

Congratulations on owning or considering owning one of the finest telescopes commercially available today. We hope that by learning to collimate your telescope it will give you many years and thousands of hours of pleasure. **Please be sure to read this entire procedure BEFORE you begin.** You may be able to skip some of the beginning instructions, but you must know them to proceed.

The primary and secondary mirrors have been very accurately adjusted at Vixen's factory before being shipped to you. If, for any reason, either mirror needs to be removed, it is extremely important to mark the edge of the mirror or holder for repositioning when replacing. This is critical to reproducing the best view when recollimated.

If you are removing the secondary mirror holder there are a varying number of washers between the secondary and the vanes. It is imperative that you keep all of these as this will set the correct unique distance of the secondary from the primary mirror. You will also need a Centering Eyepiece for this adjustment. Many amateurs make them out of a 35mm film canister.

At the focuser end of the telescope, especially on the VC200L as it has the rear corrector lens element, you may need to add an extension to the focuser draw tube. You can use the Star Diagonal Flip Mirror system in the straight through position or any of the other 1.25" eyepiece adapters with the 43mm or 60mm extension tubes with appropriate adapters where necessary. Be sure to have them accessible before you begin.

Deep breath... Is it dark outside? Can you see and track a moderately bright star? Are the seeing conditions good and „steady“? Have you let the Optical Tube reach outside air temperature yet (20 to 45 minutes typical)? Are you sure you are not looking over any thermal feature, your neighbors fireplace, set up on top of the garage with the dryer set to stun? Then we are ready to begin.

Star Test

- Point and track on a star of approximately 2nd magnitude that is higher than 45 degrees in the sky.
- The night **must** be steady, if you see rapidly twinkling stars, enjoy the night but do not attempt collimation as the atmosphere is likely causing more disruption than any collimation errors you may be able to remove.
- If the seeing is steady and you have found and are tracking a moderately bright star, very close to the center of the eyepiece at medium low magnification then you are ready to slightly defocus the star image.

What you should see is a diffraction pattern or rings around rings around rings. This pattern of rings should (if you are in perfect collimation) be concentric, or forming a perfect "doughnut" like shape. You should have a fuzzy edged doughnut forming a perfect circle of rings inside of rings inside of rings. These rings can be faint, and if the seeing conditions are poor or the atmosphere too turbulent (not steady skies like described above) you may not be able to see them at all.

Perhaps you will see these rings, but the perfect concentric doughnut I described above will look more like an Egg with a hole in it! Not to worry, this is what we were looking for and is by far the most likely cause of any slight loss in image sharpness, contrast or less than stellar telescope performance.

If you have an Egg, not a Doughnut then you will want to move the defocused image slightly off center in the direction of the hole. Do this so when you make your adjustments, the image will be moving back towards the center of the field of view.

- Once you have off centered the image in the direction of the hole, you are now ready to adjust the **SMALLER** screws on the back of the telescope.
- Use the smaller Allen key adjustments closest to the outside of the telescope as you are looking at the back.
- You are now ready to make the elliptical egg into a perfectly concentric doughnut.
- Please note there are adjustment screws closer "In" towards the focuser (these are for collimating the focuser do not use these for this Star Test adjustments)

Once you have made your defocused star a concentric ring of diffraction rings, you can replace the Low/Medium powered eyepiece with a higher magnification eyepiece. Repeat the process until you have achieved your best collimation.

If you can not achieve collimation the above way, then either the Primary Mirror, Secondary Mirror or, as unlikely but not impossible, the Focuser may be mechanically off.

If so, then it is easiest to check the Primary Mirror first. If it is true, then move to the Secondary Mirror check and finally to the Focuser.

Primary Mirror

- Find an evenly illuminated wall greater than 20 feet away that you can point the telescope towards.
- Remove everything from the focuser drawtube at the back of the telescope and focus so the tube is completely inside the telescope.
- Put your eye approximately 2" from the edge of the focuser and look straight down the inside edge of the focus tube (do not center your eye down the focus tube, your eye is looking down the focuser on the inside edge).
- Look at the Outer Edge of the CENTRAL BLACK DOUGHNUT as your eye is along the edge of the focuser.
- Note the side of the focuser your eye is on. If you are looking down the focuser at the bottom or 6 O'clock, and then on the Outer Edge of that Central Black Doughnut you will see a VERY THIN dark ring at 12 O'clock to that Black Doughnut. This is a reflection from the secondary baffle.
- Now as you move your eye around the focuser, being sure to keep your eye at the edge of the focuser looking straight down the focus tube not in the center, moving from 6 o'clock to 7-8-9 etc the space between the outer edge of the Central Black Doughnut will remain the same.
- As you learn what to look for here, you can move the focus tube OUT to make the adjustment even more critical, but harder to see when learning.

If the thin ring is not evenly spaced from that central black doughnut, then you will need to adjust both Push/Pull screws at the back of the telescope until it is. These are the same set of screws on the far outside of the optical tube on the rear that you used for the Star Test procedure above. Then use the above Star Test method for final critical collimation.

Secondary Mirror

If you have taken out or need to take out the Secondary, remember not to lose any of the washers between the mirror holder and the center of the spider vanes. When retightening the set screw remember to first tighten all 3 "pull" Phillips screws equally (one turn each until holder is stable). Then tighten the 3 "push" set screws equally until they are all just snug.

- Point the telescope at an evenly illuminated wall being sure it is well away from the sun. This point should not be in the path of the sun for the duration of this process.
- Rack the focuser all the way in and insert the Centering Eyepiece. You will see a dark ring in the center of the view, if it is off centered, you will need to center it using the collimating adjustments on the secondary mirror holder.
- Once you believe this is close or perfect, then extend the focuser as you are watching. The dark ring outside the primary should be equal in all directions, and then as you adjust the focuser back, the dark ring will disappear all at once.
- You are seeing the very edge of the primary mirror complete the field. If you do not see this, adjust the secondary until this happens.
- To adjust, be sure to loosen one push screw before you tighten any others as the secondary mirror can be over-tightened and cause distortion of this flat optical plane.

Adjusting the Focuser

Remove the Secondary Mirror making sure not to lose any washers and **mark the orientation**. Do not remove the spider assembly; the secondary will come out if you carefully slide it between the spiders.

- Rack the focuser all the way out, if you have any extensions you will want to use them or the Star Diagonal Flip Mirror, with the mirror out of the optical path.
- Insert a centering eyepiece.
- Center the secondary holder in the field of view by moving the Focuser adjustment screws (these are the push/pull screws on the back of the optical tube closest to the focuser). Remember to always loosen one first before tightening the other.
- When finished, the secondary mirror holder will be centered.
- You will then most likely need to collimate the Secondary if you move the focuser.

When you have completed all the steps, we recommend that you Star Test your telescope to verify collimation.