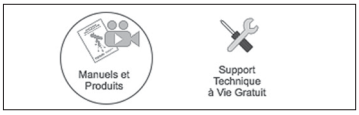
ADDENDUM

Collimation of Orion Maksutov-Cassegrain Telescopes

Francais

❶Pour obtenir le manuel d'utilisation complet, veuillez vous rendre sur le site Web **OrionTelescopes.eu/fr** et saisir la référence du produit dans la barre de recherche.

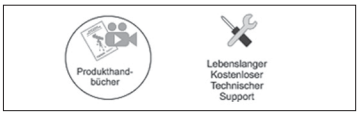
❷Cliquez ensuite sur le lien du manuel d'utilisation du produit sur la page de description du produit.



Deutsche

❶Wenn Sie das vollständige Handbuch einsehen möchten, wechseln Sie zu **OrionTelescopes.de**, und geben Sie in der Suchleiste die Artikelnummer der Orion-Kamera ein.

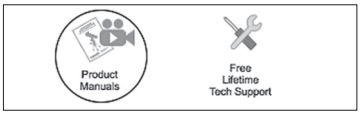
❷Klicken Sie anschließend auf der Seite mit den Produktdetails auf den Link des entsprechenden Produkthandbuches.



Español

❶Para ver el manual completo, visite **Orion-Telescopes.eu** y escriba el número de artículo del producto en la barra de búsqueda.

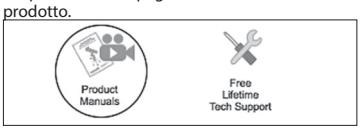
❷A continuación, haga clic en el enlace al manual del producto de la página de detalle del producto.



Italiano

❶ Per accedere al manuale completo, visitare il sito Web **OrionTelescopes.eu**. Immettere the product item number nella barra di ricerca

❷ Fare quindi clic sul collegamento al manuale del prodotto nella pagina delle informazioni sul prodotto.



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Collimation is the alignment of a telescope's optics with its mechanical axis. Your Maksutov-Casegrain's optics were collimated at the factory and should generally *not* need adjustment unless the telescope has been handled roughly. This manual describes how to test the collimation of your telescope and provides step by step instructions for proper alignment should that be needed.

I. 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 during the star test!

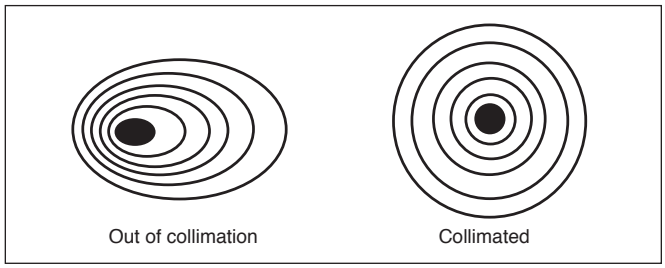


Figure 1. ***A star test will determine if a telescope's optics are properly collimated. An unfocused view of a bright star through the eyepiece should appear as illustrated on right if optics are perfectly collimated. If circle is unsymmetrical, as in illustration on left, scope needs collimation.***

II. The Collimation Screws

On Orion Maksutov-Cassegrain telescopes only the primary mirror's tilt can be adjusted. The secondary mirror is fixed in place on the inside of the meniscus lens and cannot be adjusted.

To adjust the tilt of the primary mirror, you will use six collimation screws on the rear cell of the telescope. On the smaller Maks, the six screws are evenly spaced: three large screws that alternate with three smaller screws **(Figure 2a)**. On the larger, 150mm and 180mm Maks, the six screws are arranged in three close pairs, with each pair consisting of one large and one small screw **(Figure 2b)**. The large and small collimation screws work together to adjust the tilt of the primary mirror in a "push-pull" fashion. One must be loosened and the other tightened by equal amounts in order to adjust the mirror's tilt.

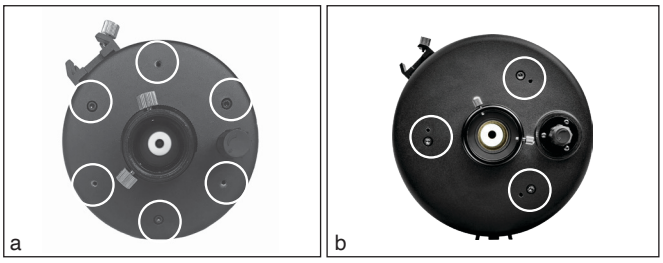


Figure 2. a) ***Orion 90mm, 102mm, and 127mm Maks have six evenly spaced collimation screws on the rear cell, whereas*** **b)** ***Orion 150mm and 180mm Maks have three close pairs of collimation screws.***

The collimation screws are Allen head screws; you will need metric Allen wrenches to turn these screws (sizes needed are stated in the procedures below). Metric Allen wrench sets are available at many hardware stores or on the internet.

III. The Collimation Procedure

The procedure for collimating an Orion Maksutov-Cassegrain will be slightly different depending on whether it has the collimation screws in three close pairs (for the 150mm and 180mm Maks) or it has them evenly spaced (for the 90mm, 102mm, and 127mm Maks). We will first describe the procedure for the smaller Maks, then in Section B we will cover the procedure for the larger Maks.

A. Collimating the Orion 90mm, 102mm, and 127mm Maksutov-Cassegrains

Follow this procedure for Maksutov-Cassegrains having six equidistant (evenly spaced) collimation screws on the rear cell, as in **Figure 2a**. You will need a 3mm and a 2mm Allen wrench to turn the collimation screws.

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

If your telescope is out of collimation, the view will resemble **Figure 3a**. A properly collimated scope will resemble **Figure 3b**. The direction of the misalignment in your telescope may differ from **Figure 3a**, but the diagram gives you the general idea of how things will look.

Locate the black crescent near the outer edge of the field of view. The appearance of such a black crescent indicates that the telescope is out of alignment. Note which way the front of the telescope would need to move in order to "fill" that black crescent and resemble **Figure 3b**. Then look at the back end of the telescope and locate the collimation screw that is in the

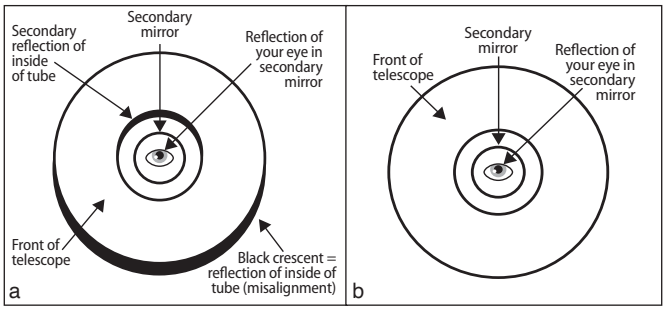


Figure 3. a) ***If the telescope's optics are out of alignment the view through the rear opening of the telescope will resemble this.*** **b)** ***With the optics properly aligned the view through the rear opening of the telescope will look like this.***

direction that the front of the telescope needs to move, or basically, the direction of the black crescent.

For example, if the view resembled **Figure 3a**, then you would want to move the front opening of the telescope down. Thus, the collimation screw you would start with would be the screw on the bottom as shown in **Figure 4a**. Your actions now depend on whether this collimation 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.

If the collimation screw is a large screw

1. Using the 3mm Allen wrench, turn the large screw clockwise a small amount, no more than 1/4 of a turn **(Figure 4a)**.
2. ow, with the 2mm Allen wrench turn the two adjacent small screws **(Figure 4b)** counterclockwise no more than 1/4 turn.
3. Locate the small screw that is 180° opposite the first screw **(Figure 4c)** and turn it clockwise no more than 1/4 turn.
4. Turn the two large screws adjacent to the small screw **(Figure 4d)** counterclockwise no more than 1/4 turn.
5. Repeat the above steps until the black crescent shrinks in size and finally disappears. You will need to repeat this procedure (or the small screw procedure below) starting with a different screw if the black crescent appears in a location other than at the bottom of the field of view as in this example.

If the collimation screw is a small screw

Follow these steps if the screw closest to the direction of the black crescent is a small collimation screw. It's basically the same as the above procedure except that you start with a small screw, then adjust the two adjacent large screws, etc.

1. Using the 2mm Allen wrench, turn the small screw counterclockwise a small amount, no more than 1/4 turn.
2. Now, with the 3mm Allen wrench, turn the two adjacent large screws clockwise no more than 1/4 turn.
3. Locate the large screw that is 180° opposite the first screw and turn it counterclockwise no more than 1/4 turn.
4. Turn the two small screws adjacent to the large screw clockwise no more than 1/4 turn.
5. Repeat the above steps until the large black crescent shrinks in size and finally disappears. You will need to repeat this procedure (or the large screw procedure above) starting with a different screw if the large black crescent appears in a location other than at the bottom of the field of view as in this example.

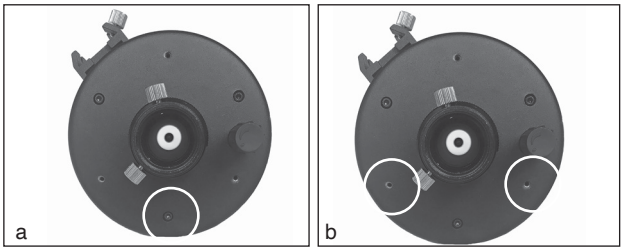
Once this collimation procedure has been successfully completed, a star test should show concentric rings with the dark secondary mirror shadow perfectly centered, as in **Figure 1** (right side).

B. Collimating the Orion 150mm and 180mm Maksutov-Cassegrains

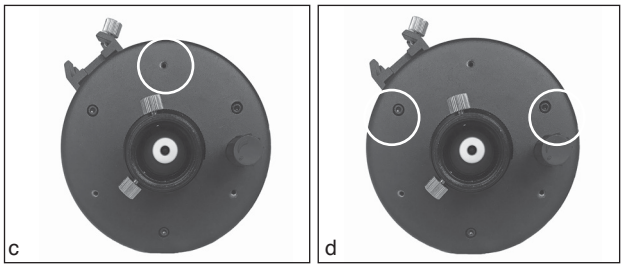
Follow this procedure for Maksutov-Cassegrains having three close pairs of collimation screws on the rear cell. **Figure 2b** shows the back of the 180mm Maksutov-Cassegrain. You will need a 4mm and a 2.5mm Allen wrench to turn these screws.

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 light-colored 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 or a Cheshire*

Figure 4. Collimation Sequence



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



c) ***Turn the small screw that is 180° opposite the first screw clockwise no more than 1/4 turn.*** **d)** ***Turn the two large screws adjacent to the small screw counterclockwise no more than 1/4 turn.***

eyepiece will aid greatly in keeping your eye centered and is strongly recommended.

If your telescope is out of collimation, the view will resemble **Figure 3a**; if it is properly collimated the view will resemble **Figure 3b**. The direction of the misalignment in your telescope may differ from **Figure 3a**, but the diagram will give you the general idea of how things will look.

In **Figure 3a**, note the black crescent at the outer edge of the field of view. The appearance of such a black crescent indicates that the telescope is out of alignment. Note which way the front of the telescope would need to move in order to "fill" that black crescent and resemble **Figure 3b**. Then locate the pair of collimation screws on the back of the scope that is closest to the direction that the front of the telescope needs to move. So for instance, if the black crescent you see is like that pictured in **Figure 3a** – on the bottom – then you would start with the pair of screws closest to the bottom, as in **Figure 5**.

Each pair of screws acts independently from the other pairs. So for instance, you may only need to adjust one pair of screws to bring the primary mirror into proper collimation. On the other hand, you may find you need to adjust two pairs or all three pairs.

1. For this example, starting with the bottom-most pair of collimation screws, first tighten (turn clockwise) the large screw in the pair by no more than 1/4 turn, then loosen (turn counterclockwise) the adjacent small screw by no more than 1/4 turn.
2. Then look into the rear opening of the tube and determine if the black crescent has reduced in size, increased in size, or been completely "filled", i.e., disappeared. If the crescent has reduced in size, continue adjusting the same pair of collimation screws in the same manner – tightening the large screw by a small amount and loosening the small screw by the same amount – until the crescent has been completely "filled."
3. If the crescent has increased in size, the optics have been moved further out of alignment. To correct this, reverse what you did in step 1 by tightening the small screw and loosening the large one in the pair by up to 1/4 turn, to undo the previous adjustment. Then adjust one or both of the other two pairs of collimation screws to try to shrink the black crescent until it disappears.

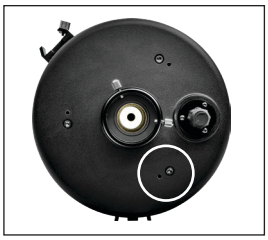


Figure 5. ***If the view inside the tube shows the black crescent at the bottom, as in Figure 3a, then the first adjustment should be to the pair of collimation screws closest to that direction, as indicated here.***

You will need to repeat this procedure starting with a different pair of collimation screws if the black crescent appears in a location other than near the bottom of the field of view as in this example.

It will take some trial and error to get a feel for which screw pairs to adjust and by how much in order to nail the perfect collimation! But keep at it and you will eventually succeed.

Again, collimation should only be attempted if you have confirmed the telescope is actually out of collimation after performing a star test!

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This Orion product is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid. Proof of purchase (such as a copy of the original receipt) is required. This warranty is only valid in the country of purchase.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights. It is not intended to remove or restrict your other legal rights under applicable local consumer law; your state or national statutory consumer rights governing the sale of consumer goods remain fully applicable.

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