INSTRUCTION MANUAL

Orion® TableTop Telescopes

#10012 SkyScanner™ 100mm TableTop Reflector

#10022 StarMax™ 90mm TableTop Maksutov-Cassegrain

Francais

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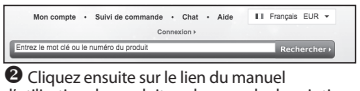

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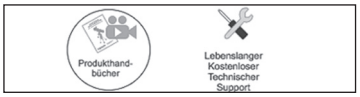

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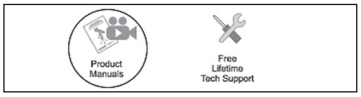

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Figure 1. Components of the SkyScanner 100 TableTop Reflector telescope.

Congratulations on your purchase of an Orion TableTop telescope. 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.

Orion TableTop telescopes are real astronomical instruments, with high-quality optics and precision-engineered mechanics; they are not toys. Your telescope will arrive almost fully assembled out of the box! Only the visual accessories need to be installed. These include the EZ Finder II reflex sight, the eyepiece, and in the case of the StarMax 90, the diagonal.

These compact telescopes are designed for grab-and-go portability. Whether you set yours on a picnic table, the hood of your car, or on an optional tripod for your viewing session, we're sure you and your family and friends will love scanning the night sky for its many hidden treasures.

The following instructions will help you to get the maximum performance from your new telescope, please read them thoroughly.

WARNING: ***Do NOT look at the Sun without a professionally made* solar filter *on the telescope; serious eye damage may result if you look at the Sun with any unfiltered optical instrument. Do not leave the telescope unsupervised around children. Always cover the lenses when leaving the telescope in direct sunlight.***

Figure 2. Components of the StarMax 90 TableTop Mak-Cass telescope.

I. Parts List

- Optical tube
- Base
- 20mm Bertele eyepiece, 1.25”
- 10mm Bertele eyepiece, 1.25”
- EZ Finder II reflex sight
- 90-degree star diagonal (10022 only)
- Moon filter, 1.25"
- MoonMap 260
- Dust cap
- Allen wrench, 2mm (10012 only) (Not pictured)

When unpacking the telescope it is suggested that you save the internal packaging. In the unlikely event the product needs to be returned, the shipping materials can be reused to ensure it arrives safely at its destination. Make sure all the parts listed in the Parts List and shown in **Figures 1** and **2** are present.

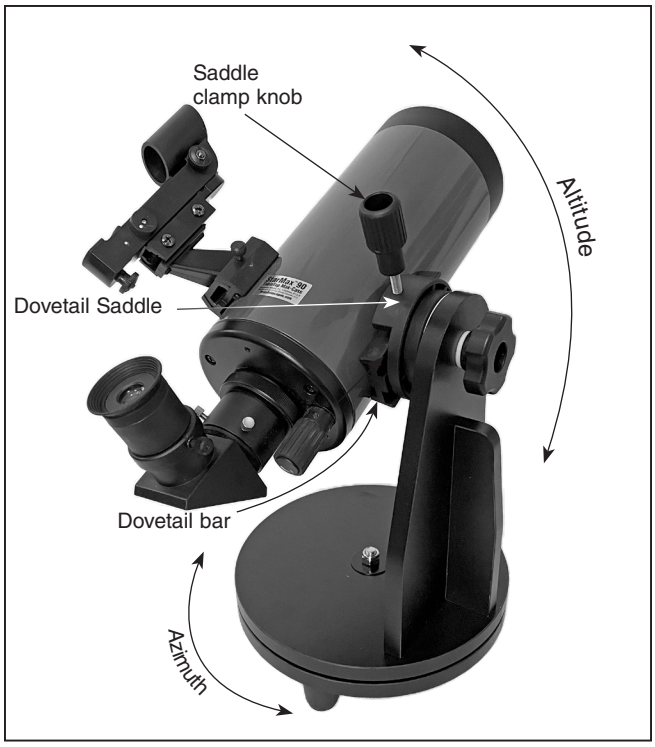


Figure 3. The telescope optical tube is attached to the dovetail saddle via a dovetail bar mounted on the telescope tube. StarMax 90 Mak-Cass pictured here.

II. Setting Up the Telescope

Your new TableTop telescope arrives with the optical tube already attached to the base. Carefully remove the assembled telescope from the shipping box and set it upright on its base. Remove the plastic bag from the telescope.

Rotate the telescope tube so it is positioned somewhat like in the pictures on the cover of this manual. You may note that the saddle clamp knob (see **Figure 3**) is in a downward position. That is fine if it is. But if you'd prefer to have it in the upward position as shown in **Figure 3**, for more convenient access to it, that's easy enough to do. Just hold the telescope tube in one hand and loosen the saddle clamp knob with the other until you can lift or slide the telescope tube's dovetail bar out of the saddle. Then rotate the saddle until the clamp knob is pointing up. Finally, reattach the telescope tube to the saddle and tighten the saddle clamp knob.

Install the EZ Finder II

Slide the foot of the EZ Finder's bracket into the dovetail shoe on the telescope tube (**Figure 4**). Make sure the EZ Finder II is oriented with the sight tube facing the front end of the telescope, as shown.

Install and Eyepiece and (for the StarMax 90) the Diagonal

The TableTop telescopes come with two 4-element Bertele eyepieces: one of 20mm focal length and the other of 10mm focal length. More information about the eyepieces are provided later in this manual.

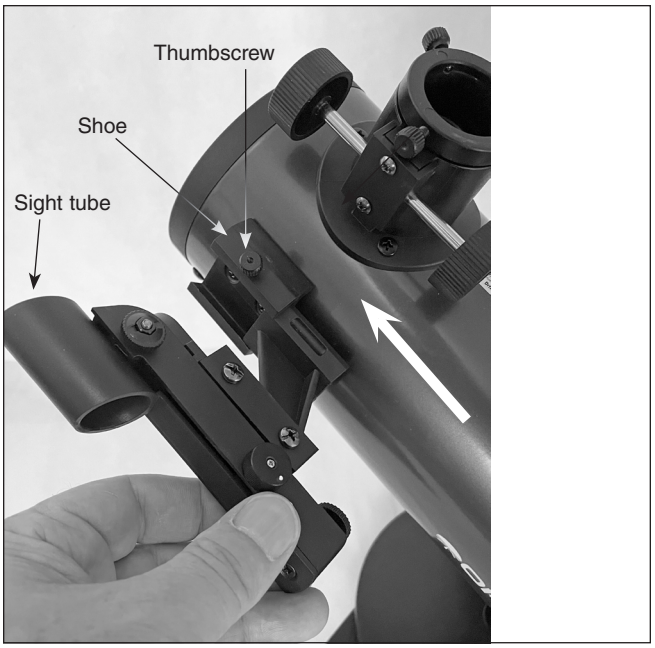


Figure 4. Slide the foot of the EZ Finder II bracket into the dovetail shoe on the telescope tube, as shown. Then tighten the thumbscrew.

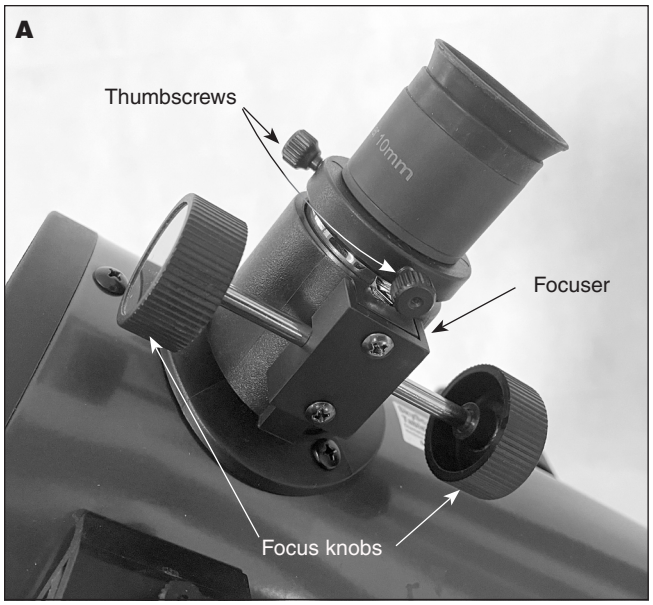
For the SkyScanner 100 Reflector, insert an eyepiece directly into the focuser (**Figure 5A**). First remove the cap from the focuser and loosen the two thumbscrews to provide clearance for the eyepiece barrel. Then insert the barrel of the eyepiece into the focuser and lightly retighten the thumbscrews.

For the StarMax 90 Mak-Cass, you will first insert the star diagonal into the visual back adapter. The diagonal deflects the light exiting the telescope by 90 degrees, providing a more convenient angle for viewing through the eyepiece. Once the diagonal is secured in the visual back adapter with the two thumbscrews, insert an eyepiece into the diagonal and secure it with the thumbscrew on the diagonal (**Figure 5B**).

Tabletop or (Optional) Tripod?

One of the great assets of the TableTop telescopes is their extremely compact, portable size. You may find that the most comfortable way to use the telescope is while sitting down or kneeling on the ground next to it. If you wish to raise the telescope off the ground a bit so that it can be used while standing or sitting in a chair, then a platform such as a milk crate, a camping table, or a picnic table might be just the ticket.

One other possibility for how to "mount" the telescope is on an optional tripod. The TableTop telescopes are equipped with a built-in photo tripod adapter (**Figure 6**), which features a female 3/8"-16 threaded insert in the center, and a removable 1/4"-to-3/8" thread adapter pre-installed in it. The adapter allows the TableTop telescope base to be mounted on most standard photographic tripods. Most photo tripods have either a 3/8"-16 or a 1/4"-20 threaded post to allow attachment of a pan head or ball head. Attaching the TableTop telescope to the tripod's threaded post rather than to a pan head will provide better stability. So we recommend removing any pan head or ball head from the tripod and installing the telescope directly



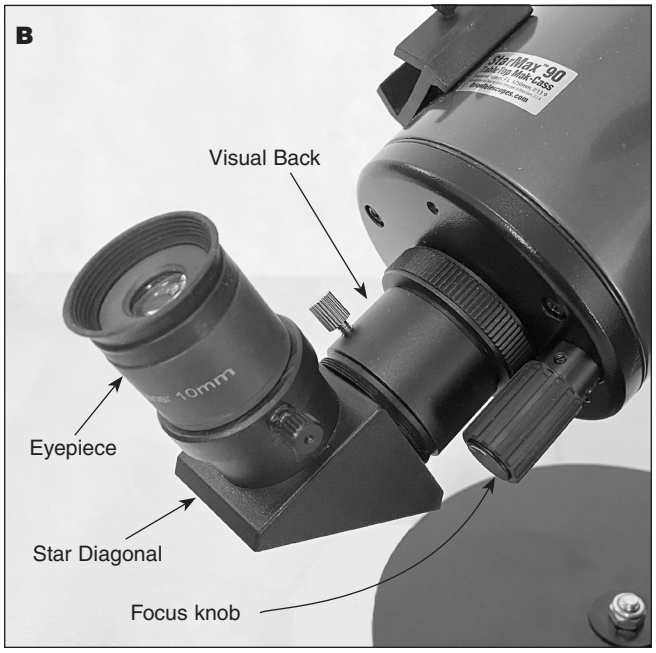


Figure 5. **A)** The rack-and-pinion focuser on the SkyScanner 100 TableTop Reflector **B)** The focus knob on the StarMax 90 TableTop Mak-Cass.

on the tripod itself. If the tripod has a 3/8" post, you will need to remove the 1/4"-to-3/8" thread adapter from the telescope's tripod adapter (**Figure 6**), to expose the 3/8" threads. This can be done using a flat-blade screwdriver, as the thread adapter has two opposing slots on its top edge to accommodate a screwdriver blade. If the tripod has a ¼"-20 post, then the TableTop base can be threaded on as equipped right out of the box.

Simply thread the base onto the tripod's threaded post until tight (**Figure 7**).

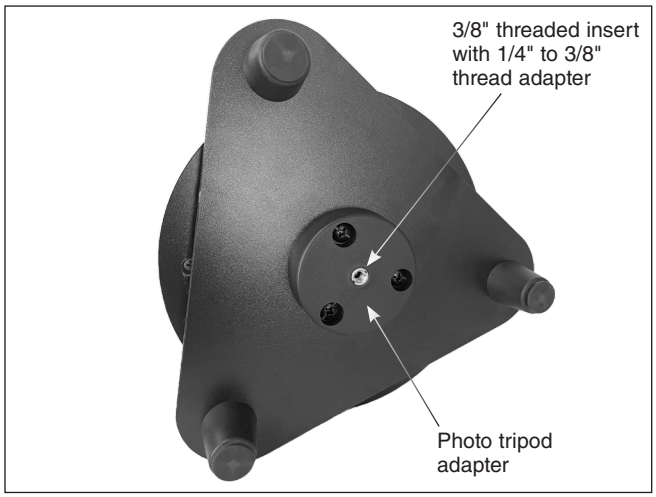


Figure 6. The photo tripod adapter on the bottom of the base has a 3/8" threaded insert and a 1/4"-to-3/8" thread adapter installed.

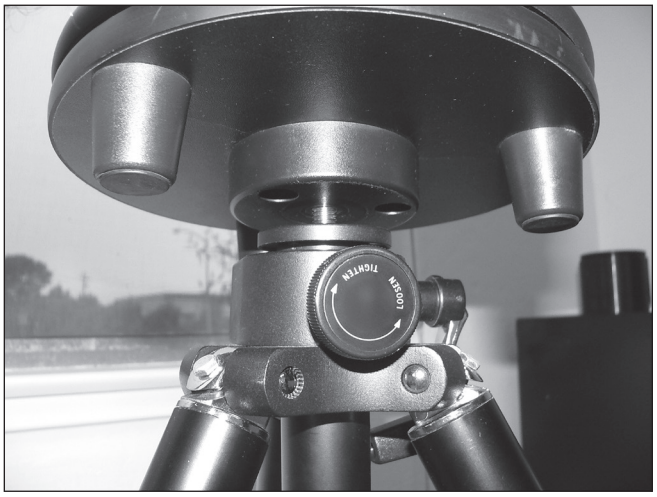


Figure 7. Mounting the TableTop base on a photo tripod.

Using the EZ Finder II Reflex Sight

The included EZ Finder II reflex sight (**Figure 8**) 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 9**).

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.

Turn the power knob clockwise until you hear the "click" indicating that power has been turned on. Look through the back of the reflex sight with both eyes open to see the red dot inside the sight tube. Position your eye at a comfortable distance from the back of the unit. The intensity of the dot is adjusted by turning the power knob. For best results when

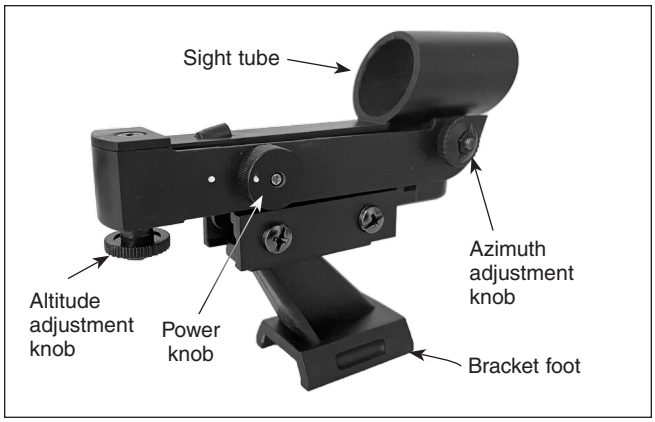


Figure 8. The EZ Finder II "red dot" scope.

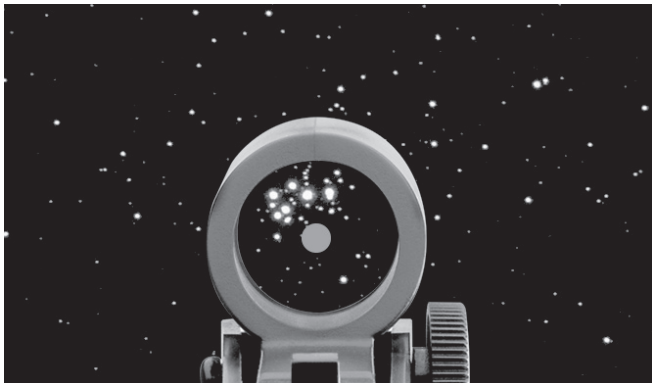


Figure 9. The EZ Finder II superimposes a tiny red dot on the sky, showing right where the telescope is pointed.

stargazing, use the dimmest possible setting that allows you to see the dot without difficulty. Typically a dimmer setting is used under dark skies and a bright setting is used under light-polluted skies or in daylight.

Aligning the EZ Finder

To use the red dot finder scope properly, it must be aligned with the main telescope. When the EZ Finder II is properly aligned with the telescope, an object that is centered on reflex sight's red dot should also appear in the center of the field of view of the telescope's eyepiece. Alignment 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 telscope.
2. With the 20mm 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 telescope eyepiece.

Note: *The image in the eyepiece will appear rotated (upside down) in the SkyScanner 100 Reflector. This is normal for reflector telescopes. The image will appear right-side-up but mirror reversed in the StarMax 90 Mak-Cass.*

Next, you will also center the target object on the EZ Finder II's red dot. Without moving the telescope, use the EZ Finder II's altitude and azimuth adjustment knobs (shown in **Figure 8**) to position the red dot on the object.

4. 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 EZ Finder II's alignment again. When the object is centered in the telescope eyepiece and in the EZ Finder II, the EZ Finder II is properly aligned with the telescope. The EZ Finder II's alignment should be checked before each observing session.

At the end of your observing session, be sure to turn the power knob counterclockwise until it clicks off.

Replacing the Battery

Replacement 3-volt lithium (CR-2032) batteries are available from many retail outlets. To replace the dead battery, use a small Phillips head screwdriver to remove the battery cover (**Figure 10A**). Then carefully pull back on the retaining clip and shake out the old battery. Do not over-bend the retaining clip. Then slide the new battery under the retaining clip with the positive (+) side facing the clip as shown (**Figure 10B)**.

The EZ Finder II alignment should be checked before every observing session. Choose any distant target (during the day) or bright star (at night), center the object in the telescope's eyepiece, and then adjust the knobs until the object is centered on the red dot of the reflex sight. (See **Figure 5**.)

At the end of your observing session, be sure to turn the power knob counterclockwise until it clicks off. When the two white dots on the EZ Finder II's body and power knob are lined up, the EZ Finder II is turned off.

III. Operating the Telescope

Eyepiece Selection

By using eyepieces of different focal lengths, it is possible to attain different magnifications you're your TableTop telescope. That's because the magnifying power of a telescope is dependent on both the focal length of the telescope and of the eyepiece being used with it.

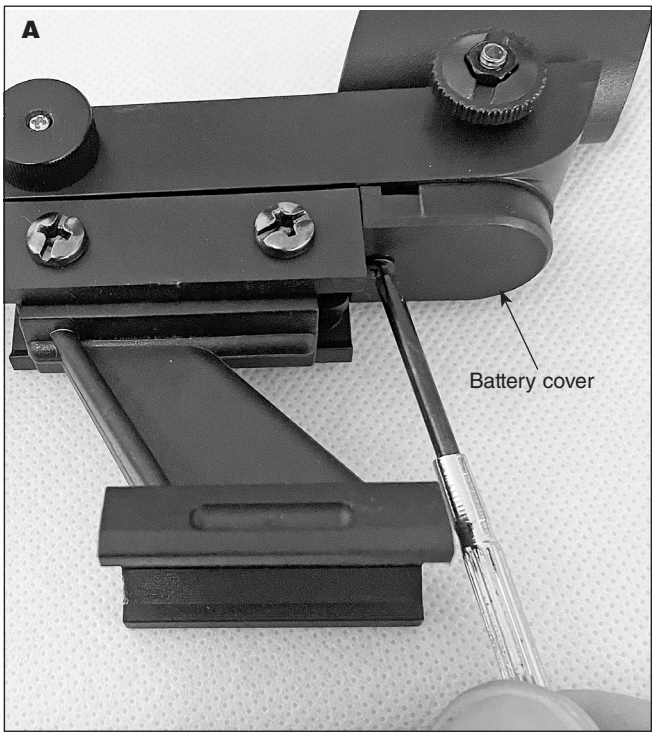
To calculate the magnification of a telescope-eyepiece combination, simply divide the focal length of the telescope by the focal length of the eyepiece.

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

So, for example, the StarMax 90 Mak-Cass has a focal length of 1250mm. When used with the 20mm eyepiece, the resulting magnification would be 62.5x

$$\frac{\textbf{1250mm}}{\textbf{20mm}} = \textbf{62.5x}$$

For the SkyScanner 100 Reflector, it has a focal length of 400mm. When used with the 10mm eyepiece, the resulting magnification is 40x.



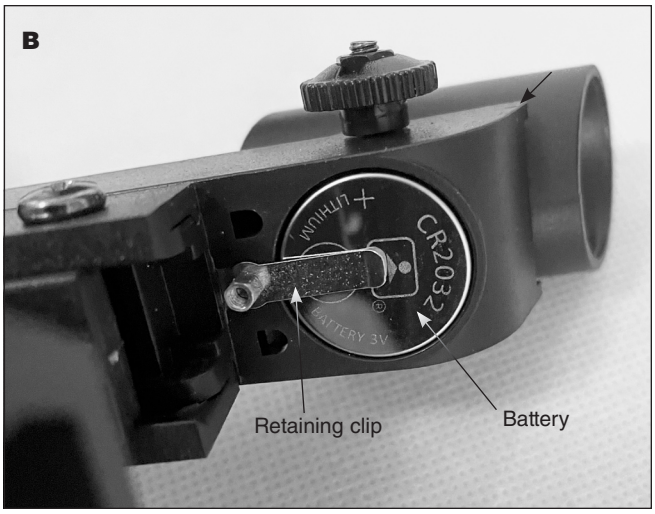


Figure 10. To replace the EZ Finder II's CR2032 3V lithium battery, **A**) first remove the small Phillips screw to unlock the battery cover, **B)** remove the old battery and replace it with the positive (+) side facing the retaining clip.

$$\frac{400\text{mm}}{10\text{mm}} = 40\text{x}$$

Your telescope comes with two eyepieces: one with 20mm focal length for low power, wide field viewing, and the other with 10mm focal length for higher-power observation. Other eyepieces can be used 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.

We recommend starting a viewing session by inserting your lowest-power (longest focal length) eyepiece to locate and center the target object. Low magnification yields a wide 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 (narrow field of view) eyepiece is like trying to find a needle in a haystack! Once you've centered the object in the eyepiece, you can switch to a higher magnification (shorter focal length) eyepiece, if you wish. This is recommended for small and bright objects, like planets and double stars. The Moon also takes higher magnifications well. The best rule of thumb with eyepiece selection is to start with a low power, wide-field eyepiece, and then work your way up in magnification. If the object looks better, try an even higher magnification eyepiece. If the object looks worse, then back off the magnification a little by using a lower-power eyepiece.

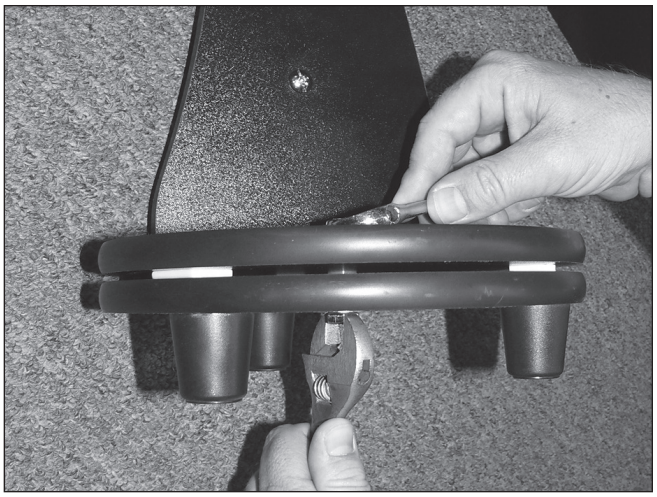


Figure 11. Making optional adjustments to the azimuth tension.

Magnification Limits

Every telescope has a useful magnification limit of about 2x per millimeter of aperture. This translates to a limit of 200x for the SkyScanner 100 Reflector, and 180x for the StarMax 90 Mak-Cass. Some telescope manufacturers will use misleading claims of ultra-high magnifications: "See distant galaxies at 640X!" While such magnifications are technically possible, the actual image at that magnification would be a dim, indistinct blur. Low and moderate magnifications are what give the best views. A small, but bright and crisply detailed image is always better than a dim, blurry, over-magnified one.

Altitude and Azimuth (Aiming the Telescope)

Your TableTop telescope's base permits motion along two axes: altitude (up/down) and azimuth (left/right) (**Figure 3**). 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.

Both the altitude and azimuth axes have adjustable tension. You want 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. Tension on both axes is set at the factory, but if you feel some further tweaking is warranted, read on.

Tension in the altitude axis is adjusted by turning the large tension adjustment knob (**Figure 3**) to be tighter or looser.

To adjust the tension of the azimuth axis you will first need to remove the photo tripod adapter (**Figure 6**). Simply loosen and remove the three Phillips-head screws on the adapter, and it will lift right off. Then you must use two 13mm or adjustable wrenches (not included), one on each nut, as shown in **Figure 11**, to tighten or loosen them as needed to adjust the amount of friction. Once you have made the necessary adjustments, reinstall the adapter with the three Phillips-head screws.

Focusing the Telescope

The TableTop telescopes both come equipped with an adjustable focuser designed to keep images sharp. The SkyScanner 100 Reflector has a 1.25" rack-and-pinion focuser with two large manual focusing knobs (**Figure 5A**). The StarMax 90 Mak-Cass has a single focus knob on the back end of the tube assembly (**Figure 5B**).

We recommend practicing focusing in the daytime when starting out to get the hang of it. With the 20mm eyepiece inserted into the focuser, 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 the focus knob 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.

IV. 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 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.

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 lights, street lights, 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 12**.)

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 a celestial object in the field of view. This is called "tracking" the object. It's easy to do with the TableTop telescopes because of their smooth motions on both axes. As the object moves off towards the edge of the eyepiece's field of view, just lightly nudge or tug the telescope to re-center the object. Objects appear to move across the

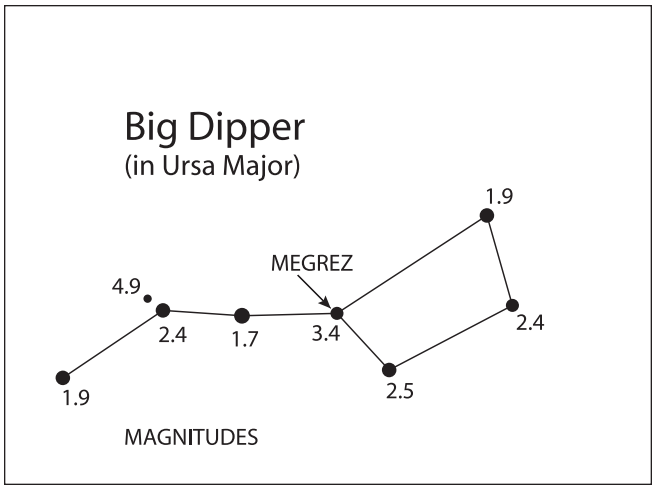


Figure 12. Megrez connects the Big Dipper's "handle" to its "pan." If you cannot see Megrez, a magnitude 3.4 star, then the viewing conditions are poor.

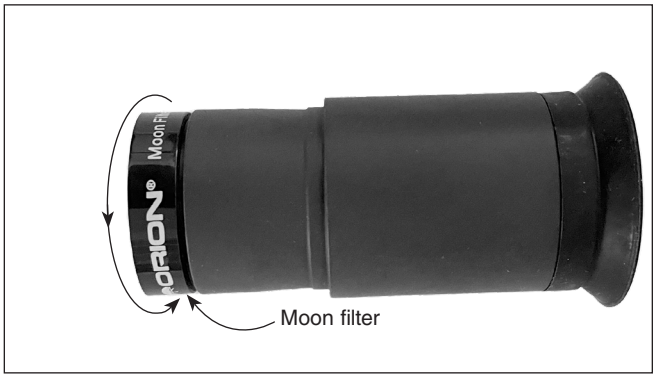


Figure 13. The Moon filter threads into the eyepiece barrel as shown.

field of view faster at higher magnifications. This is because the field of view becomes narrower.

Daytime Terrestrial Viewing

Some telescopes can be used for daytime terrestrial observation in addition to nighttime stargazing. Of the two TableTop telescopes covered in this manual, only the StarMax 90 Mak-Cass is suitable for terrestrial viewing. With the supplied accessories, the images you see are right-side-up, but mirror reversed. Obviously, this is not ideal. For a correctly oriented image, you can purchase a 1.25" "correct-image" or "image erecting" diagonal and substitute it for the "star diagonal" that came with the telescope. Then you will see a normally oriented image, just like you see with your eyes.

Also note that the StarMax 90 optical tube can be removed from the TableTop base and mounted on a standard photo tripod, if desired. The telescope's dovetail mounting bar has two ¼"-20 threaded holes on the bottom. Most tripod pan heads or ball head quick-release plates have a ¼"-20 threaded post, which would allow coupling of the StarMax 90 optical tube to the tripod.

The SkyScanner 100 Reflector, like any other reflector type telescope, is not recommended for terrestrial viewing. That's because the image it renders is rotated or upside down and not easily corrected. This is not an issue for astronomical viewing because there is no "right side up" in space!

Using the Orion Moon Filter and MoonMap 260

Moon Filter

This popular accessory reduces glare from the bright lunar surface for more comfortable viewing. It also boosts contrast so you can enjoy more-detailed views of surface features. The neutral density filter transmits only 13% of incoming light to the eyepiece, preventing the overpowering brightness from washing out details, providing better clarity and resolution, and reducing eye strain. It does not alter the natural color of the Moon, either. Just screw the filter into the threaded barrel of the eyepiece and you're all set (**Figure 13**).

MoonMap 260

With locations and names of over 260 features on the Moon such as craters, mountains, valleys, "seas" and more, the Orion MoonMap 260 is a great tool for beginning astronomers. This detailed map will even show you where various spacecraft have landed on the Moon's surface! The whole family will enjoy looking at the Moon with the telescope, then using the MoonMap 260 to learn the names of the craters and other features observed. 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 Hubble Space Telescope 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. But remember that you are seeing these objects using your own telescope with your own eyes, in real time. And that's pretty cool!

V. 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 the included 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 telescope. 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 EZ Finder II 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. 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. 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 favorite. Defocusing a star slightly can help to 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 on the internet; 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, planetarium program or app, or a planisphere. These guides will help you locate the brightest and best deep-sky objects for viewing with your TableTop telescope. You can also try low-power scanning of the Milky Way. Pop in the 20mm 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.

VI. 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.

VII. Specifications

StarMax 90 TableTop Maksutov-Cassegrain

Optical design	Maksutov-Cassegrain
Primary mirror coating	Aluminum with SiO2 overcoat
Meniscus lens coating	Anti-reflection multi-coatings on both lens surfaces
Secondary mirror coating	Aluminum with SiO2 overcoat
Aperture	90mm
Focal length	1250mm
Focal ratio	f/13.9
Central obstruction diameter	29.8mm
Focuser	Internal
Base	MDF material with laminate finish
Mounting saddle	Vixen-style dovetail with clamp knob
Optical tube mounting adapter	Vixen-style dovetail bar; two ¼”-20 threaded holes on bottom
Eyepieces	20mm 4-element Bertele design, 1.25”, multi-coated
	10mm 4-element Bertele design, 1.25”, multi-coated
Magnification with supplied eyepieces	62.5x (20mm) and 125x (10mm)
Diagonal	Mirror star diagonal, 90°, 1.25”
Finder scope	EZ Finder II Reflex Sight (3V lithium ion battery included)
Moon filter	Neutral density, 13% transmission, 1.25”
Tripod adapter	On bottom of base, 3/8” threaded hole with 1/4” to 3/8” thread insert
Weight, assembled telescope	6 lbs. 3.6 oz.
Optical tube length	11.1”
Base diameter and height	9.5” D x 11.1” H

SkyScanner 100 TableTop Reflector

Optical design	Newtonian reflector
Primary mirror figure	Parabolic
Primary mirror coating	Aluminum with SiO2 overcoat
Secondary mirror	35mm minor axis diameter
Secondary mirror coating	Aluminum with SiO2 overcoat
Aperture	100mm
Focal length	400mm
Focal ratio	f/4
Central obstruction diameter	39.4mm
Focuser	Rack and pinion, 1.25”
Base	MDF material with laminate finish
Mounting saddle	Vixen-style dovetail with clamp knob
Optical tube mounting adapter	Vixen-style dovetail bar; two ¼”-20 threaded holes on bottom
Eyepieces	20mm 4-element Bertele design, 1.25”, multi-coated
	10mm 4-element Bertele design, 1.25”, multi-coated
Magnification with supplied eyepieces	20x (20mm) and 40x (10mm)
Finder scope	EZ Finder II Reflex Sight (3V lithium ion battery included)
Moon filter	Neutral density, 13% transmission, 1.25”
Tripod adapter	On bottom of base, 3/8” threaded hole with 1/4” to 3/8” thread insert
Weight, assembled telescope	5 lbs. 4.6 oz.
Optical tube length	14.25”
Base diameter and height	9.5” D x 11.1” H

Appendix A

Collimation – Aligning the Optics

Collimation is the process of aligning the telescope's optics. For the StarMax 90 Maksutov-Casegain telescope, the optics were aligned at the factory and should not need any further adjustment by the user. Reflector telescopes, on the other hand, do require occasional collimation adjustment by the user, because the two mirrors that make up the optical system can become slightly misaligned during transport of the telescope, or due to temperature changes. Although the optics of the SkyScanner 100 Reflector were aligned at the factory, it is possible that the mirrors became misaligned in transit.

Accurate collimation is important to ensure the best images from your telescope. Collimation is a relatively easy process and can be done in daylight or darkness. To check the collimation, remove the eyepiece and look down the focuser drawtube. You should see the secondary mirror centered in the drawtube, 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 14A**. If the entire primary mirror reflection is not visible in the secondary mirror, as in **Figure 14B**, you will need to adjust the tilt of the secondary mirror with the three setscrews surrounding the center screw (**Figure 15**). Using the included 2mm Allen wrench, first loosen one of the three alignment setscrews by, say, a half turn, and then tighten the other two to take up the slack. Is the primary mirror reflection more centered in the secondary mirror now? You may need to loosen a different screw then tighten the other two to better center the primary mirror in the secondary. It's a matter of trial and error. The goal is to center the primary mirror reflection in the secondary mirror, as in **Figure 14A**, by adjusting these three screws in this fashion. Do not adjust the center screw.

The primary mirror of the SkyScanner 100 Reflector is fixed in place, so it is not adjustable.

The view down the focuser drawtube should now resemble **Figure 14A**. A simple star test will indicate how well the telescope optics are 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 16**). 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 may need to make slight corrections to the telescope's position in order to keep the star in the center of the field of view. A good star to point at for a star test is Polaris, the North Star, because its position does not move significantly over time.

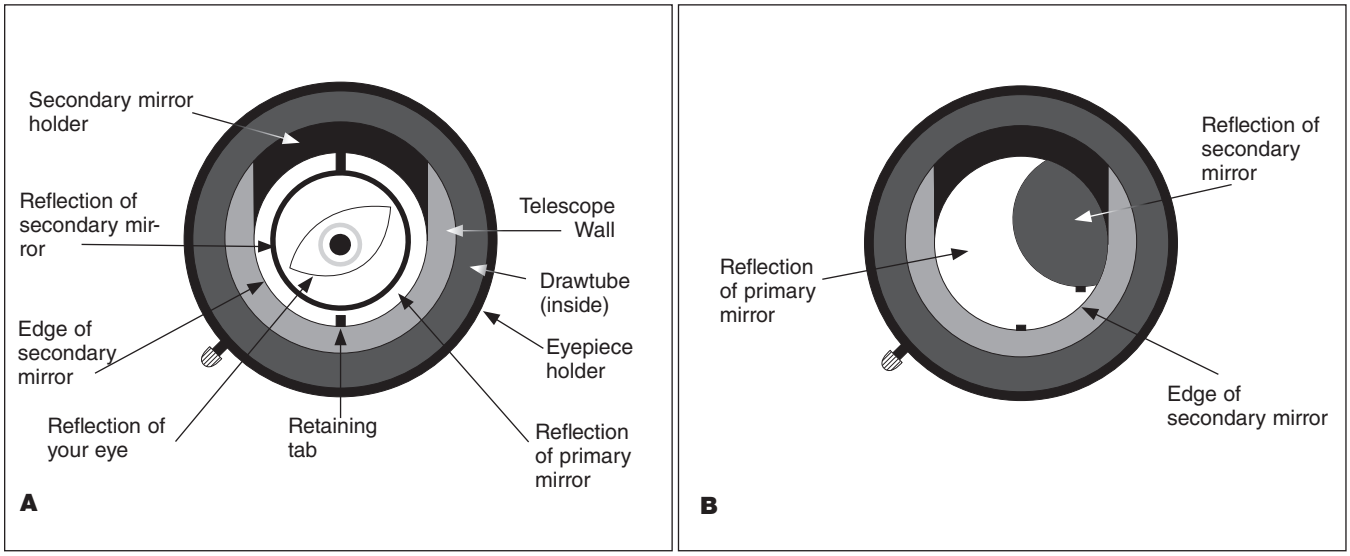


Figure 14. Collimating the optics. **A.** When the mirrors are properly aligned, the view down the focuser should look something like this. **B** Here, the secondary mirror is centered under the focuser, but it needs to be tilted so that the entire primary mirror is visible

Figure 15. Use the included 2mm Allen wrench to adjust the three secondary mirror collimation setscrews.

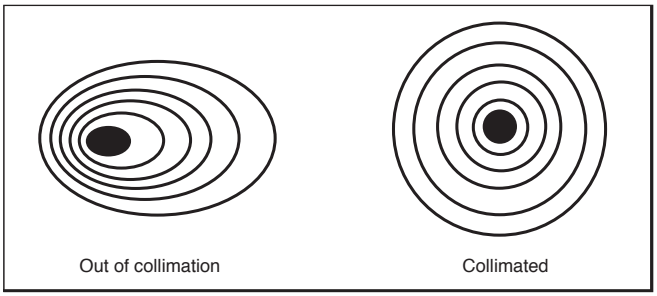


Figure 16. A star test will determine if the telescope's optics are properly collimated.

Appendix B

Cleaning the Optics

Cleaning Lenses

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 StarMax 90 Maksutov-Casegrain and exposed lenses of your eyepieces. Never use regular glass cleaner or cleaning fluid designed for eyeglasses. Before cleaning with fluid and tissue, blow any loose particles off the lens with a blower bulb. Then apply some cleaning fluid to a tissue, never directly on the optics. Wipe the lens gently in a circular motion, applying only very slight pressure, 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. On larger lenses, clean only a small area at a time, using a fresh lens tissue on each area. Never reuse tissues.

Cleaning Mirrors

You should not have to clean the SkyScanner 100 Reflector's primary mirror very often, if ever. (and you will never need to clean the primary mirror of the StarMax 90 Mak-Cass, since it is inside a closed tube.) Covering the telescope with the dust cap when it is not in use will help prevent dust from accumulating on the mirrors. When bringing the telescope inside after an evening's viewing it is normal for moisture to accumulate on the mirror due to the change in temperature. We suggest leaving it uncovered overnight to allow this condensation to evaporate. Improper cleaning can scratch mirror coatings, so the fewer times you have to clean the mirrors, the better. Small specks of dust or flecks of paint on the mirror have virtually no effect on the visual performance of the telescope.

If you believe your telescope primary mirror needs cleaning, please email us at: support@telescope.com or contact Orion Technical Support at (800) 676-1343.

Appendix C – WARNING!

Dust Cap of the SkyScanner 100 TableTop Reflector

The dust cover supplied with the SkyScanner 100 TableTop Reflector consists of two parts, an outer portion and a smaller, removable inner cap that is press-fit into the outer portion (**Figure 17**). Please always keep the inner cap seated in the outer portion of the cap; there is no reason to remove the inner cap. This is an older cap design that was intended to allow removal of the inner cap to produce a smaller aperture, which would cut down on brightness when observing the Moon, for example. But using a Moon filter such as the one included with your telescope, is a much more effective means of reducing lunar brightness.

The inner cap is not intended to be removed for "safer" viewing of the Sun! **Looking through this telescope – even with the smaller aperture created when removing only the inner cap – could result in permanent eye damage or blindness!** The only safe way to view the Sun through this telescope is to use a properly fitted, professionally made solar filter covering the front opening of the telescope.

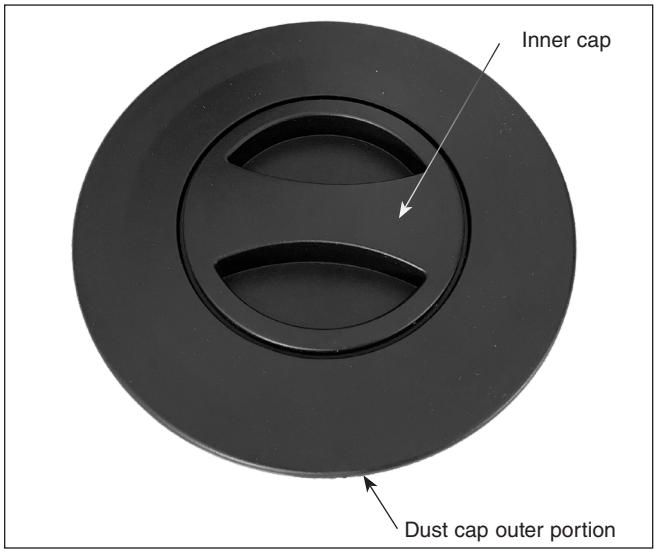


Figure 17. The dust cap of the SkyScanner 100 reflector has two parts. But there is no reason to remove the small inner cap. Always keep it attached to the outer portion of the cap.

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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