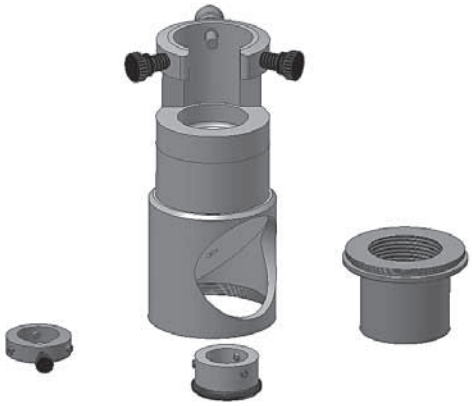
INSTRUCTION MANUAL

Orion® SkyLine™ Laser Pointer Telescope Collimation System

#5696



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OrionTelescopes.com
Customer Support (800) 676-1343
E-mail: support@telescope.com
Corporate Offices (831) 763-7000
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Congratulations on the purchase of the new revolutionary Skyline Laser Pointer Telescope Collimation System (LPCS). The LPCS is not the common laser collimator. It is a great unique new laser collimation system that has advanced features such as:

- full rotating body (on ball bearings with no backlash);
- compatible with most commercial available presentation laser pointers, red, green, blue or others;
- alignment verification before use.

Figure 1. The LPCS with Orion SkyLine Deluxe Green Laser Pointer.

1.1. What Makes the LPCS a Completely New Revolutionary Approach to the Collimation Problem?

While most laser collimation systems perform reasonably well, the LPCS guarantees that all variables that play into the collimation of your telescope can be controlled. This is, one can determine and control how the LPCS system will ultimately perform.

1.2. What Kind of Laser Pointers Can the LPCS Be Used With?

The LPCS is *NOT* supplied with a Laser Pointer. The user needs to supply one. There is a vast array of commercial presentation laser pointers available (we suggest the Orion SkyLine Deluxe Green Laser Pointer SKU#05673). *From the traditional red, to the more shiny green, there are even blue and violet laser pointers.* Most round shape laser pointers (Cylindrical shape) from 13mm to 15mm in diameter can be used. It depends on your personal preference, what kind of telescope you have, collimation method and if plan to use it during daytime too.

Figure 2. Different Laser pointers can be used with the LPCS.

WARNING: Laser pointers emit 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 "target" on the angled viewing screen. Because of the potential danger from the laser beam, store your Laser Pointer out of the reach of children.

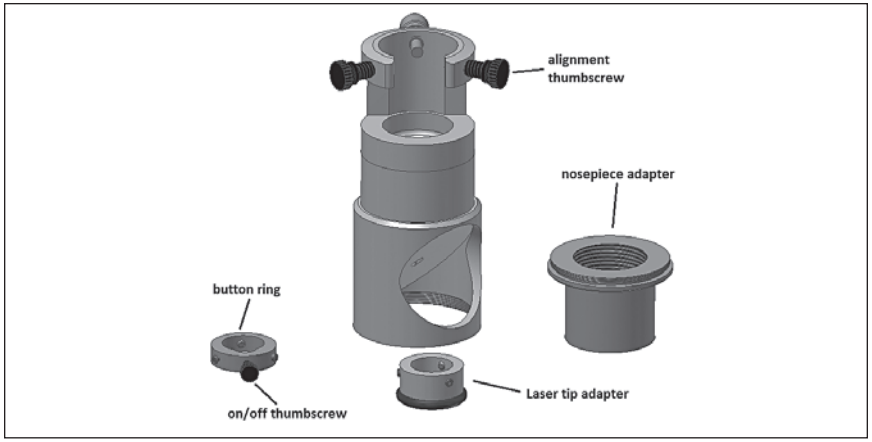

Figure 3. Knowing the different LPCS components.

2. Getting Started – Knowing Your LPCS

The LPCS is supplied with three adapters.

1. Nosepiece adapter – a standard 1.25" to T-threads male adapter; this allows the LPCS to be used on 1.25" eyepiece focusers.
2. Button ring – turn on/off the laser by rotating the thumbscrew on the button ring;
3. Laser tip adapter – secures the laser pointer to the LPCS body and allows some degree of movement for adjustment;
   When the 1.25" nosepiece is removed, the LPCS exposed female T-threads can be directly attach to some telescope focusers that have male T-thread.

2.1. Getting Started – Preparing the Laser Pointer

Start by inserting the button ring from the laser pointer aperture end. Use the supplied Allen wrench to tighten the 3 hex screws. The on/off thumbscrew should be aligned with the on/off push button. To verify if the thumbscrew is aligned with the push button gently turn the thumbscrew clockwise (CW) to power the

WARNING: ***Never look directly at the Sun with the naked eye or with a telescope – unless you have a proper solar filter installed over the front of the telescope! Otherwise, permanent, irreversible eye damage may result.***

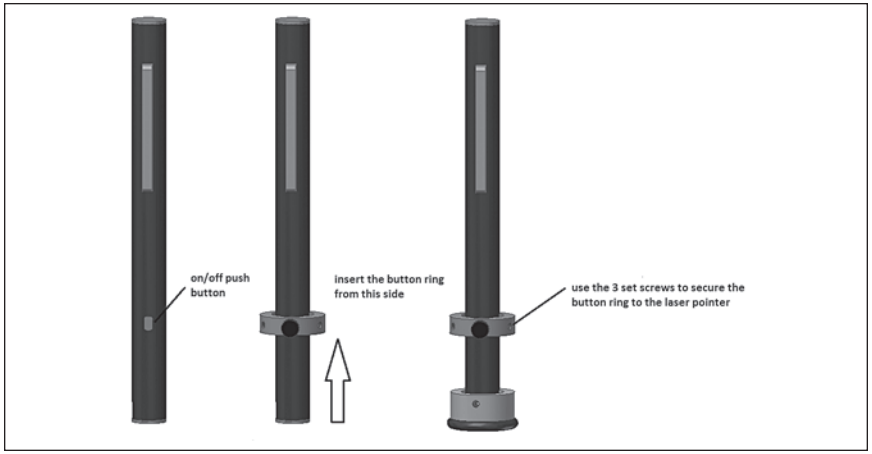

Figure 4. Preparing the Laser pointer to be used with the LPCS.

laser on. Turn to the opposite direction (CCW) to turn back off.

WARNING: the laser system on your laser pointer should be kept on for the minimum time possible. Lasers loose intensity if they overheat. This happens after just a couple of minutes of continuous operation.

It is also important to center the laser pointer in relation to the laser tip adapter. The laser pointer barrel should be approximately at the same distance from the adapter wall. Tighten the three set screws in order to secure the laser to the adapter. The laser tip should also touch the inside surface of the adapter for more stability.

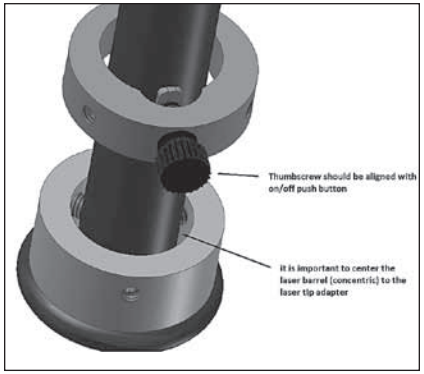

Figure 5. Centering both adapters is important.

You can now test if the laser is ready to be fitted to the LPCS. Turn the laser on (using the thumbscrew) and check if the laser beam is passing through the circular aperture of the laser tip barrel. Make sure that you don't look directly at the beam. Point it to a non-reflective surface such as a wall or a sheet of paper. The laser beam should project a clearly visible laser dot. If the laser is only partially visible please readjust the laser tip adapter set screws.

2.3. Getting Started – Fitting the Laser Pointer into the LPCS

Now that you have fixed the button ring and the laser tip adapter to the laser pointer it is time to fit the laser pointer into the LPCS and learn how it works.

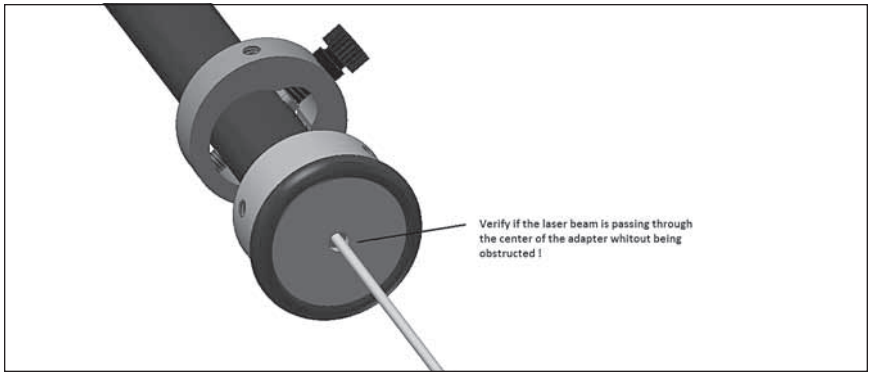

Figure 6. Verify if the laser beam is not obstructed.

After inserting the assembly, tighten the thumbscrews so they touch the laser pointer barrel (on some laser pointer models it may be that the thumbscrews touch the button ring). The same applies for the adjustment spring. Make sure that the laser pointer is more or less aligned with the LPCS body. You are now ready to start aligning the LPCS.

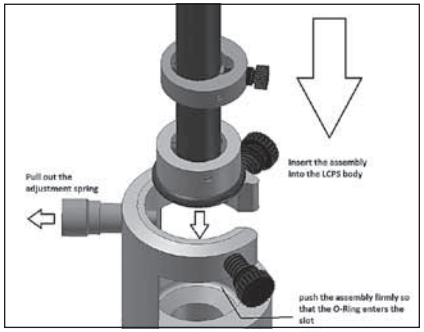

Figure 7. Insert the Laser Pointer into the LPCS for use.

3. Aligning the LPCS

Insert the LPCS into the telescope focuser. Make sure that the LPCS is firmly tighten to the telescope (use the focuser thumbscrews). Turn the laser pointer on. The laser projects a dot on the primary mirror of your Newtonian telescope. The LPCS top rotates freely. Rotate it by one turn. You will notice that the laser dot on the primary mirror describes a circle (circle 1. Figure 10.) on the primary mirror surface. This means that the laser pointer is out of alignment with the mechanical axis of the LPCS.

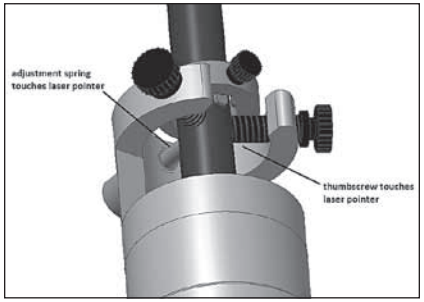

Figure 8. Tighten the thumbscrew for adjustment.

Start by adjusting the two thumbscrews. Choose one and slightly loosen it. The laser pointer is now moving when you are turning the thumbscrew so does the laser dot. This means it is changing the direction it is pointing to. Rotate the

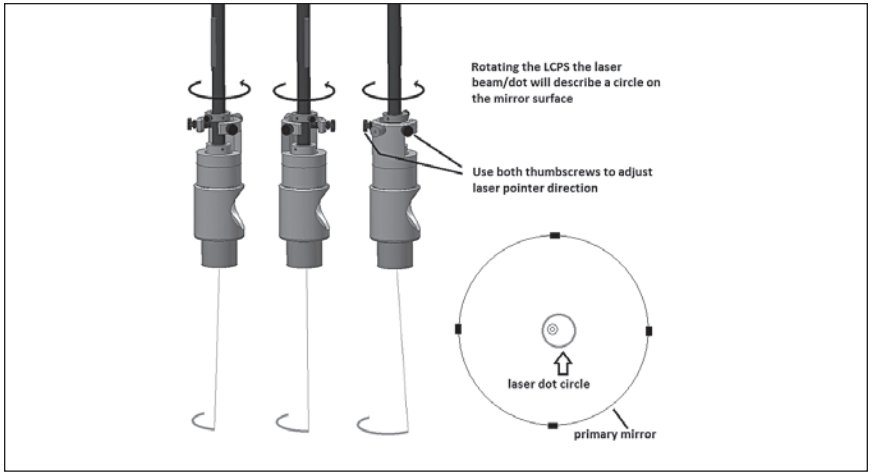

Figure 9. Observing the laser dot circle diameter.

LPCS slowly again, one turn should be enough to observe the laser dot describing now a new circle (circle 2. Figure 9.) on the telescope mirror.

Understanding the circles – smaller is better!
New circle has a larger diameter than the previous circle? It means that your laser pointer alignment is getting worse. Is the circle getting smaller? It means your laser pointer is getting better aligned!

Play with both thumbscrews until you understand how they contribute to getting the circle smaller and smaller. You will reach a point where you cannot get a circle smaller than diameter of the laser dot (circle 3. Figure 10.) Don't worry, it means you have achieve mechanical alignment between the laser pointer and the LPCS.

4. Collimating a Telescope Using a Laser Collimator

Now that you have aligned the LPCS it is time to collimate you telescope. The LPCS works the same way as a laser collimator.

WARNING: Laser pointers and laser collimators emit 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 Laser pointer or laser collimator out of the reach of children.

Laser collimators uses a low wattage laser to project a beam down through the telescope's focuser. The beam reflects off the secondary mirror to the primary

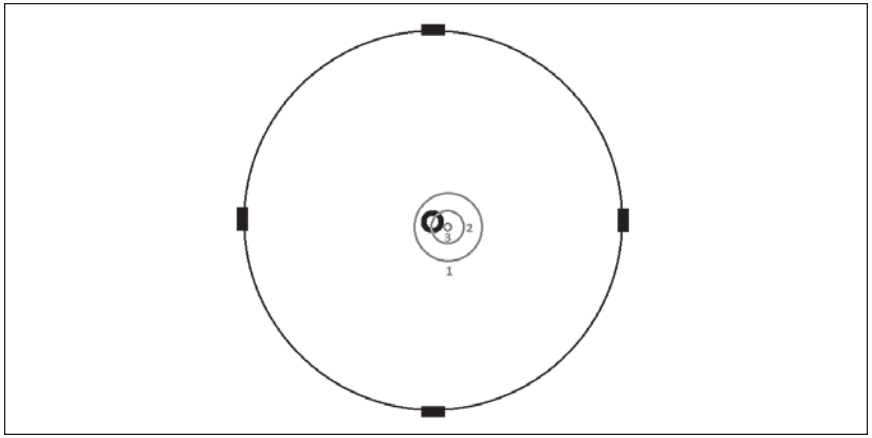

Figure 10. The dot circles getting smaller when the laser pointer is getting aligned with the mechanical axis of the LPCS. Notice that the circles are placed off-centered in relation to the mirror center. This is the most common situation as only by pure luck one can have the laser circle perfectly aligned with the telescope mirror.

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 dot on each reflected surface.

The LPCS works equally well to collimate telescope optics in daylight or at night in the dark. A green laser pointer outputs more light making it easier to use during the day.

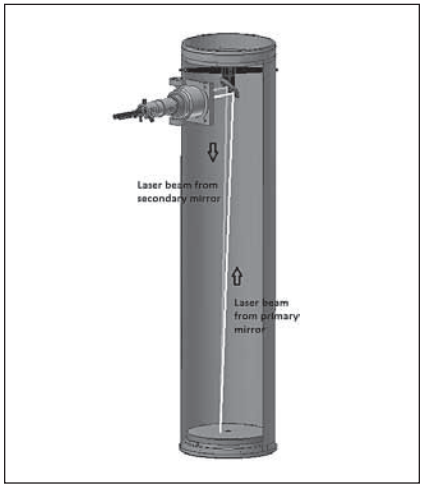

Figure 11. The beam reflects off the secondary mirror to the primary mirror, then bounces back up to the secondary mirror and exits through the focuser onto the angled viewing screen of the collimator itself.

4.1. Before You Begin Collimating with the LPCS

Accurate collimation of your telescope's optics using the LPCS 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.

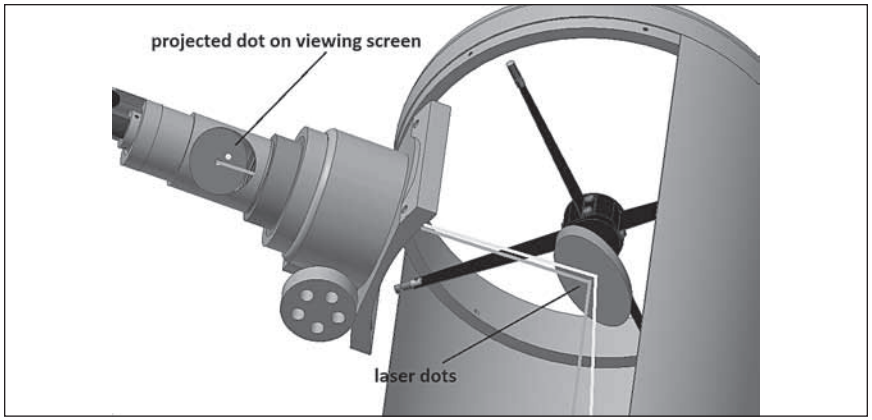

Figure 12. The beam is generally not visible, but you'll see a bright dot on each reflected surface and the viewing screen.

4.1.1. 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 centermarked from the factory, with a tiny adhesive ring applied to the mirror surface (Figure 13). 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.

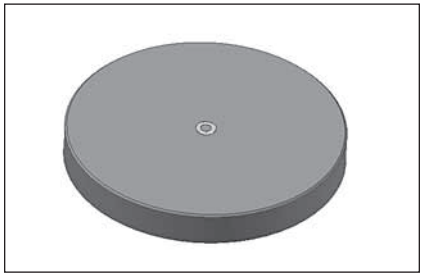

Figure 13. A center mark (ring) on a reflector's primary mirror greatly aids in collimation.

4.1.2. 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 LPCS into your telescope's focuser drawtube (Figure 15) 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

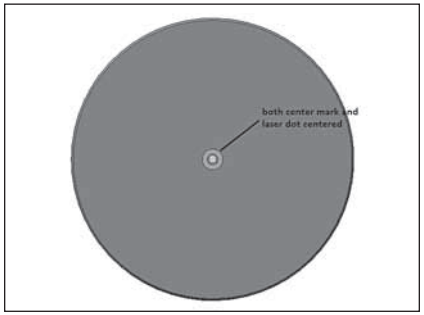

Figure 14. When the secondary mirror is aligned both center mark and laser dot are centered.

focuser straight up, as in Figure 15. Being perpendicular to the force of gravity ensures that the collimator will seat squarely in the eyepiece holder. Then turn the laser on by turning the On/Off thumbscrew. (Alternatively, you could turn the laser on before inserting it into the focuser). Look down the front of the optical tube.

Remember to keep your eyes clear of any direct reflections of the beam. Notice the laser 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 laser spot should be centered in the collimation target (ring) on the mirror. If it isn't, adjustments will need to be made to the secondary mirror's tilt (Figure 16). 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 14).

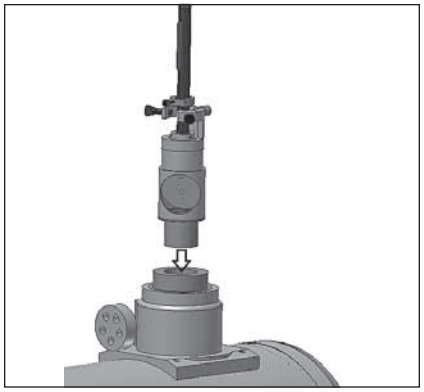

Figure 15. Inserting the LPCS into the focuser drawtube and tightening the thumbscrews to secure the nosepiece adapter.

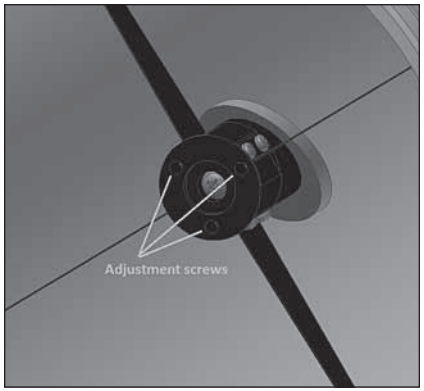

Figure 16. Adjustment screws allows tilting the secondary mirror which makes the laser dot on the primary mirror to move.

4.1.3. 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 17)

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 LPCS before each observing session to check and make adjustments to the mirrors as needed. To preserve battery life, be sure to turn the laser pointer OFF after each use.

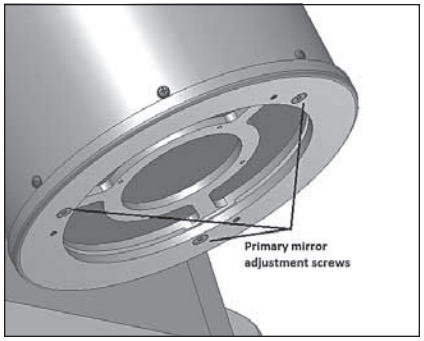

Figure 17. Adjusting the primary mirror screws moves the laser dot on the viewing screen.

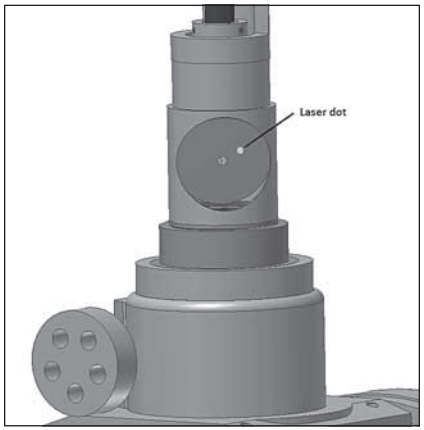

Figure 18. The laser dot is projected on the viewing screen. When perfectly collimated the laser dot is coincident with the central hole.

4.2. Care and Maintenance of your LPCS

The LPCS is manufactured of the highest quality components. Great care was taken to avoid any backlash between components. If it is dropped or handled roughly, the internal ball bearings may become loose, and the LPCS performance might be reduce Avoid exposing the LPCS to water, dust, heat, or prolonged periods of direct sunlight.

Appendix A: Marking the Primary Mirror

To achieve the best accuracy when collimating with the Orion LPCS, 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 19a). 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 19b and c). Now, cut about 1/4 inch off the tip of the paper wedge you have created (Figure 19d). 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 19e). 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 19f).

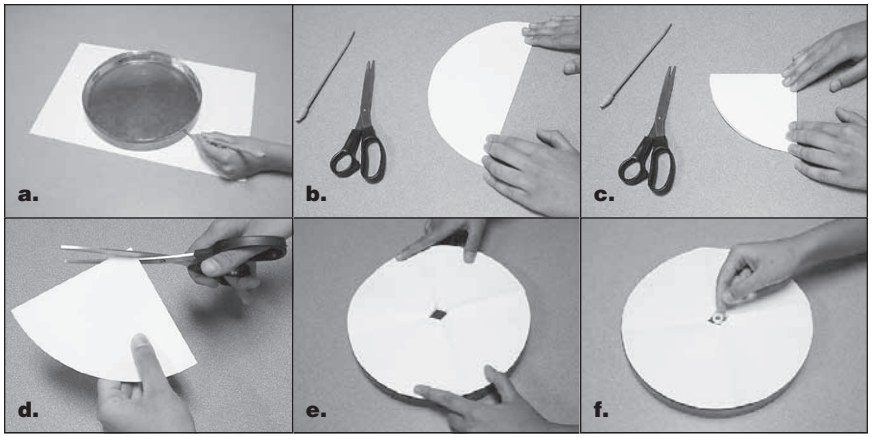

Figure 19. To mark the center of an unmarked primary mirror, **a)** trace the outline of the mirror on a piece of paper and carefully cut out the circle, **b)** fold the circle in half, and **c)** then in half again, **d)** cut the tip off the paper wedge, **e)** place the template on the mirror surface 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.

The center of the primary mirror is now marked, as in Figure 13, 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 LPCS, 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 LPCS 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 LPCS 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.

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®
OrionTelescopes.com
89 Hangar Way, Watsonville, CA 95076
Customer Support Help Line (800) 676-1343

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