

# Orion SkyQuest™ XX12 IntelliScope® Truss Tube Dobsonian

#10023

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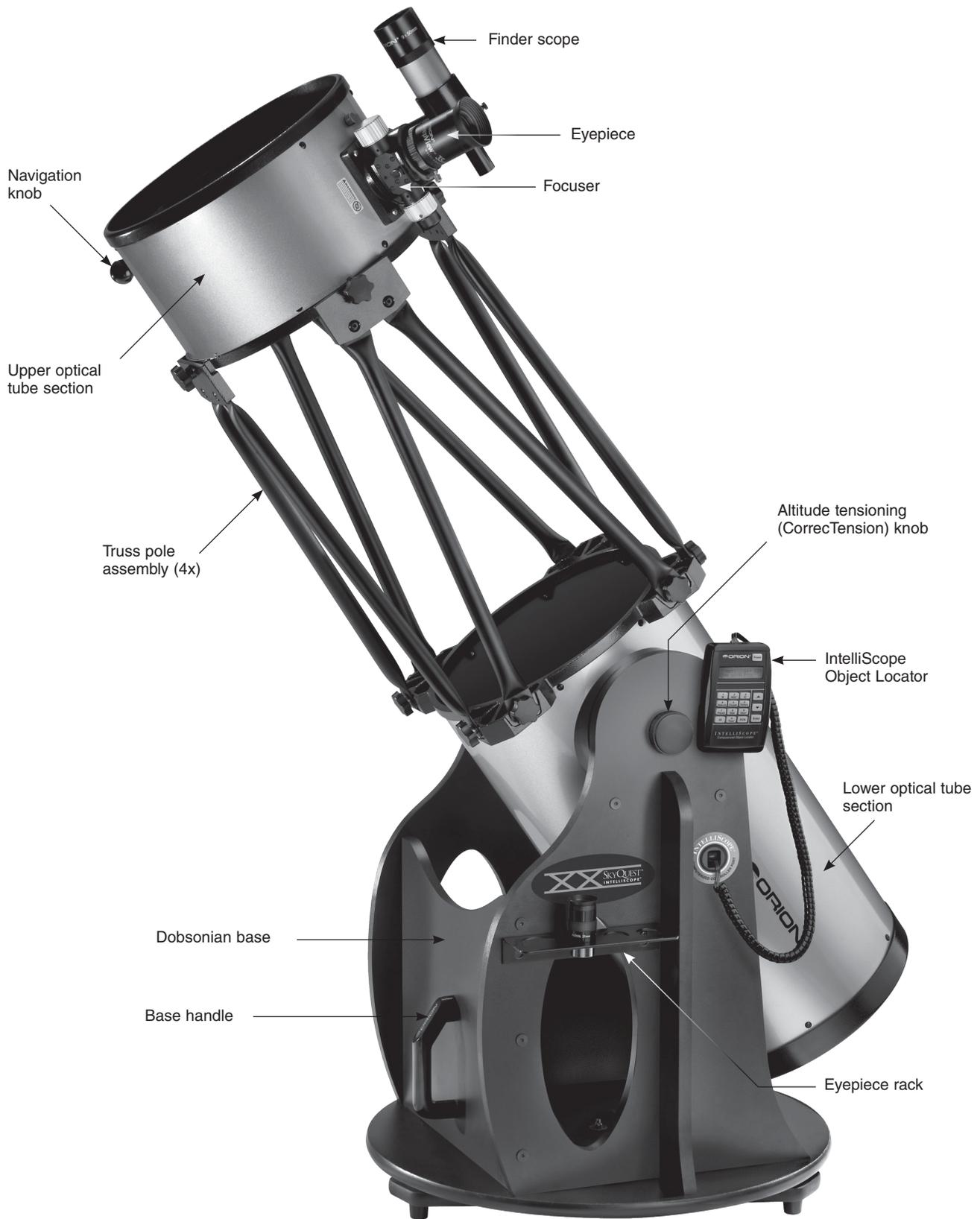
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**Figure 1.** The SkyQuest XX12 IntelliScope Truss Tube Dobsonian.

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*Congratulations on your purchase of an Orion® SkyQuest™ XX12 IntelliScope® Truss Tube Dobsonian (XX12). It's a deep sky observer's dream telescope, offering jumbo 12" Pyrex® optics: a stylish base outfitted with IntelliScope object locating technology, and a sturdy truss tube design that easily disassembles into compact, portable components. This high performance astronomical instrument is designed to provide dazzling views of celestial objects, yet be transportable and easy to use.*

With the IntelliScope Computerized Object Locator, you gain the ability to locate and view thousands of celestial objects with the push of a button. Searching for objects is a thing of the past, as the IntelliScope's high-resolution digital encoders find them for you — in seconds! Genuine Ebony Star on Virgin PTFE/UHMW azimuth bearings and large 8" diameter adjustable-tension altitude bearings make slewing the telescope and keeping objects centered in the eyepiece easy. Deluxe features, such as a 2" dual-speed Crayford focuser, and full accessory assortment, including a 2" eyepiece and 9x50mm finder scope, provide everything you need to enjoy your journey through the universe.

Please read these instructions thoroughly before beginning assembly and subsequent use of the telescope.

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## 1. Unpacking

The telescope is packed in three boxes, one containing the optical tube assembly and accessories (including the IntelliScope Object Locator kit), another containing the unassembled Dobsonian base, and the last containing the primary mirror in its cell. Be careful unpacking the boxes. We recommend keeping the original packaging. In the event that the telescope needs to be shipped to another location, or returned to Orion for warranty repair, having the proper packaging will help insure that your telescope will survive the journey intact.

Make sure all the parts in the Parts List are present. The parts are listed by the box they should arrive in, but some of the parts may be in different boxes than indicated. Be sure to check all boxes carefully, as some parts are small. If anything appears to be missing or broken, immediately call Orion Customer Support (800-676-1343) or email [support@telescope.com](mailto:support@telescope.com) for assistance.

***WARNING: Never look directly at the Sun through your telescope or its finder scope — 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.***

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# Parts List

## Box #1: Optical Tube Assembly and Accessories

(refer to **Figure 2**)

### Qty. Description

1	Lower tube section
1	Upper tube section
2	Dust covers
4	Truss pole assemblies
1	IntelliScope Object Locator kit (see Box #1A below for list of parts)
1	35mm Deep View eyepiece, 2" barrel diameter
1	10mm Sirius Plössl eyepiece, 1.25" barrel diameter
1	9x50 finder scope
1	Finder scope bracket with O-ring
1	Cooling accelerator fan kit
1	Collimation cap
1	Azimuth encoder board
1	Encoder connector board
1	Encoder disk
2	Hex keys (2mm, 2.5mm)

## Box #1A: IntelliScope Object Locator kit

(located inside OTA box)

(refer to **Figure 3**)

### Qty. Description

1	IntelliScope Object Locator
1	Altitude encoder assembly
1	Controller cable (coil cable)
1	Azimuth encoder cable (24" long)
1	Altitude encoder cable (53" long)
1	Azimuth encoder spacer washer, thin (1/4" outer diameter, 0.015" thick)
6	Wire clips
1	9V Battery
1	Nylon hook-and-loop adhesive strips
1	Bumper
2	Altitude encoder nylon spacer washers (1/4" outer diameter, color white)
3	Encoder wood screws (1/2" long)
1	Instruction manual

## Box #2: Dobsonian Base

(refer to **Figure 4**)

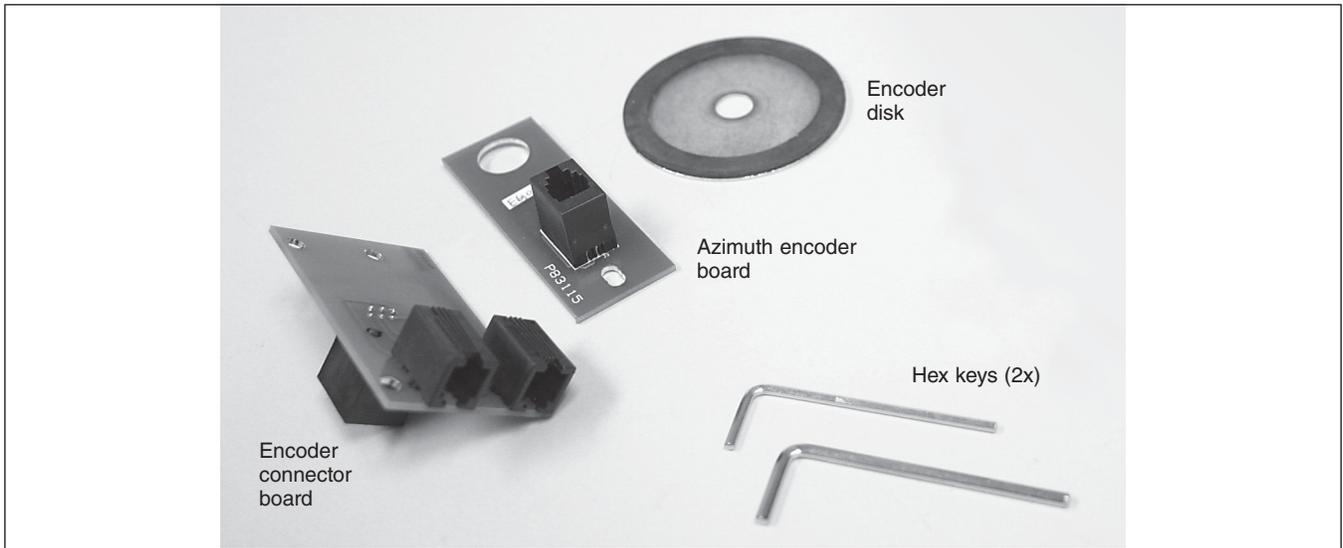
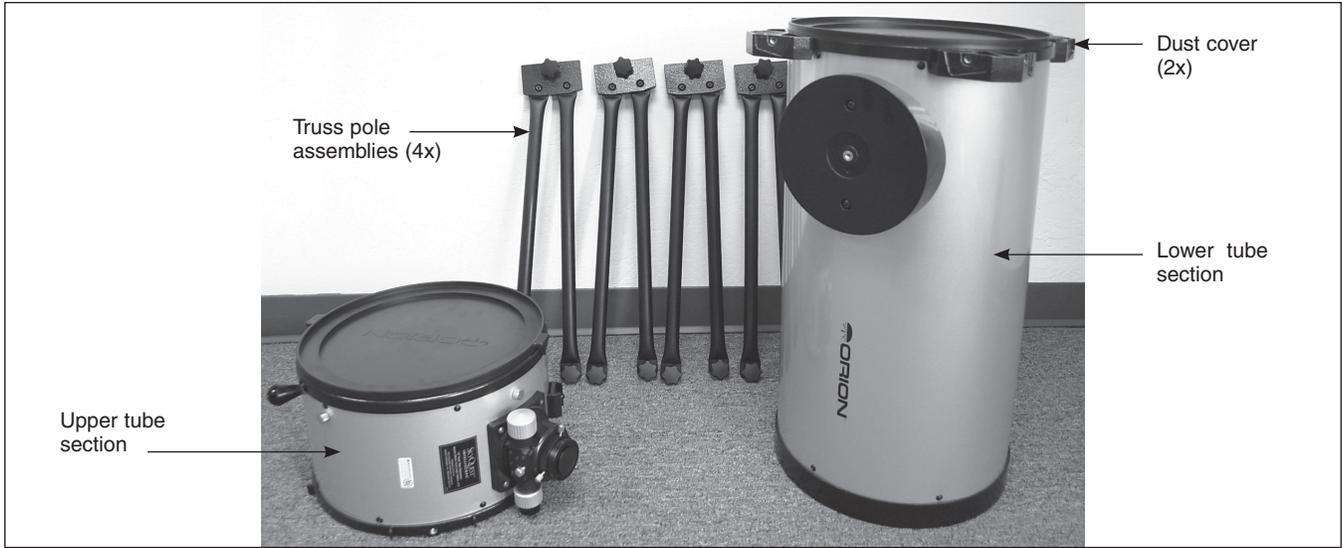
### Qty. Description

1	Left panel
1	Right panel
1	Front brace
1	Top baseplate
1	Ground baseplate
2	Side braces
20	Base assembly wood screws (2" long, color black)
1	Handle
2	Handle screws (hex head, 1.5" long)
2	Handle washers (5/8" outer diameter)
1	Crescent wrench
1	Hex key (size 4mm)
3	Plastic feet
3	Feet wood screws (1" long)
5	Encoder wood screws (1/2" long)
1	Brass azimuth bushing
1	Azimuth axis screw (hex head, length 2.25")
2	Fender washers (1" outer diameter)
1	Hex lock nut
4	Altitude bearing cylinders
4	Altitude bearing cylinder screws (1.5" long, color black)
1	Vertical stop knob
5	Vertical stop washers, thick (5/8" outer diameter, 1/16" thick)
2	Vertical stop washers, thin (1/2" outer diameter, 1/32" thick)
3	Azimuth encoder spacer washers, thick (0.35" outer diameter, 0.032" thick)
1	Eyepiece rack
2	Eyepiece rack wood screws (3/4" long, color black)
2	Altitude tensioning knobs
1	Tensioning PTFE/UHMW washer (color white, 1" outer diameter)
1	Tensioning metal washer (1" outer diameter)

## Box #3: Primary Mirror and Cell

### Qty. Description

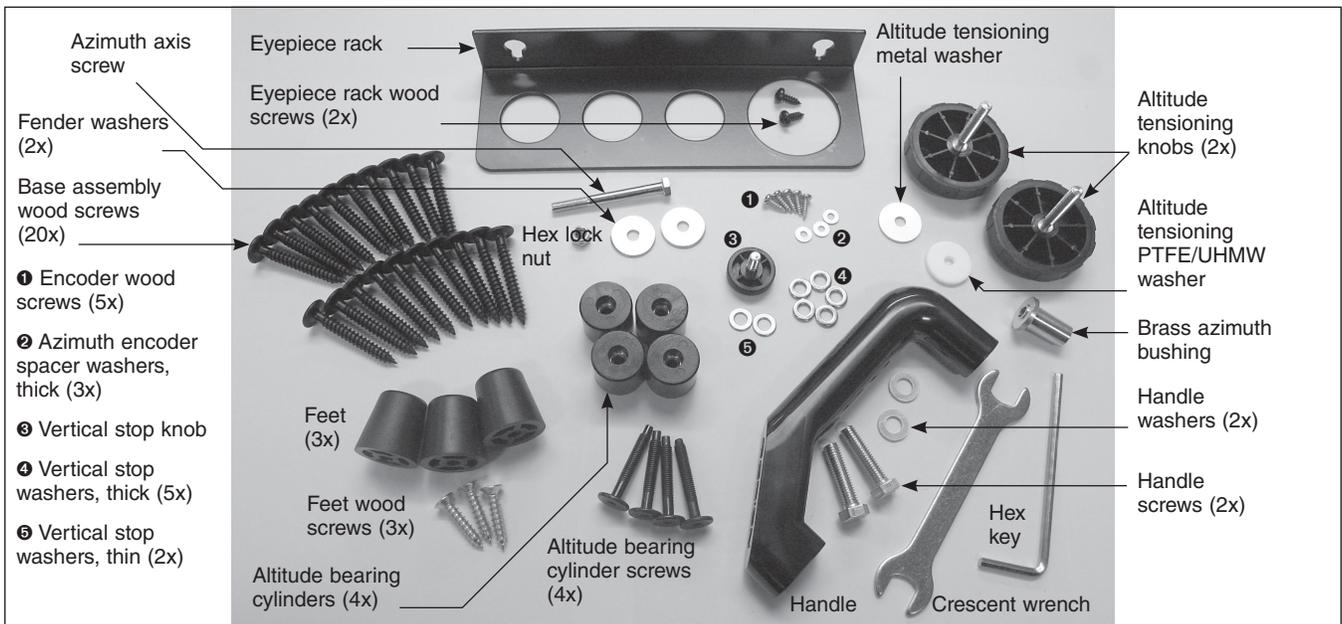
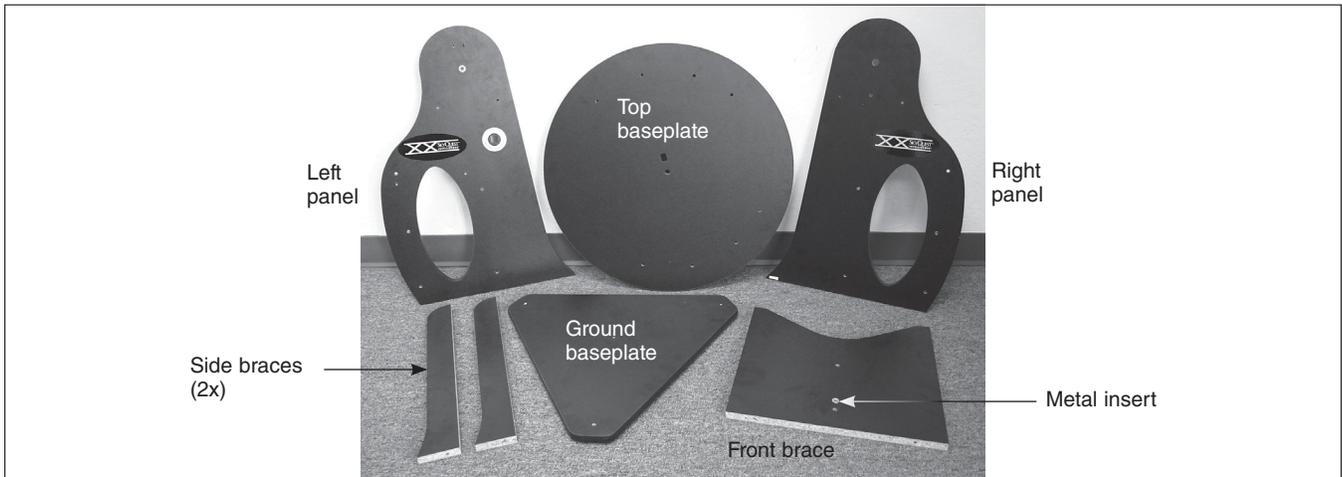
1	Primary mirror
1	Mirror cell
3	Collimation knobs
3	Nylon washers (3/4" outer diameter)
3	Springs



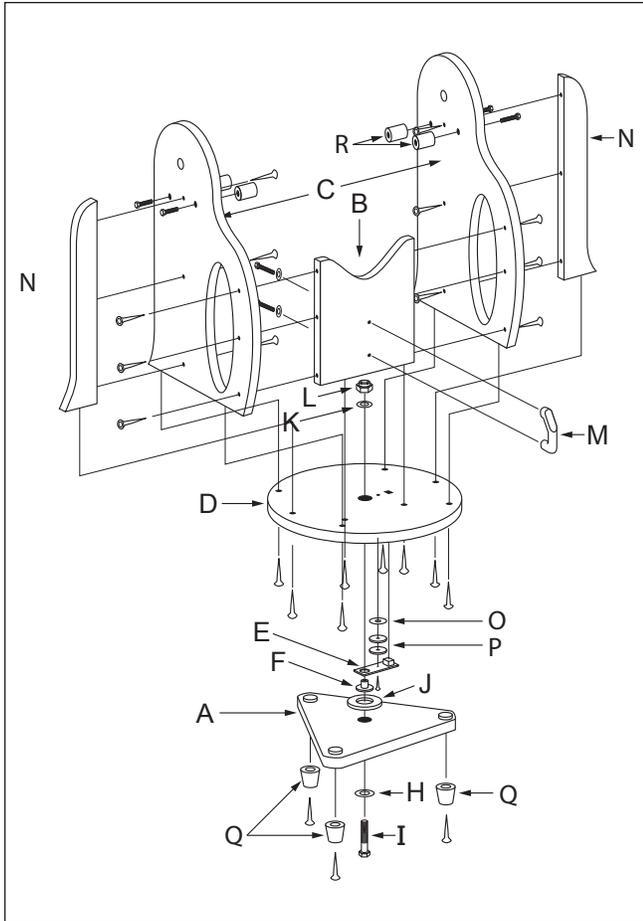
**Figure 2.** The parts in the box containing the optical tube and accessories.



**Figure 3.** The parts in the IntelliScope Object Locator kit.



**Figure 4.** The parts in the box containing the Dobsonian base.



**Figure 5.** Exploded view of the Dobsonian base.

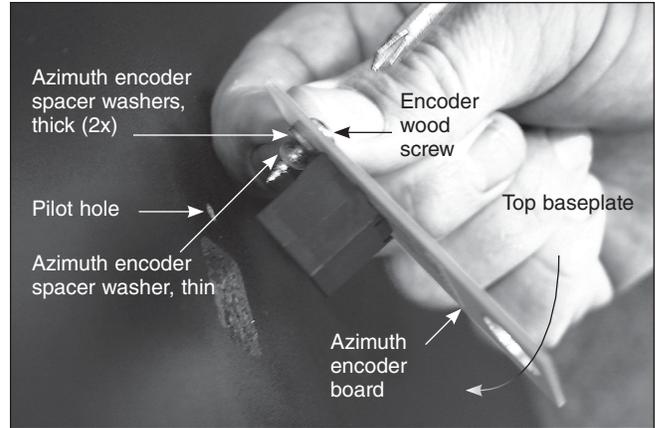
## 2. Assembly

Now that you have unpacked the boxes and familiarized yourself with all the parts in front of you, it's time to begin assembly.

### Assembly of the Dobsonian Base

Refer to **Figure 5** during base assembly. The base need only be assembled once, unless you disassemble it for long-term storage. The assembly process takes about an hour and requires, in addition to the supplied tools, a Phillips screwdriver, and two adjustable crescent wrenches. (You can substitute a 10mm crescent wrench for one of the adjustable crescent wrenches, or use a pair of pliers.) When tightening screws, tighten them until firm, but be careful not to strip the holes by over-tightening. If you use an electric screwdriver, do final tightening with a standard screwdriver to avoid stripping.

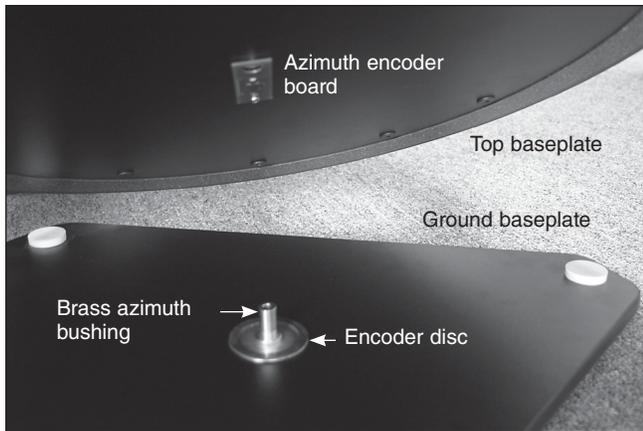
1. With a Phillips screwdriver, screw the feet (Q) into the underside of the ground baseplate (A) using the feet wood screws provided. Insert the screws through the feet and thread them into the predrilled starter holes.
2. Connect the side braces (N) to the side panels (C) using three of the base assembly screws for each panel. Connect each brace to the surface of the panel with the



**Figure 6.** To install the azimuth encoder board, insert an encoder board mounting screw through the slotted hole in the board. Then, add two thick and one thin encoder spacing washers onto the screw. Now, insert the modular connector on the encoder board into the square hole in the top baseplate, and thread the screw into the pilot hole using a Phillips head screwdriver.

SkyQuest IntelliScope label on it. The screws go through the holes in the panels and thread into the starter holes in the side braces. Use the 4mm hex key to firmly tighten the screws.

3. Connect the front brace (B) to the two side panels (C) with six of the base assembly screws. The screws go through the holes in the side panels and thread into the starter holes in the front brace. The side panels should be oriented so the side braces are facing outward. The front brace should be oriented so that the surface with the metal insert (**Figure 4**) faces inwards. Do not completely tighten the screws yet.
4. Connect the assembled structure to the top baseplate (D) with the remaining eight base assembly screws in the pre-drilled holes. The side of the top baseplate with the Ebony Star laminate bearing surface ring should be facing downwards.
5. Firmly tighten the six base assembly screws installed in step 2.
6. The azimuth encoder board (E) attaches to the underside of the top baseplate (D). The azimuth encoder board can be found in the box with the optical tube. Between the azimuth encoder board and top baseplate goes two thick spacer washers (P) and one thin spacer washer (O). These washers are critical in providing the proper spacing for the assembled azimuth encoder. The two thick azimuth encoder spacer washers are included with the base, but the thin azimuth encoder spacer washer is included with the IntelliScope Object Locator kit. Insert an encoder wood screw through the slotted hole in the azimuth encoder board so that the head of the screw is on the side of the encoder board without the modular connector. Now, place the two thick and one thin azimuth encoder spacer washers on the screw (**Figure 6**).

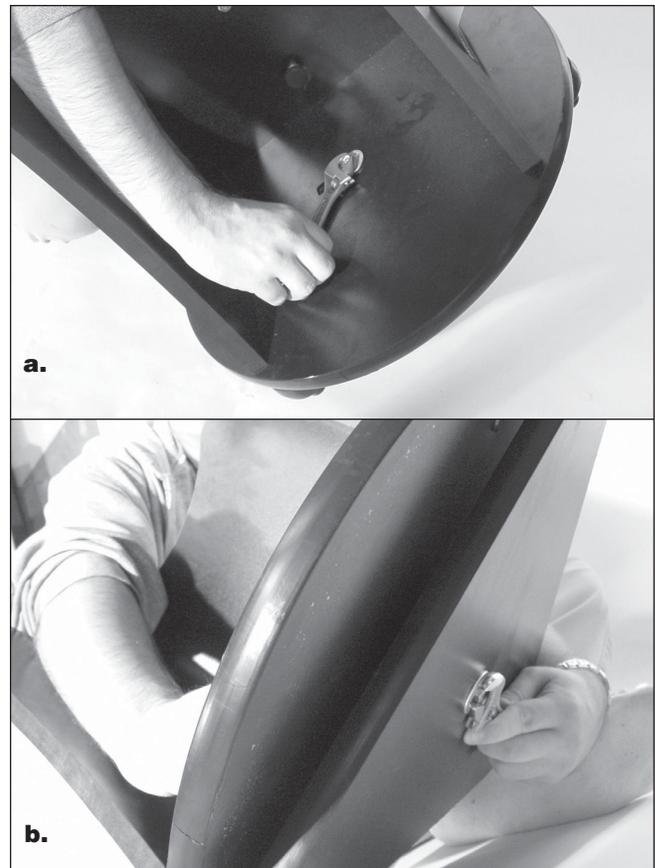


**Figure 7.** Lower the top baseplate onto the bottom baseplate. The brass bushing should pass through the center hole in the top baseplate (and the large hole in the azimuth encoder board).

7. Insert the modular jack on the azimuth encoder board (E) into the square-shaped hole in the top baseplate (D) and align the encoder board so the screw lines up with the pre-drilled pilot hole in the baseplate, and the large hole in the encoder board lines up with the central hole in the baseplate (**Figure 6**). Thread the encoder wood screw (with spacer washers attached) into the pre-drilled pilot hole with a Phillips screwdriver and tighten until just tight.

*Note: After the azimuth encoder board is installed to the bottom of the top baseplate, do not rest the baseplate on the ground, or the encoder board could be damaged. At this stage, rest the partially assembled base on its side.*

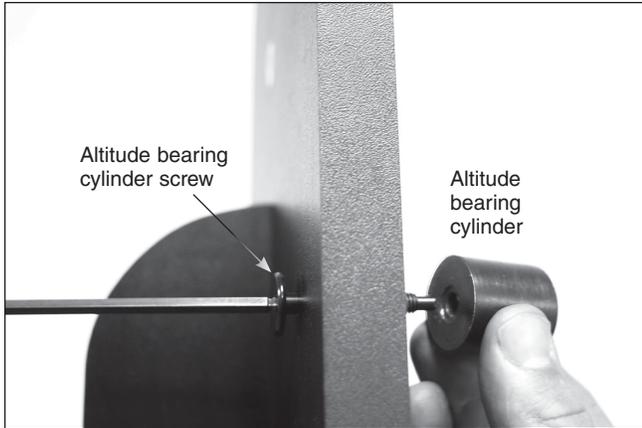
8. Position the ground baseplate (A) so that it is standing on its plastic feet. Place one fender washer (H) onto the azimuth axis screw (I), then insert the screw up through the hole in the ground baseplate.
9. Place the encoder disk (J), flat side down, over the azimuth axis screw (I) and onto the ground baseplate (A). The encoder disk is found in the box with the optical tube assembly.
10. Place the brass azimuth bushing (F) onto the azimuth axis screw (I) so the wide end of the bushing is closest to the encoder disk (J). Seat the bushing onto the encoder disk so the registration feature on the bushing goes into the hole in the encoder disk.
11. Carefully position the top baseplate (D) over the ground baseplate (A) and lower it so the brass azimuth bushing (F) goes through the center hole in the top baseplate (**Figure 7**). When the top baseplate is resting on the ground baseplate, the brass bushing should extend just above the top surface of the top baseplate.
12. Place the remaining fender washer (K) onto the shaft of the azimuth axis screw (I), then thread the hex lock nut (L) onto the end of the azimuth axis screw and tighten it finger tight, for now.
13. To tighten the hex lock nut (L) onto the azimuth axis screw (I), tilt the assembled Dobsonian base at a slight angle



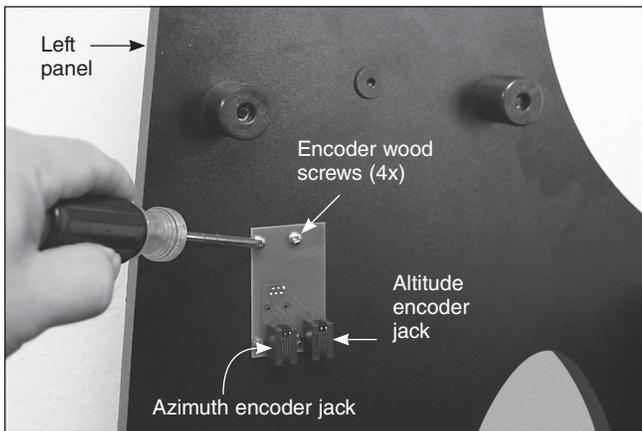
**Figure 8.** To connect the baseplates, tilt them only slightly, as shown. Do not place them on their side. **(a)** Use one wrench (or pliers) to hold the hex nut steady **(b)** while turning the hex head of the azimuth axis screw with another wrench.

to lift the ground baseplate off the ground. Now, with one wrench (or pliers) hold the head of the azimuth axis screw still while turning the hex lock nut with the other wrench. **Figure 8** shows this being done. Tighten the hex lock nut just until the top fender washer is no longer moving freely, then tighten the hex nut 3/16 to 1/4 turn beyond that. This provides the proper spacing between the encoder disk and the azimuth encoder board.

14. Two altitude bearing cylinders (R) connect to the interior surface of each side panel. Line up one of the altitude bearing cylinders with one of the two through holes in each side panel. The beveled end of the cylinder should be facing away from the side panel. Push a bearing cylinder screw through the side panel and thread it into the built-in nut in the cylinder with the included 4mm hex key (**Figure 9**). Repeat this for the remaining three bearing cylinders.
15. Attach the encoder connector board to the interior surface of the left side panel. The encoder connector board can be found in the box with the optical tube. Place the board against the left panel so that the modular jack fits into the square-shaped hole and using a Phillips screwdriver, thread four encoder wood screws through the connector



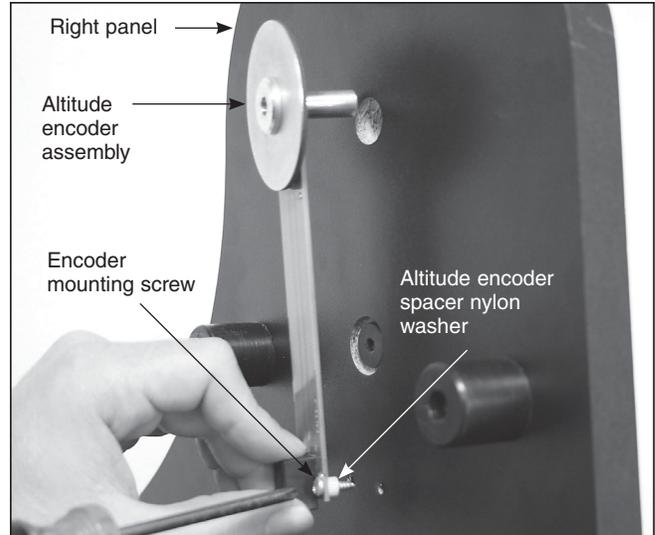
**Figure 9.** Push a bearing cylinder through the side panel and thread it into the altitude bearing cylinder. The beveled end of the cylinder should be facing away from the side panel.



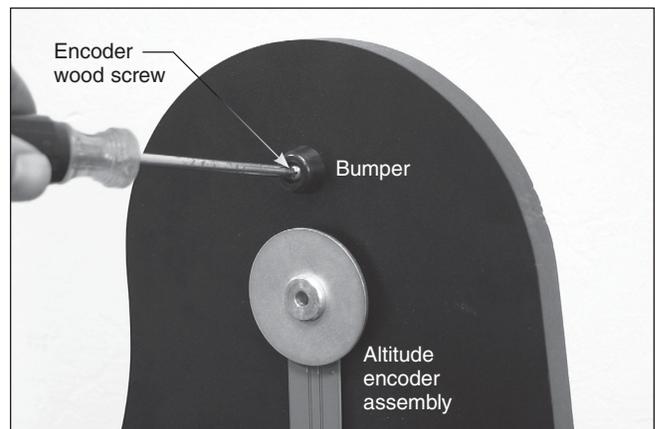
**Figure 10.** Attach the encoder connector board to the left panel with four of the encoder board mounting screws.

board and into the pre-drilled pilot holes in the left panel until tight (**Figure 10**).

16. The altitude encoder assembly and its mounting hardware can be found in the box with the IntelliScope Object Locator kit. The altitude encoder assembly is installed onto the base's right side panel. Below the 5/8" through hole in the right panel, there are two predrilled starter holes in the inward-facing surface. Take two of the encoder wood screws supplied in the IntelliScope kit and push them through the two slotted holes in the bottom of the altitude encoder's board. The screw heads should be on the same side as the altitude encoder's modular jack. Now, place an altitude encoder nylon spacer washer on the end of each screw (**Figure 11**).
17. Thread the encoder wood screws into the starter holes in the right side panel with a Phillips screwdriver (**Figure 11**). The shaft on the altitude encoder assembly should protrude through the 5/8" through-hole in the right panel. It will take a bit of dexterity to keep the nylon spacer washers on the ends of the screws when installing, so don't



**Figure 11.** To install the altitude encoder assembly onto the interior surface of the right panel, insert two encoder board mounting screws through the slotted holes in the board. Then, add an altitude encoder spacer nylon washer onto each screw. Now, insert the shaft of the altitude encoder through the hole in the right side panel, and thread the screws into the two pilot holes using a Phillips head screwdriver.

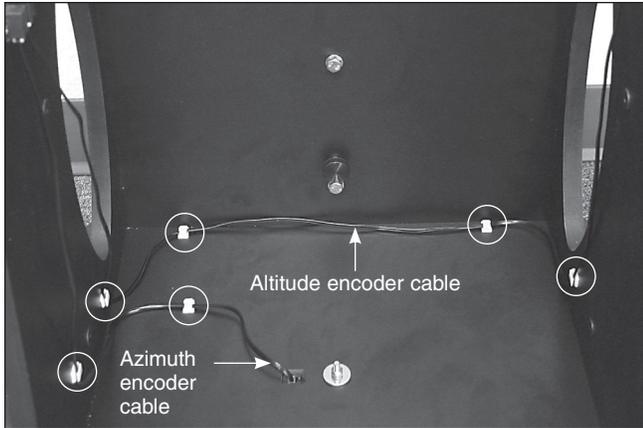


**Figure 12.** Install the bumper into the pilot hole above the altitude encoder assembly using one of the encoder wood screws.

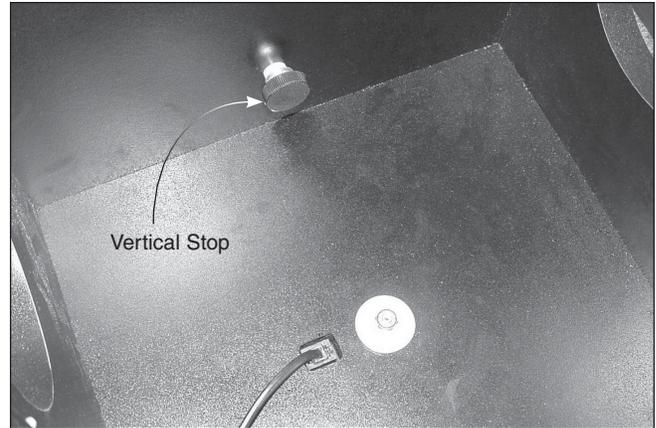
get frustrated if it takes a couple tries. The screws should not be fully tightened; they should be tight, but not tight enough to prevent the altitude encoder from moving up and down within the slots in the encoder board.

*Note: The right panel does not have a white nylon bushing pressed into its 5/8" through hole like the left panel does. This is an intended design.*

18. There is a pilot hole above the altitude encoder assembly; this is where the plastic bumper (found in the IntelliScope kit) which protects the altitude encoder assembly will be installed. Take the remaining encoder wood screw from the IntelliScope kit, push it through the bumper, and use a Phillips screwdriver to thread it into the pilot hole until tight (**Figure 12**).

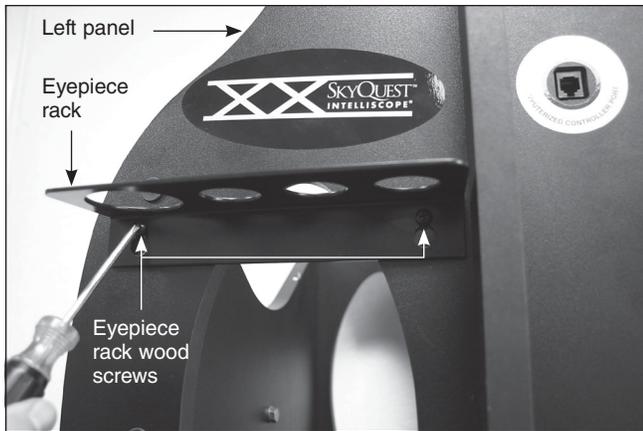


**Figure 13.** Use the wire clips to secure the cables neatly to the base.



**Figure 14.** Thread the vertical stop, with washers attached, into the threaded insert in the front brace.

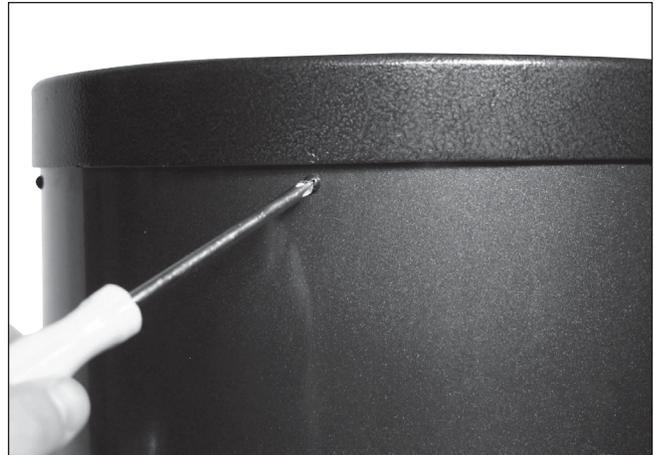
19. Connect one end of the azimuth encoder cable (the shorter of the two flat cables in the IntelliScope kit) to the encoder jack in the top baseplate of the Dobsonian base. Connect the other end to the encoder connector board installed on the base's left side panel. The azimuth encoder cable should plug into the jack on the left side of the encoder connector board (**Figure 10**).
20. Connect one end of the altitude encoder cable (the longer of the two flat cables in the IntelliScope kit) to the modular jack on the altitude encoder assembly. Connect the other end of the altitude encoder cable to the jack on the right side of the encoder connector board (**Figure 10**).
21. Use the wire clips provided with the IntelliScope kit to secure the altitude and azimuth cables neatly to the base. We recommend using two clips for the (shorter) azimuth cable, and four clips for the (longer) altitude cable (**Figure 13**). The clips have adhesive backing; simply peel the paper off the back of the clip and press the adhesive back to the base where you want the clip to be located.
22. Insert one end of the controller cable into the larger of the two jacks on the top of the IntelliScope Object Locator. Insert the other end into the "IntelliScope Computerized Controller Port" in the left panel of the Dobsonian base.
23. Two hook-and-loop strips (one strip of "hooks" and one strip of "loops") have been provided to hang the IntelliScope Object Locator in a convenient location on the base when not in use. Place the "hooks" strip on the back of the controller, and the "loops" strip on the base in a convenient spot. Make certain the location of the strip on the base will not cause the Object Locator to interfere with the motions of the telescope. You may want to consider using the optional holster instead of the supplied hook-and-loop strips. The holster is a metal holder custom designed to fit the IntelliScope Object Locator. When installed at the top of the Dobsonian base, it provides a firm mounting for the Object Locator at a convenient position for easy access. The Object Locator can be removed or kept in the holster during use.
24. Slide the battery cover off the back of the Object Locator and insert the 9-volt alkaline battery. Make sure the positive and negative terminals of the battery are oriented as shown in the bottom of the battery compartment. Replace the battery cover.
25. Attach the handle (M) to the front brace (B) with the two handle screws. Place one handle washer on each screw, then press the handle against the front brace (the end of the handle with the Orion logo should be facing upwards). Thread the screws from the interior surface of the front brace into the handle until tight using the supplied crescent wrench.
26. Place two of the five thick vertical stop washers and one of the two thin vertical stop washers onto the shaft of the



**Figure 15.** Using the two eyepiece rack wood screws, install the eyepiece rack into the pilot holes near the top of the oval cutout in the left panel.

vertical stop screw. Thread the vertical stop knob into the threaded insert on the inside of the front brace (B) until tight (**Figure 14**). The position of the vertical stop is adjusted by adding or removing washers, this is why extra thick and thin washers are included. Adjusting the vertical stop is required when using the IntelliScope Object Locator, since the optical tube must be precisely vertical during the initial alignment procedure. The manual included with the IntelliScope Object Locator kit will detail the procedure for adjusting the vertical stop; once the vertical stop is properly adjusted, it should not need to be adjusted again.

27. The aluminum eyepiece rack holds three 1.25" eyepieces and one 2" eyepiece in a convenient place on the base, within easy reach while you're observing. Near the top of the oval cutout in the left side panel you will notice two pre-drilled pilot holes located approximately 6" apart. Thread the eyepiece rack screws into the starter holes with a Phillips screwdriver. Now "keyhole" the eyepiece rack onto the wood screws and continue tightening the screws (**Figure 15**). If you want to remove the rack, be certain the screws are loose enough so that you can lift the rack and remove it through the larger part of the keyholes. If you want to have the rack permanently attached, tighten the screws firmly.



**Figure 16.** To remove the rear end ring, unthread the six screws that connect it to the tube.

The base is now fully assembled. It should not need to be disassembled, but we do recommend removing the IntelliScope Object Locator and eyepiece rack when transporting the base.

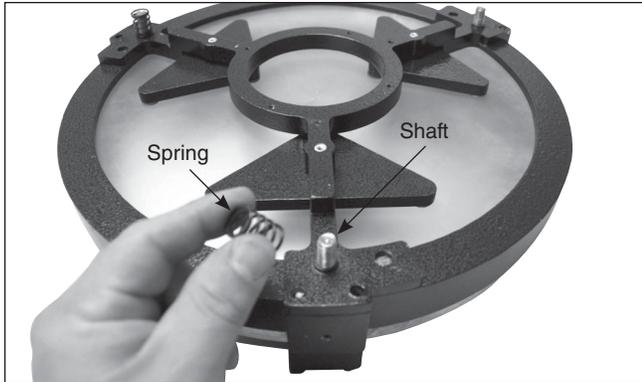
### Assembly of the Optical Tube

In order to prevent damage to the primary mirror in shipment, it is shipped in its cell separately from the optical tube. Once the primary mirror is installed into the telescope, there will be no need to remove the mirror except for periodic cleaning (see "Cleaning Mirrors").

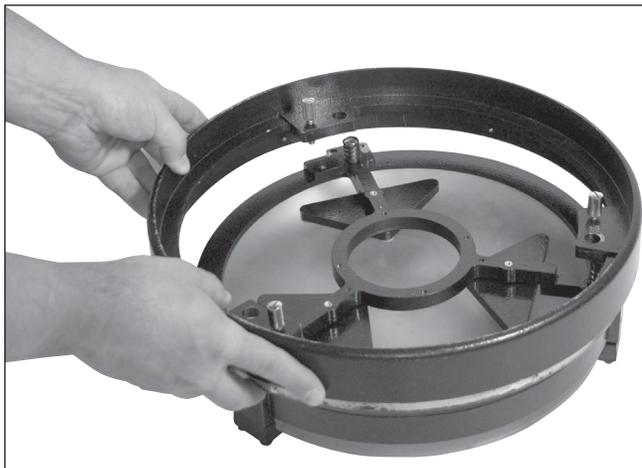
First, the mirror will be installed into the tube, then, the upper and lower sections of the tube will be assembled together with the truss poles.

1. To install the mirror cell into the optical tube, the rear end ring attached to the lower section of the optical tube must first be removed. This is done by unthreading and removing the six Phillips-head screws that connect the end ring to the tube (**Figure 16**), and then pulling the end ring off of the tube.

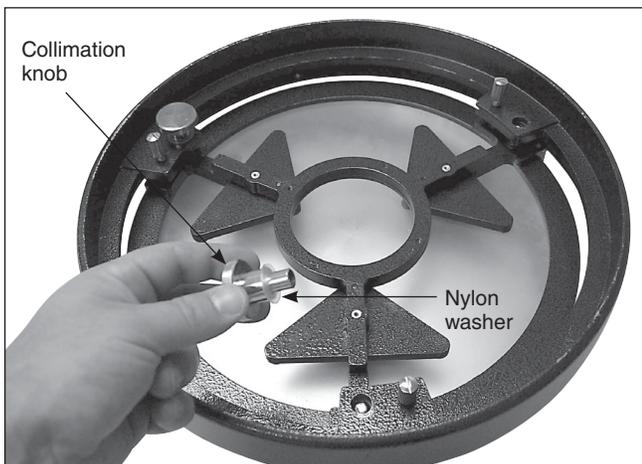
**Warning:** *Once the rear end ring is removed from the tube, the raw edge of the tube itself will be exposed. Be careful not to cut or otherwise hurt yourself on the tube's edge. Also be careful not to pinch yourself when attaching the assembled mirror cell onto the tube.*



**Figure 17.** Place the three springs on the exposed threaded shafts of the mirror cell.



**Figure 18.** Lower the rear end ring onto the mirror cell so that the threaded shafts pass through the end ring, and the end ring rests on the springs.

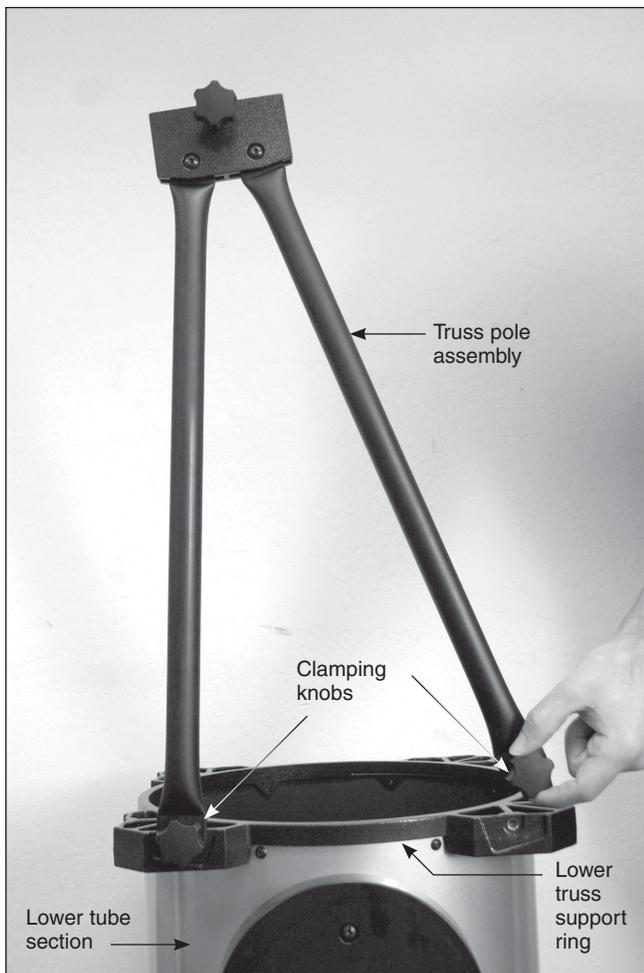


**Figure 19.** Thread the collimation knobs, with nylon washers attached, through the rear end ring and onto the threaded shafts. Make sure the knobs have at least three full turns of engagement on the shafts.



**Figure 20.** Locate the area of tube that is bulging out and preventing the end ring from fully seating.

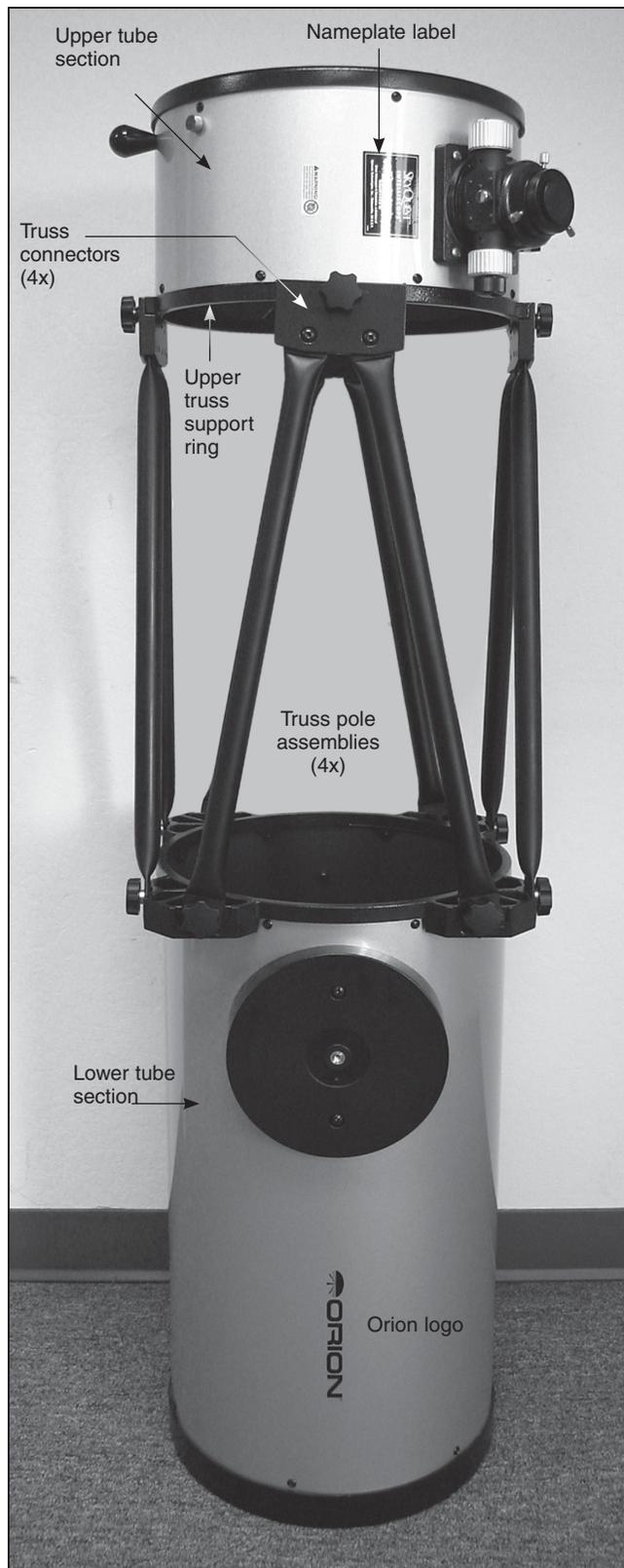
2. Next, assemble the rear end ring to the mirror cell. Find a clean, flat surface, and turn the mirror cell over so that the mirror is facing downwards. Place the three springs onto the three exposed threaded shafts (**Figure 17**). Lower the end ring onto the mirror cell so the threaded shafts pass through it, and the end ring rests on the springs (**Figure 18**). Add a nylon washer to each collimation knob and thread the collimation knobs through the end ring and onto the threaded shafts (**Figure 19**). Make sure the knobs have at least three full turns of engagement on the shafts. The mirror cell is now ready to be installed onto the lower tube section.
3. Assembling the end ring (and mirror cell) back onto the tube can be a bit tricky. This is because the large diameter and thin aluminum of the tube will cause the tube to become somewhat out of round once the end ring is removed. To assemble the rear end ring (with mirror and mirror cell now connected) to the tube, stand the lower section of the tube up vertically so the raw edge of the tube is facing upwards. Line up the threaded holes in the edge of the end ring with the holes in the end of the tube. Then, lower the entire assembly onto the tube. There may be a bulge in the perimeter of the tube which prevents the end ring from fully seating onto the tube (**Figure 20**). Press against this bulge, and the entire mirror cell assembly should seat onto the tube. Now, replace the six Phillips head screws that connect the rear end ring to the tube.
4. The cooling accelerator fan can now be connected to the rear of the mirror cell. Refer to the instruction sheet that comes with the fan kit for installation instructions.
5. Now, the upper and lower sections of the tube will be connected with the four truss pole assemblies. This is a procedure that will be done whenever the telescope has been disassembled for transport or storage. It is very easy to do, and should only take a couple of minutes. Start by connecting the eight clamping knobs on the ends of the pole assemblies to the lower truss support ring on the



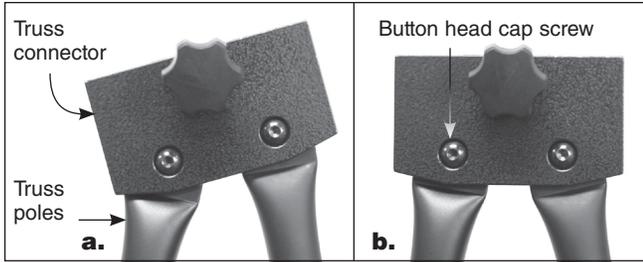
**Figure 21.** The clamping knobs on the ends of the truss pole assemblies thread into the holes in the lower truss support ring on the lower tube section.

lower optical tube section (**Figure 21**). This is done by simply threading the knobs into the holes in the ring. Do not completely tighten these knobs just yet.

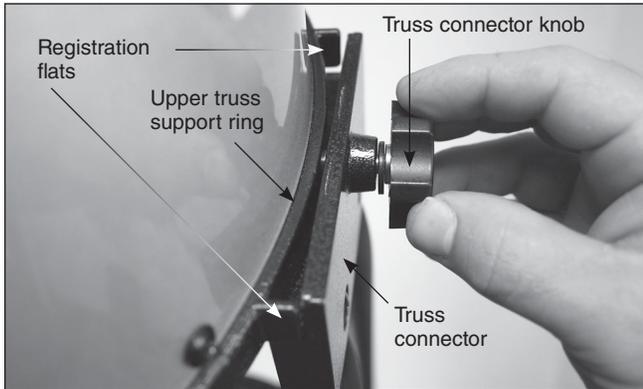
6. Connect the upper tube section to the four truss connectors at the top of the poles. Orient the upper tube section as shown in **Figure 22**. Hold the upper tube section with one hand while threading the knobs in the truss connectors into the holes in the upper truss support ring. If necessary, you can slightly adjust the position of the truss connector with respect to the pole ends in order to have the knobs and holes line up (**Figure 23**). When tightened, the knob will clamp the truss connector against the registration flats on the upper truss support ring (**Figure 24**). Repeat this for the other three truss connectors. Firmly tighten the knobs.
7. Firmly tighten the eight clamping knobs into the lower truss support ring.
8. If, after assembling, the truss poles are loose within the truss connectors, use the supplied 4mm hex key to tighten the button head cap screws which connect the poles to



**Figure 22.** When the optical tube is assembled, the upper tube section should be oriented relative to the lower tube section as shown. Note the orientation of the nameplate label on the upper tube section relative to the Orion logo on the lower tube section.



**Figure 23.** The position of the truss connectors relative to the pole ends can be adjusted to register the truss connectors with the upper truss support ring.



**Figure 24.** When the knob in the truss connector is tightened, it will clamp the truss connector against the registration flats on the upper truss support ring.

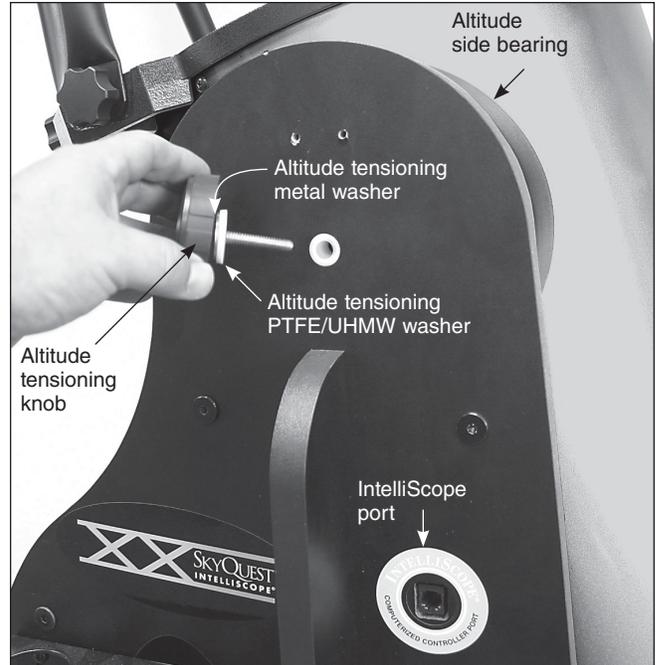
the truss connectors (see **Figure 23**). This should rarely need to be done.

The telescope is now assembled and ready to be placed into the Dobsonian base. To disassemble the tube, completely unthread the truss connector knobs from the upper truss support ring while holding the upper tube section. Then, unthread the truss poles from the lower truss support ring.

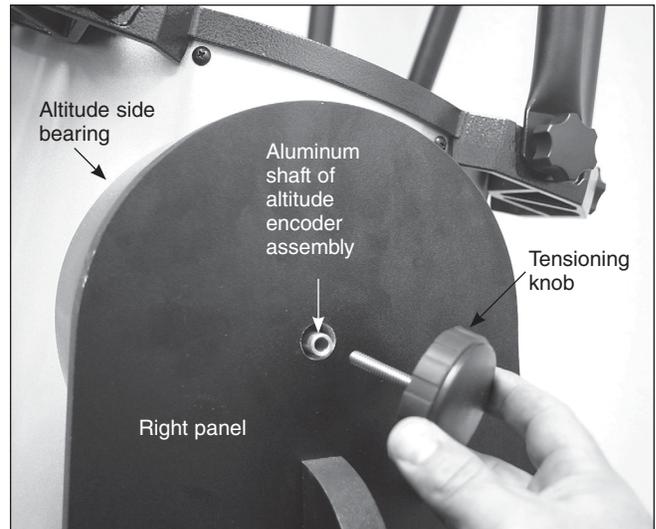
### Connecting the Optical Tube to the Dobsonian Base

Now that the base and tube are assembled, it is time to connect them together.

1. Lift the optical tube and gently place it into the Dobsonian base so the altitude bearings on either side of the tube rest on the base's bearing cylinders. Be careful when doing this, as the optical tube is somewhat heavy and unwieldy. Orient the optical tube on the base as seen in **Figure 1**. Make certain the optical tube does not get hung up on the vertical stop or the CorrecTension pads (i.e. the three square white pads on the inward-facing surface of the left side panel) as you put it in place. Also, be very careful not to hit the altitude encoder with the side bearing on the tube when doing this or damage to the encoder could result. The bumper helps to prevent such contact. Once on the bearing cylinders, the tube should pivot freely up and down with gentle hand pressure. Note that the tube will not yet be properly balanced, since the eyepiece



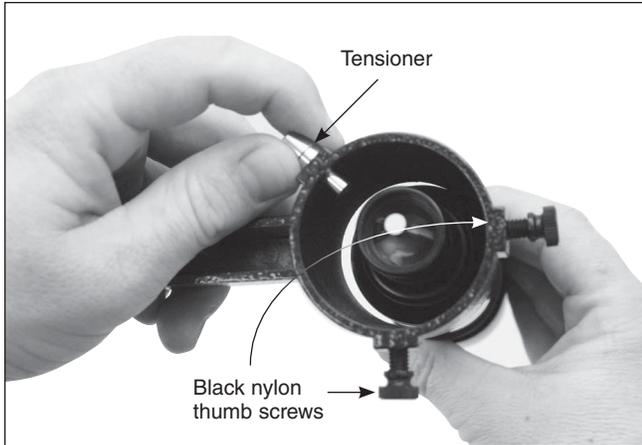
**Figure 25.** The altitude tensioning knob, with metal and PTFE/UHMW washers attached, goes into the side of the base with the IntelliScope port, and threads the tube's altitude side bearing.



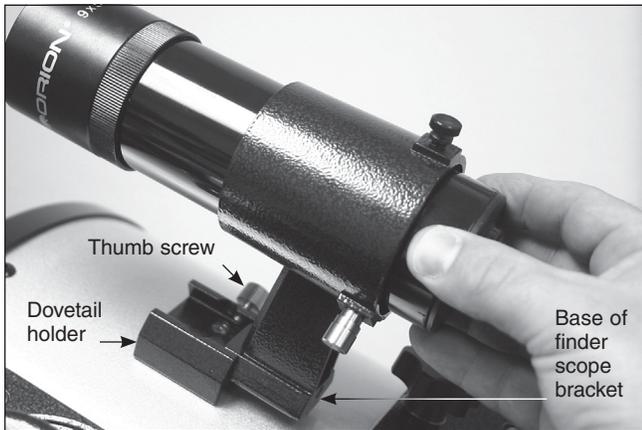
**Figure 26.** The other tensioning knob goes through the hollow aluminum shaft of the altitude encoder and threads into the other altitude side bearing on the tube.

and finder scope are not in place, and the altitude tensioning knob has not been installed.

2. Select one of the altitude tensioning knobs and slide the tensioning metal washer onto shaft, followed by the tensioning white PTFE/UHMW washer (you will need to thread the PTFE/UHMW washer onto the shaft, this keeps both washers captive on the knob's shaft). These parts are found in the box with the Dobsonian base. Push the shaft of the knob through the hole in the side panel which



**Figure 27.** Pull-back on the tensioner and slide the finder scope into its bracket until the O-ring is seated in the bracket ring.



**Figure 28.** The base of the finder scope bracket goes into the dovetail holder and is secured with the holder's thumb screw.

has the IntelliScope port (**Figure 25**). Thread the knob into the optical tube's altitude bearing until the knob pulls the altitude bearing against the CorrecTension pads on the interior surface of the left panel.

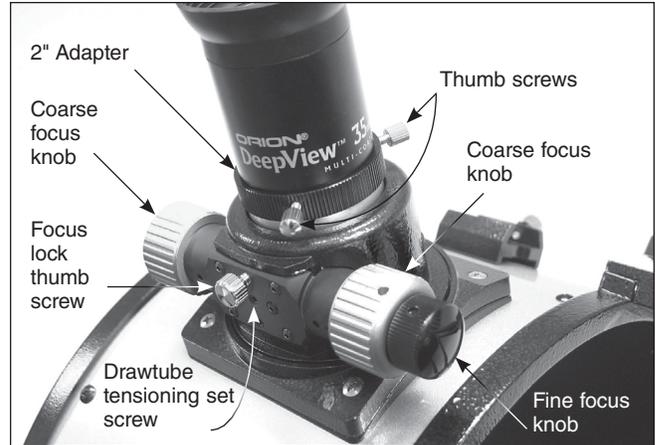
3. Take the other tensioning knob and push it through the altitude encoder's aluminum shaft (now protruding from the right side panel) and into the tube's other altitude bearing (**Figure 26**). You can move the altitude encoder up-and-down a bit with the knob in order to have the knob's shaft line up with the threaded hole in the tube's altitude bearing. Make sure this knob is always fully tightened, or else the IntelliScope's altitude encoder will not work properly.

The telescope tube is now connected to the base. If you wish to remove the optical tube from the base, you will first need to unthread and remove both the tensioning knobs.

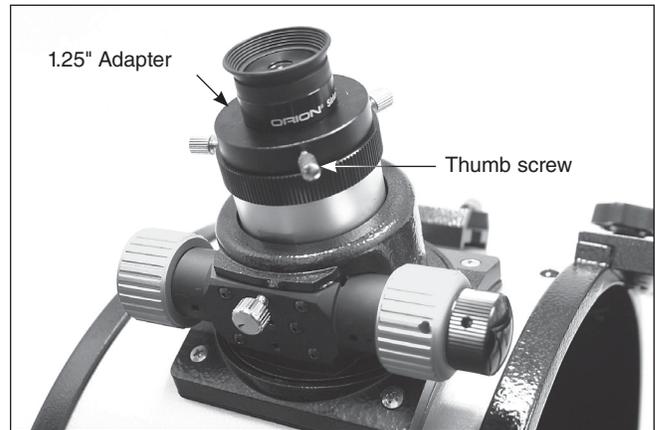
### Installing the Finder Scope and Eyepieces

These accessories can be found in the optical tube assembly box.

1. To install the finder scope into its bracket, first remove the O-ring from the bracket and place it over the body of the finder scope until it seats into the groove in the middle of



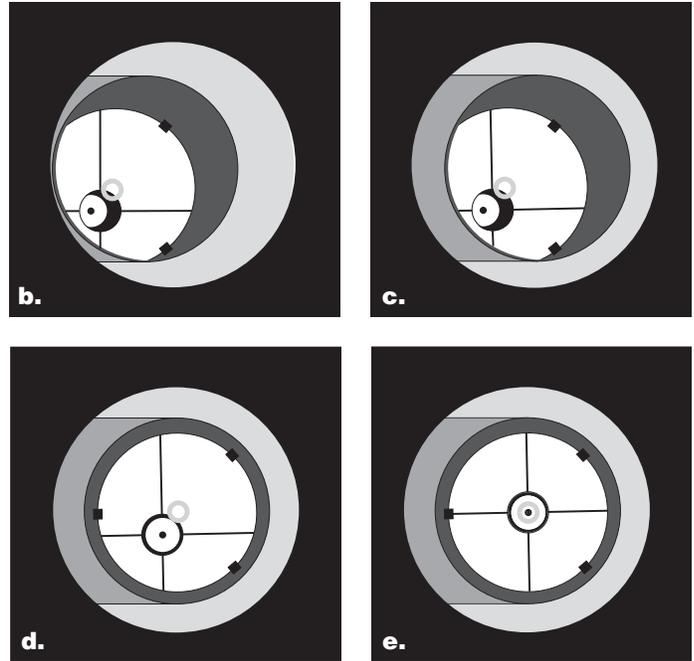
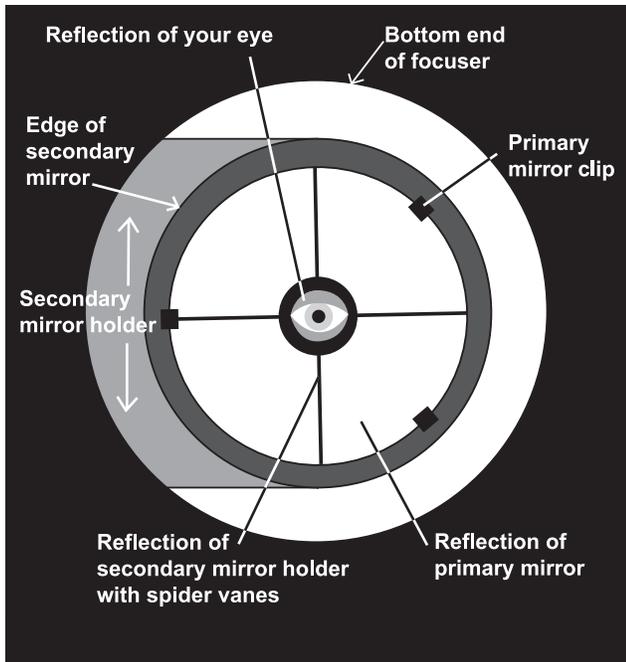
**Figure 29.** The 2" DeepView eyepiece installed in the focuser.



**Figure 30.** The 1.25" Sirius Plössl eyepiece installed in the focuser.

the finder. Unthread the black nylon alignment screws on the bracket until the screw ends are flush with the inside diameter of the bracket. Slide the eyepiece end (narrow end) of the finder scope into the end of the bracket's cylinder opposite the alignment screws while pulling the chrome, spring-loaded tensioner on the bracket with your fingers (**Figure 27**). Push the finder scope through the bracket until the O-ring seats just inside the front opening. Release the tensioner and tighten the two black nylon screws a couple of turns each to secure the finder scope in place. The tips of the tensioner and nylon screws should seat into the wide groove on the finder scope's body.

2. Insert the base of the finder scope bracket into the dovetail holder located adjacent to the telescope's focuser (**Figure 28**). Lock the bracket into place by tightening the thumb screw on the dovetail holder.
3. The final step in the assembly process is to insert an eyepiece into the telescope's focuser. First, take the cover cap off the focuser drawtube. To use the 2" Deep View eyepiece, loosen the two thumb screws on the 2" adapter (on the end of the focuser drawtube) and remove the 1.25" adapter. Then place the 2" eyepiece directly into the 2"



**Figure 31.** 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, if the optics are out of alignment, the view might look something like this. (c) Here, the secondary mirror is centered under the focuser, but it needs to be adjusted (tilted) so that the entire primary mirror is visible. (d) The secondary mirror is correctly aligned, but the primary mirror still needs adjustment. When the primary mirror is correctly aligned, the “dot” will be centered, as in (e).

adapter and secure it with the two thumb screws loosened previously (**Figure 29**). The other eyepiece and 1.25" adapter can be placed in the eyepiece rack until they are needed.

- To install the 1.25" Sirius Plössl eyepiece instead of the 2" Deep View eyepiece, keep the 1.25" adapter in the focuser, and make sure the two thumb screws on the 2" adapter are tightened. Now, loosen the thumb screw on the 1.25" adapter, do not loosen the two thumb screws on the 2" adapter. Insert the 1.25" eyepiece into the 1.25" eyepiece adapter, and secure it by retightening the thumb screw on the 1.25" eyepiece adapter (**Figure 30**). The other eyepiece can be placed in the eyepiece rack until it is needed.

The basic assembly of your SkyQuest IntelliScope Dobsonian is now complete. It should appear as shown in **Figure 1**. The dust covers should always remain in place on the top of the upper and lower tube sections when the telescope is not in use. It is also a good idea to store eyepieces in an eyepiece case and to replace the cover caps on the focuser and finder scope when the telescope is idle.

### 3. Aligning (Collimating) the Optical System

To get the sharpest images, your telescope's optical system must be in precise alignment. The process of aligning the primary and secondary mirrors is called collimating. Collimating is relatively easy to do and can be done in daylight or at night.

Because the primary mirror is shipped separately from the optical tube, the telescope's optics must be collimated before it can be used. Most of the adjustments will be to the tilt of the primary mirror, as the secondary mirror has been pre-aligned at the factory. It is also a good idea to check the collimation (optical alignment) of your telescope before each observing session and make any necessary adjustments.

To check 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 depicted in **Figure 31a**. If anything is off-center, as in **Figure 31b**, proceed with the following collimation procedure.

#### The Collimation Cap and Mirror Center Mark

Your XX12 comes with a collimation cap. This is a simple cap that fits on the focuser drawtube like a dust cap, but has a hole in the center and a reflective inner surface. The cap helps center your eye so that collimating is easier to do. **Figures 31b** through **31e** assume you have the collimation cap in place.

As an additional aid in collimating, the primary mirror of the XX12 has a tiny adhesive ring marking its exact center. This center ring will not affect the images you see when observing with the telescope in any way (since it lies directly in the shadow of the secondary mirror), but it will greatly facilitate collimating when using the supplied collimation cap or other, more sophisticated alignment devices, such as the Orion LaserMate Laser Collimator.



**Figure 32.** This image shows the XX12 properly set up for collimation. Note the white paper placed across from the focuser and the level angle of the optical tube. Ideally, the telescope should be pointing at a white wall.

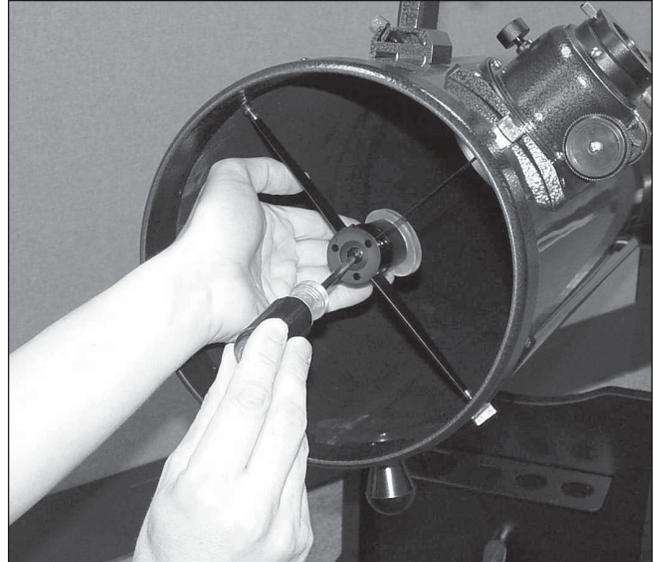
### Preparing the Telescope for Collimating

Once you get the hang of collimating, you will be able to do it quickly even in the dark. For now, it is best to collimate in daylight, preferably in a brightly lit room and aimed at a white wall. It is recommended that the telescope tube be oriented horizontally. This will prevent any parts from the secondary mirror from falling down onto the primary mirror and causing damage if something comes loose while you are making adjustments. Place a sheet of white paper inside the optical tube directly opposite the focuser. This will provide a bright “background” when viewing into the focuser. When properly set up for collimation, your telescope should resemble **Figure 32**.

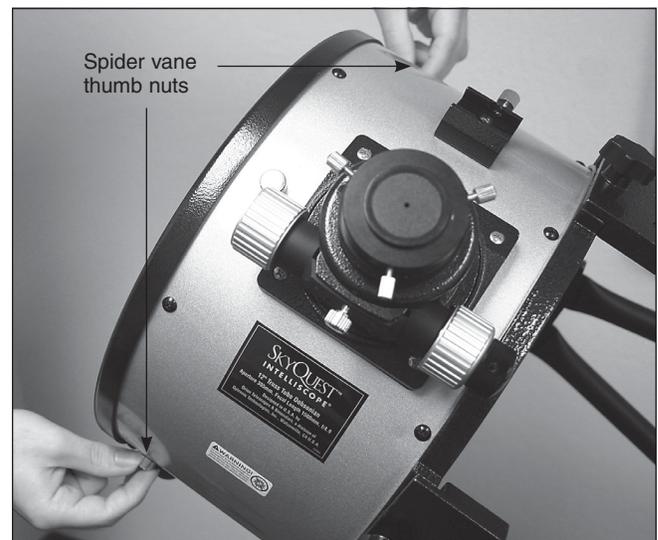
### Aligning the Secondary Mirror

With the collimation cap in place, look through the hole in the cap at the secondary (diagonal) mirror. Ignore the reflections for the time being. The secondary mirror itself should be centered in the focuser drawtube. If it isn't, as in **Figure 31b**, its position must be adjusted. This positional adjustment of the secondary mirror will rarely, if ever, need to be done.

To adjust the secondary mirror left-to-right in the focuser drawtube, use the included 2mm hex key to loosen the three small alignment set screws in the center hub of the 4-vaned spider several turns. Now, grasp the mirror to prevent it from rotating (be careful not to touch the surface of the mirror), while turning the center screw with a Phillips head screwdriver (**Figure 33**). Turning the screw clockwise will move the secondary mirror toward the front opening of the optical tube, while turning the screw counter-clockwise will move the secondary mirror toward the primary mirror. When the secondary mirror is centered left-to-right in the focuser drawtube, rotate the secondary mirror holder until the reflection of the primary mirror is as centered in the secondary mirror as possible. It may not be perfectly centered, but that is OK for now. Tighten the three small alignment set screws equally to secure the secondary mirror in that position.



**Figure 33.** To center the secondary mirror under the focuser, hold the mirror holder in place with one hand while adjusting the center screw with a Phillips screwdriver. Do not touch the mirror's surface!

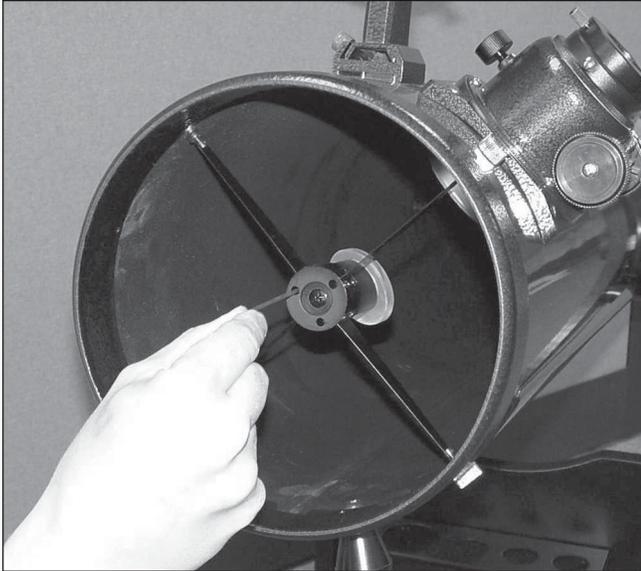


**Figure 34.** To center the secondary mirror up-and-down in the focuser drawtube, make adjustments to the two knurled spider vane thumb nuts that are perpendicular to the focuser.

*Note: When making these adjustments, be careful not to stress the spider vanes or they may bend.*

To adjust the secondary mirror up-and-down in the focuser drawtube, adjust the length of the two spider vanes perpendicular to the focuser. This is done by adjusting the knurled thumb nuts that secure the vanes to the tube (**Figure 34**). Loosen one thumb nut, then tighten the other until the secondary mirror is centered in the drawtube. Do not loosen the thumb nuts too much, as they will completely unthread from the ends of the spider vanes.

The secondary mirror should now be centered in the focuser drawtube. Now we will shift our attention to the reflections



**Figure 35.** Adjust the tilt of the secondary mirror by loosening or tightening the three alignment set screws with a 2mm hex key.

within the secondary mirror in order to properly adjust the tilt of the secondary mirror. Adjusting the tilt of the secondary mirror and the tilt of the primary mirror are the two collimation adjustments that will be done most often.

If the entire primary mirror reflection is not visible in the secondary mirror, as in **Figure 31c**, you will need to adjust the tilt of the secondary mirror. This is done by alternately loosening one of the three secondary mirror alignment set screws while tightening the other two, as depicted in **Figure 35**. Do not make excessive turns of these set screws or force them past their normal travel. A simple 1/2 turn of the screw can dramatically change the tilt of the secondary mirror. The goal is to center the primary mirror reflection in the secondary mirror, as in **Figure 31d**. Don't worry that the reflection of the secondary mirror (the smallest circle, with the collimation cap "dot" in the center) is off-center. You will fix that in the next step.

### Aligning the Primary Mirror

The final adjustment is made to the tilt of the primary mirror. It will need adjustment if, as in **Figure 31d**, the secondary mirror is centered under the focuser and the reflection of the primary mirror is centered in the secondary mirror, but the small reflection of the secondary mirror (with the "dot" of the collimation cap) is off-center.

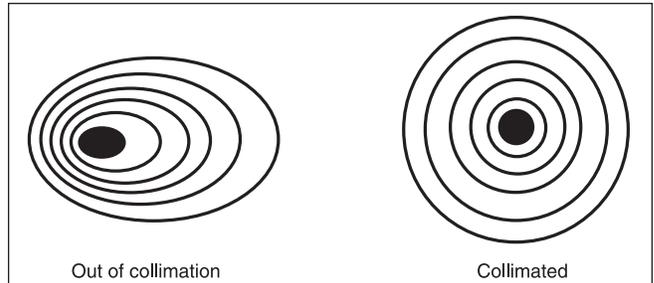
The tilt of the primary mirror is adjusted with the three large spring-loaded collimation knobs on the rear end of the optical tube (bottom of the primary mirror cell). The three smaller thumb screws lock the mirror's position in place. These thumb screws must be loosened before any collimation adjustments can be made to the primary mirror.

To start, turn the smaller thumb screws counterclockwise a few turns each. Use a screwdriver in the slots, if necessary.

Now, try tightening or loosening one of the collimation knobs (**Figure 36**). Look into the focuser and see if the secondary mirror reflection has moved closer to the center of the primary



**Figure 36.** The tilt of the primary mirror is adjusted by turning one or more of the three collimation knobs.



**Figure 37.** A star test will determine if a telescope's optics are properly collimated. An unfocused view of a bright star through the eyepiece should appear as illustrated on the right if the optics are perfectly collimated. If the circle is unsymmetrical, as in the illustration on the left, the telescope needs collimation.

mirror reflection. You can easily determine this with the collimation cap and mirror center mark by simply watching to see if the "dot" of the collimation cap is moving closer or further away from the "ring" on the center of the primary mirror. If turning the one knob does not seem to bring the dot closer to the ring, try using one of the other collimation knobs. It will take some trial-and-error using all three knobs to properly align the primary mirror. Over time you will get the feel for which collimation screws to turn to move the image in a given direction.

When you have the dot centered as much as is possible in the ring, your primary mirror is collimated. The view through the collimation cap should resemble **Figure 31e**. Re-tighten the locking thumb screws in the bottom of the mirror cell.

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 high in the sky and center it in the eyepiece's field of view. Slowly defocus the image with the focusing knob. If the telescope is correctly collimated, the expanding disk should be a perfect circle (**Figure 37**). If the image is unsymmetrical, the telescope is out of collimation. The dark shadow cast by the secondary mirror should appear in the very center of the out-of-focus cir-

cle, like the hole in a doughnut. 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, then the optics will always appear to be 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.

#### Note About the 2" Crayford Focuser

The 2" Crayford focuser of the XX12 can be collimated using three pairs of push-pull screws located at the base of the focuser. The focuser was collimated at the factory, however, and should not need to be adjusted. Focuser collimating is only required under very rare circumstances, but has been made available for this telescope should such a need arise.

## 4. Using Your Telescope

Before using your SkyQuest telescope for the first time at night, we recommend getting a feel for its basic functions during daylight hours. Find a spot outdoors where you have a clear view of some object or landmark that is at least 1/4-mile away. It is not critical that the base be exactly level, but it should be placed on somewhat flat ground or pavement to ensure smooth movement of the telescope.

Remember, never point the telescope at or near the Sun without using a proper solar filter over the front aperture.

#### Altitude and Azimuth Motion

The XX12’s Dobsonian base permits smooth motion of the telescope along two axes: altitude (up/down) and azimuth (left/right) (**Figure 38**). For altitude motion, the side bearings (made of heavy duty ABS plastic) on the telescope tube glide on pairs of bearing cylinders made from ultra-high molecular weight (UHMW) polyethylene. For azimuth motion, the Ebony Star laminate on the underside of the top baseplate rides on three Virgin PTFE/UHMW bearing pads attached to the ground baseplate. These choices of bearing materials provide optimum friction characteristics for moving the telescope when slewing or tracking.

To move the telescope, simply take hold of the navigation knob (see **Figure 1**) and gently move the tube up or down and left or right as desired. Both motions can be made simultaneously and in a continuous manner for easy aiming.

When the telescope is pointed high in altitude, rotating the tube in azimuth can cause the base to “tip” because of the reduced leverage. In this case it is helpful to place your other hand on the base or the optical tube to help “guide” the tube.

#### Setting the Altitude Tension

A nice feature of the SkyQuest IntelliScope Dobsonians is the redesigned CorrecTension system. Because of their relatively light weight, smaller Dobsonians (under 16") have always been plagued by insufficient friction on the altitude bearing surfaces. As a result, such telescopes move up and down much too freely. This causes problems when the observer



**Figure 38.** Dobsonians have two axes of motion; altitude (up/down) and azimuth (left/right).

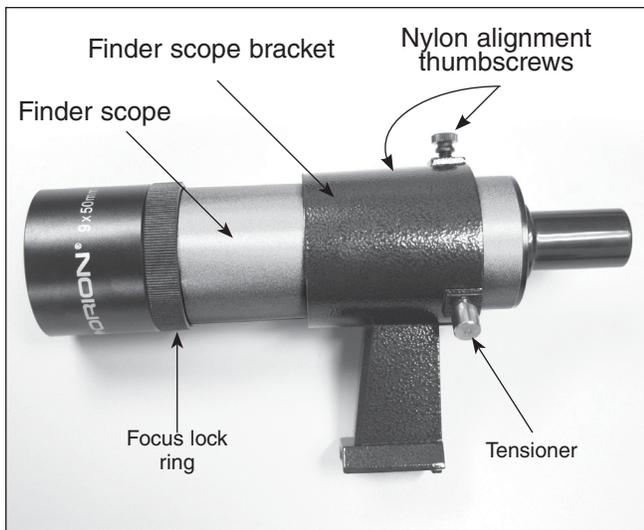
tries to accurately center and track an object for viewing, especially at higher powers. Also, the telescope becomes very sensitive to balance, requiring additional equipment such as counterweight systems or springs to compensate. SkyQuest IntelliScope Dobsonians employ a simple yet effective remedy for the friction problem that obviates the need for such cumbersome countermeasures. CorrecTension Friction Optimization utilizes a simple “disc brake” to apply the correct level of tension to the altitude bearings. With this system, you can change eyepieces or add a barlow lens without having to tediously adjust the telescope’s balance as you would with other Dobsonians.

The telescope should move smoothly with just gentle hand pressure. While azimuth friction is not adjustable, the altitude friction can be adjusted to the desired level by loosening or tightening the altitude tensioning knob. Note that the altitude tensioning knob is the knob on the same side of the base as the IntelliScope Controller Port; the knob on the opposite side of the base is merely an encoder retaining knob; it does not affect altitude tension and should always be fully tightened.

A good way to set the altitude tension is to point the telescope at about a 45° angle. Then, turn the altitude tensioning knob until the altitude motion feels roughly equal to the azimuth motion; this ensures optimal performance. The motion should be ideal — not too stiff, not too loose. You will want to be able to “track” the motion of celestial objects while viewing them by making small movements of the telescope without experiencing jerking (too much tension) or overshooting of the desired position (too little tension).

#### Focusing the Telescope

The XX12 comes standard with a 2" dual-speed Crayford focuser. The large 2" format focuser allows use of 2" or 1.25"



**Figure 39.** The 9x50 finder scope.

eyepieces and the Crayford design prevents imaging shifting while focusing. The focuser has coarse focus knobs and a fine focus knob for most precise focusing.

With the 35mm Deep View eyepiece in the focuser and secured with the thumb screws, move the telescope so the front end is pointing in the general direction of an object at least 1/4-mile away. Now, with your fingers, slowly rotate one of the coarse focus knobs until the object comes into sharp focus. Go a little bit beyond sharp focus until the image just starts to blur again, then reverse the rotation of the knob, just to make sure you're close to the focus point.

Now, use the fine focus knob to achieve precise focus. Eleven turns of the fine focus knob turns the coarse focus knobs only once, so it offers much finer adjustment than is possible with just the coarse focus knobs alone. You'll find this is a great convenience, especially when attempting to focus at high magnifications.

If you have trouble focusing, rotate the coarse focusing knob so the drawtube is inward as far as it will go. Now look through the eyepiece while slowly rotating the focusing knob in the opposite direction. You should soon see the point at which focus is reached.

The thumb screw on the bottom of the body of the focuser (**Figure 29**) will lock the focuser drawtube in place once the telescope is properly focused. Before focusing, remember to first loosen this thumb screw.

If you find the drawtube tension when focusing is either too tight (i.e. focus knob is difficult to turn) or too loose (i.e. drawtube moves by itself under the weight of the eyepiece), you can adjust it by tightening or loosening the drawtube tensioning set screw on the focuser, which is located just below the focus lock thumb screw (**Figure 29**). Adjust this set screw with the included 2.5mm hex key. Do not loosen the set screw too much as there must be some tension to keep the drawtube secure within the focuser. The other set screw below the



**Figure 40.** The view through a straight finder scope and reflector telescope is rotated 180°. This is true for the XX12 and its finder scope as well.

drawtube tensioning set screw does not affect drawtube tension and should not be adjusted.

### Viewing with Eyeglasses

If you wear eyeglasses, you may be able to keep them on while you observe, if your eyepieces have enough eye relief to allow you to see the whole field of view. You can try this by looking through the eyepiece first with your glasses on and then with them off, and see if the glasses restrict the view to only a portion of the full field. If they do, you can easily observe with your glasses off by just refocusing the telescope as needed. If you suffer from severe astigmatism, however, you may find images noticeably sharper with your glasses on.

### Aligning the Finder Scope

SkyQuest IntelliScope Dobsonians come with a high-quality, large-aperture 9x50 achromatic crosshair finder scope as standard equipment (**Figure 39**). This greatly aids in finding objects to view in the night sky. The finder scope must be accurately aligned with the telescope for proper use. The finder scope uses a spring-loaded bracket which makes alignment very easy. As you turn either of the thumb screws, the spring in the bracket's tensioner moves in-and-out to keep the finder scope secure in its bracket.

To align the finder scope, first aim the main telescope in the general direction of an object at least 1/4-mile away - the top of a telephone pole, a chimney, etc. Position that object in the center of the telescope's eyepiece.

*Note: The image in the finder scope and the telescope will appear rotated 180°. This is normal for finder scopes and reflector telescopes (**Figure 40**).*

Now look through the finder scope. Ideally, the object should be within the field of view. If not, then coarse adjustments to the bracket's alignment thumb screws will be needed. Once the image is in the finder scope's field of view, you will now use the bracket's alignment thumb screws to center the object on the intersection of the crosshairs. By loosening or tightening the alignment thumb screws, you change the line of sight of the finder scope. Continue making adjustments to the align-

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ment thumb screws until the image is centered in both the finder scope and the telescope's eyepiece.

Check the alignment by moving the telescope to another object and fixing the finder scope's crosshairs on the exact point you want to look at. Then look through the telescope's eyepiece to see if that point is centered in the field of view. If it is, the job is done. If not, make the necessary adjustments until the two images match up.

The finder scope alignment should be checked before every observing session. This can easily be done at night, before viewing through the telescope. Choose any bright star or planet, center the object in the telescope eyepiece, and then adjust the finder scope bracket's alignment thumb screws until the star or planet is also centered on the finder's crosshairs. You'll find the finder scope to be an invaluable tool for locating objects in the night sky.

### **Focusing the Finder Scope**

The finder scope with your XX12 has adjustable focus. If the images in the finder appear somewhat out of focus, you will need to refocus the finder scope for your vision. Loosen the focus lock ring located behind the objective lens cell on the body of the finder scope (**Figure 39**). Back the lock ring off by a few turns, for now. Focus the finder scope on a distant object by threading the objective lens cell in-or-out on the finder scope body. Precise focusing will be achieved by focusing the finder scope on a bright star. Once the image appears sharp, retighten the lock ring behind the objective lens cell. The finder scope's focus should not need to be adjusted again.

### **Aiming/Pointing the Telescope**

With the finder scope aligned, the telescope can be quickly and accurately pointed at anything you wish to observe. The finder scope has a much wider field of view than the telescope's eyepiece, and therefore it is much easier to find and center an object in the finder scope. Then, if the finder scope is accurately aligned, the object will also be centered in the telescope's field of view. Start by once again moving the telescope until it is pointed in the general direction of the object you want to see. Some observers find it convenient to sight along the tube to do this.

Now, look in the finder scope. If your general aim is accurate, the object should appear somewhere in the field of view. Make small adjustments to the telescope's position until the object is centered on the finder's crosshairs. Now, look in the telescope's eyepiece and enjoy the view!

### **Magnification**

Now that the object you want to view is centered in the 35mm eyepiece, you may want to increase the magnification to get a closer view. Loosen the thumb screws on the focuser drawtube and remove the eyepiece. Place it in the eyepiece rack, if you wish. Place the 1.25" eyepiece adapter into the focuser and secure it with the two thumb screws. Insert the 10mm eyepiece into the 1.25" eyepiece adapter, and tighten the thumb screw on the 1.25" adapter. If you were careful not to bump the telescope, the object should still be visible in the field of view. Notice that the object being viewed is now larger, but somewhat dimmer.

Magnification, or power, is determined by the focal length of the telescope and the focal length of the eyepiece. Therefore, by using eyepieces of different focal lengths, the resultant magnification can be varied.

Magnification is calculated as follows:

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

The XX12 has a focal length of 1500mm. So, the magnification with the supplied 35mm eyepiece is:

$$1500\text{mm} \div 35\text{mm} = 43\text{x}$$

The magnification provided by the 10mm eyepiece is:

$$1500\text{mm} \div 10\text{mm} = 150\text{x}$$

The maximum attainable magnification for a telescope is directly related to how much light its optics can collect. A telescope with more light-collecting area, or aperture, can yield higher magnifications than a smaller aperture telescope. The maximum practical magnification for any telescope, regardless of optical design, is about 50x per inch of aperture. This translates to about 600x for the XX12. Of course, such high magnification will only yield acceptable images if atmospheric conditions are favorable.

More typically, useful magnifications will be limited to 200x or less, regardless of aperture. This is because the Earth's atmosphere distorts light as it passes through. On nights of good "seeing," the atmosphere will be still and will yield the least amount of distortion. On nights of poor seeing, the atmosphere will be turbulent, which means different densities of air are rapidly mixing. This causes significant blurring of the incoming light, which prevents sharp views at high magnifications.

Keep in mind that as magnification is increased, the brightness of the object being viewed will decrease; this is an inherent principle of the physics of optics and cannot be avoided. If magnification is doubled, an image appears four times dimmer. If magnification is tripled, image brightness is reduced by a factor of nine!

The XX12 is designed to accept eyepieces with a barrel diameter of either 1.25" or 2". At low magnifications, 2" eyepieces can provide a wider field of view than standard 1.25" eyepieces. A wider field can be desirable for viewing extended deep sky objects that are too large to fit within a narrower field of view.

### **Tube Balance**

SkyQuest IntelliScope Dobsonians are designed to balance with standard supplied accessories, such as an eyepiece and a finder scope. But what if you want to use a larger finder scope or a heavier eyepiece?

Traditional Dobsonian designs require the user to compensate by adding weight to the opposite end of the telescope tube. Such counterweighting systems can be expensive and cumbersome. The CorrecTension system of the SkyQuest IntelliScope Dobsonians, however, solves the finicky balance problem. The brake pads press against the altitude bearings on the optical tube and increase the friction. With CorrecTension, the added weight of front-end loads will not

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adversely affect the balance of the telescope. Simply tighten the tensioning knob to compensate for an extra load.

### Transporting the Telescope

Even though it is a larger-aperture instrument, the XX12 has been designed to be easy to transport. The optical tube uncouples from the base, the tube disassembles, and each component can be carried separately. The base even has a carry handle for your convenience.

Before disassembling the telescope, remove the finder scope (with bracket) and any eyepieces from the optical tube, and remove the IntelliScope Object Locator from the base. The eyepiece rack can also be removed from the base, if you wish. This will prevent these accessories from being damaged during transport. These items can be placed in optional accessory cases.

To remove the optical tube from the base, simply unthread the altitude tensioning knobs from the tube's altitude side bearings until they are free of the tube and base. Then, using both hands, carefully lift the tube off the base. It is convenient to lift the tube by grasping the truss poles, which is OK to do. The tube is somewhat heavy, so don't hesitate to have a friend help lift the tube, if necessary.

*Note: If you choose to thread the knobs back into the altitude bearings after removing the optical tube from the base, be careful not to bend the knobs when transporting the telescope.*

To disassemble the optical tube, unthread the knobs in the truss pole connectors from the upper truss support ring while holding the upper tube section. Once all four knobs are unthreaded, remove the upper tube section. Now, unthread the eight knobs on the pole ends from the lower truss support ring, and remove the truss pole assemblies from the lower tube section. Place the dust covers on the tops of the upper and lower tube sections. The telescope is now disassembled and ready to be transported.

When putting the XX12 into a vehicle, common sense prevails. It is especially important that the optical tube sections do not get knocked around; this can cause the optics to become misaligned, and could dent the tube.

We recommend transporting (and storing) the tube assembly in the optional padded case set for proper protection. The case set includes a two padded cases for the tube sections, a pole case which holds the four truss pole assemblies, and a secondary mirror cover. All cases have carry handles, and one of the padded cases has an accessory pocket for added convenience.

## 5. Astronomical Observing

The SkyQuest XX12 IntelliScope Truss Tube Dobsonian provides prodigious capability for observing the many wonders of the heavens, from the major planets to deep-space nebulae and galaxies. In this section we give you some astronomical observing tips and briefly summarize what you can expect to see.

### The IntelliScope Computerized Object Locator

One of the most exciting features of the SkyQuest XX12 IntelliScope Truss Tube Dobsonian is its compatibility with the IntelliScope Computerized Object Locator. When plugged into the IntelliScope port on the telescope's base, the Object Locator enables the user to point the telescope quickly and effortlessly to more than 14,000 astronomical objects with the push of a button. After a simple two-star alignment procedure, you just select an object to view from the intuitive keypad, then read the guide arrows on the Object Locator's illuminated liquid crystal display and move the telescope in the corresponding direction. In seconds, the object will be waiting in the telescope's field of view, ready to observe. It's that simple!

The two guide arrows and associated "navigation numbers" tell you in what direction to move the telescope to pinpoint an object's location. As the telescope approaches the object's location, the numbers get progressively smaller. When the navigation numbers reach zero, the telescope will be pointed right at the object. You just look into the eyepiece and enjoy the view!

The IntelliScope Computerized Object Locator works by communicating electronically with the pair of high-resolution, 9,216-step digital encoders installed in the base. The encoders allow highly precise positioning of the telescope to coordinates programmed into the Object Locator's database for each astronomical object. Since the telescope is not dependent on motors for movement, you can point the telescope at your target much more quickly (and quietly!) than other computerized telescopes can — and without guzzling all those batteries in the process.

The Object Locator's database includes:

- 7,840 objects from the Revised New General Catalog
- 5,386 objects from the Index Catalog
- 110 objects from the Messier Catalog
- 837 selected stars (mostly double, multiple, and variable stars)
- 8 planets
- 99 user-programmable objects

With the user-friendly IntelliScope Object Locator, there are many ways to locate an astronomical object. If you know its catalog number (NGC or Messier number, for instance), you can enter it using the illuminated keypad buttons. Or you can press one of the object category buttons (Cluster, Nebula, Galaxy, etc.) to access a list of objects by type. For a tour of the best objects visible in a given month, you just press the Tour button.

Another great feature of the IntelliScope is the ability to identify an "unknown" object in the field of view — just press the ID button. You can even add up to 99 objects of your own choosing to the Object Locator's database. The backlit, two-line LCD on the Object Locator shows you the object's catalog number, its common name if it has one, the constellation in which it resides, its right ascension and declination coordinates, the object type, magnitude, angular size, as well as a brief description in scrolling text.



**Figure 41.** The optional light shroud for the XX12 prevents stray light from entering the telescope. It also helps prevent dew from forming on the optical surfaces.

The IntelliScope Object Locator is a wonderful convenience for both the novice and experienced observer. You'll spend more time actually observing astronomical objects instead of hunting for them. For instructions on how to operate the Object Locator, refer to the instruction manual included in the box with the IntelliScope Object Locator kit.

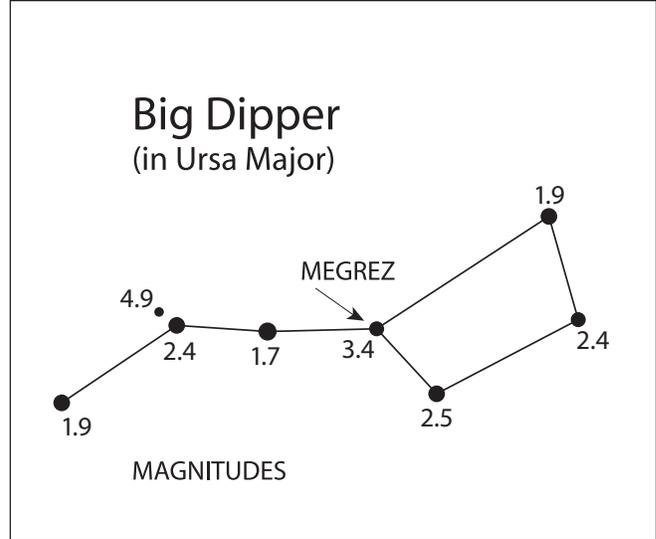
### Selecting an Observing Site

Since most astronomical objects are faint, observing them from dark skies will give you the best views. While some objects, such as the planets and Moon, are bright enough to see clearly even from light-polluted city skies, for nebulae, galaxies, and most star clusters, the less ambient light there is to reduce contrast, the better.

When it isn't possible or convenient to get out of town to a pitch-black observing location, try to set up in a spot that is removed from street and building lights and that has a clear view of a large portion of the sky. Avoid pointing the telescope above buildings, if possible, since they radiate heat which degrades images. For observing faint deep sky objects, choose a moonless night. Using the optional light shroud will be a necessity (see below). Also, use of a light-pollution filter, like the Orion SkyGlow Broadband filter, can mitigate the effects of background sky brightness, enhancing the view of faint objects.

### Use of the Optional Light Shroud

When viewing from light-polluted skies, we highly recommend using the optional light shroud for the XX12. The light shroud is a black nylon cloth wrap which fits over the exterior of the truss poles (**Figure 41**). The shroud prevents stray light from entering the telescope through the open truss section of the tube and degrading image contrast. The shroud also helps prevent dew from forming on the optical surfaces of the telescope.



**Figure 42.** Megrez connects the Big Dipper's handle to its "pan." It is a good guide to judging the transparency of the night sky. If you cannot see Megrez (a 3.4-magnitude star) then transparency is poor.

### Seeing and Transparency

Atmospheric conditions play a huge part in quality of viewing. Light from stars and other celestial objects must travel through miles of Earth's atmosphere to reach our eyes. The air in the atmosphere will refract and bend the light. Atmospheric turbulence will worsen the effects of refraction, which can cause the image you see in your telescope to be unstable. The steadiness of the atmosphere is called the "seeing" condition.

In conditions of good seeing, star twinkling is minimal and objects appear steady in the eyepiece. Seeing is best overhead, worst at the horizon. Also, seeing conditions generally get better later in the evening, as much of the heat absorbed by the Earth during the day has radiated off into space. In conditions of bad seeing, stars will twinkle and objects will appear unsteady and blurry in the telescope.

"Transparency" is the clarity of the atmosphere, which can be adversely affected by the presence of moisture, smoke, and dust. All tend to scatter light, which reduces an object's brightness. Good transparency is desirable for astronomical observing, especially for viewing faint objects.

One good measure of transparency is by how many stars you can see with your unaided eyes. If you cannot see stars of magnitude 3.5 or dimmer, then transparency is poor. Magnitude is a measure of how bright a star is. The brighter a star, the lower its magnitude. A good star to remember for this is Megrez (magnitude 3.4), which is the star in the Big Dipper that connects the handle to the "dipper." If you cannot see Megrez, then you have fog, haze, clouds, smog, light pollution or other conditions which are hindering your viewing (**Figure 42**).

### Cooling the Telescope

All optical instruments need time to reach thermal equilibrium with the outdoor air, which is essential for peak performance.

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Images will be poor if the optics are not in equilibrium with the outdoor temperature.

When moved from a warm indoor location to cooler outside air (or vice-versa), a telescope needs time to cool to the outdoor temperature. The bigger the instrument and the larger the temperature change, the more time will be needed. The open truss tube design of the XX12 promotes good air ventilation of the optics, but it will still require at least 30 minutes or so to equilibrate. If the temperature difference between indoors and outdoors is more than 40°, it will likely take longer. In the winter, storing the telescope outdoors in a shed or garage greatly reduces the amount of time needed for the optics to stabilize. Also, after setting up outdoors, it is a good idea to keep the telescope covered until the Sun sets so the tube does not heat greatly above the temperature of the air.

The XX12 comes with a cooling accelerator fan. The fan hastens the equilibration of the primary mirror to the ambient temperature by increasing airflow. The fan is powered by its battery pack, which requires eight D-cell batteries (not included). To turn the fan on, simply plug the battery pack's cable into the jack on the fan. Turn the fan on after setting up the telescope outside at night, but prior to using it. When the mirror has reached the ambient outdoor temperature, turn the fan off by unplugging the battery pack.

### **Let Your Eyes Dark-Adapt**

Do not 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. Many observers notice improvements after several hours of total darkness. As your eyes become dark-adapted, more stars will glimmer into view and you will be able to see fainter details in objects you view in your telescope. Exposing your eyes to very bright daylight for extended periods of time can adversely affect your night vision for days. So give yourself at least a little while to get used to the dark before you begin observing.

To see what you are 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. Dim light is preferable to bright light.

Be aware, too, that nearby porch and streetlights and automobile headlights will spoil your night vision. Close your eyes when you hear an automobile approaching your observing site!

### **Eyepiece Selection**

By using eyepieces of different focal lengths, it is possible to attain many different magnifications with your telescope. The telescope comes with two high-quality eyepieces: a 35mm focal length 2" Deep View eyepiece, which provides a magnification of 43x, and a 10mm focal length 1.25" Sirius Plössl eyepiece, which provides a magnification of 150x. 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. This allows the observer to choose the best eyepiece to use depending on

the object being viewed. At least to begin with, the two supplied eyepieces will suffice nicely.

Whatever you choose to view, always start by inserting your lowest-power (longest focal length) eyepiece to locate and center the object. Low magnification yields a wide field of view, which shows a larger area of sky in the eyepiece. This makes acquiring and centering an object much easier. If you try to find and center objects with high power (narrow field of view), it's like trying to find a needle in a haystack! Once you've centered the object in the eyepiece, you can switch to higher magnification (shorter focal length eyepiece), if you wish. This is especially recommended for small and bright objects like planets and double stars. The Moon also takes higher magnifications well.

Deep sky objects, however, typically look better at medium or low magnifications. This is because many of them are quite faint, yet have some extent (apparent width). Deep sky objects will often disappear at higher magnifications, since greater magnification inherently yields dimmer images. This is not the case for all deep sky objects, however. Many galaxies are quite small, yet are somewhat bright, so higher power may show more detail.

The best rule of thumb with eyepiece selection is to start with a low power, wide field, and then work your way up in magnification. If the object looks better, try an even higher magnification. If the object looks worse, then back off the magnification a little by using a longer focal length eyepiece.

### **Astronomical Objects**

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

#### **A. The Moon**

With its rocky and cratered surface, the Moon is one of the most interesting and easy subjects to view with your telescope. The best time to view it is during its partial phases when shadows fall on the craters and canyon walls to give them definition. While the full moon may look like a tempting target, it is not optimal for viewing. The light is too bright and surface definition is low.

Even at partial phases the Moon is very bright. Use of an optional Moon filter helps to dim the glare. It simply threads onto the bottom of the eyepiece. You'll find the Moon filter improves viewing comfort, and helps bring out the subtle features on the lunar surface.

#### **B. The Sun**

You can change your nighttime telescope into a daytime Sun viewer by installing an optional 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 any optical instrument without a professionally made solar filter, or permanent eye damage could result. Also, be sure to cover the finder scope, or better yet, remove it altogether.*

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### C. The Planets

The planets don't stay put like the stars, so to find them you should refer to Sky Calendar at our website OrionTelescopes.com, or use the IntelliScope Object Locator. Venus, Mars, Jupiter, and Saturn are the brightest objects in the sky after the Sun and the Moon. Your XX12 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, optional higher power eyepieces are recommended and often required for detailed observations. Not all the planets are usually 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. Higher power eyepieces should bring out the cloud bands on the planet's disk.

*Saturn:* The ringed planet is a breathtaking sight. 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 conditions) is necessary for a good view. Look closely and you may see the Cassini division, a thin, dark gap in the rings. You should also see one or more of Saturn's moons, which look like faint nearby stars. The brightest is the 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.

*Mars:* The Red Planet makes a close approach to Earth every two years. Observing Mars is most favorable at these times. You should see a salmon-colored disk with some distinct dark patches, and you may be able to spot a whitish polar ice cap. To see surface detail on Mars, you will need a high power eyepiece and very steady air!

### D. The Stars

Stars will appear as tiny points of light. Even powerful telescopes cannot magnify stars to appear as anything more than pinpoints. You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. The famous "Double-Double" in the constellation Lyra and the gorgeous two-color double star Albireo in Cygnus are 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; that is, objects that reside outside of our solar system. These include gaseous nebulae, open and globular star clusters, and a variety of different types of galaxies.

The large aperture of the XX12 is particularly well suited to gathering light, which is critical for observing these faint celestial entities. For deep sky observing, it is important that you find an observing site well away from light pollution. Take

plenty of time to let your eyes adapt to the darkness. 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 from these fascinating objects.

Beginners are often surprised to discover that the deep sky objects they see in the eyepiece of a telescope are mostly grayish, not colorful like those you see in long-exposure astro-images. The reason is that our eyes are not sensitive to color in faint light. Still, there is something very special about seeing an astronomical object in real time with your own eyes — "live," if not in living color.

### Note About Astro-imaging

The SkyQuest XX12 IntelliScope Truss Tube Dobsonian is designed for visual, not imaging, use. The Dobsonian mount is not an equatorial-type mount, so it cannot be motor driven for long exposure astro-imaging. The telescope has also been optically optimized for visual use, since photographic optimization degrades visual performance.

With that in mind, however, it is possible to do some simple astro-imaging with the XX12. With the use of afocal imaging techniques (where the camera is simply held to the eyepiece to take a picture) and digital cameras, it is possible to capture images of bright objects. Certain imaging accessories, such as the Orion SteadyPix, can help in obtaining images by the afocal method.

## 6. 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 OK. The telescope can be stored assembled or disassembled, but be sure to keep the dust covers on the telescope when not in use. We highly recommend storing the optical tube sections in the optional case set for the XX12. Small components like eyepieces and other accessories should be kept in an optional accessory case.

Your XX12 requires very little mechanical maintenance. The optical tube is steel and has a painted finish that is fairly scratch-resistant. If a scratch does appear on the tube, it will not harm the telescope. Smudges on the tube or base can be wiped off with a soft cloth and household cleaning fluid.

### Cleaning Eyepiece Lenses

Any quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated optics can be used to clean the exposed lenses of your eyepieces or finder scope. Never use regular glass cleaner or cleaning fluid designed for eyeglasses. Before cleaning with fluid and tissue, however, blow any loose particles off the lens with a blower bulb or compressed air. Then apply some cleaning fluid to a tissue, never directly on the optics. Wipe the lens gently in a circular motion, then remove any excess fluid with a fresh lens tissue. Oily fingerprints and smudges may be removed using this method. Use caution; rubbing too hard may scratch the

lens. For larger lenses, clean only a small area at a time using a fresh lens tissue on each area. Never reuse cleaning tissues.

### Cleaning Mirrors

You should not have to clean the telescope's mirrors very often; normally once every few years or so. Covering the telescope with the dust covers when it is not in use will prevent dust from accumulating on the mirrors. 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 have virtually no adverse effect on the visual performance of the telescope. The large primary mirror and the elliptical secondary mirror of your telescope are front surface aluminized and over-coated with hard silicon dioxide, which prevents the aluminum from oxidizing. These coatings normally last through many years of use before requiring re-coating.

To clean the secondary mirror, you will need to remove it from the telescope. Before doing so, remove the upper tube section from the assembled telescope. Hold the secondary mirror stationary while loosening the center Phillips-head screw. Handle the mirror by its edge; avoid touching the mirror surface itself. Once the mirror (still in its holder) is removed from the tube, follow the same procedure described below for cleaning the primary mirror. You do not need to remove the secondary mirror from its holder when cleaning.

To clean the primary mirror, you must carefully remove the mirror cell from the telescope. To do this, remove the six screws on the side of the tube near the rear end ring (see **Figure 16**). You do not need to remove the collimation screws on the bottom of the mirror cell. Remove the entire mirror cell from the tube. You will notice the primary mirror is held down with three clips fastened by two screws each. Loosen the screws and remove the clips. There are also three nylon-tipped set screws which support and retain the mirror's edge. These set screws are located on the perimeter of the mirror cell. Use a small flathead screwdriver to loosen each of these set screws a few turns. You may now remove the mirror from the mirror cell. Do not touch the surface of the mirror with your fingers; lift it carefully by its edge.

Set the mirror, aluminized face up, on a clean, soft towel. Fill a clean sink free of abrasive cleanser with room temperature water, a few drops of liquid dishwashing detergent, and, if possible, a capful of 100% isopropyl alcohol. Submerge the mirror (aluminized face up) in the water and let it soak for a few minutes (or hours if it's a very dirty mirror). Wipe the mirror under water with clean cotton balls, using extremely light pressure and stroking in a straight line across the mirror. Use one ball for each wipe across the mirror. Then rinse the mirror under a stream of lukewarm water. Any particles on the surface can be swabbed gently with a series of cotton balls, each used just one time. Dry the mirror in a stream of air (a "blower bulb" works great), or remove any stray drops of water with the corner of a paper towel. Cover the mirror surface with a tissue, and leave the mirror in a warm area until it is completely dry before reassembling the telescope.

## 7. Specifications

### Optical Tube Assembly

Primary mirror:	305mm diameter reflective surface, Pyrex, parabolic, center marked
Focal length:	1500mm
Focal ratio:	f/4.9
Primary mirror cell:	9-point flotation, 3 spring-loaded collimation knobs
Secondary mirror:	70mm minor axis, Pyrex
Secondary mirror holder:	4-vaned spider assembly, 0.7mm thick spider vanes, 3 SHCS for tilt adjustment
Mirror coatings:	Aluminum with SiO <sub>2</sub> overcoat
Finder:	Crayford, accepts 2" and 1.25" eyepieces, 11:1 fine focus knob, all metal construction
Optical tube design:	Truss tube
Truss poles:	8 total (4 truss pole assemblies with 2 poles each), 1.0" outer diameter, aluminum black anodized, captive assembly hardware
Navigation knob:	Included
Optical tube material:	Steel
Tube outer diameter:	14.0"
OTA weight, assembled:	49.5 lbs.
OTA weight, disassembled:	Lower tube section weighs 34.3 lbs., upper tube section weighs 9.36 lbs., truss pole assemblies weigh 1.4 lbs. each
OTA length, assembled:	56"
OTA length, disassembled:	Lower tube section is 26" long, upper tube section is 8" long, truss pole assemblies are 22" long

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## Mount

Dobsonian base: CorrecTension altitude tensioning, side brace supports, carry handle

Azimuth bearing material: Virgin PTFE/UHMW on Ebony Star laminate

Altitude bearing material: Ultra-high molecular weight (UHMW) polyethylene on ABS plastic

Altitude bearing diameter: 8.0"

IntelliScope functionality: Computerized Object Locator system included

Base weight: 34 lbs.

Approximate base dimensions: 25" diameter x 30.5" tall

## Accessories

2" Eyepiece: 35mm Deep View, multi-coated, threaded for Orion filters

1.25" Eyepiece: 10mm Sirius Plössl, multi-coated, threaded for Orion filters

Eyepiece magnifications: 43x and 150x

Finder scope: 9x power, 50mm aperture, achromatic, crosshairs, 5° field of view

Finder scope bracket: Spring-loaded X-Y adjustment, dovetail base

Eyepiece rack: Holds three 1.25" eyepieces and one 2" eyepiece

Cooling accelerator fan: Included, runs off of 12V DC

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## 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](http://www.OrionTelescopes.com/warranty).



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