



# ASTRO-TECH AT8RC

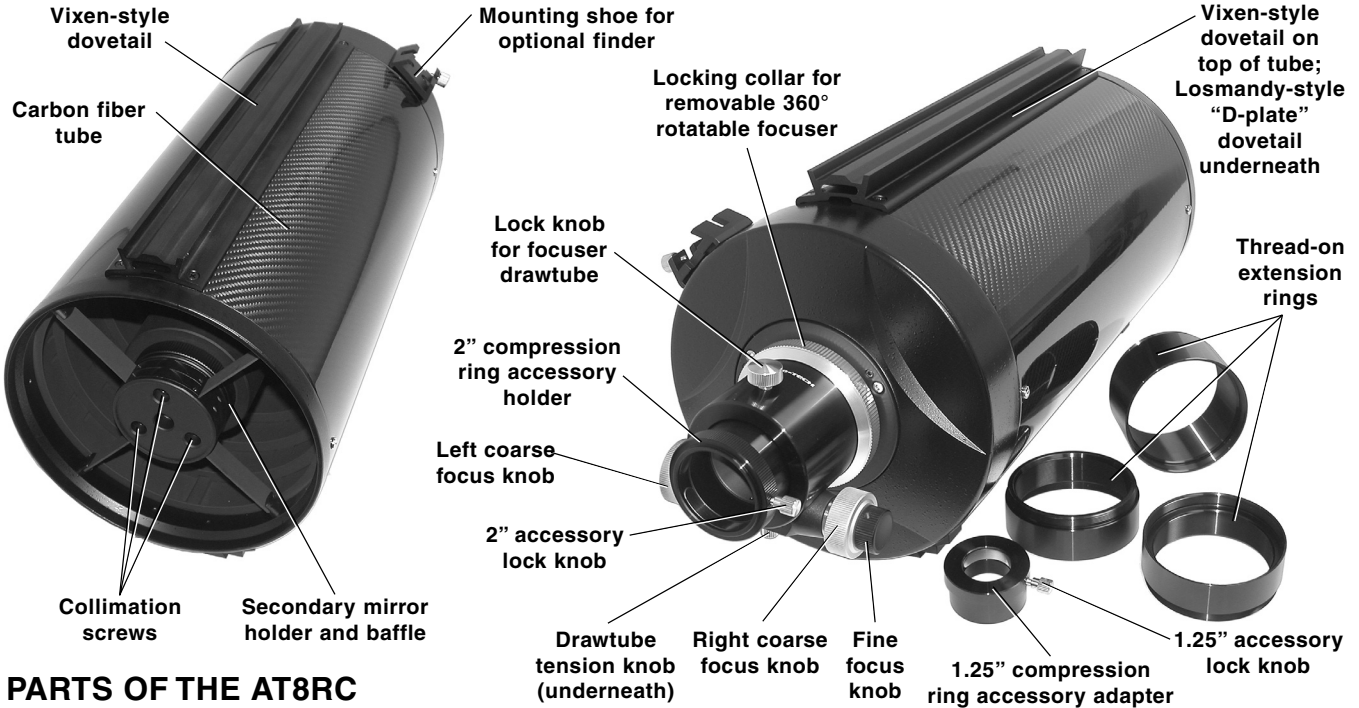
from Astronomy Technologies

Thank you for choosing this **Astro-Tech AT8RC 8" f/8** Ritchey-Chrétien astrographic reflector.

Your AT8RC is designed for coma-free imaging using DSLRs and CCD cameras. It is particularly good with systems involving long imaging equipment chains (CCD camera, filter wheel, adaptive optics system, electric focuser, etc.)

These instruction sheets will provide you with information on how to get the most out of your new Ritchey-Chrétien reflector, and how to properly maintain your telescope so it can give you a lifetime of quality imaging.

Please familiarize yourself with your astrograph's parts and functions before operating it for the first time.



## PARTS OF THE AT8RC

### Astro-Tech AT8RC Ritchey-Chrétien Astrograph Specifications

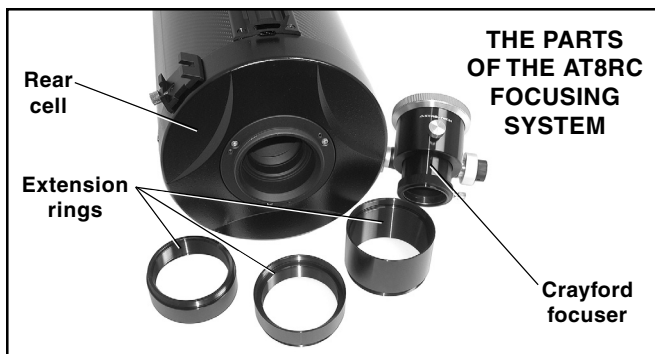
<b>Aperture</b> .....	203mm (8")
<b>Focal Length</b> .....	1625mm
<b>Focal Ratio</b> .....	f/8
<b>Optical Type</b> .....	dual hyperbolic mirror true Ritchey-Chrétien reflector
<b>Mirrors</b> .....	low thermal expansion quartz, 99% reflectivity dielectric multicoatings
<b>Secondary Mirror Holder Obstruction</b> .....	95mm (47% by diameter, 22% by area)
<b>Field Stops</b> .....	ten internal knife-edge baffles
<b>Tube Diameter</b> .....	9.02" (229mm) o. d.
<b>Tube Length (without focuser)</b> .....	18.5" (470mm)
<b>Tube Length (with focuser)</b> .....	22" (560mm)

<b>Tube Weight (without focuser)</b> .....	14.8 lbs. (6.73 kg)
<b>Tube Weight (with focuser)</b> .....	16.4 lbs. (7.45 kg)
<b>Mounting System</b> .....	one 15.5" Vixen-style dovetail, one 15.5" Losmandy-style "D-plate" dovetail
<b>Focuser</b> .....	removable dual-speed linear Crayford with 10:1 reduction ratio fine focus; 2" and 1.25" compression ring accessory holders; 360° rotating camera angle/observing angle adjuster
<b>Focuser Mounting Thread</b> .....	90mm x 1mm metric
<b>Focuser Travel</b> .....	1.97" (50mm)
<b>Focuser Extension Rings</b> .....	two 25mm, one 50mm
<b>Finder</b> .....	none; mounting shoe provided for optional Astro-Tech multiple reticle finder or similar finder

**Components of the Focusing System:** Your AT8RC has a 2" Crayford focuser with a 2" compression ring accessory holder on the focuser drawtube. There is also a separate 1.25" compression ring accessory holder that can be slipped into the drawtube's 2" holder. These allow you to use either 1.25" or 2" photographic accessories with no other adapters needed.

To minimize drawtube flexure under heavy loads during imaging, the drawtube travel of the removable AT8RC focuser is kept short, at 50mm. To make up for the longer back focus and lengthy all-purpose drawtube travel found in scopes

used both visually and for imaging (typically 80mm to 135mm or more), the AT8RC focusing system has several components, as shown in the illustration on the next page. They consist of a removable 2" linear Crayford focuser that is threaded onto the scope's rear cell when you receive your AT8RC and three thread-on extension rings (two 1" and one 2"). The rings can be installed singly or in combination between the focuser and the AT8RC's rear cell. They provide a flex-free solid metal focuser extension to take up any unneeded back focus.

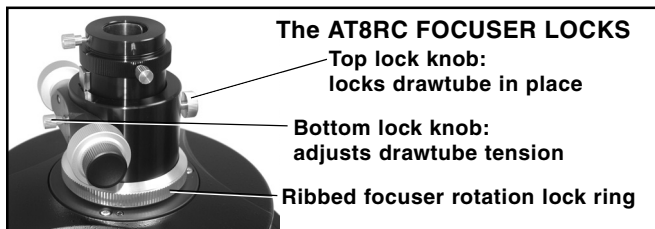


The focuser is used by itself or (more typically) in combination with one or more extension rings to place your camera at the telescope focal plane. Many long equipment train imaging setups will require either one or no extension rings. Two or three extension rings will generally be needed for imaging with a CCD that is used without other accessories and with DSLRs. A little experimentation will be called for to determine what combination of focuser and extension ring(s) will be needed for your particular combination(s) of components.

In some rare cases, there may not be enough focuser extension even when using all three extension rings. Astro-Tech makes optional thread-on extension rings in 1" and 2" lengths that can be used along with the three supplied extension rings to add the extra non-flexing focuser length needed.

**Be careful not to cross-thread any of the focuser components when and if changing them in the dark.**

**The Crayford Focuser:** The backlash-free linear drive Crayford focuser has dual-speed focusing. There are two coarse focusing knobs. The right knob also has a smaller concentric knob with a 10:1 reduction gear for microfine focusing. This provides very precise image control during critical CCD/DSLR imaging. The focus knobs have ribbed gripping surfaces so they are easy to adjust, even while wearing gloves or mittens in cold weather.



There are two chrome lock knobs on the focuser, as shown in the illustration above. The smaller bottom knob (in the housing between the focus knobs) adjusts the tension on the Crayford focuser drawtube to accommodate different weight equipment loads without focuser slippage. **This tension lock knob should always be tightened firmly, even with a light equipment load, to avoid drawtube flexure.**

The larger top knob (by the Astro-Tech logo) locks the focuser drawtube in place by disengaging the focusing knobs once the correct photographic focus has been reached.

**Rotating the Focuser:** Your AT8RC focuser can be rotated a full 360° for the best photographic composition prior to critical focusing. To rotate the focuser, loosen the ribbed aluminum focuser rotation lock ring (shown above) by turning the ring slightly counterclockwise. This ring also connects the focuser to the telescope rear cell or to an extension ring. Adjust the focuser to the desired angle. Then turn the lock ring back in the opposite direction to lock the focuser in its new orientation. It is best to adjust the focuser orientation before fine-tuning the focus and locking the drawtube.

**Mounting Your AT8RC:** The underside of the AT8RC has a 15.5" long Losmandy-style "D-plate" dovetail rail running from front cell to rear cell. This will let you install your AT8RC on any high-payload equatorial mount that uses a Losmandy-style dovetail to hold a telescope. You can also use the dovetail rail to piggyback your AT8RC on a larger scope using any accessory mounting system that uses Losmandy-style dovetail adapters.

There is also a 15.5" long Vixen-style dovetail running from front cell to rear cell on top of your AT8RC. If you have mounted your AT8RC directly on an equatorial mount using the Losmandy-style dovetail bar on the underside of the scope, this Vixen-style dovetail will let you mount accessories (such as Astro-Tech photoguide rings) on top of your AT8RC.

You can also invert your AT8RC to put the Vixen-style dovetail on the bottom. This lets you install your AT8RC on one of the many lighter-payload equatorial mounts that use a Vixen-style dovetail to hold a scope. Either way, the long length of the dovetail rails makes it easy to balance your AT8RC (and gives you the room to add optional counterweights at the nose of the AT8RC to balance long equipment trains, if needed).

**Finderscope:** No finderscope is provided, due to the photographic nature of the AT8RC. However, a rear cell mounting shoe is provided that will hold an optional Astro-Tech #ATF illuminated multireticle finder, or any similar red dot finder or refractor-type finder that will fit the mounting shoe.

**Caring for Your Scope Finish:** The body of your AT8RC is made of low thermal expansion carbon fiber cloth encapsulated in a clear epoxy shell. Automotive-grade paint is used on the aluminum front and rear cells. The focuser and dovetails are anodized. All of these very durable surfaces can become smudged with fingerprints during use, but these will not harm the finishes. A little moisture from your breath and a quick wipe with a clean handkerchief is generally enough to remove the fingerprints. Avoid harsh chemical cleaners or organic solvents like benzene, acetone, etc., as these may affect the clear epoxy finish.

**Cleaning Your Scope Optics:** Because the mirrors are protected by the optical tube and dust covers, they will rarely (if ever) need cleaning. Small amounts of dust on the mirrors will not appear in the image or block enough light to be an issue and can be safely ignored. If you absolutely feel you *must* clean the optics, however, you can do so *at your own risk*, but it is *not* recommended. You will have to disassemble the optical tube to do it, and recollimate it afterwards. This can often result in an inadvertent change in the image-critical factory-fixed spacing between the primary and secondary mirrors that will affect your performance.

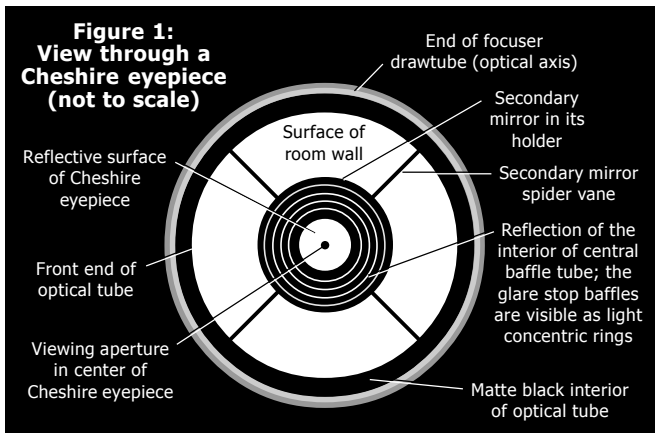
**Any damage or mirror-spacing changes to your AT8RC sustained during an attempt to disassemble and clean the optics is not covered by warranty.**

**Collimating Your AT8RC Optics:** Your Astro-Tech AT8RC Ritchey-Chrétien's primary and secondary mirrors were collimated at the factory before being shipped. Nevertheless, rough treatment in transit could potentially cause the secondary mirror to be knocked out of collimation, and rough and bumpy roads during transit to a dark sky observing site might require periodic re-adjustments. The optical axis of the primary mirror/baffle tube assembly is less likely to be knocked out of collimation, but is capable of being collimated if needed.

**Preliminary Collimation Check:** You can roughly check the collimation of both mirrors indoors before performing a more rigorous star test for a final tweaking in the field. You will need a Cheshire eyepiece to do this collimation check.

Set up your scope in a well-lit room with the telescope pointed horizontally. Remove the lens cover and point the

telescope at a white (or light colored) wall. Remove all of the extension rings and attach the focuser directly to the optical tube. Insert the Cheshire eyepiece fully into the focuser using the 1.25" eyepiece adapter. Lock the focuser drawtube firmly in place. Make sure there is a light source directed at the 45° cutout in the side of the Cheshire.



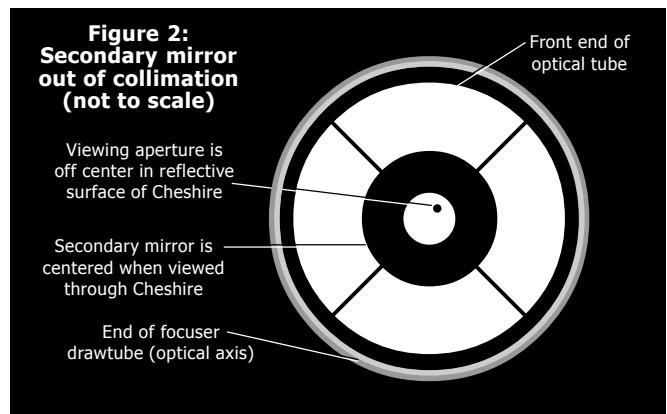
Look through the Cheshire eyepiece. You will see a small black dot within a centrally-located bright circle as seen in Figure 1, above. The central black dot is the viewing aperture in the center of the Cheshire eyepiece. The bright circle around the central dot is the 45° reflective surface of the Cheshire eyepiece and the larger black circle surrounding that is a reflection of the interior of the scope's baffle tube in the secondary mirror. Your room wall and the interior of the optical tube form the background.

Concentric light-colored rings will be visible in the black circle of the secondary mirror if your room and the light source aimed at the cutout in the side of the Cheshire are bright enough. These are the reflections from the glare stops machined into the baffle tube interior. You are seeing the front of the glare stops that face the sky and their visibility here simply shows that they are doing their job of reflecting stray light back at the sky.

The outermost ring of light around the entire Cheshire field, as shown in Figure 1, is the end of the focuser drawtube (the optical axis of the scope). You can disregard this for the time being. It will be covered later, when checking the primary mirror collimation.

If the central black dot (the viewing aperture of the eyepiece) appears centered in the circular reflective surface of the Cheshire eyepiece as shown above, no further significant adjustment of the secondary mirror will be necessary.

**Secondary Mirror Collimation:** However, if the black dot of the viewing aperture appears off-center as in Figure 2, at the top of the next column, adjust the three secondary mirror collimation screws shown below until the viewing aperture is centered as closely as possible in the Cheshire's circular



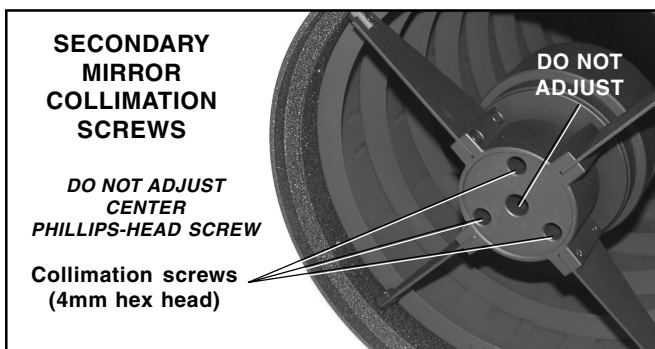
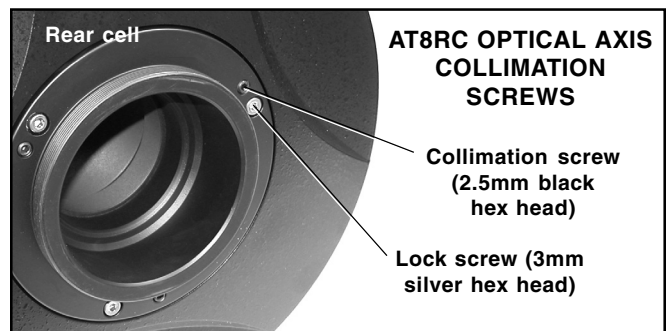
reflective surface.

A user-supplied 4mm hex key is required to collimate the secondary mirror. Adjust only the three hex head screws around the perimeter of the holder, as shown in the illustration in the previous column. *Do not adjust the center screw.* Adjusting the center screw can cause the secondary mirror to fall off and any resulting damage will not be covered under warranty.

As you adjust each of these screws you will need to make equal counter-adjustments to the other two. In other words, as you tighten one screw you will need to loosen, by an equal amount, the other two. The opposite is also true. If a screw is loosened, the two opposing screws should be tightened. When the process is complete you should have equal tension on all three screws.

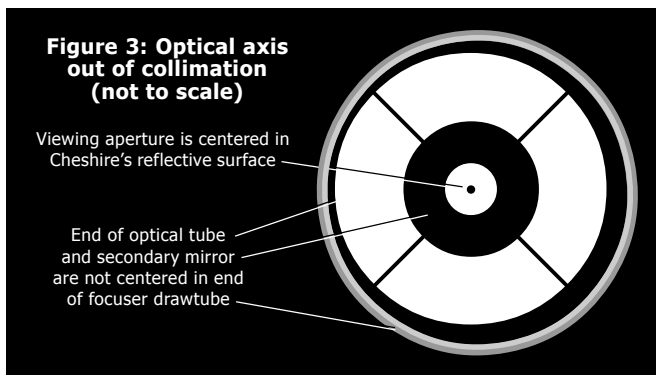
Only minor adjustments should be required to fine-tune the collimation. Adjust the screws no more than an eighth of a turn or less at a time. This will help prevent accidentally putting the optics grossly out of collimation. The force vector diagram on the next page will show you how different adjustments affect the tilt of the secondary mirror.

The correct alignment of the secondary mirror is critical in determining if the optical axis (primary mirror) requires alignment. Be certain you have properly aligned the secondary mirror before proceeding to the next step of adjusting the optical axis collimation, using the primary mirror collimation screws shown below.



**Optical Axis (Primary Mirror) Collimation:** As mentioned above, the optical axis of the scope (the primary mirror/baffle tube assembly) will rarely need collimation. If the optical axis does get knocked out of collimation, however, the image through the Cheshire eyepiece will appear to be shifted to one side within the light ring formed by the end of the focuser drawtube, as shown in Figure 3 on the next page. If properly collimated, all of the light and dark circles will be concentric, as shown in Figure 1 in the previous column.

Adjusting the optical axis will require user-supplied 3mm and 2.5mm hex keys. There are three pairs of "push-pull" hex-head screws on the rear cell of the optical tube, as shown



in the illustration on the previous page. Each pair consists of a smaller black screw and a larger chrome screw. These must be adjusted in tandem. As you loosen one, tighten the other in each pair to adjust the tilt of the optical axis in relation to the secondary mirror. This procedure will require only micro-adjustments, if any. When properly aligned you will see a concentric outer white circle around the perimeter of your view through the Cheshire eyepiece and all circular light and dark elements will be concentric.

Once the optical axis has been collimated, recheck the secondary mirror collimation and tweak as necessary, then confirm the optical axis collimation one last time.

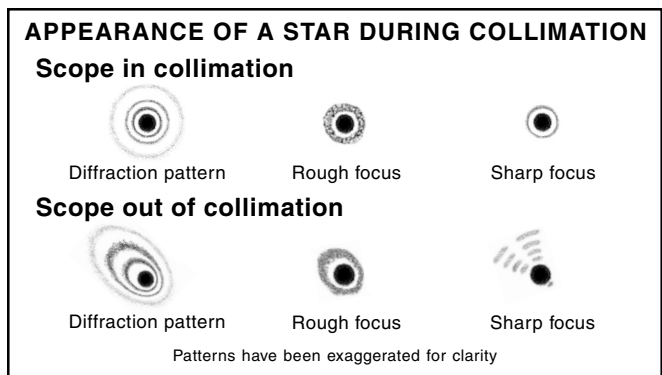
**Star Testing:** For optimum imaging performance, perform a star test to confirm the accuracy of your collimation. The star test relies on your eye and an out of focus star for collimation, rather than a Cheshire eyepiece. Seeing conditions will affect the end result, so it is somewhat more difficult than collimating indoors.

Install all three extension rings between the scope's rear cell and the focuser. Using the 1.25" compression ring adapter, insert an eyepiece directly into the focuser drawtube and visually center and focus on a bright star at a reasonably high magnification. Do not use a star diagonal in the system and be certain that the focuser tension and drawtube lock knobs are tightened firmly after focusing. Choose a star close to the zenith rather than at the horizon to minimize atmospheric distortions.

The diagram at the top of the next column illustrates the appearance of collimated (top) and out of collimation (bottom) images of the star being examined. The top left image is the diffraction pattern in a collimated scope. The center and right-hand images show what the star looks like when roughly focused and sharply focused. The bottom row of images show the same sequence through an out-of-collimation scope.

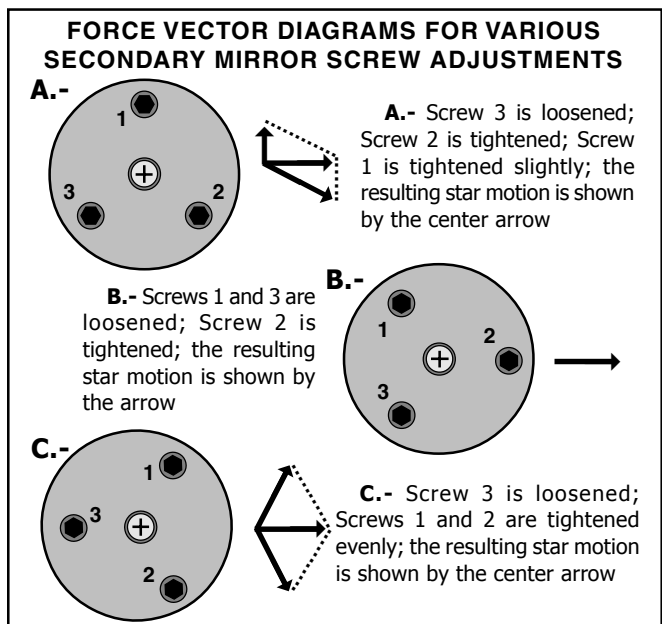
If collimation is needed, begin by placing a bright star in the center of a low to medium power eyepiece field (again without using a star diagonal). Defocus the image until it is about the apparent size of a dime or nickel held at arm's length. This will show the diffraction pattern, which should look like a bull's-eye with the circular shadow of the secondary mirror holder in the center, as shown in the illustration in the next column. If the shadow of the secondary is not precisely in the center of the diffraction rings, adjust the collimating screws to tilt the secondary mirror until the shadow of the secondary is centered in the diffraction pattern and the diffraction rings are concentric.

Always make adjustments to the collimating screws in tiny



increments, only a fraction of a turn at a time. The image of the collimating screw that is being tightened. If the secondary shadow needs to be shifted in a direction between two screws, those two must be tightened to make the image shift in that direction, while the single screw on the opposite side should be loosened. As each adjustment is made, the secondary shadow will move off center. Recenter the star's image in the field before making the next adjustment. You need to keep the star precisely centered in your field of view while collimating, which is critical to avoid false negatives.

Refer to the diagrams below, which show the direction the star image will move when different combinations of collimating screws are loosened and tightened. In all cases, the star image needs to be shifted in the 3 o'clock direction. The screws that must be adjusted depend on the orientation of the three collimating screws in relation to the desired star movement direction.



Repeat the collimation procedure several times, using successively higher power eyepieces, until you are sure the collimation is exact. Finally, after the final adjustments have been made, make sure that all of the collimating screws are snugged down tightly and evenly to ensure that the collimation will hold for many trips out into the field.