

**Instruction Manual
For
StarSplitter
&
StarSplitter Video
Astronomy Solution**



Astronomy Labs LLC

We Bring the Universe Down to Earth

www.astronomylabs.com

support@astronomylabs.com

**Copyright 2013
Astronomy Labs LLC**

v 1.0

Table of Contents

Page

- 3 Parts List
- 4 About Your StarSplitter
- 5 Operating Your StarSplitter
- 7 Operating the StarSplitter Video Astronomy Solution
- 9 Electrical and Video Connections
- 9 Connecting to a Display Device
- 10 Using the Low-light Video Camera

Please take a moment to record some essential information about your StarSplitter product.

Serial Number _____

(located on sticker on bottom of StarSplitter unit)

Video Camera Serial Number _____

(if StarSplitter Video Astronomy Solution)

Date of Purchase _____

Parts List

StarSplitter unit with dust caps
(if you purchased the StarSplitter only)

If you purchased the StarSplitter Video Astronomy Solution you will have the following additional parts:

Super Low Light Video Camera

1.25-inch to C-mount Adapter

Parfocal ring

10 ft coax BNC video cable

RCA to BNC adapter
(already attached to the BNC video cable)

12V wall mount power supply

About Your StarSplitter

Your StarSplitter is a versatile device that will give you exciting new capabilities in stargazing. As a stand-alone device it allows you to attach two accessories to your telescope at once and observe with them simultaneously. It achieves this by optically splitting the output of the telescope and sending equal intensity to each of the StarSplitter's 2 ports. What you do with each output port is entirely up to you! The ports are mechanically identical with the same backfocus distance. This makes it easy to reach focus simultaneously with most standard 1.25-inch accessories including eyepieces and cameras. You can use a parfocal ring to help you achieve focus. The StarSplitter is similar to a flip-mirror, but is more compact and needs less backfocus. It is also simpler and does not require you to constantly switch between ports like a flip-mirror. This is especially handy for remote telescope installations, public viewing, telescopes where the output is hard to access, or situations when you don't want to constantly think about which port is selected.

The StarSplitter is made of lightweight aluminum and weighs a total of 6.675 oz (189 grams). It has a durable black anodized finish. Its dimensions are 1 5/8" wide, 3 3/4" long, 2 3/4" high and requires an additional 75 mm of focus travel. When not in use the StarSplitter should be stored in a covered container with the dust caps installed.

Warning! Never look at the sun with your StarSplitter without using safe solar viewing equipment and methods. Failure to do so invalidates the warranty and can result in immediate and irreparable damage to your StarSplitter and/or permanent damage to eyes or other accessories mounted to the StarSplitter.

Operating Your StarSplitter

Two Eyepieces

Your StarSplitter can be operated with an eyepiece attached to each port, allowing for 2 different magnification views at the same time. This is ideal for having a low magnification view and a high magnification view without having to swap eyepieces. A parfocal ring (included with the StarSplitter Video Astronomy Solution) can be used to help achieve simultaneous focus with both eyepieces.

Eyepiece + Astro Camera

Any astronomical CCD camera that fits 1.25-inch adapters can fit either of the StarSplitter's ports. You can attach an astro camera and an eyepiece at the same time. A low-power eyepiece is especially useful for aiming the telescope as it usually has a wider field of view than the CCD camera. You can look visually through an eyepiece and adjust the telescope's pointing to place targets onto the CCD chip. Simultaneous focus can be achieved by a parfocal ring or by adjusting the position that the CCD camera is inserted into the StarSplitter port.

Eyepiece + Autoguider Camera

The StarSplitter can be used as above, except substituting an autoguider camera for an astronomical CCD camera. The eyepiece + autoguider arrangement works best if you use a separate guidescope. Just like above, the eyepiece port helps in aiming the telescope and putting a suitable guidestar onto the autoguider camera. The fact that each port of the StarSplitter is always active (unlike a flip-mirror) means you don't have to remember which port is currently selected. This greatly simplifies its use in the dark.

Astro Camera + Autoguider Camera

You can attach two cameras to the StarSplitter at the same time. As long as both have similar back focus distances, simultaneous focus can be achieved. This tends to be possible with webcams, video cameras, and CCD cameras with standard 1.25-inch adapters. It is much harder with most digital SLR (DSLR) cameras as these have much longer back focus distances. Simultaneous focus can be achieved by varying the distance each camera is inserted into the StarSplitter port. The camera with the longest back focus requirement should be inserted all the way into one port and the telescope's focus adjusted to bring this camera into focus. Then the other camera should be focused by inserting it into the other StarSplitter port and varying the insertion distance until focus is achieved. A parfocal ring may be helpful. At this point, do not adjust the focus of the telescope, only the position of the 2nd camera. When using an astronomical CCD camera in conjunction with an autoguider camera the StarSplitter functions as an on-axis guider. The autoguider sees the same lightpath as your telescope and astro camera and eliminates differential flexure that might occur with a separate guidescope. Also, as compared to an off-axis guider, the autoguider camera sees a wider field of view, which includes the middle of the telescope's field of view. This will typically show guidestars as less distorted. Also, the high quality beamsplitter delivers undistorted images to both autoguider and CCD ports. The autoguider potentially sees brighter stars than it would on a separate, smaller guidescope, giving you a greater chance of finding a suitably bright guidestar. Also, since both ports are always active, you don't have to worry about flipping between ports as you would with a flip mirror. This is great for remote telescopes and telescopes where the camera is hard to access.

Operating the StarSplitter Video Astronomy Solution

If you purchased the StarSplitter video astronomy solution, you have both the base StarSplitter dual-port accessory as well as a super low-light video camera and all accessories needed to operate it. The video camera is removable and you can operate the StarSplitter without it. All the previously mentioned operating modes and ways of attaching cameras and accessories are available to you. This makes the StarSplitter extremely useful and versatile. We hope it will be the centerpiece of your astronomy activities for many years to come.

With the StarSplitter Video Astronomy Solution you have a unique and exciting new way of doing astronomy. The addition of a super low-light color video camera allows you to see more detail than you could see by eye. It also allows for display of video images from your telescope on a TV or computer, creating a more engaging and social stargazing experience. This is particularly useful for star parties and outreach events. When the StarSplitter has both an eyepiece and video camera attached, members of the public can see video of the deep-sky object being viewed while they wait in line to look through the telescope. Eyepiece viewing is always enabled and there is no need to switch between eyepiece observing and video observing. Both are active all the time. People can compare the view through the eyepiece with the image on a video display, and since the video camera is more sensitive than your eye, those waiting in line will get a satisfying view.

If poor eyesight is a problem, this is a great way to reinvigorate your love of astronomy. You no longer have to strain to look through an eyepiece in the dark. The StarSplitter Video Astronomy Solution will simply output a video signal and you can comfortably watch deep

sky objects on a TV or computer, potentially from the comfort of inside your house or warm room in your observatory.

Another great use of the StarSplitter is as a video finderscope. If you have a separate finderscope mounted on your telescope, you can attach the StarSplitter Video Astronomy Solution to your finderscope and use it to help aim and align the main telescope. When aligning a telescope, it is useful to have a wide field of view image through an eyepiece for rough alignment. However, to precisely center an object through an eyepiece can be a difficult matter of judgment. Using a video camera to accurately place an object at the precise center of the screen is easier, allowing for more accurate alignment of your telescope. Your main telescope probably has a small field of view. You could be just a few arcminutes off in pointing and not see the object you're looking for. With a StarSplitter Video Astronomy Solution mounted on a separate finderscope, the video camera allows you to see deep-sky objects in real time, so there is no doubt where your main telescope is pointed. If your main telescope is pointed a little off target, you can quickly see this and get pointed back at your object by using the video finderscope.

The video output of the StarSplitter can also be useful when you collimate or adjust your telescope's optics. When collimating or performing a star test, the ability to see video through the telescope of the airy disk of stars greatly improves the ease of collimation and you can see in real time the effects of any adjustments made to your telescope.

Electrical and Video Connections

The two connections for the super low light video camera are power and video signal. Power is provided by the included 12V power adapter. This plugs into the receptacle cable extending a few inches from the rear of the video camera. If operation away from AC power is desired, a 12V DC power source can be substituted. These include 12V batteries such as commercially available "power packs" commonly used to power telescopes in the field.

The video signal can be accessed through the BNC plug on the back of the camera labeled "Video Out". Using the included 10 ft coax BNC video cable, attach the BNC end to the back of the camera. The other end comes with a RCA adapter plug already pre-installed. This end goes to your video display device (either the AV input on a TV or the input to a video capture device for a computer). The camera works with most standard video capture devices (not included). If another type of connector besides BNC or RCA is needed for your display device, appropriate adapters can be found at an electronics store.

Connecting to a Display Device

Connecting the video camera to a video display device, either a TV or a computer is very straightforward. For a TV, simply connect the end of the BNC cable that has the RCA adapter to the "AV" input of the TV. The RCA adapter will have a thin metal prong that extends out from the connector a few millimeters. In order to connect to a computer such as a laptop, you will need a separate video capture device. There are dozens of video capture devices on the market and most are compatible with the StarSplitter and the RCA style video connector. The RCA connector is removable. If your capture device needs another type of adapter, this can be purchased separately.

Using the low-light Video Camera

The low light camera included with the StarSplitter Video Astronomy Solution is a high-resolution color video camera with many adjustable parameters. Control of the camera's parameters is achieved via on-screen menus that are accessed using 5 pushbuttons on the side of the camera. These buttons are "Enter", "Up", "Down", "Left", and "Right". To bring up the main menu, press the Enter button. The "Up" and "Down" buttons allow you to scroll through the menu items. There is documentation on the menus and camera controls included in with the camera. Please read these to familiarize yourself with the camera menus and features.

There are several camera features that are particularly useful for video astronomy. The first item on the on-screen menu (1. Lens) should be set to "Manual".

The second menu item (2. Exposure) is the heart of the camera and the one you will likely adjust the most. The camera is capable of taking exposures as short as $1/100000$ s. It is also capable of integrating 256 frames together to create an effective exposure approximately 8 seconds long. This large exposure range makes the camera well suited to capturing both bright objects (such as planets) and faint objects (such as galaxies and nebulae). But you will have to adjust this menu to choose the appropriate exposure time. On the same "Exposure" menu are also controls for the on-screen brightness. The "AGC" controls the gain of the camera and can be set to "Low", "Med", or "High". Feel free to experiment with these settings, as some objects will look better with different settings. Also "BLC" should be "OFF" and feel free to experiment with the "D-WDR" settings.

The white balance is adjusted by the menu (3. White Bal).

The 4th menu (4. Day&Night) controls whether the camera records in color or black&white. Feel free to experiment with this selection. Selecting color will reveal objects in color, however, the color contrast in most astronomical objects will show modestly.

The 5th menu (5. 3DNR) is one of the more exciting features of the camera for use in astronomy. It is the dynamic noise reduction and, with it enabled, it actively reduces the electronic noise in the image. With it ON you can also adjust the amount of noise reduction by adjusting the level slider bar in the 3DNR menu.

The 6th menu (6. Special) contains several miscellaneous functions as well as two sub-menus. Included in the "D-Effect" sub-menu are "Freeze" which allows you to freeze the video frame, "Mirror" which allows you to reverse the orientation of the video image (potentially useful for aligning the directions of the telescope's motions with that of the video image), "D-zoom" which zooms the video image, and "Neg Image" which forms the negative of the video image (i.e. bright objects are black and dark objects are white). In the "Defect" sub-menu of the "Adjust" menu is a very important feature. The camera has the ability to detect static pixel defects such as hot pixels and noisy pixels and to subtract these from the video signal, thus making for a more uniform, cleaner image. This defect mapping needs to be done only once, as pixel defects should not change over time. However, you can re-do the defect mapping as often as you like and the changes will be automatically stored in onboard memory and automatically applied whenever the camera is on.

The 7th menu (7. Adjust) controls the image sharpness. It also allows you to optimize the video for your type of display monitor.

The 8th menu (8. Reset) resets all parameters to the factory defaults. This can be useful if you have adjusted the camera's parameters and have arrived at a point where the image quality is poor but you can't determine what setting or combination of settings is the cause. Doing a reset allows you to start from scratch, but you'll also need to re-do the defect mapping from menu 6.