INSTRUCTION MANUAL

Orion® 150mm Maksutov-Cassegrain

#9967 Optical Tube Assembly

Figure 1. The 150mm Maksutov-Cassegrain optical tube assembly.

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Welcome to a new world of adventure! Your new 150mm Maksutov-Cassegrain (Mak-Cass) telescope is a fine-quality instrument designed for both daytime terrestrial viewing and nighttime stargazing. Compact, portable, but with plenty of aperture, and easy to use, this versatile scope will provide many hours of enjoyment for the whole family.

These instructions will help you set up and properly use and care for your telescope. Please read them over thoroughly before getting started.

Getting Started

Your telescope comes fully assembled from the factory. The optics have been installed and collimated, so you should not have to make any adjustments to them. Keep the dust covers on the telescope when it is not in use.

Please keep the original shipping box. In the unlikely event you should need to ship the telescope back to Orion for warranty repair service, you should use the original packaging. The box also makes a very good container for storing the telescope.

Mounting the Telescope

The dovetail mounting plate on the 150mm Maksutov-Cassegrain is specifically designed to couple directly to the SkyView Pro equatorial mount, which is an excellent mount choice. Other equatorial and altazimuth mounts may require removing the mounting plate so the tube can be attached with tube rings.

Alternatively, the 150mm Mak-Cass optical tube assembly can be mounted onto any standard camera tripod or mount that has a 1/4"-20 mounting stud. The stud threads into one of the holes on the underside of the mounting plate. There are several threaded holes in the mounting plate; use the one that will best balance the telescope on the tripod or mount.

Camera tripods or altazimuth mounts are desirable for terrestrial (land) viewing because they allow simple vertical and horizontal movement of the telescope. An equatorial mount is desirable for astronomical viewing because it allows easy tracking of celestial objects as the Earth rotates. Also, the setting circles on the equatorial mount enable you to locate objects by their celestial coordinates (right ascension and declination), which can be found in many observing books and star atlases.

Use of Optional Accessories

Your telescope does not come with any accessories so as to offer the greatest flexibility in configuring it to your needs. If you do not already own a 1.25" diagonal, a 1.25" eyepiece, and a finder scope with dovetail bracket, you will need to purchase these items separately. Consult the Orion catalog or www.OrionTelescopes.com for these optional accessories.

The 150mm Maksutov-Cassegrain can use almost any 1.25" diagonal or eyepiece. To install a diagonal, unthread the thumbscrews on the eyepiece adapter at the rear of the tube and insert the diagonal. Secure it with the thumbscrews. Then insert an eyepiece into the diagonal and secure it with the thumbscrew(s) on the diagonal. The diagonal provides a comfortable viewing angle and image orientation, while the eyepiece is what actually magnifies the image produced by the optical tube.

A finder scope is also required for easy aiming of the telescope. The finder scope makes it easier to locate the subject you want to observe in the telescope, because the finder scope has a much wider field of view. The dovetail holder on the telescope's tube is for a finder scope bracket. Any optional Orion finder scope will come with a bracket that has a dovetail base. The dovetail base goes into the dovetail holder, and is secured with the thumbscrew on the holder.

Focusing

Point the telescope so the front end is aimed in the general direction of an object you wish to view. When you first look in the eyepiece, the image you see may be fuzzy, or out of focus. If so, gently turn the focus knob with your fingers until the image becomes sharp. Go a little bit beyond sharp focus until the image just starts to blur again, then reverse the rotation of the knob, just to make sure you've hit the exact focus point. You will have to readjust the focus when aiming at subjects of varying distances, or after changing eyepieces.

If you have trouble focusing, rotate the focus knob counterclockwise as far as it will go. Now look through the eyepiece while slowly rotating the focus knob clockwise. You should soon see the point at which focus is reached.

Do You Wear Eyeglasses?

If you wear eyeglasses, you may be able to keep them on while you observe, if your eyepieces have enough "eye relief" to allow you to see the whole field of view. You can find out by looking through the eyepiece first with your glasses on and then with them off, and see if the glasses restrict the view to only a portion of the full field. If they do, you can easily observe with your glasses off by just refocusing the telescope the needed amount.

If your eyes are astigmatic, however, images will probably appear the best with glasses on. This is because a telescope's focuser can accommodate for nearsightedness or farsighted-

WARNING: ***Never look directly at the Sun through your telescope—even for an instant—without a professionally made solar filter that completely covers the front of the instrument, or permanent eye damage could result. Young children should use this telescope only with adult supervision.***

ness, but not astigmatism. If you have to wear your glasses while observing and cannot see the entire field of view, you may want to purchase additional eyepieces that have longer eye relief.

Calculating Magnification

To calculate the magnification, or power, of a telescope with an eyepiece, simply divide the focal length of the telescope by the focal length of the eyepiece:

$$\frac{\textbf{Telescope Focal Length (mm)}}{\textbf{Eyepiece Focal Length (mm)}} = \textbf{Magnification}$$

For example, the 150mm Maksutov-Cassegrain, which has a focal length of 1800mm, used in combination with a 25mm eyepiece, yields a magnification of:

$$\frac{\textbf{1800 mm}}{\textbf{25 mm}} = \textbf{72x}$$

It is desirable to have a range of eyepieces of different focal lengths to allow viewing over a range of magnifications. It is not uncommon for an observer to own five or more eyepieces. Orion offers many different eyepieces of varying focal lengths, so check the catalog or www.OrionTelescopes.com for a wide selection of additional eyepieces to choose from.

Every telescope has a useful limit of power of about 2x per millimeter of aperture (i.e. 300x for the 150mm Mak-Cass). Claims of higher power by some telescope manufacturers are a misleading advertising gimmick and should be dismissed. Keep in mind that at higher powers, an image will always be dimmer and less sharp (this is a fundamental law of optics). The steadiness of the air (the “seeing”) can also limit how much magnification an image can tolerate.

Always start viewing with your lowest-power (longest focal length) eyepiece in the telescope. It’s best to begin observing with the lowest-power eyepiece, because it will typically provide the widest true field of view, which will make finding and centering objects much easier. After you have located and centered an object, you can try switching to a higher-power eyepiece to ferret out more detail, if atmospheric conditions permit. If the image you see is not crisp and steady, reduce the magnification by switching to a longer focal length eyepiece. As a general rule, a small but well-resolved image will show more detail and provide a more enjoyable view than a dim and fuzzy, over-magnified image.

Terrestrial Viewing

For land viewing, it’s best to stick with low power eyepieces that yield a magnification under 100x. At higher powers, images rapidly lose sharpness and clarity due to “heat waves” caused by Sun-heated air.

Remember to aim well clear of the Sun, unless the front of the telescope is fitted with a professionally made solar filter and the finder scope is covered with a completely opaque material or removed altogether

Maksutov-Cassegrain telescopes are capable of focusing on objects that are quite close, so you can view fine details of objects that are nearby. Try focusing on a flower or insect at close distance to enter a normally unseen microscopic world.

Astronomical Viewing

When choosing a location for nighttime stargazing, make it as far away from city lights as possible. Light-polluted skies greatly reduce what can be seen with the telescope. Also, give your eyes at least 20 minutes to dark-adapt to the night sky. You’ll be surprised at how many more stars you will see! Use a red flashlight, to see what you’re doing at the telescope, or to read star charts. Red light will not spoil your dark-adapted night vision as readily as white light will.

To find celestial objects with your telescope, you first need to become reasonably familiar with the night sky. Unless you know how to recognize the constellation Orion, for instance, you won’t have much luck locating the Orion Nebula. A simple planisphere, or star wheel, can be a valuable tool for learning the constellations and seeing which ones are visible in the sky on a given night. A good star chart or atlas, like the Orion DeepMap 600, can come in handy for helping locate interesting objects among the dizzying multitude of stars overhead. Except for the Moon and the brighter planets, it is pretty time-consuming and frustrating to hunt for objects randomly, without knowing where to look. It is best to have specific targets in mind before you begin looking through the eyepiece.

Photography

When coupled to a 35mm single-lens reflex camera (or digital equivalent), the 150mm Mak-Cass becomes a telephoto lens. For terrestrial or astronomical photography, you need only a T-ring for your specific camera model. The T-ring attaches to your camera and threads onto the telescope’s eyepiece adapter (see Figure 2).

Use the camera’s viewfinder to frame the picture. Use the telescope’s focuser to focus the image. You may want to consider using a remote shutter release instead of the shutter release on the camera; touching the camera can vibrate the system and blur the resulting photographic image. Also, be sure to use a solid tripod.

Care & Maintenance

If you give your telescope reasonable care, it will last a lifetime. When not in use, keep the dust cover on the front of the tube and the dust cap on the eyepiece adapter. Store it in a clean, dry, dust-free place, safe from rapid changes in temperature and humidity. Do not store the telescope outdoors, although storage in a garage or shed is OK.

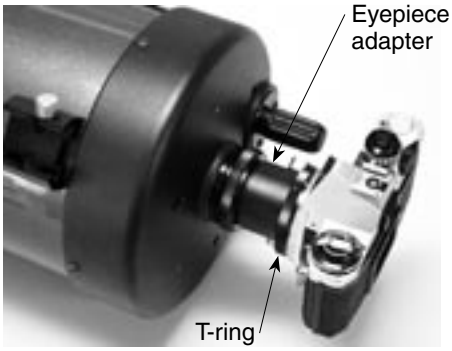

Figure 2.
A T-ring is all that is needed to connect a 35mm SLR camera to the telescope; it threads onto the eyepiece adapter with eyepiece and diagonal removed.

Your telescope requires very little mechanical maintenance. The optical tube is aluminum and has a smooth painted finish that is fairly scratch-resistant. If a scratch does appear on the tube, it will not harm the telescope. If you wish, you may apply some auto touch-up paint to the scratch. Smudges on the tube can be wiped off with a soft cloth and household cleaning fluid.

Any quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated optics can be used to clean the front meniscus lens of the telescope. Never use regular glass cleaner or cleaning fluid designed for eyeglasses. Before cleaning with fluid and tissue, however, blow any loose particles off the lens with a blower bulb or compressed air. Then apply some cleaning fluid to a tissue, never directly on the optics. Wipe the lens gently, then remove any excess fluid with a fresh lens tissue. Oily fingerprints and smudges may be removed using this method. Use caution; rubbing too hard may scratch the lens. For the large surface of the meniscus lens, clean only a small area at a time, using a fresh lens tissue on each area. Never reuse tissues.

Specifications

#9967 150mm Maksutov-Cassegrain OTA

Optical design: Maksutov-Cassegrain

Aperture: 150mm

Effective focal length: 1800mm

Focal ratio: f/12.0

Central obstruction diameter: 47mm

Primary mirror coating: Aluminum with SiO2 overcoat

Meniscus lens coating: Anti-reflection multi-coatings on both sides of lens

Eyepiece adapter: Accepts 1.25" format accessories, camera t-threads

Optical tube mounting plate: Fits SkyView Pro Equatorial Mount, AZ-3 Altazimuth Mount, and standard photo-style tripods

Weight: 12.1 lbs

Appendix: Collimating

Collimating is the process of aligning a telescope's optics. Your Maksutov-Cassegrain'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 3). 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.

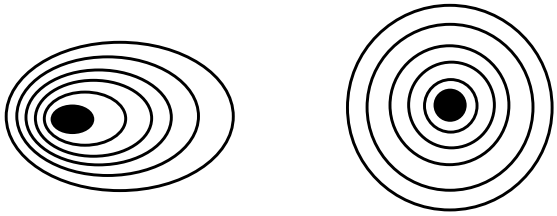

Figure 3. A star test will determine if a telescope's optics are properly collimated. An unfocused view of a bright star through the eyepiece should appear as illustrated on right if optics are perfectly collimated. If circle is unsymmetrical, as in illustration on left, scope needs collimation.

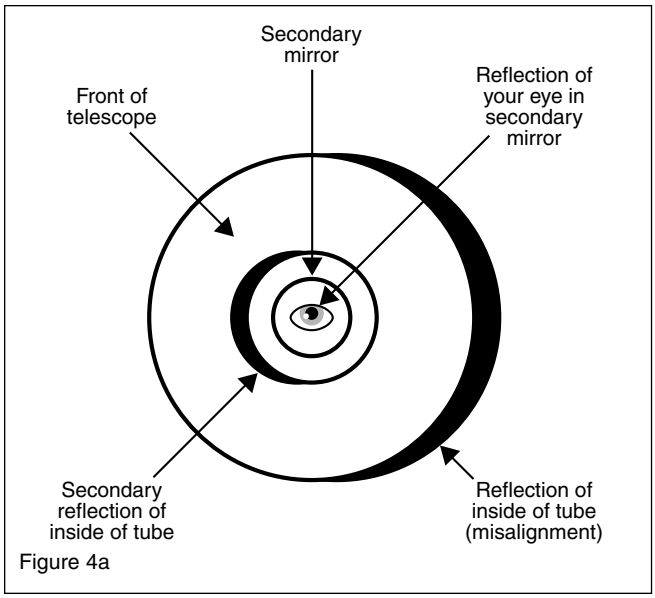

Figure 4a

Figure 4a. If the telescope's optics are out of alignment the view through the rear opening of the telescope will resemble Figure-4a.

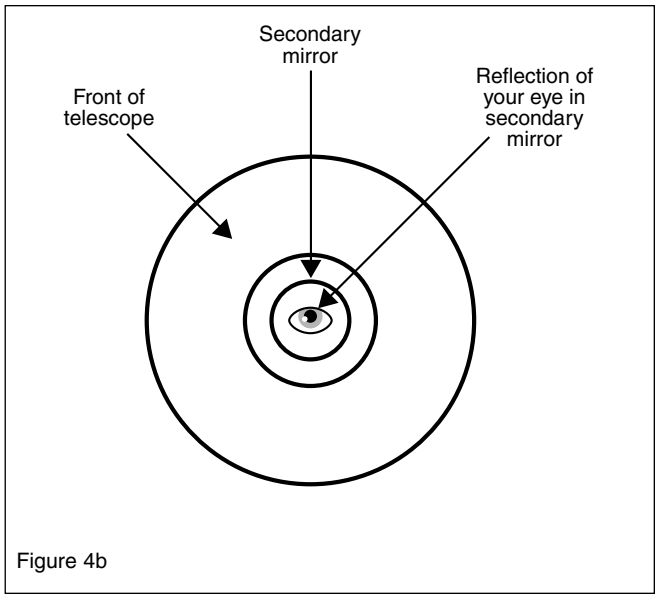

Figure 4b

Figure 4b. With the optics properly aligned the view through the rear opening of the telescope will resemble Figure 4b.

Collimating

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 cross-hairs, 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.

Once you are ready to collimate, look into rear opening of the tube. If your telescope is out of collimation, it will resemble Figure 4a. A properly collimated scope will resemble Figure 4b. The direction of the misalignment in your telescope may differ from Figure 4a, 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 4mm and 2.5mm 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 4a). Note which way the front of the telescope would need to move in order to "fill" that black crescent and resemble Figure 4b. 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 your telescope resembled Figure 4a, then you would want to move the front opening of the telescope scope to the right. The alignment screw you would start with would be the screw on the right as shown in Figure 5.

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

Figure 5. If the view through the rear opening of the telescope resembled Figure 4a, 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 6a. 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.)

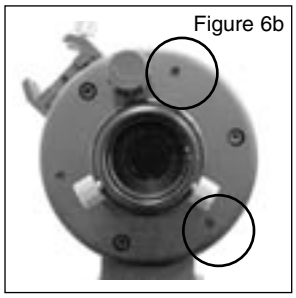

Figure 6b. Now, with the 2mm Allen wrench, turn the two adjacent small screws *counterclockwise* no more than 1/4 turn.

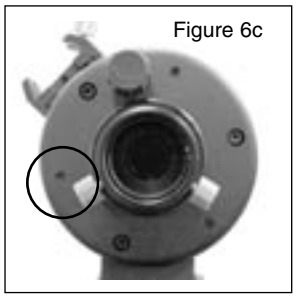

Figure 6c. Turn the small screw that is 180° opposite the first screw *clockwise* no more than 1/4 turn.

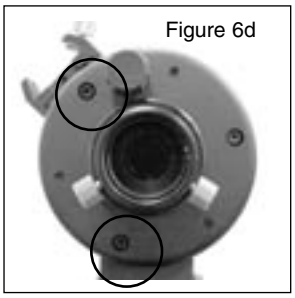

Figure 6d. Turn the two large screws adjacent to the small screw *counterclockwise* no more than 1/4 turn.

If the alignment screw is a large screw

First, using the 4mm Allen wrench, turn the large screw *clockwise* a small amount, no more than a 1/4 turn. (Figure 6a)

Now, with the 2.5mm Allen wrench turn the two adjacent small screws (Figure 6b) *counterclockwise* no more than 1/4 turn.

Locate the small screw that is 180° opposite the first screw (Figure 6c) and turn it *clockwise* no more than 1/4 turn.

Turn the two large screws adjacent to the small screw (Figure 6d) *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.

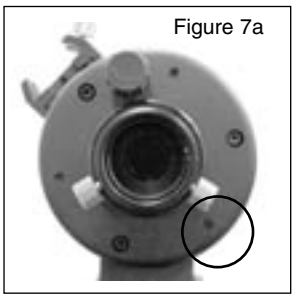

Figure 7a. Using the 2mm Allen wrench, turn the large screw *counterclockwise* a small amount, no more than 1/4 of a turn. (Note: Actual selected alignment screw will vary.)

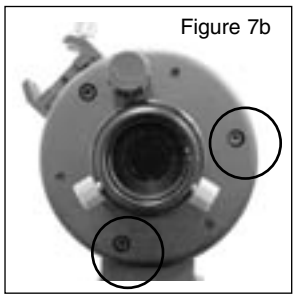

Figure 7b. Now, with the 3mm Allen wrench turn the two adjacent large screws *clockwise* no more than 1/4-turn.

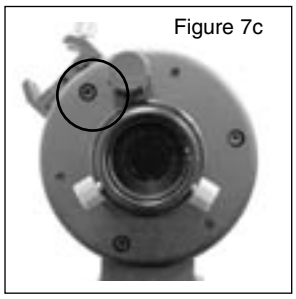

Figure 7c. Turn the large-screw that is 180° opposite the first screw *counterclockwise* no more than 1/4-turn.

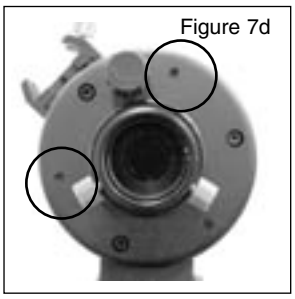

Figure 7d. Turn the two large screws adjacent to the small screw *clockwise* no more than 1/4 turn.

If the alignment screw is a small screw

First, using the 2.5mm Allen wrench, turn the small screw *counterclockwise* a small amount, no more than a 1/4 turn. (Figure 7a)

Now, with the 4mm Allen wrench, turn the two adjacent large screws (Figure 7b) *clockwise* no more than 1/4 turn.

Locate the large screw that is 180° opposite the first screw (Figure 7c) and turn it *counterclockwise* no more than 1/4 turn.

Turn the two small screws adjacent to the large screw (Figure 7d) *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 4b.

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).

One-Year Limited Warranty

This Orion 150mm Maksutov-Cassegrain Telescope 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 to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. If the product is not registered, proof of purchase (such as a copy of the original invoice) is required.

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, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, P. O. Box 1815, Santa Cruz, CA 95061; (800)-676-1343.

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