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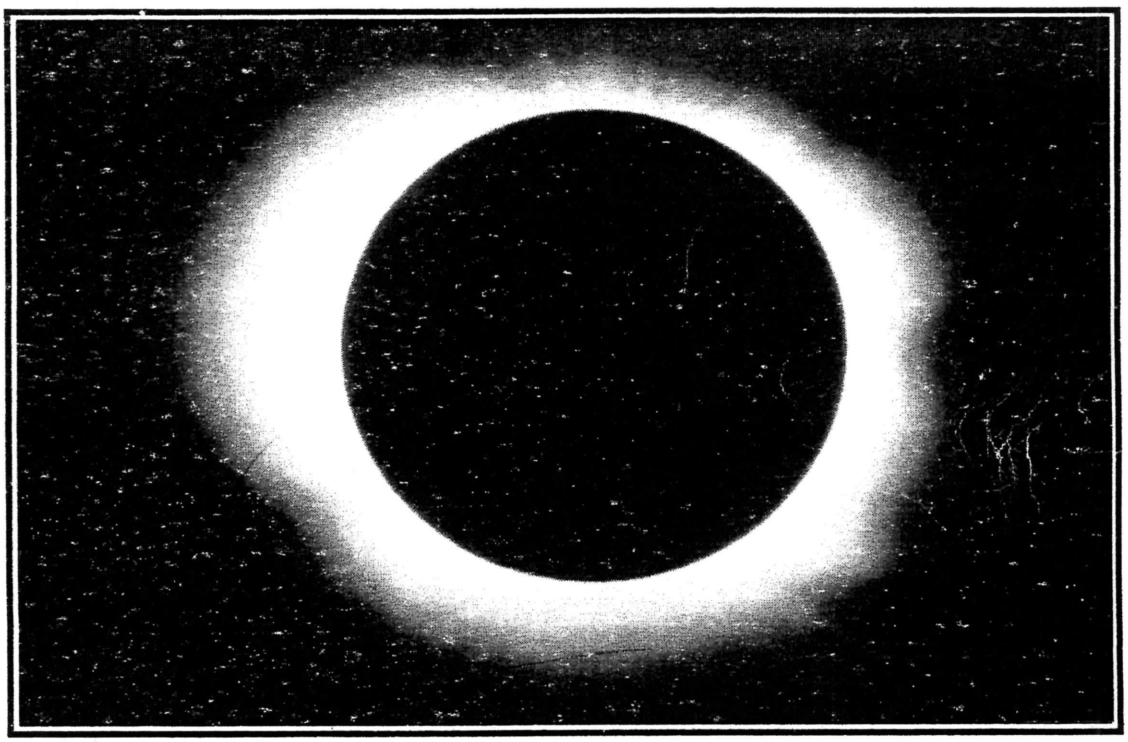

# THE CELESTRON C5
# INSTRUCTION MANUAL


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# THE CELESTRON C5 INSTRUCTION MANUAL

• The C5 •

• The C5+ •

• The C5 Spotting Scope •

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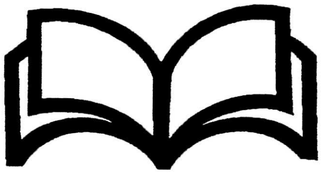
# INTRODUCTION

Welcome to the Celestron world of amateur astronomy! For more than a quarter of a century, Celestron has provided amateur astronomers with the tools needed to explore the universe. The Celestron C5 continues in this proud tradition combining large aperture optics with ease of use and portability. With a mirror diameter of 5 inches, your Celestron C5 has a light gathering power of 300 times that of the unaided human eye. Yet, the C5 optical system is extremely compact and portable because it utilizes the Schmidt-Cassegrain design. This means you can take your C5 to the mountains or desert or wherever you observe.

The Celestron C5 is made of the highest quality materials to ensure stability and durability. All this adds up to a telescope that gives you a lifetime of pleasure with a minimal amount of maintenance. And, your C5 is versatile — it grows as your interest in astronomy grows.

But, your Celestron C5 is not limited to astronomical viewing alone. It can also be used for terrestrial viewing to study the world around you. In fact, Celestron offers a spotting scope version for the observer whose primary interest is nature watching or photography.

## How to Use This Manual



This manual is designed to instruct you in the assembly and use of your C5 telescope, C5+ telescope, or C5 spotting scope. The manual covers all three versions of the C5 and is broken down into five major sections. The first section covers the proper procedure for setting up your C5 telescope. The assembly procedure for the C5 and C5+ telescopes is the same and, therefore, covered in one section. The assembly instructions for the C5 spotting scope are included here, though only a few sections apply.

The second section covers basic operations that are common to both telescopes and the spotting scope. This includes focusing, aligning the finder, and taking your first look. The third section deals with the basics of astronomy which includes celestial coordinate system, the motions of the stars, and polar alignment. The fourth major section covers the proper procedure for using the clock drives of the astronomical telescopes. This is where the C5 and C5+ differ greatly and, as a result, each telescope is considered separately. The fifth section covers visual observing of the Moon, planets, and deep sky objects. The sixth section deals with celestial photography covering all major forms working from the easiest to the most difficult. The last major section is on telescope maintenance, specifically on cleaning and collimation. This section applies to all C5s.

In addition to the above mentioned, there is a partial list of optional accessories for all models of the C5. Included is a brief description of each accessory's function. The final part of this manual contains a list of celestial objects visible through your Celestron telescope. Included are the coordinates for each object, its brightness, and a code which indicates the object type. In addition, there is a list of bright stars for aligning the setting circles.

Read the assembly instructions through completely before you attempt to set up your C5. Then, once you've set up your C5, read the section on "Telescope Basics" before you take it outside and use it. This will ensure that you are familiar with your telescope before you try and use it under a dark sky.

Since it will take a few observing sessions to familiarize yourself with your C5, you should keep this manual handy until you have fully mastered your telescope's operation.

## A Word of Caution

Your Celestron C5 is designed to give you hours of fun and rewarding observations. However, there are a 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. PERMANENT AND IRREVERSIBLE EYE DAMAGE MAY RESULT.

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

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 , ALLOWING UNFILTERED SUNLIGHT TO PASS THROUGH TO THE EYE.

**NEVER LEAVE THE TELESCOPE UNSUPERVISED, EITHER WHEN CHILDREN ARE PRESENT OR ADULTS WHO MAY NOT BE FAMILIAR WITH THE CORRECT OPERATING PROCEDURES OF YOUR TELESCOPE.**

**NEVER POINT YOUR TELESCOPE AT THE SUN UNLESS YOU HAVE THE PROPER SOLAR FILTER. WHEN USING YOUR TELESCOPE WITH THE CORRECT SOLAR FILTER, ALWAYS COVER THE FINDER. ALTHOUGH SMALL IN APERTURE, THIS INSTRUMENT HAS ENOUGH LIGHT GATHERING POWER TO CAUSE PERMANENT AND IRREVERSIBLE EYE DAMAGE. FURTHERMORE, THE IMAGE PROJECTED BY THE FINDER IS HOT ENOUGH TO BURN SKIN OR CLOTHING.**

## The Schmidt-Cassegrain Optical System

A telescope is an instrument that collects and focuses light. The nature of the optical design determines how the light is focused. Some telescopes, known as refractors, use lenses while others, known as reflectors, use mirrors. The Schmidt-Cassegrain optical system (or Schmidt-Cass for short) uses a combination of mirrors and lenses and is referred to as a compound or catadioptric telescope. 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 which prevents stray light from passing through to the eyepiece or camera without striking the primary or secondary mirrors.

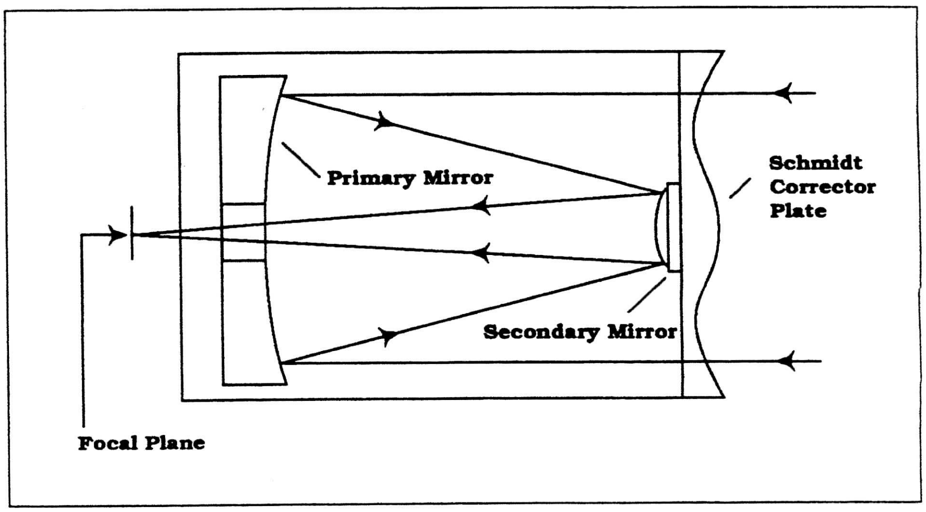



**Figure 1-1**

**This cross sectional diagram shows the light path of the Schmidt-Cassegrain optical system. Note that the light rays travel the length of the telescope tube three times, making this a compact optical design. Please note that the curve of the corrector plate is exaggerated.**

The C5 is available in three versions: the C5, C5+ and C5 spotting scope. The C5 and C5+ are astronomical telescopes that come on a heavy-duty single fork arm that attaches to the drive base. The clock drive is a single motor spur gear type that is built into the drive base. Both the C5 and C5+ are 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 C5 and C5+ are:

- Visual back 1-1/4"
- Prism star diagonal 1-1/4"
- 25mm Kellner eyepiece 1-1/4"
- Heavy-duty table top wedge with built-in bubble level — 0° to 90° range
- 5x24 finder and bracket
- Clock drive cord (C5 only)
- Hand controller (C5+ only)
- Spun aluminum lens cap
- Three 3/8"x16x1" hand tightening knobs
- Allen wrenches

The C5 spotting scope has the same tube assembly as the C5 and the C5+, but without the fork mount and clock drive. The C5 spotting scope comes ready to attach to a photographic tripod for terrestrial viewing. The standard accessories are:

- Visual back 1-1/4"
- 45° erect image diagonal 1-1/4"
- 26mm Plössl ocular 1-1/4"
- 8x20 erect image finder
- Photo tripod adapter block
- Deluxe foam fitted carrying case

This section covers the correct assembly for the C5, C5+ and C5 spotting scope. Assembly instructions for the C5 and C5+ are identical and no reference is made between the two in this section. The section which describes the use of the motor drives, titled "Using the Drive," differentiates between the two versions.

Assembly instructions for the C5 spotting scope are also covered here. However, only a few sections (i.e., attaching eyepieces, attaching the finder, attaching the scope to a tripod, etc.) apply. Please consult the Table of Contents for a complete listing of topics and page numbers.

## Unpacking Your Celestron C5

Remove the contents of the box and place all parts on a clean work surface. Since the Celestron C5 comes fully assembled, all you need to do is attach the standard accessories and you are ready to begin. Save the box since you may want to ship your telescope in the future.

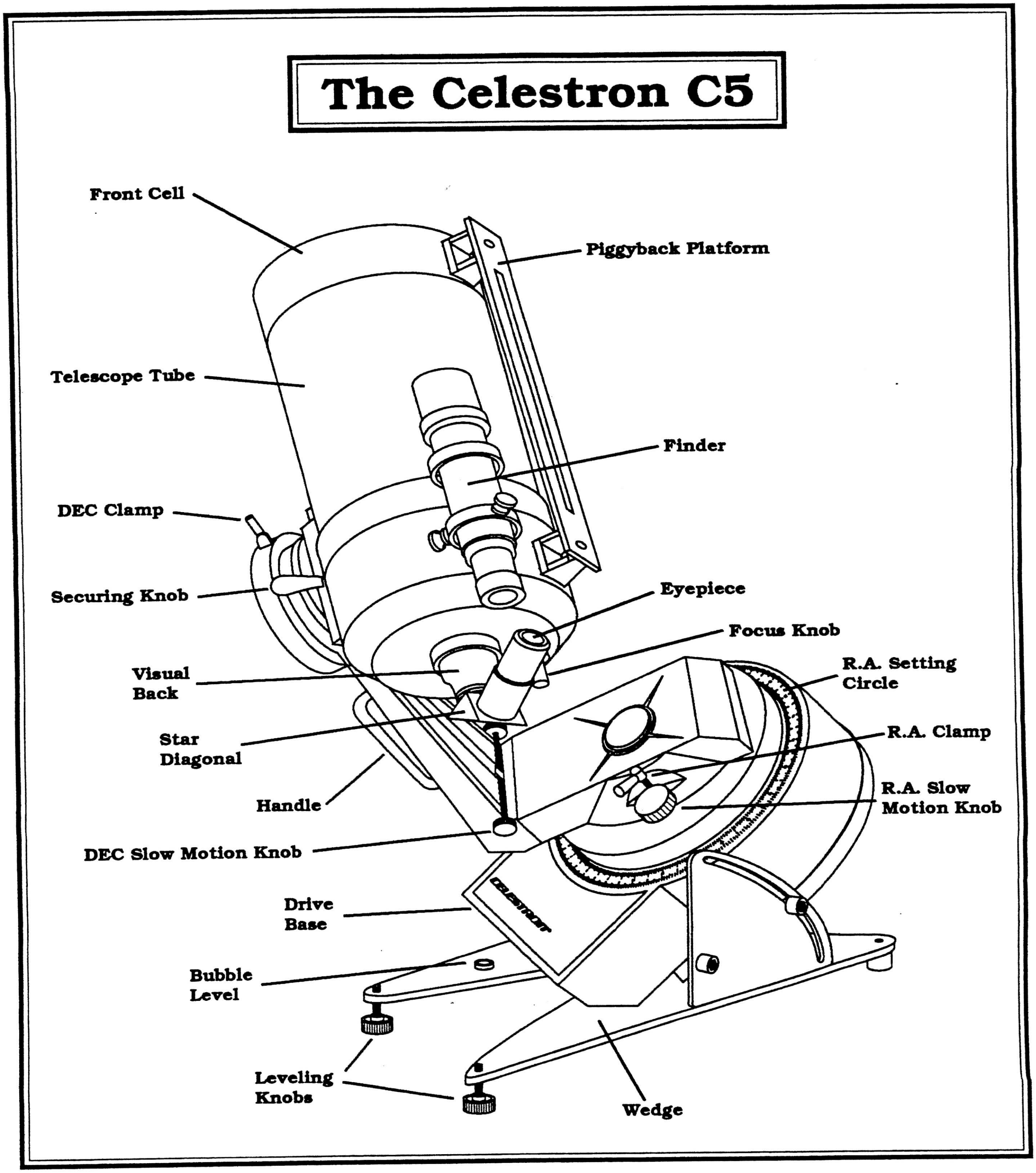



**Figure 2-1**

**The Celestron C5 fully assembled with all the standard accessories attached.**

## Attaching the C5 to the Wedge

For astronomical viewing, you must attach the telescope onto the wedge. The wedge tilts the telescope's axis of rotation allowing you to polar align the telescope, use the setting circles, and the clock drive. If you have the optional Celestron adjustable tripod, you should attach the wedge to the tripod BEFORE attaching the telescope to the wedge. To mount the telescope on the wedge:

1. Loosen the four Allen head screws on the side plates. There are two on each side plate which hold the tilt plate in place. You need a 3/16" Allen hex wrench to do this.

2. Move the tilt plate until the latitude scale indicates the latitude of your observing site (see figure 2-2).

3. Tighten the Allen head screws on the side plates to hold the tilt plate in position.

4. Lay the telescope on its side and locate the three threaded holes in the bottom of the drive base.

5. Thread one of the 3/8"x16x1" knobs about two turns into the hole that is opposite the rectangular portion of the base.

6. Pick the telescope up by the handle on the fork tine and position it above the wedge. It should be oriented so that the telescope is over the base of the wedge with the bolt pointing toward the tilt plate. Point the rectangular portion of the drive base toward the base of the wedge.

7. Slide the knob into the slot on the top of the tilt plate (see figure 2-3).

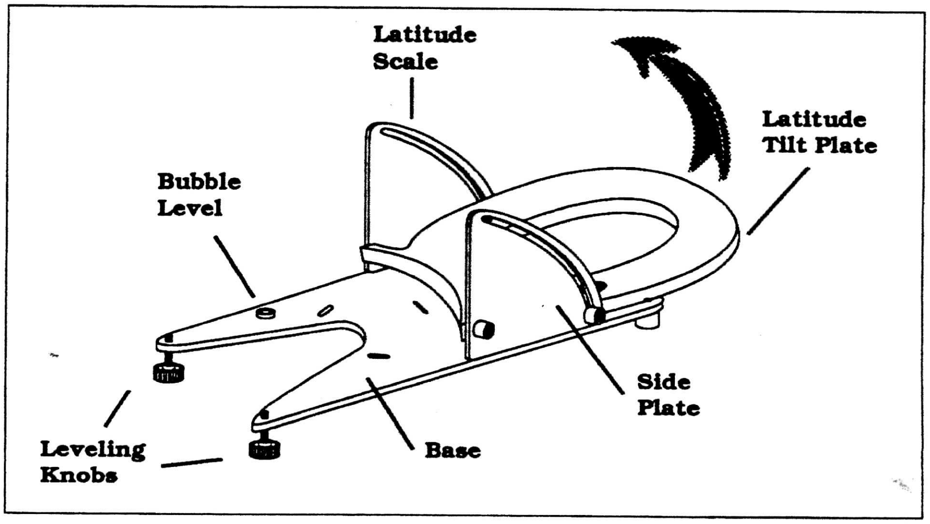



**Figure 2-2**

**Adjusting the wedge to the proper latitude is easier to do before the telescope is attached. The latitude scale is on top of the left side plate.**

8. Tighten the knob 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 move the base enough to insert the two remaining knobs. (If you do not tighten the bolt at all, the drive base may be tilted slightly preventing the remaining two bolts from threading straight in.)

9. 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.

10. Insert the knobs and tighten all three completely.

There is no need to loosen these until you are ready to remove the telescope from the wedge. For rock steady observing on uneven terrain or in the absence of a solid table, either of the optional adjustable tripods (#93501-R or #93591) are recommended.

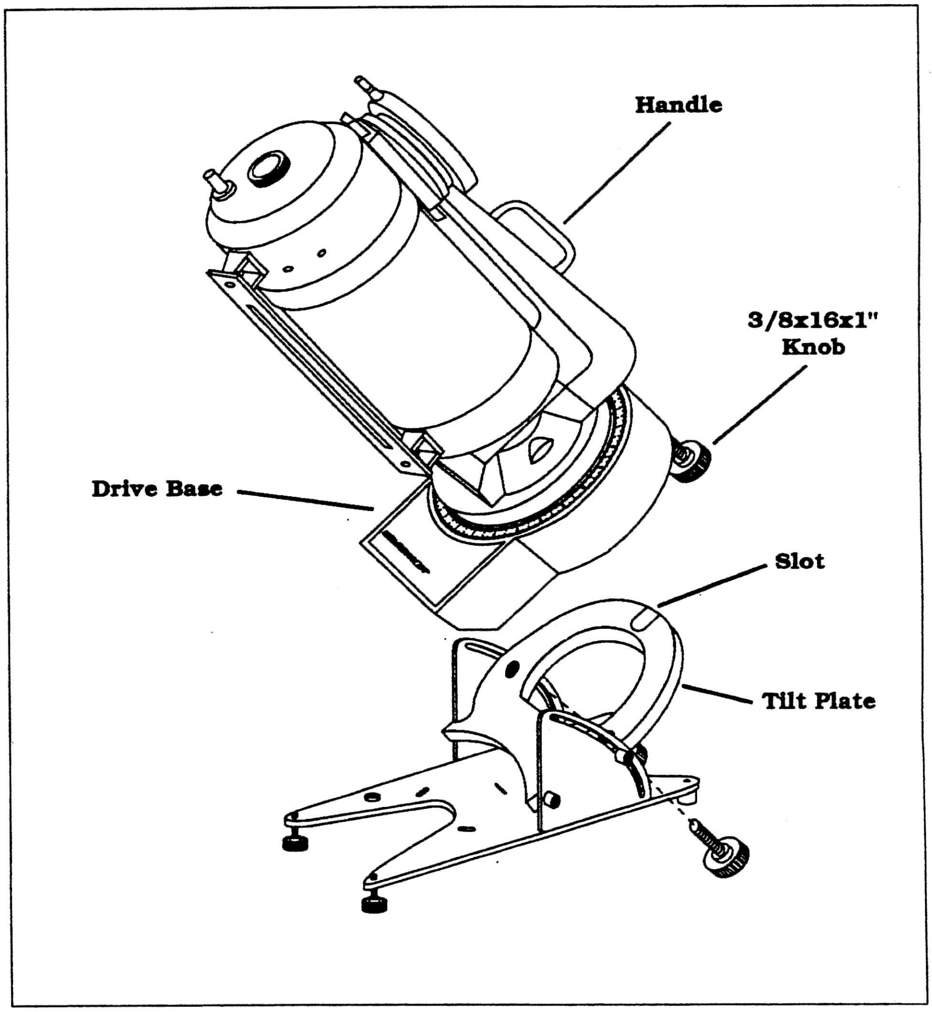



**Figure 2-3**

## Attaching the Visual Accessories

There are several accessories that come standard with all the Celestron C5 telescopes. The installation and use of each of these is described in this section.

### The Visual Back

The visual back allows you to attach all visual accessories to the telescope. To attach the visual back:

1. Remove the plastic cover on the rear cell.
2. Place the knurled slip ring on the visual back over the threads on the rear cell.
3. Hold the visual back with the thumbscrew in a convenient position and rotate the knurled slip ring clockwise until tight.

Once this is done, you are ready to attach other accessories, such as eyepieces, diagonal prisms, etc.

If you want to remove the visual back, rotate the slip ring counterclockwise until it is free of the rear cell.

### The Star Diagonal (or Erect Image Diagonal)

The star diagonal is a prism that diverts the light at a right angle from the light path of the telescope. For astronomical observing, this allows you to observe in positions that are more comfortable than if you were to look straight through. The C5 spotting scope comes with an erect image diagonal that is designed for terrestrial viewing. Both mount to the telescope in the same manner. To attach the star diagonal:

1. Turn the thumbscrew on the visual back until its tip no longer extends into (i.e., obstructs) the inner diameter of the visual back.
2. Slide the chrome portion of the star diagonal into the visual back.
3. Tighten the thumbscrew on the visual back to hold the star diagonal in place.

If you wish to change the orientation of the star diagonal, loosen the thumbscrew on the visual back until the star diagonal rotates freely. Rotate the diagonal to the desired position and tighten the thumbscrew.

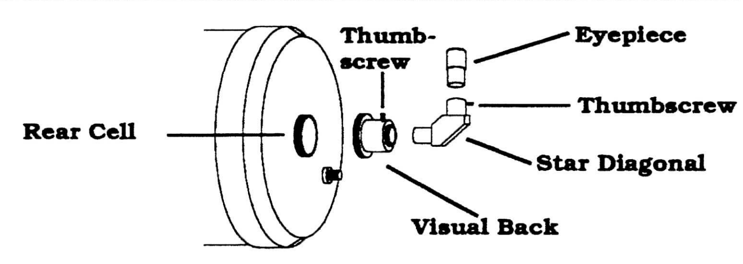



**Figure 2-4**

## The Eyepieces

The eyepiece, or ocular, is the optical element that magnifies the image focused by the telescope. The eyepiece fits into either the visual back directly or the star diagonal (or, for the C5 spotting scope, the erect image diagonal). To install an ocular:

1. Loosen the thumbscrew on the star diagonal (or erect image diagonal) so it does not obstruct the inner diameter of the eyepiece end of the diagonal.

2. Slide the chrome portion of the eyepiece into the star diagonal (or erect image diagonal).

3. Tighten the thumbscrew to hold the eyepiece in place.

To remove the eyepiece, loosen the thumbscrew on the star diagonal and slide the eyepiece out.

Eyepieces are commonly referred to by focal length and barrel diameter. The focal length of each eyepiece is printed on the eyepiece barrel. The longer the focal length (i.e., the larger the number) the lower the eyepiece power or magnification; and the shorter the focal length (i.e., the smaller the number) the higher the magnification. Generally, you will use low-to-moderate power when viewing. For more information on how to determine power, see the section on "Calculating Magnification."

Barrel diameter is the diameter of the barrel that slides into the star diagonal or visual back. Both C5 telescopes and the C5 spotting scope use eyepieces with a standard 1-1/4" barrel diameter.

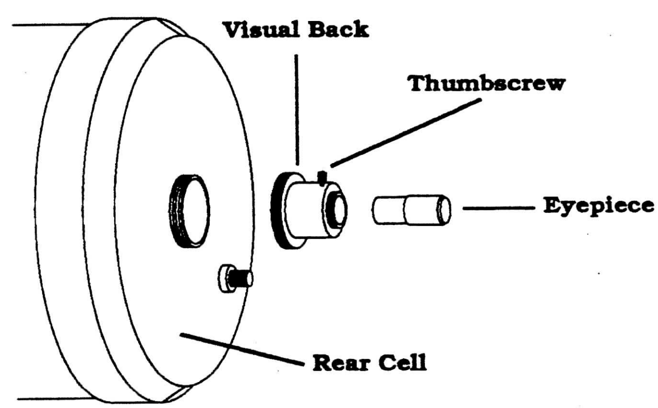



**Figure 2-5**

**Attaching the eyepiece directly to the C5 rear cell. Doing this changes the image orientation seen through the telescope or spotting scope from reversed to inverted (i.e., upside down and backwards.**

## Installing the Finder

Both the C5 and C5+ come standard with a 5x24mm finder while the C5 spotting scope comes with a terrestrial (erect image) 8x20 finder. The purpose of the finder is to locate objects that might otherwise be overlooked in the narrow, higher power field of view of the telescope. To ensure the finder and bracket are not damaged during shipping, they are **NOT** attached to the telescope.

Begin by removing the finder and mounting hardware from the plastic shipping 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. In addition, there is also a rubber O-ring used to keep the finder secure in the bracket. Mounting the finder and bracket is a two-step process; first mounting the bracket to the telescope, then mounting the finder in the bracket.

## Attaching the Finder Bracket to the Telescope

1. Locate the two holes in the rear cell of the telescope just right of center (when looking from the back of the tube).

2. Remove the tape covering the two holes. The tape prevents dust and moisture from entering the optical tube before the finder is installed.

3. 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 (eyepiece end) of the telescope (see figure 2-6).

4. Thread the screws in by hand and then tighten with one of the Allen wrenches provided.

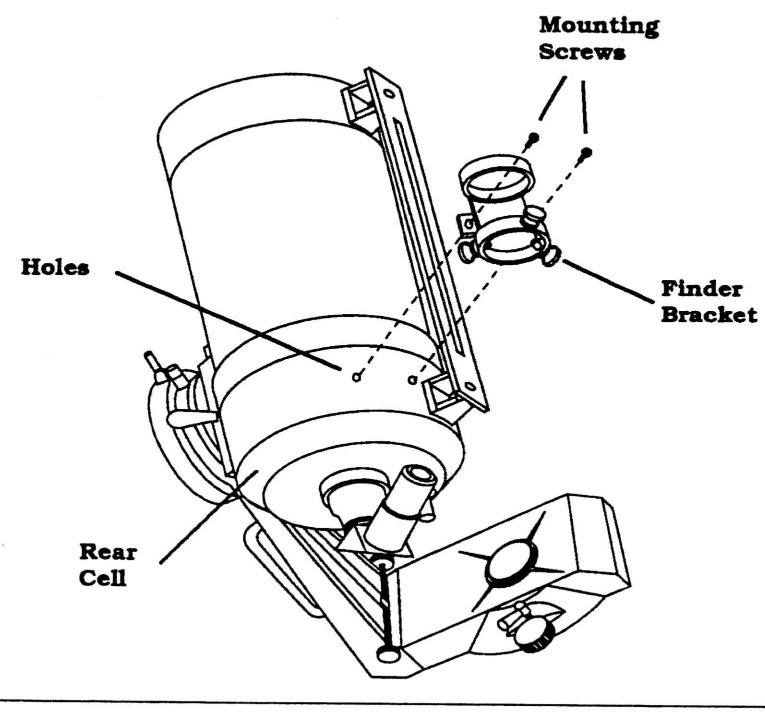



**Figure 2-6**

## Attaching the Finder to the Bracket

With the bracket firmly attached to the telescope, you are ready to attach the finder to the bracket.

1. Thread the three screws into the finder bracket. Tighten the screws until the ends are flush with the inner diameter of the bracket ring. **Do not thread them in completely or they will interfere with the placement of the finder.**

2. Slide the rubber O-ring onto the back (eyepiece end) of the finder — it may need to be stretched a little.

3. Position the O-ring on the main body of the finder so that it is toward the front (i.e., objective) end of the finder.

4. Slide the finder, eyepiece end first, into the front ring of the bracket (see figure 2-7). Push it back until the O-ring is snug inside the front ring of the bracket. For the C5 spotting scope, the 8x20 finder slides in objective end first.

5. Hand tighten the three set screws until snug.

To align the finder, please see the section on "Aligning the Finder."

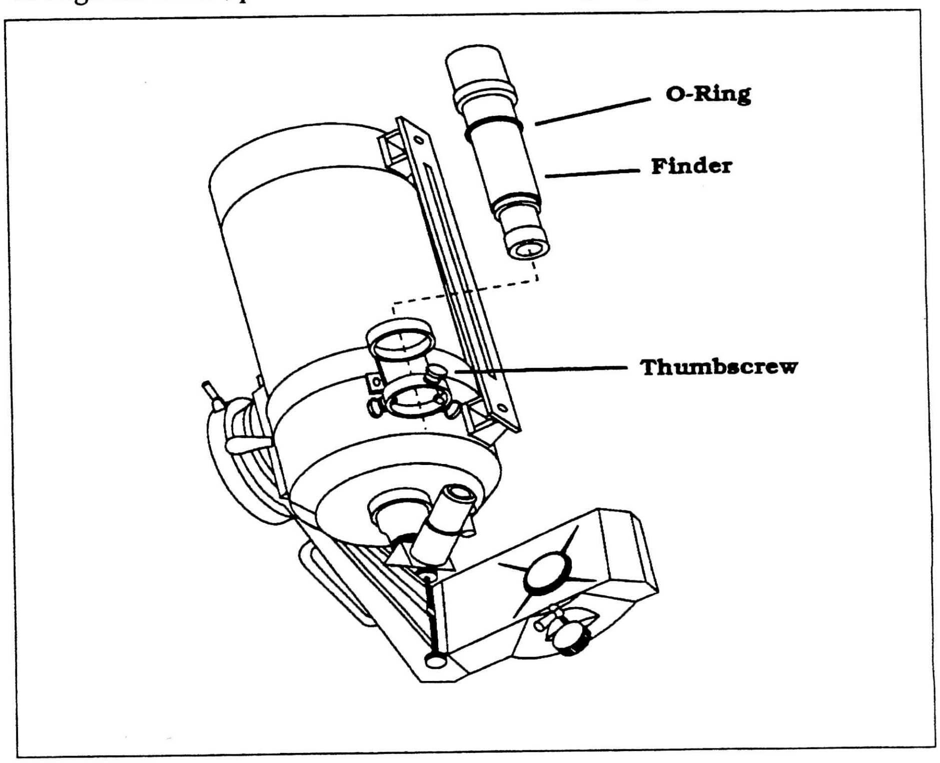



**Figure 2-7**

## Removing the Lens Cap

The Celestron C5 lens cap is made of spun aluminum with a felt-lined inner diameter. The lens cap slides over the outer diameter of the C5's front cell for a snug fit. To remove the lens cap, simply hold onto the outer edge of the lens cap and pull away from the front cell.

## Moving the C5 in R.A. and DEC

Once set up, you will need to move your C5 to various areas of the sky to observe different objects. Pointing the telescope is done by moving the telescope in right ascension (R.A.) and declination (DEC). The R.A. axis moves east and west while the DEC axis moves the telescope north and south (see figure 2-9). To make large directional changes:

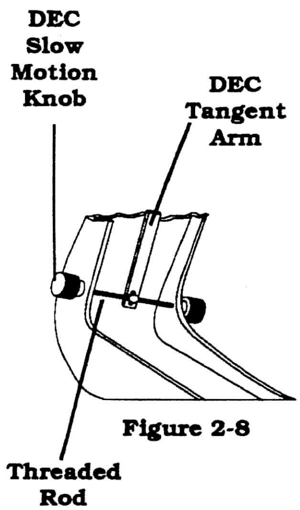


**Figure 2-8**

1. Loosen the R.A. and DEC clamps on the mount.
2. Move the telescope to the desired position.
3. Tighten the R.A. and DEC clamps to hold the telescope in place.

For fine adjustments, use the R.A. and DEC slow motion knobs. To make an adjustment in declination, simply turn the declination slow motion knob. The DEC clamp does NOT have to be loosened. Once you have the desired target centered in the field, stop rotating the DEC knob. If the DEC slow motion knob will not turn, the DEC tangent arm may have reached the end of the threaded rod. To correct this, rotate the DEC knob in the opposite direction until the tangent arm is in the center of the threaded rod (see figure 2-8). Release the DEC clamp and manually center the object you were looking at. Tighten the DEC clamp and the DEC slow motion knob will again allow fine adjustments for both north and south.

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, tighten the R.A. clamp by turning it clockwise. The clamp must be sufficiently locked for the drive motor to engage and move the telescope. When the telescope is balanced, the half tightened R.A. clamp can operate as a clutch. Please note that you should never turn the R.A. knob while the R.A. clamp is in the FULLY locked position.

**WARNING:**

**DO NOT FORCE THE R.A. KNOB TO TURN WHEN THE R.A. CLAMP IS FULLY TIGHTENED. 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 DAMAGE THE TELESCOPE.**

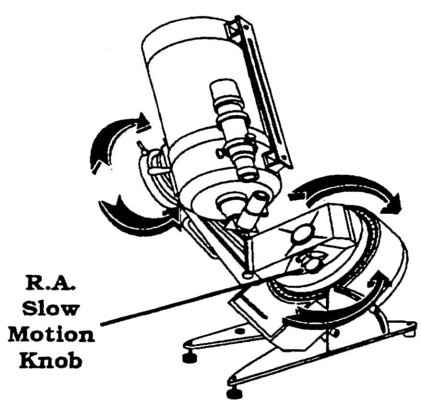


**Figure 2-9**

The telescope comes equipped with setting circles to help you locate objects in the night sky. The DEC setting circle is incremented in degrees while the R.A. setting circle is incremented in hours and minutes with a marker every five minutes. The numbers on the inner circle are for the northern hemisphere while those on the outer circle are for the southern hemisphere.

Without attaching the telescope to the wedge, you can begin terrestrial observing. With the telescope in this configuration, the R.A. and DEC controls will sweep vertically (in altitude) and horizontally (in azimuth) relative to the horizon.

## Adjusting the Wedge

In order for the clock drive to track accurately, the telescope's axis of rotation must be parallel to the Earth's axis of rotation. The process of making these two axes parallel is called polar alignment. Polar alignment is achieved NOT by moving the telescope in right ascension or declination, but by adjusting the wedge. For the purpose of polar alignment, the wedge can be adjusted in two directions: vertically, which is called altitude and horizontally, which is called azimuth. Once aligned, the wedge should not be moved. Changes in the direction the telescope is pointing are made moving the telescope in right ascension and declination. This section simply covers the correct procedure for adjusting the wedge during the polar alignment process. The actual process of polar alignment, that is, making the telescope's axis of rotation parallel to the Earth's, is described later in this manual in the section on "Polar Alignment."

When ready to observe, find a flat, sturdy surface on which to set the wedge (e.g., a picnic table). Or, if using either of the optional tripods, set it up on the ground.

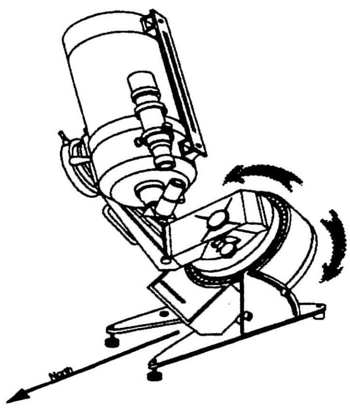


**Figure 2-10**

**Adjusting the wedge is done only for polar alignment. The adjustment should be minor if you adjusted the wedge to your latitude prior to attaching the telescope (see page 6).**

The method of adjusting the wedge in azimuth (i.e., left-to-right) depends on how it is set up.

- If the wedge is sitting on a flat surface, simply move the wedge left or right until pointing at true north.
- If mounted on the tripod, loosen the three bolts that hold the wedge to the tripod. Then, pivot the wedge left or right until pointing in the proper direction.

Adjusting the wedge in altitude (up and down) is the same regardless of how the wedge is set up. To adjust the wedge in altitude:

1. Hold the telescope securely by the fork tine.
2. Loosen the two screws on the side of the wedge that hold the tilt plate in position. You will need a 3/16" Allen hex key to do this. Caution: You will be holding the entire weight of the telescope and mount at high and low latitude positions.
3. Move the wedge (see figure 2-10) to the desired elevation (i.e., latitude).
4. Tighten the screws on the side plates of the wedge. Check all four screws.

This adjustment is used if the wedge is attached to the tripod or on a flat surface. Although these directions sound somewhat ambiguous now, they will make more sense after you have read the section on polar alignment.

NOTE: If you have already done some reading about celestial coordinates, you will understand that altitude is interchangeable with the phrase "latitude." Setting your observing site's latitude on the latitude scale and making sure that the wedge's bubble is level is the same as rough setting your elevation or altitude as described above.

## Removing the C5 From the Fork Tine

Your Celestron C5 can be removed from the fork tine and attached to a photographic tripod. This allows you to use your Celestron C5 as a spotting scope or, with the optional accessories, a telephoto lens. To remove the Celestron C5 tube from the fork tine:

1. Orient the telescope tube so that it is parallel to the ground.
2. Locate the tripod block safety screw on the back of the photo tripod adapter block. The back of the photo tripod adapter block is the end closest to the eyepiece. **Please note that the C5 Spotting Scope does NOT have the tripod block safety screws.**
3. Remove the tripod block safety screw on the back of the photo tripod adapter block.
4. Hold the telescope tube handle securely.
5. Loosen the securing knob on top of the fork tine (see figure 2-11).
6. Slide the Celestron C5 tube — front cell first — out of the dovetail bracket on the top of the fork tine.
7. Replace the tripod block safety screw on the back of the photo tripod adapter block. This will prevent the tripod block safety screw from being lost.

Your Celestron C5 can now be attached to a standard photographic tripod. Attaching the C5 back to the fork tine is done in reverse order. However, you must position the tube inside the female dovetail mounting bracket on the fork tine so that the telescope swings through without hitting the base.

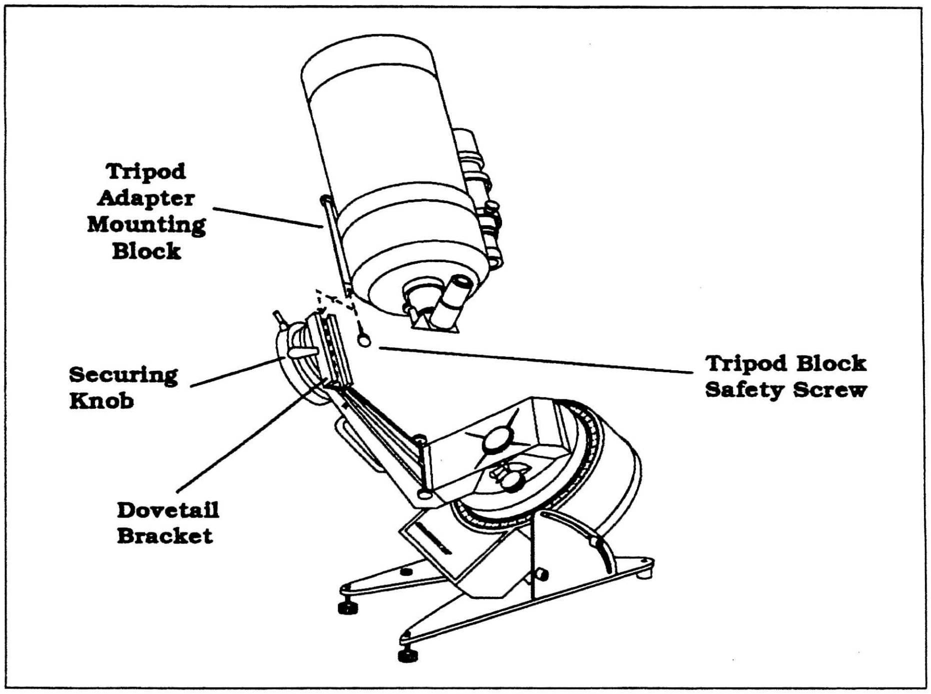



**Figure 2-11**

**Removing the C5 (or C5+) from the fork tine.**

## Attaching the C5 to a Photographic Tripod

Once removed from the fork tine, the C5 and C5+ will attach to any photographic tripod with a 1/4x20 threaded screw. (The C5 spotting scope comes ready to attach to a photographic tripod.) The C5 attaches to the tripod via a photo tripod adapter block that has three 1/4x20 holes. To attach the C5 to a photographic tripod:

1. Place any of the 1/4x20 holes in the photo tripod adapter block over the 1/4x20 screw on your photographic tripod.

2. Tighten the 1/4x20 screw to hold the C5 firmly in place.

If the telescope/spotting scope is not properly balanced, try using one of the other holes in the photo tripod adapter block. Once mounted on the photographic tripod, you are ready to use your C5 as a terrestrial spotting scope. Keep in mind that with the optional T-Adapter and T-Ring, your C5 becomes a 1250mm f/10 telephoto lens.

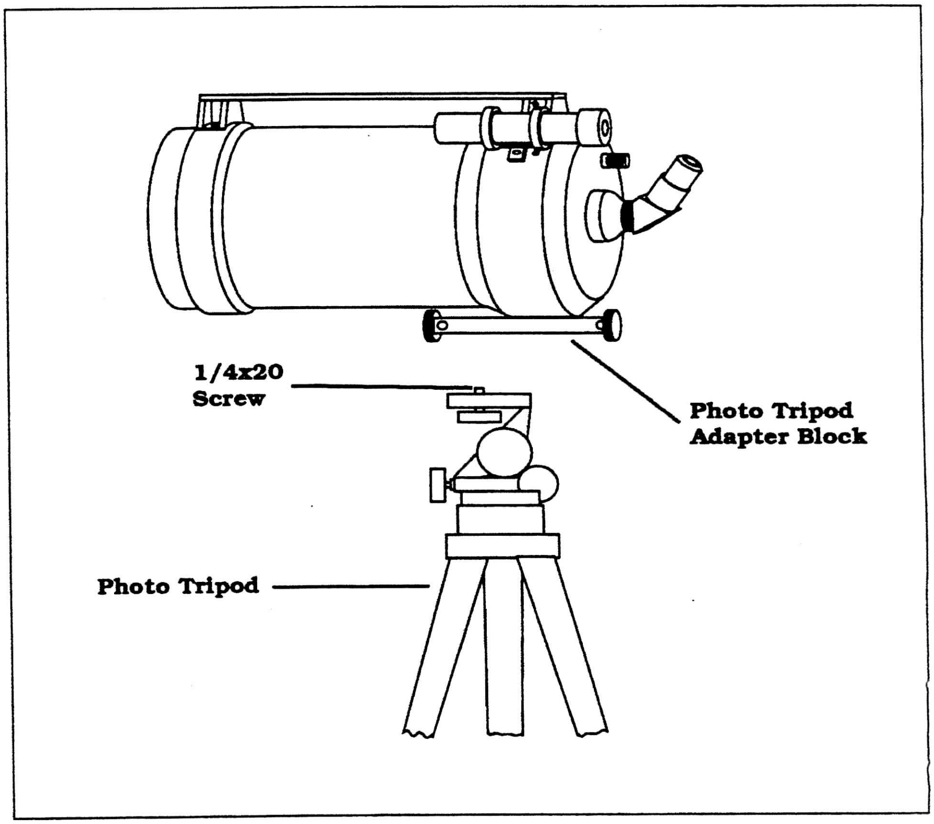



**Figure 2-12**

**The Celestron C5 spotting scope attaching to a photographic tripod. Once removed from the fork tine, the C5 and C5+ can be used as a spotting scope or telephoto lens. The C5 spotting scope does not have the tripod block safety screws illustrated above.**

## Removing the C5 From the Wedge

When transporting your C5, you should remove it from the wedge and return it the box or optional carrying case. To remove the telescope from the wedge:

1. Remove the two lower knobs that hold the drive base to the wedge.
2. Hold the telescope securely by the fork tine handle.
3. **Loosen** the top bolt that holds the telescope to the wedge. **CAUTION: Do NOT remove the top bolt or the telescope will separate from the wedge and fall to the ground.**
4. Hold the telescope by the fork arm and slide it up, off the wedge.

Remove the last 3/8"x16x1" knob and your C5 can now be returned to the box or optional carrying case.

## Transporting the C5

If you plan on driving to a dark sky observing location, you can transport your Celestron C5 as is (i.e., with the wedge attached — but, be sure to lay it on its side while driving to prevent it from falling over). 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. Or, if so desired, the wedge may be removed from the tripod as well. For easy handling, Celestron offers a carrying case (#302077) specifically designed for the C5. This case holds the C5 on the fork arm and many of the standard accessories. The C5 spotting scope comes standard with a foam-fitted carrying case which should be used whenever transporting your C5.

If you plan on shipping your C5 via common carrier, all parts should be returned to their original shipping containers.

## Storing the C5

When not in use, your Celestron C5 can be left fully assembled and set up. However, all lens and eyepiece covers should be put back in place. This will help prevent dust build-up on the optical surfaces and reduce the number of times you may need to clean the instrument. You may want to return your Celestron C5 to its original shipping container and store it there. If this is the case, all optical surfaces should still be covered to prevent any dust build-up.

## What Next?

Now that you have completely assembled your Celestron C5, you are ready to learn more about the basic operation of your telescope or spotting scope. Turn to the section entitled "Getting Started" which will provide you basic information needed to get you started using your C5. For C5 and C5+ telescope owners, continue onto the sections on "Astronomy Basics" and "Using the Drive." C5 spotting scope owners may wish to explore the section on visual observing as this instrument can also be used for casual astronomical observing.

## Technical Specifications

Following is pertinent technical information for the Celestron C5 telescopes and spotting scope that you may find useful.

- Hand figured diffraction limited optical system
- 5" aperture (125mm) f/10
- Focal length — 1250mm (50")
- Schmidt-Cassegrain optical system
  Resolution 0.9 arc sec.
- Tube — 11" long
- Weight (with mount) — 23 pounds
- 5x24 finder
- Highest useful magnification — 500x
- Lowest useful magnification — 23x
- Limiting magnitude (visual) — 13
- Single arm swing-through fork tine
- Manual slow motion controls in R.A. and DEC
- Quick release mechanism allows you to remove the telescope from the fork mount in seconds. Unique dovetail system with safety locks requires no tools!
- Dual reading R.A. setting circle works in both the northern and southern hemisphere
- Spur gear drive utilizes pre-loaded tapered bearings for a sturdy and accurate drive system
- DEC axis uses pre-loaded roller and thrust ball bearing — only manufacturer to do so!
- Handles on both the fork arm and telescope tube for easy handling
- Spun aluminum lens cover
- Starbright coatings standard — AR coating on corrector yield greater light transmission while HR coatings on primary and secondary mirrors provide greater reflectivity.
- Telescope and fork mount fits into airline overhead when stored in optional foam-fitted carrying case (wedge and tripod separate)

**C5 Only**

Electric clock drive — 110V - 60Hz AC power

**C5+ Only**

Electric Clock Drive — DC power with built-in dual axis electronic drive controller with hand controller — it features precision speed control with plus and minus guiding speed adjustment at 40% sidereal rate. It runs up to 50 hours with a 9-volt Alkaline battery (included). Simple change to operate in the southern hemisphere. Auto guider compatible! 110V AC with optional adapter.

**C5 Spotting Scope**

- Weight — 6 pounds
- Highest useful magnification — 300x (daytime)
- Near Focus — Approximately 20'
- Angular field of view with standard eyepiece: 1.2°
- Angular field of view using optional Reducer/Corrector lens: 1.9°
- Carrying handle
- Deluxe foam-fitted carrying case
- Spun aluminum lens cover
- 8x20 Erect Image Finder

Once your telescope is fully assembled, you are ready for your first look. This section deals with the basics of telescope and spotting scope operation.

## Focusing

The Celestron C5 focusing mechanism controls the position of the primary mirror which is mounted on a sleeve that slides back and forth on the primary baffle tube (see figure 3-2). The focusing knob, which moves the primary mirror, is on the rear cell of the C5 below the star diagonal and eyepiece when attached to the fork mount and drive. When attached to a photographic tripod, the focus knob is to the right of the star diagonal and eyepiece. Turn the focusing knob until the image is sharp. If the knob will not turn, the primary mirror has reached the end of its travel on the focusing mechanism. Turn the knob in the opposite direction until the image is sharp. Once an image is in focus, turn the knob clockwise to focus on a closer object and counterclockwise for a more distant object (see figure 3-1). 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 20 feet) to infinity. For astronomical viewing, out-of-focus star images are very diffuse making them difficult, if not impossible, to see. If you turn the focus knob too quickly, you can go right through focus without seeing the image. For best results, your first astronomical target should be a bright object (like the Moon) so that the image is visible even when out of focus.

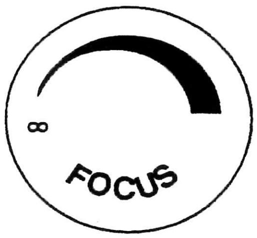



**Figure 3-1**

**The decal on the end of the focus knob shows the correct rotational direction for focusing the C5.**

Critical focusing is best accomplished when the focusing knob is turned in such a manner that the mirror moves against the pull of gravity. In doing so, any mirror shift is minimized. For astronomical observing, both visually and photographically, this is done by turning the focus knob counterclockwise. For macro viewing, when the C5 is pointing down, this is done by turning the focus knob clockwise.

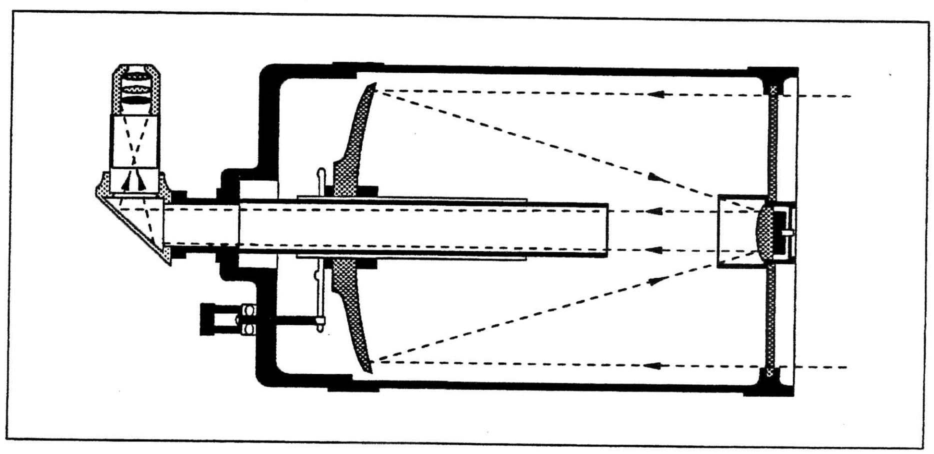


**Figure 3-2**

**This diagram shows the focusing mechanism of the C5 telescopes and spotting scopes.**

## Aligning the Finder

The Celestron C5 comes with a 5x24mm finder (8x20 for the C5 Spotting Scope) that helps in aiming the main telescope at distant objects that are hard to find in the narrow field of the telescope. The first number used to describe the finder is the power while the second number is the diameter of the objective lens in millimeters. This means the 5x24 finder is 5 power and has a 24mm objective lens. Incidentally, power is always compared to the unaided human eye. So a 5 power finder magnifies images five times more than the human eye.

To make the alignment process a little easier, you should perform this task in the daytime when it is easier to locate objects in the telescope without the finder. To align the finder:

1. Choose a conspicuous object that is in excess of one mile away. This will eliminate any possible parallax effect.

2. Point your telescope at the object you selected and center it in the main optics of the telescope.

3. Check the finder to see where your alignment target is located in the field of view.

4. Adjust the screws on the finder bracket, tightening one while loosening another, until cross hairs are centered on the target.

5. Tighten each set screw a quarter of a turn to ensure that they will not come loose easily.

In the 5x24 finder, the image orientation through the finder is inverted (i.e., upside down and reversed from left-to-right). Because of this, it may take a few minutes to familiarize yourself with the directional change each screw has on the finder. In the 8x20 finder, the image is correctly oriented.

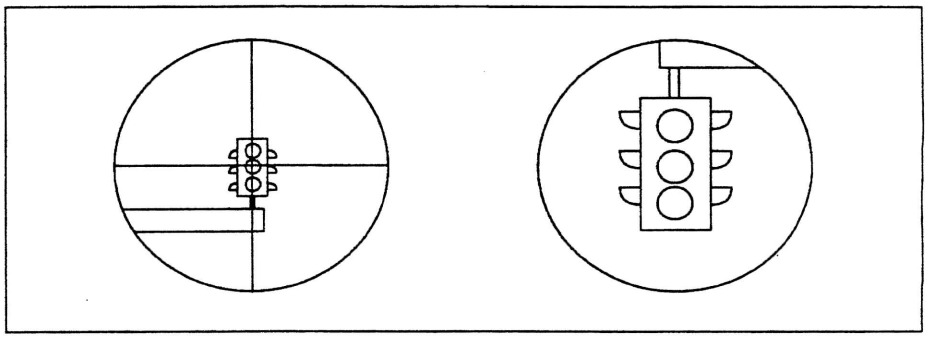


**Figure 3-3**

**LEFT: The image as seen through the 5x24 finder of the C5 and C5+ telescopes: RIGHT: The image as seen through the C5 and C5+ tele-scope. Because the image orientations do not match, it may take a few minutes to familiarize yourself with the directional change each screw has on the alignment. The image seen through the spotting scope matches the images seen through its 8x20 finder.**

## Your First Look

With the telescope fully assembled and all the accessories attached, you are ready for your first look. Observing can be broken down into two distinct categories; terrestrial and celestial. Terrestrial observing is generally done in the daytime as subjects are usually wild life, birds, or scenic views. Celestial observing is generally done at night when stars and planets are visible. Regardless of your preference, your first look should be done in the daytime so you can see the various parts of your C5 and better familiarize yourself with its operation.

## Daytime Observing

Before you can use your C5 to look at anything it must first be attached to a stable mount. For spotting scope owners, this would be a heavy-duty photographic tripod. For telescope owners, this could be the wedge supplied with the C5 or an optional photographic tripod.

WARNING !

**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.**

To use your C5 in the daytime:

1. Find a distant object that is fairly bright.
2. Insert a low power eyepiece (one with a long focal length — 25 to 30mm) into the telescope.
3. Adjust the tripod until the C5 is pointed in the direction of the object you selected. If using either the C5 or C5+ mounted on the wedge, release the R.A. and DEC clamps, if needed, and point the telescope in the direction of the object you selected.
4. Locate the object in your finder.
5. Move the C5 until the object is centered in the finder.
6. Look through the main optics and the object will be there (if you aligned the finder first).

Once you have found the object, you will most likely need to focus. If the object is moving, leave adjustment clamps loose so that you can pan easily. Try using different eyepieces to see how the field changes with various magnifications.

## Nighttime Observing

Looking at objects in the sky is quite different than looking at objects on Earth. For one, many objects seen in the daytime are easy to see with the naked eye and can be located in the telescope by using landmarks. In the night sky, many objects are not visible to the naked eye. To make things easier, you are better off starting with a bright object like the Moon or one of the planets.

1. Orient the telescope so that the polar axis is pointing as close to true north as possible. You can use a landmark that you know faces north to get you in the general direction.

2. Adjust the levelers on the wedge or the tripod legs (if using either of the optional tripods) until the wedge is sitting flat.

3. Adjust the mount until the latitude indicator points to the latitude of the site from which you are observing.

4. Insert a low power eyepiece (i.e., one with a large focal length) into the telescope to give you the widest field possible.

5. Turn the clock drive on.

6. Loosen the right ascension and declination clamps and point the telescope at the desired target. The Moon or one of the brighter planets is an ideal first target.

7. Locate the object in the finder, center it, and then look through the telescope.

8. Turn the focus knob until the image is sharp.

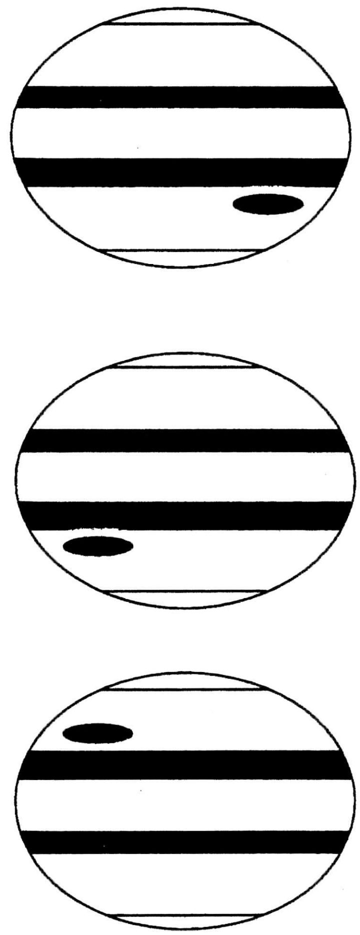
9. Take your time and study your subject. If observing the Moon, look for small details in the craters.

That's all there is to using your Celestron C5. However, don't limit your view of an object to a single eyepiece. After a few minutes, try using a different eyepiece, a more powerful one. This gives you an idea of how the field of view changes. Center your target and focus. If observing the Moon you will be looking at a few craters at once.

NOTE: If not using the clock drive, the stars will appear to drift out of the field of view. This is due to the Earth's rotation. In fact, anything in the sky, day or night, will drift out of the field unless the telescope has been polar aligned and the clock drive is running. More on this in the section on "Polar Alignment."

## Image Orientation

The image orientation through your C5 changes depending on how the eyepiece is inserted into the telescope. When using the star diagonal, the image is right-side-up, but reversed from left-to-right (i.e., reverted). If inserting the eyepiece directly into the visual back (i.e., without the star diagonal or erect image diagonal), the image is upside-down and reversed from left-to-right (i.e., inverted). This is normal for the Schmidt-Cassegrain design and applies to the 5x24 finder as well. When using the erect image diagonal, the image is correctly oriented. The C5 Spotting Scope comes with an erect image finder so the view is correctly oriented.



**Actual image orientation, as seen with an erect image diagonal**

**Reversed from left-to-right, as viewed with a star diagonal**

**Inverted, as viewed with an eyepiece inserted directly into the rear cell of the telescope (i.e., visual back)**

**Figure 3-4**

**These simplified drawings of the planet Jupiter illustrate the different image orientations obtained when using various viewing configurations.**

## Calculating Magnification

You can change the power of your Celestron C5 telescope just by changing the eyepiece (ocular). To determine the magnification of your Celestron C5, simply divide the focal length of the telescope by the focal length of the eyepiece used. In equation format, the formula looks like this:

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

Let's say, for example, that you are using a 30mm eyepiece. To determine the magnification, you simply divide the focal length of your C5 (1250mm) by the focal length of the eyepiece (30mm). Dividing 1250 by 30 yields a magnification of 42 power.

Although the power is variable, each instrument — under average skies — has a limit to the highest useful magnification. The general rule is that 60 power can be used for every inch of aperture. For example, the C5 is 5" in diameter. Multiplying 5 by 60 gives a maximum useful magnification of 300 power. Although this is the maximum useful magnification, most observing is done between 20 to 35 power for every inch of aperture which is 100 to 175 times for the C5.

## Determining Field of View

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

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

As you can see, before determining the field of view, you must first calculate the magnification. Using the example in the previous section, we can determine the field of view using the same 30mm eyepiece. The 30mm Ultima eyepiece has an apparent field of view of 50°. Divide the 50° apparent field by the magnification, which is 42 power. This yields an actual field of 1.2°, or a little over one degree.

To convert degrees to feet at 1,000 yards, which is more useful for terrestrial observing, simply multiply by 52.5. Continuing with our example, multiply the angular field 1.2° by 52.5 produces a linear field width of 63 feet at a distance of one thousand yards.

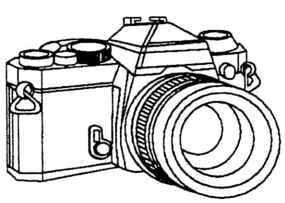
The apparent field of each eyepiece that Celestron manufactures is found in the Celestron Accessory Catalog (#93685).

## General Observing Hints

When working with any optical instrument, there are a few things to remember to ensure you get the best possible image.

- Never look through window 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 image. In some cases, you may actually see a double image.
- Never look across or over objects that are producing heat waves. This includes asphalt parking lots on hot summer days or building rooftops.
- Hazy skies, fog, and mist can also make it difficult to focus when viewing terrestrially. The amount of detail seen under these conditions is greatly reduced. Also, when photographing under these conditions, the processed film may come out a little grainier than normal with lower contrast.
- When using your C5 as a telephoto lens, the split screen or microprism focuser of the 35mm SLR camera may "black out." This is common with all long focal length lenses. If this happens, use the ground glass portion of your focusing screen. To achieve a very sharp focus, 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 your C5. When using a camera, however, you should always wear corrective lenses to ensure the sharpest possible focus. If you have astigmatism, corrective lenses should be worn at all times.

## General Photography Hints



Your Celestron C5 can be used for both terrestrial and astronomical photography. Your C5 has a fixed aperture and, as a result, a fixed f/ratio. To properly expose your subjects photographically, you need to set your shutter speed accordingly. Most 35mm single lens reflex (SLR) cameras offer through-the-lens metering that lets you know if your picture is under or overexposed. This is important for 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. More on this in the section on "Celestial Photography."

To reduce vibration when tripping the shutter, use a cable release. Releasing the shutter manually can cause vibration, something that produces blurred photos. A cable release allows you to 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.

The following section deals with observational astronomy in general. It includes information on the night sky, polar alignment, and using your telescope for astronomical observing. Most of the information in this section applies to the C5 and C5+.

## The Celestial Coordinate System

To help find objects in the sky, astronomers use a celestial coordinate system that 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 is latitude. However, in the sky this is referred to as declination, or DEC for short. Lines of declination are named for their angular distance above and below the celestial 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 coordinate and those north of the celestial equator are either blank (i.e., no designation) or preceded by a plus sign (+).

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 and are evenly spaced 15 degrees apart (at the celestial equator). Although the longitude lines are separated by an angular distance, they are also a measure of time. Each line of longitude is one hour apart from the next. Since the Earth rotates once every 24 hours, there are 24 lines total. 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 toward the west.

Your Celestron C5 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.

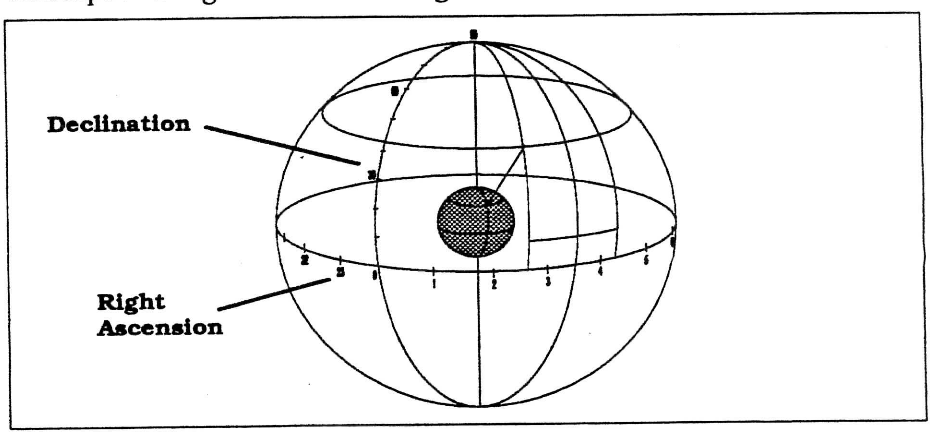



**Figure 4-1**

**The celestial sphere seen from the outside showing R.A. and DEC.**

## Motion of the Stars

The daily motion of the Sun across the sky is familiar to even the most casual observer. This daily trek is not the Sun moving as early astronomers thought, but the result of the Earth's rotation. The Earth's rotation also causes the stars to do the same, scribing out a large circle as the Earth completes one rotation. The size of that circular path a star follows depends on where it is in the sky. Stars near the celestial equator form the largest circles rising in the east and setting in the west. Moving toward the north celestial pole, the point around which the stars in the northern hemisphere appear to rotate, these circles become smaller. Stars in the mid-celestial latitudes rise in the northeast and set in the northwest. Stars at high celestial latitudes are always above the horizon, and are said to be circumpolar because they never rise and never set. You will never see the stars complete one circle because the sunlight during the day washes out the starlight. However, part of this circular motion of stars in this region of the sky can be seen by setting up a camera on a tripod and opening the shutter for a couple of hours. The processed film will reveal semicircles that revolve around the pole. (This description of stellar motions also applies to the southern hemisphere except all stars south of the celestial equator move around the south celestial pole.)

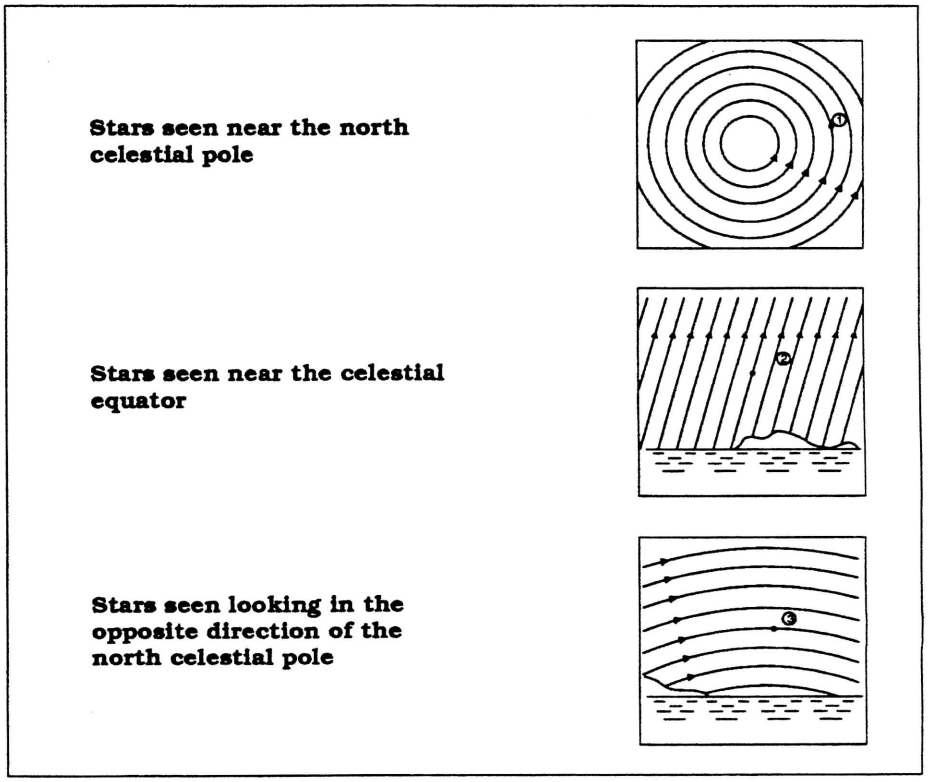



**Figure 4-2**

**All stars appear to rotate around the celestial poles. However, the appearance of this motion varies depending on where you are looking in the sky. Near the north celestial pole the stars scribe out recognizable circles centered on the pole (1). Stars near the celestial equator also follow circular paths around the pole. But, the complete path is interrupted by the horizon. These appear to rise in the east and set in the west (2). Looking toward the opposite pole, stars curve or arc in the opposite direction scribing a circle around the opposite pole (3).**

## Polar Alignment

In order for a telescope to track the stars, you must meet two criteria. First, you need a drive motor that moves at the same rate as the stars. The Celestron C5 comes standard with a built-in drive motor designed specifically for this purpose. 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.

Polar alignment is the process by which the telescope's axis of rotation (called the polar axis) 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 observed through the telescope appear stationary (i.e., they will not drift out of the field of view). If not using the clock drive, all objects in the sky (day or night) will slowly drift out of the field. This motion is caused by the Earth's rotation. Even if you are not using the clock drive, polar alignment is still desirable since it reduces the number of corrections needed to follow an object and limits all corrections to one axis (R.A.). There are several methods of polar alignment, all of which work on a similar principle, but performed somewhat differently. Each method is considered separately, beginning with the easier methods and working to the more difficult.

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.

**Definition:**

The polar axis is the axis around which the telescope rotates when moved in right ascension. This axis points in the same direction even when the telescope moves in right ascension and declination.

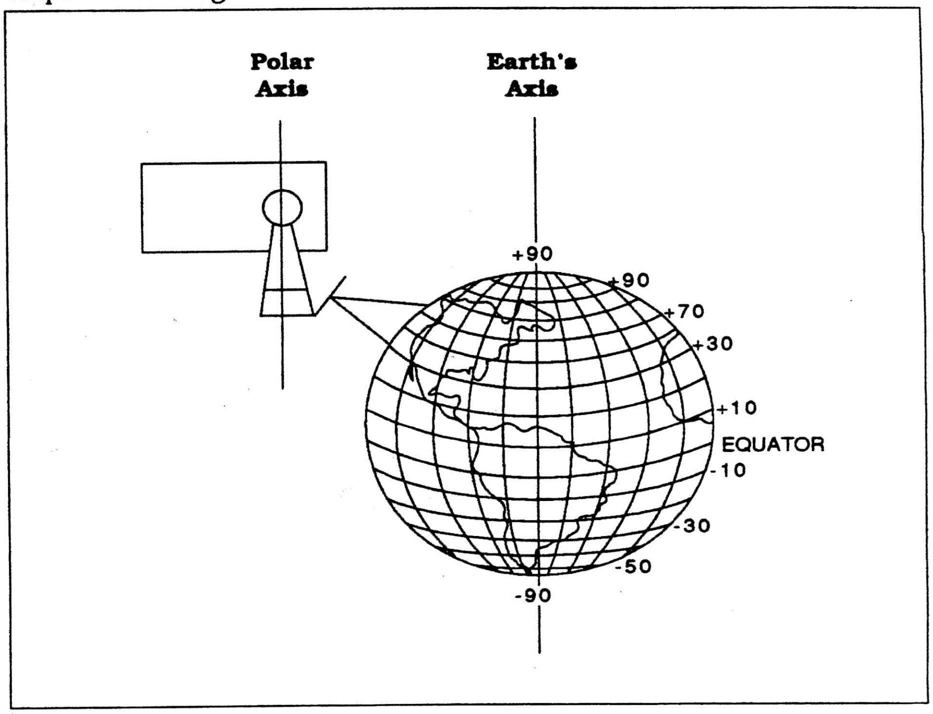



**Figure 4-3**

## Finding the Pole

In 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.

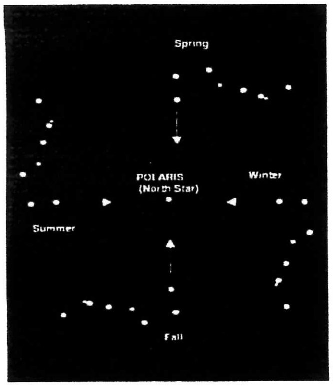



**Figure 4-4**

**The position of the Big Dipper changes throughout the year and throughout the night.**

Many 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 (see figure 4-5). Since the Little Dipper (technically called Ursa Minor) is not one of the brightest constellations in the sky, it may be difficult to locate from urban areas. If this is the case, use the two end stars in the bowl of the Big Dipper (the pointer stars). Draw an imaginary line through them toward the Little Dipper. They point to Polaris. The position of the Big Dipper changes during the year and throughout the course of the night (see figure 4-4).

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

**Definition:**

The north celestial pole is the point in the northern hemisphere around which all stars appear to rotate. The counterpart in the southern hemisphere is referred to as the south celestial pole.

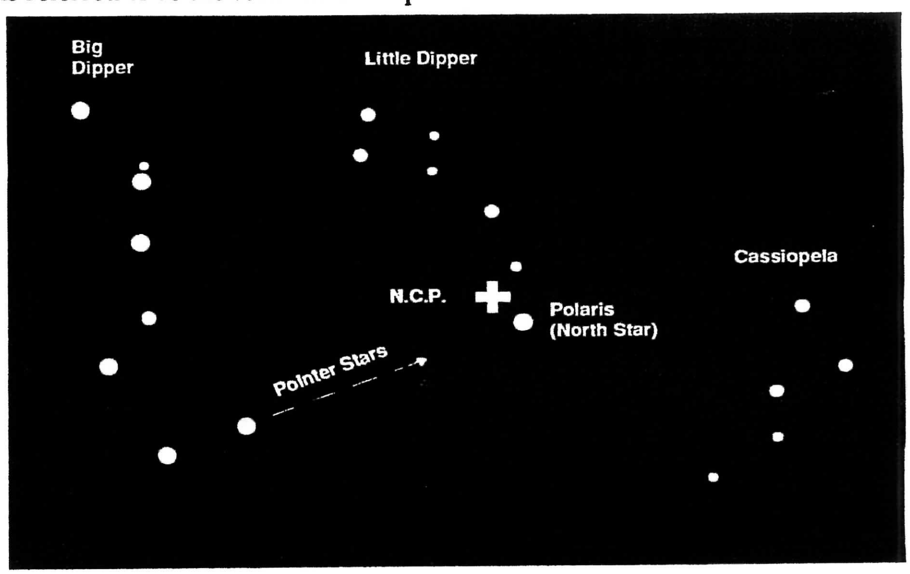



**Figure 4-5**

**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 (north) celestial pole. Cassiopeia, the "W" shaped constellation is on the opposite side of the pole from the Big Dipper. The North Celestial Pole (N.C.P.) is marked by the plus ("+") sign.**

## Latitude Scales

The easiest way to polar align your C5 is with a latitude scale. Unlike other methods that require finding the celestial pole by identifying certain stars near it, this method works off of a known constant to determine how high the polar axis should be pointed. The Celestron C5 wedge can be adjusted from 0 to 90 degrees.

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, imagine 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, let's say that you move one degree south — your latitude is now +89° and the celestial pole is no longer directly overhead. It has moved one degree 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 happens 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 is 34° above the northern horizon. All a latitude scale does then is to point the polar axis of the telescope at the right elevation above the northern (or southern) horizon. To align your telescope:

1. Make sure the polar axis of the mount is pointing due north. The fork arm is parallel to the polar axis and can be used to determine where the polar axis is pointing. Use a landmark that you know faces north.

2. Level the telescope in a north/south direction by adjusting the leveling knobs on the wedge or, if using either of the optional field tripods, by adjusting the tripod legs.

NOTE: **Leveling the tripod is only necessary if using this method of polar alignment. Perfect polar alignment is still possible using other methods described later in this manual without leveling the tripod. If the table is not level, east/west leveling is not possible. Adjust both leveling knobs so the wedge does not rock or teeter.**

3. Adjust the wedge in altitude until the latitude indicator points to your latitude. Moving the mount affects the angle the polar axis is pointing. For specific information on adjusting the equatorial mount, please see the section "Adjusting the Wedge."

This method can be done in daylight, thus eliminating the need to fumble around in the dark. Although this method does **NOT** put you directly 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 (a couple of seconds) and short exposure piggyback astrophotography (a couple of minutes).

## Pointing at Polaris

This method uses Polaris as a guidepost to the celestial pole. Since Polaris is less than a degree from the celestial pole, you can simply point the polar axis of your C5 at Polaris (see figure 4-7). Although this is by no means perfect alignment, it does get you within one degree. Unlike the previous method, this must be done in the dark when Polaris is visible.

1. Set the telescope up so that the polar axis is pointing north.

2. Loosen the DEC clamp and move the telescope so that the tube is parallel to the polar axis (see figure 4-6). 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 fork arm.

3. Adjust the wedge in altitude and/or azimuth until Polaris is in the field of view of the finder.

4. Adjust the wedge in altitude and/or azimuth until Polaris is in the field of view of the telescope.

   **Remember, while Polar aligning, do NOT move the telescope in R.A. or DEC. You do not want to move the telescope itself, but the polar axis. The telescope is used simply to see where the polar axis is pointing.**

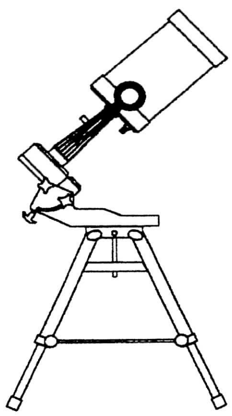


**Figure 4-6**

**The C5 on optional field tripod with the telescope parallel to the polar axis (fork arm).**

Like the previous method, this gets you close to the pole, but not directly on it. The following method helps improve your accuracy for more serious observations and photography.

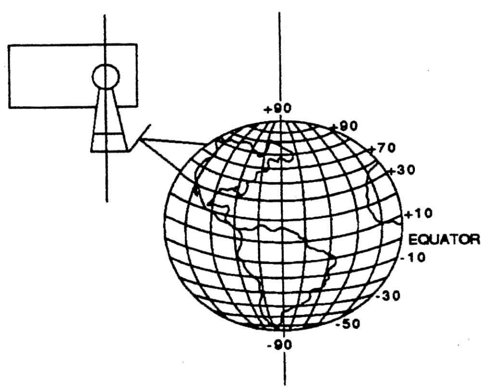



**Figure 4-7**

**One might think that pointing at the pole produces a parallax effect, thus skewing the telescope's axis of rotation with that of the Earth's. Polaris, however, is over 50 light years away, thus making any parallax effect negligible. (One light year is 6.4 trillion miles. To find the distance to Polaris in miles, multiply 6.4 trillion by 50!)**

## Declination Drift

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

To perform the declination drift method you need to choose two bright stars. One should be near the eastern horizon and one due south near the meridian. Both stars should be near the celestial equator (i.e., 0° declination). 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 east/west horizon, any misalignment in the north-south direction is revealed. As for hardware, you will need an illuminated reticle ocular to help you recognize any drift. For very close alignment, a Barlow lens is also recommended since it increases the magnification and reveals any drift faster.

When looking due south, insert the diagonal so the eyepiece points straight up. Insert the cross hair ocular and align the cross hairs so that one is parallel to the declination axis and the other is parallel to the right ascension axis. Move your C5 manually in R.A. and DEC to check parallelism.

First, choose your star near where the celestial equator and the meridian meet. The star should be approximately within 1/2 an hour of the meridian and within five degrees of the celestial equator. Center the star in the field of your telescope and monitor the drift in declination.

- 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 the appropriate adjustments to the polar axis to eliminate any drift. Once you have eliminated all the drift, move to the star near the eastern horizon. The star should be 20 degrees above the horizon and within five degrees of 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.

Again, make the appropriate adjustments to the polar axis to eliminate any drift. Unfortunately, the latter adjustments interact with the prior adjustments ever so slightly. So, repeat the process again to improve the accuracy checking both axes for minimal drift. Once the drift has been eliminated, the telescope is very accurately aligned. You can now do prime focus deep-sky astrophotography for long periods.

NOTE: If the eastern horizon is blocked, you may choose a star near the western horizon, but you must reverse the polar high/low error directions. If using this method in the southern hemisphere, the procedure is the same as described above. However, the direction of drift is reversed.

## Aligning the R.A. Setting Circle

Before you can use the setting circles to find objects in the sky, you need to align the R.A. setting circle. In order to align the setting circle, you need to know the names of a few of the brightest stars in the sky. If you don't, they can be learned by using the Celestron Sky Maps (#93722) or consulting a current astronomy magazine. To align the R.A. setting circle:

1. Locate a bright star near the celestial equator. The farther you are from the celestial pole, the better the reading of the R.A. setting circle. The star you choose 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 list at the back of this manual.)

2. Center the star in the finder.

3. Center the star in the field of view of the telescope.

4. Start the clock drive so that the mount tracks the star.

5. Look up the coordinates of the star. You can consult a star catalog or use the list at the end of this manual.

6. Rotate the setting circle until the proper coordinates line up with the R.A. indicator. The R.A. setting circle should rotate freely.

The R.A. setting circle is now aligned and ready to use. The R.A. setting circle is clutched to the R.A. gear rotation. As long as the drive is operating, the circle does not need to be reset once indexed to the correct coordinate (i.e., once aligned). If the drive is ever turned off, then the R.A. setting circle must be reset once reactivated.

Once you have finished this process you are ready to use the setting circles to locate objects in the night sky. See the section on "Using the Setting Circles," for specific information.

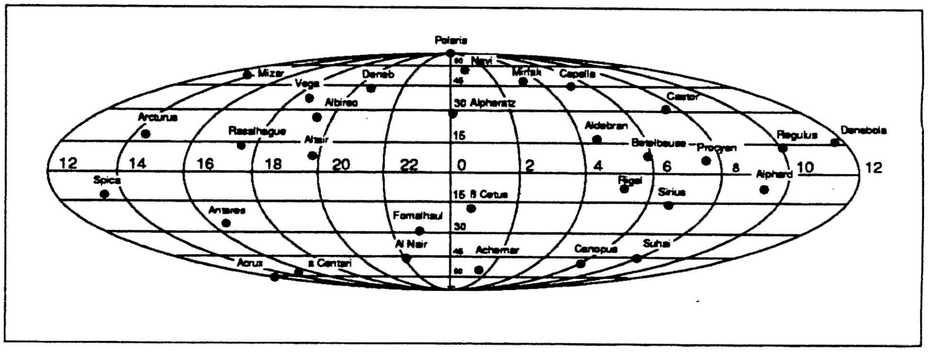



**Figure 4-8**

## Adjusting the DEC Setting Circle

The declination setting circle is calibrated at the Celestron factory. The process of polar alignment then correctly sets it for astronomical use. However, the DEC setting circle may slip and, as a result, need to be recalibrated or aligned. To align the DEC setting circle:

1. Place your C5 base (without wedge) on a flat, level surface. Verify that the surface is flat by using a bubble level.
2. Place the bubble level across the base of the drive unit to determine if the telescope is sitting perfectly flat. If not, shim the base until it is flat.
3. Release the DEC clamp and rotate the telescope tube until it is pointing straight up (see figure 4-9). To ensure that it is pointed straight up, place the bubble level across the front cell of the C5.
4. Lock the declination clamp to hold the telescope in place.
5. Loosen the Phillips head screw in the center of the DEC setting circle.
6. Rotate the declination setting circle until it reads 90°. Since the circle is **NOT** labeled as to plus or minus, it makes no difference which one of the 90° marks you use.
7. Tighten the Phillips head 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.

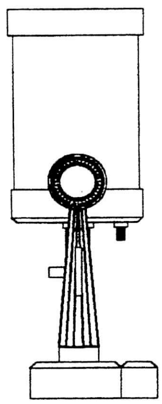


**Figure 4-9**

Once complete, the setting circle should not need to be readjusted unless it comes loose.

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

To track the Sun, Moon, planets, and stars as they move across the sky, the C5 and C5+ come with built-in motor drives. While the basic assembly and operation of the C5 and C5+ are the same, the use of their drives are quite different. The use of the motor drive is the focus of this section with each considered separately.

## Using the C5 Drive

The C5 uses a single motor spur gear drive that is powered by an AC motor. The power cord needed to run the motor is supplied with the C5. To activate the drive:

1. Plug the drive cord into the socket on the bottom of the drive base (see figure 5-1).
2. Plug the other end into a 110 volt AC wall socket (use an extension cord, if necessary).

In order for the clock drive to track accurately — across the sky from east to west — the telescope must be polar aligned. The process of polar alignment, which was discussed earlier in this manual, makes the telescope's axis of rotation parallel to the Earth's, ensuring that the telescope moves in the right direction. Keep in mind that the clock drive moves the telescope only in right ascension at a rate that is half of the hour hand on a clock. Therefore, the telescope makes one complete revolution every twenty-four hours, so the motion is very hard to detect simply by looking at the telescope.

To run your C5 off a car battery, you need the optional DC inverter (#93525).

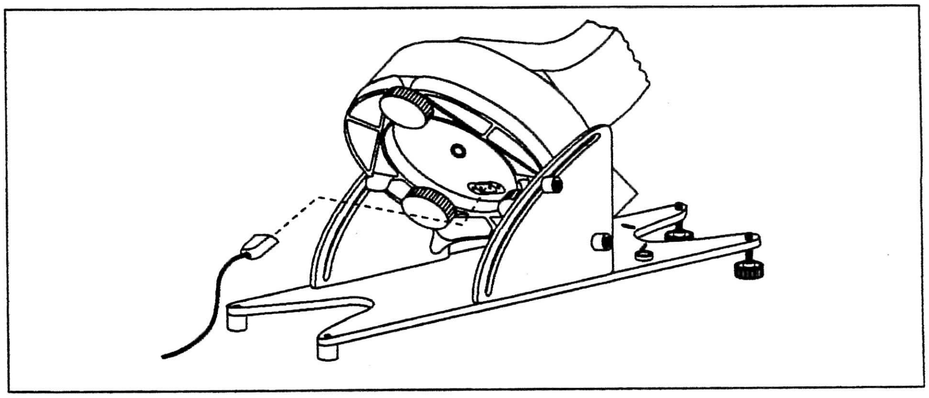


**Figure 5-1**

**Plugging the power cord into the drive base supplies power to the drive motor thus allowing the telescope to track the stars. There is no "ON/OFF" switch.**

## Using the C5+ Drive

Like the C5, the C5+ uses a spur gear motor to drive the telescope across the sky. The C5+, however, is DC powered and operated by an internal 9-volt battery that is included with the telescope. In addition, the C5+ has built-in electronics that work as a drive controller allowing you to do long exposure deep-sky astrophotography.

Following is a brief description of each function.

## Powering Up the Drive

The "ON/OFF" switch supplies power to the drive motor. Once on, the motor tracks at sidereal rate, that is, the rate at which the stars move across the sky. The LED above the "ON/OFF" switch illuminates when the drive is on.

In order for the clock drive to track accurately — across the sky from east to west — the telescope must be polar aligned. The process of polar alignment, which was discussed earlier in this manual, makes the telescope's axis of rotation parallel to the Earth's, ensuring that the telescope moves the right direction. Keep in mind that the clock drive moves the telescope only in right ascension at a rate that is half of the hour hand on a clock. Therefore, the telescope makes one complete revolution every twenty-four hours, so the motion is very hard to detect simply by looking at the telescope.

The drive motor in your C5+ is accurate enough to keep objects in the field for long periods. However, if you watch closely, you will notice that the object drifts slowly back and forth in right ascension. This is known as periodic error which all telescope drives have to some degree. For visual observing, periodic error does not pose a problem. If, however, you are interested in astrophotography, you must use the hand controller to keep your guide star stationary.

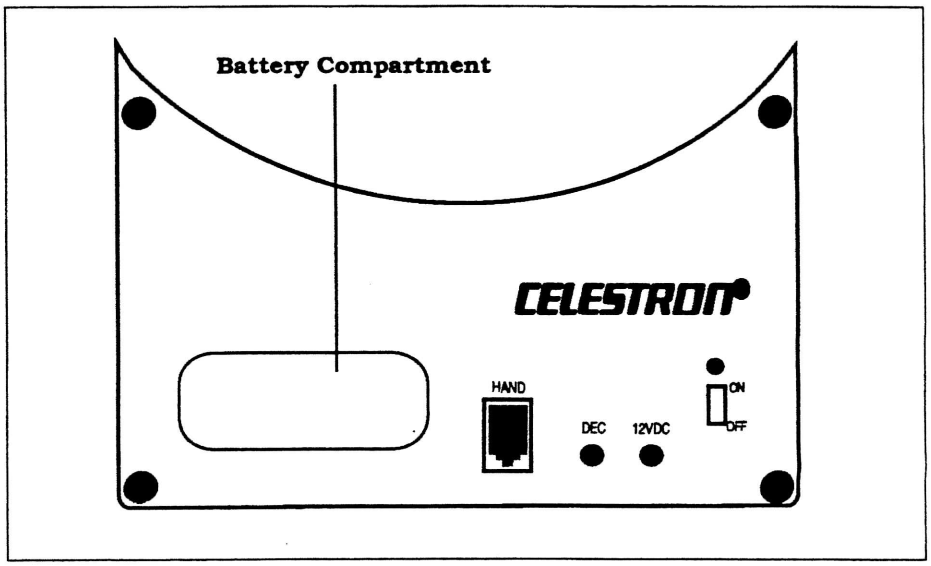



**Figure 5-2**

**The cover plate for the C5+ drive base.**

## Outlets

On the drive base cover there are three outlets, two miniature jacks and one modular telephone jack. Starting from the left, the first is labeled "Hand." This is the outlet that the hand controller plugs into. To plug the hand controller into the drive base:

1. Hold the end of the cable with the modular telephone jack over the outlet in the base.

2. Orient the jack so that the plastic tab is down.

3. Slide the jack into the outlet until it clicks.

The hand controller is now installed and ready to use. Pressing the buttons on the hand controller will speed the motor up or slow it down allowing you to track accurately for long exposure astrophotography. If you are using the optional DEC motor, all corrections to the DEC axis will also be made from the hand controller.

The next outlet is for the optional DEC motor, and appropriately labeled "DEC." Once the DEC motor is attached to the mount, the cable plugs into the cover plate allowing you to make all corrections to the DEC axis from the hand controller.

The last outlet, labeled "12V DC," is for an external power source. Celestron offers two adapters for external power, one for AC (#18768-PEC) and one for DC (#18830-PEC). **When plugging into an external power source, ALWAYS plug the connector into the drive base first, then the power-source outlet. Failure to do so could damage the circuit board.**

## The Hand Controller

On the hand controller there are four buttons used to make guiding corrections in right ascension and declination during astrophotography. The right and left buttons move the telescope in right ascension. The up and down buttons are for declination corrections, but they work only if using the optional DEC motor (#93547). With the hand controller cord facing down, the default settings are as follows:

- "Up" button moves the telescope north
- "Down" button moves the telescope south
- "Right" button moves the telescope west
- "Left" button moves the telescope east

To change the direction of the north/south buttons, press the "Down" button while powering up the drive. Once this is done, the "Down" button will move the telescope north and the "Up" button will move the telescope south. If you are NOT using the optional DEC motor then all corrections to the declination axis must be made manually (i.e., by turning the DEC slow motion knob).

If the drive does not respond when the correction buttons have been pressed, check to make sure that the hand controller cable is plugged into the drive base correctly.

## Northern/Southern Hemisphere Operation

When taking your C5+ to the southern hemisphere, there is a need to reverse the R. A. tracking motor direction. In previous telescopes this was accomplished by installing a reversed motor. Now, the direction the drive motor moves the telescope is within the control of the user. Changing from northern hemisphere to southern hemisphere requires changing the polarity of the drive motor. To do this:

1. Remove the drive base cover. There are four Phillips head screws that hold it in place.

2. Locate the wires that go from the drive motor to the circuit board. The wires are red and black and attach to a two-pin connector.

3. Unplug the connector from the circuit board noting the orientation.

4. Rotate the connector 180°.

5. Plug the connector back into the circuit board.

6. Replace the drive cover.

The direction of the drive motor is now reversed and will work in the opposite hemisphere.

## Changing the Battery

Once the battery has been drained, it must be replaced. To replace the battery:

1. Locate the battery compartment cover. It is on the left side of the drive base cover next to the hand controller outlet.

2. Remove the battery compartment cover.

3. Remove the battery from the terminal.

4. Attach a new, fresh battery to the terminal.

5. Replace the battery compartment cover.

To obtain the longest possible run time, use an alkaline battery. This type of battery will power the drive for up to 50 hours of continuous use. Keep in mind that the DEC motor (if used) consumes more power than the main R.A. drive motor, thus reducing the run time.

## Trouble Shooting

If the battery voltage gets low, either change the battery or plug the drive into an external power source. Optional adapters allow the drive to run off AC power or 12-volt DC power. If the battery is new, a blinking LED may indicate a mechanical problem. Call the Celestron repair department for assistance.

With your C5 set up, you are ready to use it for celestial observing. This section covers visual observing of both solar system and deep-sky objects.

## Observing the Moon

In the night sky, the Moon is a prime target for your first look because it is extremely bright and easy to find. 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 during this phase.

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 most of the 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 the 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 is more noticeable at higher power.

If you are using the clock drive and have polar aligned, the Moon will remain centered. Consult your local newspaper or a current astronomy magazine to find out when the Moon will be visible. Try using filters to increase contrast and bring out more detail on the lunar surface.

## Observing the Planets

Other easy targets in the night sky include the five naked eye 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 ring system and Cassini division are 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.

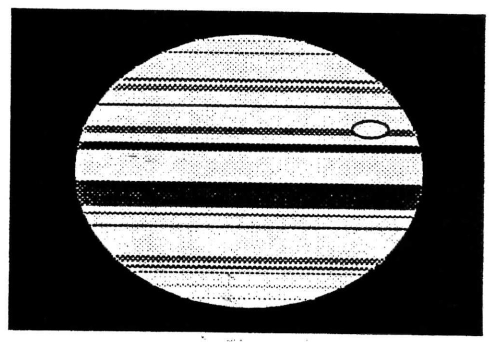


**Figure 6-1**

**This scanned drawing of Jupiter provides a good representation of what you can expect to see with moderate magnification during good seeing conditions. The large, bright cloud belts should be immediately obvious. Smaller, faint belts become visible with practice and experience.**

## Observing the Sun

Although overlooked by many amateur astronomers, solar observation is both rewarding and fun. H[redacted], 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.

**WARNING:**

**Never project an image of the Sun through the telescope. Because of the folded optical design, tremendous heat build-up will result inside the optical tube. This can damage the telescope and/or any accessories attached to the telescope.**

For safe solar viewing, use a Celestron solar filter (#94139). This filter reduces the intensity of the Sun's light, making it safe to view. With this filter you can see sunspots as they move across the solar disk and faculae, which are bright patches seen near the Sun's edge. **Be sure to cover the objective lens of the finder or completely remove the finder when observing the Sun. This will ensure that the finder itself is not damaged and that no one looks through it inadvertently.**

### SOLAR OBSERVING HINTS

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

## Observing Deep-Sky Objects

Deep-sky objects are simply those objects outside the boundaries of our solar system. They include star clusters, planetary nebulae, diffuse nebulae, double stars, and other galaxies outside our own Milky Way. The Celestron Sky Maps (#93722) can help you locate the brightest deep-sky objects.

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 seen in long exposure photographs. 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. Light Pollution Reduction filters help reduce the background sky brightness, thus increasing contrast.

## Using the Setting Circles

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

1. Select 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.
2. Look up the coordinates in an atlas or reference book.
3. Move the telescope in declination until the indicator is pointing at the correct declination coordinate.
4. Move the telescope in R.A. until the indicator points to the correct coordinate (do NOT move the R.A. circle). The telescope will track in R.A. as long as the clock drive is operating and the R.A. clamp is in the locked position.
5. Look through the finder to see if you have located the object.
6. Center the object in the finder.
7. Look in the main optics using a low power eyepiece; the object should be there. The telescope will track in R.A. as long as the clock drive is operating.
8. Repeat the process for each object observed throughout the observing session.

You may not be able to see fainter objects in the finder. When this happens, gradually sweep the telescope around until the object is visible.

The declination setting circle is scaled in degrees while the R.A. setting circle is incremented in minutes with a marker every fifth minute. 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.

At the end of this manual there is a list of deep-sky objects well within reach of your Celestron C5 telescope.

## Star Hopping

You can use your setting circles to find these objects (as described earlier in this manual) or try star-hopping. Star hopping is done by using bright stars to guide you to an object. Here are directions for two popular objects.

The Andromeda Galaxy, M31, is an easy first target. To find M31:

1. Locate the constellation of Pegasus, a large square visible in the fall and winter months.

2. Start at the star in the northeast corner. The star is Alpha (α) Andromedae.

3. Move northeast approximately 7°. There you will find two stars of equal brightness — Delta (δ) and Pi (π) Andromedae — about 3° apart.

4. Continue in the same direction another 8°. There you will find two stars — Beta (β) and Mu (μ) Andromedae — about 3° apart.

5. Move 3° northwest — the same distance between the two star — to the Andromeda galaxy. It is easily visible in the finder.

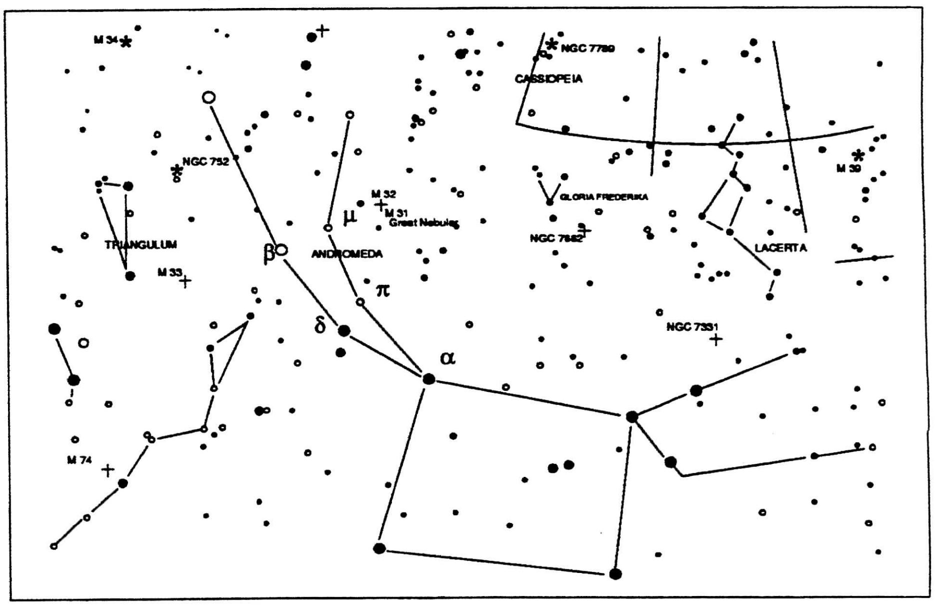



**Figure 6-2**

**Star hopping to the Andromeda Galaxy is a snap to find since all the stars needed to do so are visible to the naked eye. Note that the scale for this star chart is different from the one on the following page which shows the constellation Lyra.**

Star hopping may take some getting used to since you can see more stars through the finder than you can see with the naked eye. And, some objects are not visible in the finder. One such object is M57, the famed Ring Nebula. Here's how to find it:

1. Find the constellation of Lyra, a small parallelogram visible in the summer and fall months. Lyra is easy to pick out because it contains the bright star Vega.

2. Start at the star Vega — Alpha (α) Lyrae — and move a few degrees southeast to find the parallelogram. The four stars that make up this geometric shape are all similar in brightness, making them easy to see.

3. Locate the two southern most stars that make up the parallelogram — Beta (β) and Gamma (γ) Lyrae (see figure 6-3).

4. Point the finder half way between these two stars.

5. Move about 1/2° toward Beta (β) Lyrae, but remaining on a line that connects the two stars.

6. Look through the telescope and the Ring Nebula should be in the telescope. Its angular size is quite small and, therefore, not visible in the finder.

These two examples should give you an idea of how to star hop to deep sky objects. To use this method on other objects, consult any of the star atlases listed at the end of this book.

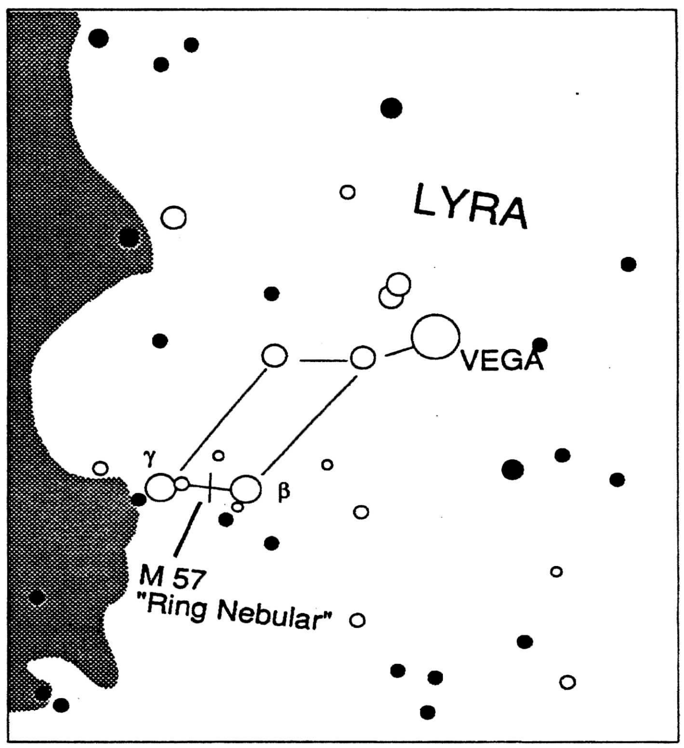



**Figure 6-3**

**Although the Ring Nebula lies between two naked eye stars, it may take a little time to locate since it is not visible in the finder. Note that the scale for this star chart is different from the one on the previous page which shows the several constellations including Pegasus, Triangulum, and Andromeda.**

## Viewing Conditions

Viewing conditions affect what you can see through your C5 telescope during an observing session. Conditions include transparency, sky illumination, and seeing. Understanding viewing conditions and the affect they have on observing will help you get the most out of your C5 telescope.

### Transparency

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

### Sky Illumination

General sky brightening caused by the Moon, aurorae, natural airglow, and light pollution greatly affect transparency. While not a problem for the Moon, planets, and brighter stars, bright skies reduce the contrast of extended nebulae making them difficult, if not impossible, to see. To maximize your observing, limit deep sky viewing to moonless nights far from the light polluted skies found around major urban areas. LPR filters enhance deep sky viewing from light polluted areas by blocking unwanted light while transmitting light from certain deep sky objects. You can, on the other hand, observe planets and stars from light polluted areas or when the Moon is out.

### Seeing

Seeing conditions refer to the stability of the atmosphere and directly effects the clarity of star images and the amount of fine detail seen in extended objects like the planets. The air in our atmosphere acts as a lens which bends and distorts incoming light rays. The amount of bending depends on air density. Varying temperature layers have different densities and therefore bend light differently. Light rays from the same object arrive slightly displaced creating an imperfect or smeared image. These atmospheric disturbances vary from time-to-time and place-to-place. The size of the air parcels compared to your aperture determines the "seeing" quality. Under good seeing conditions, fine detail is visible on the brighter planets like Jupiter and Mars, and stars are pinpoint images. Under poor seeing conditions, images are blurred and stars appear as blobs. Seeing conditions are rated on a five-point scale where one is the worst and five is the best (see figure 6-4). Seeing conditions can be classified in one of three categories which are based on the cause.

Type 1 seeing conditions are characterized by rapid changes in the image seen through the telescope. Extended objects, like the Moon, appear to shimmer while point sources (i.e., stars) appear double. Type 1 seeing is caused by currents within or very close to the telescope tube. These currents could be caused by a telescope that has not reached thermal equilibrium with the outdoor surroundings, heat waves from people standing near the telescope, or heated dew caps. To avoid the problems associated with Type 1 seeing, allow your telescope approximately 20 to 30 minutes to reach thermal equilibrium. Once adjusted to the outdoor temperature, don't touch the telescope tube with your hands. When pointing the telescope, hold the C5 by the star diagonal. If observing with others, make sure no one stands in front of or directly below the telescope tube.

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

Type 3 seeing conditions are characterized by fast ripples, but sharp images. In extended objects fine detail is visible, but the images shift around the field. Stars are crisp points, but they shift small distances rapidly around the field. The cause of type 3 seeing is turbulence in the upper atmosphere which means the observer has less control over it. However, the effects of Type 3 seeing are generally less pronounced than the other two types. You can never really avoid Type 3 seeing. Your best bet is to wait until moments of steadiness. If the seeing is extremely bad, pack up and wait for a better night.

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

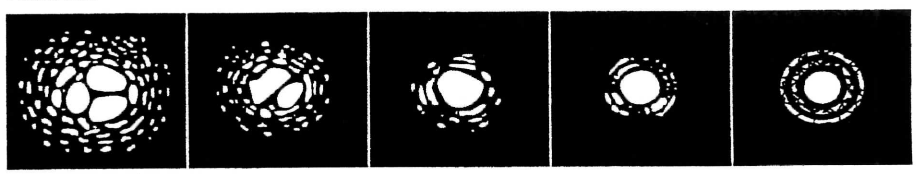


**Figure 6-4**

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

After looking at the night sky for awhile you may want to try photographing it. Several forms of celestial photography are possible with your Celestron C5 telescope. The most common forms of celestial photography, in order of difficulty are: short exposure prime focus, piggyback, eyepiece projection, and long exposure deep sky. Each of these is discussed in moderate detail with enough information to get you started. Topics include the accessories required and some simple techniques. More information is available in some of the publications listed at the end of this manual.

In addition to the specific accessories required for each type of celestial photography, there is the need for a camera — but not just any camera. The camera does not have to have many of the features offered on today's state-of-the-art equipment. For example, you don't need auto focus capability or mirror lock up. Here are the mandatory features a camera needs for celestial photography. First, a 'B' setting which allows for time exposures. This excludes point and shoot cameras and limits the selection to SLR cameras, the most common type of 35mm camera on the market today.

Second, the 'B' or manual setting should not run off the battery. Many new electronic cameras use the battery to keep the shutter open during time exposures. Once the batteries are drained, usually after a few minutes, the shutter closes, whether you have finished with the exposure or not. Look for a camera that has a manual shutter when operating in the time exposure mode. Olympus, Nikon, Minolta, Pentax, Canon and others have made such camera bodies.

The camera should have interchangeable lenses so you can attach it to the telescope and use a variety of lenses for piggyback photography. If you can't find a new camera, you can purchase a used camera body that is not 100-percent functional. The light meter does not have to be operational since you will be determining the exposure length manually.

Use a cable release with a locking function to hold the shutter open while you do other things. Mechanical and air releases are available.

## Short Exposure Prime Focus

Short exposure prime focus photography is the best way to begin recording celestial objects. It is done with the camera attached to the telescope without an eyepiece or camera lens in place. To attach your camera, you need the Celestron T-Adapter (#93633) and a T-Ring for your specific camera (i.e., Minolta, Nikon, Pentax, etc.). The T-Ring replaces the 35mm SLR camera's normal lens. Prime focus photography allows you to capture the entire solar disk (if using the proper filter) as well as the entire lunar disk. To attach your camera to your C5:

1. Remove all visual accessories.
2. Thread the T-Ring onto the T-Adapter.
3. Mount your camera body onto the T-Ring the same as you would any other lens.
4. Thread the T-Adapter onto the back of the Celestron C5 while holding the camera in the desired orientation (either vertical or horizontal).

With your camera attached to the telescope, you are ready for prime focus photography. Start with an easy object like the Moon. Here's how to do it:

1. Load your camera with film that has a moderate-to-fast speed (i.e., ISO rating). Faster films are more desirable when the Moon is a crescent. When the Moon is near full, and at its brightest, slower films are more desirable. Here are some film recommendations:
    - T-Max 100
    - T-Max 400
    - Any 100 to 400 ISO color slide film
    - Fuji Super HG 400
2. Center the Moon in the field of your C5 telescope.
3. Focus the telescope by turning the focus knob until the image is sharp.
4. Set the shutter speed to the appropriate setting (see table 7-1).
5. Trip the shutter using a cable release.
6. Advance the film and repeat the process.

| Lunar Phase | ISO 50 | ISO 100 | ISO 200 | ISO 400 |
|---|---|---|---|---|
| Crescent | 1/2 | 1/4 | 1/8 | 1/15 |
| Quarter | 1/4 | 1/8 | 1/15 | 1/30 |
| Full | 1/60 | 1/125 | 1/250 | 1/500 |

**Table 7-1**

**Above is a listing of recommended exposure times when photographing the Moon at the prime focus of your Celestron C5.**

The exposure times listed here should be used as a starting point. Always make exposures that are longer and shorter than the recommended time. Also, try bracketing your exposures, taking a few photos at each shutter speed. This will ensure that you will get a good photo. If using black and white film, try a yellow filter to reduce the light intensity and to increase contrast.

Keep accurate records of your exposures. This information is useful if you want to repeat your results or if you want to submit some of your photos to various astronomy magazines for possible publication!

This technique is also used for photographing the Sun with the proper Celestron solar filter.

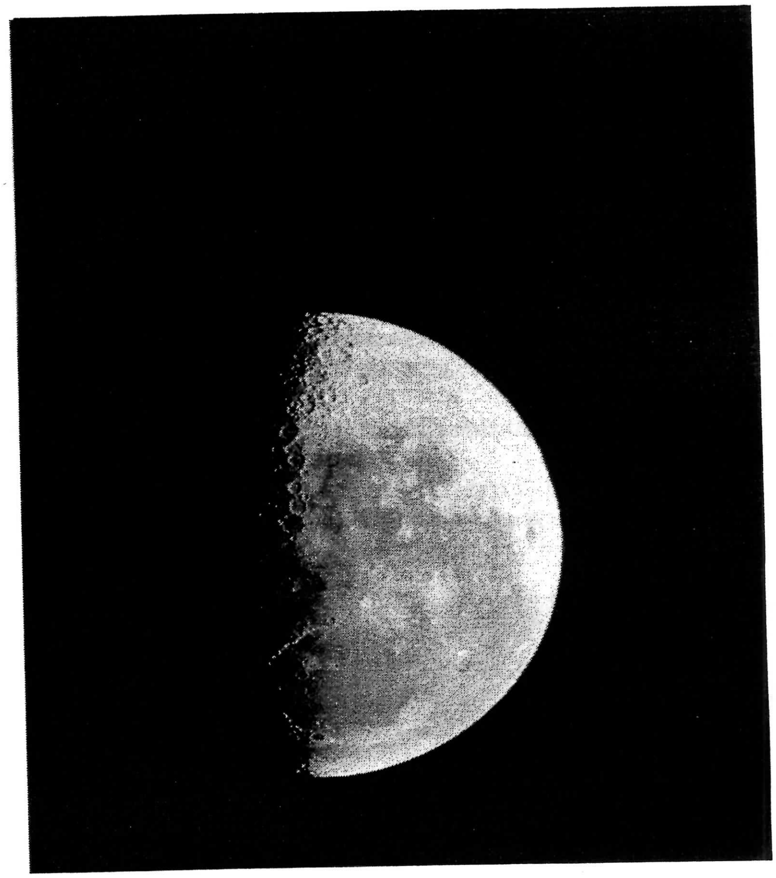


**Figure 7-1**

**The Moon taken at prime focus of a Celestron C5. The exposure was 1/15 of a second on Ektar 25 ISO film.**

## Piggyback

The easiest way to enter the realm of deep-sky, long exposure astrophotography is via the piggyback method. Piggyback photography is done with a camera and its normal lens riding on top of the telescope. 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. To attach the camera to the telescope, use the optional piggyback counterpoise kit (#93603), which allows you to attach your camera body to the platform that runs the length of the telescope tube. The piggyback kit includes all the mounting hardware and counterweights. (See the instruction sheet that accompanies this product for installation instructions.)

As with any form of deep-sky photography, it should be done from a dark sky observing site. Light pollution around major urban areas washes out the faint light of deep-sky objects. You can still practice from less ideal skies.

1. Polar align the telescope (using one of the methods described earlier) and start the clock drive.
2. Load your camera with slide film, ISO 100 or faster, or print film, ISO 400 or faster!
3. Set the f/ratio of your camera lens so that it is a half stop to one full stop down from completely open.
4. Set the shutter speed to the "B" setting and focus the lens to infinity setting.
5. Locate the area of the sky that you want to photograph and move the telescope so that it points in that direction.
6. Find a suitable guide star in the C5 telescope field. This is 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 makes it easy to detect any drift.
7. Release the shutter using a cable release.
8. Monitor your guide star for the duration of the exposure. For the C5+, make all R.A. corrections using the hand controller. DEC corrections are made from the hand controller if using the optional DEC motor. If not, all DEC corrections must be made by carefully turning the DEC slow motion knob by hand as needed. For the C5, make all corrections manually.
9. Close camera's shutter.

As for lenses, use good ones that produce sharp images near the edge of the field. The lenses should have a resolving power of at least 40 lines per millimeter. A good focal length range is 35 to 200mm for lenses designed for 35mm cameras.

The exposure time depends on the film being used. However, five minutes is usually a good starting point. With slower films, like 100 ISO, you can expose as long as 45 minutes. With faster films, like 1600 ISO, you really shouldn't expose more than 5 to 10 minutes. When getting started, use fast films to record as much detail in the shortest possible time. Here are proven recommendations:

- Ektar 1000 (color print)
- Konica 3200 (color print)
- Fujichrome 1600D (color slide)
- 3M 1000 (color slide)
- T-Max 3200 (black and white print)
- T-Max 400 (black and white print)

As you perfect your technique, try specialized films, that is films that are designed or specially treated for celestial photography. Here are some popular choices:

- Ektar 125 (color print)
- Fujichrome 100D (color slide)
- Tech Pan, gas hypered (black and white print)
- T-Max 400 (black and white print)

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

Once you have mastered piggyback photography with wide angle and normal lenses, try longer focal length lenses. The longer the focal length, the more accurate your guiding must be. You can continue to increase the focal length of the lens until you are ready for prime focus photography with your Celestron C5.

**Figure 7-2**

**A two minute exposure of the summer Milky Way shot on Kodak T-Max 3200 ISO film with a 16mm Nikkor lens set at f/4.**

## Eyepiece Projection

This form of celestial photography is designed for objects with small angular sizes, primarily the planets and individual lunar features. Planets, although physically quite large, appear small in angular size because of their great distances. Moderate to high magnification is, therefore, required to make the image large enough to see any detail. Unfortunately, the camera/telescope combination alone does not provide enough magnification to produce a usable image size on film. In order to get the image large enough, you must attach your camera to the telescope with the eyepiece in place. To do so, you need two additional accessories; a tele-extender (#93643), which attaches onto the visual back, and a T-ring for your particular camera make (i.e., Minolta, Nikon, Pentax, etc.).

Because of the high magnifications during eyepiece projection, the field of view is quite small which makes it difficult to find and center objects. To make the job a little easier, align the finder as accurately as possible. This allows you to get the object in the field based on the finder's view alone.

Another problem introduced by the high magnification is vibration. Simply tripping the shutter — even with a cable release — produces enough vibration to smear the image. To get around this, use the camera's self-timer if the exposure time is less than one second — a common occurrence when photographing the Moon. For exposures over one second, use the "hat trick." This technique incorporates a hand-held black card placed over the aperture of the telescope to act as a shutter. The card prevents light from entering the telescope while the shutter is released. Once the shutter has been released and the vibration has diminished (a few seconds), move the black card out of the way to expose the film. After the exposure is complete, place the card over the front of the telescope and close the shutter. Advance the film and you're ready for your next shot. Keep in mind that the card should be held a few inches in front of the telescope, and not touching it. It is easier if you use two people for this process; one to release the camera shutter and one to hold the card. Here's the process for making the exposure.

1. Find and center the desired target in the view finder of your camera.
2. Turn the focus knob until the image is as sharp as possible.
3. Place the black card over the front of the telescope.
4. Release the shutter using a cable release.
5. Wait for the vibration caused by releasing the shutter to diminish. Also, wait for a moment of good seeing.
6. Remove the black card from in front of the telescope for the duration of the exposure (see table 7-2).
7. Replace the black card over the front of the telescope.
8. Close the camera's shutter.

Advance the film and you are ready for your next exposure. Don't forget to take photos of varying duration and keep accurate records of what you have done. Record the date, telescope, exposure duration, eyepiece, f/ratio, film, and some comments on the seeing conditions.

The following table lists exposures for eyepiece projection with a 17mm eyepiece. All exposure times are listed in seconds or fractions of a second.

| Planet | ISO 50 | ISO 100 | ISO 200 | ISO 400 |
|---|---|---|---|---|
| Moon | 2 | 1 | 1/2 | 1/4 |
| Mercury | 8 | 4 | 2 | 1 |
| Venus | 1/8 | 1/15 | 1/30 | 1/60 |
| Mars | 8 | 4 | 2 | 1 |
| Jupiter | 2 | 1 | 1/2 | 1/4 |
| Saturn | 8 | 4 | 2 | 1 |

**Table 7-2**

The exposure times listed here should be used as a starting point. Always make exposures that are longer and shorter than the recommended time. Also, try bracketing your exposures, taking a few photos at each shutter speed. This will ensure that you will get a good photo. It is not uncommon to go through an entire roll of 36 exposures and have only one shot turn out. Also, don't expect to record more detail than you can see visually in the eyepiece at the time you are photographing.

Once you have mastered the technique, experiment with different films, different focal length eyepieces, and even different filters.

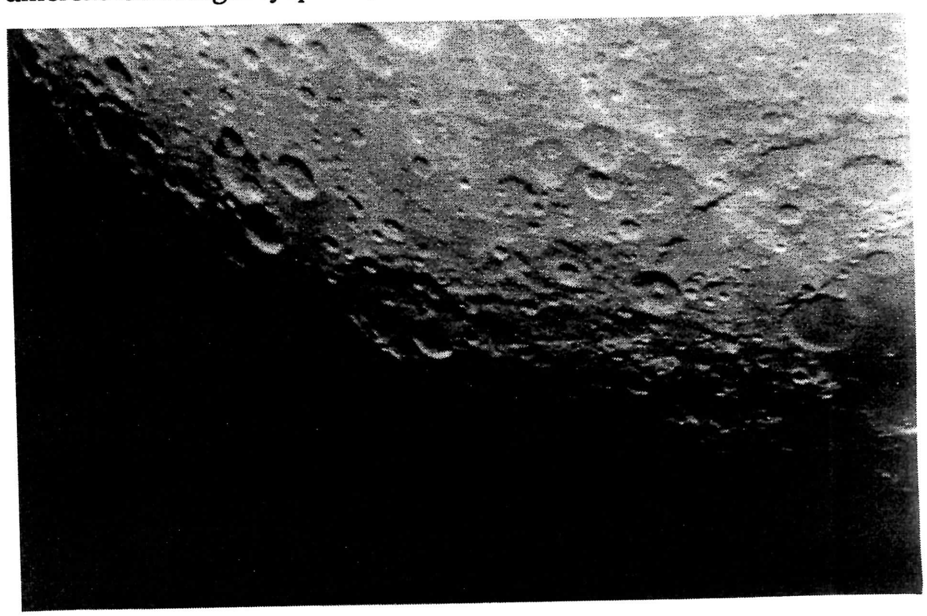


**Figure 7-3**

**The Moon taken with a C5 using eyepiece projection photography. The photo was taken with a 17mm ocular on Ektar 25 ISO film. The exposure was 1 second.**

## Long Exposure Prime Focus

This is the last form of celestial photography to be attempted after others have been mastered. It is intended primarily for deep sky objects, that is objects outside our solar system which includes star clusters, nebulae, and galaxies. While it may seem that high magnification is required for these objects, just the opposite is true. Most of these objects cover large angular areas and fit nicely into the prime focus field of your Celestron C5 telescope. The brightness of these objects, however, requires long exposure times and, as a result, are rather difficult.

There are several techniques for this type of photography, and the one chosen will determine the standard accessories needed. If, for example, you use a separate guidescope, the camera attaches to the telescope with a T-Adapter (#93633) and a T-Ring for your specific camera. However, the best method for long exposure deep sky astrophotography is with an off-axis guider. This devise allows you to photograph and guide through the telescope simultaneously. Celestron offers a very special and advanced off-axis guider, called the Radial Guider (#94176-5). In addition, you will need a T-Ring to attach your camera to the Radial Guider.

Other equipment needs include a guiding eyepiece. Unlike piggyback photography which allows for fairly loose guiding, prime focus requires meticulous guiding for long periods. To accomplish this you need a guiding ocular with an illuminated reticle to monitor your guide star. For this purpose, Celestron offers the Micro Guide Eyepiece (#94171) or the 6mm guiding eyepiece (#93324). Here is a brief summary of the technique.

1. Polar align the telescope using the declination drift method.
2. Remove all visual accessories.
3. Thread the Radial Guider onto your Celestron C5.
4. Thread the T-Ring onto the Radial Guider.
5. Mount your camera body onto the T-Ring the same as you would any other lens.
6. Set the shutter speed to the "B" setting.
7. Focus the telescope on a star using a focusing aid such as the Celestron MFFT-55. (The camera and T-Ring must be removed if using the MFFT-55.)
8. Center your subject in the field of your camera.
9. Find a suitable guide star in the telescope field. This can be the most time consuming process.
10. Open the shutter using a cable release.
11. Monitor your guide star for the duration of the exposure using the buttons on the hand controller to make the needed corrections.
12. Close the camera's shutter.

When getting started, use fast films to record as much detail in the shortest possible time. Here are proven recommendations:

- Ektar 1000 (color print)
- Konica 3200 (color print)
- Fujichrome 1600D (color slide)
- 3M 1000 (color slide)
- T-Max 3200 (black and white print)
- T-Max 400 (black and white print)

As you perfect your technique, try specialized films, that is films that are designed or specially treated for celestial photography. Here are some popular choices:

- Ektar 125 (color print)
- Fujichrome 100D (color slide)
- Tech Pan, gas hypered (black and white print)
- T-Max 400 (black and white print)

There is no exposure determination table to help you get started. The best way to determine exposure length is look at previously published photos to see what film/exposure combinations were used. Or take unguided sample photos of various parts of the sky while the drive is running. Always take exposures of various lengths to determine the best exposure time.

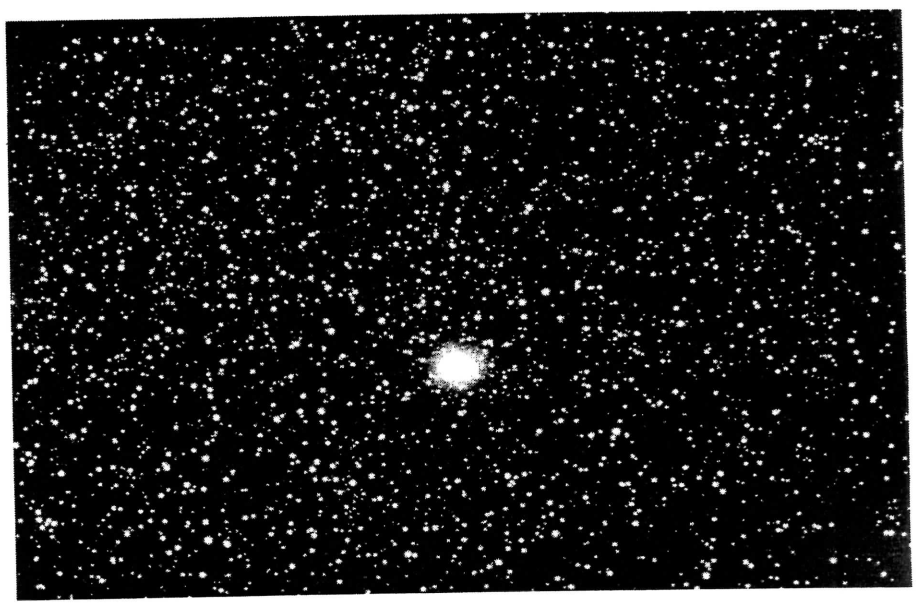


**Figure 7-4**

**A globular cluster shot at the prime focus of the Celestron C5. The original exposure was approximately 45 minutes on Ektachrome 400 slide film.**

While the C5 telescopes and spotting scope require little maintenance, there are a few things to remember that will ensure your telescope performs at its best.

## Care and Cleaning of the Optics

Occasionally, dust and/or moisture may build up on the corrector plate of your C5. 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 brush (made of camel's hair) or a can of pressurized air. Spray at an angle to the lens for approximately two to four seconds. Then, use an optical cleaning solution and white tissue paper to remove any remaining debris. Apply the solution to the tissue and then apply the tissue paper to the lens. Low pressure strokes should go from the center of the corrector to the outer portion. **Do NOT rub in circles!**

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

Occasionally, you may experience dew build-up on the corrector plate of your C5 during an observing session. If you want to continue observing, the dew must be removed, either with a hair dryer or by pointing the telescope at the ground until the dew has evaporated. The optional Dew Cap/Lens Shade (#94011) helps reduce the amount of dew build-up on the corrector plate.

If moisture condenses on the inside of the corrector, place the telescope in a dust-free environment and point it down. Remove the accessories from the rear cell of the telescope or spotting scope to allow the moisture to evaporate from the optical tube.

To minimize the need to clean your C5, 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 C5 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 C5 is directly related to its collimation, that is the alignment of its optical system. Your C5 was collimated at the factory after it was completely assembled. However, if the telescope or spotting scope is dropped or jarred severely during transport, it may have to be collimated. The only optical element that can be adjusted is the tilt of the secondary mirror.

To check the collimation of your C5 you will need a light source. A bright star near the zenith is ideal since there is a minimal amount of atmospheric distortion. Turn your telescope drive on so that you don't have to manually track the star. Or, if you are not using the clock drive, use Polaris. Its position relative to the celestial pole means that it moves very little thus eliminating the need to track it.

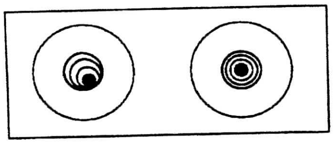


**Figure 8-1**

**Left: With an out-of-focus star image at the center of the field, the secondary mirror shadow is off center indicating the telescope is out of collimation Right: The out-of-focus star image showing good collimation.**

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.

To verify collimation, view a star near the zenith. Use a medium to high power ocular — 12mm to 6mm focal length. It is important to center a star in the center of the field to judge collimation. Slowly cross in and out of focus and judge the symmetry of the star. If you see a systematic skewing of the star to one side, then recollimation is needed.

To accomplish this, you need to tighten the secondary collimation screw(s) that move the star across the field toward the direction of the skewed light (see figure 8-1). Make only small corrections, approximately 1/6 to 1/8 of the field. Recenter the star by moving the telescope before making further adjustments.

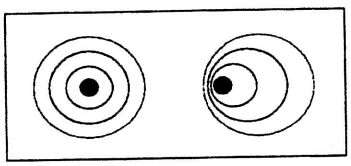


**Figure 8-2**

**In focus images show the C5 in collimation (left) and out of collimation (right).**

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 (see figure 8-2), not the shadow of the secondary housing. This (stellar) image appears 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.

Perfect collimation yields a star or planetary image very symmetrical just inside and outside of focus. Also, perfect collimation delivers the optimal optical performance specifications that your telescope is built to achieve.

If seeing (i.e., air steadiness) is turbulent, collimation is difficult to judge. Wait until a better night if it is turbulent or aim to a steadier part of the sky. A steadier part of the sky is judged by steady versus twinkling stars.

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. IF TIGHTENING ONE SCREW IN THE DIRECTION YOU NEED TO GO IS DIFFICULT, SIMPLY LOOSEN THE OTHER TWO SCREWS BY EQUAL AMOUNTS TO BRING ABOUT THE SAME CHANGE. DO NOT BE INTIMIDATED BY TOUCHING UP COLLIMATION AS NEEDED TO ACHIEVE OPTIMAL HIGH-RESOLUTION VIEWS. IT IS WORTH THE TROUBLE!!!!

The following is a partial list of optional accessories available for your Celestron C5. You will find that additional accessories enhance your viewing pleasure and expand the usefulness of your telescope or spotting scope. Certain accessories are confined to use with a particular C5 model. The first section lists the accessories that are common to all models. After that, all accessories are grouped by the model with which they can be used. For ease of reference, all the accessories are listed in alphabetical order.

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

**Barlow Lens** - A Barlow lens is a negative lens that increases the focal length of a telescope. Used with any eyepiece, it doubles the magnification of that eyepiece. Celestron offers two Barlow lens in the 1-1/4" size for the C4.5 The 2x Ultima Barlow (#93506) is a compact design that is multicoated for maximum light transmission and parfocal when used with the Ultima eyepieces. It works very well with all Celestron eyepieces. The latest Barlow to be added to Celestron's product line (#93510) is a low profile achromatic design that is fully multicoated. It weighs just 4 oz. and it under 3" in length.

**Dew Cap/Lens Shade (#94011)** - 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 can build up on the corrector plate at night. The dew cap also acts as a lens shade by preventing stray light from falling on the corrector plate and into the tube possibly reducing contrast. The C5 dew cap/lens shade uses a bayonet mounting system for a snug fit.

**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). It is useful for daytime, terrestrial viewing. This accessory comes standard with the C5 spotting scope.

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

- **Plössl** - Plössl eyepieces have a 4-element lens designed for low-to-high power observing. The Plössls offer razor sharp views across the entire field, even at the edges! In the 1-1/4" barrel diameter, they are available in the following focal lengths: 7.5mm, 10mm, 17mm, 26mm, and 40mm.
- **Ultima** - Ultima is not really a design, but a trade name for our 5-element, wide field eyepieces. In the 1-1/4" barrel diameter, they are available in the following focal lengths: 5mm, 7.5mm, 12.5mm, 18mm, 24mm, 30mm, 35mm, and 42mm. These eyepieces are all parfocal. The 35mm Ultima gives the widest possible field of view with a 1-1/4" diagonal and is ideal for the C5 with or without the Reducer/Corrector.

- **Lanthanum Eyepieces (LV Series)** - Lanthanum is a unique rare earth glass used in one of the field lenses of this new eyepiece. The Lanthanum glass reduces aberrations to a minimum. All are fully multicoated and have an astounding 20mm of eye relief — perfect for eyeglass wearers! In the 1-1/4" barrel diameter, they are available in the following focal lengths: 2.5mm, 4mm, 5mm, 6mm, 9mm, 10mm, 15mm, 20mm, and 25mm.

In addition to the previously mentioned, there is also a deluxe compact zoom ocular (#93306) that has a variable focal length of 6.5 to 18mm. This provides 71 to 195 power on the C5.

**Eyepiece Filters** - To enhance your visual observations of solar system 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, #38A blue, #47 violet, #56 light green, #58 green, #80A light blue, #82A pale blue, #96 neutral density - 50%T, #96 neutral density - 25%T, #96 neutral density - 13%T, and polarizing. The filters are sold separately so you can buy them individually as you need them!

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

**LED Flashlight (#93592)** - The LED flashlight uses a red light emitting diode (LED) to allow reading star maps and locating telescope accessories and functions without ruining your night vision. The LED flashlight is small, only 6 inches long, and weighs in at a mere 3 ounces.

**Light Pollution Reduction (LPR) Filters** - These filters are designed to enhance your views of deep sky astronomical objects when viewed from urban areas. LPR Filters selectively reduce the transmission of certain wavelengths of light, specifically those produced by artificial lights. This includes mercury and high and low pressure sodium vapor lights. In addition, they also block unwanted natural light (sky glow) caused by neutral oxygen emission in our atmosphere. Celestron offers a model for 1-1/4" eyepieces (#94126A), a model that attaches to the rear cell ahead of the star diagonal and visual back (#94127A), and one attaches to the back of the radial guider (#94129). This last model allows you to guide on an unfiltered star while the light from your subject passes through the filter to a camera.

**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.

**Reducer/Corrector (#94175)** - This lens reduces the focal length of the telescope by 37%, making your C5 a 787.5mm f/6.3 instrument. In addition, this unique lens also corrects inherent aberrations to produce crisp images all the way across the field when used visually. When used photographically, there is some vignetting that produces a 26mm image on the processed film. It also increases the field of view significantly and is ideal for wide-field, deep-space viewing. It is also perfect for beginning prime focus, long-exposure astrophotography when used with the radial guider. It makes guiding easier and exposures much shorter.

**Series 6 Drop-In Filters (#93617) -** Primarily designed for terrestrial photography, the drop-in filters fit into the rear cell of the Celestron C5. 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 filter is used on the Celestron C5 telescope as a dust seal. The filter threads onto the rear cell of your telescope. All other accessories, both visual and photographic (with the exception of Barlow lenses), thread onto the skylight filter. The light loss caused by this filter is minimal.

**Solar Filter (#94139) -** Celestron Solar Skreen® solar filter permits direct observation of the Sun in complete safety. This filter, which transmits .001% of visible light, allows you to see sunspots as they move across the solar disk. In addition to reducing the intensity of the Sun's visible light, it also blocks 99.999% of invisible infrared light. The Celestron Solar Skreen® solar filter is made of precision engineered Mylar polyester film. A layer of aluminum is vacuum-deposited on one surface of each of the dual sheets of Mylar used to make each filter. The aluminum coating produces a cool, comfortable pale blue image of the Sun. (A #21 orange eyepiece filter works well in conjunction with this filter to produce a more natural colored Sun with greater contrast.) This filter can be used for both visual observation and photography of the Sun.

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. ALWAYS COVER YOUR FINDER OBJECTIVE WITH AN OPAQUE COVER.**

**Stereo Binocular Viewer (#94122) -** The stereo viewer is the ultimate accessory for visual observation. This device allows you to adapt two eyepieces (of equal focal length) to the telescope for simultaneous viewing (i.e., like binoculars). The result: a three-D effect when observing many celestial objects. It is great for the Sun and Moon. This is a must for avid planetary observers! **This accessory will <u>NOT</u> work with the Reducer/Corrector Lens.**

**T-Adapter (#93633) -** A T-Adapter (with additional T-Ring) allows you to attach your SLR camera to the rear cell of your Celestron C5. This turns your C5 into a 1250mm telephoto lens perfect for terrestrial photography and short exposure lunar and filtered solar photography.

**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 SLR camera body to the T-Adapter, radial guider, or tele-extender. This accessory is mandatory if you want to do astrophotography through the telescope. Each camera make (i.e., Minolta, Nikon, Pentax, etc.) has its own unique mount and therefore, its own T-Ring. Celestron has 10 different models for 35mm cameras.

**Tele-Extender, Deluxe (#93643)** - 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 which allows you to capture very high power views of the Sun, Moon, and planets on film. The tele-extender fits over the eyepiece onto the visual back. This tele-extender works with eyepieces that have large housings, like the Celestron Ultima series.

## The following accessories are for the C5 and C5+ telescopes:

**Adjustable Tripod** - A stable tripod is a must for serious astronomical observing and photography. Celestron offers two field tripods for this purpose. Model #93501-R is the same tripod designed for the C8 and Ultima 11 telescopes. It has rubber covered legs, weighs approximately 26 pounds, and offers maximum rigidity. The second is a lightweight field tripod designed specifically with the C5 in mind (#93591). It weighs less than 10 pounds and folds down to a compact 6"x36". It has a center brace and is perfectly sized for the C5.

**Advanced Astro Master (#93900)** - Imagine observing hundreds of deep-sky objects in one night. With the Advanced Astro Master you don't have to. This unique accessory contains a data base of more than 10,000 objects! Included are the Messier catalog, NGC catalog, IC catalog, portions of the ESO catalog, portions of the UGC catalog, special non-stellar catalog which contains objects not found in any of the other catalogs, a star catalog containing 241 interesting double and multiple stars, an user definable catalog that allows you to enter 25 of your favorite objects. And, scrolling information cross references *Sky Atlas 2000.0* or *Uranometria* . Unlike other digital setting circles, which require the use of a clock drive, the Advanced Astro Master can be used with or without a clock drive. All you have to do is align on one of the 30 stars in the Advanced Astro Master's data base and you are ready to observe. Once aligned, the system keeps track of where it is pointed. The hardware mounting kit for the C5 is #93914.

**Carrying Case (#302077)** - A compact and portable case (9-1/2"x15"x20") designed for the C5 and C5+. It is made of ABS plastic for rough handling. It features custom fitted foam to secure the C5 and C5+ on the mount with eyepiece cut outs. It fits into small car trunks or in most airline overhead compartments.

**Illuminated Reticle Ocular - 6mm - 1-1/4" (#93324)** - When it comes to guiding eyepieces, you can't get more magnification in a single ocular. With 6mm of focal length, this ocular produces 208 power with your C5! The reticle has adjustable illumination making it easy to see the cross hairs. The X and Y axis of the cross hairs are adjustable making it easy to center a guide star. The LED is battery operated so there are no cords or wires to get in the way.

**Micro Guide Eyepiece (#94171)** - This multipurpose illuminated 12.5mm reticle can be used for guiding deep-sky astrophotos, measuring position angles, angular separations, and more. The laser etched reticle provides razor sharp lines and the variable brightness illuminator is completely cordless. The micro guide eyepiece produces 100 power when used with the C5 at f/10.

**Multi Function Focal Tester-55** - The Celestron MFFT-55, short for Multi Function Focal Tester-55, is a unique focusing aid developed and successfully used in Europe for years. This tool allows astrophotographers to accurately evaluate their telescope's focal plane in three main areas of interest; focus, collimation (squareness), and curvature of field. With the MFFT-55 it is now possible to focus on and off the optical axis at 3, 16, 22, and 30mm diameters in four quadrants in a single setup. When used as a null focus tool for long exposure astrophotography, focus results are excellent and repeatable.

**Piggyback Counterpoise (#93603)** - The Piggyback Counterpoise 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 in tandem while you guide or photograph through the telescope. Piggyback photography is the only way to capture wide swaths of sky, constellations, and large nebulae easily. The piggyback platform comes standard with the C5 and C5+ telescopes and is attached to the telescope tube. The Piggyback Counterpoise consists of the hardware needed to use the piggyback platform. The set consists of fasteners that attaches the camera to the piggyback platform and the counterweight bar and adjustable weight set that attaches to the fork arm needed to balance the telescope in R.A.

**Radial Guider (#94176-5)** - The Celestron® Radial Guider is specifically designed for use in prime focus, deep sky astrophotography and takes the place of the T-Adapter. This device allows you to photograph and guide simultaneously through the optical tube assembly of your telescope. This type of guiding produces the best results since what you see through the guiding eyepiece is exactly reproduced on the processed film. The Radial Guider is a "T"-shaped assembly that attaches to the rear cell of the telescope. As light from the telescope enters the guider, most passes straight through to the camera. A small portion, however, is diverted by a prism at an adjustable angle up to the guiding eyepiece. This guider has two features not found on other off-axis guiders; first, the prism and eyepiece housing rotate independently of the camera orientation making the acquisition of a guide star quite easy. Second, the prism angle is tunable allowing you to look at guide stars on-axis. This accessory works especially well with the Reducer/Corrector. NOTE: The 5" radial guider is unique to the C5.

**Vibration Suppression Pads (#93503)** - These pads rest between the ground and tripod feet of your telescope. They reduce the amplitude and vibration time of your telescope when shaken by the wind or an accidental bump. This accessory is a must for long exposure prime focus photography.

## The following accessories are for the C5+:

**AC Adapter - 110V - 60Hz (#18768-PEC)** - The AC Adapter allows you to run your C5+ off AC current rather than the standard DC battery.

**Batteries & Battery Recharger** - Celestron currently offers two batteries to power your C5+ telescope. One rated at 7AH (#93696) the second rated at 12AH (#93697). The sealed lead-acid design provides years of usage and are virtually maintenance free, except for proper recharging. The battery charger (#93698) works with either of these two batteries.

**Car Battery Adapter (#18830-PEC)** - To save the internal battery, Celestron offers the Car Battery Adapter that allows you to run the C5+ drive off an external power source. The adapter attaches to the cigarette lighter of your car, truck, van, or motorcycle.

**Declination Motor (#93547)** - The electric DEC Motor allows you to make fine tracking corrections to the DEC axis of your telescope without touching the instrument. All corrections are made remotely from a hand control box which eliminates the possibility of bumping or shaking the telescope while attempting by hand. The motor is fully clutched to allow for manual setting adjustments. It is a very compact design.

## The following accessories are for the C5 only:

**DC Inverter (#93525)** - The DC Inverter allows you to run your C5 off a DC power source. Power cables allow for attachment directly to the battery terminals or the cigarette lighter.

## The following accessories are for the C5 Spotting Scope only:

**Deluxe Photo Tripod Slow Motion Control (#93804-A)** - If you have ever tried pointing a spotting scope while mounted on a photographic tripod, you know how tough it can be to center your subject. The Deluxe Photo Tripod Slow Motion Control solves that problem. Fitting between the C5 and the photographic tripod, this accessory allows you to make fine pointing adjustments, both vertically and horizontally.

**Photographic Tripod (#93596)** - Even at low power, your C5 Spotting Scope produces too much power to hand hold. For the best results, use a stable platform like the Celestron Photographic Tripod. This tripod has an oil fluid pan head for smooth panning. The quick release head allows you to attach and remove the C5 quick and easily. It is extremely lightweight and rigid.

**Shoulder Mount (#94147)** - The Celestron Shoulder Mount is a stable yet movable platform for either visual or photographic use. Fashioned after the stock of a rifle, this device allows you to hold your camera and lens still for high power photography which is extremely useful for sports and wildlife photography.

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

## THE MESSIER CATALOG

The Messier Catalog, compiled by Charles Messier, was the first extensive listing of star clusters and nebulae. Messier's primary observational purpose was to discover comets. He compiled this list so that others searching for comets would not be confused by these objects. His list still remains popular today because all of these objects are easily visible in amateur telescopes.

| M# | NGC# | Const. | R.A. H M S | DEC ° ' | Mag | Type | Proper Name |
|---|---|---|---|---|---|---|---|
| M1 | NGC 1952 | Tau | 5 34.5 | 22 01 | 8.4 | P. Neb. | Crab Nebula |
| M2 | NGC 7089 | Aqr | 21 33.5 | -00 49 | 6.5 | Gl. Cl. | |
| M3 | NGC 5272 | CVn | 13 42.2 | 28 23 | 6.4 | Gl. Cl. | |
| M4 | NGC 6121 | Sco | 16 23.6 | -26 32 | 5.9 | Gl. Cl. | |
| M5 | NGC 5904 | Ser | 15 18.5 | 2 05 | 5.8 | Gl. Cl. | |
| M6 | NGC 6405 | Sco | 17 40.0 | -32 13 | 4.2 | Op. Cl. | Butterfly Cluster |
| M7 | NGC 6475 | Sco | 17 54.0 | -34 49 | 3.3 | Op. Cl. | |
| M8 | NGC 6523 | Sgr | 18 03.7 | -24 23 | 5.8 | D. Neb. | Lagoon Nebula |
| M9 | NGC 6333 | Oph | 17 19.2 | -18 31 | 7.9 | Gl. Cl. | |
| M10 | NGC 6254 | Oph | 16 57.2 | -4 06 | 6.6 | Gl. Cl. | |
| M11 | NGC 6705 | Sct | 18 51.1 | -6 16 | 5.8 | Op. Cl. | Wild Duck Cluster |
| M12 | NGC 6218 | Oph | 16 47.2 | -1 57 | 6.6 | Gl. Cl. | |
| M13 | NGC 6205 | Her | 16 41.7 | 36 28 | 5.9 | Gl. Cl. | Hercules Cluster |
| M14 | NGC 6402 | Oph | 17 37.6 | -3 15 | 7.6 | Gl. Cl. | |
| M15 | NGC 7078 | Peg | 21 30.0 | 12 10 | 6.4 | Gl. Cl. | |
| M16 | NGC 6611 | Ser | 18 18.9 | -13 47 | 6.0 | D. Neb. | Eagle Nebula |
| M17 | NGC 6618 | Sgr | 18 20.8 | -16 11 | 7.0 | D. Neb. | Omega Nebula |
| M18 | NGC 6613 | Sgr | 18 19.9 | -17 08 | 6.9 | Op. Cl. | |
| M19 | NGC 6273 | Oph | 17 02.6 | -26 16 | 7.2 | Gl. Cl. | |
| M20 | NGC 6514 | Sgr | 18 02.4 | -23 02 | 8.5 | D. Neb. | Trifid Nebula |
| M21 | NGC 6531 | Sgr | 18 04.7 | -22 30 | 5.9 | Op. Cl. | |
| M22 | NGC 6656 | Sgr | 18 36.4 | -23 54 | 5.1 | Gl. Cl. | |
| M23 | NGC 6494 | Sgr | 17 56.9 | -19 01 | 5.5 | Op. Cl. | |
| M24 | NGC 6603 | Sgr | 18 16.4 | -18 29 | 4.5 | Op. Cl. | |
| M25 | IC 4725 | Sgr | 18 31.7 | -19 15 | 4.6 | Op. Cl. | |
| M26 | NGC 6694 | Sct | 18 45.2 | -9 24 | 8.0 | Op. Cl. | |
| M27 | NGC 6853 | Vul | 19 59.6 | 22 43 | 8.1 | P. Neb. | Dumbbell Nebula |
| M28 | NGC 6626 | Sgr | 18 24.6 | -24 52 | 6.9 | Gl. Cl. | |
| M29 | NGC 6913 | Cyg | 20 23.0 | 38 32 | 6.6 | Op. Cl. | |
| M30 | NGC 7099 | Cap | 21 40.4 | -23 11 | 7.5 | Gl. Cl. | |
| M31 | NGC 224 | And | 0 42.7 | 41 16 | 3.4 | Sp. Gx. | Andromeda Galaxy |
| M32 | NGC 221 | And | 0 42.7 | 40 52 | 8.2 | El. Gx. | |
| M33 | NGC 598 | Tri | 1 33.8 | 30 39 | 5.7 | Sp. Gx. | Pinwheel Galaxy |
| M34 | NGC 1039 | Per | 2 42.0 | 42 47 | 5.2 | Op. Cl. | |
| M35 | NGC 2168 | Gem | 6 08.8 | 24 20 | 5.1 | Op. Cl. | |

| M# | NGC# | Const. | R.A. H M S | DEC ° ′ | Mag | Type | Proper Name |
|---|---|---|---|---|---|---|---|
| M36 | NGC 1960 | Aur | 5 36.3 | 34 08 | 6.0 | Op. Cl. | |
| M37 | NGC 2099 | Aur | 5 52.0 | 32 33 | 5.6 | Op. Cl. | |
| M38 | NGC 1912 | Aur | 5 28.7 | 35 50 | 6.4 | Op. Cl. | |
| M39 | NGC 7092 | Cyg | 21 32.3 | 48 26 | 4.6 | Op. Cl. | |
| M40 | | UMa | 12 22.2 | 58 05 | 8.0 | dbl | |
| M41 | NGC 2287 | CMa | 6 47.0 | -20 44 | 4.5 | Op. Cl. | |
| M42 | NGC 1976 | Ori | 5 35.3 | -5 27 | 4.0 | D. Neb. | Great Orion Nebula |
| M43 | NGC 1982 | Ori | 5 35.5 | -5 16 | 9.0 | D. Neb. | |
| M44 | NGC 2632 | Cnc | 8 40.0 | 19 59 | 3.1 | Op. Cl. | Beehive Cluster |
| M45 | | Tau | 3 47.5 | 24 07 | 1.2 | Op. Cl. | Pleiades |
| M46 | NGC 2437 | Pup | 7 41.8 | -14 49 | 6.1 | Op. Cl. | |
| M47 | NGC 2422 | Pup | 7 36.6 | -14 30 | 4.4 | Op. Cl. | |
| M48 | NGC 2548 | Hya | 8 13.8 | -5 48 | 5.8 | Op. Cl. | |
| M49 | NGC 4472 | Vir | 12 29.8 | 8 00 | 8.4 | El. Gx. | |
| M50 | NGC 2323 | Mon | 7 03.0 | -8 20 | 5.9 | Op. Cl. | |
| M51 | NGC 5194-5 | CVn | 13 29.9 | 47 12 | 8.1 | Sp. Gx. | Whirlpool Galaxy |
| M52 | NGC 7654 | Cas | 23 24.2 | 61 35 | 6.9 | Op. Gx. | |
| M53 | NGC 5024 | Com | 13 12.9 | 18 10 | 7.7 | Gl. Cl. | |
| M54 | NGC 6715 | Sgr | 18 55.1 | -30 29 | 7.7 | Gl. Cl. | |
| M55 | NGC 6809 | Sgr | 19 40 .0 | -30 58 | 7.0 | Gl. Cl. | |
| M56 | NGC 6779 | Lyr | 19 16.6 | 30 11 | 8.2 | Gl. Cl. | |
| M57 | NGC 6720 | Lyr | 18 53.6 | 33 02 | 9.0 | P. Neb. | Ring Nebula |
| M58 | NGC 4579 | Vir | 12 37.7 | 11 49 | 9.8 | Sp. Gx. | |
| M59 | NGC 4621 | Vir | 12 42.0 | 11 39 | 9.8 | El. Gx. | |
| M60 | NGC 4649 | Vir | 12 43.7 | 11 33 | 8.8 | El. Gx. | |
| M61 | NGC 4303 | Vir | 12 21.9 | 4 28 | 9.7 | Sp. Gx. | |
| M62 | NGC 6266 | Oph | 17 01.2 | -30 07 | 6.6 | Gl. Cl. | |
| M63 | NGC 5055 | CVn | 13 15.8 | 42 02 | 8.6 | Sp. Gx. | Sunflower Galaxy |
| M64 | NGC 4826 | Com | 12 56.7 | 21 41 | 8.5 | Sp. Gx. | Black Eye Galaxy |
| M65 | NGC 3623 | Leo | 11 18.9 | 13 05 | 9.3 | Sp. Gx. | Leo's Triplet |
| M66 | NGC 3627 | Leo | 11 20.3 | 12 59 | 9.0 | Sp. Gx. | Leo's Triplet |
| M67 | NGC 2682 | Cnc | 8 50.3 | 11 49 | 6.9 | Op. Cl. | |
| M68 | NGC 4590 | Hya | 12 39.5 | -26 45 | 8.2 | Gl. Cl. | |
| M69 | NGC 6637 | Sgr | 18 31.4 | -32 21 | 7.7 | Gl. Cl. | |
| M70 | NGC 6681 | Sgr | 18 43.2 | -32 18 | 8.1 | Gl. Cl. | |
| M71 | NGC 6838 | Sge | 19 53.7 | 18 47 | 8.3 | Gl. Cl. | |
| M72 | NGC 6981 | Aqr | 20 53.5 | -12 32 | 9.4 | Gl. Cl. | |
| M73 | NGC 6994 | Aqr | 20 58.0 | -12 38 | | ast | |
| M74 | NGC 628 | Psc | 1 36.7 | 15 47 | 9.2 | S | |
| M75 | NGC 6864 | Sgr | 20 06.1 | -21 55 | 8.6 | Gl Cl. | |
| M76 | NGC 650-1 | Per | 1 42.2 | 51 34 | 11.5 | P. Neb. | Cork Nebula |
| M77 | NGC 1068 | Cet | 2 42.7 | 0 01 | 8.8 | Sp. Gx. | |
| M78 | NGC 2068 | Ori | 5 46.7 | 0 03 | 8.0 | D. Neb. | |
| M79 | NGC 1904 | Lep | 5 24.2 | -24 33 | 8.0 | Gl. Cl. | |
| M80 | NGC 6093 | Sco | 16 17.0 | -22 59 | 7.2 | Gl. Cl. | |

| M# | NGC# | Const. | R.A. H M S | DEC ° ′ | Mag | Type | Proper Name |
|---|---|---|---|---|---|---|---|
| M81 | NGC 3031 | UMa | 9 55.8 | 69 04 | 6.8 | Sp. Gx. | Bodes Nebula |
| M82 | NGC 3034 | UMa | 9 56.2 | 69 41 | 8.4 | Ir. Gx. | |
| M83 | NGC 5236 | Hya | 13 37.7 | -29 52 | 7.6 | Sp. Gx. | |
| M84 | NGC 4374 | Vir | 12 25.1 | 12 53 | 9.3 | El. Gx. | |
| M85 | NGC 4382 | Com | 12 25.4 | 18 11 | 9.2 | El. Gx. | |
| M86 | NGC 4406 | Vir | 12 26.2 | 12 57 | 9.2 | El. Gx. | |
| M87 | NGC 4486 | Vir | 12 30.8 | 12 24 | 8.6 | El. Gx. | Virgo A |
| M88 | NGC 4501 | Com | 12 32.0 | 14 25 | 9.5 | Sp. Gx. | |
| M89 | NGC 4552 | Vir | 12 35.7 | 12 33 | 9.8 | El. Gx. | |
| M90 | NGC 4569 | Vir | 12 36.8 | 13 10 | 9.5 | Sp. Gx. | |
| M91 | NGC 4548 | Com | 12 35.4 | 14 30 | 10.2 | Sp. Gx. | |
| M92 | NGC 6341 | Her | 17 17.1 | 43 08 | 6.5 | Gl. Cl. | |
| M93 | NGC 2447 | Pup | 7 44.6 | -23 52 | 6.2 | Op. Cl. | |
| M94 | NGC 4736 | CVn | 12 50.9 | 41 07 | 8.1 | Sp. Gx. | |
| M95 | NGC 3351 | Leo | 10 44.0 | 11 42 | 9.7 | Sp. Gx. | |
| M96 | NGC 3368 | Leo | 10 46.8 | 11 49 | 9.2 | Sp. Gx. | |
| M97 | NGC 3587 | UMa | 11 14.9 | 55 01 | 11.2 | P. Neb. | Owl Nebula |
| M98 | NGC 4192 | Com | 12 13.8 | 14 54 | 10.1 | Sp. Gx. | |
| M99 | NGC 4254 | Com | 12 18.8 | 14 25 | 9.8 | Sp. Gx. | Pin Wheel Nebula |
| M100 | NGC 4321 | Com | 12 22.9 | 15 49 | 9.4 | Sp. Gx. | |
| M101 | NGC 5457 | UMa | 14 03.2 | 54 21 | 7.7 | Sp. Gx. | |
| M102 | NGC 5457 | UMa | 14 03.2 | 54 21 | 7.7 | dup | |
| M103 | NGC 581 | Cas | 1 33.1 | 60 42 | 7.4 | Op. Cl. | |
| M104 | NGC 4594 | Vir | 12 40.0 | -11 37 | 8.3 | Sp. Gx. | Sombrero Galaxy |
| M105 | NGC 3379 | Leo | 10 47.9 | 12 35 | 9.3 | El. Gx.. | |
| M106 | NGC 4258 | CVn | 12 19.0 | 47 18 | 8.3 | Sp. Gx. | |
| M107 | NGC 6171 | Oph | 16 32.5 | -13 03 | 8.1 | Gl. Cl. | |
| M108 | NGC 3556 | UMa | 11 11.6 | 55 40 | 10.0 | Sp. Gx. | |
| M109 | NGC 3992 | UMa | 11 57.7 | 53 23 | 9.8 | Sp. Gx. | |
| M110 | NGC 205 | And | 0 40.3 | 41 41 | 8.0 | El. Gx. | |

Object Abbreviations:

- 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. All coordinates are in epoch 2000.0.

| Star Name | Constellation | Epoch 2000.0 R.A. H M S | Epoch 2000.0 DEC ° ′ ″ | Magnitude |
|---|---|---|---|---|
| Sirius | CMa | 06 45 09 | -16 42 58 | -1.47 |
| Canopus | Car | 06 23 57 | -52 41 44 | -0.72 |
| Arcturus | Boo | 14 15 40 | +19 10 57 | -0.72 |
| Rigel Kent. | Cen | 14 39 37 | -60 50 02 | +0.01 |
| Vega | Lyr | 18 36 56 | +38 47 01 | +0.04 |
| Capella | Aur | 05 16 41 | +45 59 53 | +0.05 |
| Rigel | Ori | 05 14 32 | -08 12 06 | +0.14 |
| Procyon | CMi | 07 38 18 | +05 13 30 | +0.37 |
| Betelgeuse | Ori | 05 55 10 | +07 24 26 | +0.41 |
| Achernar | Eri | 01 37 43 | -57 14 12 | +0.60 |
| Hadar | Cen | 14 03 49 | -60 22 22 | +0.63 |
| Altair | Aqi | 19 50 47 | +08 52 06 | +0.77 |
| Aldebaran | Tau | 04 35 55 | +16 30 33 | +0.86 |
| Spica | Vir | 13 25 12 | -11 09 41 | +0.91 |
| Antares | Sco | 16 29 24 | -26 25 55 | +0.92 |
| Fomalhaut | PsA | 22 57 39 | -29 37 20 | +1.15 |
| Pollux | Gem | 07 45 19 | +28 01 34 | +1.16 |
| Deneb | Cyg | 20 41 26 | +45 16 49 | +1.28 |
| Beta Crucis | Cru | 12 47 43 | -59 41 19 | +1.28 |
| Regulus | Leo | 10 08 22 | +11 58 02 | +1.36 |

## FOR FURTHER READING

The following is a list of astronomy books that will further enhance your understanding of the night sky. The books are broken down by classification for easy reference.

**Astronomy Texts**

| | |
|---|---|
| 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 | Dickinson, Costanzo, Chaple |
| NGC 2000.0 | Sinnott |

**General Observational Astronomy**

| | |
|---|---|
| The Cambridge Astronomy Guide | Liller & Mayer |
| A Complete Manual of Amateur Astronomy | Sherrod |
| The Guide to Amateur Astronomy | Newton & Teece |

**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 |
| Observe Comets | Edberg & Levy |

**Astrophotography**

| | |
|---|---|
| Skyshooting | Mayall & Mayall |
| Astrophotography A Step-by-Step Approach | Little |
| Astrophotography for the Amateur | Covington |
| Astrophotography | Gordon |
| Astrophotography II | Martinez |
| A Manual of Celestial Photography | King |
| Manual of Advanced Celestial Photography | Wallis & Provin |
| Colours of The Stars | Malin & Muirden |

# CELESTRON LIMITED WARRANTY

## CELESTRON PRODUCTS

Celestron International (CI) warrants that each Celestron brand telescope, spotting scope and binocular shall be free from defects in materials and workmanship for its usable lifetime. CI will repair or replace such product or part thereof which, on inspection by CI is found to be defective in materials or workmanship. As a condition to the obligation of CI to repair or replace such product, the product must be returned to CI together with proof-of-purchase satisfactory to CI.

## RETURN AUTHORIZATION ALL PRODUCTS

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

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

CI shall be responsible for all costs of transportation (excluding insurance) in the event the product is returned no later than one year following the first retail purchase. Thereafter, the customer shall be responsible for all costs of transportation and insurance, both to and from the factory of CI, and shall be required to prepay such costs.

## ACCESSORIES/ELECTRONIC COMPONENTS

CI warrants that all CI accessories and electronic components of telescopes shall be free from defects in materials and workmanship for one year from the date of sale to the first retail purchaser. The warranties set forth in this paragraph shall be the exclusive warranties provided by CI with respect to CI accessories and electronic features of telescopes and shall be deemed to limit the obligation of CI under any other provisions of this warranty.

## WARRANTY

CI shall use reasonable efforts to repair or replace any product covered by this limited warranty within thirty days of receipt. In the event repair or replacement shall require more than thirty days, CI shall notify the customer accordingly. CI reserves the right to replace any product which has been discontinued from its product line with a new product of comparable value and function. In the event no product of comparable value and function is then marketed by CI, CI may, in lieu of replacement, pay the current fair market value of the product in serviceable condition.

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

CI DISCLAIMS ANY WARRANTIES, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR USE, EXCEPT AS EXPRESSLY SET FORTH HEREIN.

THE SOLE OBLIGATION OF CI UNDER THIS LIMITED WARRANTY SHALL BE TO REPAIR OR REPLACE THE COVERED PRODUCT, IN ACCORDANCE WITH THE TERMS SET FORTH HEREIN. CI EXPRESSLY DISCLAIMS ANY LOST PROFITS, GENERAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM BREACH OF ANY WARRANTY, OR ARISING OUT OF THE USE OR INABILITY TO USE ANY CI PRODUCT. ANY WARRANTIES WHICH ARE IMPLIED AND WHICH CANNOT BE DISCLAIMED SHALL BE LIMITED IN DURATION TO A TERM OF ONE YEAR FROM THE DATE OF ORIGINAL RETAIL PURCHASE.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitation on how long an implied warranty lasts, so the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

CI reserves the right to modify or discontinue, without prior notice to you, any model or style optical instrument.

If warranty problems arise, or if you need assistance in using your CI product, contact:


**Celestron International**
**Consumer Relations Department**
**2835 Columbia Street**
**Torrance, CA 90503**
**310/328-9560**


This warranty supersedes all other product warranties.

## SOLAR WARNING

**NEVER VIEW THE SUN THROUGH A TELESCOPE, SPOTTING SCOPE, OR BINOCULAR WITHOUT THE PROPER CELESTRON SOLAR FILTER. VIEWING THE SUN WITHOUT THE PROPER FILTER MAY RESULT IN PERMANENT AND IRREVERSIBLE EYE DAMAGE. NEVER LEAVE THE INSTRUMENT UNSUPERVISED, EITHER WHEN CHILDREN ARE PRESENT OR ADULTS WHO MAY NOT BE FAMILIAR WITH THE CORRECT OPERATING PROCEDURES OF YOUR INSTRUMENT.**

# CELESTRON®

2835 Columbia Street
Torrance, CA 90503
Tel. (310) 328-9560



(Products or instructions may change without notice or obligation.)

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03-94
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