FastFocus Collimation Instructions

Step-by-Step Instructions for Collimating the Celestron Optics with FastFocus installed.

After installing the FastFocus SMSF focuser on the Celestron C-11 or C-14 EdgeHD telescope, the optics will need to be re-collimated. Optical collimation is the process of aligning all optical elements such that each element is centered on the same optical axis. Fortunately, with the EdgeHD scopes the corrector elements inside the baffle tube are already aligned with the primary mirror and corrector plate. Only the secondary mirror must be adjusted to collimate the entire telescope. The Celestron C1100 EdgeHD OTA with Optec's FastFocus and split wiring kit are shown at right.

Optec has designed a simple push-pull system into the FastFocus motorized mirror holder for easy collimation in the field. We find that visual collimation using an eyepiece is the most efficient method of performing the collimation and will describe the process in this document.

Requirements for Collimation

We recommend two eyepieces be used for collimation – a medium power eyepiece, perhaps around 20 to 25mm focal length, and a high power eyepiece of 9mm or less focal length. You should install the visual back and star diagonal that were included with your EdgeHD scope and adjust for comfortable viewing.

The only tool required is a 5/32" ball-driver hex wrench included with the FastFocus kit. Replacement ball-drivers can be obtained from Optec, most local hardware stores, or online at McMaster-Carr (www.mcmaster.com – item # 5497A29).

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Push-Pull Screws

The FastFocus SMFS focuser includes three sets of 10-32 x ½" long socket head cap screws (SHSC). Each pair includes one rounded point SHCS screw and one regular SHCS screw. The FastFocus mechanism consists to two adjacent plates with the base plate attached to the Fastar ring on the Celestron corrector plate, and a second plate that supports the motor mechanism with the secondary mirror. This top motor plate provides the collimation adjustment against the fixed bottom mounting ring. The top plate is anodized orange while the bottom mounting ring is black.

Figure 1

The PULL screws pass through the top plate and thread into the base plate mounting ring. The PUSH screws thread into the top plate and push against the base plate. The push screws work against the pull screws to fix each pair in place. By adjusting each of the three pairs of push-pull screws, you can easily make fine adjustments to the mirror position.

Initial Setup

The initial setup conditions for collimation can be established in advance. Connect your computer to the FocusLynx hub and command the FastFocus to the center position at 22,400 steps. Check each push-pull set of screws to ensure there is a small gap between the plates. That is, the top plate should not be resting directly on the bottom plate mounting ring as there may not be enough adjustment available to perform the collimation. To start, each push-pull pair should be snug, holding the top plate securely against the bottom mounting ring plate with an approximately 1 to 2mm gap.

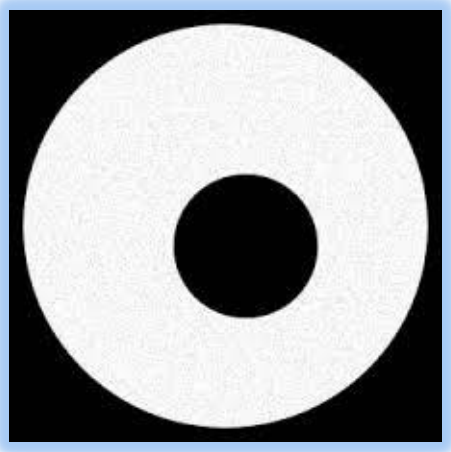
Figure 2

Insert your medium power eyepiece. Locate a reasonably bright star or open cluster and adjust the coarse focus knob on the scope to bring the star into best focus. Now use the

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FastFocus hand controller or PC to de-focus the star a bit. If the out-of-focus star looks similar to the image shown in Figure 2, the scope is in need of collimation.

The Collimation Procedure will bring the dark central obstruction spot to the center of the illuminated circle.

At medium power you may not see the diffraction rings or Airy's disk. As you work through the process you will want to switch to the high powered eyepiece and tighten up the focus. The image at right (Figure 3) shows an out-of-collimation star at high power very close to best focus.

Figure 3

For now, leave your medium power eyepiece in place. Notice that one side of the star appears to be "pinched". We will use the handle of the ball-driver to identify this pinched side and adjust the central obstruction shadow to the center, thereby removing the "pinch".

Collimation Procedure: Step-by-Step

Step 1 – Rough Collimation

With the medium power eyepiece in place and the star centered, place the handle of the 5/32" ball driver in front of the OTA on one side. We usually place the handle such that it extends toward the center like the hands on a clock. Looking through the eyepiece, you should be able to see the handle as a dark band across a portion of the star. Move the handle around the front of the OTA until it covers the narrowest portion of the pinched side of the star.

Now look for the set of push-pull screws closest to the ball-driver handle. Start by adjusting this pair of push-pull screws.

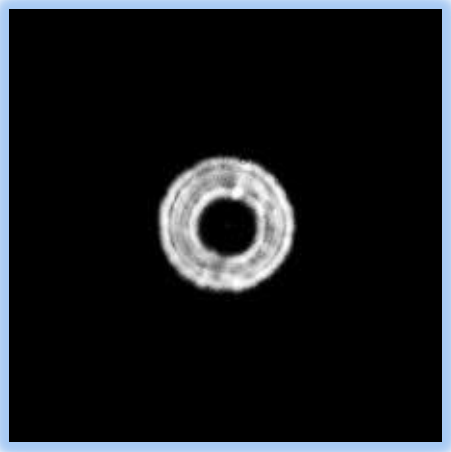

Figure 4

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Step 2 – "To Remove the Pinch, Tighten the Pull"

With the push-pull pair closest to the pinched side of the star identified, you will want to loosen the push screw and tighten the pull screw using the 5/32" ball driver. Notice that a very small adjustment will result in a significant change in the star image. In addition, the star will naturally move in your field of view which is why we start with a medium power eyepiece. Using an open cluster or field with many stars can make this process a bit easier rather than chasing a single star around.

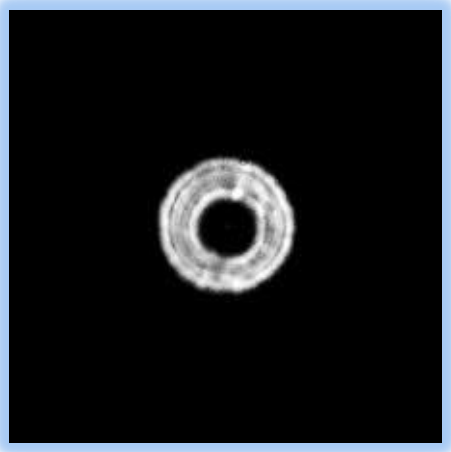

Figure 5

Continue adjusting the push-pull screws until the central obstruction spot (dark circle at right) is centered as best as possible with the medium power eyepiece. After a few minutes you will be get used to the simplicity of the push-pull system by adjusting either screw to improve the view. At times you will likely adjust two or more pairs of the push-pull screws to center the central obstruction shadow.

In the end, you should see something similar to the image in Figure 5.

Step 3 – High Power Adjustment

With the rough collimation accomplished you can switch to your high powered eyepiece. Adjust the focus using the FastFocus Hand Controller until you are at the best focus. Look closely for the diffraction rings and Airy's Disk.

Once you've visually identified the diffraction pattern and Airy's disk, you can continue using the same process as the rough collimation above to fine-tune your telescopes collimation. Note, however, that if you are field collimating your scope, you will have better success if you perform the final high power adjustments on a night of good seeing. Atmospheric turbulence will make this final adjustment frustrating. However, with practice you will find that you can even collimate using these techniques on "less-than-optimal" nights.

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Alternatives to Field Testing

You can perform both rough and final collimations using artificial stars available from many telescope suppliers. Hubble Optics offers a very good 5-star artificial star light that many users find useful. Visit http://www.hubble-optics.com/artificial-stars.html for additional details. See Figure 6 below.

Another common technique for daytime collimation is to use the reflection of Christmas lights in a garden gazing ball. At Optec, we use a collimated light beam reflected off a field of chrome ball-bearings to create 64 artificial stars making collimation very easy while avoiding the negative effects of atmospheric turbulence. Whichever technique you use, you will find that your final images are far superior with a well collimated scope.

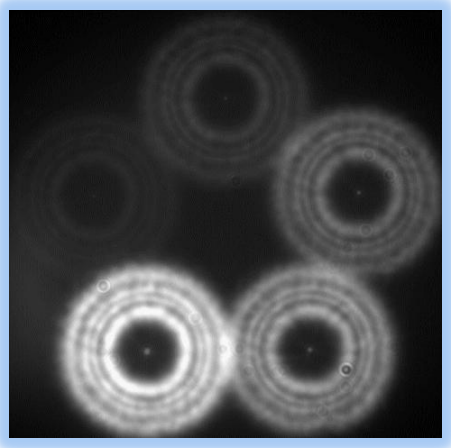

Figure 6

Additional Star Testing

For more detailed information regarding telescope optics and critical optical evaluation methods, we strongly recommend Harold Richard Suiter's *Star Testing Astromomical Telescopes*. This book is full of excellent images, examples, and diagrams explaining how to star test your telescope. Order the book online from Willmann-Bell at http://www.willbell.com/tm/tm5.htm.

Optec User Group

The Optec User Group on Yahoo! can also provide answers to specific configuration questions and provides a forum to communicate with other users. Click the banner below to subscribe.

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