INSTRUCTION MANUAL

Orion® SkyScanner BL 102mm and 135mm Dobsonian Reflector Telescopes

#52598 SkyScanner BL 102mm

#52599 SkyScanner BL 135mm

#52598

#52599

Congratulations on your purchase of the Orion SkyScanner BL Dobsonian Reflector telescope. Your new SkyScanner BL Dobsonian Reflector Telescope is designed for easy yet eye-opening exploration of the heavens. If you have never owned a telescope before, we would like to welcome you to amateur astronomy. Take some time to familiarize yourself with the night sky. Learn to recognize the patterns of stars in the major constellations. With a little practice, a little patience, and a reasonably dark sky away from city lights, you'll find your telescope to be a never-ending source of wonder, exploration, and relaxation.

These instructions will help you set up and use your SkyScanner BL telescope. Please read them thoroughly before getting started. Please save all original packaging. This will help protect your SkyScanner BL in the unlikely event to need to return it.

The list of Included Items and the Assembly instructions are provided separately for the SkyScanner BL 102 and the SkyScanner BL 135. Please refer to the relevant sections for your particular telescope.

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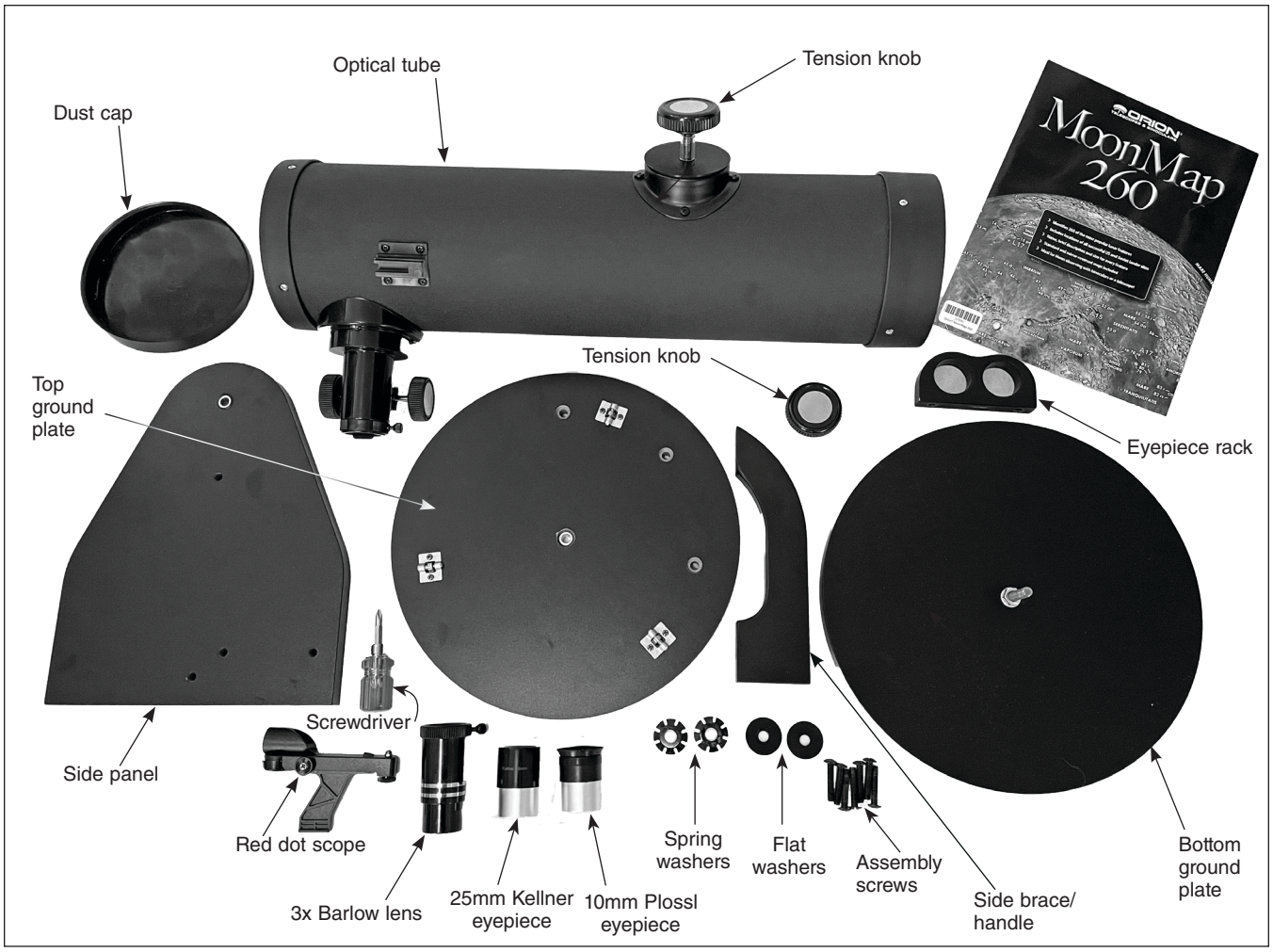

Figure 1. Parts of the SkyScanner BL 102mm Dobsonian.

SkyScanner BL 102

Included Items

Unpack and identify all included items, using the list below and **Figure 1** for reference.

- SkyScanner BL 102mm optical tube
- Red dot finder scope
- 25mm Kellner eyepiece
- 10mm Plossl eyepiece
- 3x Barlow lens

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.

- MoonMap 260
- Bottom ground plate (with feet and azimuth axis bolt pre-installed)
- Top ground plate
- Side panel
- Side brace
- Eyepiece rack
- Assembly screw (x7)
- Tension knob (x2)
- Spring washer (x2)
- Flat washer (x2)
- Screwdriver (with interchangeable flat and Philips bit)
- Dust cap

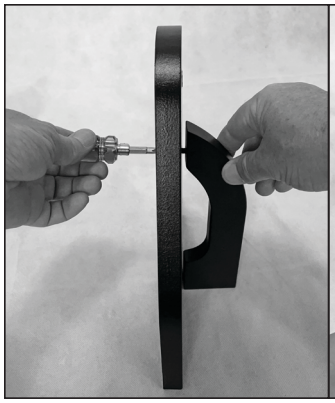

Figure 2. Installing the side brace/handle

Figure 3. Use two screws to attach the eyepiece rack

Figure 4. Attach the side panel assembly to the top ground plate.

Figure 5. Place top portion of base onto bottom ground plate.

Assembly of the SkyScanner BL 102mm

1. Attach side brace to side panel with two assembly screws (**Figure 2**).
2. Attach eyepiece rack to side panel with two assembly screws (**Figure 3**).
3. Attach side panel assembly to top side of top ground plate with three assembly screws (**Figure 4**).
4. Place top portion of base onto bottom ground plate, centering the hole in top ground plate over the pre-installed center bolt in the bottom ground plate (**Figure 5**).
5. Place a flat washer followed by a spring washer onto the center bolt. Make sure the spring washer is oriented as shown in **Figure 6**. Now thread a tension knob onto the center bolt (do not over-tighten).
6. Remove tension knob and sleeve from altitude axis bolt on side hub of optical tube (**Figure 7**).
7. Install optical tube on side panel by inserting bolt of optical tube's altitude hub through the hole in the side panel, as shown in **Figure 8A**. Make sure the plastic disc is between the hub and the side panel.
8. Now place a flat washer followed by a spring washer onto the exposed end of the bolt, the thread on a tension knob (do not overtighten). (**Figure 8B**)
9. Now install the red dot finder scope by sliding the bracket into the finder base on the optical tube as shown in **Figure 9**.
10. Finally, insert the 25mm eyepiece into the focuser draw-tube collar and secure it with the thumbscrew (**Figure 10**)

With your telescope now fully assembled, you can skip to the section titled "Getting Started."

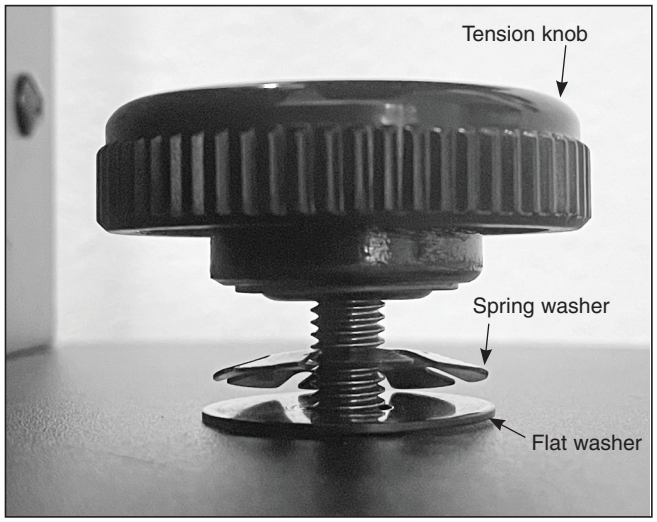

Figure 6. With the top portion of the base installed on the bottom ground plate, place a flat washer then a spring washer onto the center bolt as shown, then thread on a tension knob.

SkyScanner BL 135

Included Items

Unpack and identify all included items, using the list below and **Figure 11** for reference.

- SkyScanner BL 135mm optical tube
- Red dot finder scope
- 25mm Kellner eyepiece
- 10mm Plossl eyepiece
- 3x Barlow lens
- MoonMap 260
- Bottom ground plate (with feet and azimuth axis bolt pre-installed)
- Top ground plate
- Side panel (x2)
- Side brace (x2)
- Front panel
- Bearing cylinders (x4)
- Eyepiece rack
- Assembly screw (x18)
- Azimuth tension knob

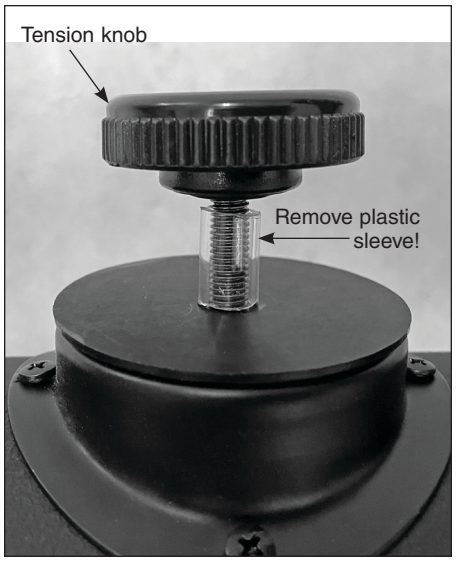

Figure 7. Remove and discard the plastic sleeve on altitude axis bolt.

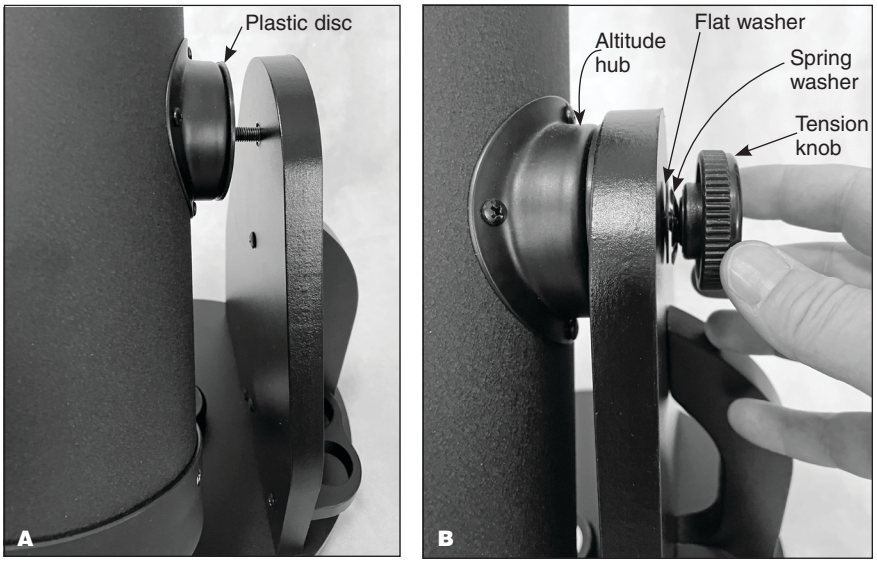

Figure 8. A) Insert the altitude axis bolt through the hole at the top of the side panel. **B)** Thread a flat washer, then a spring washer, then a tension knob onto the bolt.

- Spring washer
- Flat washer
- Screwdriver (with interchangeable flat and Philips bit)
- Dust cap

Assembly of the SkyScanner BL 135mm

1. Attach a side brace to the outside surface of a side panel with two assembly screws (**Figure 12**). Do this for both side panels.
2. Attach the front panel to the two side panels as shown in **Figure 13**.
3. Now bolt the top ground plate onto the panel assembly using 8 assembly screws, as shown in **Figure 14**.
4. Place top portion of base onto bottom ground plate, centering the hole in top ground plate over the pre-installed center bolt in the bottom ground plate (**Figure 15**). Then place the flat washer followed by the spring washer over the center bolt. Then thread on the tension knob (**16**).
5. Remove the nut and washer from each of the threaded ends of the carry handle. Then insert the handle into the two holes from the outside of the front panel. Place a washer on each exposed threaded end of the handle, followed by a nut. Tighten the nuts with a small adjustable wrench or pair of pliers (**17**).
6. Attach the eyepiece rack to the front panel with two assembly screws (**Figure 17**).
7. Install two altitude bearing cylinders on the inside surface of each side panel using assembly screws (**Figure 18**). The screws should be inserted from the outside of the panel.
8. Now place the Dobsonian optical tube into the base, resting the tube's two altitude hubs on the pairs of bearing cylinders you installed in the previous step (**Figure 19**). Then insert an altitude tension knob into the uppermost hole in each side panel and thread it into the tube's altitude hub (**Figure 20**).
9. Now install the red dot finder scope by sliding the bracket into the finder base on the optical tube as shown in **Figure 9**.
10. Finally, insert the 25mm eyepiece into the focuser draw-tube collar and secure it with the thumbscrew (**Figure 10**).

Getting Started

The SkyScanner BL telescopes were designed specifically for visual observation of astronomical objects in the night sky. Like all Newtonian reflector telescopes, they are not suited for daytime terrestrial usage because the image in the eyepiece is rotated or upside-down.

One of the great assets of SkyScanner BL telescopes is their compact size and portability. For the 102mm model especially, due to its overall short height, you will find that viewing while sitting or kneeling next to the telescope is the most comfortable. If you wish to raise the telescope off the ground so that it can be used while standing or sitting in a chair, then you can set the telescope on a platform such as a milk crate or table, or even the hood of your car. It is not critical that the telescope be exactly level, but it should be placed on a relatively flat surface to ensure smooth movement.

Altitude and Azimuth (Aiming the Telescope)

The SkyScanner BL's altazimuth base permits motion along two axes: altitude (up/down) and azimuth (left/right) (**Figure 21**). Simply grasp the front of the optical tube and move the telescope left or right so that the base rotates. Move the optical tube up or down in the same manner. Both motions can be made simultaneously and in a continuous manner for easy aiming. This way you can point to any position in the night sky, from horizon to horizon.

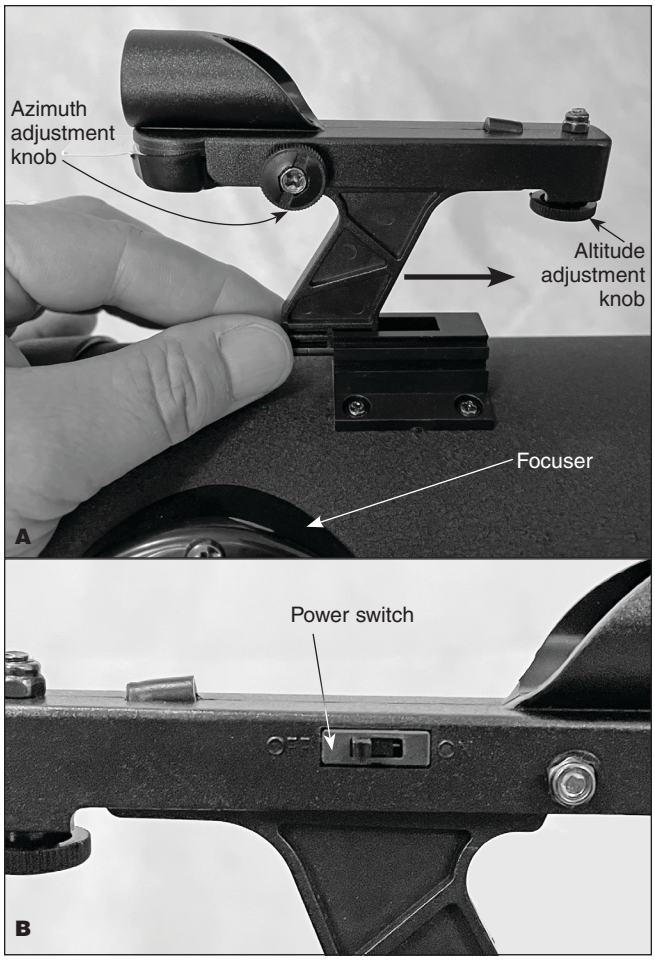

Figure 9. A) Install the red dot scope by sliding the bracket into the base as shown. **B)** The power switch has two brightness settings.

Both the altitude and azimuth axes of the SkyScanner BL are equipped with tension adjustment knobs, which you installed earlier. These should be adjusted so there is sufficient friction of motion to keep the telescope from rotating too freely in each axis, which can make it difficult to land on and stay aimed at an object you wish to view. However, if you apply too much tension the telescope will be difficult to move smoothly and in small increments needed to center an object in the eyepiece for viewing.

Focusing the Telescope

Both SkyScanner BL telescopes come equipped with a rack-and-pinion focuser. The SkyScanner BL 102mm has a 1.25" focuser, which accepts only eyepieces with 1.25"-diameter barrels. The SkyScanner BL 135mm model comes with a 2" focuser that has a 1.25" adapter installed in it. This focuser can accept eyepieces with either 2"-diameter barrels or 1.25" barrels.

To use an optional 2" eyepiece in the SkyScanner BL 135mm, you must first remove the 1.25" adapter from the focuser (**Figure 22**). To do so, just loosen the thumbscrew until it is nearly all the way out, then the adapter can be removed. Place the 2" eyepiece's barrel into the drawtube collar and tighten it with the thumbscrew.

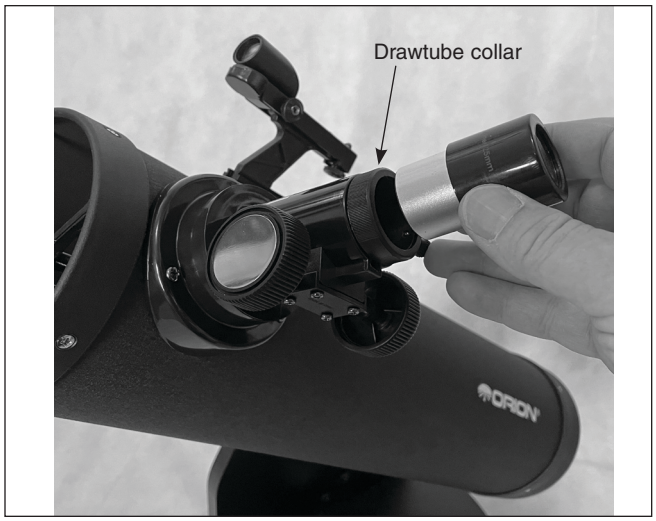

Figure 10. Insert an eyepiece into the focuser and secure it with the thumbscrew.

We recommend practicing focusing in the daytime when starting out to get the hang of it. With the 25mm eyepiece inserted into the focuser and secured with the thumbscrew, aim the optical tube so the front (open) end is pointing in the general direction of an object at least 1/4-mile away. With your fingers, slowly rotate one of the focus wheels until the object comes into sharp focus. Go a little bit beyond sharp focus until the image starts to blur again, then reverse the rotation of the knob gradually, until you've nailed the exact focus point.

Aligning and Using the Red Dot Finder Scope

The included red dot finder scope (**Figure 9**) makes pointing your telescope almost as easy as pointing your finger. It permits easy object targeting prior to observation in the higher-power main telescope. It superimposes a red dot generated by an internal LED light on the sky, showing right where your telescope is pointed (**Figure 23**).

Before you can use the red dot finder scope, you must remove the small tab sticking out from the battery compartment. Doing so will allow the pre-installed 3V CR-2032 button cell battery to make contact with the finder scope's electronic circuitry to power the finder's red LED illuminator. The tab can then be discarded.

To use the red dot finder scope properly, it must be aligned with the main telescope. This is easiest to do during daylight hours, before observing at night. Follow this procedure:

1. First, remove the dust cover from the front of the telescope.
2. With the 25mm eyepiece installed in the focuser, point the telescope at a well-defined land target (e.g., the top of a telephone pole) that's at least a quarter mile away.
3. Center the target in the eyepiece.

Note: *The image in the eyepiece will appear rotated (upside down). This is normal for reflector telescopes.*

4. Turn on the red dot finder scope by sliding the power switch to ON (refer to **Figure 9B**). The power switch actually has two illumination settings: the middle position

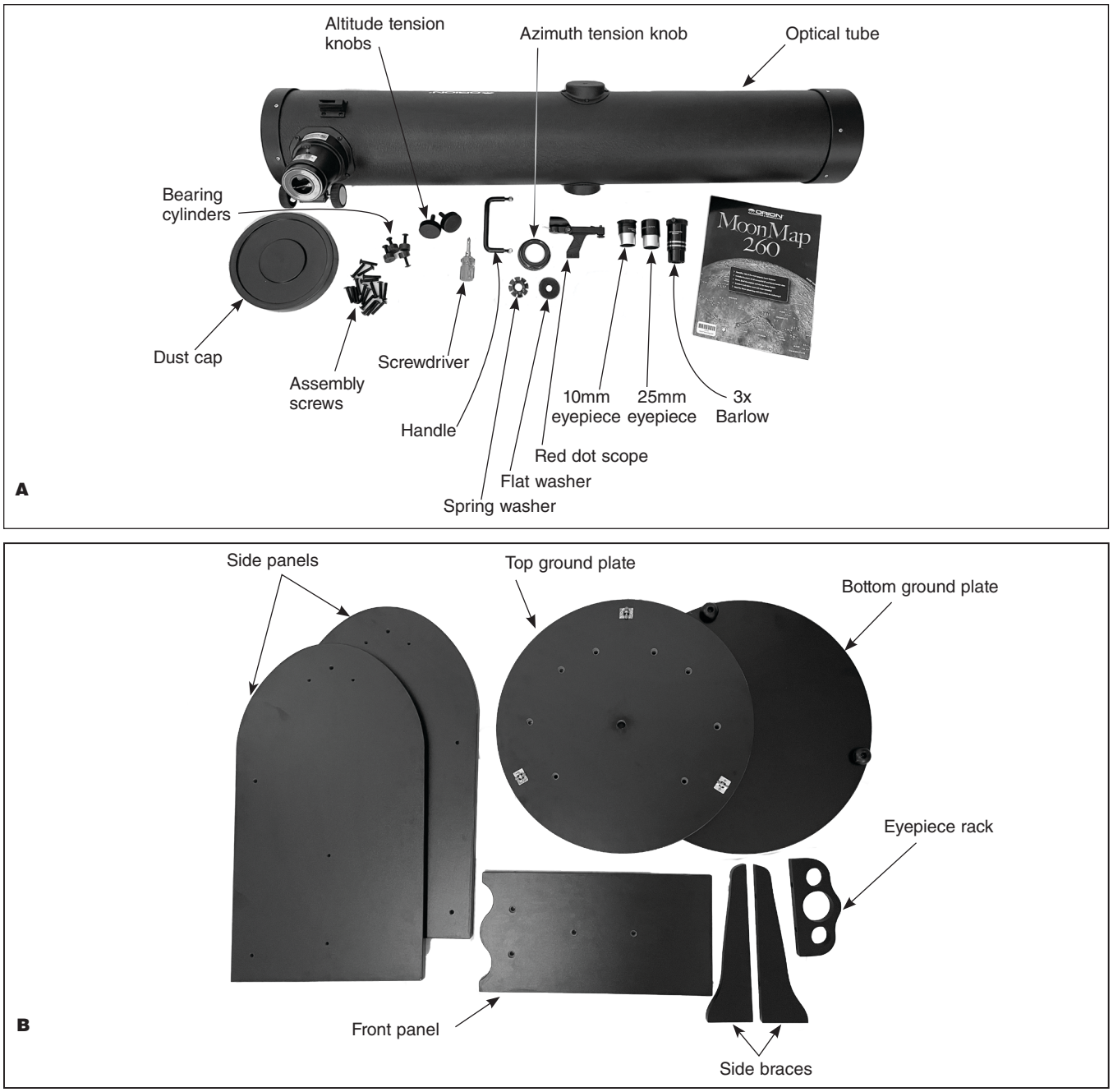

Figure 11. A) The optical tube and other parts of the SkyScanner BL 135mm Dobsonian. **B)** The main base components.

provides dim illumination while pushing the switch all the way to the right provides brighter illumination. Typically the dimmer setting is used under dark skies and the brighter setting is used under light-polluted skies or in daylight. Position your eye at a comfortable distance from the rear of the unit. Look through the rear of the finder scope with both eyes open to see the illuminated red dot. The target object should appear in the field of view somewhere near the red dot.

5. You'll want to center the target object on the red dot. Without moving the telescope, use the finder scope's altitude and azimuth adjustment knobs (shown in **Figure 9A**) to position the red dot on the object.

6. When the red dot is centered on the distant object, check to make sure the object is still centered in the telescope's eyepiece. If it isn't, re-center it then adjust the finder scope's alignment again. When the object is centered in the telescope eyepiece and on the finder scope's red dot, the finder scope is properly aligned with the telescope. The red dot finder scope's alignment should be checked before every observing session.

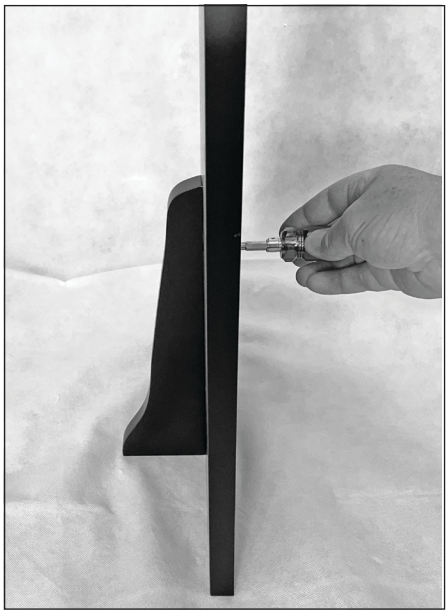

Figure 12. Attach a side brace to each side panel with base assembly screws.

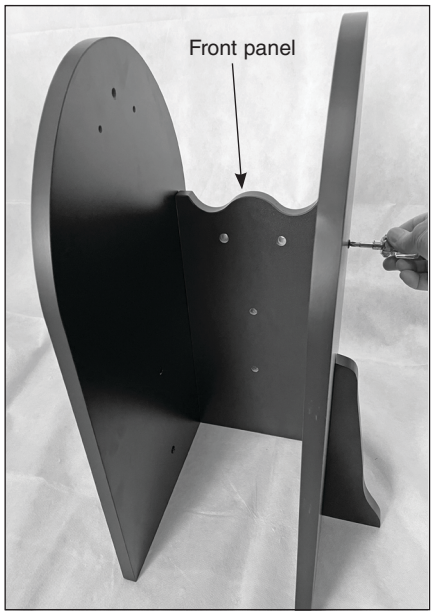

Figure 13. Attach the front panel to the two side panels.

Figure 14. Install the top ground plate to the side panel assembly as shown.

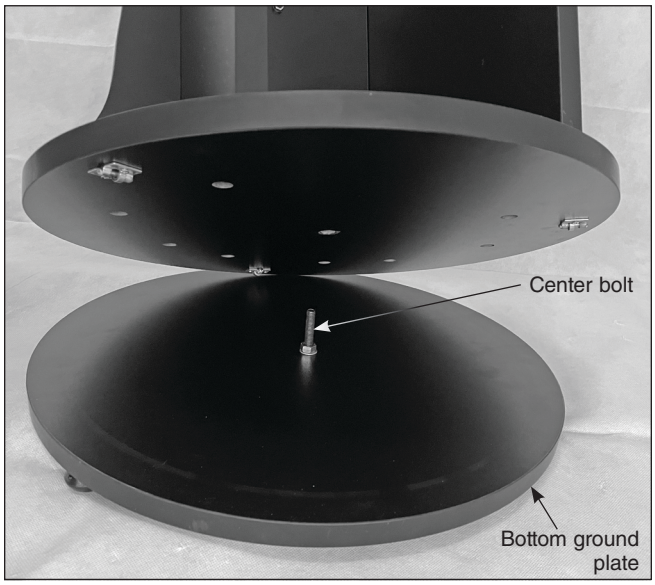

Figure 15. Place the base assembly over the bottom ground plate so that the center bolt aligns with the center hole in the top ground plate.

At the end of your observing session, be sure to slide the power switch to OFF to preserve battery life.

Changing the Battery in the Red Dot Scope

The red dot scope uses a standard CR2032 3V lithium ion battery. Should it die, follow these steps to replace it with a fresh one:

1. Remove the battery cover by pulling it downward from the front slot (**Figure 24**).
2. Remove the old battery from underneath the spring tab and replace it with a new one, with (+) side facing the spring tab as shown in **Figure 25**.
3. Replace the battery cover and snap it into place.

Using your Telescope

Choosing an Observing Site

When selecting a location for observing, get as far away as possible from direct artificial light such as street lights, porch lights, and automobile headlights. The glare from these lights will greatly impair your dark-adapted night vision. Avoid viewing over rooftops and chimneys, as they often have warm air currents rising from them. Similarly, avoid observing from indoors through an open (or closed) window, because the temperature difference

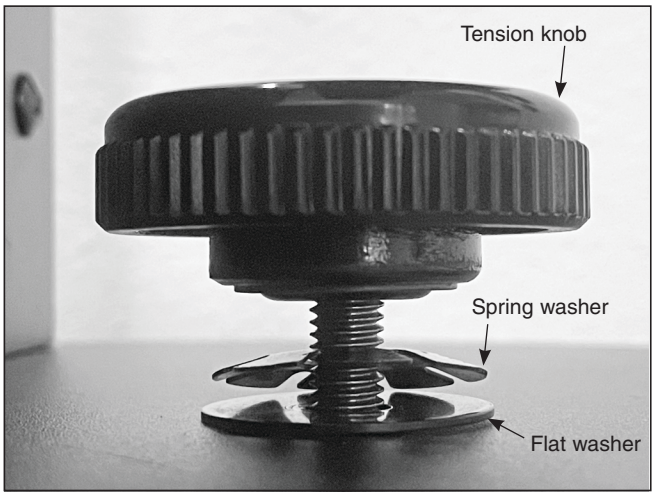

Figure 16. Place the flat washer then the spring washer over the bolt, then thread on the azimuth tension knob.

Figure 17. Install the carry handle and the eyepiece rack as shown.

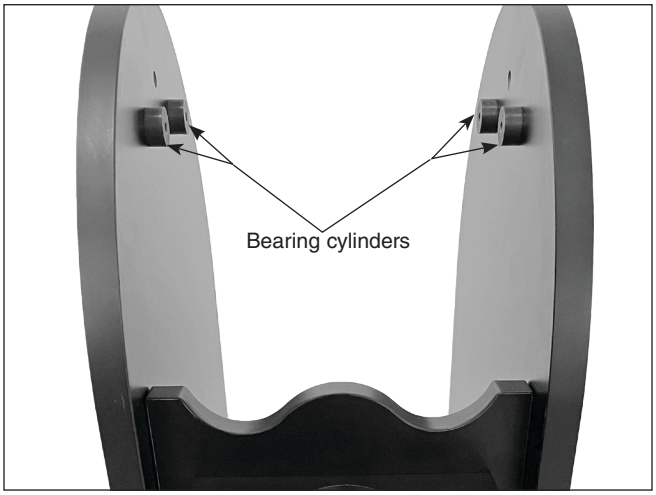

Figure 18. Attach a pair of bearing cylinders to the inside of both of the side panels. Insert the screws from the outside of the panels.

between the indoor and outdoor air will cause image blurring and distortion.

If at all possible, escape the light-polluted city sky and head for darker country skies. You'll be amazed at how many more stars and deep-sky objects are visible in a dark sky!

Cooling the Telescope

All optical instruments need time to reach "thermal equilibrium." The bigger the instrument and the larger the temperature change, the more time is needed. Allow at least 20 minutes for your telescope to acclimate to the temperature outdoors before you start observing with it.

Figure 19. Lift the optical tube into the base, resting the altitude hubs on the bearing cylinders installed in the previous step.

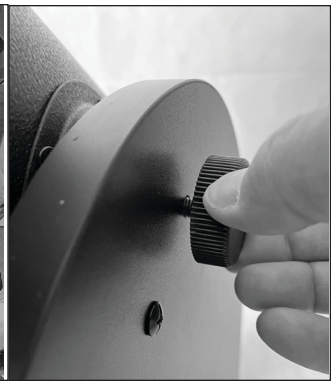

Figure 20. Thread an altitude tension bolt through the hole in the side panel and into the altitude hub on each side.

Figure 21. The SkyScanner BL Dobsonians have two axes of motion: altitude (up/ down) and azimuth (left/right).

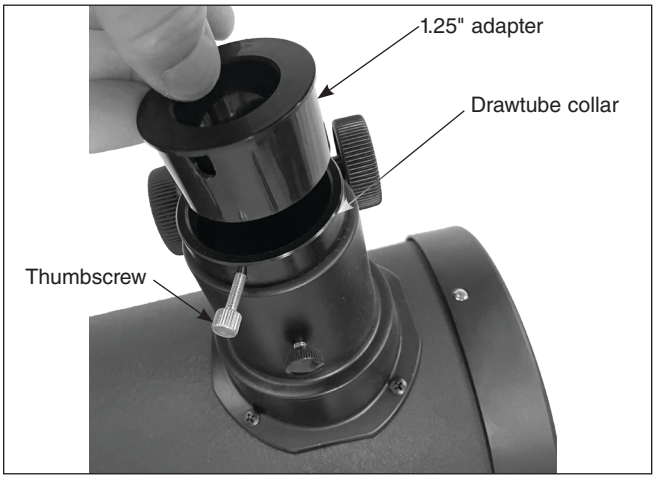

Figure 22. The focuser on the SkyScanner BL 135mm Dobsonian has a 1.25" adapter, which can be removed by loosening the thumbscrew. With the adapter removed, the focuser can accept optional 2" eyepieces.

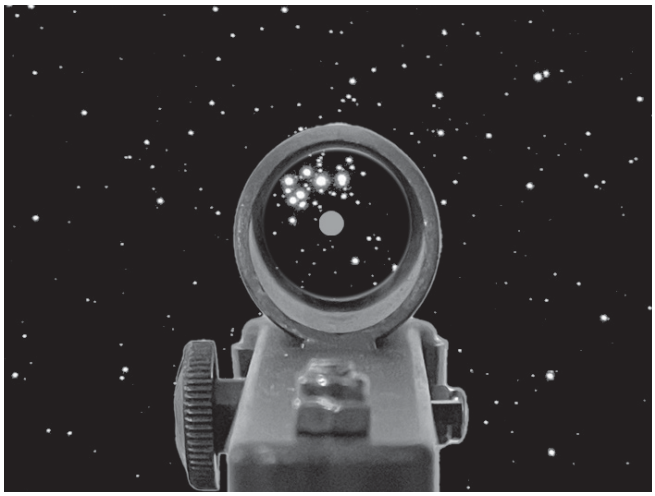

Figure 23. The red dot scope superimposes a red LED dot onto the night sky, showing right where your telescope is pointed.

Figure 24. To change the red dot scope's CR2032 battery, pull down the battery cover and remove it.

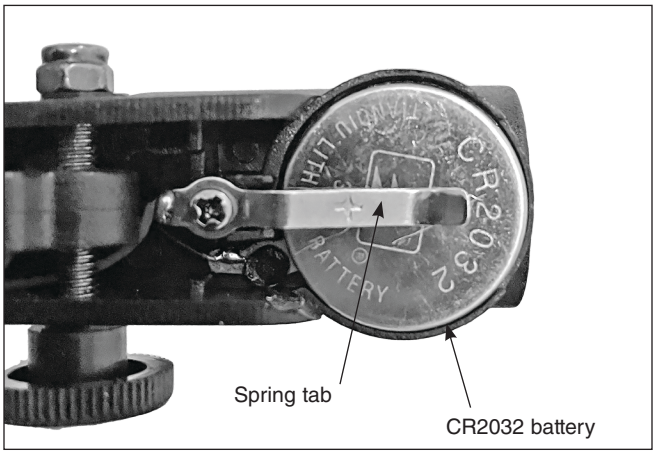

Figure 25. Remove the old battery and place a new CR2032 battery under the spring tab, with the positive (+) side of the battery facing the tab.

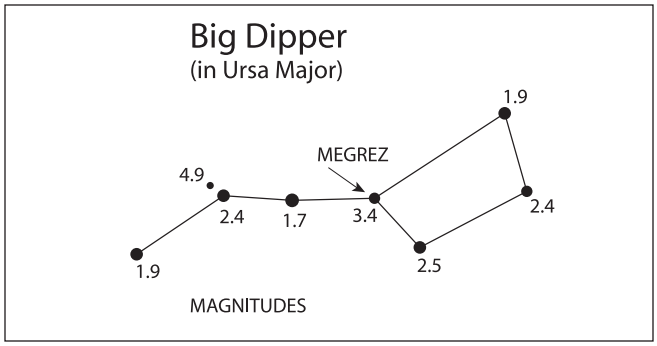

Figure 26. Megrez connects the Big Dipper's handle to it's "pan." It is a good guide to how conditions are. If you can not see Megrez (a 3.4 mag star) then conditions are poor.

Figure 27. The included 3x Barlow lens is inserted between the focuser and the eyepiece, as shown here.

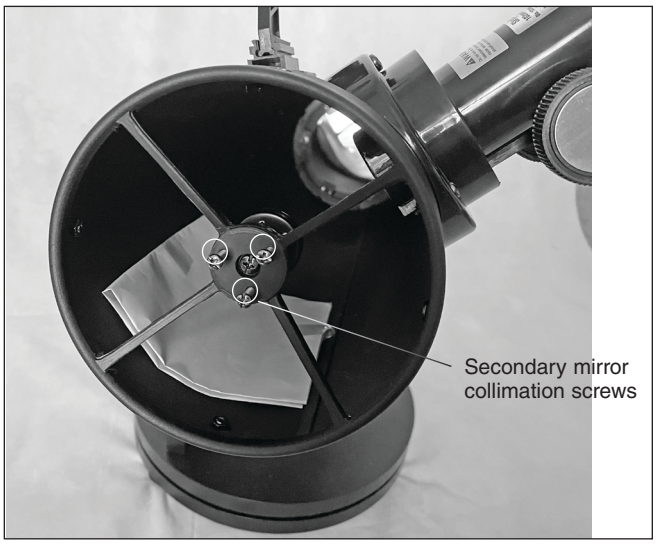

Figure 28. Orient the optical tube horizontally for collimation, and place a piece of white paper inside the tube opposite the focuser.

Let Your Eyes Dark-Adapt
Don't expect to go from a lighted house into the darkness of the outdoors at night and immediately see faint nebulas, galaxies, and star clusters—or even very many stars, for that matter. Your eyes take about 30 minutes to reach perhaps 80% of their full dark-adapted sensitivity. As your eyes become dark-adapted, more stars will glimmer into view and you'll be able to see fainter details in objects you view in your telescope.

To see what you're doing in the darkness, use a red-filtered flashlight rather than a white light. Red light does not spoil your eyes' dark adaptation like white light does. A flashlight with a red LED light is ideal. Beware, too, that nearby porch, streetlights, and car headlights will ruin your night vision.

"Seeing" and Transparency
Atmospheric conditions vary significantly from night to night. "Seeing" refers to the steadiness of the Earth's atmosphere at a given time. In conditions of poor seeing, atmospheric turbulence causes objects viewed through the telescope to "boil." If you look up at the sky and stars are twinkling noticeably, the seeing is poor and you will be limited to viewing at lower magnifications. At higher magnifications, images will not focus clearly. Fine details on the planets and Moon will likely not be visible.

In conditions of good seeing, star twinkling is minimal and images appear steady in the eyepiece. Seeing is best overhead, worst at the horizon. Also, seeing generally gets better after midnight, when much of the heat absorbed by the Earth during the day has radiated off into space.

Especially important for observing faint objects is good "transparency" - air free of moisture, smoke, and dust. All tend to scatter light, which reduces an object's brightness. Transparency is judged by the magnitude of the faintest stars you can see with the unaided eye (6th magnitude or fainter is desirable). If you cannot see stars of magnitude 3.5 or dimmer then conditions are poor. Magnitude is a measure of how bright a star is - the brighter a star is, the lower its magnitude will be. A good star to remember for this is Megrez (mag. 3.4), which is the star in the "Big Dipper" connecting the handle to the "dipper". If you cannot see Megrez, then you have fog, haze, clouds, smog, or other conditions that are hindering your viewing. (See **Figure 26**.)

Tracking Celestial Objects
The Earth is constantly rotating about its polar axis, completing one full rotation every 24 hours; this is what defines a "day". We do not feel the Earth rotating, but we see it at night from the apparent movement of stars from east to west. When you observe any astronomical object, you are watching a moving target. This means the telescope's position must be continuously adjusted over time to keep an object in the field of view. This is easy to do with the SkyScanner BL because of its smooth motions on both axes. As the object moves off towards the edge of the field of view, just lightly nudge or tug the telescope to re-center it. Objects appear to move across the field of view faster at higher magnifications. This is because the field of view becomes narrower.

Eyepiece Selection

By using eyepieces of different focal lengths, it is possible to attain many magnifications or powers with the SkyScanner BL. Your telescope comes with two 1.25" eyepieces: one with 25mm focal length and one with 10mm focal length. To calculate the magnification of a telescope-eyepiece combination, simply divide the focal length of the telescope by the focal length of the eyepiece:

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

For example, the SkyScanner BL 102mm, which has a focal length of 640mm, used in combination with the 25mm Kellner eyepiece, yields a magnification of 26x:

$$\frac{640\text{mm}}{25\text{mm}} = 26\text{mm}$$

The 10mm Plossl eyepiece included with the SkyScanner BL 102mm produces a magnification of 64x.

For the SkyScanner BL 135mm, the 25mm eyepiece yields a magnification of 44x, while the 10mm Plossl eyepiece magnifies 110x. Other 1.25" telescope eyepieces can be purchased to achieve higher or lower powers. It is quite common for an observer to own five or more eyepieces to access a wide range of magnifications.

Whatever you choose to view, always start by inserting your lowest-power (longest focal length) eyepiece to locate and center the object (in this case the 25mm). Low magnification yields a wider field of view, which shows a larger area of sky in the eyepiece. This makes finding and centering an object much easier. Trying to find and center objects with a high power eyepiece, which has a narrower field of view, is like trying to find a needle in a haystack! Once you've centered the object in the eyepiece with the 25mm, you can switch to a higher magnification (shorter focal length) eyepiece, if you wish.

The best rule of thumb with eyepiece selection is to start with a low power eyepiece, and then work your way up in magnification. If the object looks bet¬ter, try an even higher magnification eyepiece. If the object looks worse, then back off the magnification a little by using a lower-power eyepiece.

Magnification Limits

Every telescope has a useful magnification limit of about 2x per millimeter of aperture. This comes to 204x for the SkyScanner BL 102mm, and 270x for the SkyScanner BL 135mm. Some telescope manufacturers will use misleading claims of excess magnification, such as "See distant galaxies at 640X!" While such magnifications are technically possible, the actual image at that magnification would be an indistinct blur. Low and moderate magnifications are what give the best views. A small, but bright and detailed image is always better than a dim, unclear, over-magnified one.

Using the MoonMap 260

Orion's MoonMap 260 is a great observing aid to use when viewing the Moon with your SkyScanner BL. With it you will be able to identify a myriad of lunar features. Because the view in the SkyScanner BL is rotated from upright, you may find it useful to rotate the MoonMap so the image on the map matches what you see in the telescope eyepiece. Concentrate each evening on the "terminator", where the illuminated portion of the lunar

surface meets the dark portion. Due to the low angle at which sunlight strikes this part of the Moon, shadows cast by crater walls and other high-elevation features are elongated, thereby making such features stand out more vividly. Using a red flashlight (sold separately) to read the MoonMap in the dark will be helpful; the red light will not spoil your eyes' dark adaptation.

What to Expect

So what will you see with your telescope? You should be able to see bands on Jupiter, the rings of Saturn, craters on the Moon, the waxing and waning of Venus, and many bright deep-sky objects. Do not expect to see color as you do in NASA photos, since those are taken with long-exposure cameras and have "false color" added. Our eyes are not sensitive enough to see color in deep-sky objects except in a few of the brightest ones.

But remember that you are seeing these objects using your own telescope with your own eyes, in real time. And that's pretty cool!

Objects to Observe

Now that you are all set up and ready to go, one critical decision must be made: what to look at?

A. The Moon

With its rocky surface, the Moon is one of the easiest and most interesting targets to view with your telescope. Lunar craters, maria, and even mountain ranges can all be clearly seen from a distance of 238,000 miles away! With its ever-changing phases, you'll get a new view of the Moon every night. The best time to observe our one and only natural satellite is during a partial phase, that is, when the Moon is NOT full. During partial phases, shadows are cast on the surface, which reveal more detail, especially right along the border between the dark and light portions of the disk (called the "terminator"). A full Moon is too bright and devoid of surface shadows to yield a pleasing view. Make sure to observe the Moon when it is well above the horizon to get the sharpest images. Use an optional Moon filter to dim the Moon when it is very bright. It simply threads onto the bottom of the eyepiece barrel. You'll find that a Moon filter improves viewing comfort, and also helps to bring out subtle features on the lunar surface.

B. The Sun

You can change your nighttime telescope into a daytime Sun viewer by installing an optional full-aperture solar filter over the front opening of the SkyScanner BL. The primary attraction is sunspots, which change shape, appearance, and location daily. Sunspots are directly related to magnetic activity in the Sun. Many observers like to make drawings of sunspots to monitor how the Sun is changing from day to day.

Important Note: *Do not look at the Sun with this telescope without a professionally made solar filter installed on the front opening, or permanent eye damage could result. Do not use the red dot scope when solar viewing, either.*

C. The Planets

Planets, being in our own solar system and having their own orbits, do not stay at "fixed" locations like the stars do. So to find them you should refer to Sky Calendar at our website (telescope.com), or to charts published monthly in Astronomy, Sky & Telescope, or other astronomy magazines. Venus, Jupiter, and Saturn are the brightest objects in the sky after the Sun and the Moon. Your SkyScanner BL is capable of showing you these planets in some detail. Other planets may be visible but will likely appear star-like. Because planets are quite small in apparent size, you will need to use high power (the 3X Barlow lens should come in handy here). Not all the planets are generally visible at any one time.

JUPITER: The largest planet, Jupiter, is a great subject for observation. You can see the disk of the giant planet and watch the ever-changing positions of its four largest moons - Io, Callisto, Europa, and Ganymede.

SATURN: The ringed planet is a breathtaking sight when it is well positioned. The tilt angle of the rings varies over a period of many years; sometimes they are seen edge-on, while at other times they are broadside and look like giant "ears" on each side of Saturn's disk. A steady atmosphere (good seeing) is necessary for a good view. You will probably see a bright "star" close by, which is Saturn's brightest moon, Titan.

VENUS: At its brightest, Venus is the most luminous object in the sky, excluding the Sun and the Moon. It is so bright that sometimes it is visible to the naked eye during full daylight! Ironically, Venus appears as a thin crescent, not a full disk, when at its peak brightness. Because it is so close to the Sun, it never wanders too far from the morning or evening horizon. No surface markings can be seen on Venus, which is always shrouded in dense clouds.

D. The Stars

Stars will appear like twinkling points of light. Even powerful telescopes cannot magnify stars to appear as more than a point of light. You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. The gorgeous two-color double star Albireo in Cygnus is a favorites. Defocusing a star slightly can help bring out its color.

E. Deep-Sky Objects

Under dark skies, you can observe a wealth of fascinating deep-sky objects, including gaseous nebulas, open and globular star clusters, and a variety of different types of galaxies. Most deep-sky objects are very faint, so it is important that you find an observing site well away from light pollution. Take plenty of time to let your eyes adjust to the darkness. Do not expect these subjects to appear like the photographs you see in books and magazines; most will look like dim gray smudges. Our eyes are not sensitive enough to see color in deep-sky objects. But as you become more experienced and your observing skills get sharper, you will be able to ferret out more and more subtle details and structure.

To find deep sky objects in the sky, it is best to consult a star chart or planisphere. These guides will help you locate the brightest and best deep-sky objects for viewing with your SkyScanner BL. You can also try low-power scanning of the Milky Way. Pop in the 25mm eyepiece and just cruise through the "star clouds" of our galaxy. You'll be amazed at the rich fields of stars and objects you'll see! The Milky Way is best observed on summer and winter evenings.

Aligning the Mirrors (Collimation)

Collimation is the process of adjusting the optics of a telescope so they are precisely aligned with one another and with the telescope tube. For this reflector telescope, the primary and secondary mirrors must be in precise alignment. Your telescope's optics were aligned at the factory, and should not need much or any adjustment unless the telescope is handled roughly. Accurate mirror alignment is important to ensure the sharpest possible images viewed through your telescope, so it should be checked occasionally. With practice, collimating is relatively easy to do and can be done in daylight.

It helps to perform the collimation procedure in a brightly lit room with the telescope pointed toward a bright surface, such as a light-colored wall. The telescope tube should be oriented horizontally (parallel to the ground). Placing a piece of white paper in the telescope tube opposite the focuser (i.e., on the other side of the secondary mirror from the focuser) will also be helpful (see **Figure 28**). You will need the included screwdriver with the Philips bit to perform the collimation.

To check your telescope's collimation, remove the eyepiece and look down the focuser. You should see the secondary mirror centered in the focuser, as well as the reflection of the primary mirror centered in the secondary mirror, and the reflection of the secondary mirror (and your eye) centered in the reflection of the primary mirror, as in **Figure 29A**. Got all that? Review it again carefully, and compare what you see to **Figure 29A**. If anything is off-center, proceed with the following collimation procedure.

NOTE: Precise collimation is best achieved by using an optional collimating tool, such as a quick-collimation cap, a Cheshire eyepiece, or a laser collimator. Check our website for available collimating tools. **Figures 29B** through **29D** assume that you have an optional Cheshire eyepiece or collimation cap in the focuser.

Primary Mirror Center Mark

You may have noticed that your SkyScanner BL has a small adhesive dot in the exact center of the primary mirror. This "center mark" allows you to achieve a very precise collimation of the primary mirror; you don't have to guess where the center of the mirror is, which is important in the collimation process. This center mark is especially useful when using an optional collimating device.

Note: *The adhesive dot should not be removed from the primary mirror. Because it lies directly in the shadow of the secondary mirror, its presence in no way adversely affects the optical performance of the telescope or the image quality. That might seem counter-intuitive, but it's true! Leave it in place.*

Aligning the Secondary Mirror

Align the secondary mirror first. Note that for the SkyScanner BL 102mm the secondary mirror collimation screws are Philips head screws, so you will need to use the Philips screwdriver to adjust them. The SkyScanner BL 135mm model's secondary mirror collimation screws are thumbscrews, so you use your fingers to adjust them.

Look down the focuser at the secondary (diagonal) mirror. If the entire primary mirror reflection is not visible in the secondary

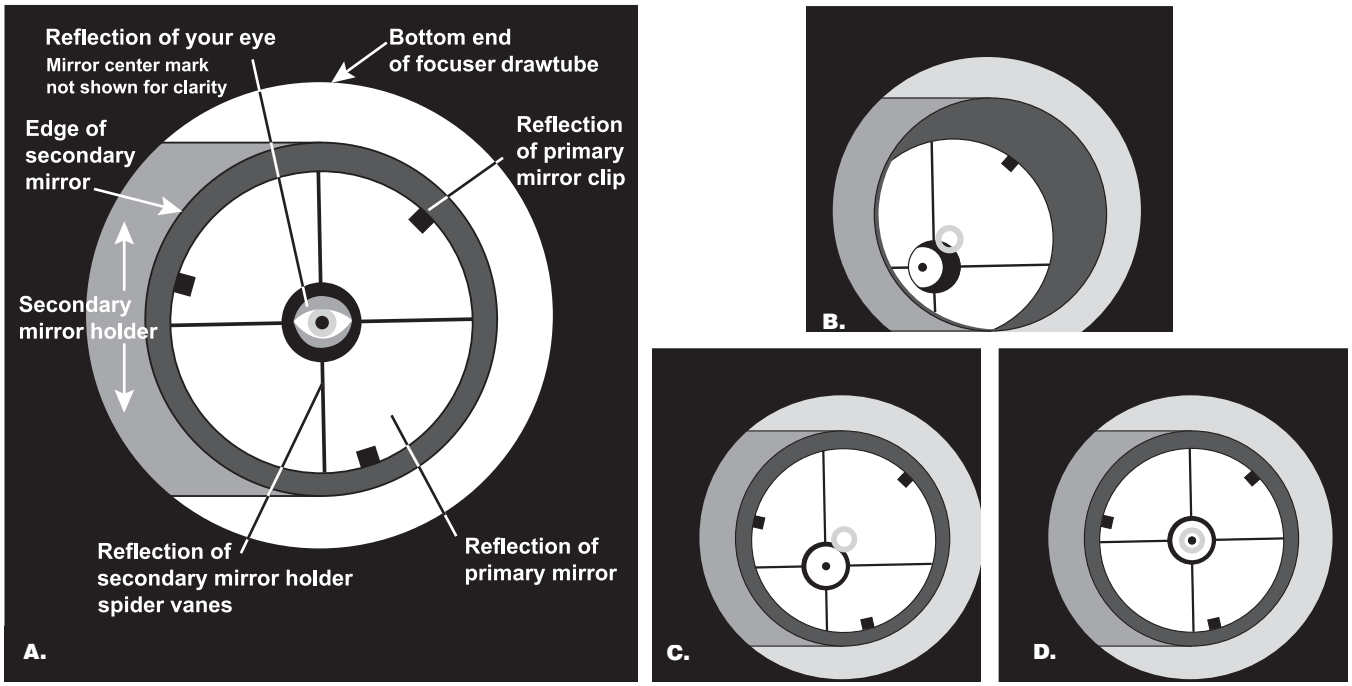

Figure 29. Collimating the optics. **(A)** When the mirrors are properly aligned, the view down the focuser drawtube should look like this. **(B)** With the collimation cap in place, (with a collimation cap or Cheshire eyepiece in place). Here, only part of the primary mirror is visible in the secondary mirror, so the secondary mirror needs to be adjusted (tilted). **(C)** Here the secondary mirror is correctly aligned because the entire primary mirror is visible in it. But the reflection of the secondary mirror is off-center. So the primary mirror still needs adjustment. **(D)** Now the primary mirror is correctly aligned, so the secondary mirror is centered.

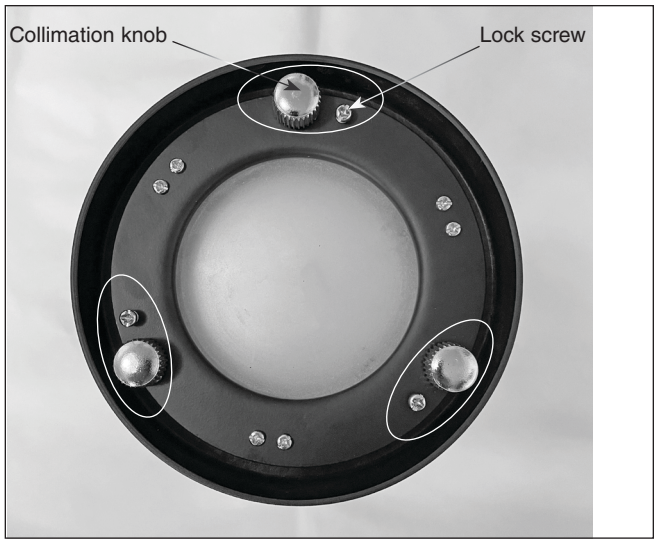

Figure 30. The optical tube's rear cell has three pairs of collimation screws. The large knobs are the spring-loaded collimation knobs while the small Philips screws are the locking screws.

mirror, as in **Figure 29B**, you will need to adjust the tilt of the secondary mirror. This is done by alternately loosening one of the three secondary mirror alignment screws then lightly tightening the other two (**Figure 28**). The goal is to center the primary mirror reflection in the secondary mirror, as in **Figure 29C**. Don't worry that the reflection of the secondary mirror (the smallest circle) is off-center. You will fix that in the next step. It will take some trial and error to determine which screws to loosen and tighten to move the reflection of the primary mirror to the center of the secondary mirror. But be patient and you'll get it.

Aligning the Primary Mirror

The final adjustment is made to the primary mirror. It will need adjustment if, as in **Figure 29C**, the reflection of the primary mirror is centered in the secondary mirror, but the small reflection of the secondary mirror is off-center. The tilt of the primary mirror is adjusted using three spring-loaded collimation knobs and three small locks screws on the back end of the optical tube (**Figure 30**).

First use a Philips screwdriver to loosen the three lock screws a turn or so. Then tighten one of the collimation knobs about a quarter turn and see if the secondary mirror reflection has moved closer to the center of the primary. If it moved farther away then try loosening the same collimation knob a bit. Repeat this process on the other two sets of collimation screws, if

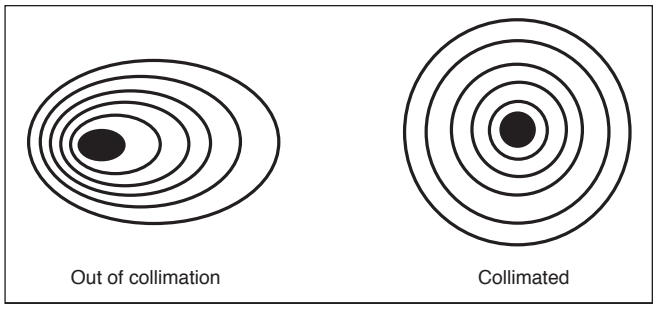

Figure 31. A star test will determine if the telescope's optics are properly collimated.

necessary, adjusting them one way or the other and seeing if the secondary mirror reflection moves closer to the center of the primary mirror reflection. It will take a little trial and error to get a feel for how to tilt the mirror in this way. When the center hole in your collimating tool is centered as much as possible on the reflection of the adhesive dot on the primary mirror, your primary mirror is collimated. The view through the collimation cap should resemble **Figure 29D**. Then, very lightly tighten the three lock screws so that the primary mirror stays in that position. A simple star test will tell you whether the optics are accurately collimated.

Star-Testing the Telescope

When it is dark, point the telescope 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 perfect circle (**Figure 31**). If the image is unsymmetrical, the scope is out of collimation. 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 and 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.

Telescope Care and Maintenance

If you give your telescope reasonable care, it will last a lifetime. 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 okay. Small components like eyepieces and other accessories should be kept in a protective box or storage case. Keep the dust cover on the front of the telescope when it is not in use.

Specifications

SkyScanner BL 102mm	
Primary mirror:	102mm diameter
Secondary mirror:	25mm minor axis
Mirror coatings:	Aluminum with SiO2 overcoat
Central obstruction:	31.2mm (30.6%)
Focal length:	640mm
Focal ratio:	f/6.3
Focuser:	1.25" Rack-and-pinion, accepts 1.25" eyepieces
Eyepieces:	25mm Kellner and 10mm Plossl, 1.25"
Magnification:	26x (with 25mm), 64x (with 10mm)
Barlow lens:	3x magnifying power
Finder:	LED red dot reflex sight, 3V lithium battery
Mount:	Single-arm altazimuth, composite base, laminated
Weight, assembled:	10 lbs., 6.5 oz.
Tube Length:	21.5" (54.6cm)
Tube Outer Diameter:	5.7" (145mm)

SkyScanner BL 135mm	
Primary mirror:	135mm diameter
Secondary mirror:	35mm minor axis
Mirror coatings:	Aluminum with SiO2 overcoat
Central obstruction:	38mm (28.1%)
Focal length:	1100mm
Focal ratio:	f/8.1
Focuser:	2" Rack-and-pinion, accepts 1.25" and 2" eyepieces
Eyepieces:	25mm Kellner and 10mm Plossl, 1.25"
Magnification:	44x (with 25mm), 110x (with 10mm)
Barlow lens:	3x magnifying power
Finder:	LED red dot reflex sight, 3V lithium battery
Mount:	Dobsonian altazimuth, composite base, laminated
Weight, assembled:	32 lbs., 9 oz.
Tube Length:	40" (101.6cm)
Tube Outer Diameter:	6.9" (176mm)

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.

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