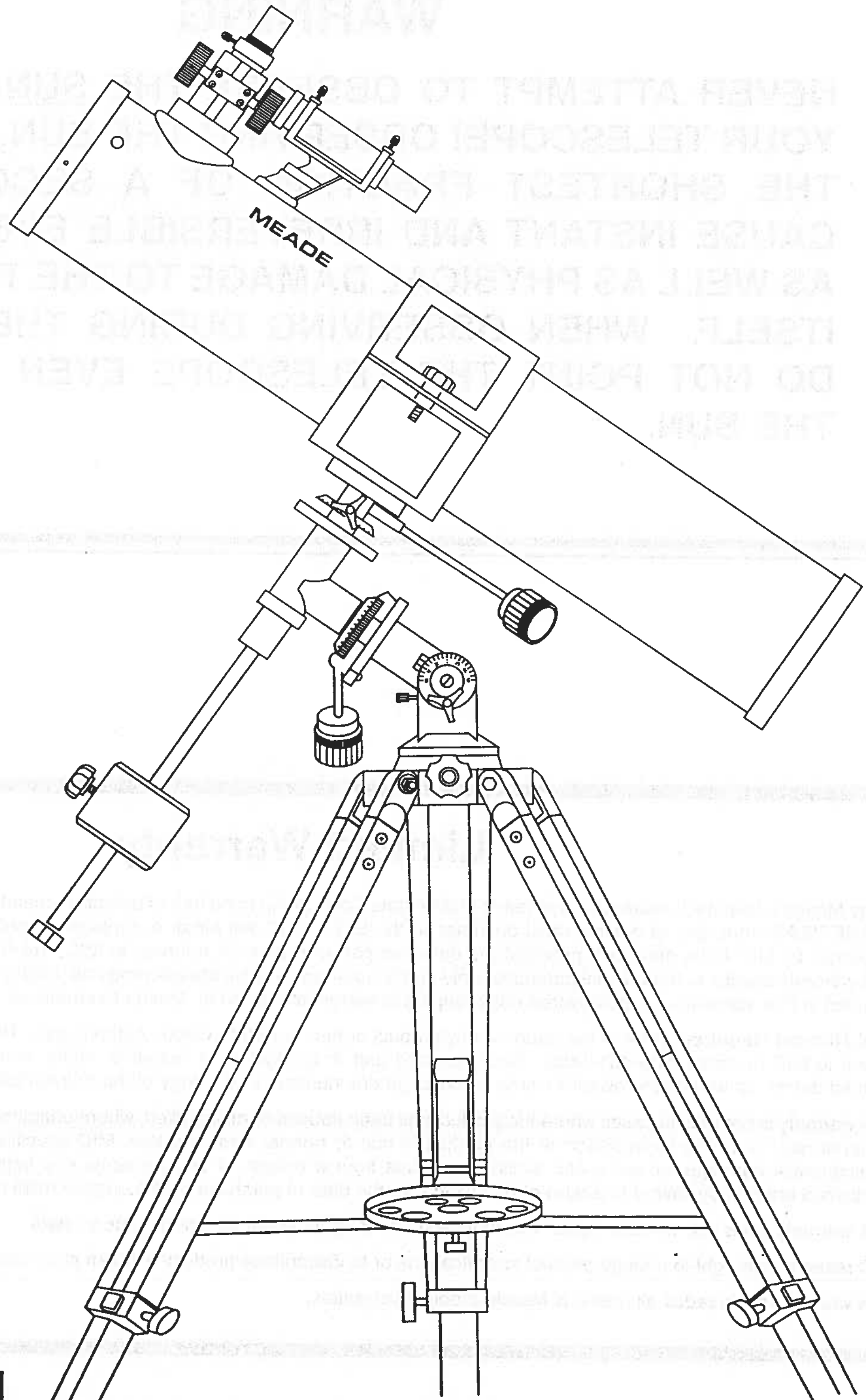
Instruction Manual

Meade Model 4400: 4.5" Equatorial Reflecting Telescope



Meade Instruments Corporation

6001 Oak Canyon, Irvine, California 92620 ■ (949) 451-1450

Rev. A
5-98

WARNING

NEVER ATTEMPT TO OBSERVE THE SUN THROUGH YOUR TELESCOPE! OBSERVING THE SUN, EVEN FOR THE SHORTEST FRACTION OF A SECOND, WILL CAUSE INSTANT AND IRREVERSIBLE EYE DAMAGE, AS WELL AS PHYSICAL DAMAGE TO THE TELESCOPE ITSELF. WHEN OBSERVING DURING THE DAYTIME, DO NOT POINT THE TELESCOPE EVEN CLOSE TO THE SUN.

Limited Warranty

Every Meade telescope is warranted by Meade Instruments Corp. (MIC) to be free of defects in materials and workmanship for a period of **ONE YEAR** from date of original retail purchase in the U.S.A. MIC will repair or replace the product, or part thereof, found upon inspection by MIC to be defective, provided the defective part or product is returned to MIC, freight prepaid, with proof of purchase. This warranty applies to the original purchaser only and is non-transferable. Meade products purchased outside North America are not included in this warranty, but are covered under separate warranties issued by Meade International Distributors.

RGA Number Required: Prior to the return of any product or part, a Return Goods Authorization (RGA) number **must** be obtained by writing to MIC or calling 949-451-1450. Each returned part or product must include a written statement detailing the nature of the claimed defect, as well as the owner's name, address, phone number, and a copy of the original sales invoice.

This warranty is not valid in cases where the product has been abused or mishandled, where unauthorized repairs have been attempted or performed, or where depreciation of the product is due to normal wear-and-tear. MIC specifically disclaims special, indirect, or consequential damages or lost profit, which may result from a breach of this warranty. Any implied warranties which can not be disclaimed are hereby limited to a term of one year from the date of purchase by the original retail purchaser.

This warranty gives you specific rights. You may have other rights which vary from state to state.

MIC reserves the right to change product specifications or to discontinue products without prior notice.

This warranty supersedes all previous Meade product warranties.

TABLE OF CONTENTS

Key to Fig. 1

1. Tripod legs
2. Equatorial mount
3. R.A. flexible cable control
4. Dec. flexible cable control
5. Counterweight
6. Counterweight shaft
7. Counterweight lock
8. Safety washer/knob
9. Latitude lock
10. Polar axis
11. Latitude adjustment thumbscrew
12. Telescope optical tube assembly
13. Cradle clamp hinges
14. Cradle clamp assembly
15. Cradle lock knob
16. Viewfinder bracket mounting bolts
17. Focuser
18. Focuser thumbscrew
19. Eyepiece
20. Viewfinder bracket
21. Declination axis
22. R.A. lock
23. Dec. lock
24. 5 x 24 viewfinder
25. Telescope front dust cover
26. Viewfinder bracket thumbscrews
27. R.A. setting circle
28. Dec. setting circle
29. Latitude scale
30. Azimuth lock
31. Focus knobs
32. Accessory shelf mounting knob
33. Azimuth base
34. Tripod leg adjustment lock knobs
35. R.A. worm block assembly
36. Dec. tangent arm assembly
37. Accessory tray
38. Leg braces
39. Polar shaft nut
40. Azimuth knob– to tighten azimuth base

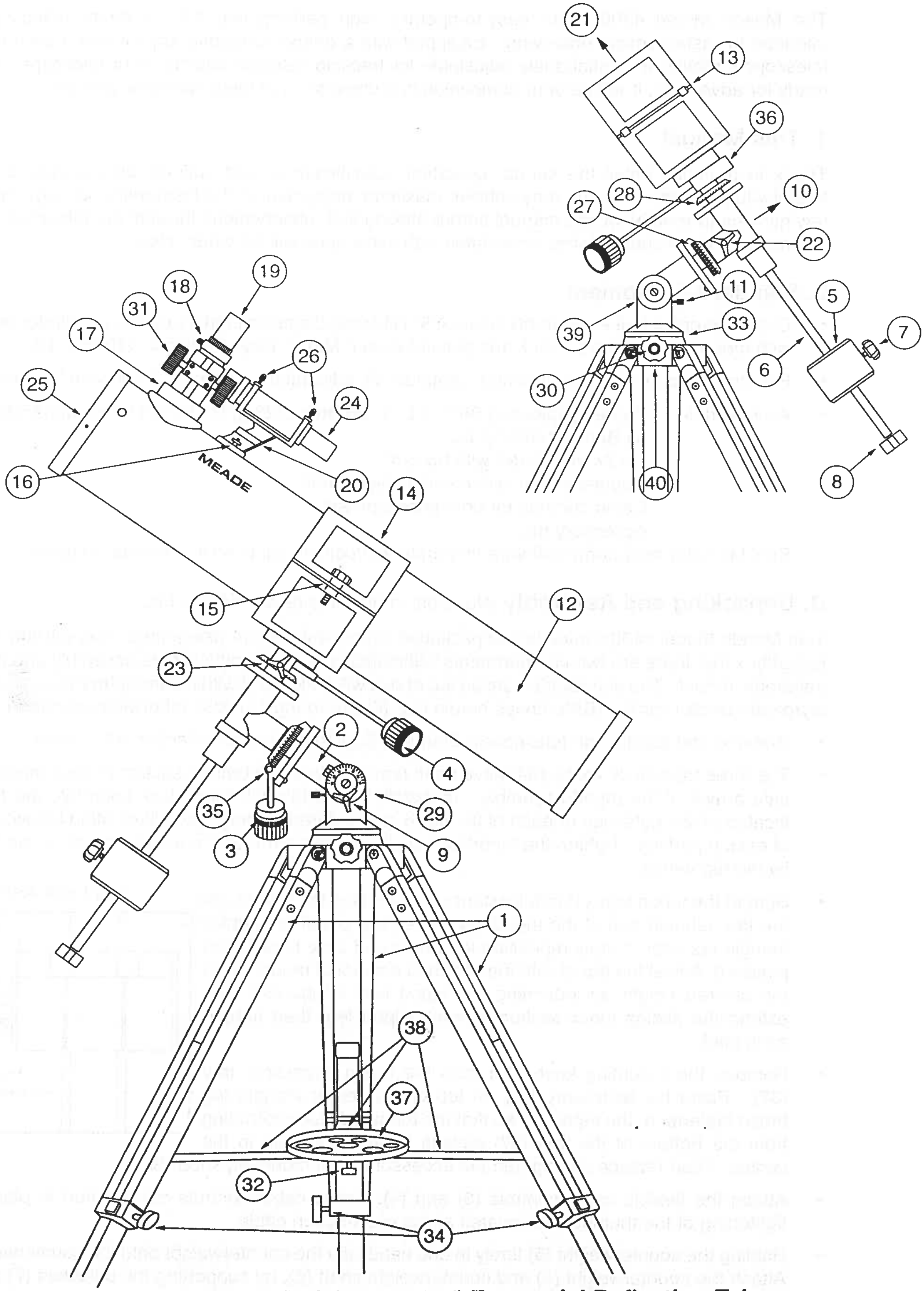


Fig. 1: Meade Model 4400: 4.5" Equatorial Reflecting Telescope

A. Introducing the Meade Model 4400

The Meade Model 4400 is an easy-to-operate, high performance 4.5" (114mm) reflecting telescope, intended for astronomical observing. Equipped with a deluxe equatorial mount and aluminum tripod, the telescope's motion is continuously adjustable for tracking celestial objects. Your telescope comes to you ready for adventure; it will be your companion in a universe of planets, galaxies, and stars.

1. This Manual

These instructions detail the set-up, operation, specifications, and optional accessories of your Meade Model 4400. In order that you may achieve maximum enjoyment of the instrument, we urge that you take a few minutes to read all of this manual before making first observations through the telescope. As you read this manual, the technical terms associated with telescopes will be made clear.

2. Standard Equipment

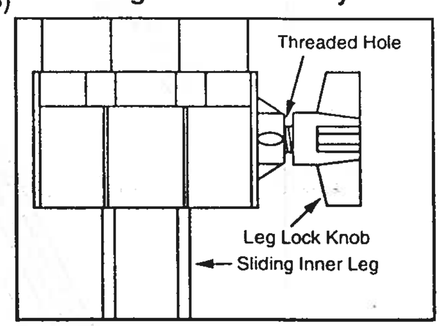
- Complete optical tube assembly with a 4.5" (114mm) diameter primary mirror, viewfinder mounting bolts with mounting nuts, and a rack and pinion focuser. Mirror focal length = 910mm; f/8.
- Equatorial mount with pre-attached, continuously adjustable, aluminum tripod with leg braces.
- Accessories: Three eyepieces (.965" O.D.): SR4mm (228x), H12.5mm (73x), and H25mm (36x)
  3x Barlow (.965" O.D.)
  5 x 24 viewfinder with bracket
  Counterweight with counterweight shaft
  Cable controls for both telescope axes
  Accessory tray
- StarNavigator astronomy software (separate instructions supplied in software package)

B. Unpacking and Assembly (Numbers in brackets below refer to Fig. 1)

Your Meade Model 4400 comes to you packaged almost entirely pre-assembled. You will find upon opening the giftbox that there are two compartments within that contain the optical tube assembly and the tripod with equatorial mount. The accessories described above will be located within compartments custom-cut into the styrofoam block inserts. (References herein e.g. (6) are to Fig.1 unless otherwise specified.)

- Remove and identify the telescope's Standard Equipment listed in Section A.2., above.
- The three tripod lock knobs (34) have been removed from the bottom section of each tripod leg to insure safe arrival of the tripod assembly. To install, thread in each tripod lock knob into the threaded hole located at the right side of each of the three gray colored castings (see illustration below) at the bottom of each tripod leg. Tighten the tripod lock knob only to a "firm feel" to avoid damage to the tripod caused by overtightening.
- Spread the tripod legs (1) to full extension so that the leg braces (38) are taut (should one of the tripod leg braces slip out of the center triangle fastener, merely reposition the brace and slide it back into position). Adjust the tripod with the attached equatorial mount (2) to the desired height by loosening the tripod lock knobs (34) and extend the sliding inner section of each tripod leg; then tighten each knob.

Leg Lock Assembly



- Remove the mounting knob (32) from the round accessory tray (37). Place the accessory tray on top of the center triangle leg brace fastener of the tripod (1) so that the threaded stud protruding from the bottom of the tray (37) passes through the hole in the center. Then replace and tighten the accessory shelf mounting knob (32).
- Attach the flexible cable controls (3) and (4). These cable controls are secured in place with a firm tightening of the thumbscrew located at the end of each cable.
- Holding the counterweight (5) firmly in one hand, slip the counterweight onto the counterweight shaft (6). Attach the counterweight (5) and counterweight shaft (6), by supporting the unlocked (7) counterweight firmly in one hand, while threading the counterweight shaft into the base of the Declination axis of the

telescope's equatorial mount with the other (see Fig. 1). Once firmly attached, slide the counterweight to the midpoint on the counterweight shaft and secure it in place with the lock knob (7) of the counterweight. Note: If the counterweight ever slips, the secured threaded safety washer/knob (8) will not let the weight slide entirely off the counterweight shaft. **Be certain that this safety washer/knob is always in place.**

- Release the latitude lock (9) of the equatorial mount, and tilt the polar axis (10) of the telescope to roughly a 45° angle. Adjust the latitude adjustment thumbscrew (11) if necessary to accommodate this position. With the polar axis thus tilted, firmly re-tighten the latitude lock (9).
- Loosen the Cradle Lock Knob (15) of the cradle clamp ring (14) and open the cradle clamp.
- Remove the viewfinder bracket mounting nuts from the viewfinder bracket mounting bolts (16) that protrude from the optical tube (12), near the focuser. Place the viewfinder bracket's mounting holes (located at the base of the bracket) over the mounting bolts, so that the bracket is oriented as shown in Fig. 1. Then replace the viewfinder bracket mounting nuts, and tighten to a firm feel. Position the viewfinder's objective lens so it is pointing at the open end (front) of the optical tube.
- While firmly holding the optical tube (12), position it onto the lower half of the open cradle clamp (14) (which is positioned directly over the mount), with the midpoint of the optical tube's length lying roughly in the center of the cradle clamp. Then position the upper portion of the cradle clamp over the tube (12). Next, tighten the cradle lock knob (15) to a firm feel; do not overtighten. Please note that you may want to change the rotational position of the optical tube to gain a more comfortable observing position of the focuser (17). This adjustment may be performed several times in one observing session, as desired, by loosening the pressure on the cradle lock knob and rotating the tube.
- Insert the H25mm eyepiece (19) into the focuser, and tighten the focuser thumbscrew (18) to secure the eyepiece.

The telescope is now fully assembled. Before it can be properly used, however, the telescope must be balanced and the viewfinder aligned.

1. Balancing the Telescope

In order for the telescope to move smoothly on its mechanical axes, it must first be balanced about the 2 telescope axes: the polar axis (10) and the Declination axis (21). All motions of the polar aligned telescope (more on this later) take place by moving about these two axes, separately or simultaneously. To obtain a fine balance of the telescope, follow the method below:

- Loosen the R.A. lock (22) and rotate the telescope so that the counterweight shaft (6) is parallel to the ground (horizontal).
- Slide the counterweight along the counterweight shaft until the telescope remains in one position without tending to drift down in either direction. Then tighten the counterweight lock knob (7), locking the counterweight in position.
- Lock the R.A. lock (22), and unlock the Declination lock (23), but keep the counterweight shaft in its horizontal position. The telescope will now turn freely about the Declination axis. Loosen the cradle lock knob (15) so that the optical tube in the cradle can slide up-or-down in the cradle with the application of modest pressure. Move the tube in the cradle until it is balanced rotationally about the Declination axis. Re-tighten the knob (15).

The telescope is now properly balanced on both axes.

2. Alignment of the Viewfinder

The wide field of view provided by the 5 x 24mm viewfinder permits easy object sighting prior to observation in the higher-power main telescope. The 5 x 24 Viewfinder (24) and viewfinder bracket (20) should be attached to the telescope tube assembly as described above. In order for the viewfinder to be functional, however, it must be aligned to the main telescope, so that both the viewfinder and main telescope point at the same position in the sky. With this simple alignment performed, finding objects is greatly facilitated, since you will first locate an object in the wide-field viewfinder, then you will look in the eyepiece of the main telescope for a detailed view. To align the viewfinder follow these steps:

- Remove the telescope front dust cover (25).

- Place the low- power (H25mm) eyepiece into the focuser of the main telescope.
- Unlock the R.A. lock (22) and the Dec. lock (23) so that the telescope turns freely on both axes. Then point the main telescope at some well-defined land object (e.g. the top of a telephone pole) at least 200 yards distant, and re-lock the R.A and Dec. axes. Turn the cable controls, (3) and (4), to center the object in the telescopic field of the main telescope.
- Looking through the viewfinder, loosen or tighten, as appropriate, one or more of the viewfinder bracket thumbscrews until the viewfinder's crosshairs are likewise centered on the object previously centered in the main telescope. Hint: center the front of the viewfinder in the bracket using the 3 front ring thumbscrews, then make final object centering adjustments with the back 3 thumbscrews.
- Check this alignment on a celestial object, such as a bright star or the Moon, and make any refinements necessary, using the method outlined above.

With this alignment performed, objects first located in the wide-field viewfinder will also be centered in the main telescope's field of view. (Note: The viewfinder and telescope presents an image which is upside-down; this is customary in all astronomical viewfinders.)

C. Understanding Celestial Movements and Coordinates

Understanding where to locate celestial objects, and how those objects move across the sky is fundamental to enjoying the hobby of astronomy. Most amateur astronomers adopt the simple practice of "star-hopping" to locate celestial objects by using star charts or astronomical software which identify bright stars and star patterns (constellations) that serve as "road maps" and "landmarks" in the sky. These visual reference points guide amateur astronomers in their search for astronomical objects. And, while star-hopping is the preferred technique, a discussion of using setting circles for locating objects is desirable since your telescope is provided with this feature. However, be advised, compared to star-hopping, object location by use of setting circles requires a greater investment in time and patience to achieve a more precise alignment of the telescope's polar axis to the celestial pole. For this reason, in part, star-hopping is popular because it is the faster, easier way to become initiated in the hobby.

Understanding how astronomical objects move: Due to the Earth's rotation, celestial bodies appear to move from East to West in a curved path through the skies. The path they follow is known as their line of Right Ascension (R.A.). The angle of this path they follow is known as their line of Declination (Dec.). Right Ascension and Declination is analogous to the Earth-based coordinate system of latitude and longitude.

Understanding celestial coordinates: Celestial objects are mapped according to the R.A. and Dec. coordinate system on the "celestial sphere" (Fig. 2) the imaginary sphere on which all stars appear to be placed. The Poles of the celestial coordinate system are defined as those 2 points where the Earth's rotational axis, if extended to infinity, North and South, intersect the celestial sphere. Thus, the North

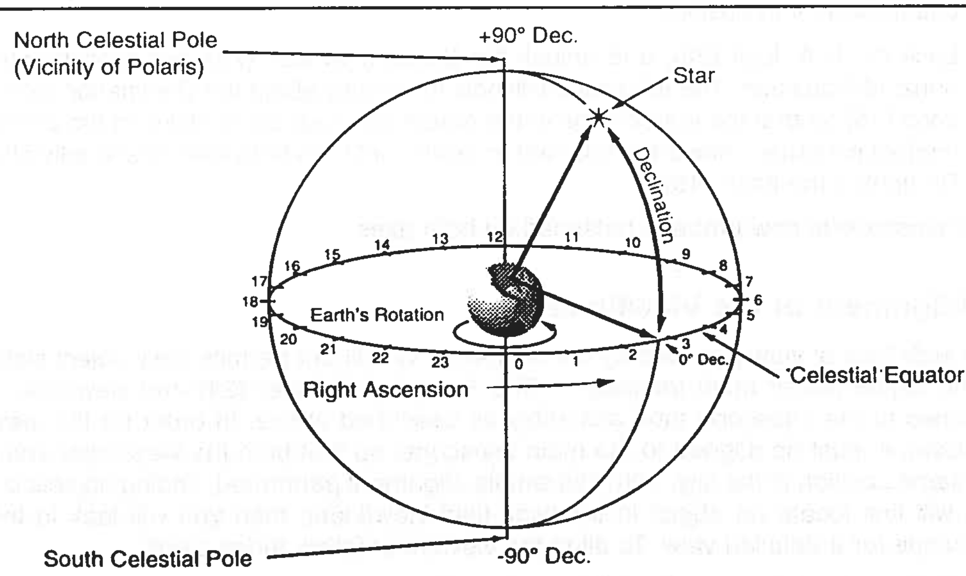


Fig. 2: Celestial Sphere

Celestial Pole is that point in the sky where an extension of the Earth's axis through the North Pole intersects the celestial sphere. In fact, this point in the sky is located near the North Star, or Polaris.

On the surface of the Earth, "lines of longitude" are drawn between the North and South Poles. Similarly, "lines of latitude" are drawn in an East-West direction, parallel to the Earth's equator. The celestial equator is simply a projection of the Earth's equator onto the celestial sphere. Just as on the surface of the Earth, imaginary lines have been drawn on the celestial sphere to form a coordinate grid. Celestial object positions on the Earth's surface are specified by their latitude and longitude.

The celestial equivalent to Earth latitude is called "Declination," or simply "Dec," and is measured in degrees, minutes or seconds north ("+") or south ("-") of the celestial equator. Thus any point on the celestial equator (which passes, for example, through the constellations Orion, Virgo and Aquarius) is specified as having 0°0'0" Declination. The Declination of the star Polaris, located very near the North Celestial Pole, is +89.2°.

The celestial equivalent to Earth longitude is called "Right Ascension," or "R.A." and is measured in hours, minutes and seconds from an arbitrarily defined "zero" line of R.A. passing through the constellation Pegasus. Right Ascension coordinates range from 0hr0min0sec up to (but not including) 24hr0min0sec. Thus there are 24 primary lines of R.A., located at 15 degree intervals along the celestial equator. Objects located further and further east of the prime (0h0m0s) Right Ascension grid line carry increasing R.A. coordinates.

With all celestial objects therefore capable of being specified in position by their celestial coordinates of Right Ascension and Declination, the task of finding objects (in particular, faint objects) in the telescope can be simplified. The setting circles, R.A. (27) and Dec. (28) of the Meade Model 4400 telescope may be dialed, in effect, to read the object's coordinates, positioning the object in the vicinity of the telescope's telescopic field of view. However, these setting circles may be used to advantage only if the telescope is first properly aligned with the North Celestial Pole.

D. Lining Up with the Celestial Pole

Objects in the sky appear to revolve around the celestial pole. (Actually, celestial objects are essentially "fixed," and their apparent motion is caused by the Earth's axial rotation). During any 24 hour period, stars make one complete revolution about the pole, making concentric circles with the pole at the center. By lining up the telescope's polar axis (10) with the North Celestial Pole (or for observers located in Earth's Southern Hemisphere with the South Celestial Pole), astronomical objects may be followed, or tracked, simply by moving the telescope about one axis, the polar axis.

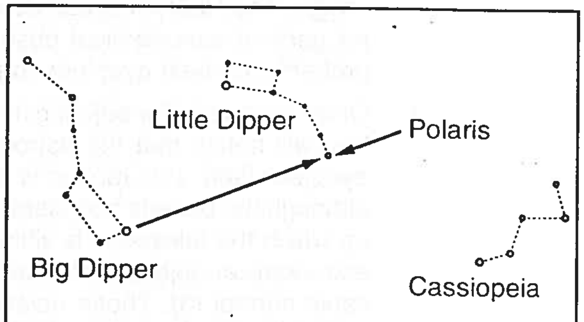


Fig. 3: Finding Polaris

If the telescope is reasonably well aligned with the pole, therefore, very little use of the telescope's Declination flexible cable control is necessary — virtually all of the required telescope tracking will be in Right Ascension. (If the telescope were perfectly aligned with the pole, no Declination tracking of stellar objects would be required). For the purposes of casual visual telescopic observations, lining up the telescope's polar axis to within a degree or two of the pole is more than sufficient: with this level of pointing accuracy, the telescope can track accurately by slowly turning the telescope's R.A. flexible cable control and keep objects in the telescopic field of view for perhaps 20 to 30 minutes.

To line up the Meade Model 4400 with the pole, follow this procedure:

1) Release the Azimuth lock (30) of the Azimuth base (33), so that the entire telescope-with-mounting may be rotated in a horizontal direction. Rotate the telescope until the polar axis (10) points due North. Use a compass or locate Polaris, the North Star (see Fig. 3), as an accurate reference for due North.
2) Level the mount, if necessary, by adjusting the heights of the three tripod legs.
3) Determine the latitude of your observing location by checking a road map or atlas. Release the latitude lock (9) and tilt the telescope mount so that the pointer indicates the correct latitude of your viewing location on the latitude scale (29). Re-tighten the latitude lock (9). Note: To the right of the latitude scale you will find the latitude adjustment thumbscrew (11). If needed for additional stability, the mount can rest firmly on this thumbscrew at most latitude settings.

4) If steps (1) - (3) above were performed with reasonable accuracy, your telescope is now sufficiently well-aligned to the North Celestial Pole for visual observations.

Once the mount has been polar-aligned as described above, the latitude angle need not be adjusted again, unless you move to a different geographical location (i.e. a different latitude). The only polar alignment procedure that need be done each time you use the telescope is to point the polar axis due North, as described in step (1) above.

E. Using the Telescope

With the telescope assembled, balanced and polar aligned as described above, you are ready to begin observations. Decide on an easy-to-find object such as the Moon, if it is visible, or a bright star to become accustomed to the functions and operations of the telescope. For the best results during observations, follow the suggestions below:

> We repeat the warning stated at the outset of this manual: **Never point the telescope directly at or near the Sun at any time! Observing the Sun, even for the smallest fraction of a second, will result in instant and irreversible eye damage, as well as physical damage to the telescope itself.**

- To center an object in the main telescope, loosen the telescope's R.A. lock (22) and Dec. lock (23). The telescope can now turn freely on its axes. Use the aligned viewfinder to first sight-in on the object you wish to observe; with the object centered on the viewfinder's crosshairs, re-tighten the R.A. and Dec. locks.
- Your telescope comes with an assortment of eyepieces (see Section G on Calculating Power and Section J on Optional Accessories for higher and lower powers with the telescope), always start an observation with a low power eyepiece (e.g. the H25mm eyepiece); get the object well-centered in the field of view and sharply focused. Then try the next step up in magnification. If the image starts to become fuzzy as you work into higher magnifications, then back down to a lower power; the atmospheric steadiness is not sufficient to support high powers at the time you are observing. Keep in mind that a bright, clearly resolved but smaller image will show far more detail than a dimmer, poorly resolved larger image. The H25mm eyepiece included with the Meade Model 4400 presents a wide field of view, ideal for general astronomical observing of star fields, clusters of stars, nebulae, and galaxies. It is also probably the best eyepiece to use in the initial finding and centering of any object.
- Once centered, the object can be focused by turning one of the knobs of the focusing mechanism (31). You will notice that the astronomical object in the field of view will begin to slowly move across the eyepiece field. This motion is caused by the rotation of the Earth on its axis, as described in Section C, although the planets and stars, are, for practical purposes, fixed in their positions in the sky. The platform on which the telescope is sitting (the Earth) rotates once every 24 hours under these objects. To keep astronomical objects centered in the field of the polar aligned telescope, simply turn the R.A. flexible cable control (3). These objects will appear to move through the field more rapidly at higher powers. Note that the Declination flexible cable control is used only for centering purposes, and not for tracking.
- Avoid touching the eyepiece while observing through the telescope. Vibrations resulting from such contact will cause the image to move. Likewise, avoid observing sites where ground-based vibrations may resonate the tripod. Viewing from the upper floors of a building may also introduce image movement.
- You should allow a few minutes to allow your eyes to become "dark adapted" before attempting any serious astronomical observations. Use a red filtered flashlight to protect your night vision when reading star maps or inspecting the components of the telescope.
- Avoid setting up the telescope inside a room and observing through an open window (or worse yet, a closed window). Images viewed in such a manner may appear blurred or distorted due to temperature differences between inside and outside air. Also, it is a good idea to allow your telescope a chance to reach the ambient (surrounding) outside temperature before starting an observing session.
- Avoid viewing objects low on the horizon–objects will appear better resolved with far better contrast when viewed higher in the atmosphere. Also, if images appear to "shimmer" in the eyepiece–reduce power until the image steadies. This condition is caused by air turbulence in the upper atmosphere.

The Meade Model 4400 may be used for a lifetime of rewarding astronomical observing, but basic to your enjoyment of the telescope is a good understanding of the instrument. Read the above instructions carefully until you understand all of the telescope's parts and functions. One or two observing sessions will serve to clarify these points forever in your mind.

The number of fascinating objects visible through your Meade reflector is limited only by your own motivation. Astronomical software, or a good star atlas (see "Meade Star Charts" in optional accessories, page 15) will assist you in locating many interesting celestial objects. These objects include:

- Cloud belts across the surface of the planet Jupiter.
- The 4 major satellites of Jupiter, visible in rotation about the planet, with the satellite positions changing each night.
- Saturn and its famous ring system, as well as several satellites of Saturn, much fainter than the major satellites of Jupiter.
- The Moon: A veritable treasury of craters, mountain ranges and fault lines. The best contrast for viewing the Moon is during its crescent phase. The contrast during the full Moon phase is low due to the angle of illumination.
- Deep-Space: Nebulae, galaxies, multiple star systems, star clusters—hundreds of such objects are visible through the Meade Model 4400.

F. Using Setting Circles

Setting circles of the polar aligned equatorial mount can facilitate the location of faint celestial objects not easily found by direct visual observation. To use the setting circles, follow this procedure:

- Use a star chart or star atlas, and look up the celestial coordinates, Right Ascension and Declination (R.A. and Dec.), of an easy-to-find bright star that is within the general vicinity of the faint object you wish to locate.
- Center the determined bright star in the telescope's field of view.
- Manually turn the R.A. setting circle (27) to read the R.A. of the object now in the telescope's eyepiece.
- The setting circles are now calibrated (the Dec. setting circle (28) is factory calibrated). To locate a nearby faint object using the setting circles determine the faint object's celestial coordinates from a star chart, and move the telescope in R.A. and Declination until the setting circles read the R.A. and Dec. of the object you are attempting to locate. If the above procedure has been carefully performed, the faint object will now be in the field of a low power eyepiece.
- The R.A. Setting Circle must be manually re-calibrated on the current Right Ascension of a star manually every time the telescope is set up, and reset to the centered object's R.A. coordinate before moving to a new R.A. coordinate setting. The R.A. Setting Circle has two sets of numbers, the inner set is for Southern hemisphere use while the outer set of numbers (the set closest to the R.A. gear), is for use by observers located North of the Earth's equator (e.g. in North America).

G. Calculating Power

The power, or magnification of the telescope depends on two optical characteristics: the focal length of the main telescope and the focal length of the eyepiece used during a particular observation. For example, the focal length of the Meade Model 4400 telescope is fixed at 910mm. To calculate the power in use with a particular eyepiece, divide the focal length of the eyepiece into the focal length of the main telescope. For example, using the H25mm eyepiece supplied with the Meade Model 4400, the power is calculated as follows:

$$\text{Power} = 910\text{mm} \div 25\text{mm} = 36\text{x}$$

While the theoretical power of any telescope is virtually limitless, the most often useful magnification is determined by the nature of the object being observed and, most importantly, by the prevailing atmospheric conditions. Generally, higher powers of perhaps 78x to 228x will be the most often useful and enjoyable, consistent with sharp, steady images. When unsteady air conditions prevail, extreme high-power results in a situation where the object detail observed is actually diminished—often referred to as empty magnification. Empty magnification can make a planet appear as no more than a featureless, fuzzy orb of bright light. Also, keep in mind that wide-field deep-space observation is generally a low-power application of your telescope. Meade Instruments manufactures several types of optional eyepieces that are available for your telescope to increase or decrease power (see section J, "Optional Accessories").

diagonal assembly up or down the tube along the slotted holes, until the diagonal mirror is centered in the drawtube.

If the diagonal mirror (1, Fig. 8) is above or below of center within the drawtube, thread in one of the spider vane adjustment/ lock knobs while unthreading the other. Only make adjustments to 2 knobs at a time until the diagonal mirror is in the drawtube. When the spider vane is correctly positioned, it will look like Fig. 9. (Note that the diagonal mirror is misaligned.)

c. Diagonal holder adjustments

If the diagonal mirror (1, Fig. 9) is centered in the drawtube (2, Fig. 9), but the primary mirror is only partially visible in the reflection (3, Fig. 9), the 3 Phillips-head diagonal tilt screws (2, Fig. 5) must be unthreaded slightly to the point of where you can rotate the diagonal holder (3, Fig. 5) from side-to-side by grasping the diagonal holder with your hand and rotating until you see the primary mirror become as centered in the reflection of the diagonal mirror as possible. Once you are at the best position, thread in the 3 Phillips-head diagonal tilt screws to lock the rotational position. Then, if necessary, make adjustments to these 3 Phillips-head screws to refine the tilt-angle of the diagonal mirror until the entire primary mirror can be seen centered within the diagonal mirror reflection. When the diagonal mirror is correctly aligned, it will look like Fig. 10. (Note that the primary mirror is shown out of alignment.)

d. Primary mirror adjustments

If the diagonal mirror (1, Fig. 10) and the reflection of the primary mirror (2, Fig. 10) appear centered within the drawtube (3, Fig. 10), but the reflection of your eye and the reflection of the diagonal mirror (4, Fig. 10) appear off-center, you will need to adjust the primary mirror tilt Phillips-head screws of the primary mirror cell (3, Fig. 6).These primary tilt screws are located behind the primary mirror, at the lower end of the main tube. See Fig. 4. To adjust the primary mirror tilt screws, first unscrew several turns, the 3 hex-head primary mirror cell locking screws (2, Fig.6) that are next to each primary mirror tilt Phillips-head screw. Then by trial-and-error, turn the primary mirror tilt Phillips-head screws (3, Fig. 6) until you develop a feel for which way to turn each screw to center the reflection of your eye. Once centered, as in Fig. 7, turn the 3 hex-head primary mirror cell locking screws (2, Fig. 6) to relock the tilt-angle adjustment.

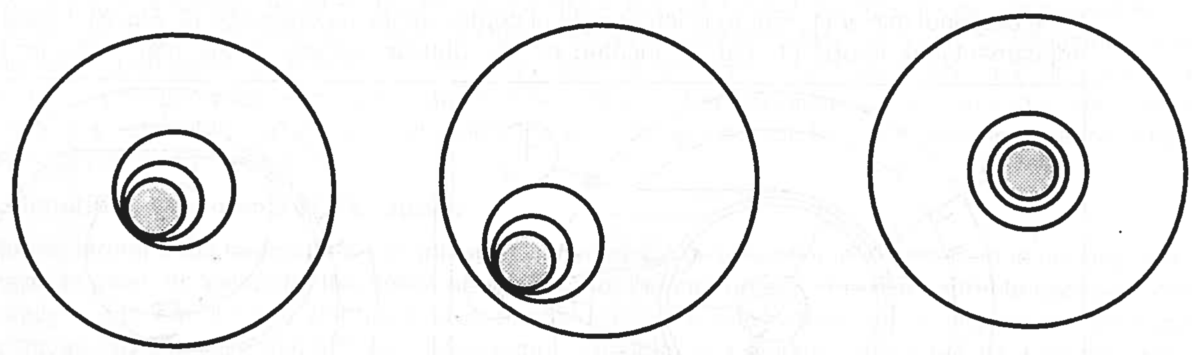


Fig. 11A **Fig. 11B** **Fig. 11C**

e. Star testing the collimation

With the collimation performed, you will want to test the accuracy of the alignment on a star. Use the H25mm eyepiece and point the telescope at a moderately bright (second or third magnitude) star, then center the star image in the telescope's field-of-view. With the star centered follow the method below:

- Bring the star image slowly out of focus until one or more rings are visible around the central disc. If the collimation was performed correctly, the central star disc and rings will be concentric circles, with a dark spot dead center within the out-of-focus star disc (this is the shadow of the secondary mirror), as shown in Fig.11C. (An improperly aligned telescope will reveal elongated circles (Fig. 11A), with an off-center dark shadow.)
- If the out-of-focus star disk appears elongated (Fig. 11A), you will need to adjust the primary mirror Phillips-head tilt screws of the primary mirror cell (3, Fig. 6).

- To adjust the primary mirror tilt screws (3, Fig. 6), first unscrew several turns the 3 hex-head primary mirror cell locking screws (2, Fig. 6), to allow free turning movement of the tilt knobs.
- Using the flexible cable controls (3) and (4), Fig. 1, move the telescope until the star image is at the edge of the field-of-view in the eyepiece, as in Fig. 11B.
- As you make adjustments to the primary mirror tilt screws (3, Fig. 6), you will notice that the out-of-focus star disk image will move across the eyepiece field. Choose one of the 3 primary mirror tilt screws that will move the star disk image to the center of the eyepiece field.
- Repeat this process as many times as necessary until the out-of-focus star disk appears as in Fig. 11C, when the star disk image is in the center of the eyepiece field.
- With the star testing of the collimation complete, tighten the 3 hex-head primary mirror locking screws (2, Fig. 6).

I. Specifications: Meade Model 4400

Primary (main) mirror focal length: 910mm

Primary mirror diameter: . . . . .4.5" (114mm)

Focal ratio: f/8

Mounting : . . . . .German equatorial

J. Optional Accessories

To allow use of the Meade Model 4400 for photography, refer to the latest Meade General Catalog.

Additional Eyepieces (.965"): Meade recommends the following eyepieces for enhanced astronomical viewing:

- MA9mm (.965"): Provides high quality, higher power, close-up observation of the Moon and planets (101x).
- MA40mm (.965"): Offers the most dramatic, wide field of view for observing deep-space objects (23x).

American-Size Eyepieces (1.25" O.D.): With the optional Eyepiece Holder Adapter (1.25") for the focuser in place, Meade's American-size (1.25") can be utilized. Meade Instruments offers several types of high-performance, American-sized eyepieces to fit every observing requirement and budget. See the Meade General Catalog, Meade advertising in *Sky & Telescope* and *Astronomy* magazines, or contact your full-service Meade dealer for details and suggestions on purchasing optional Meade accessory eyepieces.

Eyepiece Holder Adapter (1.25"): Replaces the .965" eyepiece holder. The Eyepiece Holder Adapter is required for using the following accessories: American-size eyepieces (1.25"), #126 2x Barlow lens, Variable Projection Camera Adapter (to use the Variable Projection Camera Adapter, the #126 2x Barlow lens and the appropriate American-size eyepiece(s) are also required).

#532 Electric Motor Drive: With the #532 Motor Drive attached, the telescope automatically tracks astronomical objects in their paths across the sky. Three AA size (user-supplied) batteries power the DC servo motor to rotate the Right Ascension control shaft of the telescope at a constant rate that results in one revolution of the telescope in RA every 24 hours, fully compensating for the effects of the Earth's rotation. The #532 Motor Drive easily attaches in minutes to the telescope. A North-South switch permits operation in either of the Earth's Northern or Southern hemispheres.

Meade Star Charts: Bound 12" x 14" charts with a large easy-to-read planisphere on the front cover, printed on heavy, coated paper, suitable for field use. Includes listings and mapped locations of hundreds of interesting celestial bodies for observation through the telescope.

FOR PHOTOGRAPHY

To allow use of the Meade Model 4400 for photography, the following accessories must be purchased in addition to the Eyepiece Holder Adapter mentioned above:

#126 2x Telenegative Barlow Lens (1.25" O.D.): To permit photography, the #126 Barlow lens must be placed into the Eyepiece Holder Adapter (1.25"), then the Variable Projection Camera Adapter must be attached to the #126 Barlow lens via the thumbscrew lock provided for that purpose. Note: as a stand-alone Barlow lens, this accessory yields high-performance imaging in conjunction with Meade 1.25" eyepieces; doubling the power of any eyepiece used.

Variable Projection Camera Adapter (1.25" O.D.): The Variable Projection Camera Adapter includes a machined sliding mechanism, permitting variable projection distances during eyepiece-projection photography. The Variable Projection Camera Adapter (1.25") permits direct attachment of 35mm SLR cameras to the Meade Model 4400's focuser for short exposure astrophotography of the Moon. (Requires T-Mount for your specific brand of 35mm camera and an appropriate focal length eyepiece. Also, the Variable Projection Camera Adapter **must** be used with the #126 Barlow Lens, mentioned above.

WRITE FOR THE FULL-LINE MEADE GENERAL CATALOG
MEADE INSTRUMENTS CORPORATION • 6001 OAK CANYON • IRVINE, CA 92620
FOR SERVICE CALL (949) 451-1450, 8:30AM-4:00PM PACIFIC TIME, MONDAY-FRIDAY

Meade Instruments Corporation
6001 Oak Canyon, Irvine, California 92620 ■ (949) 451-1450