to Do

Moon

Learn your way around our closest celestial neighbor

- Image the craters, mountains and valleys
- Image the different phases from New Moon to Full moon
- Image the detail at the terminator
- Create a moon mosaic out of many smaller images

Planets

- Take a movie of the position of the great red spot of Jupiter during the Gas Giant's <10 hour day
- Image Jupiter's moons and their shadows as they transit across the Gas Giant
- Follow in Galileo's footsteps by imaging the different phases of Venus

Solar

- Using a full aperture Solar Filter to image sunspots

Terrestrial

- Image wildlife from a far distance so as not to disturb feeding and nesting spots

Specifications

StarShoot™ 1.3mp Solar System Color Imaging Camera V

Sensor	Micron MT9P031 (color)
Sensor Size	1/2.5" format
Pixel Size	2.2 micron square
Effective pixels	1.3mp
Resolution	1272x952
Scan mode	Progressive
Shutter	Rolling Shutter
Frame rate	Up to 16 fps at 1272x952 Up to 46 fps at 632x472
Color depth	24bit
A/D converter	8 bit
Exposure range	0.001-0.4 seconds
White Balance	Auto/Manual

Dynamic Range	60dB
Operating system	Win 7/8/10, Mac 10.11 and newer
Physical connection	Standard C-mount
Data interface	USB 2.0/480Mb/s

StarShoot™ 3mp Solar System Color Imaging Camera V

Sensor	Micron MT9T001 (color)
Sensor Size	1/2" format
Pixel Size	3.2 micron square
Effective pixels	3.0mp
Resolution	2040x1528
Scan mode	Progressive
Shutter	Rolling Shutter
Frame rate	Up to 4 fps at 2040x1528
Color depth	24bit
A/D converter	8 bit
Exposure range	0.001-1.0 seconds
White Balance	Auto/Manual
Dynamic Range	54dB
Operating system	Win 7/8/10, Mac 10.11 and newer
Physical connection	Standard C-mount
Data interface	USB 2.0/480Mb/s

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 to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. If the product is not registered, proof of purchase (such as a copy of the original invoice) is required.

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, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, 89 Hangar Way, Watsonville, CA 95076; (800) 447-1001.



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