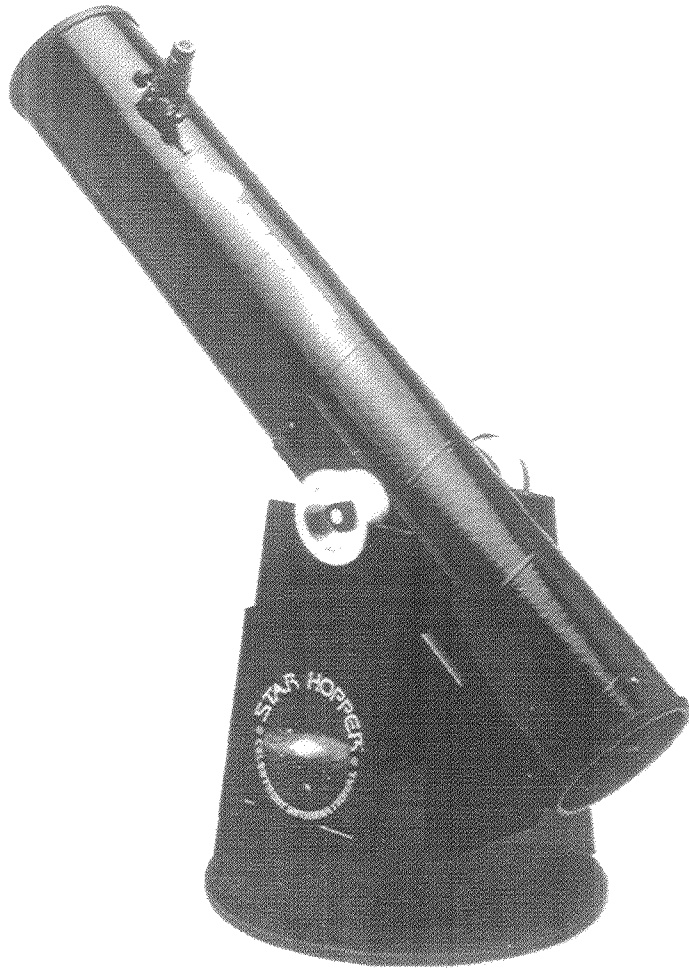


***CELESTRON***®



**STAR HOPPER**®

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**INSTRUCTION MANUAL**

# STAR HOPPER

## INSTRUCTION MANUAL ADDENDUM

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The following instructions on assembling the mount for the Star Hopper 6 and 8, should supersede those found in the Instruction Manual supplied with your CELESTRON STAR HOPPER. Enhancements of the telescope design could not be incorporated in the manual at the time of printing. The instructions on assembling the mount on pages 7 - 9 of the instruction manual should read as follows:

Before the telescope can be used the Dobsonian mount must be assembled. The box with the mount contains the parts necessary for assembly, including:

### **Assembling The Base For The Star Hopper 6" & 8 "**

- Two side panels
  - Front panel
  - Base plate (with the four pre-drilled holes)
  - Ground plate (with the teflon pads)
  - Nylon sleeve
  - Two nylon washers
  - Azimuth pivot bolt
  - Locking nut
  - Wood screws
  - Three rubber feet
  - Plastic screw head caps
1. Locate the front panel and the two side panels of the base (refer to Figure 1 to identify all the parts referred to in these instructions).
  2. Align the predrilled holes of the side panels with the holes on the edge of the front panel and attach using four of the wood screws. Do not completely tighten the screws yet. ( The Star Hopper® logo should be facing the outside of the base).
  3. Turn the side panel assembly upside down on a flat surface and align the predrilled hole on the base plate with the holes on the bottom of the side panels.
  4. Use the remaining wood screws to fasten the base plate to the side panels by inserting the screws through the countersunk holes and tightening until the head of the screw is below the surface of the base plate.
  5. Press on the black plastic caps over the heads of the wood screws.
  6. Screw the rubber feet into the bottom of the ground plate. Position the feet so they are directly under the three teflon pads on the other side of the ground plate.
  7. Place the base plate with side panels attached on top of the teflon pads of the ground plate and align the center holes.

8. Insert the nylon sleeve into the center hole of the base plate until it is flush with the top surface.
9. Place a nylon washer over the azimuth pivot bolt, and insert the bolt through the center hole of the ground plate and through the nylon sleeve.
10. Thread the azimuth pivot bolt into the T-nut at the bottom of the ground plate and tighten. (Note: If the center bolt is over-tightened it will make the base difficult to rotate in azimuth).

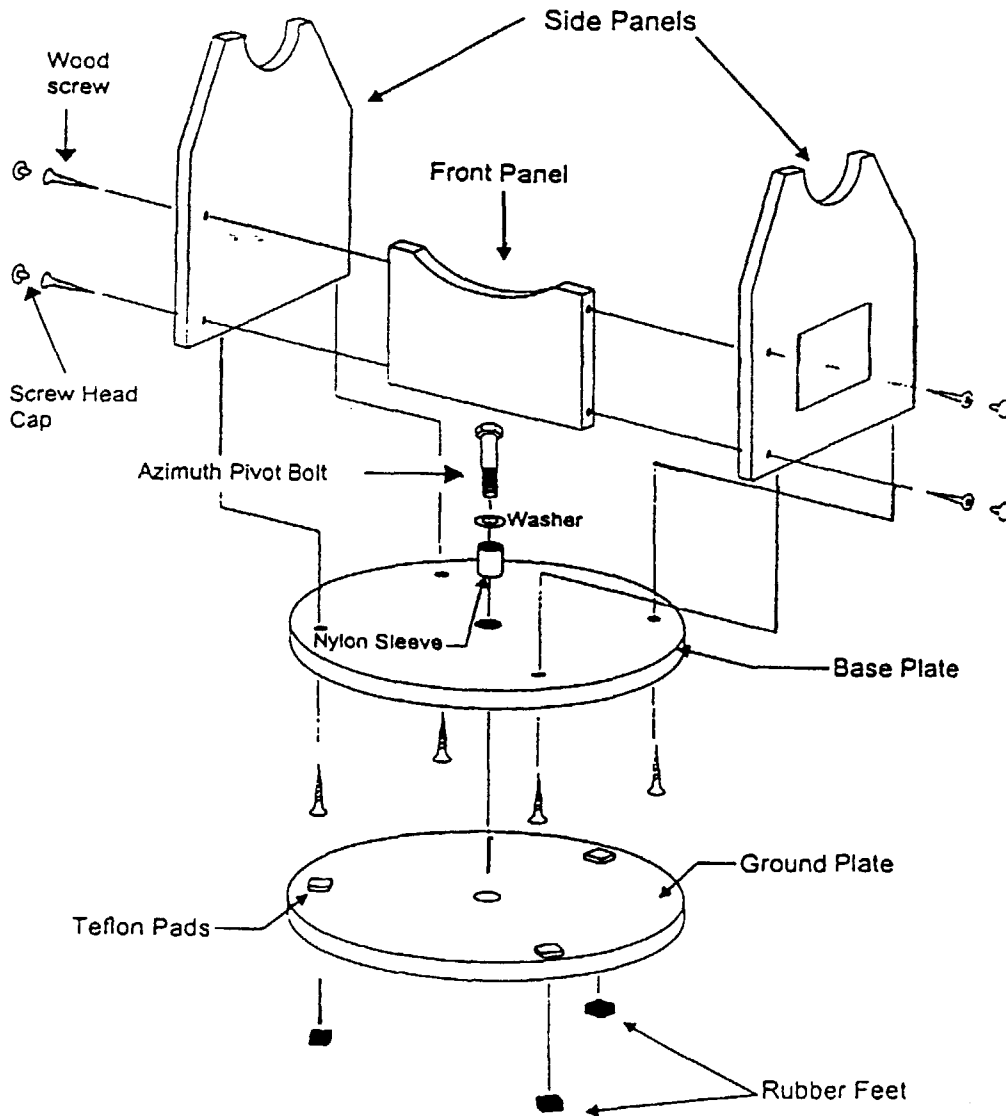


Figure 1

## TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	2
Diagram of <b>Star Hopper</b> <sup>®</sup> 4½ .....	4
Diagram of <b>Star Hopper</b> <sup>®</sup> 6 & 8 .....	5
<b>GLOSSARY</b> .....	6
<b>UNPACKING the Star Hopper</b> <sup>®</sup> 6 and 8 .....	7
<b>ASSEMBLY of the Star Hopper</b> <sup>®</sup> 6 and 8 .....	7
<i>Assembling the Mounting</i> .....	7
<i>Assembling the Optical Tube</i> .....	9
<i>Mounting the Primary Mirror</i> .....	10
<b>BALANCING THE TELESCOPE</b> .....	11
<b>INSTALLING OPTIONAL FINDERSCOPIES</b> .....	12
<b>COLLIMATION</b> .....	12
<i>Aligning the Secondary Mirror</i> .....	13
<i>Aligning the Primary Mirror</i> .....	13
<b>NIGHT TIME STAR COLLIMATING</b> .....	13
<b>TELESCOPE BASICS</b> .....	15
<i>Focusing the Telescope</i> .....	15
<i>Pointing the Telescope</i> .....	16
<i>Calculating Magnification</i> .....	16
<i>Determining Field of View</i> .....	16
<b>CELESTIAL OBSERVING</b> .....	17
<i>Observing the Moon</i> .....	17
<i>Observing the Planets</i> .....	17
<i>Observing the Sun</i> .....	17
<i>Observing Deep-Sky Objects</i> .....	18
<i>Star Hopping</i> .....	18
<b>"SEEING CONDITIONS"</b> .....	20
<i>Transparency</i> .....	20
<i>Sky Illumination</i> .....	20
<i>Seeing</i> .....	21
<b>CLEANING THE OPTICS</b> .....	22
<b>TECHNICAL SPECIFICATIONS</b> .....	23
<b>OPTIONAL ACCESSORIES</b> .....	24

## INTRODUCTION

Congratulations on your purchase and welcome to the **Celestron** world of astronomy. If you're a newcomer to the hobby of astronomy, some of the terms and telescope components described in this instruction manual may be new to you. To assist you in assembling and operating your telescope, the next few pages will explain some commonly used terms and show diagrams of your new telescope and its components. If you're already well-versed in the language of astronomy and telescopes, you might want to review these sections, then move on to unpacking and assembling your new **Celestron** telescope.

Please note that the **Star Hopper® 4½** comes pre-assembled, so the sections that will be most useful to you initially are about setting your telescope up for use, including:

Balancing the telescope - page 11

Collimation - pages 12-14

Telescope basics - pages 15 -16

You'll also find this instruction manual contains a wealth of useful information on celestial observing, commonly used terms in astronomy, instruction on the care of your telescope, and optional accessories to enhance your viewing experience.

**Celestron's Star Hopper®** Dobsonians are designed for beginners, yet they include advanced features that even an experienced observer will appreciate. Below is an overview of these features, followed by more detailed information in the next section.

### • Balance Systems

**Star Hoppers** provide smooth, low friction altitude movement, allowing quick and easy balancing when using optional accessories, such as heavier oculars or finderscopes. Without proper balance, such fine aiming adjustments as centering an object in a high power eyepiece are difficult. **Celestron** is the only company to offer an adjustable counterbalance system standard on its Dobsonian telescopes. In addition, the telescope tube ring on the **Star Hopper® 4½** allows for rotation of the telescope tube in a circular motion, for easy adjustment while observing.

### • Optics

The **Star Hopper® 4½** mirror cell is carefully designed to support the telescope's optical elements, without stressing or pinching them, a common source of image distortion with other designs. This system keeps the optics clean and the low mass primary mirror means cool down time is short.

The **Star Hopper® 6 and 8** feature **Celestron's V-Spectrum LTM (low thermal mass) Optical System**. This system includes a unique molded Pyrex mirror, multicoated for increased reflectivity. It's mounted on the **Pinnacle** mirror cell and provides superior optical and thermal qualities.

The **V- Spectrum LTM** mirror is manufactured and hand figured to reach the optimal marriage of weight to optical surface, resulting in a mirror with 40% less mass than traditional mirrors. Reduced mass lowers the "cool down" period required to bring the mirror to ambient temperature, leaving more time for observing.

The **Pinnacle** mirror cell features a mirror adjustment system that allows for fast collimation when using the supplied collimation tool.

Our unique and heavy duty, single vane secondary mirror bracket creates minimal obstruction. This allows more light to reach the primary mirror, which in turn provides a brighter image and better resolution.

• **Inner Diameter Tubes**

Celestron's Star Hopper® Dobsonians (6" and 8") have their primary mirrors housed in oversized, flat black, anti-reflective painted tubes, which reduce light scatter and tube currents, increasing image sharpness. These large telescope tubes also increase image contrast and improve "seeing" when viewing planets and the moon.

**Rack and Pinion Focuser**

The Star Hoppers use a Rack and Pinion focuser which accepts 1 1/4" oculars. This type of focuser is more convenient to use than helical focusers, which many other Dobsonians feature.

**Altazimuth Mount**

Our unique altazimuth mount features a 10° angled rocker box as its base on the Star Hopper® 6 and 8, for increased stability and ease of use.

**CAUTION: READ THIS SECTION BEFORE USING YOUR TELESCOPE**

Your Celestron Star Hopper® telescope is designed to give you hours of fun and rewarding observations. However, there are a few things to be aware of before using your telescope that will ensure your safety and protect your equipment.

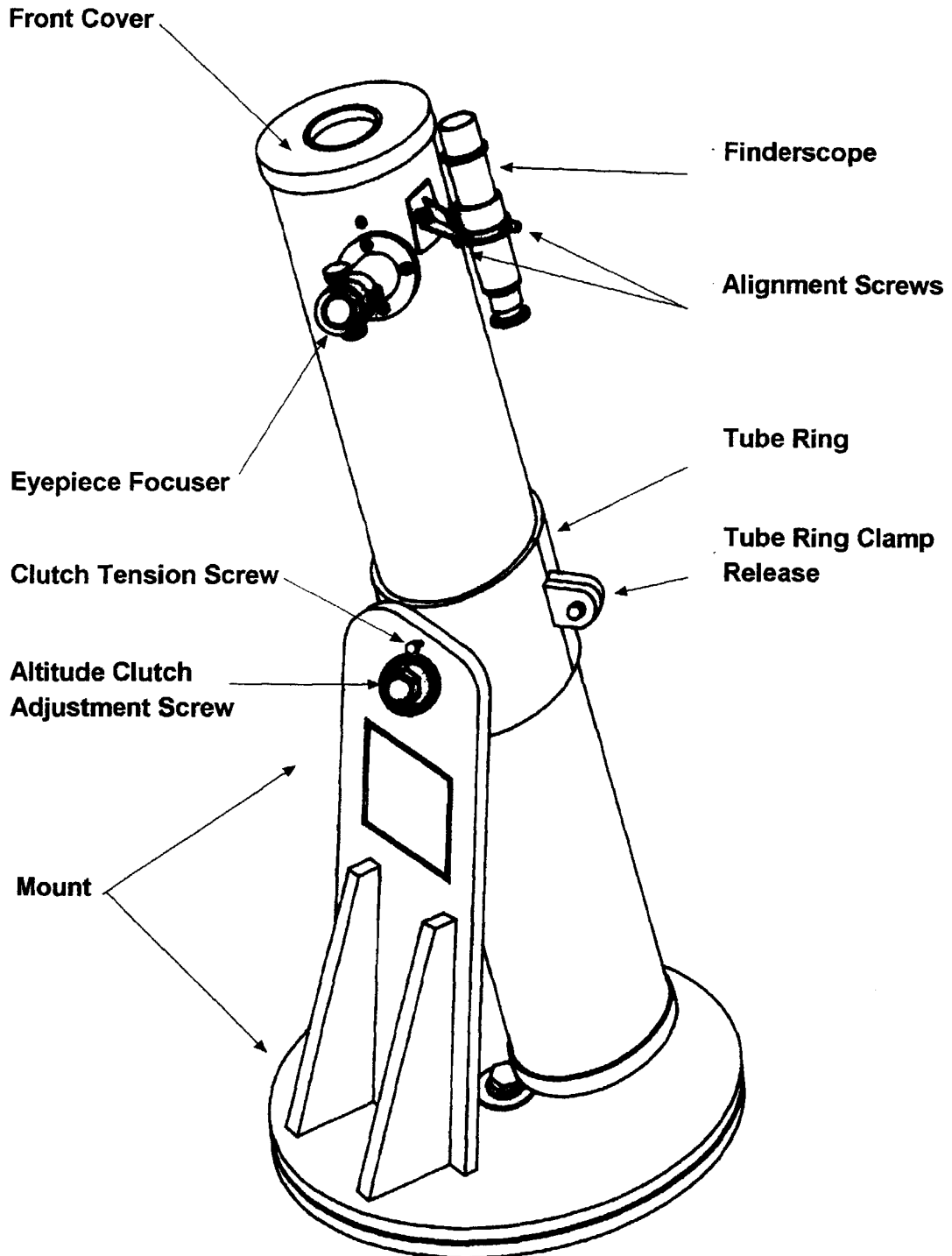
NEVER LOOK DIRECTLY AT THE SUN WITH THE NAKED EYE OR WITH A TELESCOPE. NEVER POINT YOUR TELESCOPE AT THE SUN UNLESS YOU ARE USING THE PROPER SOLAR FILTER. PERMANENT AND IRREVERSIBLE EYE DAMAGE MAY RESULT.

NEVER USE YOUR TELESCOPE TO PROJECT AN IMAGE OF THE SUN ONTO ANY SURFACE. INTERNAL HEAT BUILD-UP CAN DAMAGE THE TELESCOPE AND/OR ANY ACCESSORIES THAT MAY BE ATTACHED TO IT.

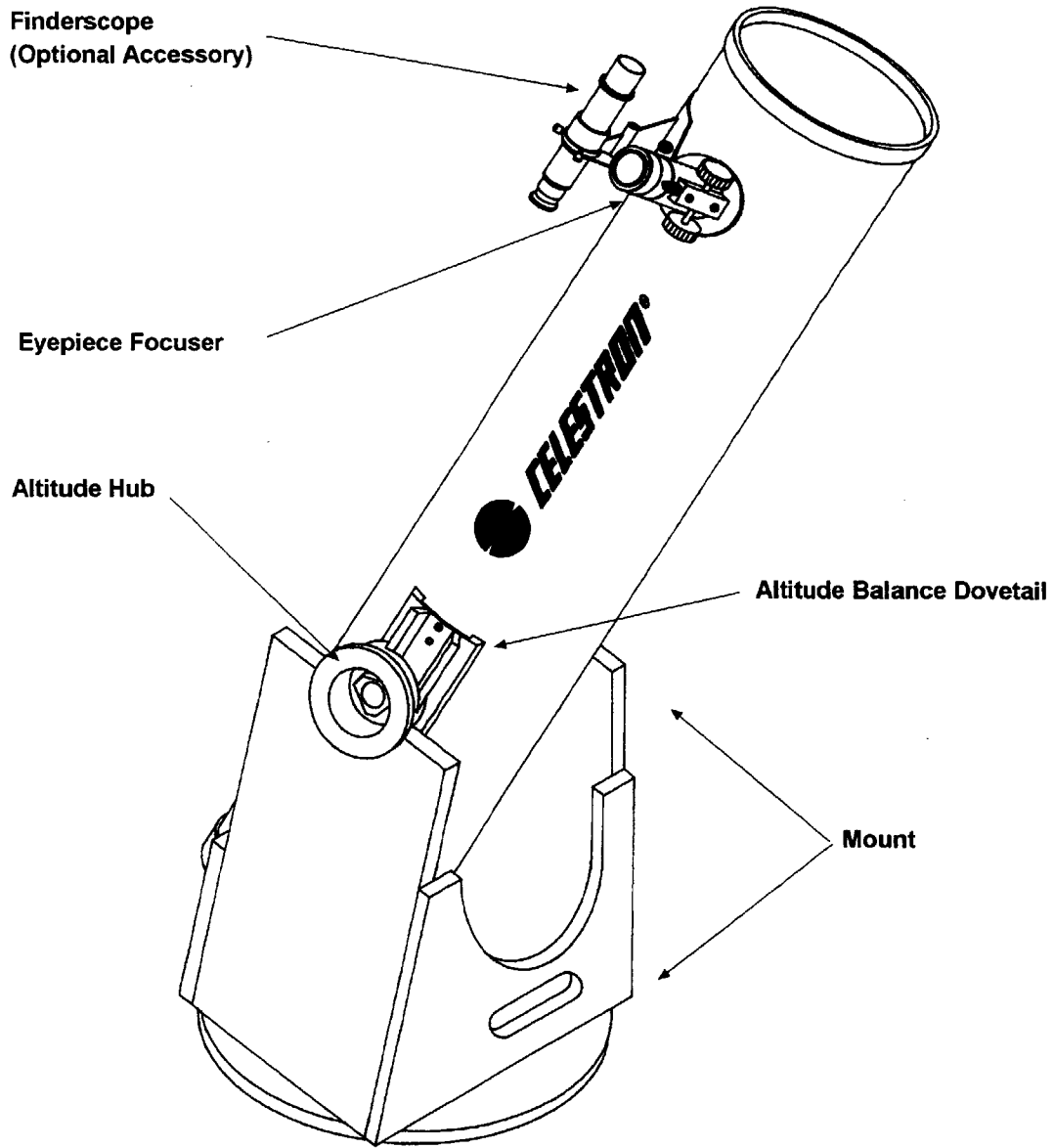
NEVER LEAVE YOUR TELESCOPE UNSUPERVISED, ESPECIALLY WHEN CHILDREN ARE PRESENT. THIS ALSO HOLDS TRUE FOR ADULTS WHO MAY NOT BE FAMILIAR WITH THE CORRECT OPERATING PROCEDURES FOR YOUR TELESCOPE.

NEVER USE AN EYEPIECE SOLAR FILTER OR A HERSHEY WEDGE. INTERNAL HEAT BUILD-UP WITHIN THE TELESCOPE CAN CAUSE THESE DEVICES TO CRACK, BREAK OR DAMAGE YOUR TELESCOPE. ANY SOLAR FILTER USED SHOULD BE A FILTER FOR THE PRIMARY LENS, SUCH AS CELESTRON'S SOLAR SKREEN (SEE OPTIONAL ACCESSORIES ON PAGES 22 -23).

ALWAYS COVER A FINDERSCOPE (IF INSTALLED) WHEN USING YOUR TELESCOPE WITH THE CORRECT SOLAR FILTER. ALTHOUGH SMALL IN APERTURE, THIS INSTRUMENT HAS ENOUGH LIGHT GATHERING POWER TO CAUSE PERMANENT AND IRREVERSIBLE EYE DAMAGE. THE IMAGE PROJECTED BY THE FINDERSCOPE IS HOT ENOUGH TO BURN SKIN OR CLOTHING.



Star Hopper® 4 1/2



**Star Hopper® 6 and 8**

## GLOSSARY

**Altazimuth mount** - the simplest type of mount, with two motions: altitude (up and down) and azimuth (side-to-side). "Mount" refers to the parts of the telescope supporting the tube, which carries all the telescope's optics. The mount is made up of the ground plate, or base, and the rocker box.

**Altitude clutch adjustment screw** - used on the **Star Hopper 4½** to adjust the clutch tension on the altitude axis.

**Altitude hubs** - used on the **Star Hopper 6** and **8** to provide an axis of rotation for altitude adjustments.

**Aperture** - the diameter of the main optical element of the telescope; either the primary mirror or objective lens. The larger the aperture, the more light the telescope collects. More light creates a brighter, sharper image.

**Barlow lens** - these lenses are optional accessories that double the magnifying power of your eyepieces by increasing their effective focal length. For example, an 18mm eyepiece mounted on a 2x Barlow lens would have the magnifying power of a 9mm eyepiece. It's like having two eyepieces in one - an economical way to increase your range of magnifications without buying new eyepieces.

**Collimation** - the proper alignment of the optical elements in a telescope, which is critical to achieving optimum results. Poor collimation results in visual aberrations and distorted images. A full description of how to collimate your telescope follows on pages 12 - 14.

**Collimation cap** - a tool for aligning the optics in a telescope. The optics to be aligned in the **Star Hopper** telescopes are the primary mirror and the secondary mirror.

**Deep-sky objects** - celestial objects outside the boundaries of our solar system.

**Dobsonian telescope** - simple, azimuth mounted Newtonian telescope.

**Extended objects** - large celestial objects, other than stars, such as nebulae and galaxies.

**Field of view** - the size, in degrees, of the area you can see through the eyepiece of your telescope.

**Finderscope** - a low power telescope with cross hairs mounted to the side of a higher powered telescope, used to locate objects more easily.

**Focal length** - the distance from the optical center of the lens to the point where the incoming light rays converge, creating a clear, focused image.

**Inner diameter** - the measured diameter of the inside of the telescope tube.

**Newtonian reflecting telescope** - generally use a concave parabolic primary mirror to collect and focus incoming light into a flat secondary mirror, which reflects the image into the eyepiece.

**Off-axis coma** - associated mainly with parabolic reflector telescopes, this is a blur caused by the spherical aberration of oblique rays of light passing through a lens. The blur will be more pronounced near the edges of the field of view and have a V-shaped appearance.

**Pinnacle mirror cell** - a stress free support for the primary mirror, made of aluminum to conduct heat away from the mirror for quicker "cool down" time. The cell is designed to allow air flow within the telescope tube, assisting the entire system to reach thermal equilibrium rapidly.

**Primary mirror** - gathers incoming light and forms a sharply focused image of the object being viewed.

**Refracting telescope** - a long, thin tube in which light passes in a straight line from the front objective lens directly to the eyepiece at the opposite end of the tube.

**Secondary mirror** - reflects light from the primary mirror to the eyepiece. It's also known as a diagonal mirror because it is at 45° with respect to the optical axis.

**"Seeing" or "seeing conditions"** - refer to the stability of the atmosphere, transparency and sky illumination. See pages 20 and 21 for a full description.

**Thermal turbulence** - turbulence caused by temperature variations. Some sources are differences in temperature between the telescope tube and the air within it, or viewing near a heat source, such as a parking lot releasing stored daytime heat.

**Tube currents** - convection currents within the telescope caused by differences in temperature between the air and the telescope tube. These currents form near the wall of the telescope tube, therefore the **Star Hopper's** oversized tube is very beneficial in reducing interference caused by currents.

**V-Spectrum Low Thermal Mass Optical System** - a unique **Celestron** optical system utilizing a molded Pyrex mirror for reduced thermal mass, in conjunction with the pinnacle mirror cell (see above).

# INSTRUCTIONS FOR UNPACKING AND ASSEMBLING STAR HOPPER<sup>®</sup> 6 AND 8 TELESCOPES

## UNPACKING

The **Star Hopper<sup>®</sup> 6** and **8** telescopes come in two boxes.

The first box contains the telescope tube, collimating tool, 25mm SMA 1¼" ocular, and the primary mirror, with the pinnacle mirror cell.

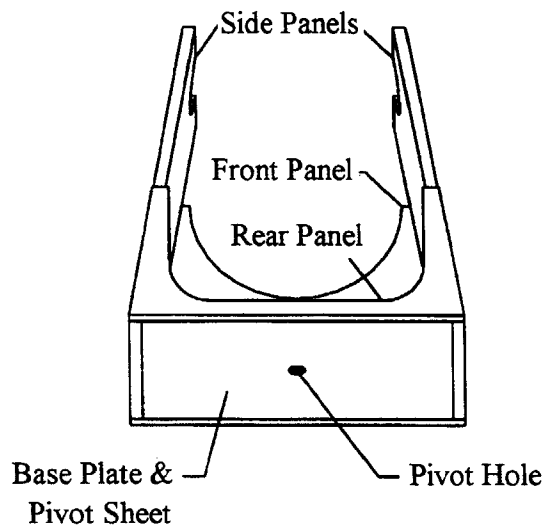
The second box contains the parts necessary to assemble the altazimuth mount, including:

- Two side panels
- Front panel
- Back panel
- Base plate
- Ground plate
- White pivot sleeve
- Azimuth pivot disk
- Four rubber feet (this includes an extra one)
- 24 #8, 1¼" wood screws
- One  $\frac{5}{16}$ -18 x 1¾ hex head cap screw (azimuth pivot screw)
- Azimuth pivot washer

## ASSEMBLY

### Assembling the Mount for the Star Hopper<sup>®</sup> 6 and 8

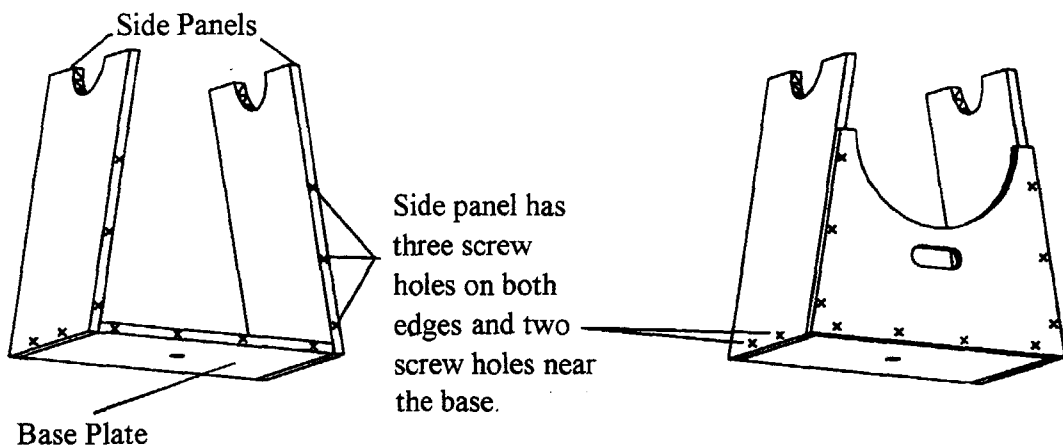
See Figure 1 in order to assemble the mount.



**Figure 1**

1. Locate the base plate. This is the rectangular plate with a white rectangular friction sheet on the bottom. Place the side with the friction sheet down for assembly.
2. Locate the two side panels. The side panels have two inch radius cut outs and **Star Hopper**<sup>®</sup> logos on the outside.
3. Place one side panel, with the radius cut out end up and the **Star Hopper**<sup>®</sup> logo facing out, against the base plate. Line up the two holes in the base plate with the two holes in the side panel. Thread two of the wood screws through the side panel and into the base plate. Do not tighten the screws completely.
4. Place the second side panel against the other side of the base plate and repeat procedure 3.

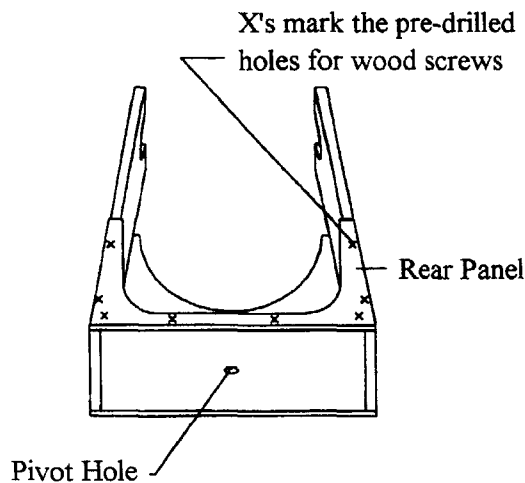
As shown in Figure 2, each side panel has three holes on both edges and two holes near the base. The front and rear panel can be mounted on either side as shown in Figures 3 and 4, with the wood screws supplied.



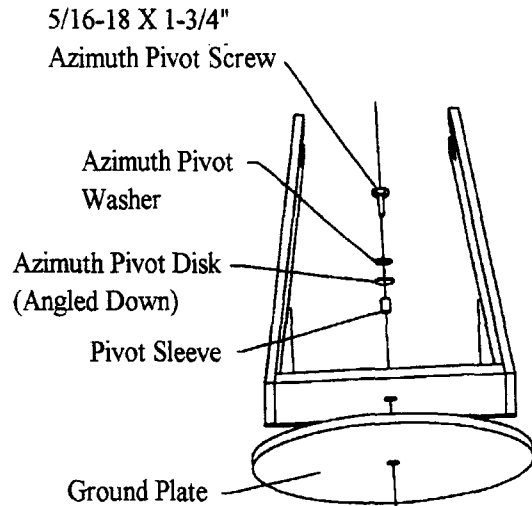
**Figure 2**

**Figure 3**

5. To attach the front panel, place it against the two side panels, as shown in Figure 3. Insert the wood screws through the front panel and into the side panels and the base plate. Attaching the front panel will require ten wood screws. Once again, do not tighten the screws completely.
6. Place the rear panel against the rear of the mount and attach it using eight wood screws. See Figure 4.
7. Make sure all panels are oriented such that all edges and corners are flush, then tighten all screws completely.



**Figure 4**



**Figure 5**

8. Position the round ground plate with its six pads facing up. Place the rocker box on top of the ground plate and insert the white pivot sleeve through the center hole. Line up the hole in the ground plate with that of the base plate. Put the  $\frac{5}{16} \times 1\frac{3}{4}$ " screw with the azimuth pivot washer (small washer) and the azimuth pivot disk (larger, angled washer) through the sleeve in the base plate and into the ground plate. It is essential that the azimuth pivot disk be assembled angling downwards, with the azimuth pivot washer mounted on top of it. Refer to Figure 5 for a pictorial view. Thread the pivot screw into the ground plate Tee-nut and tighten. The washer and screw should be flush against the sleeve, but should not touch the wood.
9. Carefully hammer the three rubber feet onto the bottom of the ground plate. For stability, space them  $120^\circ$  apart and near the outer edge of the plate. You may receive more than three rubber feet, but using just three, evenly spaced as described, will give you the most stable base for your telescope.

The mount is now ready for the telescope tube.

### Assembling the Optical Tube

The optical tube assembly consists of eight parts, all of which are pre-assembled, except for the primary mirror. The parts are as follow:

- Optical tube
- Focuser - .96" and  $1\frac{1}{4}$ "
- Secondary mirror assembly
- Two dovetail brackets
- Two altitude bearings
- V-Spectrum LTM optical system (primary mirror and cell)

## Mounting the Primary Mirror

The primary mirror is mounted on the pinnacle mirror cell at Celestron. The pinnacle mirror cell fits into the rear of the telescope tube and is secured with the three supplied mounting screws. To mount the mirror/cell into the back of the tube:

1. Place the telescope tube on its side.
2. Locate the three holes, which are 120° apart, in the rear of the tube (i.e. the end opposite the focuser).
3. Remove tissue paper from the reflective surface of the mirror.
4. Place the mirror/cell assembly into the rear of the tube, mirror end first.
5. Orient the mirror cell such that the holes on the side of the cell best line up with the holes in the tube. (It may be helpful to rotate the mirror cell 120° in either direction to find the best alignment of the holes).
6. Place a screw through the washer and tube and into the mirror cell. Only thread the first two screws into the mirror cell about two turns allowing enough play to align the third screw.
7. Manually line up the last mirror cell hole with the tube hole and thread the screw into the mirror cell. Don't tighten completely until all three screws are threaded into the mirror cell. Tighten screws sequentially, for balance.

Once the mirror is placed into the tube, it does not need to be removed again. The next thing to do is collimate, or align the optics of the telescope. See the collimation section, on pages 12 and 14.

## Mounting the Primary Mirror (Aluminum tube only)

1. Place the telescope tube on its side.
2. Locate the three holes, which are 120° apart, in the rear of the tube (i.e. the end opposite the focuser).
3. Remove tissue paper from the reflective surface of the mirror.
4. Place a screw through the washer and inside one of the tube holes.
5. From the inside of the tube, place a second washer onto the screw and thread one of the hex head nuts half way onto the screw (See Figure 6).
6. Thread the screw into the mirror cell hole. Only thread the first two screws into the mirror cell about two turns allowing enough play to align the third screw.
7. Manually line up the last mirror cell hole with the tube hole and thread the screw into the mirror cell. Don't tighten completely until all three screws are threaded into the mirror cell. Tighten screws sequentially, for balance.

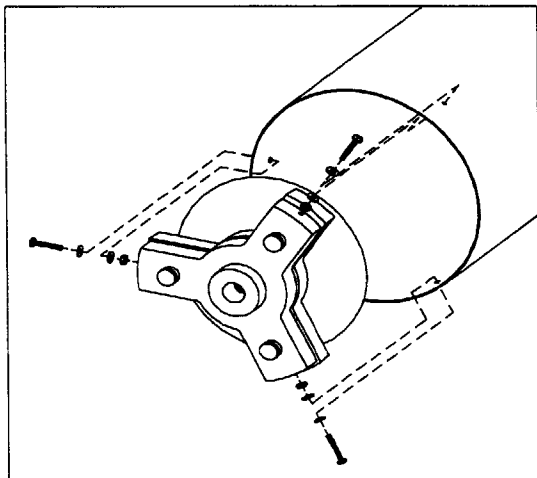
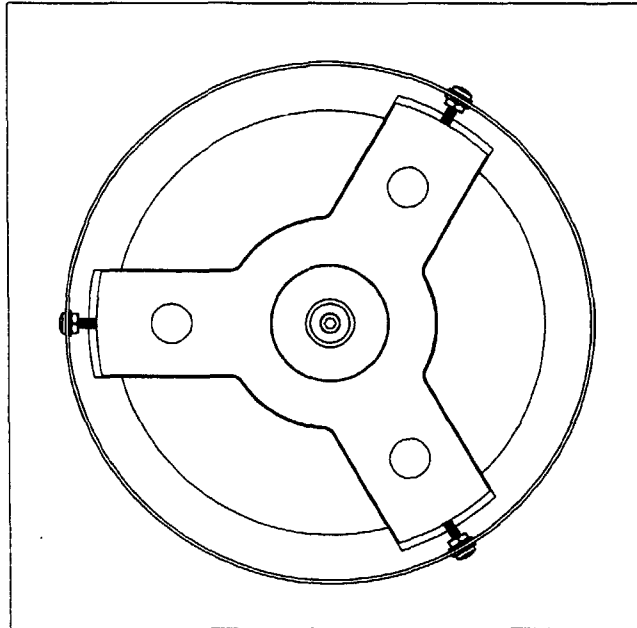


Figure 6 -- Aluminum tube only

8. After all three screws are in place, tighten the hex nut against the inner wall of the tube locking the mirror cell in place (See Figure 7).



*Figure 7 -- Rear view of aluminum tube model*

## Balancing the Telescope

The **Celestron Star Hopper**<sup>®</sup> 6 and 8 come with dovetail slide bars for balancing. This feature allows virtually any optional accessory to be used with the telescopes, while still achieving balance easily. To balance the telescope:

- Put the telescope tube in the rocker box.
- Orient the telescope tube so it is horizontal.
- With the telescope in the horizontal position, loosen the altitude hubs on both sides of the telescope.
- Slide the telescope in whichever direction it needs to go in order to achieve balance. If the telescope rotates such that the front of the tube goes up, then slide the telescope forward and try again. If the rear goes up, then slide the telescope toward the rear.
- Once a balanced position has been found, make sure the sides of the telescope tube are parallel to the sides of the rocker box by moving the telescope tube slightly left or right within the rocker box, as needed.
- Tighten the altitude hubs.

### Balancing the Star Hopper<sup>®</sup> 4 $\frac{1}{2}$

- Place the standard eyepiece in the focuser (or any optional eyepiece you choose).
- Place the telescope tube in the horizontal position.
- Loosen the clamp release screw on the tube ring. This allows the telescope tube to slide back and forth in the ring.
- Slide the telescope, forward or backward, in the tube ring until the telescope is balanced.
- Tighten the clamp release screw on the tube ring.

## Adjusting the friction on the Star Hopper® 4½ altitude axis

To accommodate individual preferences, the clutch tension is adjustable, but after a desired clutch tension is set, there is no need to adjust it again. When properly adjusted, clutch tension should be light enough that the telescope can move smoothly and easily, but tight enough that the wind won't move the telescope.

### To adjust the clutch tension:

- Balance the telescope and orient the tube in a horizontal position (see section above on balancing the telescope).
- Using the diagram on page 4, locate the altitude clutch adjustment screw. It is the bolt attaching the telescope mounting ring to the mount.
- Use a wrench to tighten or loosen the bolt until the desired clutch tension is achieved.
- **IMPORTANT:** Don't over tighten the bolt, as this could result in cracking the wood of the mount.
- A plastic screw is provided to give increased friction when viewing either with the telescope tube pointed straight up, or in high wind conditions. This screw should make contact with the rotation disk (inside the side panel) that the telescope is attached to without pressing hard against it, which would hinder altitude movement. **NOTE:** When viewing objects near the zenith (straight up in the sky) the finderscope should be pointed either toward the side panel or at a 180° angle away from it, for optimal balance.

## Installing Finderscopes (Optional Accessory)

Celestron offers optional finderscopes that are useful in pointing the telescope at a particular object and locating it in your field of view. A finderscope is a small auxiliary telescope with cross hairs, of low power, but with a wide field of view, and is attached to the main telescope. The Star Hopper® 4½ comes with a 5x24 finderscope. The Star Hopper® 6 and 8 telescopes have a set of pre-drilled holes for the 6x30 finderscope, (item #93777) or the 5x24 finderscope (#93775). To install the finderscope, locate the two holes next to the focuser on the telescope tube. Place the finderscope bracket on the telescope tube and line up the holes in the base of the bracket with the holes in the tube. Use the screws and nuts provided with the finderscope to attach the bracket to the telescope tube. Do this by putting the screws through the finderscope bracket and into the pre-drilled holes in the telescope tube, then tightening them.

Besides the 6x30 or 5x24, another excellent finderscope option for the Star Hopper® 6 and 8 is Celestron's Star Pointer (item #51630). For more options, see the Optional Accessories section on pages 24 and 25.

## Collimation

The optical performance of most Newtonian reflecting telescopes can be optimized by re-collimating (aligning) the telescope's optics, as needed. To collimate the telescope simply means to bring its optical elements into balance. Poor collimation will result in optical aberrations and distortions.

Before collimating your telescope, take time to familiarize yourself with all its components, using the diagrams on pages 4 and 5. The primary mirror is the large mirror at the back end of the telescope tube. This mirror is adjusted by loosening and tightening the three screws, placed 120 degrees apart, at the end of the telescope tube. The secondary mirror (the small, elliptical mirror under the focuser, in the front of the tube) also has three adjustment screws. To see what is necessary to go through the following steps, point your telescope toward a bright wall or blue sky outside (see warning on page 3 regarding safe solar viewing). Once you have collimated your telescope, refer to the chart on page 15 to confirm that your alignment is correct.

**Do not touch the socket head cap screw in the center of the mirror cell of the Star Hopper® 6 and 8.**

## **Aligning the Secondary Mirror**

If you have an eyepiece in the focuser, remove it. Pull the focuser tube in completely, using the focusing knobs, until its silver tube is no longer visible. You will be looking through the focuser at a reflection of the secondary mirror, projected from the primary mirror. During this step, ignore the silhouetted reflection from the primary mirror. Insert the collimating cap into the focuser and look through it. With the focus pulled in all the way, you should be able to see the entire primary mirror reflected in the secondary mirror. If the primary mirror is not centered in the secondary mirror, adjust the secondary mirror screws by alternately tightening and loosening them until the periphery of the primary mirror is centered in your view. **DO NOT** loosen or tighten the center screw in the secondary mirror support, because it maintains proper mirror position.

## **Aligning the Primary Mirror**

Now adjust the primary mirror screws to re-center the reflection of the small secondary mirror, so it's silhouetted against the view of the primary. As you look into the focuser, silhouettes of the mirrors should look concentric. Repeat steps one and two until you have achieved this.

Remove the collimating cap and look into the focuser, where you should see the reflection of your eye in the secondary mirror.

## **Night Time Star Collimating**

After successfully completing daytime collimation, night time star collimation can be done by closely adjusting the primary mirror while the telescope tube is on its mount and pointing at a bright star. The telescope should be set up at night and a star's image should be studied at medium to high power (30-60 power per inch of aperture). If a non-symmetrical focus pattern is present, then it may be possible to correct this by re-collimating only the primary mirror.

### **Procedure**

**(Please read this section completely before beginning)**

To star collimate in the Northern Hemisphere, point at a stationary star like the North Star (Polaris). It can be found in the north sky, at a distance above the horizon equal to your latitude. It's also the end star in the handle of the Little Dipper. Polaris is not the brightest star in the sky and may even appear dim, depending upon your sky conditions.

Prior to re-collimating the primary mirror, locate the collimation screws on the end plate at the base of the telescope tube. These three screws are to be adjusted one at a time. Normally, motions on the order of an  $\frac{1}{8}$  turn will make a difference, with approximately a  $\frac{1}{2}$  to  $\frac{3}{4}$  turn being the maximum required.

With Polaris or a bright star centered within the field of view, focus with either the standard ocular or your highest power ocular, i.e. the shortest focal length in mm, such as a 6mm or 4mm. Another option is to use a longer focal length ocular with a Barlow lens. When a star is in focus it should look like a sharp pinpoint of light. If, when focusing on the star, it is irregular in shape or appears to have a flare of light at its edge, this means your mirrors aren't in alignment. If you notice the appearance of a flare of light from the star that remains stable in location, just as you go in and out of exact focus, then re-collimation will help sharpen the image.

Take note of the direction the light appears to flare. For example, if it appears to flare toward the three o'clock position in the field of view, then you must move whichever screw or combination of collimation screws necessary to move the star's image toward the direction of the flaring. In this example, you would want to move the image of the star in your eyepiece, by adjusting the collimation screws, toward the three o'clock position in the field of view. It may only be necessary to adjust a screw enough to move the star's image from the center of the field of view to about halfway, or less, toward the field's edge (when using a high power ocular).

Collimation adjustments are best made while viewing the star's position in the field of view and turning the adjustment screws simultaneously. This way, you can see exactly which way the movement occurs. It may be helpful to have two people working together: one viewing and instructing which screws to turn and by how much, and the other performing the adjustments.

**IMPORTANT:** After making the first, or each adjustment, it is necessary to re-aim the telescope tube to re-center the star again in the center of the field of view. The star image can then be judged for symmetry by going just inside and outside of exact focus and noting the star's pattern. Improvement should be seen if the proper adjustments are made. Since three screws are present, it may be necessary to move at least two of them to achieve the necessary mirror movement.

## **ANSWERS TO FREQUENTLY ASKED QUESTIONS**

**Q.** If I re-collimate the primary mirror, will alignment remain as I set it?

**A.** Yes, unless or until the telescope is severely jarred or bumped.

**Q.** Is exact collimation necessary?

**A.** For the majority of users, the collimation of the telescope, as delivered, will be satisfactory. Probably only those requiring extremely sharp imagery will want or need to perform collimation, and then only once.

**Q.** Why is it necessary to re-center the star after each mirror adjustment?

**A.** All Newtonian telescopes have what is called off-axis coma (see glossary). Due to this, the best images are always obtained in the center of an eyepiece view. Therefore, that is where you should judge star symmetry.

**Q.** On some nights the star's image fluctuates in size, position and symmetry without my doing anything. What is the cause of this?

**A.** This represents turbulent "seeing," which is caused by several factors (please see pages 18 and 19 for a full description). Some steps you can take to minimize visual disturbances are to let the telescope tube remain outside for 30 minutes before judging symmetry, allowing time for the temperature within the telescope tube to balance with that of the outer environment. It will also help to wait for a still night or a still time of night. Further, be aware that using your telescope near a heat source such as a rooftop, car hood or any surface retaining daytime heat on a cool night will cause local thermal turbulence and must be avoided.

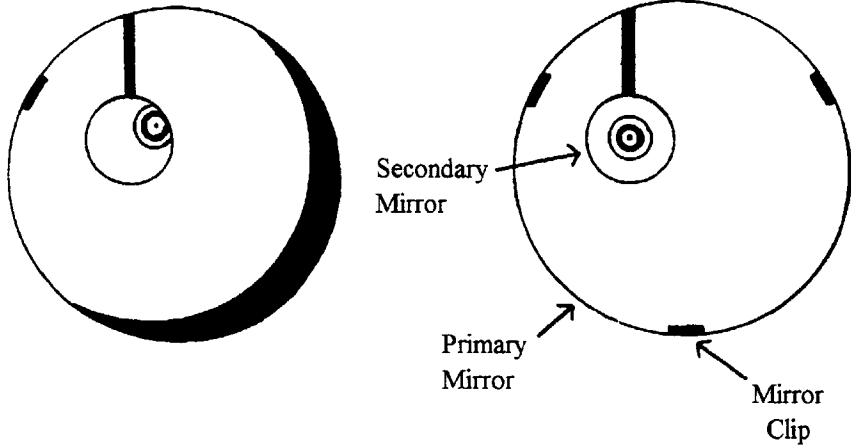
**Q.** What if the daytime adjustment appears off after star collimating the primary mirror at night?

**A.** If star images look great, that is the bottom line. No further adjustment is necessary.

## Newtonian collimation views as seen through the focuser using the collimation cap

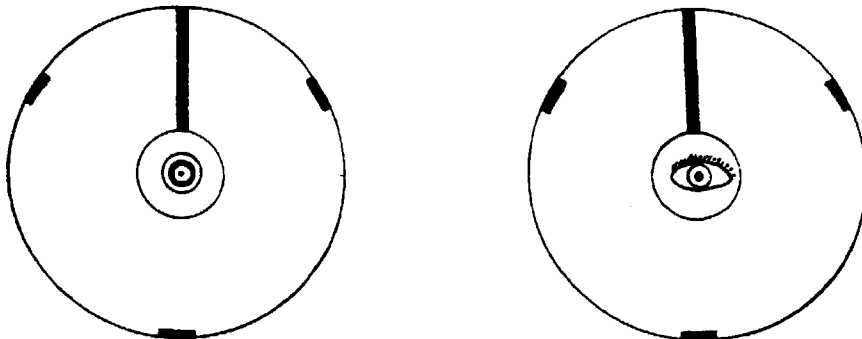
Secondary mirror needs adjustment.

Primary mirror needs adjustment.



Both mirrors aligned with the collimating cap in the focuser.

Both mirrors aligned with your eye looking into the focuser.



## TELESCOPE BASICS

### Focusing the Telescope

To focus your telescope, begin by putting the eyepiece in the eyepiece holder of the focuser. When doing astronomical viewing, you'll find that out of focus star images are very diffuse and difficult to see. Therefore, choose a bright object, like the moon or a planet for your first astronomical target. This way, the image will be visible even when out of focus. Turn the focus knob until the object's image becomes sharp. If you're focusing on a star, its image should, as closely as possible, resemble a pinpoint. If you're focusing on the moon or a planet, turn the focus knob until the image is sharp.

## Pointing the Telescope

To aim your telescope, first locate a bright star near the object you are trying to find. You can then use your telescope tube to sight with, helping to zero in on the object you wish to view. This can be done much as you might sight down the barrel of a gun when lining up a shot. The idea is to use the line of the telescope tube to assist you in creating a visual line between your eye and the object you want to view. Once the star is aligned with the edge of the telescope tube, look inside the eyepiece and gently move the tube up and down and from side to side until you see the object in the field of view. Use of an optional finderscope makes locating objects for viewing much easier.

## Calculating Magnification

You can change the viewing power of your **Celestron Star Hopper**<sup>®</sup> telescope just by changing the eyepiece (ocular). There are various optional eyepieces shown in the Optional Accessories section of this manual on pages 24 and 25. To determine the magnification of your telescope, simply divide the focal length of the telescope by the focal length of the eyepiece used. In equation format, the formula looks like this:

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

To determine the magnification using the standard 25mm eyepiece, simply divide the focal length of your 6" or 8" **Star Hopper**<sup>®</sup> telescope (1220mm) by the focal length of the eyepiece (25mm). Dividing 1220mm by 25 yields a magnification of 49 power. Although the power is variable, each telescope, used under average skies, has a limit to its highest useful magnification. The general rule is that 60 power is the maximum that can be used for every inch of aperture, although seeing condition rarely allow this. For example, the **Star Hopper**<sup>®</sup> 8 is 8" in diameter. Multiplying 8 by 60 gives a maximum useful magnification of 480 power. Although this is the maximum useful magnification, most observing is done in the range of 20 to 35 power for every inch of aperture, which is 90 to 158 for the **Star Hopper**<sup>®</sup> 4½, 120 to 210 for the **Star Hopper**<sup>®</sup> 6 and 160 to 280 times for the **Star Hopper**<sup>®</sup> 8.

## Determining Field of View

Determining the field of view is important if you want to get an idea of the angular size of the object you are observing. To calculate the actual field of view, divide the apparent field of the eyepiece (supplied by the eyepiece manufacturer) by the magnification. In equation format, the formula looks like this:

$$\text{True Field} = \frac{\text{Apparent Field of Eyepiece}}{\text{Magnification}}$$

As you can see, before determining the field of view, you must calculate the magnification. Using the example above, we can determine the field of view using the same 25mm eyepiece. The 25mm SMA eyepiece has an apparent field of view of 52°. Divide the 52° by the magnification, which is 49 power. This yields an actual field of 1.06°, or a little over a degree. The apparent field of each eyepiece that **Celestron** manufactures is found in the **Celestron Accessory Catalog** (#93685).

## CELESTIAL OBSERVING

Now that your telescope is set up, you're ready to use it for observing. This section covers visual observing for both solar system and deep-sky objects.

### Observing the Moon

In the night sky, the moon is a prime target for your first look because it is extremely bright and easy to find. Although the beauty of the full moon may make it seem a perfect viewing object, in fact, the light reflected from its fully illuminated face can be overpowering. In addition, little or no contrast can be seen during this phase.

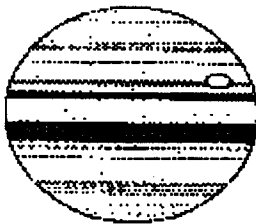
One of the best times to observe the moon is during its partial phases, such as a crescent or quarter moon. At these times, long shadows reveal a great amount of detail on the lunar surface. At low power, with the standard eyepiece, you'll be able to see the whole lunar disk at one time. Change to higher power (magnification) with an optional eyepiece to focus in on a smaller area. Keep in mind that the rotation of the earth will cause the moon to drift out of your field of view. You'll have to manually adjust the telescope to keep the moon centered. This effect is more noticeable at higher power. Consult a current astronomy magazine or your local newspaper to find out the current phase of the moon.

### Lunar Observing Hint

To increase contrast and bring out visible detail on the lunar surface, try using different filters (available through your local **Celestron** dealer). A yellow filter works well for improving contrast.

### Observing the Planets

Other easy targets include the five "naked eye" planets of our solar system, so called because they can be spotted in the night sky by the unaided eye. You can see **Venus** go through its lunar-like phases. **Mars** can reveal a host of surface detail and one, if not both, of its polar caps. You'll be able to see the cloud belts of **Jupiter**, perhaps even the great Red Spot. In addition, you'll be able to see the moons of Jupiter as they orbit the giant planet. **Saturn**, with its beautiful rings, is easily visible at moderate power, as is **Mercury**. All you need to know is where to look. Most astronomy publications indicate where the planets are in the sky each month.



This drawing of Jupiter provides a good representation of what you can expect to see with moderate magnification, during good "seeing" conditions.

### Observing the Sun

Although overlooked by many amateur astronomers, solar observation is both rewarding and fun. However, because the sun is so bright, special precautions must be taken when observing this star, so as not to damage your eyes or your telescope. Never project an image of the sun through the telescope. This can damage the telescope and/or any accessories attached to the telescope. For safe solar viewing, use a **Celestron** solar filter (available for the **Star Hopper**® 4½ and 8). The filter reduces the intensity of the sun's light, making it safe to view. With this filter you can see sunspots as they move across the solar disk and faculae, which are bright patches seen near the sun's edge. If you purchased an optional finderscope, be sure to cover its lens or remove it completely when

observing the sun. This will ensure that the finderscope itself is not damaged and that no one looks through it inadvertently.

## Solar Observing Hints

- The best time to observe the sun is in the early morning or late afternoon, when the air is cooler.
- To locate the sun without a finderscope, watch the shadow of the telescope tube until it forms a circular shadow.

## Observing Deep-Sky Objects

Deep-sky objects are simply those objects outside the boundaries of our solar system. They include star clusters, planetary nebulae, diffuse nebulae, double stars and other galaxies outside our own Milky Way. Unlike the sun, moon and our five major planets, most deep-sky objects are not visible to the naked eye. Finding them requires a method called star hopping, described below. **Celestron Sky Maps (#93722)** can help you locate the brightest deep-sky objects.

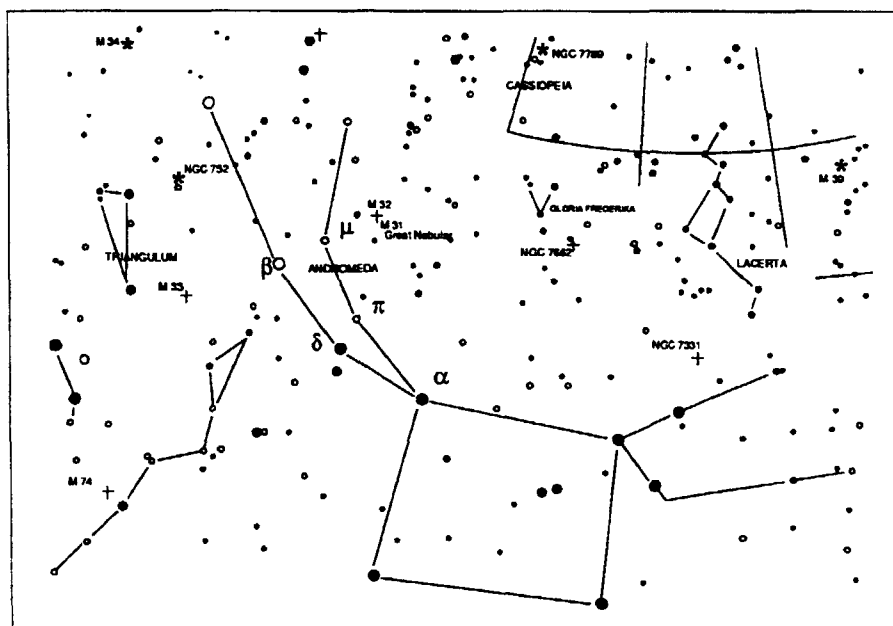
Most deep-sky objects have a large angular size. Therefore, a low-to-moderate power lens is all you need to see them. Visually, they are too faint to reveal any of the color seen in long exposure photographs. Instead, they appear black and white. Because of their low surface brightness, they should be observed from a "dark-sky" location. Light pollution around large urban areas washes out most nebulae making them difficult, if not impossible, to observe.

## Star Hopping

One way to find deep-sky objects is by star hopping and a finderscope is very helpful. Star hopping is done by using bright stars to "guide" you to an object. For successful star hopping, it is helpful to know the field of view of your telescope. If you're using the standard **Celestron 25mm SMA** ocular, your field of view is more than 1°. If you know an object is 3° away from your present location, then you just need to move 3 fields of view. If you're using another ocular, then consult the section on determining field of view on page 16. Listed below are directions for locating two popular objects.

The Andromeda Galaxy, also known as M31, is an easy target. To find M31:

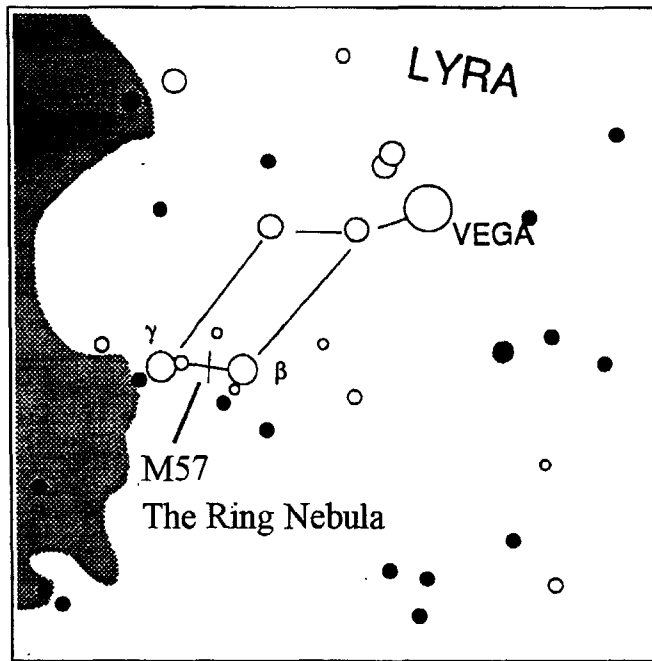
1. Locate the constellation of Pegasus, a large square visible in the fall (in the eastern sky, moving toward the point overhead) and winter months (overhead, moving toward the west).
2. Start at the star in the northeast corner—Alpha ( $\alpha$ ) Andromedae.
3. Move northeast approximately 7°. There you will find two stars of equal brightness—Delta ( $\delta$ ) and Pi ( $\pi$ ) Andromeda—about 3° apart.
4. Continue in the same direction another 8°. There you will find two stars—Beta ( $\beta$ ) and Mu ( $\mu$ ) Andromedae—also about 3° apart.
5. Move 3° northwest—the same distance between the two stars—to the Andromeda galaxy.



Star hopping to the Andromeda Galaxy (M31) is a snap, since all the stars needed to do so are visible to the naked eye.

Star hopping may take some getting used to since you can see more stars through a finderscope (optional with the 6" and 8") than you can see with the naked eye. Also, some objects are not visible in a finderscope. One such object is M57, the famed Ring Nebula. Here's how to find it:

1. Find the constellation of Lyra, a small parallelogram visible in the summer and fall months. Lyra is easy to pick out because it contains the bright star Vega.
2. Start at the star Vega—Alpha ( $\alpha$ ) Lyrae—and move a few degrees southeast to find the parallelogram. The four stars that make up this geometric shape are all similar in brightness, making them easy to see.
3. Locate the two southernmost stars that make up the parallelogram—Beta ( $\beta$ ) and Gamma ( $\gamma$ ) Lyra.
4. Point the finderscope halfway between these two stars.
5. Move about  $\frac{1}{2}^\circ$  toward Beta ( $\beta$ ) Lyra, while remaining on a line connecting the two stars.
6. Look through the telescope and the Ring Nebula should be in your field of view. The Ring Nebula's angular size is quite small and, therefore, not visible in the finderscope.
7. Because the Ring Nebula is rather faint, you may need to use "averted vision" to see it. "Averted vision" is a technique of looking slightly away from the object you're observing. So, if you are observing the Ring Nebula, center it in your field of view and then look off toward the side. This causes light from the object viewed to fall on the black and white sensitive rods of your eyes, rather than your eyes color sensitive cones. These two examples should give you an idea of how to star hop to deep-sky objects. To use this method on other objects, consult any of the star atlases, then star hop to the object of your choice using "naked eye" stars.



Although the Ring Nebula lies between two “naked eye” stars, it may take a little time to locate because it isn’t visible in a finderscope. Note that the scale for this star chart is different from that of the chart on the previous page, which shows several constellations, including Pegasus, Triangulum and Andromeda.

## “Seeing” Conditions

Viewing conditions affect what you can see through your telescope during an observing session. Conditions include transparency, sky illumination and “seeing”. Understanding viewing conditions and the affect they have on observing will help you get the most out of your telescope.

### Transparency

Transparency refers to the clarity of the atmosphere and is affected by clouds, moisture, dust and other airborne particles. Thick cumulus clouds are completely opaque, while cirrus clouds can be thin, allowing light from the brightest stars through. Hazy skies absorb more light than clear skies, making fainter objects hard to see and reducing contrast on brighter objects. Dust particles and gases ejected into the upper atmosphere from volcanic eruptions also affect transparency. Ideal conditions are when the night sky is inky black.

### Sky Illumination

General sky brightening caused by the moon, aurorae, natural airglow and light pollution greatly effect transparency. While not a problem when viewing brighter stars and planets, bright skies reduce the contrast of extended nebulae, making them difficult, if not impossible, to see. To maximize your observing, limit deep-sky viewing to moonless nights, far from the light polluted skies found around major urban areas. Light Pollution Reduction (LPR) filters enhance deep-sky viewing from light polluted areas by blocking unwanted light, while transmitting light from certain deep-sky objects. Planets and stars can still be observed from light polluted areas or when the moon is out.

## "Seeing"

The terms "seeing conditions" or "seeing" refer to the stability of the atmosphere, which directly effects the amount of fine detail seen in extended objects. Essentially, extended objects are objects other than stars, of some size, such as nebulae and galaxies.

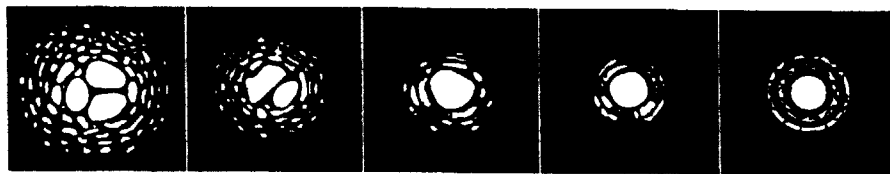
The air in our atmosphere acts as a lens, which bends and distorts incoming light rays. The amount of bending depends on air density. Varying temperature layers have different densities and, therefore, bend light differently. Light rays from the same object arrive slightly displaced, creating an imperfect or smeared image. These atmospheric disturbances vary from time-to-time and place-to-place. Another form of turbulence that effects seeing conditions is referred to as "air parcels". These air parcels are the smaller turbulence patterns in the air, within your immediate environment. The size of the air parcels, compared to the aperture of your telescope, also determines seeing quality. Under good seeing conditions, fine detail is visible on the brighter planets like Jupiter and Mars, and stars are pinpoint images. Under poor seeing conditions, images are blurred and star images are diffuse. Seeing conditions are rated on a five-point scale with one being the worst condition and five the best. Seeing conditions can be classified in one of three categories. The definitions of these categories are based on the causes of the different seeing conditions.

**Type 1** seeing conditions are characterized by rapid changes in the image seen through the telescope. Extended objects, like the moon, appear to shimmer while point sources (stars) appear double. Type 1 seeing is caused by air currents within, or very close to, the telescope tube. These currents are caused by a telescope that has not reached thermal equilibrium with the outdoor surroundings or heat waves from people standing near the telescope. To avoid the problems associated with Type 1 seeing, allow your telescope approximately 30 minutes outdoors to reach thermal equilibrium with the environment. If observing with others, make sure no one stands in front of or directly below the telescope tube.

The images produced by **Type 2** seeing conditions don't move as quickly as those produced by Type 1 conditions, but the images are quite blurry. Fine detail is lost and contrast is low for extended objects. Stars appear spread out and lack sharpness. Type 2 seeing conditions are produced in the lower atmosphere, most likely by heat waves from the ground or buildings. To avoid the problems associated with Type 2 seeing, select a good observing site. Look for broad hilltops or open grassy fields. Stable thermal conditions found near lakes and atmospheric inversions tend to produce good seeing. Avoid sites that overlook asphalt parking lots, plowed fields, valleys or shorelines. If you can't get a better location, wait until the early morning hours when the surroundings are uniformly cool and seeing is generally better.

**Type 3** seeing conditions are characterized by fast ripples that create shimmer in the visual field, affecting otherwise sharp images. For extended objects, fine details are visible, but images shift around the field. Stars are crisp points, but they rapidly shift small distances within the field of view. The cause of Type 3 seeing is turbulence in the upper atmosphere, which means the observer has no control over it. However, the effects of Type 3 seeing are generally less pronounced than those of Type 1 and 2 conditions. Type 3 seeing conditions can't really be avoided, so your best bet is to wait for moments of atmospheric steadiness. If seeing conditions are extremely bad, you might consider waiting for a better night.

The conditions described here apply to both visual and photographic observations.



Seeing conditions directly affect image quality. These drawings represent a point source (i.e., star) under bad seeing conditions (left) to excellent conditions (right). Most often, seeing conditions produce images that lie somewhere between these two extremes.

## CLEANING THE OPTICS

While your **Star Hopper**<sup>®</sup> telescope requires little maintenance, there are a few things to remember that will ensure your telescope performs optimally.

### Care and Cleaning of the Optics

Occasionally, dust may build up on the primary mirror of your **Star Hopper**<sup>®</sup> telescope. Special care should be taken when cleaning any telescope so as to avoid damaging its optics. You shouldn't need to clean your optics more than twice a year at the most. Generally, it's better to leave dust on the mirror, should a small amount accumulate there. A small amount of dust will have little affect on the image, but cleaning the optics too often can damage the mirror's reflective coatings. Also, take precautions to keep dust out of your telescope.

If cleaning is necessary, remove the primary mirror from the tube. To remove dust from the primary mirror, use a brush (made of camel's hair) or a can of pressurized air. When using pressurized air, spray at an angle to the mirror for approximately two to four seconds. Then, use an optical cleaning solution and white, unscented (Kleenex type) tissue paper to remove any remaining debris. Apply the solution to the tissue and then apply the tissue paper to the lens. Low pressure strokes should go from the center of the mirror to the outer edge. DO NOT rub in circles or apply pressure.

You can use a commercially made lens cleaner (available at most camera stores) or mix your own. A good cleaning solution is isopropyl alcohol mixed with distilled water. The solution should be 60% isopropyl alcohol and 40% distilled water. Or, liquid dish soap diluted with water (a couple of drops per one quart of water) can be used.

## TECHNICAL SPECIFICATIONS

Listed below is technical information pertinent to the Celestron Star Hopper<sup>®</sup> 4½, 6 and 8 telescopes.

	Star Hopper <sup>®</sup> 4.5 Item # 10400	Star Hopper <sup>®</sup> 6 Item # 10600	Star Hopper <sup>®</sup> 8 Item # 10800
Optical system	Newtonian	Newtonian	Newtonian
Aperture	4.5" (114mm)	6" (152mm)	8" (203mm)
Focal length	910mm (35.8")	1220mm (48")	1220mm (48")
F/ratio	f/8	f/8	f/6
Ocular:	25mm SMA	25mm SMA	25mm SMA
Apparent field	52°	52°	52°
Magnification	36x	49x	49x
Secondary mirror diameter:			
Obstruction	1.25" or 7.7% by area	1.5" or 6% by area	1.5" or 4% by area
Aluminized surface	1.2"	1.5"	1.5"
Primary mirror	Coated glass	Multicoated Pyrex	Multicoated Pyrex
Highest useful power	270x	360x	480x
Lowest useful power	16x	22x	29x
Resolution: Rayleigh Criterion	1.21 arcseconds	0.76 arcseconds	0.68 arcseconds
Dawes Criterion	1.01 arcseconds	0.91 arcseconds	0.57 arcseconds
Field of view with standard eyepiece	1.4°	1.1°	1.1°
Exit pupil with standard eyepiece	3.1mm	3.1mm	4.1mm
Light gathering power	267x unaided eye	474x unaided eye	843x unaided eye
Limiting visual magnitude	12.8	13.4	14.0
Optical tube length	35"	52"	52"
Tube outer diameter	5.5"	8.50"	10.50"
Focuser:	Rack and Pinion	Rack and Pinion	Rack and Pinion
Focuser height (minimum)	3"	3"	3"
Focuser travel	2"	2"	2"
Focus (distance from tube edge)	4"	3.5"	3.25"
Tube weight	6 lbs.	18 lbs. 5 oz.	24 lbs. 14 oz.
Mount design	Dobsonian hybrid	Dobsonian hybrid	Dobsonian hybrid
Mount weight	12 lbs.	21 lbs. 1 oz.	30 lbs. 6 oz.
Shipping weight & dimensions (given in inches)	35 lbs. (17x17x41)	24 lbs. (17x61x18) 31 lbs. (24x24x6)	30 lbs. (17x61x18) 41 lbs. (24x24x6)

## OPTIONAL ACCESSORIES

### Barlow Lenses

A Barlow lens is a lens that, when used with any eyepiece, doubles the magnification of that eyepiece by increasing its effective focal length. **Celestron** offers two Barlow lenses in the 1-1/4" size. The 2x Ultima Barlow (#93506) is a compact triplet design that is fully multicoated for maximum light transmission and parfocal when used with the Ultima eyepieces. The 2x Ultima works very well with all **Celestron** eyepieces. The latest Barlow to be added to **Celestron's** product line (#93507) is a low profile achromatic design. It weighs just 4 oz. and is under 3" in length.

### Eyepiece Filters

These filters are an invaluable aid in lunar and planetary observations. They reduce glare and light scattering; increase contrast, definition and resolution; reduce irradiation and lessen eye fatigue. **Celestron** offers a wide range of colored filters that thread onto the 1-1/4" oculars. Available are: #12 Deep Yellow, #21 Orange, #25 Red, #58 Green, #80A Light Blue, #96 Neutral Density (25% T and 13% T), and Polarizing filters. Filters are also available in sets of four (#94118 - Series 1-4).

### Eyepieces

Like telescopes, eyepieces come in a variety of designs, and **Celestron** offers an excellent selection of designs, each with its own advantages. For the 1-1/4" barrel diameter there are four different eyepiece designs available.

- **Plössl** - Plössl eyepieces have a 4-element lens designed for low-to-high power observing. The Plössls offer razor sharp views across the entire field of view, even at the edges. In the 1-1/4" barrel diameter, they are available in the following focal lengths: 6.3mm, 7.5mm, 10mm, 12.5mm, 17mm, 20mm, 26mm, 32mm, and 40mm.
- **Ultima** - Ultima is **Celestron's** top of the line eyepiece, using a hybrid design of four to seven different elements. Featuring long eye relief and a wide field of view, these eyepieces are fully multicoated on each air-to-glass surface to enhance contrast levels. Each eyepiece is designed by computer to reduce optical aberrations to the absolute minimum. In the 1-1/4" barrel diameter, they are available in the following focal lengths: 5mm, 7.5mm, 12.5mm, 18mm, 24mm, 30mm, 35mm and 42mm. These eyepieces are all parfocal.
- **Lanthanum Eyepieces (LV Series)** - Lanthanum is a unique, rare earth glass used in one of the field lenses of this new eyepiece. Use of this special glass reduces optical aberrations to a minimum. All lenses are fully multicoated and have an astounding 20mm of eye relief—perfect for eyeglass wearers! In the 1-1/4" barrel diameter, they are available in the following focal lengths: 2.5mm, 4mm, 5mm, 6mm, 9mm, 10mm, 12mm, 15mm, and a 8-24 zoom.
- **SMA Series** - high quality yet economical 6mm, 10mm and 12mm eyepieces designed to offer a wide field of view.

In addition, a deluxe compact **zoom ocular** (#93306) with variable focal length of 6.5 to 18mm is available. It provides a range of 68-188 power on the **Star Hopper**® 6 and 8 telescopes and 51-140 on the **Star Hopper**® 4½.

### Flashlights

**Celestron's** #93592 red and #93588 night vision LED (light emitting diode) flashlights conveniently allow you to read star maps without diminishing your night vision. Both feature adjustable brightness and are small and lightweight, (#93592 is only 6 inches long, and weighs in at a mere 3 ounces).

### Light Pollution Reduction (LPR) Filter (#94126A)

A 1 1/4" filter that threads onto a 1 1/4" eyepiece, designed to enhance your views of deep-sky astronomical objects when observed from urban areas. The LPR filter selectively reduces the transmission of certain wavelengths of light, specifically those produced by artificial lights. This includes mercury, and high and low pressure sodium vapor lights. Additionally, it blocks unwanted natural light (also known as sky glow).

**Polarizing Filter Set (#93608)**

The polarizing filter set limits the transmission of light to a specific plane, thus increasing contrast between various objects. These filters are especially helpful for lunar and planetary observing.

**Sky Maps (#93722)**

When learning the night sky, Celestron Sky Maps offer just the guidance you need. The maps show all the constellations and brighter deep-sky objects and are printed on heavy, moisture-resistant paper for durability. The front cover features a rotating planisphere, indicating when specific constellations are visible.

**Solar Filters**

Celestron's Solar Skreen solar filter (#94166 for the Star Hopper<sup>®</sup> 8 and #94134 for the Star Hopper<sup>®</sup> 4<sup>+</sup>) permits completely safe, direct observation of the sun. This filter, which transmits .001% of visible light, allows sunspots to be seen as they move across the solar disk. While reducing the intensity of the sun's visible light, it also blocks 99.999% of invisible infrared light. The Solar Skreen solar filter is made of precision engineered Mylar polyester film. A layer of aluminum is vacuum-deposited on one surface of the dual sheets of Mylar used to make each filter. This aluminum coating produces a cool, comfortable, pale blue image of the sun. A #21 orange eyepiece filter works well in conjunction with the Solar Skreen filter to produce a more naturally colored image of the sun.

**Star Pointer (#51630)**

This electronic finderscope can be used on any telescope by itself, or as a complement to other finderscopes for easily locating viewing objects. It's used with both eyes open and features variable brightness control for comfortable viewing. It works by projecting a red dot on the image of the object to be viewed in the sky, which the telescope is then lined up with. This finderscope is compact and lightweight, it weighs just 1.5 oz. and is only 4.5" in length, and is easily mounted using the adhesive strip on its base.

**Peterson First Guides<sup>®</sup> - Astronomy (93728)**

A simplified field guide to the stars, the planets and the universe featuring full color maps showing the positions of the stars throughout the year. This useful guide also includes beautiful constellation paintings, photographs, and clear, concise descriptions of stars, the planets, the sun, the moon, comets, black holes, galaxies and more.

**Planisphere (#93720)**

A colorful rotating star map that indicates when specific constellations are visible, with removable markers for tracking the movement of solar system objects. Available in three different latitudes: 30°, 40° and 50°.

"The Sky - Level 1 from Celestron" CD-ROM (#93700) presented by Celestron and Software Bisque, is the most comprehensive CD-ROM on the market for all levels of astronomers. It features a 10,000 object database, 75 full color enhanced images, 360° screen rotation, zoom from 4° to 235°, realistic sky display showing stellar brightness and contrast and more. Comet Hale-Bopp and Hyakutake coordinates included. This CD-ROM is easy to load, requiring only a 4MB system to run. Windows and Windows 95 compatible.

**A full description of all Celestron accessories can be found in the Celestron Accessory Catalog (#93685).**

## **CELESTRON ONE YEAR LIMITED WARRANTY**

**A.** Celestron International (CI) warrants its telescopes to be free from defects in materials and workmanship for one year. CI will repair or replace such product or part thereof which, upon inspection by CI is found to be defective in materials or workmanship. As a condition to the obligation of CI to repair or replace such product, the product must be returned to CI together with proof-of-purchase satisfactory to CI.

**B.** The proper Return Authorization Number must be obtained from CI in advance of return. Call Celestron at 310-328-9560 to receive the number to be displayed on the outside of your shipping container.

All returns must be accompanied by a written statement setting forth the name, address and daytime telephone number of the owner, together with a brief description of any claimed defects. Parts or product for which replacement is made shall become the property of CI.

**The customer shall be responsible for all costs of transportation and insurance, both to and from the factory of CI, and shall be required to prepay such costs.**

CI shall use reasonable effort to repair or replace any telescope covered by this warranty within thirty days of receipt. In the event repair or replacement shall require more than thirty days, CI shall notify the customer accordingly. CI reserves the right to replace any product which has been discontinued from its product line with a new product of comparable value and function.

**This warranty shall be void and of no force of effect in the event a covered product has been modified in design or function, or subjected to abuse, misuse, mishandling or unauthorized repair. Further, product malfunction or deterioration due to normal wear is not covered by this warranty.**

CI disclaims any warranties, express or implied, whether of merchantability or fitness for a particular use, except as expressly set forth herein.

The sole obligation of CI under this limited warranty shall be to repair or replace the covered product, in accordance with the terms set forth herein. CI expressly disclaims any lost profits, general, special, indirect or consequential damages which may result from breach of any warranty, or arising out of the use or inability to use any CI product. Any warranties which are implied and which cannot be disclaimed shall be limited in duration to a term of one year from the date of original retail purchase.

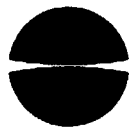
Some states do not allow the exclusion or limitation of incidental or consequential damages or limitation on how long an implied warranty lasts, so the above limitations and exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

CI reserves the right to modify or discontinue, without prior notice to you, any model or style of telescope. If warranty problems arise, or if you need assistance in using your telescope, contact:

Celestron International  
Customer Service Department  
2835 Columbia Street, Torrance, CA 90503  
310-328-9560  
310-212-5835 fax  
Monday - Friday 8AM-4PM PST

This warranty supersedes all other product warranties.

**NOTE: This warranty is valid to U.S.A. and Canadian customers who have purchased this product from an authorized CI dealer in the U.S.A. or Canada. Warranty outside the U.S.A. and Canada is valid only to customers who purchased from a CI International Distributor or Authorized CI Dealer in the specific country. Please contact them for any warranty service.**



**CELESTRON<sup>®</sup>**

Celestron International  
2835 Columbia Street  
Torrance, CA 90503  
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