

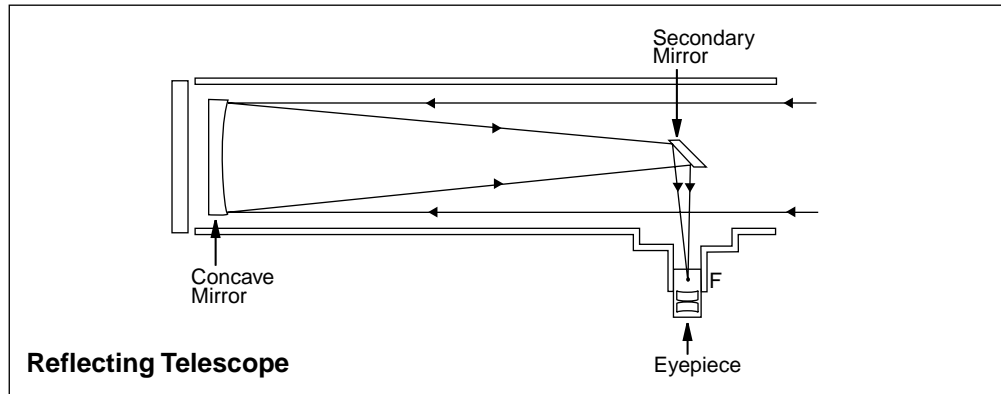
# Instruction Manual

## DS-114AT Reflecting Telescope



**Meade Instruments Corporation**

**Reflecting Telescopes** use a concave primary mirror to collect light and form an image. In the Newtonian type of reflector, light is reflected by a small, flat secondary mirror to the side of the main tube for observation of the image. Light is collected by a concave mirror and brought to a focus at F.





## WARNING!

**Never use a Meade® DS-114AT Telescope to look at the Sun!** Looking at or near the Sun will cause instant and irreversible damage to your eye. Eye damage is often painless, so there is no warning to the observer that damage has occurred until it is too late. Do not point the telescope or its viewfinder at or near the Sun. Do not look through the telescope or its viewfinder as it is moving. Children should always have adult supervision while observing.

## CAUTION:

Use care to install batteries as indicated by the battery compartment. Follow battery manufacturer's precautions. Do not install batteries backward or mix new and used batteries. Do not mix battery types. If these precautions are not followed, batteries may explode, catch fire, or leak. Improperly installed batteries void your Meade warranty.

**If you are anxious to use your DS-114AT Telescope for the first time, before a thorough reading of this instruction manual, see the QUICK-START GUIDE on page 4.**

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# QUICK-START GUIDE

This Quick Start procedure explains how to set up your DS-114AT for manual viewing. If you wish to make observations using the Autostar handbox, please turn to **HOW TO ASSEMBLE YOUR TELESCOPE**, page 10 and take the time and care necessary to assemble *all* the components that are supplied with this telescope.



1. **Remove the optical tube and tripod from the gift-box.**

Perform this setup on a flat, stable surface. It is recommended that you perform this operation in the daytime or in bright light the first time you assemble the telescope.

The optical tube assembly is shipped with the cradle rings, yoke mount, and tripod attached. Carefully remove the assembly from the box. Lay the assembly on the floor.



2. **Remove the optical tube from the mount.**

The optical tube is shipped oriented the wrong direction in the yoke mount for observing—you must remove the tube from the mount and turn it around 180°.

Loosen the cradle ring lock knobs and move the knobs out of the way so that you can open the cradle rings. Once the rings are open, remove the optical tube from the cradle rings.



3. **Stand the tripod and orient the cradle rings.**

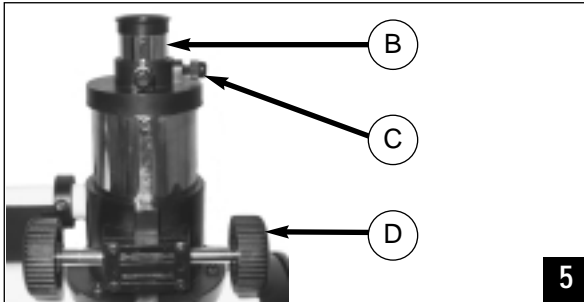
Stand the tripod on a flat surface and gently pull the legs apart to a fully open position. Turn the cradle rings so that the ring base is horizontal (parallel) to the ground. Tighten the alt lock (A) to a firm feel, so the rings remain in that position.



**4. Attach and balance the optical tube.**

Turn the optical tube around and replace it into the cradle rings. Fasten the cradle rings lock knobs so that they only hold the optical tube loosely; do not tighten the lock knobs yet. Note the optical tube's and the yoke's orientation in photo.

Slide the tube back and forth until you find a position where the tube remains horizontal (*i.e.*, without tipping up or down). Then tighten the cradle rings lock knobs to a firm feel.



**5. Insert the eyepiece.**

Remove the supplied 25mm eyepiece (B) from its container and place it into the eyepiece holder. Tighten the thumbscrews (C) to a firm feel only. Remove the dust cover from the end of optical tube assembly. Use the focus knobs (D) to bring objects into focus.



**6. Adjust tripod.**

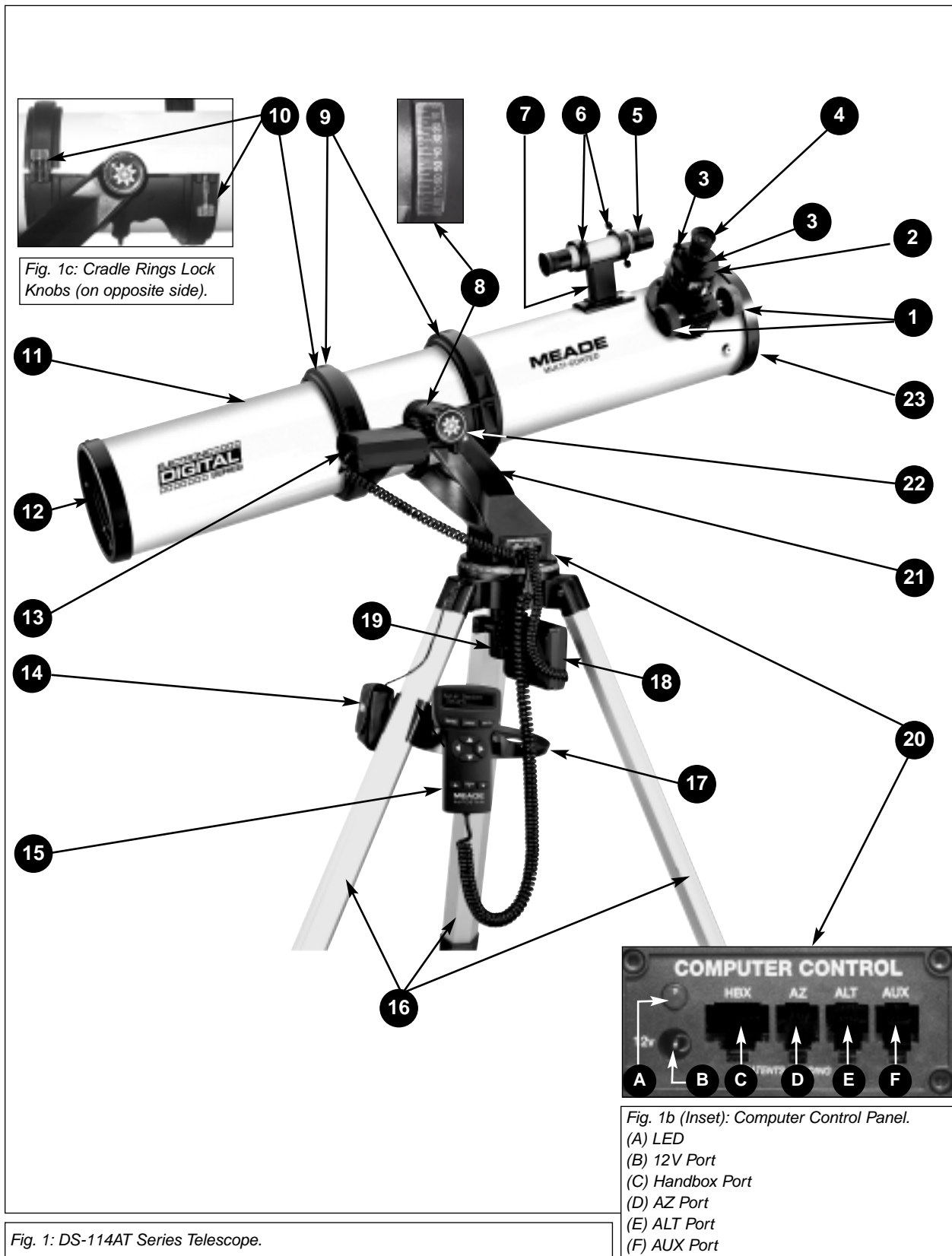
Adjust the height of the tripod by lifting the clip on each leg and extending the sliding inner section of each tripod leg to the desired length. Then press the clip back against the leg to lock in place.



**7. Sight along the tube.**

Sight along the side of the telescope's main tube to locate an object and then observe through the eyepiece.

**If you wish to attach the viewfinder, see page 10.**  
**If you wish to initialize Autostar, see page 15.**  
**If you wish to align the telescope, see page 17.**  
**If you wish to use Autostar to automatically view objects, see page 19 for some examples.**



# TELESCOPE FEATURES

The DS-114AT telescope has a variety of useful features. *Be sure to become acquainted with all of these controls before you begin making observations through the telescope.*

5 Want to learn more about the **viewfinder**? See pages 10 through 12.

12 Want to learn more about **collimation**? See pages 29 and 30.

15 Want to learn more about **Autostar's buttons**? See pages 8 and 9. **Autostar's menus**? See pages 22 through 27.

- 1 **Focus Knobs:** Move the telescope's focus drawtube in a finely-controlled motion to achieve precise image focus.
- 2 **Eyepiece Holder:** Holds the eyepiece in place.
- 3 **Eyepiece Holder Thumbscrews (2):** Tighten the eyepiece in place. Tighten to a firm feel only.
- 4 **Eyepiece:** Place one of the supplied eyepieces into the eyepiece holder (2, Fig. 1).
- 5 **Viewfinder:** Provides an easier way to initially sight objects than the main telescope eyepiece which has a narrower field of view.
- 6 **Viewfinder Alignment Screws (4):** Adjust these screws to align the viewfinder.
- 7 **Viewfinder Alignment Bracket:** Attaches the viewfinder to the telescope (11, Fig. 1).
- 8 **Alt Indicator:** Displays the angle (in degrees) of the altitude of the optical tube.
- 9 **Cradle Rings (2):** Hold optical tube securely in place.
- 10 **Cradle Ring Lock Knobs (2):** Tighten to a firm feel to hold the optical tube securely in place. Fig. 1c depicts a cradle ring clamped in place by one of the lock knobs and one of the lock knobs hanging loose.
- 11 **Optical Tube:** The main optical component that gathers the light from distant objects and brings this light to a focus for observation with the eyepiece.
- 12 **Primary Mirror Cell:** Contains the optical tube's primary mirror and 3 screws that are used in a collimation adjustment. **Note:** *Do not remove the piece of felt from the cell.*
- 13 **Alt (Vertical) Gear and Motor:** Moves the telescope along the vertical axis.
- 14 **Battery Pack:** Supplies power to the assembly. Install 10 user-supplied AA batteries.
- 15 **Autostar:** Autostar is able to control nearly all the functions of the telescope.
- 16 **Tripod Legs:** To use, spread the legs as far as they will open. Adjust the height of the tripod by lifting the clip on each leg and extending the sliding inner section of each tripod leg to the desired length. Then press the clip back against the leg to lock in place.
- 17 **Accessory Tray:** Conveniently holds extra eyepieces, Autostar, and other accessories.
- 18 **Az (Horizontal) Gear and Motor:** Moves the telescope along the horizontal axis.
- 19 **Az Lock:** Controls the manual horizontal movement of the telescope. Turning the Alt lock counterclockwise unlocks the telescope enabling it to be freely moved by hand on the horizontal axis. Turning the Alt lock clockwise (to a firm feel only) prevents the telescope from being moved manually and engages the vertical motor drive clutch for Autostar operation.
- 20 **Computer Control Panel (Fig. 1b)**
  - A. **LED:** The red power indicator light illuminates when power (*i.e.*, the battery pack) is supplied to the Autostar handbox and to the telescope's motor drive.
  - B. **12V:** Plug the battery pack into this port.
  - C. **Handbox (HBX) Port:** Plug the #494 Autostar handbox into this port.
  - D. **Azimuth (AZ) Port:** Plug the Az motor into this port.
  - E. **Altitude (ALT) Port:** Plug the Alt motor into this port.
  - F. **Auxiliary (AUX) Port:** Provides connection for Meade accessories.
- 21 **Yoke Mount:** Along with the cradle rings, holds the optical tube assembly (11, Fig. 1).
- 22 **Alt Lock:** Controls the manual vertical movement of the telescope. Turning the Alt lock counterclockwise unlocks the telescope enabling it to be freely tilted by hand on the vertical axis. Turning the Alt lock clockwise (to a firm feel only) prevents the telescope from being moved manually and engages the vertical motor drive clutch for Autostar operation.
- 23 **Dust Cap:** Pull to remove the dust cap from the front lens of the telescope.

**Note:** *The dust cap should be replaced and the power turned off to the telescope after each observing session. Verify that any dew that might have collected during the observing session has evaporated prior to replacing the dust cap.*



# AUTOSTAR FEATURES

Control of the DS-114AT Series Telescopes is through the operation of the #494 Autostar handbox. Nearly all functions of the telescope can be operated with just a few pushes of Autostar's buttons. Some of the major features of Autostar are:

- Automatically move the telescope to any of the 1400 objects stored in the database or manually enter the astronomical coordinates of any celestial object.
- Take a guided tour of the best celestial objects to view on any given night of the year.
- Access a glossary of astronomical terms.
- Calculate which eyepiece to use for optimum viewing of a celestial object.

Autostar has soft-touch keys and the LCD (Liquid Crystal Display) is backlit with a red LED (Light Emitting Diode) for easy viewing in the dark.

**NOTE:** Autostar does not require batteries; the telescope's batteries supply power to Autostar.



Fig. 2: #494 Autostar Handbox.

**TIP:** When a message is scrolling across the display, press and hold the Up Arrow key to increase the scrolling speed or press and hold the Down Arrow key to decrease the scrolling speed.

**DEFINITION:** Throughout this manual, you will notice the term "Alt/Az." Alt/Az is frequently used to refer to Altitude (vertical) and Azimuth (horizontal). Alt/Az is just one of many methods used by amateur astronomers to help locate stars in the night sky.

- 1 **2-Line LCD:** Displays Autostar menu and help information.
  - **Top line:** Displays the menu or category name.
  - **Bottom line:** Displays a menu option or information about a subject.
- 2 **ENTER Key:** When an option is displayed, press ENTER to enable the choice. When a menu is displayed, press ENTER to access the next menu or data level in the Autostar database. ENTER is similar to the RETURN key on a computer. See **MOVING THROUGH AUTOSTAR'S MENUS**, page 15 and **MENUS AND MENU OPTIONS**, page 22.
 

**NOTE:** If ENTER is pressed for two seconds or more and then released, Autostar emits a beep and "ENTER to Sync" is displayed. If the "ENTER to Sync" feature is accessed by mistake, press MODE to return to the previous screen. See **HIGH PRECISION**, page 26, for more details about this feature.
- 3 **MODE Key:** When a menu is displayed, press MODE to return to the previous menu or data level in the Autostar database. MODE is similar to the ESCAPE key on a computer.
 

**NOTE:** Pressing MODE while in the "Select Item" level moves Autostar to the top-most screen: "Select Item: Object."

**NOTE:** If MODE is pressed and held for two seconds or more, the following information is then available using the Scroll keys (6 and 7, Fig. 2):

  - Right Ascension and Declination (astronomical) coordinates
  - Altitude (vertical) and Azimuth (horizontal) coordinates
  - Local Time and Local Sidereal Time (LST)
  - Timer and Alarm Status

Press MODE again to return to the previous menu.
- 4 **GO TO Key:** Moves the telescope to the currently selected object. While the telescope is moving, the operation may be aborted at any time by pressing any key except GO TO. Pressing GO TO again resumes the operation.

The GO TO key also allows you to perform a "spiral search." A spiral search is useful when the telescope is commanded to go to an object, but that object is not visible in the eyepiece after the telescope finishes its search. (This sometimes occurs during the alignment procedure.) Press GO TO when the slew is finished and the telescope starts slewing in a spiral pattern at a very slow speed around the search area. Look through the eyepiece and when the object does become visible, press MODE to stop the spiral search. Then use the Arrow keys to center the object.



5 Want to learn more about **slew speeds**? See page 14.

- 5 **Arrow Keys:** Move the telescope in a specific direction (up, down, left, and right), at any one of nine different slew speeds.

The Arrow Keys can also be used to scroll through the letters of the alphabet and numerical digits. The Down Arrow key starts with the letter "A" and the Up Arrow key starts with the digit "9." The Left and Right Arrow keys moves the cursor left and right across the LCD display.

- 6, 7 **Scroll Keys:** Access options of the menu displayed on the top line of the screen. Options within the menu are displayed, one at a time, on the second line. Press the Scroll keys to move through the options. Press and hold a Scroll key to move quickly through the options, or to change scroll speeds of text.

The Scroll keys also scroll through the letters of the alphabet and numerical digits.

*Tip: When a message is scrolling across the display, press and hold the Up Scroll key to increase the scrolling speed, or press and hold the Down Scroll key to decrease the scrolling speed.*

*NOTE: The Scroll Down key and the Down Arrow key move forward through the alphabet & digits (A to Z, 0 to 9). The Scroll Up key and the Up Arrow key move backward (Z to A, 9 to 0). Common symbols are also available in the list.*

- 8 **Speed/? Key:** Press the Speed/? key to cycle through the nine slew speeds that move the telescope. Each time the Speed/? key is briefly pressed, the current speed will be shown for about two seconds on the display.

The Speed/? key also accesses the "Help" file. "Help" provides on-screen information for whatever task is currently active.

*NOTE: Pressing the Speed/? key very briefly changes the slew speed. Holding down the Speed/? key longer (one to two seconds) accesses the Help function.*

If you have a question about an Autostar operation (e.g., INITIALIZATION, ALIGNMENT, etc.), hold down the Speed/? key and follow the directions that scroll on the second line of the LCD screen. When a word appears in **[brackets]**, press ENTER to access the Autostar Glossary. A definition or more detailed information is displayed. Press MODE to return to the scrolling Autostar Help display.

When satisfied with the Help provided, press MODE to return to the original screen and continue with the chosen procedure.

- 9 **Coil Cord:** Plug the Autostar coil cord into the HBX port (**C, Fig. 1b**) of the computer control panel.



**DS-114AT TIPS**

### Join an Astronomy Club Attend a Star Party

A fun way to learn more about astronomy is to join an astronomy club. Check your local newspaper, school, library, or telescope dealer to find out if there's a club in your area.

At club meetings, you will meet other astronomy enthusiasts with whom you will be able to share your discoveries. Clubs are an excellent way to learn more about observing the sky, to find out where the best observing sites are, and to compare notes about telescopes, eyepieces, filters, tripods, and so forth.

Often, club members are excellent astrophotographers. Not only will you be able to study examples of their art, but you may even be able to pick up some "tricks of the trade" to try out on your DS-114AT telescope.

Many groups hold regularly scheduled star parties at which you can observe with many different telescopes and examine other pieces of astronomical equipment. Magazines such as *Sky & Telescope* and *Astronomy* print schedules for many popular star parties around the United States and Canada.

# GETTING STARTED

## Packing List

Assembling the telescope for the first time requires only a few minutes. When first opening the packing box, note carefully the parts listed on your giftbox.

## How to Assemble Your Telescope

The telescope attaches directly to the tripod. The telescope in this way is "mounted" in an "Altazimuth" ("Altitude-Azimuth," or "vertical-horizontal") format. The telescope mounted this way moves along the vertical and horizontal axes, corresponding to the astronomical axes known as Declination (vertical) and Right Ascension (horizontal).

Perform this setup on a flat, stable surface. It is recommended that you perform this operation in the daytime or in bright light the first time you assemble the telescope.



Fig. 3 Remove assembly from the giftbox.



Fig. 4: Adjust the cradle rings.



Fig. 5 Attach tray to the tripod:



Fig. 6: Attach and balance the optical tube.

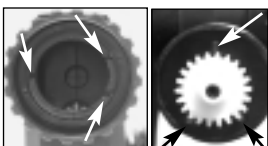


Fig. 7: Motor (left) and gear (right) assembly. Note the slots and the locator tabs.

1. **Remove the optical tube and tripod from the giftbox:** The optical tube assembly is shipped with the cradle rings (9, Fig. 1), yoke mount (21, Fig. 1), and tripod attached. Carefully remove the assembly from the box. Lay the assembly on the floor.
2. **Remove the optical tube from the mount:** The optical tube (11, Fig. 1) is shipped oriented the wrong direction in the yoke mount for observing—you must remove the tube from the mount and turn it around 180°. Loosen and unlatch the cradle ring lock knobs (10, Fig. 1) so that you can open the cradle rings (9, Fig. 1). Once the rings are open, remove the optical tube from the cradle rings. Carefully note the orientation of the tube, so that you can rotate it 180° later on when you replace it in the rings.
3. **Stand the tripod and adjust the cradle rings:** Stand the tripod on a flat surface and gently pull the legs (16, Fig. 1) apart to a fully open position. Turn the cradle rings so that the cradle ring base is horizontal (parallel) to the ground. Tighten the alt lock (22, Fig. 1), so the rings remain in the horizontal position.
4. **Attach the utility tray to the tripod:** Place one of the tray's flanges around one edge of a tripod leg and then pull the tray around until the other flange snaps in place (Fig. 5). The utility tray (17, Fig. 1) can be pushed up or down the tripod leg to a convenient height.
5. **Attach and balance the optical tube:** Turn the optical tube around 180° and replace it into the cradle rings. Fasten the cradle rings lock knobs (10, Fig. 1) so that they only hold the optical tube loosely; do not tighten the lock knobs yet. Slide the tube back and forth until you find a position where the tube remains horizontal (i.e., without tipping up or down). Then tighten the cradle rings lock knobs to a firm feel.
6. **Attach the Alt (vertical) motor to the Alt gear:** Place the knurled ring of the motor assembly over the Alt gear. Note that three small plastic tabs project outwards from the face of the gear (Fig. 7). These "locator" tabs fit into the mating slots inside the knurled ring. Wiggle the motor assembly over the gear assembly until the motor slips into place. Thread the knurled ring over the mating threads of the gear assembly to lock the motor. See Fig. 8. Tighten to a firm feel only.
7. **Attach the Az (horizontal) motor to the Az gear:** Attach the Az motor assembly to the the Az gear using the procedure described in step 6. See Fig. 9.
8. **Connect the motor assembly cords:** Plug the cord from the alt motor assembly into the Alt port (E, Fig.1b) of the computer control panel. Plug the cord from the az motor assembly into the Az port (D, Fig.1b) of the computer control panel.
9. **Attach the viewfinder bracket:** Use a Phillips-head screwdriver to thread the two attachment screws in the viewfinder bracket (these screws are placed inside the bracket at the factory) into the mating threads located on the optical tube (Fig. 10).
10. **Attach the viewfinder tube:** Carefully remove the rubber eyecup from the viewfinder before sliding the viewfinder into the bracket. Then slide the viewfinder, eyepiece-end first (the end to which the rubber cup was attached) into the viewfinder bracket. Replace the rubber eyecup. Tighten the four alignment thumbscrews (6, Fig. 1 and Fig. 11) to a firm-feel to hold the viewfinder in the bracket.
11. **Insert the eyepiece:** Remove the supplied 25mm eyepiece from its container and place it into the eyepiece holder (2, Fig. 1). Tighten the thumbscrew (3, Fig. 1) to a firm feel only.

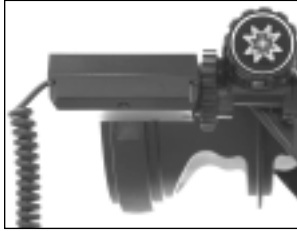


Fig. 8: Attach Alt motor.

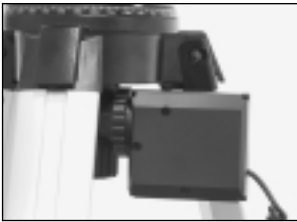


Fig. 9: Attach Az motor.



Fig. 10: Attach the viewfinder bracket to the optical tube.



Fig. 11: Attach the viewfinder tube to bracket and tighten thumbscrews.



Fig. 12: Insert 10 AA batteries into battery pack.

- Connect Autostar:** Plug the coil cord of the Autostar Controller into the HBX port (C, Fig.1b) of the computer control panel.

**WARNING:** Make sure you plug in Autostar **before** you plug in the battery pack.

**NOTE:** Autostar does not require batteries; the telescope's batteries supply power to Autostar.

- Insert batteries:** Install 10 AA user-supplied batteries into the battery pack (Fig.12), oriented as shown on the diagram on the battery slots of the battery holder.

**CAUTION:** Use care to install batteries as indicated by the battery compartment. Follow battery manufacturer's precautions. Do not install batteries backwards or mix new and used batteries. Do not mix battery types. If these precautions are not followed, batteries may explode, catch fire, or leak. Improperly installed batteries void your Meade warranty. Always remove the batteries if they are not to be used for a long period of time.

- Connect battery pack:** Plug the battery pack into the 12V port (B, Fig.1b) of the computer control panel. Attach the pack to one of the tripod legs using the Velcro fastener or set it on the utility tray.

- Adjust tripod:** Adjust the height of the tripod to a convenient viewing height by lifting the clip on each leg and extending the sliding inner section of the leg to the desired length. Then press the clip back against the leg to lock in place.

- Remove the dust cover:** Pull out the dust cover (23, Fig. 1) from the optical tube.

Assembly of the telescope is now complete.

## Some Notes About the Dual-Motor System

- For the motors to be operational, the Az and Alt lock-knobs (19, Fig. 1) and (22, Fig. 1) must be in their locked positions. *Firm-feel tightening of these locks is sufficient. Do not overtighten.* If these are not sufficiently tightened, Autostar may display a motor fault message.
- When setting up the telescope, *always* plug in the battery pack to the control panel last, after plugging in the two motors and Autostar. Connecting the battery pack to the control panel before the motors and Autostar are connected may result in false electrical signals being sent to the motors, causing them to malfunction. In this case unplug the battery pack from the control panel, wait a few seconds, and plug the battery pack back into the control panel. This operation clears the motors of any false signals.
- Take care that cords do not become wrapped around the telescope; keep the cords "loose" at all times. Do not allow the telescope to slew into the tripod or other fixed object. Do not touch or hold the telescope tube while it is moving.
- If the motors stall or do not have sufficient power to move the telescope, place fresh batteries in the battery pack. Long-life alkaline batteries are recommended.
- The first time you initialize your system, make sure you train the drives. This allows Autostar to move the telescope precisely to objects. See page 16 for detailed information.

## The Viewfinder

Because the main telescope has a fairly narrow field of view, locating objects directly in the main telescope can sometimes be difficult. The viewfinder (5, Fig. 1) is a small, wide-field telescope with crosshairs that permits you to locate objects more easily. When the viewfinder and optical tube are aligned to each other, both point to the same position in the sky. An object located in the viewfinder is therefore also positioned within the field of the main telescope. Before aligning the viewfinder to the optical tube, focus the viewfinder.

### Focusing the Viewfinder:

- Turn the viewfinder eyepiece on its internal thread. Generally a few turns are sufficient to achieve proper focus.

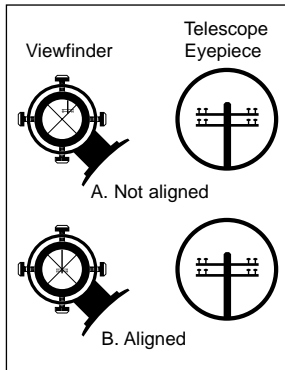


Fig. 13: Aligning the viewfinder. Note that objects appear upside-down and reversed left-for-right when observed in the viewfinder.

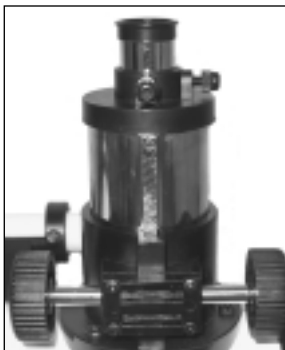


Fig. 14: Eyepiece and focuser assembly.



Fig. 15: Eyepiece and Barlow lens.

**DEFINITION:**

A capital "X" is used to denote an eyepiece's (or a Barlow's) power or magnification. For example, "40X" is read as "40-power."

**Aligning the Viewfinder:**

It is recommended that you perform steps 1 through 4 of this procedure during the daytime and step 5 at night.

1. Loosen the Az lock (19, Fig. 1) and the Alt lock (22, Fig. 1) by turning the locks about one turn counterclockwise, permitting the telescope to move freely on its axes.
2. If you have not already done so, place a low-power (e.g., 25mm) eyepiece in the eyepiece holder of the main telescope (2, Fig. 1) and point the telescope at an easy-to-find land object (e.g., the top of a telephone pole). Turn the focuser knob (1, Fig. 1) so that the image is sharply focused. Center the object precisely in the main telescope's field of view.
3. Re-tighten the Az lock (19, Fig. 1) and the Alt lock (22, Fig. 1).
4. Now, looking through the viewfinder, turn some or all of the viewfinder's alignment screws (6, Fig. 1) until the viewfinder's crosshairs point precisely at the same object as centered in the main telescope. The viewfinder is now aligned to the main telescope. The right-hand image in Fig. 13A shows an object centered in the main telescope before the viewfinder (the left-hand image) has been aligned to the main telescope. Fig. 13B shows these same images after the viewfinder and main telescope are aligned.
5. Check this alignment on a celestial object, such as the Moon or a bright star, and make any necessary refinements.

**Choosing an Eyepiece**

A telescope's eyepiece magnifies the image formed by the telescope's main optics. Each eyepiece has a focal length, expressed in millimeters, or "mm." The smaller the focal length, the higher the magnification. For example, an eyepiece with a focal length of 9mm has a higher magnification than an eyepiece with a focal length of 25mm.

Your telescope comes supplied with a low-powered 25mm eyepiece which gives a wide, comfortable field of view with high image resolution.

Low power eyepieces offer a wide field of view, bright, high-contrast images, and eye relief during long observing sessions. To find an object with a telescope, always start with a lower power eyepiece such as a 25mm. When the object is located and centered in the eyepiece, you may wish to switch to a higher power eyepiece to enlarge the image as much as practical for prevailing seeing conditions.

*NOTE: Viewing conditions vary widely from night-to-night and site-to-site. Turbulence in the air, even on an apparently clear night, can distort images. If an image appears fuzzy and ill-defined, back off to a lower power eyepiece for a more well-resolved image.*

The power (or magnification) of a telescope is determined by the focal length of the telescope and the focal length of the eyepiece being used. To calculate eyepiece power, divide the telescope's focal length by the eyepiece's focal length. For example, you may wish to use a 25mm eyepiece. Look up the focal length of the telescope under "Specifications," page 30. The focal length is listed as 910mm.

**Telescope focal length** divided by **Eyepiece focal length** = **Eyepiece power**

$$910 \div 25 = 37$$

The eyepiece power, or magnification is therefore 37X (approximately).

**The Barlow Lens**

Some Meade telescopes include a power multiplier called a Barlow lens. The Barlow supplied with the DS-114AT triples the power obtained by an eyepiece alone. In the example above, a 25mm eyepiece results in 37X magnification. When used with the supplied Barlow, the telescope optics result in a 111X magnification. To use the Barlow, insert it into the eyepiece holder, followed by the eyepiece (Fig. 15).



# OBSERVING

## Observing by Moving the Telescope Manually

If you wish to observe a distant land object, such as a mountain top or a bird, you can observe by merely pointing the telescope and looking through the eyepiece.

1. Loosen the telescope's Az lock (19, Fig. 1) and Alt lock (22, Fig. 1).
2. Move your telescope to point at distant street signs, mountains, trees, and other structures. Use your viewfinder to help site-in on an object.
3. Center the object in the viewfinder's crosshairs and then in the telescope eyepiece. When the object is centered in your eyepiece, remember to re-tighten the Az and Alt locks.
4. Practice focusing objects with the focus knob (1, Fig. 1).
5. Once you get a feel for how your telescope moves and focuses, try to view something more challenging, like a bird or a distant moving train.

You can also observe stars and objects in the night sky using this method, but note that objects begin to slowly drift across the eyepiece field. This motion is caused by the rotation of the Earth. As you become familiar with the Autostar handbox operation, you can counteract the drift using the automatic tracking feature in the Autostar Setup menu (see **TRACKING AN OBJECT AUTOMATICALLY**, page 14), or by using Autostar's GO TO capabilities (see **GO TO SATURN**, page 19).

## Terrestrial Observing

DS-114AT telescopes are excellent high-resolution, terrestrial (land) telescopes. Viewing terrestrial objects requires looking along the Earth's surface through heat waves. These heat waves often cause degradation of image quality. Lower power eyepieces, such as a 25mm eyepiece, magnify these heat waves less than higher power eyepieces. Therefore, lower power eyepieces provide a steadier, higher quality image. If the image is fuzzy or ill-defined, reduce to a lower power eyepiece, where the heat waves do not have such an effect on image quality. Observing in early morning hours, before the ground has built up internal heat, produces better viewing conditions than during late afternoon hours.

## Observing Using Autostar's Arrow Keys

You may observe land and astronomical objects using Autostar's Arrow keys to move the telescope.

1. Tighten the Alt lock (22, Fig. 1) and Az lock (19, Fig. 1).
2. Verify that Autostar is properly connected to your telescope.
3. Plug the battery pack into the 12V port.

The Autostar screen is activated and a copyright message displays briefly, followed by a short beep. Then Autostar takes a few moments to start up the system.

4. A message displays that warns not to look at the Sun. At the end of this message, press the key prompted by Autostar to signify that the message has been read and understood.



**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.**

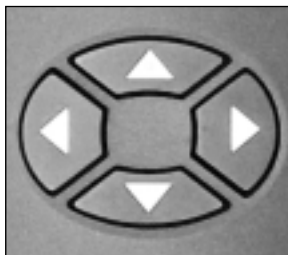


Fig. 16: Autostar's Arrow keys.

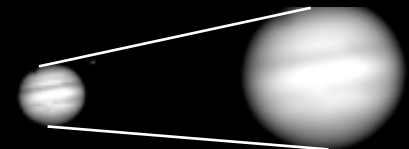
### DS-114AT TIPS

#### Too Much Power?

Can you ever have too much power? If the type of power you're referring to is eyepiece magnification, yes, you can! The most common mistake of the beginning observer is to "overpower" a telescope by using high magnifications which the telescope's aperture and atmospheric conditions cannot reasonably support. Keep in mind that a smaller, but bright and well-resolved image is far superior to one that is larger, but dim and poorly resolved (see below). Powers above 200X should be employed only under the steadiest atmospheric conditions.

Autostar can calculate the best eyepiece for you to use. Try out the "Eyepiece Calc" feature in the Utilities menu.

Most observers should have three or four additional eyepieces to achieve the full range of reasonable magnifications possible with the DS-114AT telescopes. See "OPTIONAL ACCESSORIES," page 31.



**Fig. 17a & 17b: Jupiter; example of too much magnification.**

5. The Arrow keys are now activated. Press the Arrow keys (**5, Fig. 2**) to slew (move) the telescope up, down, right, or left.
6. Press the SPEED/? key (**8, Fig. 2**) to change the telescope's slew speed. See **SLEW SPEEDS**, below, for more information.
7. Use the viewfinder (**5, Fig. 1**) to locate an object and practice using the Autostar's Arrow keys to center the object in the telescope eyepiece's field of view.
8. Use the telescope's focus knob (**1, Fig. 1**) to bring the object into focus.

## Slew Speeds

Autostar has nine slew speeds that are directly proportional to the sidereal rate (see **TRACKING AN OBJECT AUTOMATICALLY** below for a definition of "sidereal rate") and have been calculated to accomplish specific functions. Pressing the SPEED/? key changes the slew speed, which is shown for about two seconds on Autostar's display.

The nine available speeds are:

- Speed 1 = 2x = 2 x sidereal (0.5 arc-min/sec or 0.008°/sec)
- Speed 2 = 8x = 8 x sidereal (2 arc-min/sec or 0.033°/sec)
- Speed 3 = 16x = 16 x sidereal (4 arc-min/sec or 0.067°/sec)
- Speed 4 = 32x = 32 x sidereal (8 arc-min/sec or 0.13°/sec)
- Speed 5 = 64x = 64 x sidereal (16 arc-min/sec or 0.27°/sec)
- Speed 6 = 0.5° = 120 x sidereal (30 arc-min/sec or 0.5°/sec)
- Speed 7 = 1°/s = 240 x sidereal (60 arc-min/sec or 1°/sec)
- Speed 8 = 2°/s = 480 x sidereal (120 arc-min/sec or 2°/sec)
- Speed 9 = Max = (Maximum speed possible, dependent on battery power)

**Speeds 1, 2, or 3:** Best used for fine centering of an object in the field of view of a higher power eyepiece, such as a 12mm or a 9mm eyepiece.

**Speeds 4, 5, or 6:** Enables centering an object in the field of a low-to-moderate power eyepiece, such as a standard 25mm eyepiece.

**Speeds 7 or 8:** Best used for rough centering of an object in the eyepiece.

**Speed 9:** Moves the telescope quickly from one point in the sky to another.

## Observe the Moon

Point your telescope at the Moon (note that the Moon is not visible every night) and practice using the Arrow keys and the slew speeds to view different features. The Moon contains many interesting features, including craters, mountain ranges, and fault lines. The best time to view the Moon is during its crescent or half phase. Sunlight strikes the Moon at an angle during these periods and adds a depth to the view. No shadows are seen during a full Moon, causing the overly bright surface to appear flat and rather uninteresting. Consider the use of a neutral density Moon filter when observing the Moon. Not only does it cut down the Moon's bright glare, but it also enhances contrast, providing a more dramatic image.

## Astronomical Observing

Used as an astronomical instrument, your telescope has many optical and electromechanical capabilities. It is in astronomical applications where the high level of optical performance is readily visible. The range of observable astronomical objects is, with minor qualification, limited only by the observer's motivation.

## Tracking an Object Automatically

As the Earth rotates beneath the night sky, the stars appear to move from East to West. The speed at which the stars move is called the sidereal rate. You can set up your telescope to move at the sidereal rate so that it automatically "tracks" the stars and other objects in the night sky. If the telescope is not tracking an astronomical object, the object will drift out of the eyepiece field of view. The tracking function automatically keeps an object more or less centered in the telescope's eyepiece.

To automatically track objects, you must first set the telescope in the home position, then initialize Autostar, train the drive, and finally select "Targets: Astronomical" from the Autostar Setup menu. You must also learn how the Autostar keypad operates in order to move through the Autostar menus.

### WARNING:

*Do not look through the telescope's eyepiece or viewfinder while it is rapidly moving. Children should always have adult supervision while observing.*

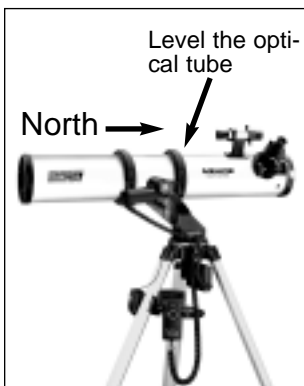


Fig. 18: Alt/Az Home Position.

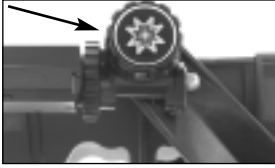


Fig. 19: The Alt lock (motor attached).

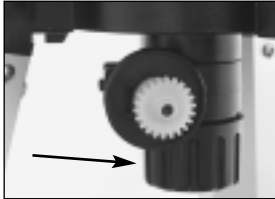


Fig. 20: The Az lock (motor not attached).

**DEFINITION:**

**Initialization** is a procedure that ensures Autostar operates correctly. When you first use Autostar, it doesn't yet know where the observation site is or the time or date of the observation session.

During the procedure, you will enter information, such as the current time and date, and observation location. Autostar uses this information to precisely calculate the location of celestial objects (such as stars and planets) and to move your telescope correctly for various operations.

## The "Alt/Az" Home Position

1. Loosen the telescope's Alt lock (**Fig. 19**).
2. Level the optical tube and tripod base.
3. Tighten the Alt lock (**Fig. 19**) to a firm feel only.
4. Loosen the Az lock (**Fig. 20**) and turn the telescope horizontally until it points North. See **LOCATING THE CELESTIAL POLE**, page 32 for more information.
5. Tighten the Az lock. Press ENTER.

## Moving Through Autostar's Menu

The Autostar database is organized in levels for quick and easy navigation.

- Press ENTER to go deeper into Autostar's menu levels.
- Press MODE to move back toward the top menu level.
- Press the Scroll keys to move up and down through the options available for each level.
- Press the Arrow keys to enter characters and digits.

The Arrow keys are also used to move the telescope.

## Initializing Autostar

This section describes how to initialize Autostar. Perform this procedure the first time you use Autostar or after performing a RESET (see **RESET**, page 27).

1. **Tighten Locks:** Make sure that the Alt lock (**22, Fig. 1**) and Az lock (**19, Fig. 1**) are secured.
2. **Connect Autostar:** Verify that Autostar is properly connected to your telescope.
3. **Supply Power:** Plug the battery pack into the 12V port.  
The Autostar screen activates and a copyright message displays briefly, followed by a short beep. Then Autostar takes a few moments to start up the system.
4. **Sun Warning:** A message displays that warns you not to look at the Sun. At the end of this message, press the key prompted by Autostar to signify that the message has been read and understood.
5. **Getting Started:** The Getting Started menu displays a scrolling message. Press ENTER (**2, Fig. 2**) to bypass the Help tutorial and continue with initialization.
6. **Enter Date:** Autostar then requests the current date. Use the Up and Down Arrow keys (**5, Fig. 2**) to enter the digits for the date. Use the Right Arrow key (**5, Fig. 2**) to move right from one number to the next in the day display, and also to move to the month (use the Left Arrow key if you wish to move left). Then, use the Scroll keys (**6 or 7, Fig. 2**) to cycle through the list of months.  
When the current month is displayed, use the Right Arrow (**5, Fig. 2**) to move to the year. Use the Up and Down Arrow keys to enter all four digits of the current year. Press ENTER when the date has been entered.
7. **Enter Time:** Autostar then requests the current time. Use the Up and Down Arrow keys to enter the time. (Use a "0" for the first digit if less than 10.) Use the Right (or Left) Arrow key to move from one number to the next. Press either the Up or Down Arrow keys (**5, Fig. 2**) to scroll to "AM" or "PM." If you select the "blank" choice that follows "AM" and "PM," the clock displays time in a 24-hour (military time) format. Press ENTER to start the clock.
8. **Daylight Savings Time:** The next screen requests the status of Daylight Savings Time. Pressing a Scroll key toggles between the YES/NO settings. Select the desired setting by pressing ENTER.

**NOTE:** Daylight Savings Time may be referred to by a different name in various areas of the world.

**NOTE:** When multiple choices are available within a menu option, the current option is usually displayed first and highlighted by a right pointing arrow (>).

9. **Select Country:** The next screen asks for the country or state of the observing site. Use the Scroll keys to cycle through the database of countries, states, and provinces (listed alphabetically). Press ENTER when the correct location displays.



10. **Select City:** The next screen asks for the city closest to the observing site. Use the Scroll keys to cycle through the database of cities (listed alphabetically). Press ENTER when the correct city appears on screen.
11. **Select Model Number:** The next screen asks for the telescope model. Use the scroll keys to locate your telescope model number. Press ENTER when your model number displays.
12. **Initialization Complete:** System initialization is complete and the screen reads "Align: Easy."

## Training the Drive

After you initialize Autostar for the first time you need to train the drives of the telescope. Training the drive allows the telescope to point accurately at astronomical objects. Perform this procedure every 3 to 6 months to maintain the highest level of pointing accuracy.

1. Verify that Autostar initialization is complete.
2. Press MODE until "Select Item: Object" displays.
3. Press the Scroll Up key once. "Select Item: Setup" displays.
4. Press ENTER to access the Setup menu. "Setup: Align" displays.
5. Press either Scroll key several times until "Setup: Telescope" displays.
6. Press ENTER to access the Telescope menu. "Telescope: Telescope Model" displays.
7. Press either Scroll key several times until "Telescope: Train Drive" displays.
8. Press ENTER. "Train Drive: Az Train" displays. The next four steps are the procedure for training the Az or horizontal drive.
9. Press ENTER. "Drive Setup" and a scrolling message displays. The scrolling message asks you to center a terrestrial object in the eyepiece. Use a terrestrial object, such as a telephone pole or lamp post, as your reference object. Press ENTER after reading the message.
10. "Center reference object" displays. Center the object ONLY using the Arrow keys and then press ENTER.
11. "Slewing" displays and the telescopes moves left. "Press → until it is centered" displays. Bring the reference object back to the center of the eyepiece using ONLY the Right Arrow key. When the reference object is centered, press ENTER.

**Important Note:** If you overshoot the center of the eyepiece as you perform the "press [Arrow key] until it is centered" steps (steps 11, 12, 16, 17), you must start this procedure over again. ONLY use the **prompted** Arrow key to center the reference object. For example, if the display reads ""Press ← (Left Arrow key) until it is centered," do not use the Right Arrow key to return to the center of the eyepiece if you overshoot the center. If you do overshoot, press Mode until "Select Item: Object" displays and begin the procedure again.

12. "Slewing" displays and the telescopes moves right. "Press ← until it is centered" displays. Bring the reference object back to the center of the eyepiece using ONLY the Left Arrow key. When the reference object is centered, press ENTER.
13. "Train Drive: Az Train" displays again. Press the Scroll Down key once. "Train Drive: Alt Train" displays. The next four steps are the procedure for training the Alt or vertical drive.
14. Press Enter. "Drive Setup" and a scrolling message displays. The scrolling message once again asks you to center a terrestrial object in the eyepiece. Press ENTER after reading the message.
15. "Center reference object" displays. Center the object using ONLY the Arrow keys and then press ENTER.
16. "Slewing" displays and the telescopes moves down. "Press ↑ until it is centered" displays. Bring the reference object back to the center of the eyepiece using ONLY the Up Arrow key. When the reference object is centered, press ENTER.
17. "Slewing" displays and the telescopes moves up. "Press ↓ until it is centered" displays. Bring the reference object back to the center of the eyepiece using ONLY the Up Arrow key. When the reference object is centered, press ENTER.
18. Drive training is now complete. Press MODE to exit the Train Drive menus.

**IMPORTANT****NOTE:**

Autostar requests the Country/State, City, and Telescope Model information only the first time Autostar is activated. If you wish to change this information, use the "Site" and "Telescope Model" options in the Setup menu. See page 26 for more information.

**IMPORTANT****NOTE:**

While performing the automatic tracking procedure, use ONLY the Arrow keys to move the telescope. Once the telescope has been set in the Alt/Az home position, do not loosen the az and alt locks (19 and 22, Fig. 1), or move the base manually, or alignment will be lost.

## Observe a Star using the Automatic Tracking Feature

In this example, the Autostar Arrow keys are used to find a star, and then Autostar's tracking capability automatically keeps the star centered in your telescope's eyepiece.

- Set in Home Position:** Level the optical tube and point it North. Make sure that the Alt lock (22, Fig. 1) and Az lock (19, Fig. 1) are secured as described previously.
- Connect Autostar:** Verify that Autostar is properly connected to your telescope. See **HOW TO ASSEMBLE YOUR TELESCOPE** page 10.
- Supply Power:** Plug the battery pack into the 12V port.  
The Autostar display activates and a copyright message appears briefly, followed by a short beep. Then Autostar takes a few moments to start up the system.
- Sun Warning:** A message displays that warns not to look at the Sun. At the end of this message, press the key prompted by Autostar to signify that the message has been read and understood.
- Enter Date and Time:** Enter these values as previously described.
- Select Setup: Align Option:** Press MODE (3, Fig. 2). "Setup: Align" displays.
- Select Setup: Targets Option:** Press the Scroll Down key (7, Fig. 2) repeatedly until "Setup: Targets" displays. Press ENTER (2, Fig. 2).
- Select Targets: Astronomical Option:** "Targets: Terrestrial" displays. Press either of the Scroll keys once (6 or 7, Fig. 2). "Targets: Astronomical" now displays.
- Locate a Bright Star:** Use the Arrow keys (5, Fig. 2) to locate a bright star in the night sky. Use the viewfinder (5, Fig. 1) to help line up on the star. You may choose any unobstructed, bright star for the purposes of this exercise. Use Autostar's Arrow keys to center the star in the eyepiece.
- To Start Tracking:** Once the star is centered, press ENTER to select "Astronomical." The telescope's tracking motors then engage. It may take the tracking motors several seconds to begin tracking. When they do, it may be necessary to once again center the star in the eyepiece. The tracking motors will then keep the star you have chosen in the center of the eyepiece.  
If you wish to track another star, use the Arrow keys to slew the telescope to the star. Center the star. The tracking motors will then keep that star in the center of the eyepiece.
- To Stop Tracking:** Press ENTER. "Setup: Targets" displays. Press ENTER. "Targets: Astronomical" now displays. Press either of the Scroll keys once. "Targets: Terrestrial" displays. Press ENTER. Tracking is now turned off.

## Easy (Two-Star) Align

The fastest and easiest way to locate objects with Autostar's GO TO capabilities is to use the Easy Align menu option.

Autostar automatically picks two stars from its database for the Easy Align procedure. During this procedure, Autostar slews the telescope to a first alignment star. The user is asked to verify that the telescope is pointed at the chosen star and then prompted to center the star in the eyepiece. The process is repeated with a second star to complete the alignment.

**NOTE:** Before aligning the telescope, first verify that **INITIALIZING AUTOSTAR**, page 15, has been performed. See **MOVING THROUGH AUTOSTAR'S MENUS**, page 15, if you wish to learn how to operate Autostar's keys.

### How to Easy Align Your Telescope

If you have just applied power to Autostar, perform steps 1 through 5. If you have already performed the initialization procedure, go to step 6.

- Sun Warning** - Press the key prompted by Autostar to accept.
- Getting Started** - Press ENTER to continue.
- Enter Date** - Enter the current date as previously described, then press ENTER.
- Enter Time** - Enter the current time as previously described. Select "AM," "PM," or 24-hour clock (blank). Then press ENTER.

5. **Daylight Savings** - Select "Yes" or "No," then press ENTER.
6. **Alignment Option Screen** - "Setup: Align" displays. Press ENTER.
7. **Select Alignment** - "Align: Easy" displays. Press ENTER.
8. **Set Alt/Az Home Position** - Autostar then prompts you to set the telescope in the Alt/Az Alignment home position. To set your telescope in the "Alt/Az" home position (**Fig. 18**):
  - Loosen the telescope's Alt lock (**22, Fig. 1**).
  - Level the tripod base and the optical tube.
  - Tighten the Alt lock (**22, Fig. 1**) to a firm feel only.
  - Loosen the Az lock (**19, Fig. 1**) and turn the telescope horizontally until it points North. See **LOCATING THE CELESTIAL POLE**, page 32 for more information.
  - Tighten the Az lock (**19, Fig. 1**). Press ENTER.
9. **Star Alignment** - Autostar then chooses two stars to align upon. When the telescope slews to the first star for alignment, it may not appear in the field of view in the eyepiece. The alignment star should be easily recognized and be the brightest star in the area of the sky where the telescope is pointing. Use the Arrow keys to move the telescope until the star is visible and centered in the eyepiece. Press ENTER. Repeat procedure for the second alignment star.

When the procedure is performed correctly, "Alignment Successful" displays. If Autostar does not display this message, perform this procedure again.

**NOTE:** *Autostar locates alignment stars based on the date, time, and location entered. The alignment stars may change from night to night. All that is required is for the observer to center the selected stars in the eyepiece when prompted.*

**NOTE:** *The GO TO key also allows you to perform a "spiral search." A spiral search is useful when the telescope slews to an object, but that object is not visible in the eyepiece after the telescope finishes its search. (This sometimes occurs during an alignment procedure.) Press GO TO when the slew is finished and the telescope starts slewing in a spiral pattern at a very slow speed around the search area. Look through the eyepiece and when the object does become visible, press MODE to stop the spiral search. Then use the Arrow keys to center the object.*

Two other methods of alignment are available to the observer: Two-Star and One-Star. These methods are included in case the observer prefers to pick out his or her own alignment stars.

### **Two-Star Alt/Az Alignment**

Two-Star Alignment requires some knowledge of the night sky. Two-Star Alignment is identical to Easy Align (see **EASY (TWO-STAR) ALIGN**, page 17), except Autostar displays a database of bright stars and *two* stars are chosen *by the observer* from this database for alignment. It is recommended that you choose stars with which you are familiar from this database when first trying out this method or the One-Star Alignment method.

### **One-Star Alt/Az Alignment**

One-Star Alignment also requires some knowledge of the night sky. One-Star Alignment is identical to Easy Align (see **EASY (TWO-STAR) ALIGN**, page 17), except Autostar displays a database of bright stars and *one* star is chosen *by the observer* from this database for alignment.

**IMPORTANT NOTE:** *The accuracy of One-Star Alt/Az Alignment, unlike the Two-Star Alignment procedures, depends on how well the observer levels the telescope and how close to North the telescope is pointed when setting the Home Position (**Fig. 18**). Because the Two-Star Alignment methods use two stars to align upon, they are more precise than One-Star Alignment.*

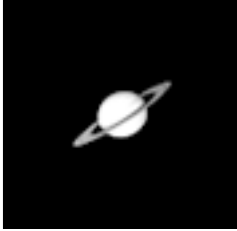


Fig. 21: One of the most beautiful celestial sights, Saturn.

## Go To Saturn

After performing the Easy Align procedure, the motor drive begins operating and the telescope is aligned for a night of viewing. Objects in the eyepiece should maintain their position even though the Earth is rotating beneath the stars.

**IMPORTANT NOTE:** Once aligned, only use GO TO or the Arrow keys to move the telescope. Do not loosen the Alt and Az locks (**22 and 19, Fig. 1**), or move the base manually, or alignment will be lost.

This exercise shows how to select a celestial object (Saturn) for viewing from Autostar's database.

**NOTE:** Saturn is not always visible and you may need to choose another object from Autostar's Object database; however, the procedure, as described below, remains the same—just choose a different object in step 3.

1. After the telescope is aligned, "Select Item: Object" displays. Press ENTER.
2. "Object: Solar System" displays. Press ENTER.
3. "Solar System: Mercury" displays. Keep pressing the Scroll Down key until "Solar System: Saturn" displays.
4. Press ENTER. "Calculating" displays. Then "Saturn" and a set of coordinates displays. Note that Saturn's (and other planets') coordinates may change throughout the year.
5. Press GO TO. "Saturn: Slewing..." displays and the telescope slews until it finds Saturn. You may need to use the Arrow keys to center Saturn precisely in the eyepiece. Autostar then automatically moves the telescope so that it "tracks" Saturn (or whatever other object you may have chosen); *i.e.*, Saturn remains centered in the eyepiece.

## Take a Guided Tour

This example demonstrates using "Tonight's Best" Guided Tour.

1. After observing Saturn, press MODE twice so that "Select Item: Object" displays again.
2. Press the Scroll Down key twice. "Select Item: Guided Tour" displays.
3. Press ENTER. "Guided Tour: Tonight's Best" displays. Press ENTER.



**NOTE:** If you wish to try out other Guided Tours, press the Scroll Down key to scroll through other tour choices. When the tour you wish to select displays, press ENTER.

4. "Tonight's Best: Searching..." displays. After calculating, "Tonight's Best: Jupiter" displays.

**NOTE:** Different objects may be displayed on a tour list on any given night.

Press ENTER to display information about the object. Press GO TO to move the telescope to the object.

5. Press MODE to return to the Tour list. Press the Scroll keys to scroll through the list. Press ENTER when you find the next object you wish to observe.
6. Press and hold down MODE for two seconds to exit the Guided Tour menu.

DS-114AT TIPS

### Which One's the Alignment Star?

If Autostar has chosen an alignment star with which you are unfamiliar, how can you be sure if the star in your eyepiece is really the alignment star?

The rule of thumb is that an alignment star is usually the brightest star in that area of the sky. When you view an alignment star in an eyepiece, it stands out dramatically from the rest of the stars in that portion of the sky.

If you have an obstruction, such as a tree or a building blocking your view of the alignment star, or if you have any doubts at all about the star that has been chosen, no problem. Just press the Scroll Down key and Autostar will find another star to align upon.

# BASIC AUTOSTAR OPERATION

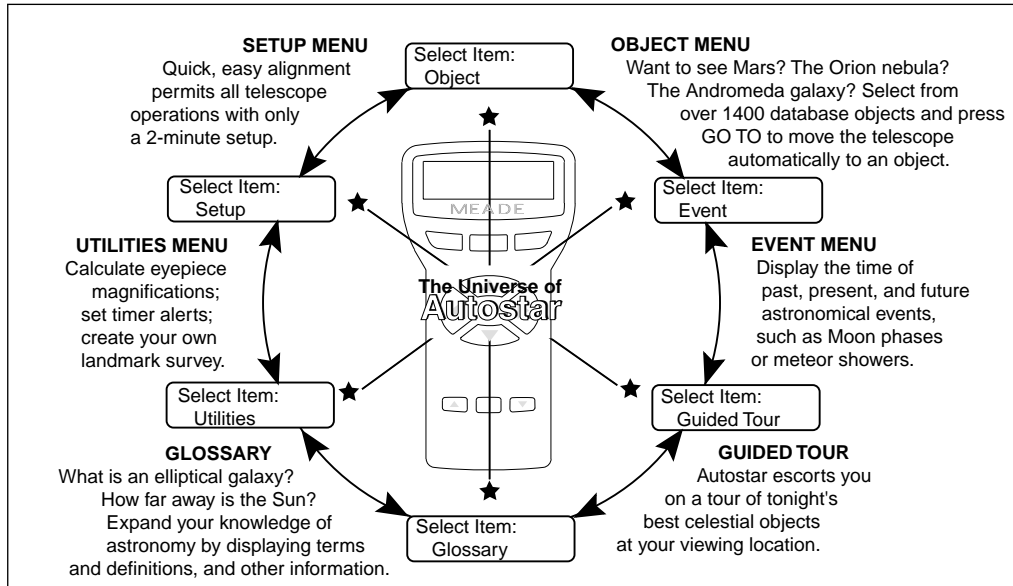


Fig. 22: The Autostar Universe: The six primary categories listed in the Select Item menu of Autostar.

It is important to understand that menu selections are set in a loop (Fig. 23). This means that pressing the Scroll Down key (7, Fig. 2) cycles down through all the available options within a given category, then returns to the first option. The Scroll Up key (6, Fig. 2) cycles up through the options in the opposite order. Note that this capability is a quick way to get to an option that is near the bottom of the list. The following example demonstrates this capability.

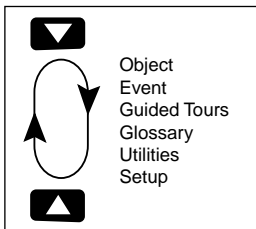


Fig. 23: Menus set in a loop.

### Example:

To navigate to the "Select Item: Setup" menu option when the "Select Item: Object" menu is displayed:

1. Press the Scroll Down key four times or the Scroll Up key once.

Autostar displays two lines of information. The top line shows the current menu level. The second line displays an option which may be selected within that menu level. Some options are choices that select the next menu level down. The Scroll keys move up and down within the list of available options, showing one option at a time.

When the desired option is displayed on the second line, press the ENTER key to choose that option and move down one menu level.

Press the MODE key to leave a level (e.g., the wrong menu option is chosen).

**IMPORTANT NOTE:** No matter how many levels into Autostar are traveled, each press of the MODE key moves up a level, until the top level, "Select Item," is reached. Once in the Select Item level, press MODE to return to the topmost level, "Select Item: Object."

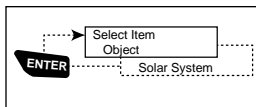


Fig. 24: Autostar levels.

## Autostar Navigation Exercise

To demonstrate how the Autostar menu structure works, the following exercise calculates Sunset time so an evening observing session can be planned.

**NOTE:** To perform an accurate calculation, Autostar must be properly initialized with the current date, time, and location of the observing site. To enter the current date, time, and location information of your observing site, see **INITIALIZING AUTOSTAR**, page 15, before proceeding with this exercise.

#### To Calculate Sunset time:

1. Press the MODE key several times, until "Select Item: Object" is displayed.
2. Press the Scroll Down key once to display the "Event" option in the "Select Item" menu.
3. Press the ENTER key to choose the "Event" option and move down a level. "Event: Sunrise" is displayed.
4. Press the Scroll Down key once to display the "Sunset" option in the Event menu.
5. Press the ENTER key to choose the "Sunset" option and move down another level.
6. Autostar calculates the Sunset time based on the current date, time, and location. Autostar then displays the results of the calculation.
7. Press MODE once to start moving back up through the Autostar levels. The first level up is the Event menu.
8. Press MODE again to move up another level. This is the top level, "Select Item."
9. Press MODE again to return to the starting point of "Select Item: Object."

### Entering Numbers and Text into Autostar

#### To enter numbers and text:

- Use the Up and Down Arrow keys to scroll through numbers 0 - 9 and the alphabet. The Down Arrow key begins with the letter "A;" the Up Arrow key begins with digit "9."

#### To move the cursor across the display:

- Use the Right or Left Arrow key (**5, Fig. 2**) to move the cursor from one number to the next in the display.
- Press ENTER when the desired information has been entered.

### Navigating Autostar

Autostar's menus are organized for quick and easy navigation:

- Press ENTER (**2, Fig. 2**) to go deeper into Autostar's menu levels.
- Press MODE (**3, Fig. 2**) to move back toward the top menu level.
- Press the Scroll keys (**6 and 7, Fig. 2**) to move up and down through the options or lists
- Press the Arrow keys (**5, Fig. 2**) to move the cursor across the display.
- Press the Speed/? key (**8, Fig. 2**) to access on-line help.

### Adjusting the Speed of a Scrolling Message

- Press and hold the Up Arrow key to increase the scrolling speed when a message is scrolling across the display.
- Press and hold the Down Arrow key to decrease the scrolling speed when a message is scrolling across the display.

**TIP:** When multiple choices are available within a menu option, the option that is currently selected is usually displayed first and highlighted by a right pointing arrow(>).



# MENUS AND MENU OPTIONS

## Object Menu

Almost all observing with Autostar is performed using the Object menu category. (**NOTE:** *Exceptions include Guided Tour and Landmark Survey.*) See **GO TO SATURN**, page 19, for an example of observing using the Object menu. Also see **USING THE GUIDED TOUR**, page 19.

Many Autostar menu categories contain databases. An Autostar *database* is a list of viewable objects, such as stars, planets, comets, nebulae, and so forth. When one of these objects is selected from a database, Autostar moves your telescope (if properly aligned) and points it at the selected object.

The Object Menu options include:

**Solar System** is a database of the eight planets (Earth is not included) in order out from the Sun, followed by the Moon, asteroids, and comets.

**Constellation** is a database of all 88 Northern and Southern Hemisphere constellations. When this menu option is chosen and a constellation name appears on the first line of the screen, press GO TO once to change the second line to the name of the brightest star in the constellation. Press GO TO a second time to slew the telescope to that star. Use the Scroll keys to cycle through the list of stars in the constellation, from brightest to dimmest.

**Deep Sky** is a database of objects outside our Solar System such as nebulae, star clusters, galaxies, and quasars.

**Star** is a database of stars listed in different categories such as named, double, variable, or nearby.

**Satellite** is a database of Earth-orbiting objects such as the International Space Station, the Hubble Space Telescope, Global Positioning System (GPS) satellites, and geosynchronous orbit satellites.

**User Objects** allows the user to define and store in memory deep-sky objects of specific interest that are not currently in the Autostar database. See "Appendix B" for more information.

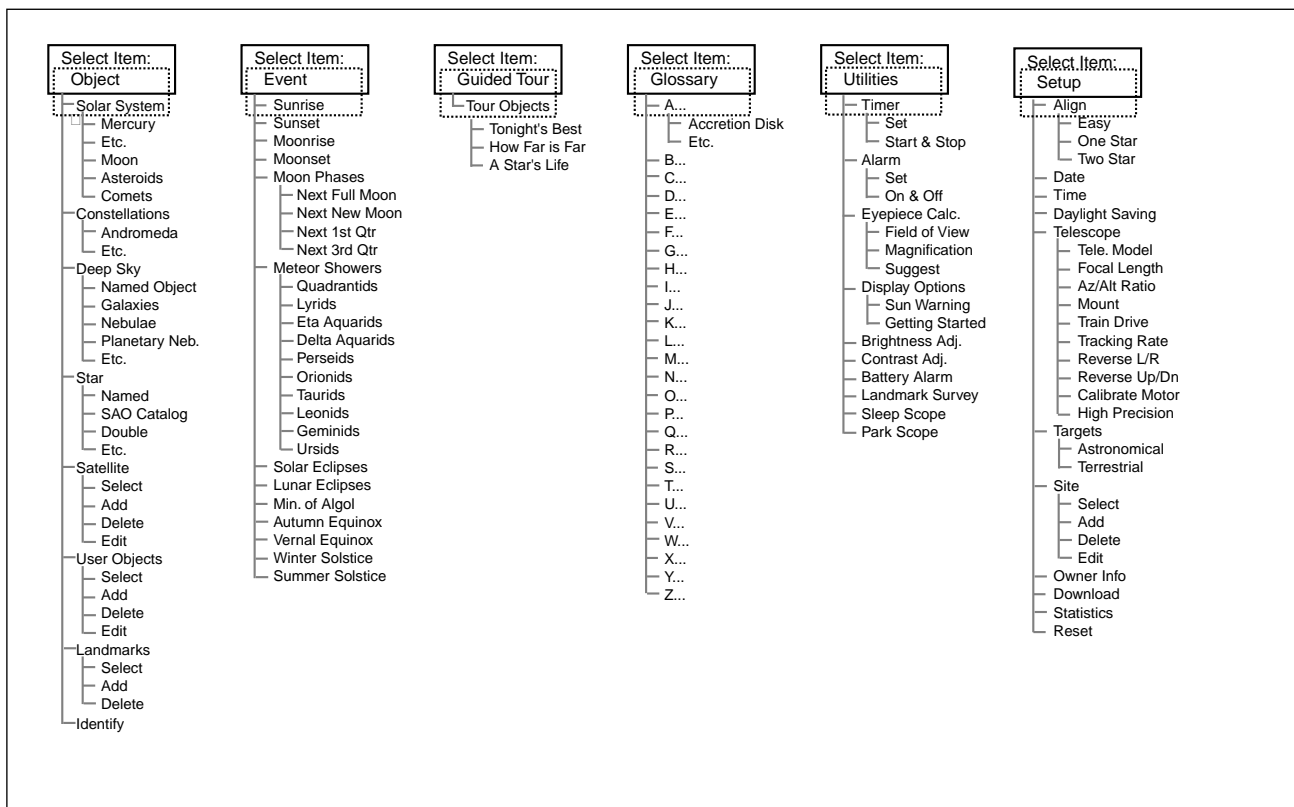


Fig. 25: The complete Autostar Menu structure.



**Landmarks** stores the location of terrestrial points of interest in the permanent Autostar database.

**IMPORTANT NOTE:** To use the Landmark function, the telescope must be located and aligned exactly as when the landmark was added to the database.

- **Select:** To select a Landmark already in the database (see **ADD** below), choose the "Select" option and scroll through the list. Press ENTER to select a Landmark, then press GO TO and the telescope slews to the object.
- **Add:** To add a Landmark, choose the "Add" option. Enter a name for the Landmark. Locate and center the Landmark in the eyepiece, then press ENTER.

**Identify** is an exciting feature for an observer who wants to scan the night sky and start exploring. After the telescope has been properly aligned, use the Autostar Arrow keys to move about in the sky. Then follow this procedure:

**IMPORTANT NOTE:** Only use the Arrow keys to move the telescope during the Identify procedure. Do not loosen the telescope locks or move the base or alignment is lost.

1. When a desired object is visible in the eyepiece, keep pressing MODE until the "Select Item: Object" menu is displayed. Press ENTER to select this menu.
2. Scroll through the Object menu options until the "Object: Identify" screen appears.
3. Press ENTER. Autostar searches the database for the identity of the object being observed.
4. If the telescope is not directly on an Autostar database object, the nearest database object is located and displayed on the screen. Press GO TO and the telescope slews to that object.

### Event Menu

The Event menu provides access to dates and times of astronomical events. The Event database includes:

**Sunrise** and **Sunset** calculates the time that the Sun rises or sets on the current date. Find rise and set times for other dates by entering a new date into the "Setup: Date" menu. See **DATE**, page 25.

**Moonrise** and **Moonset** calculates the time that the Moon rises or sets on the current date. Find rise and set times for other dates by entering a new date into the "Setup: Date" menu. See **DATE**, page 25.

**Moon Phases** displays the date and time of the next Full, New, 1st Quarter, and 3rd Quarter Moon.

**Meteor Showers** provides information on upcoming meteor showers, such as the Perseids, the Leonids, etc. Also lists the dates of the showers and when they reach maximum.

**NOTE:** Meteors are fast moving objects that cover large areas of the sky and are usually best observed with the naked eye.



**WARNING!**  
Never use a

**Meade DS-114AT Telescope to look at the Sun! Looking at or near the Sun will cause instant and irreversible damage to your eye. Eye damage is often painless, so there is no warning to the observer that damage has occurred until it is too late. Do not point the telescope or its viewfinder at or near the Sun. Do not look through the telescope or its viewfinder as it is moving. Children should always have adult supervision while observing.**



### Observing Considerations

- Try to pick an observing site away from street and house lights, and car headlights. While this is not always possible, the darker the site, the better.
- Give your eyes about ten minutes to adjust to the darkness before observing. Give your eyes a rest from observing every ten or fifteen minutes to relieve eye-strain.
- Try not to use a standard flashlight. Seasoned observers use red LED flashlights or tape red cellophane over their flashlights for setup and map reading so they don't have to continually readjust their eyes to the darkness. Be careful not to shine bright lights if there are other observers in the area. Never shine a flashlight into a telescope while someone is observing!
- Dress warmly. It gets chilly when you're sitting for prolonged periods, even on some summer nights.
- Practice setting up your equipment during the day or in a lighted area to become familiar with it before going to a dark site.
- Use your 25mm eyepiece to view terrestrial objects and wider areas of space, such as open star clusters. Use your higher power eyepieces when you wish to view something up close, such as craters on the Moon or the rings of Saturn.
- Know your observing site. If you're going to try out an unfamiliar site, check it out in the daylight for obstructions and pitfalls.

**Solar Eclipse** lists upcoming Solar Eclipses, including the date and type (total, annular, or partial) of eclipse, and the location and time of the first and last contacts of the Moon's shadow. Use the Scroll Up and Down keys to display the available data. Remember, never use a telescope to look at the Sun! See "WARNING!" on page 23.

**Lunar Eclipse** lists upcoming Lunar Eclipses, including the date and type (total, partial, penumbral) of eclipse. Use the Scroll Up and Down keys to display the available data.

**Min. (Minimum) of Algol** is the minimum brightness of the dramatic eclipsing binary star system, Algol. It is relatively close at a distance of 100 light years. Every 2.8 days during a 10-hour period, Algol undergoes a major change in apparent magnitude as one of the two stars passes behind the other. The combined magnitude of the two stars thus dips from +2.1 to a minimum of +3.4 halfway through the eclipse as the second star is hidden. Autostar calculates minimum magnitude time at mid-eclipse.

**Autumn and Vernal Equinox** calculates the time and date of the fall or spring equinox of the current year.

**Winter and Summer Solstice** calculates the time and date of the winter or summer solstice of the current year.

## Glossary Menu

The Glossary menu provides an alphabetical listing of definitions and descriptions for common astronomical terms and Autostar functions. Access directly through the Glossary menu or through hypertext words embedded in Autostar. A *hypertext word* is any word in [brackets], usually found when using the Autostar Help function or when reading a scrolling message such as a description of a planet or star. Press ENTER whenever a hypertext word is on screen and Autostar goes to the glossary entry for that word.

To access directly from the Glossary menu, use the Scroll keys to scroll through the alphabet. Press ENTER on the desired letter. Scroll to the desired entry and then press ENTER to read the description.

## Utilities Menu

The Utilities menu provides access to several extra features within Autostar, including a countdown timer and an alarm. The Utilities functions include:

**Timer** selects a countdown timer. This feature is useful for functions such as astrophotography and tracking satellites. See **OBSERVING SATELLITES**, page 34. To use the Timer, press ENTER, then choose "Set" or "Start/Stop."

- **Set:** Enter the time to be counted down, in hours, minutes, and seconds, then press ENTER.
- **Start/Stop:** Activates the timer set previously. Use the Scroll keys to toggle between ON and OFF. When ON is displayed, press ENTER to activate the timer. When the timer runs out, four beeps sound and the timer is deactivated.

**Alarm** selects a time for an alarm signal as a reminder. To use the Alarm, press ENTER, then choose "Set" or "Start/Stop."

- **Set:** Enter the time of day for the alarm to sound, in hours, minutes, and seconds, then press ENTER.
- **Start/Stop:** Activates the alarm set previously. Use the Scroll keys to toggle between ON and OFF. When ON is displayed, press ENTER to activate the alarm. When the alarm time arrives, Autostar beeps. Press ENTER to deactivate the alarm.

**Eyepiece Calc** calculates information about an eyepiece for the specific telescope to which Autostar is connected.

- **Field of View:** Scroll through a list of available eyepieces. When an eyepiece is selected, the field of view is calculated.
- **Magnification:** Scroll through a list of available eyepieces. When an eyepiece is selected, the magnification is calculated.
- **Suggest:** Autostar calculates and suggests the best eyepiece for viewing, based on the telescope and the object being viewed.

**Display Options** enables or disables Autostar's two initial displays. If both displays are disabled, Autostar begins with the Date display.

- **Sun Warning:** Turns the "Sun Warning" message on or off.
- **Getting Started:** Turns the "Getting Started" message on or off.

**Brightness Adj:** Adjusts the brightness of the display using the Scroll keys. When complete, press ENTER.

**Contrast Adj:** Adjusts the contrast of the display using the Scroll keys. When complete, press ENTER.

***NOTE:** This feature is usually only required in very cold weather.*

**Landmark Survey** automatically slews the telescope to all user-defined landmarks with a short pause at each location. Press ENTER to start the survey. While a slew is in progress, press any key to skip that object and go to the next landmark on the list. To observe a landmark for a longer period, press MODE when paused on the object to stop the survey. Press ENTER to restart the survey at the first object on the list. See **LANDMARKS**, page 23.

**Sleep Scope** is a power saving option that shuts down Autostar and the telescope without forgetting its alignment. With "Sleep Scope" selected, press ENTER to activate the Sleep function. Autostar goes dark, but the internal clock keeps running. Press any key, except ENTER, to re-activate Autostar and the telescope.

**Park Scope** is designed for a telescope that is not moved between observing sessions. Align the telescope one time, then use this function to park the telescope. Next time it is powered up, enter the correct date and time – no alignment is required. Pressing ENTER causes the telescope to move to its pre-determined Park position. Once parked, the screen prompts to turn off power.

***IMPORTANT NOTE:** When the "Park Scope" option is chosen and the display prompts you to turn off the telescope's power, Autostar is unable to be returned to operation without turning the power off and then back on.*

## Setup Menu

The Setup menu's primary function is to align the telescope (see **EASY ALIGN**, page 17). However, there are numerous other features available within the Setup menu, including:

**Date** changes the date used by Autostar. This function is useful to check events in the past or future. For example, set the Date menu for a day three months in the future. Then check the "Select Item: Event" menu for the Sunset time on that date. See **EVENT MENU**, page 23.

**Time** changes the time entered into Autostar. Setting the correct time is critical for Autostar to properly calculate locations and events. Time may be set to 24-hour mode (military time) by selecting the "blank" option which follows the "AM" and "PM" options.

**Daylight Saving** is used to enable or disable Daylight Savings time.

***NOTE:** Daylight Savings Time may be referred to by different names in various areas of the world.*



## DS-114AT TIPS

### Surf the Web

One of the most exciting resources for astronomy is the Internet. The Internet is full of websites with new images, discoveries, and the latest astronomical information. For example, when comet Hale-Bopp made its approach to our Sun in 1998, astronomers around the world posted new photos daily.

You can find websites for virtually any topic relating to astronomy on the Internet. Try the following key word searches: NASA, Hubble, HST, astronomy, Messier, satellite, nebula, black hole, variable stars, extrasolar, Chandra, gamma burster, comets, Astronomy Day, etc.

Check out Meade's website for the latest product and technical information. You can download the latest software revisions, links to other astronomical sites, coordinates of celestial objects, and the latest satellite tracking information for the Autostar handbox. See page 31 for more information. You'll find our website at:

<http://www.meade.com/>

Here are some other sites you might find useful:

- *Sky & Telescope:*  
<http://www.skypub.com/>
- *Astronomy:*  
<http://www.astronomy.com/astro/>
- *The Starfield:*  
<http://users.nac.net/gburke/>
- *Astronomy Picture of the Day:*  
<http://antwrp.gsfc.nasa.gov/apod/>
- *Heaven's Above (satellite information):*  
<http://www.heavens-above.com/>
- *Photographic Atlas of the Moon:*  
[http://www.lpi.ursa.edu/research/lunar\\_orbiter](http://www.lpi.ursa.edu/research/lunar_orbiter)
- *Hubble Space Telescope Public Pictures*  
<http://opposite.stsci.edu/pubinfo/pictures.html>

**Telescope** accesses the several options, including:

- **Model:** Allows you to select the telescope model connected to Autostar.
- **Focal Length:** Displays the focal length of the selected telescope.
- **Az Ratio and Alt Ratio:** The Az (Azimuth) ratio and Alt (Altitude) ratio refers to the gears of the telescope's motors. Do not alter these numbers.
- **Az Percent:** The Az (Azimuth) Percent allows you to change the azimuth backlash, *i.e.*, the way the Arrow keys move the telescope along the azimuth (horizontal) axis. If you enter a value near 100, the telescope tube responds more quickly (it responds immediately at 100%) as you hold down an Arrow key and also slews (moves) the tube more quickly. If you enter a value near 0, it takes longer for the tube to respond as you hold down an Arrow key and also slews the tube more slowly. Experiment with this option. Try changing the percent value until you get a "feel" for the Arrow keys that is comfortable for you.  
**Alt Percent:** The Alt (Altitude) Percent operates identical to the AZ Percent option (see above), but allows you to change the altitude backlash, *i.e.*, the way the Arrow keys move the telescope when moving along the altitude (vertical) axis.
- **Train Drive:** Trains the Altitude and Azimuth motors to locate objects with more precision.  
If you are experiencing any problems with pointing accuracy, follow the procedure described in **TRAINING THE DRIVE**, page 16, to insure accurate pointing and tracking.
- **Tracking Rate:** Changes the speed at which the telescope tracks targets in the sky.
  - a. **Sidereal:** The default setting for Autostar; sidereal rate is the standard rate at which stars move from East to West across the sky due to the rotation of the Earth.
  - b. **Lunar:** Choose this option to properly track the Moon over long observing sessions.
  - c. **Custom:** Allows entry of user-defined tracking rates.
- **Reverse L/R:** Reverses the functions of the Left and Right Arrow keys (*i.e.*, the Right key moves the telescope to the left).
- **Reverse UP/DOWN:** Reverses the functions of the Up and Down Arrow keys (*i.e.*, the Up key moves the telescope down).
- **Calibrate Motor:** If the telescope motors appear to have a problem, use this option to retest the motors before performing a Reset. This option is also used if an Autostar unit is moved between telescopes, to match Autostar to the new telescope. To calibrate the motors, select this option and press ENTER.
- **High Precision:** If High Precision is turned on, when looking for a faint celestial object (*i.e.*, a nebula or galaxy), Autostar first slews to a nearby bright star and displays "ENTER to Sync." Center the star in the eyepiece, then press ENTER. At that point the telescope has a high precision alignment to that part of the sky and it then slews to the object that was originally requested.

**Targets** switches between Astronomical targets and Terrestrial targets. If "Astronomical" is selected, the telescope tracking motor is activated and any object you observe will remain centered in the eyepiece. If "Terrestrial" is selected, the tracking motor is turned off. To learn how to track an object automatically, see page 17.

**Site** provides access to several options including:

- **Select:** Displays the currently selected observing site. Use the Scroll keys to cycle through all available sites (see **ADD** below). Press ENTER when the site you wish to select displays. Use this option when you move to a different geographic location.
- **Add:** Allows you to add new observing sites to the database (up to six sites may be stored). Scroll through the list of Countries/States. Press ENTER when the site you wish to add displays. Then choose the desired city in the same manner.
- **Delete:** Deletes a stored site from the database.

Time Zone	Shift
Atlantic	-4 Hours
Eastern	-5 Hours
Central	-6 Hours
Mountain	-7 Hours
Pacific	-8 Hours
Hawaii	-10 Hours

Table 1: Time Zone shift.

- **Edit:** Edits a selected site, including: the name, latitude, longitude, and time zone. Time Zone refers to the Greenwich Mean Time (GMT) time zone shift. Users West of Greenwich, England use “-” hours, East of Greenwich use “+” hours. For the United States, look up the time zone shift in **Table 1**.

**NOTE:** Autostar compensates for Daylight Savings time, if selected. See **SETUP MENU: DAYLIGHT SAVING**, page 25.

**Owner Info** accesses the owner information menu, including:

- **Name:** Users may enter both their first and last names using the Up and Down Arrow keys to cycle through the alphabet. Use the Right and Left Arrow keys to move through the text. Press ENTER when the entry is complete.
- **Address:** Use the Up and Down Arrow keys to enter your street address, city, state, and zip code. Press ENTER when the entry is complete.

**Download** transfers information from a personal computer or another Autostar. During the operation, the warning “Downloading Do Not Turn Off” appears.

**NOTE:** The Download function requires the optional #506 Astrofinder Software and Cable Connector Kit. See the instruction sheet included with the kit for more information on how to download. Also see **OPTIONAL ACCESSORIES**, page 31.

**Statistics** provides basic statistical data about Autostar, including:

- **Characters Free:** Shows how much room is available in user-defined object memory.
- **Version:** Shows the current version of the Autostar software.

**Reset** completely resets Autostar. Most values entered into the menus revert to factory defaults. Autostar requires initialization again after a Reset before proceeding with observations. See **INITIALIZING AUTOSTAR**, page 15.

# CARING FOR YOUR TELESCOPE

Your DS-114AT telescope is a precision optical instrument designed to yield a lifetime of rewarding observations. Given the care and respect due any precision instrument, your telescope will rarely, if ever, require factory servicing. Maintenance guidelines include:

- a. Avoid cleaning the telescope's optics: a little dust on the front surface of the telescope's correcting lens causes virtually no degradation of image quality and should not be considered reason to clean the lens.
- b. When absolutely necessary, dust on the front lens should be removed with gentle strokes of a camel hair brush or blown off with an ear syringe (available at any pharmacy). DO NOT use a commercial photographic lens cleaner.
- c. Organic materials (e.g., fingerprints) on the front lens may be removed with a solution of 3 parts distilled water to 1 part isopropyl alcohol. You may also add 1 drop of biodegradable dishwashing soap per pint of solution. Use soft, white facial tissues and make short, gentle strokes. Change tissues often.

**CAUTION:** Do not use scented or lotioned tissues or damage could result to the optics.

- d. If used outdoors on a humid night, water condensation on the telescope surfaces will probably result. While such condensation does not normally cause any damage to the telescope, it is recommended that the entire telescope be wiped down with a dry cloth before the telescope is packed away. Do not, however, wipe any of the optical surfaces. Rather, simply allow the telescope to sit for some time in the warm indoor air, so that the wet optical surfaces can dry unattended.
- e. If your telescope is not to be used for an extended period, perhaps for one month or more, it is advisable to remove the batteries from the battery pack. Batteries left in the battery pack for prolonged periods may leak, causing damage.
- f. Do not leave the telescope inside a sealed car on a warm summer day; excessive ambient temperatures can damage the telescope's internal lubrication and electronic circuitry.

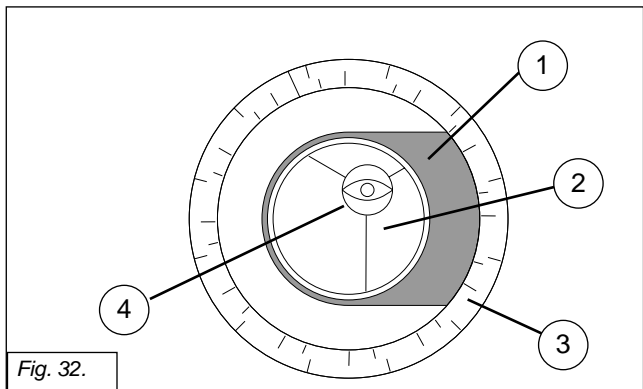
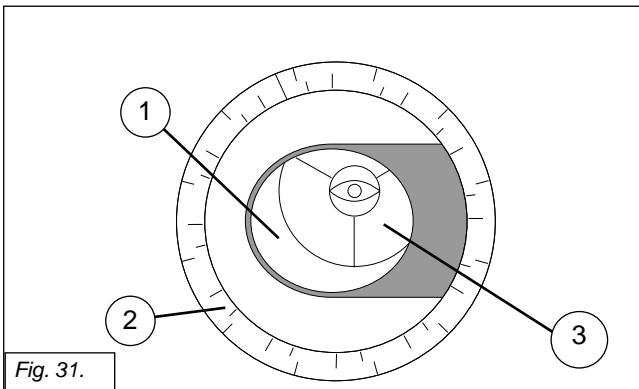
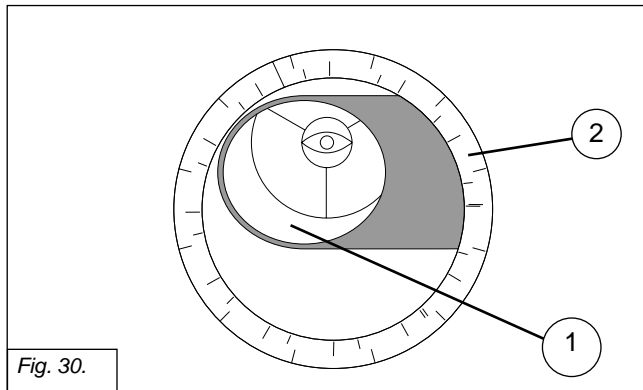
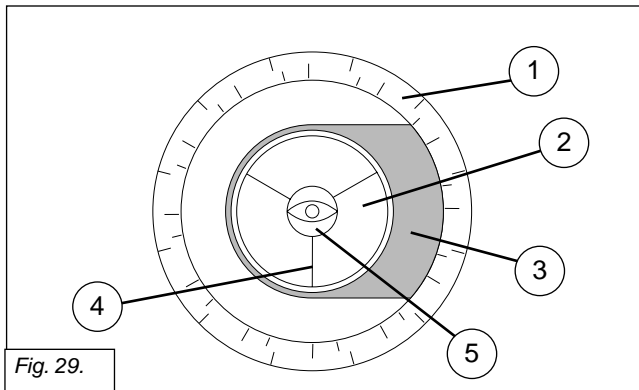
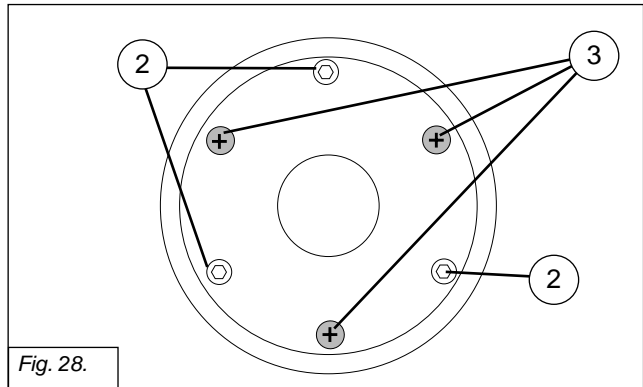
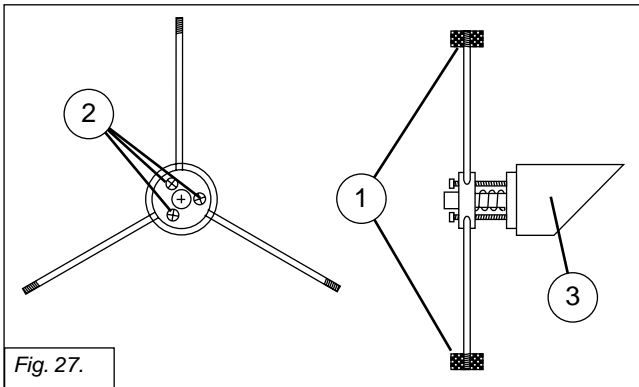
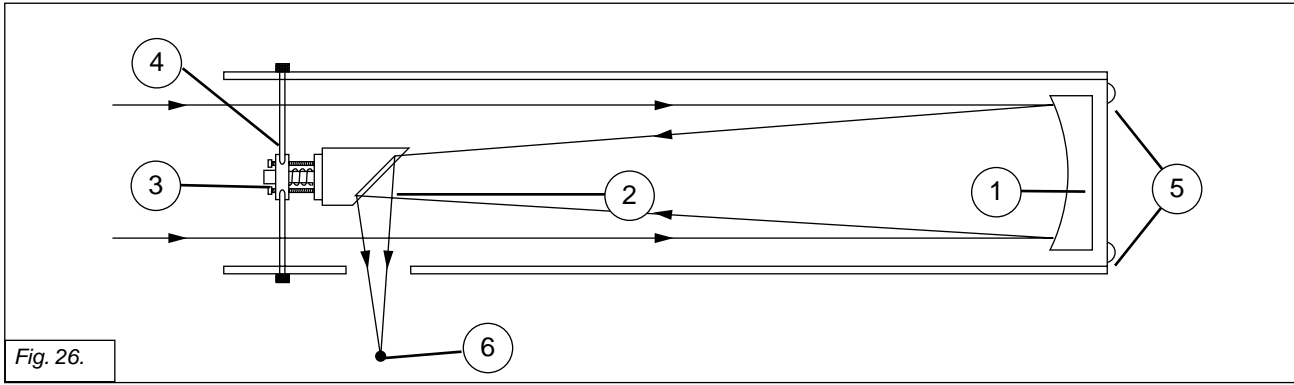
## Collimation

Your DS-114AT may occasionally require re-alignment, particularly if the telescope has received rough handling in shipment. Good optical alignment is essential for telescope performance, and in any case the alignment procedure is not difficult to follow.

The optical systems of the DS-114AT reflecting telescopes includes the following parts: primary mirror (1, Fig. 26); secondary mirror (2, Fig. 26); secondary mirror-holder (3, Fig. 26); secondary mirror-vanes (4, Fig. 26) and (1, Fig. 27); primary mirror-tilt screws (5, Fig. 26). The telescope's image is brought to a focus at (6, Fig. 26).

1. **Confirm alignment** - To confirm optical alignment look down the focuser drawtube (1, Fig. 29) with the eyepiece removed. The edge of the focuser drawtube frames reflections of the primary mirror (2, Fig. 29), the secondary mirror (3, Fig. 29), the three ("spider") vanes (4, Fig. 29) holding the secondary mirror, and the observer's eye (5, Fig. 29). With the optics properly aligned, all of these reflections appear concentric (centered), as shown in Fig. 29. Any deviation from concentricity of any of these telescope parts with the eye requires adjustments to the secondary mirror-holder (Fig. 27) and/or the primary mirror cell (Fig. 28), as described below.
2. **Secondary mirror-vane adjustments:** If the secondary mirror (1, Fig. 30) is left or right of center within the drawtube (2, Fig. 30), slightly loosen the 3-vane adjustment/lock knobs (1, Fig. 27) located on the outside surface of the main tube and slide the entire secondary mirror-holder system up or down in the slotted holes of the main tube until the secondary mirror is centered in the drawtube. If the secondary mirror (1, Fig. 30) is above- or below-center within the drawtube, thread inward one of the adjustment/lock knobs (1, Fig. 27) while unthreading another of these knobs. Only make adjustments to two knobs at a time until the secondary mirror appears as in Fig. 31.







3. *Secondary mirror-holder adjustments:* If the secondary mirror (**1, Fig. 31**) is centered in the focuser drawtube (**2, Fig. 31**), but the primary mirror is only partially visible in the reflection (**3, Fig. 31**), the three "+" (Phillips head) secondary mirror-tilt screws (**2, Fig. 27**) should be slightly unthreaded to the point where the secondary mirror-holder (**3, Fig. 27**) can rotate about its axis parallel to the main tube. Grasp the secondary mirror-holder (avoid touching the mirror surface!) with your hand and rotate it until, looking through the drawtube, you can see the primary mirror centered as well as possible in the reflection of the secondary mirror. With the rotation of the secondary mirror-holder at this best-possible position, thread in the three Phillips head screws (**2, Fig. 27**) to lock the rotational position. Then, if necessary, make adjustments to these three Phillips head screws to refine the tilt-angle of the secondary mirror, until the entire primary mirror can be seen centered within the secondary mirror's reflection. With the secondary mirror thus aligned the image through the drawtube appears as in **Fig. 32**.

4. *Primary mirror adjustments:* If the secondary mirror (**1, Fig. 32**) and the reflection of the primary mirror (**2, Fig. 32**) appear centered within the drawtube (**3, Fig. 32**), but the reflection of your eye and the reflection of the secondary mirror (**4, Fig. 32**) appear off-center, then the primary mirror tilt requires adjusting, using the Phillips head screws of the primary mirror cell (**3, Fig. 28**). These primary mirror-tilt screws are located behind the primary mirror, at the lower end of the main tube. See **Fig. 28**. Before adjusting the primary mirror-tilt screws, first unscrew by several turns (use either a hex wrench or pliers) the three hex-head primary mirror lock screws (**2, Fig. 25**) which are also located on the rear surface of the primary mirror cell and which alternate around the cell's circumference with the three Phillips head screws. Then by trial and error turn the primary mirror Phillips head tilt screws (**3, Fig. 28**) until you develop a feel for which way to turn each screw to center the reflection of your eye in the drawtube. (An assistant is helpful in this operation.) With your eye centered as shown in **Fig. 29**, turn the three hex head primary mirror lock screws (**2, Fig. 28**) to re-lock the tilt-angle of the primary mirror.

The telescope's optical system is now aligned, or collimated. This collimation should be re-checked from time to time, with small adjustments (per steps 1, 2, and/or 3, above) effected as required to keep the optics well-aligned.

## Specifications

### DS-114AT

Optical design.....	Reflector
Clear aperture .....	114mm
Focal length .....	910mm
Focal ratio .....	f/8
Resolving power.....	1.0 arc secs
Max power .....	325X
Mounting.....	Single-arm, motorized Alt-Az
Alignment .....	Altazimuth
Slew Speeds .....	1x sidereal to 5.5°/sec in 9 increments
Tripod .....	Aluminum, full-length; adjustable w/accessory tray
Optical Tube Dimensions .....	5.5" x 34"
Batteries (user-supplied) .....	10 x AA

### Autostar

Processor .....	68HC11, 8MHz
Flash Memory .....	512KB, reloadable
Keypad .....	10 key alphanumeric
Display .....	2 line, 16 character LCD
Backlight.....	Red LED
RS-232 .....	Optional
Coil Cord .....	24"
Database .....	more than 1400 objects
Length.....	5.60" (14.2cm)
Width (LCD end).....	3.08" (78cm)
Width (Connector end) .....	2.10" (53.5cm)
Depth .....	0.93" (23.5cm)
Autostar net weight.....	0.35 lbs (0.169kg)

# OPTIONAL ACCESSORIES

A wide assortment of professional Meade accessories is available for the DS-114AT Telescopes. The premium quality of these accessories is well-suited to the quality of the instrument itself. **Consult the Meade General Catalog for complete details on these and other accessories.**

**Eyepieces (1.25" barrel diameter):** For higher or lower magnifications with a DS-114AT Telescope, Meade 3-element Modified Achromatic eyepieces, available in focal lengths of 9, 12, 25, and 40mm, provide a high level of image resolution and color correction at an economical price. Alternately, 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.

**MH 50mm Wide-Field Eyepiece (2" Optical Diameter):** Ideal for spectacular low-power scanning of star fields in the Milky Way or for the study of broad diffuse nebulae, the wide-field MH 50mm eyepiece is a highly desirable accessory for all DS-114AT Telescopes (except for the DS-2060mm models, which cannot accept large-barrel eyepieces).

**#1240 Electric Focuser:** Attaches easily and quickly to any DS-114AT model for smooth, vibration-free focusing. Each focuser includes coarse and microfine speeds. The standard equipment hand controller accepts one (user-supplied) 9-volt battery; alternately, the focuser may be operated through the Electronic Controller or Autostar handbox.

**#506 AstroFinder™ Software and Cable Connector Kit:** Displays more than 10,000 celestial wonders – galaxies, nebulae, star clusters, stars, and planets – on your PC, enabling even the beginner to locate and identify objects to observe with the telescope or to print out star charts for use in observing sessions. Operates with any Windows™-based personal computer. The Cable Connector Kit permits connection of the DS-114AT telescope model, Autostar, and PC, for downloading of new software to Autostar or for updating of Earth satellite or other celestial object positions. This kit is included with each AstroFinder Software package.

**Camera Adapter:** A DS-114AT telescopes may be used for through-the-telescope photography of the Moon and planets or for terrestrial objects. For eyepiece-projection photography with any of these telescopes, use the Basic Camera Adapter (1.25"). See the Meade General Catalog for more information.

**Electronic Eyepiece™:** Now everyone can easily share views from an eyepiece – of the Moon, planets, stars, and land objects – on a television screen. The built-in NTSC video output allows for direct connection to monitors, VCR's, and camcorders. Continuous capture mode allows you to view and record astronomical and terrestrial images in real time. This easy-to-set up and easy-to-use monochrome CMOS imager offers built-in contrast control adjustment for varying astronomical and terrestrial lighting conditions, and is available in 1.25" or .965" barrel diameters.

## Meade Customer Service

If you have a question concerning your DS-114AT Telescope, contact the Meade Instruments Customer Service Department at:

**Telephone:** (949) 451-1450

**Fax:** (949) 451-1460

Customer Service hours are 8:30 AM to 4:30 PM, Pacific Time, Monday through Friday. In the unlikely event that your DS-114AT telescope requires factory servicing or repairs, write or call the Meade Customer Service Department first, before returning the telescope to the factory, giving full particulars as to the nature of the problem, as well as your name, address, and daytime telephone number. The great majority of servicing issues can be resolved by telephone, avoiding return of the telescope to the factory.

# APPENDIX A

## Locating the Celestial Pole

To get basic bearings at an observing location, take note of where the Sun rises (East) and sets (West) each day. After the site is dark, face North by pointing your left shoulder toward where the Sun set. To precisely point at the pole, find the North Star (Polaris) by using the Big Dipper as a guide (**Fig. 33**).

**IMPORTANT NOTE:** For almost all astronomical observing requirements, approximate settings are acceptable. Do not allow undue attention to precise alignment of the telescope to interfere with your basic enjoyment of the instrument.

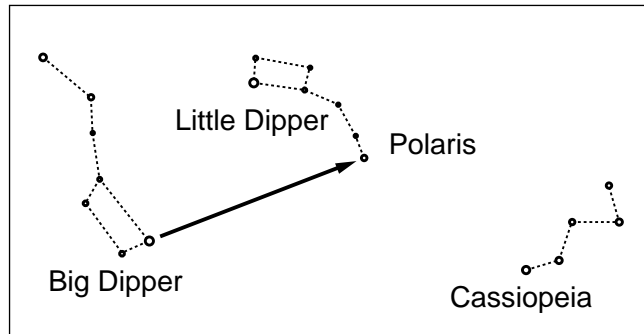


Fig. 33: Locating Polaris.

## APPENDIX B

### **TIP:**

#### **Entering R.A. and Dec. Coordinates of an object without using the menus:**

*If you do not wish to navigate through the menus, a more direct way to enter coordinates is to press and hold MODE for two seconds or more. R.A. and Dec. coordinates display. Press GO TO. "Object Position" and a set of coordinates displays. Enter the R.A. and Dec. coordinates of any celestial object using the Up and Down Arrow keys, overwriting the coordinates currently displayed. As soon as the coordinates are entered, Autostar slews the telescope to the coordinates. Note that the telescope must be initialized and placed in the Alt/Az home position (see page 15) for this procedure to operate properly.*

*However, if you wish to store the coordinates of an object in memory, use the method described at the right.*

### **Using Autostar to Find Objects Not in the Database**

Although Autostar contains a database of more than 1400 celestial objects (stars, nebulae, planets, etc.) that you can observe, you may eventually want to view objects that are not part of the database. Autostar provides a feature that allows you to enter an object's R.A and Dec. coordinates in the "User: Objects" option of the Object menu and allows automatic slewing of the telescope to the user-entered coordinates.

In order to use this menu option, you first need to look up the R.A and Dec. coordinates of the object or objects you wish to observe. Check out your local library, computer store, bookstore, CD Roms, Internet, or magazines (such as *Sky & Telescope* or *Astronomy*), to find coordinates of celestial objects. The objects/coordinates you enter become part of your own permanent database, called "User Objects."

#### **To enter coordinates of an object into the "User: Objects" option of the Object menu:**

1. Make sure Autostar has been initialized and the telescope has been aligned.
2. After the telescope is aligned, "Select Item: Object" displays. (If necessary, use the Scroll keys to scroll through the menus, as previously described, to find this option.) Press ENTER.
3. "Object: Solar System" displays. Keep pressing the Scroll Up key until "Object: User Object" displays and press ENTER.
4. "User Object: Select" displays. Press the Scroll Down key once. "User Object: Add" displays. Press ENTER.
5. "Name" displays on the top line and a blinking cursor on the second line. Use the Arrow keys, as previously described, to enter the name of the object you wish to add to the database. When you are finished, press ENTER.
6. "Right Asc.: 00.00.0" displays. Use the Up and Down Arrow keys to enter the digits for the Right Ascension coordinate of your object. When you are finished, press ENTER.
7. "Declination: +00°.00" displays. Use the Up and Down Arrow keys to enter the digits for the Declination coordinate of your object. If necessary, use the Scroll Keys to change "+" to "-." When you are finished, press ENTER.
8. Autostar then prompts you to enter the size of the object. This step is optional. Use the Up and Down Arrow keys to enter the size (in arc-minutes), if so desired, and press ENTER to go to the next display. If you do not wish to enter this information, simply press ENTER.
9. Autostar then prompts you to enter the magnitude of the object. This step is also optional. Use the Up and Down Arrow keys to enter this information, if so desired, and press ENTER to go to the next display. "User Object: Add" displays again.

#### **To GO TO a user-entered object:**

In this procedure, you will choose an object from the User Object list and GO TO the object.

1. With "User Object: Add" displayed, press the Scroll Up key once. "User Object: Select" displays. Press ENTER.
2. Use the Scroll keys (if necessary) to scroll to the desired object. Press ENTER.
3. The name of the object and the Right Ascension and Declination coordinates display.
4. Press GO TO and the telescope slews to the object.

# APPENDIX C

## Observing Satellites

In this procedure, you will prepare your telescope to observe a satellite pass.

1. Go to the "Object: Satellite" menu option and press ENTER.
2. Use the Scroll keys to scroll through the list of satellites.
3. Select a satellite from the list and press ENTER.
4. "Calculating...." and then "Tracking..." displays. If the satellite is going to make a pass, "Located" displays.
5. Use the Scroll keys to display data about the pass: aos – acquisition of signal and los – loss of signal. If you subtract the aos from the los, you can calculate how long the satellite will be visible. Location information also displays.
6. "Alarm" displays after the location information. Press ENTER and Autostar automatically sets the alarm to sound a minute before the satellite's scheduled appearance. You may return to regular observations until the alarm goes off.
7. When the alarm goes off, return to the Satellite menu and press a Scroll key until the desired satellite is on the top line of the display.
8. Press GO TO. Autostar slews the telescope to where the satellite should appear. The motor drive stops and a countdown is displayed.

**NOTE:** *If the scheduled appearance position of the satellite is obstructed (i.e., by a building, tree, or hill), press ENTER and Autostar starts to move the telescope along the expected satellite track. When the track clears the obstruction, press ENTER again to pause the telescope, then continue with this procedure.*

9. With about 20 seconds left on the countdown timer, start watching through the telescope viewfinder for the satellite to enter the field of view.
10. When the satellite enters the viewfinder field of view, press ENTER. The telescope starts to track with the satellite.
11. Use the Autostar Arrow keys to center the object in the viewfinder, then look through the eyepiece to view the object.

Satellite orbits change and new satellites (including the Space Shuttle) are launched. Visit the Meade website ([www.meade.com](http://www.meade.com)) approximately once a month to get updated information and instructions on how to download this data to Autostar. If orbital parameters are more than one month old, the satellite pass may not happen at the time predicted by Autostar. Downloading requires the optional #506 AstroFinder™ Software and Cable Connector Kit. See **OPTIONAL ACCESSORIES**, page 31.

**NOTE:** *Satellite observing is an exciting challenge. Most satellites are in low orbit, travelling at approximately 17,500 mph. When visible, they move quickly across the sky and are only in the field of view for a few minutes, requiring Autostar to slew the telescope rapidly. Best viewing is near Sunrise or Sunset when the sky is still dark. Viewing in the middle of the night can be problematic because the satellite may pass overhead, but not be visible as it is in the Earth's shadow.*

# BASIC ASTRONOMY


In the early 17th century Italian Scientist Galileo, using a telescope smaller than your DS-114AT model, turned it skyward instead of looking at the distant trees and mountains. What he saw, and what he realized about what he saw, has forever changed the way mankind thinks about the universe. Imagine what it must have been like being the first human to see moons revolve around the planet Jupiter or to see the changing phases of Venus! Because of his observations, Galileo correctly realized Earth's movement and position around the Sun, and in doing so, gave birth to modern astronomy. Yet Galileo's telescope was so crude, he could not clearly make out the rings of Saturn.

Galileo's discoveries laid the foundation for understanding the motion and nature of the planets, stars, and galaxies. Building on his foundation, Henrietta Leavitt determined how to measure the distance to stars, Edwin Hubble gave us a glimpse into the possible origin of the universe, Albert Einstein unraveled the crucial relationship of time and light, and 21st-century astronomers are currently discovering planets around stars outside our solar system. Almost daily, using sophisticated successors to Galileo's telescope, such as the Hubble Space Telescope and the Chandra X-Ray Telescope, more and more mysteries of the universe are being probed and understood. We are living in the golden age of astronomy.

Unlike other sciences, astronomy welcomes contributions from amateurs. Much of the knowledge we have on subjects such as comets, meteor showers, variable stars, the Moon, and our solar system comes from observations made by amateur astronomers. So as you look through your Meade DS-114AT telescope, keep in mind Galileo. To him, a telescope was not merely a machine made of glass and metal, but something far more—a window through which the beating heart of the universe might be observed.

## Autostar Glossary

Be sure to make use of Autostar's Glossary feature. The Glossary menu provides an alphabetical listing of definitions and descriptions of common astronomical terms.



## DS-114AT TIPS

This manual gives only the briefest introduction to astronomy. If you are interested in pursuing further studies, a few topics are suggested below that are worth reading up on. Try looking up some of these topics in the Autostar glossary.

Also below is a small sampling of books, magazines, and organizations that you might find helpful.

### Topics

1. How is a star born? How does a solar system form?
2. How is the distance to a star measured? What is a light year? What is red shift and blue shift?
3. How are the craters on our Moon formed? How old is the Moon and Earth? How old is the Sun?
4. What is a black hole? A neutron star?
5. What are stars made of? Why are stars different colors? What is a white dwarf? A red giant? Have we ever seen the surface of a star besides our own Sun?
6. What is a nova? A supernova?
7. What are comets? Minor planets? Meteors? Meteor showers? Where do they come from?
8. What is a planetary nebula? A globular cluster?
9. What is the Big Bang? Is the universe expanding or contracting, or does it always remain the same? What is dark matter?
10. What is an extrasolar planet? What is an accretion (or protoplanetary) disk?
11. What is the difference between an elliptical, a spiral, and an irregular galaxy?

### Books

1. [The Guide to Amateur Astronomy](#) by Jack Newton and Philip Teece
2. [The Sky: A User's Guide](#) by David Levy
3. [Turn Left at Orion](#) by Guy Consolmagno & Dan Davis
4. [Astrophotography for the Amateur](#) by Michael Covington

### Magazines

1. *Sky & Telescope*  
Box 9111, Belmont, MA 02178
2. *Astronomy*  
Box 1612, Waukesha, WI 53187

### Organizations:

1. Astronomical League  
Executive Secretary  
5675 Real del Norte, Las Cruces, NM 88012
2. The Astronomical Society of the Pacific  
390 Ashton Ave, San Francisco, CA 94112
3. The Planetary Society  
65 North Catalina Ave, Pasadena, CA 91106

And watch Jack Horkheimer, *Star Gazer*, on your local PBS station.



Access directly through the Glossary menu or through hypertext words embedded in Autostar. See "GLOSSARY MENU," page 24, for more information.

### Objects in Space

Listed below are some of the many astronomical objects that can be seen with the DS-114AT Series Telescope:



Fig. 34: The Moon. Note the deep shadows in the craters.

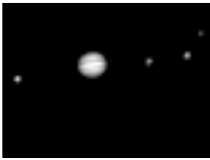


Fig. 35: Jupiter and its four largest moons. The moons can be observed in a different position every night.

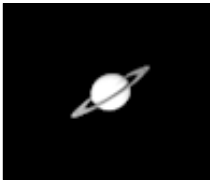


Fig. 36: Saturn has the most extensive ring structure in our Solar System.



Fig. 37: The Pleiades is one of the most beautiful open clusters.

#### The Moon

The Moon is, on average, a distance of 239,000 miles (380,000km) from Earth and is best observed during its crescent or half phase when Sunlight strikes the Moon's surface at an angle. It casts shadows and adds a sense of depth to the view (**Fig. 34**). No shadows are seen during a full Moon, causing the overly bright Moon to appear flat and rather uninteresting through the telescope. Be sure to use a neutral Moon filter when observing the Moon. Not only does it protect your eyes from the bright glare of the Moon, but it also helps enhance contrast, providing a more dramatic image.

Brilliant detail can be observed on the Moon, including hundreds of lunar craters and maria, described below.

**Craters** are round meteor impact sites covering most of the Moon's surface. With no atmosphere on the Moon, no weather conditions exist, so the only erosive force is meteor strikes. Under these conditions, lunar craters can last for millions of years.

**Maria** (plural for mare) are smooth, dark areas scattered across the lunar surface. These dark areas are large ancient impact basins that were filled with lava from the interior of the Moon by the depth and force of a meteor or comet impact.

#### Planets

Planets change positions in the sky as they orbit around the Sun. To locate the planets on a given day or month, consult a monthly astronomy magazine, such as *Sky and Telescope* or *Astronomy*. (**Tip:** enter a date in the Date menu and you can determine if a planet(s) will be visible during the night of the entered date by checking its rise and set times). Listed below are the best planets for viewing through the DS-114AT.

**Venus** is about nine-tenths the diameter of Earth. As Venus orbits the Sun, observers can see it go through phases (crescent, half, and full) much like those of the Moon. The disk of Venus appears white as Sunlight is reflected off the thick cloud cover that completely obscures any surface detail.

**Mars** is about half the diameter of Earth, and appears through the telescope as a tiny reddish-orange disk.

**Jupiter** is the largest planet in our solar system and is 11 times the diameter of Earth. The planet appears as a disk with dark lines stretching across the surface. These lines are cloud bands in the atmosphere. Four of Jupiter's 16 moons (Io, Europa, Ganymede, and Callisto) can be seen as "star-like" points of light when using even the lowest magnification (**Fig. 35**).

**Saturn** is nine times the diameter of Earth and appears as a small, round disk with rings extending out from either side (**Fig. 36**). Saturn's rings are composed of billions of ice particles ranging in size from a speck of dust to the size of a house. Titan, the largest of Saturn's 18 moons can also be seen as a bright, star-like object near the planet.

#### Deep-Sky Objects

Star charts can be used to locate constellations, individual stars and deep-sky objects. Examples of various deep-sky objects are given below:

**Stars** are large gaseous objects that are self-illuminated by nuclear fusion in their core. Because of their vast distances from our solar system, all stars appear as pinpoints of light, irrespective of the size of the telescope used.

**Open Clusters** are loose groupings of young stars, all recently formed from the same diffuse nebula. The Pleiades is an open cluster 410 light years away (**Fig. 37**).

**Constellations** are large, imaginary patterns of stars believed by ancient civilizations to be the celestial equivalent of objects, animals, people, or gods. These patterns are too large to be seen through a telescope. To learn the constellations, start with an easy grouping of stars, such as the Big Dipper in Ursa Major. Then, use a star chart to explore across the sky.







## MEADE LIMITED WARRANTY

Every Meade telescope, spotting scope, and telescope accessory is warranted by Meade Instruments Corporation ("Meade") to be free of defects in materials and workmanship for a period of ONE YEAR from the date of original purchase in the U.S.A. and Canada. Meade will repair or replace a product, or part thereof, found by Meade to be defective, provided the defective part is returned to Meade, 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 from Meade by writing, 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, and phone number.

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. Meade specifically disclaims special, indirect, or consequential damages or lost profit which may result from a breach of this warranty. Any implied warranties which cannot be disclaimed are hereby limited to a term of one year from the date of original retail purchase.

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

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

This warranty supercedes all previous Meade product warranties.



ADVANCED PRODUCTS DIVISION

**Meade Instruments Corporation**

*World's Leading Manufacturer of Astronomical Telescopes for the Serious Amateur*  
6001 Oak Canyon, Irvine, California 92618 ■ (949) 451-1450

FAX: (949) 451-1460 ■ [www.meade.com](http://www.meade.com)

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