

Instruction Manual

Meade 60EQ-A: 2.4" (60mm) Equatorial Refracting Telescope



Meade Instruments Corporation

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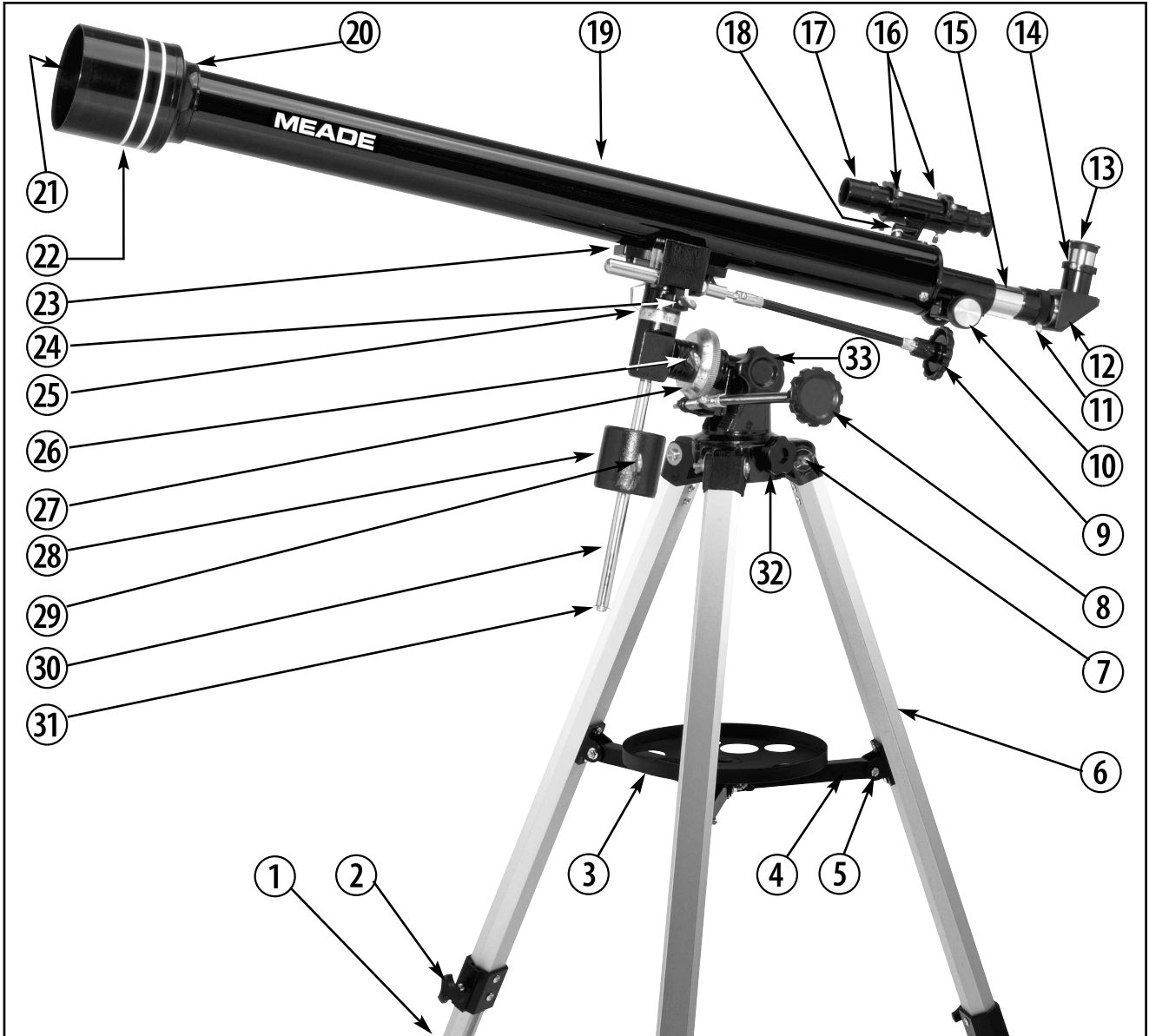


Fig. 1: Meade 60EQ-A 2.4" Equatorial Refracting Telescope

Features in Fig. 1:

- | | |
|---|------------------------------------|
| 1. Adjustable sliding inner leg extension | 17. Viewfinder |
| 2. Sliding leg extension lock | 18. Viewfinder bracket |
| 3. Accessory tray | 19. Main optical tube |
| 4. Leg brace | 20. Object lens cell |
| 5. Leg brace support | 21. Dust cap (not visible) |
| 6. Tripod legs | 22. Dew shield/lens shade |
| 7. Tripod-to-mount attachment point | 23. Optical tube saddle plate |
| 8. Right ascension control cable | 24. Declination lock |
| 9. Declination control cable | 25. Declination setting circle |
| 10. Focuser knob | 26. Right ascension lock |
| 11. Diagonal mirror thumbscrew | 27. Right ascension setting circle |
| 12. Diagonal mirror | 28. Counterweight |
| 13. Eyepiece | 29. Counterweight lock |
| 14. Eyepiece holder and thumbscrew | 30. Counterweight shaft |
| 15. Focuser draw tube | 31. Counterweight safety washer |
| 16. Viewfinder collimation screws | 32. Azimuth adjustment lock |
| | 33. Latitude adjustment lock |

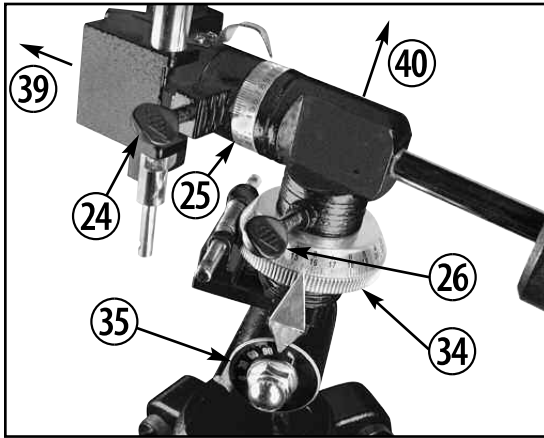


Fig. 2: Close up of the mount.

Features in Fig. 2:

- 24. Declination lock
- 25. Declination setting circle
- 26. Right ascension lock
- 34. Right Ascension setting circle
- 35. Latitude circle
- 39. Declination axis
- 40. Polar axis

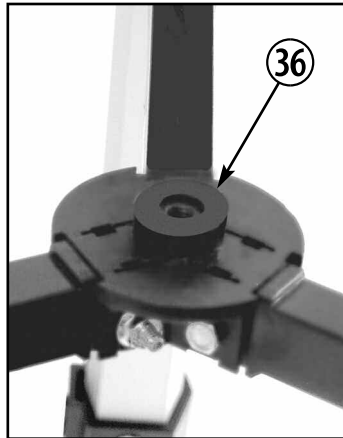


Fig. 3: Attaching the accessory tray.

Feature in Fig. 3:

- 36. Mounting bolt hole

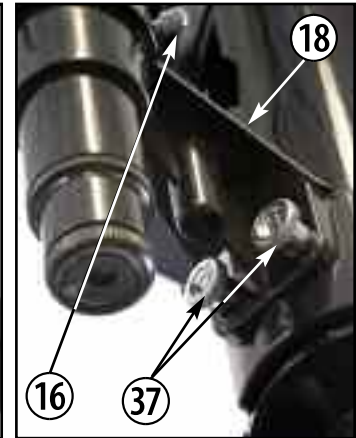


Fig. 4: Attaching the viewfinder.

Features in Fig. 4:

- 16. Viewfinder collimation screws
- 37. Viewfinder bracket mounting thumbscrews

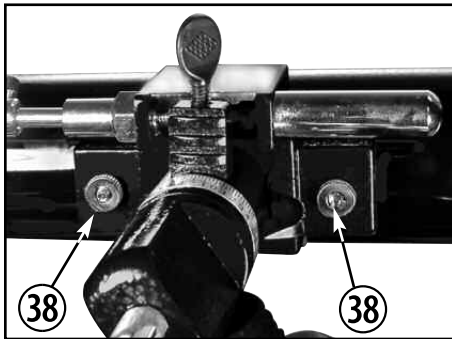


Fig. 5: Attaching the Optical Tube. Underside view of the optical tube saddle plate.

Feature in Fig. 5:

- 38. Optical tube attachment thumbscrews

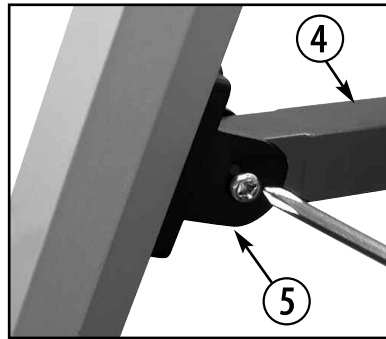


Fig. 6: Attaching a leg brace to a leg brace support.

Features in Fig. 6:

- 4. Leg brace
- 5. Leg brace support

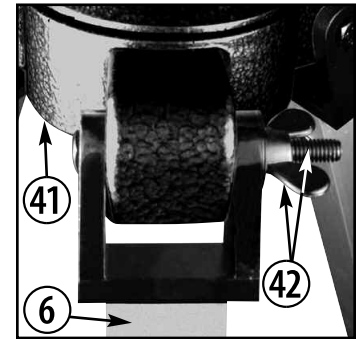


Fig. 7: Attaching tripod legs to telescope mount.

Features in Fig. 7:

- 6. Tripod leg
- 41. Telescope mount
- 42. Wingnut and bolt

STANDARD EQUIPMENT

- Complete optical tube assembly (objective lens diameter = 60mm; focal length = 900mm)
- Full-length, fully adjustable, aluminum tripod and accessory tray, with slots for extra eyepieces and other accessories
- MA 25mm (36X) eyepiece (1.25" O.D., "Outside Diameter"), MH 9mm (75X) eyepiece (1.25" O.D.)
- 2x Barlow lens
- Diagonal mirror (1.25" O.D.)
- 5x24mm viewfinder with bracket
- Complete equatorial mount with counterweight assembly
- Flexible control cables on both axes
- Hardware package: A. 3 bolts (2.5" long) with wing nuts and washers
B. 3 screws (1/2" long) with wing nuts and screwdriver tool
- Astronomy software (separate instructions supplied in software package)

INTRODUCTION

This manual details the set-up, operation, specifications and optional accessories of the Meade 60EQ-A 2.4" (60mm) Equatorial Refracting Telescope.

UNPACKING AND ASSEMBLY

1. Remove and identify the telescope's components, using the listing above.
2. Attach the 3 aluminum tripod legs (**6, Fig. 1**) to the base of the altazimuth mount (**7, Fig. 1**) with the 3 leg braces supports (**5, Fig. 1**) facing inward. Three bolts each about 2.5" long, with washers and wing nuts (**42, Fig. 7**), are provided for this purpose in a hardware package. Stand the telescope upright, spreading the tripod legs evenly apart so that the accessory tray can be positioned to attach to the 3 leg braces.
3. Use the provided 3 short screws, washers and bolts to attach the accessory tray (**3, Fig. 1**) to the tripod. Line up one of the leg braces (**4, Fig. 1**) between the opening of one of the tripod leg brace supports (**5, Fig. 1**) on the tripod so that one of the short screws will be able to pass through the holes of the leg brace support and the leg brace. Using a Phillips-head screwdriver, thread one of the short screws through the hole. Place a washer on the other end, followed by the matching nut. Tighten to a firm feel. Repeat this procedure until all 3 leg braces are mounted on the 3 leg brace supports. See **Fig. 6**.
4. To attach the accessory tray (**3, Fig. 1**) to the leg braces (**4, Fig. 1**), place the round accessory tray over the over mounting bolt hole (**36, Fig. 3**). Threading the attachment knob into the the mounting hole on top of the tray and turning the knob clockwise. Tighten to a firm feel, but do not overtighten—you will need to remove the tray if you wish to collapse the tripod. To remove the tray, just rotate the knob counterclockwise and remove the knob. You can then lift and remove the tray.
5. Extend the sliding center portion of the adjustable height tripod leg (**1, Fig. 1**) to the desired length for all 3 legs. Lock the tripod legs by tightening the leg lock thumbscrew (**2, Fig. 1**) to a firm feel.
6. Holding the counterweight (**28, Fig. 1**) firmly in one hand, slip the counterweight onto the counterweight shaft (**30, Fig. 1**). Attach the counterweight and counterweight shaft, by supporting the unlocked counterweight firmly in one hand while threading the counterweight shaft into the base of the Declination axis of the telescope's equatorial mount (see position in **Fig. 1**). Once firmly attached, slide the counterweight about 2 inches from the bottom of the counterweight shaft and secure it in place with the counterweight lock (**29, Fig. 1**) of the counterweight. **Note:** If the counterweight ever slips, the secured threaded safety washer/screw (**31, Fig. 1**) will not let the weight slide entirely off the counterweight shaft. **Be certain that this safety washer/screw is always in place.**
7. Attach the flexible cables (**8, Fig. 1**) and (**9, Fig. 1**), as shown. These cables are secured in place with a firm tightening of the thumbscrews located at the attachment ends of each cable.
8. Tilt the polar axis (**40, Fig. 2**) of the telescope to roughly a 45° angle with the horizon. This tilt is accomplished by first loosening the latitude adjustment lock (**33, Fig. 1**), adjusting the mount and firmly re-tightening the latitude control lock.
9. Remove the optical tube attachment thumbscrews (**34, Fig. 3**) from the optical tube mounting bolts that are on the underside of the main optical tube (**19, Fig. 1**). Then lay the telescope optical tube assembly onto the saddle plate (**23, Fig. 1**) passing the mounting bolts through the holes in the saddle of the mount. Re-attach the attachment thumbscrews to the mounting bolts, and tighten to a firm feel. See **Fig. 5**. Be sure the focuser portion of the optical tube is on the same side of the saddle as the Declination control cable (**9, Fig. 1**).
10. Attach the viewfinder bracket (**18, Fig. 1**) to the telescope using the 2 thumbscrews provided (**37, Fig. 4**). The bracket fits over the two small bolts near the focus knob (**10, Fig. 1**). Thread the thumbscrews over the bolts and tighten to a firm feel. Slide the Viewfinder tube into the bracket and loosely tighten the tube. See "Aligning the Viewfinder" below.
11. Insert the diagonal mirror (**12, Fig. 1**) into the focuser drawtube (**15, Fig. 1**) and the 25mm eyepiece (**13, Fig. 1**) into the diagonal mirror. Secure each in place with a moderate tightening of the respective thumbscrews.

The telescope is now completely assembled. Before it can be affectively used, however, the viewfinder (**17, Fig. 1**) must be aligned with the main telescope.

ALIGNING THE VIEWFINDER

The wide field of view provided by the 5 x 24mm viewfinder (**17, Fig. 1**) permits easy object sighting prior to observation in the higher-power main telescope. To align the viewfinder, follow this procedure:

1. First remove the dust cap (**21, Fig. 1**, not visible in photo) from the dew shield/lens shade (**22, Fig. 1**). Then using the lowest power (25mm) eyepiece, point the *main* telescope at some well defined land target (e.g. the top of a telephone pole) at least 200 yards distant.
2. Look through the viewfinder and tighten or loosen, as appropriate, the viewfinder's 6 collimation screws (**16, Fig. 1 and Fig. 4**), until the cross hairs of the viewfinder are precisely centered on the same object already centered in the main instrument's field of view. *Hint:* Center the front of the viewfinder in the bracket using the 3 front ring thumbscrews, then make final object centering adjustments with the 3 back ring thumbscrews.
3. With this alignment accomplished, objects located first in the wide-field viewfinder will then be centered in the main telescope's field of view. Focusing of objects in the viewfinder is accomplished by turning the threaded eyepiece of the viewfinder. (**Note:** The viewfinder presents an image which is upside-down; this is customary in all astronomical viewfinders).

BALANCING THE TELESCOPE

In order for the telescope to move smoothly on its mechanical axes, it must first be balanced as follows:

Note: If the counterweight is positioned as recommended on the previous page—the telescope is already approximately balanced.

1. Loosen the Right Ascension lock (**26, Fig. 1**). With the R.A. lock loosened, the telescope mount will turn freely about the polar axis. Rotate the telescope about the polar axis so that the counterweight shaft (**30, Fig. 1**) is parallel to the ground (horizontal).
2. Loosen the counterweight's locking thumb screw (**29, Fig. 1**) and slide the counterweight (**28, Fig. 1**) along the shaft until the telescope remains in any given position without tending to drift up or down the polar axis. Then retighten the counterweight lock.

The telescope is now balanced.

UNDERSTANDING CELESTIAL MOVEMENTS AND COORDINATES

Understanding where to locate celestial objects and how those objects move across the sky is the key to enjoying the hobby of astronomy. Most amateur astronomers practice "star-hopping" to locate celestial objects. They use star charts or astronomical software to identify bright stars and star patterns as "landmarks" in their search for astronomical objects. Another technique for locating objects is use the setting circles that are provided on your telescope. See Step #6, page 9.

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.

All stars and celestial objects are mapped onto an imaginary sphere surrounding the Earth. This mapping system is similar to the system of latitude and longitude on Earth surface maps.

In mapping the surface of the Earth, lines of longitude are drawn between the North and South Poles and lines of latitude are drawn in an East-West direction, parallel to the Earth's equator. Similarly, imaginary lines have been drawn to form a latitude and longitude on the celestial sphere. These lines are known as **Right Ascension** and **Declination**. The path an object follows through the sky is known as Right Ascension (R.A.). The angle of this path an object follows is known as Declination (Dec.).

The celestial map also contains two poles and an equator just like a map of the Earth. The celestial poles are defined as those two points where the Earth's North and South poles, if extended to infinity, would cross the celestial sphere. Thus, the North Celestial Pole (see **Fig. 8**) is that point in the sky where the North Pole intersects the celestial sphere. The North Star, Polaris, is located very near the North Celestial Pole. The celestial equator is a projection of the Earth's equator onto the celestial sphere.

So just as an object's position on the Earth's surface can be located by its latitude and longitude, celestial objects may also be located using Right Ascension and Declination. *For example:* You can locate Los Angeles, California, by its latitude (+34°) and longitude (118°). Similarly, you can locate the Ring Nebula

(also known as “M57”) by its Right Ascension (18hr) and its Declination (+33°).

■ **Right Ascension (R.A.):** This celestial version of longitude is measured in units of hours (hr), minutes (min), and seconds (sec) on a 24-hour “clock” (similar to how Earth’s time zones are determined by longitude lines). The “zero” line was arbitrarily chosen to pass through the constellation Pegasus, a sort of cosmic Greenwich meridian. R.A. coordinates range from 0hr 0min 0sec to 23hr 59min 59sec. 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 zero R.A. grid line (0hr 0min 0sec) carry higher R.A. coordinates. See **Fig. 8**.

■ **Declination (Dec.):** This celestial version of latitude is measured in degrees, arc-minutes, and arc-seconds (e.g., 15° 27' 33"). Dec. locations North of the celestial equator are indicated with a plus (+) sign (e.g., the Dec. of the North celestial pole is +90°). Dec. locations South of the celestial equator are indicated with a minus (–) sign (e.g., the Dec. of the South celestial pole is –90°). Any point on the celestial equator (such as the constellations of Orion, Virgo, and Aquarius) is said to have a Declination of zero, shown as 0° 0' 0." See **Fig. 8**.

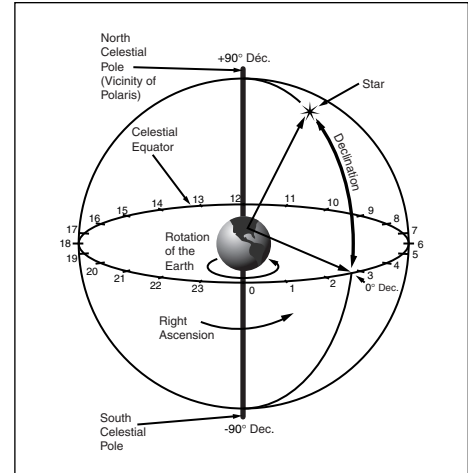


Fig. 8: Celestial Sphere.

As all celestial objects therefore may be located with their celestial coordinates of Right Ascension and Declination, the task of finding objects (in particular, faint objects) in the telescope is vastly simplified. The setting circles, R.A (34, Fig. 2) and Dec. (25, Fig. 2) of your telescope may be dialed, in effect, to read the object coordinates and the object found without resorting to visual location techniques. However, these setting circles only perform correctly if the telescope is properly aligned with the North Celestial Pole.

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 rotation). During any 24 hour period, stars make one complete revolution about the pole, circling with the pole at the center. By lining up the telescope’s polar axis (40, Fig. 2) 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,” by moving the telescope about one axis, the polar axis.

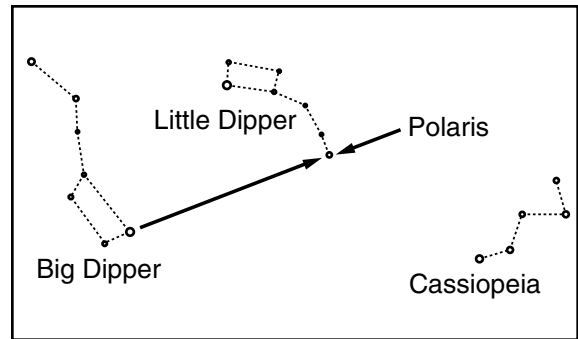


Figure 9: Finding Polaris

If the telescope is reasonably well aligned with the pole, therefore, very little use of the telescope’s Declination flexible cable control is necessary and 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 whatsoever). 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.

POLAR ALIGNMENT OF THE EQUATORIAL MOUNT

To line up the Meade 60EQ-A with the pole, follow this procedure:

1. Release the Azimuth lock (32, Fig. 1) of the Azimuth base, so that the entire telescope-with-mounting may be rotated in a horizontal direction. Rotate the telescope until it points due North. Use a compass or locate Polaris, the North Star (see Fig. 9), 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 (**33, Fig. 1**) and tilt the telescope mount so that the star “Polaris” is centered in the telescope’s viewfinder eyepiece, then re-tighten the latitude lock.
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 you need to perform each time you use the telescope is to point the polar axis due North, as described in step (1) above.

USING THE TELESCOPE

1. With the telescope aligned to the Pole, you are now ready to begin observations.
 - a. First, decide on an easy to find object. Land objects, during the daytime are a good way to become accustomed to the functions and operations of the telescope. At night, try observing the Moon, if it is visible, or a bright star.
 - b. Slightly loosen the telescope’s R.A. lock (**26, Fig. 1**) and Declination lock (**24, Fig. 1**). With a slight amount of hand-pressure the telescope should now be able to turn freely on its 2 axes.
 - c. Using the aligned viewfinder (**17, Fig. 1**), sight-in the object you have chosen. With the object centered on the viewfinder’s cross hairs, re-tighten the R.A. and Declination locks.
 - d. The object should now be somewhere in the main telescope’s field of view. Next, using the 25mm eyepiece, precisely center the object in the main telescope’s field of view, and sharply focus the image by turning the focus knob (**10, Fig. 1**). The 25mm eyepiece included as standard equipment is the best eyepiece to use for the initial finding and centering of any object. The 25mm eyepiece presents a bright, wide field of view, ideal for terrestrial and general astronomical observing of star fields, clusters of stars, nebulae, and galaxies. For lunar and planetary viewing, switch to a higher power eyepiece such as the 9mm—conditions permitting. 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 higher powers at the time you are observing.
 - e. Note that the object immediately starts to drift out of the field of view. This motion is caused by the Earth’s rotation. If your telescope is polar aligned, you can “track” the object and keep it in the field of view by turning the R.A. control cable (**8, Fig. 1**). Objects will appear to move through the field of view more rapidly at higher powers. **Note:** The Declination control cable (**9, Fig. 1**) is used only for centering purposes, and not for tracking.
2. Avoid touching the eyepiece while observing through the telescope. Vibrations resulting from such contact will cause the image to move. Avoid observing sites where ground-based vibrations may shake the tripod. Viewing from the upper floors of a building may also introduce image movement.
3. Allow a few minutes for your eyes to become “dark adapted” before attempting observations. Use a red-filtered flashlight to protect your night vision when reading star maps or inspecting components of the telescope.
4. 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.
5. Certain atmospheric conditions can distort an observed image. Planets, in particular, viewed while low on the horizon often exhibit lack of sharpness—the same object when observed higher in the sky will appear to be much better resolved with far greater contrast. Also, turbulent air in the upper atmosphere can cause the images to “shimmer” in the eyepiece—reduce power until the image steadies. Keep in mind that a bright, clearly resolved, but smaller image will show far more interesting detail than a larger, dimmer, fuzzy image.
6. Setting Circles: These etched dials (**25, Fig. 1**) and (**27, Fig. 1**) aid in the location of faint celestial objects, perhaps, not easily found by direct visual observation. To use the setting circles, follow this procedure:

- a. Using a star chart or star atlas, look up the celestial coordinates (Right Ascension and Declination) of an easy to find object, such as a bright star.
- b. With the telescope polar aligned as previously described, center the object in the telescope's field of view.
- c. Manually turn the R.A. setting circle (**27, Fig. 1**) to read the R.A. of the object now in the telescopic field.
- d. The setting circles are now calibrated (the Declination circle is factory pre-calibrated). To locate a faint object using the setting circles, determine the 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 Declination of the object you are attempting to locate. If the above procedure has been carefully performed, the faint object will now be located in the vicinity of the telescope's telescopic field in a low power eyepiece.
- e. The R.A. circle must be re-calibrated to the R.A. of a known object each time the setting circles are used, which may be several times in one observing session.

APPLICATIONS OF THE TELESCOPE

The number of fascinating objects visible through your Meade refractor is limited only by your own imagination. Astronomical software, or a good star atlas 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, with the satellite positions changing each night.
- Saturn and its famous ring system, as well as several faint moons.
- The Moon: A veritable treasury of craters, mountain ranges and fault lines. The best viewing of the Moon is during its crescent phases. Images observed during the full Moon phase will be poor due to the angle of illumination.
- Deep-Space: Nebulae, galaxies, multiple star systems, star clusters—hundreds of such objects can be located through the Meade 60EQ-A. These objects are best observed under dark skies.
- Terrestrial Objects: Your Meade refractor may also be used for the observation of land subjects. In this case, note that the diagonal mirror results in an image which is reversed left-for-right, but which is correctly oriented up-and-down. For a fully corrected image, the #928 Erect Image Prism system is required. (See "OPTIONAL ACCESSORIES"). Terrestrial observations should almost always be made using a low-power eyepiece for bright, sharp images. Land objects will not normally accept higher powers because the telescope is being used through the thickest part of the Earth's atmosphere, unlike astronomical observations made by pointing the telescope up through the atmosphere.

CALCULATING POWER

The power, or magnification, at which a telescope is operating is determined by 2 factors: The optical, or focal, length of the telescope's objective lens and the focal length of the eyepiece. The focal length of the Meade 60EQ-A is 900mm. To compute power, divide the focal length of the eyepiece into the focal length of the objective lens. The result is the magnifying power of the telescope. For example, when the 25mm eyepiece is used with the Meade 60EQ-A:

$$\text{Power} = 900\text{mm} \div 25\text{mm} = 36\text{X}$$

The Barlow lens serves to increase the power of each eyepiece. Insert the 2X Barlow lens into the the diagonal prism, followed by the eyepiece, and secure by tightening the respective thumbscrews. For example, the 25mm (36X) eyepiece, when used in conjunction with the 3X Barlow Lens, provides 108X. The 9mm eyepiece provides 100X; when used the 2X Barlow, it provides 200X.

The letters "MA" refers to the "Modified Achromatic" optical design, which yields corrected images with refractor telescopes. The optical design has no bearing on the power of the eyepiece.

A few words of wisdom about power. While the theoretical power or magnification of a telescope is virtually limitless, there are, however, practical limits imposed by the Earth's atmosphere as to what can be

seen well at a given power. The most often useful higher magnification with any 60mm diameter telescope is in the range of 80 to 120 power. The general rule to follow with any telescope, regarding power: Only use as much magnification as supports a steady, well-defined image. This often varies with the stability of the air being viewed through and is one reason why having various eyepieces is highly desirable. Higher powers are no guaranty of better images; in fact, the opposite is often true. Also, keep in mind, that land viewing and wide-field, deep-space observation are low power applications of your telescope.

MAINTENANCE

As with any quality optical instrument, lens surfaces should be cleaned as infrequently as possible. A little dust on the surface of the objective (front) lens causes negligible degradation of image quality and should not be considered reason to "clean" the lens. When lens cleaning does become necessary, use a camel's hair brush or compressed air blown gently to remove dust. Wipe only with a soft, clean cloth, applying as little pressure as possible to avoid scratching glass surfaces. **Note:** Remove the dew shield/lens shade (**22, Fig. 1**) to access the objective lens (**20, Fig. 1**) for cleaning.

SPECIFICATIONS

Focal Length	.900mm
Aperture (Diameter)	.60mm (2.4")
Eyepieces:	.MA 25mm, MH 9mm
f/ratio	.f/15
Mounting Type	.Equatorial

OPTIONAL ACCESSORIES

See your Meade or full-service Meade dealer for further details on any of these accessories.

#928 45° Erecting Prism (1.25 O.D.): Correctly orients the telescopic image during terrestrial observing and yields an image position at a 45° angle to the main telescope tube, resulting in a more comfortable observing position in most cases.

Additional Eyepieces (1.25" barrel diameter): For higher or lower magnifications with the telescopes that accommodate 1.25" eyepieces, Meade 3-element Modified Achromatic eyepieces, available in focal lengths of various sizes, provide a high level of image resolution and color correction at an economical price. Also, at slightly higher prices, Meade 4-element Series 3000 Plössl eyepieces yield wider fields of view with excellent edge-of-field corrections and are available in a range of focal lengths including 5, 6.7, 9.5, 16, 25, and 40mm.

Basic Camera Adapter (1.25" O.D.): Permits direct attachment of 35mm SLR cameras to the telescope. (Requires T-Mount for your specific brand of camera). Suitable for lunar disk and land photography.

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