INSTRUCTION MANUAL

Orion® LaserMate™ Deluxe II Laser Collimator

#5691

Newtonian reflectors perform at their best when primary and secondary mirrors are accurately aligned. Such alignment, called collimation, is critical for achieving a sharp, highly resolved view through the telescope. Collimation, while intimidating at first glance, is really not difficult to do. And it's made all the easier with the Orion LaserMate Deluxe II! This handy tool, designed specifically for collimating the optics of Newtonian reflectors, provides a quick, easy way to a) determine if one or both of your telescope's mirrors need adjustment, and b) make the necessary adjustment(s) quickly and easily.

The LaserMate Deluxe II's angled "rear view" screen allows collimation of the primary mirror to be done at the back of the scope, where the collimation knobs are, obviating the need to walk to the front of the scope repeatedly.

This second-generation LaserMate Deluxe improves on the original design by incorporating a wider flange between the 1.25" barrel and the adjoining housing, to better ensure that the collimator seats solidly and squarely in the focuser's eyepiece holder.

With the dead-on collimation provided by the LaserMate Deluxe II, you will enjoy the cleanest, crispest images possible from your instrument every time out!

Contents

1 LaserMate Deluxe II collimator

1 CR2032 3V lithium battery (installed)

1 Sheet of three adhesive center-mark rings

ORION®
TELESCOPES & BINOCULARS
AN EMPLOYEE-OWNED COMPANY

IN 465 Rev. A 06/12

WARNING: The LaserMate Deluxe II emits laser radiation, so it is important not to shine the beam into your or anyone's eye. During the collimation procedure, avoid direct reflections of the laser beam into your eye. It is safe to view the reflection off a mirror surface as long as the beam is not directed into your eye. It is also safe to view the laser when it is reflected off a surface that diffuses the light, such as the white "target" on the angled viewing screen. Because of the potential danger from the laser beam, store your LaserMate out of the reach of children.

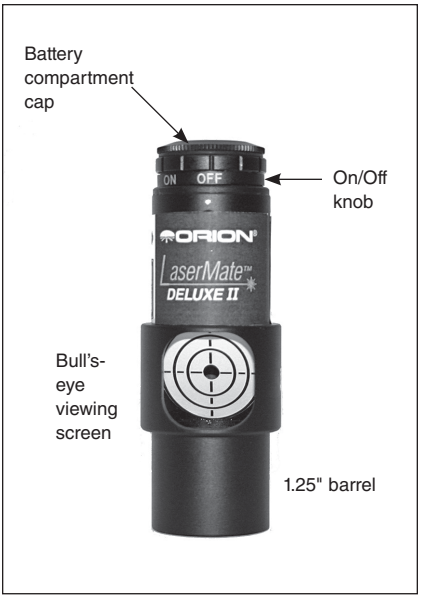

Figure 1. The LaserMate Deluxe II laser collimator

This laser collimator uses a low-wattage laser to project a red beam down through the telescope's focuser. The beam reflects off the secondary mirror to the primary mirror, then bounces back up to the secondary mirror and exits through the focuser onto the angled, bulls-eye viewing screen of the collimator itself. The beam is generally not visible, but you'll see a bright red dot on each reflected surface.

The LaserMate Deluxe II works equally well to collimate telescope optics in daylight or at night in the dark.

The LaserMate's laser diode has been precisely aligned within its housing at the factory. Do not remove the label on the housing or attempt to make adjustments to the LaserMate's alignment screws (which have been covered to prevent access); doing so will void the terms of the warranty.

Before You Begin Collimating with the LaserMate Deluxe II

Accurate collimation of your telescope's optics using the LaserMate Deluxe II will most easily be achieved if you do a rough collimation of the optics with your eye first. This is because if the optics are grossly misaligned, it may be confusing to interpret which surfaces the laser is being reflected off of. Refer to your telescope's instruction manual for the procedure on how to do a rough collimation with your eye.

Is Your Primary Mirror Center-Marked?

For best results in collimating your Newtonian's optics, the exact center of the primary mirror should be marked beforehand. Almost all Newtonian reflectors

sold by Orion come precisely center-marked from the factory, with a tiny adhesive ring applied to the mirror surface **(Figure 2)**. It doesn't interfere with the light path or degrade the image you see since it lies in the shadow of the secondary mirror, so it should not be removed. If your primary mirror is not center-marked, see Appendix A for instructions on how to mark it using one of the adhesive rings supplied with the LaserMate Deluxe II.

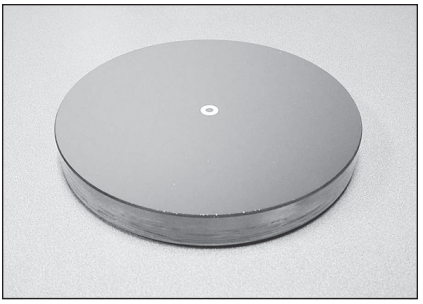

Figure 2. A center mark (ring) on a reflector's primary mirror greatly aids in collimation.

Adjusting the Tilt of the Secondary Mirror

The first step in the collimation procedure is to check the alignment of the secondary mirror and adjust it if necessary. Insert the LaserMate Deluxe II into your telescope's focuser drawtube **(Figure 3)** and secure it with the thumbscrew(s) on the drawtube collar. (If possible, orient your telescope's optical tube so that it is parallel to the ground, with the focuser straight up, as in Figure 3. Being perpendicular to the force of gravity ensures that the collimator will seat squarely in the eyepiece holder. In this orientation you do not even need to tighten the thumbscrew on the holder that secures an eyepiece in place – in fact we recommend you don't, as doing so can skew the collimator slightly off the optical axis.) Then turn the collimator on by turning the On/Off knob at the top to the On position. (Alternatively, you could turn the collimator on before inserting it into the focuser.)

Figure 3. Insert the LaserMate's 1.25" barrel into the eyepiece holder of your focuser as far as it will go. It should seat squarely on the 3mm flange at the interface of the barrel and the wide section of the collimator's housing.

Look down the front of the optical tube. Remember to keep your eyes clear of any direct reflections of the beam. Notice the red spot on the surface of the primary mirror itself; this is the laser beam being reflected from the secondary mirror off the surface of the primary mirror. The red spot should be centered in the collimation target (ring) on the mirror. If it isn't, adjustments will need to be

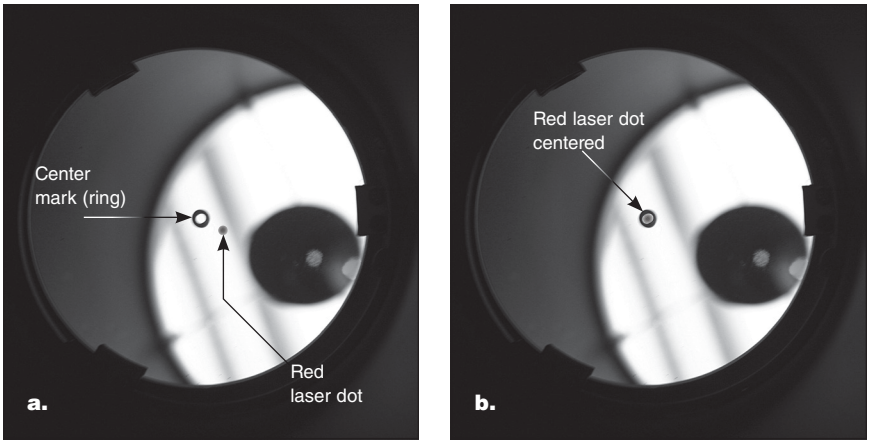

Figure 4. Adjust the secondary mirror collimation screws until the red laser spot, shown off center in **a**), is centered within the collimation target (ring) on the primary mirror (**b**).

made to the secondary mirror's tilt **(Figure 4a)**. This is done with the secondary mirror collimation screws, usually located on the central hub of the telescope's spider vane assembly.

Make adjustments to the telescope's secondary mirror collimation screws until the reflection of the laser beam is centered in the collimation target on the primary mirror **(Figure 4b)**.

Adjusting the Tilt of the Primary Mirror

The final collimation step is to adjust the tilt angle of the primary mirror. Orient the collimator in the focuser so that the viewing screen is facing the rear of the telescope. While standing at the rear of the telescope (where the primary mirror collimation screws/knobs are), look over at the bulls-eye viewing screen of the collimator. You should see the red laser dot somewhere on the viewing screen. If you don't, then the collimation is grossly off. In that case, place a piece of paper in front of the open tube and note the position of the laser dot on the paper. Make adjustments to the primary mirror collimation screws to move the laser dot closer to the center and eventually onto the collimator's bulls-eye viewing screen **(Figure 5a)**.

Once the laser dot is on the viewing screen, you can perform the final collimation. Adjust the primary mirror collimation knobs until the laser dot hits the center hole of the bulls-eye screen and pretty much disappears, except for some red "spray" around the periphery of the hole **(Figure 5b)**. You can make certain the laser dot is properly aimed into the hole by slightly adjusting one of the collimation knobs to bring the laser dot out of the hole, then return it by turning the collimation screw the other way.

Collimation of the optical system is now complete! Go out and enjoy the view! The alignment of the mirrors should not need to be adjusted again unless the

telescope is handled roughly. If you handle the telescope gently during transport, then only slight adjustments will need to be made to the mirrors. Use the LaserMate Deluxe II before each observing session to check and make adjustments to the mirrors as needed.

To preserve battery life, be sure to turn the LaserMate OFF after each use.

Care and Maintenance of Your LaserMate Deluxe

Your LaserMate Deluxe II is manufactured of the highest quality components. The internal laser diode is precision aligned with the mechanical axis of the housing at the factory and tested to meet stringent specifications. Like all electronic equipment, the LaserMate should be handled with care. If it is dropped or handled roughly, the internal laser could become misaligned. Avoid exposing the collimator to water, dust, heat, or prolonged periods of direct sunlight. To extend battery life, store the collimator in a cool, dry environment.

Installing a New Battery

The LaserMate Deluxe II is powered by a single CR2032 3V lithium ion "button cell" battery. When the laser beam starts to dim or completely fades, it's time to replace the battery. To do so, unscrew the knurled battery compartment cap at the top of the collimator. With a knife tip or the end of a paper clip, lift the edge of the expired battery out **(Figure 6).**

Insert a fresh CR2032 battery with the positive (+) side up. Then replace the cap. The CR2032 is a commonly used battery in watches, calculators,

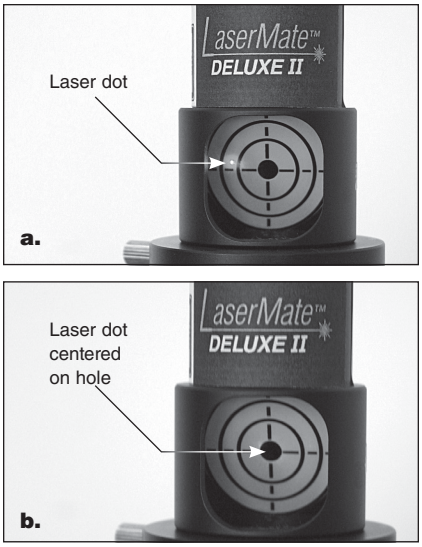

Figure 5. Adjust the primary mirror collimation screws so that the red laser spot, shown off center on the LaserMate's viewing screen in **a**), lands directly on the center hole of the bull's eye (**b**). The laser spot will mostly disappear except for some "spray" around the periphery of the hole.

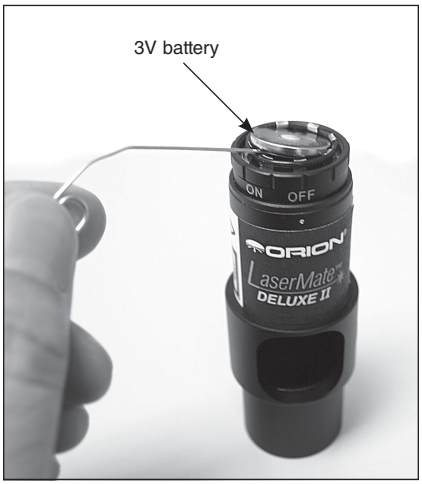

Figure 6. To remove the 3V button cell battery, pry the edge up with a paper clip or knife tip as shown.

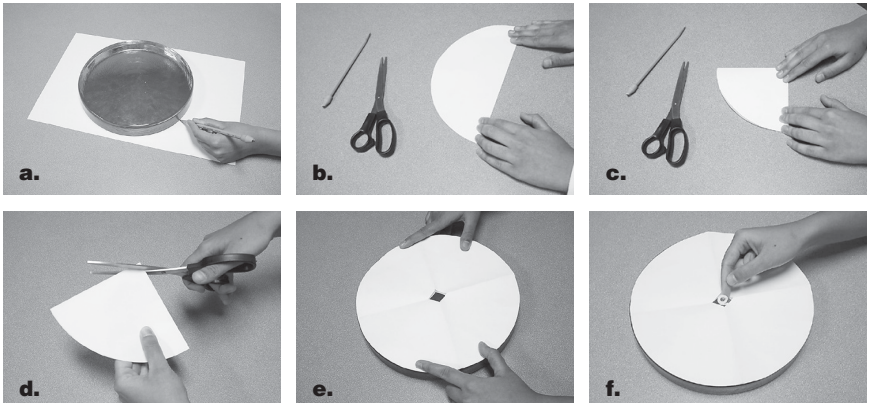

Figure 7. To mark the center of an unmarked primary mirror, **a**) trace the outline of the mirror on a piece of paper and carefully cut out the circle, **b**) fold the circle in half, and **c)** then in half again, **d**) cut the tip off the paper wedge, **e**) place the template on the mirror surface and carefully register its edge, **f**) stick the ring label to the mirror surface through the hole in the template. Then remove the paper template

cameras, and other electronic devices, so you'll be able to find one at most drug stores or online.

Appendix A: Marking the Primary Mirror

To achieve the best accuracy when collimating with the Orion LaserMate Deluxe II, your scope's primary mirror should be precisely center marked. If your mirror was not center-marked at the factory, you can do it yourself with one of the supplied collimation targets. This will not affect the telescope's performance at all. To accurately locate and mark the mirror's center point, you must first make a paper template.

First, remove the primary mirror from your telescope. If you are unsure how to do this, consult your telescope's instruction manual. If the primary mirror is glued into its cell, it is not necessary to remove it from the cell. Handle the mirror by its edges only, and be careful not to touch the surface with your fingers.

Get a clean sheet of paper that is big enough to cover the mirror's entire surface. For large-diameter mirrors, you may need to tape several sheets of paper together. Lay the primary mirror on the paper and trace its outline with a pencil **(Figure 7a)**. Next, cut out the circle you have just traced with a pair of scissors. Fold the paper circle into quarters by folding the circle precisely in half, and then folding it in half again **(Figure 7b and c)**. Now, cut about 1/4 inch off the tip of the paper wedge you have created **(Figure 7d)**. Unfold the paper, and you will find that you have a paper template of your mirror with a hole at the center.

Make sure the template is still clean; place the paper template over the surface of the primary mirror. Carefully register the template edge with the edge of the mirror **(Figure 7e)**. Now, take one of the supplied adhesive collimation targets and affix it to the center of the mirror's surface through the hole of the paper template **(Figure 7f)**. The center of the primary mirror is now marked, as in **Figure 2**, and you can reinstall the primary mirror in the telescope.

Note: For mirror cells that use mirror clips to secure the primary mirror in place, it is important not to overtighten the mirror clips. For Orion reflector telescopes, tighten the mirror clip anchor screws until just snug, and then back off each screw by 1/2 turn. Overtightened mirror clips will put stress on the primary mirror's figure, and will introduce astigmatism into the optical system as a result.

Appendix B: Centering the Secondary Mirror Under the Focuser

Centering the secondary mirror under the focuser is an adjustment that can be made with the aid of the LaserMate Deluxe II, but it requires marking the center of the secondary mirror in the same way the center of the primary mirror was marked. This is generally undesirable due to the large area of the supplied collimation targets compared to the total area of the secondary mirror. Since centering the secondary mirror under the focuser is an adjustment that very rarely, if ever, needs to be done, we recommend simply making this adjustment by eye. Check the collimation instructions in your telescope's manual for the procedure to do this.

However, if you wish to use the LaserMate Deluxe II for centering the secondary mirror under the focuser, read on. First, you must mark the center of the secondary mirror. Do this by first removing the secondary mirror from the telescope and making a paper template the same way you made a template for the primary mirror. Then use the template and one of the remaining collimation targets to mark the secondary mirror's center. Reinstall the secondary mirror once it has been marked.

Next, place the LaserMate Deluxe II into the telescope's focuser and turn it on. Now, peer into the optical tube and look at the primary mirror. Notice the reflection of the secondary mirror on the primary mirror; you will see a bright red spot on the secondary mirror where the laser beam is reflecting off it. The red spot should be exactly at the center of the collimation target on the secondary mirror. If it is not, you will need to make adjustments to the secondary mirror's position until it is. For adjustments perpendicular to the optical axis, lengthen and shorten the spider vanes. For adjustments parallel to the optical axis, loosen or tighten the center screw of the spider hub. You may also need to adjust the rotation of the secondary mirror relative to the focuser.

Specifications

Laser power:	< 5mW
Laser wavelength:	630 – 670nm
Alignment:	± 3 arcmin
Barrel size:	1.25", fits 2" eyepiece holders with optional 2"-to-1.25" adapter
Housing:	aluminum, black anodized
Dimensions:	4" long x 1.5" diameter (widest)
Weight:	3.4 oz.
Batteries:	One CR2032 3V lithium
Certification:	meets all FDA regulations applicable at the time of manufacture

This Class 3R laser complies with US 21 CFR 1040.10 and 1040.11 and is FDA certified and IEC compliant.

One-Year Limited Warranty

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.

For further warranty information, please visit www.OrionTelescopes.com/warranty.

ORION
TELESCOPES & BINOCULARS
AN EMPLOYEE-OWNED COMPANY

Corporate Offices: 89 Hangar Way, Watsonville CA 95076 - USA
Toll Free USA & Canada: (800) 447-1001
International: +1(831) 763-7000
Customer Support: support@telescope.com