CELESTRON®

C8 INSTRUCTION MANUAL

CELESTRON C8 INSTRUCTION MANUAL

THE SP-C8

THE CLASSIC 8

THE ULTIMA 8

THE POWERSTAR 4

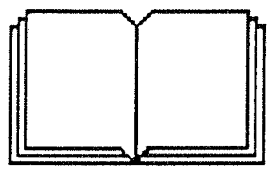
THE C8 OPTICAL TUBE

Celestron C8 Instruction Manual

INTRODUCTION

Welcome to the Celestron world of amateur astronomy! The Celestron C8 is one of the most advanced telescopes on the market today. With a mirror diameter of 8 inches, your Celestron C8 has a light gathering power of 800 times that of the unaided human eye. Yet, the C8 optical system is extremely compact and portable despite its large aperture because it utilizes the Schmidt-Cassegrain design. The Celestron 8 is designed to give you a lifetime of pleasure with a minimal amount of maintenance.

How To Use This Manual



This manual is designed to instruct you in the proper use of your Celestron C8 telescope. This includes assembly, initial use, and long term operation. There are four major sections to the manual. The first section covers the proper procedure for setting up your C8 telescope. Since this manual deals with five separate instruments, each will be considered individually. It should be noted that the difference in each telescope lies in the mounting. All five instruments use the same optical design, although the standard coatings on the optical elements may vary.

The second section covers basic operations that are common to all five telescopes. This includes attaching the accessories, focusing, aligning the finderscope, and taking your first look. The third section deals with the basics of astronomy and using your telescope for astronomical viewing. This includes polar alignment, aligning the setting circles, and using your Celestron for astronomical observations, both visual and photographic. The last major section is on telescope maintenance, specifically on cleaning and collimation.

In addition to the above mentioned, there is a partial list of optional accessories for all models of the C8. Included is a brief description of what each accessory is for. The final part of this manual contains a list of objects that can be observed through your Celestron telescope. Included are the coordinates for each object, its brightness and a code which indicates what type of an object it is. In addition, there is a list of bright stars that can be used for aligning the setting circles.

Since it will take a few observing session to familiarize yourself with your C8, you should keep this manual handy until you have fully mastered its operation.

A Word Of Caution

Your C8 is designed to give you hours of fun and rewarding observations. However, there are few things to consider 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 HAVE THE PROPER SOLAR FILTER. PERMANENT AND IRREVERSIBLE EYE DAMAGE MAY RESULT.

IN ADDITION, 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 THE TELESCOPE UNSUPERVISED, ESPECIALY WHEN CHILDREN ARE PRESENT. THIS ALSO HOLDS TRUE FOR ADULTS WHO MAY NOT BE FAMILIAR WITH THE CORRECT OPERATING PROCEDURES OF YOUR TELESCOPE.

NEVER USE AN EYEPIECE SOLAR FILTER OR A HERSCHEL WEDGE. INTERNAL HEAT BUILD-UP INSIDE THE TELESCOPE CAN CAUSE THESE DEVICES TO CRACK OR BREAK OR DAMAGE YOUR TELESCOPE.

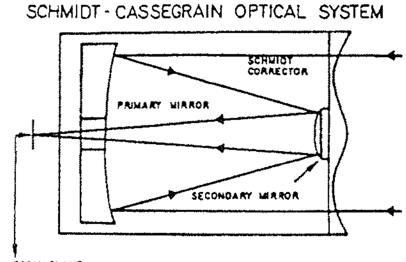
LASTLY, WHEN USING YOUR TELESCOPE WITH THE CORRECT SOLAR FILTER, ALWAYS COVER THE FINDERSCOPE. ALTHOUGH SMALL IN APERTURE, THIS INSTRUMENT HAS ENOUGH LIGHT GATHERING POWER TO CAUSE PERMANENT AND IRREVERSIBLE EYE DAMAGE. THE IMAGE PROJECTED BY THE FINDER IS HOT ENOUGH TO BURN SKIN OR CLOTHING.

The Schmidt-Cassegrain Optical System

The Schmidt-Cassegrain (or Schmidt-Cass for short) optical design is one of the most popular among amateur astronomers. This unique design offers large diameter optics while maintaining very short tube lengths, making them extremely portable. The Schmidt-Cassegrain system consists of a zero power corrector plate, a spherical primary mirror and a secondary mirror. Once light rays enter the optical system, they travel the length of the optical tube three times.

Inside the optical tube you will notice a black tube (not illustrated) that extends out from the center hole in the primary mirror. This is the primary baffle tube and it prevents stray light from passing through to the eyepiece or camera.

SCHMIDT - CASSEGRAIN OPTICAL SYSTEM



ASSEMBLING YOUR TELESCOPE

This section covers the assembly instructions for each telescope. Look in the table of contents to find out where the section for your specific telescope begins. Turn to that page and you are ready to begin.

The SP-C8

The SP-C8 is the only version of the C8 that is offered on a German equatorial mount. Like all Celestron 8 models, the SP-C8 uses a Schmidt-Cassegrain optical design. The SP-C8 is shipped in two boxes. The first contains the optical tube (i.e., telescope) and all the standard accessories, which include:

- 26mm Plossl Ocular 1-1/4"
- Visual Back 1-1/4"
- Star Diagonal 1-1/4"
- 6x30mm Finderscope and Bracket
- Piggyback Mount
- Carrying Handle
- Allen Wrench Set
- Lens Cap

The second box contains the tripod, equatorial mount and the hardware needed to set it up. Included are the:

- Super Polaris German Equatorial Mount
- Polar Alignment Finderscope
- Polar Alignment Finderscope Illuminator
- Counterweight Bar
- Two Counterweights
- Declination (DEC) Slow-Motion Knob
- Right Ascension (R.A.) Slow-Motion Knob
- Adjustable Wooden Tripod
- Bubble Level
- Accessory Tray
- Allen Wrench Set

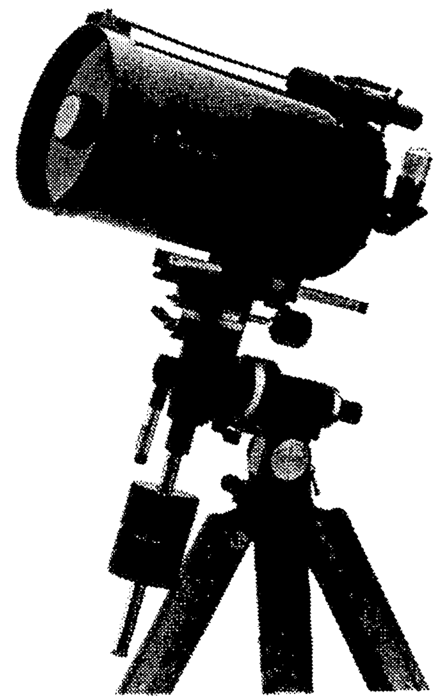
Unpacking Your SP-C8

When setting up the telescope, find a large, clear area where the parts can be laid out without fear of losing them. Start with the tripod and mount. Remove the contents of the box and place them neatly on your work surface. Leave the optical tube in its case until you are ready to attach it to the mount. Once your SP-C8 has been unpacked and assembled, you will not need the shipping boxes for everyday storage and transportation. However, you should save them in case you decide to ship your telescope via a common carrier. The foam lined foot locker for the optical tube should be kept handy for storage and transportation.

To begin setting up your SP-C8, start with the tripod and work up from there.

Setting Up The Tripod

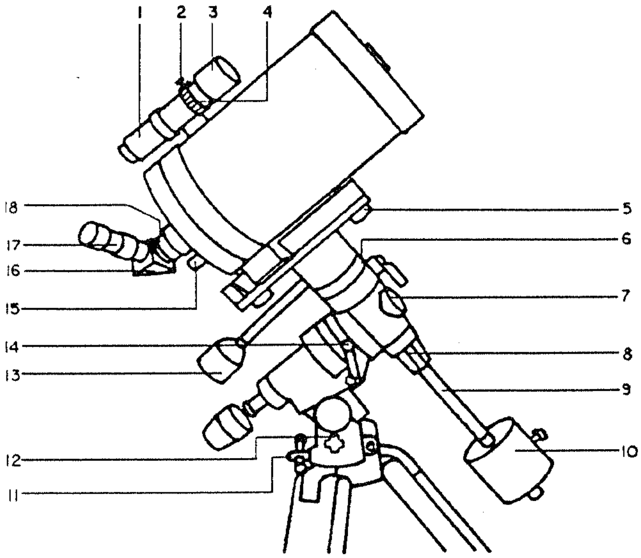
The tripod comes fully assembled with the metal plate, called the tripod head, that holds the legs together at the top. In addition, the brackets that support the accessory tray are also attached to the tripod. Stand the tripod upright and pull the tripod legs apart until the support arms for the accessory tray have been fully extended. The tripod will now stand by itself.



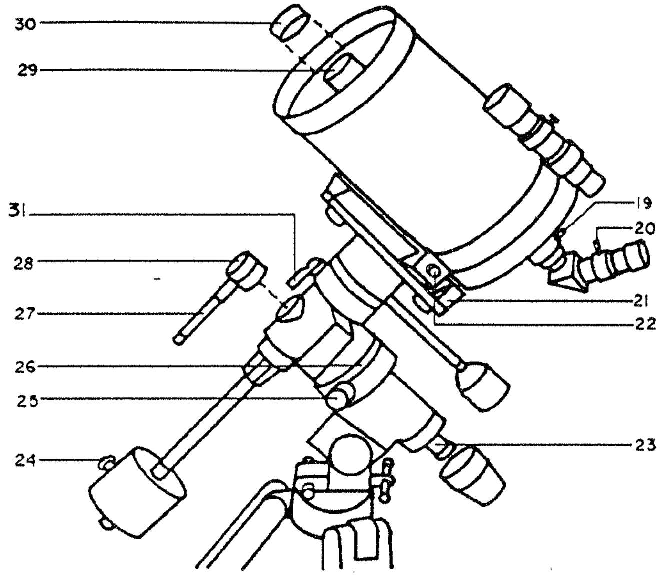
To increase the stability, tighten the bolts that hold the legs to the tripod head (use the appropriate size Allen wrench from the supplied set). This will help minimize any flexure or wobble of the legs.

NOTE: Variations in humidity can cause the tripod legs to expand and contract. These variations can cause the bolts to loosen without warning. As a result, you should periodically check the bolts to make sure they are tight.

You can adjust the height of the tripod by loosening the two wing nuts on the lower portion of each tripod leg. Once loosened, slide the center slat of the tripod leg away from the tripod head. When at the desired height, completely retighten the wing nuts to hold the leg firmly in place. This can be done either before or after the telescope has been fully set up. Keep in mind that the tripod is most stable when the legs are not extended.



SP-C8

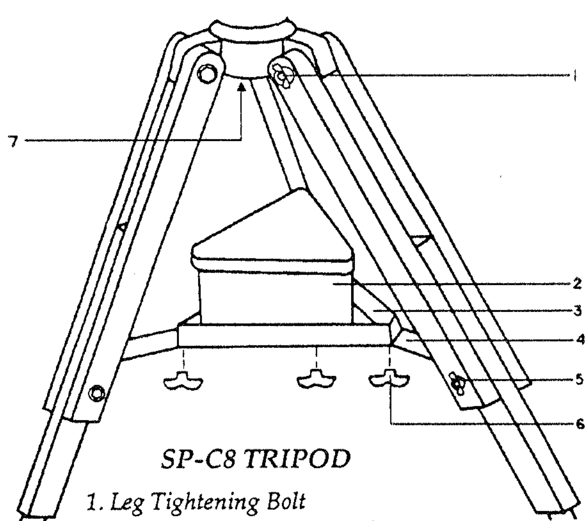


SP-C8

1. *Finder Eyepiece*
2. *Finder Alignment Screw*
3. *Finder Focus Ring*
4. *Finder Focus Lock Ring*
5. *Telescope Attachment Thumb Screw*
6. *Declination Setting Circle*
7. *Polar Axis Finder Telescope Cover*
8. *Counterweight Bar Lock Nut*
9. *Counterweight Bar*
10. *Counterweight and Safety Nut*
11. *Altitude Adjustment Screw*
12. *Altitude Tension Knob*
13. *Declination Slow Motion Knob*
14. *Right Ascension Clamp*
15. *Focus Knob*
16. *Star Diagonal*
17. *Eyepiece*
18. *Visual Back*
19. *Visual Back Set Screw*
20. *Eyepiece Set Screw*
21. *Telescope Balance Bracket*
22. *Balance Bracket Thumb Screw*
23. *Polar Axis Finder*
24. *Counterweight Lock Thumb Screw*
25. *Right Ascension Slow Motion Knob*
26. *Right Ascension Setting Circle*
27. *Penlight Illuminator*
28. *Polar Axis Finder Illuminator*
29. *Secondary Adjustment Screws*
30. *Secondary Cover*
31. *Declination Clamp*

Attaching The Accessory Tray

Next, attach the accessory tray to the tripod. The (three) wing nuts that hold the tray to the bracket will be taped to the top of the accessory tray. Remove the wing nuts and place the tray over the bracket. With the tray facing up, position the screws on the bottom of the accessory tray so that they are over the slotted holes in the brackets. Push the accessory tray down so that the screws protrude through the holes in the bracket. Place the wing nuts over the screws from the bottom of the accessory tray and tighten fully. With the accessory tray in place, the tripod will be much more stable, making it easier to attach the telescope and mount.



SP-C8 TRIPOD

1. *Leg Tightening Bolt*
2. *Accessory Box (Not Included)*
3. *Accessory Tray*
4. *Accessory Tray Bracket (Support Arm)*
5. *Leg Extension Wing Nuts*
6. *Accessory Tray Attachment Wing Nuts*
7. *Equatorial Mount Attachment Screw*

Attaching The Equatorial Head

The equatorial mount attaches to the tripod head (i.e., metal plate on the tripod). On one side of the plate there is an "N" which signifies North. This side of the tripod will face north when setting up for an astronomical observing session. Above the "N" is a peg about 3/4" high that points straight up.

Place the equatorial mount on the tripod head. The portion of the mount with a rectangular extrusion will fit over the peg on the tripod head. There are two screws, called the azimuth adjustment screws, on either side of the rectangular extrusion that may have to be retracted before the mount will sit flat on the tripod head. These screws will be used later during the polar alignment process to move the mount horizontally.

Once the mount is flush against the tripod head, tighten the knob on the underside of the tripod head. The knob is already in place and can NOT be removed. This will hold the equatorial mount firmly to the tripod head.

Attaching the R.A. Knob

With the mount securely in place, you are ready to attach some of the accessories (the telescope tube will be added last). Start with the Right Ascension (R.A.) knob. On either side of the mount, just below the R.A. setting circle, there are two shafts that extend out about 1/2" called the R.A. shafts. The R.A. knob has a small metal tube that will fit over the R.A. shaft. Loosen the set screw on the R.A. knob and slide it over the shaft. Make sure that the set screw is over the flat part of the R.A. shaft. Tighten the set screw to hold the knob in place. You will need a standard flat-blade screwdriver or an Allen wrench to tighten it completely. It makes no difference which shaft you put it over since both work the same. Use whichever one is more convenient. If, after a few observing sessions, you find the R.A. knob is more accessible from the other side, you should go ahead and move it.

Attaching The Declination Knob

Once the R.A. knob is in place, you are ready to attach the Declination (DEC) knob. The DEC knob is attached in the same manner as the R.A. knob. The only difference is that the DEC knob is slightly longer. The shaft that the DEC knob fits over is toward the top of the mount, just above the declination setting circle. Once again, you have two shafts to choose from. Use the shaft where the eyepiece end of the telescope will be mounted. This makes it easy to reach while looking through the telescope, something which is quite important when you are working in the dark.

Loosen the set screw on the DEC knob and slide the metal tube over the shaft. Make sure that the set screw is over the flat part of the DEC shaft. Tighten the set screw to hold it in place. You will need a standard flat-blade screwdriver or an Allen wrench to tighten it completely.

Attaching the Counterweight Bar

Lastly, attach the counterweight bar to the mount. To do this, retract the counterweight bar lock nut by turning it counterclockwise. This will expose the threads on the end of the counterweight bar. Thread these into the mount on the side opposite of where the optical tube will be mounted (i.e., opposite the DEC setting circle). Once threaded in all the way, tighten the lock nut for added support.

With the counterweight bar in place, you are ready to attach the counterweights. To do this, completely remove the safety thumb screw on the end of the counterweight bar. Next, loosen the set screw on the counterweight itself so that the central hole of the counterweight is unobstructed. Once the screw no longer obstructs the hole in the center of the counterweight, slide it onto the counterweight bar. Move it high enough to allow room for the second weight. Once in position, re-tighten the set screw on the counterweight to hold it in position. Repeat this process for the second weight. After both weights are in position, replace the thumb screw on the end of the counterweight bar. The thumb screw will prevent the counterweights from sliding off the bar should they ever become loose.

Setting Up The Polar Axis Finder

The polar axis finder, which is built into the mount itself, is used only during the process of polar alignment. Once polar aligned, the telescope will track the stars if you are using the optional clock drive or sky sensor computer. If you are not using the clock drive, polar alignment is still desirable since it will limit the number of corrections you will have make to one axis. This will make it much easier to follow objects. Take a few minutes to familiarize yourself with this accessory.

The eyepiece for this finder, which is near the latitude scale, has a plastic cover over it. Remove the plastic cover by pulling it straight off. Next, remove the plastic cover at the other end of the mount just above the counterweight bar.

Next, release the DEC clamp and rotate the telescope until the circle indicates -10 °. This will allow you to see through the polar axis finder. If you do NOT do this, the polar shaft will be blocked and the polar axis finder can NOT be used.

If you look through the eyepiece you will see the polar alignment reticle. The reticle has a cross hair which indicates the rotational axis of the polar axis. The large circle indicates the distance Polaris is from the true celestial pole. The small circle shows the exact position of Polaris relative to the celestial pole. To focus the eyepiece, turn the knurled ring on the end of the finder until the reticle is sharp.

Included with the polar axis finder is an illuminator so the reticle can be seen at night. The light source requires one 'AA' battery, which is NOT included with the telescope. To insert the battery, remove the top of the illuminator. Insert the positive (+) end of the battery first and replace the top of the illuminator.

Lastly, insert the light bulb end of the polar axis illuminator into the opening just above the counterweight bar. Rotate the top portion of the light source to turn the light on. The polar axis finder is now ready to use.

The correct procedure for using this accessory will be described later in the section on polar alignment. Once you have finished, remove and shut off the illuminator and replace the plastic dust cover. Also, replace the plastic cap over the eyepiece end of the polar axis finder.

When not being used to illuminate the polar alignment reticle, the illuminator can be used as a map light.

Attaching The Telescope To The Mount

With the mount fully assembled, you are ready to attach the optical tube to the mount. Remove the optical tube and all the accessories from the box. Before you attach the optical tube, make sure that the declination and right Ascension clamps are tight.

The optical tube attaches to the mount via a balance bracket. This bracket comes installed on the telescope. It is attached to a dove-tail mounting block which is bolted to the rear cell of the telescope. Remove the balance bracket by loosening the bracket's thumb screw. This will allow you to slide the balance bracket off of the telescope. The balance bracket has four holes that are drilled and tapped. The two middle holes are designed for a standard photographic tripod (1/4x20 screw). The two on each end fit in the two screws that protrude from the mounting platform on the equatorial mount. Place the holes in the bracket over the screws on the mount and begin to tighten them. Be sure that the "open end" of the bracket is toward the front of the mount (i.e, the end closest to the DEC clamp).

When the bracket is in place, the optical tube can be adapted to the balance bracket. Slide the mounting block with telescope tube back onto the balance bracket. With the corrector end pointing away from the mount, the telescope should slide onto the bracket from the top. If it slides on from the bottom, the balance bracket has been mounted backwards.

Once the telescope is on the mounting bracket, tighten the balance bracket thumb screw to hold the telescope in place. (The telescope can be mounted without removing the balance bracket. However, this is a two man operation and should NOT be attempted by one person.)

NOTE: Never loosen the balance bracket thumb screw unless you have a firm hold of the telescope tube. Also, be sure that the corrector end of the telescope is pointing away from the ground at all times.

Attaching The Finderscope

The SP-C8 comes standard with a 6x30mm finderscope. To ensure the finder and bracket are not damaged during shipping, they are NOT attached to the telescope. To mount the finder, remove it from its plastic wrapper. Included with the finder are five Allen head screws: two hold the bracket to the telescope and three hold the finder in place inside the bracket. The three that hold the finder in place are easy to identify since they are nylon tipped. In addition, there is also a rubber O-ring. This will slide over the finderscope to keep it secure in the bracket.

First, attach the bracket to the optical tube. To do this, find the two holes in the rear cell that are to the left of the piggyback mount (when looking from the back of the tube). The holes are covered with tape to prevent any dust or moisture from entering the optical tube. Remove the tape and place the finder bracket over the holes. The bracket should be oriented so that the ring with the holes for the adjustment screws is closer to the rear cell of the telescope. Start threading the screws in by hand and then tighten them with one of the Allen wrenches provided.

Next, thread the screws in that will hold the finder in place. Do not thread them in completely. If you do, they will interfere with the placement of the finderscope. Tighten the screws until the nylon heads are flush with the inner diameter of the bracket ring.

Now, take the O-ring and slide it over the back of the finder (it will NOT fit over the objective end of the finder). It may need to be stretched a little. Once on the main body of the finder, slide it toward the front (i.e., objective) end of the finder. With the O-ring in place, slide the eyepiece end of the finder into the front of the bracket. Push it back until the O-ring is snug inside the front ring of the bracket. Hand tighten the three set screws until snug. You will not need to tighten them with an Allen wrench since the finder still needs to be aligned. To properly align the finderscope, please see the section on "Aligning the Finderscope."

Balancing the Mount

To eliminate undue stress on the mount, the telescope should be properly balanced around the polar axis. In addition, proper balancing is crucial for accurate tracking if using a clock drive.

To balance the mount, release the R.A. Clamp and position the telescope off to one side of the mount (make sure that the balance bracket thumb screw it tight). The counterweight bar will extend horizontally to the opposite side of the mount. Without tightening the R.A. clamp, gradually let go of the telescope to see which way it "rolls." Loosen one or both counterweights and move them to a point where they balance the scope (i.e., it remains stationary when the R.A. clamp is released). Re-tighten the counterweights and the scope is properly balanced on the R.A. axis.

The telescope should also be balanced on the declination axis to prevent any sudden motions when the DEC clamp is released. To balance the telescope in DEC, release the R.A. clamp and rotate the telescope so that it is on one side of the mount (i.e., as described above for balancing the mount in R.A.). Once this is done, lock the R.A. clamp to hold the telescope in place. Now, hold the telescope tube with one hand while releasing the DEC clamp with the other. The telescope will most likely rotate around the declination axis. Slightly loosen the balance bracket thumb screw and slide the telescope either forward or backward in the mounting block until it remains stationary when the DEC clamp is released. Do NOT let go of the telescope tube while the balance bracket thumb screw is loose. Re-tighten the thumb screw. The telescope is now properly balanced in declination.

Adjusting The Mount

For the purpose of polar alignment, there are two directions in which the telescope mount can be moved; in a vertical direction, which is called altitude and in a horizontal direction, which is called azimuth. To adjust the R.A. or polar axis of the equatorial mount, loosen the altitude tension knob on the side of the mount. Once loose, turn the altitude adjustment screw at the back of the mount. Turning the screw clockwise raises the mount, while turning it it counterclockwise lowers the mount. Once at the desired height, re-tighten the altitude tension screw to hold the mount in place.

To move the polar axis horizontally, turn the azimuth adjustment screws. Both of these run up against the metal peg on the top of the tripod. While standing behind the telescope, the knobs will be on the front of the mount. Turning the right adjustment knob clockwise moves the telescope mount toward the right. Turning the left adjustment knob clockwise moves the mount to the left. Since both of these screws push off of the peg, they are opposed to each other. In other words, you may have to loosen one screw while tightening the other. These screws are used for fine adjustments of the mount during the polar alignment process. For rough adjustments, pick up the telescope and tripod and re-orient it.

Moving the Telescope In R.A. and DEC

For a major re-orientation of the direction the telescope is pointing (not the mount), loosen the R.A. and/or DEC clamps and move the telescope to the desired area. Once in place, re-tighten the clamps. For fine adjustments, turn the R.A. and DEC knobs. If you are using either of the optional drive systems, the telescope will track the star.

The Declination setting circle is incremented in degrees while the R.A. setting circle is incremented at 5 minute intervals.

Disassembling and Transporting Your SP-C8

Once assembled, the telescope can be left set up. The entire unit is light enough to pick up and carry outside for a casual observing session. If, however, you want to transport your SP-C8 to a remote observing location, remove the optical tube from the equatorial mount. Return it to the foam lined case to ensure safe transportation. Next, remove the three wing nuts that hold the accessory tray to the tripod and pull the tray off the bracket. The wing nuts should be screwed back onto the accessory tray once removed from the bracket. This will eliminate the possibility of them being lost. After the accessory tray has been removed, the tripod legs can be collapsed for easy transportation. The equatorial mount does NOT have to be removed if you are transporting the telescope yourself.

If you are shipping the telescope via a common carrier, you should completely disassemble the telescope and return all parts to their original shipping container.

Storing Your SP-C8

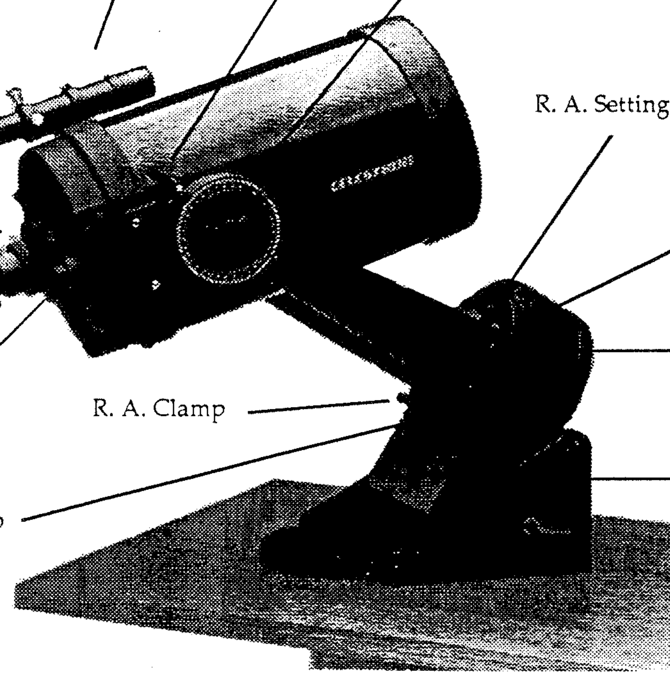
When not in use, your Celestron SP-C8 can be left fully assembled and set up. However, all lens and eyepiece covers should be put back in place. The opening to the rear cell must also be covered. This will reduce the amount of dust build-up on the optical surfaces and reduce the numbers of times you need to clean the instrument. You may want to return everything to its original shipping container and store all the parts there. If this is the case, all optical surfaces should still be covered to prevent dust build-up.

To prevent the tripod legs from warping, keep them oiled with a lemon oil. Also, when storing the tripod in the original shipping container, make sure that all the bolts are tightened.

What Next?

Now that you have completed assembling your SP-C8, you are ready to begin attaching the accessories. Please turn to the section on "Telescope Operation" for more information.

The Classic 8



The Classic 8 is a new rendition of the original fork-mounted C8. The telescope is mounted on two fork tines which are attached to the drive base. The clock drive unit is a single motor spur gear drive. The Classic 8 is shipped in two boxes. One is a foam protected carton, which includes the telescope and all the standard accessories. The wedge is packed separately in the second box. The standard accessories included with the Classic 8 are:

- 25mm Kellner Ocular 1-1/4"
- Visual Back 1-1/4"
- Star Diagonal 1-1/4"
- Wedge-8"
- Lens Cap
- 6x30mm Finderscope and Bracket
- Clock Drive Cord
- Bolt Pack (1/4x20 and 3/8-16x1)
- Allen Wrench Set

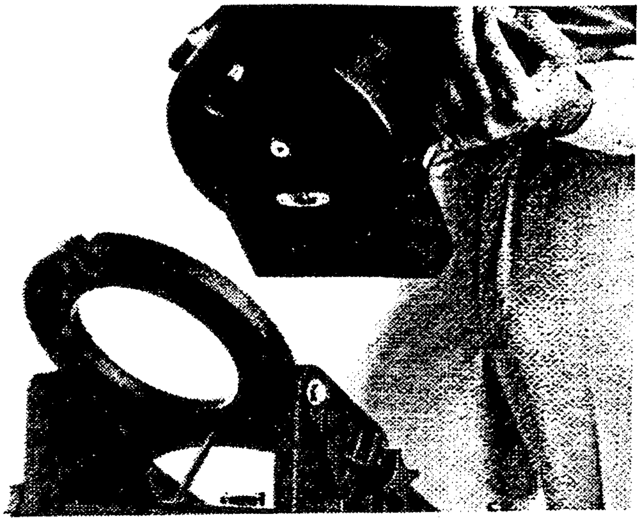
Unpacking Your Classic 8

Remove the contents of the box and place all parts in a clean work area. Since the Classic 8 comes fully assembled, all you need to do is attach some of the accessories and you are ready to begin, Save the box since you may want to ship your telescope at some time in the future.

Setting Up Your Classic 8

Setting up the Classic 8 is as easy as removing it from the box. Set the telescope on a flat, stable surface and you can begin attaching the accessories (please see the section on Attaching the Accessories). Without attaching the telescope to the wedge, you can begin terrestrial observing. With the the telescope in this configuration, the R.A. and DEC controls will sweep vertically (in altitude) and horizontally (in azimuth) relative to the horizon. This makes is much easier to find objects and center them in the telescope.

For astronomical viewing, you should mount the telescope on the wedge. This will allow you to polar align the telescope, use the setting circles and the clock drive. To mount the telescope on the wedge, partially insert one of the three bolts into the threaded hole in the base of the telescope that is furthest from the rectangular portion of the base. With the bolt in place, hold the telescope firmly by the fork arms and slide the bolt into the slot on the top of the tilt plate. Tighten the bolt slightly so that the bottom of the drive base is flush to the tilt plate. Do not tighten it fully or you will not be able to move the base so that the other two bolts can be inserted. (If you do not tighten the bolt at all, the drive base may be tilted slightly so that the remaining bolts will not go in straight.) Once flush, move the base of the telescope until the two remaining holes in the drive base line up with the holes in the tilt plate on the wedge. Once aligned, insert the screws and tighten all three completely. There is no need to loosen these until you are ready to remove the telescope from the wedge.



Attaching the telescope to the wedge

For rock steady observing, you need the optional adjustable tripod (#93501). If you have the optional Celestron adjustable tripod, you should attach the wedge to the tripod before attaching the telescope to the wedge. To remove the telescope from the wedge, remove the two lower bolts that hold the drive base to the wedge. Next, partially loosen the top bolt. Once loose, hold the telescope by the fork arms and slide it up, off of the wedge. The wedge can now be attached to the tripod.

Attaching The Finderscope

The Classic 8 comes standard with a 6x30mm finderscope. To ensure the finder and bracket are not damaged during shipping, they are NOT attached to the telescope. To mount the finder, remove it from its plastic wrapper. Included with the finder are five screws, two Allen head and three brass thumb screws. The two Allen head screws are used to hold the finder bracket to the telescope. The brass thumb screws are used to hold and adjust the finderscope in the bracket. In addition, there is also a rubber O-ring. This will slide over the finderscope to keep it secure in the bracket.

First, attach the bracket to the optical tube. To do this, find the two holes in the rear cell that are to the left of center (when looking from the back of the tube). The holes are covered with tape to prevent any dust or moisture from entering the optical tube. Remove the tape and place the finder bracket over the holes. The bracket should be oriented so that the ring with the holes for the adjustment screws is closer to the rear cell of the telescope. Start threading the screws in by hand and then tighten them with one of the Allen wrenches provided.

Next, thread the screws in that will hold the finder in place. Do not thread them in completely. If you do, they will interfere with the placement of the finderscope. Tighten the screws until the heads are flush with the inner diameter of the bracket ring.

Now, take the O-ring and slide it over the back of the finder (it may need to be stretched a little). Once on the main body of the finder, slide the O-ring towards the front (i.e., objective) end of the finder. With the O-ring in place, slide the eyepiece end of the finder into the front of the bracket. Push it back until the O-ring is snug inside the front ring of the bracket. Hand tighten the three set screws until snug. You will not need to tighten them completely since the finder still needs to be aligned. To properly align the finderscope, please see the section on "Aligning the Finderscope."

Adjusting The Wedge

As mentioned above, the Classic 8 comes with an adjustable wedge for astronomical observing. When ready to observe, find a flat, sturdy surface (for example, a picnic table) to set the wedge on. To adjust the altitude of the wedge, have someone hold the telescope while you loosen the screws on the side of the wedge that hold the tilt plate. Once the screws are sufficiently loose, move the telescope to the desired elevation and re-tighten the screws. This adjustment is used if the wedge is attached to the tripod or if it is on a flat surface. It needs to be done for polar alignment only. Once polar aligned, the slow motion R.A. and DEC knobs can be used to move the telescope.

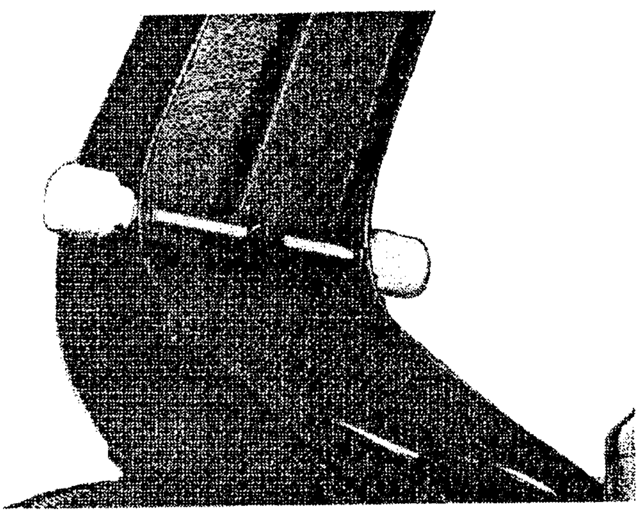
To help with adjusting the tilt plate on the wedge, use the optional Deluxe Latitude Adjuster (DLA). This accessory holds the telescope in place when the screws that hold the tilt plate are loose. In addition, the DLA allows you to make fine adjustments to the tilt plate for easier and more accurate polar alignment.

Azimuth adjustments can be made simply by moving the wedge left or right. If mounted on the tripod, use the two azimuth adjustments knobs supplied with the wedge. For more information, please see the section on "Polar Alignment."

Once you have adjusted the wedge and are aligned on the celestial pole, plug the clock drive into an AC power source of proper voltage so the telescope will track objects. To do this, plug the drive cord into the socket on the bottom of the drive base. Next, plug the other end into a wall socket (use and extension cord if necessary) and the motor will drive the telescope. If you want to run your clock drive with a car battery, you will need one of the Celestron drive correctors which has built in DC inverters.

Moving the Telescope In R.A. and DEC

Once set up, you will need to move your telescope to various areas of the sky to observe different objects. To make rough adjustments, loosen the R.A. and DEC clamps and move the telescope to the desired position. Once in place, lock the R.A. and DEC clamps to hold the telescope in place. For fine adjustments, use the R.A. and DEC slow motion knobs. If you are making an adjustment in declination, simply turn the declination knob. The DEC clamp does NOT have to be loosened. Once you have the desired target, stop rotating the DEC knob. If the DEC knob will not turn, the DEC travel arm may have reached the end of the threaded rod. To correct this, rotate the DEC knob in the opposite direction until the travel arm is in the center of the fork tine (look at the inside of the fork tine). Release the DEC clamp and manually re-center the object you were looking at. Tighten the DEC clamp and the DEC slow motion knob will again allow fine adjustments in both directions.



DEC slow motion knobs and travel arm

For fine adjustments in R.A., release the R.A. clamp until the R.A. knob can be rotated freely. Turn the R.A. knob until the desired object is centered. Once centered, re-tighten the right R.A. clamp by turning it clockwise. The clamp must be sufficiently locked for the drive motors to engage and move the telescope. **Please note that you should never turn the R.A. knob while the R.A. clamp is in the FULLY locked position.**

DO NOT FORCE THE R.A. KNOB TO TURN WHEN THE R.A. CLAMP IS FULLY ENGAGED. THIS MAY STRIP THE R.A. PINION. IN ADDITION, DO NOT FORCE THE FORK MOUNT TO SWIVEL WHEN THE R.A. CLAMP IS FULLY ENGAGED. THIS MAY CAUSE THE PRESSURE PLATE TO WEAR.

The DEC setting circle is incremented in degrees while the R.A. setting circle is incremented in 5 minute intervals.

Transporting Your Classic 8

If you plan on driving to a dark sky observing location, you can transport you Classic 8 as is (i.e., with the wedge attached). If you are using the optional adjustable tripod, remove the telescope from the wedge and return it to the original shipping container. The tripod can be completely collapsed with the wedge in place. If so desired, the wedge may be removed from the tripod as well.

If you plan on shipping your telescope via a common carrier, all parts should be returned to their original shipping containers.

Storing Your Classic 8

When not in use, your Classic 8 can be left fully assembled and set up. However, all lens and eyepiece covers should be put back in place. This will reduce the amount of dust build-up on the optical surfaces and reduce the number of times you need to clean the instrument. You may want to return everything to its original shipping container and store it there. If this is the case, all optical surfaces should still be covered to prevent dust build-up.

What Next?

Now that you have completely assembled your Classic 8, you are ready to begin attaching the accessories. Please turn to the section on "Telescope Operation" for more information.

The Ultima

The Ultima 8 is a heavy duty version of the fork mounted Celestron 8. The Ultima 8 uses a single motor Byers worm gear drive and has a 2-5/8" tapered polar shaft. For easy transportation, the Ultima has three carrying handles; one on each fork tine and one on the rear cell. In addition, the Ultima comes standard with Starbright ™ coatings and enhanced multi-layer aluminum coatings on the primary and secondary mirrors for increased reflectivity. Also, the corrector plate is fully coated to allow maximum light transmission. The Ultima is shipped in three boxes. One contains the telescope with all the standard accessories, which are:

- 30mm Plossl Ocular 1-1/4"
- 7mm Orthoscopic Ocular 1-1/4"
- Visual Back 1-1/4"
- Star Diagonal 1-1/4"
- 8x50mm Right Angle/Straight Through Polaris Finder With Bracket
- Lens Cap
- AC Charger
- Bolt Pack
- Allen Wrench Set

The second and third boxes contain the wedge and tripod which are also standard accessories. The Deluxe Latitude Adjuster is installed on the wedge.

Unpacking Your Ultima 8

Remove the wedge, tripod and telescope from their respective boxes. Remove all the accessories as well, which are located in the box with the telescope. Since all parts are completely assembled, all you need to do is attach the wedge to the tripod and the telescope to the wedge. Provided are two bolt packs (each containing three bolts) for this purpose. Locate each pack and you are ready to begin.

Setting Up Your Ultima 8 Tripod

The tripod that comes with your Ultima 8 is adjustable. To adjust the height of the tripod, unscrew the extension clamp on one of the tripod legs. Extend the leg to the desired height and re-tighten the clamp. Repeat this process for each of the legs. You can do this while the tripod legs are still folded together. Once all the legs are at the desired height, pull the legs away from the center of the tripod column. Do this until the support ring on the central tripod column is all the way to the bottom. You may have to push down on the support ring to get it all the way to the bottom.

Remember that the higher the tripod legs are extended, the less stable it will be. For casual observing, this may not pose a problem. However, if you plan on photography, the tripod should be set low to ensure stability. A recommended height is to set the tripod in such a manner that you can look directly into the eyepiece with a diagonal while seated.

Attaching The Wedge

After the tripod is set up, you are ready to attach the wedge. The wedge, like the tripod, is fully assembled and only needs to be attached to the tripod. The wedge is what allows you to orient the telescope's axis of rotation to align it with the celestial pole (please see the section on "Polar Alignment").

To attach the wedge to the tripod, place the three slots on the wedge over the three holes in the tripod head. Thread the three 5/16x18 hex head bolts into the holes until tight. Tighten the bolts until the wedge can not be moved side to side. These can be loosened later for polar alignment.

The Deluxe Latitude Adjuster (DLA) is already installed on the wedge. However, the altitude adjustment screw needs to be placed against the tilt plate. To do so, turn the altitude adjustment screw clockwise until it rests on the bottom lip of the tilt plate. This screw will now support the telescope during polar alignment.

Attaching The Ultima 8 To The Wedge

With the wedge in place on the tripod, you are ready to mount the telescope on the wedge. The telescope base fits directly onto the tilt plate of the wedge. To do this, partially insert one of the three bolts into the base of the telescope. Use the hole that is the farthest from the rectangular portion of the base. The rectangular portion of the base will slide between the side plates on the wedge and rest near the top of the tripod. With the bolt in place, hold the telescope firmly by the fork arms and slide the bolt into the slot on the top of the tilt plate. Tighten the bolt slightly so that the bottom of the drive base is flush with the tilt plate. Do not tighten it fully or you will not be able to slide the base so that the other two bolts can be inserted. If you do not tighten the bolt at all, the drive base may be tilted slightly so that the remaining bolts will not go in straight. Once flush, rotate the base of the telescope until the two remaining holes in the drive base line up with the holes in the tilt plate on the wedge. Once aligned, insert the two remaining screws and tighten all three of them completely. There is no need to loosen these until you are ready to remove the telescope from the wedge.

Attaching The Finderscope

The Ultima 8 comes standard with the Polaris 8x50mm right angle/straight through finderscope. To ensure the finder and bracket are not damaged during shipping, they are NOT attached to the telescope. To mount the finder, first remove it from its plastic wrapper. Included with the finder are five screws, two Allen head screws to hold the bracket to the telescope and three thumb screws to hold the finder in place inside the bracket. The three thumb screws are nylon tipped so they won't scratch the finderscope. In addition, there is also a rubber O-ring. This will slide over the finderscope to keep it secure in the bracket.

First, attach the bracket to the optical tube. To do this, find the two holes in the rear cell that are to the left of center (when looking from the back of the tube). The holes are covered with tape to prevent any dust or moisture from entering the optical tube. Remove the tape and place the finder bracket over the holes. The bracket should be oriented so that the ring with the holes for the adjustment screws is closer to the front cell of the telescope. Start threading the screws in by hand and then tighten them with one of the Allen wrenches provided.

Next, thread the screws in that will hold the finder in place. Do not thread them in completely. If you do, they will interfere with the placement of the finderscope. Tighten the screws until the nylon tips are flush with the inner diameter of the bracket ring.

Before the finder can be mounted in the bracket, the eyepiece and diagonal must be removed from the finder. To do this, rotate the diagonal assembly counterclockwise until the entire unit separates from the finderscope tube.

Next, take the O-ring and slide if over the back of the finder (it will NOT fit over the objective end of the finder). It may need to be stretched a little. Once on the main body of the finder, slide it up about 1 inch from the end of the finder. With the O-ring in place, slide the eyepiece end of the finder into the front of the bracket. Push it back until the end of the finder is past the end of the bracket, but NOT so far that the O-ring is snug inside the back ring of the bracket. Slightly tighten the three set screws to hold the finder in place. Now, thread the diagonal and eyepiece assembly back onto the finderscope by rotating the finder counterclockwise. Now, push the finder back until the O-ring is snug inside the rear bracket. Hand tighten the three set screws until snug. To properly align the finderscope, please see the section on "Aligning the Finder-scope."

The Polaris finder, which comes configured for right angle viewing, can also be used straight through. If you plan on using the finder for polar alignment, it is recommended that it be done while in the right angle configuration. Once it has been used for this purpose, or if you do not plan on using it for polar alignment, the finder can be converted to a straight through configuration for finding objects.

To do this, loosen the Allen screw (at the base of the eyepiece) that holds the eyepiece and reticle assembly in place. Once loose, the eyepiece and reticle assembly can be removed from the diagonal. (NOTE: there is another set screw on the side of the diagonal near the end of the finder. This allows access to the diagonal mirror. Do NOT loosen this set screw!)

Once the eyepiece assembly has been removed, unscrew the diagonal from the main finder body by rotating it counter-clockwise. When free from the finder, thread the straight through extension tube into the finder body. Now, slide the eyepiece and reticle assembly into the other end of the extension tube. Tighten the set screw on the extension tube to hold the eyepiece and reticle in place. You are now ready to use your Polaris finder straight through. Remember, in this configuration images will be inverted.

As mentioned above, the reticle in the Polaris finderscope is used for polar alignment. To help you see the reticle at night, there is an illuminator with a red Light Emitting Diode (LED). The illuminator comes with a 2.7 volt battery. To install the battery, remove the top of the illuminator housing by rotating it in the "off" direction. When the top is completely off, insert the battery with the negative (-) end first. Once in, screw the top of the illuminator back on. Turn the top until the LED comes on to verify that the battery is installed correctly. If all works well, rotate the top in the "off" direction until the LED shuts off. Be sure to turn the illuminator off when not in use so as to conserve the battery.

To vary the brightness of the reticle turn the nylon screw located in the end of the illuminator housing. The illuminator comes pre-set for maximum brightness. To decrease the brightness, turn the screw counterclockwise. You will need a flat blade screw driver.

To insert the illuminator, turn the set screw on the eyepiece housing until it no longer obstructs the inner diameter of the reticle ring. Insert the LED end of the illuminator and tighten the set screw to hold it in place.

To focus the reticle, turn the top portion of the eyepiece. The direction may vary depending on your eye sight. To focus the finderscope, loosen the knurled locking ring and turn the objective end of the finder. Once focused, re-tighten the locking ring. The finderscope is pre-set for infinity focus.

The correct procedure for using the reticle is described in the section on polar alignment.

Adjusting The Wedge

For the purpose of polar alignment, the wedge can be adjusted in two directions; the vertical direction, which is called altitude and the horizontal direction, which is called azimuth. Before adjusting the altitude, make sure that the altitude adjustment screw is completely installed. Turn the altitude adjustment handle until the screw is resting on the bottom lip on the tilt plate. This screw will support the telescope when the bolts on the side of the tilt plate are loose. Once this is done, use a crescent wrench to tighten the hex head bolts on the side of the wedge that hold the support bar of the altitude adjustment screw in place.

To adjust the altitude, slightly loosen the bolts that hold the tilt plate. Once loose, turn the altitude adjustment screw clockwise to raise the polar axis and counterclockwise to lower the polar axis. Once at the desired height, re-tighten the bolts on the side of the wedge that hold the tilt plate.

To move the telescope in azimuth, loosen the bolts that hold the wedge to the tripod. Then turn the azimuth adjustment handle on the side of the wedge. Once in the desired position, re-tighten the bolts that hold the wedge to the tripod. For rough adjustments, pick up the tripod and reposition it.

Once the appropriate adjustments have been made and you are aligned on the celestial pole, turn the clock drive on and the telescope will track objects.

Keep in mind that adjusting the wedge is done during the polar alignment process only. Once aligned the wedge and tripod do NOT have to moved. Repointing the telescope will be done with the R.A. and DEC controls.

Moving the Telescope in R.A. and DEC

Once set up, you will need to move your telescope to various portions of the sky to observe different objects. To make rough adjustments, loosen the R.A. and DEC clamps and move the telescope in the desired direction. Do NOT move the wedge and tripod, only the telescope optical tube. Once in place, lock the R.A. and DEC clamps to hold the telescope in place. For fine adjustments, use the R.A. and DEC slow motion knobs. If you are making an adjustment in declination, simply turn the declination knob. The DEC clamp does not have to be loosened. Once you have located the desired target, stop rotating the DEC knob. If the DEC knob will not turn, the DEC travel arm has most likely reached the end of the threaded rod. To correct this, turn the DEC knob in the opposite direction until the travel arm is in the center of the fork tine (look at the inside of the fork tine). Release the DEC clamp and re-center the object you were looking at. Tighten the DEC clamp and the DEC slow motion knob will again allow fine adjustments in both directions.

For fine adjustments in R.A., release the R.A. clamp until the R.A. knob rotates freely. Turn the R.A. knob until the desired object is centered. Once centered, re-tighten the R.A. clamp. The clamp must be sufficiently locked for the drive motors to engage and move the telescope. **Please note that you should never turn the R.A. knob while the R.A. clamp is in the FULLY locked position.**

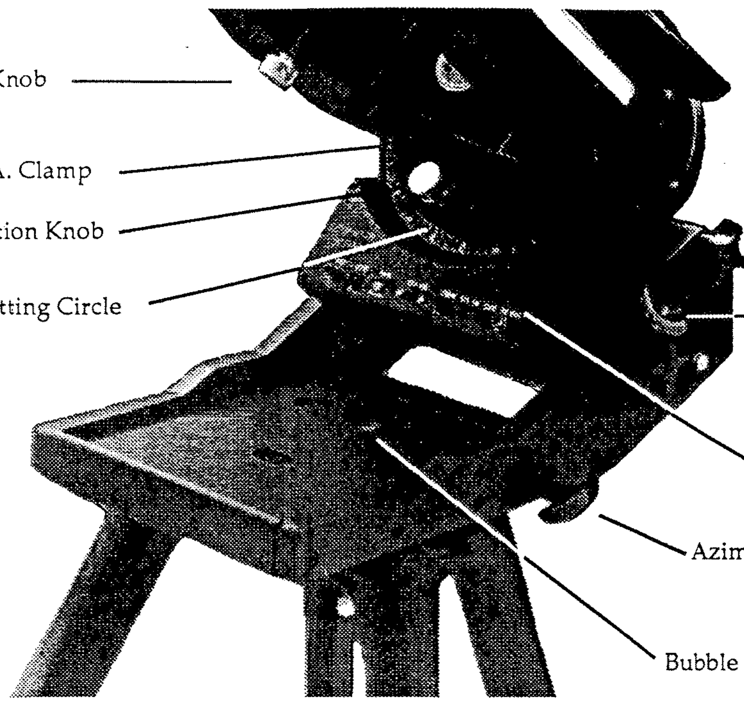
DO NOT FORCE THE R.A. KNOB TO TURN WHEN THE R.A. CLAMP IS FULLY ENGAGED. THIS MAY STRIP THE R.A. PINION. IN ADDITION, DO NOT FORCE THE FORK MOUNT TO SWIVEL WHEN THE R.A. CLAMP IS FULLY ENGAGED. THIS MAY CAUSE THE PRESSURE PLATE TO WEAR.

With the telescope set up, you are ready for your first look (please see the section on "Your First Look").

The Declination setting circle is incremented by degrees with every tenth degree labeled. The R.A. setting circle is listed by time with a indicator every 5 minutes. The numbers on the inner circle are for the northern hemisphere while those on the outer circle are for the southern hemisphere.

Using The Drive

The Ultima's entire drive system is a self contained unit in the drive base. The clock drive is powered by state-of-the-art re-chargeable lead acid batteries that can run the telescope up to 8 hours on a single charge. In addition, the batteries can NOT be over-charged and will hold a charge for 4 months.



The system can also run off of AC power (using the supplied adapter) or a car battery via an adapter (#18830). With the optional hand controller (#18833), which is not needed to operate the scope for normal tracking, you are ready for celestial photography. Other optional accessories can be added as your interest and observational skills develop.

The Ultima drive base has several components, each of which will be described separately. Starting on the left hand side, there is an outlet labeled "DEC." This port is for the cable that powers the optional Celestron DEC motor. If you are not using a DEC motor, leave this outlet empty.

Next, there is a six connector female phone jack labeled "CTR." This port accepts the male end of the optional hand controller. The hand controller is NOT needed for normal tracking. It is only used for long duration astrophotography. Insert the hand controller cable and the drive motor can now be used as drive corrector. On the hand controller there are four buttons and one knob. The buttons are for corrections in R.A. and DEC. They are labeled for North, South, East and West. The hand control knob allows you to select either lunar rate for tracking the Moon, solar for tracking the Sun or sidereal rate for tracking the stars. In addition, the control knob has a 2 Hz variance which allows for slightly different rate setting than those mentioned above. This rate variance is helpful for tracking comets.

To the right of the CTR jack is the power knob which affects the voltage supplied to the drive motors. **To ensure the longest possible running time between battery charges, leave the knob turned COMPLETELY COUNTERCLOCKWISE.** This is the lowest possible power setting. To increase the power, turn the knob clockwise. This may be required when operating in very cold weather. If the motor stops after a few minutes, shut the drive off and turn the knob clockwise slightly (approximately one sixth of a turn). Turn the drive back on again. Remember that turning the knob clockwise will decrease the operating time of the battery charge since it causes greater current drain. So use the lowest possible power setting you can under any given temperature conditions.

The "ON/OFF" switch simply supplies power to the drive motor. When on, the red LED will glow steadily. When the battery voltage reaches a recharge level, the LED will begin to blink. At this point you have about one hour of operating time remaining before you need a charge. If the LED goes out completely, turn the drive off to avoid permanent damage to the batteries. If the battery voltage gets low, you may consider plugging the telescope drive into the AC power charger or into your car battery (via the cigarette lighter). When using an external power source, you can operate indefinitely. While operating your telescope via the AC power charger, if the batteries are at a low point, they may NOT recharge. However, when operating off of DC power, the batteries will slowly recharge while the scope is in use.

When using the hand control paddle for astrophotography, pressing the East/West buttons may cause the red LED to blink if your batteries are near the recharge level. Once the buttons are released, the red LED will glow steadily again. This is normal and does not reflect a malfunction in the operation of the drive.

Be aware that the red LED is harder to see in the daytime. You may wish to use an external power supply when using your Ultima in the day. This will eliminate the possibility of completely draining the batteries and damaging them without knowing it.

The next outlet on the Ultima drive base (labeled "12 V IN") is for recharging the internal batteries. The telescope drive must be turned "OFF" in order for the batteries to charge. You can use an AC power supply or a 12 volt car battery. The recharge time required is equal to twice the previous operating time of the telescope. For example, if you observed for 8 hours, the recharge time would be 16 hours. Next to the recharge socket is a green LED. This indicates the state of the batteries during the recharge process. It will start out dim and glow steadily when the batteries are fully charged. YOU CAN NOT OVERCHARGE THE BATTERIES!

The last port on the drive base is the power supply for the optional Celestron/Tuthill Digital Setting Circles (#94117-HD).

A Word On The Charger

The charger serves two basic purposes. First, it is used to charge the batteries after they have been used for any length of time. The batteries do NOT have to be completely drained before they can be recharged. Second, the charger can also be used to power your telescope when the batteries are in need of a charge.

When using the charger to charge the batteries, there are three setting on the charger you need to be concerned with. The first is the AC power setting. There are two options, 110 volts or 220 volts. Select the appropriate option for your normal voltage.

The second setting is the polarity. Once again, there are two options; positive (+) and negative(-). This setting should be pre-set to positive. Leave it in this position.

Lastly, there is a voltage setting. The range is 3 volts to 12 volts. **Make sure that it is set to 12 volts or the batteries will NOT charge.**

The batteries are tested at the factory to ensure that they hold the proper charge. This may reduce the running time of the batteries on the first use. You may want to charge the batteries for about 4 hours just to be sure you get the full 8 hour run time. Also, when charging the batteries, the telescope drive must be OFF.

Replacing The Batteries

The batteries (#18767) in the drive base have a life range of about three years or 500 charges. After this they should probably be replaced. To do this, loosen the four Phillips head screws that hold the drive base cover to the drive base. Remove the cover plate and the internal components of the drive will be visible. Unclip the batteries and remove the wires from the positive end. When installing the new batteries, be sure that the proper polarity is used to avoid damage to the electronic base components. Replacing the batteries one at a time may help ensure that you have the proper polarity. Once installed, replace the drive base cover.

Transporting Your Ultima 8

You may leave your Ultima 8 fully set up in the house and carry it outside for a casual observing session. Since the telescope is fairly large and heavy when mounted on the tripod, you should remove the telescope and drive from the wedge. To do so, remove the two lower bolts that hold the drive base to the wedge. Next, partially loosen the top bolt. Once loose, hold the telescope by the fork arms and slide it up, off of the wedge. The tripod and wedge can now be carried outside separately and the telescope re-attached.

If you are planning a trip to a remote site, you should remove the telescope from the wedge and return it to its case.

Since the wedge does not interfere with the tripod at all, it can be left in place once firmly attached. This holds true even if you are transporting your telescope to a remote dark site observing location. The tripod legs can be collapsed and folded back together with the wedge in place. The only time you may want to remove the wedge is if you plan on packing your Ultima 8 and shipping it via a common carrier. If this is the case, you should return the wedge and tripod to their original shipping cartons.

For casual observing (terrestrial or astronomical), the Ultima 8 with fork mount and drive base can be placed on a flat, stable surface (Please see the section on "Your First Look").

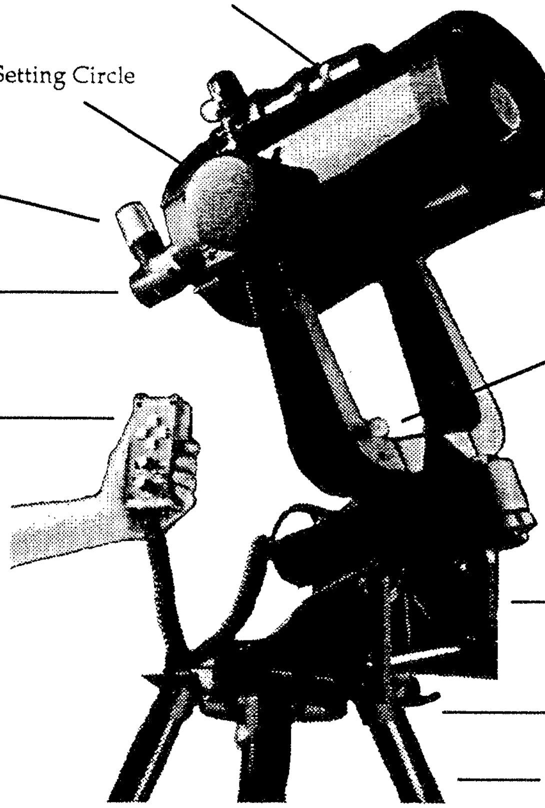
Storing Your Ultima 8

When not in use, your Ultima 8 can be left fully assembled and set up. However, all lens and eyepiece covers should be put back in place. This will reduce the amount of dust build-up on all optical surfaces and reduce the number of times you need to clean the instrument. You may want to return everything to its original shipping container and store it there. If this is the case, all optical surfaces should still be covered to prevent dust accumulation.

What Next?

Now that you have completely assembled your Ultima 8, you are ready to begin attaching the accessories. Please turn to the section on "Telescope Operation" for more information.

The Powerstar 4



The Powerstar 4 is another version of the fork-mounted Celestron 8 similar to the Classic 8. The Powerstar can run off of 9 volt (flash light) batteries, AC power, or a car battery. The Powerstar 4 uses a single motor Byers worm gear drive. In addition, it comes standard with Starbright™ coating, an enhanced multi-layer aluminum coating on the primary and secondary mirrors for increased reflectivity. Also, the corrector is fully coated to allow maximum light transmission. The Powerstar is shipped in four boxes. One contains the telescope with all the standard accessories, which are:

- 30mm Plossl Ocular 1-1/4"
- 7mm Orthoscopic Ocular 1-1/4"
- Visual Back 1-1/4"
- Star Diagonal 1-1/4"
- 8x50mm Polaris Right Angle/Straight Through Finder With Bracket
- Deluxe Latitude Adjuster Kit
- Lens Cap
- Battery Pack
- AC Adapter
- Car Battery Adapter
- Bolt Pack
- Allen Wrench Set

The second box contains additional accessories which will not fit in with the telescope. Included are:

- T-Adapter
- Piggyback Mount
- Product Guide And Reference Manual
- Dewstar

Included with the Powerstar 4 are the wedge and adjustable tripod. These two accessories are shipped in separate boxes.

Unpacking Your Powerstar 4

Remove the wedge, tripod and telescope from their respective boxes. Remove all the accessories as well, which are located in the box with the telescope. Since all parts are completely assembled, all you need to do is attach the wedge to the tripod and the telescope to the wedge. Provided are two bolt packs (each containing three bolts) for this purpose. Locate each pack and you are ready to begin.

Setting Up Your Powerstar 4

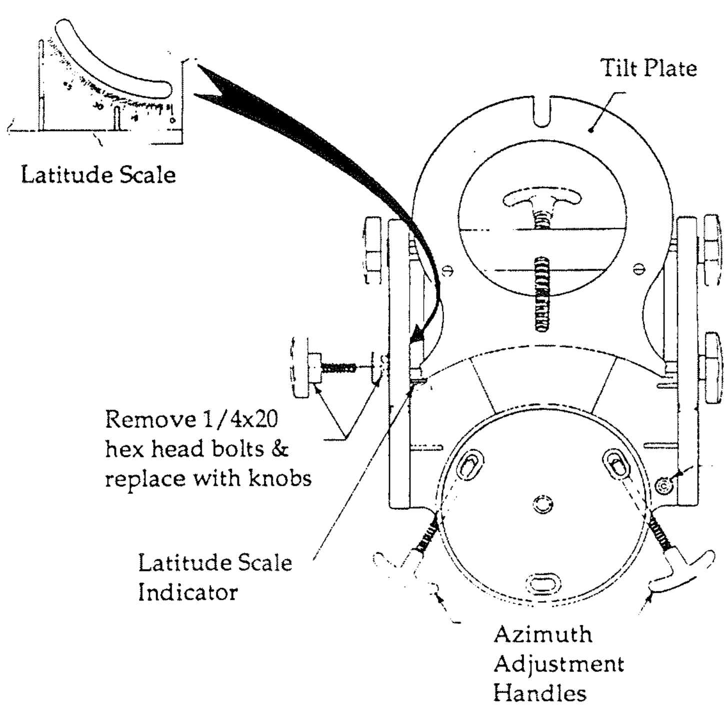
The tripod that comes with your Powerstar 4 is adjustable. To adjust the height of the tripod, release the extension clamp on one of the tripod legs. Extend the leg to the desired height and re-tighten the clamp. Repeat this process for each of the legs. You can do this while the tripod legs are still folded together. Once all the legs are at the desired height, pull the legs away from the center of the tripod column. Do this until the support ring on the central tripod column is all the way to the bottom. You may have to push down on the support ring to get it all the way to the bottom.

Remember that the higher the tripod legs are extended, the less stable it will be. For casual observing, this may not pose a problem. However, if you plan on doing photography, the tripod should be set low to ensure stability. A recommended height is to set the tripod in such a manner that you can look directly into the eyepiece while seated.

Installing The Deluxe Latitude Adjuster

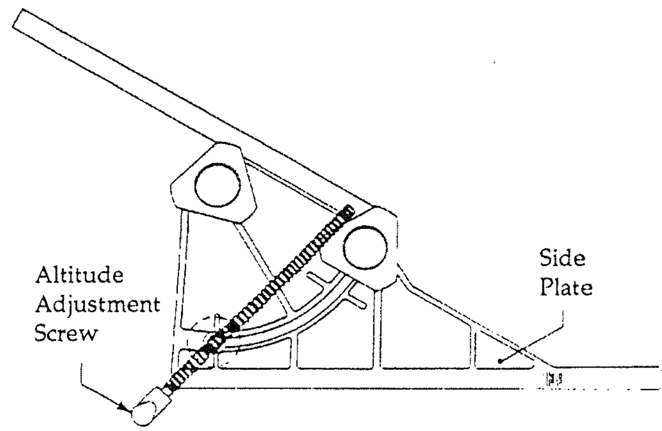
The Deluxe Latitude Adjuster (DLA) serves two basic purposes. First, the DLA allows you to make fine adjustments to the orientation of the telescope's axis for easier and more accurate polar alignment. The installation of the DLA is described below. Second, it allows you to set up your telescope without any tools. All bolts used to attach the telescope to the wedge and the wedge to the tripod have easy-to-tighten plastic handles.

Although the DLA allows you to set up your telescope without any tools, you will need a few to install it. First, use a crescent wrench to remove the hex head bolts that hold the tilt plate to the wedge. There are four in all, two on each side of the wedge. Do one side at a time. This way the bolts on the opposite side will hold the tilt plate in place. Replace the bolts with the star shaped 1/4x20 bolts. (Note: There are also three



larger 5/16-1" star shaped bolts that will be used to attach the wedge to the tripod. Do NOT attempt to use these to attach the tilt plate to the wedge.) Repeat this process on the other side of the wedge. Do NOT discard the hex head bolts. They will be used to attach the altitude adjustment screw and support bar.

Next, install the altitude adjustment screw with the round support bar. It installs underneath the tilt plate. Place the support bar parallel to the tilt plate. Line up the drilled and tapped holes on the end of the bar with the slots on the side of the wedge. The 1/4x20 hex head bolts that were used to hold the tilt plate can now be used to hold the support bar in place. Insert the bolts and hand tighten. Tighten the bolts fully with a crescent wrench.



With the support bar in place, turn the altitude adjustment screw until it rests inside the bottom lip of the tilt plate. The DLA is now installed on the wedge. The remaining plastic-handled bolts will be used to attach the wedge to the tripod and the telescope to the wedge.

Lastly, insert the azimuth adjustment handles into the holes on the base of the wedge. Rotate it clockwise until the tip begins to extend into the slotted holes on the base plate of the wedge. Do NOT screw them into the slotted holes as this will interfere with the placement of the bolts that attache the wedge to the tripod.

Attaching The Wedge

After the tripod is set up and the DLA has been installed, you are ready to attach the wedge to the tripod. The wedge is what allows you to tilt the telescope drive's axis of rotation to align it with the Earth's axis of rotation (see the section on "Polar Alignment").

To attach the wedge to the tripod, place the three slots on the wedge over the three holes in the tripod head. Thread the three 5/16x18 bolts with star shaped handles. into the holes until tight. Tighten the bolts until the wedge can not be moved from side to side. These can be loosened later for polar alignment.

Attaching The Powerstar 4 To The Wedge

With the wedge in place on the tripod and the tripod securely standing on the ground, you are ready to mount the telescope on the wedge. The telescope base fits directly onto the tilt plate of the wedge. Partially insert one of the three bolts (3/8"-16x1") into the hole that is the farthest from the rectangular portion of the base. The rectangular portion of the base will slide between the side plates on the wedge and rest near the top of the tripod. With the bolt in place, hold the telescope firmly by the fork arms and slide the bolt into the slot on the top of the tilt plate. Tighten the bolt slightly so that the bottom of the drive base is flush to the tilt plate. Do not tighten it fully or you will not be able to rotate the base so that the other two bolts can be inserted. If you do not tighten the top bolt at all, the drive base may be tilted slightly so that the remaining bolts will not go in straight. Rotate the base of the telescope until the two remaining holes in the drive base line up with the holes in the tilt plate on the wedge. Once aligned, insert the screws and tighten them completely. There is no need to loosen these until you are ready to remove the telescope from the wedge.

Attaching The Finderscope

The Powerstar 4 comes standard with the Polaris 8x50mm right angle/straight through finderscope. To ensure the finder and bracket are not damaged during shipping, they are NOT attached to the telescope. To mount the finder, first remove it from its plastic wrapper. Included with the finder are five screws, two Allen head screws to hold the bracket to the telescope and three thumb screws to hold the finder in place inside the bracket. The three thumb screws are nylon tipped so they won't scratch the finderscope. In addition, there is also a rubber O-ring. This will slide over the finderscope to keep it secure in the bracket.

First, attach the bracket to the optical tube. To do this, find the two holes in the rear cell that are left of the center (when looking from the back of the tube). The holes are covered with tape to prevent any dust or moisture from entering the optical tube. Remove the tape and place the finder bracket over the holes. The bracket should be oriented so that the ring with the holes for the finder is closer to the front cell of the telescope. Start threading the screws in by hand and then tighten them with one of the Allen wrenches provided.

Next, thread the screws in that will hold the finder in place. Do not thread them in completely. If you do, they will interfere with the placement of the finderscope. Tighten the screws until the nylon heads are flush with the inner diameter of the bracket ring.

Before the finder can be mounted in the bracket, the eyepiece and diagonal must be removed from the finder. To do this, rotate the entire housing counterclockwise until the entire unit separates from the finderscope tube.

Next, take the O-ring and slide if over the back of the finder (it will NOT fit over the objective end of the finder). It may need to be stretched a little. Once on the main body of the finder, slide it up about 1 inch from the end of the finder. With the O-ring in place, slide the eyepiece end of the finder into the front of the bracket. Push it back until the end of the finder is past the end of the bracket, but NOT so far that the O-ring is snug inside the back ring of the bracket. Slightly tighten the three set screws to hold the finder in place. Now, thread the diagonal and eyepiece assembly back onto the finderscope by rotating the finder counterclockwise. Now, push the finder back until the O-ring is snug inside the rear bracket. Hand tighten the three set screws until snug. To properly align the finderscope, please see the section on "Aligning the Finderscope."

The Polaris finder, which comes configured for right angle viewing, can also be used straight through. If you plan on using the finder for polar alignment, it is recommended that it be done while in the right angle configuration. Once it has been used for this purpose, or if you do not plan on using it for polar alignment, the finder can be converted to a straight through configuration for finding objects.

To do this, loosen the Allen screws that hold the eyepiece and reticle assembly in place. Once loose, the eyepiece and reticle unit can be removed from the diagonal. (NOTE: there is another set screw on the side of the diagonal near the end of the finder. This allows access to the diagonal mirror. Do NOT loosen this set screw!)

Once the eyepiece unit has been removed, unscrew the diagonal from the main finder body by rotating it counterclockwise. When free from the finder, thread the extension tube into the finder body. Now, slide the eyepiece and reticle unit into the other end of the extension tube. Tighten the set screw on the extension tube to hold the eyepiece and reticle in place. You are now ready to use your Polaris finder straight through. Remember, in this configuration images will be inverted.

As mentioned above, the reticle in the polar axis finder is used for polar alignment. To help you see the reticle at night, there is an illuminator with a red Light Emitting Diode (LED). The illuminator comes with a 2.7 volt battery. To install the battery, remove the top of the illuminator housing by rotating it in the "off" direction. When the top is completely off, insert the battery with the negative (-) end first. Once in, screw the top of the illuminator back on. Turn the top until the LED comes on to verify that the battery is installed correctly. If all works well, rotate the top in the "off" direction until the LED shuts off.

To vary the brightness of the reticle turn the nylon screw located in the end of the illuminator housing. The illuminator comes pre-set for maximum brightness. To decrease the brightness, turn the screw counterclockwise. You will need a flat blade screw driver. The illuminator should be turned "OFF" when not in use to conserve the battery.

To insert the illuminator, turn the set screw on the eyepiece housing until it no longer obstructs the inner diameter of the reticle ring. Insert the LED end of the illuminator and tighten the set screw to hold it in place.

To focus the reticle, turn the top portion of the eyepiece. The direction may vary depending on your eyesight. To focus the finderscope, loosen the knurled locking ring and turn the objective end of the finder. Once in focus, re-tighten the locking ring to ensure the finder stays in focus. The finderscope is pre-set for infinity focus.

Adjusting The Wedge

For polar alignment the wedge can be adjusted in two directions; the vertical direction, which is called altitude and the horizontal direction, which is called azimuth. To adjust the altitude, loosen the bolts that hold the tilt plate. Make sure the telescope and tilt plate are resting on the altitude adjustment screw, which was installed earlier. Once loose, turn the altitude adjustment screw clockwise to raise the polar axis and counterclockwise to lower the polar axis. When the desired angle has been achieved, re-tighten the bolts.

To move the telescope in azimuth, loosen the bolts that hold the wedge to the tripod. Then, turn the azimuth adjustment handles at the base of the wedge. These handles push off two of the bolts that hold the wedge to the tripod. They will be opposed to each other which means you may have to loosen on while tightening the other. Once in the desired position, re-tighten the bolts that hold the wedge to the tripod.

Once the appropriate adjustments have been made and you are aligned on the celestial pole, turn the clock drive on by plugging it into the power source (there is no "On/Off" switch on the drive base). Once on, the telescope will track objects. For more information on how to align on the celestial pole, please see the section on "Polar Alignment."

Moving the Telescope In R.A. and DEC.

Once set up, you will need to move your telescope to various portions of the sky to observe different objects. To make rough adjustments, loosen the R.A. and declination clamps and move the telescope in the desired direction. Do NOT move the wedge and tripod, only the telescope tube. Once in place, lock the R.A. and DEC clamps to hold the telescope in place. For fine adjustments, use the R.A. and DEC slow motion knobs. If you are making a fine adjustment in declination, simply turn the declination knob. The DEC clamp does not have to be loosened. Once you have located the desired target, stop rotating the DEC knob. If the DEC knob will not turn, the DEC travel arm has most likely reached the end of the threaded rod. To correct this, turn the DEC knob in the opposite direction until the travel arm is in the center of the fork tine (look at the inside of the fork tine). Release the DEC clamp and re-center the object you were looking at. Tighten the DEC clamp and the DEC slow motion knob will again allow fine adjustments in both directions.

For fine adjustments in R.A., release the R.A. clamp until the R.A. knob rotates freely. Turn the R.A. knob until the desired object is centered. Once centered, re-tighten the R.A. clamp. The clamp must be sufficiently locked for the drive motors to engage and move the telescope. **Please note that you should never turn the R.A. knob while the R.A. clamp is in the FULLY locked position.**

DO NOT FORCE THE R.A. KNOB TO TURN WHEN THE R.A. CLAMP IS FULLY ENGAGED. THIS MAY STRIP THE R.A. PINION. IN ADDITION, DO NOT FORCE THE FORK MOUNT TO SWIVEL WHEN THE R.A. CLAMP IS FULLY ENGAGED. THIS MAY CAUSE THE PRESSURE PLATE TO WEAR.

With the telescope set up, you are ready for your first look (please see the section on "Your First Look").

The Declination setting circle is incremented by degrees with every tenth degree labeled. The R.A. setting circle is listed by time with a indicator every 5 minutes. The numbers on the inner circle are for the northern hemisphere while those on the outer circle are for the southern hemisphere.

Using The Drive

The Powerstar 4 utilizes a single motor worm gear drive. On the top of the drive base plate there are three receptacles. The first, labeled "Power 12 V DC", is for the AC or DC power supply cord. Select which power source you want to use and plug it in. In addition, there is an outlet on the hand control box that can be used for the same purpose. The AC adapter uses a transformer so the drive motor will not be damaged.

Next is the "Drive" receptacle. This is where the hand control box is plugged in. To activate the drive, the hand control box and the power cord must be plugged in. The motors will begin to hum, possibly with a slight variance in frequency. The applications of the hand control box are described below.

The last outlet on the drive base is labeled "Focus Motor." This outlet is for the optional focusing motor (#94041).

The Hand Control Box

As stated above, the hand control box activates the clock drive. Once plugged in, the drive motors will begin to run. Each of the functions of the control box is described here.

The first receptacle is located on the bottom of the box. It is labeled "DC Power." Like the receptacle on the drive base, this is designed for the power, be it AC or DC. You can use this outlet or the one on the drive base, whichever is more convenient.

Next to the DC Power outlet on the hand control box is a small toggle switch which activates the map light. The map light is located above the "North" button on the face of the hand control box.

The other receptacle on the bottom of the hand control box is for the optional DEC motor (#48519). The DEC motor is ideal if you plan on long exposure astrophotography. When using this accessory, all corrections in declination can be made from the hand control box. This eliminates the need to make corrections by hand, which in turn reduces the likelihood that you might accidentally bump or shake the telescope.

On the main face of the control box you will find a knob with settings for sidereal, solar and lunar rates. This knob affects the rate at which the drive motor tracks. Sidereal is for viewing the stars and deep sky objects, solar for tracking the Sun, and lunar for tracking the Moon. The knob also allows for a small degree of variance to track objects that do not fall into one of these three categories. An example of such an object would be a comet.

Next to the rate knob is a switch labeled "N-S." This is to let the drive motors know which hemisphere you are viewing from (i.e., northern or southern). This affects the direction the drive motor rotates the telescope fork. **It should be noted that this switch setting must NEVER be changed while the telescope is operating.** If you plan a trip to a different hemisphere from which you normally observe, don't forget to change this setting. This setting should be changed while the hand control box is unplugged.

Above the knob for the tracking rate is another knob. This knob affects the rate which the focus motor moves. Once again, the electric focuser is an optional and is NOT included with the telescope. However, it should be noted that if you purchase the focus motor, the speed variance is limited to a partial rotation of the knob. The knob should be placed with the indicator pointing straight up (i.e., toward the manual override buttons). The knob can then be rotated to the full clockwise position to vary the speed. Rotating the knob counterclockwise from the vertical position will have NO effect on the speed of the focus motor.

To the right of this knob is a toggle switch which activates the focus motor. The switch must be pressed to keep the motor on. Pushing the switch up allows you to focus on objects that are closer than the one you are currently focused on. Pushing it down moves toward infinity focus. Once the switch is released, the focus motor stops.

Lastly, there is a switch labeled "2x-4x." This affects the slewing rate for R.A. and declination (if the optional DEC motor is installed). This switch setting allows you to set the slewing rate at 2 or 4 times the normal tracking rate. This is used only when pressing one of the manual override buttons.

On the very top of the hand control box are the manual override buttons. These are used for guiding the telescope and should be pressed to re-center a guide star. The override button works only while it is depressed. Once you take your finger off the button, the drive motor will return to its normal rate. The "West" button increases the tracking rate enabling the telescope to catch up to the star. The "East button stops the drive motor allowing the star to catch up to the telescope.

Installing and Replacing The Batteries

To install the batteries, open the vinyl pouch on the end of the DC power cord. Remove the plastic housing and insert the appropriate size batteries with the polarity indicated on the plastic housing. Replace the plastic battery housing in the vinyl case and you are ready to use the drive. The batteries will last up to four hours. In extremely cold weather the battery life will be sharply reduced. Placing the battery housing inside a warm pocket will counteract this.

Transporting Your Powerstar 4

You may leave your Powerstar 4 fully set up in the house and carry it outside for a casual observing session. However, since the telescope is large and somewhat heavy on its tripod, you may want to remove the telescope and drive from the wedge when moving it. To do so, remove the two lower bolts that hold the drive base to the wedge. Next, partially loosen the top bolt. Once loose, hold the telescope by the fork arms and slide it up, off of the wedge. The tripod and wedge can now be carried outside and the telescope re-attached.

If you have a strong back, you may be able to pick the telescope up while still attached to the wedge and tripod. If you do this, position yourself as close to the telescope as possible and pick it up underneath the tripod head. With the tripod legs extended, it may be difficult to move through doorways. You may wish to collapse the tripod legs or partially fold them in toward the center.

If you are planning a trip to a remote site, you should remove the telescope from the wedge and return it to its case. Since the wedge does not interfere with the tripod at all, it can be left in place once firmly attached. This holds true even if you are transporting your telescope to a dark observing site. The tripod legs can be collapsed and folded back together with the wedge in place. The only time you may want to remove it is if you plan on shipping your Powerstar 4 via a common carrier. If this is the case, you should return the wedge and tripod to their original shipping cartons.

For casual looking, the Powerstar with fork mount and drive base can be placed on a flat, stable surface (Please see the section on "Your First Look").

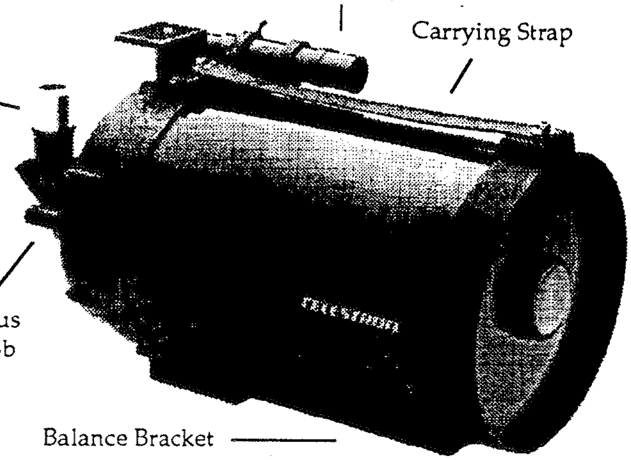
Storing Your Powerstar 4

When not in use, your Powerstar 4 can be left fully assembled and set up. However, all lens and eyepiece covers should be put back in place. This will reduce the amount of dust build-up on all optical surfaces and reduce the number of times you need to clean the instrument. You may want to return everything to its original shipping container and store it there. If this is the case, all optical surfaces should be covered to prevent dust build-up.

What Next?

Now that you have completely assembled your Powerstar 4, you are ready to begin attaching the accessories. Please turn to the section on "Telescope Operation" for more information.

The Celestron 8 Optical Tube Assembly



The Celestron 8 optical tube is simply the telescope without the fork mount and clock drive unit. In its standard configuration, the C8 optical tube assembly is designed to attach to a standard photographic tripod for terrestrial viewing. However, this does not mean that the C8 optical tube assembly can not be used for astronomical viewing. On the contrary, it can be used as an alt-azimuth telescope for casual astronomical observations. The C8 optical tube assembly is shipped in one carton which contains the telescope and all standard accessories which included:

- 26mm Plossl Ocular 1-1/4"
- Visual Back 1-1/4"
- Star Diagonal 1-1/4"
- 6x30mm Finderscope And Bracket
- Balance Bracket (for tripod adaption)
- Allen Wrench Set

Unpacking Your C8 Optical Tube Assembly

The C8 optical tube comes in a foam lined foot locker with all the standard accessories. Remove all the parts from the box and you are ready to set up the optical tube.

Setting Up Your C8 Optical Tube Assembly

The balance bracket is attached to the C8 and ready to adapt to a photographic tripod. The balance bracket has two 1/4x20 holes for attaching to a tripod. The two holes are either side of the center of the bracket. The bracket is held to the C8 by a small thumb screw. Be sure the thumb screw is tight **BEFORE** you attempt to attach your C8 to a tripod. To attach the C8 optical tube to a photographic tripod, place either of the holes in the balance bracket over the 1/4x20 screw on your photographic tripod. Tighten the screw to hold the bracket in place. Once this is done you are are ready to attach the finderscope and accessories. Attaching the finderscope is described in the following section, while attaching the accessories is described under "Telescope Basics."

NOTE: Never loosen the balance bracket thumb screw unless you have a firm hold of the telescope tube. Also, be sure that the corrector end of the telescope is pointing away from the ground at all times.

If so desired, the balance bracket can be removed from the telescope and mounted on the tripod by itself. The optical tube can then be added once the bracket is secure. If this is done, be sure that the closed end of the bracket (the part with the flange) is on the same side as the slow motion handles of your tripod.

Attaching The Finderscope

The C8 optical tube comes standard with a 6x30mm finderscope. To ensure the finder and bracket are not damaged during shipping, they are NOT attached to the telescope. To mount the finder, remove it from its plastic wrapper. Included with the finder are five Allen head screws. Two hold the bracket to the telescope and three hold the finder in place inside the bracket. The three that hold the finder in place are easy to identify since they are nylon tipped. In addition, there is also a rubber O-ring. This will slide over the finderscope to keep it secure in the bracket.

First, attach the bracket to the optical tube. To do this, find the two holes in the rear cell that are right of center (when looking from the back of the tube). The holes are covered with tape to prevent any dust or moisture from entering the optical tube. Remove the tape and place the finder bracket over the holes. The bracket should be oriented so that the ring with the holes for the adjustment screws is closer to the rear cell of the telescope. Start threading the screws in by hand and then tighten them with one of the Allen wrenches provided.

Next, thread the screws in that will hold the finder in place. Do not thread them in completely. If you do, they will interfere with the placement of the finderscope. Tighten the screws until the nylon heads are flush with the inner diameter of the bracket ring.

Next, take the O-ring and slide it over the back of the finder (it may need to be stretched a little). Once on the main body of the finder, slide it toward the front (i.e., objective) end of the finder. With the O-ring in place, slide the eyepiece end of finder into the front of the bracket. Push it back until the O-ring is snug inside the front ring of the bracket. Hand tighten the three set screws until snug. You will not need to tighten them with an Allen wrench since the finder still needs to be aligned. To properly align the finderscope, please see the section on "Aligning the Finderscope."

With the finderscope in place you are ready to attach the standard accessories, align the finderscope and have a look through the telescope. All of these functions are described in the following section.

TELESCOPE OPERATION

Once your telescope has been fully assembled, you are ready to attach the accessories and have a look. This section deals with basic telescope operation that is common to all Celestron 8 telescopes.

Attaching The Accessories

There are several accessories that come standard with all the Celestron 8 telescopes. The installation and use of each of these is described in this section.

The Visual Back

The visual back is the accessory that allows you to attach all visual accessories to the telescope. The SP-C8, the Powerstar 4 and the C8 Optical Tube come with the visual back installed. It is not installed on the Classic and Ultima. To attach the visual back, remove the plastic cover on the rear cell. Place the knurled slip ring on the visual back over the threads on the rear cell. Hold the visual back with the set screw in a convenient position and rotate the ring clockwise until tight.

If you want to remove the visual back, rotate the slip ring counterclockwise until it is free of the rear cell. Once this is done, you are ready to attach other accessories.

The Star Diagonal

The star diagonal is a prism that diverts the light at a right angle to the light path of the telescope. This allows you to observe in positions that are physically more comfortable than if you were to look straight through. To attach the star diagonal, turn the set screw on the visual back until it no longer extends into (i.e., obstructs) its inner diameter of the visual back. Then, slide the chrome portion of the star diagonal into the visual back and tighten the set screw to hold the star diagonal in place.

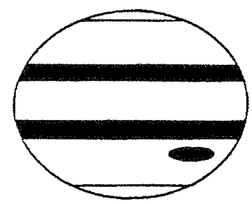
If you wish to change the orientation of the star diagonal, loosen the set screw on the visual back until the star diagonal rotates freely. Move the diagonal to the desired position and re-tighten the set screw.

The Oculars

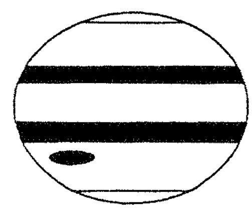
The ocular, or eyepiece, is an optical element that magnifies the image produced by the telescope. The ocular(s) fit into either the visual back directly, the star diagonal or the porro prism. To attach an ocular, loosen the set screw on the star diagonal or porro prism so that it does not obstruct the inner diameter of the eyepiece end of the diagonal. Slide the chrome portion of the eyepiece into the star diagonal or porro prism and re-tighten the set screw.

To remove the eyepiece, loosen the set screw on the star diagonal and slide the eyepiece out. You can replace it with another ocular.

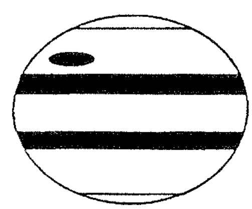
It should be noted that the image orientation will change depending on the accessory being used. When using the star diagonal, the image will be right-side-up, but reversed from left-to-right. If inserting the eyepiece into the visual back (i.e., without the star diagonal), the image will be inverted.



Actual orientation



Reversed from left to right; As viewed with a star diagonal



Inverted; As viewed with the eyepiece inserted directly into the visual back

Focusing

Each of the Celestron 8 telescopes uses the same focusing mechanism. The primary mirror is mounted on a ring which slides back and forth on the primary baffle tube. The focusing knob, which moves the primary mirror, is on the rear cell of the telescope. Turn the focusing knob until the image is sharp. If the knob will not turn, it has reached the end of its travel on the focusing mechanism. Turn the knob in the opposite direction until the image sharp. Once an image is in focus, turn the knob clockwise to focus on a closer object and counterclockwise for a more distant object.
A single turn of the focusing knob moves the primary mirror only slightly. Therefore, it will take many turns (about 40) to go from close focus (approximately 25 feet) to infinity.

When working with any optical instrument, there are several focusing hints. First, try to avoid looking through glass. Glass found in household windows is optically imperfect, and as a result, may vary in thickness from one part of a window to the next. This inconsistency can and will affect the ability to focus your telescope. In most cases you will not be able to achieve a truly sharp focus. In some cases, you may actually see a double image.

Second, never look across or over objects that are producing heat waves. This could include asphalt parking lots on hot summer days or building rooftops.

In addition, hazy skies, fog, and mist can also make it difficult to focus when viewing terrestrially. The amount of detail that can be seen under these conditions will be greatly reduced. Also, when photographing under these conditions, the processed film may come out a little grainier than normal.

When using your telescope as a telephoto lens, the split screen or microprism focuser of the 35mm camera may "black out." This is common with all long focal length lenses. If this does happen, use the ground glass portion of your focusing screen. To achieve a very sharp focus you may consider using a focusing magnifier. (These are readily available from your local camera store.)

If you wear corrective lenses (specifically glasses), you may want to remove them when observing with an eyepiece attached to the telescope. However, when using a camera you should always wear corrective lenses to ensure the sharpest possible focus. If you have astigmatism, corrective lenses must be worn at all times.

Aligning The Finderscope

The Ultima 8 and Powerstar 4 come with an 8x50mm finderscope while the SP-C8, the Classic 8 and the optical tube assembly come with a 6x30mm finderscope. The finder is designed to help you aim the main telescope at distant objects that would be hard to find in the narrow field of the main optics. To make things a little easier, you should align the finderscope during the day when it is easier to locate objects.

The first number used to describe the finder is the power. The second number is the diameter of the objective lens in millimeters. For example, the Ultima finder is 8x50. This means it is 8 power and has a 50mm objective lens. Incidentally, power is always compared to the unaided human eye. So an 8 power finder magnifies images 8 times more than the human eye.

To align the finder, choose a target that is over 500 yards away. This will eliminate any possible parallax effect. Point the C8 at your target and center it in the main optics of the telescope. Once you have the target centered, lock the R.A. and DEC clamps to hold the telescope in place. Now, adjust the screws on the finderscope bracket, tightening one while loosening another, until the cross hairs are centered on the target. Once your target is centered on the cross hairs, tighten each screw an additional quarter of a turn until you are sure they will not come loose easily. Accurate alignment of the finderscope will make it much easier to find objects in the main optical tube.

Image orientation through the finder will depend on the viewing configuration that you are using. For example, the 6x30mm finderscope (standard with the SP-C8, the Classic 8 and the optical tube assembly) produces images that are upside down and reversed from left-to-right. This is normal for any finderscope that is used straight through. If using a right angle finder (as is standard on the Ultima 8 and the Powerstar 4) the image is right-side-up, but reversed from left-to-right. Once again, this is normal for any finder used in this configuration. Because of this, it may take a few minutes to familiarize yourself with the directional change each screw has on the finderscope.

Your First Look

With the telescope fully assembled and all the accessories attached, you are ready for your first look. Your first look should be done in the daytime when it will be easier to locate adjustment knobs and clamps. This will help to familiarize you with your telescope, thus making it easier to use at night.

Begin by finding a distant object that is fairly bright. Insert a low power eyepiece into your telescope (a low power eyepiece will have a longer focal length than a higher power one). Release the R.A. and DEC clamps and point the telescope at the object you selected. Locate the object in your finderscope first and lock the R.A. and DEC clamps. Use the slow motion knobs to center the object. Once centered, look through the main optics and the object should be there. Try using different eyepieces to see how the field of view changes with various magnifications.

If using the Classic 8, Ultima 8 or Powerstar 4, casual terrestrial observing like this can be done with the telescope and fork mount placed on a flat, sturdy surface. In this configuration, the R.A. and DEC slow motion controls can be used to make horizontal and vertical adjustments, respectively.

NEVER POINT YOUR TELESCOPE AT THE SUN UNLESS YOU HAVE THE PROPER SOLAR FILTER. PERMANENT AND IRREVERSIBLE EYE DAMAGE MAY RESULT, AS WELL AS DAMAGE TO YOUR TELESCOPE. ALSO, NEVER LEAVE YOUR TELESCOPE UNATTENDED DURING A DAYTIME OBSERVING SESSION, ESPECIALLY WHEN CHILDREN ARE PRESENT.

The following section deals with observational astronomy in general. This includes information on the night sky, polar alignment and using your telescope for astronomical observations.

The Celestial Coordinate System

In order to help find objects in the sky, astronomers use a celestial coordinate system which is similar to our geographical coordinate system here on Earth. The celestial coordinate system has poles, lines of longitude and latitude and an equator. For the most part, these remain fixed against the background stars.

The celestial equator runs 360 degrees around the Earth and separates the northern celestial hemisphere from the southern. Like the Earth's equator, it bears a reading of zero degrees. On Earth this would be latitude. However, in the sky this is now referred to as declination, or DEC for short. These circular lines of declination above and below the celestial equator are named for their angular distance from the equator. The lines are broken down into degrees, minutes and seconds of arc. Declinations south of the equator carry a minus sign (-) in front of the number and those north are preceded by a "+." In the northern hemisphere all the stars appear to rotate around the north celestial pole.

The celestial equivalent of longitude is called Right Ascension, or R.A. for short. Like the Earth's lines of longitude, they run from pole to pole. While the longitude lines are separated by an angular distance, they are also a measure of time. Lines of longitude can be space 15 °or one hour apart from the next. Since the Earth rotates once every 24 hours, there are 24 lines total, making a 360° circle.

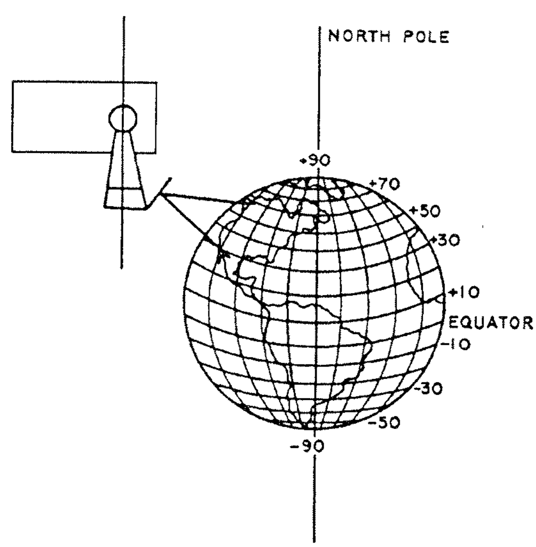
As a result, the R.A. coordinates are marked off in units of time. It begins with an arbitrary point in the constellation of Pisces designated as 0 hours, 0 minutes, 0 seconds. All other points are designated by how far (i.e., how long) they lag behind this coordinate after it passes overhead moving towards the west.

Your Celestron telescope comes equipped with setting circles that translate the celestial coordinates into a precise location for the telescope to point. The setting circles will not work properly until you have polar aligned the telescope and aligned the R.A. setting circle. It should be noted that the process of polar alignment sets the declination setting circle.

Polar Alignment

In order for the telescope to track the stars it must meet two criteria. First, you need a drive motor that will move at the same rate as the stars. The Classic, Ultima and Powerstar 4 all have built-in drive motors designed specifically for this purpose. The SP-C8 and optical tube assembly can have optional drive motors fitted to them. The second thing you need is to set the telescope's axis of rotation so that it tracks in the right direction. Since the motion of the stars across the sky is caused by the Earth's rotation about its axis, the telescope's axis must be made parallel to the Earth's axis.

Polar alignment is the process by which the telescope's axis of rotation is aligned (made parallel) with the Earth's axis of rotation. Once aligned, a telescope with a clock drive will track the stars as they move across the sky. The result is that objects being observed through the telescope will appear stationary (i.e., they will not drift out of the field of view). If your telescope does not use a clock drive, all objects in the sky (day or night) will drift out of the field. This apparent motion is caused by the Earth's rotation. Even if you are not using a clock drive, polar alignment is still desirable since it will reduce the number of corrections needed to follow an object and will limit all corrections to one axis (R.A.). There are several methods of polar alignment, all of which work on a similar principle, but are performed somewhat differently. Each method will be considered separately, beginning with the easier methods and working to the more difficult, but more precise.



When the telescope's axis of rotation is parallel to the Earth's axis, stars appear stationary when using a clock drive. The process of making the telescope's axis of rotation parallel to the Earth's is described in the section on "Polar Alignment."

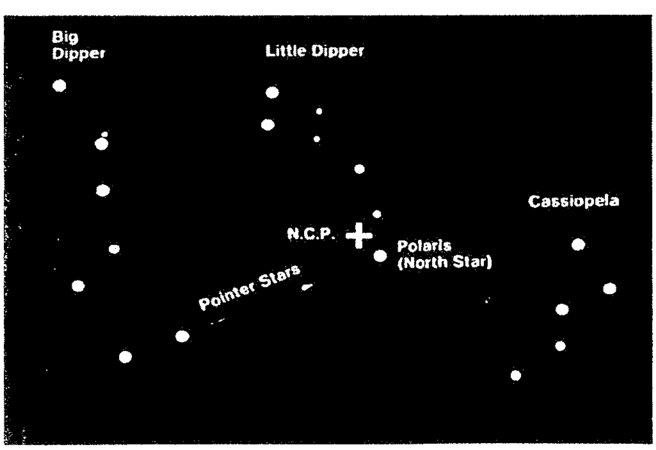
Although there are several methods mentioned here, you will never use all of them during one particular observing session. Instead, you may use only one if it is a casual observing session. Or, you may use two methods, one for rough alignment followed by a more accurate method if you plan on doing astrophotography.

Finding the Pole

For each hemisphere, there is a point in the sky around which all the other stars appear to rotate. These points are called the celestial poles and are named for the hemisphere in which they reside. For example, in the northern hemisphere all stars move around the north celestial pole. When the telescope's polar axis is pointed at the celestial pole, it is parallel to the Earth's rotational axis.

Many of the methods of polar alignment require that you know how to find the celestial pole by identifying stars in the area. For those in the northern hemisphere, finding the celestial pole is not too difficult. Fortunately, we have a naked eye star less than a degree away. This star, Polaris, is the end star in the handle of the Little Dipper. Since the Little Dipper (technically called Ursa Minor) is not one of the brightest constellations in the sky, it may be difficult to locate, especially from urban areas. If this is the case, use the two end stars in the bowl of the Big Dipper. Draw an imaginary line through them (about five times the distance between these two stars) toward the Little Dipper. They will point to Polaris. The position of the Big Dipper will change during the year and throughout the course of the night. When the Big Dipper is low in the sky (i.e., near the horizon) it may be difficult to locate.

Observers in the southern hemisphere are not as fortunate as those in the northern hemisphere. The stars around the south celestial pole are not nearly as bright as those around the north. The closest star that is relatively bright is Sigma Octantis. This star is just within naked eye limit (magnitude



The two stars in the front of the bowl of the Big Dipper point to Polaris which is less than one degree from the true celestial pole. Cassiopia, the "W" shaped constellation is on the opposite side of the pole from the Big Dipper.

5.5) and lies 59 arc minutes from the pole. For more information about stars around the south celestial pole, please consult a star atlas.

Fortunately, several methods of polar alignment described here use an indirect means to align the telescope's polar axis.

Latitude Scales

The easiest way to polar align a telescope is with a latitude scale. Unlike other methods that require you find the celestial pole by identifying certain stars, this method works off of a known constant to determine how high the polar axis should be pointed. Most scales have a range of 60° or more.

The constant, mentioned above, is a relationship between your latitude and the angular distance the celestial pole is above the northern (or southern) horizon. The angular distance from the northern horizon to the north celestial pole is always equal to your latitude. To illustrate this, image that you are standing on the north pole, latitude 90°. The north celestial pole, which has a declination of +90°, would be directly overhead (i.e., 90° above the horizon). Now lets say that you move 1°. Your latitude is now +89° and the celestial pole is no longer directly overhead. It has moved 1° closer toward the northern horizon. This means the pole is now 89° above the northern horizon. If you move one degree further south, the same thing would happen again. As you can see from this example, the distance from the northern horizon to the celestial pole is always equal to your latitude.

If you are observing from Los Angeles, which has a latitude of 34°, then the celestial pole would be 34° above the northern horizon. All a latitude scale does then is to point the polar axis of the telescope at the correct altitude above the northern (or southern) horizon.

To align your telescope, you first need to make sure the telescope is pointing due north. Use a landmark that you know faces north. Also, be sure that the tripod is level. Adjust the tripod legs until the built-in bubble level indicates that the mount is level. Next, move the equatorial head up or down until the latitude indicator points to your latitude. For specific information on adjusting the equatorial head, please see the section for your specific telescope.

This method can be used in daylight, thus eliminating the need to fumble around in the dark. Although this method does NOT put you directly or precisely on the pole, it will limit the number of corrections you will make when tracking an object. It will also be accurate enough for short exposure prime focus planetary photography and short exposure piggyback astrophotography.

Level On The Telescope

This method works on the same principle as the latitude scale, except it is a little easier. With this method the telescope tripod does not have to be level.

Instead of a latitude scale, the DEC setting is used. From the previous example you can see that the Declination of the point overhead is equal to your latitude. If, for example, you are observing from plus 41° latitude, then the point overhead is +41°. Therefore, when the telescope is pointing straight up, the declination circle should read 41°.

Start by moving the telescope so that it is pointing up, away from the mount and the DEC setting circle reads your latitude. Now, place a bubble level across the top of the telescope. Move the telescopes equatorial head (in elevation only) until the bubble level indicates that it is level. When this is done, the polar axis of the telescope will be pointing at the celestial pole.

Polaris As A Guide

This method utilizes Polaris as a guide post to the celestial pole. Since Polaris is less than a degree from the celestial pole, many amateurs simply point their polar axis at Polaris. Although this is by no means a perfect alignment, it is close.

Set the telescope up so that the polar axis is pointing north. To polar align the telescope, move the telescope so that the tube is parallel to the polar axis. When this is done the declination setting circle will read +90°. If the declination setting circle is not aligned, move the telescope so that the tube is parallel to the polar axis. This can be done just by looking at the tube and making sure it is parallel relative to the fork tines or polar axis. (If the DEC circle is not aligned, please see the instructions on "Aligning The Declination Setting Circle.")

Once the declination setting circle reads +90° and the telescope tube is parallel to the fork tines or polar axis, move the mount in altitude and/or azimuth until Polaris is in the field of view of the finderscope. Rough adjustments in azimuth can be made by moving the tripod. Once in the finderscope, use the fine adjustments to center it. Now check to see if Polaris is in the field of view of the telescope. Repeat the above procedure until Polaris is in the center of the telescope field of view. While Polar aligning, do NOT move the R.A. or DEC slow motion controls. You do not want to move the telescope itself, but rather the mount. The telescope is used simply to see where the mount is pointing.

Culmination Of Polaris

All the methods mentioned thus far have been designed to get you close to the celestial pole, but not 100% on! This method allows you to get very close with a minimal amount of time and effort.

The culmination of Polaris refers to the time when Polaris is directly above or below the celestial pole. It is much easier to find the true celestial pole when Polaris is directly above or below it. Before you attempt this, you need to determine the field of view of the telescope with the eyepiece that you are using for alignment. Instructions for determining the true field can be found in the Celestron general information manual.

Find Polaris by the previous method. Once on Polaris, move the telescope toward the celestial pole. If Polaris is above the pole, lower the polar axis using the altitude adjustment controls. If Polaris is below the celestial pole, raise the polar axis. Use stars within the field to determine how far you need to move the polar axis. Once you have moved the appropriate distance, lock all altitude and azimuth knobs to prevent the mount from moving. You are now aligned accurately enough to attempt eyepiece projection and piggyback astrophotography.

Many magazines and journals will have the time of Polaris' culminations. This method can also be used on Sigma Octantis in the southern hemisphere.

Although it is much easier to find Polaris when is directly above or below the celestial pole, you do NOT need to wait until these times to polar align. Instead, you use the exact position of Polaris relative to the celestial pole and then move the telescope in the appropriate direction.

If you are due east or west of the pole, it will be like the culmination of Polaris where you are moving the telescope axis in one direction (i.e., left or right). If Polaris is not directly above/below or east/west of the north pole, then you will have to move the polar axis of the telescope in two directions. This can be a little tricky, but it will work. As when Polaris is directly above or below the pole, move the telescope the appropriate distances in the desired direction, using stars within the field to determine the distance. Remember, do NOT move the R.A. and DEC knobs. You must adjust the polar axis by moving it in altitude and azimuth.

Just remember that if you are using a star diagonal, the image is reversed from left-to-right. In this case, the stars will move out of the field in the direction you are moving the telescope. Or if you are looking straight through the image will be upside down and backwards. Don't let the image drift fool you. Move the telescope in the proper direction.

More Precise Polar Alignment

A more precise polar alignment can be achieved once you have completed any of the preliminary methods and aligned your R.A. setting circle. Start with your telescope at Polaris as is described in the section on polar alignment, "Polaris As A Guide." Next, align your R.A. setting circle as described in the section on aligning the setting circles. Now, look up the coordinates of Polaris. Release the R.A. clamp and rotate the telescope until the coordinates of Polaris are indicated. Lock the R.A. clamp to hold the telescope in place. Next, move the telescope in declination only until the DEC setting circle reads +90°. Then, continue to move the telescope in DEC only away from the Big Dipper until the circle reads +89.2°, Polaris' declination. Lock the declination clamp to hold the telescope in place. Now adjust the mount in altitude and azimuth until Polaris is in the center of the field of your telescope. When this is done, your telescope is pointing at Polaris, but your polar axis is pointing at the celestial pole.

You will now be accurately aligned for deep sky astrophotography of up to 15 minutes duration and also for eyepiece projection photography.

Declination Drift

This method of polar alignment allows you to get the most accurate alignment on the celestial pole. The declination drift method should be done after any one of the previously mentioned methods has been completed. This method will be required if you want to do long exposure deep sky astrophotography through the telescope. Although declination drift is very simple and straightforward, it requires a great deal of time and patience to complete. The declination drift method requires that you monitor the drift of selected guide stars. The drift of each guide star will tell you how far away you are from the true celestial pole and in what direction.

To perform the declination drift method you need to choose two bright stars. One should be near the eastern horizon and one near the meridian. (The meridian is an imaginary line that runs from the celestial pole to the opposite horizon and passes through the point directly overhead.) Both stars should be near the celestial equator. You will monitor the drift of each star one at a time and in declination only. While monitoring a star on the meridian, any misalignment in the East-West direction will be revealed. While monitoring a star near the horizon, any misalignment in the North-South direction will be revealed. As for hardware, you will need an illuminated reticle ocular with cross hairs to help you recognize any drift. If you do not have an illuminated reticle, you can defocus a star until it fills most of the field. Or you can place the star near the edge of the field. In any of these cases, the drift will be much easier to detect. A Barlow lens is also recommended since it will increase the magnification and reveal any drift faster.

First choose your star near where the celestial equator and the meridian meet. The star should be +/-1/2 hour off the meridian and +/-5 degrees off the celestial equator. Monitor the drift in declination only. Ignore all drift in R.A.

> If the star drifts south, the polar axis is too far east.
>
> If the star drifts north, the polar axis is too far west.

Make small adjustments to the polar axis to eliminate any drift. Once you have managed to eliminate all drift, move to the star near the horizon, preferably the eastern. The star should be 20° above the horizon and within +/- 5 degrees off the celestial equator.

> If the star drifts south, the polar axis is too low.
>
> If the star drifts north, the polar axis is too high.

Once again, make the appropriate adjustments to the polar axis to eliminate any drift. Once the drift has been eliminated, the telescope is very accurately aligned. You will now be able to do prime focus deep sky astrophotography for long periods with very few corrections needed.

If using this method in the southern hemisphere, the procedure is the same as described above. However, the directions of drift are reversed.

Polar Alignment Finderscopes

There are two finderscopes specifically designed for polar alignment that can be used with the Celestron 8 telescopes. The first is the standard finderscope that comes with the Ultima 8 and the Powerstar 4. This same finderscope can be purchased as an optional accessory for the SP-C8 or Classic 8. The second polar alignment finderscope is standard with the SP-C8 and is built into the polar shaft (i.e., axis) of the mount. They both work on the same principle, but their methods of operation are slightly different.

These methods are generally easier than those already described and they are fairly accurate.

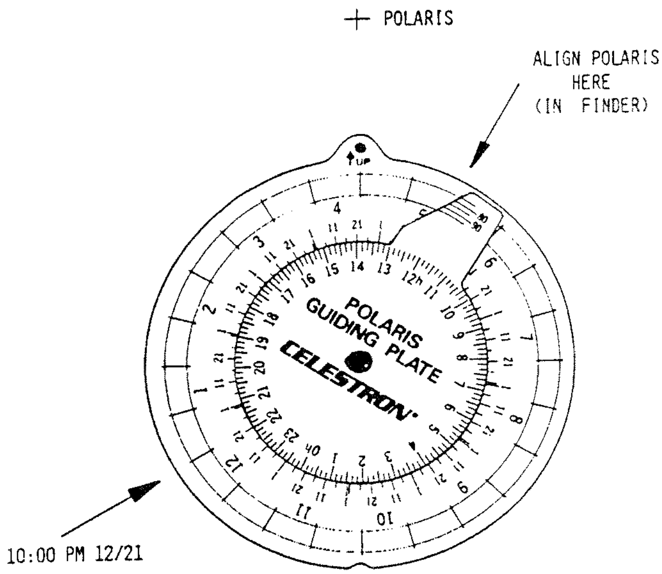
The 8x50mm Polaris Finderscope

Built into the 8x50mm finderscope for the Ultima 8 and the Powerstar 4 is a reticle with a single cross hair and two circles divided into 24 segments. The inner circle is roughly 4/5 of a degree in radius. Like any finderscope, the cross hair is used to indicate the center of the field when locating objects. The circles, however, are used for polar alignment. With the finderscope there is a Polaris Guiding Plate. This device will indicate the precise position of Polaris relative to the celestial pole for the exact date and time you are polar aligning.

To use this polar alignment method, begin by aligning the finderscope with the main optical tube (see the section on "Aligning The Finderscope"). Also, make sure that the finder is in the right angle configuration. With the telescope on its mount, release the declination clamp and rotate the telescope until the declination setting circle reads +90°. Next, look through the finderscope and make sure the cross hairs are vertical and horizontal relative to the horizon. If they are not, loosen the Allen head set screw (on the finderscope) just below the eyepiece and reticle assembly. Rotate the housing until the cross hairs are in the proper orientation and retighten the set screw.

Next, take the Polaris guiding plate and hold it alongside the telescope. The edge with the arrow should point up, away from the northern horizon. Rotate the inner circle, which is a graduated hour circle, until your current local time corresponds to the proper date on the outer circle. If this is done during daylight savings time, subtract one hour. The time is listed as a 24 hour clock (i.e., 6:00pm is 1800 hours, etc...) and the date circle lists every fifth day. Once this is done, the position of Polaris relative to the celestial pole will be indicated by the slanted tab that extends out into the month circles. The numbers 80 and 90 on the tab show the position of Polaris in 1980 and 1990, respectively.

With the position of Polaris as it should appear in the finderscope provided by the Polaris Guiding Plate, you are now ready to align the telescope. The outer portion of the month circle (two concentric circles) looks exactly like the



Polaris Guiding Plate

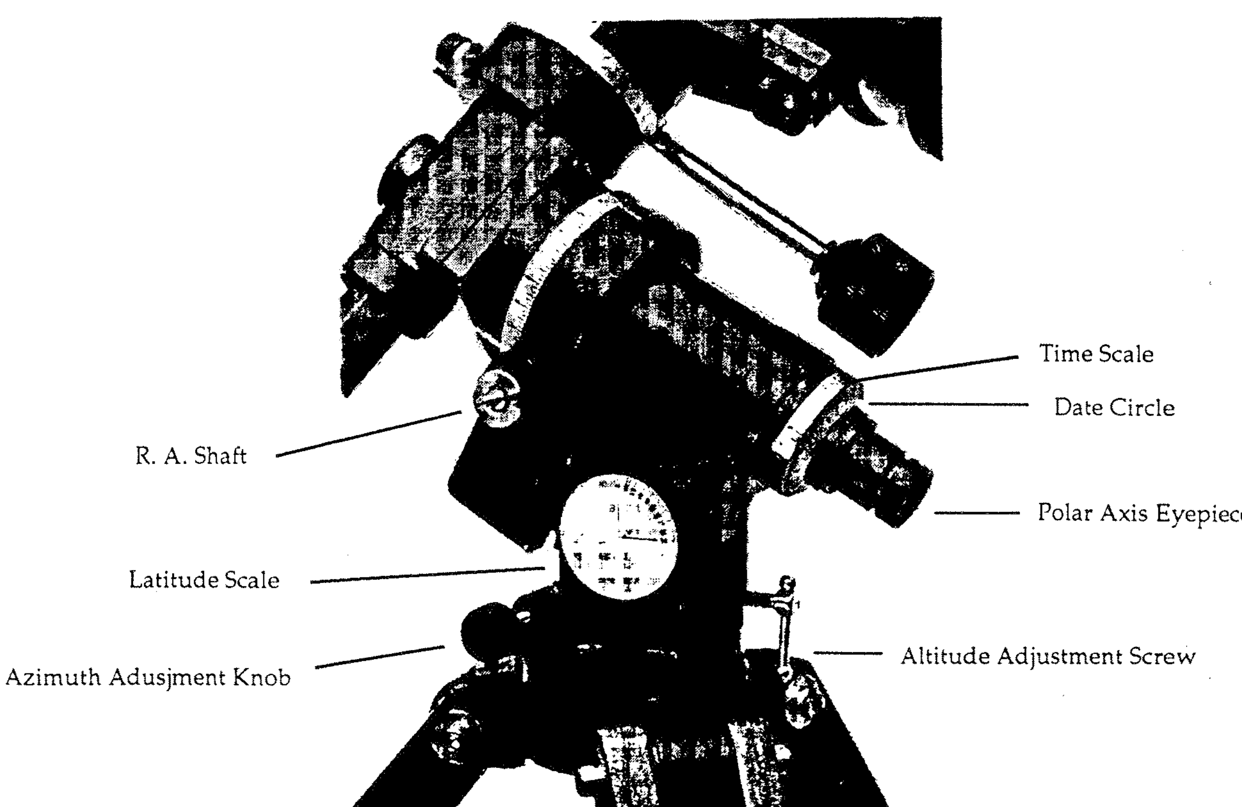
The Polaris Guiding Plate indicates the position of Polaris relative to the celestial pole as seen through the 8x50mm Polaris Finderscope. This finder is standard with the Ultima 8 and the Powerstar 4 and is offered as an optional accessory for the SP-C8 and the Classic 8. The plate is currently indicating the position of Polaris for 10:00pm on December 21. The outer circle matches the illuminated reticle in the finderscope.

reticle in the finderscope. Move the wedge on the tripod and the tilt plate of the wedge until Polaris is in the same position on the reticle as indicated on the Polaris guiding plate. Do NOT move the telescope in R.A. or declination. Re-tighten the altitude and azimuth adjustment locks.

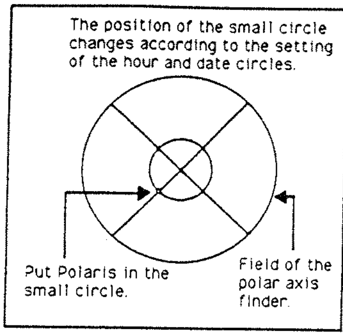
Since this method is done when it is dark, the finder has an illuminator to help you see the cross hairs. The battery for the illuminator is included with the finderscope. For replacement purposes, the correct battery for this finder is a 2.7 volt battery (Duracell #PX14 or an Eveready EPX14). Turn the illuminator off when not in use to conserve the battery.

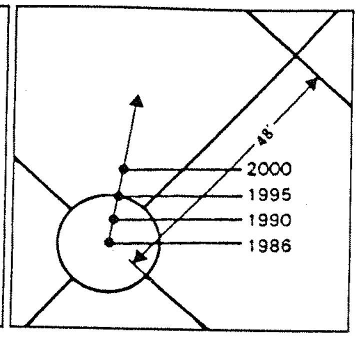
SP-C8 Polar Axis Finder

With the SP-C8 set up and ready for use, you can polar align the telescope using the built-in polar axis finder. First, familiarize yourself with the three different scales at the eyepiece end on the polar axis finder. The first one, which runs half way around the mount, is the time circle. It lists times from 1800 hours (6:00pm) to 600 hours (6:00am). Next to the time circle is the date circle listing the months numerically 1 to 12. The longest mark shows the last day of the preceding month. Medium tick marks show every tenth day, while the shortest tick marks show every other day. The distance between the last short tick and the longest (which shows the last day of the previous month) will vary depending on how many days are in the month. On the inside of the date circle is the meridian off-set scale. This allows you to indicate how far, east or west, you are from the closest standard time meridian. All you have to do is line up the circles and the



SUPER POLARIS MOUNT
(The meridian off-set scale is on the opposite side of the finder eyepiece.)



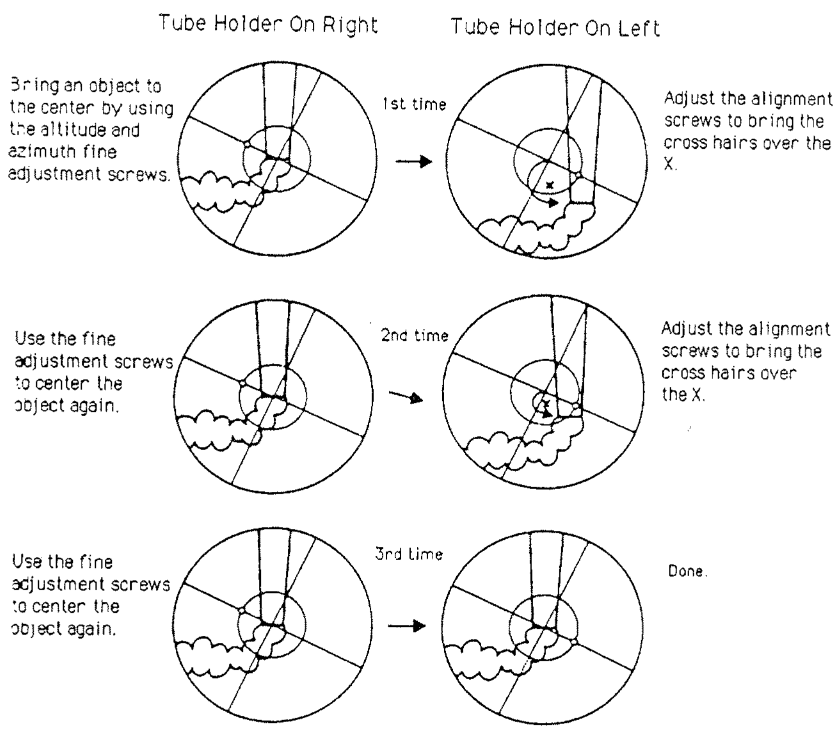


Left: The Polar Axis Finder reticle. The position of the small (Polaris) circle will change depending on the time of day and the season.

Right: Due to a wobble of the Earth's axis, the position of Polaris gradually changes over time. This diagram shows the position of Polaris on the finder reticle through the year 2000.

reticle inside the polar axis finder will show you the exact position of Polaris relative to the celestial pole.

First, you need to know the longitude of your observing location. This information can be obtained from a map of the area. Once you know your longitude, find the difference between that and the closest time meridian. The standard time meridians are 75, 90, 105 and 120 degrees for the continental United States, 150 and 165 degrees for Alaska and 150 for Hawaii. The difference between these will be set on the meridian off-set scale. Let's take an example to make more sense out of this. Say you live at west longitude 85°,0 minutes. This is exactly 5° east of the 90° standard time meridian. Rotate the date circle so the meridian indicator points to 5° east. (The meridian indicator is on the black ring just below the meridian off-set scale. The indicator is on the right side of the mount when standing behind the telescope.)



The Polar Axis Finder can be recalibrated by rotating the mount while looking at a distant object. When properly calibrated, the object centered on the cross hairs should stay centered while rotating the mount 180° in R. A.

Next, release the R.A. clamp and rotate the telescope until the date circle matches the time circle for the exact time you are polar aligning. As you rotate the telescope in R.A. the date circle will move with the telescope. If this is done during daylight savings time, subtract one hour. Once the proper date matches your time, lock the R.A. clamp to hold the telescope in place. Look through the polar axis finder and the small circle will indicate the correct position of Polaris relative to the celestial pole. Now, use the fine adjustment controls discussed earlier to move the telescope in altitude and azimuth until Polaris is in the small circle (the one that sits on the larger circle). Once in the small circle, you have achieved an accurate polar alignment. If you have the optional drive motors, you can do prime focus astrophotography for long periods of time.

To verify your alignment, you can check the position of Polaris throughout your observing session. The position of the small circle will change as you move the telescope in R.A. However, Polaris should scribe out a circle that follows the path of the larger circle. If it does not, then the alignment process was done incorrectly or the finder needs to be calibrated.

Calibrating The Polar Axis Finder

The polar axis finder is installed and calibrated at the factory. If the adjustment screws are loosened or if the mount is jarred severely, the polar axis finder may have to be recalibrated. Calibrating the finder is a two step process. First, the small circle which indicates the proper position of Polaris relative to the pole must be aligned. Second, the optical axis of the finder must coincide with the mechanical or rotational axis of the mount. Each of these functions will be discussed separately.

Start by releasing the R.A. clamp and rotate the telescope until the small circle is directly below the point where the cross hairs intersect. Now, turn the date circle until October 10th lines up with 1:00AM on the time circle. (At this time on this date Polaris is at upper culmination, that is, directly above the pole. Since the image in the finder is inverted, the small circle is placed below the cross hairs.) Next, loosen the Allen head screws that secure the ring with the meridian indicator. Once loose, turn the ring until the meridian indicator points to the "0" mark on meridian off-set scale. Re-tighten the Allen head screws and the circle is correctly calibrated to indicate the position of Polaris relative to the celestial pole.

To calibrate the optical axis of the finderscope, remove the optical tube, the counterweights and the counterweight bar from the mount. Next, loosen the Allen head screw just above the altitude tension knob. Partially remove the side plate and incline the polar axis so that it is parallel to the ground. Next, loosen the R.A. clamp and rotate the mount until the platform where the telescope sits is off to the right of the mount.

Now, find an object in excess of five hundred yards away and center it on the cross hairs. Release the R.A. clamp and rotate the mount so that the telescope platform is on the left side of the mount. The object originally seen at the intersection of the cross hairs will, most likely, have moved off center. The point where the cross hairs intersect (center of the optical axis) will scribe a semi-circle around the point where mechanical axis of the mount is pointing. Determine how far and in what direction the optical axis moved from the mechanical axis. Turning the set screws that control the optical axis, move the current optical axis toward the point where the mechanical axis is pointing. Keep in mind that the image is inverted. It may take a few minutes to familiarize yourself with the set screws that move the finder in the correct direction. Repeat this process until the mechanical axis of the finder stays centered on the cross hairs. When finished, tilt the mount to your correct latitude and re-install the optical tube and counterweight bar.

Aligning The R.A. Setting Circle

When you align your telescope on the celestial pole, the declination setting circle is aligned in the process. The next step is to align the R.A. setting circle.

To align the R.A. setting circle, locate a bright star near the celestial equator. The farther you are from the celestial pole the better your reading on the R.A. setting circle will be. The star you have chosen to align the setting circle with should be a bright one whose coordinates are known and easy to look up. (For a list of bright stars to align the R.A. setting circle, see the table at the back of this book.) Center the star in the finderscope. Then look through the main telescope and see if the star is in the field. If not, find it and center it. Now, start the clock drive so that it will track the star. Look up the coordinates of the star. Rotate the R.A. setting circle until the proper coordinates line up with the R.A. indicator (line on the base of the telescope). The R.A. setting circle should rotate freely. Once the proper coordinates are set, do not move the R.A. setting circle. It will rotate with the clock drive and will stay in alignment while the clock drive is running (except on the SP-C8 mount). If you turn the drive off for any length of time, the R.A. setting circle will have to be realigned. Once you have finished this process you are ready to use the setting circles to locate objects in the night sky.

Adjusting The DEC Setting Circle

The declination setting is calibrated at the Celestron factory. And, as mentioned above, the process of polar alignment then correctly sets if for astronomical use. However, the DEC setting circle on the Ultima 8 and Powerstar 4 is designed to rotate, which means the calibration can be changed if the circle is moved accidentally. In addition, with the Classic 8 there may be the need to re-align the declination setting circle. The circle, which is held in place by a Phillips head screw, may become loose allowing the circle to rotate. If either of these happens, the circle needs to be re-calibrated or aligned.

To align the DEC setting circle, place your C8 base on a flat, level surface. Verify that the surface is flat by using a bubble level. Place the base of the C8 on your work surface (i.e., without the wedge attached). With the base sitting on your work surface, place the bubble level across the base of the drive unit to determine if the telescope is sitting perfectly flat. If not, you may have to shim the base until it is flat.

Once the telescope base is level, release the DEC clamp and rotate the telescope tube until it is pointing straight up. To ensure that it is pointed straight up, place the bubble level across the front cell of the telescope. Once the telescope is pointing straight up, lock the declination clamp. Now rotate the declination setting circle until it reads 90°. Since the circle is NOT labeled as to the plus or minus, it makes no difference which of the 90° marks you use.

On the Classic 8, once the setting circle reads 90°, tighten the Phillips screw in the center of the DEC setting circle. Hold the DEC setting circle in place while tightening the screw to prevent the setting circle from slipping. Once complete, the setting circle should not need to be re-adjusted unless it comes loose or is manually moved.

A faster but less accurate method would be simply to make the tube parallel to the fork tines just by looking at the scope. This can be done with the telescope on or off the wedge.

Using The Setting Circles

Once the setting circles are aligned you can use them to find any objects with known coordinates.

Start by selecting an object to observe. Use a seasonal star chart or planisphere to make sure the object you chose is above the horizon. As you become more familiar with the night sky, this will no longer be necessary. Once you have decided on an object and are certain it is currently above the horizon, look up the coordinates in an atlas or reference book. Next, go over to the telescope and release the DEC clamp. Move the telescope in declination until the indicator is pointing at the correct declination coordinate. Lock the Declination clamp to prevent the telescope from moving. Now, release the R.A. clamp and move the telescope in R.A. until the indicator points to the correct coordinate (do NOT move the R.A. circle). Lock the R.A. clamp to prevent the telescope from slipping in R.A. The telescope will track in R.A. as long as the clock drive is operating. Look through the finderscope to see if you have located the object. Once located, center the object in the finder. Now, look in the main optics using a low power eyepiece; it should be there. You may not be able to see fainter objects in the finder. When this happens, gradually sweep through the sky around the area you are currently looking at. This process can be repeated for each object throughout any given night.

If you are not using a clock drive, the R.A. setting circle must be re-set after you have observed each object. However, you do not need to realign the setting circle on a bright star. Instead, use the R.A. coordinates for the object you are currently observing. Keep in mind, that once you have aligned the R.A. setting circle, you will have to move quickly to the next object since the circle is not keeping up with the moving sky. If using the SP-C8, the circle must be re-set after each object even if you are using the clock drive. On this particular scope, the R.A. setting circle does NOT move with the telescope even when the drive is running.

The declination setting circle is scaled in degrees while the R.A. setting circle is incriminated in 5 minute intervals. As a result, the setting circles will get you close to your target, but not directly on it. Also, the accuracy of your polar alignment will also affect how accurately your setting circles read.

NOTE: At the end of this manual there is a list of deep sky objects well within reach of your Celestron telescope.

Observing The Sun, Moon and Planets

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 our star so as not to damage your eyes or your telescope. Never project an image of the Sun through the telescope. Because of the folded optical design, tremendous heat build-up can result inside the optical tube. This could damage the telescope and/or any accessories attached to the telescope. Use a Celestron solar filter to view the Sun in complete safety. These filters reduce the intensity of the Sun's light, making it safe to view. With these filters you can see Sunspots as they move across the solar disk with the Sun's rotation and tiny rice-grain shaped structures called granules, which are convection cells on the Sun. Be sure to cover the lens of the finderscope when when observing the Sun. This will ensure that finderscope itself is not damaged and that no one looks through it accidentally.

In the night sky, the Moon is a prime target for your first look because it is extremely bright and easy to find. Often, it is a temptation to look at the Moon when it is full. At this time, the face we see is fully illuminated and its light can be overpowering. In addition, little or no contrast can be seen at this time.

One of the best times to observe the Moon is during its partial phases (around the time of first or third quarter). Long shadows reveal a great amount of detail on the lunar surface. At low power you will be able to see the entire lunar disk at one time. Change to higher power (magnification) to focus in on a smaller area. Keep in mind that if you are not using a clock drive, the rotation of the Earth will cause the Moon to drift out of your field of view. You will have to manually adjust the telescope to keep the Moon centered. This effect will be more noticeable at higher power. If you are using a clock drive, the Moon will remain centered (assuming you are polar aligned). Consult your local newspaper or a current astronomy magazine to find out when the Moon will be visible.

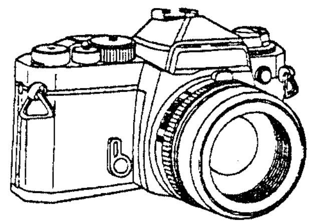
This same method can be used to observe the planets. You can see Venus go through its lunar-like phases. Mars can reveal a host of surface detail and one, if not both, of its polar caps. You will be able to see the cloud belts of Jupiter and the great Red Spot (if it is visible at the time you are observing). In addition, you will also be able to see the Moons of Jupiter as they orbit this gas giant. Saturn, with its beautiful rings, is easily visible at moderate power. All you need to know is where to look. Most astronomy publications tell where the planets can be found in the sky each month.

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. The Celestron Sky Maps (#93722) can help you locate the brightest deep sky objects. You can use your setting circles or "star hop" to an object from an area you are familiar with.

Most deep sky objects have a large angular size. Therefore, low to moderate power is all you need to see them. Visually, they are too faint to reveal any color. Instead, they have a black and white appearance. And, 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.

Photography Hints



Your Celestron can be used for both terrestrial and astronomical photography. Celestron telescopes have fixed apertures and, as a result, fixed f/ratios. To properly expose your subjects photographically you will need to set your shutter speed accordingly. Most 35mm single lens reflex (SLR) cameras offer through-the-lens metering which will let you know if your picture will be under or over-exposed. This is more of a consideration when doing terrestrial photography, where exposure times are measured in fractions of a second. In astrophotography, the exposures are much longer, requiring that you use the "B" setting on your camera. The actual exposure time is determined by how long you keep the shutter open.

To reduce vibration when tripping the shutter, use a cable release. Releasing the shutter manually can cause vibration, something that can produce unsharp photos. A cable release will keep your hands clear of the camera and telescope, thus reducing the possibility of shaking the telescope. Mechanical shutter releases can be used, though air type releases are best.

Don't forget the focusing hints described earlier in the focusing section of this manual.

Photographing The Moon

After looking at the night sky for a while you may want to try photographing it. If you do, start with a nice, bright object like the Moon.

Load your camera with film that has a moderate to fast speed (i.e., a high ISO rating). Faster films are more desirable when the Moon is close to new (phase). When the Moon is full, and at its brightest, slower films are more desirable. If photographing during the full phase, use a yellow filter to reduce the light intensity and to increase contrast (when using black and white film). To attach your camera you will need the Celestron T-adapter (#93633) and the T-ring for your specific camera.

Consult the Celestron accessory manual for a list of recommended exposure times. These exposure times should be used as a starting point. Always make exposures that are longer and shorter than the recommended time. Take a few photos at each shutter speed. This will ensure that you will get a good photo.

Keep accurate records of your exposures. This information will be useful if you want to repeat your results or submit them for possible publication in astronomical magazines!

Photographing Deep Sky Objects

The easiest way to enter the realm of deep sky astrophotography is via the piggyback method. Piggyback photography is done with a camera and its normal lens riding on top of the telescope. To attach the camera to the telescope, use the piggyback mount (#93598) for the Classic 8, the Ultima 8 and the Powerstar 4. The SP-C8 comes with a piggyback mount.

Through piggyback photography you can capture entire constellations and record large scale nebulae that are too big for prime focus photography. Because you are photographing with a low power lens and guiding with a high power telescope, the margin for error is very large. Small mistakes made while guiding the telescope will not show up on film.

As with any form of deep sky photography, you must be at a dark sky observing site. Light pollution around major urban areas will wash out the faint light of deep sky objects.

Once at your observing site, load your camera with fast film, ISO 400 or faster! Polar align the telescope as usual and start the clock drive. With the camera attached to the piggyback mount, set the f/ratio of your camera lens so that it is one stop down from completely open. Also, set the shutter speed to the "B" setting. Locate the area of the sky that you want to photograph and move the telescope so that it points in that direction. Find a suitable guide star in the telescope field. This will be relatively easy since you can search a wide area without affecting the area covered by your camera lens. If you do not have an illuminated cross hair eyepiece for guiding, simply defocus your guide star until it fills most of the field of view. This will make it easy to detect any drift.

Once the guide star is centered you are ready to begin your exposure. Release the shutter using a cable release and monitor your guide star. If you are not using a drive corrector, all adjustments to compensate for the drift must be made manually. If you are using a clock drive, the corrections will be made from the hand control box. The exposure time will depend on the film being used. However, 5 minutes is usually a good starting point. With slower films, like 400 ISO, you can expose as long as 45 minutes. With faster films, like 1600 ISO, you really shouldn't expose more than 10 to 20 minutes.

As with all forms of photography, keep accurate records of your work. This information can be used later if you want to reproduce certain result or if you want to submit photos for possible publication.

Once you have mastered piggyback photography with wide angle lenses, try longer focal length lenses. The longer the focal length, the more accurate you guiding must be. You can continue to increase the focal lengths of the lens until you are ready for prime focus photography with your C8.

TELESCOPE MAINTENANCE

After you have set up your telescope and started using it, there are a few things to remember for future reference.

Care and Cleaning Of The Optics

Occasionally, dust and/or moisture may build up on the corrector plate of your telescope. Special care should be taken when cleaning any instrument so as not to damage the optics.

If dust has built up on the corrector plate, remove it with a camel hair brush or a can of pressurized air. Spray at an angle to the lens for approximately 2 to 4 seconds. Then, use optical cleaning solution and lens paper (or white tissue paper) to remove any remaining debris. Low pressure strokes should go from the center of the corrector to the outer portion. Do NOT rub in circles!

You can use commercially made lens cleaner or mix your own. A good cleaning solution is isopropyl alcohol (not rubbing 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.

Occasionally, you may experience dew build-up on the corrector plate of your telescope during an observing session. This may be removed with a hair dryer or by pointing the telescope at the ground until the dew has evaporated. To slow the dewing process, use the optional Dewstar dew cap (#94017). If moisture condenses on the inside of the corrector, remove the accessories from the rear cell of the telescope. Place the telescope in a dust-free environment and point it down. This will remove the moisture from the telescope tube.

To minimize the need to clean your telescope, replace all lens covers once you have finished using it. Since the rear cell is NOT sealed, the cover should be placed over the opening when not in use. This will prevent contaminants from entering the optical tube.

Internal adjustments and cleaning should be done only by the Celestron repair department. If your telescope is in need of internal cleaning, please call the factory for a return authorization number and price quote.

Collimation

The optical performance of your Celestron telescope is directly related to its collimation, the alignment of its optical system. Your Celestron 8 was collimated at the factory after it was completely assembled. However, if the telescope is dropped or jarred severely, it may have to be recollimated. The only optical element that may need to be adjusted, or is possible, is the tilt of the secondary mirror.

To check the collimation of your telescope you will need a light source. A bright star near the zenith is ideal since there will be a minimal amount of atmospheric distortion. Turn your telescope drive on so that you won't have to manually track the star. Or, if your telescope does not have a clock drive, use Polaris. Its position relative to the celestial pole means that is moves very little thus eliminating the need to manually track it.

Terrestrial observers can use a bright spot in excess of 500 feet away. It should be done while the Sun is low and in the opposite direction you are pointing the telescope. Or, if performing this procedure at night, you can use a distant street light.

Before you begin the collimation process, be sure that your telescope is in thermal equilibrium with the surroundings. Allow 45 minutes for the telescope to reach equilibrium if you move it between large temperature extremes.

With a low power eyepiece (in the 26mm range), defocus the light source until it occupies about 1/5 of your field. Place it in the center of the field. The image will look somewhat like a donut. The dark circle in the the center, which is caused by the secondary housing, should be perfectly centered in relation to the outer circle of the defocused image. If it is not, the telescope is out of collimation.

Before you adjust the collimation, you need to reposition the image in the field of view. Move the defocused image toward the edge of the field in the direction that the shadow is off center.

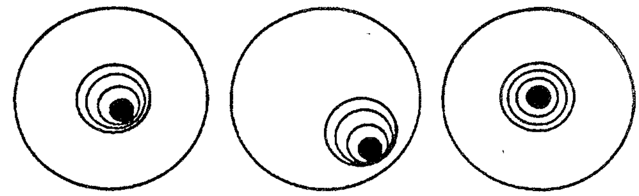
Remove the orange cap that covers the set screws on the secondary housing. To do this, slip a flat blade screwdriver under one side of the cap. Very gently pry the cover completely off.

With the cover off, tighten the set screw(s) lying in the direction that the shadow is off center. Loosen the other screw(s) after tightening the first one. If a particular screw can NOT be tightened, loosen the other two. Continue this process until the defocused star image is back at the center of the field.

Once the defocused image is back in the center of the field, the shadow (from the central obstruction) may still be off center. If this is the case, repeat this process until the shadow is completely centered within the defocused image. Continue this process using successively higher power eyepieces until you have reached the highest power eyepiece you will be using.

When using higher power, 6mm and above, collimation is best accomplished with the telescope in focus. In this instance, you are observing the Airy disk, not the shadow of the secondary housing. This (stellar) image will appear as a bright point of light with a diffraction ring around it. When the point of light is perfectly centered within the diffraction ring, your telescope is in collimation. Keep in mind that to use high power the seeing conditions must be very good.

NOTE: THE ADJUSTMENT SCREWS ON THE SECONDARY MIRROR ARE VERY SENSITIVE. USUALLY A TENTH OF A TURN WILL COMPLETELY CHANGE THE COLLIMATION OF THE TELESCOPE. DO NOT FORCE THESE SCREWS IF THEY WILL NOT TURN. OLDER C8 TELESCOPES MAY HAVE A SCREW IN THE CENTER OF THE SECONDARY HOUSING. DO NOT TURN OR ADJUST THIS SCREW SINCE IT HOLDS THE SECONDARY MIRROR IN PLACE.



Left: *With an out-of-focus star image at the center of the field, the secondary mirror shadow is off-center. This image indicates the telescope is out of collimation.*

Middle: *To recollimate, move the defocused image in the direction that the shadow is off-center.*

Right: *Move the image back to the center of the field using the collimation screws on the secondary mirror housing. Final collimation is done with the stellar image in focus.*

OPTIONAL ACCESSORIES

The following is a list of optional accessories that can be used with your Celestron 8. Certain accessories are confined to the use of one particular Celestron 8 models. The first section lists all the accessories that are common to all models. After that, all accessories will be grouped by the scope they can be used with.

Accessory Case (#93500) - This rugged ABS plastic case is designed for carrying a few accessories. Inside is a foam padding that is die cut to 1x1 inch squares. These squares can be removed to accommodate accessories with a custom fit.

Barlow Lens - A Barlow lens is a negative lens that increases the focal length of a telescope. Used with an eyepiece, it will increase the magnification. Celestron offers three different Barlow lenses for the C8, in 2 power ranges. There is a 2x Barlow (#93508) that doubles the magnification and 3x Barlow (#93510) which triples the magnification. In addition, there is also a Deluxe 2x Barlow (#93509) which is designed for use with the Celestron Plössls. It is multi-coated for maximum light transmission and parfocal when used with the Plössls.

Dew Cap/Lens Shade (#94017) - The dew cap is a tube (about the same diameter as the telescope) that fits on the front end of the telescope to reduce the amount of dew that builds up on the corrector plate. The dew cap also acts as a lens shade by preventing stray light from falling on the corrector plate.

Erect Image Diagonal (#94112) - This accessory is an Amici prism arrangement that allows you to look into the telescope at a 45° angle with images that are oriented properly (upright and correct from left to right). This accessory is not needed if you are using the Porro prism.

Eyepiece Types - Like telescopes, eyepieces come in a variety of designs. Each different design has its own advantages and disadvantages. For the 1-1/4" barrel diameter there are two different eyepiece designs available.

- **Orthoscopic** - these eyepiece have a 4-element lens designed for moderate to high power, narrow field observing. They are generally used in short focal lengths, anywhere from 4 to 25mm. These eyepieces are also best suited for eyepiece projection photography (except the zoom eyepiece). In the 1 1/4" barrel diameter, they are available in the following focal lengths: 4mm, 5mm, 6mm, 7mm, 9mm, 12mm, 18mm, 25mm, and 8.4 to 21mm zoom.

- **Plössl** - these eyepieces are also a 4-element ocular designed for low to high magnifications. The Plössl offers razor sharp images across the entire field, even at the edge. All Plössl oculars are multi-coated and parfocal, so you don't have to refocus when changing from on Plössl to another. In the 1-1/4" size, they are available in the following focal lengths: 7.5mm, 10mm, 17mm, 22mm, 26mm, 30mm, 36mm, and 45mm.

Eyepiece Filters - To enhance your visual observations of planetary objects, Celestron offers a wide range of colored filters that thread into the 1 1/4" oculars. Available are: #1A Skylight, #8 Yellow, #12 Deep Yellow, #15 Deep Yellow, #21 Orange, #23A Light Red, #25 Red, #38 Blue, #47 Violet, #56 Light Green, #58 Green, #80A Light Blue, #82A Pale Blue, #96 Neutral Density and Polarizing filters.

Filter Adapter (#93551) - This accessory allows you to attach screw-in filters to eyepieces that are not threaded. The filter is threaded into the adapter which is then placed on the eyepiece.

Finderscopes - Finderscopes are used to help you locate objects in the main telescope. The larger the finderscope, the more you will see. The only option for finderscopes is the right angle/straight through illuminated Polaris 8x50 finderscope. This finder comes standard with the Ultima 8 and can be mounted on the Classic 8 or the SP-C8. It includes the Polaris reticle used for polar alignment.

Multiple Ocular Holder (#93588) - The multiple ocular holder (MOH) is a turret which holds 4 eyepieces and rotates around a star diagonal. This allows you to keep four of your favorite eyepieces attached to the telescope at one time. Changing the eyepiece is as easy as rotating the eyepiece holder.

Polarizing Filter Set (#93608) - The polarizing filter assembly limits the transmission of light to a specific plane, thus increasing contrast between various objects. This is used primarily for terrestrial, lunar and planetary observing.

Porro Prism (#93612) - The Porro prism is an accessory that allows you to view straight through your telescope and provides correctly oriented images.(i.e., right-side-up and correct from left-to-right). The Porro prism is used for terrestrial viewing.

Rich Field Adapter (#93614) - The rich field adapter (RFA) uses a tele-compressor lens to reduce the f/ratio and effective focal length of the telescope. The lower effective focal length gives a wider field of view. The RFA comes with a 22mm ocular.

Series 6 Drop-In Filters (#93617) - Primarily designed for terrestrial photography, the drop-in filters fit into the rear cell of the C8. The T-adapter (or visual back) then threads over the filter to hold it in place. Included in the set are a skylight (#1A), a yellow (#8), a yellow-green (#11), a red (#25), a blue (#80A) and a neutral density (#96).

Skylight Filter (#93621) - The Skylight filters are used on C8 telescopes as a dust seal. The filter threads onto the rear cell on your telescope. All other accessories, both visual and photographic (with the exception off Barlow lenses), thread onto the skylight filter. Although it does cut down on a portion of the incoming light, it is a very small amount.

Sky Maps (#93722) - When learning the night sky, the Celestron sky maps offer the ideal solution. The maps include all the constellations and brighter deep sky objects.

The maps are printed on a heavy stock paper that is moisture resistant. On the front cover is a rotating planisphere which indicates when specific constellations are visible.

Solar Filters - Celestron offers solar filters which allow you to observe the Sun in complete comfort and safety. The filters, which are "white light" filters, allow you see sunspots and mottled areas known as granules. These filters reduce the amount of sunlight that is seen, by more than 99.99%.

NOTE: NEVER LOOK DIRECTLY AT THE SUN WITH THE NAKED EYE OR WITH A TELESCOPE. NEVER POINT YOUR TELESCOPE AT THE SUN UNLESS YOU HAVE THE PROPER FILTER.

Star Diagonal (#93632 or #93519) - Like the 1-1/4" star diagonals, the 2" star diagonals allows you to view at a right angle to the telescope's main optical tube. The right angle viewing position is ideal for looking at objects that are overhead or generally a great distance from the horizon. The C8 comes standard with a 1-1/4" star diagonal (#93769 for the SP-C8 and the Classic and #94115 for the Ultima). As an optional accessory, Celestron offers 2" star diagonals (#93632 and #93519) to be used with a 2" eyepiece.

Stereo Viewer (#94122) - The stereo viewer is the ultimate in visual observation. This accessory allows you adapt two eyepieces to the telescope for simultaneous viewing (i.e., like binoculars). The result: a three-D effect when observing many celestial objects.

T-Adapter (#93633) - A T-adapter (with T-ring) allows you to attach your camera to the prime focus of C8. This is used for terrestrial photography and short exposure lunar photography. It can be used for long exposure deep space photography if you use a separate guide scope.

T-C Adapter (#93636) - This adapter allows you to couple a video or movie camera to a telescope. The camera must have a removable lens with a standard "C" thread. The T-C adapter threads into the camera and then onto the T-Adapter.

T-Ring - The T-ring couples your camera body to the T-adapter, off-axis guider body or tele-extender. This accessory is mandatory if you want to do astrophotography through the telescope. Each camera make (i.e., Minolta, Nikon, etc. . .) has its own unique mount and therefore, its own T-ring.

Tele-Compressor (#93643) - The tele-compressor reduces the effective focal length of your telescope, thus giving a lower f/ratio for faster deep sky photographs. It increases the size of the field and increases the speed of the telescope. Celestron offers one tele-compressor for the C8. It reduces the focal length and f/ratio by one-half. This lens, which is the same one used in the Rich Field Adapter (RFA), is designed for photography.

Tele-Extender (#93646) - The tele-extender is a hollow tube that allows you to attach a camera to the telescope when the eyepiece is installed. This accessory is used for eyepiece projection photography. The tele-extender threads over the eyepiece onto the visual back.

The following accessories are for the SP-C8, the Classic 8, the Ultima 8 and the Powerstar 4:

Illuminated Projection Reticle (#93567) - The projection reticle works like the eyepiece reticle. This the system projects a bulls-eye with concentric rings into your field. Any eyepiece can be used with the projection reticle and the bulls-eye can be located anywhere in the field, making the acquisition of a guide star much easier.

Illuminated Reticle Ocular Assembly (#93565) - The illuminated reticle eyepiece has illuminated cross hairs for easier guiding on a star. This ocular can be used with an off-axis guider or star diagonal, depending on the type of photography you are doing.

Motorized Focuser - This accessory allows you to focus the telescope electronically instead of manually. The motorized focuser eliminates the possibility of bumping or shaking the telescope when focusing.

Off-Axis Guider Body (#93591) - The off-axis guider allows you to guide and photograph through the telescope at the same time. The guider uses a small prism to divert a portion of light up to the guiding eyepiece. The camera sits behind the prism.

The Off-Axis Guiding System (#93589) - Consists of the off-axis guider body and the illuminated reticle ocular assembly. If you are considering the purchase of these two accessories, the off-axis guiding system is more economical.

The following accessories are for the Classic 8, the Ultima 8 and the Powerstar 4 only:

Counterweight Set (#93542) - The counterweight set is a small group of weights that can be threaded into the front cell of the telescope. This allows you to balance the telescope when you have heavy accessories mounted on it. The set consists of 6 weights: two 14 oz., two 10 oz., and two 5.5 oz. Aside from threading into the front cell, the weights also thread into each other, so they can be used in any combination.

Counterweight Bar Assembly (#93521) - The bar assembly is an metal rod that runs the length of the telescope tube and is attached to the front and rear cells via two castings. The bar allows you to slide the counterweights for better dynamic balance. Included are two 3 pound weights.

Digital Setting Circles (#94117) - The digital setting circles offer larger, illuminated read-outs for your R.A. and DEC setting circles. This makes the coordinates easier to read and gives a higher degree of accuracy. The digital setting circles for the Ultima (94117-HD) are also available.

Electric Declination Motor (#93526) - The electric DEC motor allows you to make corrections to the DEC axis of your telescope without touching the instrument. All corrections are made from a hand control box. This eliminates the possibility of bumping or shaking the telescope while making manual corrections.

Piggyback Mount - The piggyback mount allows you to attach a camera to the top of the telescope. This way the camera can photograph with its normal or wide angle lens while you guide through the telescope. There are two versions of this accessory. The first attaches to the rear cell of the telescope next to the finderscope (#93598). The second (#93599) model attaches to the optional counter-weight bar.

The following accessories are for the SP-C8:

Motor Drive with Drive Corrector - This unit is a motor drive and drive corrector in one. It is a necessity if you want to do any form of celestial photography. There are two versions; a single axis R.A. only model (#93811) and dual axis R.A. and DEC model (#93810). The dual axis comes with a DEC motor.

Sky Sensor Computer (#93797) - This device allows you to find objects by selecting them in the computer. Included with the unit are the drive motors and control box. If you purchase this unit, you do NOT need to purchase the motor and drive corrector described above.

Super Polaris Half Pier (#93801) - When observing near the zenith, the tripod can get in the way of the telescope. To eliminate this interference, Celestron offers the half pier, which raises the mount about 13 inches.

The following accessories are for the Classic 8 only:

Drive Corrector - The drive corrector allows the manual override of the motors in the clock drive. This is used primarily for guiding during deep sky astrophotography. Celestron offers two types of drive correctors for the Classic C8; a single axis R.A. only (#93532) and a dual axis R.A. and DEC (#93533). The single axis corrector allows corrections on the right Ascension axis only, while the dual axis allows corrections to the R.A. and DEC axes.

Adjustable Tripod (#93501) - This accessory is almost mandatory if you want to do any serious work with your Classic 8. This allows you to set your telescope anywhere and in any position you like.

Deluxe Latitude Adjuster (#93528) - Also an important accessory, this device allows you to raise and/or lower the tilt plate with fine accuracy. Although used primarily for polar aligning, it is a tremendous time saver.

Carrying Case For Classic 8 (#302069) - For easy transportation of the tube and fork mount, Celestron offers a heavy duty, foam fitted deluxe case.

The following accessories for the Ultima 8 only:

Electric Hand Controller (#18833) - The hand controller box allows you to make slow motion adjustments to the R.A. axis. It plugs into the base of the Ultima 8. By adding the optional DEC motor, the Ultima becomes a dual axis drive corrector.

Digital Setting Circles (#94117-HD) - The digital setting circles offer larger, illuminated read-outs for your R.A. and DEC setting circles. This makes the coordinates easier to read and gives a higher degree of accuracy.

The following accessories are for the C8 optical tube assembly only:

Adjustable Tripod (#3501) - This accessory is almost mandatory if you want to do any serious astronomical observing. It is designed to be used with the fork mount, drive and wedge. This allows you to set your telescope anywhere and in any position you like.

Fork Mount And Drive (#11009) - This unit allows you to turn your optical tube into a clock driven telescope. The fork mount and drive base is the same one used for the Powerstar 4. With the optional wedge, the telescope can be polar aligned allowing you to use the setting circles and do serious astrophotography.

Wedge (#93656) - The wedge allows you to tilt the polar axis of your telescope so that the clock drive unit can track the stars. It is designed to be used with the fork mount and drive base. The wedge can be set on a flat, sturdy surface or attached to the adjustable tripod.

A full description of all Celestron accessories can be found in the Celestron accessory catalog (#93685).

THE MESSIER CATALOG

Messier #	Coordinates 2000.00 R.A. Hr Min	DEC Deg Min	Constellation	Magnitude	Object type
M1	05 34.5	+22 01	Tau	11.0	P. Neb. *
M2	21 33.5	-00 49	Agr	6.3	Gl. Cl.
M3	13 42.2	+28 23	CVn	6.2	Gl Cl.
M4	16 23.6	-26 31	Sco	6.1	Gl. Cl.
M5	15 18.5	+02 05	Ser	6.0	Gl. Cl.
M6	17 40.0	-32 12	Sco	6.0	Op. Cl.
M7	17 54.0	-34 49	Sco	5.0	Op. Cl.
M8	18 03.7	-24 23	Sgr	7.0	D. Neb. *
M9	17 19.2	-18 31	Oph	7.6	Gl. Cl.
M10	16 57.2	-04 06	Oph	6.4	Gl. Cl.
M11	18 51.1	-06 16	Sct	7.0	Op. Cl.
M12	16 47.2	-01 57	Oph	6.7	Gl. Cl.
M13	16 41.7	+36 28	Her	5.8	Gl. Cl. *
M14	17 37.6	-03 15	Oph	7.8	Gl. Cl.
M15	21 30.0	+12 10	Peg	6.3	Gl. Cl.
M16	18 18.9	-13 37	Ser	7.0	D. Neb. *
M17	18 20.9	-16 10	Sgr	7.0	D. Neb. *
M18	18 19.9	-17 08	Sgr	7.5	D. Neb.
M19	17 02.6	-26 16	Oph	6.9	Gl. Cl.
M20	18 02.4	-23 02	Sgr	6.0	D. Neb.*
M21	18 04.7	-22 30	Sgr	7.0	Op. Cl.
M22	18 36.4	-23 54	Sgr	5.2	Gl. Cl.
M23	17 56.9	-19 01	Sgr	6.0	Op. Cl.
M24	18 18.4	-18 25	Sgr	6.0	Op. Cl.
M25	18 31.7	-19 04	Sgr	6.0	Op. Cl.
M26	18 45.2	-09 24	Sct	9.0	Op. Cl.
M27	19 59.6	+22 43	Vul	8.2	P. Neb. *
M28	18 24.6	-24 52	Sgr	7.1	Gl. Cl.
M29	20 24.0	+38 31	Cyg	8.0	Op. Cl.
M30	21 40.4	-23 11	Cap	7.6	Gl. Cl.
M31	00 42.7	+41 16	And	3.7	Sp. Gx. *
M32	00 42.7	+40 52	And	8.5	El. Gx. *
M33	01 33.8	+30 39	Tri	5.9	Sp. Gx.
M34	02 42.0	+42 47	Per	6.0	Op. Cl.
M35	06 08.8	+24 20	Gem	5.3	Op. Cl.
M36	05 36.3	+34 08	Aur	6.3	Op. Cl.
M37	05 53.0	+32 33	Aur	6.2	Op. Cl.
M38	05 28.7	+35 50	Aur	6.2	Op. Cl.
M39	21 32.3	+48 26	Cyg	5.4	Op. Cl.
M40	12 22.2	+58 05	UMa	9.3	Dbl Str.

Messier #	Coordinates	Constellation	Magnitude	Object type
	2000.00 R.A. DEC Hr Min Deg Min			
M41	06 47.0 -20 44	CMa	5.2	Op. Cl.
M42	05 35.3 -05 23	Ori	4.0	D. Neb. *
M43	05 35.5 -05 16	Ori	9.0	D. Neb. *
M44	08 40.0 +20 00	Cnc	4.5	Op. Cl.
M45	03 47.5 +24 07	Tau	1.3	Op. Cl. *
M46	07 41.8 -14 49	Pup	6.0	Op. Cl.
M47	07 36.6 -14 29	Pup	4.6	Op. Cl.
M48	08 13.8 -05 48	Hya	5.8	Op. Cl.
M49	12 29.8 +08 00	Vir	8.9	El. Gx.
M50	07 03.0 -08 21	Mon	7.0	Op. Cl.
M51	13 29.9 +47 12	CVn	8.4	Sp. Gx. *
M52	23 24.2 +61 36	Cas	7.0	Op. Cl.
M53	13 12.9 +18 10	Com	7.6	Gl. Cl.
M54	18 55.1 -30 28	Sgr	7.7	Gl. Cl.
M55	19 40.0 -30 57	Sgr	6.1	Gl. Cl.
M56	19 16.6 +30 11	Lyr	8.3	Gl. Cl.
M57	18 53.6 +33 02	Lyr	9.0	P. Neb. *
M58	12 37.7 +11 49	Vir	9.9	Sp. Gx.
M59	12 42.0 +11 39	Vir	10.3	El. Gx.
M60	12 43.7 +11 33	Vir	9.3	El. Gx.
M61	12 21.9 +04 28	Vir	9.7	Sp. Gx.
M62	17 01.2 -30 07	Oph	7.2	Gl. Cl.
M63	13 15.8 +42 02	CVn	8.8	Sp. Gx.
M64	12 56.7 +21 41	Com	8.7	Sp Gx.
M65	11 18.9 +13 06	Leo	9.6	Sp. Gx.
M66	11 20.3 +13 00	Leo	9.2	Sp. Gx.
M67	08 51.3 +11 48	Cnc	7.0	Op. Cl.
M68	12 39.5 -26 45	Hya	8.0	Gl. Cl.
M69	18 31.4 -32 21	Sgr	7.7	Gl. Cl.
M70	18 43.2 -32 17	Sgr	8.2	Gl. Cl.
M71	19 53.7 +18 47	Sge	6.9	Gl. Cl.
M72	20 53.5 -12 32	Aqu	9.2	Gl. Cl.
M73	20 59.0 -12 38	Aqu	10.0	Asterism
M74	01 36.7 +15 47	Psc	9.5	Sp. Gx.
M75	20 06.1 -21 55	Sgr	8.3	Gl. Cl.
M76	01 42.2 +51 34	Per	11.4	P. Neb.
M77	02 42.7 -00 01	Cet	9.1	Sp. Gx.
M78	05 46.7 +00 04	Ori	10.0	D. Neb.
M79	05 24.2 -24 31	Lep	7.3	Gl. Cl.
M80	16 17.0 -22 59	Sco	7.2	Gl. Cl.

Messier #	Coordinates	Constellation	Magnitude	Object type
	2000.00 R.A. DEC Hr Min Deg Min			
M81	09 55.8 +69 04	UMa	6.9	Sp. Gx. *
M82	09 56.2 +69 42	UMa	8.8	Ir. Gx. *
M83	13 37.7 -29 52	Hya	7.5	Sp. Gx.
M84	12 25.1 +12 53	Vir	9.8	El. Gx.
M85	12 25.4 +18 11	Com	9.5	El. Gx.
M86	12 26.2 +12 57	Vir	9.8	El. Gx.
M87	12 30.8 +12 23	Vir	9.3	El. Gx. *
M88	12 32.0 +14 25	Com	9..7	Sp. Gx.
M89	12 35.7 +12 33	Vir	10.3	El. Gx.
M90	12 36.8 +13 10	Vir	9.7	Sp. Gx.
M91	12 35.4 +14 30	Com	9.5	Sp. Gx.
M92	17 17.1 +43 08	Her	6.3	Gl. Cl.
M93	07 44.6 -23 53	Pup	6.0	Op. Cl.
M94	12 50.9 +41 07	CVn	8.1	Sp. Gx.
M95	10 44.0 +11 42	Leo	9.9	Sp. Gx.
M96	10 46.8 +11 49	Leo	9.4	Sp. Gx.
M97	11 14.9 +55 01	UMa	11.1	P. Neb. *
M98	12 13.8 +14 54	Com	10.4	Sp. Gx.
M99	12 18.8 +14 25	Com	9.9	Sp. Cl.
M100	12 22.9 +15 49	Com	9.6	Sp. Gx.
M101	14 03.5 +54 21	UMa	8.1	Sp. Gx *
M102	- - - - - - - - - - -	- - -	-	- - - -
M103	01 33.1 +60 42	Cas	7.1	Op. Cl.
M104	12 40.0 -11 42	Vir	8.0	Sp. Cl.
M105	10 47.9 +12 43	Leo	9.5	El. Gx.
M106	12 19.0 +47 18	CVn	9.0	Sp. Gx.
M107	16 32.5 -13 03	Oph	9.0	Gl. Cl.
M108	11 11.6 +55 40	UMa	10.5	Sp. Gx.
M109	11 57.7 +53 22	UMa	10.6	Sp. Gx.
M110	00 40.4 +41 41	And	10.0	Sp. Gx. *

(* denotes object of special interest.)

Sp. Gx.-Spiral Galaxy
El. Gx.-Elliptical Galaxy
Ir. Gx.-Irregular Galaxy
Op. Cl.-Open Cluster
Gl. Cl.-Globular Cluster
D. Neb.-Diffuse Nebula
P. Neb-Planetary Nebula

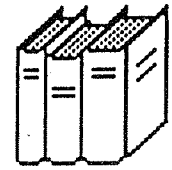
NOTE: All coordinates for the objects in the Messier catalog are listed in epoch 2000.00.

LIST OF BRIGHT STARS

The following is a list of bright stars that can be used to align the R.A. setting circle.

Star Name	Coordinates 2000.00 R.A. Hr Min Sec	DEC Deg Min Sec	Constellation	Magnitude
Sirius	06 45 09	-16 42 58	CMa	-1.47
Canopus	06 23 57	-52 41 44	Car	-0.72
Arcturus	14 15 40	+19 10 57	Boo	-0.72
Rigel Kent.	14 39 37	-60 50 02	Cen	+0.01
Vega	18 36 56	+38 47 01	Lyr	+0.04
Capella	05 16 41	+45 59 53	Aur	+0.05
Rigel	05 14 32	-08 12 06	Ori	+0.14
Procyon	07 38 18	+05 13 30	CMi	+0.37
Betelgeuse	05 55 10	+07 24 26	Ori	+0.41
Archernar	01 37 43	-57 14 12	Eri	+0.60
Hadar	14 03 49	-60 22 22	Cen	+0.63
Altair	19 50 47	+08 52 06	Aqi	+0.77
Aldebaran	04 35 55	+16 30 33	Tau	+0.86
Spica	13 25 12	-11 09 41	Vir	+0.91
Antares	16 29 24	-26 25 55	Sco	+0.92
Fomalhaut	22 57 39	-29 37 20	PsA	+1.15
Pollux	07 45 19	+28 01 34	Gem	+1.16
Deneb	20 41 26	+45 16 49	Cyg	+1.28
Beta Crucis	12 47 43	-59 41 19	Cru	+1.28
Regulus	10 08 22	+11 58 02	Leo	+1.36

ASTRONOMY BOOKS (FOR FURTHER READING)



General Astronomy

Astronomy Now	Pasachoff & Kutner
Cambridge Atlas Of Astronomy	Audouze & Israel
McGraw-Hill Encyclopedia Of Astronomy	Parker
Astronomy-The Evolving Universe	Zeilik

Atlases

Atlas Of Deep Sky Splendors	Vehrenberg
Sky Atlas 2000.0	Tirion
Sky Catalog 2000.0 Vol 1 & 2	Hirshfeld & Sinnott
Uranometria Vol. 1 & 2	Tirion, Rappaport, Lovi
Magnitude 6 Star Atlas	Edmund Scientific

Visual Observation

Observational Astronomy For Amateurs	Sidgwick
Astronomical Calendar	Ottewell
Burnham's Celestial Handbook Vols. 1, 2 & 3	Burnham
The Planet Jupiter	Peek
Field Guide To The Stars & Planets	Menzel & Pasachoff
The Cambridge Astronomy Guide	Liller & Mayer
Observe Comets	Edberg & Levy
A Complete Manual Of Amateur Astronomy	Sherrod

Astrophotography

Skyshooting	Mayall & Mayall
Astrophotography A Step by Step Approach	Little
Astrophotography For The Amateur	Covington
Astrophotography	Gordon
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Manual Of Advanced Celestial Photography	Wallis & Provin
Colours Of The Stars	Malin & Muirden

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