

# Vixen® Collimating Vixen VC200L / VMC200L Optical Tubes

**Version: June 13, 2006**

- A. Before you start re-collimating the optics of your VC200L / VMC200L optical tubes, please read this entire procedure thoroughly. As you reach each step, please re-read the entire step before proceeding.
- 1) The main mirror and secondary mirror of the VC200L / VMC200L optical tubes have been adjusted to the correct position at Vixen's factory before shipment. Make sure to mark the edge of the mirrors and holders for correct repositioning before you remove the mirrors for any reason. It will be very important to put the mirrors back in their original position so that you can reproduce the best view when re-collimated.
  - 2) Please take care not to lose the washers between the secondary mirror holder and the center of the spider vanes. The number of washers here differs in each unit. The distance between the primary mirror and the secondary mirror has been adjusted precisely by using these washers.
  - 3) You may need to add an extension to the drawtube to collimate the focuser and the secondary mirror. This may be the Flip Mirror system in the straight through position, or the 31.7mm / 1¼" Eyepiece Adapter and one of the 43mm Extension Tube #AV-EA-2957 or 60mm Extension Tube #AV-EA-2956 with the appropriate adapter rings. Unscrew the eyepiece adapter from the drawtube if necessary to install extension tube. If you will be using a laser or a long Cheshire eyepiece, some kind of extension is mandatory with the VC200L to prevent contact with the rear corrector lens element
- B. Adjusting the focuser (In extreme cases: ordinarily you do not need to adjust this part)
- 1) Remove the secondary mirror and holder from the front spider. Don't forget to mark the orientation first. Aim the scope approximately horizontally. Remove the model name sticker and loosen the 3 collimation screws (fig 1-1) one full turn. Remove the Phillips screw in the center of the spider, being careful not to lose the washers that may drop out from between the spider and the secondary (they may stick to either one). Leave the spider in place. To get the secondary assembly out of the tube, aim it at the tube wall and carefully slide it between the vanes.
  - 2) Follow either (a) or (b) below to collimate the focuser. The visual method (a) is preferred.
    - a. Attach an extension tube, rack out the focuser, and insert a centering sight tube or Cheshire eyepiece into the eyepiece holder and look into it. As shown in figure 2, make the circle (a) of the secondary holder concentric with the outer circle (b) formed by the edge of field at the end of the baffle tube. Do this by adjusting the push/pull screws around the focuser (fig. 1-2). To adjust push/pull screws, always loosen one and tighten the other of the pair. If it moves in the wrong direction, reverse the order or move to another pair. The baffle tube will move with the focuser. Make sure to finish by tightening all the adjusting screws.

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b. If you use a laser collimator, first be sure that the laser itself is collimated. Using an extension tube, insert the laser making sure it is flush up against the drawtube extension and tighten the focuser tension knob. Snug down the set screws gently and rotate the collimator. If the beam moves at all, the collimator will need to be adjusted before proceeding. If laser passes collimation test: place a piece of transparent tape over the central hole in the spider or use a holographic laser. Adjust the push/pull screws around the focuser (fig. 1-2) until the beam goes through the center of the hole in the spider. Just getting the beam to shine through the hole is not good enough; it must go through the exact center. It may still be valuable to recheck collimation visually as it is most important to be sure the end of the baffle tube is centered on the spider.

### C. Collimating the secondary mirror

- 1) When you install the secondary mirror and holder, make sure to replace the washers as described in section A.2. Attach the mirror holder to the spider with only the center 'pull' Phillips screw by tightening until the holder is roughly stable. Then retighten the 3 'push' collimation set screws nearly one turn each or until they are all just snug.
- 2) Point the telescope at some bright, uniformly lit object, such as a white wall or daytime sky (well away from the sun). Attach the extension tube to the focuser drawtube and insert the centering eyepiece into the eyepiece holder. Rack in the drawtube and look into the centering eyepiece. Look for the dark ring in the center of view. This is formed by the reflection of the inside of the drawtube. It may be well off center if the secondary mirror is badly out of collimation (Fig. 3). It should be exactly centered.
- 3) Follow either (a) or (b) below to collimate the secondary. The visual method (a) is preferred.
  - a. As you extend the drawtube outward, you will see the edge of the primary mirror (surrounded by a ring of darkness) go out of the field of view. The dark ring outside the primary must disappear evenly inside the end of the baffle tube (which will not appear quite as dark, it is very subtle) as the drawtube is racked out (Fig. 4). Some older scopes have three mirror clips which make it easier to see the edge of the primary. Adjust the tilt of the secondary mirror by adjusting the three 'push' collimation screws (fig. 1-1). Loosen at least one screw before tightening another. Do not over-tighten the three collimation screws as this may distort the secondary mirror.
  - b. To use a Cheshire eyepiece with crosshairs, simply adjust the secondary mirror to align the reflection of the crosshairs in the bright center of the central black donut with the crosshairs themselves. Keep in mind though, that the procedure above (3.a.) may be more sensitive. If using a laser, adjust the secondary so that the reflected beam goes directly back to its source. Laser collimators with a "rear view" port are useful for this application.

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## D. Collimating the primary mirror

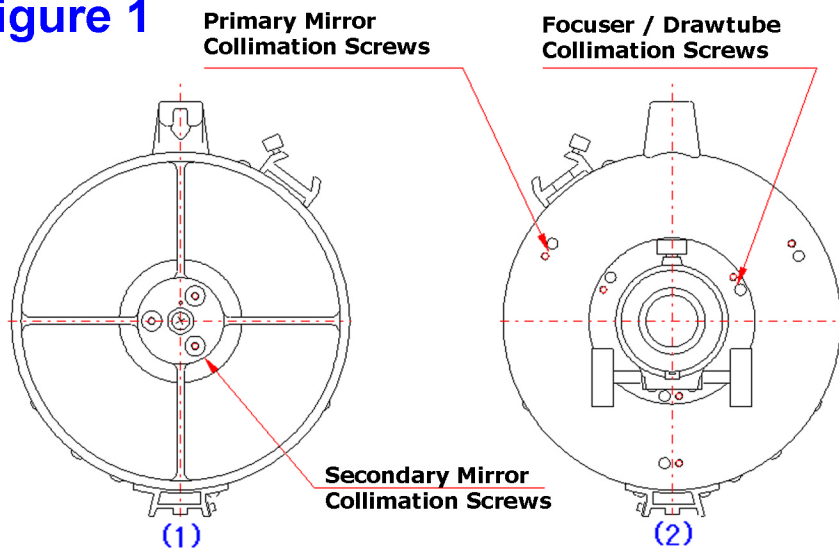
- 1) Remove all sight tubes and extensions from the drawtube and rack it all the way in. Look along the inside edge of the drawtube (not the center) and look at the outer edge of the central black donut. Just outside that donut you will see a reflection of the edge of the secondary baffle as a section of a thin dark ring with light on either side (Fig. 5). If collimation is good, that ring will be evenly spaced from the central donut as you move your eye all the way around the inside edge of the drawtube. This is more sensitive than it sounds, and can be made most sensitive by racking the drawtube out a little and/or adding an eyepiece adapter so that you can just see a gap of light all the way around. If the light gap is not even or cannot be seen on one side, adjust the primary mirror push/pull collimation screws (fig. 1-2) to center the pattern. This should get the collimation very close. Other methods such as trying to align the spiders with Cheshire crosshairs or using a holographic laser are not as reliably accurate, but can be used.

## E. Star Test

- 1) Once the coarse collimation adjustments are made, take the telescope out at night and check star images.
- 2) Under steady seeing conditions, aim the telescope at a second-magnitude star more than 45 degrees above the horizon at moderate magnification. (Do not use a star diagonal.)
- 3) Place the star in the center of the field and make the star image slightly out of focus to see whether the rings surrounded the star (diffraction rings) are concentric. If the optical axis is not aligned correctly, the off-centered diffraction rings will appear as shown in figure 6-1.
- 4) Move the optical tube to displace the star image a little from the center of the field toward the direction of off-centered rings. (Fig. 6-2)
- 5) Adjust the collimation screws of the primary mirror (Fig. 1-2) to bring the out-of-focus star image back toward the center of the field. Repeat steps 3 and 4 above until the diffraction pattern becomes concentric. (Fig. 6-3)
- 6) Changing to an eyepiece with high magnification will allow you to make a more accurate optical collimation.

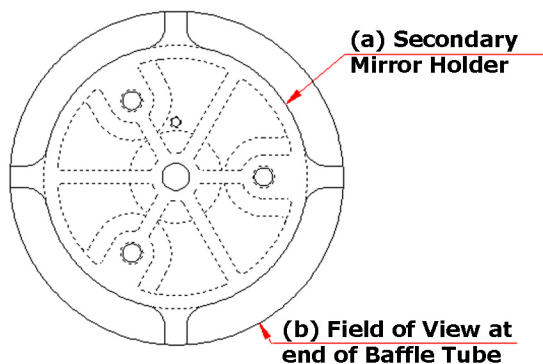
# Collimation Screw Locations

Figure 1



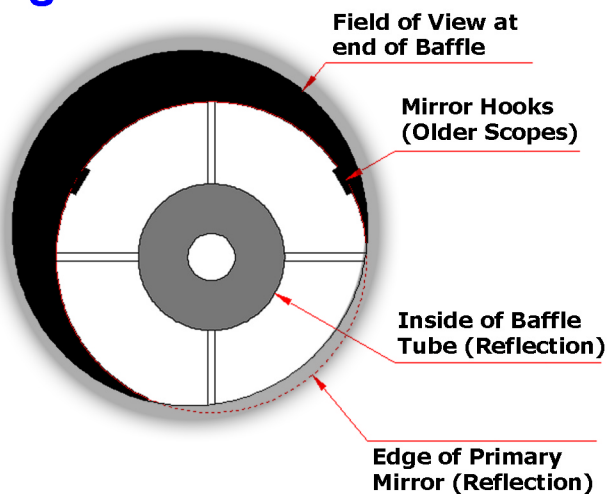
# View Through Sight Tube

Figure 2



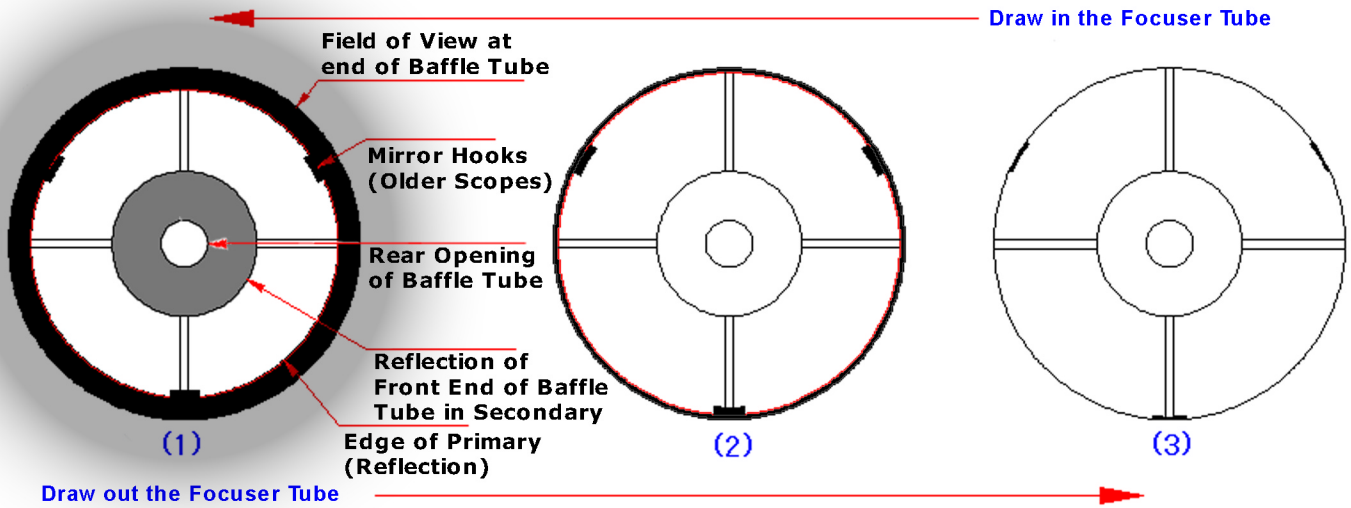
# Secondary Out of Collimation

Figure 3



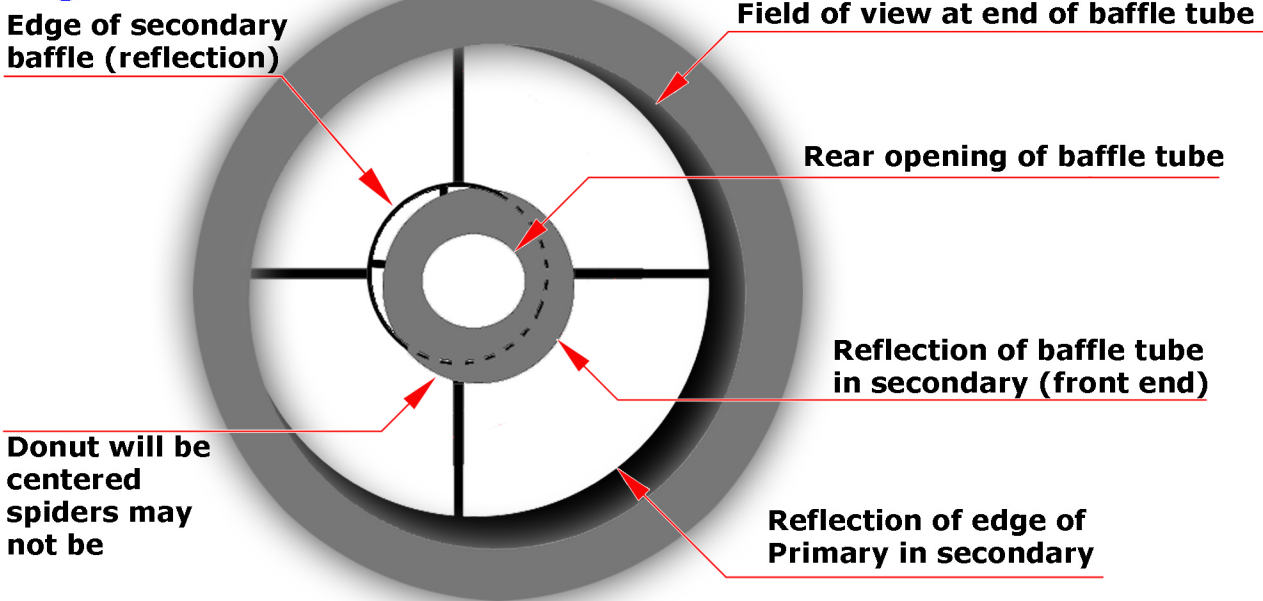
# Fine Tuning Secondary Collimation

## Figure 4



# Preliminary Primary Collimation

## Figure 5



# Final Primary Collimation

## Figure 6

