



DIFFRACTION LIMITED

SBIG[®] StarChaser
Off-Axis Guiding Cameras



User's Manual

Version 2.11 – January 12, 2024

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

European Union

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

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and

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Diffraction Limited

33 Roydon Place, Unit 5, Ottawa, ON Canada, K2E 1A3

Telephone: 613-225-2732

Fax: 613-225-9688

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SBIG StarChaser User's Manual

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1 – The SBIG StarChaser Guiders

Diffraction Limited's SBIG StarChaser guiders provide autoguiding fully independent of the main camera. Featuring built-in adaptive optics support, StarChasers are available either as a standalone guide camera, or with integrated off-axis guiding. The fully integrated SC-2 and SC-3 models feature a pick-off mirror, guider camera, guide port and adaptive optics control. Off-axis guiding eliminates the problem of flexure between the imaging camera and a separately mounted guider by using the same optical path for both the main camera and the guider.

There are three models of the SBIG StarChaser, designated SC-1 as the standalone guider, SC-2 for 2-inch diameter cameras, and SC-3 for 3-inch diameter cameras.

The StarChaser SC-1 includes both T-thread and 2-inch eyepiece options. A 1.25-inch adapter is optionally available. The SC-1 can be used with a guide scope, or with a third-party off-axis or ONAG device.

The StarChaser SC-2 works with the 2-inch format STC series, STF series, and Aluma CCD series cameras and filter wheels, as well as the FW8S-STT filter wheel for STT cameras. It acts both as an off-axis guider and a controller for the optional AO-8A Adaptive Optics Unit.

The StarChaser SC-3-LONG works with STX series cameras and filter wheels. The StarChaser SC-3-SHORT works with Aluma AC, STXL and 3-inch format STC series cameras and filter wheels. Aside from a difference in back focus range the two SC-3 variants work identically. The SC-3 acts both as an off-axis guider and a controller for the optional AO-X Adaptive Optics Unit.

Competing off-axis guider assemblies are awkward to use, consume too much back focus, and require you to focus by sliding a camera in and out of an eyepiece holder. SBIG pioneered simplified off-axis guiding, with guide sensors built into CCD cameras. Later, we created the self-guiding filter wheel, placing the guide sensor in the light path, ahead of photon-robbing narrowband filters.



Next Generation Off-Axis Guiding

The StarChaser represents our next generation of off-axis guiding technology. The guider attaches to the front of your filter wheel and adds minimal back focus distance: 0.8" (20.3 mm) for the SC-2, or 0.87" (22.1 mm) for the SC-3. The SC-2 weighs only 0.6 lb (273 gm) and the SC-3 only 0.9 lb (400 gm). The guiders feature a high-sensitivity 1.3 megapixel Global Shutter CMOS sensor with 4.8 micron pixels.

Unlike competing autoguiders, the StarChaser has a mechanical shutter for easy dark frame correction. This feature, standard on all SBIG guiders, optimizes sensitivity and eliminates hot pixels that can degrade guiding accuracy.

The pick-off mirror position is adjustable by loosening a locking knob and sliding the mirror into or out of the housing. This allows you to avoid vignetting the main sensor while optimizing the light path into the guide sensor. Once that is set, focus is adjusted simply by turning a second knob.

Adaptive Optics Control

Thanks to the SBIG StarChaser, our renowned Adaptive Optics (AO) technology is now available for virtually our entire camera line! Our AO-8A and AO-X units bolt onto the front of the StarChaser SC-2 and SC-3 respectively, which in turn are attached to your SBIG standard filter wheels and cameras. Adaptive optics technology eliminates guiding errors caused by common mount problems such as stiction, periodic error, and wind loads. It can even reduce "slow seeing" effects resulting in higher resolution images.

Supports Your SBIG Investment

Our renowned MaxIm LT software is included with your purchase, providing integrated control of your StarChaser and SBIG main camera. We also provide API interfaces for third-party software running under Windows, MacOS, or Linux. An ASCOM standard camera interface is also included. Note however that ASCOM does not currently support adaptive optics.

The StarChaser SC-2 supports the following SBIG cameras: STC-7, STC-428, STF-8300, STF-8050, STF-3200, STF-1603, STF-4070, Aluma 47-10, Aluma 77-00, Aluma 8300, Aluma 3200, Aluma 814 and Aluma 694. The SC-2 attaches to the FW8-8300 or FW8S-Aluma filter wheel. You can also attach it directly to the front of the camera if you wish, by using an available filter wheel spacer. It is also compatible with older SBIG STT equipment, and an adapter is available to support the venerable STL series cameras. All cameras supported by the SC-2 can now be used with our AO-8A Adaptive Optics unit. This brings AO capability to our STF camera line for the first time. The StarChaser SC-2 connects directly to our AO-8A Adaptive Optics unit. All guiding and AO operations take place independently of the main camera.

The StarChaser SC-3 supports the following SBIG cameras: Aluma AC4040, Aluma AC2020, STX-9000, STX-16801, STX-16803, STXL-6303E, STXL-11002, and STXL-16200. The LONG variant is used for the STX series cameras, while the SHORT variant is used for all other models. The SC-3 attaches to the front of the filter wheel, or can be attached directly to the front of the camera. The SC-3 also connects directly to our AO-X Adaptive Optics unit. All guiding and AO operations take place independently of the main camera.

On the telescope side, the SC-2 uses the same adapter plates that are used on our FW8-8300 and FW8S-Aluma filter wheels. This includes "STL" thread, "Small SCT" thread, T-thread, M48x0.75, and of course, 2" nosepiece interfaces. The SC-3 uses the same adapter plate included with the camera. An optional 2" diameter Nose Plate is also available for STXL cameras.



The StarChaser SC-1 can be used with separate guide scopes or with third-party off-axis or ONAG devices.

The StarChaser requires only a +12V power supply (included) and a USB 2.0 mini cable (6 foot / 2 meter cable included). It can send guider commands to the telescope either via ASCOM PulseGuide or the included ST-4 style guide cable.

2 – Supplied components

Observe proper handling procedures for sensitive electronic equipment and unpack your StarChaser and accessories carefully in a clean, dry, static-free area. Inspect the contents to ensure all components are present and in good order. You should find the following:

- StarChaser SC-1, SC-2 or SC-3 (-LONG/-SHORT) Off-Axis Guiding Camera
- Power supply:
 - Universal +12V (60014A)
 - Power cable with US plug (51089), European plug (50392), or Australia/New Zealand plug (50390) (type specified on ordering)
 - Power extension cable (68007)
- ST-4 style guider-to-telescope mount interface cable (TIC) RJ12-RJ12. NOTE: This cable has its pin connections flipped from one end to the other – they are not straight-through connections.
- USB 2.0 A to Mini-B cable, 6 feet (2 meters)
- *SC-2 only*: Four 4-40 x 1-inch socket head cap screws
- *SC-3 only*: Four 6-32 x 1-1/8" socket head cap screws
- *SC-2 & 3 only*: 7/64-inch hex key wrench
- *SC-2 only*: Flat adapter plate 2.156 x 24 (40-12053-00) (SC-3 uses the adapter plate from your main camera)
- *SC-1 & 2 only*: 2" Nosepiece adapter with cap (40-12121-00)
- USB flash drive

3 – Installing the software

NOTE:

If you already have MaxIm DL Pro, **please update to the latest version.**

The MaxIm LT imaging application supplied with your SBIG StarChaser allows you to operate it using a Windows computer. The application is found on the flash drive included with your camera. Drivers (excluding application software) are also provided for the Mac and Linux operating systems.

3.1 System requirements

The following hardware and software is required for MaxIm LT:

- MS Windows (applicable versions: 7, 8, 8.1, 10)
- Recommended minimum memory size: 1 GB or larger.
Processing larger images or opening multiple images simultaneously will require correspondingly more memory. 2 GB memory is recommended for processing large arrays, including images larger than 6 megapixels.
- Disk space: 100 MB for program installation
- Video display: 1024x768, 16-bit color or higher
- Mouse

3.2 Windows installation

1. Proceed to step 8 if you are an SBIG camera owner who already has MaxIm DL Pro or MaxIm LT installed.
2. Go to the Registration page on the Diffraction Limited website at: <https://diffractionlimited.com/maxim-lt-registration>
3. Enter the requested information and serial number to register the MaxIm LT application. Use your camera's serial number for this. You will then automatically be emailed a license key.
4. Insert the supplied USB flash drive into an available USB port on your computer.
5. Open Windows Explorer and navigate to the DL Imaging Driver (Aluma) folder on the flash drive.
6. Double-click Launcher.exe, then choose Install MaxIm DL. This applies whether you are installing the included MaxIm LT application or a licensed version of the fully-featured MaxIm DL program.
7. Follow the on-screen instructions and enter the license key you received when prompted.

NOTE 1:

To enter your license key properly, you must select all the text from the email you receive and copy it to the clipboard. You then start MaxIm LT and open the Enter License dialog. The license key will be entered automatically

– there is no need to paste it since MaxIm LT finds it on the clipboard and pastes it for you.

NOTE 2:

The required USB drivers are available through Windows Update. The drivers will automatically be downloaded when the device is plugged in and if an internet connection is present. If the USB drivers do not install automatically, then please see [3.3 Manual Windows Driver Installation](#).

8. StarChaser uses the DL Imaging driver package. Download the latest drivers and camera configuration utility from the Diffraction Limited website at: <https://diffractionlimited.com/down/SetupDLAPI.exe>
9. When the download is complete, open Windows Explorer and navigate to your Downloads folder, then double-click the **SetupDLAPI.exe** file. Follow the on-screen instructions to install the DL Config Utility application.
10. When the installation is complete, an entry named DL Config Utility will appear on the Start menu under the DL Config folder icon.

NOTE:

In addition to being a standalone program, this utility is also accessible from within MaxIm LT.

Click OK to finish.

11. Proceed to section [4 – Installing the StarChaser hardware](#) to install the guider.

3.3 Manual Windows Driver Installation

Automatic installation requires:

- Your Windows system to have the latest updates installed
- An active Internet connection

Simply plug in the camera's USB cable and power it up – the drivers should install automatically.

Should this not happen, these are the steps to install the drivers manually:

1. Plug the included **USB Flash Drive** into your computer, and access it via Windows Explorer
2. Copy this folder to a convenient location on your hard drive:

```
\DL Imaging Driver (Aluma, STC, StarChaser)\System Drivers
```

3. Open the **Windows Device Manager**
4. Right-click on **SBIG Driver**, select **Update Drivers**.
5. Click **Browse my computer for drivers**
6. Click **Browse** to open a directory picker

7. Select the folder on your hard drive where you copied the system driver files (Step 2)
8. Click **Next** and continue through until the device drivers are detected and installed
9. If successful go to the section [1.4 Testing the Camera](#) and test out the connection.

Note:

On some systems it may be necessary to also update the FTDI D3XX USB drivers. Our USB drivers are based on FTDI's, and some systems may require these to be updated.

The FTD3XX driver update is available on the USB Flash Drive under:

\DL Imaging Driver (Aluma, STC, StarChaser)\

Alternatively, you can download the latest version from:

<https://ftdichip.com/drivers/d3xx-drivers/>

3.4 MacOS and Linux Drivers

Drivers for the Mac and Linux operating systems are available by request.

Please post your request in our Support forum, Aluma section at:

<https://forum.diffractionlimited.com/forums/aluma-series.49>

3.5 Software Development Kit

A software development kit for all DL Imaging cameras is available by request.

Please post your request in our Support forum, Aluma section at:

<https://forum.diffractionlimited.com/forums/aluma-series.49>

4 – Installing the StarChaser hardware

The SC-1 simply attaches to your guide scope or off-axis guider. The following installation procedure applies to the SC-2 and SC-3.

This procedure presumes that you have the following hardware currently installed on your imaging camera:

- **For SC-2:** FW8S-Aluma, FW8-8300, or FW8S-STT Filter Wheel
- **For SC-3:** FW8S-STXL or FW7-STX filter wheel and Adapter Plate (10018)

An FW8S-Aluma filter wheel and SC-2 are shown in the following photographs for illustrative purposes. However, the procedure for mounting either a StarChaser SC-2 or SC-3 to an applicable filter wheel is identical, except as cited.

NOTE:

If you want to attach the StarChaser SC-2 directly to the camera in place of a filter wheel, you can purchase a Filter Wheel Spacer (CA-FWSPACER) from Diffraction Limited. The StarChaser SC-3 does not require a spacer and can be attached directly to the front of your camera.

PROCEDURAL ORDER:

- If you are installing a new filter wheel along with your StarChaser, follow the instructions in your camera and filter wheel user manuals to install the wheel before installing the StarChaser.
 - If you currently have an adaptive optics unit installed with your camera and a filter wheel, the AO must be removed from your filter wheel before installing the StarChaser.
 - If you are installing an AO unit along with your StarChaser, then complete the entire procedure in this section first, followed by the procedure in [5.1 Configuration and connection](#). Then perform steps 1 to 9 in procedure [5.2 Pick-off mirror adjustment and focusing](#). You can then install the AO unit as described in section [6 – Installing an Adaptive Optics Unit](#).
1. Carefully remove the StarChaser guider and other components from their packaging. Retain the packaging materials for future use, if ever required.
 2. Place your imaging camera and filter wheel assembly on a clean flat surface, with the telescope opening facing upwards.
 3. Ensure that the power into the camera is disconnected.

CAUTION:

Never “hot plug” cables into or from units. This is especially important for AUX and I²C connectors. Always disconnect power before connecting or disconnecting accessories or cables.

4. Remove the four 4-40 x 1-inch screws (for SC-2) or 6-32 x 1-1/8" screws (for SC-3) that fasten the adapter plate to the front of the filter wheel. Set the adapter plate aside.
5. Place the StarChaser onto the filter wheel, with the SBIG logo facing away from the filter wheel. Align the four screw holes of the guider with those on the filter wheel. Note the orientation of the StarChaser and filter wheel.



6. **For SC-2 only:** Attach the supplied 2" nosepiece to the supplied flat plate adapter. For the SC-2 we recommend using the supplied 2.156" adapter plate and the included nosepiece since the larger aperture reduces the chance of vignetting the guide camera. You can optionally use your original T-thread adapter plate instead. Place the nosepiece and attached adapter plate over the StarChaser and align the four mounting holes with those on the guider.

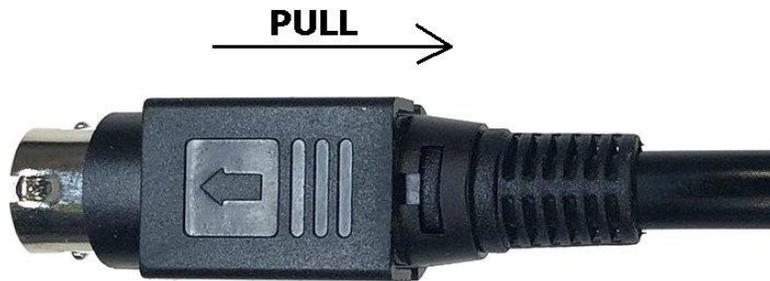


7. **For SC-3 only:** Attach the Adapter Plate (10018) that was supplied with the camera over the StarChaser and align the four mounting holes with those on the guider.
8. Insert the four 4-40 x 1-inch screws (SC-2) or 6-32 x 1-1/8" screws (SC-3) that you removed in step 4 in through the top of the adapter plate.
9. Thread and tighten the four screws into the filter wheel.

The StarChaser is now ready to be configured and adjusted. Proceed to section [5 – Setting up the StarChaser](#).

IMPORTANT NOTE:

The power connectors have a locking mechanism – both the power brick connector and the extension cable connector. The lock is engaged by pressing the plug into the socket. It is unlocked by pulling back on the shell. If you experience difficulty latching it, try pulling on the shell a couple of times to loosen it up.



Pull to Unlatch

NOTE:

STC-7 users may want to add some extra space between the SC-2 and the camera. This provides much greater flexibility as it allows all pick-off mirror positions to be accessed within the focus range of the guider.



ACC13 StarChaser Spacer/Adapter

To do this, install the ACC13 StarChaser Spacer/Adapter between the STC-7 and the StarChaser SC-2.

- Use the **unthreaded holes** only.
- One side has a **raised inside edge**, which goes upwards **into the SC-2**.
- This will increase the backfocus distance by 0.2" (5.08 mm).

FW8-8300 users can use the same adapter attaching the StarChaser SC-2. Many existing FW8-8300 units have mounting holes at 45°, which adversely affects installation. In this case use the unthreaded holes to attach the ACC13 adapter to the filter wheel, and the threaded holes to attach the StarChaser SC-2 to the adapter. This will rotate the SC-2 to properly align with the camera and filter wheel.

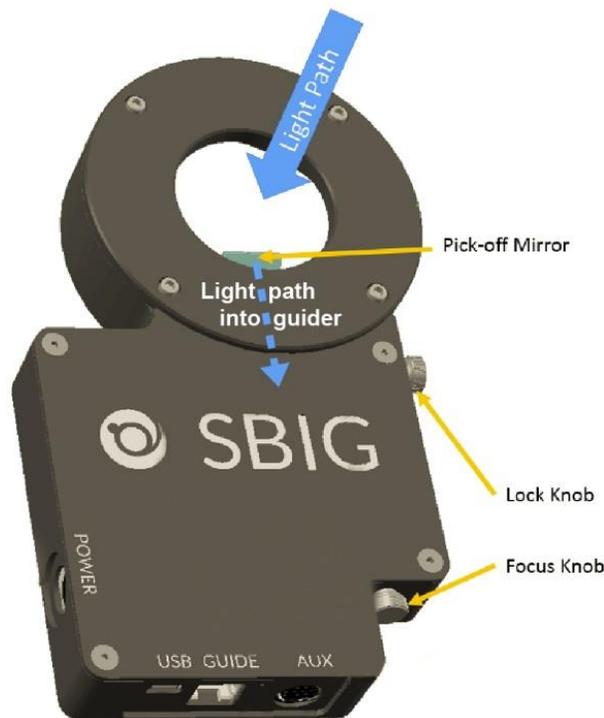
5 – Setting up the StarChaser

The SBIG StarChaser includes the MaxIm LT application, and this section describes how to set up the guider with that software. MaxIm LT allows full configuration and control of the SBIG StarChaser.

This procedure details the basic steps to configure and adjust the StarChaser to get it ready for autoguiding. Click on *Help Topics* or *PDF Manual* under the program's *Help* menu for detailed information on performing autoguiding, parameter descriptions, and for various tutorials. Please note however that since MaxIm LT and MaxIm DL Pro both share the same PDF Manual and Help files, not all of the program features detailed in those files will be enabled in MaxIm LT. Full program feature access requires MaxIm DL Pro.

5.1 Configuration and connection

1. Loosen the LOCK knob on the side of the guider assembly by turning it counter clockwise. The SC-2 is shown here for illustration purposes.



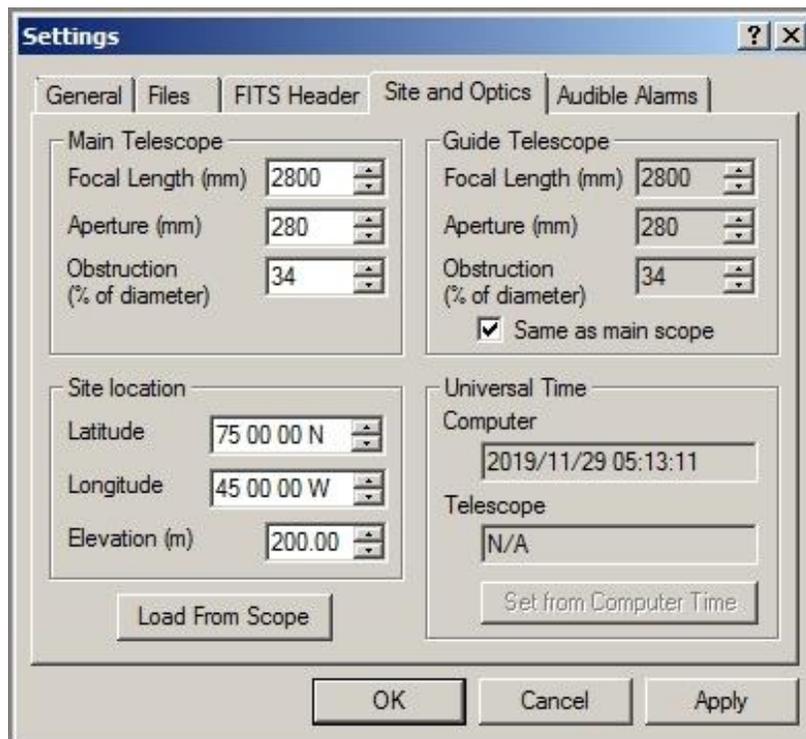
2. Start with the pick-off mirror fully extended into the optical axis. You can move the mirror upwards into this position by simply tilting the unit. Tighten the LOCK knob by turning it clockwise.

➔ CAUTION:

Do not touch the reflective surface of the mirror.

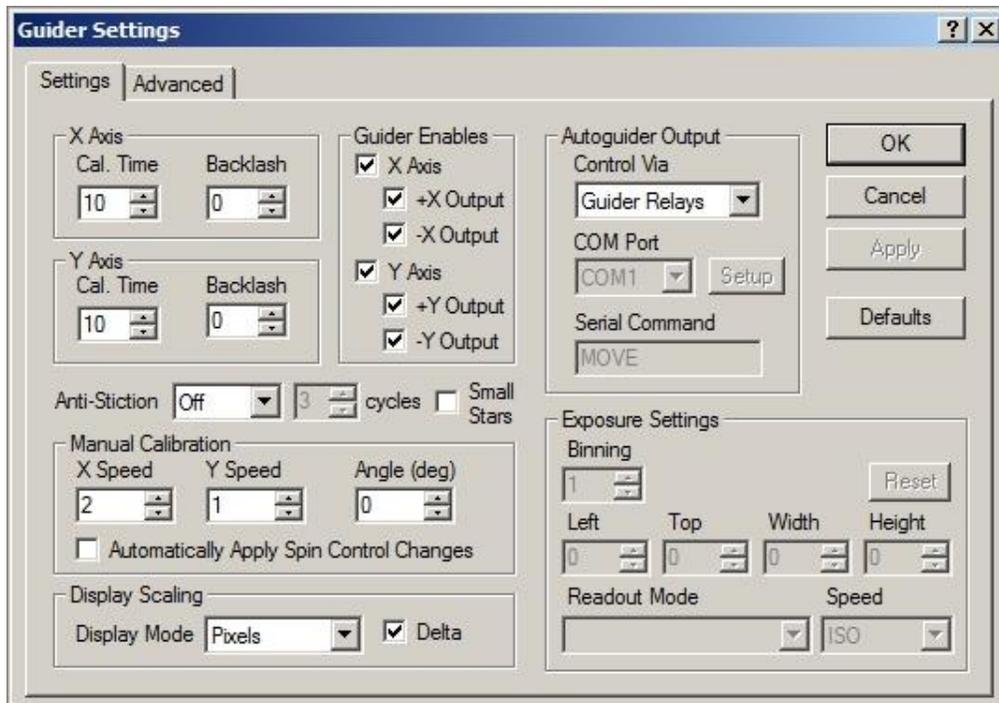
For most optical systems this will provide an unvignetted view. However, for very fast optical systems there is a possibility of vignetting. A test for vignetting is provided following this connection procedure.

3. Mount the camera+filter wheel+StarChaser equipment assembly onto your telescope.
4. Attach your camera and filter wheel cables in their usual manner and then power the units up.
5. Connect the supplied USB cable between the StarChaser's USB port and your computer.
6. If you plan to use the supplied ST-4 telescope mount interface cable to send autoguider commands to the telescope mount, connect the cable between the StarChaser's GUIDE port and the telescope mount's guider port. If your telescope mount has an ASCOM driver that supports "Pulse Guide" then you can alternatively send the autoguider commands through that interface. Additional information is provided in step 10 below.
7. Connect the StarChaser's power supply to the POWER port and apply power.
8. Launch MaxIm LT to connect to and configure the main camera, filter wheel, and guider.
9. Click the *Settings* item under the main *File* menu. In the **Settings** window click the *Site and Optics* tab and enable the *Same as main scope* checkbox in the *Guide Telescope* block. Click *OK* to finish.



10. You have several options for sending the autoguider commands from the StarChaser to your telescope mount. If you connected the ST-4 style telescope mount interface cable in step 6, commands can be sent directly from the StarChaser to the mount. Alternatively if your telescope has an ASCOM standard driver for computer control via USB, serial port, or other means, then you do not need to connect that cable.

Click the Camera Control icon  to open the **Camera Control** window and then click the *Guide* tab. Click the *Settings* button to open the *Guider Settings* form.

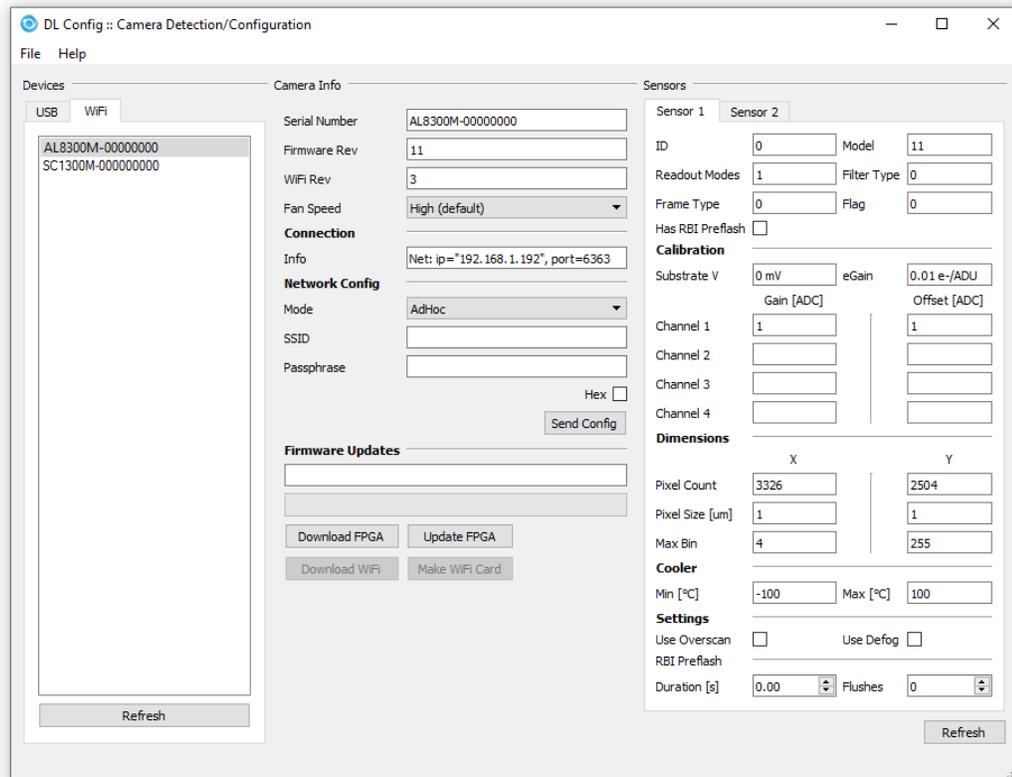


Set the *Autoguider Output Control Via* drop-down menu to your preferred method:

- To send commands directly from the StarChaser to the mount via the ST-4 telescope mount interface cable, select *Guider Relays*.
- If you are using MaxIm DL Pro to control the telescope mount via the **Observatory Control** window and ASCOM driver, then select *Telescope*. This allows you to use a single cable to control the mount and send autoguider commands, and so the ST-4 cable is not necessary.
- If you are using MaxIm LT then the **Observatory Control** window is not available. In this case, select *ASCOM Direct* and click the *Setup* button to configure your ASCOM driver. Note that this method is also recommended for MaxIm DL Pro if you are using the DC-3 Dreams ACP Observatory Control software to control the telescope. The ST-4 cable is not necessary for this option either.

Choose your desired method and then click *OK* to finish.

11. Click the *Setup* tab in the **Camera Control** window.
 - If you are configuring an Aluma or Aluma AC imaging camera with the StarChaser then go to step 12.
 - If you are configuring an STF, STT, STX, or STXL imaging camera with the StarChaser then go to step 13.
12. For Aluma or Aluma AC imaging cameras with the StarChaser:
 - a. Set up the main imaging camera under *Camera 1* as *DL Imaging* and click the *Advanced* button. The **DL Config** form opens. This form allows you to check camera parameters and also to perform firmware updates and additional camera configuration.



- b. Select your camera from the *Devices* list. Various camera parameters will auto-populate the display fields under the *Sensor 1* tab. Use the default values and close the form.
- c. Back in the **Camera Control** window, ensure that the *Dual Chip Mode* checkbox is not selected.
- d. Click the *Setup Filter* button under *Camera 1* and set the *Filter or Controlling Camera Model* parameter to *DL Imaging+FW*.
- e. Configure your filter positions, names, and focus offsets as desired in the list. Click the *OK* button to accept your settings and close the form.
- f. Configure the StarChaser under *Camera 2*. Click the *Setup Camera* button and select *DL Imaging* as the *Camera Model*.

- g. If you will be using an adaptive optics unit, select *Sensor 1* from the *AO* drop-down menu. Otherwise select *Off*.
 - h. Press the *Advanced* button to open the **DL Config** form.
 - i. Select the StarChaser from the *Devices* list. Various parameters will auto-populate the display fields. Use the default values and close the form.
 - j. Back in the **Camera Control** window, click the *Connect* button. This connects your main imaging camera and the StarChaser.
 - k. Proceed to [5.2 Pick-off mirror adjustment and focusing](#).
13. For STF, STT, STX, or STXL imaging cameras with the StarChaser:
- a. Set up the main imaging camera under *Camera 1*. Select *SBIG Universal* from the *Camera Model* dropdown menu and *USB* from the *Connect To* menu, then click *OK* to accept your settings and close the form.
 - b. Back in the **Camera Control** window, ensure that the *Dual Chip Mode* checkbox is not selected.
 - c. Click the *Setup Filter* button under *Camera 1* and set the *Filter or Controlling Camera Model* parameter to *SBIG Universal*.
 - d. Configure your filter positions, names, and focus offsets as desired in the list. Click the *OK* button to accept your settings and close the form.
 - e. Configure the StarChaser under *Camera 2*. Click the *Setup Camera* button and select *DL Imaging* as the *Camera Model*.
 - f. If you will be using an adaptive optics unit, select *Sensor 1* from the *AO* drop-down menu. Otherwise select *Off*.
 - g. Press the *Advanced* button to open the **DL Config** form.
 - h. Select the StarChaser from the *Devices* list. Various parameters will auto-populate the display fields. Use the default values and close the form.
 - i. Back in the **Camera Control** window, press the *Connect* button. This connects your main imaging camera and the StarChaser.
 - j. Proceed to [5.2 Pick-off mirror adjustment and focusing](#).

5.2 Pick-off mirror adjustment and focusing

Prior to using the StarChaser for autoguiding, the position of the pick-off mirror may need to be adjusted to eliminate or minimize any possible vignetting in your optical system. Perform the following procedure to determine if you need to make an adjustment for use in your system. This should be done prior to installing an adaptive optics unit, if applicable.

1. Point the telescope at a nearby wall or flat field screen illuminated by ambient light or artificial light of some kind. Total darkness is not necessary.
2. Click the *Expose* tab in the **Camera Control** window and enable the *Camera 1* radio button. Start the main camera in *Continuous* mode, with an exposure duration adequate to get a uniform but not saturated field. A count level of 5,000 to 50,000 should be fine for a 16-bit CCD or 1,000 to 3,500 for a 12-bit CMOS sensor. Use the **Information** window to view the pixel values in the images.
3. If you see a shadow on one side of the camera's image, this is the shadow of the guider mirror vignetting the camera's CCD. Since this is undesirable, it requires adjustment. The amount of adjustment varies with the telescope design and focal ratio. The goal of this adjustment is to get the mirror as far into the field of view as possible without vignetting the main imager. If you do not see a shadow, proceed to step 9.
4. Disconnect the units in MaxIm LT, power them down, and remove the equipment assembly from the telescope. Place it on a flat surface with the telescope side facing up. A flat surface is required here, otherwise the pick-off mirror may shift position on its own when you loosen the LOCK knob in the next step.
5. Loosen the LOCK knob on the side of the StarChaser guider assembly by turning it counter clockwise.
6. Push the pick-off mirror downwards into the guider body by a **small** amount - the entire range of motion for the pick-off mirror is only about ¼-inch (6 mm). Move the mirror by gently grasping its sides and sliding it down.

 **CAUTION:**

Do not touch the reflective surface of the mirror.

Tighten the LOCK knob by turning it clockwise.

7. Reinstall the equipment assembly onto the telescope, power the units back up, and reconnect to them in MaxIm LT. Repeat steps 2 and 3.
8. If vignetting is still present, repeat steps 4 to 7 until the vignetting is removed or minimized. Otherwise, proceed to step 9.

Once the pick-off mirror has been properly positioned, it should only require re-adjustment if you mount your camera assembly on another telescope type or otherwise change your optical configuration.

9. If you are installing an adaptive optics unit, then proceed to section [6 – Installing an Adaptive Optics Unit](#) to complete your installation. Otherwise, complete this procedure to focus the StarChaser.
10. Point the telescope at a star-rich region in the night sky. Select the desired main camera filter to use and ensure that the *Camera 1* radio button is enabled. Start the main camera in *Continuous* mode and focus it using the telescope focuser controls. Stop the exposures when focusing is completed.
11. Enable the *Camera 2* radio button and start the StarChaser in *Continuous* mode with an exposure duration of 1 to 3 seconds.
12. Focus the StarChaser’s image by turning the FOCUS knob on the unit until a good focus is achieved.

Finding guide stars initially can sometimes be a bit difficult, so target an open cluster or other star-rich area of the sky to facilitate this. Also, as is typical for off-axis guiders, the off-axis arrangement without correcting optics may not yield perfectly round stars on the guide sensor. This is normal and will not affect performance.

NOTE 1:

Once you have obtained a good initial focus, it is sometimes beneficial to slightly defocus a guide star image when actually guiding. This may allow the system to perform more consistent centroid calculations.

NOTE 2:

You may see a gradient in the guider image’s sky background. This is due to the various apertures upstream from the guider assembly limiting its field of view, but this does not affect guiding. It merely causes stars that are farther off-axis to be dimmer.

13. Perform the standard guider calibration procedure in your MaxIm LT or MaxIm DL Pro software to calibrate the StarChaser. Refer to the online Help file for procedural details.

When the calibration is complete, your StarChaser is ready for guided imaging!

TIPS:

The pick-off mirror position affects the back-focus distance, so to achieve the full range of back-focus adjustment you may need to reposition the mirror.

Sometimes the mirror may be difficult to access. You can move the pick-off mirror by loosening the lock screw, gently tipping the unit, and then tightening it again. It is easy to move it to either end stop; it is also possible with a gentle motion to move it to intermediate positions.

6 – Installing an Adaptive Optics Unit

You must perform the procedure in [5.1 Configuration and connection](#), and then steps 1 to 9 in procedure [5.2 Pick-off mirror adjustment and focusing](#) prior to installing an Adaptive Optics unit.

NOTE 1:

An FW8S-Aluma filter wheel, SC-2, and AO-8A are shown in this procedure for illustrative purposes. However, the procedure for mounting an SC-3 to an appropriate filter wheel and AO-X unit is identical, except as cited.

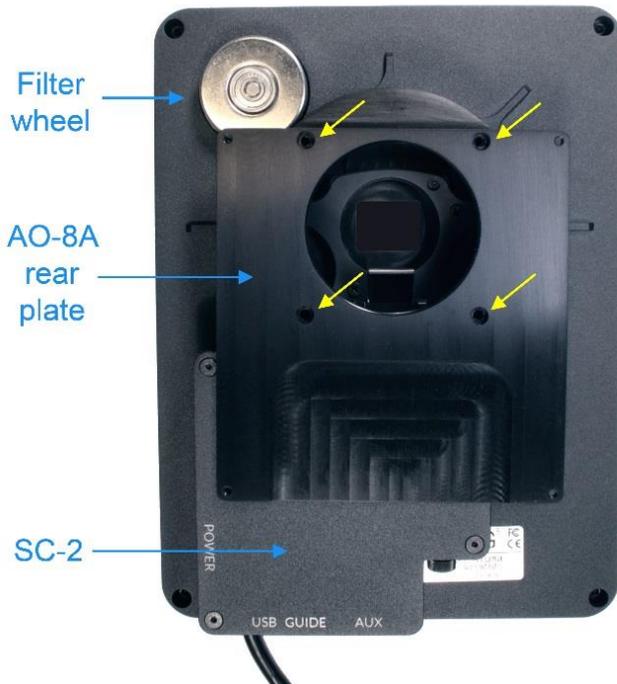
NOTE 2:

For SC-2: If you want to use an AO-8T (the STT version) instead of the AO-8A, note that the connector is a different type. You can use Adapter Cable (11044) available separately from Diffraction Limited for this purpose. The adapter cable plugs directly into the male connector on the AO-8T housing and the pigtail connector is not used.

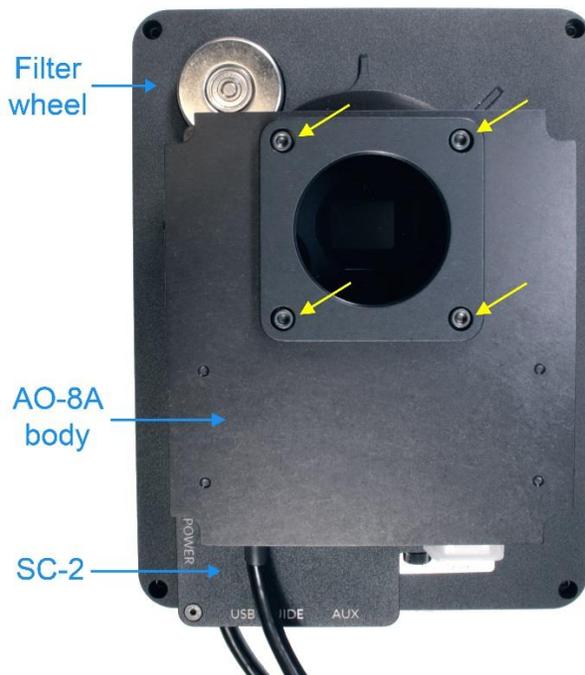
NOTE 3:

For SC-3: If you want to use an AO-X, the Adapter Cable (11044) is available separately from Diffraction Limited. If you purchase a package including both the StarChaser SC-3 and the AO-X, then the cable is included.

1. Disconnect the camera and guider in the **Camera Control** window of MaxIm LT. Then turn off the AC power to both the camera and StarChaser units.
2. Detach required cables and remove the camera+filter wheel+StarChaser assembly from your telescope. Place it on a clean flat surface, with the telescope opening facing upwards.
3. Detach and remove the adapter plate from the StarChaser by removing the four 4-40 x 1-inch screws (for SC-2) or 6-32 x 1-1/8" screws (for SC-3). Set the adapter plate aside.
4. Place your AO unit on a clean flat surface, with the telescope opening facing upwards.
5. On the front (telescope side) of the AO there are four screws that hold the unit together. Remove the screws and carefully lift off both the front plate and the body of the AO from the rear plate. Place them aside on a clean flat surface.
6. Place the AO rear plate on top of the StarChaser and align the four mounting holes.



7. Fasten the AO rear plate and the StarChaser to the filter wheel using the four supplied 4-40 x 1-inch screws (for SC-2) or 6-32 x 1-1/8" screws (for SC-3).
8. Carefully place the AO body and front plate back onto the rear plate and fasten them together using the four screws removed in step 5.



9. **For SC-2:** Attach the T-thread nosepiece that was supplied with your camera to the front of the AO-8A unit. No adapter plate is required here. **For SC-3:** Attach the camera's adapter plate to the front of the AO-X and then attach the T-thread nosepiece to the plate. Note also that if your camera was supplied with adapter plate shims, then these need to be reinstalled under the plate, as stated in the camera's user manual.



10. Re-install the completed equipment assembly onto your telescope.
11. Re-attach your camera, filter wheel, and StarChaser cables.

➡ CAUTION:

Never “hot plug” cables into or from units. This is especially important for AUX and I²C connectors. Always disconnect power before connecting or disconnecting accessories or cables.

12. **For SC-2:** Connect the fixed cable on the AO-8A to the StarChaser SC-2 AUX port. If you are installing an AO-8T, connect the Adapter Cable (11044) between the male connector on the AO-8T and the StarChaser SC-2 AUX port.
13. **For SC-3:** Connect the Adapter Cable (11044) between the AO-X unit's I²C OUT port and the StarChaser SC-3 AUX port.
14. Apply power to the main imaging camera and the StarChaser.
15. Launch MaxIm LT and click the Camera Control icon  to open the **Camera Control** window.

16. In the *Setup* tab, click the *Connect* button. You configured all of your components in [5.1 Configuration and connection](#) and MaxIm LT retains those settings, so no additional configurations are required.
17. Point the telescope at a star-rich region in the night sky. Select the desired main camera filter to use and ensure that the *Camera 1* radio button is enabled. Start the main camera in *Continuous* mode and focus it using the telescope focuser controls. Stop the exposures when focusing is completed.
18. Enable the *Camera 2* radio button and start the StarChaser in *Continuous* mode with an exposure duration of 1 to 3 seconds.
19. Focus the StarChaser's image by turning the FOCUS knob on the unit until a good focus is achieved. Finding guide stars initially can sometimes be a bit difficult, so target an open cluster or other star-rich area of the sky to facilitate this. Also, as is typical for off-axis guiders, the off-axis arrangement without correcting optics may not yield perfectly round stars on the guide sensor. This is normal and will not affect performance.

NOTE 1:

Once you have obtained a good initial focus, it is sometimes beneficial to slightly defocus a guide star image when actually guiding. This may allow the system to perform more consistent centroid calculations.

NOTE 2:

You may see a gradient in the guider image's sky background. This is due to the various apertures upstream from the guider assembly limiting its field of view, but this does not affect guiding. It merely causes stars that are farther off-axis to be dimmer.

20. Perform either the standard guider or AO calibration procedure in your MaxIm LT or MaxIm DL Pro software to calibrate the StarChaser. Refer to the online Help file for procedural details.

When the calibration is complete, your StarChaser is ready for guided imaging!

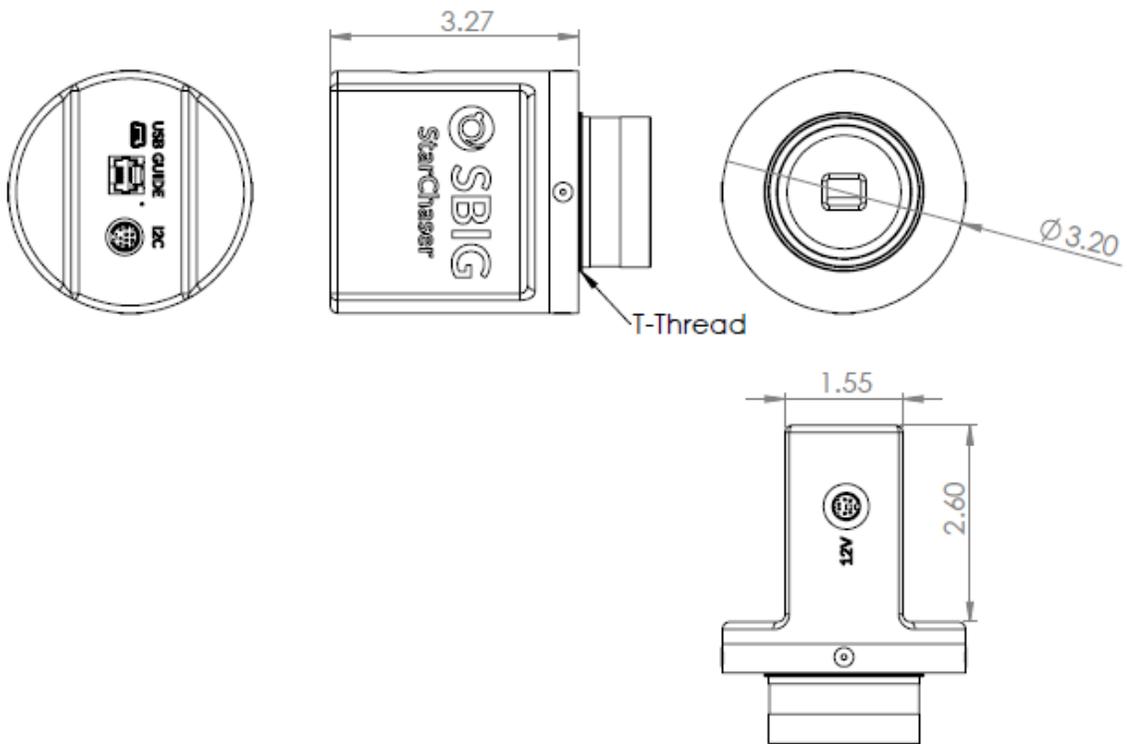
7 – Maintenance

The StarChaser Off-Axis Guiding Camera requires only minimal maintenance. Use cotton swabs and isopropyl (rubbing) alcohol to clean the pick-off mirror if it becomes necessary. Never re-use a cotton swab - use only fresh ones. Apply only gentle pressure with the cotton swab during cleaning.

8 – Specifications

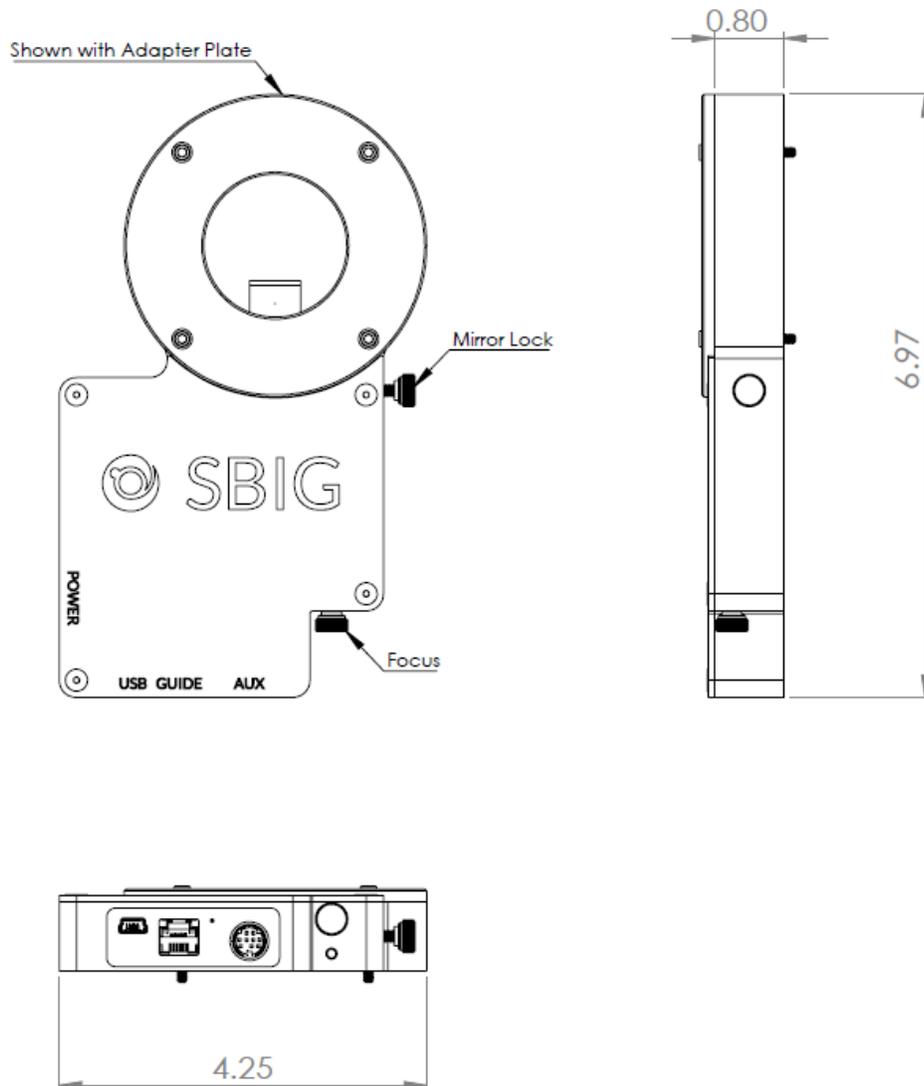
StarChaser SC-1

- Sensor: 1.3 megapixel global shutter CMOS
1280 x 1024 pixels, 4.8 micron square pixels
10-bit ADC readout
- Power: Approximately 300 mA
- Dimensions:
- Weight: Approximately 0.3 pounds (136 gm)



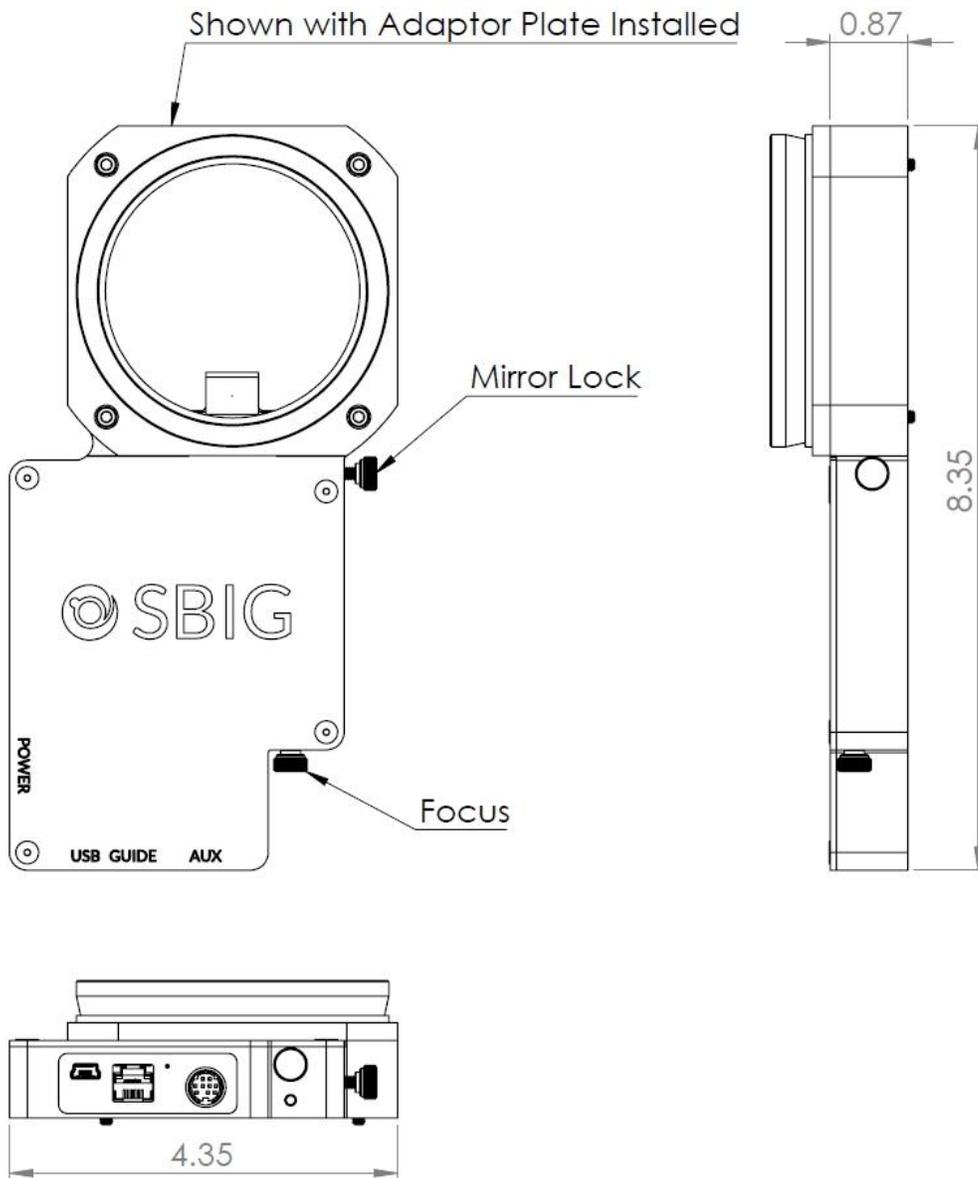
StarChaser SC-2

Sensor:	1.3 megapixel global shutter CMOS 1280 x 1024 pixels, 4.8 micron square pixels 10-bit ADC readout
Power:	Approximately 300 mA
Dimensions:	6.97 x 4.25 x 0.80 inches (177 x 108 x 20.3 mm)
Weight:	Approximately 0.6 pounds (273 gm)
Back focus Range:	1.73" to 2.96" (43.9 mm to 75.2 mm)



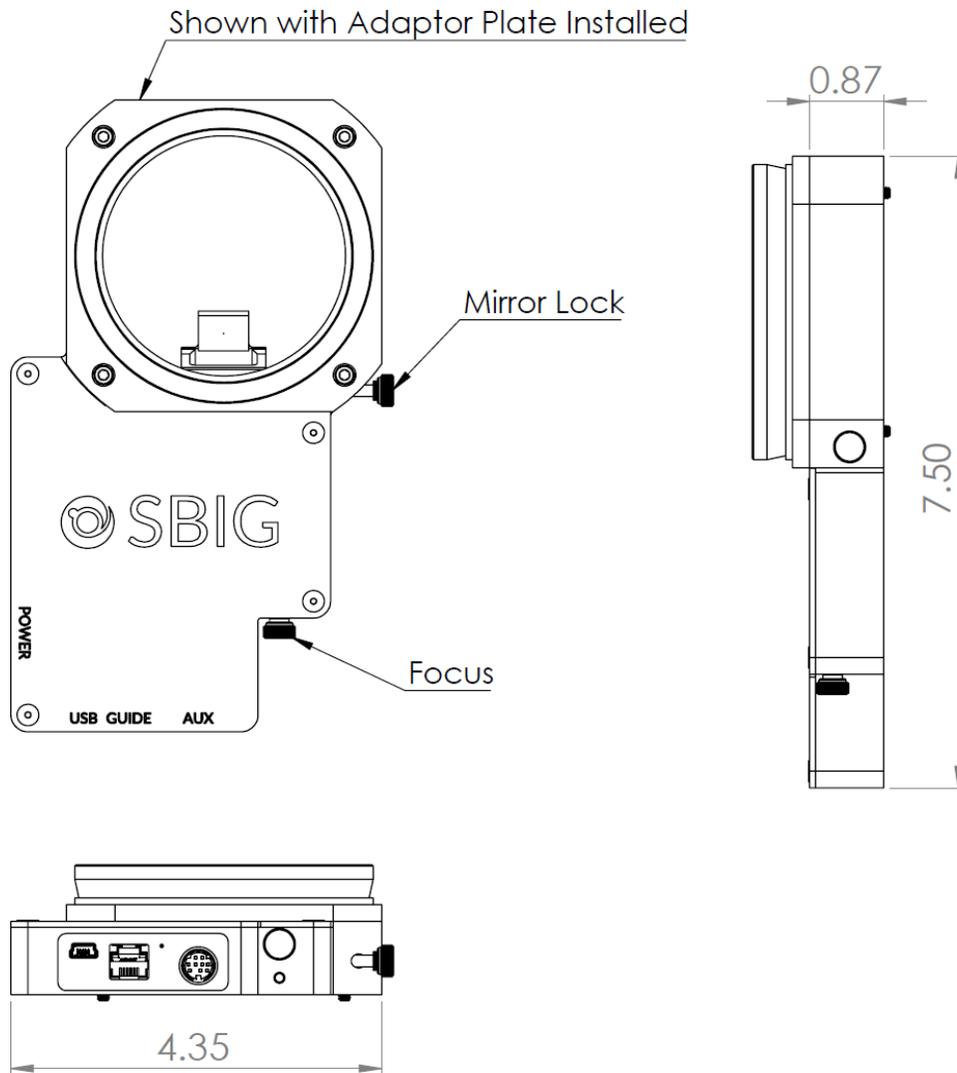
StarChaser SC-3-LONG

Sensor:	1.3 megapixel global shutter CMOS 1280 x 1024 pixels, 4.8 micron square pixels 10-bit ADC readout
Power:	Approximately 300 mA
Dimensions:	8.35 x 4.35 x 0.87 inches (212 x 110 x 22.1 mm)
Weight:	Approximately 0.9 pounds (400 gm)
Back focus range:	2.23" to 4.23" (56.6 mm to 107.4 mm)



StarChaser SC-3-SHORT

Sensor:	1.3 megapixel global shutter CMOS 1280 x 1024 pixels, 4.8 micron square pixels 10-bit ADC readout
Power:	Approximately 300 mA
Dimensions:	7.50 x 4.35 x 0.87 inches (191 x 110 x 22.1 mm)
Weight:	Approximately 0.9 pounds (400 gm)
Back focus range:	1.51" to 3.06" (33.4 mm to 77.7 mm)



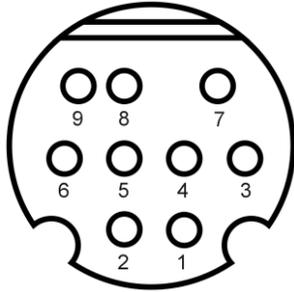
Appendix A: SBIG StarChaser Camera Details

5.1 A-1 Connector pinouts

USB connector pinout is to the USB standard. The connector works with USB 2.0 mini cables.

AUX connector (9-pin mini-DIN)

The diagram shows the pin number identification when looking into the camera connector.

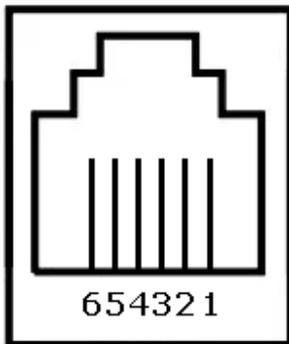


Pin 1: GND	Pin 6: 3.3V Out
Pin 2: I2C SDA	Pin 7: 12V Out
Pin 3: I2C SCL	Pin 8: N/C
Pin 4: N/C	Pin 9: N/C
Pin 5: N/C	

NOTES:

- I2C interface is nominally 3.3V, and will accept up to 5V input.

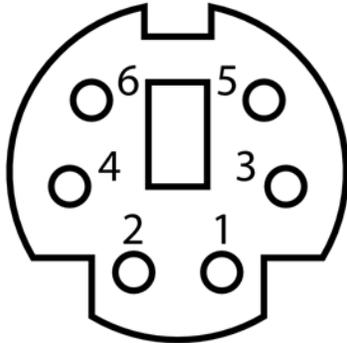
GUIDE OUT (RJ-12) Looking into the StarChaser; diagram orientation matches the StarChaser connector panel with the locking tab at top:



Pin 1: X+
Pin 2: Y+
Pin 3: Y-
Pin 4: X-
Pin 5: COMMON
Pin 6: AUX (not connected)

POWER connector (6-pin mini-DIN)

The diagram shows the pin number identification when looking into the camera connector.



Pins 1, 3, 5: +12V

Pins 2, 4, 6: GND

NOTES:

- Maximum recommended input voltage is 14V DC
- The shell of the connector is connected to ground via 1 Megaohm in parallel with 100 pF, and should be connected to the cable shield.
- Power ground is connected to the chassis of the camera through a low impedance.
- For a positive retention power connection we recommend using locking connector Kycon 806-KMDLAX-6P.



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