
Collimating Orion® StarMax™ and Apex™ Maksutov-Cassegrain Telescopes

(StarMax 90,102, and 127, Apex 90, 102, and 127)
(9821,9824,9826,9820,9823,9825)

Collimating is the process of aligning a telescope's optics. Your StarMax or Apex's primary mirror was aligned at the factory and should not need adjustment unless the telescope is handled roughly. This manual contains information on how to test the collimation of your telescope and instructions for proper alignment should that be needed.

Star-Testing the Telescope

Before you start adjusting the primary mirror of your telescope, make certain that it is actually out of collimation by performing a star test.

Take your telescope out at dusk and let it acclimate to the outside temperature; this usually takes 30-60 minutes. When it is dark, point the telescope upwards at a bright star and accurately center it in the eyepiece's field of view. Slowly

de-focus the image with the focusing knob. If the telescope is correctly collimated, the expanding disk should be a circle (Figure 1). If the image is unsymmetrical, the scope is out of collimation. Also, the dark shadow cast by the secondary mirror should appear in the very center of the out-of-focus circle, like the hole in a donut. If the "hole" appears off-center, the telescope is out of collimation.

If you try the star test but the bright star you have selected is not accurately centered in the eyepiece, the optics will always appear out of collimation, even though they may be perfectly aligned. It is critical to keep the star centered, so over time you will need to make slight corrections to the telescope's position in order to account for the sky's apparent motion.

Collimating the StarMax/Apex

To collimate your telescope, remove the diagonal and eyepiece and look into rear opening of the tube (also remove the dust cover from the front of the tube). This should be done indoors, with the telescope pointed at a white wall in a well-lit room. Try to keep your eye centered with respect to the rear opening of the tube as best as possible. Using an Orion Collimating Eyepiece will aid greatly in keeping your eye centered and is strongly recommend.

Alternatively, you can make a crude collimating tool out of an empty, black plastic 35mm film canister. It will not have crosshairs, so it won't be as precise, but it will be better than nothing. Cut 1/2" from the top lip of the canister and put a 1/16" to 1/8" diameter hole in the center of its bottom. Insert the film canister collimating tool into the focuser like an eyepiece with the bottom end out.

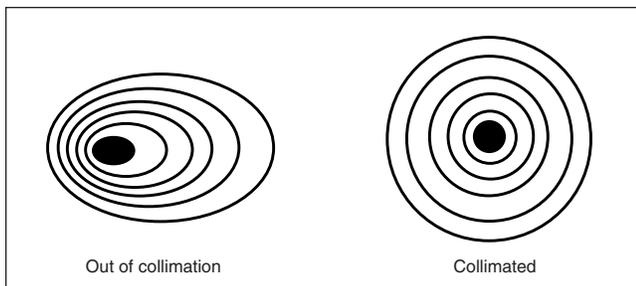


Figure 1: A star test will determine if a telescope's optics are properly collimated. An unfocused view of a bright star through the eyepiece should appear as illustrated on right if optics are perfectly collimated. If circle is unsymmetrical, as in illustration on left, scope needs collimation.

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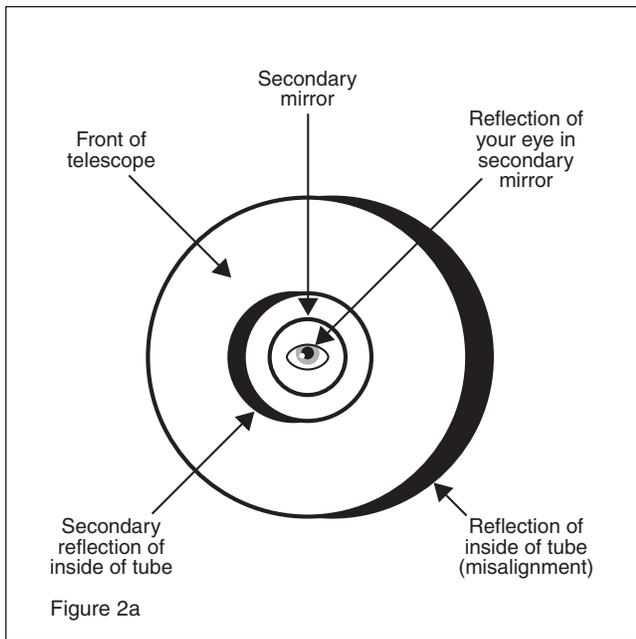


Figure 2a: If the telescope's optics are out of alignment the view through the rear opening of the telescope will resemble Figure-2a.

Once you are ready to collimate, look into rear opening of the tube. If your telescope is out of collimation, it will resemble Figure 2a, a properly collimated scope will resemble Figure 2b. The direction of the misalignment in your telescope may differ from Figure 2a, but the diagram will give you the general idea of how things will look.

Note there are six alignment screws on the back of the optical tube, three large and three small. You will need 3mm and 2mm Allen wrenches to turn these screws. These alignment screws push and pull the mirror cell in order to tilt it. When you loosen or tighten one of these screws, the other five screws must be adjusted as well to keep the proper amount of pressure on the back of the mirror cell. By making slight adjustments to how much the screws are tightened and loosened, you will change the alignment of the primary mirror.

Look into the rear opening of the tube and locate the black crescent that shows the telescope is out of alignment. (Figure 2a). Note which way the front of the telescope would need to move in order to "fill" that black crescent and resemble Figure 2b. Then look at the back end of the telescope and locate the alignment screw that is in the direction that the front of the telescope needs to move. For example, if the view in

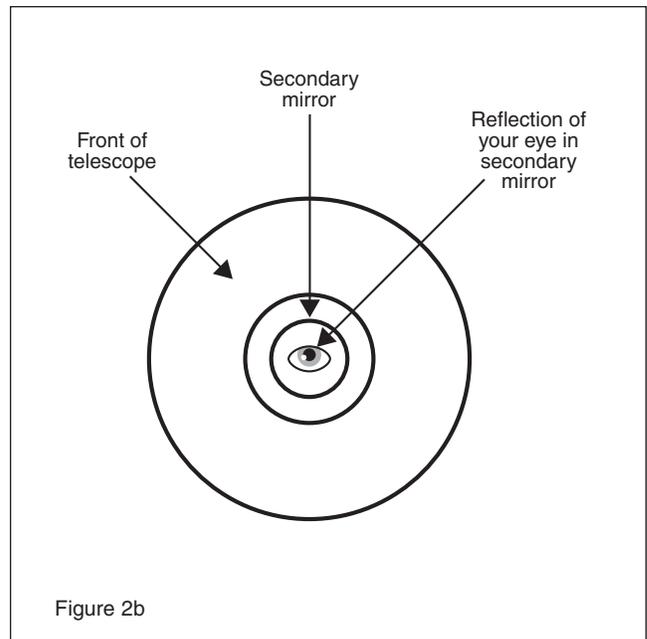


Figure 2b: With the optics properly aligned the view through the rear opening of the telescope will resemble Figure 2b.

your telescope resembled Figure 2a, then you would want to move the front opening of the telescope scope to the right. Then the alignment screw you would start with would be the screw on the right as shown in Figure 3.

Your actions now depend on whether this alignment screw is a small or large screw. Please note that you will be working to adjust the mirror cell by keeping all the screws not too loose and not too tight. Follow the steps listed below carefully and refer to the figures that accompany them.

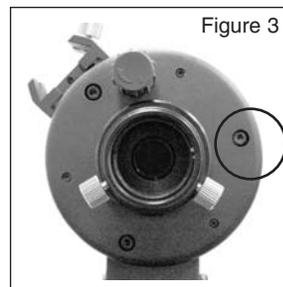


Figure 3: If the view through the rear opening of the telescope resembled Figure 2a, then the alignment screw you would start with would be this one. The actual first alignment screw you would pick will vary depending on which way the front opening would need to move in order to "fill" the black crescent.



Figure 4a

Figure 4a: Using the 3mm Allen wrench, turn the large screw *clockwise* a small amount, no more than 1/4 of a turn. (Note, actual selected alignment screw will vary.)

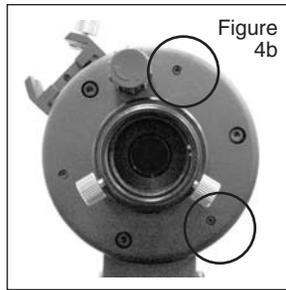


Figure 4b

Figure 4b: Now, with the 2mm Allen wrench, turn the two adjacent small screws *counterclockwise* no more than 1/4 turn.

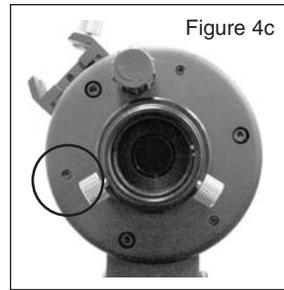


Figure 4c

Figure 4c: Turn the small screw that is 180° opposite the first screw *clockwise* no more than 1/4 turn.

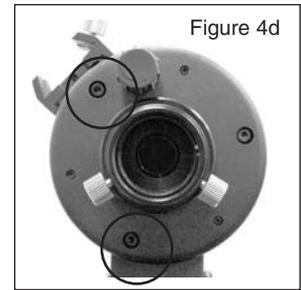


Figure 4d

Figure 4d: Turn the two large screws adjacent to the small screw *counterclockwise* no more than 1/4 turn.

If the alignment screw is a large screw

First, using the 3mm Allen wrench, turn the large screw *clockwise* a small amount, no more than a 1/4 turn. (Figure 4a)

Now, with the 2mm Allen wrench turn the two adjacent small screws (Figure 4b) *counterclockwise* no more than 1/4 turn.

Locate the small screw that is 180° opposite the first screw (Figure 4c) and turn it *clockwise* no more than 1/4 turn.

Turn the two large screws adjacent to the small screw (Figure 4d) *counterclockwise* no more than 1/4 turn.

Repeat the above steps until the front opening is centered in the direction you wanted it to go. You may need to repeat this (or the small screw adjustment process) with other screws in order to align it in other directions.

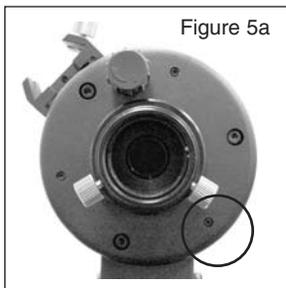


Figure 5a

Figure 5a: Using the 2mm Allen wrench, turn the large screw *counterclockwise* a small amount, no more than 1/4 of a turn. (Note: Actual selected alignment screw will vary.)

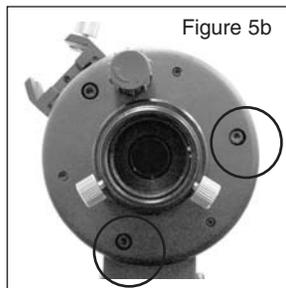


Figure 5b

Figure 5b: Now, with the 3mm Allen wrench turn the two adjacent large screws *clockwise* no more than 1/4-turn.

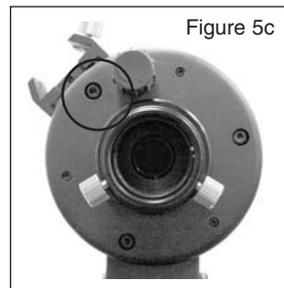


Figure 5c

Figure 5c: Turn the large-screw that is 180° opposite the first screw *counterclockwise* no more than 1/4-turn.

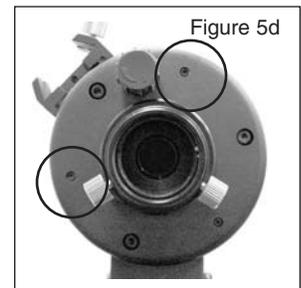


Figure 5d

Figure 5d: Turn the two large screws adjacent to the small screw *clockwise* no more than 1/4-turn.

If the alignment screw is a small screw

First, using the 2mm Allen wrench, turn the small screw *counterclockwise* a small amount, no more than a 1/4 turn. (Figure 5a)

Now, with the 3mm Allen wrench, turn the two adjacent large screws (Figure 5b) *clockwise* no more than 1/4 turn.

Locate the large screw that is 180° opposite the first screw (Figure 5c) and turn it *counterclockwise* no more than 1/4 turn.

Turn the two small screws adjacent to the large screw (Figure 5d) *clockwise* no more than 1/4 turn.

Repeat the above steps until the front opening is centered in the direction you wanted it to go. You may need to repeat this

(or the large screw adjustment process) with other screws in order to align it in other directions.

Repeat these two procedures as needed until the view through the scope resembles Figure 2b.

Finishing Collimation

Once you have finished adjusting your telescope, you will need to perform another star test (described earlier) to check the collimation. If your telescope appears collimated after star testing, it should not need adjustment again unless it is roughly handled.

If you have gone through this process and your telescope is still out of collimation, please contact Orion customer support. You may need to return the telescope for repair (covered on warranty for 1 year after purchase).